

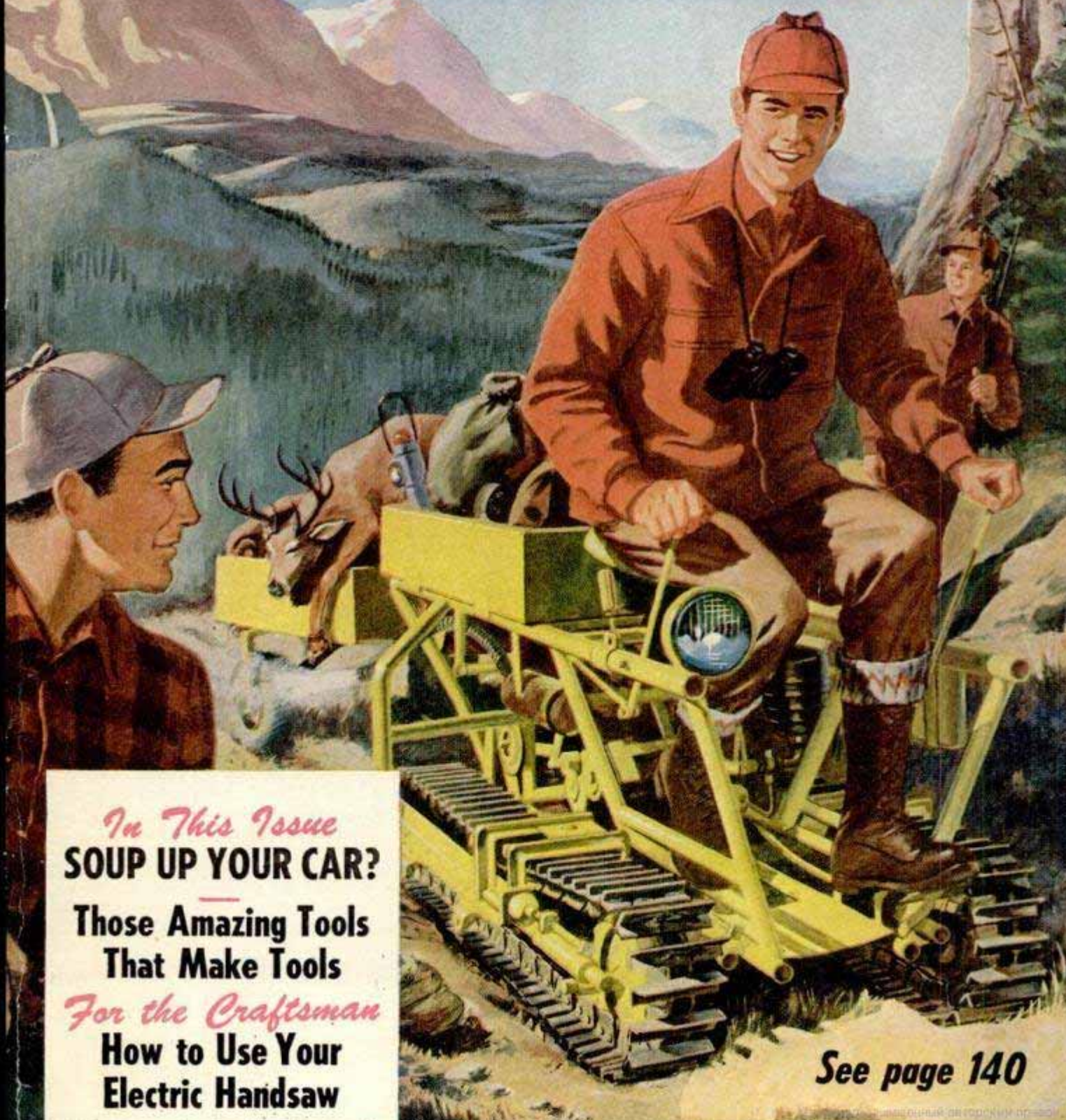
POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

No. 410428

REG. U.S. PAT. OFF.



In This Issue
SOUP UP YOUR CAR?

Those Amazing Tools
That Make Tools
For the Craftsman
How to Use Your
Electric Handsaw

See page 140

**BUILDS THE FIRE IN BUICK'S
FIREBALL ENGINE**

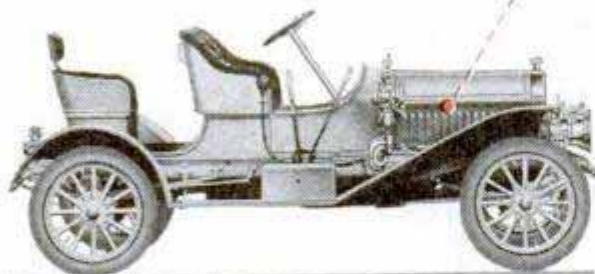
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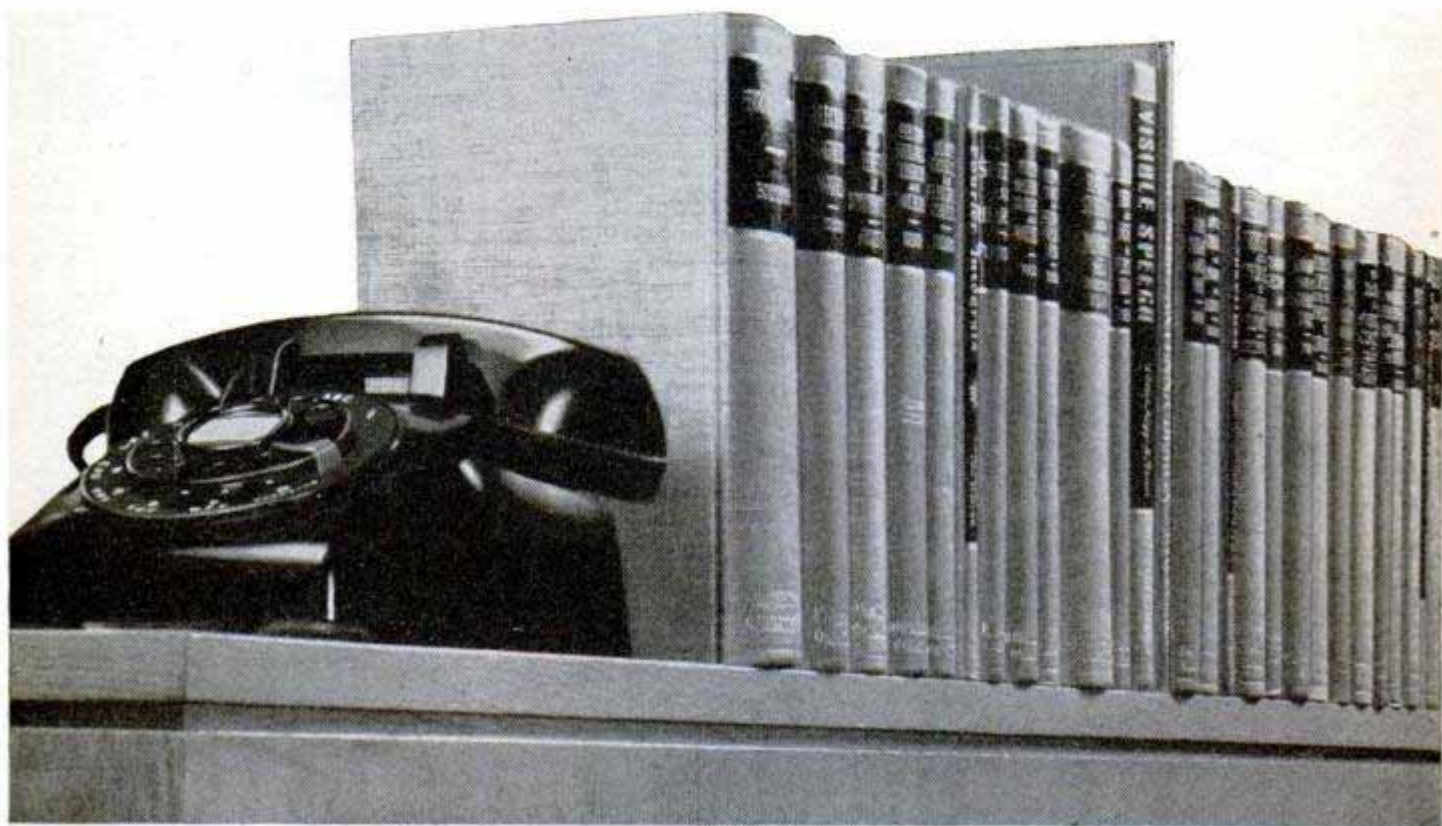
Vinyl-Tile BY
GOOD YEAR

This One



RTE3-KU3-HNT1

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H. H. WINDSOR, JR., *Editor and Publisher*



this month's cover

CLAWING ITS WAY up a mountain trail is the "Go-Devil," as strange yet useful a vehicle as you'll find anywhere in the Rockies. For years, Alco Timmons rode horses in hunting elk, antelope and deer, then toted his kill out of the rough Rocky wilderness on his mounts. But Timmons discovered that there were hunting spots too rough even for a horse. The result—and Timmons' handiwork—is the Go-Devil, a power-packed little vehicle that won't give up anywhere this side of mountain-goat country. Only 54 inches long, the tiny tractor will fight its way up a steep mountain grade hauling three hunters and the carcasses of two or three animals. Under full load there's not much of the tractor to be seen, for three men—including one perched 'way out front for balance—just about cover up the mighty crawler. For more details on the Go-Devil, its motor and its unique trailer turn to [page 140](#)

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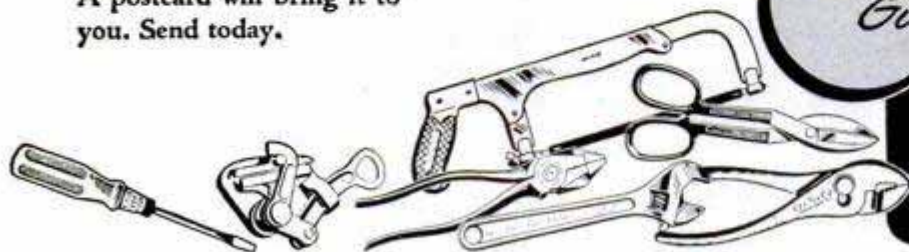
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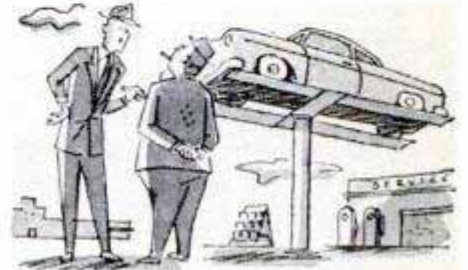


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THE EDITORS



Letter to the Editor:

Through a friend I learned about that article in *Popular Mechanics* (March 1952) on extrasensory perception. Some years ago [at a] summer resort near the St. Lawrence River . . . I met two animals which interested me. True, there was nothing of extrasensory powers in them . . . The duck



was a constant companion of the dog. But what was remarkable was this: every time a stick was thrown out into the river, the dog would swim after it; then the duck would swim out furiously after the dog, and it would hop on the back of the dog's head and hold on with its beak, riding all the way back.

John Mathusz,
New York City.

Letter From a Modern "Stradivarius"

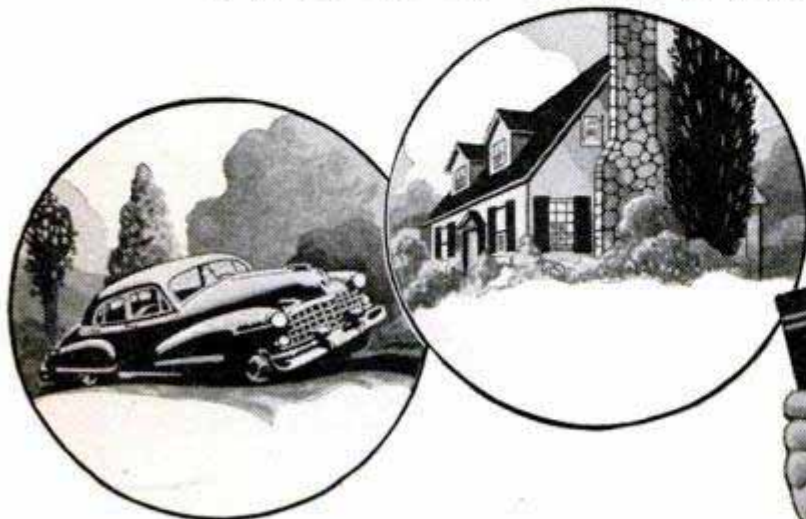
The letter that follows comes to us from Dr. Ben Sweetland of San Francisco. Some years ago Doctor Sweetland reviewed on his radio program the *Popular Mechanics* book, "You Can Make a Stradivarius Violin." The result of that broadcast is revealed in this letter, a rare human document that gives us a warm feeling for a hobbyist who devoted a new-found skill to enriching the lives of others:

"Dear Doctor Sweetland:

"A few years ago I heard a hobby program, where you described the making of a violin. It seemed to me to be the most

(Continued to page 8)

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TRAIN IN MIAMI - AIR CAPITAL OF THE WORLD

(Continued from page 6)

wonderful thing; even if I never played an instrument myself, I had always an adoration for the violin. Still I lived a drab sort of life . . . dissatisfied . . . disgruntled.

"And when you spoke about the possibility to build a violin, it seemed like a revelation of beauty—like a rainbow in glowing colors at the other end of the street. I secured the plans and began at once to build my first violin. It took me exactly three months, so lovingly and caressingly did I do the work.

"As I said before, I do not play any musical instrument, but I seem to have an appreciation of music and especially of the magic tunes of a fiddle. So there I was, with a violin I hoped would be good, and no one to play it. Just as carefully as I built this first treasure, I began searching for the very person who should have it to play.

"I did find the boy, whose parents could not afford to buy one, but whose hungry heart longed to possess a violin of his own. He has had lessons in school and practiced on a borrowed instrument.

"I know you appreciate the great joy and satisfaction which came to me from then on. The boy makes big strides and comes frequently to play for me, because, strangely enough, this first violin of mine does sound beautiful. Maybe it is not my work at all. Maybe it is the art of the boy, who produces these magical tones, but it could be the combination. I like to think so, because both of us, the boy and I, are in a kind of ecstasy when he plays.

"I have made already three violins and each time one is finished, I go on a search for the person who should have it. The second violin went to a nine-year-old girl in the orphanage. She, too, is very talented and promises to become a very good musician. And the last one went to an elderly gentleman, a refugee from Europe, who had lost everything.

"He is a very outstanding violinist, and was so grateful for the instrument that he immediately gave his services free to the two children who received my first two violins. He gives them lessons in my house and these hours are hours of gold to me.

"He has already opened a studio to teach and made a success of it. There is such a blessing in giving and it all started with that hobby broadcast of yours, years ago. . . . Thank you."

Letter to the Editor:

Recently I recalled an experience signifying the versatility of your magazine. For some it may seem ludicrous but for others it might save some of the long

(Continued to page 10)

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(Continued from page 8)

hours usually incurred while waiting for a repairman.

During my last years at Berlin high school I did an abnormal amount of riding in an antique automobile. On one trip I had the misfortune of experiencing my second blowout for the 33-mile trip from home. I dismantled the tire with the customary animosity only to find I had no tire-repair patches. The other mishap destroyed the tire beyond all methods of emergency repair, so there I was, stuck with no blowout patches for a tire, a hole two inches long, insufficient funds for a taxi and a pending engagement.

I repaired the tube with the light-duty patches and from my collection of your magazines I selected a well-read copy. Inserting it within the casing over the injury, I then assembled the unit.

The following day . . . I again tore the tire apart to find the injured surface had increased, but after being subjected to over 70 miles, your magazine still had many more to go.

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Bob Reeve,
Ulm, Germany.

Letter to the Editor:

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H. L. Bolton,
Reece, Kan.

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A Ready Reference

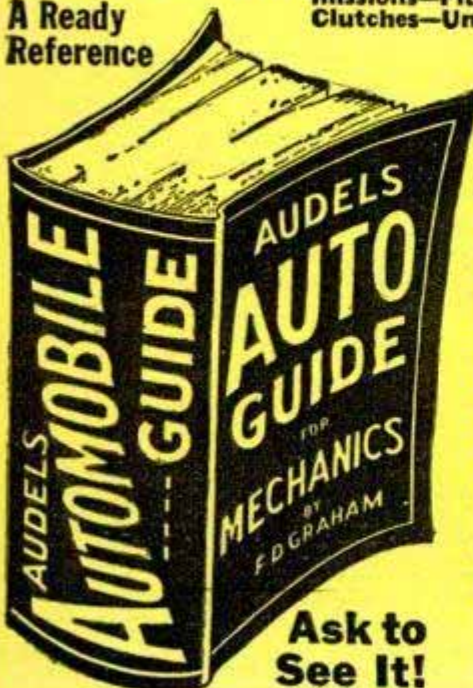
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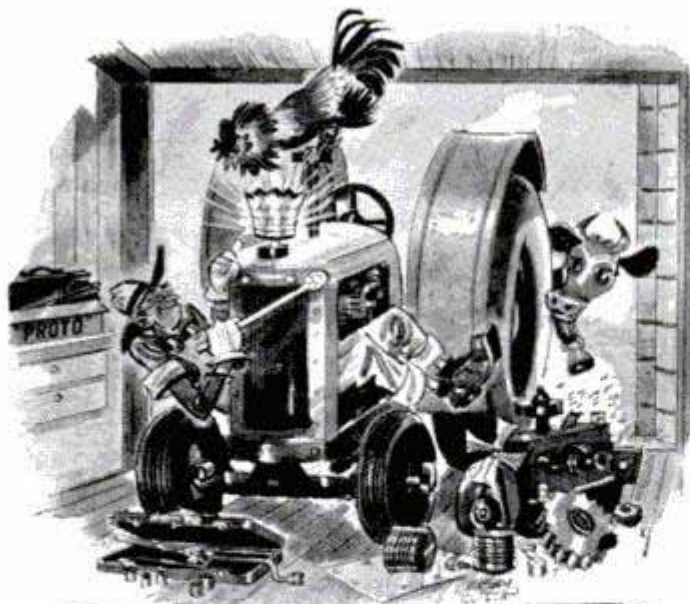
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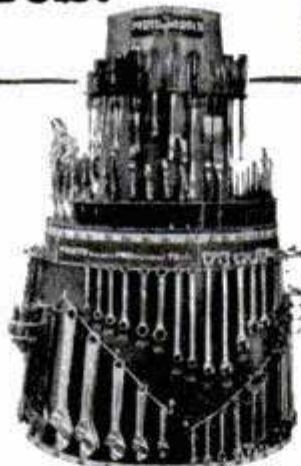
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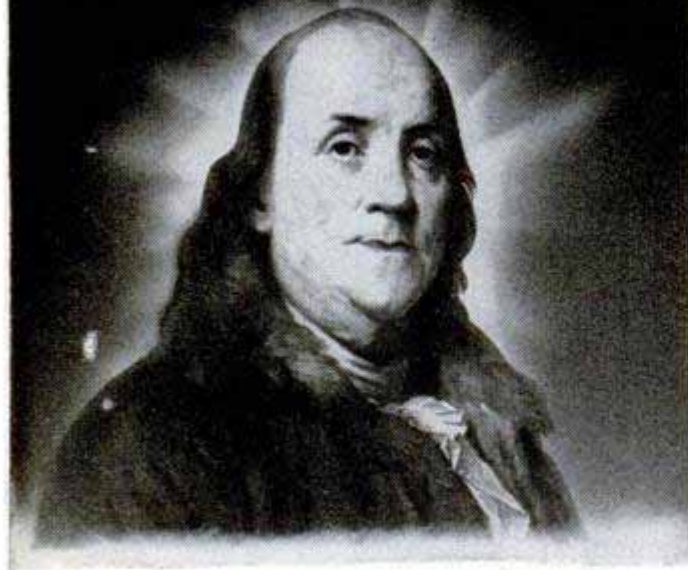
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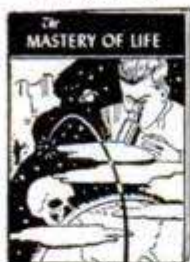


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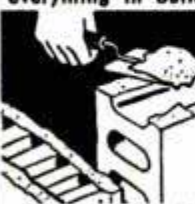
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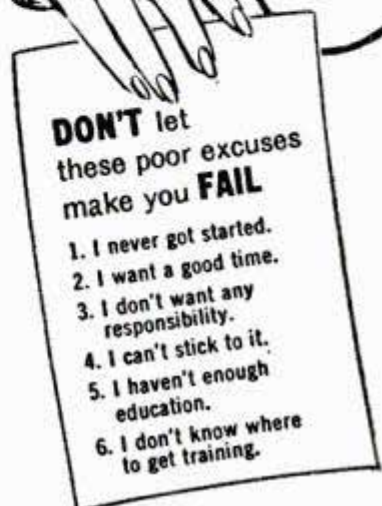
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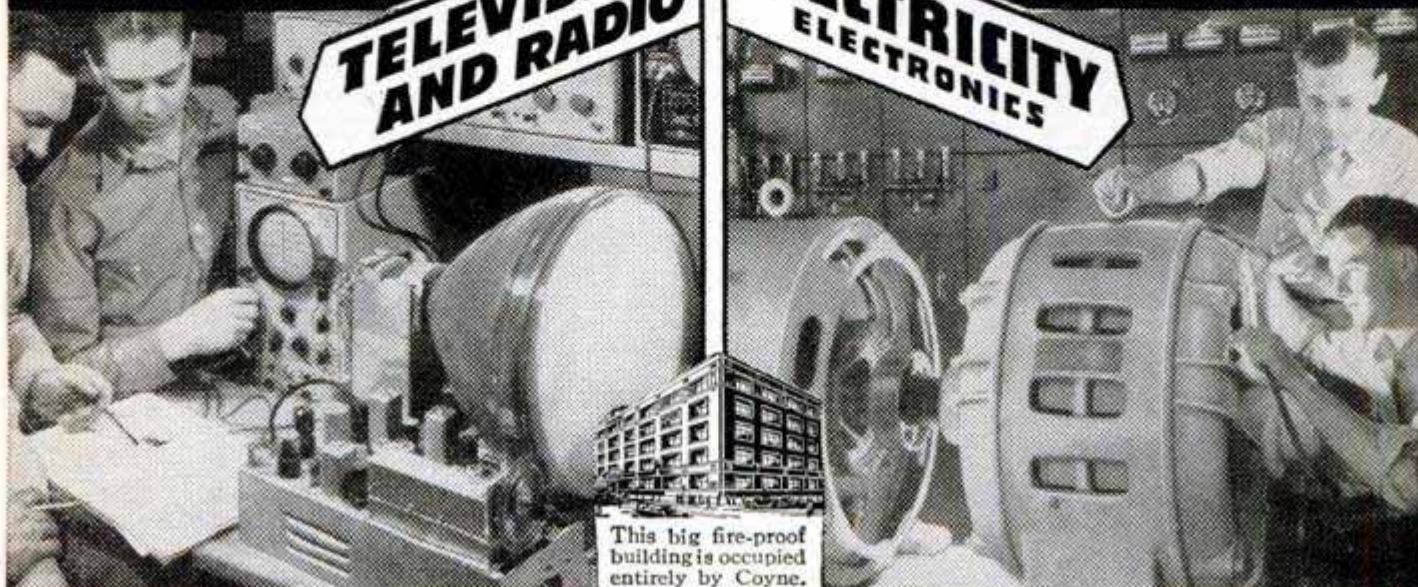


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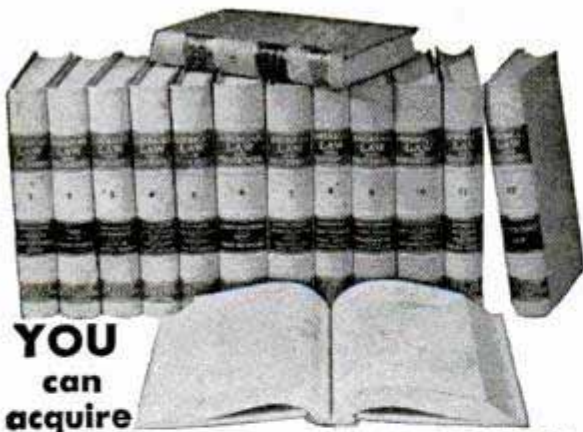
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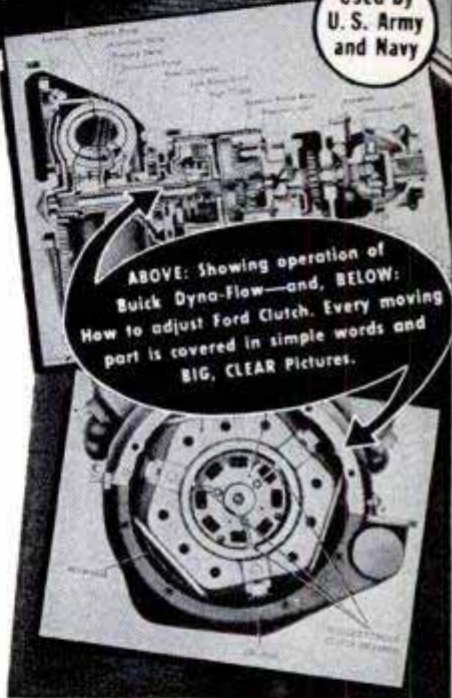
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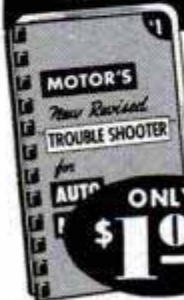
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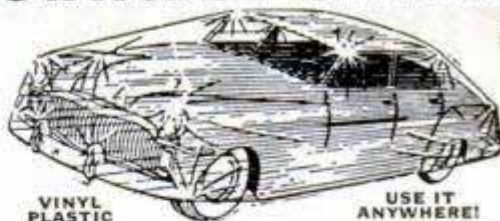
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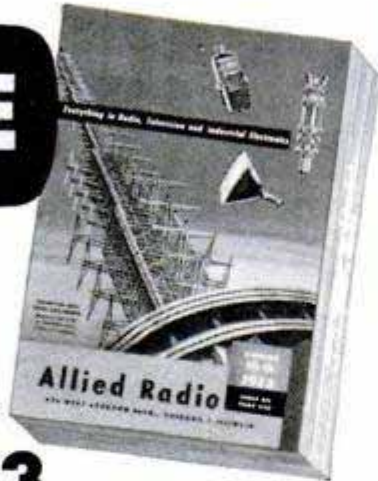
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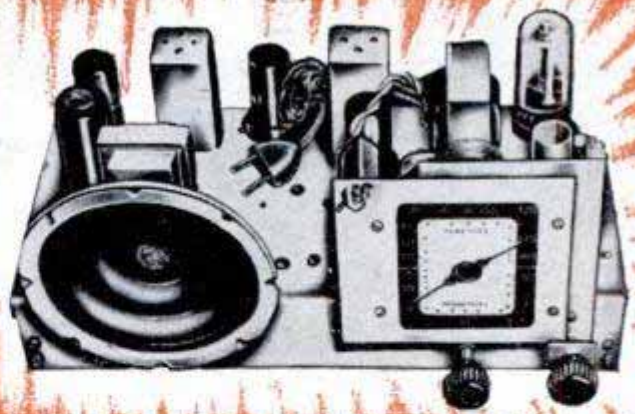
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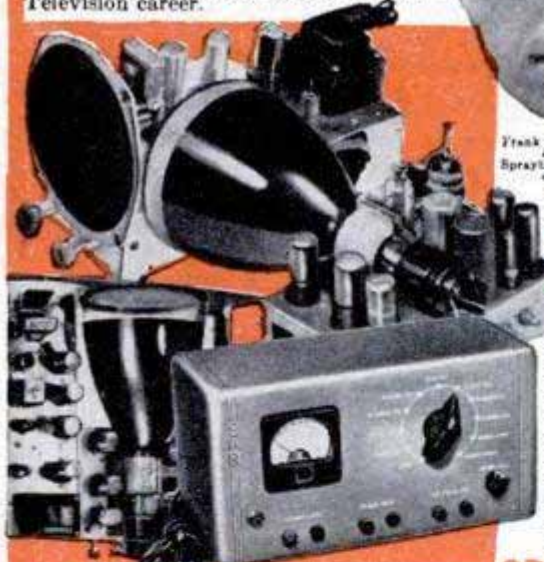


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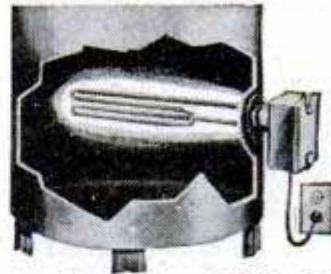
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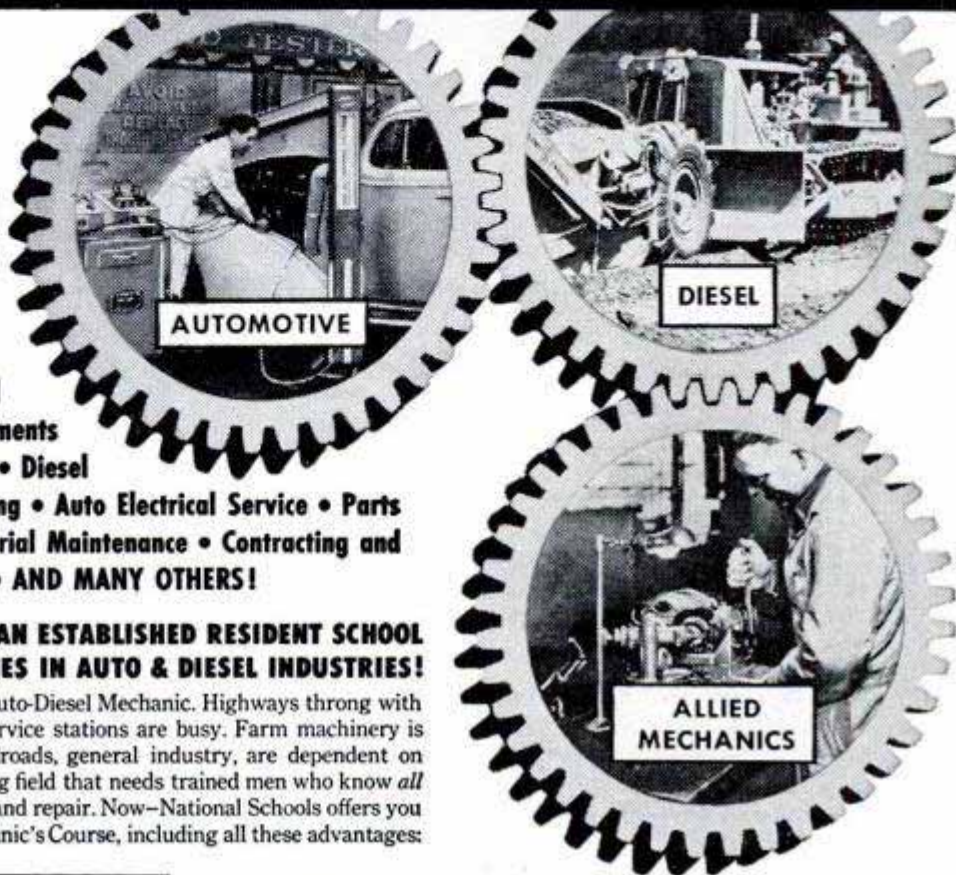
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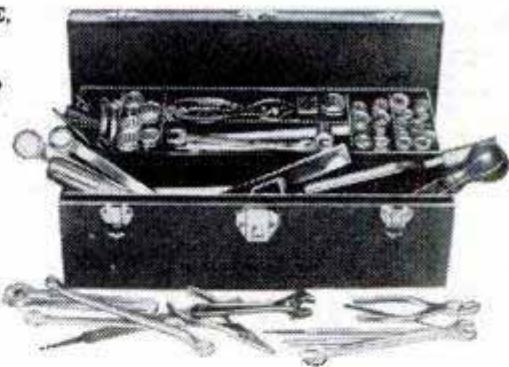
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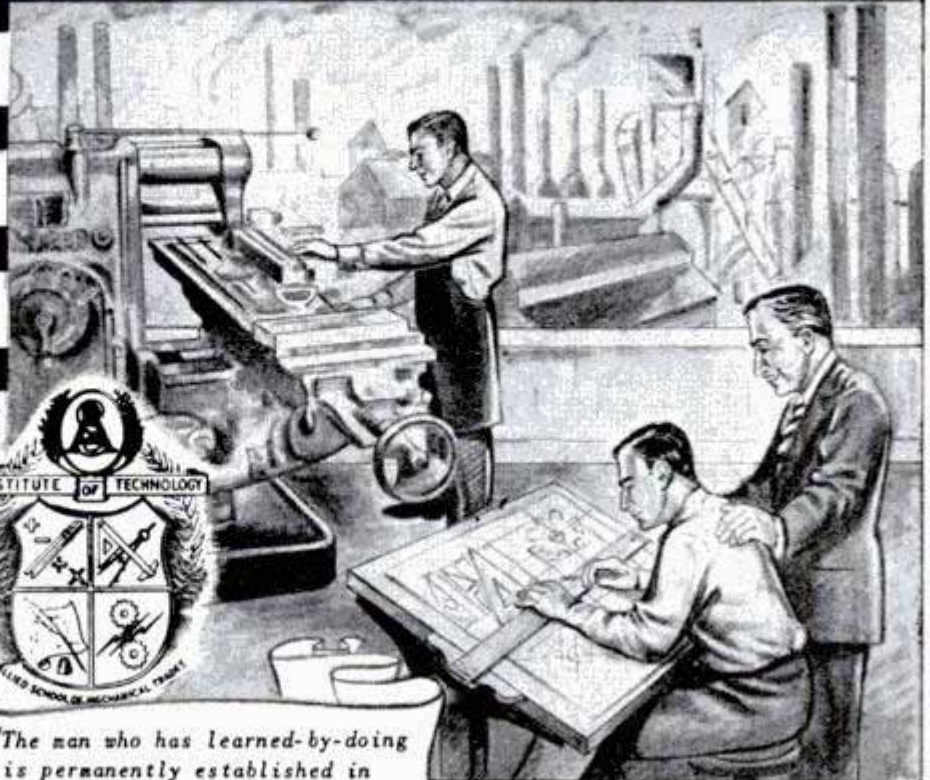
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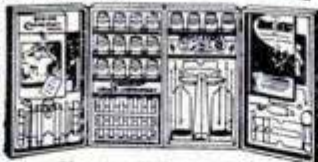
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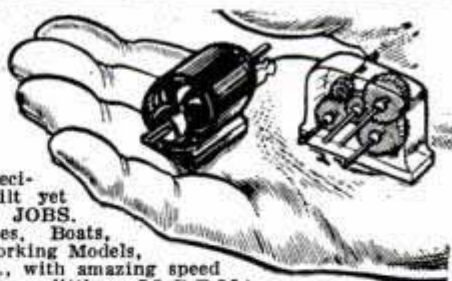
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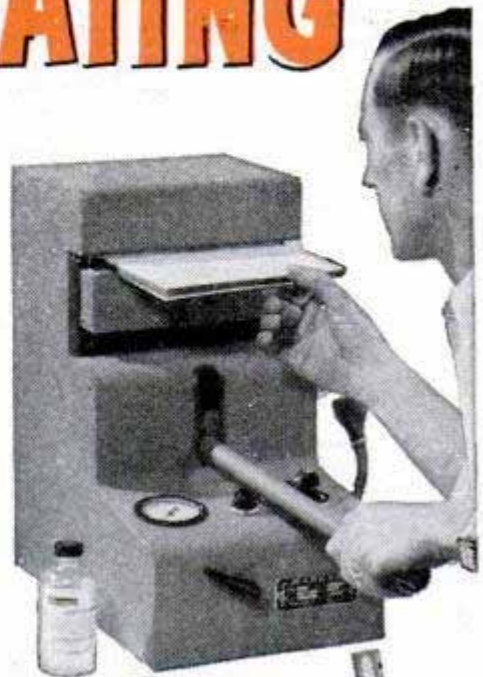
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BUY Photographic supplies wholesale. Films, cameras, projectors, binoculars. Expert camera repairing. Free catalog. Capitol Photo Supplies, 2428 Guadalupe, Austin, Texas.

ADD “Spice” to home projection shows with colorful old-time Nickelodeon slides. 2x2. Write for free list. Nickelodeon Co., New Fleidner Bldg., Portland 5, Oregon.

BASS Says: Trading since 1910. Used but good as new buys: 8mm. B.&H. Sportster \$52.50; 16mm. Keystone A-7. F:2.5 lens \$37.50; Voigt. 35mm. Vito II, flash shutter. Skopar F:3.5, like new \$38.50; Kodak Reflex F:3.5 lens, like new \$88.50; Contax I, F:2 Sonnar \$87.50; 3 1/2 x 4 1/4 Speed Graphic, Skopar F:4.5, Ibsor shutter, \$52.50. Satisfaction guaranteed. Bass Camera Co., Dept. AG, 179 W. Madison St., Chicago 2.

FREE Photographic bargain book packed with hundreds of sensational values in still and movie cameras, lenses and latest accessories. Super savings for you in new and used equipment. Liberal trade-in allowances, too, on your equipment. Write now for your free copy to Central Camera Company, Dept. 9L, 230 S. Wabash Ave., Chicago 4. (Photographic headquarters since 1899.)

PHOTO FINISHING

16 PRINTS Or 8 jumbos from roll or negatives, 25c with this ad. M. Skrudland, Box 486, Daytona Beach, Florida.

8 CONTACTS 30c, Jumbos 40c, 12, 45c; jumbos 55c. Reprints 4c; jumbos 5c. Western Photo, Dept. PM-92, Box 298, San Francisco 1, Calif.

EIGHT 5x7 Or five 8x10 enlargements, \$1.00. Wilart Enlargers, Box 967, Little Rock, Ark.

CUSTOM Photo finishing guaranteed. 8 exposures 35c; 12, 50c. Bound in beautiful plastic ringed album. Special! 35mm., 36 exposure \$1.00. Free mailer. Flash Foto, Box 36M, Brooklyn 4, N. Y.

16 JUMBO Prints from any size roll or negatives 35c, with this ad. S. Skrudland, Lake Geneva, Wis.

PERSONALIZED Xmas cards, 20-\$1.25. Send negative and 5c for sample card and list of styles. Graphic Photo Service, P.O. Box 72, Wilkes-Barre, Penna.

GUARANTEED Quality. Fast service. Eight jumbos in beautiful super pak plastic ring binder albums only 35c. Send for free mailers and particulars of our complete photo finishing service. Grand Fotos, G.P.O. Box 1410, New York 1, N. Y.

SPECIAL Offer, 8 exposure roll 25c; 12 exposure 40c. Super pak albums. Post-L-Pix, Box 1D, Worcester 4, Mass.

8 OVERSIZE Snapshots from roll, 25c with this ad. Foto's, Box 8, Aurora 1, Ill.

SATISFACTION guaranteed! Eight jumbo size prints mounted in album, 35c—12 to 16 exposure rolls, 50c. Free mailers, quick service, finest developing, finishing. Crown Studios, Box 1223-PM, Dallas, Texas.

FAST—Same day service! 8 oversized prints in attractive plastic-bound book only 35c; 12-50c; 16-60c. Satisfaction guaranteed. Free exposure guide with first order. Pic-Sure, Box 899-B, Philadelphia 5, Penna.

6 OR 8 Picture roll 35c, 12 or 16 picture roll 55c. Each roll printed and developed. Handy album pack. If you fail to get pictures on your film a new roll will be sent you without extra cost. Send coin with roll. No c.o.d.'s. Mailing containers sent free. DeLuxe Film Service, Box 1268-A, Shreveport, Louisiana.

BEAUTIFUL Enlargement from each picture on 8 exposure roll 35c. Cut Rate Photos, Dept. B-4, Janesville, Wis.

TWO Beautiful prints from each picture on 8 exposure roll 35c. Thirty-one years of satisfied customers. Quick service. Lens Photos, Dept. J-4, Janesville, Wis.

MOTION PICTURES AND SOUND EQUIPMENT

TAPE Recorders, tapes, accessories. Unusual values. Dressner, 624-M East 20th Street, New York City 9.

FREE Giant catalog of 8mm and 16mm films for home movie enthusiasts. Films for every occasion. Lee Stann, Dept. PM9, 11 Willard Ave., Mt. Vernon, N. Y.

FREE Movies. Thousands of subjects. Interesting. Entertaining. Fascinating. New directory, only 50c. National Cine, Box 247, Toms River, N. J.

TAPE Recorders at bargain prices! Eighteen makes. 1200 feet plastic tape \$2.10. Write Magnetic Recorders Co., 7120-A Melrose Avenue, Los Angeles 46, Calif.

WE Have it! Send 10c for special listings, and sample film strip. Reyelle, Box 12, Hammels, N. Y.

BARGAINS 16MM. sound films. Also for exchange. Bedner, 5300 So. Talman, Chicago.

LEARN Free lance, educational, Hollywood, and television film technique at home. State licensed. Write for free catalog, Motion Picture Institute, Birmingham 4, Michigan.

5000 NEW-Used 8-16mm. silent-sound films. International, 2120 Strauss, Brooklyn 12.

8-16MM. Silent-sound films. Complete rental library. All latest subjects. Free catalogue, sample film 10c. Garden Film, 317 West 50th, New York 19.

RENT 16MM. sound films, 50c reel. Large selection; free catalog. Film Service, 128 Chestnut St., Roselle Park, N. J.

GUARANTEED Fresh 8mm. roll, magazine; 16mm. roll, magazine movie films. Color, b&w. Free catalog. ESO-S, 47th Holly, Kansas City 2, Missouri.

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MUSIC AND MUSICAL INSTRUMENTS

SONGWRITERS—800 Names and addresses of America's best song publishers. Plus copyright information. \$1.00 Info., 338 S. Audubon, San Antonio 12x, Texas.

YOUR Words and our music. A winning combination! Send poems. Free examination. Song Promotion Guild, 350-M Broadway, New York 13.

POEMS Wanted for musical setting on percentage basis. Broadcast consideration. Sooner Song Co., 22-PM North West 8th, Oklahoma City 2.

PLAY Guitar in 7 days! Famous beginners photographic charted course positively teaches how to play over 200 hillbilly, popular and western songs by ear or note, plus latest hit songs. Free details, Ed Sale, Studio 300, Point Pleasant, N. J.

MUSICAL Instruments, accordions, guitars, 10-day trial, free catalog. Meyers, 454-A Michigan, Detroit 26, Michigan.

ELECTRIC Guitars, accordions, amplifiers, wholesale. Free catalog. Carvin, Baldwin Park, Calif.

POEMS Wanted! Opportunity knocks! Nationally known song writer composes music to your song poems. Send poems today for free examination and free copy of "Song Writing Secrets." Melody House, Dept. PM, Box 19007 La Tijera Station, Los Angeles 43, California.

SONGWRITERS—Competition demands modern harmony and singable melodies. Send poems for creative evaluation. Jimmy Seaver, Room 410, 203 N. Wabash, Chicago.

ACCORDIONS—Save 50% and up. Cash or terms. New and used. All brands. Wholesale to everyone. Free catalogue. Del Principe, 29 South Cicero, Chicago 44, Ill.

YOUR Voice made loud, clear and powerful with my diaphragm exerciser. Inexpensive. Write, Inventor "Oz," 34V, Box 665, St. Louis, Mo.

SENSATIONAL Free booklet, "How To Write And Sell Songs." Get the facts first. Poems examined free. Reliable Music Service, Box 430-P, Hollywood 28, Calif.

1952 ACCORDIONS—Wholesale. Free catalog. American Accordion Center, 5329 Belmont, Chicago.

POEMS Wanted for musical setting. Send poems for free examination. Five Star Music Masters, 630 Beacon Bldg., Boston, Mass.

LYRICS Set to music and recorded. Free examination. Cherrier Recording, 732 So. Norton, Los Angeles, California.

MUSIC Arranged. Songs printed. Frank Wildt, Music Publisher, Lancaster, Penna.

POPULAR Songs. How to write and sell them. Write for free booklet Successful Songwriting. Gateway Songs, Box 2470, Hollywood 28, Calif.

SONGWRITERS! Protect your ideas! Hold all songs; poems! Write for Safe Correct Procedure first! Song Service, Dept. P, 333 W. 56th St., New York 19, N. Y.

SONGWRITERS! Send poems, songs. Music Service, 243 West 72nd St., PM, New York 23.

POEMS Wanted to be set to music. Free examination. Send poems. McNeil, Master of Music, 510-PM S. Alexandria, Los Angeles, California.

WRITE Songs. Big money and reputation. Write for information. J. Gordon Pub. Co., 4700 South California Avenue, Chicago.

WANTED! Poems for musical settings. Write Songwriters' Service, Clifton, N. J.

RADIO AND TELEVISION

ELECTRONIC Problems, devices, advice. Free information. Registered Engineer, 5208-E Onacrest, Los Angeles 43.

EIGHT Radio building plans \$1.00. Master Kit Company, Box 206, Belleville, Ontario.

FREE 236 Page 1953 television-radio-electronic catalog! World's largest stocks, lowest prices. Complete supplies for builders, experimenters, amateurs, servicemen. Latest television, radios, phonos, recorders, sound equipment. Thousands of parts, tubes, test instruments, books, diagrams. Top quality money saving values. Get yours now! Allied Radio Corp., 833 W. Jackson Blvd., Dept. 34-J-2, Chicago 7, Ill.

BUILD 15 Radios—Only \$1.30 each. Experience unnecessary. Home radio and TV course includes trouble shooting and servicing lessons, radio principles, code instructions, practical radio building and repairs. You build and keep receivers, transmitters, amplifiers, test equipment and code oscillator. All parts, tools, instructions supplied, including radio tester and electric soldering iron. Send for big, new time and money saving catalog and radio TV repair guides. Enclose 25c. Progressive Electronics Co., 497 Union Ave., Dept. PM-22, Brooklyn 11, N. Y.

SIMPLE Radio and television trouble analyzer. Service your own sets and save. \$1.00 prepaid. Stegotronics, Colchester, Conn.

HOW To repair most radios in a few minutes without extensive study or expensive equipment. Only \$1.00. Details free. Slate's Radio Service, Corsicana, Texas.

ONE Tube loudspeaker radio diagrams 25c. Net-Loc, 44 Walker, Cambridge 38, Mass.

TELEVISION Interference filters. Price \$2.75. Stell's Co., Box 1104, Sioux City, Iowa.

MAKE Simple, tubeless, batteryless, distance-getting crystal radios. Crystal and illustrated instructions 25c postpaid. Allen, 427-P, Clinton, Mo.

TV And FM antennas. Yagi, conical, bow-tie, mounts, accessories. Lowest prices. Wholesale Supply Co., Lunenburg 1, Mass.

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START Your own mail order business with hundreds of repeat, sales proven, hobby-craft items. No stock to carry, no shipments to make. We pack and ship for you. For details and instructions send 25c. Mail Order Service, Dept. PM25, 845 S. Wabash, Chicago 5.

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TRADE Magazines will help you to success. Get latest copies through our easy-to-get-acquainted service. Hundreds of business, trade, educational, professional, hobby, sport, advertising, construction, laundry, legal, lumber, machinery, mail order, marine, metal, military, milk, milling, motion picture and others covering all interests. Send for list today. It's free. Commercial Engraving Publishing Company, 34C North Ritter, Indianapolis 19, Indiana.

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RESILVERING Mirrors, formula 50c; two-way lookout mirrors, (No one sees you), 50c; coppered mirrors, 50c. All \$1.00. Nelko-Mir, Box 3462-J, Chicago 54.

FIGURINE Molds and many others, liquid rubber, statuary plasters, flock finishes, Glo-candle wax, etc. Illustrated catalog and "Plastercraft" manual free. Blue Rapids Supply, Blue Rapids, Kansas.

MIRACLE Seller. Cross-chain. Lord's Prayer viewer with 12 imported rhinestones, fabulously boxed. Sample and wholesale prices \$1.00 postpaid. New York Article Company, G.P.O. Box 405, New York 1, N. Y.

ADVERTISING Book matches—Cash in on big demand; sell union label matches. Cuts for all businesses and political parties. Free powerhouse selling kit, low prices, protection guaranteed on repeat orders. Cash commissions. Superior Match Co., Dpt. MX-952, 7530 Greenwood, Chicago.

START Home perfume business. No equipment. Everything furnished. Emly Enterprises, Box 319-P9, North Hollywood, Calif.

ALL Profit: Get manufacturer's, distributor's, dealer's profits yourself by making, selling, installing important heating specialties. Details free. Harrington, Box 103ME, St. Matthews, Kentucky.

START Home manufacturing business. Make cleaners, soaps, polishes, cosmetics. Free literature. Kemix, Park Ridge, Ill.

REPEAT Sales guaranteed, cheapest, best glass dishwashing liquid for taverns, restaurants. Samples, details 50c. Riesen, 419 Vliet Street, Milwaukee 12, Wis.

I Made a great success in the collection agency business. I can teach you too—quickly. Write me. George H. Cole, Syracuse 2, N. Y.

LEARN Sewing machine repair. Electrify, rent, sell spare time. Make "big money" like our other men-women do. New machines, motors, parts wholesale. Details free. Taylor Service, Hamilton PM-9, Ohio.

START Your own business on credit. Your own boss. 1586 of our dealers sold \$5,000 to \$27,500 in 1951. We supply stocks, equipment on credit. 200 home necessities. Sales experience unnecessary. Pleasant, profitable business backed by world-wide industry. Write Rawleigh's, Dept. I-U-PPM, Freeport, Ill.

\$5 AN Hour and more possible in your home. You can paint it with suede. Fabulous new business. Spare or full time. Spray on rainbow colors. Auto dashboards and trunks, signs, radios, toys, figurines, lamps, etc. Beautified with amazing new 3rd dimensional plush-like finish with touch-appeal as well as eye-appeal. I'll send you complete, step-by-step plans and equipment, including high-velocity spray gun for no-risk examination in your own home. Send no money, just name and address. Coast, 1004-AS S. Los Angeles St., Los Angeles 15.

MAKE Money at home as renewal headquarters for all magazines. Big Christmas sales profits now. Liberal commissions. Supplies furnished. Write for free catalog. McGregor Magazine Agency, Dept. 500B, Mount Morris, Ill.

YOUR Own business without investment. Be an authorized agent for all magazines and take care of new and renewal orders in your territory. Experience not necessary. We furnish all supplies free. Write for our catalog. Subscription Service Company, P.O. Box 2070, Birmingham, Ala.

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IMPORT-Export! Opportunity, profitable, world-wide, mail-order business from home, without capital; or travel abroad. Established World Trader ships instructions for no-risk examination. Experience unnecessary. Free details. Mellinger 29, Los Angeles 24.

LIQUID Rubber. Make flexible molds. Quart \$2.95, 1/2 gallon \$4.75, gallon \$8.50 (prepaid). Chaney, 1130 E. 16th St., Jacksonville 6, Fla.

SELL Cheap balloons. Ten gross assorted \$5.00. Samples airmail \$1.00. Dwarkadas, Third Bholwada 38PM, Bombay 2.

SUPPLY Lists and ideas for home workers free. Lincoln Supply, Box 449, Irwin, Penna.

SEND For free booklet, "There's Money in Plastics." Bing Products, PM-952, Watertown 72, Mass.

SELL By mail, big profits, free details. Write Keystone, Box 332A, Hazelton, Penna.

EARN Income at home. Spare time. Start small, grow big. Lifetime security. Particulars free. Reho, Box 21A, Whitsett, Penna.

NATURAL Molding rubber. Free sample. Tribby Supply, Post Office Box 3091, Station F, Jacksonville, Florida.

FREE Fascinating business plan! Details. C-O-C, Box 204, New York 21.

\$4.25 DOZEN Men's ties, sample, others. Berlin, 166 Keap Street, Brooklyn 11, New York.

TO \$35.00 Weekly. Spare time, home operated mail order business. Successful small "beginner's" plan. Everything supplied. Lynn, 10420-M National, Los Angeles 34, California.

SEVERAL Mailorder money making homework offers. W. W. Jenkins, Lucasville, Ohio.

INVISIBLE Reweaving—Big profit, big demand, easy-to-learn with low-cost complete course—nothing else to buy, ever. Details free, write today: Fabricon, Dept. N-6, 8342 S. Prairie Ave., Chicago 19, Ill.

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CASH Income from your backyard! Unlimited businesses! Pickett's, Florence, Ky.

RE-REFINE Used oil. Scot re-refiner converts old oil into new. Literature free. Scot Mfg. Company, 9009 Osage Lane, St. Louis, Mo.

PRINT Without a printing press. Posters, banners, greeting cards, toys, glassware, neckties, anything! New easy revolutionary method. No special equipment or experience needed. Work full or spare time at home. No selling. We set up your own local business. Wonderful money-making opportunity. Free sample. Profitable ideas, beautifully illustrated plan free. Write: Screen-Print, 1010-M South Los Angeles Street, Los Angeles 15.

HAVE Home mail business—Success assured beginners with \$100 or more. Ideal-mailbox service. Booklet 25c. Details free. NMD Agency, Box 88-J, Dorchester 22, Mass.

MAKE Big money at home. Inexpensive. Box 475, Lomita, Calif.

FIGURINE Moulds 50c up. Write: Oman, 101 Wilken Street, St. Paul, Minnesota.

BE Own boss. Operate profitable mail order business. Sensational new monthly magazine tells how to start; where to find items; how, where to advertise. Hundreds fascinating money-making facts from experts every month. 50c copy. 12 big issues only \$5. Mail Order Business, Dept. C, 19 West 44, New York City.

WANTED! Home producers, by manufacturers in our contact service. Become a sub-contractor casting plastic products for these companies. Thousands of easy-to-make items required. Cash in at home, without previous experience. Write for free list of 100 most wanted items. Plastic Service Assoc., Dept. PM9, East Boston 28, Mass.

ESCAPE Wage slavery. Easily. Operate your own profitable lifetime business. Free literature. Corley, H186 Ackerman, Clifton, New Jersey.

GET Dollar orders by mail—Keep 90c. \$10 starts you. Details free. Genmerco, Box 142-J, Dorchester 24, Mass.

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BUY Wholesale thousands nationally advertised products at big discount. Sent free "The Wholesale Plan." American Buyers' Service, 629-PM Linden, Buffalo, N. Y.

BABY Shoe mountings. Book ends, frames, etc. Emjay Metal Co., 135-17 135 Ave., So. Ozone 20, N. Y.

TIN-Cans. Turn them into cash. Nine methods. Instructions 50c. Charles Company, 12-DAH, Norwood, Ohio.

MAKE 10 Items for 10c each—Sell at \$1.00. Complete plans \$1.00. Details free. Associated, Box 767-P, Worcester 1, Mass.

MAKE Big money making and selling your own soil conditioner, septic tank cleaner, cedar coating plaster, silicone polishes, waterless hand cleaner, nylon bleach and many other new 1952 money-makers. Investment small! Profits immense! Literature free! Liscomb Miller, Dept. 1517, Tampa, Florida.

SENSIBLE, Profitable, delightful business. Trifling capital. Carl Jamer, Manorville, N. Y.

PROFITABLE Home business. Electroplate novelties, autoparts, mirrors, baby shoes, etc. Portable Tyco Electro-Plater \$5.95. Free booklet. Tyco Metals, Box 13231-MC, Houston 19, Texas.

"MAKE Perfume." Profitable mailorder business. Catalogue free. "International," 6347 Parnell-PM-9, Chicago 21, Illinois.

MAIL Order business—Your opportunity. "How to Build Your Own Mail Order Business." Beginner's idea-book tells "how." 25c postpaid. Promptly refunded if not satisfied. Albert Zimmer, 206 Central Ave., Lockland 15, Ohio.

MAKE \$6.73. You sell one—and they're amazingly easy to sell! We have new adding machines in original factory cartons you can sell for only \$14.95 and you make 45%. They're executive model portables, precision built with automatic clearance, direct subtraction, fully guaranteed. Send for life size color photo with full details. Write today to Lightning Adding Machine Co., Inc., Dept. P-21, 1260 West Second Street, Los Angeles 26, Calif.

OPERATE "Escalator" mailorder system, selling our products or any products. Fastest, most revolutionary mailorder system known. Write: Selbyco, Decatur 160, Ill.

FREE Formulas and instructions for making newest big profit perfume specialties from tap water. DeCasto of Hollywood, P.O. Box 447, Hollywood 28, Calif.

HOME Business opportunity mailing literature to new mothers. Everything furnished. Big earnings. Orders filled. Delray, Box 3852M, Columbus 13, Ohio.

OPERATE Profitable mail order business. \$1.00 for sample and instructions. Ellison, 409 Hazel Street, Warren, Penna.

SMALL Bowling alleys earn big money. Easy. Square, Excelsior, Minn.

THROWN Away! Tons of ground rubber by recappers. Make it into plastic rubber of 1000 uses. Easy. Inexpensive. Start profitable business. Instructions, samples \$1.00. Ceeten Products, Cornelia, Ga.

START Your own mail-order business; on small capital. Proven plans. Write for interesting literature. Metro, Box MP-1794, Houston, Texas.

NEW Kind mail order home work! Carry no merchandise. No selling, manufacturing, experience, advertising investment, capital necessary. Eye-opening proof 3c stamp. S. Torrey, Melrose 76, Mass.

MAKE Perfumes at home. Write, "Carey Laboratories," 1914 Chouteau PM-9, St. Louis 3, Missouri.

FROM Basement to big time—In four years I went from basement lathe models to \$120,000 gross sales per year. I could have done it in two years if this booklet I am offering you on how to do it had been available. It covers development, manufacture, sales, finance and business records. Send \$2.00 today for what cost me \$20,000 to learn. Send now to Clay Manufacturing Co., Box 199, Northfield, Minn.

MAIL Selling opportunities galore! Free! Wehner, Box 142-A, Roxbury 19, Mass.

HOW And where to obtain capital? Free details. Star Service, Wapakoneta, Ohio.

OPERATE Profitable mailorder business. Write Jasco, 2623-M Columbus, New Orleans 19, Louisiana.

MAKE Money from newspaper clippings. Siegel, Box 183 PM, New York 2.

START Home mailing business. Little capital required. Instructions telling how, 25c (refundable.) Siwaslian, 4317C Gleaner, Elmhurst 73, N. Y.

POPCORN Poppers, peanut roasters, candy floss. Sno-Konette, Northside Co., Indianola, Iowa.

EARN 400% Selling attractive low priced watches. Free salesman's sample. Result Sales, 580 Fifth Ave., New York 36A.

WATERLESS Hand cleaners. Highly profitable home mailorder and mfg. business. Simply add water to concentrates or ready-packed under your own label. Everything furnished. Western B Aircraft, Los Angeles 19.

START Business without capital! Reliable. 15-A Park Row, New York 38, N. Y.

SMALL Investment in Artkote molds puts you in \$5.00 hour stone facing business. Sample mold \$2.00. Dividend Company, Liverpool, N. Y.

FIX Typewriters. Free booklet describes our modern, inexpensive home-study course. Factory methods taught. Write: Typewriter, 8915 Corbet, Tarentum, Penna.

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300% PROFIT Or more. Send for pattern to make wallet from 1 pc. of leather. No sewing. Scissors and pattern needed only. \$1.00 check or money-order. S.E.B., Box 33, Westville, N. J.

SELL By mail to automobile owners. Millions of prospects. Fast selling items. Everything furnished. Write: Eastern, Box 142-P, Dorchester 24, Mass.

MUSHROOMS Grown. Boxes, barrels. Manureless process 50c. Spawn \$1.00. Gordons, 553 William, Winnipeg, Manitoba.

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BIG Profits making new greaseless doughnuts. Start in kitchen. Wholesale to grocers and cafes. Free plans. M. Ray Company, 3605 South 15th Ave., Minneapolis 7, Minnesota.

REPRESENT US in your area. Write for descriptive folder. International Trading Center, 1900 Euclid, Cleveland 15, Ohio.

AMAZING. Refinish auto dash. Grain appears like magic. Details free. Modern Aids, 248 So. Main, Jamestown, N. Y.

BIG Money and fun growing live miniature Ming trees on your window sill. Write for free rare tree seed and plan. National Nursery Gardens, 8463 South Van Ness, Inglewood 4, California.

SEA-Shells for making gifts, novelties, jewelry. Catalog 10c. Instruction book of 155 photographed designs \$1.10. Giftrcrafts, Box 4550-PX, Coral Gables, Florida.

MAKE Your home workshop pay up to \$6.00 hourly for your spare time. Even more with wife's help, and she'll love it! Details free. The Old House, Box 8, Spring, Texas.

FLEXIBLE Rubber moulds for plaster and Marble figurines. Sample and large illustrated catalog 25c, refunded on first order. K-C Novelties, Dept. 23, Easthampton, Mass.

MAKE Money spare or full time, casting metal toys and novelties. Big wholesale and chain store demand for autos, soldiers, ashtrays, banks, etc., keeps manufacturers busy. Production moulds furnished for up to 100 and more castings per hour. No experience or special place necessary. Write for information and illustrations of patterns needed. Metal Cast Products Co., Dept. A, 1696 Boston Road, New York 60, N. Y.

EARN Money at home with your typewriter! Spare time! Details free. Edwards, Publisher, 3915-PM 12th, Des Moines 13, Iowa.

WHY Not make extra dollars repairing zippers? Excellent profits uncrowded field. Details free. Texas Specialty Company, 204-B Texas, Texarkana, Texas.

FREE Folder—100 ways to make money in silk screen printing. National, Box 88-PM, Dorchester 22, Mass.

SELL By mail to women—Real merchandise. Everything furnished, orders filled. Big profits. Charles, Box 32-S, New York 63, N. Y.

START Mailorder bookshop—Build your future. 25c brings booklet, samples, exciting ideas. General Publications, Ossining, New York.

START A Venetian blind laundry. Profit opportunity for lifetime business. New machine method. Free booklet on request. F. C. Co., 442 N. Seneca, Wichita 12, Kans.

MAKE Tough, durable plastic—1c pound. Makes attractive floors, walls, built-ins, roofs. Build good home, \$150.00 room. Bays Laboratory, Oklahoma City 9.

LIQUID Molding rubber, \$2.95 quart, \$9.95 gallon prepaid! Plastercraft Supply Company, 3051 St. Clair Ave., Cleveland 14, Ohio.

NEW Exceptionally profitable plans, ideas for home operated mail business. Rush name. Miller, 1772-P Carlyon Road, East Cleveland 12, Ohio.

MAKE Flexible molds! Cast plaques, bookends, figurines! Free sample! H. Tooker, 630-R Chestnut, Hamilton, Ohio.

21 POPCORN, Candy apple formulas, proven money-makers. Send \$1 today for formulas, catalog of money-making ideas. Concession Supply, 3916 Secor, Toledo, Ohio.

RECAST Old batteries into new. Latest achievements. Battery Laboratories, Minneapolis.

READ "Advance"—The voice of mail order. Offers money-making opportunities, sources of supply, personal guidance, etc. Issued monthly. Sample copy 35c. Yearly subscription \$2.00. Advance Publishing Company, 313 East 21st Street, Suite 450, New York 10, N. Y.

BOOKKEEPERS—Earn \$5000 yearly part time. Sell, operate new sensational CPA bookkeeping service. Kern, 4942 Vineland, North Hollywood, Calif.

GOOD Paying business silvering mirrors, plating autoparts, reflectors, bicycles, bathroom fixtures, etc., by late method. No tanks or shop required. Outfit furnished. Free booklet. Gunmetal Co., Ave. H, Decatur, Illinois.

POPCORN And potato chip equipment. Long Eakins Company, 5260 High, Springfield 99, Ohio.

BUY Wholesale. Thousands articles. Supply directory, 10c. Idealco, Park Ridge, Illinois.

EARN Extra money! "Homeworker Magazine" tells how. Sample 25c. Sizemore, Box 7, 4917 Kostner, Chicago 30.

BOOKKEEPERS, Keep books, small firms spare time. Manual latest technique by C.P.A.. \$3.00. Modern Business, Box 406, Youngstown 1, Ohio.

FREE Book "505 Odd, Successful Businesses." Work home! Expect something odd! Pacific, Oceanside, Calif.

46 FROM Square foot plywood; jigsaw necessary. Write: Woodarts, Bridgewater, Mass.

EXTRA Money—No selling, operate vendors. Amazing profits, details free. Silver King, Suite 220, 622 Diversey, Chicago 14.

BUY It wholesale! Manufacturers, distributors offer 850,000 items. Literature free. Olsen, 1231-A East Third St., Duluth 5, Minn.

EARTH WORM Breeding? First, get unusual story. "An Earthworm Turned His Life." Free. Earthmaster, Dept. 14, El Monte, Calif.

INCOME From local information. No selling. Write Neherco, La Verne, Calif.

UNPAINTED Bookends, plaques, statues, figurines. List. Haverty Products, 822-17th St., Altoona, Penna.

OPERATE Profitable mail order business. Write Walter Service, 4159-A East 112th, Cleveland 5, Ohio.

DOLLARS in personalized baby record books. Sell by mail. Use same literature we do. No-Co-Ro, Oakland 6, Calif.

MADE \$24,500 Using money making plans from Schemer Magazine, world's oldest mailorder publication. Box 275M, Canfield, Ohio. Year \$2.00. Sample 20c.

MINK Raising information free. Complete. Lake Superior Mink Farm, Superior, EE1, Wisconsin.

COPUBLISH Leading m.o. paper. Latest copy Mail Sale Advertiser, details, dime. Vanroy Shirk, Lebanon, Penna.

COLORGLAZED Concrete pottery made without molds. Patented method. Cemetery products, novelties, tiles. Basement leak-sealing. Money-making projects. Booklet, details free. Men only. National Potteries Company, Grand Rapids, Minnesota.

MONEYMAKING OPPORTUNITIES

BE Independent, be secure, have your own profitable business—Earn \$20.00 and more a day making beautiful, fast-selling lamps at home. No equipment needed. Illustrated course teaches you quickly. Course, parts catalog, wholesale price list—only \$2. Gearon Co., Dept. 200-B9, 27 S. Desplaines, Chicago 6, Ill.

START Home candy kitchen. Interesting information free. Schenck, 717-P W. Penn. Butler, Penna.

SELL Titania gems. \$9.75 carat wholesale. More brilliant than diamonds. Free catalogue. Diamonite, 1404-M Mitchell, Oakland 1, Calif.

WHOLESALE. Hundreds nationally advertised utilities, Bulova, Remington, Dornier, etc. Save 30% up. Illustrated catalog \$1.00 (redeemable). Modern Wholesale, Columbus, Kansas.

MAKE Money with a typewriter. Complete information 50c. Claude Wiese, 1516 Franklin, Waterloo, Iowa.

PROFITS—Free radio advertising. Pay commission only on orders received. Over 400 radio stations active. Free information. Mishek, 2, Wasaca, Minn.

\$200 WEEKLY Reported! No selling. Free booklet. T. J. Surface, Roanoke 4, Virginia.

START A buying service. Buy wholesale thousands nationally advertised products. Make big profits selling at sizeable discounts. Send postcard for details. American Buyers Service, 631-PM Linden, Buffalo, N. Y.

SELL Printing by mail! We fill orders. Free plans, samples. Sutton Printing, Box 853-G, Waycross, Georgia.

DIME Brings latest money-making opportunities. Satisfaction guaranteed. Floyd Huff, Box 291, Russellville, Arkansas.

GET Into mail order. It's fascinating. It's fun. It's highly profitable. Start at home in spare time. Details free. Lewis Bartlett, Richland, Georgia.

START A profitable subscription business in spare time! We need men and women (young or old) as representatives for all leading national magazines. Liberal commissions paid for new and renewal subscriptions. Start earning money in this pleasant work at once! Clip this ad and send with your name and address to: International Circulation Division, Dept. PM, Hearst Magazines, 250 W. 55th St., New York 19, N. Y.

HOW To get your mail order advertising free revealed by famous expert. Also other "inside" secrets. Free details. Benson Barrett, 1751-A2 Morse, Chicago 26.

WIN Contest money. General Contest Bulletin gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests, 1609½ East 5th, Duluth, Minnesota.

CREW Managers—Big profits handling \$3.95 photo enlargement deal. Allen Studio, Riegler Bldg., Little Rock, Ark.

SCHOOL Seniors—Sell classmates America's most beautiful graduation name cards. Largest selection. Highest commission. Outsell all others. Free sample kit. Printcraft, Dept. M, 1509 Maple St., Scranton 5, Penna.

BOYS Earn \$3.00 an hour on the streets in your town. Send 50c for complete detailed instructions to Brown, 4840 Washington Street, Downers Grove, Illinois.

\$10,800 PROFITS! Your own mailorder business! No capital risk! "Success plan" (worth \$2) free! Write today! Treasury, 149 Storer, New Rochelle 3, New York.

GET Into wonderful mail-order business. Orders filled free. Send 10c (refundable) for sample literature, details. Paragon, Box MP-2194, Houston, Texas.

MONEY in screen printing, selling, religious mottoes. Get info. Joseph Jones, Box 321, Meridian, Mississippi.

MAKE Money using your telephone! Book tells how. Profitable spare or full time work. For housewives, disabled persons, salesmen, etc. Send \$2.00 for "How to Telephone and Make Money" to How-To Publishing Company, 544 Market, San Francisco 4, California.

595 MONEY Making secrets. Send stamp. Book Service, P.O. Box 453, Port Chester, N. Y.

TIE-Breaker picture puzzles exposed, \$2.00. Wenograd, Box 1495, Philadelphia 5, Penna.

CHURCHES, Clubs, organizations, receive \$130.00 plus 12 card tables free. Unique Gift Plan, Pine Hill, New Jersey.

SCHUHMACHER Matmakers. Convert old tires into dollars. Devote full or spare time. S and S Patents, Inc., 1307 North Clark St., Chicago 10, Ill.

GET Money making offers. All parts United States. Trial listing 10c. 3 months 25c. year \$1. Powell, 5713-A Euclid, Cleveland 3, Ohio.

EARN Money evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle 1, Wisconsin.

MAKE Money—Sewing and assembling at home. Liebig Industries, Beaver Dam 10, Wisconsin.

BRAND New sure fire money maker. Write Post-Rite, Box 802, Sioux Falls, S. Dak.

\$100-\$200 WEEKENDS No selling or manufacturing. Brennan, 4025-Z Lanker-shim, North Hollywood, California.

50,000 ARTICLES Wholesale. Source directory, dime. Nelko, Box 3462-DR, Chicago 54.

FREE Book "505 Odd, Successful Businesses." Work home. Expect something odd! Pacific, Oceanside, Calif.

BE Appointed State Notary Public now! Details: Stationers, Helotes, Texas.

PUBLISH Your own magazine. Hand-some 52 page format, well edited, illustrated. Cost low as \$1.00 month. Brings you prestige, profits. 25c brings sample details. National, Ord, Nebr.

READ Progressive Mailtrade, the magazine that tells how to make money by mail. Dime brings sample and special offer. Progressive Mailtrade, Box 357, Sheboygan, Wisconsin.

BE The Popular Mechanics representative in your neighborhood and earn big profits in your spare time. Write Popular Mechanics Magazine, Room 408M, 200 E. Ontario St., Chicago, Ill.

FORMULAS, PLANS, ETC.

BRAND New, spectacular chemical and fireworks experiments manual. Complete set-ups, instructions \$1.00. Chemi-Technix Laboratories, 568N Riley Street, Buffalo 8, New York.

500 FORMULAS And recipes. Riches in recipes. Tried and tested processes for home, factory and workshop. 25c postpaid. Allen, 427-FP, Clinton, Missouri.

AMAZING Values. Best, latest formulas. Catalog free. Nelko, 3462-P Merchandise Mart, Chicago 54.

PRODUCT Analysis, mfr'g formulas—processes developed. Plastics, Box 1574, Boston 4, Mass.

BOOK—19,000 Formulas, processes. \$3.98 postpaid. Free literature. K. Paullin, Loudonville, Ohio.

LATEST And best in modern manufacturing formulas since 1897. Lists free! Miller, 1517-A, Tampa, Florida.

MODERN Manufacturing formulas. Jack, Chemist, 5138 Gainor Road, Philadelphia 31, Penna.

REAL Manufacturing formulas. Lists free. Cummings, Chemist, Gordon Ave., Syracuse 4, N. Y.

FORMULAS; All kinds. Latest, best. Literature free. Kemixal, Park Ridge, Ill.

TESTED Formulas. Interesting descriptive booklet free. Pont, Box 635-PM, Terre Haute, Indiana.

PLASTICS

INTERNAL Carvers increase profits, make television or night lights. Now available, plastic lamp base completely wired, with slot in top to illuminate your carved plaque. Available in opaque black, translucent ivory or pink. Send for sample and prices, \$1.25 postpaid. Arata, Roberts and Browse, Inc., Box 576, Fair Lawn, N. J.

NEW Liquid casting plastic. Clear, colors. Embed flowers, insects, coins. Saw, drill, carve. Send 25c for wholesale catalog and new sales manual showing how to make money at home. Castolite, Dept. K-101, Woodstock, Illinois.

10 LBS. Plexiglas for \$5. Assorted sizes and thicknesses of clear and colored Plexiglas shipped express collect. Send \$5 with order to world's largest plastic sign manufacturer. Neon Products, Inc., Lima, Ohio.

PLASTICS, Lucite, Plexiglas, acetates, complete supplies. Retail-wholesale prices. Catalog 10c. Gem-O-Lite, Box 686Q, North Hollywood, California.

PLASTIC, Sheets, rods, tubes, etc. Free list. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

LUCITE, Plexiglas. Any size sheets, masked. Square foot (12 x 12) cost, 1/16". \$1.20; 1/8", \$1.40; 3/16", \$1.75; 1/4", \$2.08. Include 10% postage. Almac Plastics, 230 Fifth Ave., New York 1, N. Y.

CHEMISTRY

SAVE Money! Supply catalog 20c. refundable. Laboratory Sales, Box 161-E, Brighton, Mass.

LABORATORY Apparatus, chemicals, microscopes, complete chemistry sets, minerals, uranium ore. 10c brings catalog. Porter Chemical Company, Hagerstown 1, Maryland.

BRAND New, spectacular chemical and fireworks experiments manual. Complete set-ups and instructions \$1.00. Chemi-Technix Laboratories, 568N Riley Street, Buffalo 8, New York.

AMAZING New book of science. Experiments, formulas and catalogue of laboratory supplies. Only 25c. National Scientific Co., Dept. 16, 2204 W. North Ave., Chicago 47, Illinois.

NEW Idea chemical and apparatus outfits for home experimenting. Photo-scales, microscopes, chemicals, biological and laboratory supplies in small quantities. Catalog 25c. Established 1931. John H. Winn, 124A West 23rd Street, New York, N. Y.

CHEMICALS And apparatus for industrial, analytical, and private laboratories. Catalog 20c. Dept. M-50, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N. Y.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology. 10c. Tracey Laboratories, Evanston, Illinois.

HELP WANTED

TIRED Of no money, second rate jobs? Like to start a real career with a lifetime of high salaries? Write me about two growing fields that need men. Ed Howes, Dept. 292, 456 W. Santa Barbara Ave., Los Angeles 37, Calif.

NEW Bathroom deodorizer. Hangs on wall. Banishes odors bathroom, kitchen. Lightning seller. Samples sent on trial. Kristee 175, Akron, Ohio.

AGENTS WANTED

WOMEN! Men! Make extra money in your spare time. No house-to-house canvassing required. New car given as bonus. Amazing nylons guaranteed as long as 9 months depending on quantity, against runs, snags, holes, or replaced free. Rush name and hose size for simple money making plan. Lowell Wilkin, 1729 Wash., Greenfield, Ohio.

PHOTO-Salesmen, agents. Sell beautiful hand colored plastic enlargements and sensational new photo compacts, rings, bracelets, lockets, etc. Collect deposit, we deliver. Profitable sideline. Send card for free sample kit. Novel Portrait Co., 3343 North Ave., Chicago, Ill.

NEW Plastic mending tape. Just press on! Repairs clothing instantly. Lightning seller. Samples sent on trial. Kristee 152, Akron, Ohio.

CASH In on your spare time! Sell beautiful new Regal Christmas greeting cards and gift assortments. No experience necessary. Costs nothing to get started. Show wonderful samples to friends, relatives, neighbors. Merely take orders and pocket up to 100% profit. Write today for samples on approval. Regal Greetings, Dept. 103, Ferndale, Michigan.

JOBBERs And agents wanted. Metaiglas—The marvelous multiple purpose cleanser and polish that has revolutionized cleaning problems. Samples and attractive prices sent on request. Belvidere Laboratories, Belvidere, Illinois.

EXTRA Money! Make up to \$1.00 a box selling amazing value Christmas, all occasion greeting cards, gift wrappings, gifts. Bonus. Surprise offer. Experience unnecessary. Request feature samples on approval, free samples name imprinted Christmas cards, stationery, napkins and free catalog. New England Art Publishers, North Abington 719-A, Mass.

\$1 STARTS You in business. Sell fine \$1 ties. \$1.50 and up values only \$7.20 dozen, you make \$4.80. Send only \$1 for 2 sample ties. Catalog free. Philip's Neckwear, Dept. 949, 20 West 22nd Street, New York 10.

DOUBLE Your income. Sell both guaranteed nylons and Christmas cards. Even beginners make big money with this unbeatable line Fanmour greetings, imprint stationery, napkins, children books, gifts and hosiery. Free samples of imprint greetings and catalog. Complete selling outfit on approval. Fanmour, 200 Fifth Avenue, Dept. PM-9, New York 10.

MAKE Extra money—For yourself, club or church. Up to 100% profit selling big value Christmas, all-occasion greeting card assortments to friends, others. 7 leading 21 card \$1.00 boxes, religious and novel cards. Gift wrappings, ribbons, stationery, napkins, animated books, sewing kits, unusual gifts. Over 150 items. Bonus plan. Experience unnecessary. Write for samples on approval. Special offers. Hedenkamp, 361 Broadway, Dept. PM-24, New York.

WHOLESALE Catalogue! Nationally advertised appliances, radios, watches, etc. Cam Company, 1717—58th St., Brooklyn 4, N. Y.

AMAZING Big profits selling exclusive Sunshine Christmas cards. Nationally famous 21 for \$1.00 assortment is unequalled, sells on sight. Other tremendous Sunshine values: merry holly-day, nature prints. Park Avenue kromekotes, scripture text, gift wraps, stationery, etc. Send for samples on approval. Earn big money now! Sunshine Art Studios, Dept. PM-9, Springfield 1, Mass.

BIG Profits selling ties. \$2.00 values, \$6.50 dozen. Free catalog. Empire Cravats, 648 Broadway, New York 12.

TAKE Large unit orders for wool uniforms, caps, shirts, ties, wallets, personal initialed buckles with belts, cap badges, 3000 emblems. Send for free outfit now! Hook-Fast Co., Dept. PM, Roanoke, Va.

WANTED—Salesman sell nationally advertised mdse. Televisions, radios, appliances, housewares, watches, jewelry, silverware, other gift items. Arco Sales Company, P.O. Box 6187, Sta. B, Albuquerque, N. M.

CALL On friends with sensational Christmas cards in handy assortments. Price, \$1.00. Profit up to 50c. Also popular-priced personal Christmas cards, everyday assortments, etc. Samples on approval. Wallace Brown, Dept. R-4, New York 10, N. Y.

APPROXIMATELY 100% Profit. Success depends on your ability, energy. Experience preferable. Pas-Cal Vitamin-Mineral Products, Box 203-F, Altadena, Calif.

AT Last! Something new and sensational in Christmas cards. Make extra money fast! Show satins, velours, metallics. Gets easy orders. Pays up to 100% cash profit. 30 free samples. With name 50 for \$1.25. Big line. Amazing new glo-in-the-dark ornaments, personalized matches, stationery. Several \$1.00 boxes on approval. Puro Greetings, 2801 Locust, Dept. 240-L, St. Louis, Mo.

EASY Profits selling printing! Large catalog free. Nationwide Printing Company, 2337 Bath Avenue, Brooklyn 14, N. Y.

MAKE \$1000 With reproductions of famous perfumes. Write Perfumers 49, Box 5334, Chicago 80, Illinois.

NEED Money? \$50.00 yours, sell only 100 boxes new Xmas cards. Other amazing offers. Free samples imprinted cards. Feature box assortments on approval; over 100 profitable items. Work with a national leader. Pen-'N-Brush, Dept. PM-9, 139 Duane St., New York City 13.

HIGH School and junior high school students earn big profits taking subscriptions to Hop Up magazine. Hot rods, customs, galore! Free details or send 20c for details and sample copy. Hop Up Magazine, Room 116, 530 West Colorado, Glendale, California.

CHRISTMAS Card money-makers! Everybody wants new 25 for \$1.50 gold-name cards. Cash in big. 161 fast-sellers. Profits to 100% on \$1 boxes; gift bonuses. 4 assortments on approval; imprints free. Creative Cards, 2505 Cermak, Dept. 115-C, Chicago.

BIG Profits selling magic glass cleaner. It's better. \$3.00 per case. R. E. Stiely, Millersburg, Penna.

WANTED—Purchasing agents. No money or experience required. Write Dept. C, Purchasing Manager, 2719 Lawrence, Chicago, Ill.

JUST Out! New thrilling sensation in Christmas cards. Make big money! Show lustre foils, satins, brilliants. Amazing values bring easy orders! Magic glo-in-the-dark ornaments, personalized stationery, matches. 30 free samples. With name 50 for \$1.25. Several \$1.00 boxes on approval. Joy Greetings, 507 N. Cardinal, Dept. 60-C, St. Louis, Mo.

VALUES Galore—100 blades 45c. Gross needlebooks \$4.80. Automatic cigarette lighters \$7.20 dozen. Fullsize 25c ballpens \$8.40 gross. Bargain catalog 5001 items free. Cutrate wholesalers since 1916. Mills Sales Co., 26 West 23rd St., New York.

BE A money maker. Represent magazines year around. Wonderful home work. Big Christmas profits now. Liberal commissions. Everything furnished. Write for free catalog. McGregor Magazine Agency, Dept. 500A, Mount Morris, Ill.

FAST Selling household gift items. Big profits. Tydor, Whitesboro, New York.

MAKE Money introducing world's cutest children's dresses. Big selection adorable styles. Low prices. Complete display free. Rush name. Harford, Dept. H-3341, Cincinnati 25, Ohio.

GLOW-In-the-dark Santa Claus, safe, plastic toy or tree ornament. Deluxe engraved note paper. Other novelties. Sample assortments 50c or \$1.00. Matsonian Co., Northboro, Mass.

BIG Profits selling genuine wooden nickels. Samples, wholesale prices—35c. Berkie, 1125 Fulton, San Antonio, Texas.

SELL Finest nylon hosiery. Guaranteed against everything, snags, runs, holes. Demonstration kit free to you with actual sample stocking. American Mills, Dept. 401, Indianapolis.

SELL Big money maker to men and women. Easy handwork makes fast-selling useful articles. Sample free. Sunmade Company, Brockton 64, Massachusetts.

BIG Profits in spare time! Ambitious men-women who need money. Get assortment full-size samples fine foods, household necessities. Friends, neighbors buy eagerly. Send for free details. Just write Blair, Dept. 31HS, Lynchburg, Va.

ABSOLUTELY Free! Big package actual sample fabrics and style presentation of dresses, lingerie, hosiery, etc. Take orders. Commissions big. Send no money. Melville Co., Dept. 7552, Cincinnati 25, Ohio.

HUGE Profits. Assemble rhinestone jewelry. Sample kit \$1.98. You sell for \$6.50. Wholesale catalog 20c. House of Hobbies, Box 790R, Evanston, Ill.

HOTTEST Seller ever! Get in on the ground floor! Huge profits await you as our agent selling full or part time new nationally advertised top quality Pennsylvania saw sets. Tempered steel saws for every use—all on one handle. Hacksaw, crosscut, frozen meat and bone saw, pruning saw, keyhole saw, dovetail saw, all on one handle. Tremendous value everyone can use, everyone wants! Sells on sight! Send for free illustrated catalogue. James R. Barnet Co., Dept. M, Box 188, Wellesley Hills, Mass.

CARDED Mdse. headquarters—Also agents' supplies; aspirins, combs, handkerchiefs, pocket knives, pipes, shoe laces, razor blades, nylons, novelties. Over 1000 items. Write for price lists, Maloney & Sons, 1063 W. Broad St., Columbus 8, Ohio.

\$21.60 IS Yours for selling 144 educational toys. Plastic. Sample 10c. Radio Code Whistle Co., 1259 Westlake Ave., Cleveland 7, Ohio.

BUY Wholesale thousands nationally advertised products at big discount. Sent free "The Wholesale Plan." American Buyers' Service, 627-PM Linden, Buffalo, N. Y.

SCHOOL Seniors—Earn sensational profits selling classmates America's most beautiful graduation name cards. Largest selection. Out sells all others. Free sample kit. Printcraft, Dept. M, 1509 Maple St., Scranton 5, Penna.

THEY Sell like hot cakes on a cold a.m. An easy \$25-\$50 day. More than "160" top selling, eye appealing "Xmas and all occasion" greeting card assortments. Every stop a push-over for sales and repeats. Line includes Xmas cards, gift-wrap sets, personalized stationery, notes, napkins, wide selection fine gifts and costume jewelry. We're sure and confident, that's why our sensational exclusive credit terms to outstanding producers. Write to-day for profit-making "on approval" kit. Modern, 71-A1 Fanshaw, Yonkers 5, N. Y.

SELL Nationally advertised merchandise. Catalog 25c. (Refunded first order.) Ellison, 409 Hazel St., Warren, Pennsylvania.

AMAZING Quick easy cash is yours. No selling necessary, just show Rainbow's beautiful Christmas card assortments. Children's books, gifts, novelties, personalized stationery, napkins, etc. Save friends, relatives, etc., time and money. No investment. Deal with one of New York's largest imprint companies for guaranteed satisfaction. Costs nothing to try. Write today. Samples on approval. Rainbow, 34 E. 1st St., New York 3.

BIG Profits hand made ties \$6.25 dozen. Information free. General Products, 11 North Pearl, PM2, Albany 7, N. Y.

MEXICAN Feather pictures. Christmas novelty. \$1.00 (stamps) brings \$2.00 worth samples. Refunded if unsatisfied. Aztec Art, Apartado 762, Mexico City.

GET Into toys! Big money! Show free toy-gift line full or spare time. Take orders, pocket juicy profits. Styleco, Dept. E283, Cincinnati 10, Ohio.

NATIONALLY Advertisd vinylite plastic raincoats. Men's, women's. Samples \$2.50. Yale Clothing, Meriden, Conn.

MAKE Wedding profits. Sell invitations, napkins, matches. Samples free. Dunbar's, Middlebush 3, N. J.

DO You need money? \$35 is yours for selling only 50 boxes of our 300 Christmas card line. This can be done in a single day. Free samples: Other leading boxes on approval. Many surprise items. Experience unnecessary. Free samples personalized Christmas cards, stationery, napkins. Write today. It costs you nothing to try. Cheerful Card Co., 10 White Plains, New York.

PRINTING—Salesbooks, envelopes. Free illustrated catalog. Ersco, Dept. PM, Bronx 72, N. Y.

QUICK Extra cash! Sell America's outstanding line of Christmas box assortments and personalized lines. Plus hundreds of extra profit items. Monogram playing cards, wedding invitations, gift items, deluxe album of exclusive cards, nylon hosiery. Write today for 60 free samples in six beautiful portfolios. Gift catalog included. Elmcraft Chicago, Dept. 3, 5930 S. Western Ave., Chicago 36, Ill.

BIG Bargains! Terrific profits! Selling new-used clothing. Suits \$1.75, pants 35c, topcoats \$1.00, dresses 20c, shoes 20c. As little as \$25 starts you. No experience necessary. Free wholesale catalog. Superior, 1250-A Jefferson, Chicago 7.

NEED Extra cash? Free sales kit. Sell personal initialed buckles with belts, cap badges, tie clasps, etc. Choose from 3000 emblems. Hook-Fast, Box 1425PM, Providence, R. I.

SHINE Shoes without "polish." New invention. Lightning seller. Shoes gleam like mirror. Samples sent on trial. Kristee 150, Akron, Ohio.

MEXICAN Feather pictures. Sell on sight; 200% profit! Free details. Sample 20c stamps. (No coins). Sylviap, Apartado 9036, Mexico City.

AGENTS — 300% Profit selling genuine gold window letters; stores and offices. Free samples. Metallic Sign Letter Co., 431-D North Clark, Chicago.

MEXICAN Feather pictures. High profit! Fast sellers! Adelphi, Box 57-B, Bellerose 6, N. Y.

GOLD Lacquered and silver sign letters. Windows, doors, trucks. Standard sizes. Penny and up samples. Atlas-P, 544 West 79th, Chicago 20.

YOUR Own business—Used suits \$1.50; topcoats 50c; shoes 12 $\frac{1}{2}$ c; ladies' coats 30c; dresses 10c. Enormous profits. Catalog free. Moro, 558-AA Roosevelt, Chicago 7.

CALIFORNIA Sweet smelling beads. Sensational sellers. Free particulars. Mission, 2328PM West Pico, Los Angeles 6, Calif.

\$50 WEEKLY Selling finest razor blades, other items. Free details. Edisans, Box 274, Far Rockaway, N. Y.

MAKE Tremendous profits with fast-selling costume jewelry! Buy direct! Sell your friends, neighbors and customers at big savings to them! Write for our free catalog! Penn Jewelry, Dept. P, 826 W. Lacka., Scranton, Penna.

EXCELLENT Sideline for printing and advertising salesmen. Decalcomania name plates in small quantities. Great demand. Also, make money with our line of automobile initials and sign letters. Free samples. "Ralco" XL-Roxbury, Boston 19, Mass.

AGENTS: Stamping names on key protectors. Sample 25c. Stamping outfits, checks, social security and name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

SALESMEN, Distributors, fast selling costume jewelry direct from factory. Big picture catalog, free. Pickcraft, M19 Bank, Attleboro, Massachusetts.

HIGH-GRADE SALESMEN

EASY-To-sell, nationally advertised wheel balancer. A huge market. Every service station and garage wants it. You make \$19.75 to \$24.00 per sale. You can earn up to \$86 a day easily. No experience necessary. Write Precision Engineers Company, Department 10, 701 Heinz Avenue, Berkeley, California.

WANT To make real money? You can positively make \$50.00 a day and up selling a brand new item going to every type of food and beverage store, factories, laboratories, hospitals, etc. First time advertised. Samples furnished. Utility Dura-wear, 53 West Jackson Blvd., Dept. PM-9, Chicago, Illinois.

ANYONE Can sell Hoover DuPont nylon uniforms for beauty shops, waitresses, doctors, nurses, others. In white and colors. Exclusive styles. Top quality. Low priced. Exceptional income. Real future. Equipment free. Write fully. Hoover, Dept. E-100, New York 11, N. Y.

GET Into million dollar work clothes business. Earn big money now, unlimited future! Sell finest-quality embroidered uniforms and work clothes to factories, garages, everybody! Huge profits possible. No experience needed. Gorgeous selling kit, actual fabric samples, including miracle Orlon! Everything free! Write Topps, Dept. 539, Rochester, Indiana.

A Postcard can put you in business! Complete line. Leather jackets, 151 shoe styles. Big commissions. No experience, no investment. Send postcard for free outfit. Mason Shoe Mfg. Co., Dept. MA-9, Chippewa Falls, Wisconsin.

ADVERTISING Book matches—Cash in on big demand; sell union label matches. Cuts for all businesses and political parties. Free powerhouse selling kit, low prices, protection guaranteed on repeat orders. Cash commissions. Superior Match Co., Dept. M-952, 7530 Greenwood, Chicago.

CALENDARS, Advertising novelties, matches. All styles, including religious, varnished, 12 sheet, girls. Hundreds of advertising novelties, book matches, etc. Fleming Calendar Co., Sales Division, 6539 Cottage Grove, Chicago 37, Ill.

MAKE Big money—Season starting. Sell 1953 calendars, advertising specialties and executive gift line. Experience unnecessary. Commissions advanced. Outfit free. North American Calendar, 605-AA Washington, Chicago 6.

MONEY Making opportunity! Take big profit orders for world famous patented varieties fruit trees. Also flowering shrubs, roses, vines. Big sales outfit free. Stark Bro's., Desk 30193, Louisiana, Missouri.

SALESMEN—Get happy! Hundreds different things to sell; all details free! Write what you sell now; what you'd like to sell. Your mail box will run over! Salesmen's Service, Drawer 8711, Fort Worth 12, Tex.

IS \$210 A week worth a postcard to you? Then rush card with name and address for special free trial plan that sells amazing new automatic refrigerator defroster "like hot cakes!" Write to Mr. Lewis, D-Frost-O-Matic Corp., Dept. M-102, 173 W. Madison, Chicago 2, Ill.

AD Matches! Sell amazing designs—20, 30, 40 and 240-light book matches. Bigger spot cash commissions; every business a prospect. Low prices for high quality. Repeats. Start without experience; men, women; full, part time. Buy nothing! Sales kit furnished. Match Corp., Dept. PM-33, Chicago 22, Illinois.

HOT Special. Power mower—\$36.00. County agency. Rotacut-RP, Excelsior Springs, Mo.

WRITE 3 Words—Collect \$7.65 on 10-second demonstration to merchants. Write on glass with amazing magic crayon—Presto! 5 color advertising message takes fire, glows like brilliant neon. Three sales daily bring \$22.95 profit. Rush postcard for details. Complete sales kit, free! Maxilume Co., 125 W. Hubbard, Dept. CL-8-F, Chicago 10, Illinois.

MAKE Money with fast-selling Bostonian shirts. Blouses too. Spare time, full time. Sales kit free. Bostonian, 89 Bickford, Dept. R-10, Boston 30, Mass.

BEST Source for nylons. Rich Co., 215 W. 98, New York 25.

NEW Jobs open in selling! Send name, address for five free issues of Opportunity Magazine's money-making guide, listing hundreds of companies who'll pay you well, full or part-time. No experience needed. Opportunity, 28 E. Jackson, Dept. 17, Chicago 4, Ill.

EDUCATIONAL AND INSTRUCTION

COURSES: Computing machinery, mathematics, small robots, logic, writing, statistics, etc. Individuals or study groups. Scholarships. We have students in 37 states, 10 countries. Free announcement. Berkeley, 19 Milk Street, R42, Boston 9, Massachusetts.

BECOME An accountant. No previous bookkeeping experience required. We train you at home spare time, low cost. Ask for free booklet, "Accounting, the profession that pays." LaSalle Extension University, a correspondence institution, 417 South Dearborn Street, Dept. H974, Chicago 5, Ill.

ANNOUNCING Home study course in commercial baking. Practical basic training. Good field for those with aptitude. Nearly depression proof. Send for free booklet, "Opportunities in the Baking Industry." National Baking School, 835 Diversey Parkway, Dept. 3436, Chicago 14, Ill.

BOOKKEEPERS! Increase your earnings! Operate your own simplified "Dollar-A-Week" bookkeeping and tax service. Full or spare time. Details free. No obligation. Ellis, Box 200-J, Cedar Grove, North Carolina.

GERMAN Slide rules, scales, drafting instruments. Barttro, 11J East Peoria, Pasadena, Calif.

TIRED Of no money, second rate jobs? Like to start a real career with a lifetime of high salaries? Write me about two growing fields that need men. Ed Howes, National Schools, Dept. 492, 4000 S. Figueroa St., Los Angeles 37.

WANT A diesel job? New opportunities to increase income. Higher pay. More money. We can help you qualify. Tools. Shop method home training. Write today! Diesel, Tractor, Heavy Equipment Division, Interstate Training Service, Dept. 3J, Portland 13, Oregon.

MAKE Up to \$45-\$55 week as a trained practical nurse! Learn quickly at home. Booklet free. Chicago School of Nursing, Dept. M-9, Chicago.

GET Government position! Complete home training for examination, \$9.95—Refunded if don't pass. Write Ozment Instructions, 34-CS, St. Louis, Mo.

HIGH School—No classes. Study at home. Spare time. Diploma awarded. Write for free catalog HF-24, Wayne School, 2527 N. Sheffield, Chicago 14, Ill.

WORK For U. S. gov't! Men—women. Start high as \$73.00 week. 95,000 jobs open! Qualify now! Experience usually unnecessary. Get free 32-page book showing jobs, salaries, requirements, sample tests. Write today: Franklin Institute, Dept. N-24, Rochester, N. Y.

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Start on a SHOESTRING!

The real-life stories of success in Mail Order read like fairy tales. If I had not personally known these people their stories would be hard to believe. Yet they are not only true, but they represent just a few of the hundreds of "little operators" who have been swept into big money by Mail Order.

GAINES. I personally guided his start when he invented an automatic pants presser. He started with one little ad in one magazine. Four years later he retired — with enough real estate to keep him in cash income the rest of his life.

VAN MARK. I worked with him for six years. I met him when he was a wagon man for a tea and coffee house, knocking on doors. He went into Mail Order on nothing—made money from the start—ended up six years later with savings of \$50,000 and an income of \$5000.00 a year for life without further work.

DUGGAN. A few years ago he was a truck driver. Started fooling with Mail Order in a spare room in his spare time. Last year he said, "I don't know how much I'm worth—after you get the first million you quit keeping track."

MRS. NIXON. Started a small Mail Order business at home—just to keep occupied. It looked good and she came to me for advice. I showed her how to expand. In two years the business got so big her husband resigned his job to help manage it.

FOXMAN. Foxman worked as a hack writer at \$70 a week. He had idle time in the evenings—ran an ad offering something he didn't have—got so many orders he had to find a source of supply. He made \$18,000 the first year. He gives me credit for "showing the way."

JORGENSEN. Consulted me about a specialty product. On my advice he ran one ad to "test" its saleability. That ad brought sales of \$50,000. In his first year he did a business of nearly a half million dollars. His original investment was less than a thousand.

These things I have seen. These people I have helped to the realization of their dreams — these and hundreds of others. My own fortune was made in Mail Order. And now my secrets can be yours.

L. W.

Have you ever thought of running a profitable little sideline right from your home? Has it occurred to you that you are just as capable as anyone else of making money on a product or service that can be sold by mail? Have you ever looked into the Mail Order business as it's run (on tiny investments) by innumerable small operators?

Forget about Sears and Ward's! Read about the "little fellows" . . . clerks, teachers, vets, mechanics, salesmen and others . . . who are packing Mail Order items in bedrooms, spare rooms, attics, garages, cellars . . . dumping them in the Post Office . . . and quietly banking the fistful of Money Orders, cash and checks delivered to them daily by the mailman.

An annual business of almost a billion dollars is done by "little fellows" who advertise and sell just one item! The Department of Commerce of the United States says, "A number of the most successful obtain incomes as high as \$40,000 to \$50,000.00."

It's an incredible story . . . a story of a business that's wide-open for newcomers . . . with opportunities for income far-and-away greater than you can ordinarily hope to attain by holding down a job. And in Mail Order you can stay as small as you wish—run your deal as a \$50 or \$75 weekly sideline—or consider jacking it up into really big figures as a full time operation.

Glance at the examples at left. These true stories are far from unusual. Multiply them by the hundreds and you begin to get an idea of what can be done . . . what is being done . . . in the phenomenal Mail Order field.

Yet, if you were to jump blindly into Mail Order your chances would be slim. A peculiar brand of "know-how" is vital in this little-known, little-understood business. This is fortunate for you. If any Tom, Dick, or Harry would "click" in Mail Order, the field would have been overloaded years ago.

But now you have the opportunity to learn the authentic secrets of successful Mail Order operation. They are revealed for the first time, step by step, in an extraordinary new Survey . . . the L.W. Confidential Mail Order Letters.

This Survey is not a course—not a book—not a group of lessons. It is a simple guide that anyone can follow. It shows you how to pick the right product for Mail Order. It shows you exactly how to start a profitable business fast, with cash or Money Orders in the envelopes you receive. It shows how to buy your product out of the very money you get in the mail, so you don't have to tie up cash in large supplies of your product. It gives you actual examples of ads and letters, analyzed to show how and why they make money. It demonstrates the months to start, the time to expand, the best way to get prospects' names. It reveals from A to Z the confidential facts that have made fortunes for Mail Order operators who use them.

Mail the coupon today, or simply send your name and address on a postcard. No salesman will call. We will mail, postage prepaid, a Free copy of "How to Become a Mail Order Millionaire" and along with it will give you complete facts about the L.W. Mail Order Survey. Read the facts. Then decide whether you would like to spend spare time or full time in a profitable, fascinating Mail Order enterprise. If you think you would like to follow the footsteps of hundreds of others who are now making good money in this way, you can get your L.W. Survey and begin at once.

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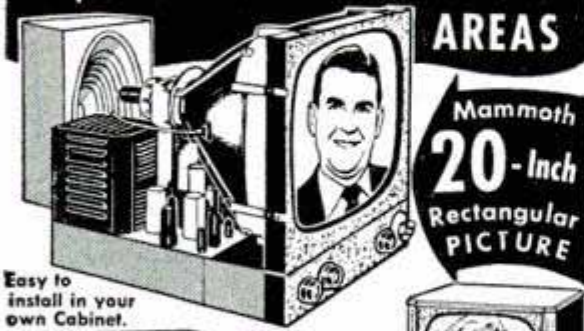
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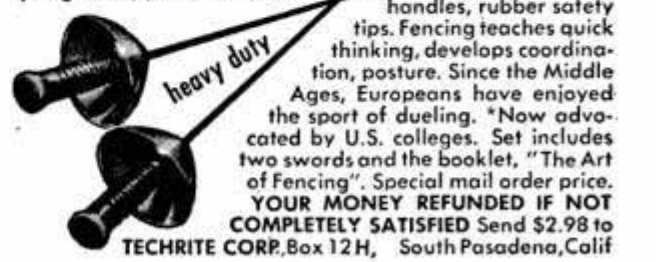
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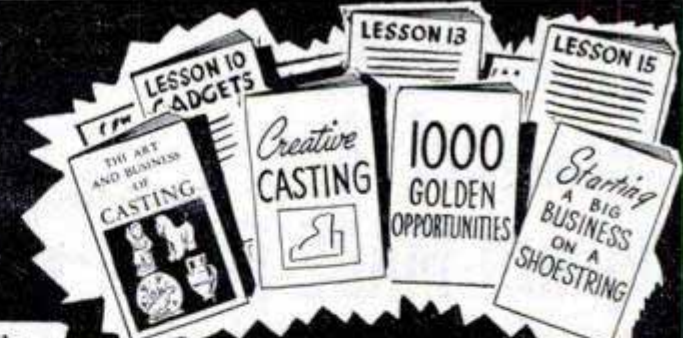
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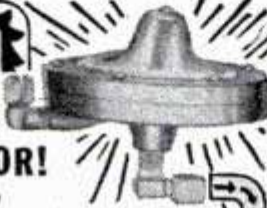
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640-15	5.95	710-15	6.50	820-15	7.50	760-16	7.75
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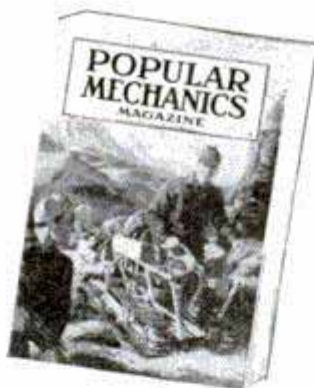
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750x16 12.50	710x15 6.50	32x6(8) 11.95
550x17 5.75	760x15 6.95	32x6(10) 12.75
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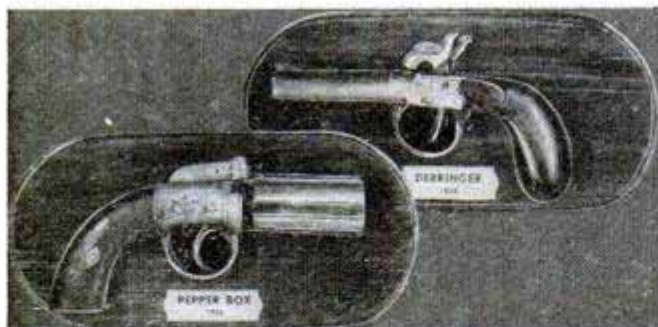
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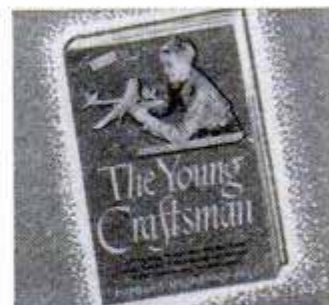
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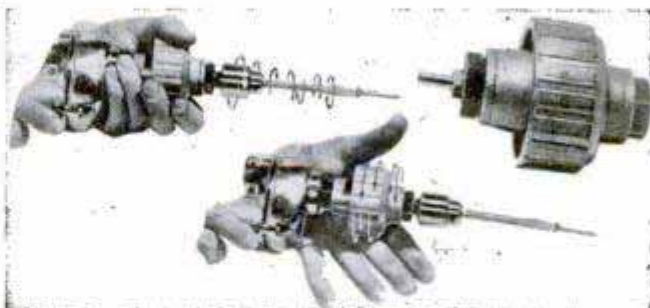
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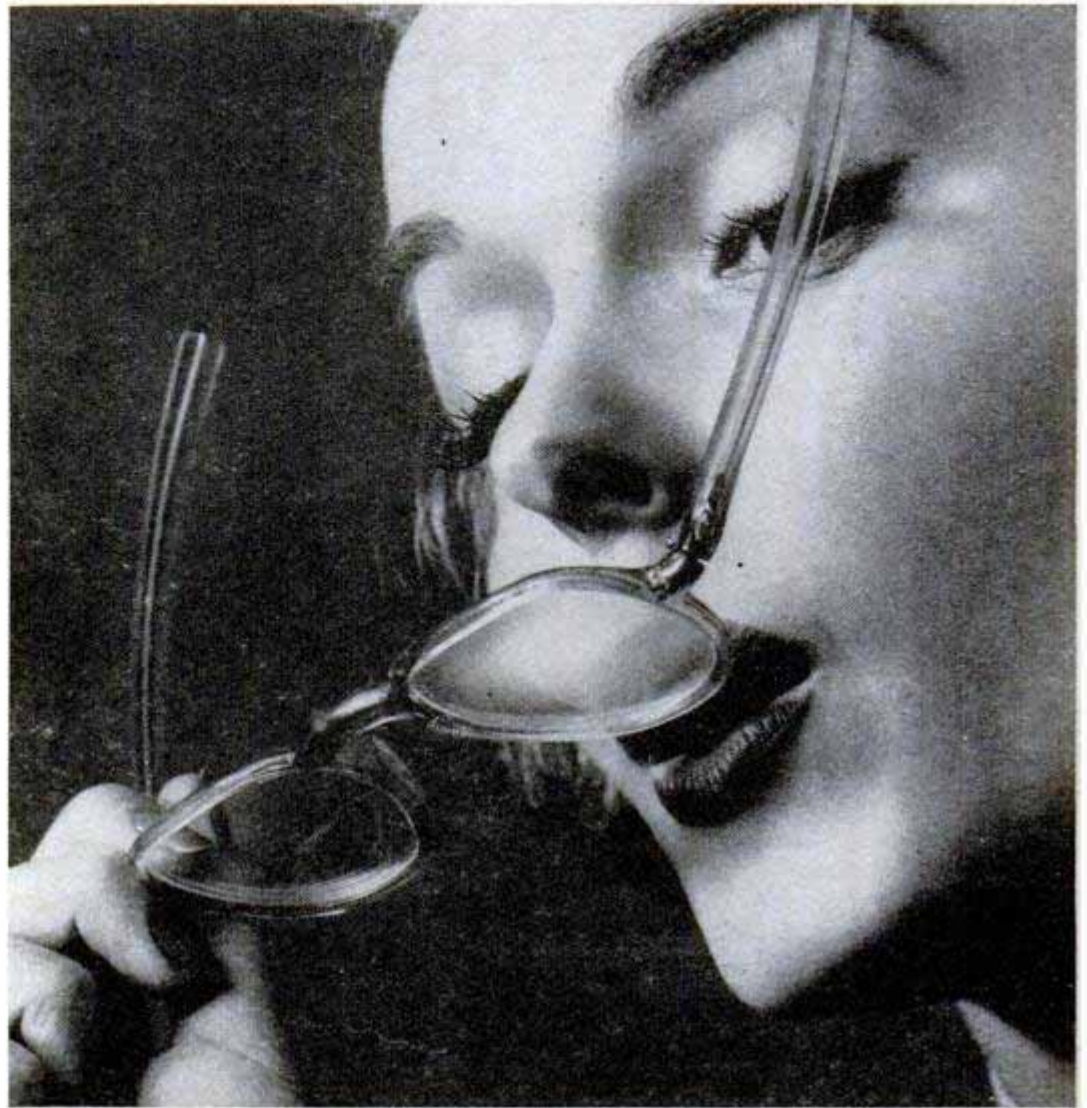
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POPULAR MECHANICS

SEPTEMBER 1952

WRITTEN SO YOU CAN UNDERSTAND IT
VOL. 98 NO. 3

It's News:



By Thomas E. Stimson, Jr.

PLANTS THAT bite back at the bugs are the big news in agriculture this year. In Wisconsin, pea vines grown from treated seed are green and healthy even though other vines right alongside them are heavily infested with pea aphids. Insects that migrate to the treated plants curl up and die within 48 hours.

At the U. S. Department of Agriculture experiment station at Beltsville, Md., researchers have reversed the tables on the red-spider mite that loves to feed on young

beans. Now the mites themselves die when they attack the plants.

At the Riverside citrus-experiment station of the University of California, lemon seedlings and mature orange trees are killing all the mites and aphids that formerly were a serious problem. And at the university's ornamental test plots in Los Angeles you can inspect flowers and shrubs that remain unharmed by insects even though they are almost touching control plants teeming with various pests.

One of the many ways the new insecticides can be utilized effectively is with a fog-spray applicator





Measuring out solution that will be used to water soil around gladiolus bulbs to ward off the mites

These plants are lethal to many insect enemies because they've been vaccinated, so to speak, with one of the new systemic insecticides. The insecticide is absorbed by the plant and circulates through its sap stream. The entire structure, from bark to fresh young leaves, becomes highly toxic to insects that exist by sucking their nutrient from the plant.

Most of the new bug killers have little or no effect on the large leaf-chewing insects such as grasshoppers, codling moths,

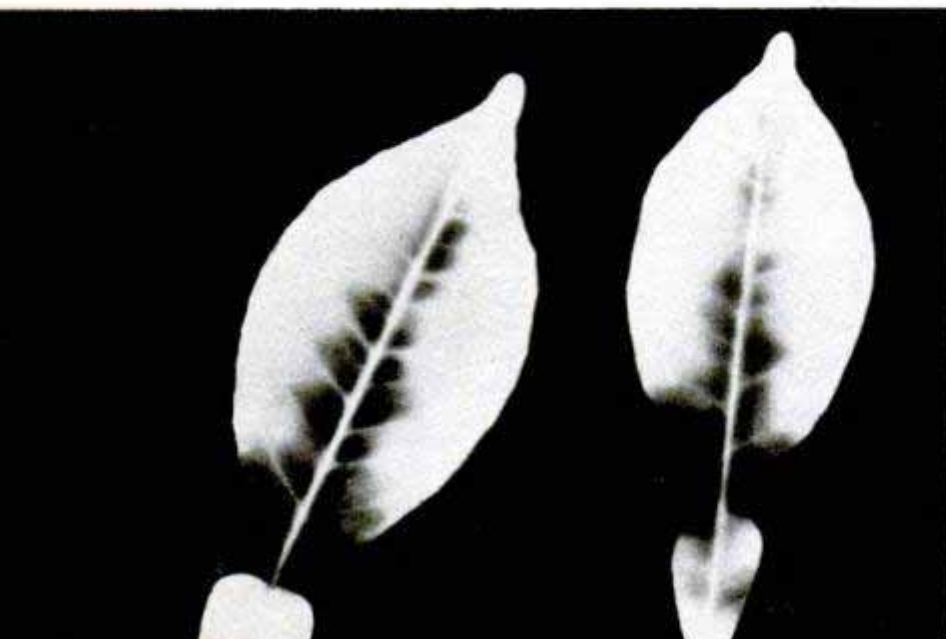


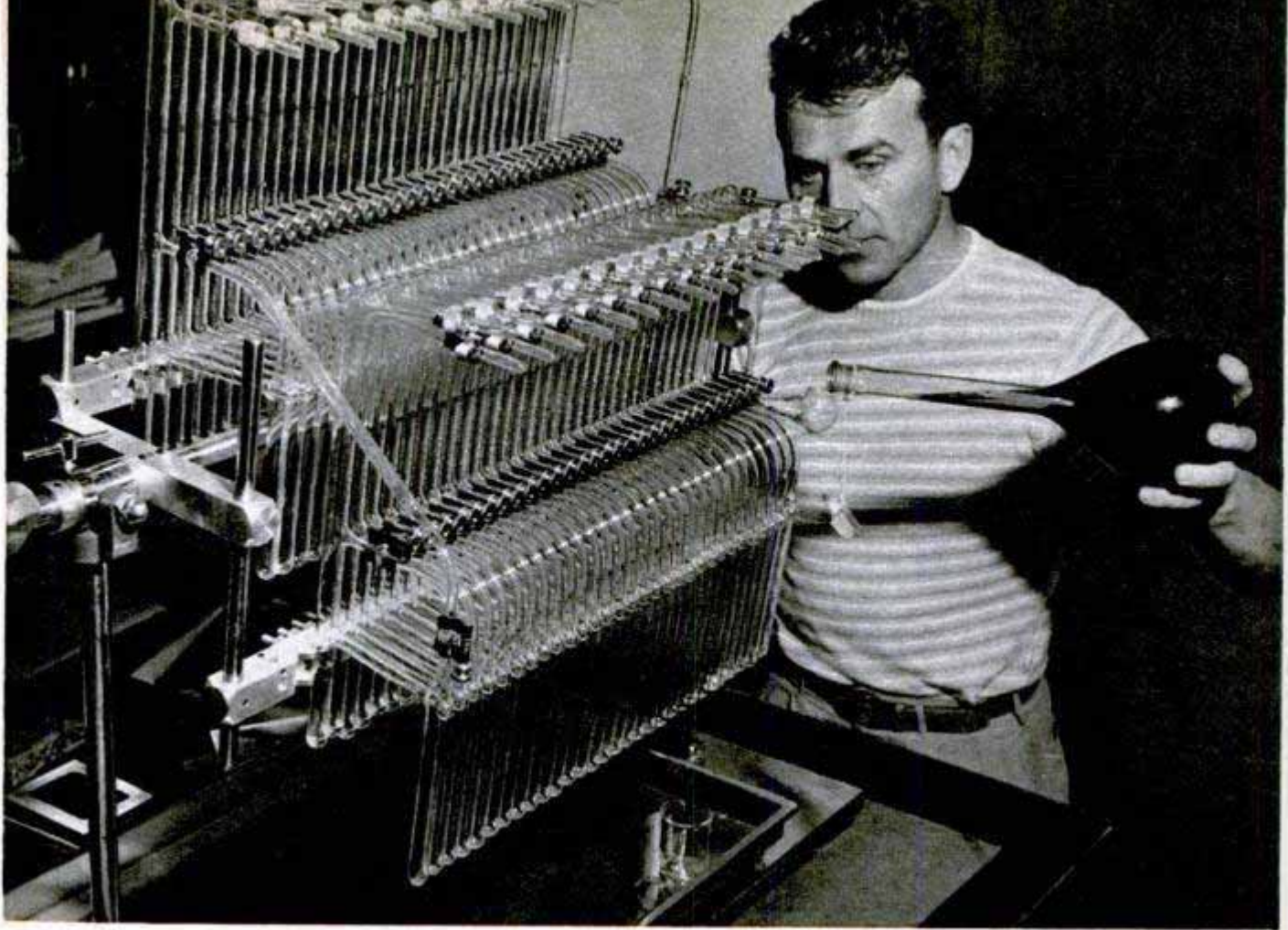
Proportioning dispenser mixes liquid fertilizer and insecticide with water flowing through garden hose

beetles, weevils and various worms. These still must be controlled by the usual methods. And the systemic insecticides are not equally effective against all sucking insects on all plants. Each combination of insect and host is receiving separate study.

In a general sense, however, agriculture now has a new and effective way of controlling the multitudes of sucking insects that cause more than half the several billion dollars of insect crop damage in the United States alone every year. To a large

Upward and outward route of systematic insecticides is traced in leaves by a radioactive-phosphorus compound





Solvents that separate all the substances in a liquid help in determining amount of phosphorus in a plant

Mite growth is stimulated by placing infested leaves below oranges, on which mites crawl and lay eggs

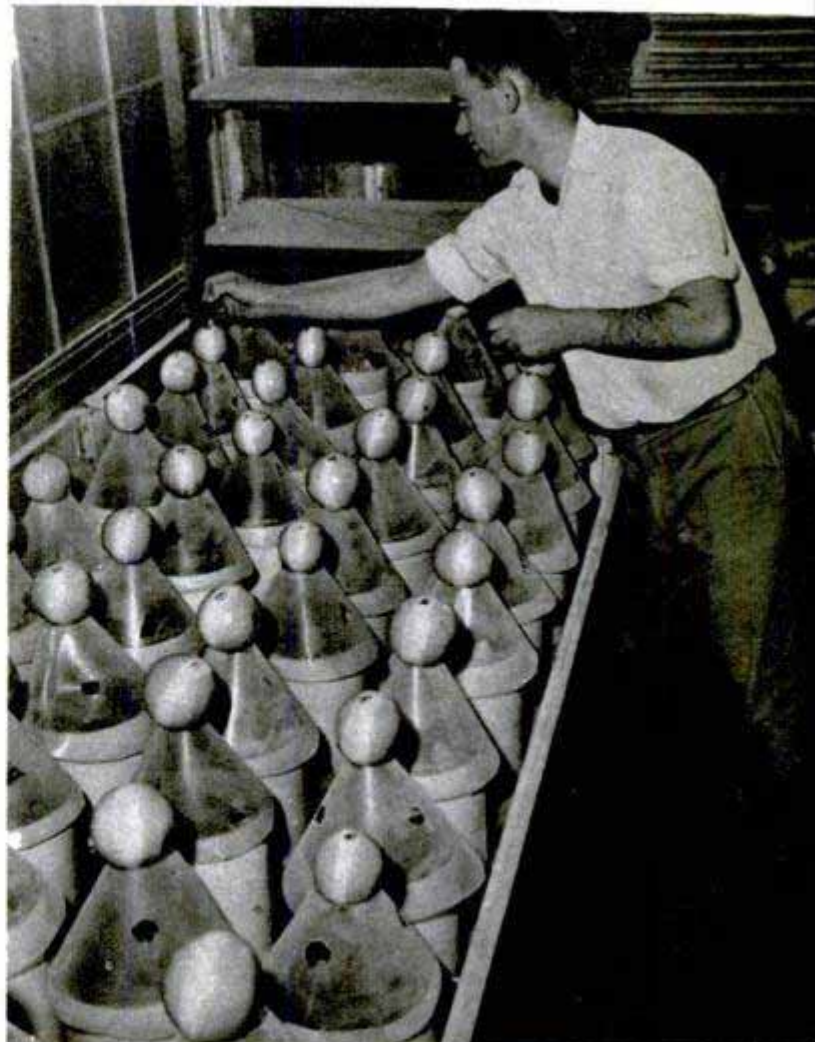
extent, too, plant diseases transmitted by these insects are automatically curtailed.

One of the most dramatic tests to which the systemics have been put occurred last year in Africa when thousands of acres of valuable cacao plants apparently were doomed by a virus transmitted by the mealy bug. A systemic insecticide wiped out the bugs and, in turn, conquered the virus epidemic.

With an ordinary insecticide sprayed or dusted on a plant, more insecticide must be applied the next week, and the week after. Only insects touched by the substance are killed.

A systemic, on the other hand, begins a 100-percent kill at once. It reaches everywhere. It poisons insects concealed under the folds of leaves or hidden in blossoms as well as those in plain sight. It is still lethal a month later. New shoots and leaves that appear long after the insecticide was applied are automatically protected. One dose often protects a plant during its entire growing season.

It seems to make little difference how the material is applied. The solution may be sprayed on the plant, added to the irrigation water or sprinkled on the ground so that it filters down to the roots. The Wisconsin pea seeds were simply moistened with insecticide before they were planted.





Entomologist at the University of California injects a systemic insecticide into the trunk of an orange tree, using bottled gas to force the fluid in under pressure

When added to a solution of chemical fertilizer and water, the material becomes part of a treatment in which plants are irrigated, fertilized and protected from pests in a single operation.

At Riverside, the material has been injected into tree trunks with good results, then the same killing effect was obtained merely by painting or spraying the solution on a section of bark. This is quick and cheap and probably will be the standard method of application for various types of fruit trees.

The new insecticides are organic phosphates. One is called OMPA, a handier title than its full name: octamethylpyrophosphoramidate. One of its commercial names is Pestox. A related compound, produced under the trade name of Systox, has an even more cumbersome chemical designation: 0, 0-diethyl-0-2 (etnylmercapto)-ethyl thiophosphate.

OMPA is solely a systemic, while Systox seems to be lethal both as a systemic and as a contact material. To date, OMPA has

been approved by the Department of Agriculture in aerosol form for control of aphids and mites on carnations, chrysanthemums and roses in greenhouses. Systox so far has been registered only as a soil drench for outdoor use on roses and chrysanthemums. Later this year systemics may be available to commercial growers of numerous other ornamental trees, shrubs and flowers. They may also become available for use on cotton against aphids and mites.

Possibly within a year or so, the systemics may be approved for use by commercial growers of edible field and truck crops and fruit. Right now the research people are double-checking to learn if the insecticides could have any ill effects on the consumers of those products.

This precaution is necessary because the phosphorus compounds are deadly poisons; in fact, the systemics are a direct outcome of German efforts during World War II to find a devastating nerve gas. The specific insecticides now being tested were compounded by Dr. Gerhard Schrader of West



Germany. All of them work by short-circuiting an insect's nervous system. Operators who apply the insecticides must take the same extreme care against breathing the fumes or coming in contact with the substances as are vitally necessary with other highly toxic insecticides.

For this reason the organic phosphates now in use probably never will become available to home gardeners. They are simply too dangerous. There's a good chance, however, that additional research will uncover other systemic insecticides less toxic to warm-blooded animals.

When properly used by trained operators, there are several reasons why the systemics appear to have a large future. They are generally applied in such dilute solutions that they are immediately toxic only to very small organisms. The plants slowly convert the insecticide into nontoxic phosphorus compounds. Crops that are sprayed or irrigated with a systemic early in the growing season apparently become completely nontoxic again by the time they are ready to be eaten.

To learn more about how a systemic insecticide circulates through a plant and how

long it remains effective, radioactive phosphorus-32 is being used as a tracer element by the entomological-research staff of the Riverside citrus-experiment station in studies under the direction of Dr. R. L. Metcalf. The work at Riverside is related to other studies on systemics being conducted at scores of other laboratories both here and abroad.

In a typical experiment the radioactive-insecticide solution is added to the water that irrigates the roots of a plant, then a Geiger tube traces its spread up the trunk, out the branches and into the leaves. The speed with which the sap stream picks up the radioactive phosphorus and circulates it through the plant structure can be determined exactly. The movement is principally upward. That is, a systemic placed in contact with the roots rapidly circulates up and out to the leaf tips, while very little goes down to the roots if it is applied only to the leaves.

Other tracer techniques that can measure one part in one billion are used to determine the amounts of active phosphorus that may remain in the edible portions of a plant at the time it would be used as food. Lengthy investigations in England have not revealed bad effects on experimental animals that were fed large quantities of apples, strawberries, shelled peas and infusions of hops from crops that had been treated with systemic insecticides. Similarly, feedings of Brussels sprouts and sugar beets that had been protected with systemics produced no pathological symptoms in experimental animals. The systemics already are in moderately wide commercial use in England.

There is a suggestion that the systemics produce larger, faster-growing plants in addition to killing insect enemies. Rose

(Continued to page 238)

Detector, left, measures radioactive phosphorus remaining in plants weeks after insecticide was applied. Hand-infesting a leaf protected by systemic insecticide, right, with mites to test toxicity of leaf on mites





Lockheed Aircraft Corp. photo

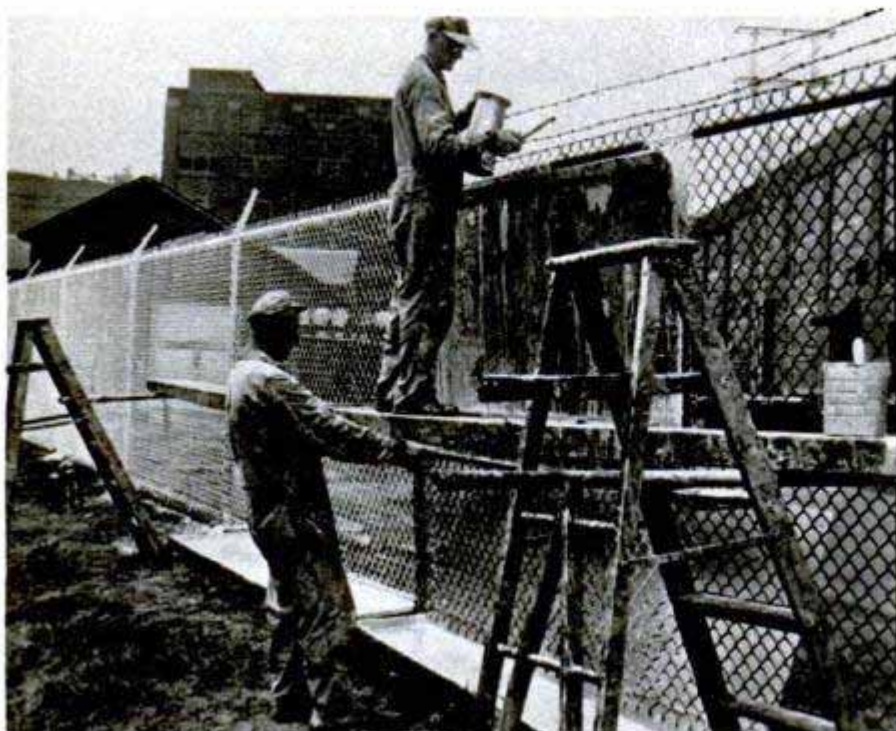
Tip Tanks for Turboprops Increase Planes' Range

Wing-tip tanks may stretch the range of fuel-hungry turboprop airliners. The jet and propeller combinations use about 50 percent more fuel than conventional engines. The big metallic teardrops, devised

by Lockheed for early jet fighters, are already in experimental use on two U. S. Navy Super Constellations. The 600-gallon tanks develop enough lift to offset their loaded weight.

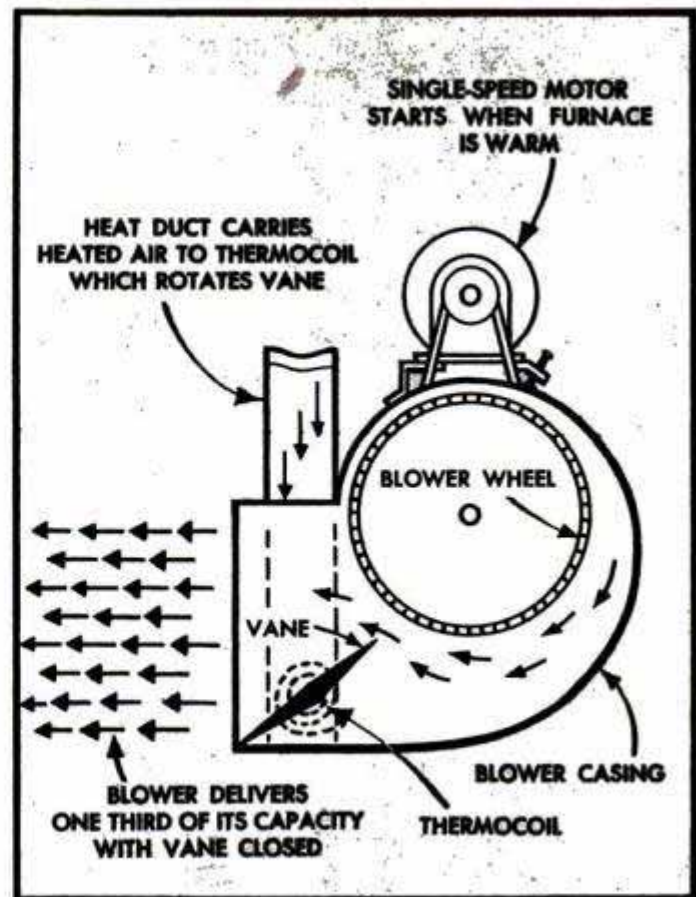
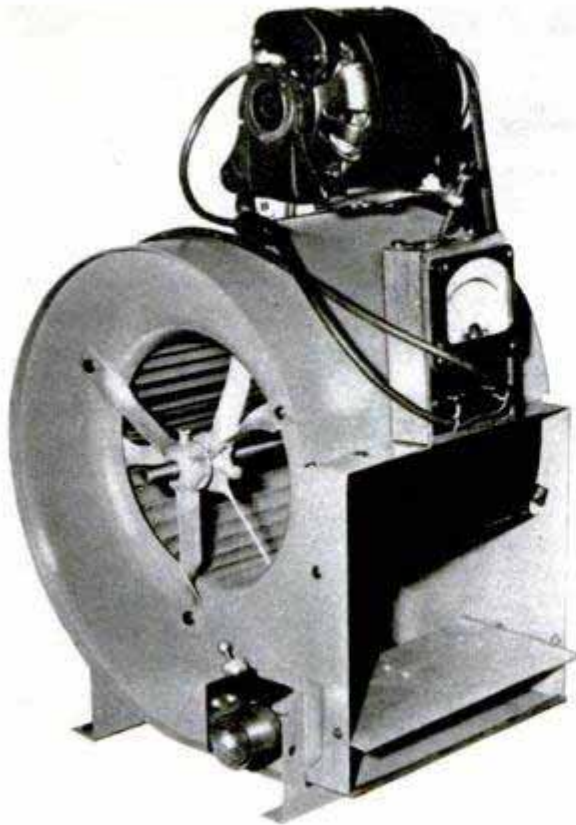
Interchangeable Lenses For Slide Projector

Color photographers can show 35-millimeter and 2¼ by 2¼-inch transparencies on the same projector thanks to its interchangeable lens system. Two sets of condenser lenses are available and both are mounted in metal cages for easy handling. Also, there are two sizes of slide changers for the projector. The condensing-lens systems prevent hot spots and increase the brilliancy of the slides. Coated five and eight-inch projection lenses are available in addition to the standard six-inch size.



Pour Painting

Painters at the Aluminum Company of America's New Kensington Works pour, rather than brush or spray, aluminum paint on the company's wire fence. Five by five-foot panels fitted closely on each side of the fence guide the paint over the wire and troughs catch the excess. After pouring, one painter goes over the fence with a brush, touching up small portions of the posts that were not covered. The method is said to reduce the cost of maintaining such fences by 50 percent.



Furnace-Blower Regulator Eliminates Blast of Cold Air

With a furnace blower that has a single-speed motor and an adjustable vane, it is possible to obtain a gradual flow of warm air without the usual cold blast at the start of the heating cycle. The control mechanism, regulated by a thermocoil arrangement, opens gradually, delivering just the

right amount of air in coordination with the amount of heat in the furnace bonnet. Wide open for full flow at peak output, the vane reduces air volume as bonnet heat is reduced but only shuts off the blower when all warm air has been drawn from the bonnet.

Solvent Degums Automobile Carburetor in 20 Minutes

Gum and varnish which accumulate inside the carburetor are removed in a 20-minute operation that involves no disassembly except removing of the air cleaner and disconnecting the fuel line. The solvent used is mixed with gasoline and fed directly into the carburetor as fuel. The engine is operated for five or ten minutes at all

speeds from idle to full throttle with frequent pumping of the accelerator. This works the solvent into all critical areas of the carburetor, dissolving and flushing away gums, lacquer and varnish. After the treatment, the engine will idle more smoothly, start easier and respond more quickly, reports the solvent's manufacturer.

See-Saw Auto Lift

Raising either end of a car to a height of four feet, a German see-saw lift is simple and inexpensive. The car is driven onto two tracks, which can be adjusted to various widths, and locked in place at or near the balancing point. One man can then easily raise either end. The automobile lift has a maximum capacity of 1½ tons.



"KILLER" FRIGATES **of BRITAIN and CANADA** **HUNT FAST NEW SUBMARINES**



FAST BRITISH ANTISUBMARINE
FRIGATE DISCHARGING HER
"SQUID" BATTERY

STARBOARD TRIPLE-BARRELED "SQUIDS"

DUAL-PURPOSE GUNS

LIGHT ANTI-AIRCRAFT GUNS

TRIPLE-BARRELED "SQUIDS"

DEPTH-CHARGE DISCHARGER

WHIP ANTENNAS

DEPTH-CHARGE THROWER

21-INCH TORPEDO TUBES

BRITISH FAST ANTISUBMARINE FRIGATE
DISPLACEMENT: 1405 TONS
(FULL-LOAD DISPLACEMENT: 2500 TONS)
LENGTH: 358 FEET BEAM: 36 FEET
STEAM TURBINES SPEED: 34 KNOTS

BRTAIN AND CANADA are building a new fleet of "killer" frigates to meet the menace of fast submarines and deadly torpedoes that follow their quarry by means of "homing" devices. Production has been stimulated both in these countries and the United States by the existence of approximately 300 Soviet U-boats.

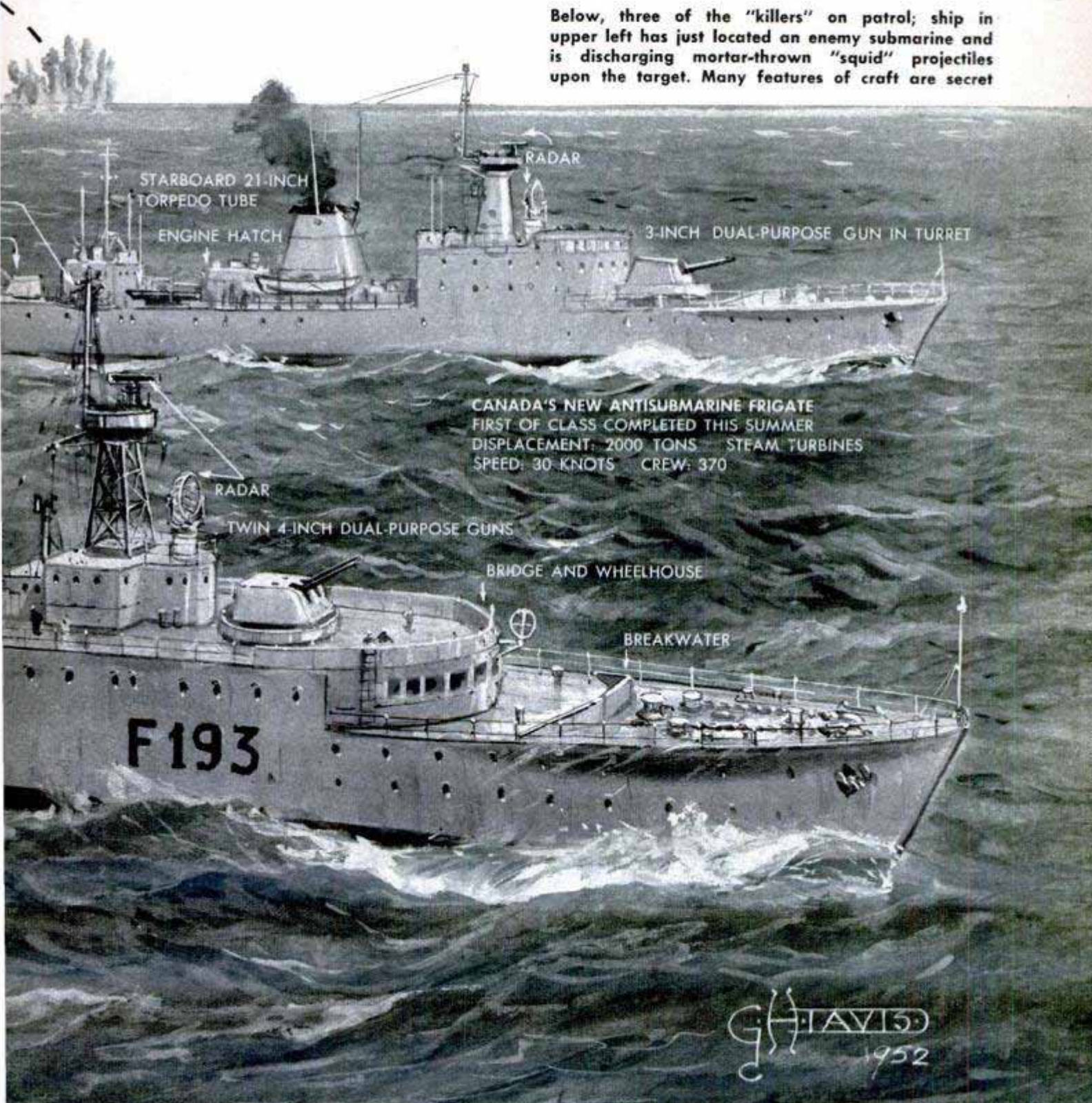
Designed for speed, seaworthiness and quantity production, the frigates have aluminum or light-alloy superstructures and upper works and possess extremely high sides and light armament.

British naval engineers originated the new design after converting several destroyers for the purpose. World War II frigates and corvettes, effective against

Axis U-boats, proved too slow for present use. Ordinary destroyers ride too low in the water to make them effective in all weather.

Among the latest antisubmarine equipment included in the new ships are "squids," triple-barreled mortars similar in action to the World War II "hedgehogs." Fired ahead of the ship, they can be trained accurately on targets spotted by listening devices and their projectiles will burst at any predetermined depth. They represent a marked advance over depth-charge throwers which fire "blind" into the area around the ship's stern and over hedgehogs which scatter the area of the target with missiles that explode only upon direct contact. ★ ★ ★

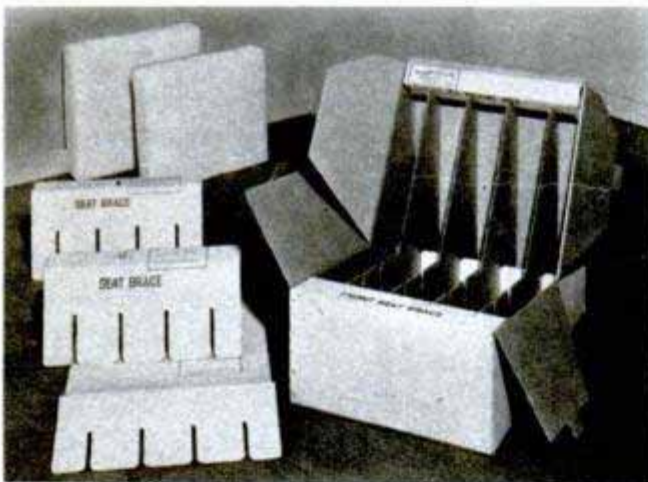
Below, three of the "killers" on patrol; ship in upper left has just located an enemy submarine and is discharging mortar-thrown "squid" projectiles upon the target. Many features of craft are secret



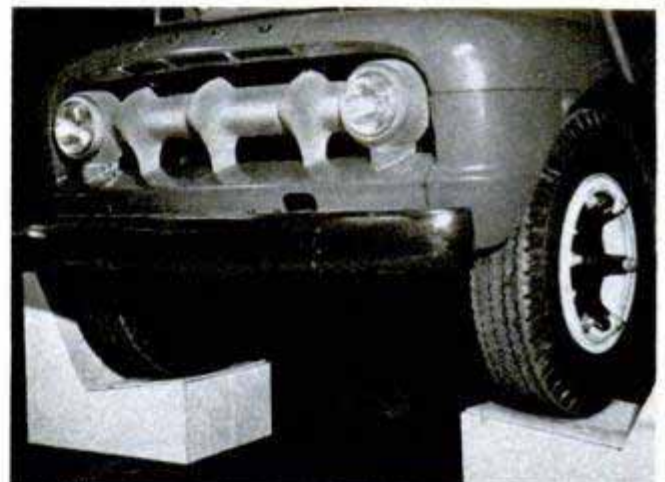
CANADA'S NEW ANTISUBMARINE FRIGATE
FIRST OF CLASS COMPLETED THIS SUMMER
DISPLACEMENT: 2000 TONS STEAM TURBINES
SPEED: 30 KNOTS CREW: 370



With spring cushions and colorful slip covers in place, the cardboard chairs are comfortable and handsome



Here are the chair components. Assembly requires no tools. It comes apart easily for storing or moving



Each chair is supporting 2200 pounds without damage. Drops from a fourth-story window did no harm either

Cardboard Easy Chair Is Strong Enough to Support 2000 Pounds

Strong enough to support a ton, a corrugated-fiberboard easy chair can be assembled without tools and knocked down for storage or moving. The framework is simply a box like those in which much of the nation's freight is moved. Strength and rigidity are provided by four vertical dividers which run up to form the support for the backrest. Cross braces nest into

these dividers like the sections of an egg crate. Flaps fold over to form a completely enclosed unit with flat surfaces to which the spring cushion pads of the chair are fastened. Slip covers in a wide range of patterns are provided with the chairs. The chair comes in two models, one with arms and one without. The armless chairs can be placed side by side to form a sofa.

Wet Battery Shipped Without Liquid in Cells Has Added Useful Life

Added useful life is claimed for a storage battery that is manufactured, shipped and delivered to the consumer in a dry state. The battery is built with fully charged plates and will retain its full strength for years in the dry state. At the point of sale,

battery acid is poured into the cells and the useful life of the battery begins. None of its energy is wasted during transportation and storage on dealer's shelves. The battery is made possible by a new glass separator and a polyethylene acid container.

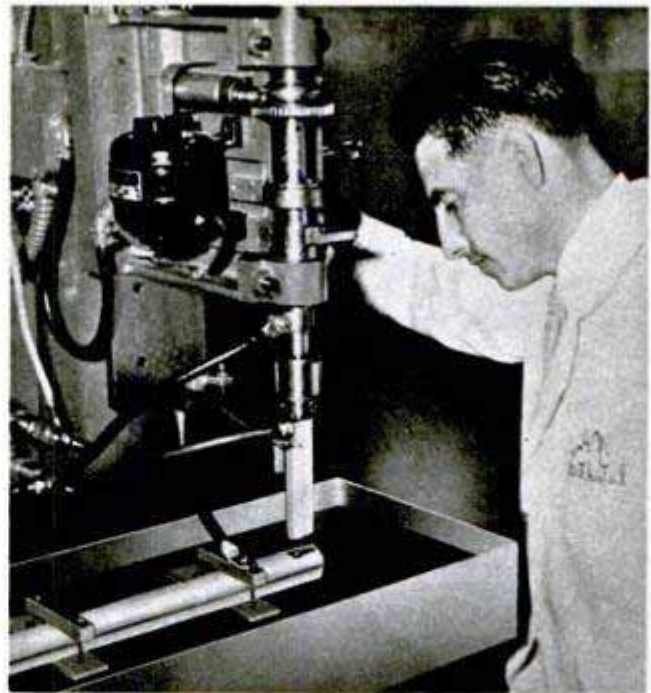
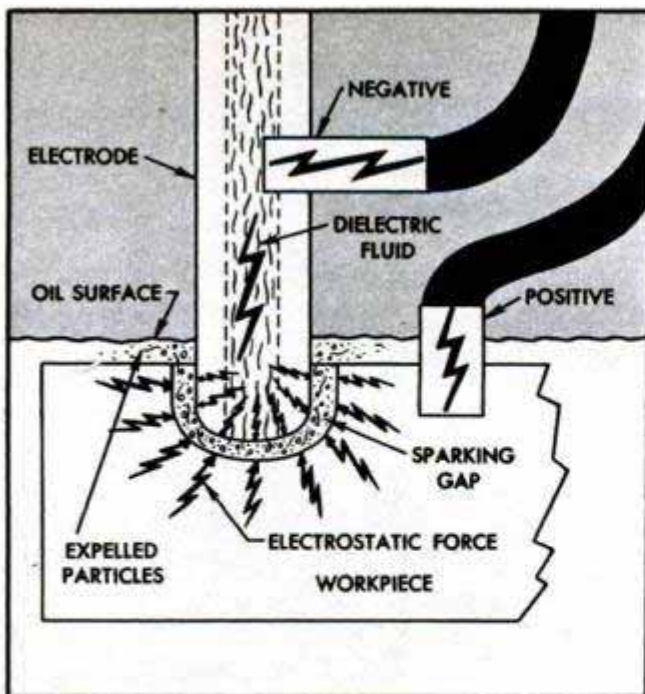


Diagram shows how the electrode, shaped to do the desired machine work, is moved down through the workpiece. The current causes metal particles to detach themselves. Right, tool is operated much like a drill press

"Method X"

Extremely hard metals such as sintered carbides can be machined accurately and easily through a system known as "Method X," which utilizes sparks as cutting tools. The cutting instrument is similar in appearance to a drill press. It can perform all metalwork operations including boring, drilling, tapping, external and internal shaping and engraving. The workpiece is clamped to a table which is submerged in a dielectric fluid such as fuel oil or kerosene. The shape of the desired machine work, such as a gear, determines the shape of the electrode, which is fastened in the

machine and brought down toward the workpiece. Electrodes are made of any highly conductive, easily machined material such as brass, and are shaped to a negative of the work to be produced. As the electrode is brought close to the workpiece, high-current densities cause metal particles to detach themselves from the work material and they are carried away by the fluid. Removal of the metal is a mechanical, not thermal, effect of the current. Particles are detached without melting, so intense heat does not change the exposed surfaces physically or chemically. Complicated shapes can be cut in the hardest metals by properly shaping the electrodes.

Meals Cooked and Served by Coin-Operated Vending Machine

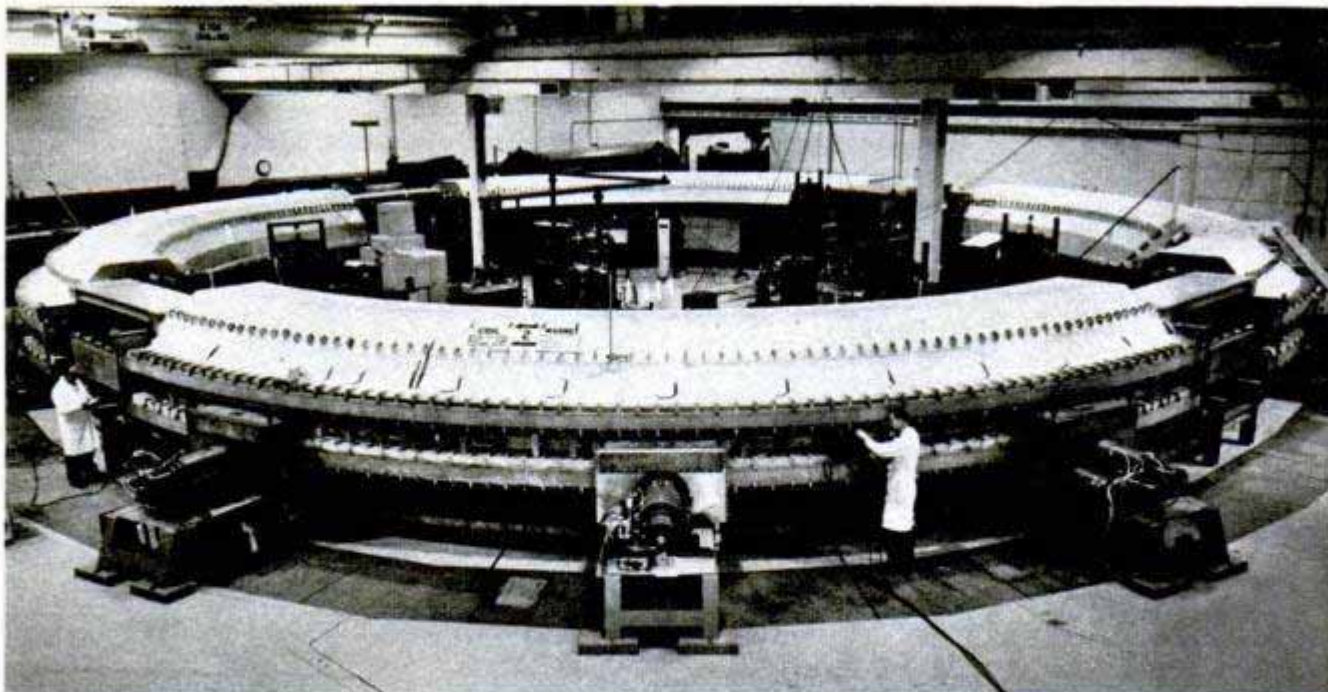
Precooked and frozen in advance, complete meals will be heated and ready to serve in little more than a minute in the near future, forecasts a General Electric engineer. The heater, says T. P. Curtis, would be placed in drugstores, railroad sta-

tions and other places where it would dispense hot meals when the customer drops in coins. Inside the machine is an electronic tube known as a magnetron. It generates high-frequency waves which defrost and heat precooked meals in 70 seconds.

Simplified Computing Drum Figures Pay-Roll Deductions

Seconds are all the time it takes to figure old-age and withholding-tax deductions on any amount of pay with a simplified computer. The machine contains a drum on which various scales are printed. The operator rotates the drum to the proper pay scale and the deductions are read off in a quarter of the normal computing time, says the maker. Interchangeable drums are available for figuring weekly, biweekly, semimonthly or monthly pay periods.





Brookhaven Cosmotron Has 60-Foot, 2200-Ton Magnet

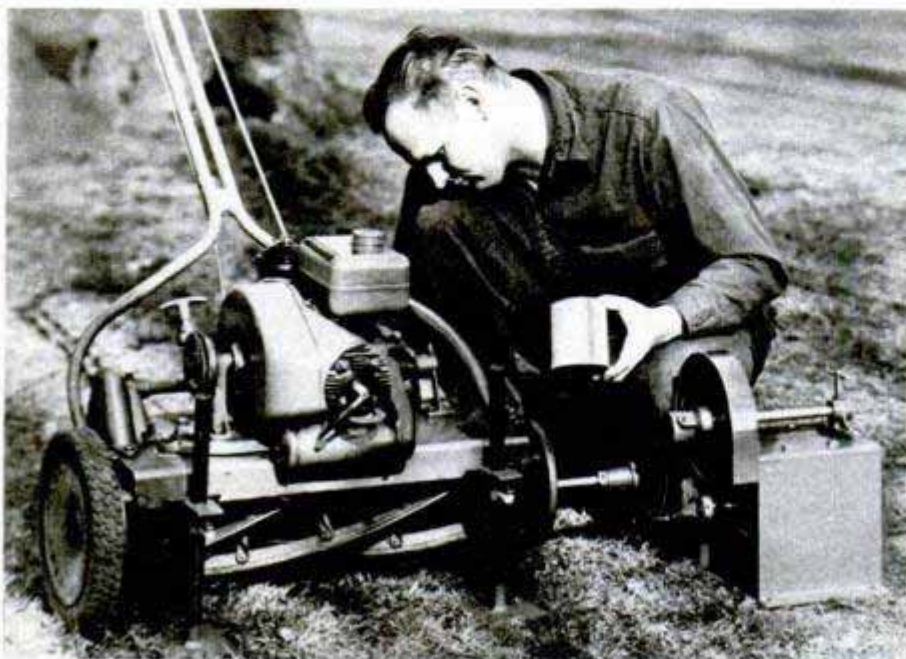
Protons will speed around the 60-foot magnet of the Brookhaven cosmotron to an energy exceeding two billion electron volts before striking targets of copper or liquid hydrogen. Collisions at such energies are expected to produce mesons, the short-lived particles which appear in cos-

mic rays and seem to hold the key to nuclear forces. The ring-shaped magnet weighs 2200 tons and is powered by a generator which delivers a maximum of 40 million watts. During the acceleration, the atomic particles will make three million trips around the magnet.

Battery Acid Kept at Constant Level by Catalytic Caps

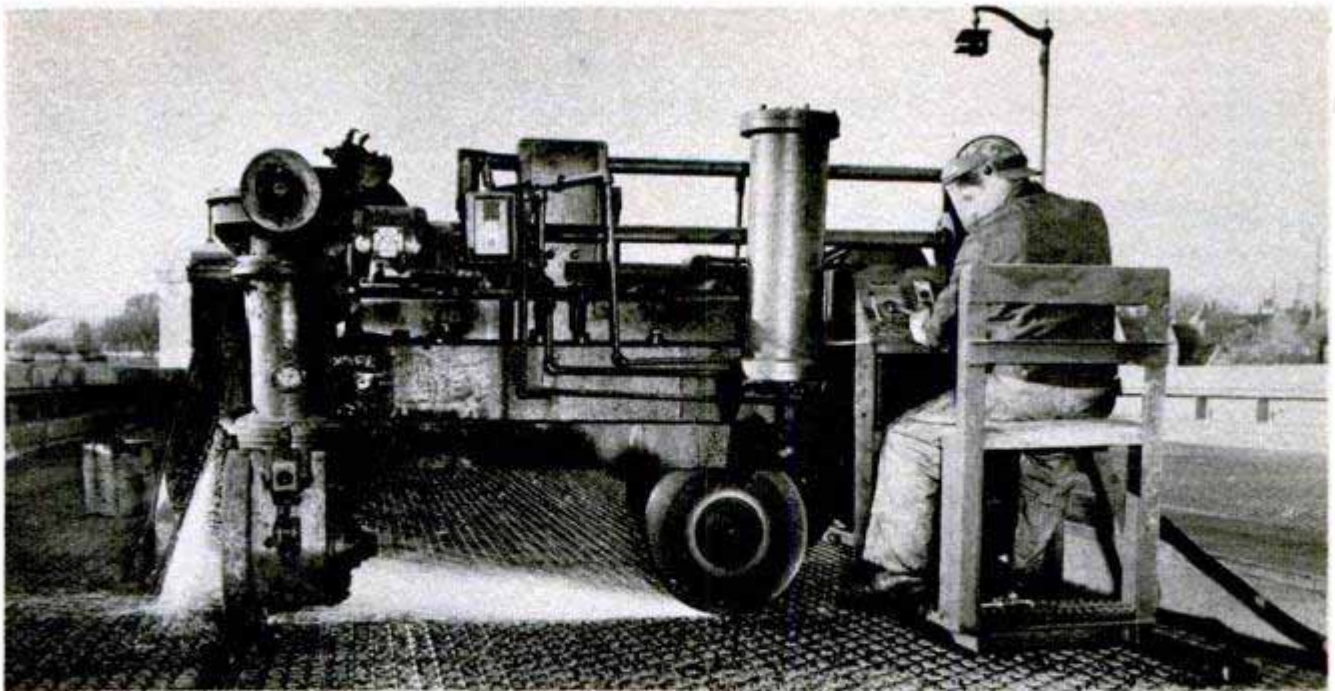
Containing a catalyst which converts escaping gases into water, a new set of automobile battery caps keeps acid at a safe level eight times longer than the conventional caps and also prevents corrosion. There is no installation problem. You merely screw on the oversize caps and throw away the originals. The catalyst also gives warning of overcharge. In normal operation, the caps are warm to the touch.

When they become hot (around 200 degrees) they indicate that the voltage indicator is not functioning properly. By capturing the corrosive sulphuric-acid fumes and washing them back into the battery, the caps prevent corrosion and also maintain a constant level of acidity in the battery. About 95 percent of the escaping water (in the form of hydrogen and oxygen) is retained by the palladium catalyst.



Lawn-Mower Lapper

Lawn mowers are quickly sharpened by a portable lapping machine which can be used anywhere within reach of an electrical outlet. The mower is supported on two jacks, its shaft connected to the machine through a coupler. The $\frac{1}{3}$ -horsepower motor turns the mower reel to sharpen the blades when a lapping compound is applied. A grinding wheel or wire brush may also be mounted on the motor shaft if desired.



Sparks shoot out from beneath grinding wheels as the rail-mounted machine goes to work on a steel roadway

“MANICURIST” FOR STEEL ROADWAYS

STEEL-SURFACE roads, similar to portable landing strips used by the Air Force, are given a nonskid “manicure” job by a mobile grinding machine. Though “waffle iron” roads of steel have been in use for years, they have proved hazardous in wet and freezing weather because the surface is so smooth. In the past the metal grids were disassembled and shipped to the factory in sections, where they were milled to provide greater traction. The new machine does the job on the site, thereby saving the cost of disassembly and preventing the closing of important highways. The “mani-

curist” uses six 24-inch carbon-steel blades to grind nonskid grooves $\frac{1}{8}$ to $\frac{1}{4}$ inch deep in the steel surface. The machine travels along a pair of portable steel tracks, grinding grooves at the rate of 360 square feet of roadway per hour. About 14,000 square feet can be grooved before the blades have to be sharpened. The grooved surface provides a great deal more friction drag than the smooth steel. The grinding machine, believed to be the only one of its kind, cost \$30,000. Its three motors—one for the hydraulic pumps, one for the saws and another for the drive—operate on 440 volts.

Rough surface on machined grid at left offers much greater traction than smooth steel surface at right

Six carbon-steel blades can grind nonskid surface on roadway at a rate of 360 square feet per hour



You Name It!



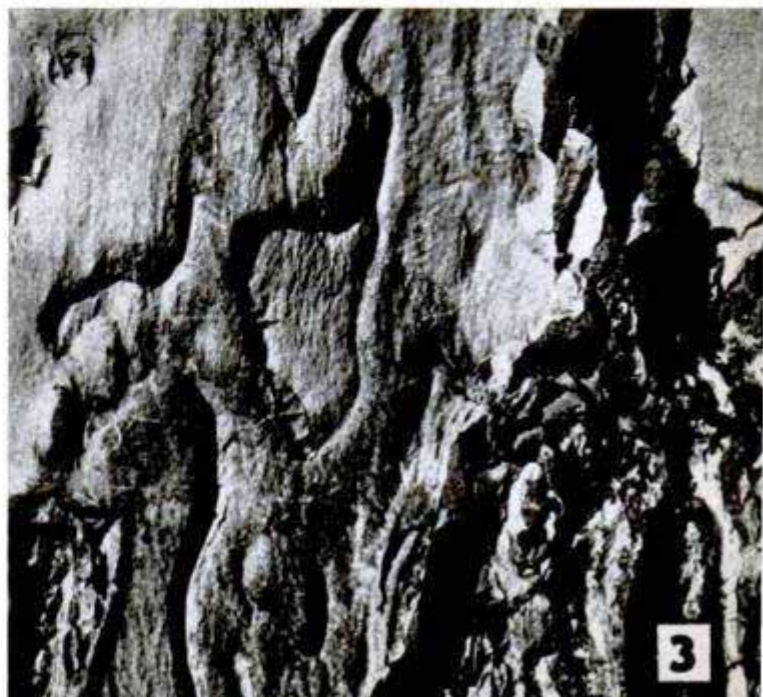
Things are not what they seem. Take a look through the camera's eye and sometimes even the commonest objects appear strange and weird. . . . See how many you can identify, then check your list with the answers on page 226.

1

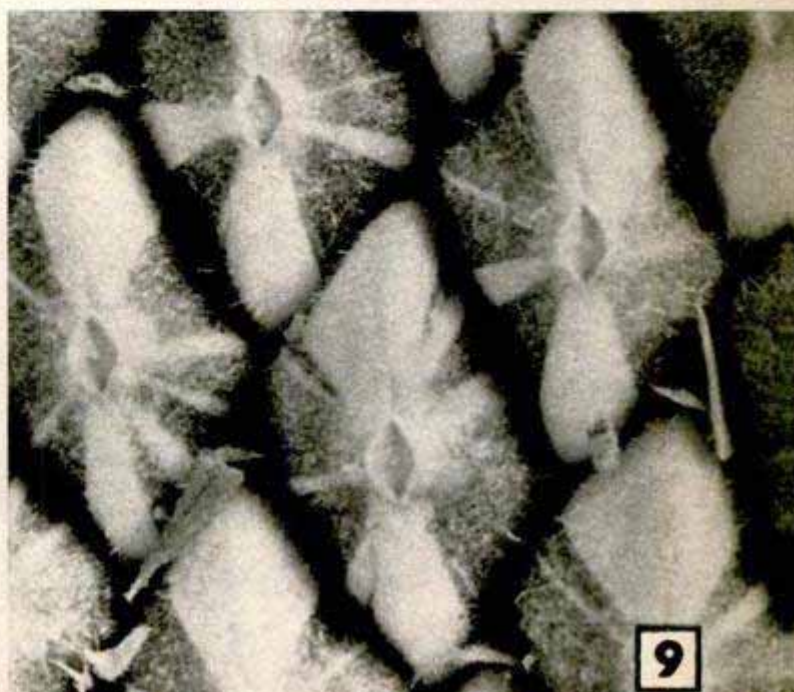
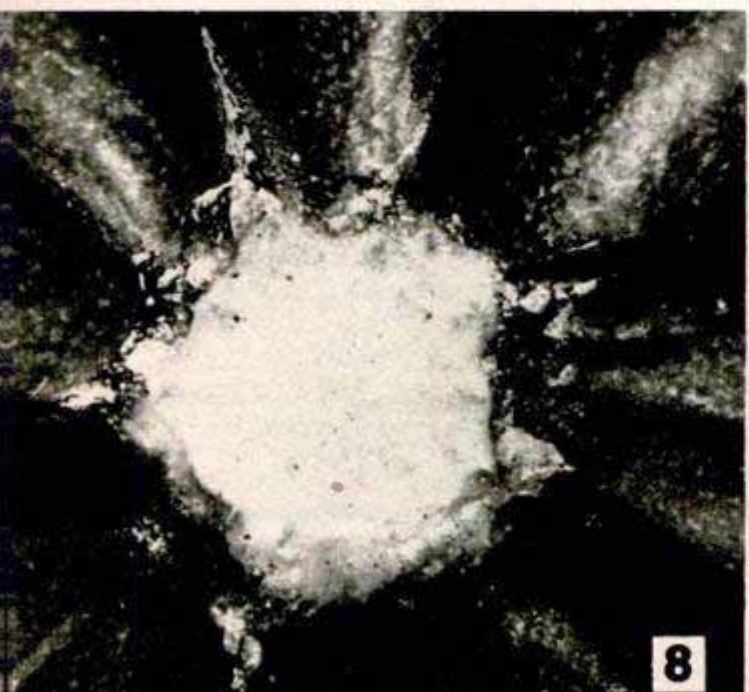
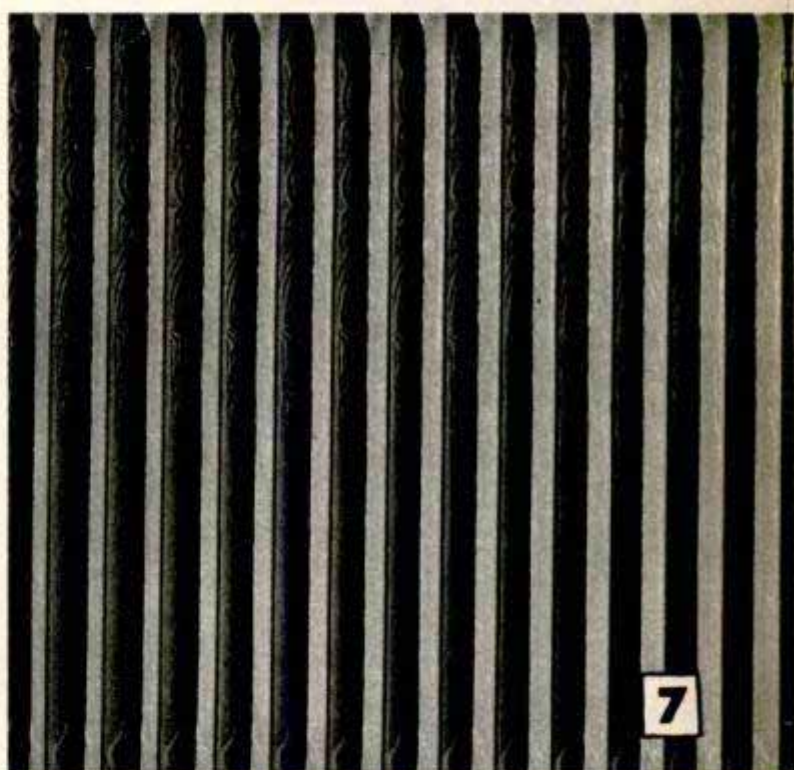
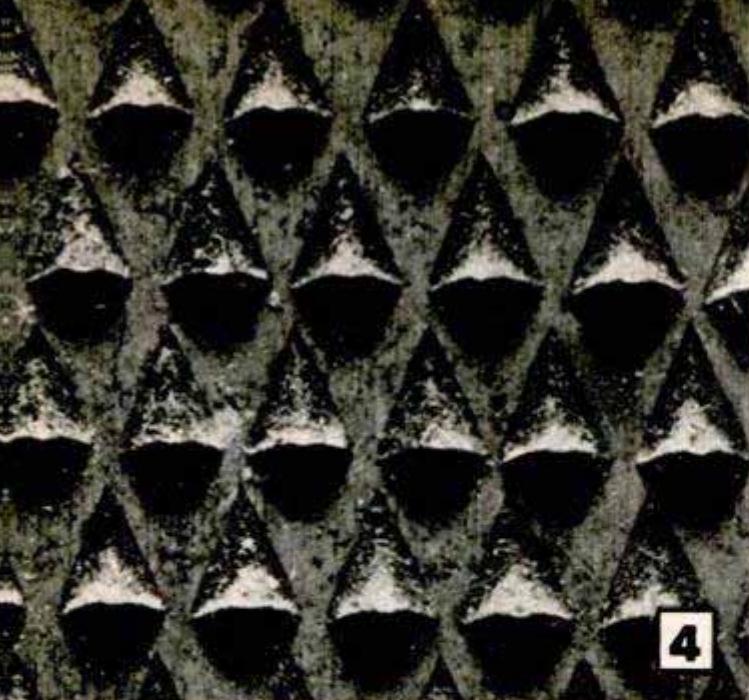
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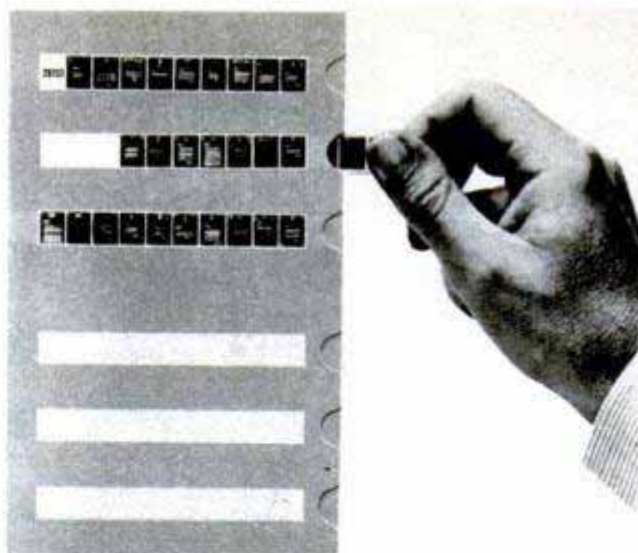
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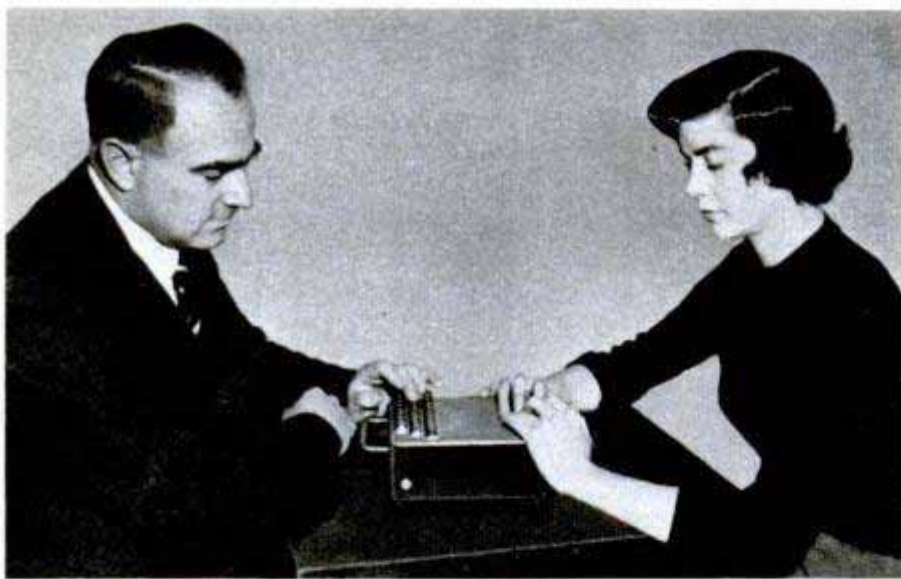
Child's Stereoscope

Children see their favorite nursery rhymes in three dimensions with a simple plastic stereoscope designed to withstand rough usage. Such stories as "Jack and the Beanstalk," "Cinderella" and others are told in a series of color prints drawn for stereoscopic vision. Ten different illustrated stories are provided with the viewer.



Microfilm File Card

Microfilm strips are filed safely in a slotted card that protects them during storage without interfering with their accessibility. The strips do not have to be removed from the card for viewing or copying. Indexing is done on the card. Inactive films are easily replaced. A 5 by 8-inch card will hold 65 microfilmed letters.



Deaf-Blind "Talker" Taps Fingertips

Through a new "conversation" instrument developed in England, those who are both deaf and blind can converse with each other or receive messages from anyone. There are two versions of the machine, each equipped with a typewriter keyboard which the speaker operates. The listener places fingers in six apertures and "receives" through Braille studs which tap the message on his fingertips. Any number of listeners can take part through repeater machines. A one-finger portable version small enough to fit into a handbag enables the carrier to converse with anyone who can operate the typewriter keyboard.



☞ Built to cool cockpits in high-speed aircraft, a new American device can change a searing blast of 600-degree air into snow within $\frac{1}{8}$ second.



Pretty puppeteer poses on stage of the world's most elaborate puppet theater to show comparative size of tiny "actors" and the 52-piece "orchestra" in pit

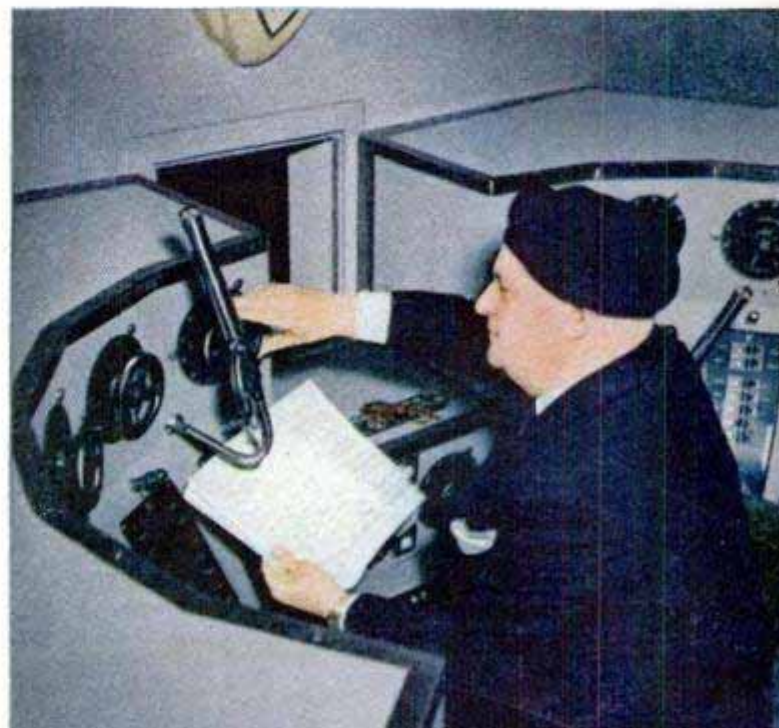
The \$500,000 Puppet Show

By Wayne Whittaker

MARVELS OF ELECTRONICS are combined with the ancient art of puppetry to give Chicago a truly unique puppet theater. The new miniature theater, which seats only 208 persons, is a medieval jewel box in red plush and gold with exquisite hand-painted murals and crystal chandeliers. Although the theater building is a separate unit, it adjoins and is operated in conjunction with a Swedish restaurant on Chicago's near north side.

Here full operas are given with recorded music and a retinue of more than 1700 specially built puppets—all on the grand scale of the New York Metropolitan or Paris opera houses. The puppets include a full 52-piece "orchestra" which occupies a pit in front of the 20-by-30-foot stage. When the lights dim, the orchestra pit is raised to stage level. A diminutive conductor,

Fredrik A. Chramer, owner of the puppet theater, directs operas from the complicated control booth





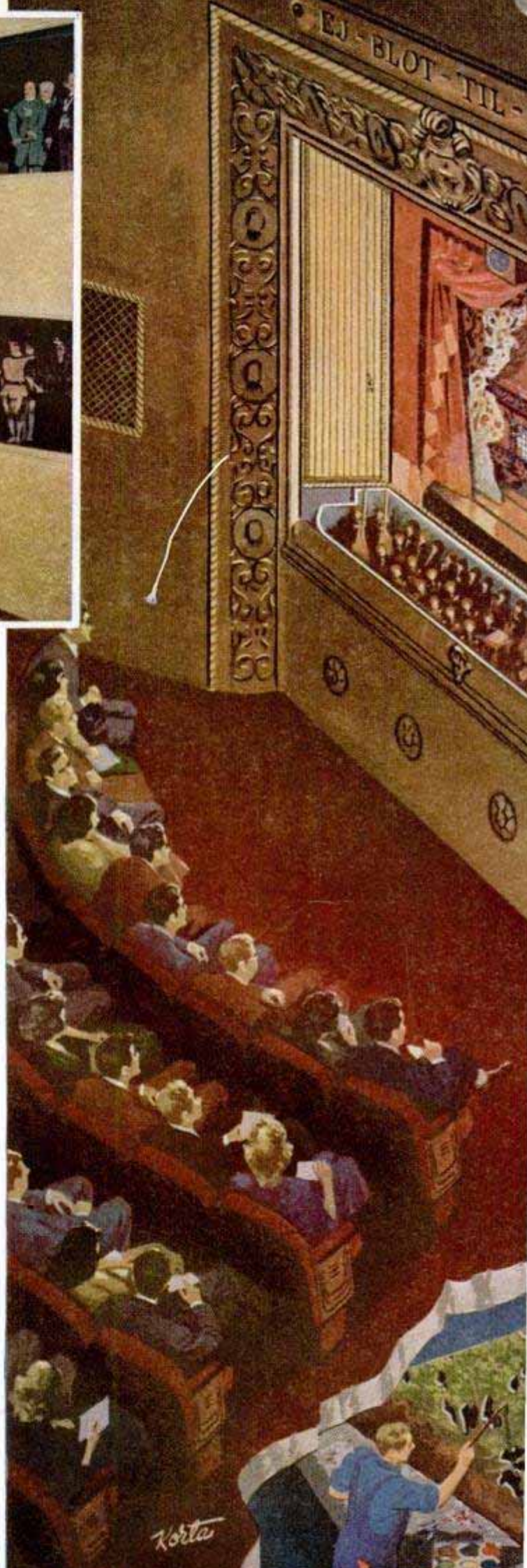
Nadine Kangas, a puppeteer, displays the full cast of puppets which will be used in the opera *Rigoletto*

fondly nicknamed "Tosci" by the puppeteers, walks out, takes a bow, turns to his orchestra and lifts his baton. He leads the group in perfect tempo, and natural movements give an almost perfect illusion. The orchestra's movements are controlled backstage by a single lever, but Tosci is operated from below the stage by one of the eight puppeteers. It takes 15 persons behind the scenes to put on an opera, including stage directors, scenery and wardrobe personnel, and one or two persons in the control booth located above the miniature balcony.

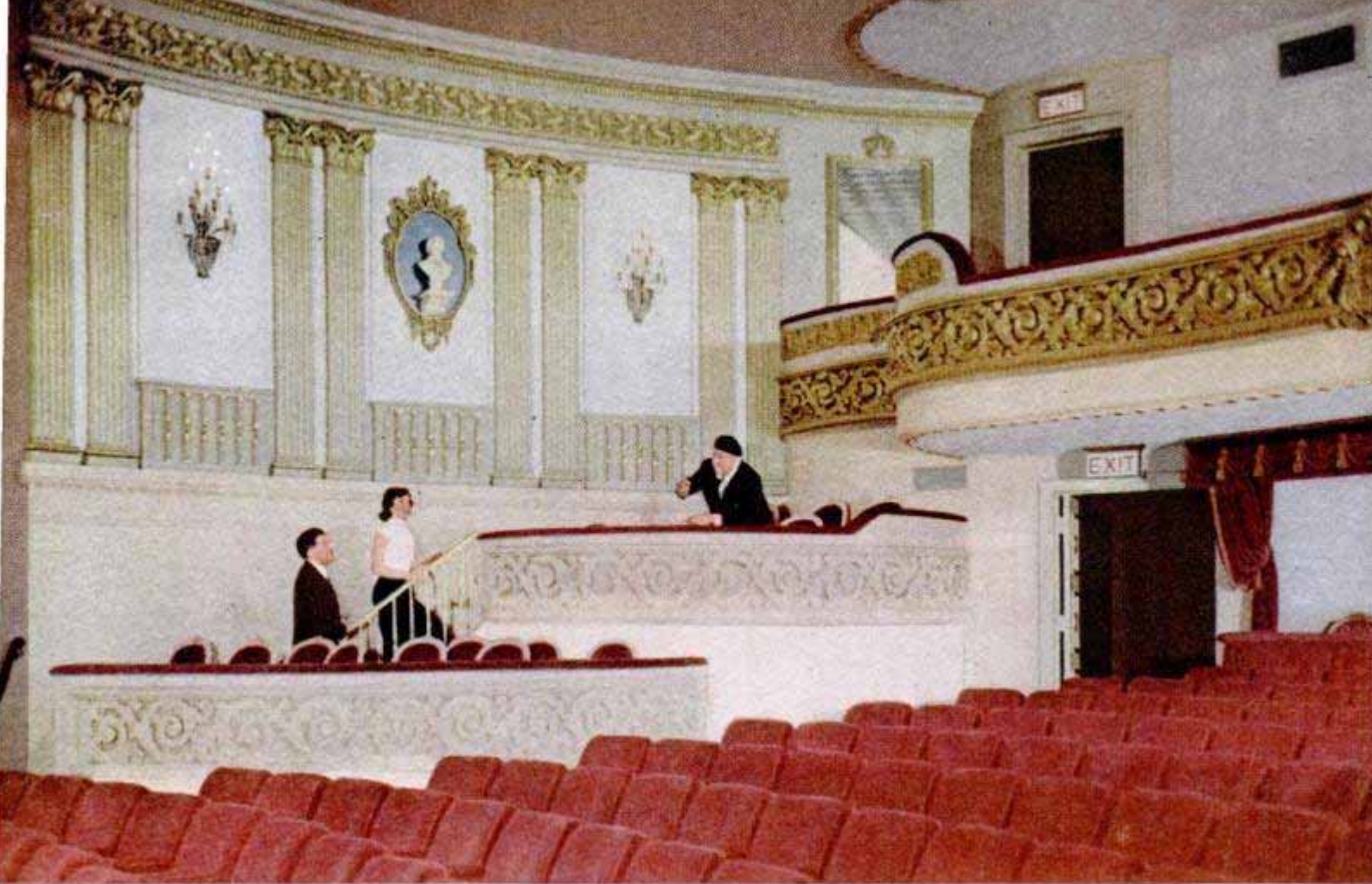
This control booth with its semicircular instrument panel, sound equipment, microphones, switches, dials and flashing lights resembles nothing more than the cockpit of a B-29 bomber. The "pilot" occupies a seat before a window that gives him a perfect view of the stage. He is almost encircled by the control board. From here he controls all sound reproduction and the elaborate lighting equipment, which consists of footlights with 620 small bulbs, proscenium border lights with 1240 bulbs, flood border lights with 112 bulbs, 20 miniature spotlights with 100-watt bulbs and two 20-foot-long cyclorama blue lights with 75-watt bulbs.

The director is in constant touch by wireless intercom with the puppeteers, who

Cutaway painting of the theater shows puppeteers at work beneath slotted stage during *Madame Butterfly* performance. Below are workrooms and storage space







Jewel-box interior of the puppet theater, which seats 208 persons, is like a miniature grand-opera house

must work in cramped space under the stage. The opera puppets are not like marionettes, which are operated by strings from above. They are rigid puppets supported from below by rods and controlled by wires with rings on the ends which fit the puppeteers' fingers. The stage floor has

Johannes Foerster studies each puppet after performance and dabs make-up paint where it's needed

row after row of horizontal slots along which the puppets move and a bisecting center slot enabling them to move from one row to another and to the front or rear of the stage.

The puppeteers sit on low stools equipped with rollers which enable them to scoot

To pick up their cues, puppeteers working below the stage wear headphones which are plugged into stools



silently about beneath the slotted floor. Occasionally there may be a collision at the height of some complicated operatic scene, but usually all runs smoothly after weeks of rehearsal. The stools are specially equipped to pick up impulses from wires built into the floor. All operators wear headphones plugged into the stools and the transmission of their cues from the control booth is similar to the operation of a walkie-talkie radio. Microphones are located under the stage so the puppeteers can talk back to the booth. Their voices come into the booth through a loudspeaker.

During a recent evening performance, a puppeteer's headphones snagged a wire connected to a bouquet which was being carried carefully by a puppet on the stage. The bouquet whisked through a slot in the floor in a jiffy. After a moment of subdued hilarity among the puppeteers, the bouquet obligingly rose through the floor and back into the hands of Suzuki, the maid of Madame Butterfly.

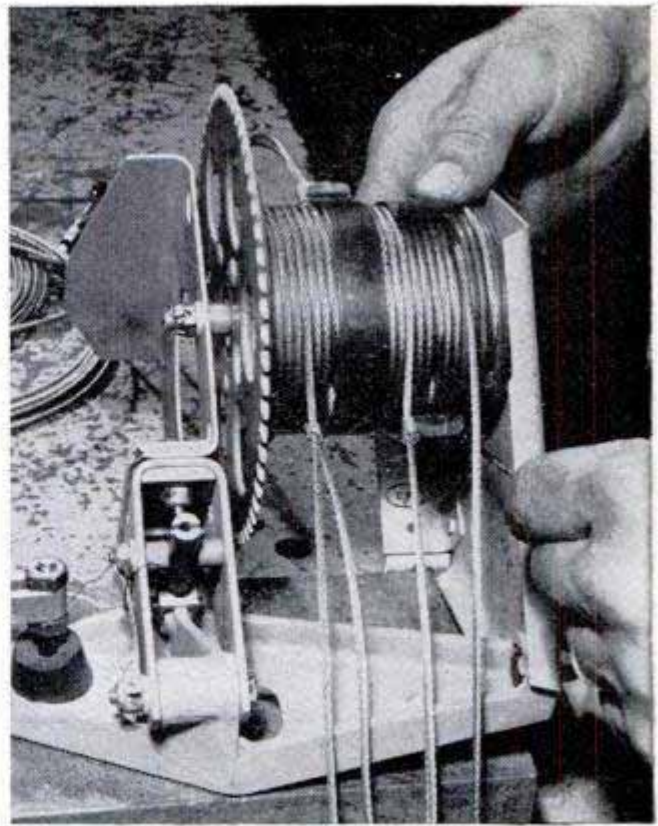
The headphones of the puppeteers pick up the opera music and singing along with the director's cues. Eventually all 17 operas will be recorded on a four-track tape so they can be fed simultaneously into the electronic control board, which will transmit only the music and singing to the theater auditorium; the music and singing plus cues into the headphones of the puppeteers; and the music and lighting directions for all scenes to the director in the booth.

One of the greatest tributes guests pay to the little opera occurs after a performance when they ask if the puppets are three or four feet high. Actually they are only 13 inches high but everything in the stage settings is in such perfect proportion that the puppets seem much larger. A great deal of the scenery, which is all built in the theater's own workshop backstage, is patterned after that of the Metropolitan Opera. The theater now owns 340 pieces of scenery for settings, which include street scenes, gardens, palaces, Japanese pagodas, bridges, forests, mountains and churches. Elaborate backdrops and other stage effects are lowered from a fly loft three stories high. The rigging ropes and weights could support the heavy settings of a normal-size theater, according to Fredrik A. Chrumer, the owner.

In many scenes where the action is simple and the lighting subdued, this miniature opera creates a complete illusion of reality—a triumph of electronics and hard work.

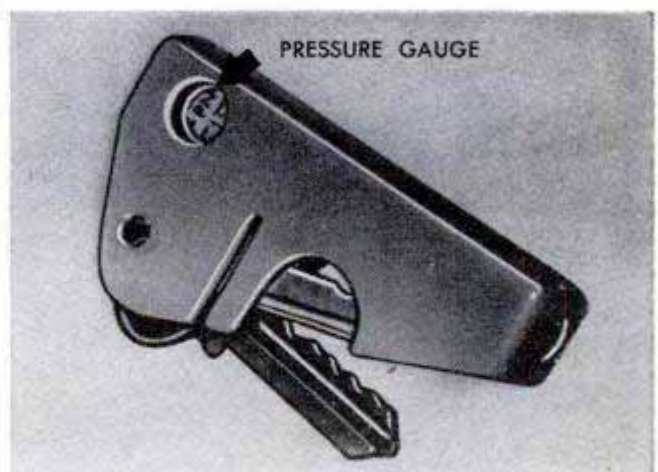
★ ★ ★

¶ Emphasizing the growing complexity of aircraft, more than three million hours of engineering time were required to design the latest U. S. Air Force bomber.



Steel Clips Save Labor

Spring-steel clips and a holding fixture are being used in a Texas aircraft plant to halve labor costs in wrapping cables on drum assemblies. Formerly, one man held the cables in place on the drum while the other performed the actual wrapping operation. The new process uses one worker, who pushes the steel clips over the drums after each cable is wound in place. He is then free to wrap additional cables on the assembly.



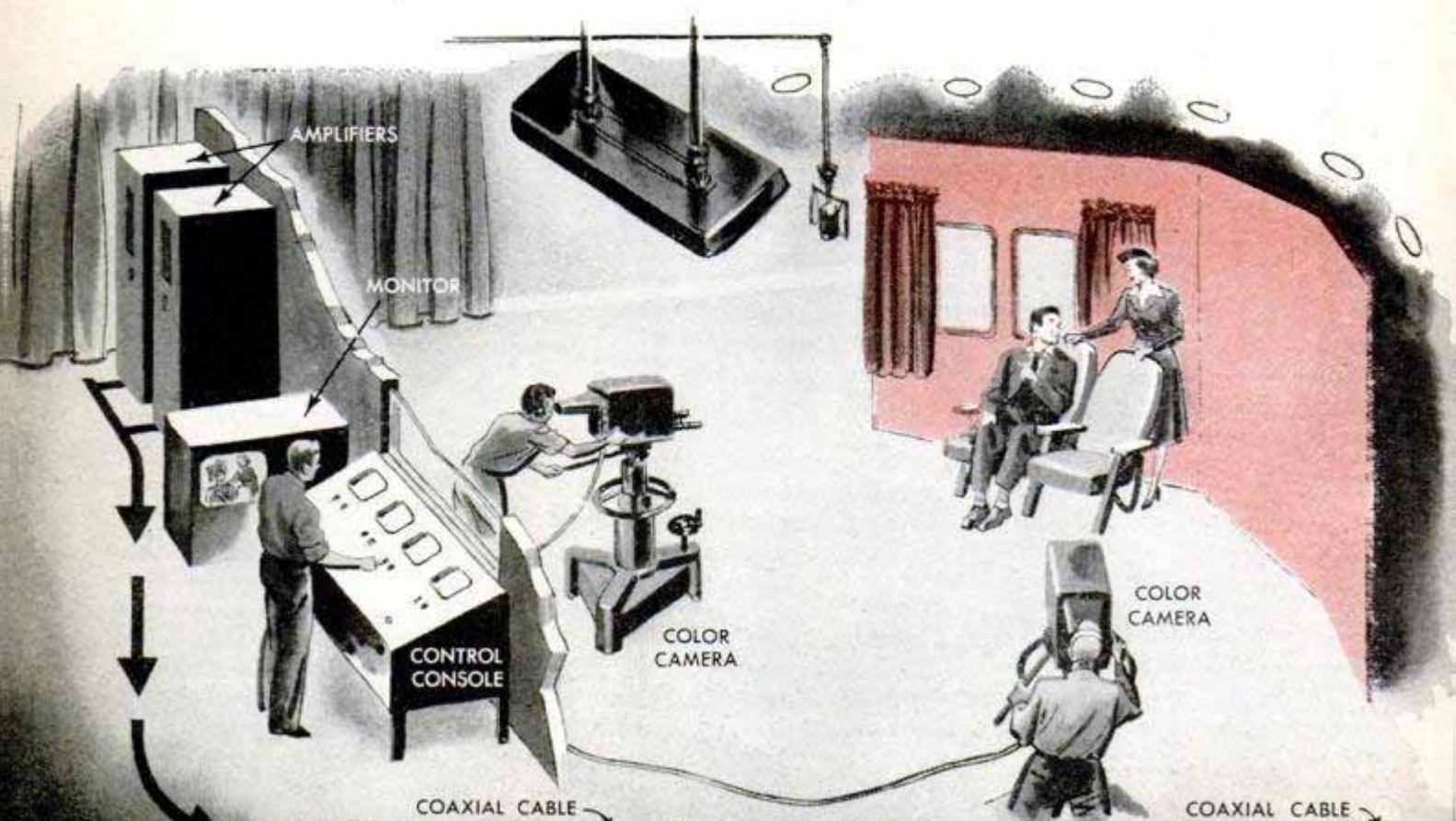
Key-Case Tire Gauge

With car keys in a neat plastic case that also includes an accurate tire gauge, motorists are constantly reminded to keep a close check on the pressure of their tires. Three keys fold into the smooth-surfaced case, which will not snag pocket or handbag linings.



While the action goes on, theatergoers blocks away watch this scene in brilliant color on a giant TV screen

TV BRINGS **COLOR** TO MOVIE THEATERS



COLORFUL DANCERS drifted across the big movie screen in the plush New York preview theater of Twentieth Century-Fox a few weeks ago. It looked like standard Technicolor, only brighter. Gaily costumed girls whirled through a grand spectacle of flashing color. Then came the surprise from an announcer in the theater:

"What you are witnessing is not a film, but a live show being performed, as you watch it, in our studios six blocks from this building!"

The trick is Eidophor — a revolutionary big-screen system of color television which soon may bring to your neighborhood theater Broadway shows in actual progress, singers and comedians as they perform 1000 miles away in a night club, scenes from concerts, operas, circuses, water carnivals, and sports events while they're happening.

Until now, the stumbling block in large-screen TV has been light. On your home receiver, you get a picture as the electron beam zips over the phosphor coating inside the face of the tube, making it glow. But projected to the size of a movie screen, that

picture would be only about as brilliant as midnight.

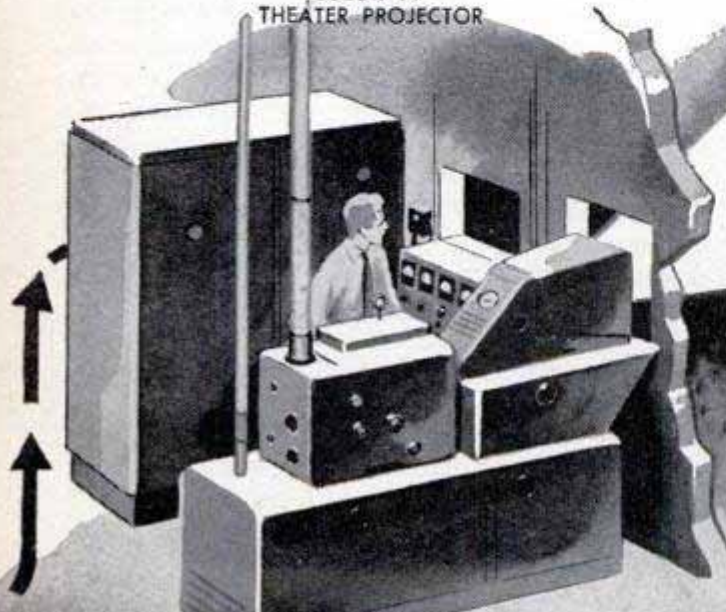
Secret of Eidophor (coined from Greek words meaning "image bearer") lies in the big projector, which looks like a standard commercial movie projector, with a carbon arc lamp to supply a dazzling light source. It is also a big color-TV receiving set. Its cathode gun, triggered by the telecast impulses, shoots an electron beam on a revolving, bowl-shaped mirror. The mirror is coated with a thick Eidophor fluid about the consistency of honey. The electron-picture impulses hit this surface and make tiny dents in it as the beam flashes along, scanning a little rectangular patch of 525 lines every 150th of a second. Though you could never see it with your eye, the beam has "carved" a relief image of the TV picture on that fluid. If you could see a cross section of the fluid under a microscope, it would look like a mountain range.

Light from the carbon arc above the bowl passes through a slotted mirror set at a 45-degree angle in front of it. Half the light hits the mirrored bars and bounces down

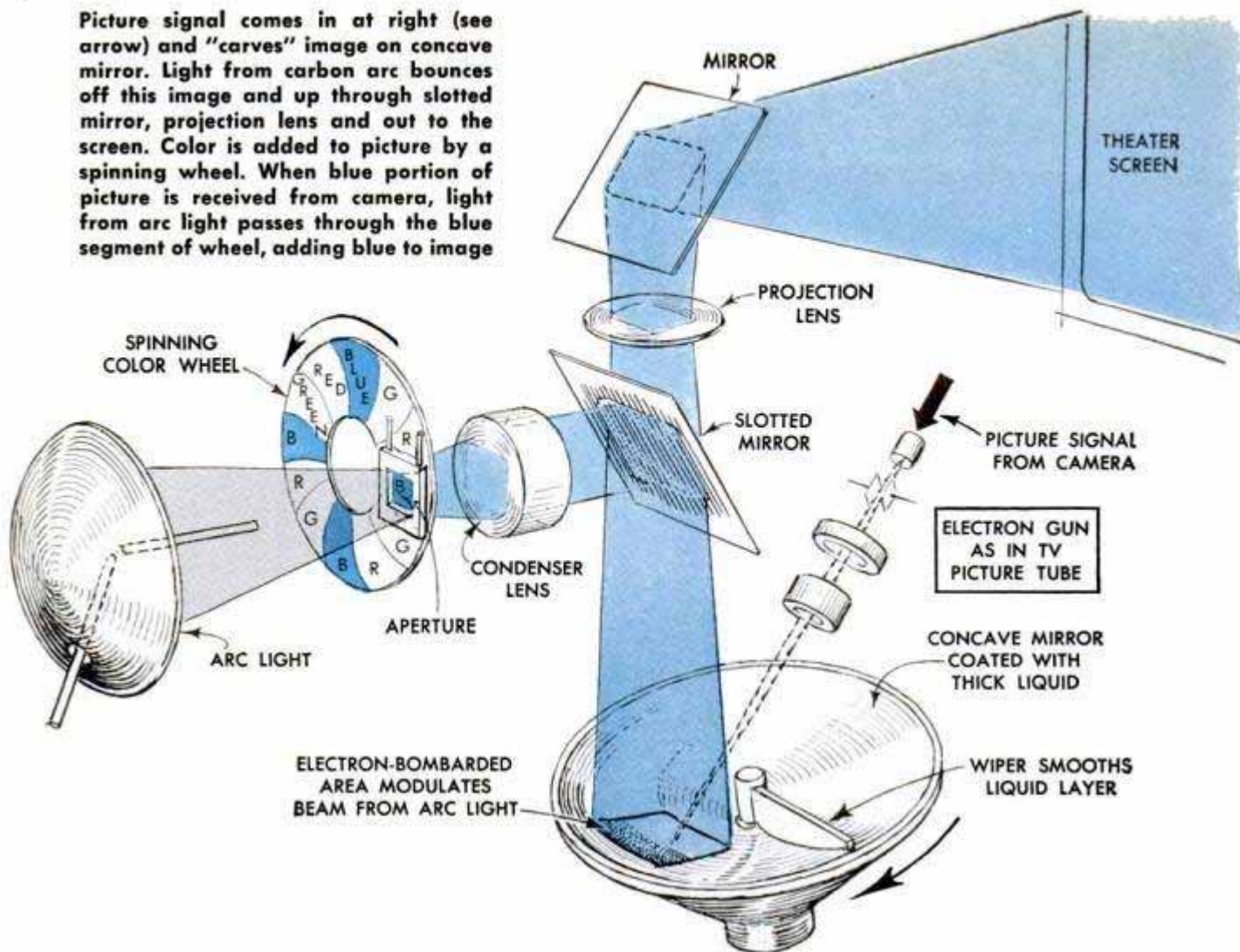


Drawing on these two pages illustrates the color system of theater television. At present, telecasts are transmitted only a few blocks via a coaxial cable, but later the signals will be relayed all over the nation. The heart of the system is the projector shown in the foreground, below. Left, this black-and-white picture was taken during a showing of color television. The scene was in full color and filled a movie screen 14 feet high and 20 feet wide

COLOR TV
THEATER PROJECTOR



Picture signal comes in at right (see arrow) and "carves" image on concave mirror. Light from carbon arc bounces off this image and up through slotted mirror, projection lens and out to the screen. Color is added to picture by a spinning wheel. When blue portion of picture is received from camera, light from arc light passes through the blue segment of wheel, adding blue to image



onto the image on the bowl. If there is no picture on the fluid, those light rays bounce right back up to the mirrored bars and back to the lamp housing. But when a picture is on the fluid, the microscopic dents deflect the light rays in varying degrees, so that they bounce up through the slots in the mirror, pass through a series of mirrors and lenses and out onto the big screen.

The tiny irregularities in the fluid will reflect more light or less, depending on how deep and steep they have been carved by the electron beam. Thus, the light and shadow of the picture are reproduced by the strong light beam bouncing off the bumps.

Concave mirror is polished before being installed in projector. In use, it is coated with a thick fluid

As the mirrored bowl containing the image revolves, its surface passes under a stationary blade that wipes the Eidophor fluid and evens its thickness.

To get color, engineers adapted the CBS sequential system of color TV.

Whirling color wheels in the TV camera and in front of the projector's carbon arc lamp are synchronized. When the camera picks up a red impulse through the red segment of its wheel, the cathode gun shoots a "red" impulse to etch a depression on the Eidophor fluid. Meantime, the carbon-arc lamp is shining through the red panel in its wheel. Hence red light will be reflected to the screen from that tiny bump in the Eidophor fluid. So, in microsecond sequence, each color speck flashes on to the screen just the way the camera records it in the studio. So fast do the flecks of color flash onto the big screen, and so fast does the electron beam scan the picture field (one complete picture each 150th of a second) that the human eye sees only a smooth flowing picture in full color.

Current plans call for launching Eidophor this year or next with a show something like the live shows at Radio City Music Hall and the "Roxy" today. It will go out to theater chains on the microwave or coaxial circuit three or four times a day. ★ ★ ★





Detroit Listening Post

By Siler Freeman

THE AMAZING sales appeal of the automatic transmission has not blinded the auto industry to its inherent imperfections. There is no company with an automatic transmission on the market which is not seeking better performance from it through design changes and improvements. Those who have not yet come out with such a transmission are still weighing the merits of the two principal types, the planetary and the torque converter.

Of all the larger companies, Chrysler perhaps has been the most reluctant to go into fully automatic transmission. It has various types which can be called only semi-automatic and has made a thorough study of one real automatic type which is not yet in production.

Which way it will go is indicated by a recent announcement that it has a new high-performance torque converter for the six-cylinder Windsor. The feature of this transmission—and it may be an important one—is that the new device combines the torque-converter oil system with the engine oil system.

The transmission carries the same name—Fluid Torque Drive—as the one used on the larger Chrysler models in conjunction with the V-8 180-horsepower engine. Chrysler officials claim that it has “high breakaway torque multiplication characteristics”; that is, it starts off fast.

Integrating the two oil systems is said to provide longer life to the engine oil. The company says that only two oil changes a year are needed in average operation.

Combining the two oil systems also eliminates the torque-converter oil pump and sump. The converter’s oil is air-cooled by blades in the outside of the converter shell and by drawing large quantities of air over the shell, the blades eliminate the need for separate oil coolers.

General Motors, which actually pioneered automatic transmissions, is not yet entirely satisfied with its three candidates. Particularly Buick’s Dynaflo and Chevrolet’s Powerglide have been neither as economical nor efficient as the company would like. Hydra-Matic is still the leader,

is being used in the other three General Motors cars and has greater acceptance.

Neither Buick nor Chevrolet will admit any shortcomings of their particular transmissions. Although Buick is attempting to keep it secret, it is known that the company will make an important change in Dynaflo in the next models. It is reported the Buick version will come much closer to Hydra-Matic and may combine the torque converter with a three-speed gearbox.

Chevrolet has been experimenting with something closer to the Ford automatic transmission which was engineered by Borg-Warner. In fact, the latter’s engineers worked out a new design for Chevrolet which was later rejected. But some of those features will be adapted to Powerglide.

There has been another persistent report that the Detroit Transmission Division of G.M. has been working on a smaller unit of Hydra-Matic, presumably for use in the new Chevrolet.

Cadillac also has been experimenting with an automatic transmission of its own. (G.M. is planning an optional air-conditioning unit on the 1953 Cadillac and Oldsmobile models.)

Just as development continues on transmissions, so does it progress on engines. Higher-octane fuels are predicted, so work is going ahead on higher compressions. Right now, the question is how many more car makers will have high-compression V-8s in their 1953 models. Mercury, which was believed a certainty in this field, isn’t so sure now.

Chevrolet is the enigma. It has a high-compression V-8 in the works and may have a pilot model out soon. But no tooling has been ordered. It appears impossible even for versatile Ed Cole, new chief engineer, to work around this obstacle in time for ’53.

Only Buick and Dodge appear on schedule with the new engines. Pontiac is holding off another year and so is Packard.

One thing is certain about the 1953 models—they will be easily distinguishable from their predecessors outside, if not under the hoods. ★ ★ ★

The OWNERS

Clymer points to the horizontal carburetor on the left side of the Nash Ambassador engine



MECHANICS MOTOR SURVEY BY FLOYD CLYMER

Ambassador
 Transmission Overdrive Hydra-Matic Drive
 15. Speedometer mileage is now 5428.
 operates satisfactorily using:
 gasoline
 m. p. g. for city driving, 17 miles per gal.
 m. p. g. for country driving, 21 miles per gal.

5. I CHANGE OIL every _____ miles (and never add oil between changes).
 I change oil every 3000 miles, but also ADD one quart every 1800 miles.

6. Roadability and handling qualities are: Excellent Good Unsatisfactory
 7. Maneuverability in traffic seems to be: Excellent Good Unsatisfactory
 8. Acceleration is: Exceptional Very Good Average Poor up to 50 mph.
 9. Curb and road clearance is: Satisfactory Too High Too Low

10. Here are my main reasons for purchasing a Nash: Style, ride, twin beds, and weather-eye system. Also visibility.

11. Particular features I like are:
 New "Golden Airflyte" body styling by Pinin Farina
 Airflyte unitized body and frame construction
 Airflex independent wheel suspension - by long, vertical coil springs.
 Nash "twin-bed" and reclining seat
 New safety-type instrument panel
 Weather-Eye heating and air-conditioning system
 New, "squeeze-type" door handles

12. Specifically, what do you dislike about your Nash? Large turning radius for small car. Wipers stop with speed-up with conventional transmission

13. Have you ever owned a Nash before? Yes No How many? Two ^{drive}

14. Would you buy another Nash? Yes Possibly No (has different fuel pump than overdrive model)

15. How do you rate your dealer service? Excellent Good Average Poor

16. How do you rate your Nash, generally? Excellent Good Average Poor

GENERAL INFORMATION

17. What type of engine would you prefer in your next new car? In-line V-type
 Number of cylinders: 6 8 Valves: Side Overhead Except with full load.

18. Are you satisfied with the horsepower rating of your Nash (88 or 120)? Yes No
 Approximately what H.P. rating would you prefer in your next new car? 120

19. What improvements would you like to see in your next car? Shorter turning radius and improvement for windshield wipers.

20. Based on your present experience, which transmission would you prefer? Conventional
 Conventional with Overdrive Hydra-Matic Drive Other type automatic trans.

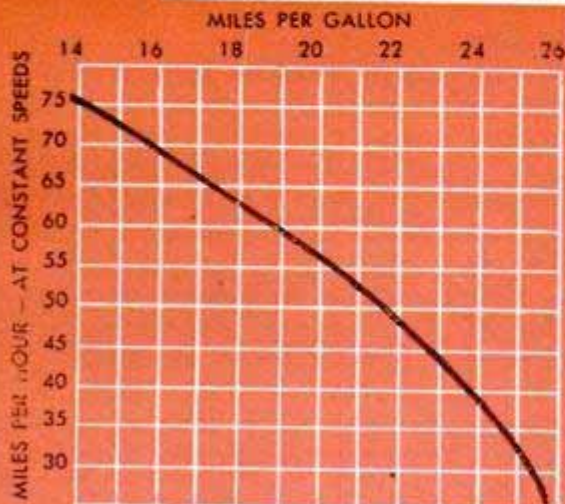
This questionnaire will be tabulated fairly, and your name will be held in strict confidence. We request that you attend to each question listed. Thank you

Please mail promptly to:

FLOYD CLYMER
 1268 SO. ALVARADO ST.
 LOS ANGELES 6, CALIF.

My name: _____
 Address: _____
 City & State: Dracont, Mass
 Occupation: Mechanic

(Please write your personal comments on reverse side.)



— Results of the economy test of the 1952 Nash Ambassador four-door sedan with Dual-Range Hydra-Matic

The true test of an automobile begins when the owner takes the wheel. This is another report from owners of 1952 cars who answered questionnaires sent by Popular Mechanics to 1000 Nash owners from coast to coast

REPORT on the 1952 NASH

By Floyd Clymer

NASH IS ONE of the few American car manufacturers to make important design changes for 1952. Eighty-eight percent of the owners who filled out our Nash questionnaires made favorable comments on the Golden Airflyte body styling. However, there were some loud howls from owners about the long turning radius of the Nash with its skirted front wheels.

This report covers the Statesman and Ambassador models, as the Rambler models were covered in a previous *P.M.* survey. While the V-8 engine trend increases, 65 percent of Nash owners prefer in-line engines. Nash owners also like six-cylinder cars as 65 percent prefer sixes while 35 percent want an eight. The fact that 32

percent of the owners rated dealer service "average" or "poor" would indicate a need for improvement there.

Despite the high-compression ratios of both Statesman and Ambassador engines—7:1 and 7.3:1 respectively—61 percent of Nash owners reporting said they use regular gasoline satisfactorily.

Nash scored unusually high in average miles per gallon, compared with other cars of similar size. Gas-mileage figures of 28 and 30 miles per gallon in country driving were reported frequently by owners of Statesman models. The lowest average figure tabulated—17.6 miles per gallon for the Ambassador in city driving—is near the highest average figure of several other cars

Wide and squat, the Nash has above-average roadability, Clymer reports. Long slot at base of the windshield is air intake of the ventilating system



ACCELERATION TEST

1952 Nash Ambassador Custom 4-Door Sedan
with Dual-Range Hydra-Matic Drive

¼ mile from zero	(Drive range 3 only)	22.10 seconds
	(Drive and Low ranges)	21.70 seconds
½ mile from zero	(Drive range 3 only)	34.40 seconds
	(Drive and Low ranges)	33.60 seconds
0 to 30 m.p.h.	(Low range only)	5.70 seconds
0 to 60 m.p.h.	(Drive range 3 only)	17.10 seconds
	(Drive and Low ranges)	16.60 seconds

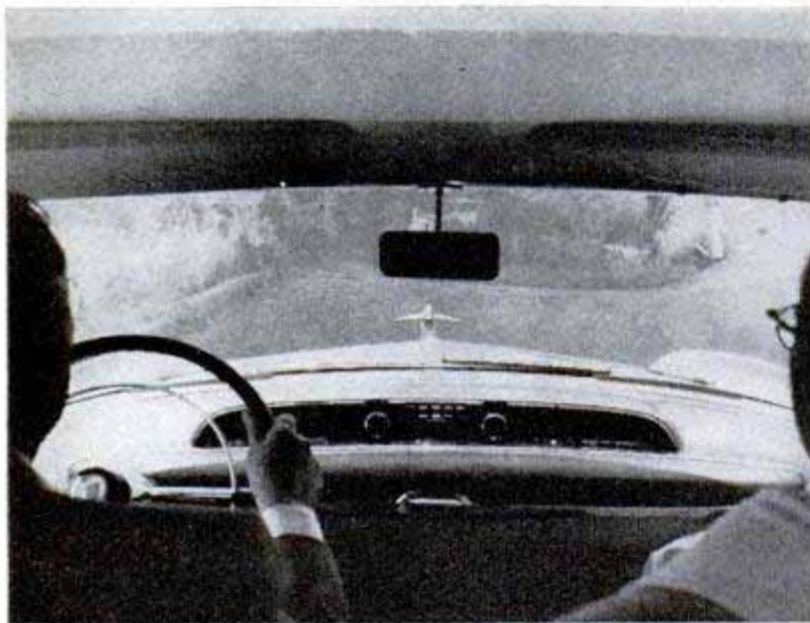
Where both Drive and Low ranges were used, the change from Low to Drive was made at about 30 m.p.h.

Top speed by speedometer—102-104 m.p.h.

Actual top speed, about 7% less (speedometer variation)



There is room plus accessibility in the sliding-drawer glove compartment mounted below the center of the new Nash dashboard



Above, sloping hood gives excellent vision ahead of car and permits driver to see both front fenders. Crash pad across the dashboard is too narrow for real protection, the report shows. Below, recessed spare tire is inconvenient when trunk is full



in the Nash price range. (The survey showed that economy of operation was one of the major reasons why owners bought Nash cars.)

Nash owners are not so automatic-transmission conscious as those of several other makes we have polled. The overdrive unit is very popular with owners. The poll showed that 60 percent of Nash owners reporting use either conventional transmission or conventional with overdrive; 58 percent said they intend to have the same on their next cars.

The new Pinin Farina Golden Airflyte body styling for 1952 was a big factor listed in "reasons for purchase." A recurring objection was the poor fitting of body, panels and doors with a few owners mentioning squeaks and rattles (as we find they do with all makes). Still remaining a resoundingly popular Nash feature is the twin-bed and reclining-seat arrangement; 81 percent of the owners said they liked this exclusive Nash offering. Sixty percent of those reporting mentioned that they liked the new squeeze-type door handles.

There were complaints about the new instrument panel. Some said that the shelf, or ledge, reflected sunlight into the windshield, while others thought the crash pad was not wide or thick enough to be any more than an ornament.

Nash's Weather-Eye heating and air-conditioning system, a pioneer in its field more than a decade ago, had general approval; 88 percent of the owners checked it as desirable. Most owners approved the Nash Airflyte unitized body and frame construction, and Airflex wheel suspension with its long coil springs.

To the question, "How do you rate your Nash generally?" the responses were: Excellent, 63 percent; good, 32 percent; average 4 percent; poor, 1 percent.

Here are some random comments from owners:

"The Statesman is excellent but underpowered." — Chicago doctor.

"We are pleased with the

Percentages From PM Poll

Owners of Statesman models.....	51%
Owners of Ambassador models.....	49%
Owners having Hydra-Matic Drive.....	40%
Owners having conventional transmission with overdrive.....	36%
Owners having conventional transmission only.....	24%
Owners using regular gasoline.....	61%
Owners using premium gasoline.....	39%
Average gasoline mileage in country:	
Statesman.....	22.5 m.p.g.
Ambassador.....	20.2 m.p.g.
Average gasoline mileage in city:	
Statesman.....	19.8 m.p.g.
Ambassador.....	17.6 m.p.g.
<i>(Owners reporting on cars with overdrive unit averaged about 2 m.p.g. more and Hydra-Matic owners about 2 m.p.g. less than above)</i>	
Average mileage for change of oil.....	1480
Add oil (also change periodically).....	5%
Average mileage for adding one quart.....	906
Roadability excellent.....	78%
good.....	21%
unsatisfactory.....	1%
Maneuverability excellent.....	57%
good.....	40%
unsatisfactory.....	3%
Acceleration exceptional.....	16%
very good.....	58%
average.....	23%
poor.....	3%
<i>(Includes both Statesman and Ambassador models)</i>	
Road clearance satisfactory.....	97%
too high.....	2%
too low.....	1%

BEST-LIKED FEATURES

Golden Airflyte body styling.....	88%
Airflyte body-frame construction.....	66%
Airflex independent wheel suspension.....	69%
Nash twin-bed and reclining seat.....	81%
Safety-type instrument panel.....	49%
Weather-Eye air-conditioning.....	88%
Squeeze-type door handles.....	60%
<i>(These percentages are based on answers to direct questions asked in questionnaires)</i>	

OWNERS' RATING OF CAR

Excellent.....	63%
Good.....	32%
Average.....	4%
Poor.....	1%

GENERAL INFORMATION

Owners preferring the following on next new car:	
In-line engine.....	65%
V-type engine.....	35%
Six cylinders.....	65%
Eight cylinders.....	35%
Overhead-valve arrangement.....	77%
Side valve location.....	23%
No increase in horsepower output.....	72%

Average horsepower output desired.....	116*
<i>(Respective Nash horsepower figures—88 and 120—were tabulated for those owners who expressed satisfaction with present ratings)</i>	
Conventional transmission with overdrive.....	48%
An automatic-transmission unit.....	42%
Conventional transmission only.....	10%
Hydra-Matic Drive exclusively.....	93%*
Other type of automatic transmission.....	7%*

**(Percentage of the 42% preferring automatic-transmission units)*

Previous Nash owners.....	73%
Will buy another Nash.....	67%
Might buy another Nash.....	30%
Will not buy another Nash.....	3%
Dealer service rated:	
Excellent.....	40%
Good.....	28%
Average.....	23%
Poor.....	9%

Chief purchase reasons (In numerical order):

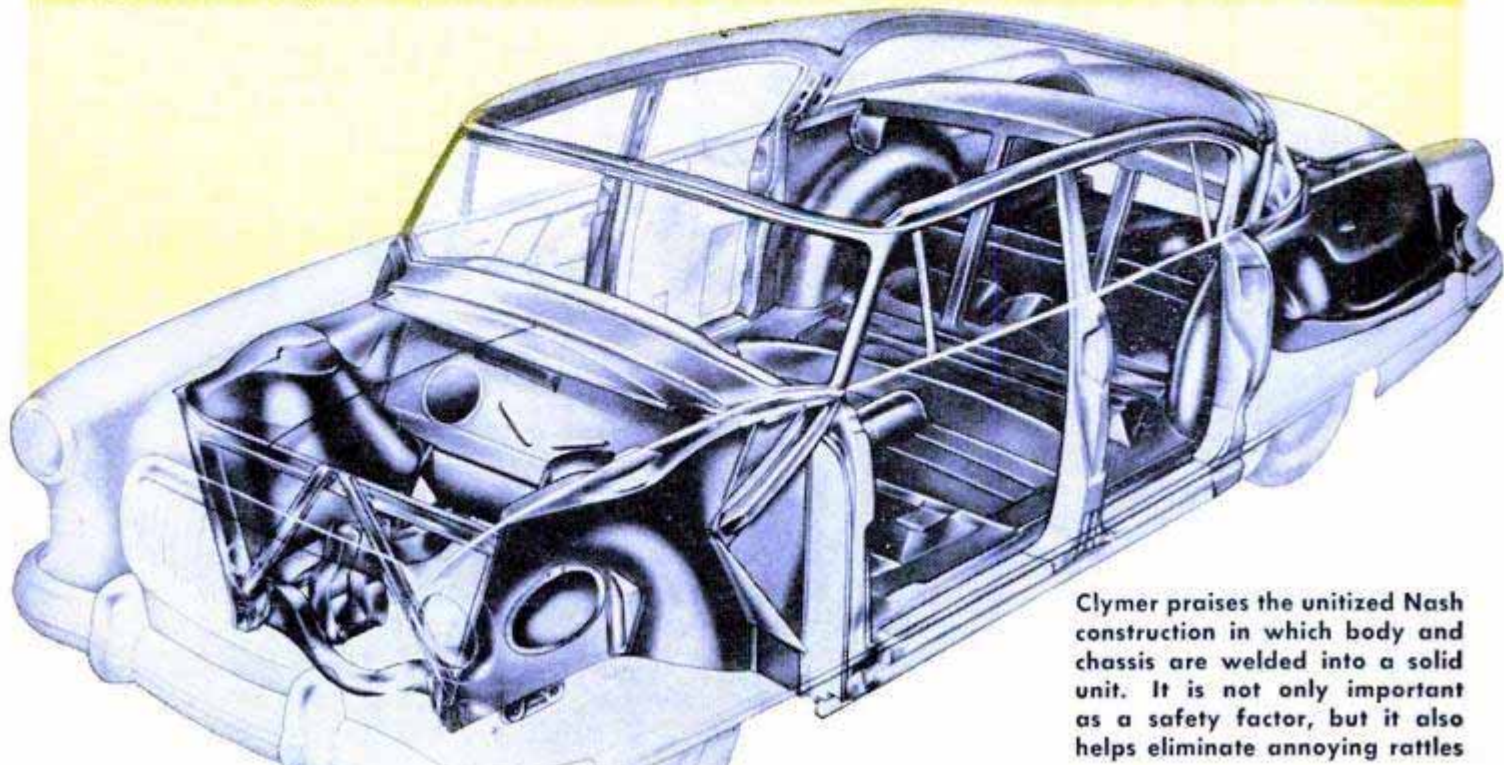
1. Economy of operation.
2. Styling features—interior or exterior.
3. Riding qualities and comfort.
4. Previous satisfactory ownership
5. Mechanical features.
6. Roadability, driving ease, handling qualities
7. Interior space—for passengers and luggage.
8. Good trade-in allowance on old car, dealer good will.

Improvements desired in next new car (in order of preference):

1. Increased acceleration and power.
2. Better body assembly and tighter construction.
3. Body-styling changes—longer hood, less width.
4. Various mechanical improvements—smoother-shifting automatic transmission, less brake-pedal pressure required.
5. Better-quality paint and chrome trim.
6. Easier steering—power-assisted or otherwise.
7. Increased gasoline economy.
8. Electric windshield wipers.
9. More comfortable riding position.
10. Shorter turning radius for parking.

Most frequent objections (both models):

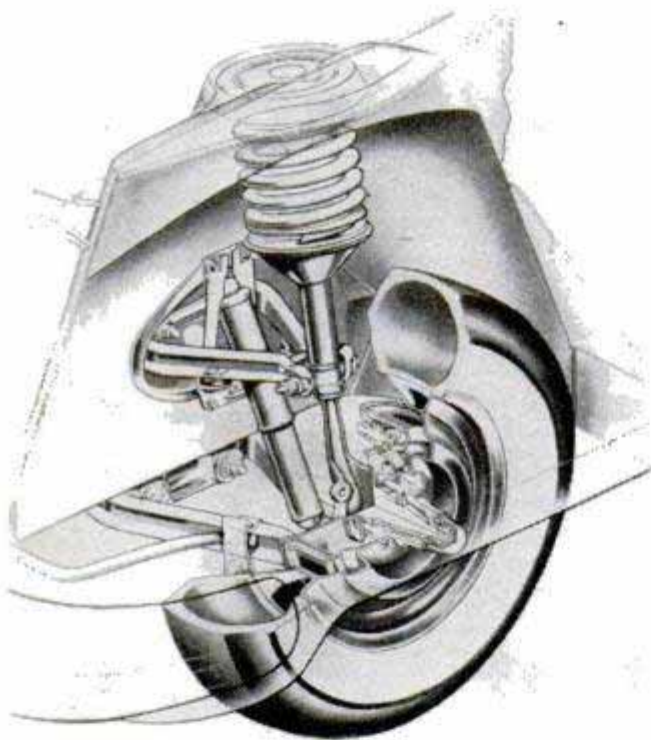
1. Body fitting or assembly.
2. Low acceleration or power.
3. Unusually wide turning circle.
4. Width of body or other styling items.
5. Thin chrome trim or paint finish.
6. Seats too soft or too short under legs.
(Particularly front seats noted)
7. Sun glare caused by bright trim through curved-glass areas, front and rear.
8. Low resale value.
9. Excess brake-pedal pressure required for quick stop.
10. Low gasoline economy.
11. Weak armrests on front doors.
12. Horizontal location of spare tire in trunk
13. Hydra-Matic shifting becomes jerky.
14. Horn ring obstructs vision of instruments—particularly Hydra-Matic quadrant.



Clymer praises the unitized Nash construction in which body and chassis are welded into a solid unit. It is not only important as a safety factor, but it also helps eliminate annoying rattles



On Hydra-Matic-equipped Nash models, you start the engine by pulling up on the knob of the shift lever



Above, high-mounted front coil springs reduce side-sway on corners. Below, exclusive with Nash is the reclining front seat that adds comfort to long trips



looks, comfort and roominess of the new Nash. More power would be desirable in the Statesman if it didn't cut down the mileage too much. The car could hold the road better and make a U-turn easier."—Chicago school secretary.

"The Ambassador is the best-handling car a woman can buy — and economical, too."—Springfield, Ill., housewife.

"The Statesman has all the room we need, gas mileage is very good and upkeep is low. Could use about 5 or 10 more horsepower for climbing."—Chicago barber.

"The seats are the way I like them. I can drive all day without feeling it's a hard day's work."—Fond du Lac, Wis., maintenance machinist.

"Bed arrangement for vacations is great."—Indianapolis lawyer.

Some owners agreed with a Dracut, Mass., machinist that the turning radius is too large and that this made the car hard to park. Others, including a Bristol, Tenn., textile supervisor, said that the doors leak.

"If you sit back on the front cushion it feels thin and inadequate."—Elizabeth City, N. C., retired naval officer.

"Doors don't close tightly. They have to be slammed."—West Allis, Wis., barber.

"Chromework and light reflect in left-front window. . . . Noisy with windows closed in wind or rapid driving."—Topeka, Kans., social worker.

"No power for this kind of country—too many hills. OK on flat stretches."—Putnam, Conn., drop-hammer operator.

"My Statesman jerks a good deal on deceleration."—Tempe, Ariz., assembler.

"Front tires are hard to change with tools supplied."—Midway Park, N. C., marine.

"Give the front end of the Nash as much style as the back end and you will have a

(Continued to page 262)

Below, easily accessible yet concealed from view is the gasoline-filler cap on the new Nash. It is beneath a hinged cover that is part of the right taillight



A Scientist Diagnoses the

FLYING SAUCER

By Dr. I. M. Levitt

Director, The Fels Planetarium, Franklin Institute, Philadelphia

ONCE UPON A TIME the only place where flying saucers were seen was in the far West. In the desert areas of western United States the lone prospector looked up, saw the momentary appearance of strange lights, and went about his work.

Today there are hundreds of thousands of persons in the desert regions working for the Atomic Energy Commission and the armed services. Today, the tremendous population in that part of the country has brought to the attention of scientists the fact that there are strange illuminated features in the sky. Make no mistake about it. Something is seen—but that something is not a flying saucer from another world nor is it an airplane from any other country on earth.

The features are mirages pure and simple. They are generally associated with hot, dry countries and are most commonly seen over desert regions. As one goes higher and higher in the atmosphere the air gets cooler and cooler, but occasionally there is found a warm layer riding on top of a cold layer of air. This is usually brought about by the ground cooling more rapidly than the air after the sun goes down. As a result, there is found a temperature inversion and the light normally going up and being lost in the sky is bent. Thus light sources from distant cities will be seen against a black sky. If there is any motion of the air layers, the lights will move across the sky at incredible speeds.

In newspaper reports which appeared in past weeks there seem to have been a great many of these observations in the East—particularly around Washington, D.C. Why should we see them over Washington when that city is far removed from the desert regions which father mirages? The answer to this question is very likely found in the unbearably hot weather to which we have been subject this summer.

The advent of the prolonged hot weather simulated desert conditions which gave rise to the mirages appearing over Washington and the eastern seaboard, and the flying-saucer scare was on again.

It is this writer's opinion that the flying saucers will continue to be seen until the

weather moderates. When the temperature inversions cease to exist, the flying saucers will disappear.

Jet planes pursued these saucers, but as yet have not succeeded in catching them and they obviously cannot catch them because they are mirages. It is true that they have been picked up on radarscopes and clocked at about 100 miles an hour, but this does not substantiate their existence.

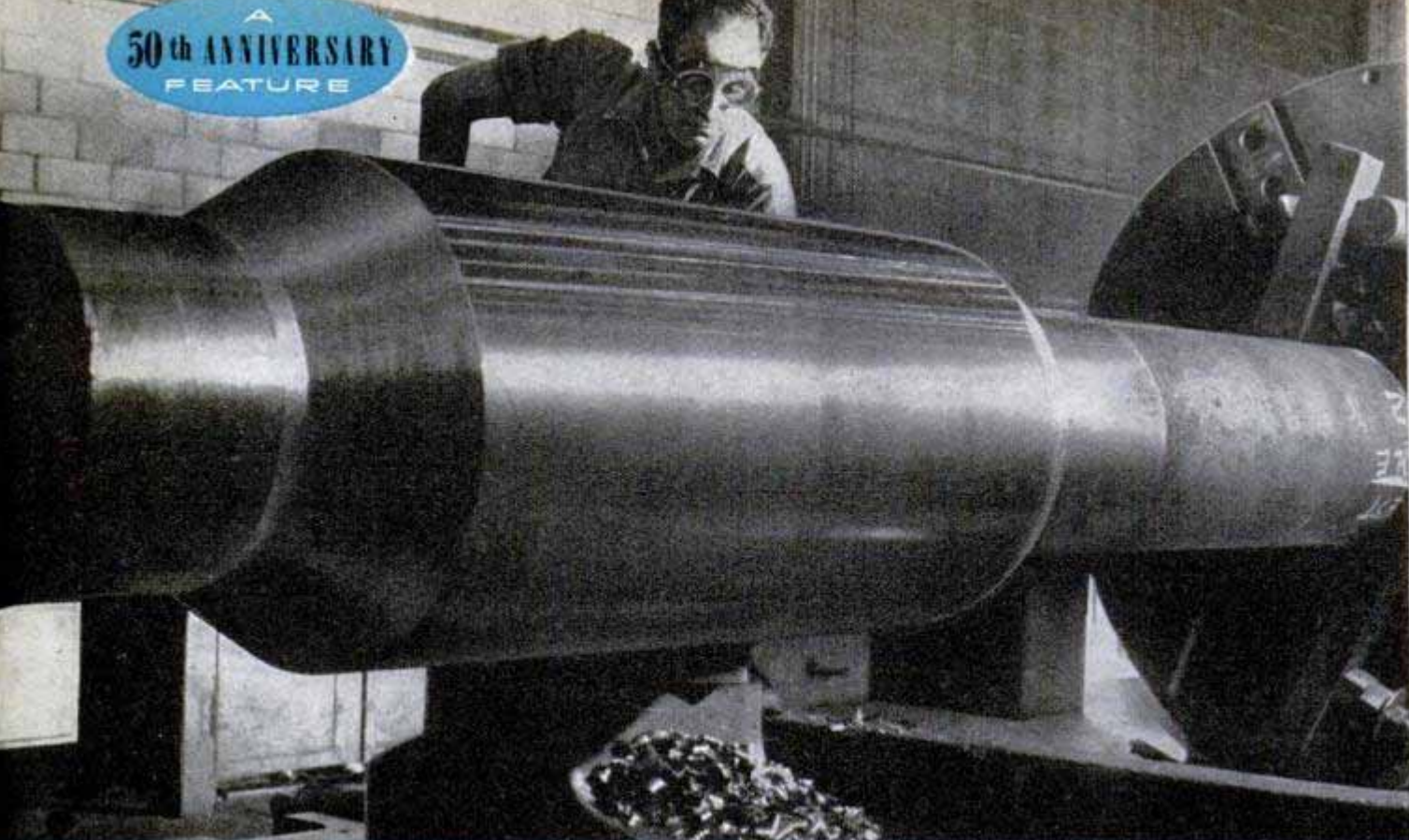
The problem of their appearance on radar screens has set many people wondering. Radar, because of its magnificent use in the past war and its high level of attainment, has been looked upon as infallible. The truth of the matter is that radar is as unstable as any other electronic device in use today.

During the last war it was not uncommon for the radar screens to pick up "twilight ghosts." Almost every evening, when the sun set, there would appear sharp "pips," or "blips," which would last for perhaps 10 minutes. This effect was most pronounced in the tropics, again where there was the maximum possibility for a temperature inversion. There are many effects in radar scanning which cannot be explained.

In a way, the effects are similar to the television anomalies which we experience today. Some of you have turned the dial and suddenly picked up a station which is several hundred miles away. This is normally an impossibility because we receive television signals purely as a line-of-sight wave. When the station is farther than 90 miles away, in most cases the signal is too attenuated for reception. However, television anomalies appear at certain times which are probably governed by atmospheric conditions and these conditions include ionized portions of the atmosphere.

Similarly, there appear radar anomalies that can give rise to the "indistinct" blips which are reported in the daily papers. Just why or how these originate is not understood except that electronic engineers know they exist. Even the wavelengths of the two systems are not too dissimilar. Normal television is transmitted at a frequency of about 200 megacycles. The normal radar

(Continued to page 298)



U. S. Steel Corp. photo

By George Scullin

Giant steel roll soon to take its place in a U. S. Steel rolling mill is machined on a 60-inch lathe in the forging shop at the firm's Homestead District works

**The jet engine and the wrist watch,
the power saw and the 1952 automobile—
all are products of those modern wonders—**

THE

AROUND early March this year, a few newspapers announced casually that the Air Force had been given the green light on the purchase of 20 machine tools. It was just a small story and the editors couldn't get too excited about it. Not even at the size of the machines, four stories high; or their cost, \$389,000,000! Stories like that are routine in this year of 1952.

But what if that story, through some slip in the time machine, had appeared before the young editors preparing the first issues of *Popular Mechanics* in 1902? What about it would be strange?

Not the words "Air Force," though man had yet to fly a power-driven aircraft. These farseeing young men were already convinced that man *would* fly, and soon, and that there would be an Air Force. Not the size of the machines. These editors were dedicating their magazine to the conviction that the years to come would produce mechanical wonders beyond anything even dreamed of at the turn of the century. To anticipate these marvels and explain them in words and pictures their readers could understand was the job they had already

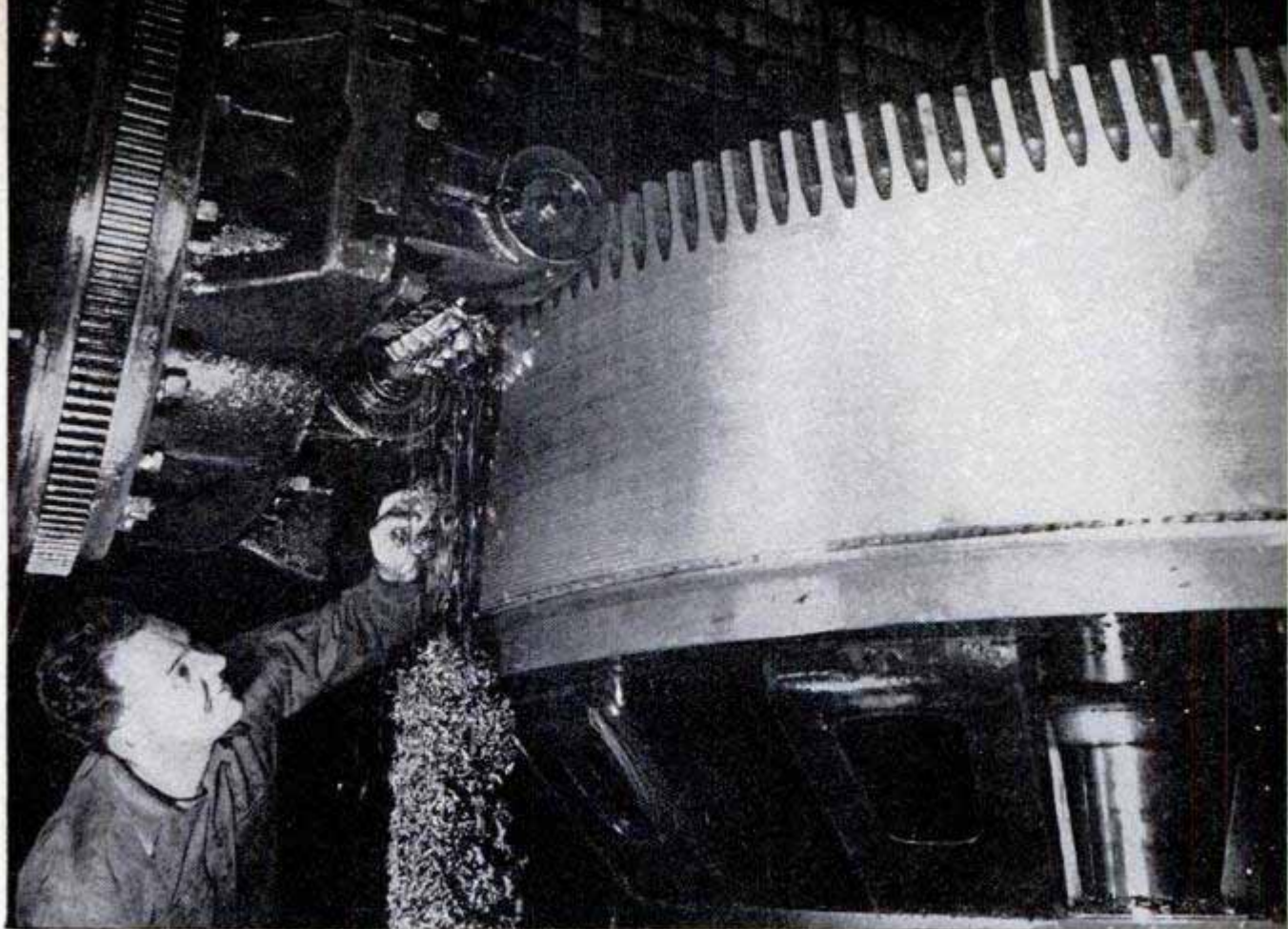
created for themselves. But we do think they would have been stunned by the \$389,000,000.

In 1902 that sum would have bought the year's output of the entire machine-tool industry, would have bought the industry as well, and there would have been enough left over to put a little white fence around the whole thing. In fact, the industry was so small that few people had ever heard of it, and fewer still knew what it was.

Yet this is the tiny industry that has made possible our entire way of life. Without it, we would be living on the products of our bare hands, with a standard of living approaching that of Colonial days.

What are these machines that produce all this magic? Well, they are a weird family. They are the tools that make the tools that make everything else. But, being a family, they also make each other. This makes them the only self-procreating race in the machine world.

To understand the huge, fantastic, almost-human machine tools of today, let's take a look at their ancestors as the first editors of *Popular Mechanics* knew them.



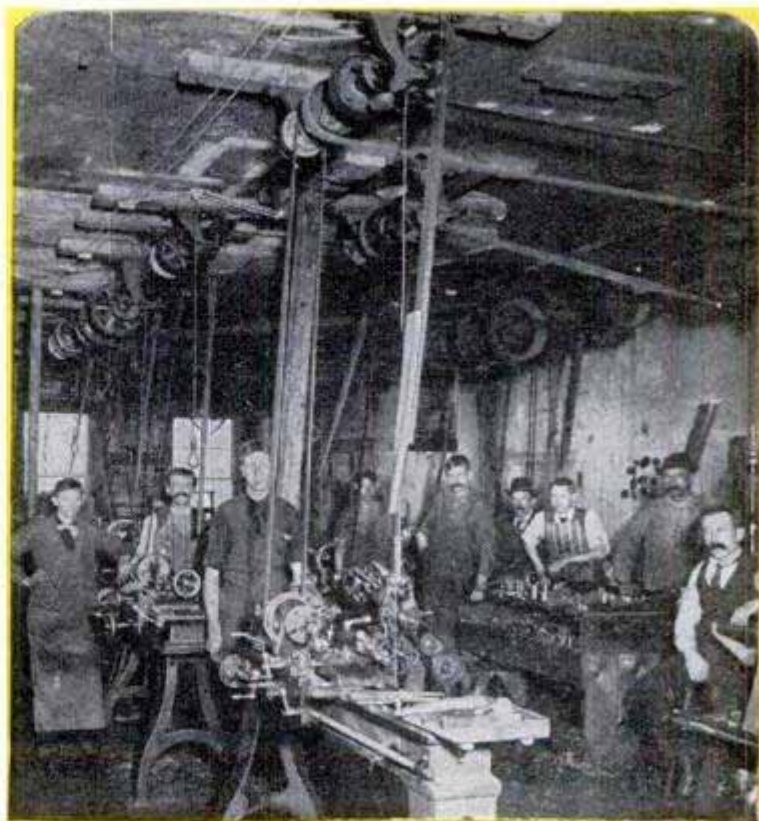
Westinghouse photo

Hobbing machine cuts teeth in a gear over eight feet in diameter; chips pile up beneath the cutting tool

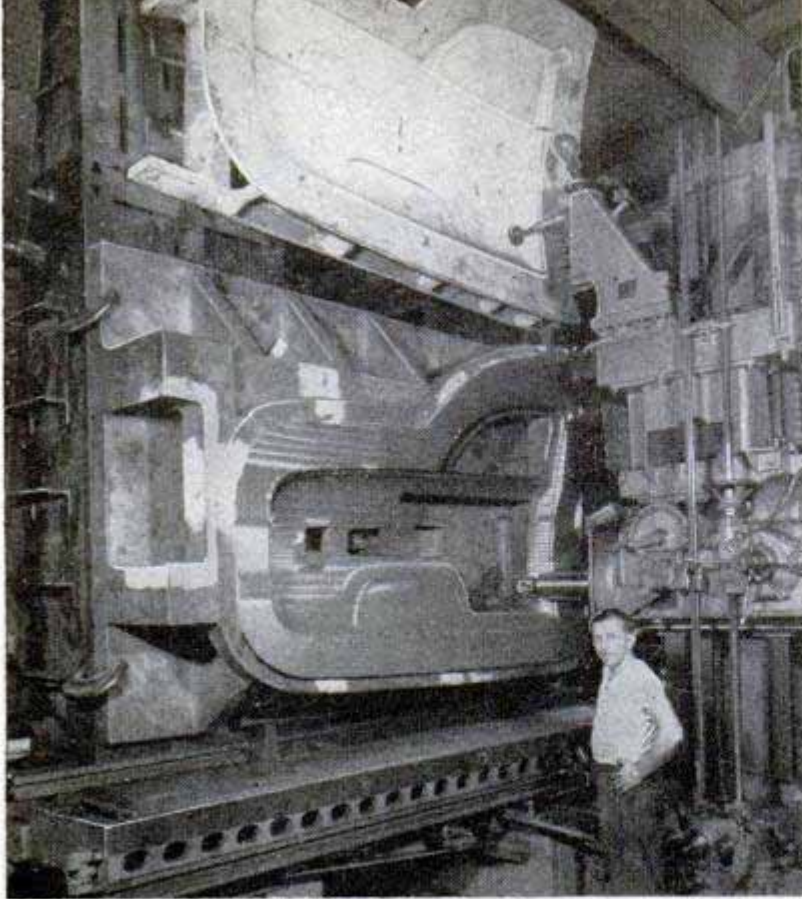
TOOLS THAT MAKE TOOLS

A lot of selective breeding has gone into them since, but basically they remain unchanged. In 1902 a machine tool was described as a non-portable, power-driven tool that shaped metal by removing surplus material in the form of chips.

The first and oldest of these tools was the lathe. By 1902 a more flexible version called the turret lathe was coming into popularity. The next was the drill, which was fine for drilling holes in metal but not always accurate enough for some of the close-tolerance work required in 1902. For tolerances of .001 inch, a boring machine was used. Today drilling and boring are words often used interchangeably, but to the

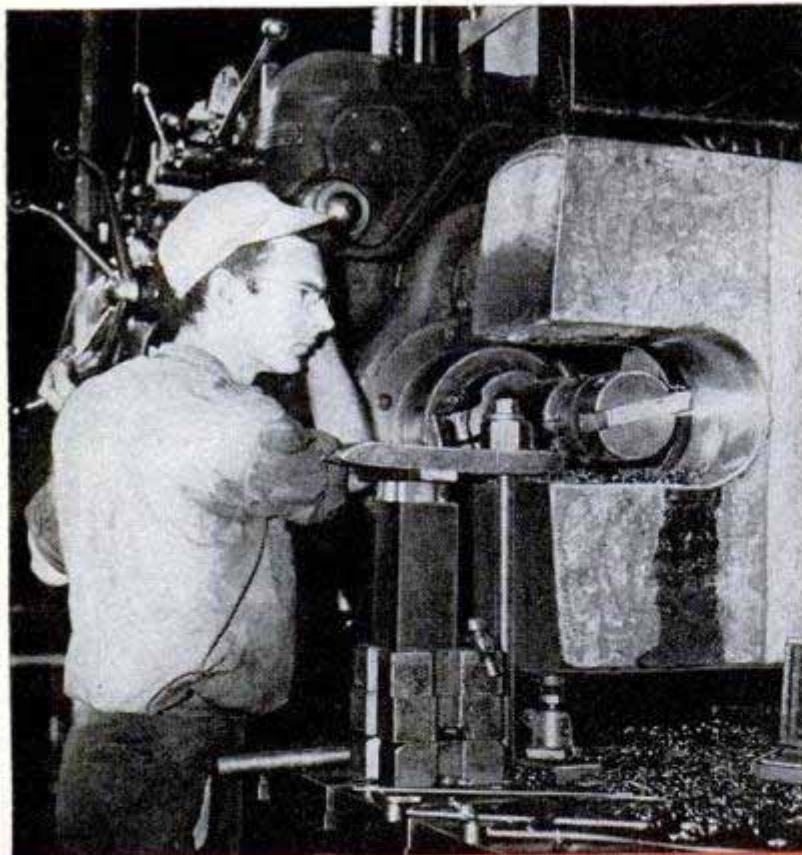


Machine-tool shop of 50 years ago presented maze of overhead pulleys. This was National Acme Company



Giddings & Lewis Machine Tool Co. photo

Horizontal boring, drilling and milling machine is equipped with hydraulic duplicating device for making automobile-body die. Below, special machine does precision work for U. S. Steel Corp.

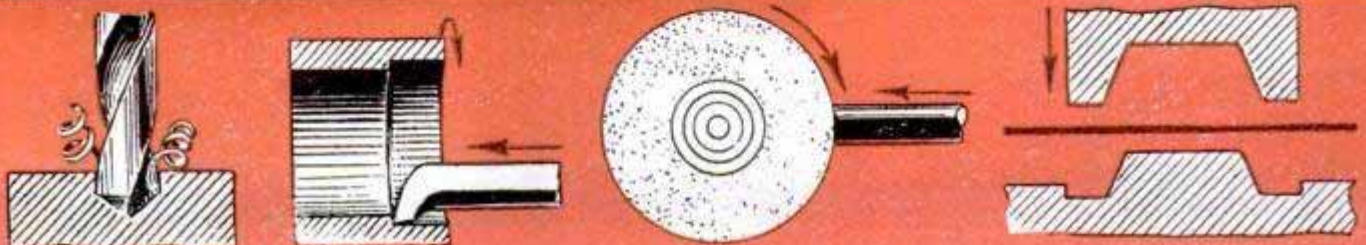


artisan of 1902 there was a big difference. A drill was a high-speed revolving tool that cut a hole in stationary stock, often whipping around as it did so to produce a hole larger than its own diameter. A boring machine revolved the stock around a stationary, absolutely rigid cutting tool, producing an unwaveringly true hole. An axle housing or a cylinder for a steam engine would be examples of boring-machine work; bolt holes and tap holes would be examples of drill-press work.

The big machines of the day were the planing machines. Since no casting is perfectly true when it comes from the foundry, the planing machine would grab a huge casting, such as the bed for a huge printing press or steamship engine, and plane it down to size much as a wood plane is used to true up a block of wood. If the single, rigidly held cutting tool remained stationary, and the work in progress was passed back and forth beneath it, the process was called planing. If the work in progress was fixed in a stationary bed, and the cutting tool passed back and forth over it, the process was called shaping, or slotting.

The milling machine was a late arrival in the machine-tool family. It was produced by crossbreeding a circular saw with a planer. Wide teeth in a rotating cutting wheel chew out the metal being fed to it. Its advantage over the straight-stroking planer was that it could smooth curved surfaces as well as flat and is handier for the production of smaller jobs. It was also ideal for cutting grooves or slots into flat or round surfaces, and for cutting the teeth in gear blanks.

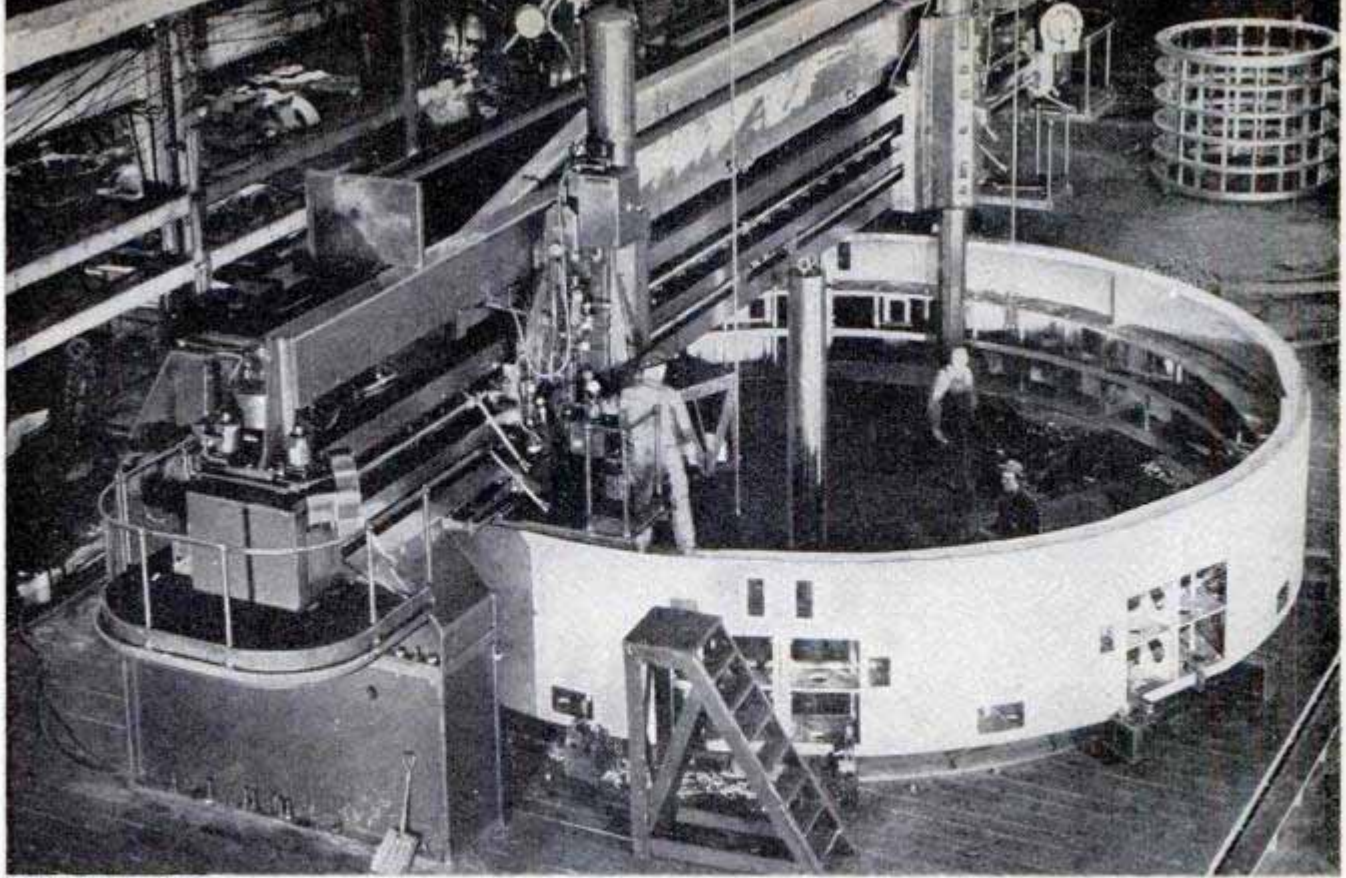
And then, of course, there were the grinding machines, highly refined descendants of



DRILLING AND BORING

GRINDING

SHEARING AND PRESSING



Westinghouse photo

Huge boring mill machines giant turbines and generators; it has 34 electric motors and weighs over 400 tons

the old grindstone. With these high-powered abrasive wheels, tools could be sharpened, burrs ground from rough stock and a mirrorlike finish applied to surfaces requiring a bright polish.

Humble, simple machines. But in their way they were the masters of what machine-tool people call "the basic arts of shaping metal." In 1902 the basic arts were turning, drilling and boring, planing and shaping, milling, and grinding. To these in recent years have been added, though they do not shape metal by removing chips, the arts of metal cutting with power shears, forging, pressing and stamping.

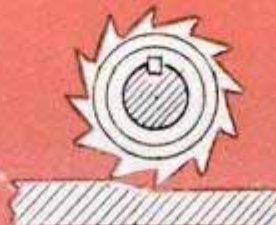
In action, the machine-tool shop of 50 years ago was a nightmare of overhead pulleys, slapping belts, squealing metal being tortured by overtaxed cutting tools, clouds of greasy spray from the coolant and grease thrown out by the exposed gears. The floor was covered with chips and spirals of metal, hard on the feet but providing a nonskid surface among the pools of oil. Along with the obvious dangers from breaking belts, snapping tools and flying chips were the dangers of mashed hands and feet in handling the heavy work. All

pieces except the heaviest of casting and rolled stock had to be muscled into the machines by hand, as many as six men being necessary to center a casting in the chucks, vises, clamps or other fixtures being used to lock it in place for machining.

But if the shop was a nightmare compared to today's standards, the pride of the men in their work couldn't be greater in any day and age. These men were true artists, imbued with a powerful, vital creative force that could whip any task, no matter how big. It seems incredible now that there were only about 10,000 of them. The entire industry consisted of less than 200 small, family owned shops, some employing less than 20 men. Most of them had come into being with the Civil War when, for the first time, there developed an acute need for weapons and machines so accurately made that their various parts were interchangeable. It was no coincidence, then, that most of the firms got their start in New England, for that was the home of the weaponmakers since Revolutionary days. By 1902, however, many had moved farther west to start businesses in Cleveland, Cincinnati, Chicago, Rockford and Milwaukee,



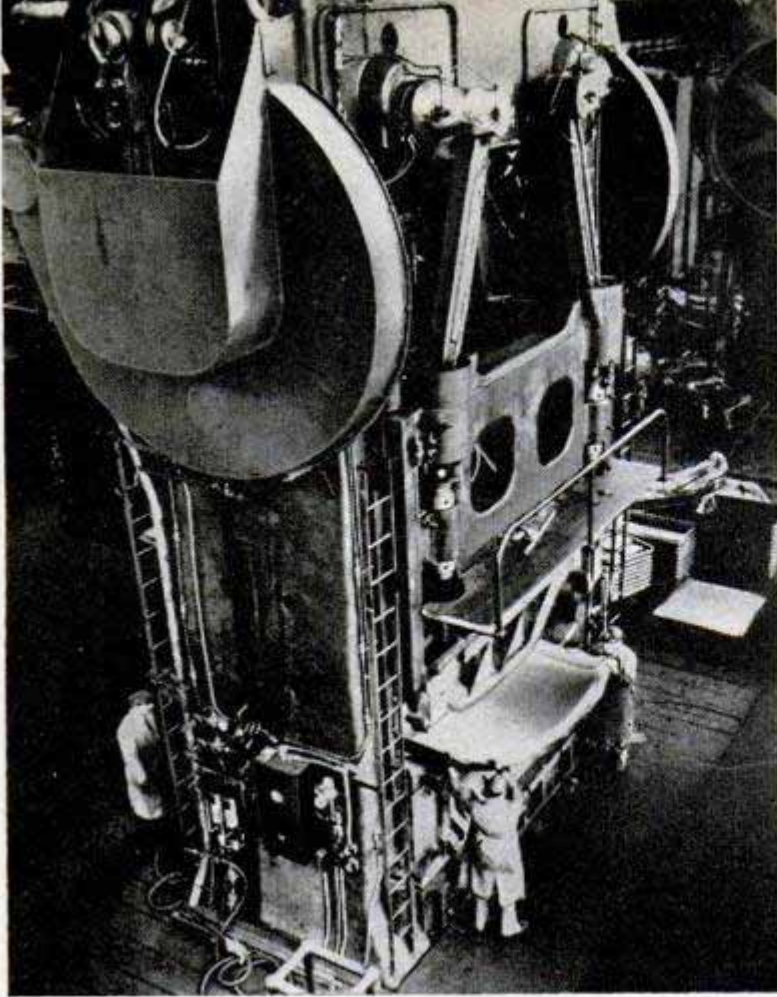
PLANING



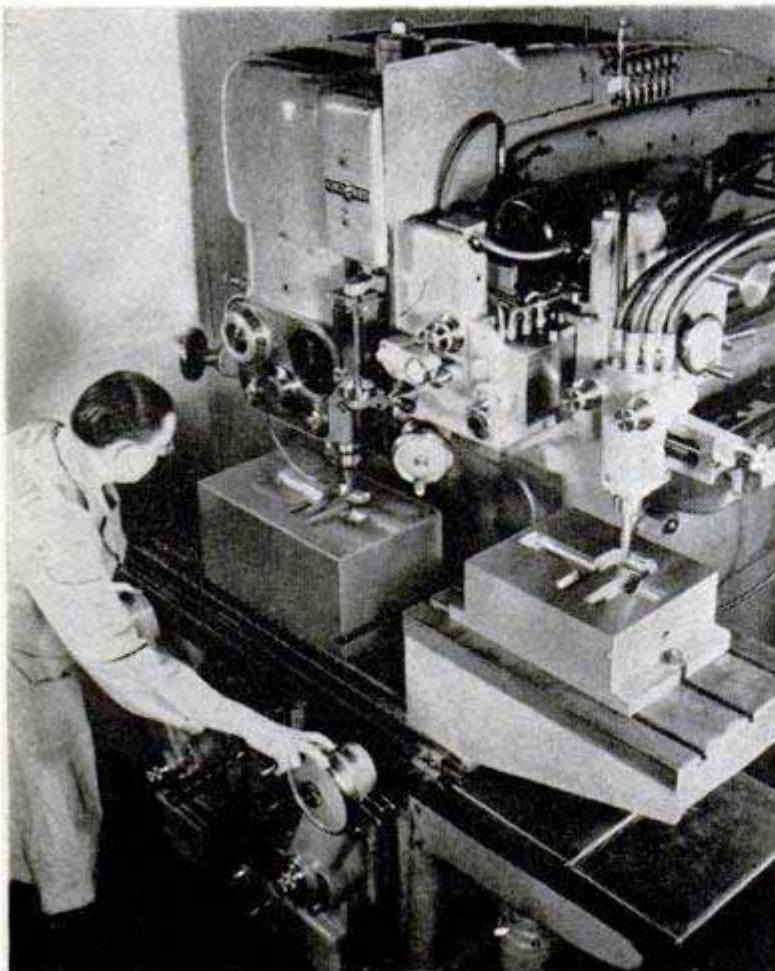
MILLING



TURNING



Towering 700-ton mechanical press stamps tops for automobiles. Below, die-sinking machine which can duplicate in hard steel the precise and intricate shapes of a plaster or wooden master

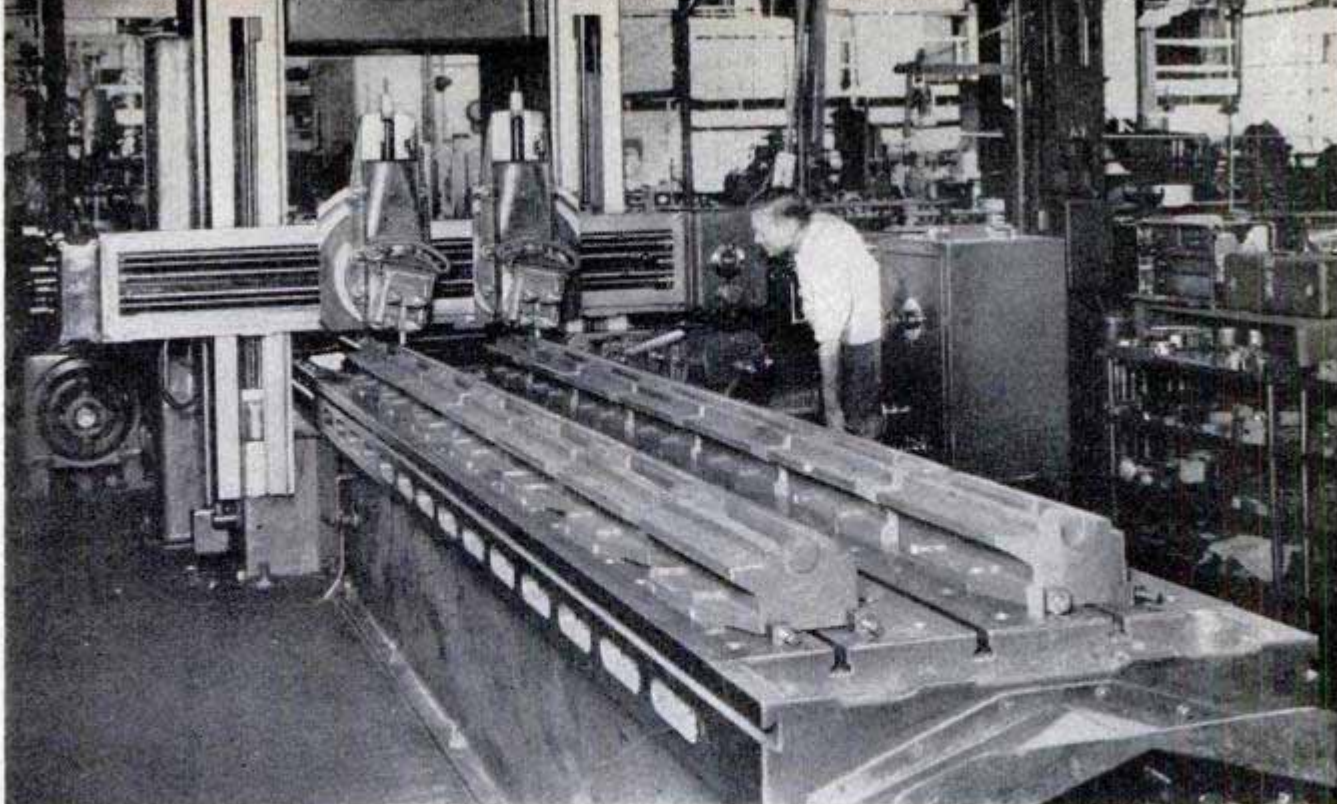


spreading their art as they went.

The making of a skilled machine-tool worker was a matter of years. Not only did he have to master every machine in the shop, he had to have the imagination to make his machines stand up and do things they had never done before. Nothing could be too big, too complex, or too technical for the machine-tool maker.

To illustrate this, machine-tool makers like to tell the story of Worcester Warner, cofounder in 1880 of the Warner & Swasey Co., makers of turret lathes. Not satisfied with the challenges within his own field, he set out to improve the accuracy of astronomical observations by building the telescope for the Lick Observatory on Mount Hamilton, Calif. By the time he finished the job he had spent so much money mastering new techniques that the turret-lathe company was all but broke. So he lost another fortune by contracting to build the Yerkes telescope, a masterpiece of incredible precision. In fact, losing money on great telescopes became such a habit with him that the casual observer might have laughed at him. But so valuable were the new techniques he mastered that each time he lost a fortune, his firm gained a bigger one. Not only were its own turret lathes drastically improved, the rest of the machine-tool industry benefited from the lessons he learned in milling, planing and grinding huge castings to tolerances of one ten-thousandth inch. Without his pioneer work in the machining of tremendous castings, there would be no 200-inch telescope on Mount Palomar, and it is certain that some of the lessons he learned advanced considerably the day of the cyclotron and all the other vast, unbelievably accurate machines that made possible atomic energy.

For a moment go back to 1902—the year that started the great race into the Machine Age. The call to get set came the year before when Oldsmobile began the mass production of automobiles. The gun went off when Packard, in that magic year of 1902, introduced the H-slot gear shift. Suddenly industry needed machine tools to cut millions of gears, turn out thousands of internal-combustion en-



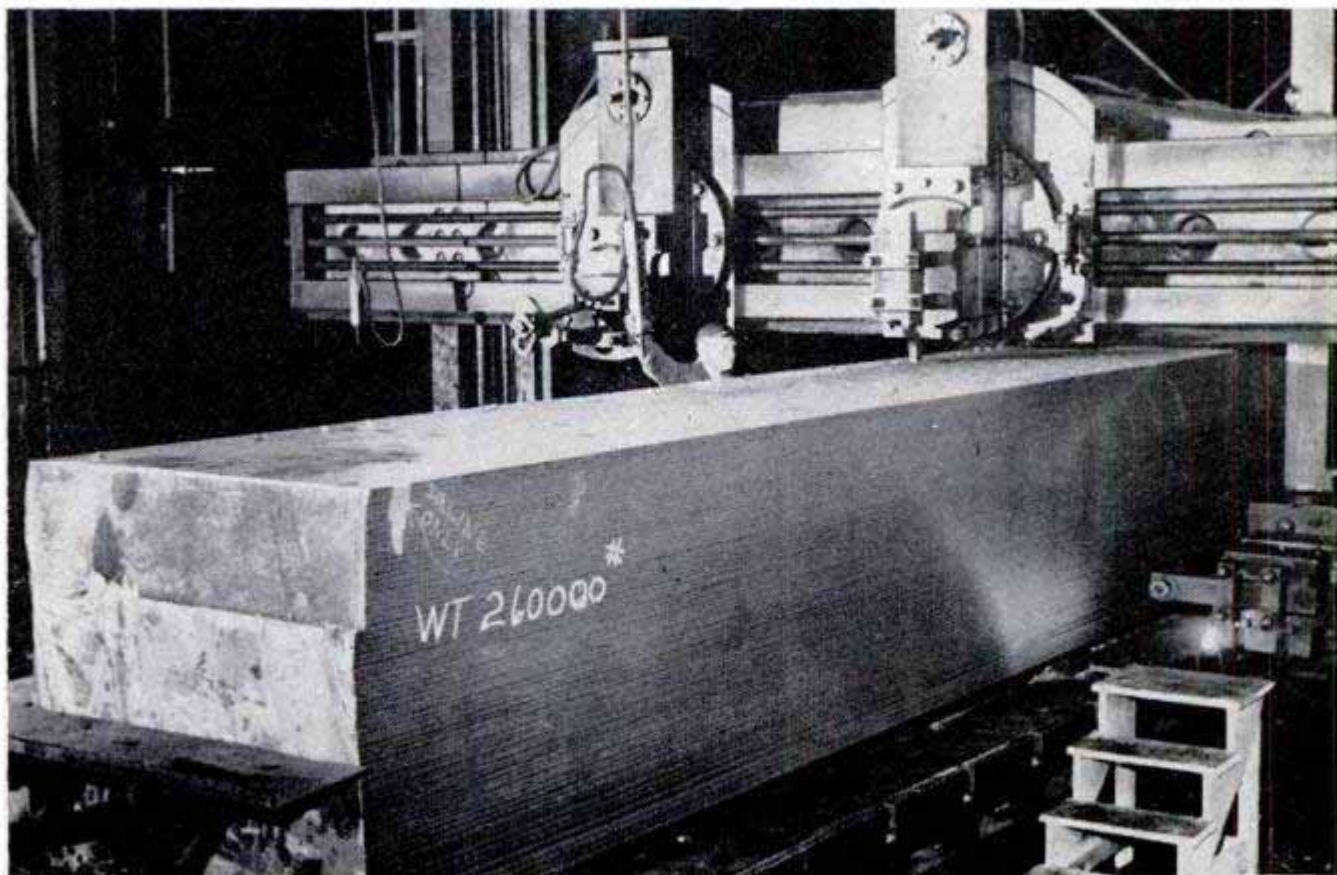
A planer — the cutting tool is held stationary and parts to be planed are moved back and forth beneath it

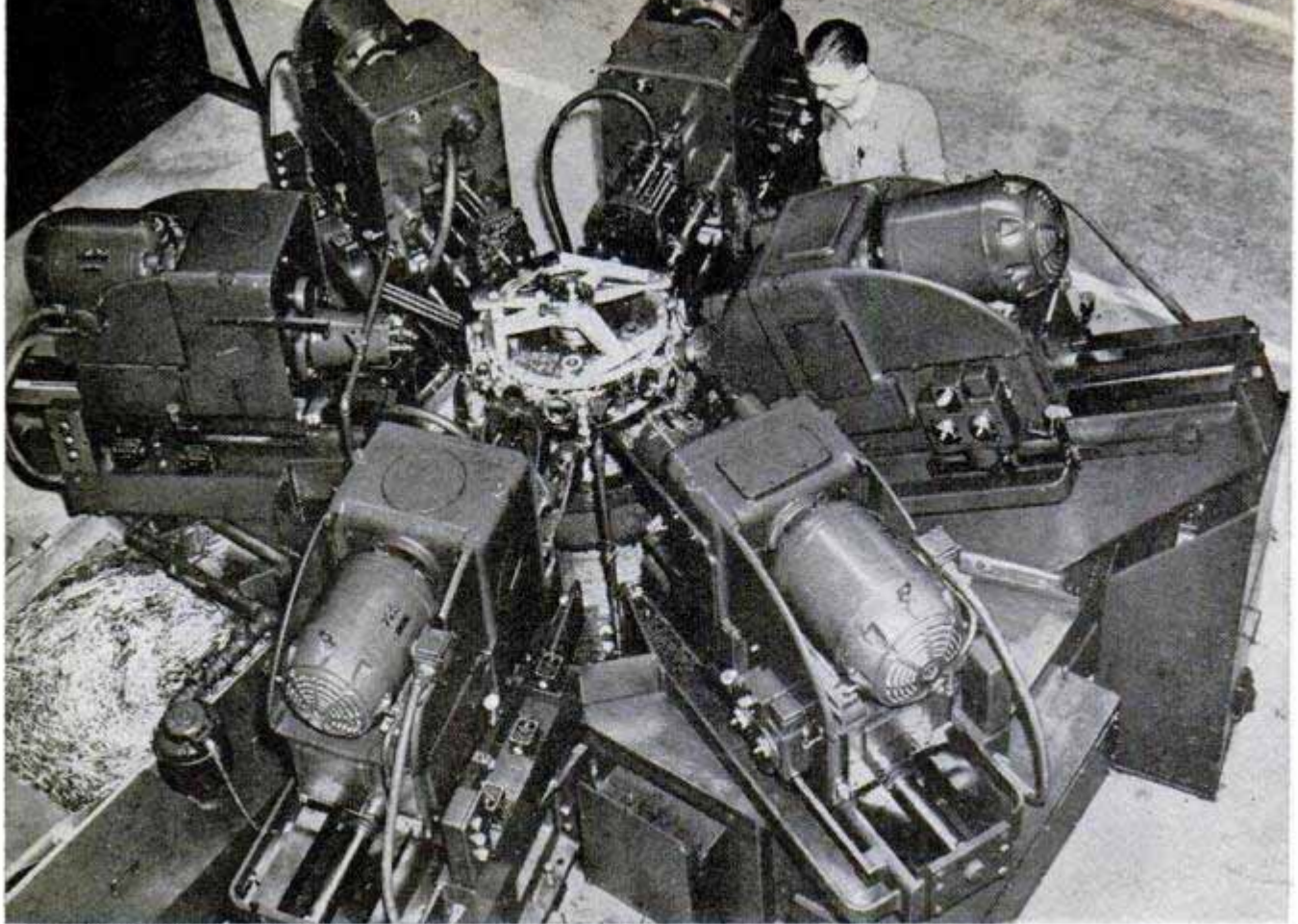
gines, stamp out car bodies, turn out wheels and axles.

The world exploded into a frenzy of mechanical action. The flying machine, the skyscraper, the Panama Canal, great locomotives and steamships, vast dams and hydroelectric plants, a telephone for the home and a thing called wireless. And World War I.

Up to World War I the tiny machine-tool industry had done its job of making millions of jobs for others without basically changing the design of its tools. The industry had built bigger tools, and faster tools, but as was pointed out firmly, there are only so many things you can do to improve hammers, saws and chisels, and similar rules applied to basic things like machine

Steel parts for an atom smasher come big. This one being machined for a cyclotron weighs 260,000 pounds





Wright Aeronautical Corp. photo

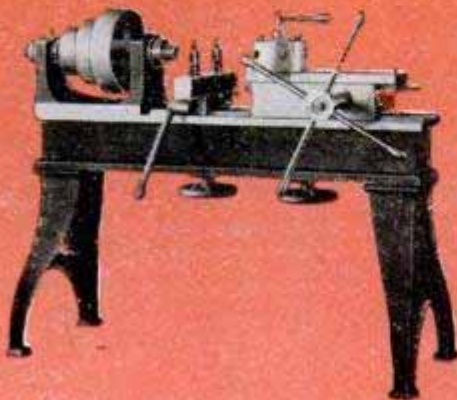
Ingenious machine performs 45 boring and facing operations in 24 minutes — used to require eight machines

tools. The staggering needs of the war changed all that hidebound thinking.

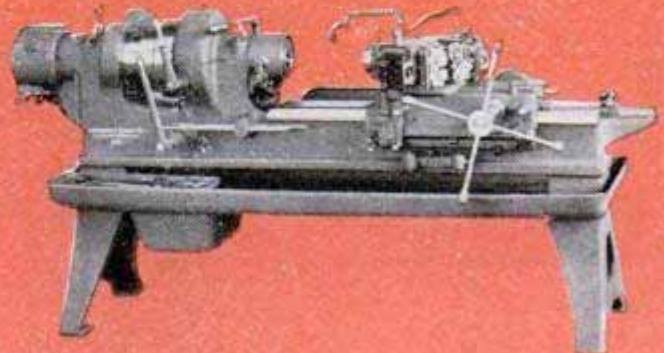
Let us take a look at what the toolmakers did to the planer. This machine had been content to pass a single casting beneath a single cutting tool and return for the next stroke. Planers were 24, 30 and 36 inches wide with tables 6, 8 or, at the most, 10 feet long. Now they extended the bed of the planer so they could put a dozen castings in a row and pass the whole works under the cutting tool in one long, mighty sweep. Then they made it wider so that they could put two rows of castings on at a time and they had two heads on the rail and two side heads, which meant that four cutting tools were at work on two parallel rows of several castings. Planers got to be 6, 8 and 10 feet wide with tables 30 and 40 feet long. Production went up 1200 percent.

Then the electrical industry came to the assistance of the planer by designing a reversing motor drive which permitted a selection of cutting speeds adapted to the material that was being handled, to say nothing of very much faster speeds, both for cutting and for return. The return speeds went up and the development of better cutting tools made higher cutting speeds practicable. In some cases the work would be set up on a second table while the planer was at work. The finished work with the table to which it had been fastened was lifted off, the next series of castings already fastened to a plate would be lowered to the planer table and the setup in that way made very quickly.

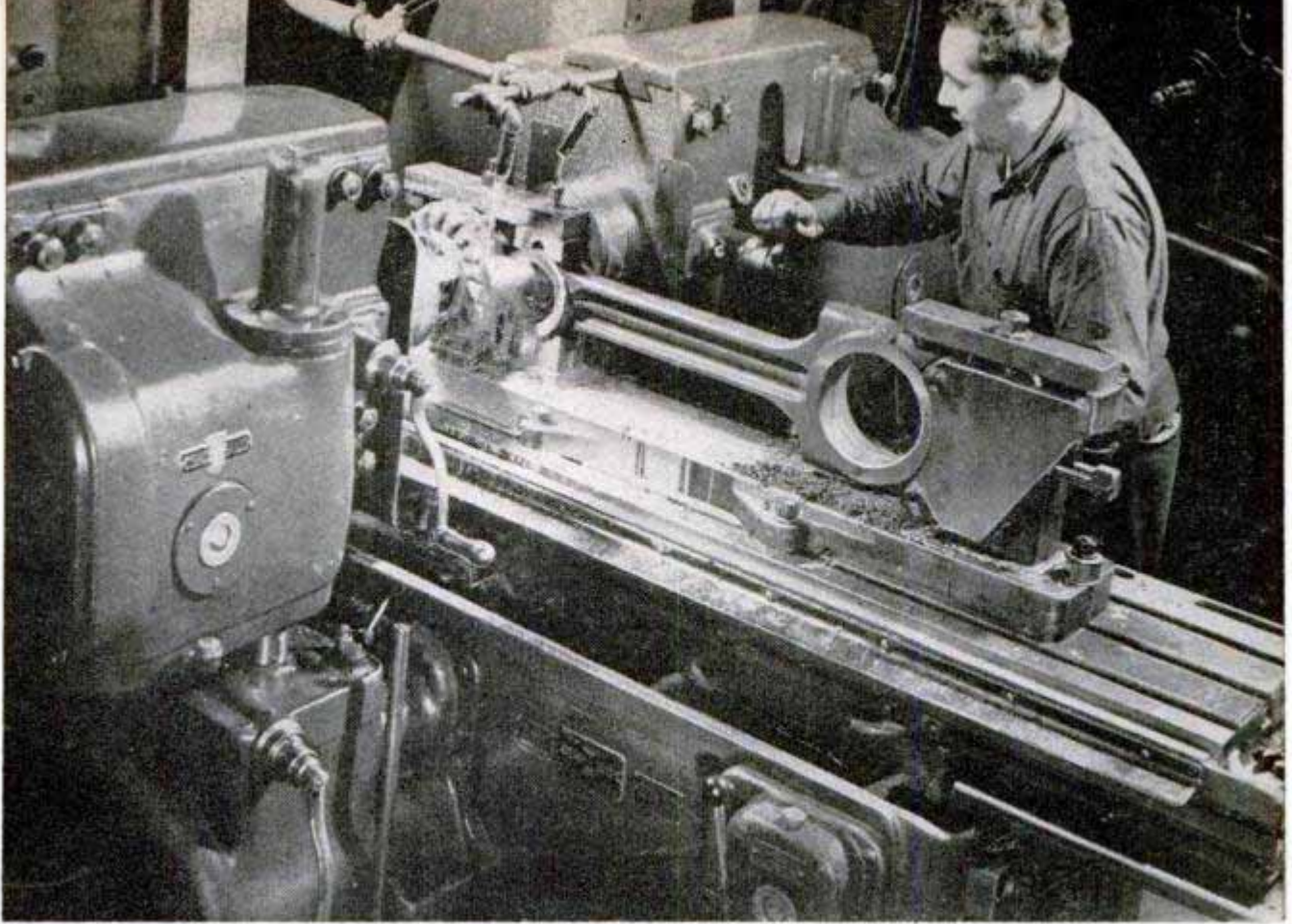
With the reversing motor drive, in planing a row of castings the table can move at slow cutting speed, speed up in the gap



1881



1900



This milling machine is finishing both sides of a diesel-engine connecting rod

between the pieces and slow down again as the tool enters the next piece.

When the castings are planed they are lifted off to a conveyor. In fact, with overhead hoists lowering the casting into place and conveyors or hoists taking them away, the operator was free to concentrate on the accuracy of his work so the result was not only an overwhelming increase in production but a very substantial improvement in accuracy.

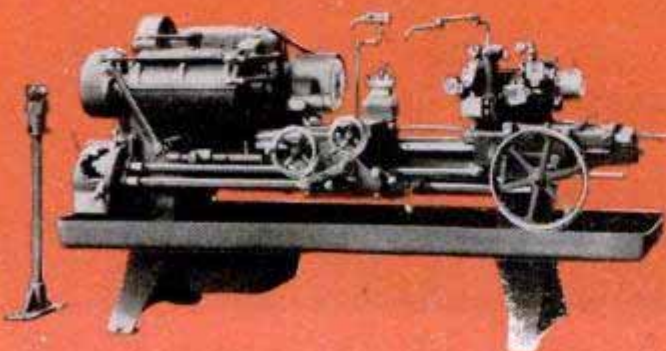
What was happening to the planer was happening to all the rest of the machine-tool family.

(Continued to page 242)

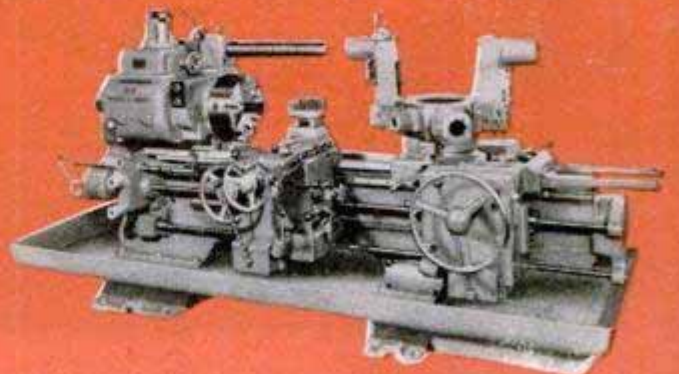


Courtesy National Machine Tool Builders Association

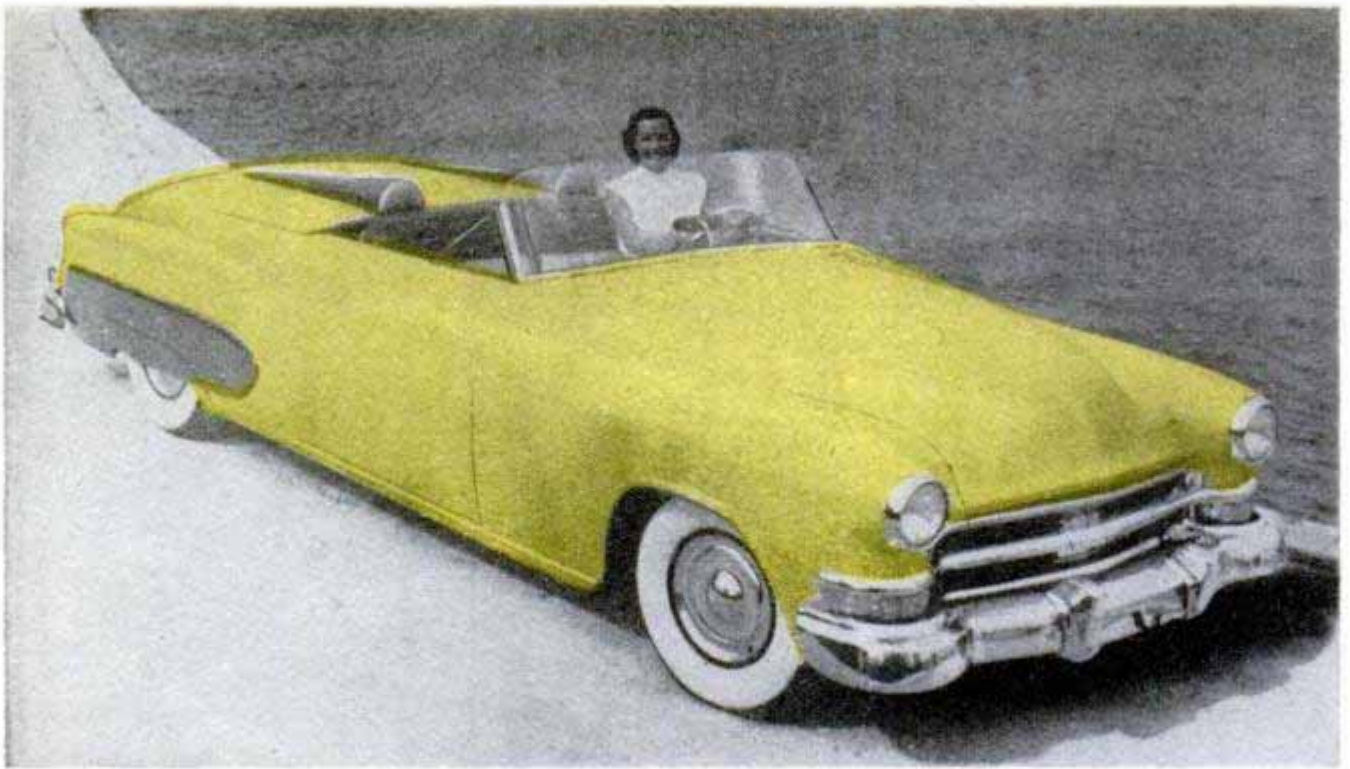
Skilled toolmaker takes many hours to finish-grind steel teeth of broaching cutter with high precision in 10,000ths of an inch



1915



1952



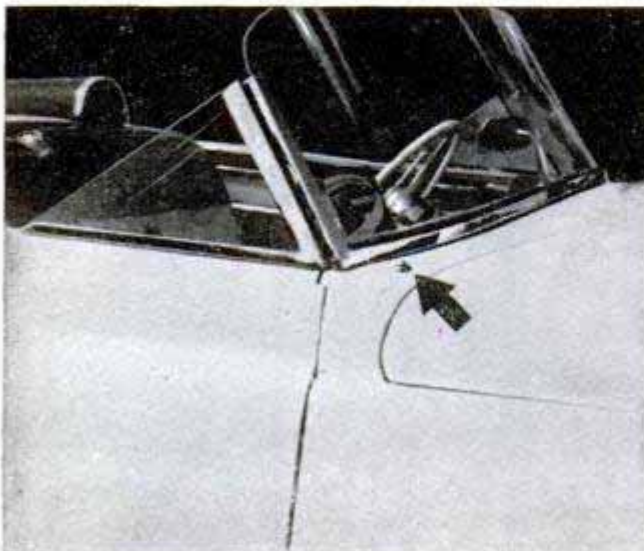
There's nothing cramped about the Cyclonic. Rear seat is blocked off here by a removable streamlined cover

SPACIOUS SPORTS CAR—THE CYCLONIC

BECAUSE he demanded speed plus comfort in a sports car, Harold A. Clark of Miami Beach, Fla., had to have it custom made—and as a result set a new standard among the low-slung, high-strung speedsters of the motorcar family.

The car, called the Clark Cyclonic, is built around a Chrysler New Yorker chassis and seats six in comfort—a welcome change in sports cars which usually specialize in cramped two or three-passenger cockpits. It's a big car, weighing over 4500 pounds and boasting an over-all length of almost 18 feet. The New Yorker chassis

Door handles are absent. Door swings open when you press a small button (arrow) in front of windshield



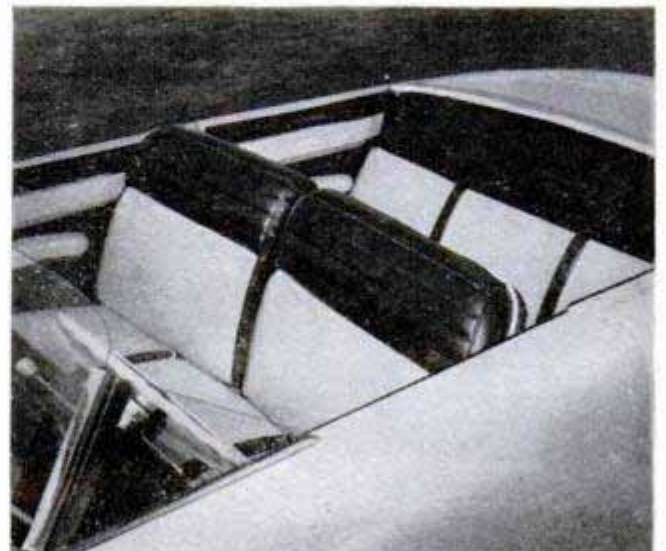
was dropped two inches to lower the center of gravity for better control on turns.

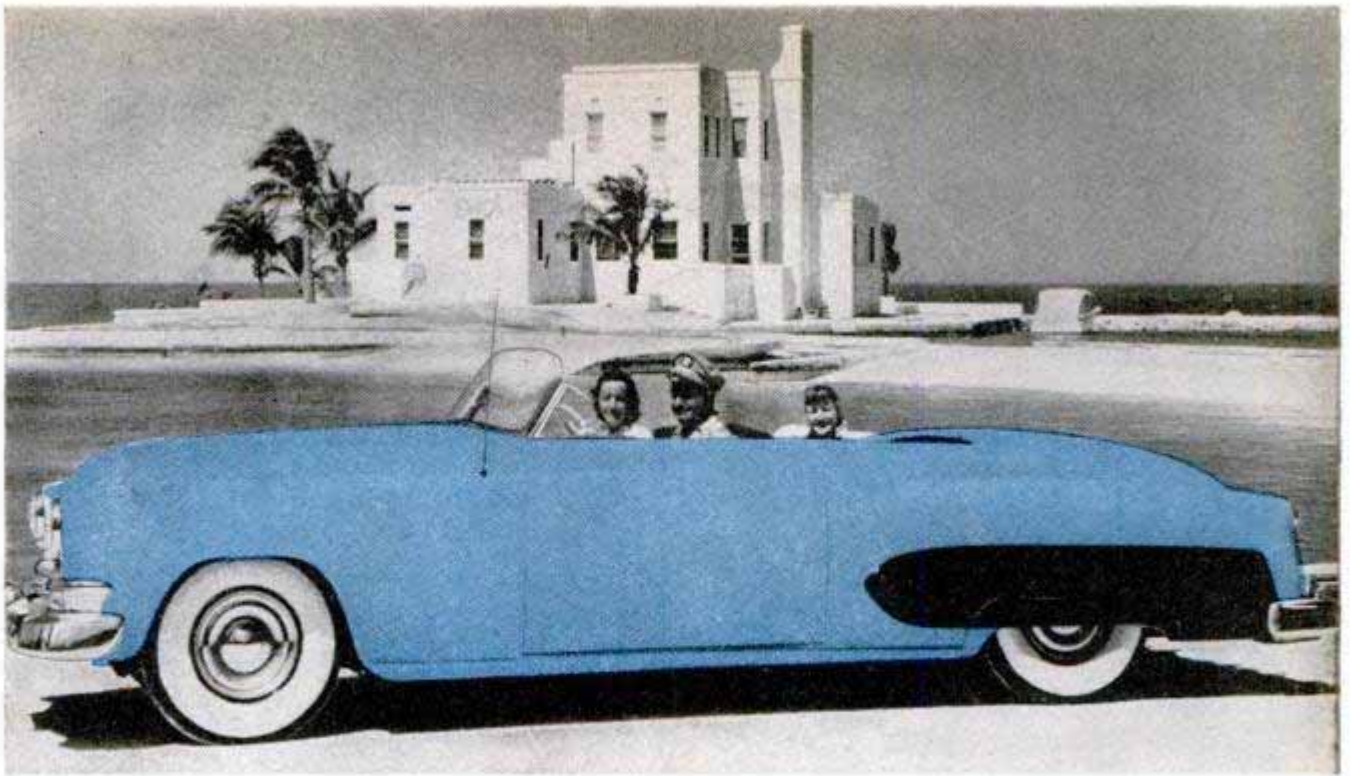
So exciting did his new car prove to be that Clark decided to manufacture models for sale. The price—\$15,000 each.

Clark's present plans call for producing about 48 cars a year in four models—a five-passenger open phaeton with no top, a six-passenger hardtop and two convertibles. Biggest prospective market is Argentina and other South American countries, according to Clark.

Powering the Cyclonic is a FirePower engine souped up to 225 horsepower by the

With its rear-seat cover off, the Cyclonic has ample room for six. The upholstery is leather, of course





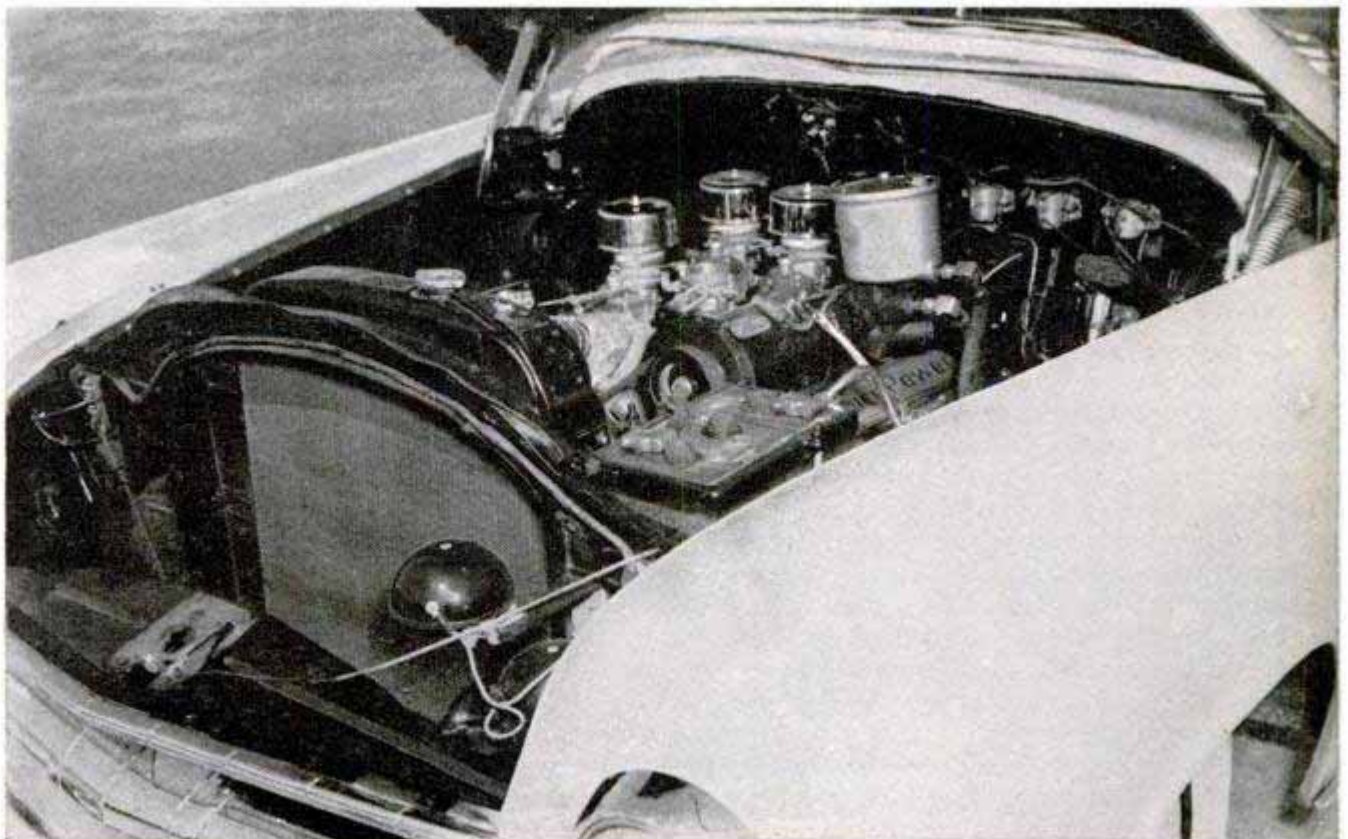
Some body parts were "borrowed" from other cars—Chrysler hood, Buick windshield and Packard rear fenders

Cunningham conversion that includes a high-compression manifold and four carburetors. New pistons and connecting rods can push that up to 250 horsepower. Another 10 horsepower is obtained with an exhaust cutout for country driving. By removing the chrome-plated air filters from atop the carburetors, Clark says he can boost output eight more horsepower. Together, these modifications add up to enough

extra power to boost the Cyclonic's top speed to 150 miles an hour.

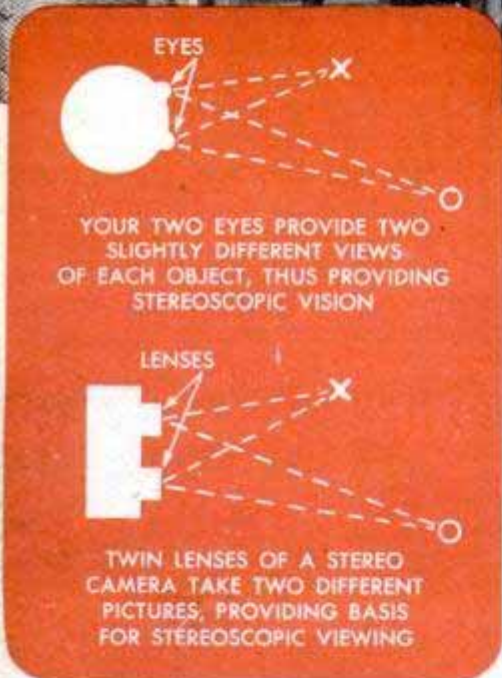
Doors and trunk are opened by solenoid magnetic switches. On each cowl, just in front of the windshield, is a small button that operates the solenoids, eliminating the need for door handles that would mar the car's smooth lines. You press a button and a door swings open. Buttons on the dashboard open the doors from inside.

Power plant is a Chrysler FirePower V-8 souped up to 225 horsepower by a new manifold and four carburetors





David White Co.
315 W. Court St.
Milwaukee, Wis.



Today, the whole family enjoys three-dimensional slides with a twin-lens projector like the Stereo-Realist model. The Polaroid glasses separate two images so brain can create depth illusion

STEREOPHOTOGRAPHY

Sweeps the Country

By Ewart Thomas

ONCE YOU'VE TAKEN pictures in three dimensions you'll never be satisfied with flat photography again."

That's what thousands of photo fans are saying and their numbers are increasing every day. Color pictures in three dimensions are almost as realistic as life.

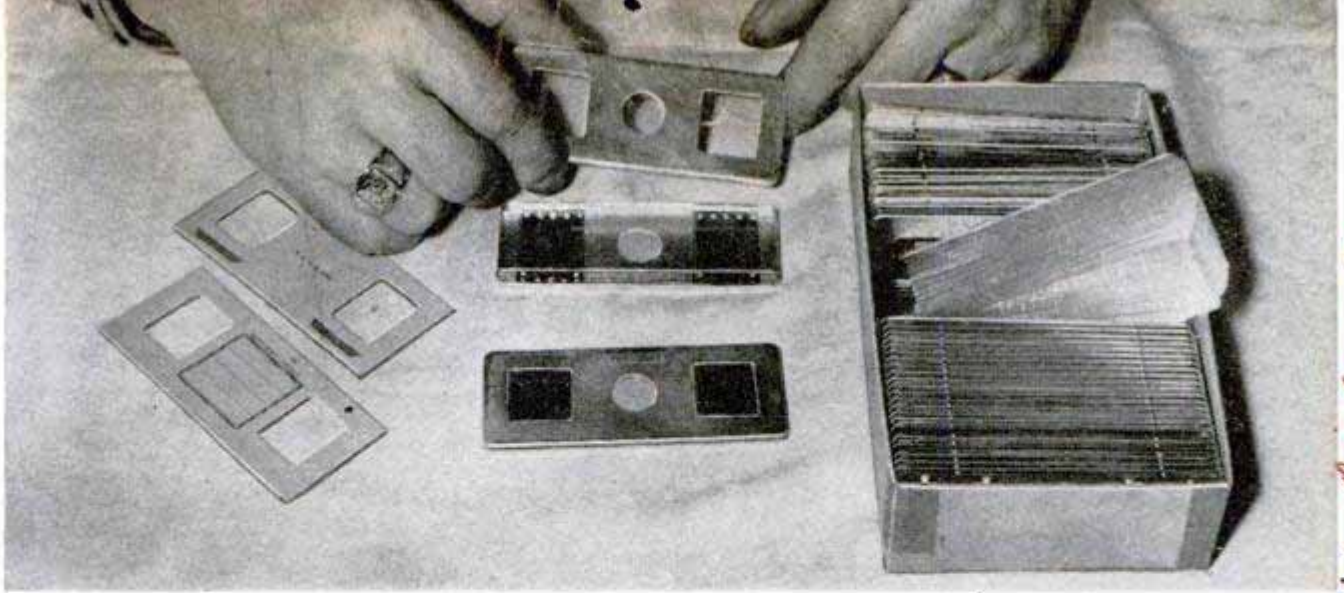
In three dimensions, a color picture of mountain scenery gives you the illusion of actually looking out a cabin door. A close-up of a flower becomes so lifelike that you can almost smell its fragrance.

The tall building that was so disappointing when photographed with a single-frame camera now seems to stretch up toward the clouds. The view of the lake that was a flop as a conventional print suddenly be-

comes a realistic picture of sparkling water.

These three-dimensional effects are produced by the same principle that governs your own two-eyed stereoscopic vision. Stereophotography uses pairs of pictures taken with lenses spaced to match the distance between the pupils of your eyes. You get the same impression of depth, distance and roundness of objects as you do when looking at the scene itself.

Hollywood has spent millions getting stereo ready for the screen, but you can just about equal the best results of the professionals at costs ranging from a few dollars to several hundred dollars. You don't have to be an expert or a millionaire to get dramatic results.



*Advertising Displays, Inc.
Covington, Ky.*

Precise mounting of the two views in slide is necessary if you are to get the stereo effect without eyestrain

You can convert your camera to stereoscopy with a "flop over" tripod head that costs \$5. You take one picture, wind the film for the next exposure, move the tripod head and camera to the other position, and shoot the second picture of the pair. Or, at virtually no cost, you can build a flat wooden tray 2½ inches wider than your camera and attach it to your tripod. Take one picture with the camera pushed snugly into one corner of the tray, the other picture with the camera in the other corner. Correctly mounted and viewed, the paired pictures provide a stereo effect.

A stereo attachment for taking both pictures at the same time has a set of diagonal mirrors and fits over the lens of your present camera. It retails at about \$15.

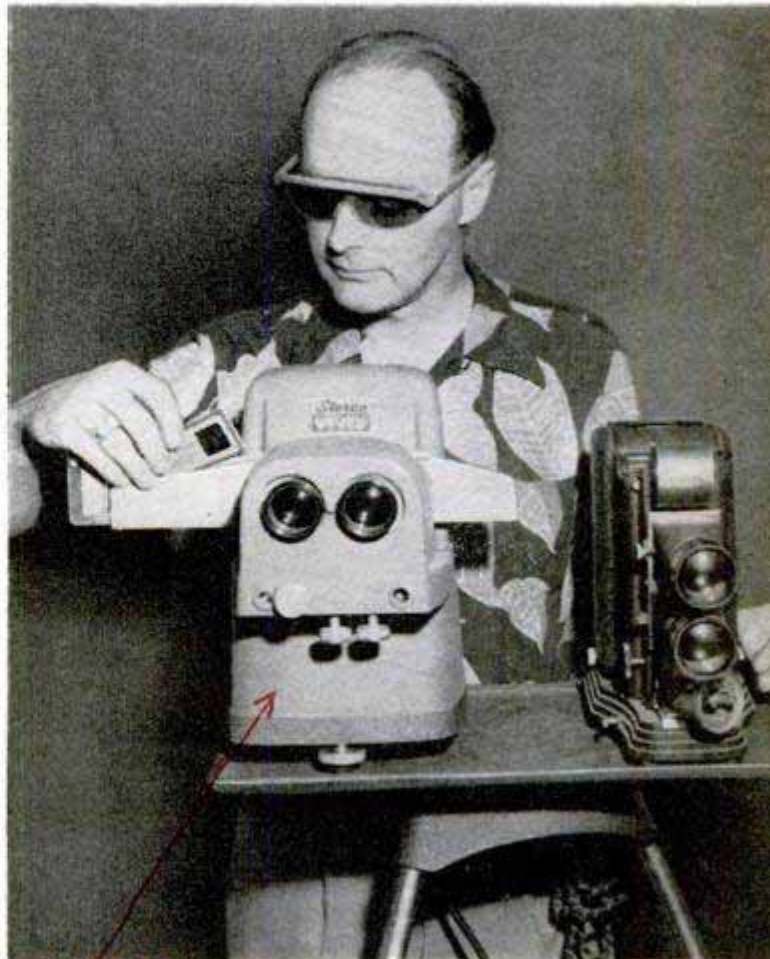
Best results, however, are obtained with cameras designed especially for stereo. These are mostly in the 35-millimeter film size and have twin corrected lenses that shoot simultaneous side-by-side pictures. Precision instruments, they usually contain built-in range finders and provision for synchronized flash. Prices begin at \$88.50 and go up past \$400.

The paired transparencies made by these

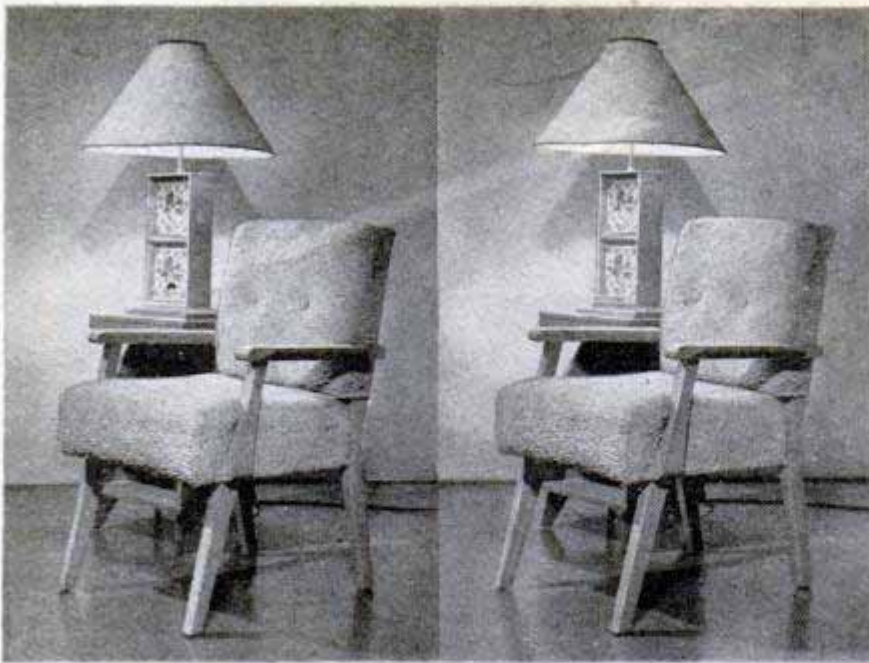
R. F. McGraw, stereo expert, uses the top camera for square pictures, the lower one for horizontal shots

One of these stereo projectors mounts its two lenses side by side, the other has them one above the other

*R. F. MCGRAW
607 N. HERMOSA
SIERRA MADRE, CALIF.*



*Three Dimension Co., Inc.
1255 Addison*



With practice you can see in depth without a viewer. Two shots at left are a stereo pair. Place a cardboard between them, as in the top sketch.



Stare down, being careful that each eye sees only one view. The two will blend into a single stereo scene. Another way is more difficult. Hold them at normal viewing distance and look over them at a distant object. Raise the pair into your line of vision as in sketch at left.



Don't refocus the eyes. You'll see three images. Concentrate on center one. It has depth

cameras are mounted in slides and are viewed in a special viewer. A cheap viewer costs a dollar. For \$15 and up, you can get one with self-contained battery illumination and adjustments for focus and parallax. The viewers will take black-and-white reversal transparencies as well as color.

You may make ordinary black-and-white prints and view them by reflected light in a stereoscope similar to those that were popular years ago. Few persons, however, are satisfied with anything less than color transparencies.

If you aren't content with a hand viewer you can project your three-dimensional color transparencies onto a screen, enlarging them to life size if the screen is big enough. You will need a two-lens stereo projector, a metallic-coated flat screen, or at least one that doesn't have a beaded surface, and Polaroid spectacles for yourself and each member of the audience.

The most dramatic effects of all are provided by motion pictures in three-dimensional color. An attachment that converts almost any 16-millimeter movie camera to stereo sells for \$45. A complete outfit consisting of camera converter, bracket, converter for the projector and a special screen lists at \$83.50. With these attachments for your equipment, you can produce films guaranteed to enthrall any audience. You can scare your guests with a scene in which an automobile charges straight at the camera. The effect is so realistic that the audience instinctively ducks out of the way. Polaroid spectacles must be worn, of course.

Here are some tips for good stereo pictures, no matter what type or size of camera you use:

Right, "flop over" tripod head keeps camera in proper position for paired stereo shots of still subjects

Hold the camera level, preferably on a tripod. It's a good idea to cement a tiny spirit level to the top of the camera. Pictures taken with the camera tipped to one side can't be straightened in the viewing mask and they create eyestrain.

Use a small aperture to focus the entire scene. A fuzzy background gets by in flat

You Can Take Stereo



*The Ward Co.
see pg. 111*



View-Master photos

Costs are cut by a new stereo camera that puts 69 pairs on a roll. Film cutter, above, automatically

punches out the pairs which are then inserted in a reel, above, and viewed with inexpensive stereoscope

photography but it spoils the illusion in stereo. Misty landscapes are not good subjects for the same reason.

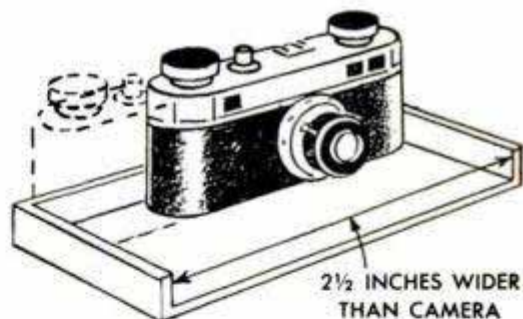
Avoid empty shadows in a picture. They look like holes or tunnels and will spoil the effect.

Use a person or object in the near foreground to heighten the stereo effect if you wish, but avoid placing the figure too close to the camera. Four feet is a safe distance for pictures to be used in a hand

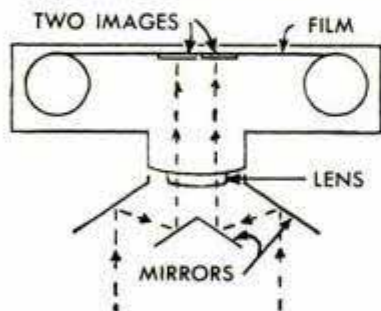
viewer, eight feet is safer for pictures that are to be projected. Closer objects will produce eyestrain.

Tilting the camera upward produces an unfortunate distortion in flat photography but in stereo the effect is realistic. (Vertical tilting is not the same as tipping the camera to one side.) In stereo, too, you can shoot through a row of tree trunks or other objects that would produce only a cluttered foreground in ordinary pictures. In a flat

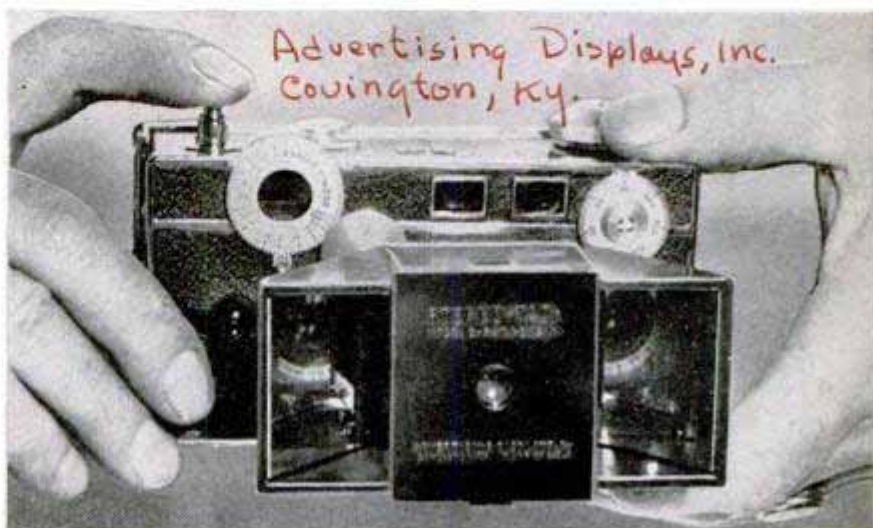
Pictures With Your Single-Lens Camera



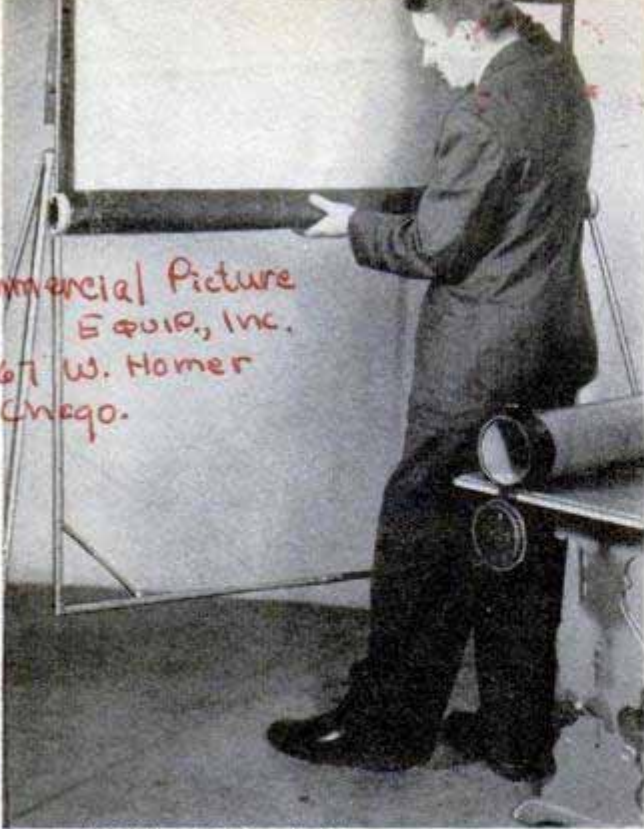
Tray holds camera for stereo. On second exposure, slide camera to other corner. Left, wide tripod head permits greater camera movement for exaggerated stereo



Right, beam splitter slips on lens of any camera to shoot stereo pair simultaneously. Each one of photos is half normal size. With it, you can take action shots. Other devices shown here take still scenes only. Above, light paths in beam splitter

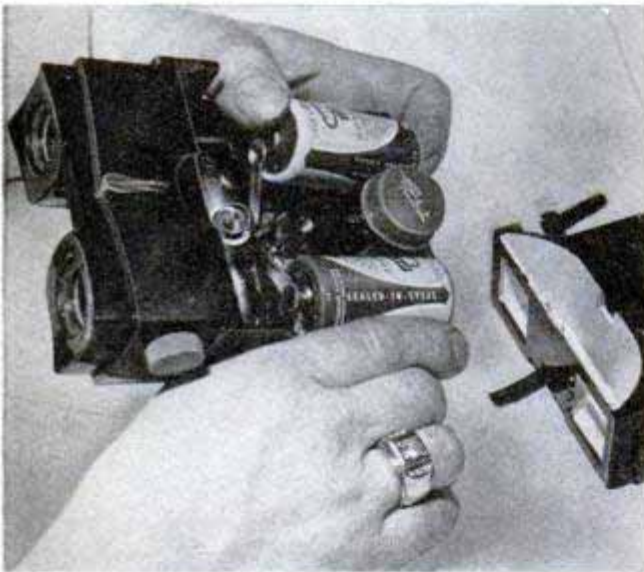


Commercial Picture
Equip, Inc.
1567 W. Homer
Chicago.



Commercial Picture Equipment photo

Rubber screen, held under tension inside metal frame, provides flat surface required for stereo projection



Most fans show stereo slides with viewers. Above, flashlight batteries power the light source of this viewer. Below, three more hand viewers. The one at right has own light, others rely on outside sources

photo the trees would block the view—in stereo you can look right past their trunks.

For a novel effect, aim the camera to pick up the reflections of a street scene on a store window. That's a shot to be avoided in ordinary photography, but in stereo you'll find that you can look through the window into the store itself, or you can focus your eyes on the reflections on the window and see, in three dimensions, the details of the scene on the street.

R. F. McGraw, photographic artist whose three-dimensional pictures have been exhibited, suggests that the best stereo pictures are those made of subjects from three to ten feet from the camera because the effect is most pronounced at short distances. The usual stereo landscapes are not effective, pretty though they may be, because any subject that is several hundred feet or more away tends to look like a painted backdrop.

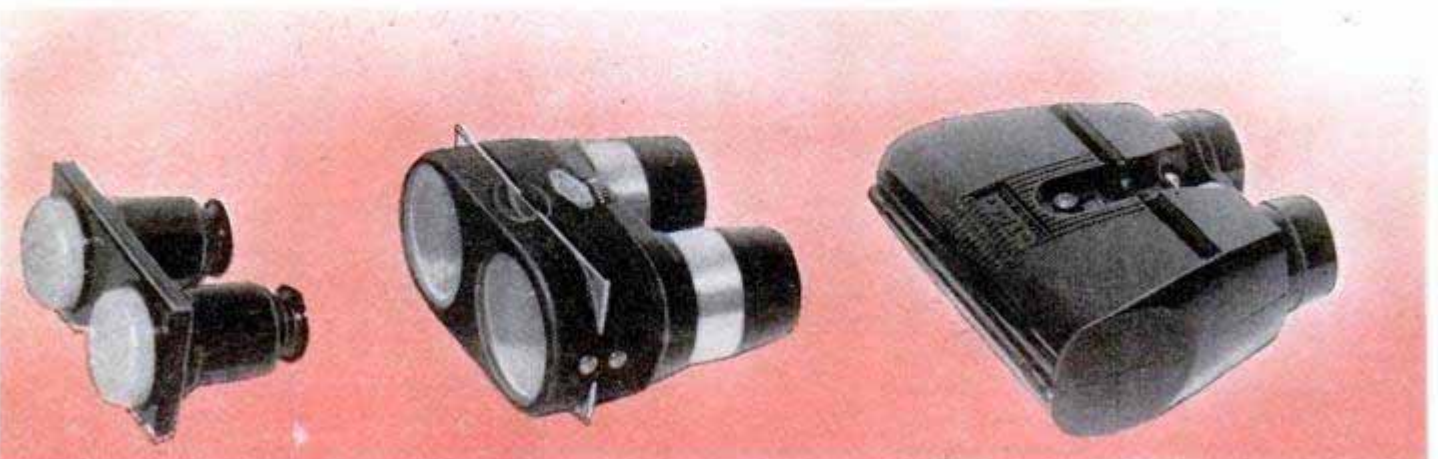
A distant scene, however, can be effectively photographed by hyperstereo; that is, by taking the two pictures at a greater than normal interocular distance apart. McGraw uses a wide arm on a tripod for making stereo pairs at distances up to 14 times the normal separation. One frame of film is exposed at one end of the arm, the other frame is exposed at the other end. Aerial stereo pairs may be made as much as $\frac{1}{2}$ mile apart to give a true picture.

There are many pseudostereoscopic effects, but true stereo must conform to three basic rules: 1. There must be two pictures from two points of view; 2. Each eye must see only the picture intended for it; 3. Superimposition of the two images must take place in the brain.

This explains why special viewers or polarizing spectacles must be used when looking at stereo pictures.

There is another method, the lenticular system, that depends on a surface consisting of parallel raised ridges or rods to impart a stereo effect. It is effective only when viewed from certain angles.

The so-called anaglyph system also con-



forms to the basic rules of stereo and was used in a few experimental motion pictures 20 years ago. Two tinted images are thrown on the screen and the audience wears spectacles with a green filter for one eye, a red filter for the other. The system works but is extremely tiring to watch.

More satisfactory and much less tiring is the modern projection system in which the two images are each polarized at a different angle. The audience wears polarizing spectacles consisting of Polaroid filters that sort out the two images, one for each eye. Motion pictures in stereo, based on this method, are being demonstrated now by the Natural Vision Corporation of Hollywood. The system was designed by Friend Baker, nationally known stereo expert, and uses two cameras and two projectors.

Somewhat different is an alternate-frame technique developed by Maj. R. V. Bernier of the Air Development Center, Wright-Patterson Air Force Base. A single motion-picture camera is used instead of twin cameras. A beam splitter which uses diagonal mirrors is placed before the camera lens and a special rotating shutter exposes one frame of film via the left mirror, the next frame via the right mirror. Thus, in succession, views as would be seen by the left and then the right eye are exposed.

For projection, a polarizer is rotated in front of the lens. One frame of film is polarized in one direction, the next frame in the opposite direction. Members of the audience wear Polaroid spectacles and each eye sees only the images intended for it.

Optical-research people say that in the future we'll have movies and television in three dimensions that can be viewed without visual aids. William G. Straube, researcher at the Pacific Optical Corp., has

To show stereo movies, a mirror device is placed in front of projector to direct both images on screen. Polarized glasses have to be worn by the audience



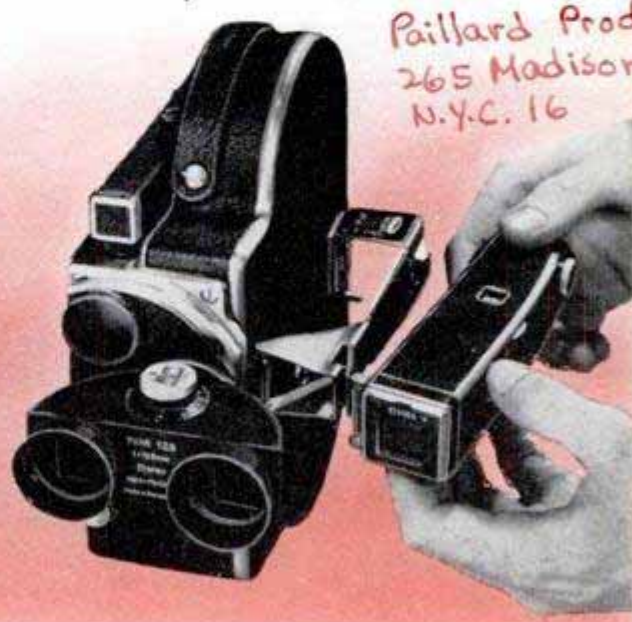
Nord Company photo

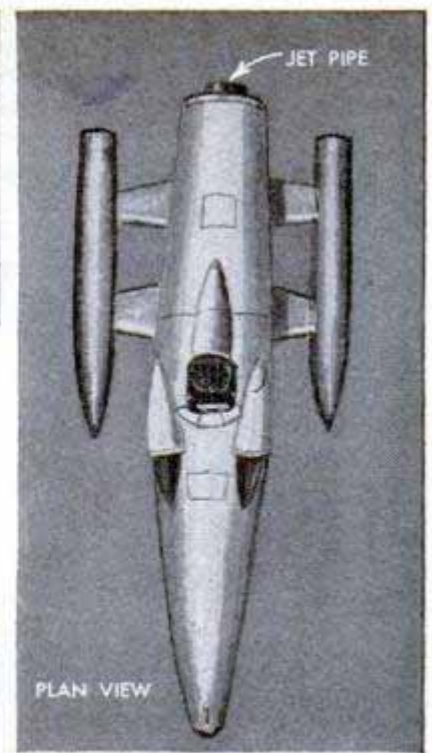
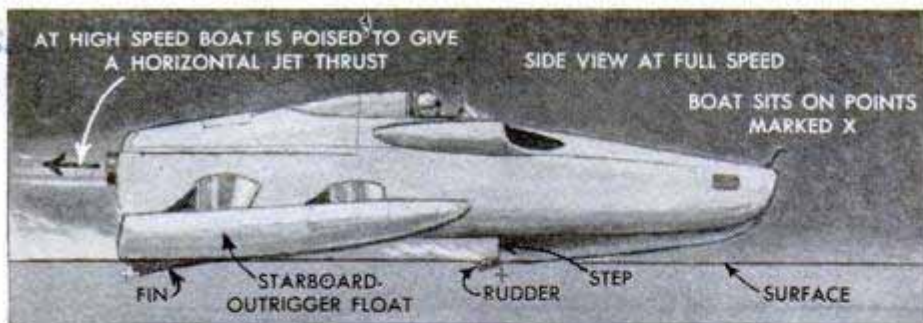
Stereo movies are made by adding a beam splitter to lens. By proper masking, regular viewfinder is used

worked out the theory of one such system.

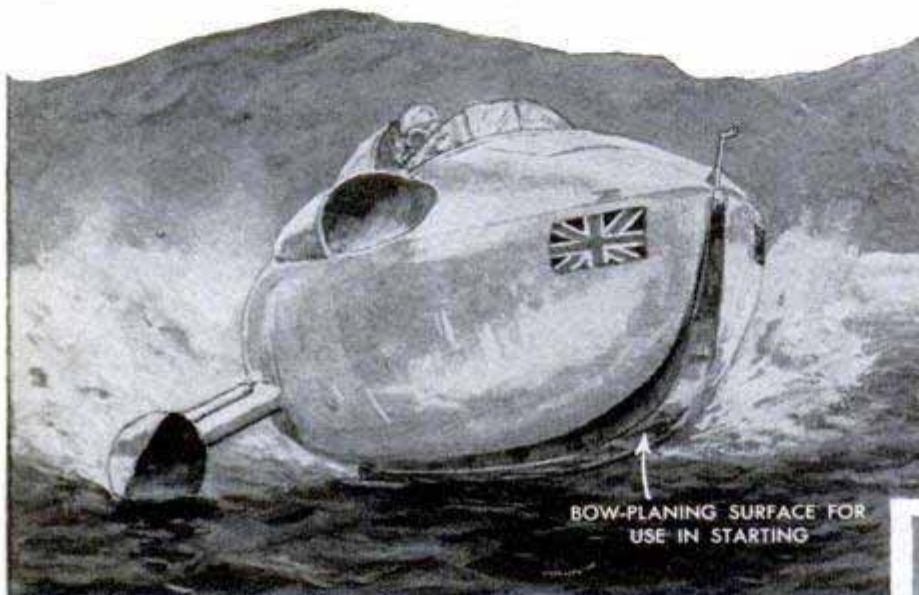
Straube proposed a large "spatial" nuclear vacuum tube in which particles in space would be ionized or excited to visibility by impulses from a radar-type viewing camera. Any scene picked up by the radar camera would be duplicated in miniature and in three dimensions inside the tube, near objects appearing in precise detail near the front of the tube and distant objects being made visible by local excitations toward the rear of the tube. Some experts think that within a decade we'll be able to build a tube like that, something that seems fantastic today. ★ ★ ★

Another stereo-movie beam splitter, designed for the Bolex camera, has bracket for offsetting viewfinder. With this outfit you can make sound movies in stereo

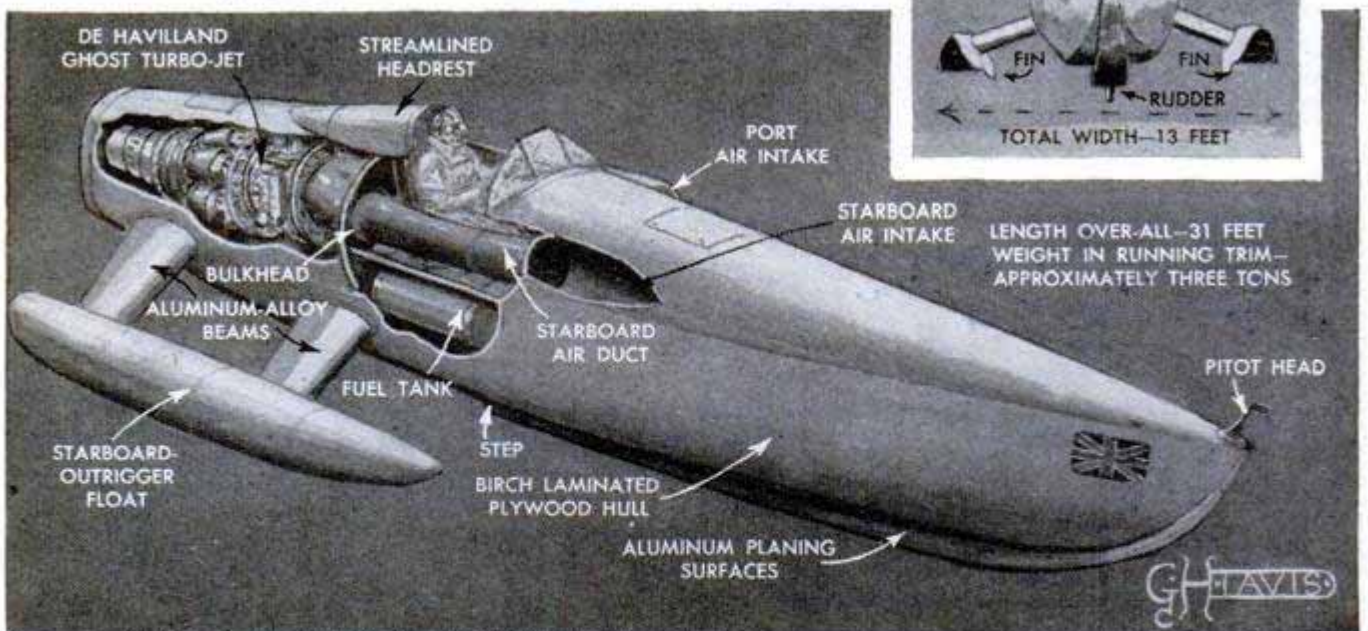
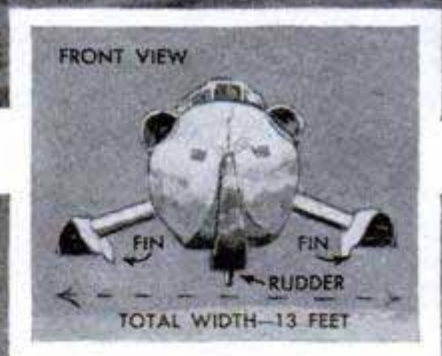




Can Jet Boat Blast Record?



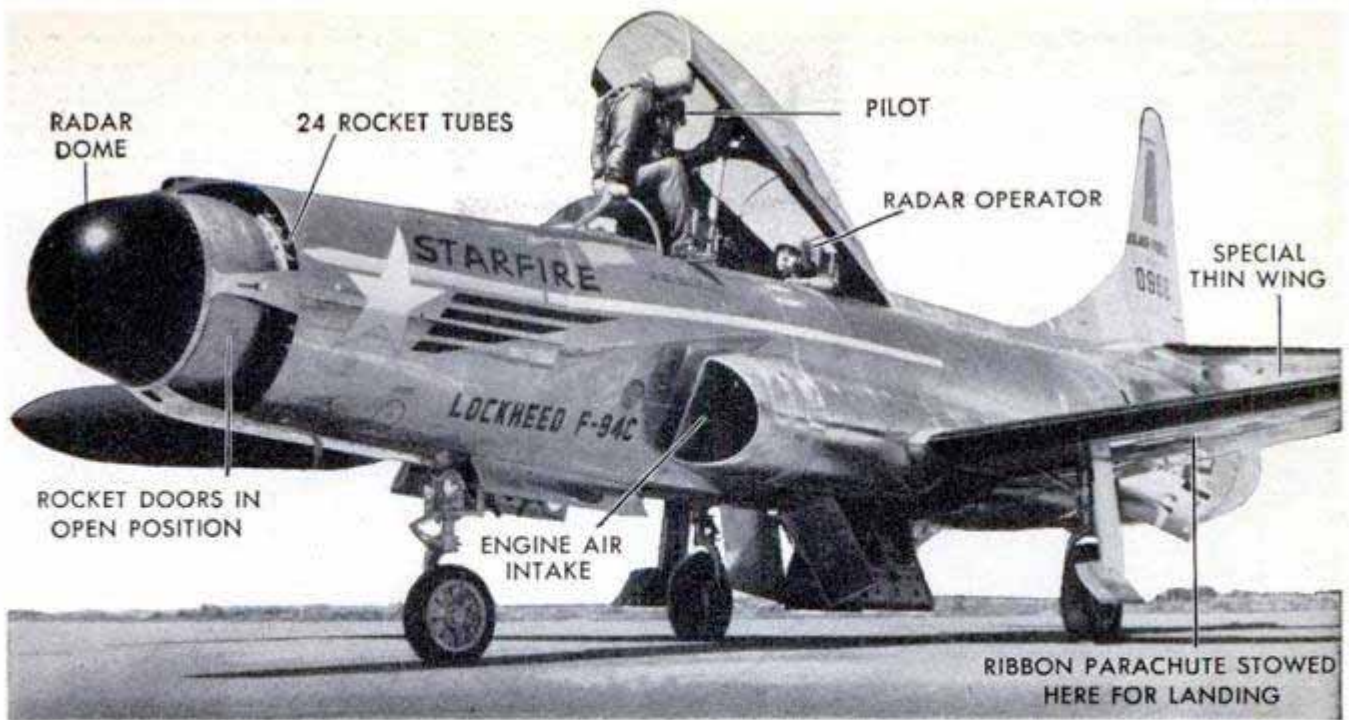
IT IS BELIEVED THAT CRUSADER WILL REACH A SPEED OF OVER 200 M.P.H. ON LAKE WINDERMERE



Drawn especially for Popular Mechanics by G. H. Davis, English artist

Can a strange new boat powered by a jet aircraft engine set a world's speed record? The answer will come soon when John Cobb, of land speed fame, tries his odd craft on Lake Windermere in England. The present speed mark, set a few weeks ago

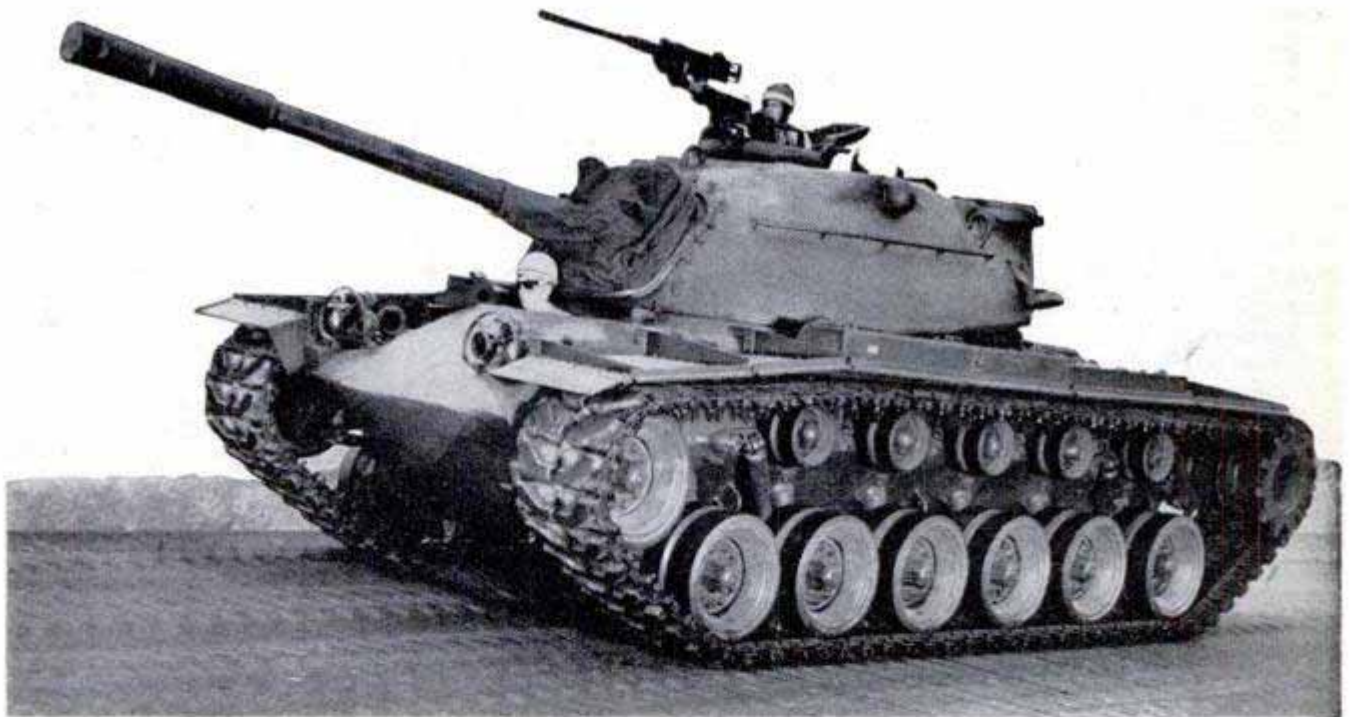
by Stanley Sayres of Seattle, Wash., is 178.497 miles per hour. Cobb expects his boat to skim the surface at better than 200 miles per hour. The 31-foot racer, made of aluminum alloy and birch plywood, has two outriggers to give it high-speed stability.



24 Rockets Ring Nose Of Lockheed's Jet Starfire

Bristling with 24 air-to-air rockets housed in a ring around its nose, the Lockheed C-94C Starfire is an almost-automatic jet airplane. Radar and specialized, brain-like instruments enable it to spot the enemy

miles away, lock onto the target, track, close and open fire—all by itself. The Starfire carries two dozen 2.75-inch rockets. It has a top speed of over 600 miles an hour and exceeds 20,000 pounds fully loaded.

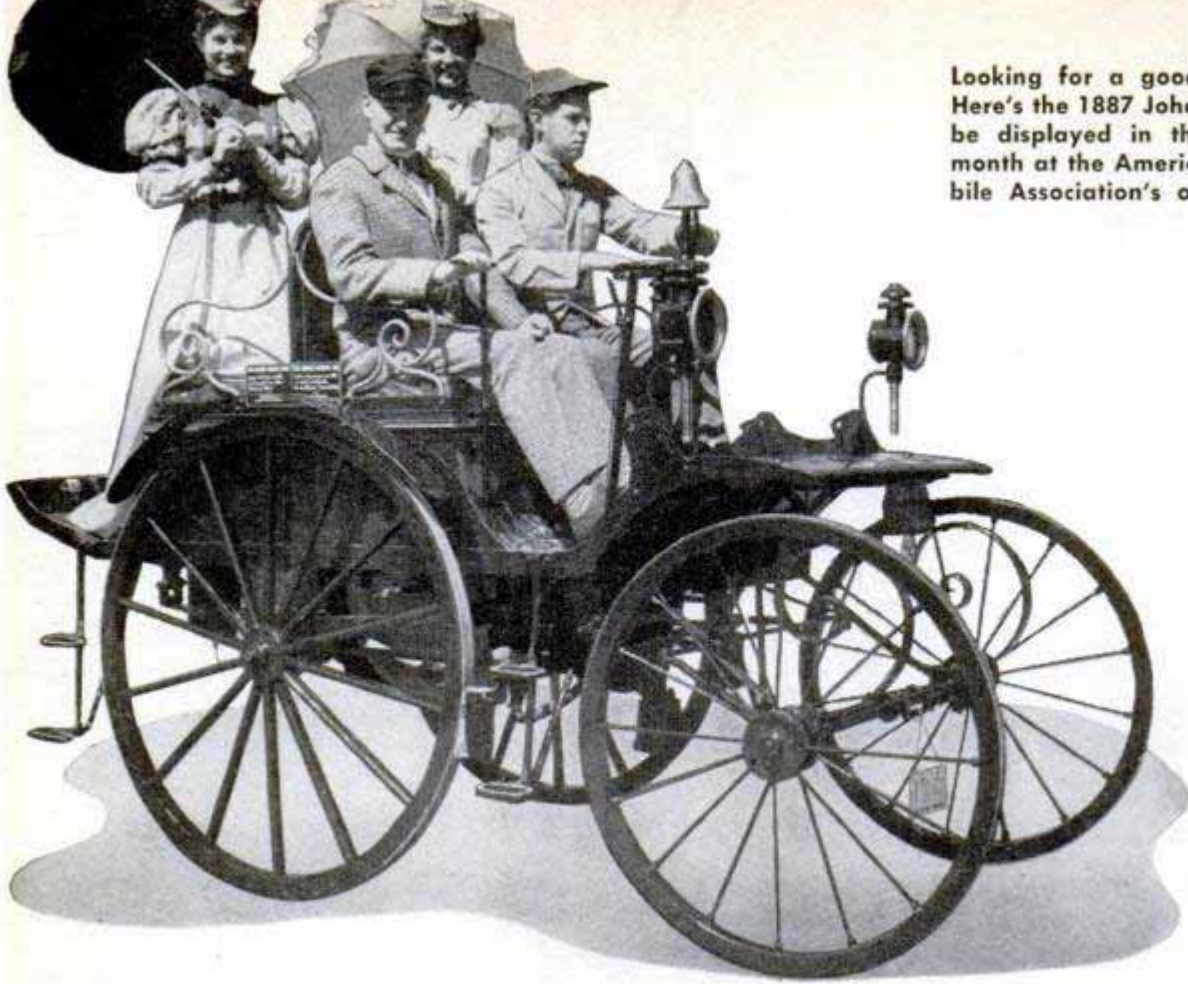


Rugged Patton Tank Has One-Piece Cast Hull

With the first one-piece hull ever cast, the new Patton 48 tanks are going into service as the U. S. Army's most rugged medium armor. Their sloping, elliptical sides afford greater protection and better vision to the crew. In the 45-50-ton class, the Patton carries a four-man crew. A high-velocity 90-mm. gun is augmented by one 30-

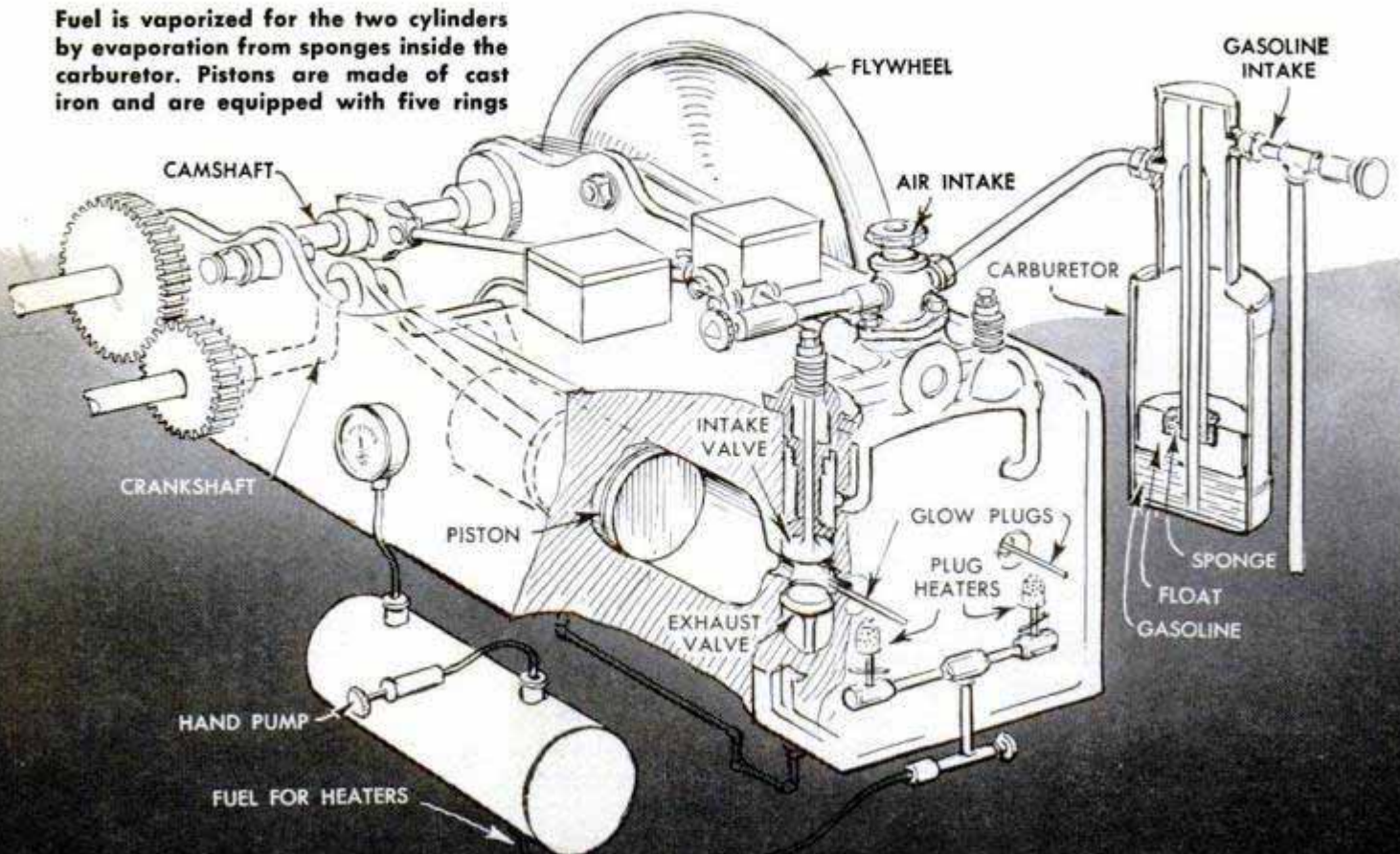
caliber and two .50-caliber machine guns. Unique is the placement of one .50-caliber gun atop the turret; it can be aimed, fired and reloaded from inside the tank without exposing any crew member. The Patton has power steering and a cross-drive transmission that eliminates driver fatigue. Its Chrysler engine develops 810 horsepower.

Looking for a good used car?
Here's the 1887 Johansen. It will
be displayed in the U. S. this
month at the American Automob-
ile Association's old-car show

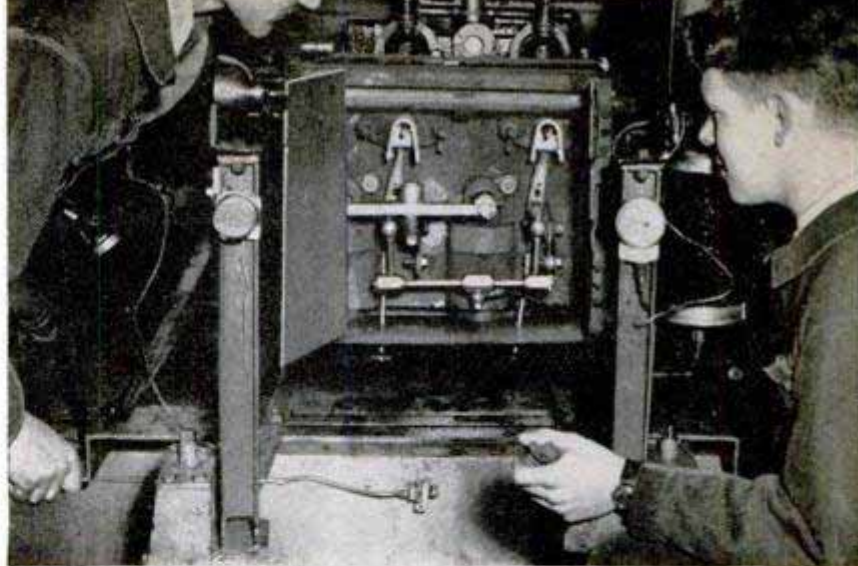
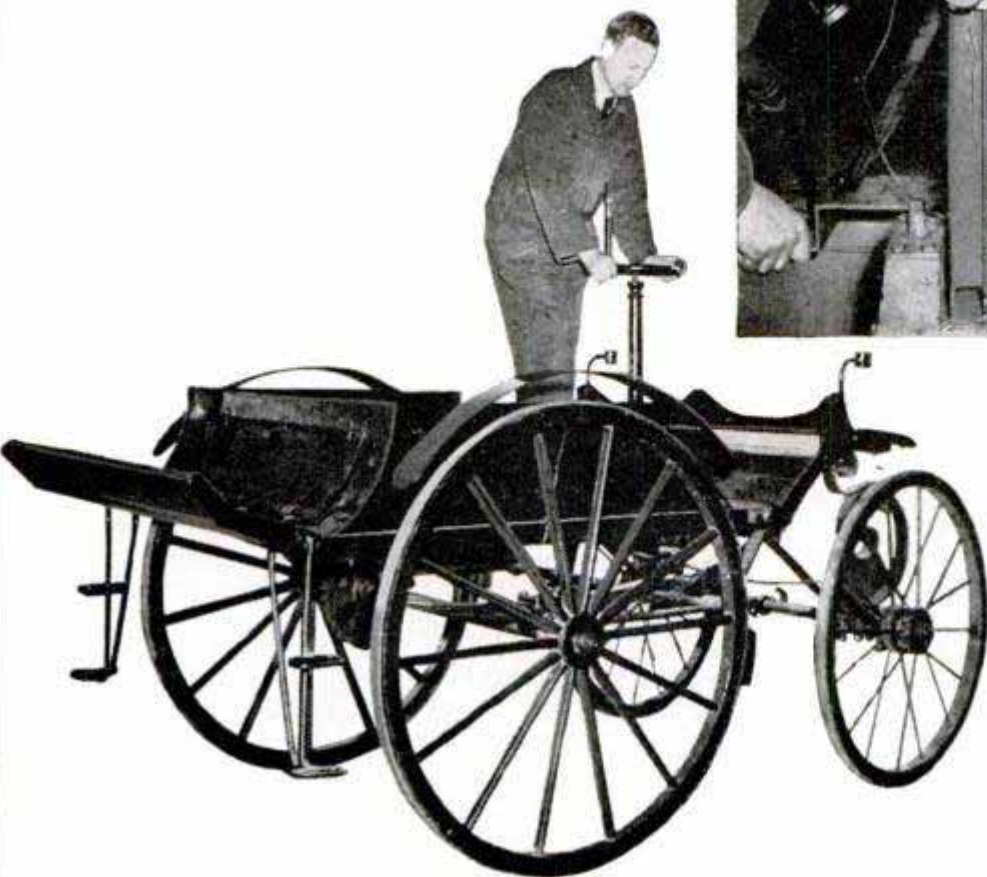


BUILT IN 1887— AND STILL RUNNING

Fuel is vaporized for the two cylinders
by evaporation from sponges inside the
carburetor. Pistons are made of cast
iron and are equipped with five rings



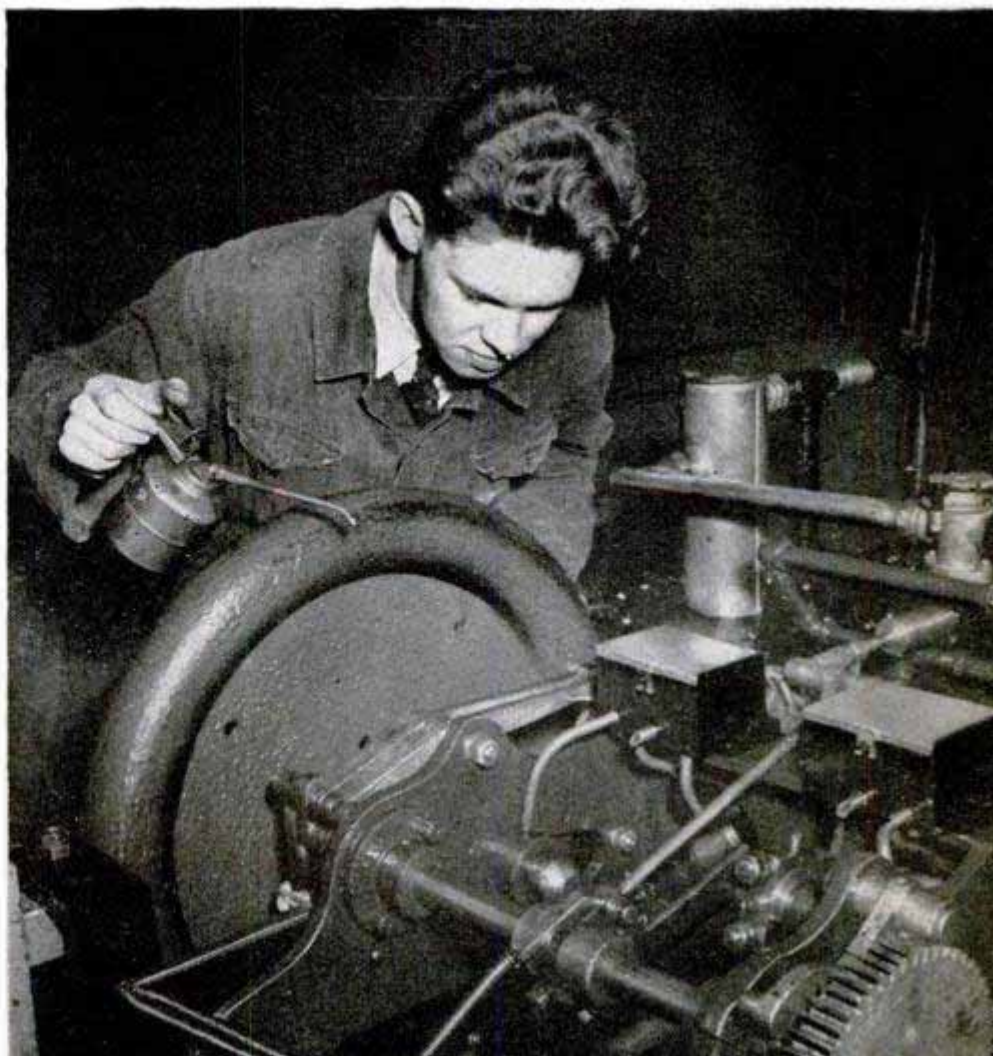
Below, steering the Johansen car is confusing to the modern driver. When you want to turn right, you spin the steering wheel to the left! Like all early cars, it was simply a carriage in which an engine replaced the horse

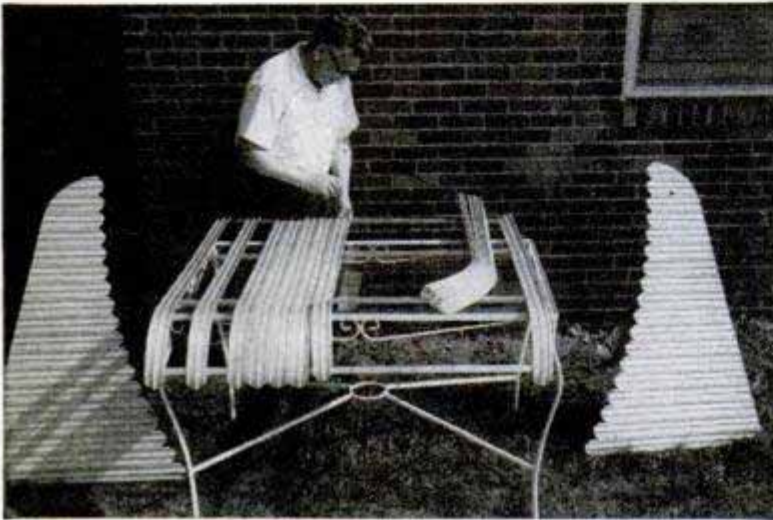


Above, the Danish mechanics who restored the 65-year-old power plant look over its ignition system. No electricity is used. Tiny blowtorches keep two steel rods hot enough to ignite the fuel. To advance the spark, both torches are moved closer to the block; to retard it, they are moved away. Below, lubrication was a problem. Two small boxes atop engine hold oil that is carried to the main bearing by pipes and wicks. Other friction surfaces have to be oiled with an oil can before starting a trip

IT WAS 65 years ago that a Copenhagen blacksmith named Urban Johansen donned a bowler hat, combed his beard and drove Denmark's first gasoline automobile. Its two-cylinder engine developed a feeble $3\frac{1}{2}$ horsepower. For several years, the car chugged around the city, until in 1890 it was stored away and forgotten—one of the world's first "junked" automobiles.

When the Royal Danish Automobile Club had its 50th birthday last year, it located the Johansen car. Parts were missing and dirt and corrosion covered the engine. Skilled Danish mechanics worked over it to put it in operating condition. The tanks were filled, the ignition heaters lighted and after two turns of the crank, the engine, for the first time in 62 years, coughed into action—a tribute to the genius of a Danish blacksmith.





All-Weather Awnings Made From Kits

Homeowners now can assemble and install their own permanent awnings and door canopies. The protective coverings are available in kit form in a variety of shapes and sizes. Each kit includes pre-drilled framing members, pre-assembled sides, curved aluminum strips, and bolts to fasten the strips to the frame. The strips interlock to form a rigid, weatherproof awning or canopy. All the parts are pretreated to give them a surface suitable for painting. The awnings, which project 43 inches from the building, have either convex or concave tops and curved or straight sides. The same awnings and canopies are available completely assembled with baked-enamel finish.

Superspark Starts Jets

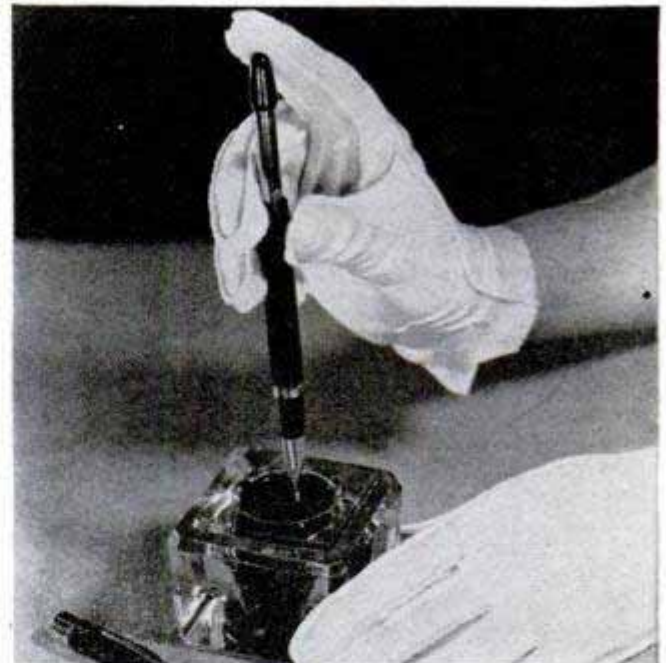
Jet-fighter planes are started by a new seven-pound electronics system that produces a 10,000-watt spark that produces a 10,000-watt spark from a mere 24-volt current supply. Developed by Bendix Aviation, the unit is now in volume production at Scintilla, N. Y.

Self-Warming Power Lines

Planned short circuits and deliberate overloading of power lines sounds like sabotage, but it's only a method of ice removal now practiced by many power companies. During sleet storms and freezing rains heavy electrical loads are applied, and so much current flows through the wires that they become heated. The ice then melts and drops to the ground. If no preventive measures are taken, lines burdened with ice may snap or swing violently in the wind, seriously damaging transmission facilities.

Another Anniversary Feature!

"Count people on the street, and every 387th will be an engineer. He looks like everyone else, often more so. Yet everything around us would collapse without him." So writes Harland Manchester, famous author, in an anniversary feature on engineering and the great American engineers. The story tells the adventures and ceaseless toil of the 400,000 engineers of American industry, "obscure as the coral that builds the atoll," who measure, check, test and design everything from bathtub faucets to atomic power plants. It's the story of a challenge that grows greater with every accomplishment. Don't miss "Engineering—the Might of America" in the October issue.



No-Dip Fountain Pen Prevents Inky Fingers

Ink blotters and pen wipers aren't necessary if you use a "messless" fountain pen which fills without dipping. A concealed tube extends from the nib when the pen is to be filled, and sucks up the ink. A slight push of the finger depressing the plunger retracts the feeder line.

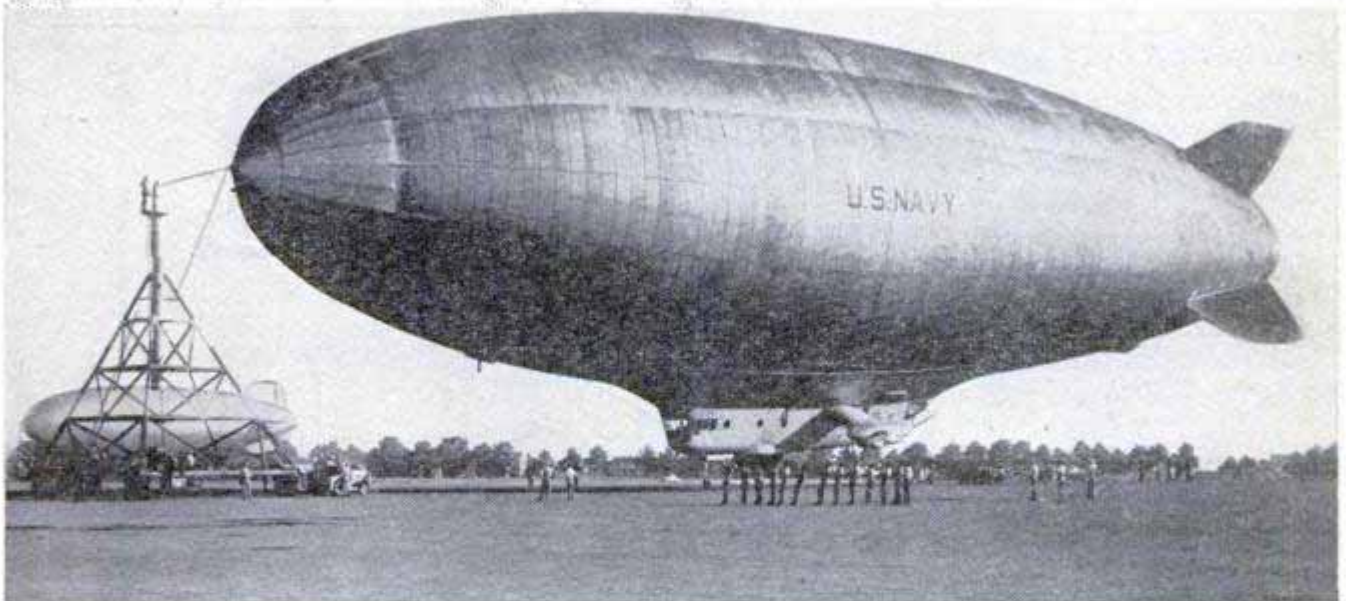


There is no space wasted in the 452-pound Sky Baby, so compactly built that there isn't room enough for a chute for the pilot. It flies 150 miles an hour



Seven-Foot Airplane Flies 150 Miles Per Hour

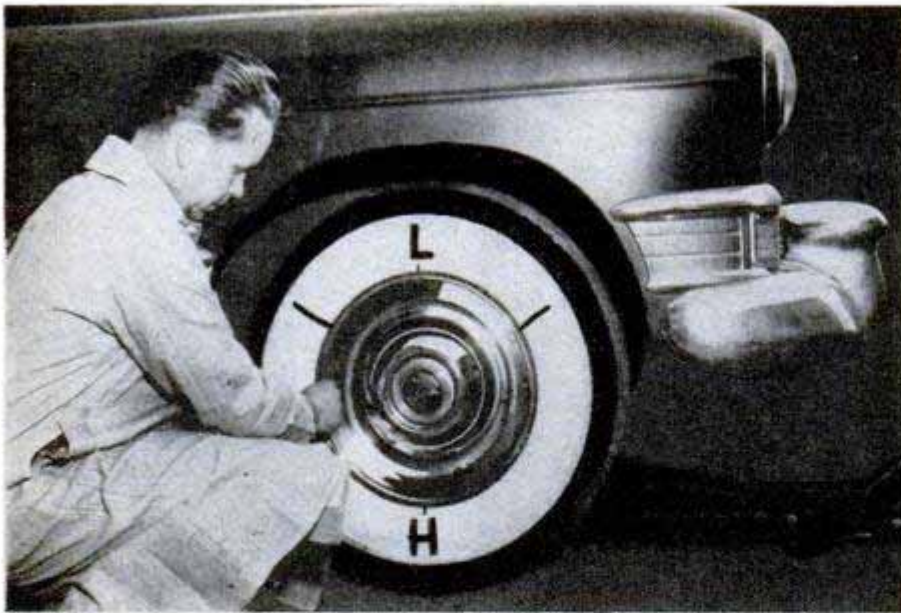
With a wingspan of slightly more than seven feet, an airplane believed to be the smallest in the world flew 150 miles an hour over the California desert. The 452-pound Sky Baby is 9 feet 10 inches long. It was built at a cost of \$2200 for air shows and exhibitions. For visibility and balance the lower wing is set ahead of the upper wing, with a gap of only 39 inches separating the two.



Navy Airship Longer Than Football Field

Described by the U. S. Navy as the largest ever built, a new nonrigid airship has been added to the lighter-than-air fleet at Lakehurst, N. J. It is 324 feet long, 95 feet high and has a helium capacity of 875,000

cubic feet. The giant ship's 800-horsepower engines can be repaired in flight and special refueling equipment will enable it to remain aloft indefinitely. It was built by Goodyear at Akron, Ohio.



After heavy portion of wheel settles to the bottom, magnetic weights, below, are added equally at ten and two o'clock positions to balance it



Wheel Balancer

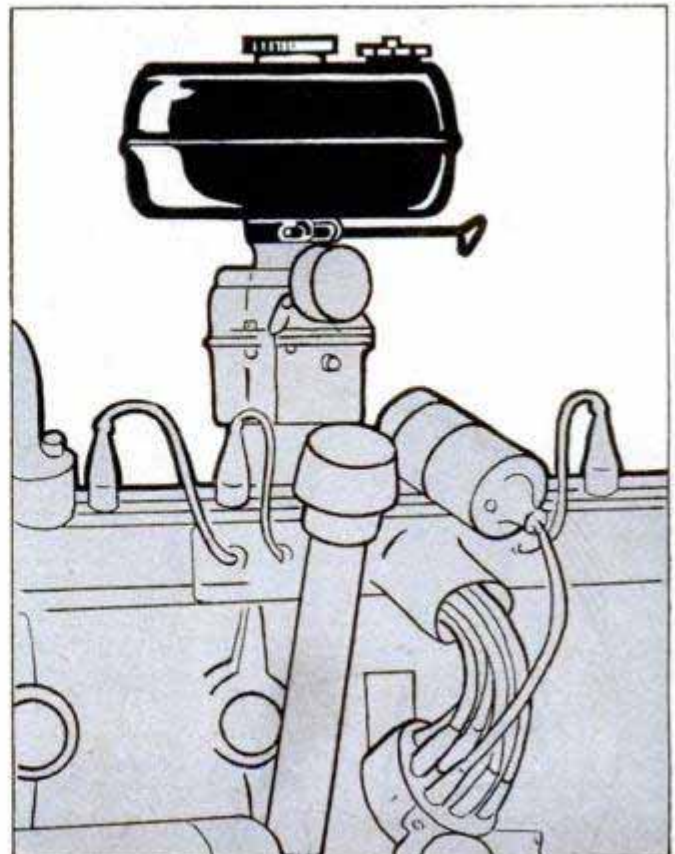
Wheel balancing is simplified and speeded with the use of a new system employing one-ounce magnetic weights and an indicator blade. It is based on the principle used in balancing armatures and generators, and the equipment can be carried in a pocket. Two wheels can be balanced in five minutes. After the heavy part of the wheel settles to the bottom, or six o'clock, position, both it and the light, or twelve o'clock, position are marked. After the wheel is turned until the light and heavy marks are horizontal, magnetic weights are added until the heavy portion is counterbalanced. The wheel is returned to its original position and conventional lead weights equal to twice the weight required to balance the wheel are attached to the rim, half at the ten o'clock position and half at two o'clock. The indicator blade is used to measure the positions accurately.

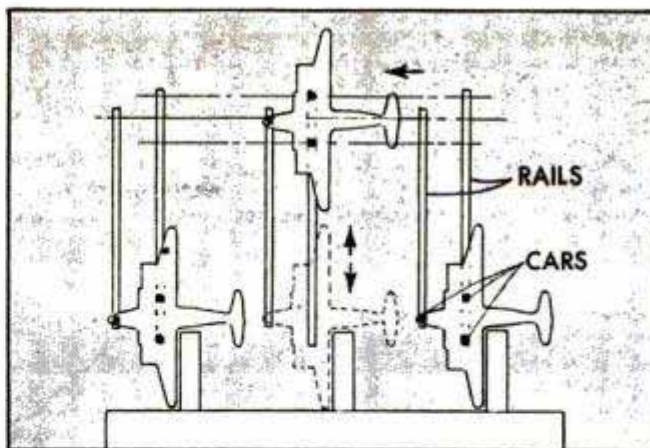
Emergency Fuel Unit

Installed in one minute on the carburetor air intake, a compact emergency fuel system starts any vehicle stalled by gasoline troubles. By-passing the gas tank, fuel pump and all lines, the unit injects the proper fuel-air mixture directly into the engine, giving normal acceleration at all speeds. It is leakproof, holds one gallon of gasoline, and is nine inches in diameter and six inches high.

Electronic Amplifier Brightens TV

Clearer, brighter TV images reportedly will result from use of a new electronic light amplifier for television sets. The amplifier receives a beam of light forming an image, transforms it into a beam of electrons, increases the intensity of the electron beam and then transforms it back into a light beam duplicating the original image with increased intensity. Lee deForest, "father of radio," and William A. Rhodes are co-inventors of the device, which they patented last spring.

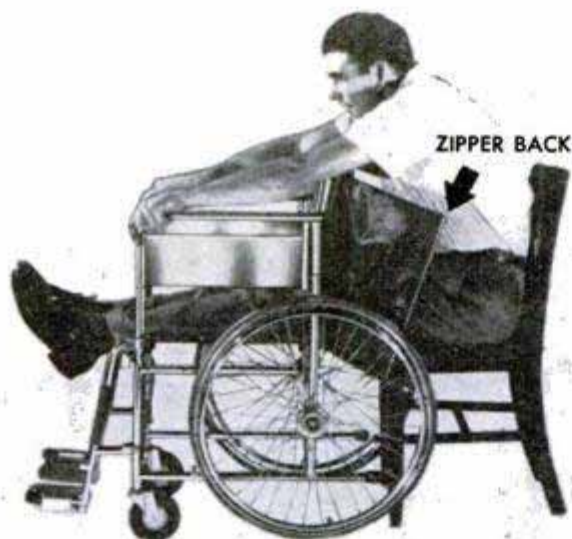




Airplane Parker Speeds Operations at Colombian Airport

At Barranquilla, Colombia, airplanes' time on the ground has been halved by equipment which moves transports sideways to the terminal over two sets of tracks that are almost flush with the ramp's surface. After the airplane is taxied into position with the nose wheel on a dolly on one

set of tracks and the main landing wheels on two dollies on the other track, an electric winch pulls it flush against the terminal. Passengers and cargo are loaded and unloaded directly to and from the building. Plane servicing can be handled by fixed units, eliminating many portable units.

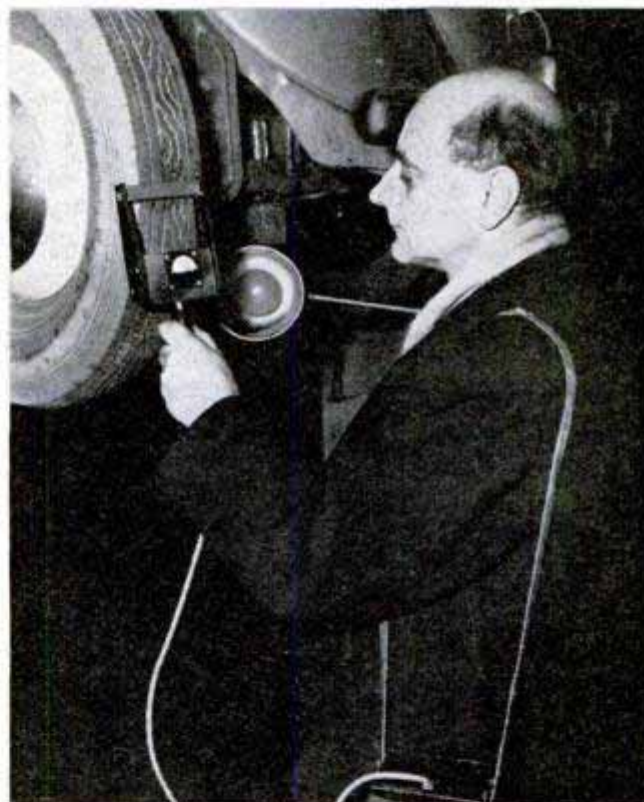


Zippered-Back Wheel Chair

Wheel-chair users have more freedom of movement when their chairs have zippered backs. Quickly opened, the zipper back enables the invalid to transfer himself from the wheel chair to a regular chair or bed by sliding backward. The return to the wheel chair is equally simple.

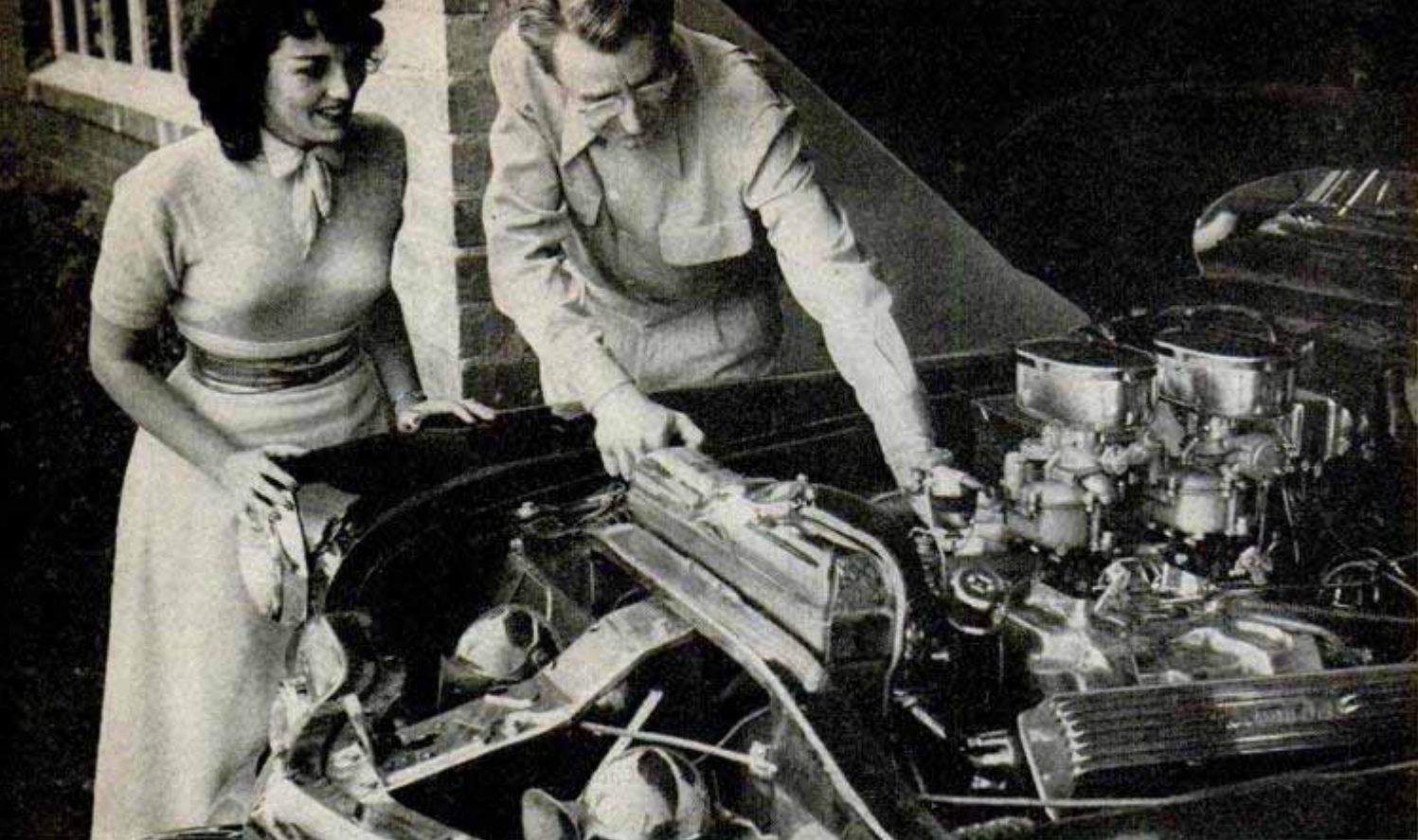
☞ "Raining cats and dogs" is too weak a term to describe the day at Baguio in the Philippines when 45.99 inches of rain fell in 24 hours.

Sources of available products described in this issue are listed on pages 12, 14 and 16. Sources of further information on other articles are listed in our free WHERE-TO-FIND-IT LIST. For your copy just write to the Bureau of Information, *Popular Mechanics*, 200 East Ontario Street, Chicago 11



Electric Detector Spots Metal Particles

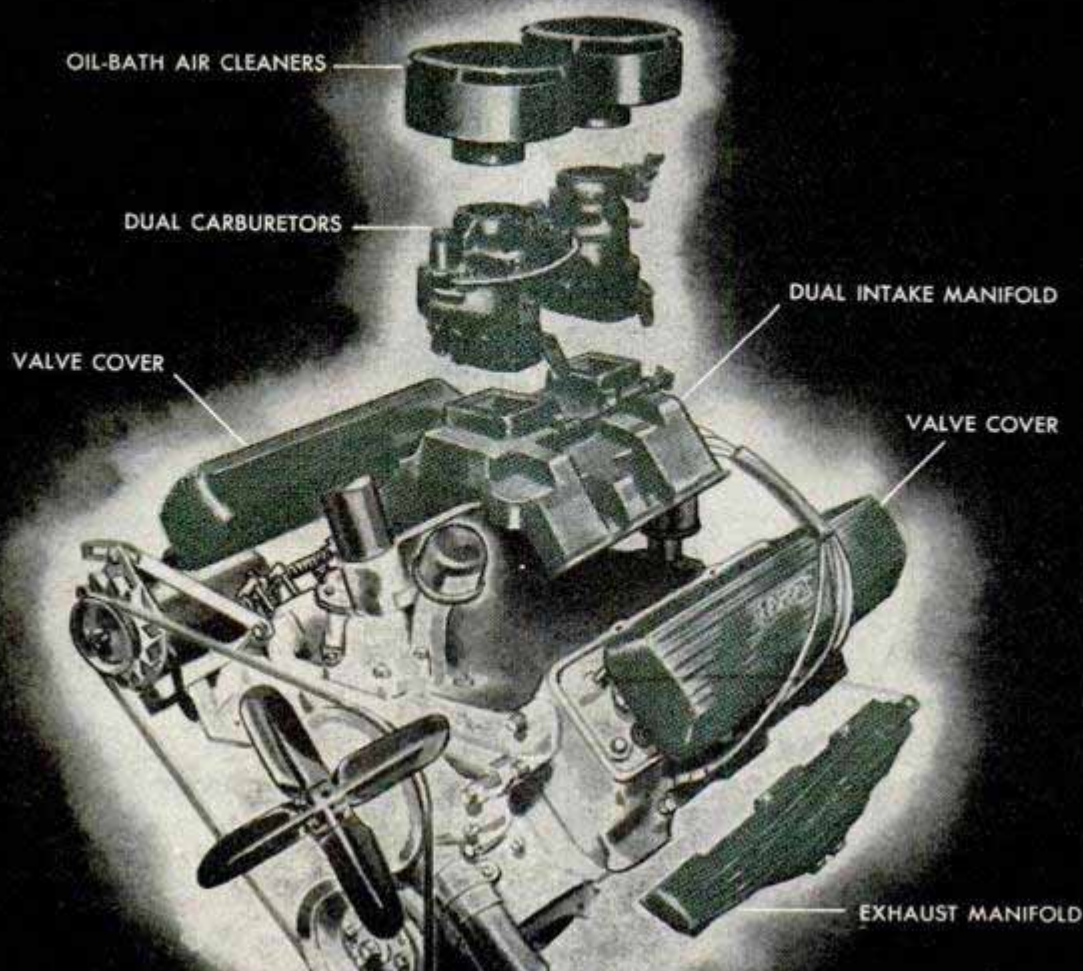
Nails or metal particles hidden beneath the surface of automobile tires are quickly spotted with a high-frequency detector developed by a German engineer. The detector consists of two coils, one to create oscillations that are picked up by the second coil. An amplifier, suspended from the operator's shoulder, transmits the data to a meter on the back of the detector unit. When the detector passes over a metal particle, the needle notifies the operator.



Cadillac owner listens as Edmunds explains engine modifications made in his shop to boost car's performance

"Soup Up" YOUR CAR?

Labeled parts in the exploded drawing of a Cadillac V-8 are those Edmunds installs in modifying engine



By Lou Jacobs, Jr.

TO MANY MOTORISTS, an automobile engine is merely something under the hood that makes the wheels go around. But not to the motorcar enthusiast! To him, an engine is a fine instrument to be tuned, adjusted and adapted until it's a slim whisker shy of the impossible perfection.

It is this enthusiast who keeps Eddie Edmunds busy. Edmunds builds engine parts that boost performance by an average of 25 percent—parts like cylinder heads, manifolds and air cleaners. Designed for stock engines, these modifiers convert any run-of-the-assembly-line car into a "souped up" custom job with more power, speed and efficiency.

You've heard a lot about hot rods and souped-up stock cars. At times, the horsepower-happy enthusiasts seem to have come from another world. In garages and back-yard workshops, amateur engineers argue over terms like volumetric efficiency and torque. But don't feel bad because you can't juggle technical nomenclature. From the Edmunds factory at West Los Angeles, Calif., you can get the same results and you don't have to know a wrist pin from a needle valve.

Suppose you're driving a late-model Plymouth with the 97-horsepower engine. Eddie Edmunds says his redesigned head and

dual-intake manifold will raise this to about 120 horsepower. Similar jumps are possible with most other cars at a cost of \$75 to \$150, depending upon the engine. For the valve-in-head Chevrolet, Edmunds claims a 26-percent boost in horsepower with the replacement of the manifold.

Students of the revamped cylinder head will understand easily that such claims are not exorbitant. Not every driver, however, knows that extra power can be obtained with mass-produced modifiers that can be bought and installed by any mechanic.

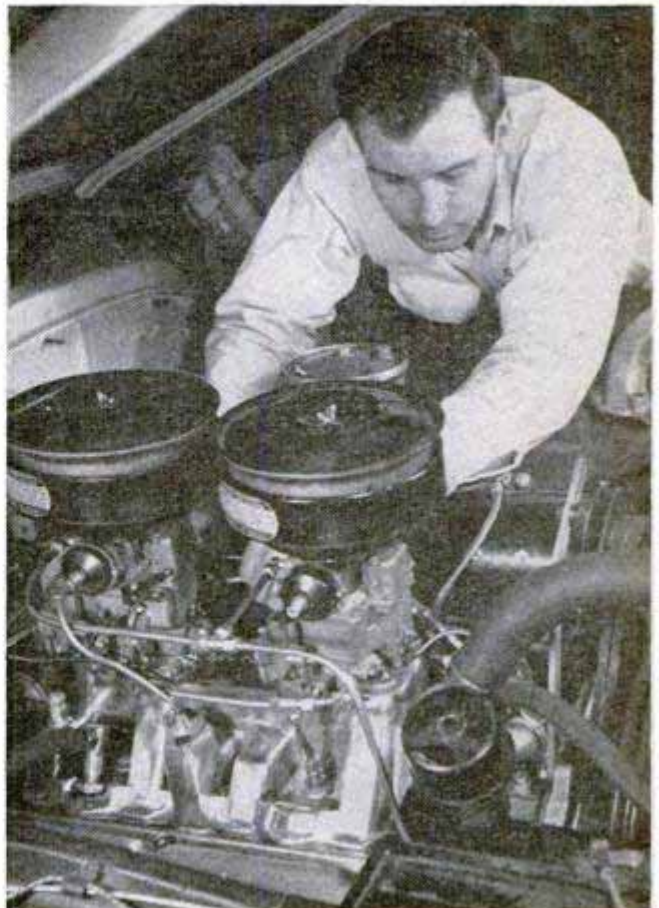
In the Mexican road race, the Chrysler Saratoga that set a new speed record with amazing sprints of 112 miles an hour was altered with an Edmunds dual-intake manifold. The Kiekhaefer Aeromarine Motors Company owned the entry. They ordered Edmunds' specially designed Chrysler manifold for the stock car and then redesigned it further. Nearly a third of the cars in that race carried Edmunds equipment that came right off his assembly line, though only one of them was actually remodeled in Edmunds' shop. The road racers installed the new parts as they came from the factory or modified them according to their requirements.

His reputation growing annually, Edmunds recently moved into a new factory where about 50 men and women work to make good engines better. In half the plant

Mechanic tightens down an Edmunds cylinder head on a 1951 Packard engine. Fluting carries off more heat



Dual-intake manifold is said to boost output of the Chrysler Fire Power engine from 180 to 214 hp.





Patternmaker works on a new model for the Edmunds Nash cylinder head. Fluted head in background is the current modification



Above, aluminum-alloy manifold is carefully fitted into a jig to be drilled. Below, all Edmunds parts are thoroughly buffed and polished to improve appearance and increase heat transmission



Edmunds manufactures his own designs for dual-intake manifolds, cylinder heads and air cleaners, all of which are said to bring out the best in any American car and in some foreign cars.

About 150 different parts cast in an aluminum alloy are drilled, buffed, polished and finished on a production-line basis. A couple of patternmakers are kept busy constantly revising designs as new-model cars are introduced. Edmunds uses his influence in Detroit to get drawings or complete engines of most American cars before they are sold to the public so he can be ready with new modifications. Not long ago he had a call from a Los Angeles dealer who announced that he had a brand-new Lincoln engine for Edmunds to work on if he was interested. The dealer explained that if he could tell customers that 200 horsepower was available for their cars he would have an extra selling point.

The other half of Edmunds' plant is the installation department where local motorists get service, where mechanics from all over come for training and where slick custom jobs are devised for affluent drivers. Edmunds' brochures boast openly about the 325 horsepower obtainable from a 160-horsepower Cadillac engine. This kind of job—which includes reboring, new cams, new ignition and the works—costs \$1475, if anyone is interested. It means virtually a new motor. Edmunds, however, will tackle any kind of a modification from the simple addition of one or more of his standard parts through revamping a whole engine, depending on the customer's desires—and his pocketbook.

At this point someone might ask, "If Edmunds can improve the ordinary motor so drastically, why don't the big manufacturers grab his stuff or devise their own for the same purpose?" The answer to that is twofold. First, although well-known, the theories of engine design and revision are complicated and controversial. More power is obtainable from delicate adjustments and major improvements involving terms like volumetric efficiency and

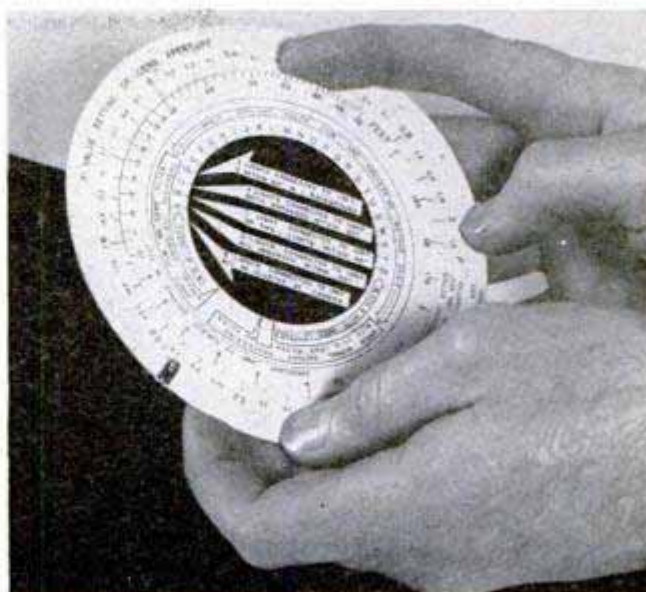
(Continued to page 240)

PHOTO FOURSOME



Twin-Socket Light Bar

Lightweight and compactly designed, a metal support that attaches to the tripod socket of a movie or still camera holds two photoflood lights for even lighting. The lights are attached to two sloping uprights which pivot on the ends of the horizontal member. For storage, the uprights can be swung inward.



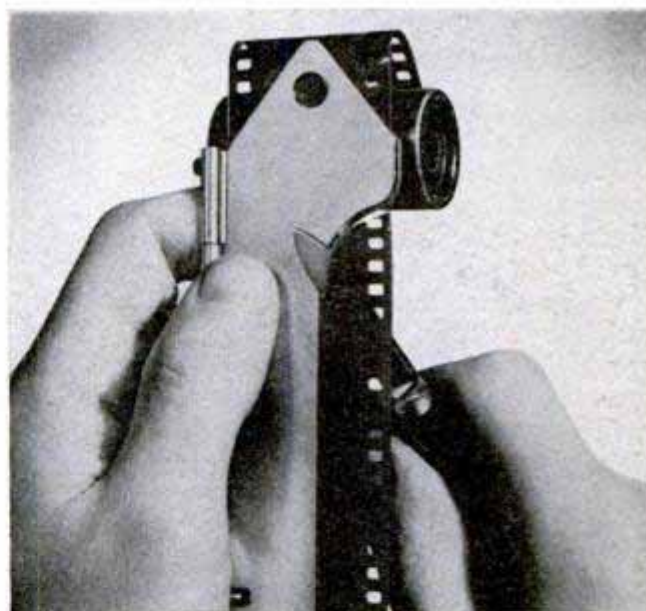
Exposure Guide

Based on 3600 controlled exposures, an exposure computer provides the speed-light photographer with a means of getting consistently good results on color work. The computer is locked in adjustment for any type of light unit from 10 to 5000-watt-seconds output. A manual is provided to explain the computer's use.



Photoflash Test Bulb

Photographers can quickly check both batteries and circuits before shooting flash pictures by means of test bulbs developed by Westinghouse. The bulbs use the proper voltage to test the circuits under normal conditions. In addition, the relative brightness of the bulb provides an indication of the battery condition.



Film-Trimming Aid

Now available is a template for photographers who buy 35-millimeter film in bulk and load their own cartridges. The user can trim the leader with a pocketknife while the template is held tightly against the film. The precisely cut leader fits into the takeup spool accurately and prevents film from binding while being wound.



Snow Melter

Live steam is being used by the Army to melt ice and snow. The snow melter, designed for use in the Arctic, consists of a steam generator mounted on a Weasel. In earlier models the snow had to be shoveled into the machine. With the new melter the snow or ice can be converted into liquid anywhere and the water is pumped off as needed. Holes can be melted through the ice of lakes by using a metal cone on the end of the steam hose. The cone minimizes the loss of heat. Fresh water can be pumped through the resulting holes.

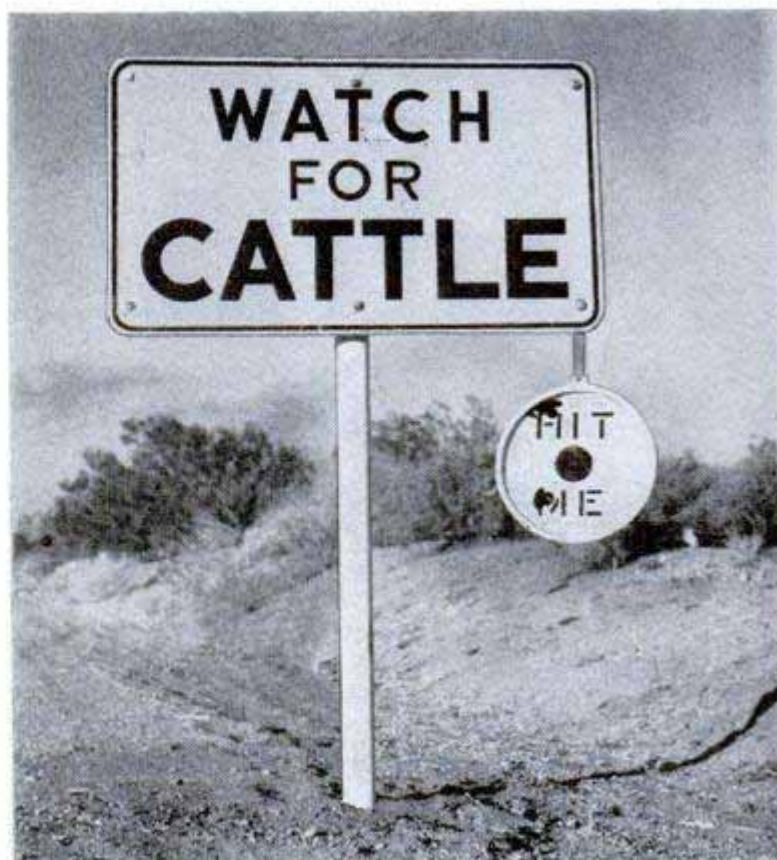


Book Restorer

Books with broken bindings and crumbling covers can be restored to good condition with a new plastic adhesive. If the binding has been broken, the adhesive merely is brushed along the "spine" of the book while the covers are clamped together.

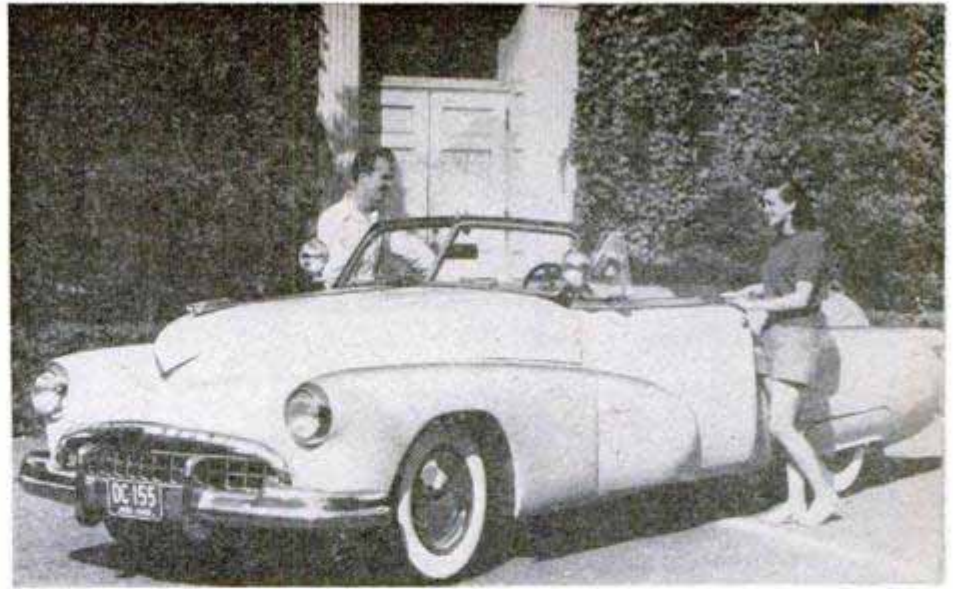
"Hit Me" Sign

When overzealous marksmen banged away at highway signs in Nevada, the highway department decided to do something to save the markers. The solution? Small bull's-eye signs bearing the message "Hit Me" were fastened below the highway signs. If dented bull's-eye markers are any indication, the project is a big success.



Reflective Sheeting

At night, motorists can see a truck outlined with reflective sheeting 70 percent faster than one without the material, according to Dr. A. R. Lauer of the Iowa State College Driving Research Laboratory. His information has guided the National Research Council in its recommendation that reflective sheeting be used to outline the rear of a motor vehicle to lessen danger of rear-end collisions.



Motor Trend photos

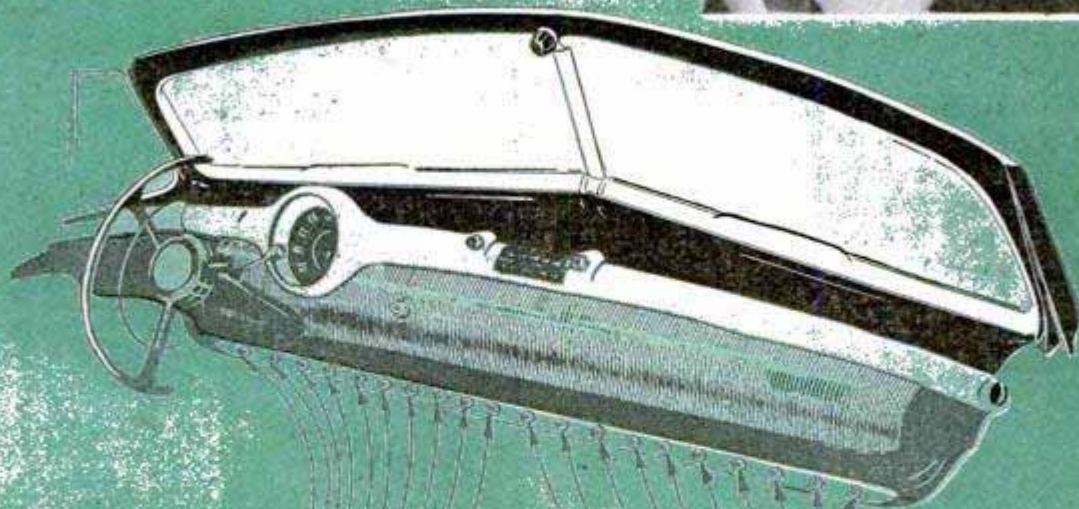
Sportster Is a \$6200 Hybrid

BASICALLY, it is a 1947 Buick convertible. But the dealer who sold it would never recognize it now! It's the Monte Carlo, a custom sports car that combines parts of 11 cars plus some novel features of its own. Included in the list of "contributors" are Ford, Mercury, Cadillac, Oldsmobile, Nash and Packard. Built for Dale Collister of East Cleveland, Ohio, the hybrid sportster cost more than \$6200. Twenty buttons on the cleanly designed dashboard control a wealth of accessories, including a record player in the glove compartment. The automatic-opening trunk lid moves straight up for about a foot before pivoting open to clear the Continental-style spare-wheel mounting. Actual construction took five men almost a year.

Above, any auto expert will spot parts of a Buick, Cadillac, Packard and Mercury in the front end. Left, tail pipes emerge from rear-fender bulge. Below, a record player is built into glove compartment. Bottom, dash control panel is neat and functional



Motor Trend drawing



- EMERGENCY BRAKE RELEASE
- SPARE BATTERY & EMERG. STARTER
- TOP CONTROL
- HOOD
- DECK LID
- LIGHTS
- THROTTLE
- MIXTURE
- INJECTOR
- COOL-AIR VENT

- COMPARTMENT
- SPOTLIGHTS
- PHONOGRAPH & REJECT
- SPEAKERS
- THERMOSTAT
- BLOWER
- SIDE DEFOG
- FRONT DEFOG
- WINDSHIELD WIPER & WASHER
- WARM-AIR DUCT

WHAT'S NEW FOR

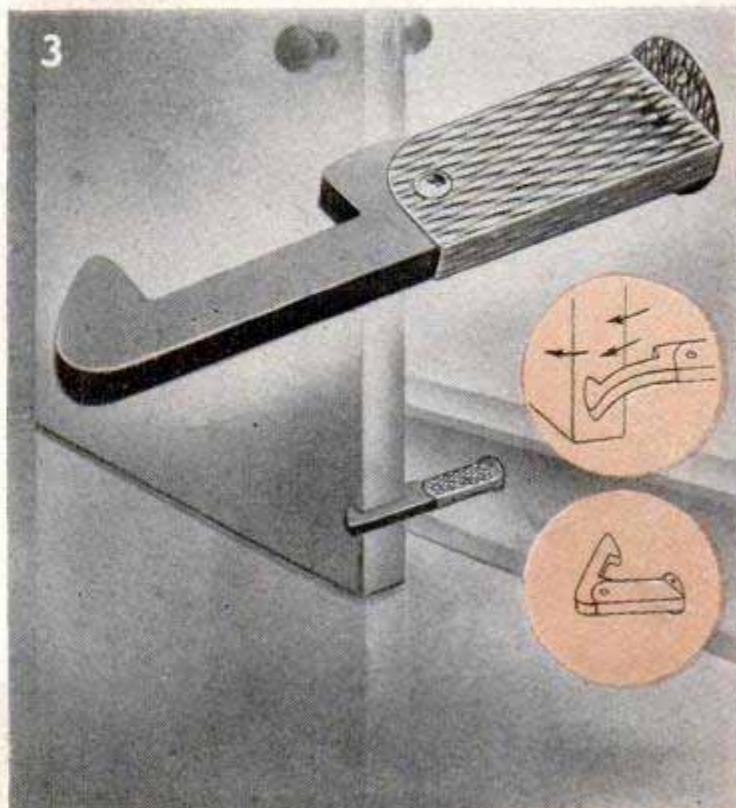
Your Home

1. "FRY BAG" made of heavy-gauge vinyl is a strong and sturdy container for use when breading meats and covering chicken sections with flour preparatory to frying. The top folds over and snaps so that the chance of losing any flour is held to a minimum. With proper care, the bag will last for many years

2. MENDING TAPE for plastic-goods repairs slashed shower curtains, raincoats and tablecloths. Strip of clear plastic tape is applied to the wrong side of torn article. A thin press cloth is laid over tape and tear, and ironed lightly. Process is also used to seal seams when making plastic articles

3. DOOR GRAB features a rubber hook which catches and holds a door that might otherwise swing shut. As the door is pushed back, it hits the inner heel of the hook which is deflected and then springs back to maintain a firm grip. The hook may also be folded back and used as a sturdy door bumper

4. RANGE TABLE on wheels masquerades as a double-oven unit until it's time to prepare a meal. Then the section is easily pulled out and used as a time-and-step saver. You can load it with food and utensils for a whole meal, then roll everything over to the side of the range for convenient cooking

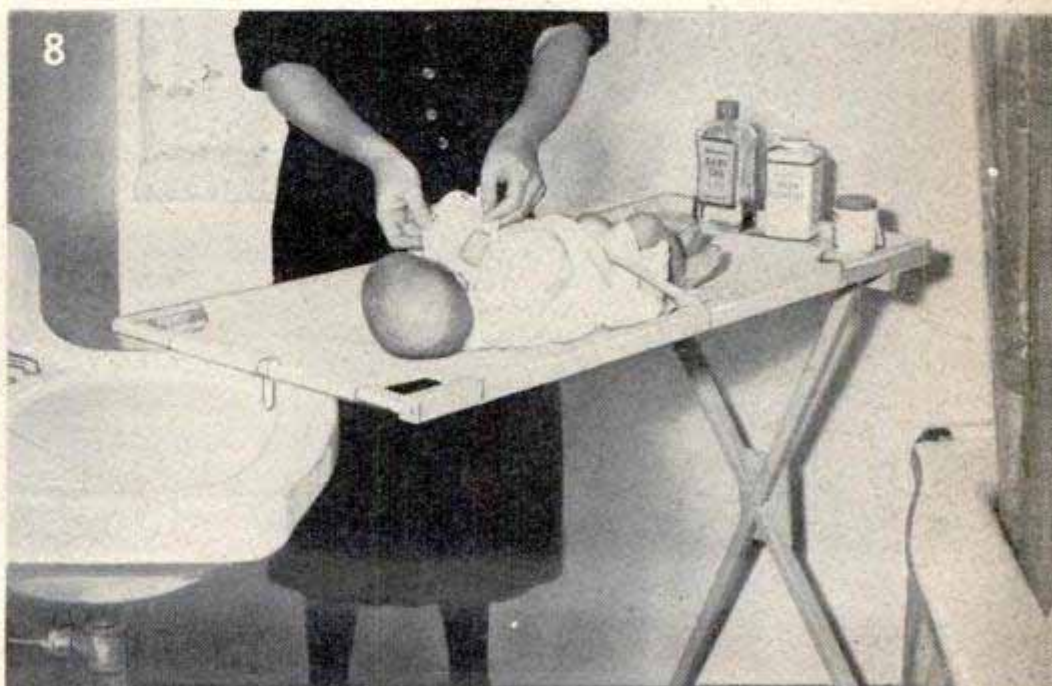
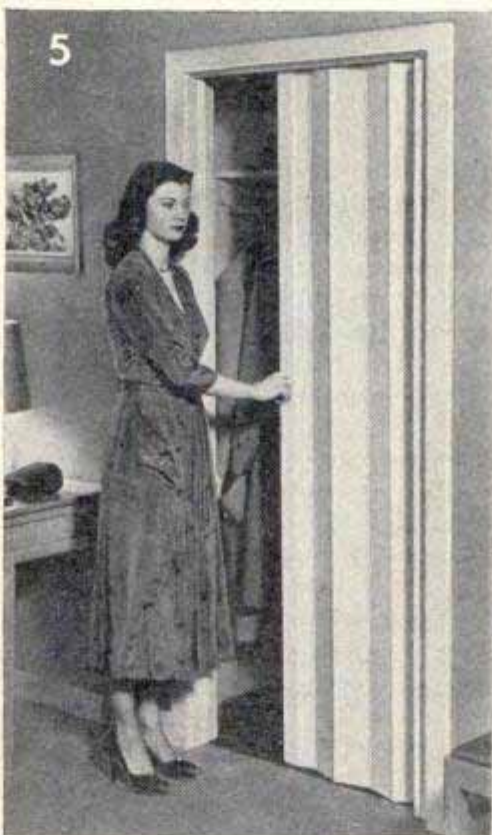


5. FOLDING DOOR of wood saves space in areas where swing-out door would be inconvenient. The door is particularly suited for use on closets, between dining room and kitchen, and in small bedrooms. Fully assembled at the factory, the door and fixtures come as a fully packaged unit which is easy to install. The door hangs from a metal track, is held together by hidden springs

6. SAFETY INCINERATOR prevents trash flying during waste disposal by a closed construction and a small-mesh screen on top of the "chimney." Designed to maintain an effective draft, the disposal unit reduces refuse to fine ashes. Sturdily built of fire-resistant alloy steel, it won't blow over and can burn unattended within 10 feet of any building. Three models in two sizes are manufactured

7. PORTABLE SHOWER turns any tub into a shower stall after only a few minutes' installation time. No tools are required to fit the sturdy unit into place. Adjustable to any height or position, it is anchored by suction fasteners. The no-splash spray head makes shower curtains unnecessary. It is easily folded and packed away for trips, and is especially well-suited for motels and resorts

8. ONE-LEG TABLE for dressing the baby can be used even in a small bathroom. With a wash basin or a chair forming its other leg, the table stands 30 inches high and provides sufficient space for dressing, changing or sponge-bathing an infant. The table top measures 37 by 17 inches. When not in use, the table folds up and can be stored in a closet or on the back of the bathroom door



What's It Like to

... A group of engineers is sampling danger on the road to make driving safer for you

By Richard F. Dempewolff

THE BIG, high-powered sedan roared around a curve in a black-top road winding through the hills outside Epping, N. H. Its tires yowled as we gunned into a long straightaway. The driver, wearing a white crash helmet, hunched low over the wheel.

"We'll take her only to 50," he yelled back at me. "Hug the floor and press yourself hard against the back of the front seat. Be sure your head is below the seat level because when that junk on the back ledge takes off, it'll need more than you to stop it." I did as I was told and waited for the jolt. From my position on the floor in back I could twist my head and watch the junk we'd piled on the ledge behind the back seat—old shoes, boxes and coat hangers. "Shrapnel" is what these men call it.

We really were moving. I saw treetops and telephone poles flash by like sticks in a picket fence. Then it came—the panic stop; an ear-piercing screech as all four tires bit the pavement, a mighty force that pressed me hard against the back of the front seat. The thud-thud of flying objects hitting something solid. Then everything was still.

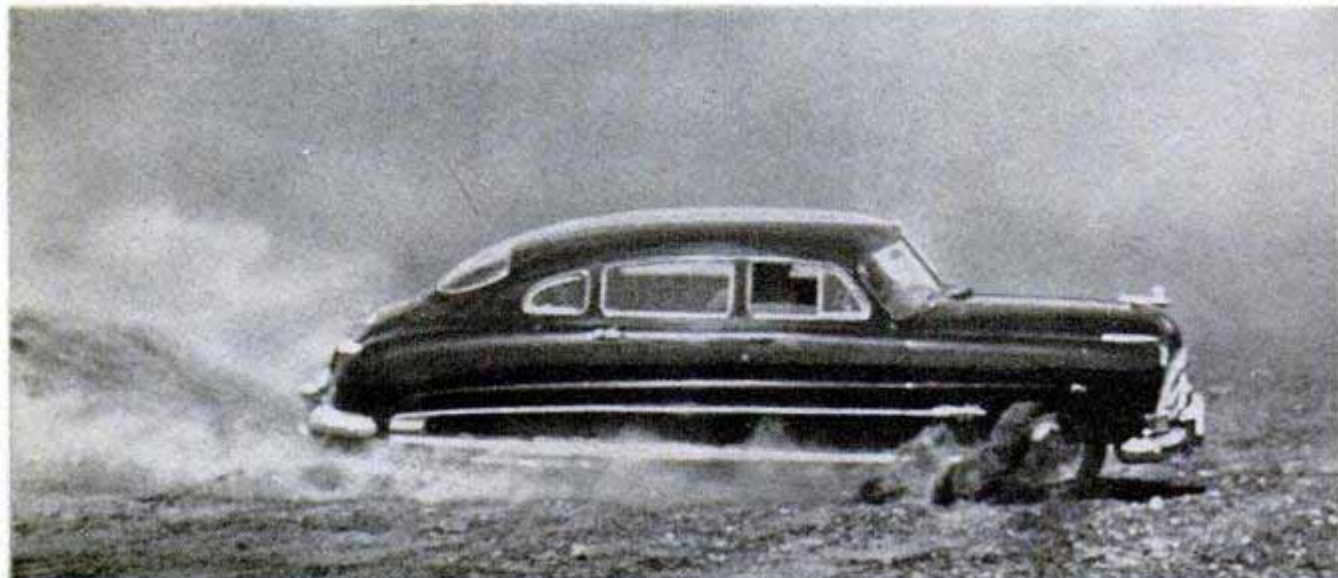
Though I'd been watching that pile of stuff on the ledge, I never saw it go. With

a take-off speed of about 50 miles per hour it had zinged to the windshield in a split second. Every bit of it was in the front seat. A shoe had knocked the driver's crash helmet askew. Without the helmet, he'd have been knocked silly. The boxes were broken at the corners. Since this was only a demonstration for my benefit, we'd used featherweight objects; the boxes were empty and the shoes light. If we'd used the kind of things most people keep on the back-seat ledge, cans of car polish, flashlights, steel tools and the like, they'd have gone where such objects always do in a head-on collision or panic stop—right through the windshield. Anyone in their path might have been killed instantly.

Admittedly, that ledge behind the back seat is a handy place to stow things. But the men in white crash helmets at Epping are proving with facts and figures that it—like many other features demanded by the customer in today's automobile—is a thing tomorrow's car should be without.

Every day the countryside around Epping reverberates to the roar of speeding engines. Tires squeal as violently rocking sedans driven by padded, helmeted men lashed to the seats are flipped into spins on dry roads. Spine-tingling sounds of cars

Engineer throws a sedan into a spin at 60 miles an hour. It didn't roll over but spun around several times



CRASH . . .



catapulting head-on into stone walls echo through the hills. Farmers listen with puzzled expressions to the shuddering drum of stock autos racing along railroad ties. It's all for the purpose of measuring what happens to the cars and the objects in them under accident situations. Radar beams track the path and speed of the loose gear that explodes in all directions when one of these cars squeals to a panic stop. Movie cameras lashed to a car's steel frame record the direction and point of impact of accurately weighted human dummies (the most battered of these is affectionately known as "Mr. Willsoffen" among the Epping drivers) as they bash their canvas heads into hazardous dashboard knobs, burst through the windshield, pop out sprung doors and wham into steering posts when the test cars screech to a violent stop.

The car-wrecking outfit that does this demolition work is Motor Vehicle Research, an organization devoted to the development of better and safer automobiles. Sparked by Dean Fales of Massachusetts Institute of Technology and A. J. White, a man with a high-compression personality, M.V.R. hopes that out of the piles of mangled steel

"Mr. Willsoffen," test dummy of life size and weight crashes skull through windshield in a panic stop

Speed Age photo
Here's what happens when safety precautions aren't observed. Four girls were killed in this 90-m.p.h. crash





Special antifatigue car has solid armrests, chrome painted flat black, steering rim as big as ax handle

in its back yard will come automobile-design features that will cut the highway death toll that last December claimed its millionth victim—the same number of American lives lost in all wars since the Battle of Lexington.

Statistics prove that in spite of the head shaking that goes on every time an airplane crashes, it is almost twice as safe to ride an airplane as a car on the basis of passenger miles covered.

As long as cars go where they're steered and as long as people do the steering, there will be accidents. The men at M.V.R. want to find and eliminate the things that kill people when they crack up. "Unless he's been in a collision," White points out, "a person can't conceive of the explosive forces unleashed in a car at the instant of impact. A car smacking a wall at 60 miles an hour gets about the same jolt it would



M.V.R. reports that simple precaution of safety belt on passengers would cut the death toll remarkably

if it were dropped nose first from a ten-story building."

What about those loose objects in the back of the car under such a wallop, for instance? Police accident records provide one source of vivid clues.

In one recent crack-up, a car traveling at 40 miles an hour rammed another head-on. A pair of shoes on the rear-seat ledge went right through the windshield. Suitcases, chains and tools in the trunk burst through the back of the rear seat and wound up piled against the driver's back.

In another disaster caused by a blowout, a speeding car hit a tree. A picnic basket in back burst wide open, sending knives, forks and plates in all directions. One of the forks was moving so fast it severed the driver's spinal column. Similarly, a bicycle lashed to the back of a convertible broke its retaining rope when the car hit an abutment

HOW NOT TO DRIVE A CAR: In crash or panic stop, children in back seat would be thrown over the windshield. Those in front would be pinned against dash. Objects on back seat and ledge become "shrapnel"

DANGEROUS





If you see a crash coming, say M.V.R. engineers, cradle head in your arms on dash

In a test at M.V.R. proving grounds, French Renault leaps across a ditch. On this particular car the front wheels didn't buckle

at 70 miles an hour and killed everyone in the car.

To learn just what happens to loose objects in panic or collision stops, White and his men loaded a standard station wagon with a 30-pound case of soft-drink bottles, cartons of canned goods and other assorted objects. Then they rigged a man on the tail gate. He was double-strapped with safety belts lashed over the back bumper, his outstretched feet were pressed hard against a four by four of solid oak that ran across the car and was secured to the frame. In his lap he held a special radar set.

The driver climbed aboard, fastened himself to the seat with a safety belt that was anchored to the steel frame of the car and off they went at 60 miles an hour. Suddenly the brake pedal shot to the floor and the interior exploded. Within a split second, the interior of the car was alive with broken

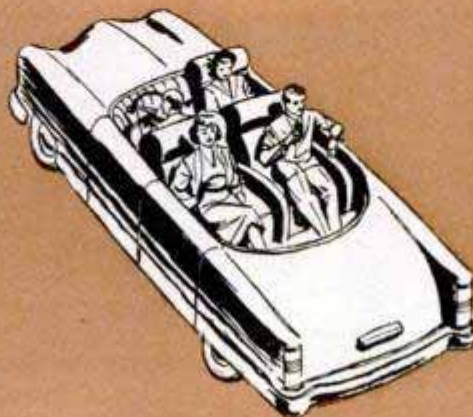
bottles. The tiny microwave beam of the radar gun, traveling at 186,280 miles per second, bounced back and forth between the set and the rocketing case of pop as it took off and clocked it at 42 miles per hour. Traveling at that speed, 30 pounds of bottles are as effective a killer as a load of grape-shot with a heavy powder charge behind it.

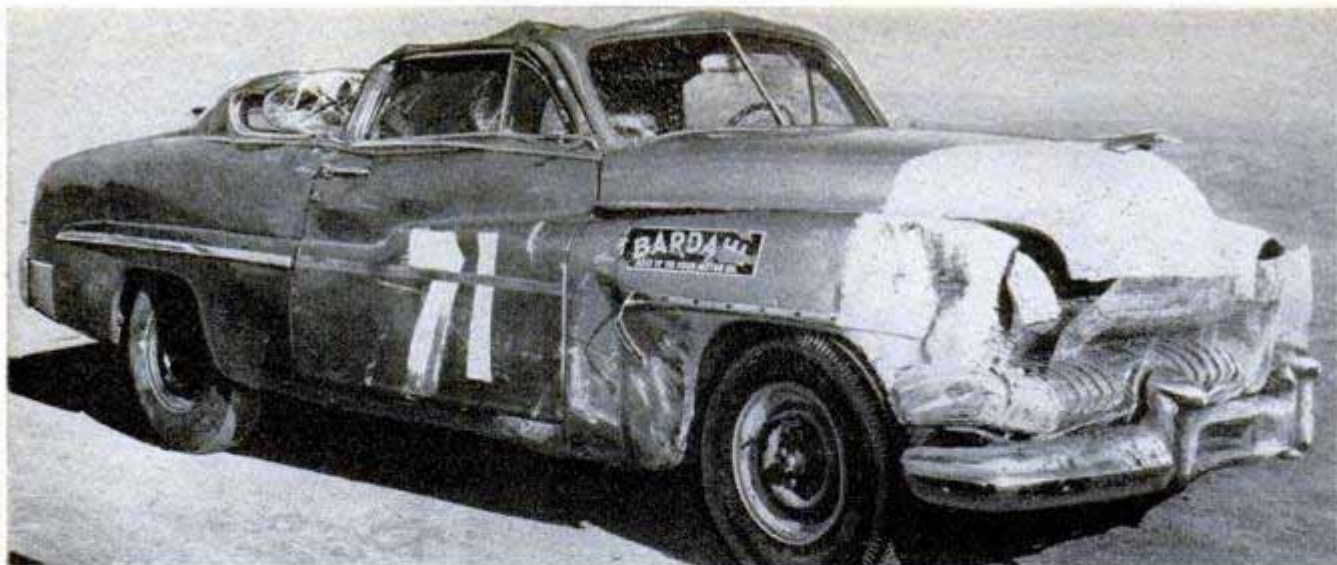
"If we hadn't had a heavy wood baffle across the wagon, it would have gone right through the front of the car taking the front seat and everything with it," said White. "Anyone in that front seat would have been killed—and that was just a panic stop, not a collision."

What happens to people in these panic stops? One driver at Epping recently took Mr. Willsoffen for a high-speed ride in a brand-new sedan and whammed the brakes at 70 miles an hour while movie cameras recorded the result in slow motion. Mr.

FOR SAFE DRIVING: These features have been tested by M.V.R. and could be built into tomorrow's car. They include baby seat welded to frame, passengers seated backward and webbed safety belts fastened to chassis

RECOMMENDED FOR SAFETY





Speed Age photo

Stock car with steel bracing supporting roof was rolled at high speed. Belted-in driver emerged unhurt

Willsoffen, sitting beside the belted-in driver, cracked his artificial skull against the dash and kept right on going through the windshield.

"Passengers just don't stand a chance," says White, "and the one beside the driver stands the least of all."

As a result of the work done so far at M.V.R., these men know that speeds as low as 40 or 45 miles an hour can be extremely dangerous. And the maddest people, they point out, are parents who ride with youngsters on their laps or permit children to stand on the front seat. "It's like putting them in the breach of a cannon," they report. "The added weight of an adult body shoving the child into the dashboard in a crash or panic stop gives the kiddie that much less chance of coming through alive."

The human skull can stand impacts up to 600 pounds per square inch. In instantaneous

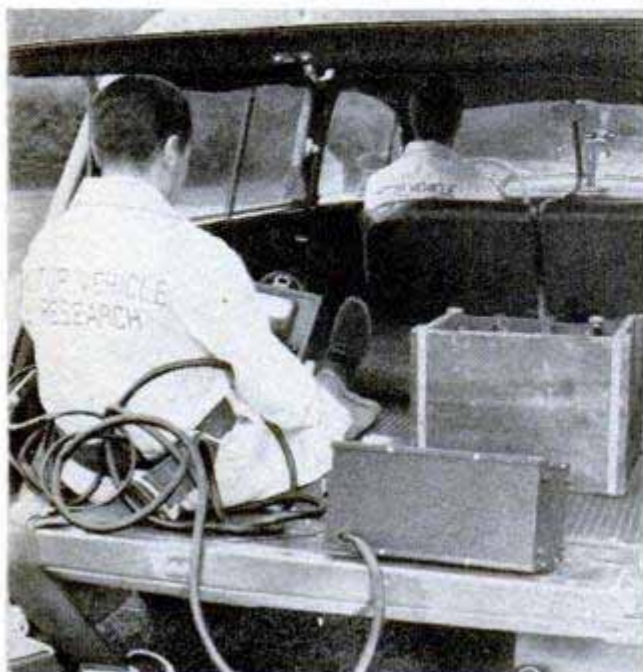
deceleration tests at Epping, radar has tracked Mr. Willsoffen's carefully weighted 180-pound body at a force equal to 500 pounds per square inch—or one G—in a car that stopped short from only 30 miles per hour. At 60 Mr. Willsoffen would leave his seat with a two-G wallop and hit the dash with an impact of nearly twice as many pounds per square inch as his simulated human skull could take.

How can Mr. Willsoffen and—more to the point—you and I survive such crash situations in a speeding car of modern design? M.V.R. has several answers, many of them already tested successfully in their roaring stock vehicles.

"As it stands," explains White, "you hardly could bounce your car end over end at 60 miles an hour and live to tell your friends about it. But professional racers

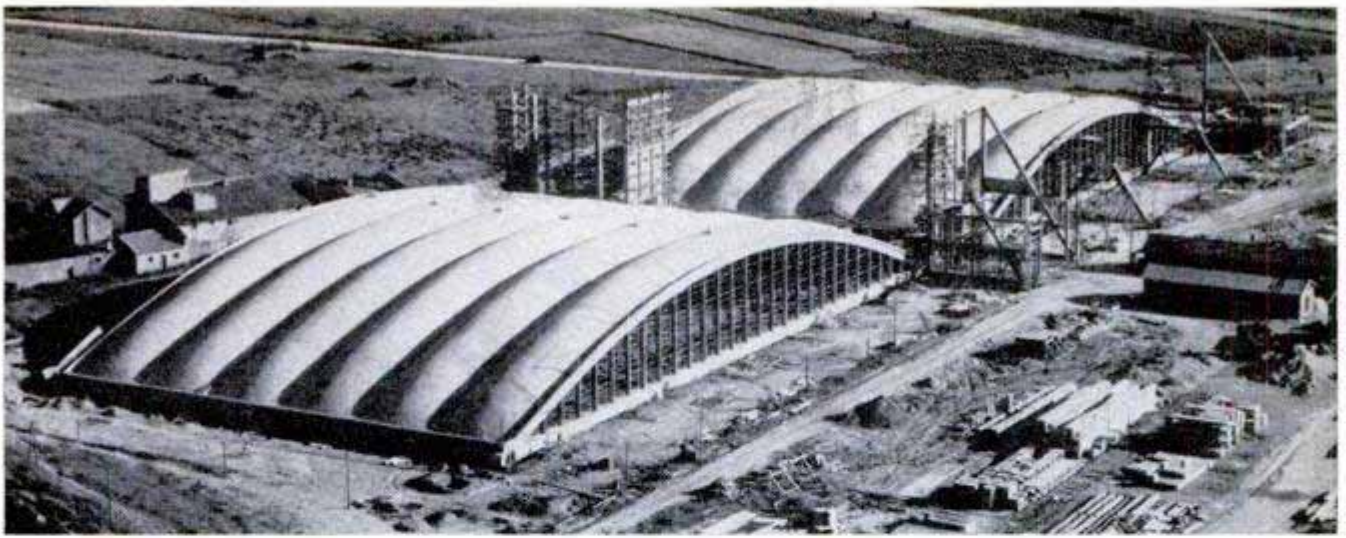
(Continued to page 220)

Braced engineer operates a radar set which will check flight of a case of soft-drink bottles in a panic stop

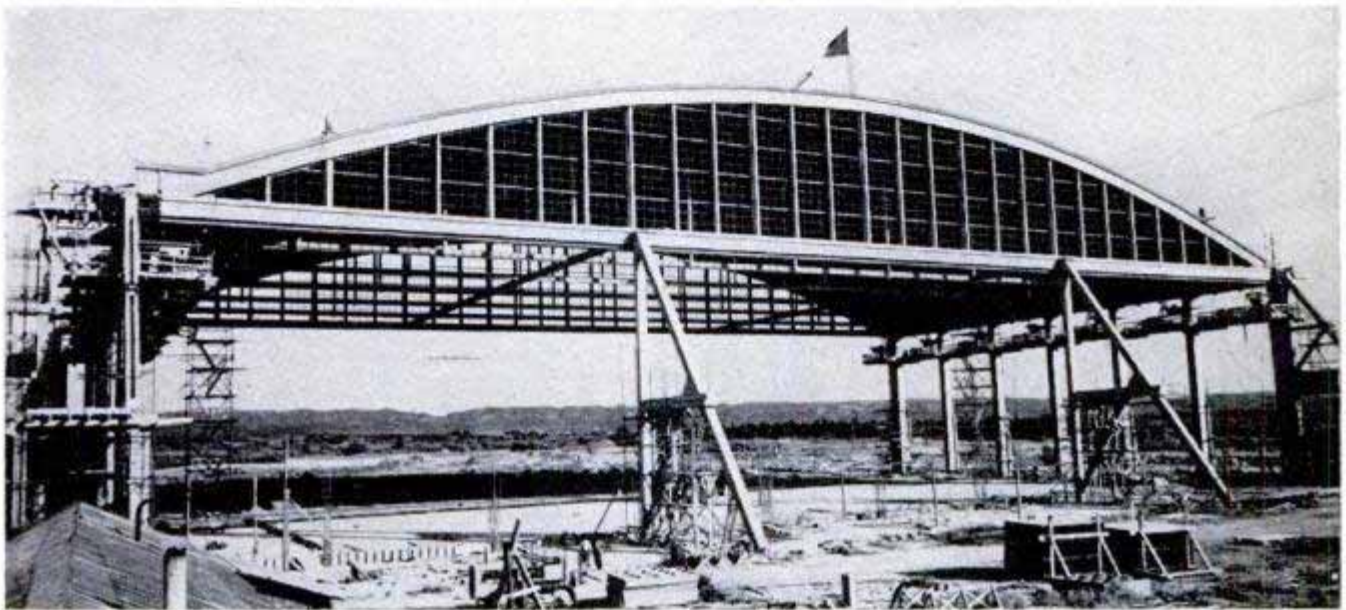


Here's what happened. Box would have crushed passenger against dash. Child in photo climbed in later





Each one large enough to cover a football field, these arched concrete roofs were poured at ground level

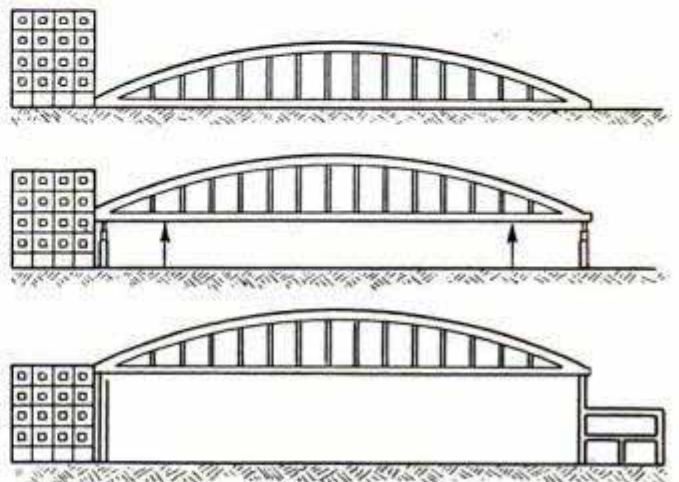


Lifting a roof to its 62-foot height required 184 working hours. The 328-foot front opening is unobstructed

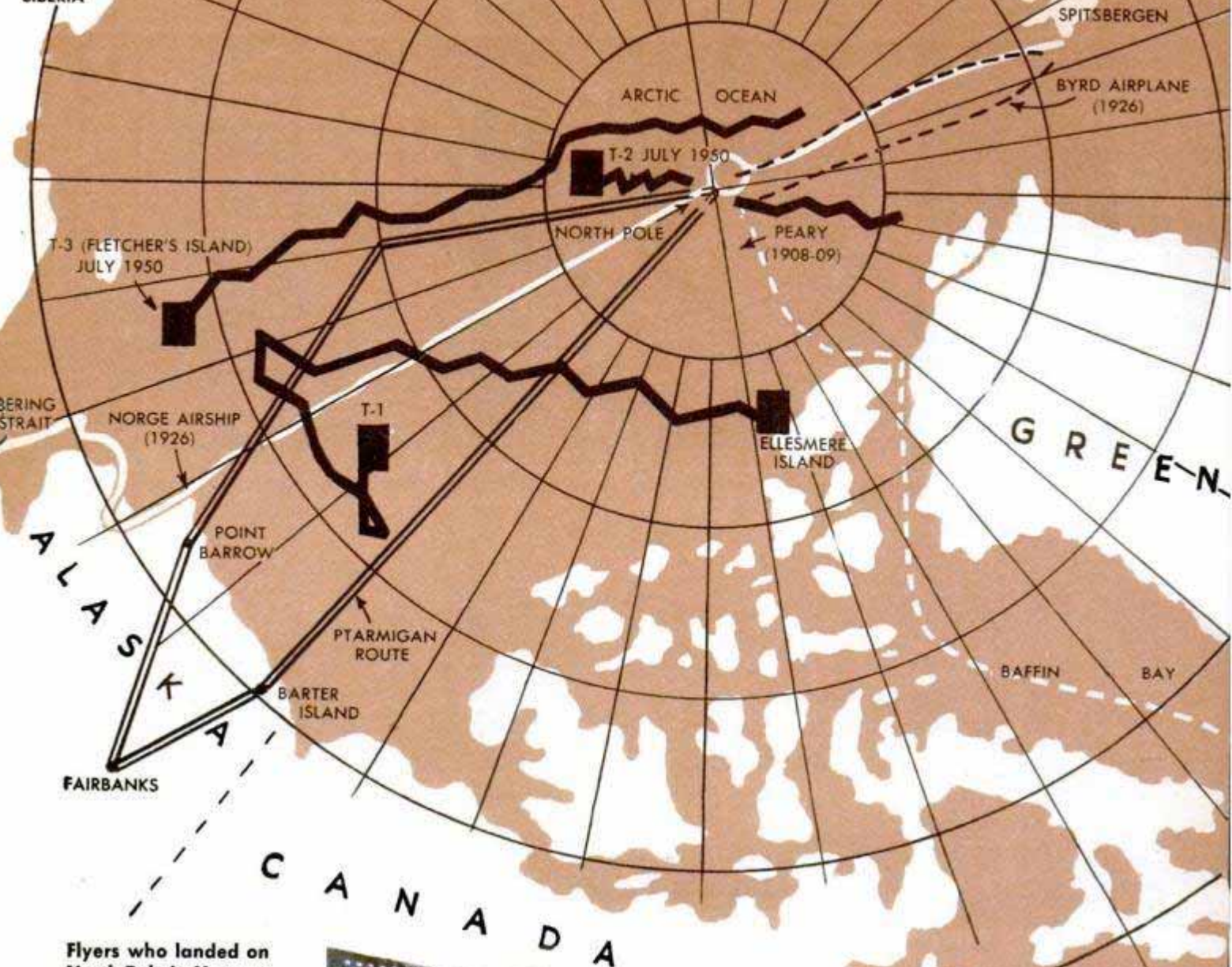
HUGE FRENCH HANGARS HAVE CONCRETE ROOFS

POURED at ground level, a reinforced-concrete roof for a French airplane hangar was elevated to its final height of 62 feet by a hydraulic-jacking operation that required 23 eight-hour shifts. Four such roofs were built to cover two double hangars at the Marseilles Airport. Each roof is 200 feet long and 328 feet wide, providing an uninterrupted entrance clearance of that width. Even the largest airplanes can roll in and out with ample clearance. The hangars are said to be the world's largest reinforced-concrete structures of this type. No roofing material is needed. The concrete is sufficiently weatherproof. Each roof weighs 4200 metric tons, or more than nine million pounds. Seven columns on each side support this tremendous weight, the monolithic self-supporting arches making addi-

tional support unnecessary. The roof is attached solidly at one end, the other end resting on huge concrete rollers which allow for movement caused by expansion and contraction of the material. The doors open by winding up on a vertical roller in the partition between the hangars.



Three stages in the roof lifting. The 18 hydraulic jacks were controlled from a central board. Hangar door will roll up like a window shade on its side



Flyers who landed on North Pole in May put American and Air Force flags at "top" of the world. Glass jars inside oil drums contain dated notes



In the suburbs of the North Pole, our scientists and Air Force men are "at home" on gigantic floating islands of ice. Here's the story of their . . .

ICE-CUBE

ICE IS A RED-HOT topic now in military circles.

Massive floating islands of it in the Arctic Ocean are currently inspiring both alarm and speculation. One such body is 20 miles wide and equally long. Their possession—and manner of use—could prove the balance factor for war or peace.

The three now known could conceivably become steppingstones for faster air operations over the "top" of the world—between Russia and North America. Several hundred miles closer to Russia than our nearest land bases, they could serve as emergency-field and weather-station sites for the international airlines.

Legally, since they have no fixed loca-





Map indicates paths of drifting ice islands since discovery, and routes of "firsts" at North Pole by land, airship and plane. U. S. airmen now fly Ptarmigan round-trip route from Fairbanks over pole every other day

By Aubrey O. Cookman, Jr.

AIRPORT

tion, they belong to no one. Probably the old axiom of possession being nine tenths of the law will be the sole determinant.

The ice islands are spacious and strong enough to handle the largest aircraft now flying, or even seriously contemplated. Their thickness is estimated at 200 or more feet, probably stout enough to withstand bombs and torpedoes as well as 300,000-pound airplanes. They are the closest we've come to an unsinkable aircraft carrier.

Some light was shed on their possibilities and importance this spring when an Air Force general and seven companions landed a twin-engine transport on the smallest of them. Among them was Lt. Col. Joseph Fletcher, the island's discoverer. It was then about 100 miles from the North Pole and the surface temperature was 50 degrees below zero. Three men were left on the island with shelter and provisions to establish an observation base. Five men were added later.

Shortly afterwards a Navy plane headed for a landing on the ice adjacent to the pole itself was forced down and disabled on the island. Its crew was evacuated by an Air Force plane on a regular supply mission. For a while the island's population was swelled to 20.

These mammoth ice cubes also have a great scientific potential as stable platforms from which one of the world's least-known regions can be studied. Its heart, the North Pole, was discovered only 42 years ago and big voids still exist in our knowledge of the Arctic. Information on currents, weather, magnetic fields and the ocean floor's topography is woefully inadequate.

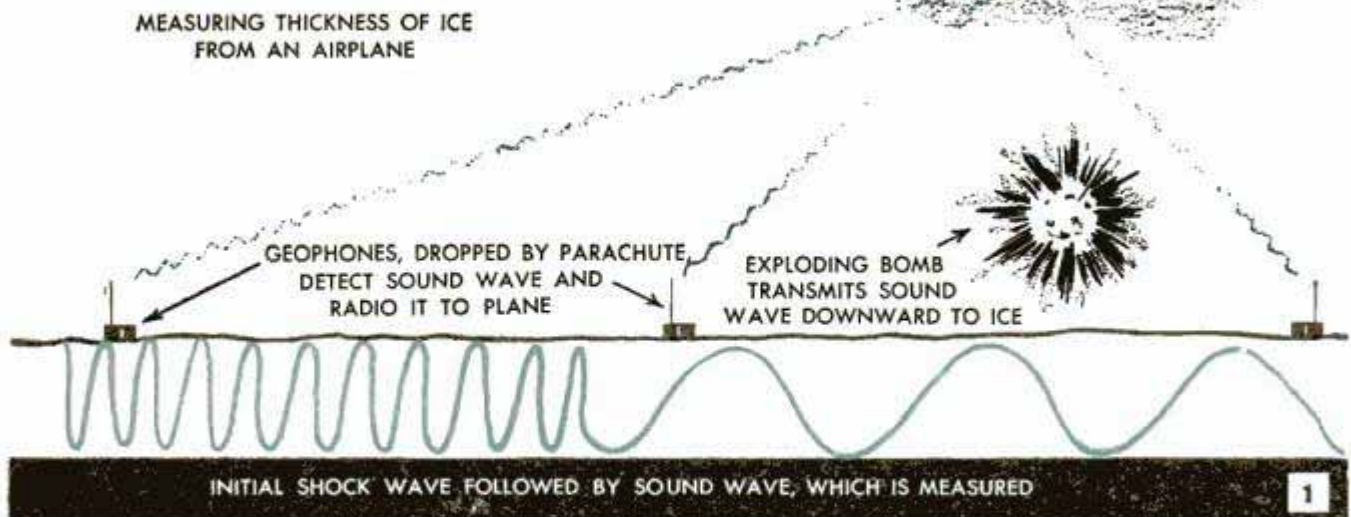
Although false, the old notion that the

About seven miles in diameter, T-3 ice island is now drifting close to the pole. It slopes from 10 to 50 feet above the surrounding ice pack. It has been renamed Fletcher's Island in honor of Lt. Col. Joseph Fletcher who this year, when temperature was 50 below, led first party to land on it

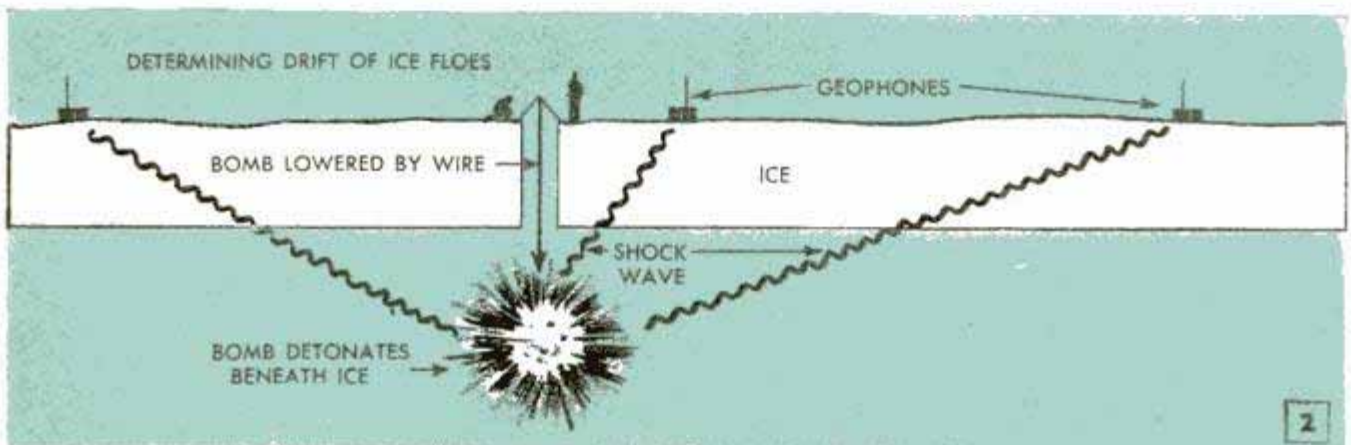
U. S. Air Force photo



1. Airmen checking ice strength for landing attempt first parachute geophones down, then drop explosive charge timed to go off just above ice. Resulting sound wave, relayed to plane, reveals ice's thickness



2. Differences in arrival times of bomb's shock waves at geophones, below, indicates floe's rate of movement



immediate pole area was an ice and snow-sheathed land mass is still widely held. It gained momentum from accounts of Adm. Robert E. Peary's dramatic dog-sled dash to the site in 1909, when the ice was frozen solid for the winter. Aerial observations by Amundsen in 1926 and countless others since have established the polar region as all water, but the erroneous, popular impression persists.

It wasn't until six years ago that the first of the islands, large as they are, was first seen. It was drifting about 300 miles north of Point Barrow, Alaska, when first detected on the radar screen of an Air Force B-29 flying a routine weather-reconnaissance mission. Fog shrouded the area but the mysterious object's position was radioed back. It wasn't until days later that other airmen finally tracked down and for the first time saw the discovery.

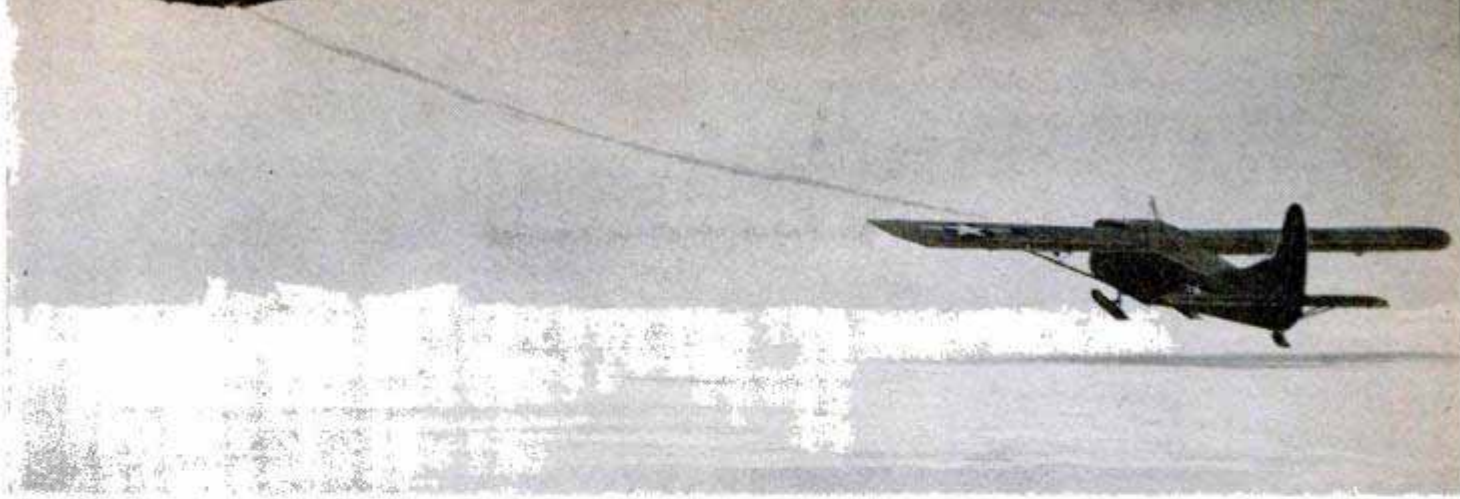
Their find was a solid sheet of snow-covered ice, wedge-shaped and about 20 miles across at its widest point. Dropping down closer, they saw that its sides were 30 to 50 feet above the sea. It was christened

Target X, then later renamed T-1 Island.

It differed unmistakably from pack ice in color and appearance. The latter is frozen sea water and has a pale-blue hue, darker where the ice is thinnest. Ten feet is about an average thickness for the floes. From October to June, when the pack is jammed most solidly, it presents a criss-cross pattern of old pressure ridges formed by wind and currents grinding the separate floes together. The edges crumple and pile up in hummocks as high as 30 feet.

The islands are apparently of freshwater glacial origin, perhaps formed on the bays and coasts of the Canadian Arctic Archipelago. Experts have pin-pointed the northern coast of Ellesmere Island as the probable birthplace of T-2, discovered in 1950. T-3, where the Air Force expedition landed and encamped, was also found in '50. If all three originated at Ellesmere, and broke off in successive chunks, the largest has been floating for thousands of years.

In contrast to the ice pack's wintertime pressure ridges and its summertime cracks and separations, the islands resemble gent-



Above, gliders have solved the problem of getting men and supplies on and off the smaller floes. Pickups by transports are now a routine Arctic operation

Camps like the one below, set up by U. S. scientific parties, now break the flat whiteness of floating ice. Note ski gear on the C-47 in the background



ly rolling plains. They have low, parallel ridges, between which shallow pools of water form during the summer. The islands tilt very slightly, generally at right angles to the ridges.

The islands drift at a slow, variable speed. Patrol planes tracking T-1 found that it moved approximately 1500 miles in three years. The path of all three is believed to follow a clockwise motion around the world's top. If any failed to continue the turn they make north of Greenland, near the Arctic Ocean's only wide and relatively deep outlet, they would probably float out through Baffin Bay into the Atlantic and melt. In the cold Arctic their size remains relatively unchanged.

This isn't the first time explorers, military strategists and others have considered ice air bases. Early in 1937 a Russian party headed by Arctic scientist Dr. Otto Schmidt put a bomber down on the frozen ice and set up a camp 11 miles from the pole. It was announced as an advance weather station to aid Russian airmen who later that same year flew nonstop over the Arctic

from Moscow to southern California.

Four of Schmidt's group stayed behind, spending nine months on an ice floe making observations. By then their fast-moving floe had drifted almost 1500 miles, nearly two thirds of the way down the east coast of Greenland. Their soundings fixed the ocean's depth at the pole at greater than 14,000 feet. Only about a half dozen other reliable depth checks are on record for that area. One early visitor followed the figure he entered in his records with this notation—"The string wouldn't reach any farther."

More recently the United States has moved vigorously into the polar picture. Since 1946, crews of the Alaskan Air Command have been flying weather missions over the pole, from Fairbanks, every other day. Units of the 10th Rescue Squadron, headed for several years by veteran Arctic explorer Col. Bernt Balchen, have combed Alaska, northern Canada and the ocean ice in reconnaissance and mercy missions.

Balchen and his men proved many times that twin-engine airplanes could be landed safely on small ice masses. Once they flew



Scaling frozen glacier walls is part of the training for flyers of Alaska's famed 10th Air Rescue Squadron

a JATO-equipped C-47 with a special retractable ski-wheel landing gear on and off Taku Glacier to aid a stranded party of 16 scientists. They've demonstrated repeatedly that helicopters are perfectly adapted for ice-floe rescues.

Air navigation in the Arctic is improving. To replace magnetic compasses, practically useless near the pole because of their tendency to point straight down, a system of gyroscopic compasses has been devised. Coupled with celestial bearings and radar information, it gives the navigator reliable checks on his course and speed. Another helpful new device enables him to take a bearing on the polarized rays of the sun after it has sunk below the horizon.

The U. S. Navy also has been active in Arctic research, with particular emphasis on oceanographic studies. This year they are repeating Operation Ski Jump, which last year accomplished 12 ice landings, one 820 miles south of the pole. Among other things, they found ice 18 inches thick will support a C-47 a short time in emergencies.

One of the most important recent contributions to Arctic operational know-how came from a team of scientists with Air Force assistance. Geophysicists, they included Albert P. Crary and Robert Cotrell of the Massachusetts Institute of Technology, and Maurice Ewing, Frank Press and Jack Oliver, of Columbia's Lamont Geological Laboratories.

Military men had been trying for years to find a way to measure the thickness of ice without having to bore holes every 1000

feet or so. An idea for measuring the ice by remote control from the air stemmed, oddly enough, from studies once made by Ewing and Press that had nothing whatever to do with ice. In fact, it had to do with a volcano—Krakatoa, the crater on an island near Java which blew up with such a bang in 1883 that the whole island disappeared into the sea and the blast's shock wave raced around the earth seven times.

Studying reports on the explosion, Ewing and Press ran into some odd inconsistencies. Documented evidence clocked the arrival of the aerial shock wave at various places where it shattered windows and buildings. Other reports, describing the sea wave that roared across the Indian Ocean, told exactly when it reached such places as the English Channel, Panama and San Francisco. Despite the fact that vibration waves in air and in water do not travel at the same speed, a comparison of reports showed that when Krakatoa exploded, the air and tidal wave arrived every place at the same time.

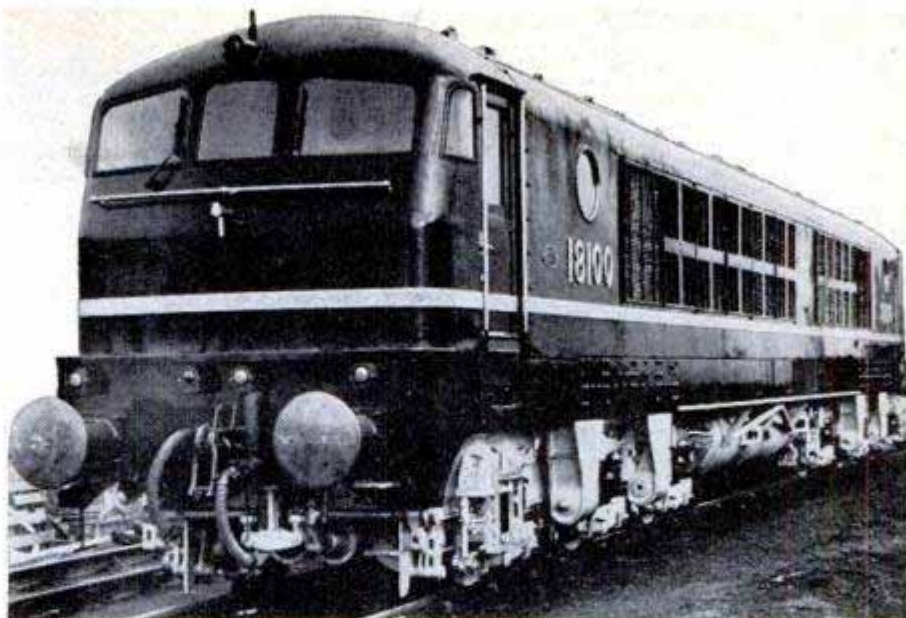
Ewing and Press decided that the air wave was the only important shock wave thrown out by the volcano. They reasoned that the tidal wave wasn't a ripple caused by the big boom but instead was created directly by the disturbance in the air. From this they concluded that any disturbance in the air affects the earth beneath it.

They checked their theory on Lake Superior's ice, setting up several geophones (baby seismographs) and then exploding

(Continued to page 260)

British Locomotive Has Jet Engines

British Railways is not counting out the iron horse in this jet age—it is giving it a more powerful punch by putting a jet-powered locomotive on the rails. The new locomotive operates on the same principle as a turbojet airplane engine except that the actual driving power is electric. The gas turbine, which drives three generators to produce the electricity, consists of three components. These are a rotary compressor which delivers air at 60 pounds per square inch, a combustion chamber in which regular diesel fuel oil is burned and a turbine where the heated air expands to develop the power for turning the generators. Each of six driving axles is geared to



British Railways photo

two electric motors. Actual rated output of the jet locomotive is 2540 horsepower at the rails, about twice that of a conventional diesel locomotive of the same weight and length. The 90-mile-per-hour engine is 66 feet long and weighs 129 long tons.



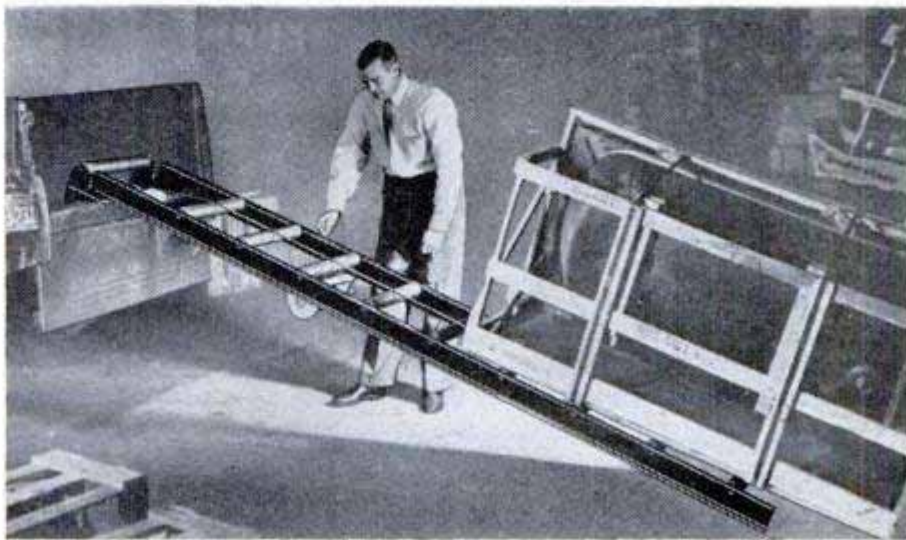
Wide-Angle Camera Takes "Instant" Panoramas Without Tripod

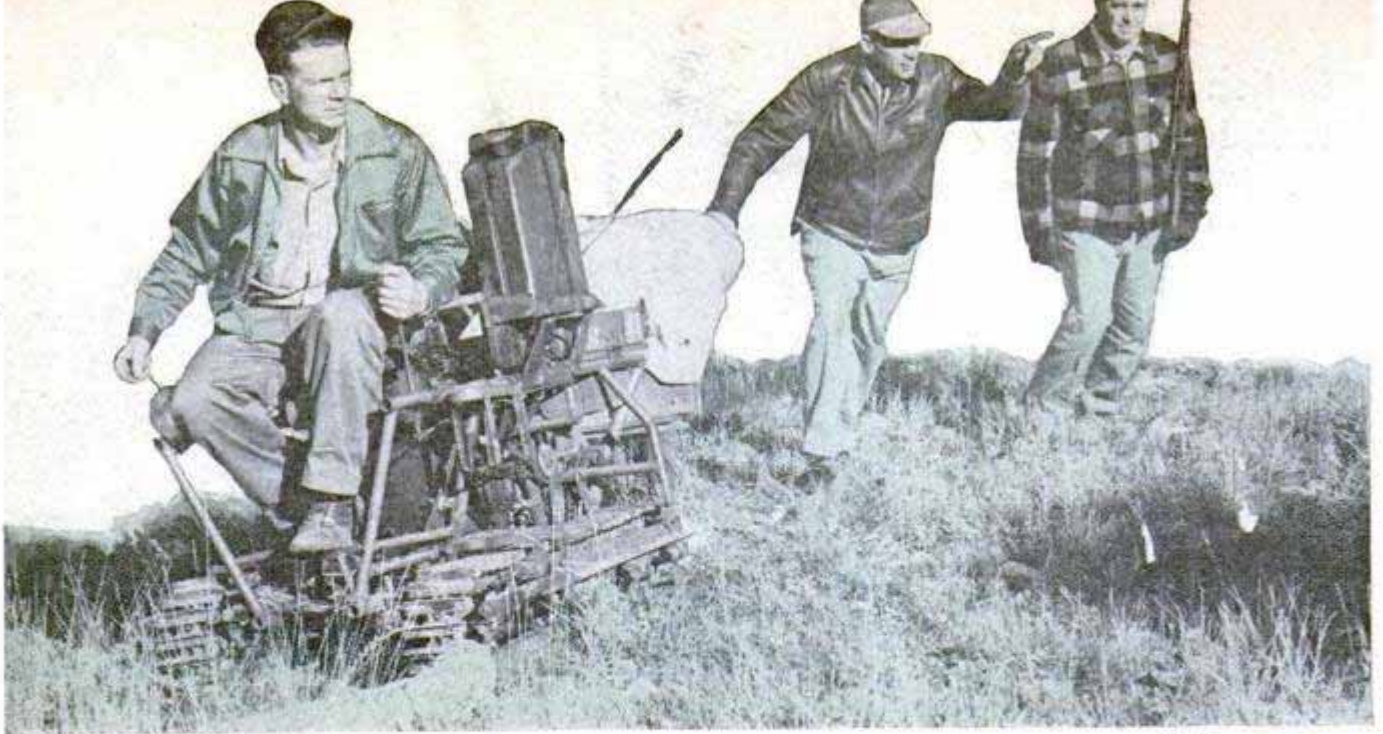
Panoramic shots without a tripod are made possible by a Japanese camera that uses a swinging lens to produce photographs of extremely wide angles. The camera has three shutter speeds— $\frac{1}{500}$, $\frac{1}{200}$ and

$\frac{1}{8}$ second. A tripod is used only with the slowest of these. Unlike most wide-angle photos, those taken with the swinging-lens camera have a minimum of distortion. It is expected to sell for about \$200.

Winch-Run Conveyor

One man can load or unload material weighing up to 1000 pounds with a new winch-operated conveyor. The conveyor is designed to handle heavy equipment in buildings which have no loading dock. One end of the 10-foot channel rests on a truck bed while the load is cranked up the channel. The two-speed winch can be locked to stop the load at any point.





Seeking big game, these men use a mountain-climbing machine which outperforms horses

GO HUNTING ON A "Go-

By Wilton S. Allen

LIKE most other hunters in the Rocky Mountains, Alco Timmons of Casper, Wyo., for many years used horses in the hunting of elk, antelope and deer and for packing the kill back to camp. Timmons kept two horses solely for this purpose but he found many spots where game was killed that were too rough for even a horse.

Timmons, whose principal business is the reconditioning of wrecked vehicles, wanted

a machine that was small and compact and could be loaded onto the back of a pickup truck, yet powerful enough to travel in the steepest and roughest of places.

After much experimentation, he developed a vehicle which he calls the "Go-Devil" because it will go almost anywhere and climb almost anything. Designed more for power than for speed, it will haul three hunters and the carcasses of two or three elk, antelope or deer up a rough grade of more than 65 degrees.

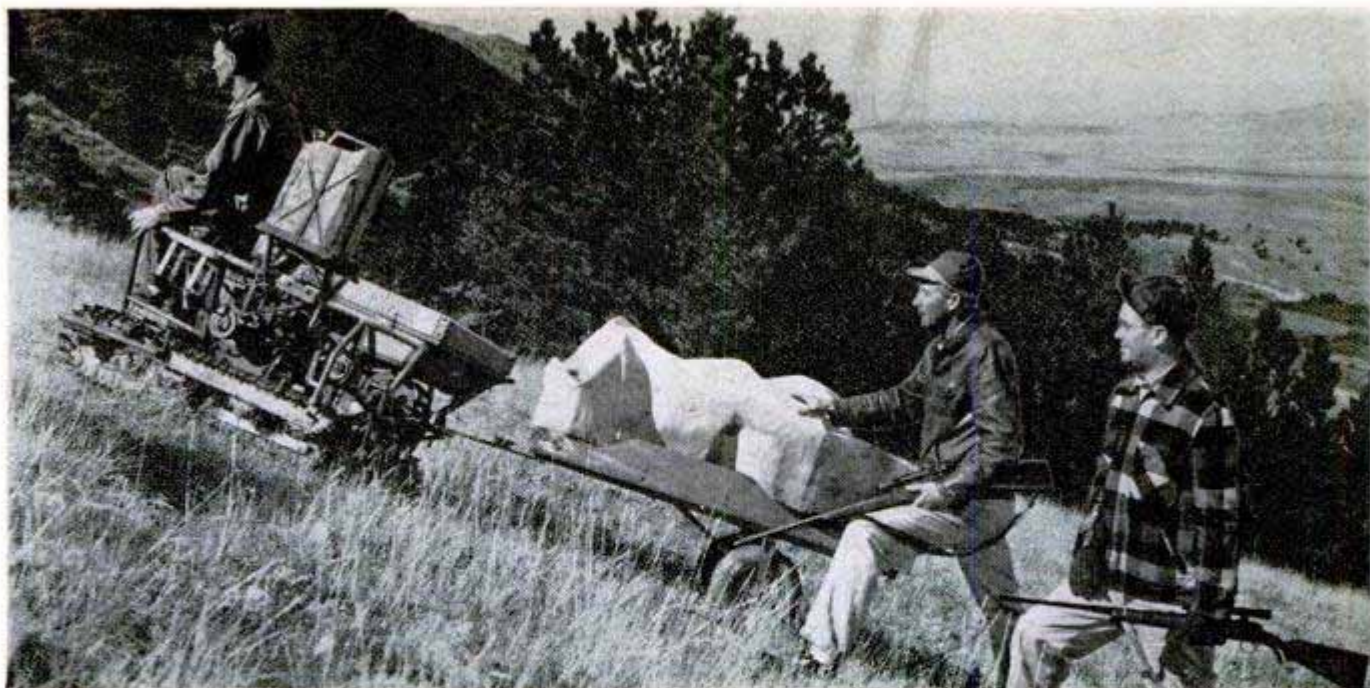
The machine measures 54 inches long, 27 inches high and 34 inches wide. It weighs less than 500 pounds, including a trailer of similar size which serves as a cover when the machine is not in use.

Timmons made most of the parts himself. The framework is of welded iron pipe, the tracks are of chain and angle steel and the one-cylinder four-horsepower scooter motor is geared down through a series of chains and belts for power.

The Go-Devil has two forward speeds and will pull more than a thousand pounds at either six or ten miles per hour. There is a control lever for each track, making 180-degree pivot turns possible, and an extra passenger seat mounted in front of the driver to permit added weight for better traction on steep climbs. ★ ★ ★

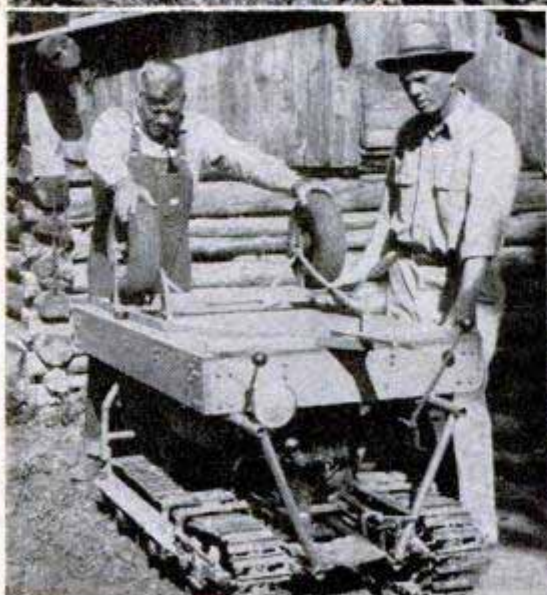
"Go-Devil" has two forward speeds. Tank-type treads permit travel in roughest terrain, 180-degree turns





-Devil"

Above, machine draws trailer loaded with game back to camp. The Go-Devil can pull more than a thousand pounds up steep hills. Below, the machine will negotiate 65-degree grades with extra passenger in front for added traction. Lower left, trailer fits over Go-Devil, serves as cover. Total weight of both is less than 500 pounds

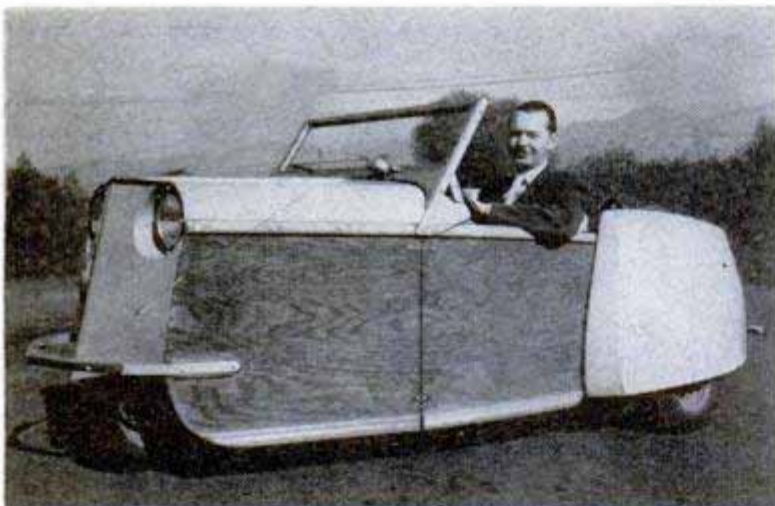




Ventilated Backrest Keeps Driver Cool, Comfortable

One of the discomforts of hot-weather driving, the perspiration-soaked shirt, is eliminated by a backrest of wood and woven, laminated fiber. The open design

provides ample ventilation and is resilient enough to be a comfortable support. It stands up against the back cushion and won't fall over when you get out of the car.



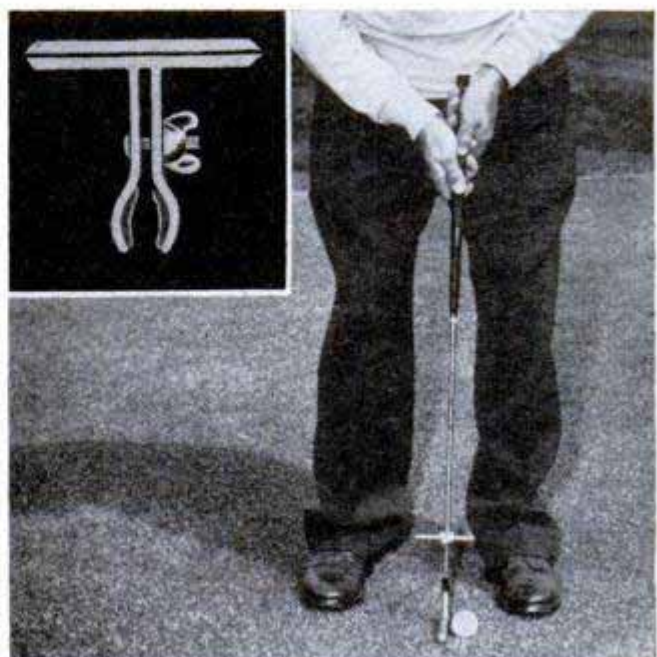
Three-Wheel Automobile

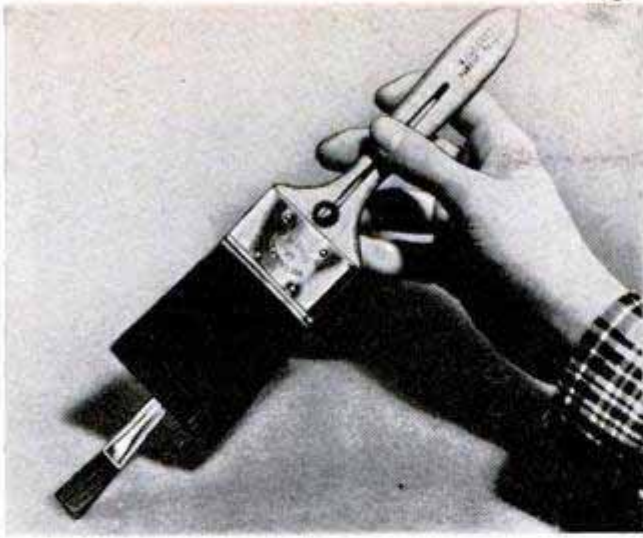
With a sheet of plywood, some auto spare parts, an 8 $\frac{1}{4}$ -horsepower engine and much ingenuity, Walter Korff of Burbank, Calif., built a three-wheel car with a top speed of 50 miles an hour. Korff's car stands 49 inches high, is 9 $\frac{1}{2}$ feet long and weighs 684 pounds. The little vehicle has an automatic clutch and transmission, sealed-beam headlights, mechanical brakes, a Chevrolet generator and a Ford starter. The total cost of the car was \$250.

Sighting Device Helps Golfers Achieve Straighter Strokes

Clamped to the shafts of putters and irons, a plastic sighting device allows the golfer to see whether his stroke follows a straight line as it goes through the hitting zone. Intended for use in practicing putting and short approach shots, the sight can be changed quickly from one club to another. A black line that runs the length of the sight shows the angle of the club face as it passes through the hitting zone.

If you do not find the information you need in the WHERE-TO-BUY-IT INDEX, starting on page 12, sources of further information are available without charge from Bureau of Information, *Popular Mechanics Magazine*, 200 E. Ontario St., Chicago





Two-in-One Brush

You always have a small brush handy when you are painting with a two-inch brush that is actually two brushes in one. A sliding button on the handle moves the small brush out for painting corners, sash and moldings. There's no need to stop to change brushes. The combination brush saves cleanup time, too—only one brush to clean instead of two.

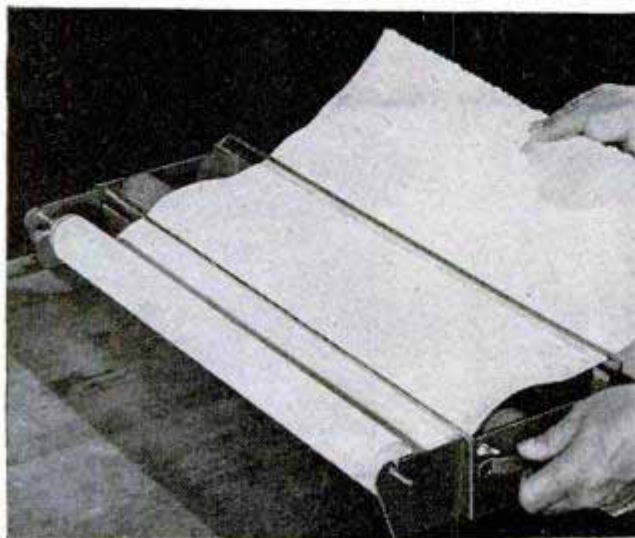
Wakeless Torpedo

Bubbles that betray a torpedo's path are eliminated with use of a fuel whose exhaust gases are absorbed by the water. A newly patented torpedo invented by the late Dr. Robert H. Canfield of Washington, D. C., burns compounds of hydrogen and carbon, or of hydrogen, carbon and oxygen. According to the inventor, torpedoes formerly were driven by the product of combustion of fuel with air. The discharged nitrogen caused the bubbles and resulting telltale wake. When the compounds are burned in the presence of nearly pure oxygen, water completely absorbs the products of combustion. The patent was delayed 16 year for security reasons.



Door Delivered in Frame

Installation of a new door already hung in its frame is simple—the two sections of the frame merely are nailed to the wall. The assembled door and frame are adjustable to fit any wall thickness from $4\frac{1}{4}$ to $5\frac{1}{2}$ inches. A carpenter can uncrate and hang the unit in about 20 minutes. All the hardware is installed except the knobs, which are slipped into place after the frame has been nailed to the wall. The units are available in all standard door sizes.



Wallpapering Device

Wallpapering is simplified by a new unit consisting of paste drum, paper roller, paste roller and a series of guides. After mixed paste is poured into the drum and a paper roll strung through the rollers, the unit is placed on the floor about one foot from the wall. The pasted paper is then pulled out, applied to the top of the wall and smoothed down with a brush.

CAFETERIA

For Boat Builders

By Jack B. Kemmerer

WHEN FRED CARNAHAN of Santa Monica, Calif., was a youngster, he was bitten by the boat bug. He has been building boats ever since. At first he had to do it the hard way—without proper tools or materials. It was then he developed a sympathy for the “poor” yachtsman who has more time and enthusiasm than money. And that is why so many enthusiasts today flock to his build-it-yourself boat yard to turn dreams into reality.

The boat yard, a few blocks from the ocean, was built for the small customer. Facilities include a machine shop, a free plans-and-design service, power tools, marine hardware and fittings department, ways for new construction, repairs and storage.

The machine shop has a lathe, circular saw, bandsaw, jointer and table sander. Once a customer proves he can handle the equipment, he is permitted to use it for any job. If the builder can't operate it, Carnahan will do the job for him at a very low cost and sometimes for nothing.

The average man who stops in for information has never owned a boat. He may have been looking for a cheap boat but has given up because even the small craft costs too much when new.

Carnahan explains that most of the cost of a boat is in the labor and not the materials. If the prospective owner is willing to build his own, he can save, in most cases, more than 50 percent.

The hull is the hardest part to build. If the customer prefers, the yard will build the hull and he can take over from there. Precut kits, made by many manufacturers, are also available and merely require assembly to put a small but first-class cruiser in the water.

The boat yard maintains a complete selection of portable power tools available on a rental basis. For \$2.50 a day, the builder can use electric sanders, power saws, drills and spray guns. When his boat is completed, he can rent a trailer to haul it to the ocean for the launching ceremony.

Marine hardware and fittings are expensive, so the boat yard has a supply of used



BOATS

CARNAHAN MARINE PROD. CO.

Walking around the build-it-yourself boat yard, you see a variety of activity, as proved by this montage. Boats range from the small cruiser at left to the 36-footer at right below. By doing the work himself, a boatowner can cut costs in half. Boat at right is in for repairs after its trip from New York through the Panama Canal. Bottom left, a salesman most of the time, this enthusiast works on the hull of his 26-foot cabin cruiser on week ends. At left is a novice building a 16-foot cabin cruiser, his first boat. Below, tiny cruiser, called "poor man's yacht," sleeps two persons and is powered by an outboard

Carnahan not only provides expert advice, but he also helps out customers who are unable to operate any of the power tools in the machine shop of his novel boat yard



equipment and the buyer can make trade-ins on the things he needs.

The yard handles 25 boats, ranging in size from 8 to 46 feet, and, in addition, ways are available for repair and storage. Space rental rates are based on the boat size and are 30 cents per foot per month.

Most amateurs work on week ends and the average boat takes about six months to complete. One young couple built a 16-foot cabin cruiser—their first boat—and always brought their baby with them. They would put her in a high chair where she could oversee the work and when the boat was finished it was named after her.

Another customer, a salesman, has built several boats and is now working on a 26-foot cabin cruiser that will sleep four. A retired newspaperman is building a 16-foot cabin cruiser himself while the yard builds the hull of a 36-footer for him. He intends to practice on the smaller cruiser and take over the larger one when the hull is ready. This boat has a glass-fiber bottom and will be one of the largest such boats built on the Pacific coast.

Twin-hull catamaran, knifing through the surf here, was built at the yard



The most unusual boat built in the yard is a catamaran with twin hulls 20 feet long. The "cat" is one of the oldest sailing designs in the world and also one of the fastest. The young man who built it has formed a club and plans are underway to construct several more at the yard.

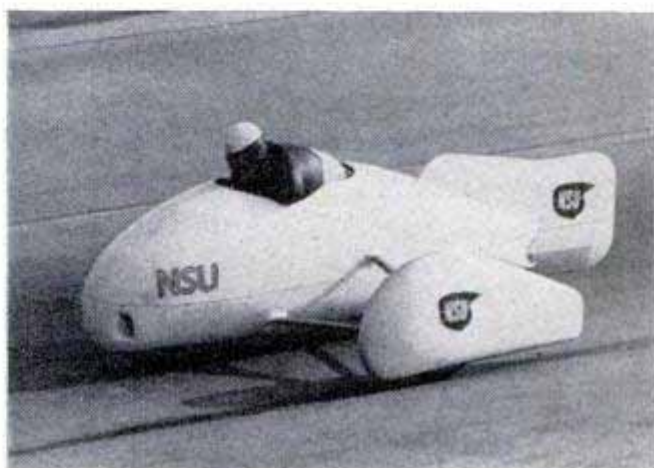
One customer even rents space for manufacture. He makes balsa-wood surfboards and sells them all along the coast.

Carnahan never forgets that his yard was started for the customer with limited capital. "If I can give a young fellow a broken can of paint or an end of something, I let him have it," he explains. "Most places charge for every little thing, but that's against our policy. We don't give merchandise away, by any means, but it doesn't cost much to be a good guy and when they have more money to spend they remember us."

Once an enthusiast has built a boat, he is generally a confirmed sailor. Invariably, in a short time the craft is too small and he's back with ideas for a larger one. About half of the yard's customers are already on their second or third boat and bid soon to get out of the "little guy" category, at least as far as their boats are concerned. ★ ★ ★



↑ Streamlining of the partially completed shell was tested in a pond. Above right, Bohm squatted in racing position so shell could be tailored to his body. Below left, shell is checked. Right, Bohm sets new record



Record-Breaking Motorcycle Carefully Streamlined

When Hermann Bohm set a new world's record for the racing motorcycle, he did it in a vehicle so streamlined it actually was tested in a pond. Bohm squatted for hours on the motorcycle while his assistants made the shell-like covering to his own measurements. When the shell was completed it

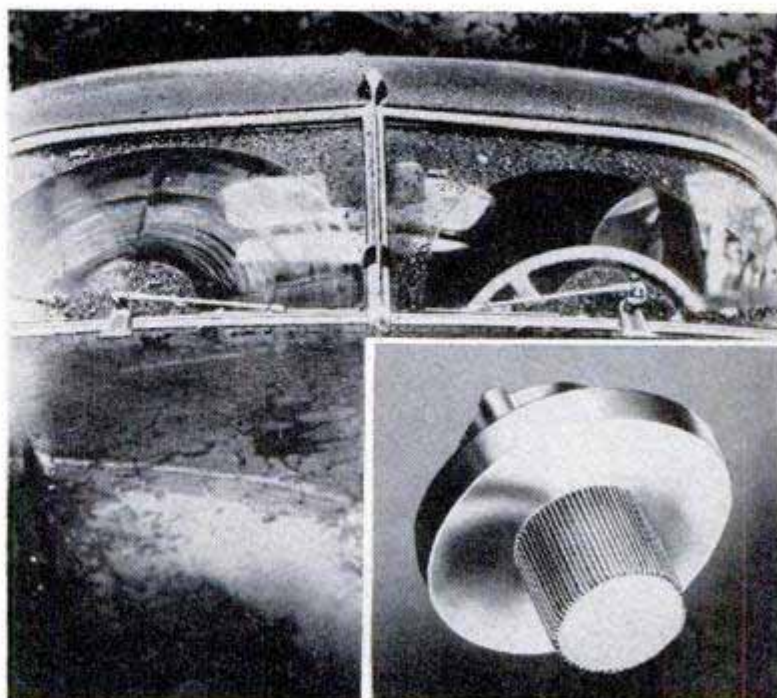
was taken to a small pond where the streamlining was given a thorough test. The sleek design finally was adopted and installed on the motorcycle. In the resulting vehicle, Bohm set a new record of 154 miles per hour for a racing motorcycle with attached sidecar.

Streak Eliminator

Despite heavy downpours, windshields can be kept crystal clear with a concentric attachment for wipers. It shifts the blade to a different wiping position at the end of each stroke. The blade moves $\frac{1}{8}$ inch to eliminate streaks and smears caused by overlapping strokes.

"Woodpecker" Field Phone

Making a sound that imitates the tap of a woodpecker, a new Army field telephone doesn't give away the position of front-line troops when it rings. The tapping noise, which replaces the bell, can be adjusted in volume. The telephone is completely waterproof.





Piper Light Transport Designed for Business Use

Intended for executive travel and charter trips, a new light transport is being tested by Piper Aircraft. The roomy four-placer is designed to fill the need for a relatively low-cost airplane for round-the-clock fly-

ing. Two 135-horsepower Lycoming engines give it a cruising speed of more than 150 miles an hour at sea level. The price for the initial production models, scheduled for next year, will be less than \$25,000.

Test-Stand Truck For Airplane Engines

Prolonged engine check-ups no longer need to keep airliners out of service. Panair, in South America, now removes an ailing engine and installs it on a mobile test-stand truck. Another engine replaces it on the airplane during the trouble-shooting and repair. The eight-ton truck is fitted with a truss and an adapter plate to take a complete propeller-and-engine power package.



Flying Jeep

Actually smaller than its earth-bound predecessor, a Jeep helicopter is capable of traveling 80 miles an hour and has a cruising range of about 120 miles. The midget can be dropped from a large plane, unpacked by two men and put into the air in 20 minutes. It will be used for observation, air evacuation of wounded or hauling small supplies and messages.

Army doctors in Korea are using an artificial kidney in the hope that it may save the lives of battle casualties subject to prolonged shock and repeated transfusions.

the

POPULAR
MECHANICS

CRAFTSMAN



MAKE YOUR LIGHTING COUNT

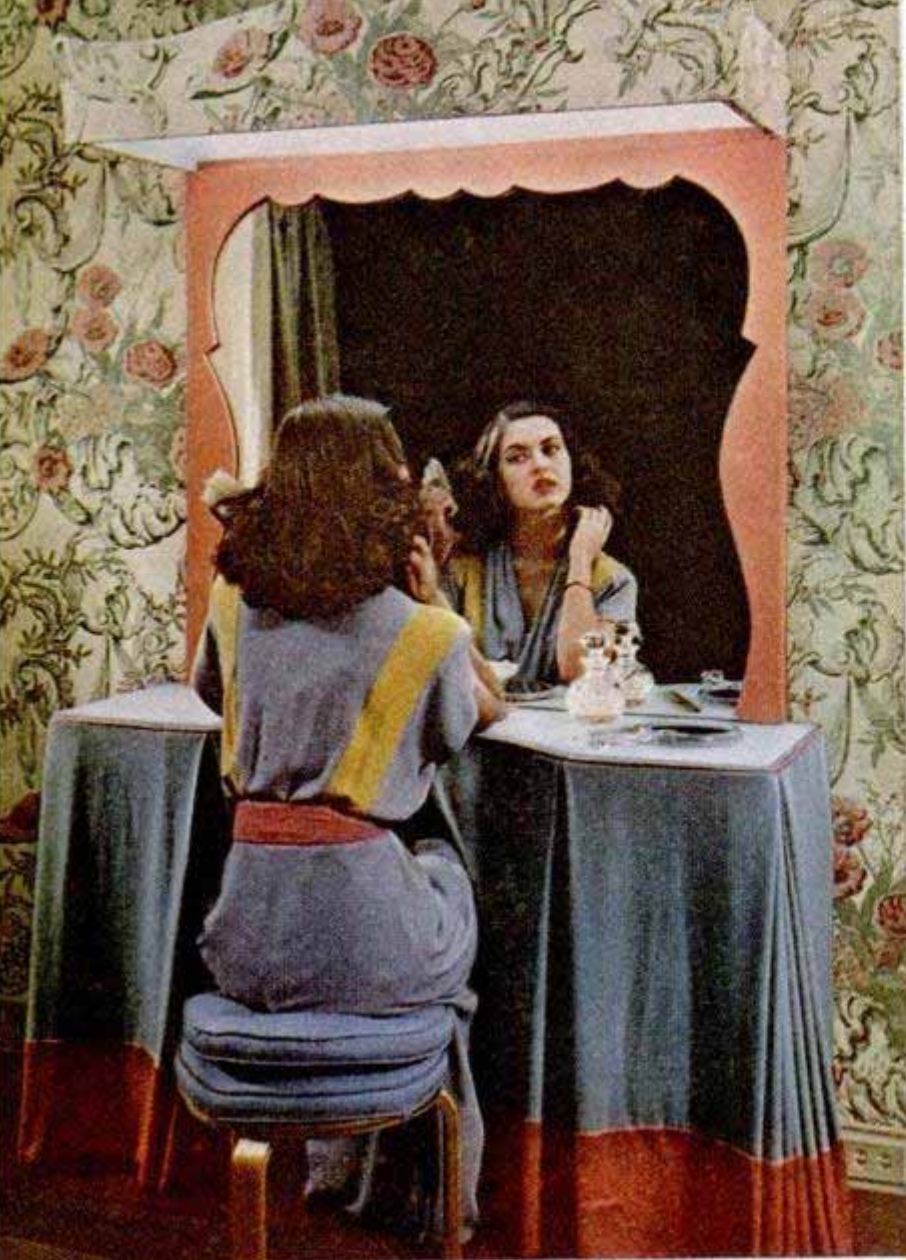
By Frank N. Stephany

DOES NIGHTFALL make your home seem cheerless even though you have tried any number of decorating schemes and rearranged the lamps in every conceivable combination? Or, do you return from work or shopping and wonder why you can't see as well in your own home as in the office or store? If so, yours is one of the majority of American homes that suffer from inadequate lighting.

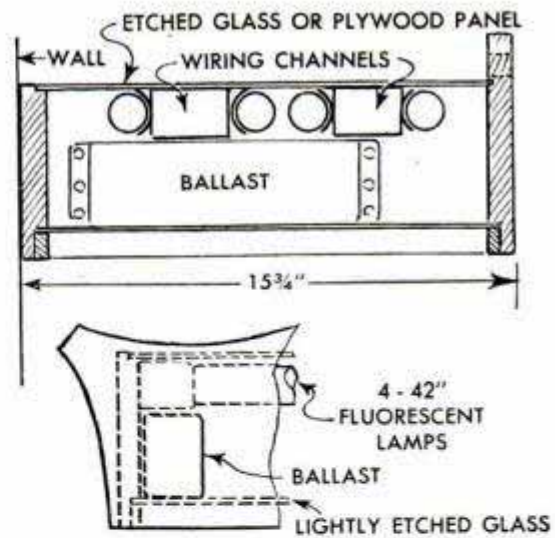
According to a recent survey by General Electric home-lighting experts, 95 percent of all homes in the average community lack

lighting in quantity and quality sufficient for the day-to-day needs and comfort of the family. In addition to the somewhat gloomy and unpleasant atmosphere which usually accompanies inadequate lighting, ordinary household tasks become more difficult and, in some cases, even unsafe.

Adequate home lighting falls into two categories which must be combined for best results. These are general room illumination, and lighting for specific tasks. The former can be achieved with concealed fluorescent lamps and indirect diffuser



Photos and information courtesy of General Electric Co.

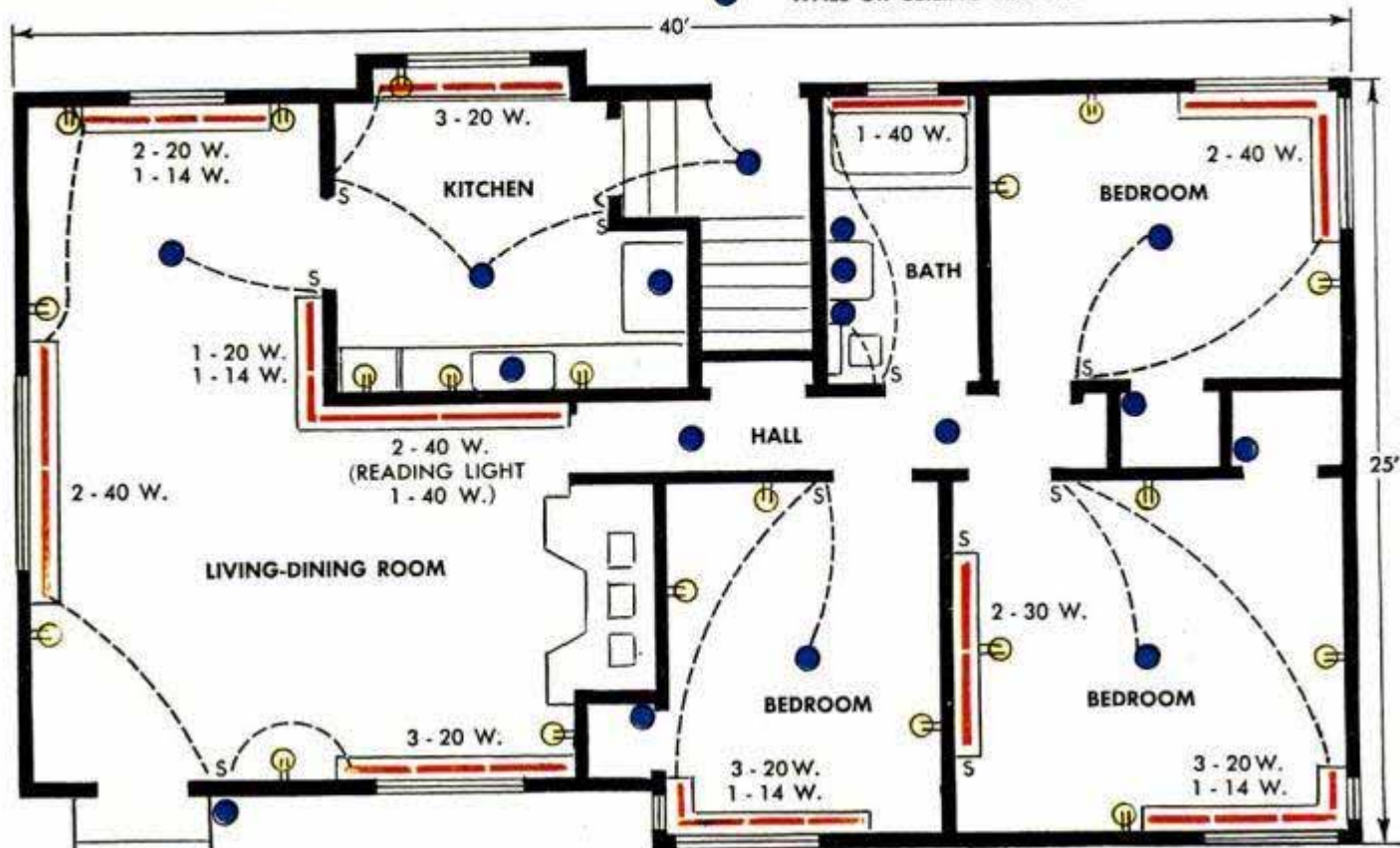


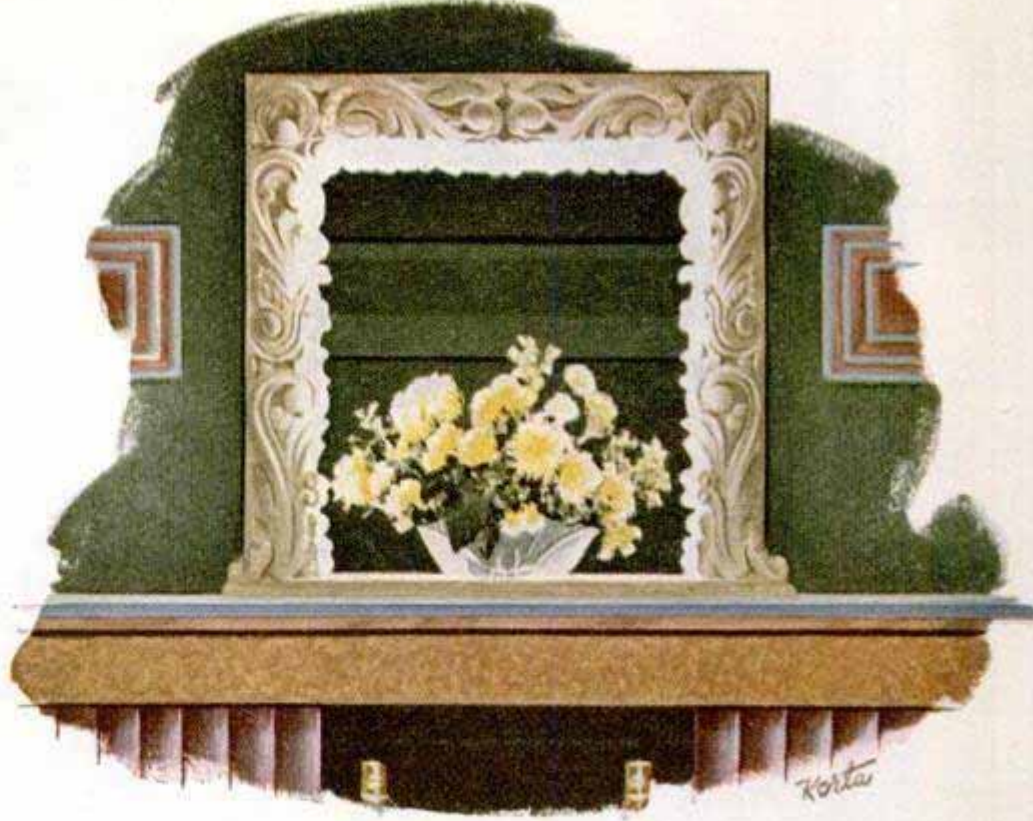
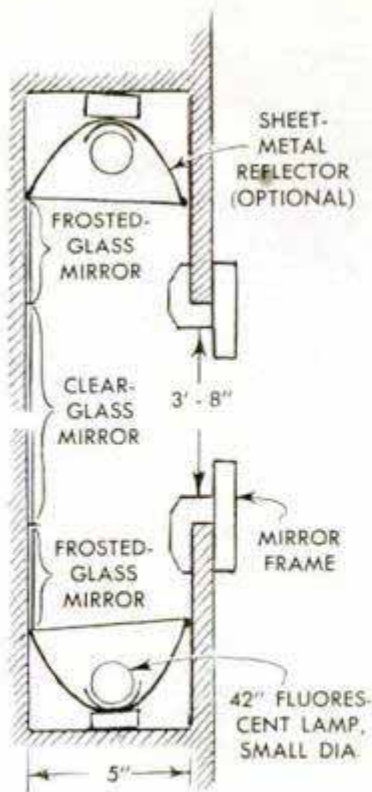
Papered to match bedroom walls, this attractive mirror canopy gives plenty of light over the dressing table as well as general room illumination. Top of canopy is etched glass for indirect light or plywood painted white to reflect downward

bowls on portable floor and table lamps, while the latter is gained by correct placement of portables and utilizing of direct fluorescent light from various types of fixtures. Good lighting need not and should not be harsh. For comfort, the light must be sufficiently diffused and yet be present in a quantity that permits quick, easy accomplishment of any particular task, such as reading, shaving, painting, sewing or cooking. Besides this, modern home light-

Diagram below indicates recommended locations of wall or ceiling fixtures, fluorescent lamps and convenience outlets for light-conditioning a modern home

- CONVENIENCE OUTLET
- FLUORESCENT LAMP
- WALL OR CEILING FIXTURE





ing should improve the beauty and livability of the home. In other words, you can literally decorate with light.

The most efficient way to attain a properly lighted home would be to build the lighting into the plans. However, as this was not done in the past and, in most cases, is not done at the present time, it is up to the homeowner to improvise with the cir-

Recessed mirror and hidden fluorescent sidelights combine to achieve this beautiful mantel treatment

cuits and outlets available to him. This can be done with surprising effectiveness and without expensive construction chiefly with the use of valance and wall-bracket lighting and the proper positioning of portable floor and table lamps.

General Electric's Horizon House, which portrays the ultimate in home lighting, is partially shown below. Soffit unit over the sofa contains two rows of fluorescent lamps to illuminate the painting, the sofa, or both





Compare photo above with same view at top of page. New ceiling fixture plus the lighting installations, Fig. 1, details A and B, accomplished the change

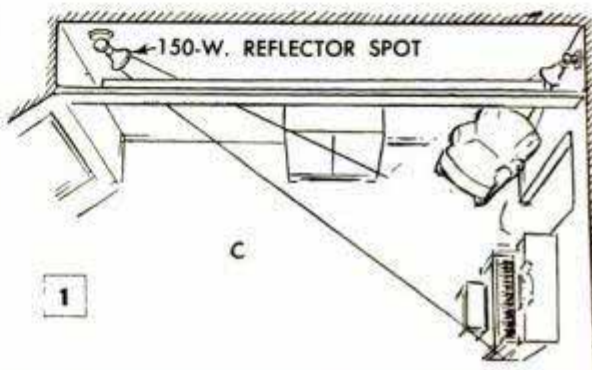
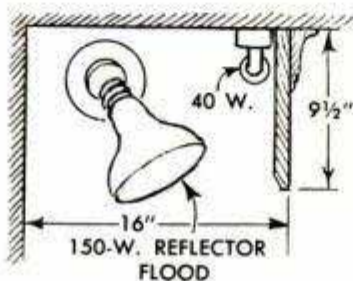
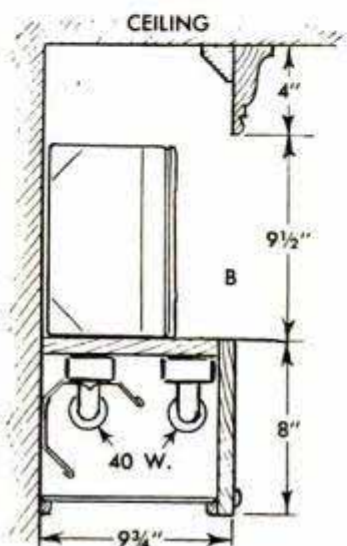
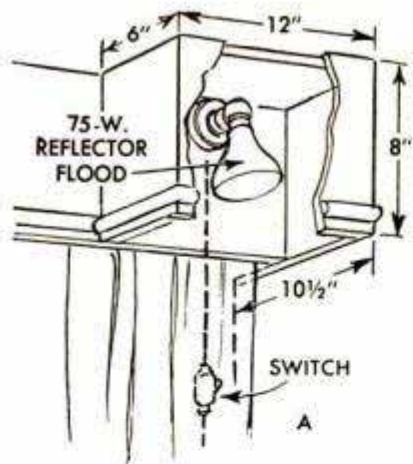
Valance along opposite living-room wall conceals two 40-w. fluorescent lamps, spotlight for piano and reflector-flood reading light, as in Fig. 1, C



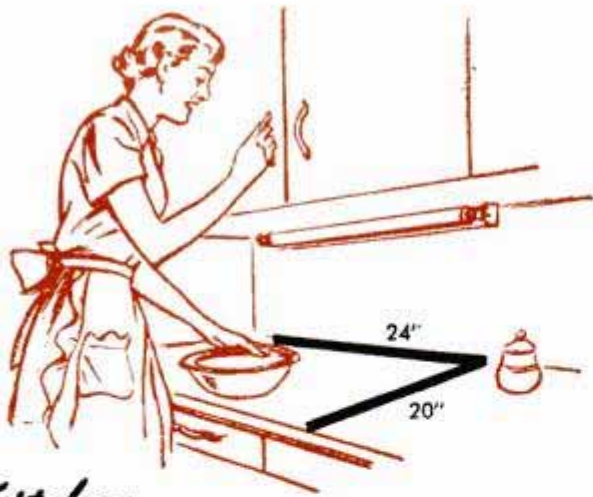
Note in photos on this page and in Fig. 1 how light played prominent role in transforming drab, gloomy living room into the most cheerful spot in the house

The floor plan on page 150 shows a typical room arrangement with suggested fluorescent-lighting installations, convenience outlets and locations of ceiling and wall fixtures. This, of course, is an ideal layout from the lighting standpoint and the homeowner who must work on a limited budget cannot expect to follow it in its entirety. However, many of the innovations can be worked out with a reasonable amount of expense and may be used to improve the quality of the lighting where it is needed most. Note, for instance, the fluorescent-light installation on the wall between the living-dining room and kitchen. One version of this setup is illustrated on page 149. Here you will notice that the reading light is concealed under a bookshelf, and fluorescent cove lighting is installed along the top of a row of wall cabinets which round the corner of the room. This is a typical example of the way lighting and utility can be combined.

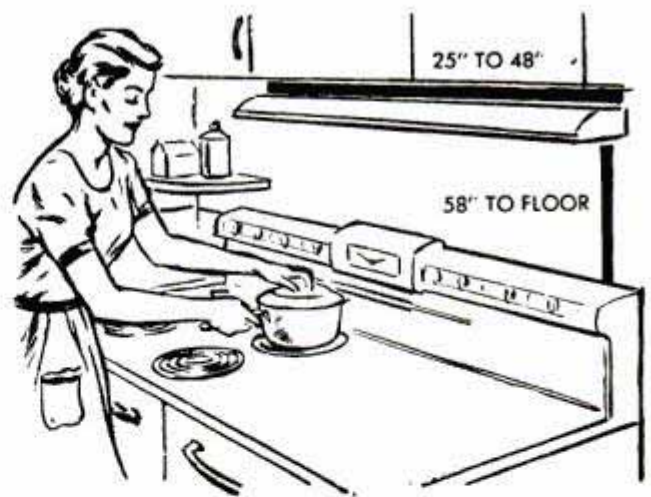
The drawings on pages 154 and 155 give recommended lighting recipes for various specific purposes. To get the most benefit from this type of pin-point lighting in your home, follow the dimensions as closely as possible and ask your lamp dealer for his recommendations as to the type of lamp and wattage of bulb most suitable for the intended purpose. Space does not permit



Indirect valance lighting, more efficient portables and a concealed mantel light brighten cozy living room



Kitchen



Reading



Bedroom



Writing Desk





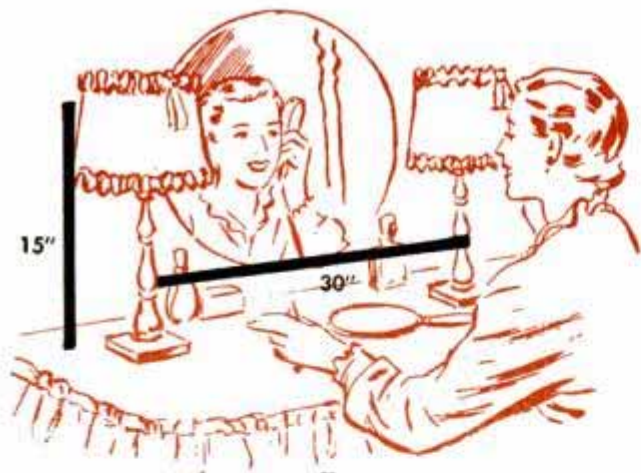
giving all the information on lighting recipes in this story. The subject is covered more thoroughly in a booklet called "See Your Home in a New Light" which probably can be obtained from the dealer where you purchase your lamps and fixtures.

As built-in cove lighting along the walls of a room is quite costly in most cases, the valance has become a popular and effective substitute for obtaining diffused over-all illumination. Fig. 3 gives the basic dimensions for different types of window valances; one type for direct lighting only, another for indirect only, and a third type which supplies direct and indirect light.

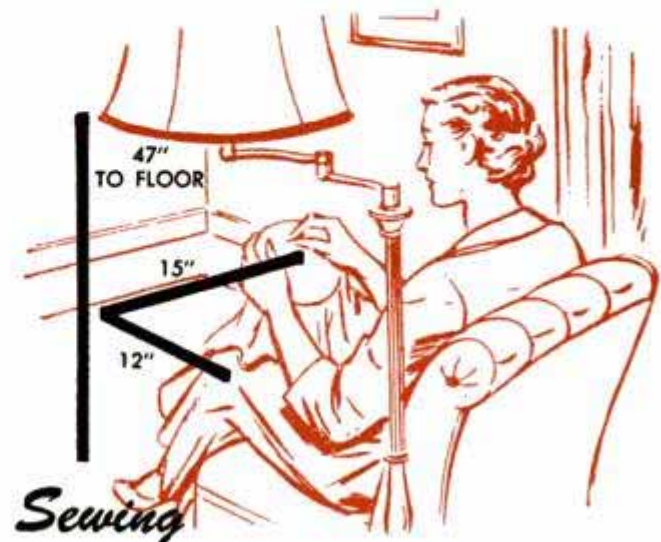
The valance intended for indirect or combination lighting should be mounted 12 in. or more down from the ceiling, and the lamp channel is located flush with the top edge of the valance. These two factors are important in order to attain maximum spread of light across the ceiling. The 4-in. distance from the wall or woodwork surface to the center of the lamp is needed for distribution of light over the full length of drapery. The latter should be hung as close to the wall as possible. However, if you



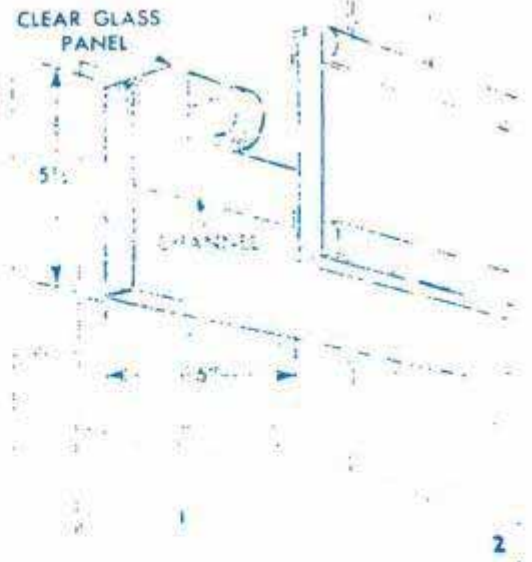
Drawings on these pages show locations of lamps for specific purposes throughout the house. When buying portable lamps, check with your dealer to be sure that size and design are suitable for intended use



Bathroom



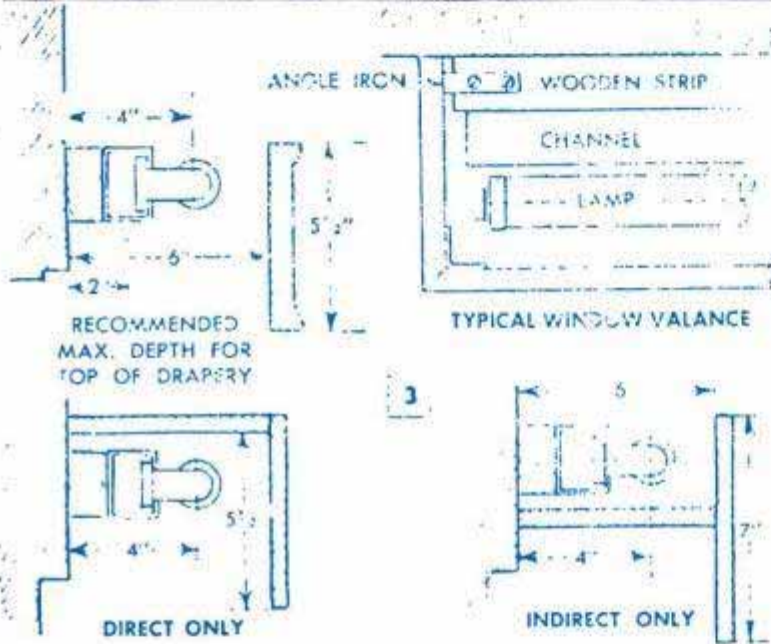
Sewing



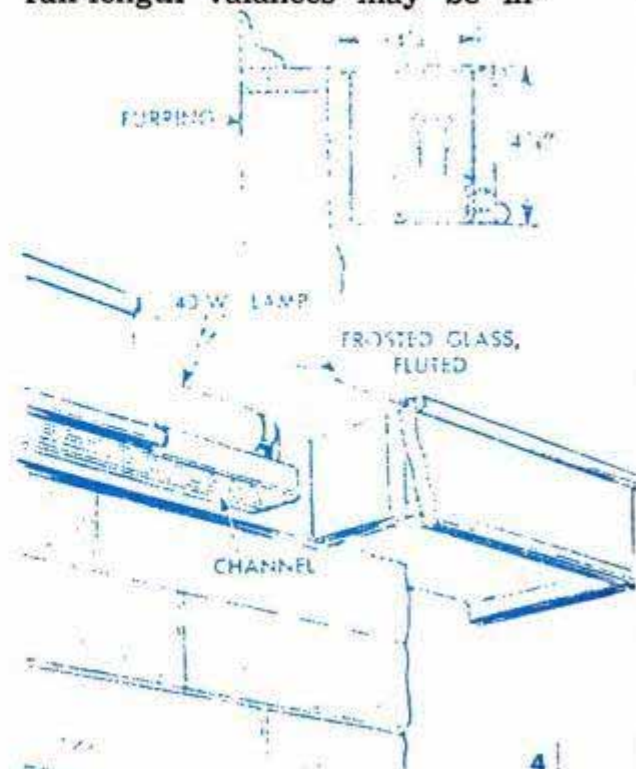
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find that with your present traverse rods, the 4-in. dimension does not bring the fluorescent tube beyond the drapery, increase the thickness of the wooden backing strip to bring the channel farther out from the wall. Then increase the distance from the valance to the wall proportionately. Paint all inside surfaces of the valance white to reflect the maximum amount of light.

The length and location of valances as well as the type selected is determined by the arrangement of the room and the effect you have in mind. In one instance a valance may be used to provide lighting along the entire length of a single wall to balance the light from portable lamps. In another, full-length valances may be in-



3



4

Panel of white-painted fiberboard above student's desk provides reflecting surface to attain maximum light from pin-up lamps

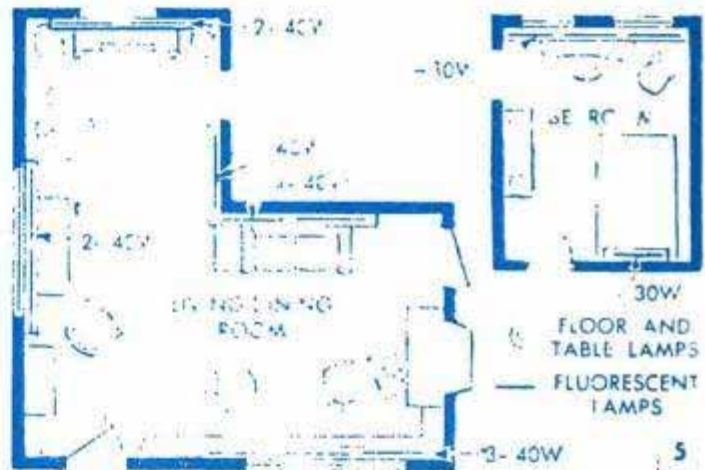
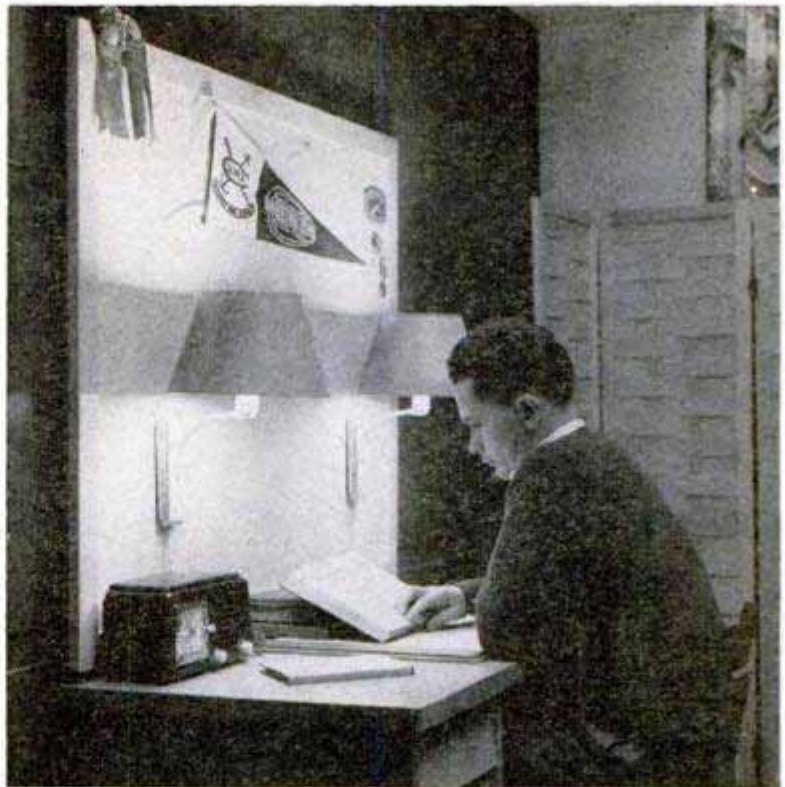
stalled along opposite or adjoining walls, or window-length valances can be used over the windows all around the room so each wall contributes to the over-all lighting effect. Bays, alcoves, picture windows, offsets and wall sections or windows flanking a fireplace all lend themselves extremely well to the valance-lighting treatment. You will find, too, that the installation of valance lighting will permit moving the furniture to new arrangements which were never before practical due to the lack of sufficient light. Fig. 5 offers an example of how furniture and portable lamps can be arranged when the general lighting level has been increased with valance lighting.

A few of many possible lighting installations are pictured and detailed on these pages. Fig. 1 details the drapery brackets, soffit lighting and the wall-length valance with its concealed spot and flood lights which combine to light-condition the redecorated living room shown in the photos. The wall bracket detailed in Fig. 2 not only provides plenty of light for working at the kitchen range, but doubles as a handy and attractive spice shelf. Utilizing a clear-glass panel for the shelf permits a certain amount of indirect illumination to produce an interesting treatment. The indirect fireplace-mantel light, Fig. 4, is an important feature of the living room pictured below Fig. 1. By means of light, the painting over the fireplace is given the prominence which it rightfully deserves. For a bookcase similar to the one pictured at the right, just install one or more fluorescent-lamp channels.

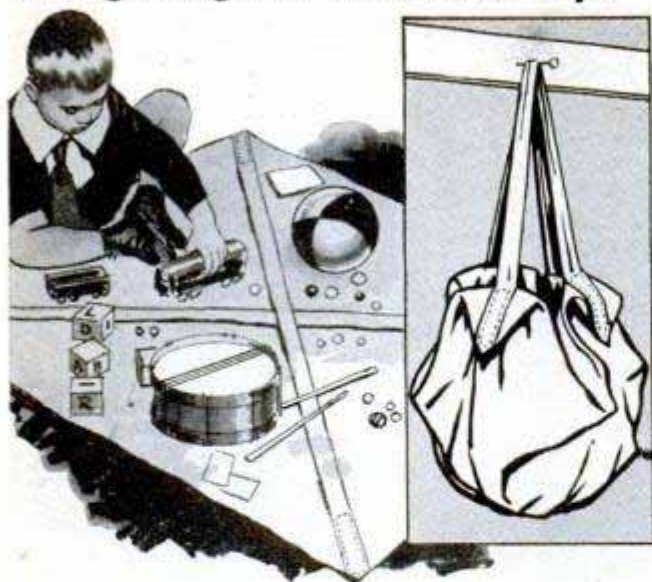
As you look through your home, keep in mind these examples of the thoughtful and successful use of light. Without a doubt you will notice for the first time any number of ways in which light can be applied in your own home to make the decorating more effective, and more important, to make your everyday living more enjoyable.

★ ★ ★

Lighted bookcase with glass top plus ceiling spotlight trained on painting form bright, dramatic corner in small apartment



Storage Bags for Children's Toys



Mothers of small children should welcome this solution to the ever-present problem of picking up toys after playtime is over for the day. By placing strips of canvas or webbing diagonally across the blanket and sewing them at the corners of the blanket, blocks, rattles, dolls and other playthings can be gathered up quickly and stored out of the way on a hook in the closet. Lifting of the straps where they cross forms a spacious bag for the purpose.

Lock Washer Quickly Improvised



The next time you have to lock a nut and there is no lock washer available, try using a common friction washer that has been slotted as indicated. To prepare the washer, cut four short, equally spaced slots in it. Then, twist each segment formed by the slots slightly to produce a propeller-like shape. Also, cut a single notch on the underside of the nut as indicated. In this way, when the nut is tightened against the washer, the notch will engage one of the four segments formed in the washer. The other three will bite into the surface under the washer and thus prevent the nut from working loose.

Herbert E. Fey, New Braunfels, Tex.

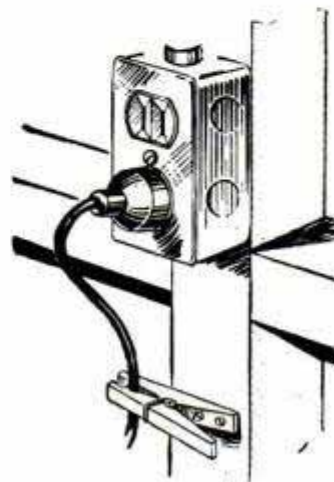
Inexpensive Fire Extinguisher Utilizes Plastic Container

Small, inexpensive fire extinguishers that will shoot a stream of carbon tetrachloride up to 10 feet are improvised quickly from plastic squeeze-type containers. Remove the nozzle head from the container and enlarge the opening with a needle so the extinguisher will throw a steady stream. Then

fill the container with carbon tetrachloride and replace the cap. It is best to use a 3 or 4-oz. container which can be sealed tightly to avoid evaporation of the chemical. Carbon tetrachloride is especially suitable for putting out small fires caused by electrical defects. *Caution:* However, be sure to provide adequate ventilation when using this chemical, as the fumes are likely to be dangerous.—Jack H. Lewis, Willow Run, Mich.

Clothespin Keeps Electric Cord In Wall Outlet

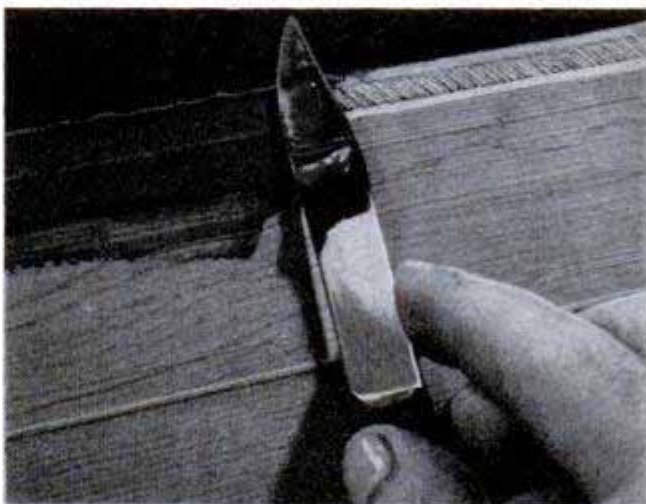
The annoyance of having an electric cord pull out or work loose in a wall outlet while operating a tool such as a soldering iron or an electric drill can be prevented with a spring-type clothespin. Mounted on the wall several inches below the outlet, the clothespin will hold the cord securely and resist (up to a certain point) any tension placed upon it. A little slack in the cord between the socket and the clothespin will facilitate the removal of the cord when necessary.

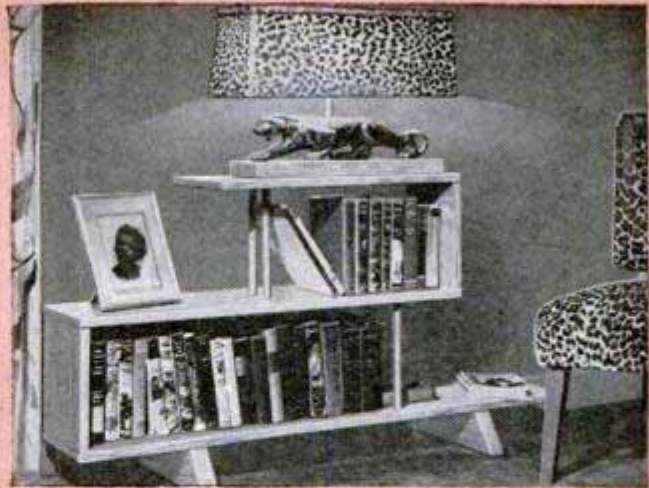
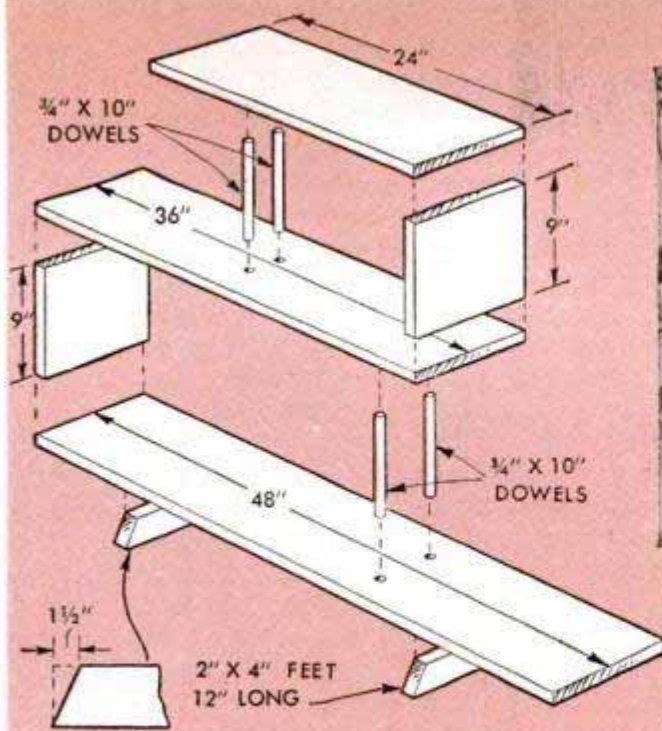


Linoleum Paste Used as Filler

Especially suitable for filling the edges of plywood, linoleum paste also will serve in many other cases as an emergency wood putty. Most brands of such paste shrink very little in drying and can be sanded to a smooth, hard finish. However, if the plywood is to be finished in a natural color, apply the cement carefully since it possibly might stain the wood.

Ken Murray, Colon, Mich.





MODERN BOOKCASE

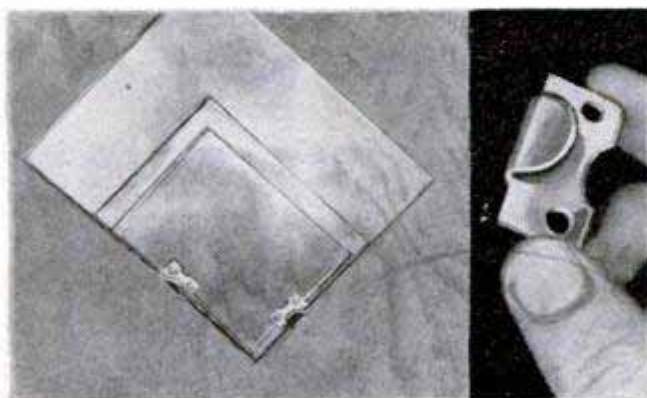
By Ray Burchette

Truly modern, this attractive bookcase can be cut and assembled in one evening and finished the next. The shelves and end panels are of 1 x 10 while the feet are sections of 2 x 4. Open ends of the shelves are supported by pairs of 3/4 x 10-in. dowels which are located about 18 in. from the ends and set in 1/2-in.-deep holes drilled in the shelf stock. Sand carefully before assembly, glue and clamp. When the glue has dried, finish sand and apply shellac or enamel

Care of Small Boat in Autumn Simplifies Spring Painting

While most boatowners prefer to paint their craft in the spring, a little care before the boat is stored in the autumn will minimize considerably the amount of work that will be necessary before painting is begun the following season. Winter is an excellent time during which a boat may be dried for painting. Before a boat is placed in storage, however, it should be cleaned thoroughly. All oil and grease should be removed before it can further penetrate the wood, as should any scum or dirt before it has dried. After applying paint cleaner with a cloth, the boat should be scoured with a stiff brush, using water containing a water softener. Small boats of the outboard and row-boat types are stored best by standing them

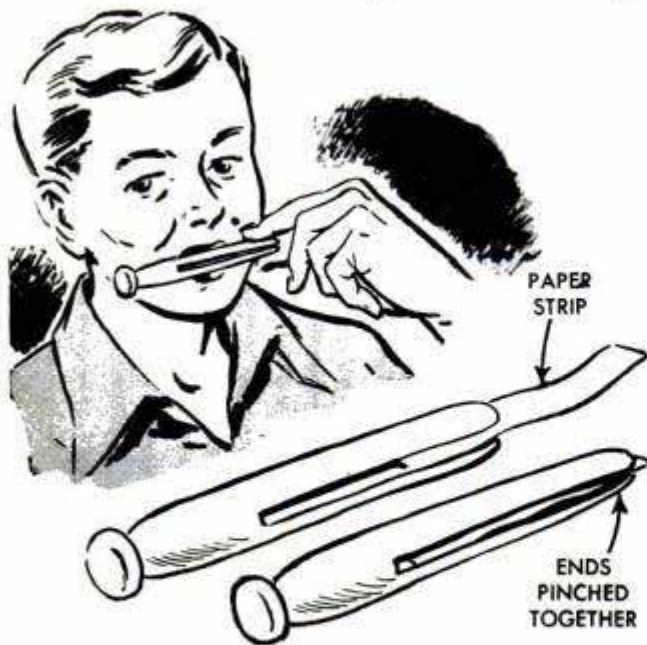
on their transoms indoors when space permits. Otherwise, they must be stored outdoors where precautions must be taken to protect them effectively from ice and drifting snow. These are accomplished by resting the boat upside down several feet off the ground upon supports placed not only at the bow and stern but also amidships. This will help forestall the possibility of any undue strain being placed upon the keel and the planking. A tarpaulin, weighted at the edges to hold it in place, should be used to cover the boat. In the spring, after the boat has been brushed and wiped clean, it will be ready for caulking and painting provided there are no minor repairs to be made.



Glass Held by Window Hangers For Storage on Wall

When placed at right angles and mounted on a wall as shown, two metal hangers of the type used for hanging screens and storm windows will safely support a pane of glass on a wall. The hangers, which are placed at a distance from one another which varies according to the size of glass to be accommodated, should be attached to the wall with flat-headed wood screws.

Kazoo Provided by Combining Clothespin and Strip of Paper



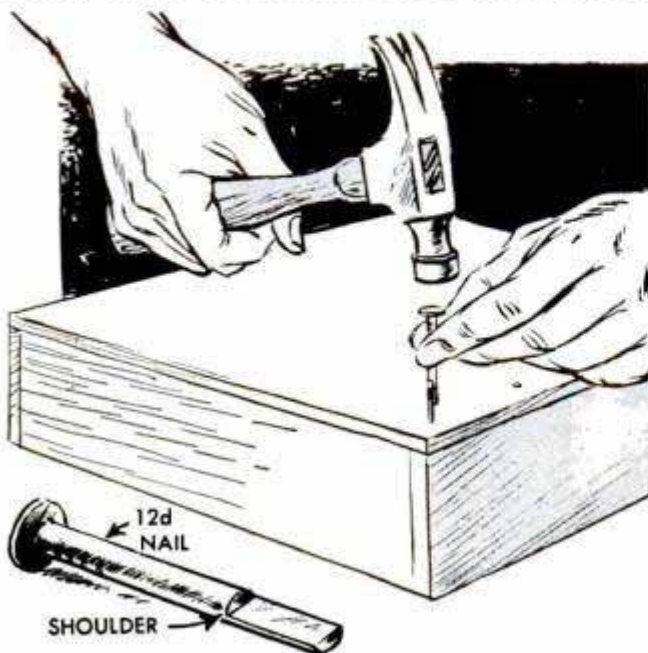
Children will enjoy "playing" a kazoo, one of the simplest of all musical instruments. This version of it can be improvised in a matter of seconds by placing a strip of stiff paper between the prongs of a clothespin. When held to the lips as shown, two different basic sounds can be produced by expelling the breath against the edge of the paper. A pleasant though slightly distorted musical tone can be produced by humming or singing into the instrument, whereas a raucous, high-pitched tone may be produced by forceful blowing. The pitch is controlled vocally when humming, while adjusting the depth to which the paper is inserted in the clothespin regulates the pitch when employing the latter technique. The paper is held in the position desired simply by pinching the ends of the clothespin together.

Index Marks Permit Binoculars to Be Focused Rapidly

Binoculars having individually focused eyepieces can be adjusted quickly without a need for looking at the graduated scale by adding an index mark to each eyepiece. To do this, first focus the binoculars for average distances and then apply a narrow strip of adhesive tape to the barrel of each eyepiece. Strips of tape approximately $\frac{1}{8}$ in. wide have been found most effective. Place the tape directly at the top of the eyepiece, carrying it slightly over the inside surface of the rim so that it can be seen while using the instrument. As a result of these markings, you will be able to see when both strips are at the top position, thus indicating that the binoculars are in proper focus.



Nail With Shoulder Filed on End Makes Improvised Brad Driver



The use of an ordinary 12d nail will provide an effective driver when starting brads. Simply remove the point and file the end of the nail as shown to form a shoulder. If desired, a shallow groove in which to fit the brad can be made by drilling a hole in the end of the nail before filing.

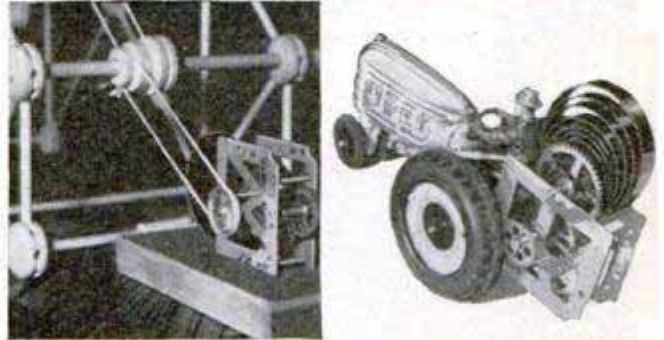
Mrs. T. F. Watts, Charlotte, N. C.

Container for Live Bait Made From Milk Carton

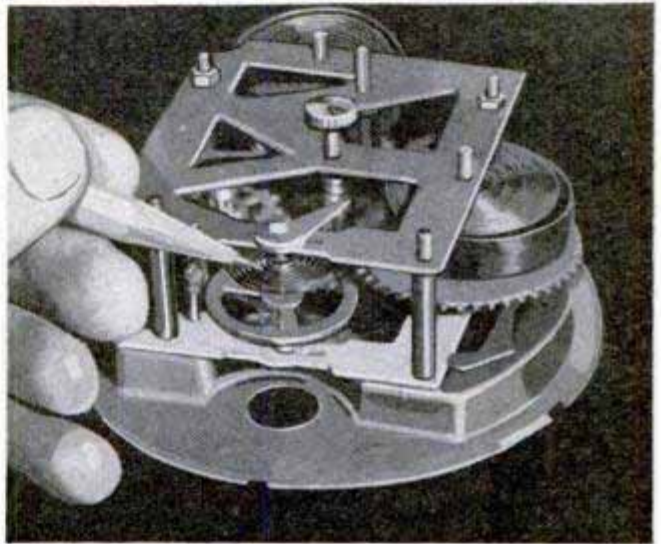
With numerous small air holes punched in it, a discarded cardboard milk carton will provide an excellent container for carrying live grasshoppers and other insect baits on a fishing trip. After rinsing and drying the carton, put in the bait and press down the pouring flap.

Henry Barthel, Roland, Okla.

Don't throw out the **CLOCK**



When that old faithful—the spring-driven alarm clock—finally breaks down, think twice before tossing it out. Stripped of its balance wheel, hairspring and pallet, the works will provide an excellent “motor” for operating several different toys. For example, it will be found ideal for driving a slow-moving ferris wheel built from a toy construction set. It can be used to power a model stern wheeler or to drive a toy tractor. In the latter case, the clock is tied to the rear axle in a position to bear against the tractor tire when under tension of a rubber band. A suitable drive pulley for the motor is fitted to the central hand shaft. This can be made from a spool or taken from a construction set. The unwanted parts are removed from the clockworks by loosening the small nuts that hold the frame together. As a precaution, be sure that the main spring is fully unwound before removing the parts, and in reassembling the works, solder the frame nuts in place to prevent loosening.—Richard F. Trump, Ames, Iowa.

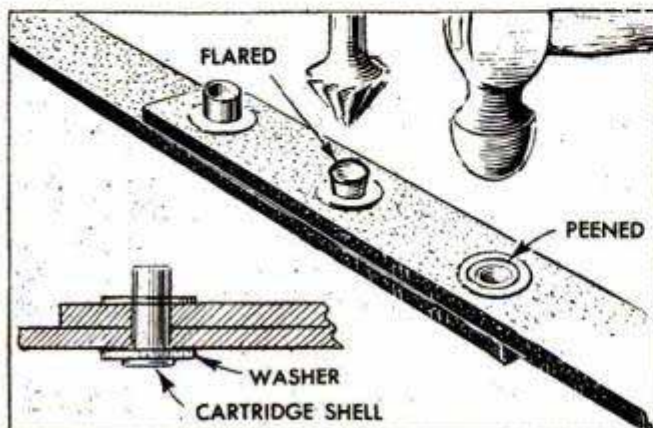


Here are the parts which must be removed—the hairspring, balance wheel and pallet, or ratchet pawl

Fired 22-Caliber Cartridges Used as Substitutes for Rivets

In a pinch where only a few rivets are needed, empty 22-cal. cartridges make neat substitutes for tubular rivets in fastening together leather, metal or other material. In the case of soft material like

leather, a washer is required under the head of the “rivet” to prevent it from pulling through. A rosehead countersink makes an ideal tool for slitting and flaring the rivets, after which the split ends are hammered flat. In addition to serving as rivets, the cartridges also can be used to punch their own holes in thin leather by striking sharply with a hammer. They also may be used to decorate a belt, holster or other leather article. *Caution:* If unfired cartridges are used, do not merely remove the bullets. Be doubly sure that the charge is removed completely, as a hammer blow will explode the unfired primer in the bottom of the cartridge.



Given a coat of fresh, white shellac, a cracked pane of glass in a window can be weatherproofed temporarily until replaced.

Solving HOME PROBLEMS



1—VACUUMING A RUG PAD is easier if a mesh vegetable bag is slipped over the nozzle of the vacuum cleaner. Bag keeps the nozzle from "sticking" to rug, enabling it to be moved back and forth readily



2—DON'T DISCARD WAX CANDLES just because they no longer can be washed clean with soap and water. You will find that wiping them with a cloth moistened with alcohol will restore the original finish quickly



VACUUM-BOTTLE CORK wrapped with aluminum foil will not absorb odors from soup or beverage in the bottle or transmit taste from one food to another

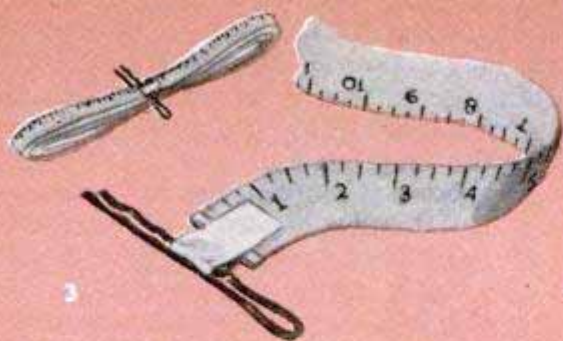
SAVE TIME when removing silk from ears of corn by brushing the corn with a whisk broom. Start at the top of the ear and brush briskly toward stem end

SERRATING ONE EDGE of short hose section and tacking over end of force-cup handle forms a handy tool for loosening lint from a clogged sink drain

CHEWING GUM can be removed from clothing by first softening the gum with egg white and then washing the soiled fabric with soap and water

KNIFE CUTS in plastic tablecloths are repaired neatly with small pieces of cellulose tape. Stick tape to underside of cloth to seal cut portion

TO FACILITATE CLEANING your fingernails after a particularly grimy or greasy job, dig them into a bar of soap several times before starting the work



3—CLOTH MEASURING TAPE won't become tangled in sewing drawer if folded and clipped with bobby pin. Tape pin to one end of measuring tape

4—IF LID OF CEREAL BOX is difficult to remove, place strip of wax paper under it before replacing. Pull end of paper upward to lift lid

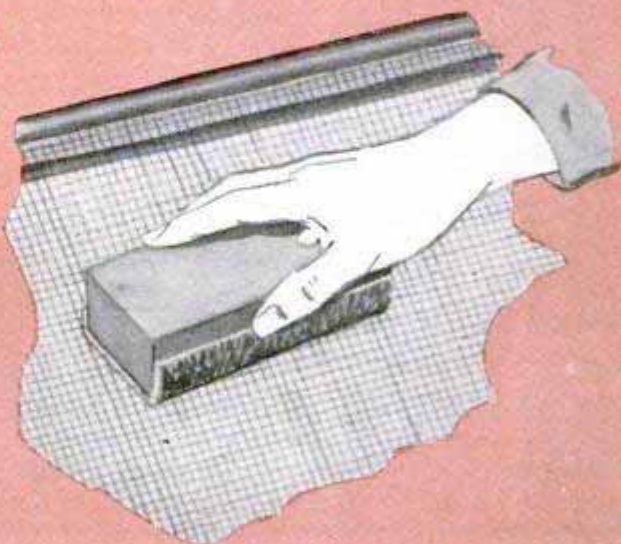
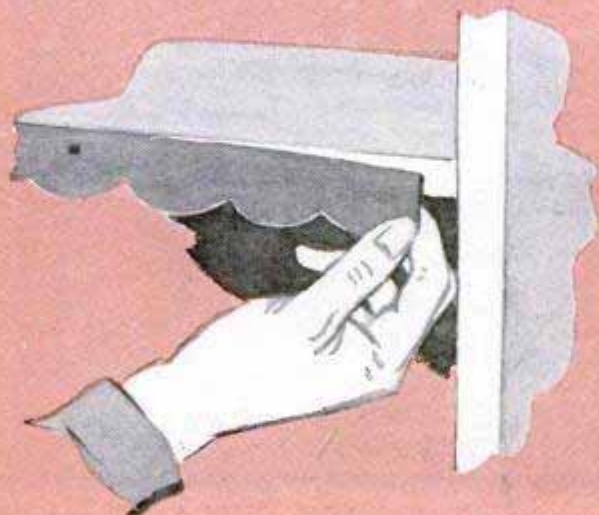
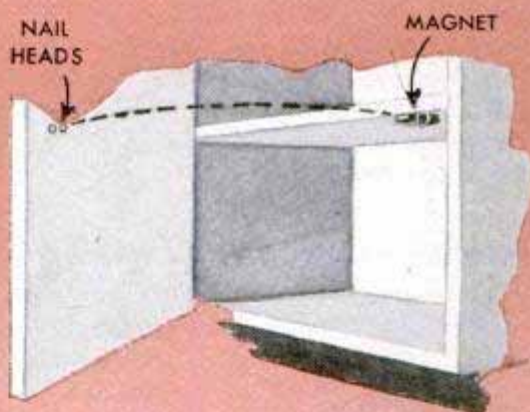
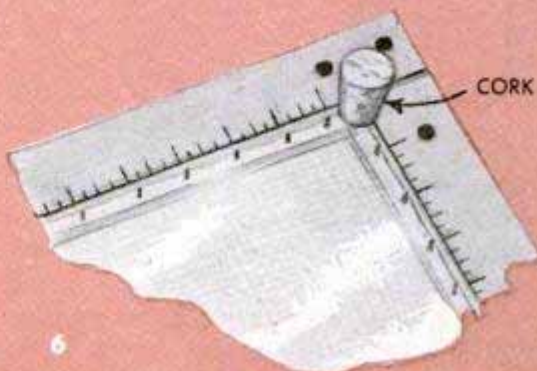
5—RUBBER TAPE on bottom of furniture legs prevents skidding. Tape is not noticeable if cut flush with front of leg and run slightly up back

6—TO KEEP CURTAINS from slipping off corner nails of stretcher, press small vacuum-bottle corks over corner nails after attaching curtains

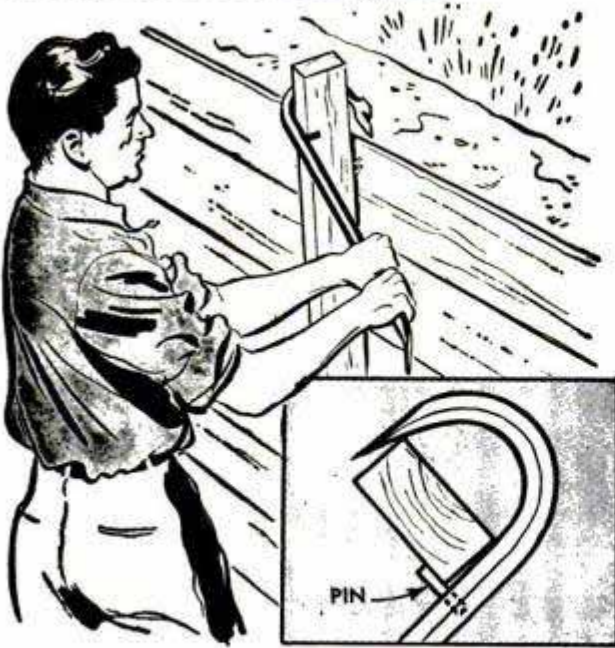
7—MAGNETIC LATCH for cabinet door is made by taping bar magnet to underside of shelf opposite two large-headed nails or tacks driven in door

8—SCREENS ARE RUSTPROOFED before storing for winter by coating lightly with linseed oil. Apply oil with scrap of carpet nailed to wooden block

9—FOR PERMANENT shelf scallop, cut strips of plywood or tempered hardboard, tack to shelf edge and paint to suit. Decals may be added

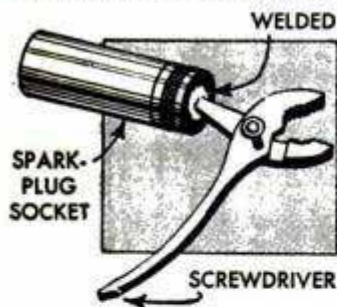


Concrete Forms Removed Quickly With Special Wrecking Bar



Fitted with a steel pin, a wrecking bar is just the thing for quickly tearing down concrete forms. The pin is located near the hooked end of the bar, as in the detail, so that a twisting pressure can be applied to the wooden uprights to pry them from the form boards. Drive the pin in a blind hole drilled in the bar, using a pin having a diameter less than $\frac{1}{4}$ in., so that the bar will not be weakened excessively by a comparatively large hole. Be sure that the hole is deep enough so that the pin may be anchored securely.

One-Piece Outboard Tool Kit



A one-piece emergency tool for the repair of an outboard motor is made easily by welding a spark-plug socket to one handle of slip-joint pliers and grinding the end of the other

handle to form a screwdriver blade. For greater usefulness, use the pliers of the type having a wire cutter incorporated in the jaws.

Colored Stripe on Golf Ball Simplifies Identification



Stamping one's name or otherwise marking a golf ball for purposes of identification still doesn't eliminate the necessity, in

most cases, of having to pick up the ball to positively identify it. However, I have found that a brightly colored stripe encircling the ball makes it easy to identify it at a glance, regardless of how the ball lies. To do a neat job of adding the stripe to each ball, a regular striping tool was used. This required a means of holding the ball in contact with the striping wheel, so I devised a simple holder from a short length of coat-hanger wire. Simulating the jaws of a caliper, the ends of the wire were pointed and spread sufficiently to grip the ball. By holding both the wire holder and the striping tool in one hand in such a way that the ball touches the wheel, a neat stripe can be painted on the ball simply by rotating it in the holder with the other hand.

Ed Packer, Chicago.

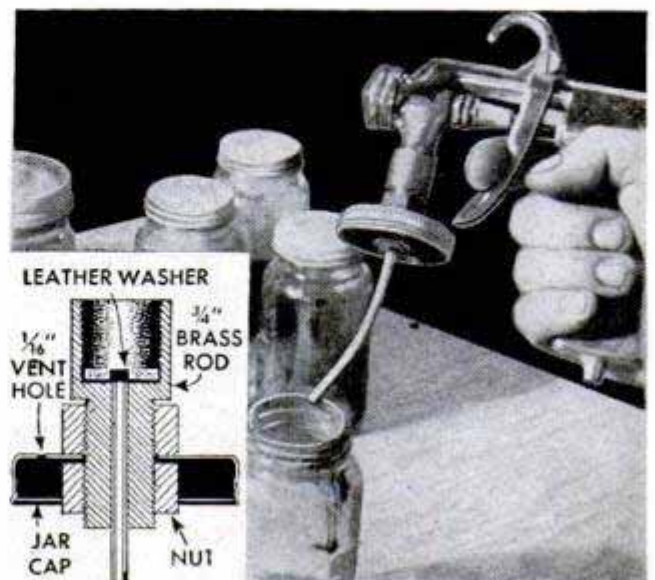
Absorbent-Cotton Dispenser

One way a dispenser for absorbent-cotton rolls can be made is by slotting the cover of a small cardboard box and then leading the cotton roll through the slot. The cover is held in place with cellulose tape.

Spray Gun Altered to Take Small Cans of Paint

In my work as a modelmaker I use many colors of paint which are purchased in 3 or 4-oz. glass jars. To save time and prevent the waste of paint, I altered my spray gun so that the paint jars could be substituted for the regular jar on the gun. To do this, I made an auxiliary suction tube, as shown in the detail, to take the smaller jars. One of the small jar covers was clamped between nuts on the tube so that the paint jars could be screwed to it. This permitted the various colors of paint to be used right out of the original jars.

Herbert R. Pfister, New York City.



1 EVENING PROJECTS

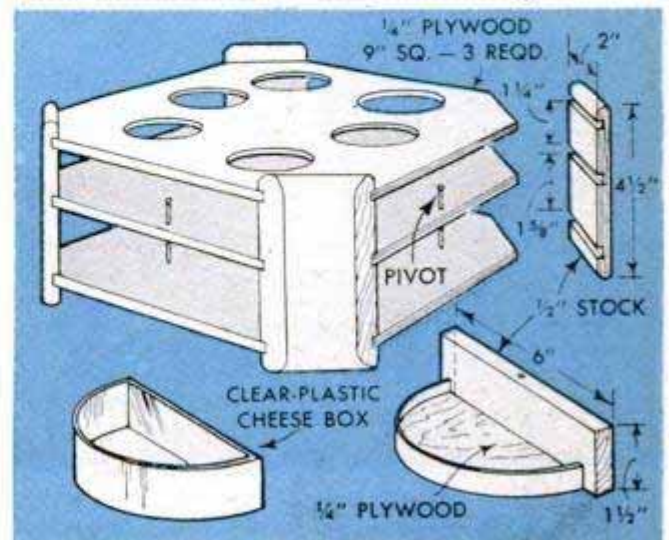
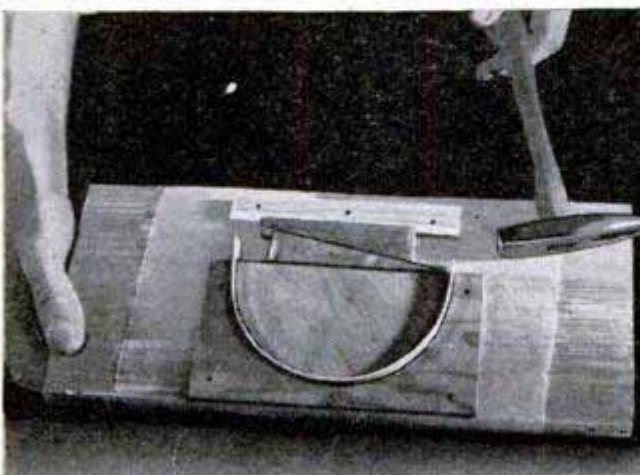
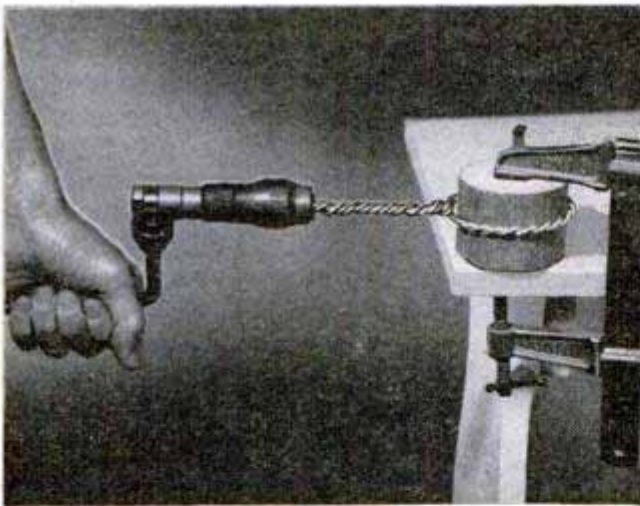


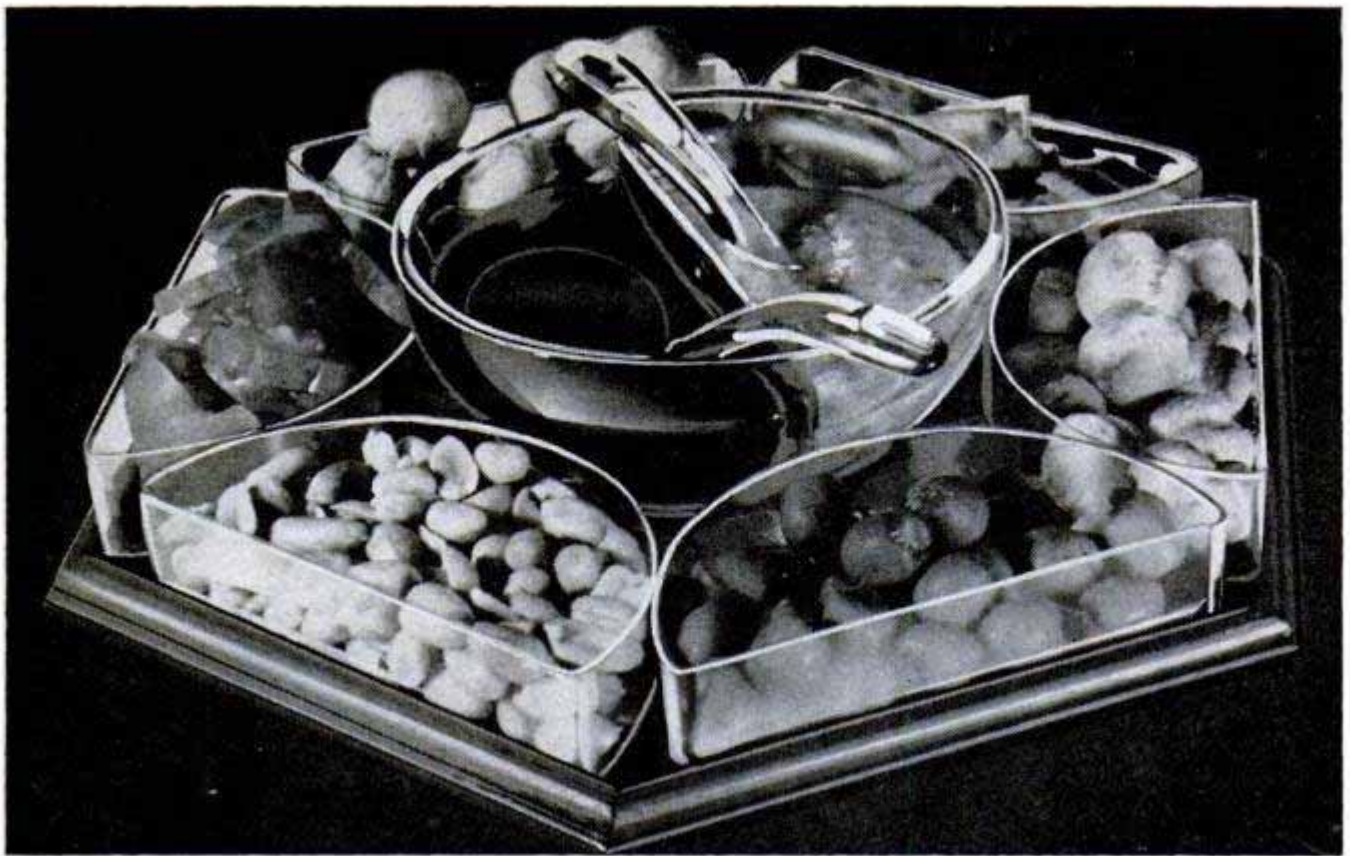
Both the refreshment server pictured above and the Lazy Susan on following page utilize plastic cheese boxes as food containers. The server is fitted with a wire bail for carrying and the cheese boxes are supported on swinging trays pivoted at the center

By Bertram Brownold

REFRESHMENT SERVER

HOSTESSES WILL like the compact and ready convenience of this little server which provides for an attractive arrangement of both food and beverages. Three square pieces cut from $\frac{1}{4}$ -in. plywood and having the corners cut diagonally, are assembled with grooved corner pieces to form a three-tiered tray. Holes cut through the top piece provide a holder for six beverage glasses. A handle, or bail, is made by twisting wire strands as in the center photo at the left. Swinging trays support semicircular plastic boxes of the type in which certain kinds of cheese are sold. Note that the bottom of each tray consists of a semicircular piece of plywood



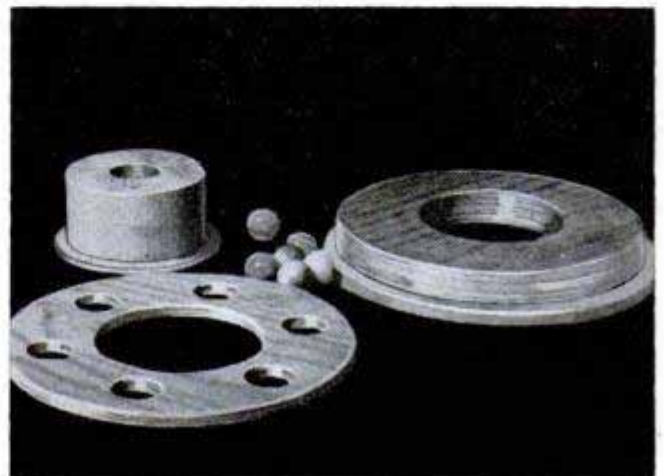
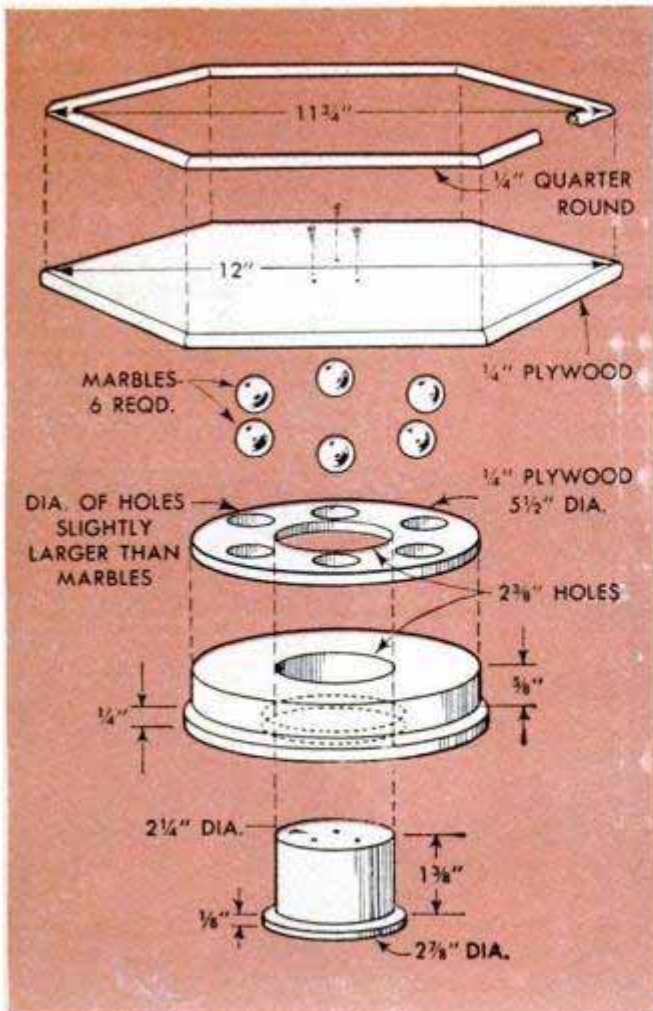


edged with a strip of $\frac{1}{16}$ -in. plywood, the edging strip being glued to the bottom piece as in the lower left-hand photo.

LAZY SUSAN

Six marbles of uniform size, which are

held in place with a plywood retainer, provide the ball thrust bearing for this Lazy Susan. The individual food trays are the same as those used on the server. The rotating tray, which also provides the upper raceway for the ball bearing, is cut to a hexagonal shape from $\frac{1}{4}$ -in. plywood and is fitted with an edging, or gallery, of $\frac{1}{4}$ -in. quarter round. The two-part base consists of shouldered turnings which telescope as in the detail at the left. Note that the bottom of the larger turning is counterbored to take the $\frac{1}{8}$ -in. flange on the smaller one. The length of the smaller turning and also the thickness of the larger one are determined by the diameter of the marbles used as bearings. In assembling, the smaller member of the base is inserted in the hole in the larger member and the balls and retainer are placed on top. Then three small screws are driven through the tray into the smaller member of the base. ★ ★ ★



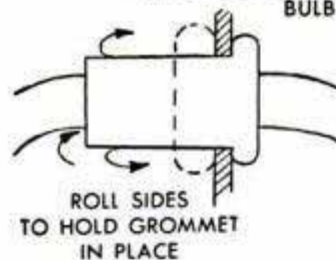
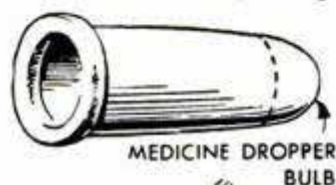
Guard for Tractor-Tire Valve Stem

One farmer devised a metal guard for the valve stems of his tractor tires to keep the hogs from chewing on them and to prevent mud frozen to the undersides of the fenders from breaking them off. The guard



consists of a 1 1/4-in. nipple placed over the valve stem and screwed into a plumbers tap that is welded to the tractor rim. The guard can be unscrewed with little difficulty to expose the valve stem when checking tire pressure.

Medicine-Dropper Bulb Makes Emergency Grommet



Lacking a rubber grommet to protect an electric cord which passed through a metal cabinet, one radio serviceman made one from a medicine-dropper bulb. The tip of the bulb was cut off and the bulb itself inserted through a hole drilled in the sheet

metal. The projecting end of the bulb was then rolled back on itself in order to provide a flange for holding the improvised grommet securely in place.

Roy M. Crabtree, Florence, Ala.

Wood-Chopping Safeguard



Nailed to a stump or chopping block as shown, a section of auto tire is all you need to eliminate the possibility of being injured by hurtling pieces while chopping kindling. The section is nailed so

that it arcs sufficiently to permit the pieces of kindling to be slipped under it.

Most screw-type jar lids, such as those used on olives, can be removed easily if they are first turned upside down and struck briskly two or three times on the palm of the hand.



Tool Made From Dowel and Wire Speeds Job of Pitting Cherries

Made from a piece of stiff wire and a short length of dowel, this simple tool will help considerably to speed up the otherwise tedious job of pitting cherries. The wire is bent as shown and inserted in holes drilled in one end of the dowel, after which the looped end of the wire is pounded flat for easy insertion in the cherry. The other end of the dowel is sanded smooth.

Cactus Having Artificial Blossoms Appears to Bloom Perennially

You'll find it very easy to make a small indoor cactus, which ordinarily blossoms only occasionally, perennially attractive by simply adorning it with small artificial flowers.



The flowers may be purchased in almost any department or ten-cent store and are attached to the spines of the cactus as shown. A realistic effect may be obtained, provided a proper selection of flowers is made.—Grover Brinkman, Okawville, Ill.

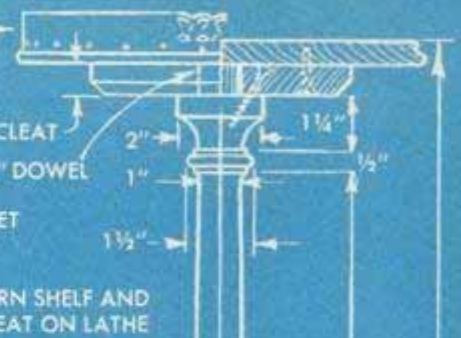
Beeswax Coating Binds Nail in Hole

If lubricated with melted paraffin, screws and nails can be driven in easily and removed later with little difficulty if necessary. When coated with beeswax, however, they can be driven in easily but will prove not only difficult to remove but also will have little tendency to work loose.

PLAN of the MONTH...



TACK BRASS GALLERY TO EDGE OF TOP WITH ESCUTCHEON PINS. SOLDER JOINT WHERE GALLERY EDGES MEET



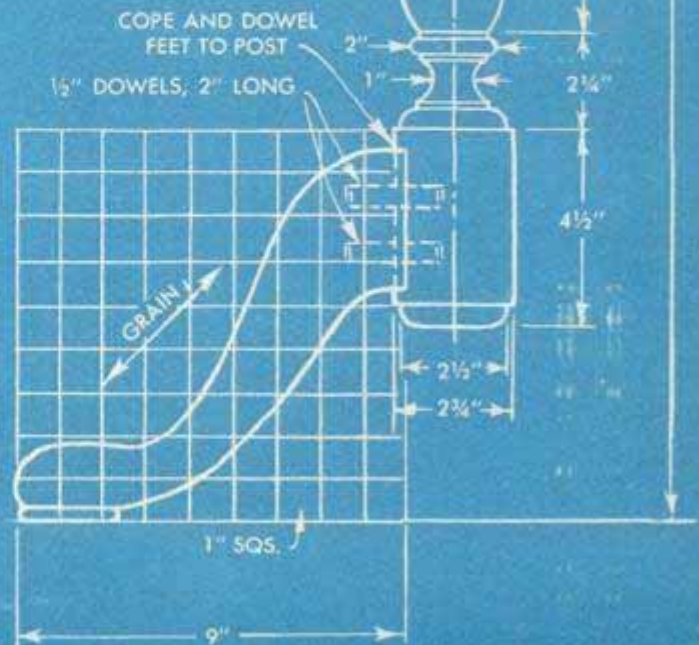
TURN SHELF AND CLEAT ON LATHE



NOTE: DRILL 1" HOLE IN TOP CLEAT FOR POST DOWEL. GLUE AND SCREW CLEAT TO POST FROM TOP OF CLEAT INTO POST. SCREW CLEAT TO TOP FROM BOTTOM SIDE OF CLEAT



TAPER FEET FROM 1 1/2" TO 1". ROUND TOP OF FEET AND CARVE BEAD AT BOTTOM



MATERIAL LIST

Triple pedestal

Mahogany plywood:

1 pc.—1/2" x 7 3/8" x 7 3/8"—Top shelf

2 pcs.—1/2" x 6 3/8" x 6 3/8"—Lower shelves

Mahogany lumber:

1 pc.—3/4" x 4" x 4"—Cleat

1 pc.—2" x 2" x 12 1/2"—Top post

1 pc.—3/4" x 4" x 18"—Shelf arm

1 pc.—2 3/4" x 2 3/4" x 17"—Bottom post

1 pc.—1 3/4" x 5" x 8"—Base

4 pcs.—1 1/4" x 2 3/4" x 9"—Legs

1 strip of brass gallery 7/8" x 22"

2 strips of brass gallery 7/8" x 18 7/8"

4 wrought-brass claw feet 1 3/16" x 2 7/32" x 1 3/16"

Single pedestal

1 pc.—1/2" x 9 3/4" x 9 3/4"—Shelf (mahogany plywood)

1 pc.—3/4" x 6" x 6"—Cleat

1 pc.—2 3/4" x 2 3/4" x 40 1/2"—Post

3 pcs.—1 1/2" x 3 1/4" x 12"—Legs

1 strip of brass gallery 7/8" x 28 5/16"

* Indicates finish sizes, allow 1/4" more for turning

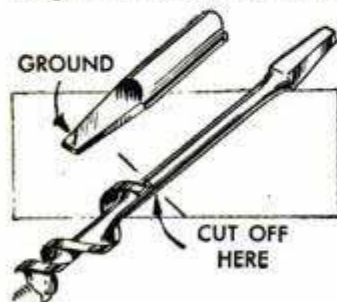
Cut-Flower Arrangement in Vase Held Firmly by Vermiculite



Courtesy The Zonolite Company

If the arrangement of cut flowers in vases plays an important part in the decor of rooms in your house, you undoubtedly will welcome this means of preventing them from being upset and disarranged easily. All that is necessary is to place the stems in a vase containing vermiculite, a new mineral product which will hold them firmly in almost any position desired once it is soaked with water. Being both absorbent and granular, vermiculite not only absorbs sufficient water to supply the life requirements of the flowers with one filling, but also permits both air and water to circulate freely about the stems. When adding water to the material, soak it thoroughly and then drain off the excessive water. If you use an extremely shallow container, it may be necessary to lay a piece of chicken wire over the top to help support long stems.

Improved Screwdriver Bit



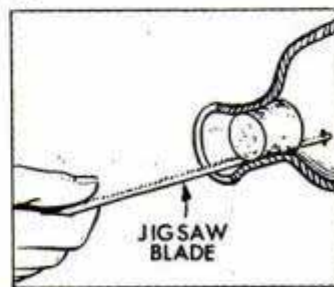
By cutting the shank from a damaged auger or twist drill, a screwdriver bit for a ratchet brace can be improvised in a short time, thus allowing you to go ahead with a job even though the hardware stores may be closed. With a hacksaw, cut off the shank at the flutes and then grind tapered flats on opposite sides of the shank to form the screw-

driver blade. Often, time can be saved in cutting the drill by deeply scoring the shank on all sides and breaking it from the body. Should you wish to harden the blade, heat it to a cherry red with a blowtorch and plunge the blade into cold water. The blade also may be formed on the cut end of the shank by heating and hammering instead of grinding. In this case, heat the end of the shank to a dull red and form the blade with a hammer. If desired, harden as above after forming.

D. A. Walker, Nashville, Tenn.

Cork Removed From Bottle With Jigsaw Blade

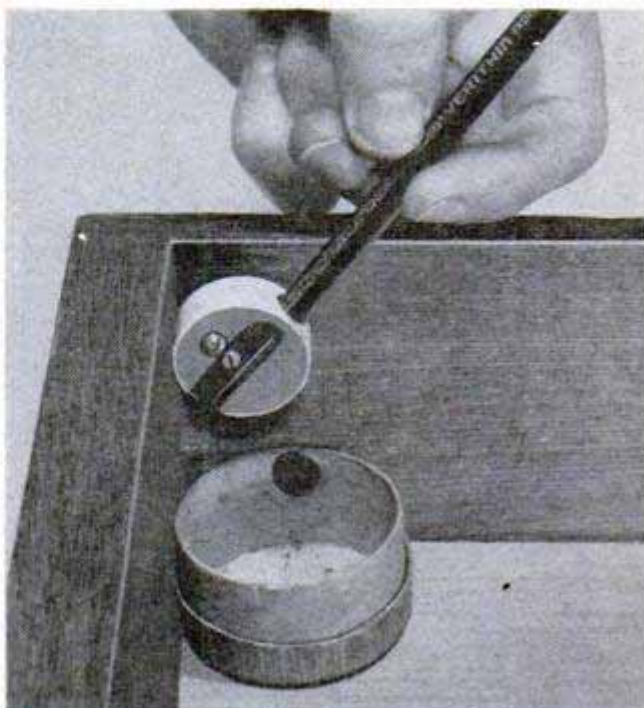
Retrieving a cork from inside a bottle very often can be done with a pin-end jigsaw blade. Insert the blade in the bottle, and with the latter tilted slightly



downward, use the toothed edge of the blade to work the cork into the neck of the bottle, after which the pin at the end will aid in drawing out the cork.

Pocket-Type Pencil Sharpener Attached to Inside of Drawer

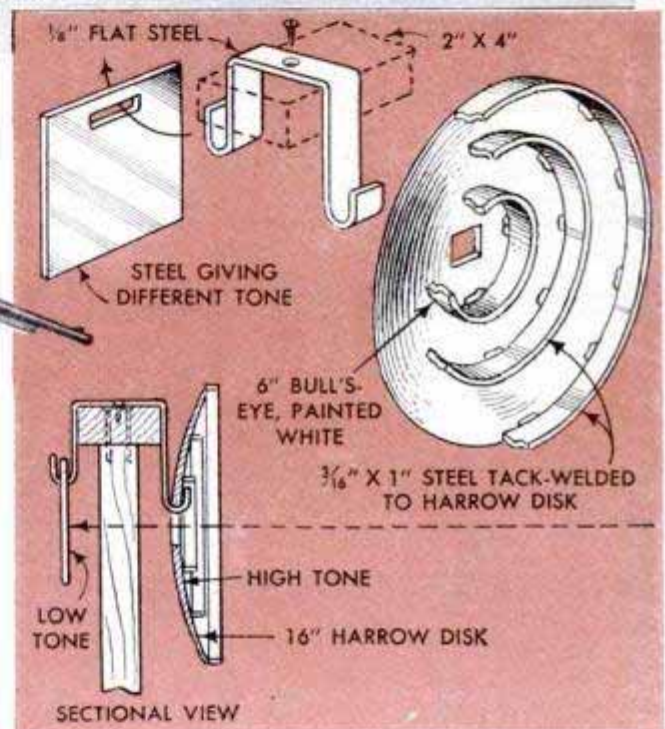
A pocket-type pencil sharpener will always be on hand if it is screwed to the inside surface of a desk drawer. Drill a small hole through the body of the sharpener for the screw, and then thumbtack a small receptacle under the sharpener to catch the shavings.—John J. Rea, Urbana, Ill.





TWO-TONE TARGET

HERE'S A NOVEL plinking target for your .22-cal. rifle, using regular ammunition. When hit, a disk-harrow blade gives out a high-pitched ringing tone, but a bullet that passes through the square center hole in the disk strikes a piece of $\frac{1}{4}$ -in. flat steel suspended directly behind the disk. The lower tone of the flat piece records the high-scoring shot. Set up the target as shown in the illustration above with a high bank of earth directly back of it to stop stray shots harmlessly. Height of the target can range from 3 to 6 ft. above the ground and the firing point should be at right angles to the curved face of the disk. For open-sighted rifles the range can vary from 25 to 75 yd., with 50 yd. a good average. Accurate shooting can be done with scope-sighted .22s at much longer ranges. Flat steel rings welded to the concave face of the disk prevent ricochets when using



ordinary lead bullets. If gallery ammunition with splashproof bullets is used the rings are not necessary. However, gallery-type ammunition is practical only for short ranges. It should be understood, of course, that this target is suitable only for use with .22-cal. rifles chambered for cartridges no larger than .22 long rifle.

Leaky Gas Line on Stranded Truck Sealed With Clay in Emergency

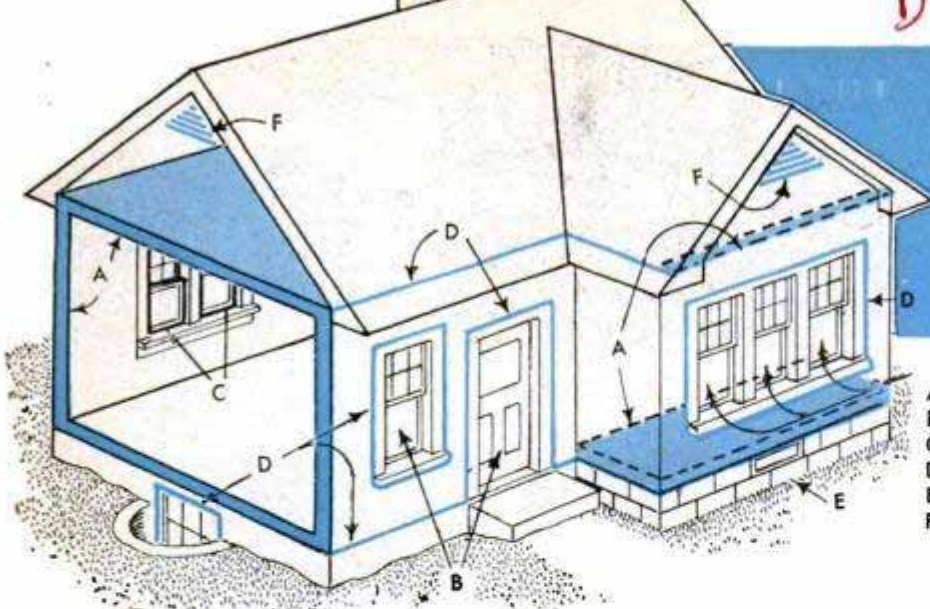
Finding themselves stranded some 15 miles from the nearest ranch in a truck with a leaky gas line, two hunters were forced to rely mostly upon their wits to overcome the predicament in which they found themselves. Picking up a wad of damp clay, one of the men kneaded it in the palm of his hand until it had the consistency of putty. He then applied a layer of the clay over the defective portion of the line and allowed time for it to dry. With

the line temporarily but effectively sealed, the men resumed their journey with no further difficulty. Nearly all types of clay will serve in this emergency if pressed tightly into contact with the fuel line.

Elinore Lamach, Klamath Falls, Ore.

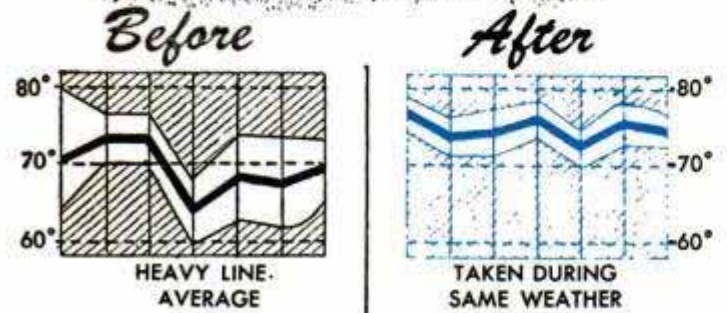
☐ To keep your lunch box looking like new, remove any rust with steel wool or fine sandpaper and then apply a coat or two of marine-type varnish to the metal.

STOP Those HEAT LOSSES

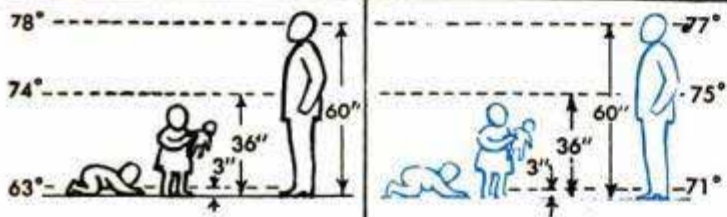


- A—INSULATION AND VAPOR BARRIERS;
- B—STORM SASH AND DOORS;
- C—WEATHER STRIPPING ON ALL SASH AND DOORS;
- D—ALL CRACKS CALKED;
- E—WALL ENCLOSES UNHEATED SPACE UNDER FLOOR;
- F—VENTS ABOVE INSULATION IN THE CEILINGS

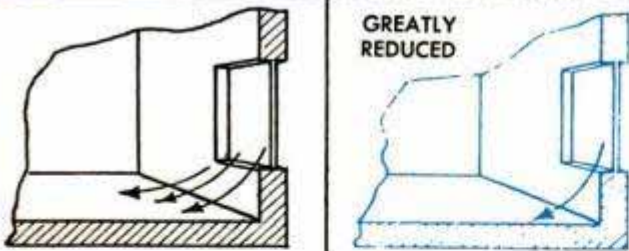
By E. R. Haan



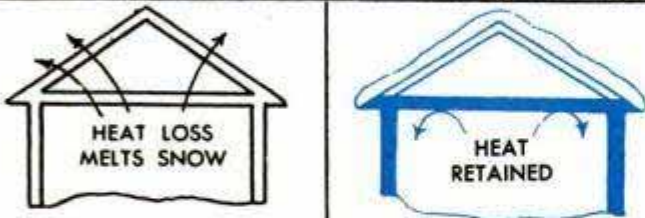
SEVEN-DAY RECORD OF TEMPERATURE VARIATIONS



RECORD OF TEMPERATURE AT VARIOUS HEIGHTS



COLD DRAFTS NEAR FLOORS



LOSS OF HEAT THROUGH ROOF

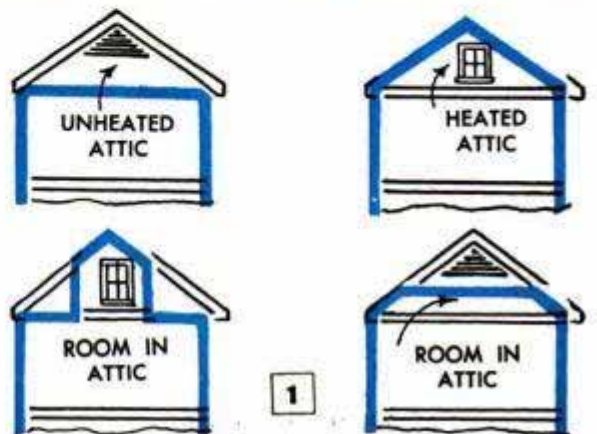


FUEL CONSUMPTION

ARE YOUR heating costs running too high and is it difficult or impossible to heat your home comfortably and uniformly in cold weather? In older homes installation of storm sash, weather stripping, and insulation and calking can reduce heat losses through the walls, ceilings and windows of the structure as much as 60 percent. Aside from the substantial saving, you will have a more comfortable, healthful home.

Insulation: Insulating values of different types of wall construction are given in Fig. 3, details A to J inclusive. Good insulating materials, properly installed, will last the life of the building and are resistant to fire, moisture and insect attack. There are four basic types, or kinds, of insulation—the loose-fill type, flexible batts, blanket and quilted forms, and the rigid-board and reflective metal-foil types. Many porous insulating materials are faced with a vapor barrier. Others require the installation of a separate barrier to prevent the passage of moisture.

Where to insulate: About 25 percent of the heat loss from the average uninsulated house is through the roof. Snow melts quickly from an uninsulated roof, even though the temperature is well below the freezing point. If it is desirable to insulate only a part of the house at one time, start with the top-floor ceiling or the roof, Fig. 1. Note also the details above and at the left.

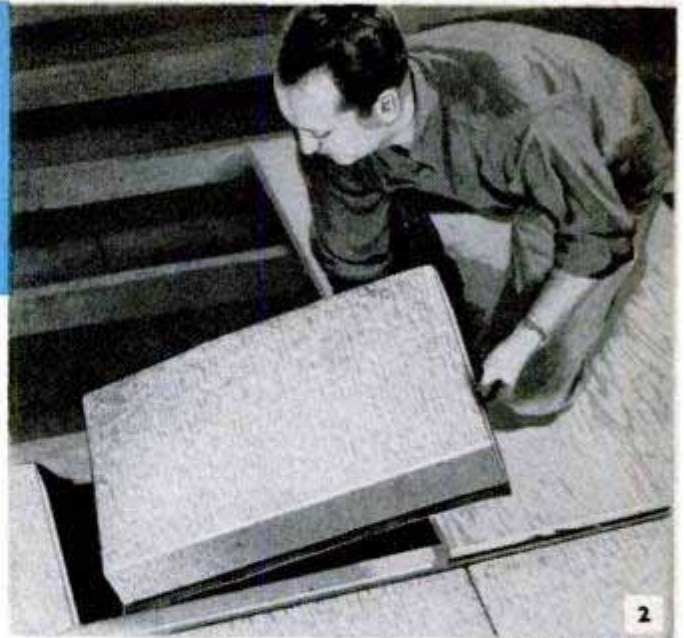


Insulation, storm sash, weather stripping and caulking can make older homes more livable and cut down costs

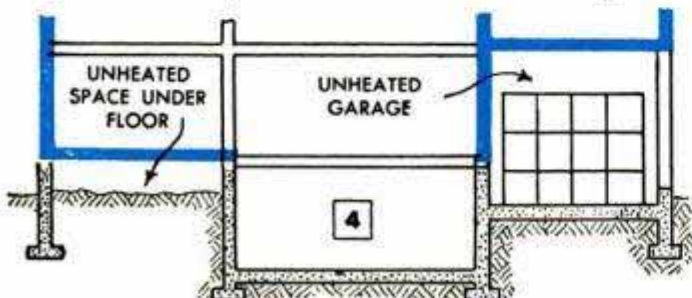
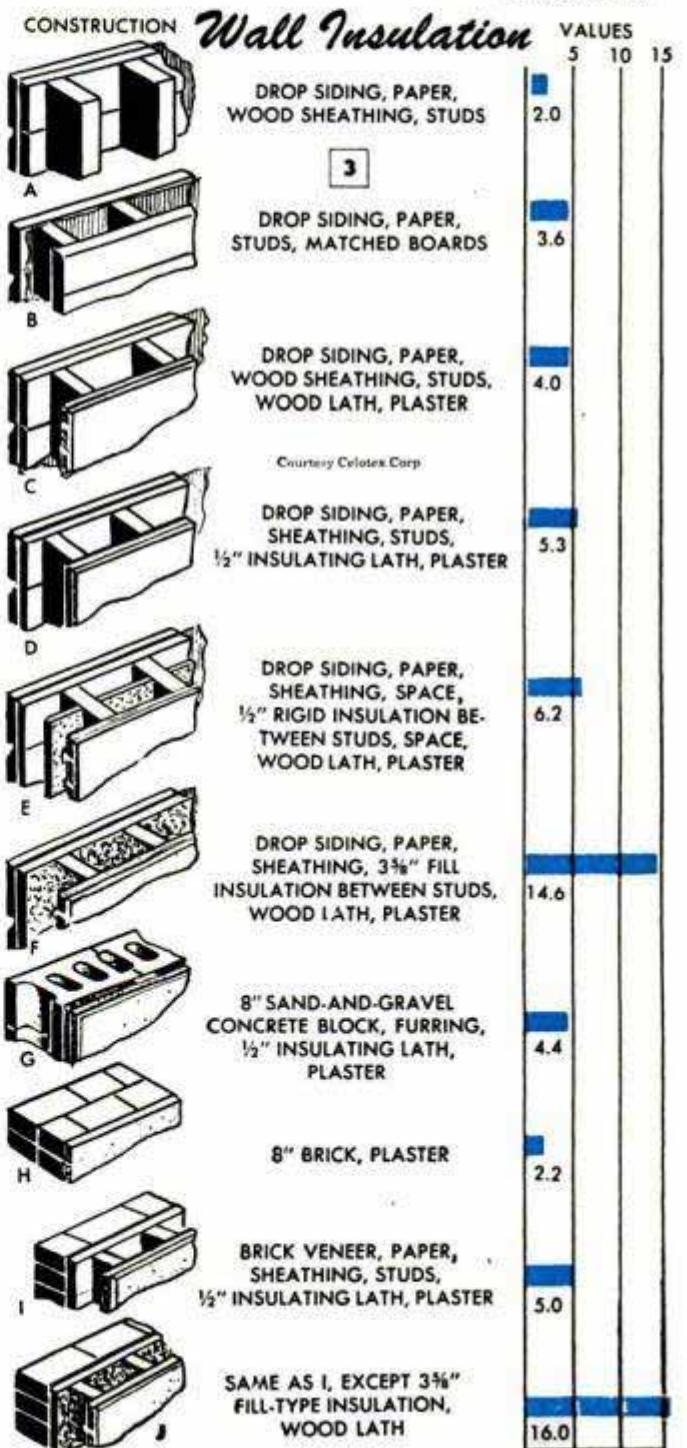
If you don't need a heated attic, insulate the ceiling, Fig. 2; if a warm attic is desired, insulate the roof. Rooms built in attics should be insulated above and on all sides facing unheated spaces. Next in importance to the roof or ceiling are the exterior walls. Include walls that separate living quarters from unheated spaces such as an attached garage or an attic stairway. Also insulate floors over unheated spaces, Fig. 4.

Importance of vapor barrier: If you live where the average January temperature is 35 deg. or less, condensation of moisture may occur if you insulate without vapor barriers. Moisture-laden air inside the house slowly penetrates the plaster and insulation and condenses to water or ice when it comes in contact with the cold inner surface of an exterior wall or roof, Fig. 6, A. Results of condensation are rotted wood, peeling paint, damage to inside walls and ceilings, and damage to insulation. To prevent this, install vapor barriers between the insulation and the heated interior of the house, Fig. 6, B. A vapor barrier may be a membrane (such as asphalt-saturated paper or felt, metal foil and waterproof wall covering) or simply vapor-resistant paint (such as aluminum paint, most lead-and-oil paints and spar varnishes). Ordinary tar paper and roofing felts are not suitable for this purpose. Insulation faced with vapor-barrier coverings, Fig. 5, can be installed directly between the studs or joists. The vapor barriers should also be used where air from a basement or crawl space can get into walls and pass upward to the attic. Walls of attic stairways must not be overlooked, and doors to attics should be weather stripped, painted or varnished, and sometimes insulated, too.

Venting spaces over insulation: When you insulate, be sure to ventilate the space

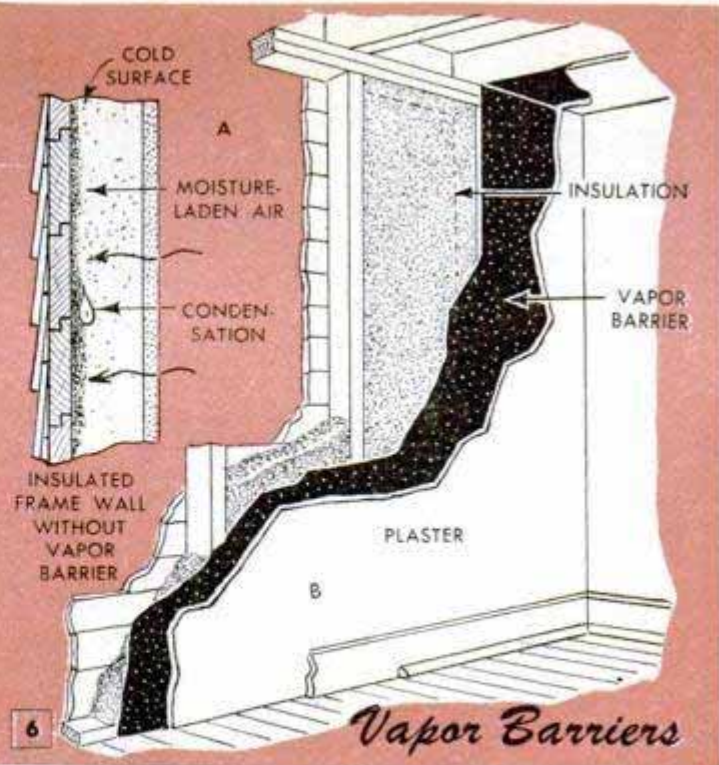


Courtesy Celotex Corp.





Courtesy United States Gypsum Co.



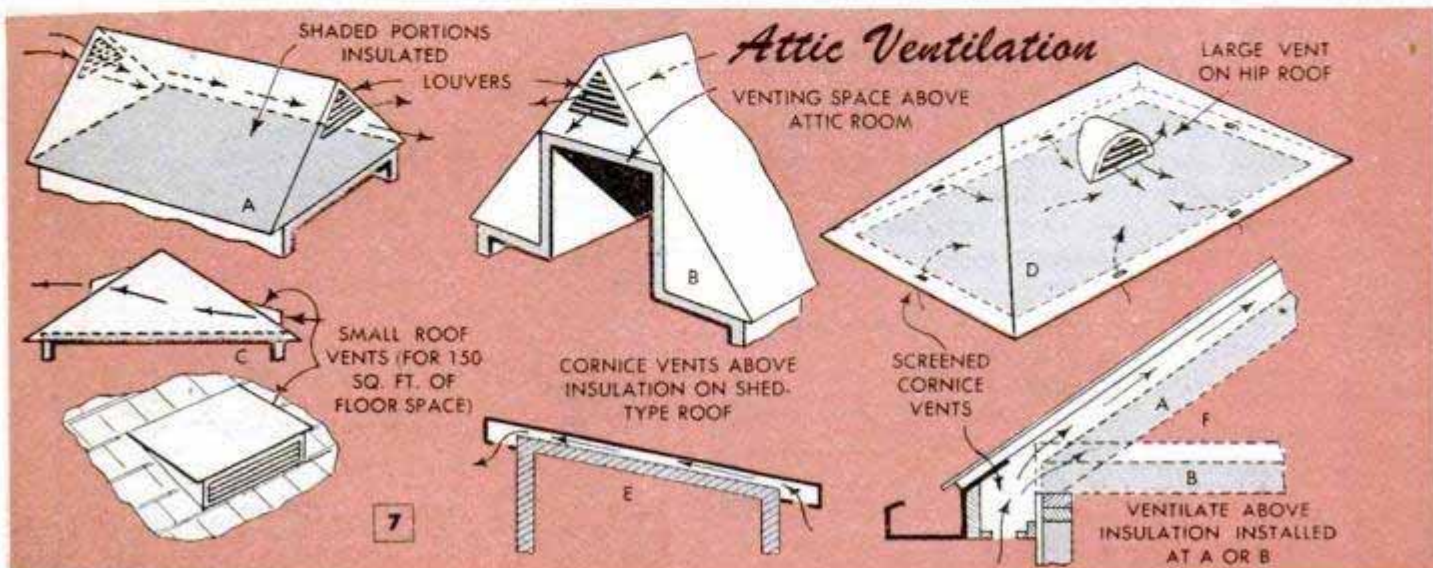
above insulated ceilings to minimize condensation on the underside of the roof. Fig. 7, A to F inclusive, shows several methods of doing this with louvers, roof vents and cornice vents. The area of the vents should be equal to at least 4 sq. ft. for every 1000 sq. ft. of attic floor area.

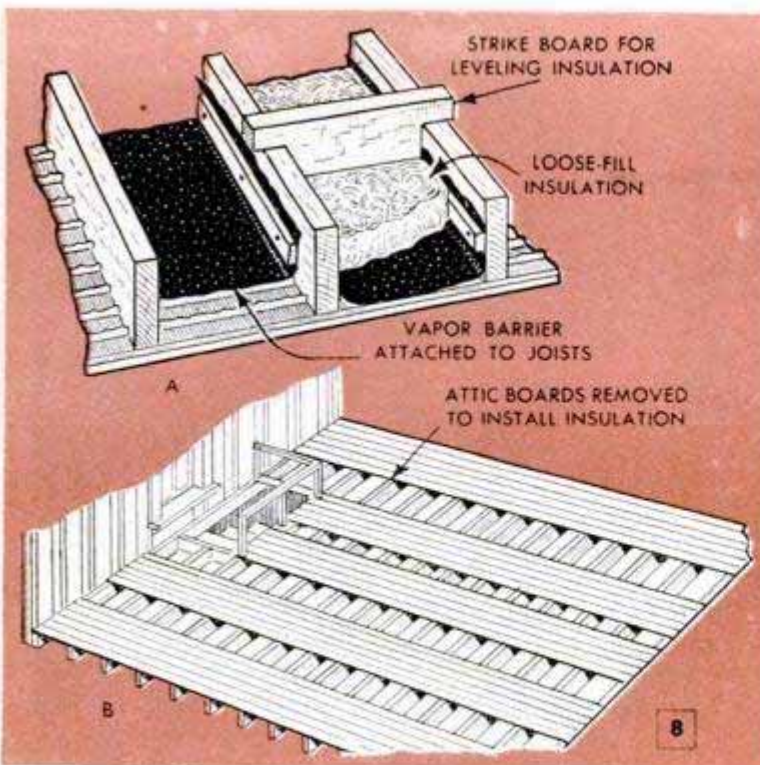
How much insulation? More insulation is needed in homes where winters are severe than where the climate is mild. For best results the thickness of insulation will depend on the kind of insulating material, the house construction, inside temperature to be maintained and other variable factors. It's best to consult a reputable dealer or contractor in your community who can advise you concerning the kind and quantity of insulation to install.

Loose fill: Loose-fill insulation comes in bags or bales. To cover a ceiling first install a vapor barrier, if necessary, directly on the ceiling. Cut the barrier to fit snugly

around all obstructions to minimize air leakage. Wedge it between joists or attach it to them with cleats nailed to the joists as in Fig. 8, A. Pour in the fill to a 4-in. thickness, Fig. 9, distributing it evenly with an improvised strike board that straddles the joists, Fig. 8. If the attic is floored, remove some of the floor boards, Fig. 8, B, so that the material can be distributed uniformly. If the area is finish-floored, it will be necessary to have a contractor blow the fill in. When this is done use water-resistant paint or wall covering on the underside of the ceiling to serve as a vapor barrier, if the climate requires it.

Insulating frame, stucco or brick-veneer walls of existing houses with loose fill generally is a job for a contractor as he has the equipment required to blow in the material as in Fig. 11. Strips of siding or other wall covering are removed temporarily and holes bored in the wall sheathing, Fig. 10.

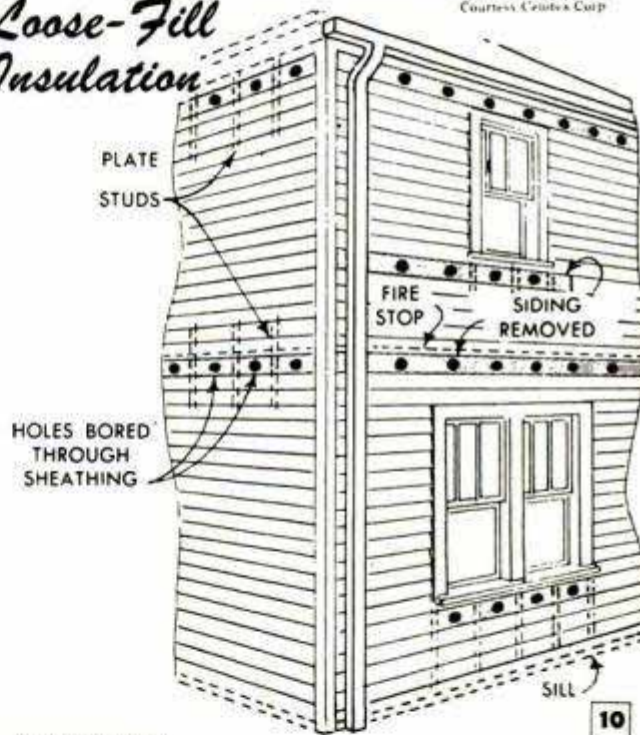


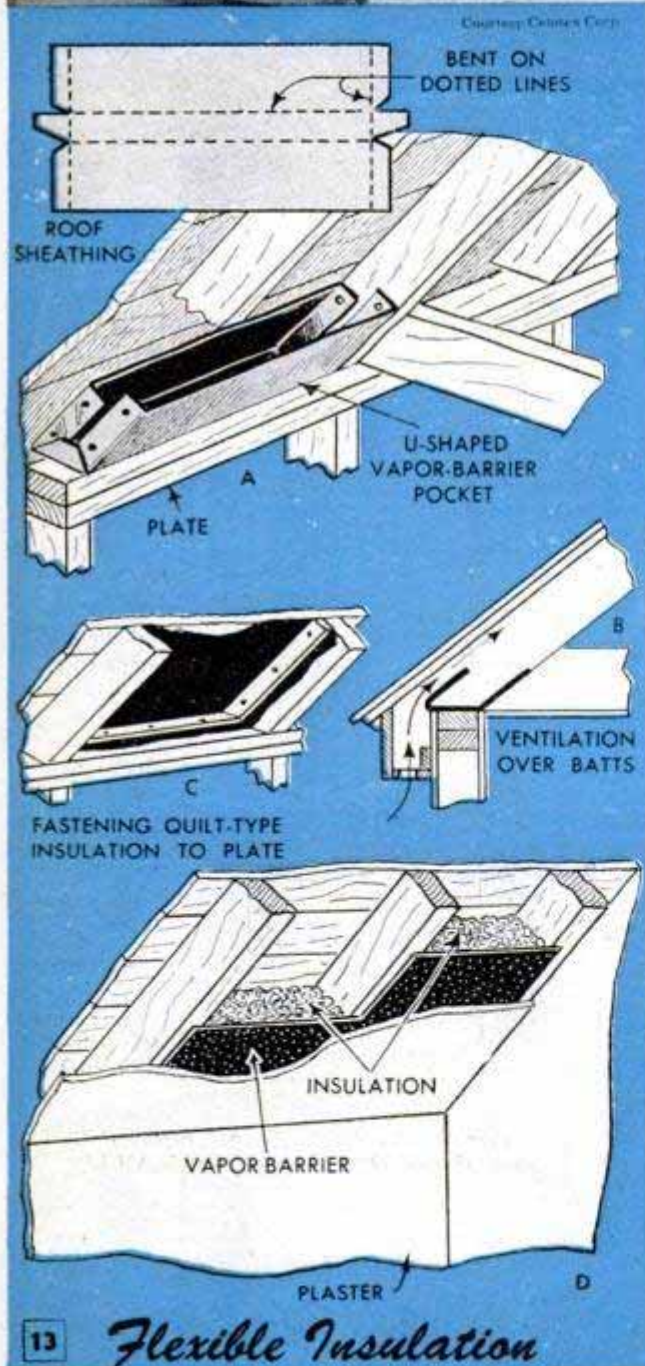


Be sure that all spaces are filled, including those under windows and fire stops.

Flexible insulation: Insulation in the batt, blanket and quilt forms comes in widths that fit snugly between studs, joists and rafters, and in lengths up to 48 in., or in rolls up to 100 ft. The thickness varies from $\frac{1}{2}$ to $3\frac{5}{8}$ in. When using flexible insulation, cut it to fit snugly around obstructions, placing it with the vapor barrier facing the inside of the house. Fill all spaces and push the ends of the batts together snugly. When insulating a sloping roof with batts or blankets, start at the eaves and work up as in Fig. 12. Make U-shaped barrier pockets to seal the spaces between rafters where they join the plate, tacking the pockets to the plate and to sides of the rafters as in Fig. 13, A. The lower end of the insulation fits in the pockets, which may fit tightly against the roof boards unless air is circulated from cornice vents. In this case space is left above the pockets and batts as shown in Fig. 13, B, and at A and B, detail F, in Fig. 7. The air space at B is left when only the floor is insulated. Detail C, Fig. 13, shows how quilt-type insulation is fastened with strips to the plate and rafters. If the vapor-barrier facing on batts has flanges at the ends, these should overlap each other. The side flanges are tacked or stapled to the rafters. Where a portion of the roof serves as a room ceiling, the wall covering will come directly against the vapor-barrier facing of the batts as in Fig. 13, D. When installing flexible insulation in walls, start at the bottom, filling all spaces between studs, and cut the batts or blankets as

Loose-Fill Insulation





Courtesy United States Gypsum Co.

necessary to fit snugly into corners and against obstructions. If you encounter water pipes in exterior walls, place the insulation between them and the sheathing.

Rigid insulating board: When remodeling or adding a room in an attic, you have the opportunity to use rigid insulating board, Figs. 14 and 15. It also has a structural value, some forms being used as sheathing, some as a plaster base, and others having a finished surface to serve as a wall covering. The board ranges from $\frac{1}{2}$ to 1 in. in thickness and comes in sheets 4 ft. wide and up to 12 ft. long. It also is available in smaller panels or in squares. The edges of panels or squares may be square, beveled, rabbeted or tongue-and-groove. Small panels are arranged horizontally and are staggered so that the joints of adjacent rows come on different studs as in Fig. 15, A. As the panels usually have interlocking edges, no horizontal nailing supports are needed between studs. Large sheets should extend from floor to ceiling as in Fig. 15, B. When shorter sheets are used, cross supports for nailing are necessary. Nail sheets to the center supporting studs first then at the edges. Space the nails 4 to 6 in. apart and about $\frac{3}{8}$ in. from the edges, using special nails available for the purpose. When rigid insulating board is used between studs, joists or rafters, it is cut to fit snugly and nailed to 1-in. strips. It also is used under floors—either sub-floors or finish floors—leaving a $\frac{1}{8}$ -in. space between sheets to allow for expansion.

Insulating masonry walls: To insulate a masonry wall, first coat it with asphalt dampproofing compound. Then nail the insulating board to 1 x 2-in. furring strips spaced 16 in. on centers as in Fig. 16. Use



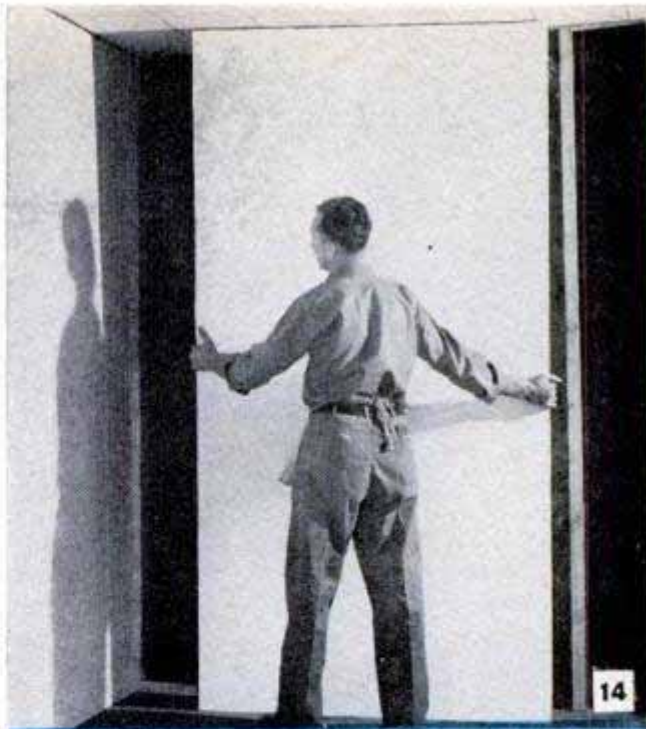
Courtesy Celotex Corp.

expansion sleeves or other screw anchors for attaching the furring strips to concrete. Thin blanket insulation can be inserted between the strips before attaching the board to obtain added insulating value.

Reflective foil: Reflective foil comes separate or as a facing on other forms of insulation and also as a facing on plaster-board. In insulating value it is roughly equivalent to $\frac{1}{2}$ -in. insulating board when exposed to an air space not less than 1 in. wide, Fig. 16. The foil also is an effective vapor barrier. Since it does not absorb heat like other forms of insulation, it is particularly useful in warm climates. Several sheets separated by air spaces also may be used. A small amount of dust on the foil does not greatly reduce its reflective power.

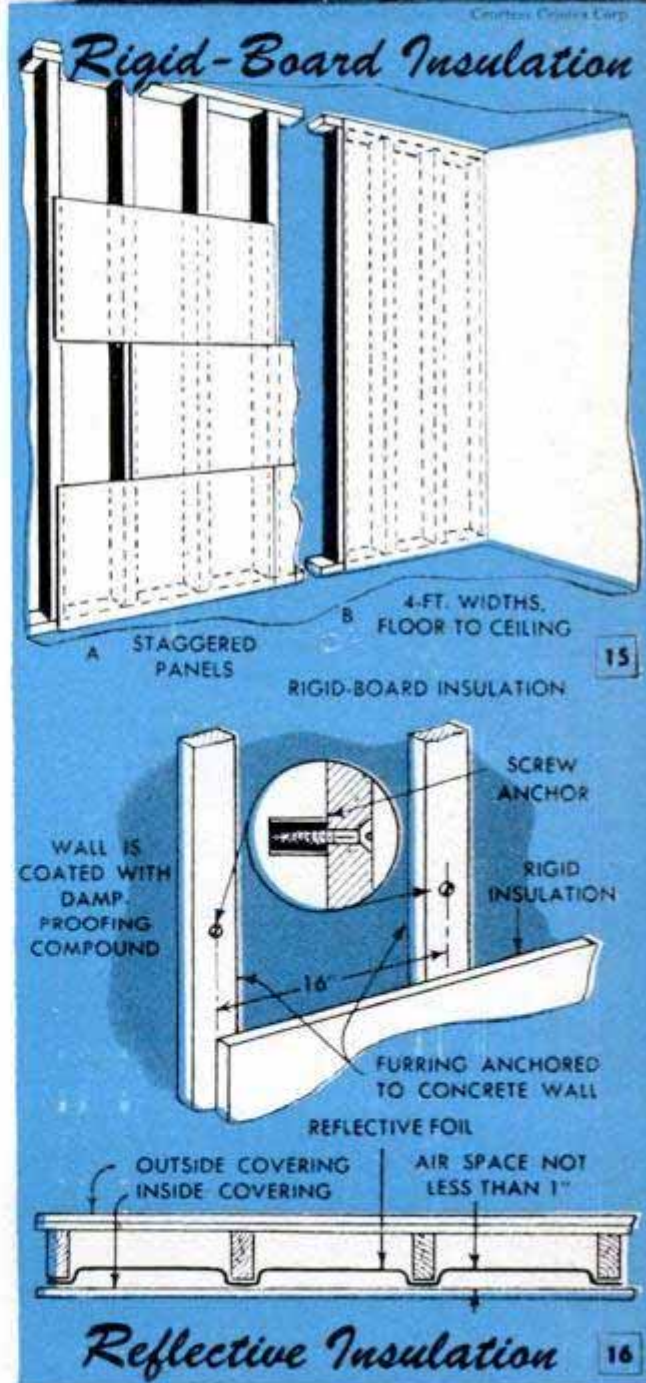
Storm sash: A properly fitted storm sash provides a dead-air space between it and the regular window, which acts as insulation. Tests at the University of Illinois have proved that a 20-percent fuel saving is possible in most homes when they are completely equipped with tight storm sash and storm doors. Another result is a 1 to 2-deg. temperature increase at the floor level. Besides saving heat, storm sash reduces condensation on windows.

If you cannot equip the entire house at one time, start by installing storm sash on the sides facing the prevailing wind direction. The inside surface of storm sash should fit tightly against the blind stop of the window casing, Fig. 18, but the sash should have $\frac{1}{8}$ -in. clearance around the edges, detail A, to compensate for swelling. If surface irregularities of contacting surfaces of sash and casing prevent a tight fit, you can seal the joint by using felt or sponge-rubber strips glued in a rabbet cut



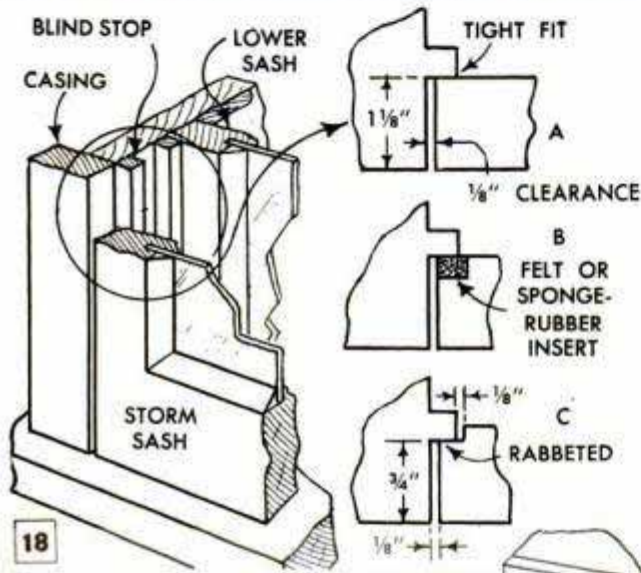
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Courtesy Celotex Corp.





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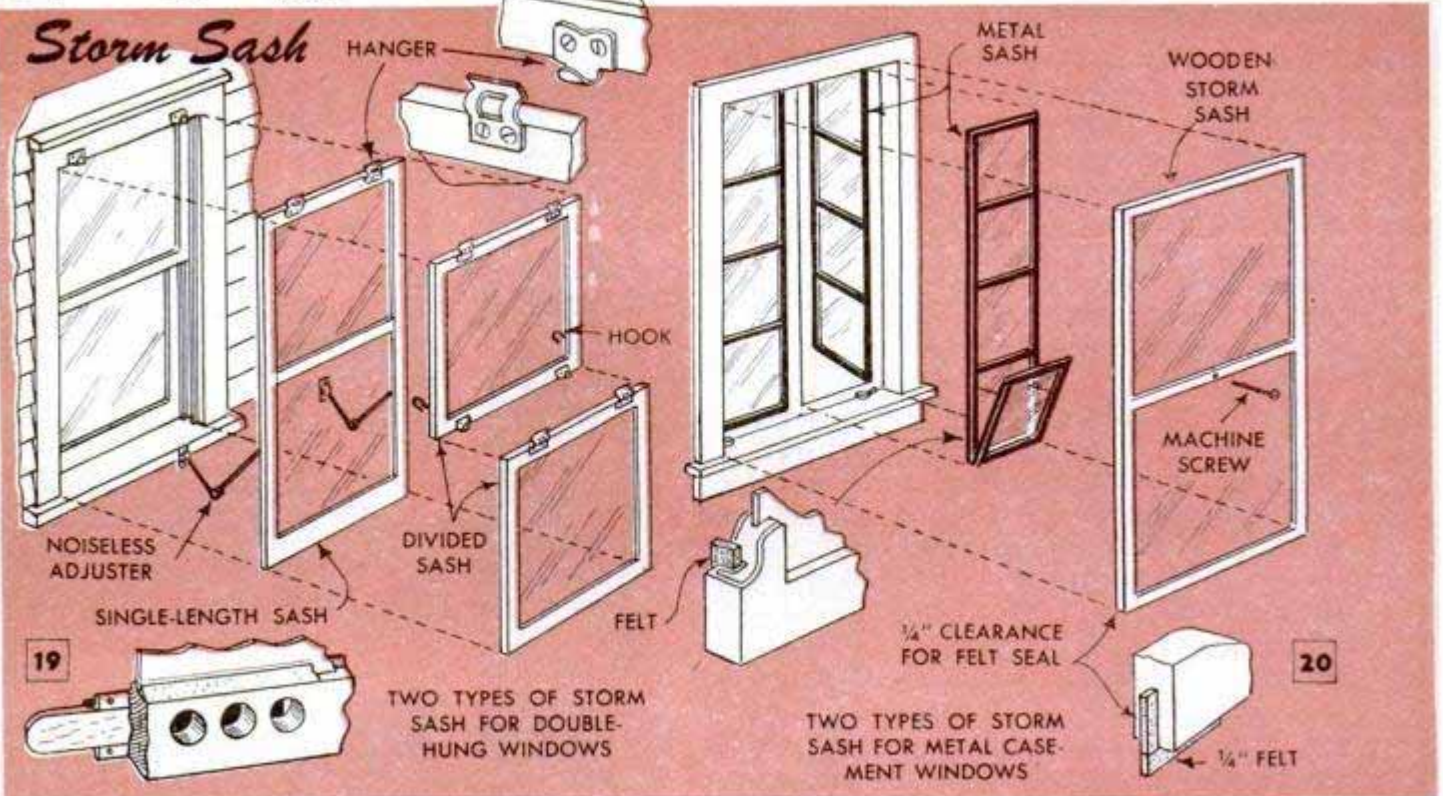


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along the edge as in detail B. Edges of 1 1/8-in. sash frames are rabbeted to make them fit old-style 3/4-in. casings, as in detail C. Storm sash for double-hung windows is available in full length or in sections, Fig. 19. Divided sash can be passed through a window and hung from the inside of the house, eliminating the need of a ladder. To hold storm sash in place, use sash hangers at the top and hooks and eyes at the bottom. Where ventilation is desired, use sash adjusters to hold the sash open or lock it when closed. As an alternative you can use ventilating openings in the lower rail.

Metal-framed storm sash for metal casement windows are applied from the inside, Figs. 17 and 20. As they generally cover individual window sections only, they do not stop condensation on the frames. To prevent this you can use a wooden sash to cover the entire window as in the right-hand detail of Fig. 20. The use of dual panes in windows as a substitute for storm sash is effective in reducing heat loss by conduction but does not prevent air leakage at the edges of the window frame or stop condensation on the frames.

Weather stripping: All types of fabric, felt and rubber weather stripping are subject to wear and shrinkage which gives them only temporary value. Fig. 22 shows how to apply various kinds to a double-hung sash. Metal weather stripping, available in various widths, is easy to install and is permanent. Exposed ends are bent back slightly to avoid catching in the wood when the sash slides over them. Fig. 23 shows how this type of weather stripping is installed on a doorframe. Note that it is cut



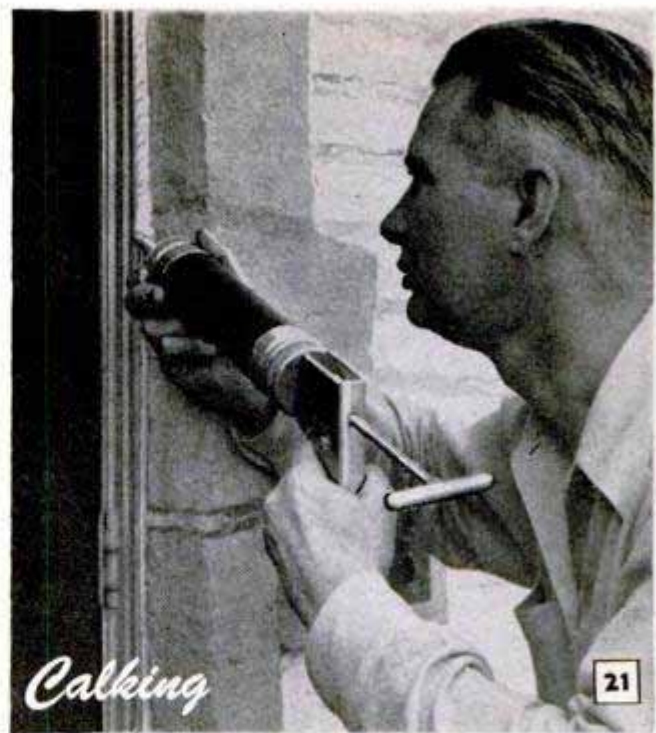
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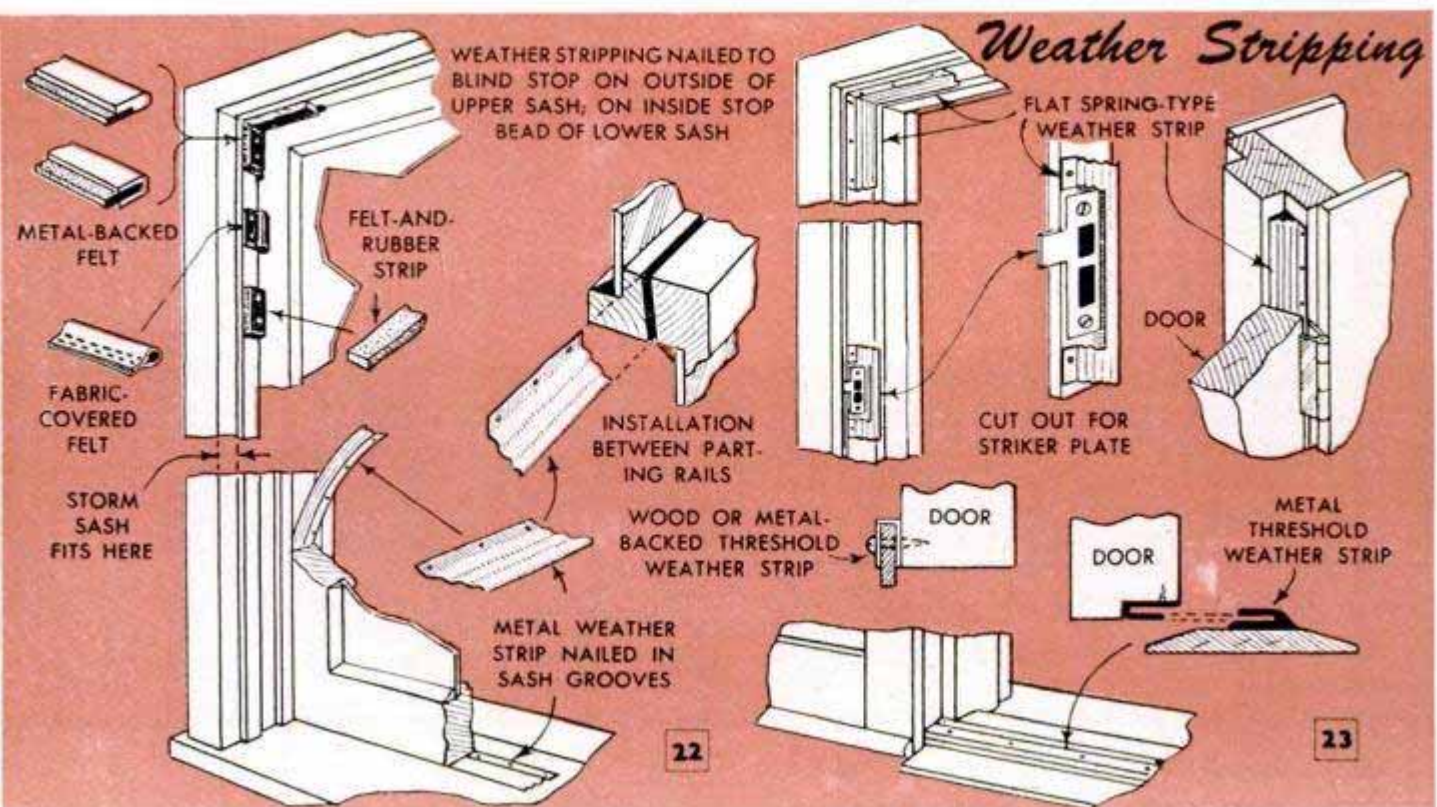
away at the striker plate. The threshold can be fitted with a wood or metal-backed felt weather strip but, for appearance and durability, a rigid metal weather strip consisting of two interlocking members is preferable. On wooden casement windows, felt or fabric weather strips go on the outside, but the flat-metal type is fitted in the same manner as on doorframes. If necessary, dress down edges of tight-fitting sash to provide clearance for the strips. On metal casement windows, the metal-framed storm sash usually has felt inserts which provide a tight seal and thus serve as weather strips. You can seal metal sash, however, by gluing rubber tape to the frame all around, using automotive rubber cement.

Calking: A fairly high percentage of heat is lost through spaces at window and door frames and through cracks at points where walls join roofs and foundations, or where pipes and conduits pass through walls. To reduce this loss fill narrow cracks with calking compound, using a calking gun as in Fig. 21 which forces the compound deeply into the cracks by pressure. Before calking, brush out loose particles of dirt from the crevices. Don't use the compound alone to fill wide cracks and openings as it will shrink and pull loose. Wide spaces must first be packed with oakum or jute before calking. Hammer this tightly in place with a blunt-edge tool so the filling is almost flush with the opening but leaves enough space to take a layer of calking compound as a final seal.

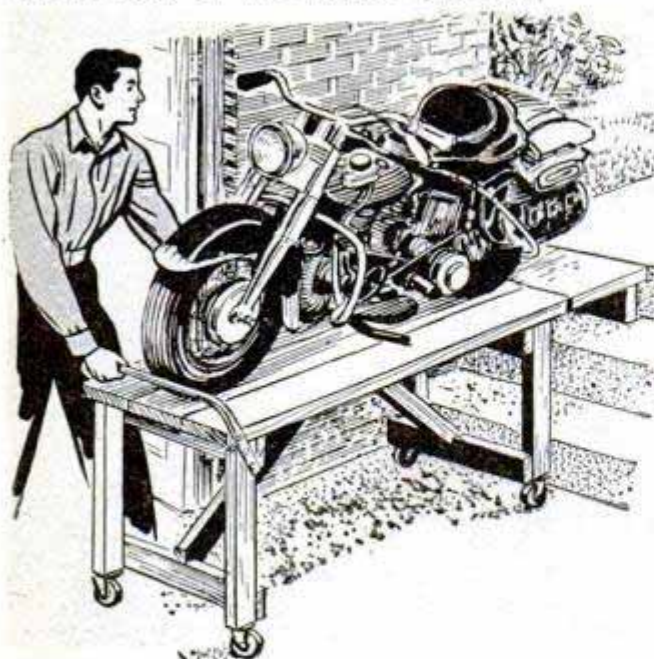
Curtain walls: If you have a basementless home built on piers instead of on a solid, continuous foundation and cold



weather makes the floor uncomfortable, a curtain wall may be the solution to the problem. This should have vents for cross circulation during warm weather and, if necessary, be provided with an entranceway. In cold climates both a curtain wall and adequate insulation under the floor are necessary. When batts or blankets are used between the floor joists, the vapor barrier should be laid face up. The batts can be given added support by nailing wallboard or wire mesh to the underside of the joists. Floors of basementless houses need not be insulated if the heating pipes or ducts pass through the crawl space, or if the space is insulated on all sides. ★ ★ ★



Motorcycle Stored in Basement With Aid of Portable Stand



In order to bring a motorcycle into his basement for maintenance and storage, one owner built a wooden stand having a hinged ramp at one end which bridges the steps so the machine may be rolled upon it. The stand, which is provided with large casters on the legs, can be wheeled to any part of the basement where it then serves as a workbench whenever repairs are to be made. Built less than half the width of a stair well, the stand is moved to one side of the opening to allow room for use of the steps when the motorcycle is rolled on or off the ramp. A handle formed from electrical-conduit pipe is bolted to one end of the stand to aid when maneuvering it into position. Construction details will vary depending on the size and weight of the motorcycle as well as on the layout of the basement.

Sack Duster for Home Garden

Deciding that my small home garden was in need of dusting, I thought of an easy way to do the job with little more than a piece of burlap and a small quantity of insecticide powder. I cut out a square piece of the cloth, placed several scoopsful of the powder on it and then gathered up the corners which I clutched in one hand. Holding the sack thus formed above the plants, I pro-

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ceeded to shake it gently, causing the powder to sift through and settle evenly over each of the plants.

Charles L. Stratton, Hollis, N. H.

Sandpaper Mask Around Keyhole Helps Guide Key at Night

Cut to fit around the keyhole of a door, a sandpaper mask will make it much easier to locate the hole for inserting a key in the dark. The roughened surface can be detected quickly by running the fingers over the area or by probing with the key itself until it grates against the sandpaper. The mask is attached with glue and painted to approximate the color of the finish of the lock.

Bess Ritter, New York City.



War-Surplus Vibration Dampeners Provide Typewriter Feet

I have found that small shear-type vibration dampeners of the type used during war-time for mounting delicate instruments in planes and tanks serve usefully as cushioned feet for standard and portable typewriters. Available in plentiful supply in war-surplus stocks, the dampeners are bolted in place where they effectively absorb and prevent transmission of vibrations from the typewriter to the table upon which the machine is rested.—Ken Murray, Colon, Mich.



Bobbins Stored on Nail

Here's one way to keep several bobbins together for locating them easily and also for making possible a quick, at-a-glance selection of the thread colors desired. All that's necessary is to slip the bobbins over a common nail and then press a cork over the pointed end to keep them in place. If one nail isn't enough to accommodate the bobbins on hand, use as many as are necessary and tie them together.—Don Nielson, Aurora, Neb.



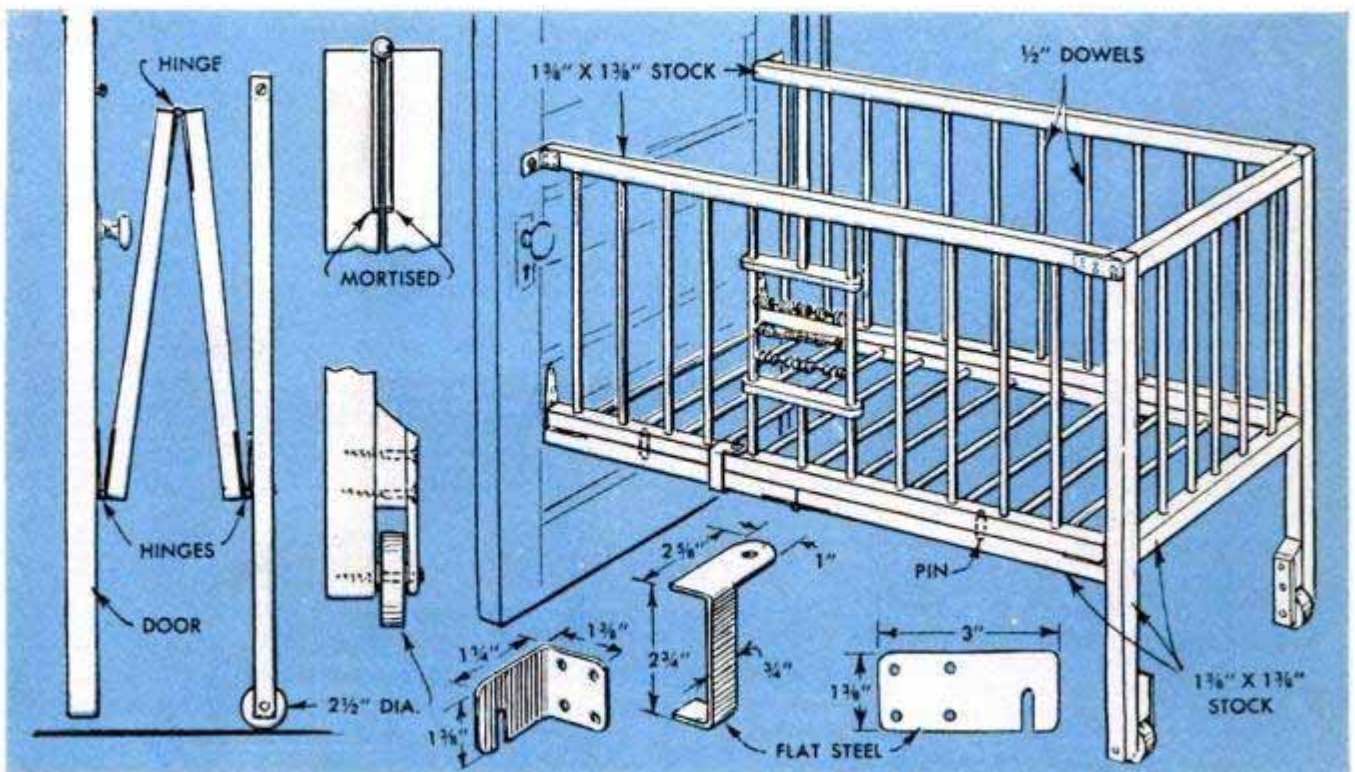


FOLDAWAY CRIB

By
**Charles and
Bertram Brownold**

A TAKE-OFF on the space-saving idea of the in-a-door bed, this on-a-door crib will appeal to young parents living in limited quarters. Attached to the inside of a closet door, the crib, minus the sides, is designed to fold flat and to swing with the door. The closet, of course, provides convenient storage for the standard mattress and sides of the crib. The bottom of the crib consists of two hinged sections which are locked in the open position by the side panels. Holes for the side-panel dowels are aligned by clamp-

ing top and bottom rails together and boring at one time, drilling only about $\frac{1}{2}$ in. deep into the top rail. Glue, plus wedges driven in saw cuts made in the ends of the dowels, anchor the latter in the rails. Projecting dowel pins in the lower rails of the side panels fit registering holes in the bottom assembly and a pivoted metal fixture clamps the two together. Slotted flat-steel plates engage round-headed screws to attach the side panels to the end panel and closet door.



Shutters Used Inside Windows In Place of Venetian Blinds



The use of outdoor shutters mounted on the inside of clear-glass windows in place of Venetian blinds proved satisfactory in the bathroom of one home. Made attractive with a coat of white enamel, the shutters not only can be opened and closed easily but also may be completely concealed behind draw drapes if desired.

Grover Brinkman, Okawville, Ill.

Tamp Improvised From Scrap Parts



One farmer, preparing to begin construction of concrete floors and walks about his farm, found that an effective tamp could be improvised from materials found in a scrap pile. He simply welded a large

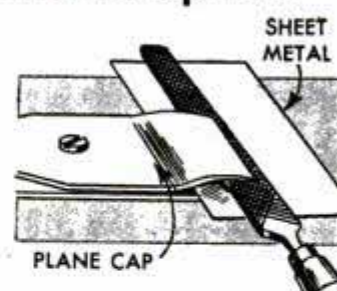
Have you heard?

There's a new type of heating that casts a blanket of warm air around the cold, exterior walls of a home. It's simple, it's clean and best of all it's comfortable. The ducts warm the floors and the outlets heat the perimeter, or outside walls. This low-cost forced-air heating system, big news in the home-building industry, is normally installed in houses built on a concrete slab, but the principles can be applied with great advantage to homes with basements. For details, see the feature article in the October issue.

gear from an old farm implement to the end of a length of pipe which formed the handle. A piece of shafting may be used in place of the pipe if desired.

Reshaping Hand-Plane Cap Iron

Accurate work cannot be done with a hand plane having a nicked chip breaker, or cap iron. A simple way of reshaping the breaker is to slacken the screw holding it to the plane iron and then place a piece of thin sheet metal over the plane iron to protect the cutting edge. Place a double-cut mill file under the edge of the breaker and on top of the sheet metal as shown. Then draw the file back and forth slowly to remove nicks and burrs from the edge of the chip breaker.



John Owen, Hawthorne, Fla.

Shield Under Coffee-Pot Handle Prevents Burned Fingers

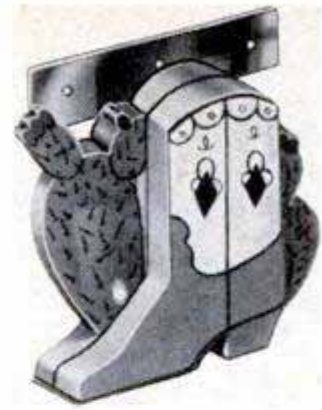
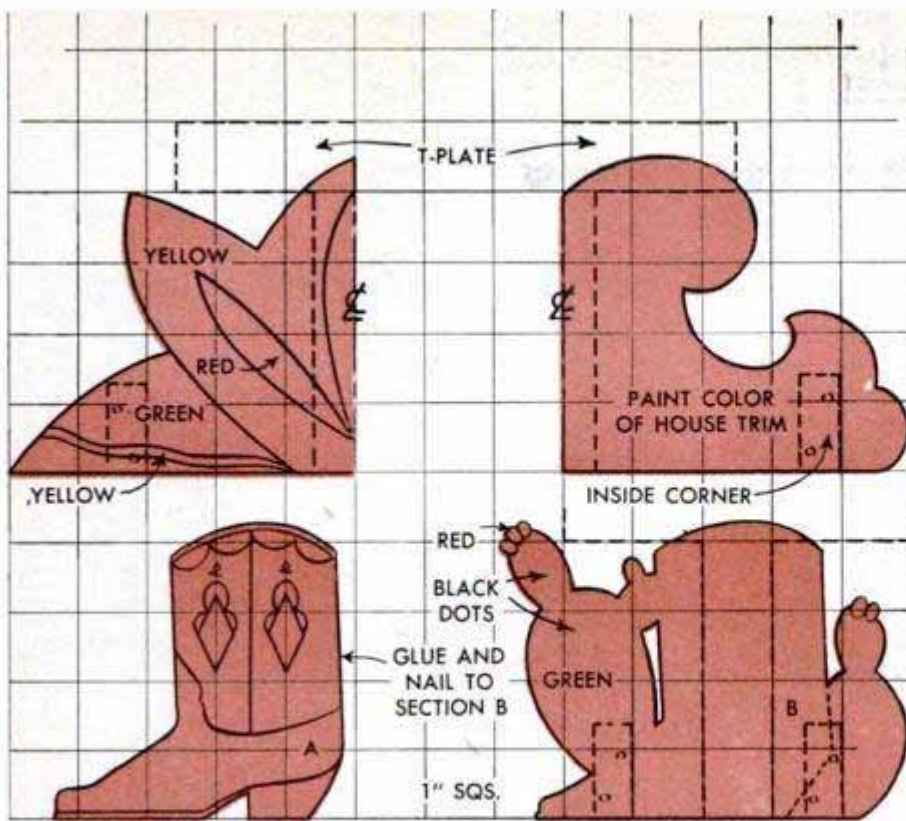
A small shield fitted under the handle of a coffee pot to be heated over an open flame not only will prevent the flame from charring the handle but also will keep it from becoming hot enough to burn the fingers. First, the pins which secure the lower end of the handle must be removed. After applying cellulose tape around the pins to protect the metal, file the peened ends of the pins and then use a small punch and a hammer to loosen and remove them. These pins will have to be replaced. Now cut a piece of sheet metal, brass or aluminum—preferably metal matching that from which the pot is made—in the shape of a fan and punch holes in the narrow end to align with the pin holes. All that remains to be done then is to insert the shield under the handle and rivet in place.



Harry Suttle, Springfield, Ohio.

Substitute Brush for Electric Razor

If the small cleaning brush supplied with an electric razor has been lost or mislaid, use a pipe cleaner as a substitute. The pipe cleaner will do a reasonably good job of removing particles from the razor head and will not damage the razor.

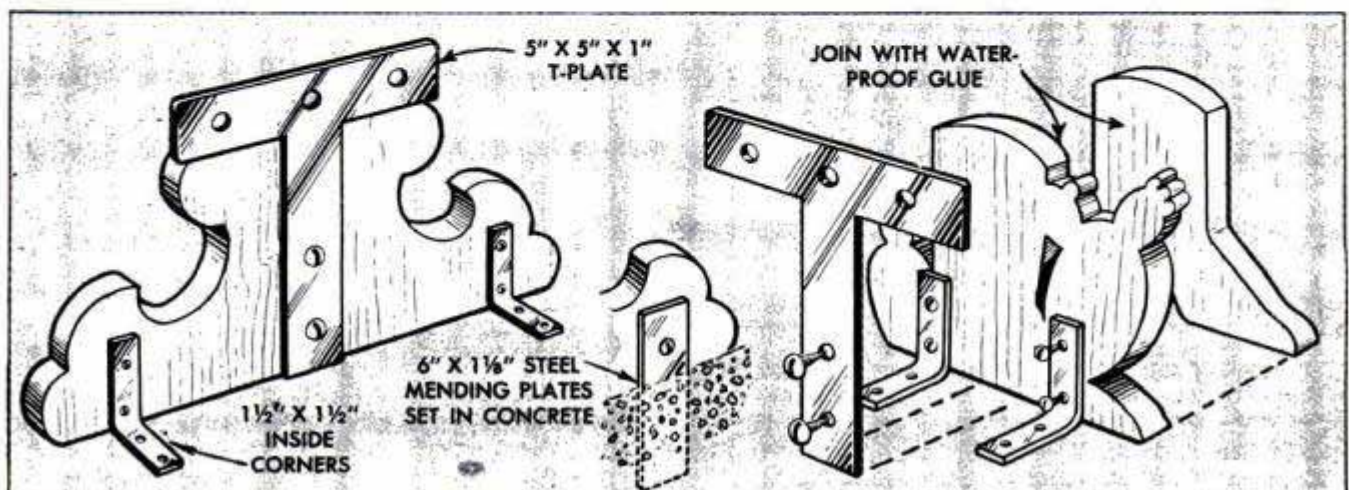


Jigsawed Boot Scrapers

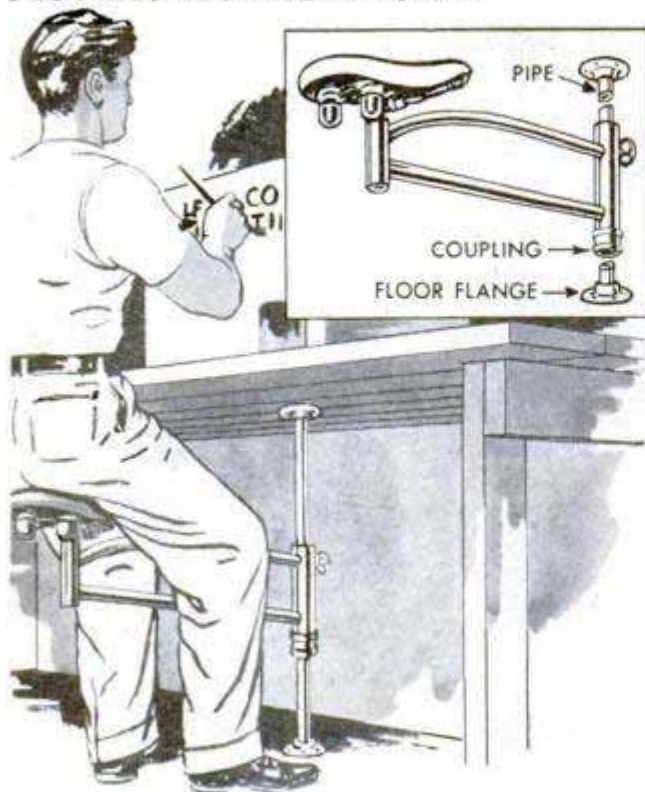
By Roberta L. Fairall

AS EYE-CATCHING as their cast-iron counterparts and far less expensive, these attractive boot scrapers are made from $\frac{3}{4}$ -in. outdoor plywood and common mending irons. They can be turned out quickly for your own use or as a salable basement-shop product. Note that the cowboy-boot design consists of two parts, the boot, part A, being joined to the cactus background, part B, with waterproof glue. The detail below shows how large T-plates are screwed to the backs of the cutouts to serve as scraper blades. If you wish to mount the scraper on a wooden porch, fasten an angle bracket near each end of the cutout.

However, if the scraper is to be set in the lawn, screw 6-in. steel mending plates to the cutout and set the ends of the plates in concrete. Before attaching the hardware to the cutouts, locate and drill the pilot holes for the screws and paint the wood. Give the entire cutout a coat of flat-white paint and then paint to match the house or decorate in suggested colors. For the latter, use tube oil colors mixed with turpentine, 1 part, and spar varnish, 1 part.



Section of Old Bicycle Frame Provides Workbench Stool



Mounted so that it pivots out of the way under a workbench when not in use, this handy seat is provided by cutting the saddle section from a discarded bicycle frame and installing it as shown. Two lengths of pipe are joined by a coupling and attached to the floor and underside of the bench by floor flanges. The pipe is cut in lengths which, when joined together with the coupling, will in turn permit the coupling to support the seat at the desired height. A hole is tapped in the pivoting joint to take a thumbscrew with which the unit may be locked in place under the bench.

Citrus Fruit Attracts Birds

If you want to attract large numbers of birds to your back yard during warmer weather, set out sections of citrus fruit at the feeding stations. Apparently many birds are especially fond of this type of food and will return again and again for the fruit. A wire soap dish nailed to a

Zooooom!

There goes a tiny model plane under such perfect control you can fly it around the living room. Driven by an ingenious hand-held motor, the craft will dive, climb and loop at a flick of your wrist. Actually the plane is powered by its own tether, a length of piano wire which constantly rotates to spin the propeller. This miniature flexible shaft is whirled by a battery-operated motor. Want to pilot the plane around your house? Don't miss this project coming up in October.

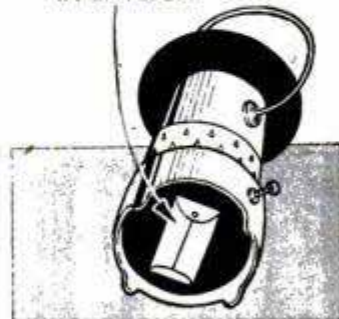
tree or to the side of a feeding station not only forms a convenient holder for the fruit but also serves as a perch. Because of its susceptibility to freezing temperatures, citrus fruit is not suitable for this purpose during cold weather.

R. M. Woodbury, Natick, Mass.

Extra Mantles Carried on Lantern

By attaching extra mantles to a gasoline lantern, you can safeguard against the possibility of being inconvenienced if one is broken when you are far removed from the source of a replacement. The extra mantles may be enclosed in a heavy envelope and taped to the bottom of the lantern as shown.

EXTRA MANTLES
IN ENVELOPE



Charles A. Haugh, Fort Wayne, Ind.

"Rodding" Clogged Auto Radiator

When old auto radiators of the flat tubular type become clogged to such an extent that flushing will not remove the scale, they usually can be restored by rodding the tubes with a length of flat steel. Cut openings through the top with a fine-toothed hacksaw blade and bend the pieces back as shown. Then insert a length of thin sheet metal in each tube and work it through slowly, turning the metal strip as it progresses. If available, a short length cut from an old bandsaw blade is just the thing for this job. When all scale has been removed from the tubes, press the bent sections back into place and solder the joints. This accomplished, flush the radiator in the regular manner.

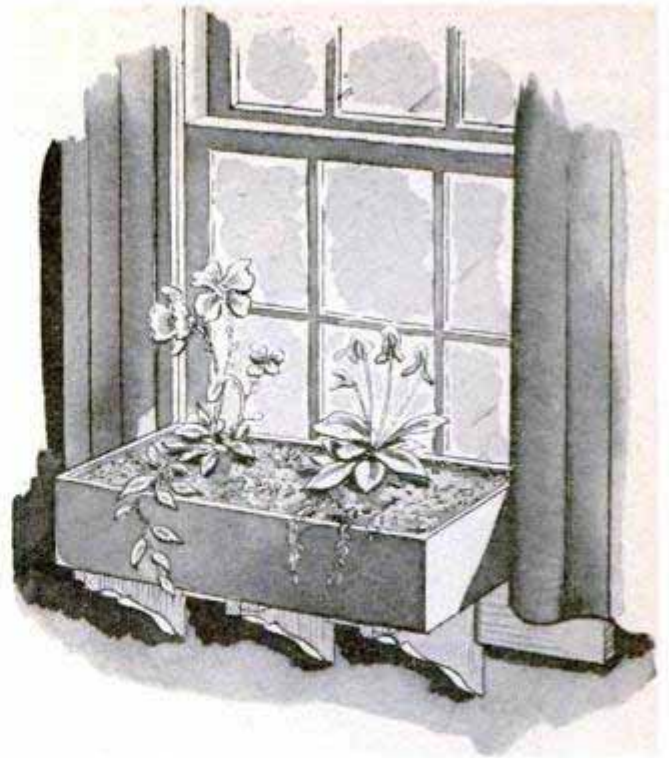
Richard Hanscom, Elmhurst, Ill.



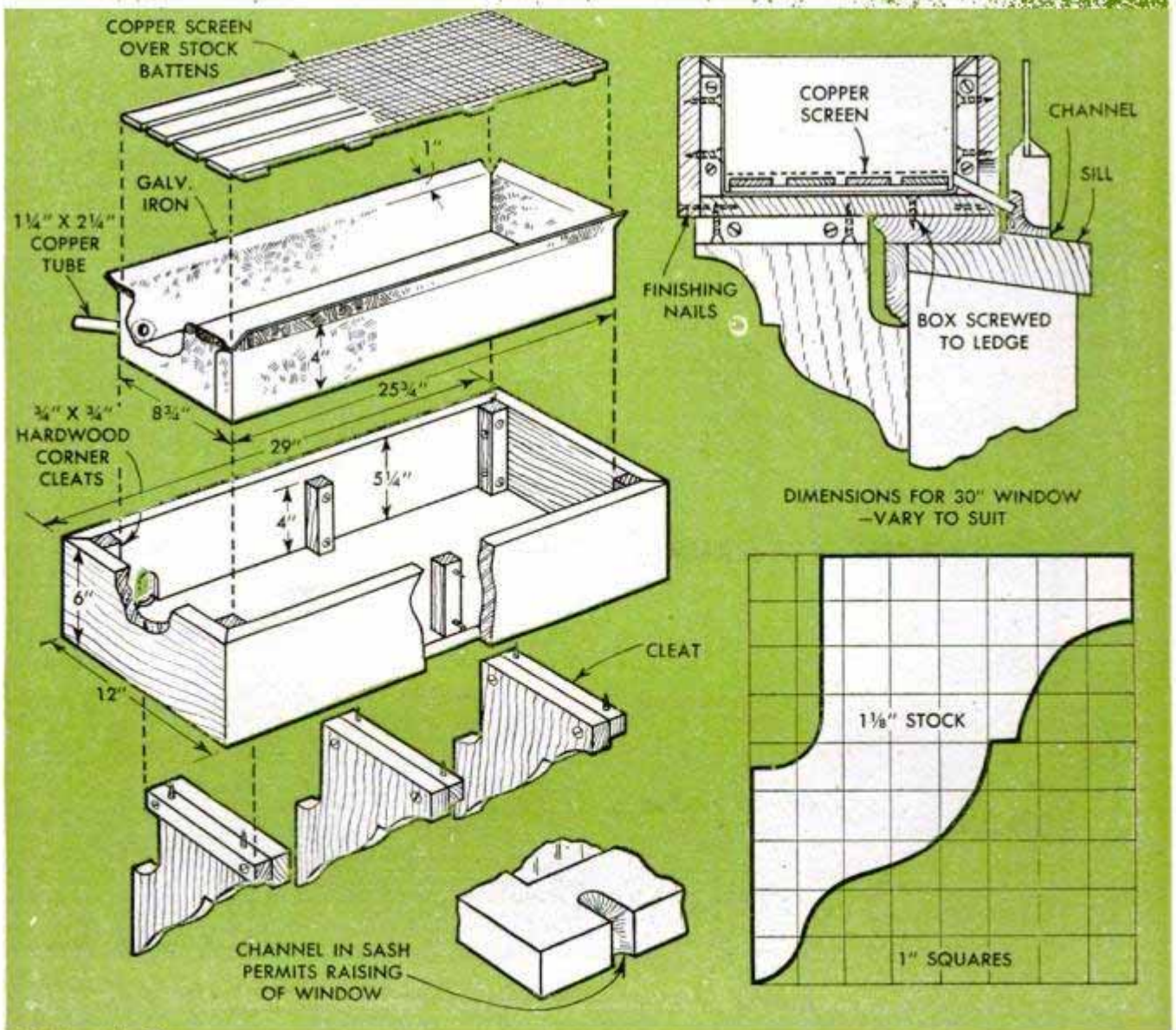
WINDOW GARDEN

By Hi Sibley

BRIGHTEN UP a window in your home this winter with an attractive display of blooming flowers, grown easily in this simple-to-build indoor flower box. Fastened to the window sill with only two screws, the box is constructed so that the need for any other means of attachment, which might deface the wall or window frame itself, is eliminated. A feature of the galvanized-iron tank is a drain tube which is fitted to one side of the tank and slipped through a slot in the side of the box to allow excessive water to drain off through a channel cut in the window sash. The channel allows the window to be raised or lowered without interference from the tube. Copper screening laid over a stock-batten grid keeps the soil from sifting through.



Braces for flower box, which are attached permanently to underside of box, provide support simply by resting against wall beneath window sill. They are cleated on sides as illustrated for added strength.



"SWITCHES"

By W. K. Mitchell and Howard B. Birt

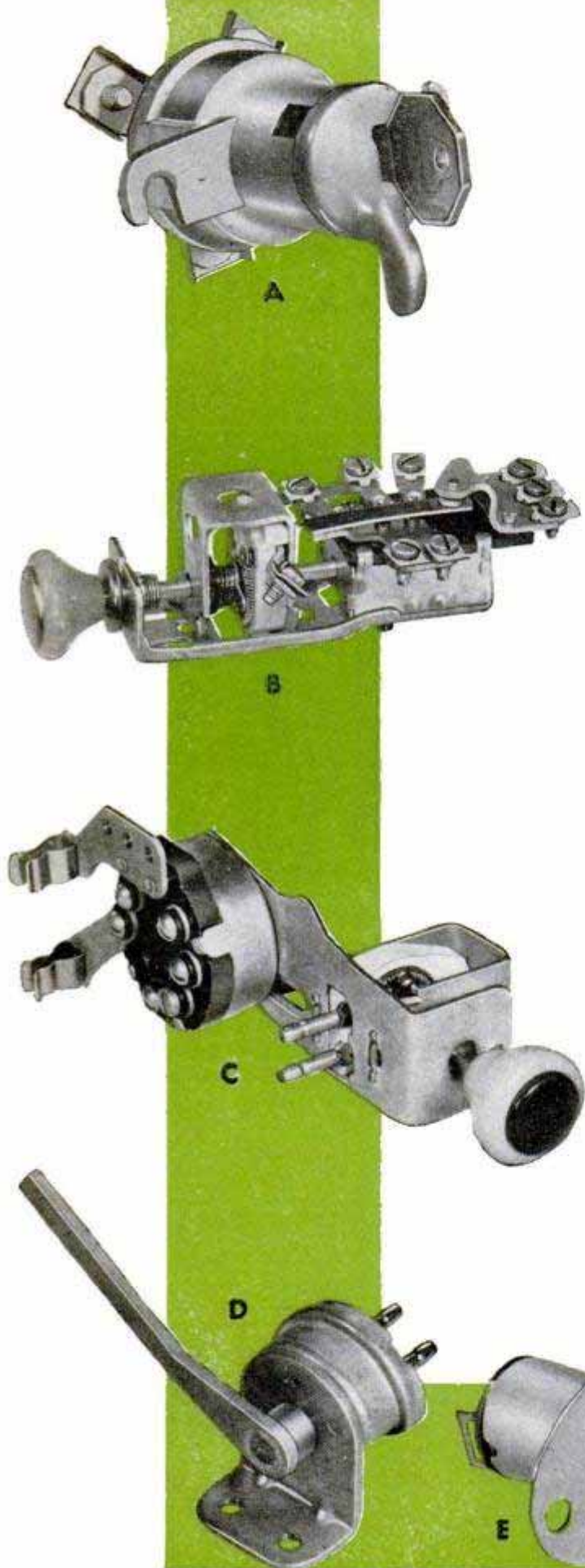
OFTEN DESCRIBED as the unseen servants of the car, many of the vital electrical switches are hidden from view and few of them ever attract more than casual notice from the driver. The average modern passenger car contains at least 12 to 15 switches and a car fully equipped with accessories and "extras" may have two dozen or more. The switches not only start the engine, operate all the lights and blow the horn, but also control most of the accessories and safety devices, such as stop lights, neutral safety feature on cars with automatic transmissions, and directional turn signals.

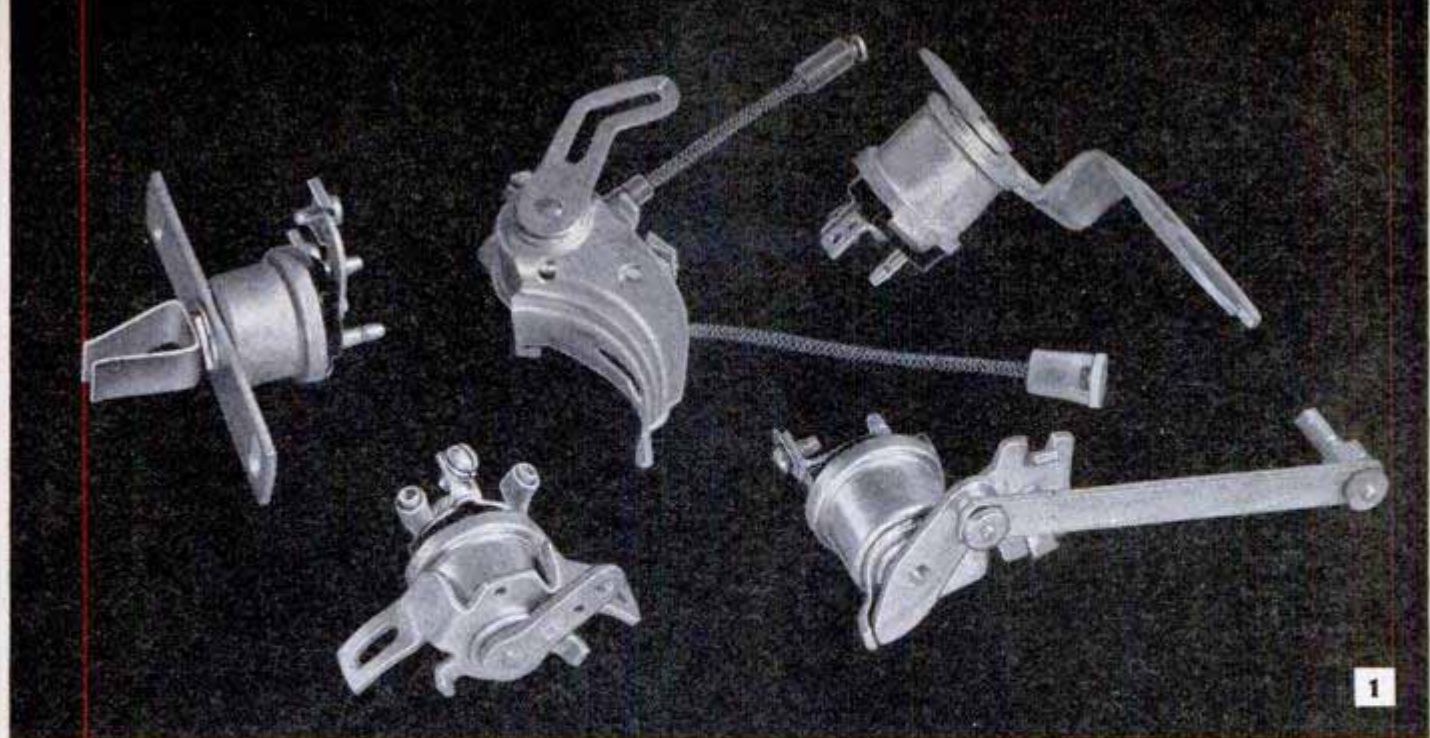
The vast majority of automobile electrical switches fall into three types based on their method of operation. These types are mechanical, magnetic (solenoid), and vacuum, with mercury switches being used in some isolated cases. Of the three types mentioned above, the mechanical switches are the most numerous.

Mechanical Switches

The ignition switch, photo A, is a lock-type switch. Its contacts are locked in an open position when the ignition is turned off. In some cases a combination ignition and starter switch is used to actuate both the ignition and starter with a single motion of the ignition key.

The switches pictured at B and C are widely used for operating the headlights, parking lights and taillights. The push-pull type, B, has three positions—off, parking and bright—and in many installations it also includes a rheostat which is used to control the brightness of the instrument-panel lights. The rheostat is operated by rotating the control knob. Photo C shows





the push-pull, rotary-contact switch which is similar to the former type except that the contacts move in a circular path when the control rod is actuated. A thermostatic circuit breaker is incorporated in this switch to eliminate the need for fuses. The circuit breaker is a bimetal device that causes the lights to blink on and off instead of going out completely when a short circuit or overload occurs.

The mechanical stop-light switch, shown at D, is located so the switch lever is moved each time the brake pedal is depressed, thus causing the stop lights to turn on. When the pedal is released, the lever is returned and the circuit broken by spring tension. Another popular switch for this purpose, photo F, operates on changes in hydraulic pressure in the master brake cylinder.

The door-jamb switch, photo E, is a small, spring-loaded unit of the off-on type used to operate the dome light automatically. When the car door is opened the plunger is released to the "on" position, and when the door is closed the plunger is depressed to throw the switch to the "off" position.

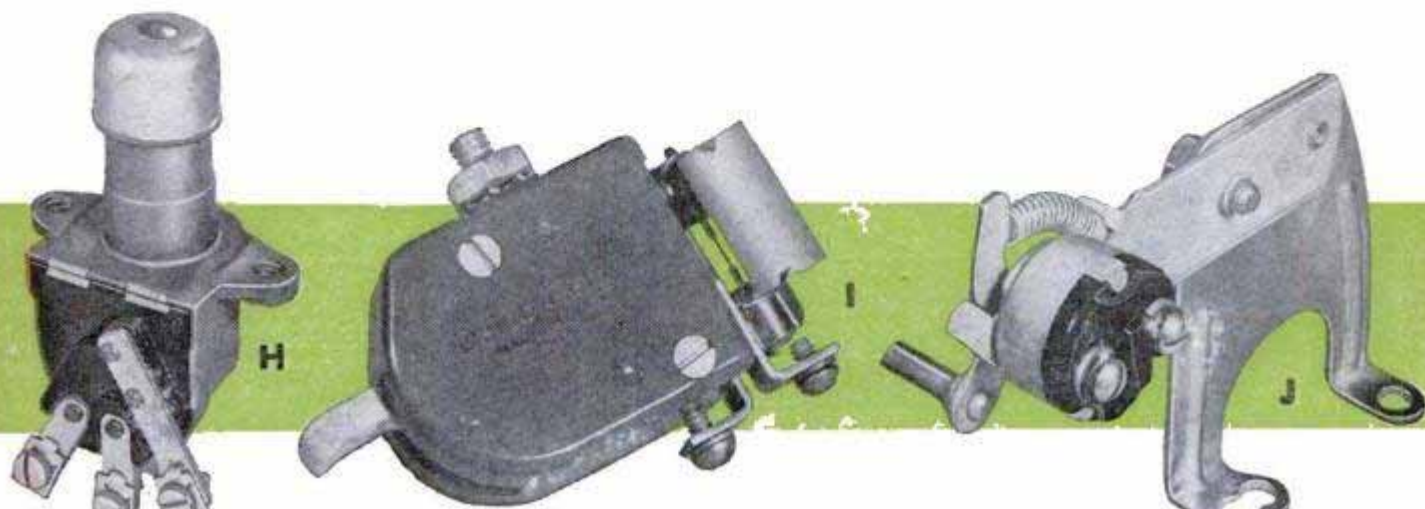
The glove-compartment switch, G, is sim-

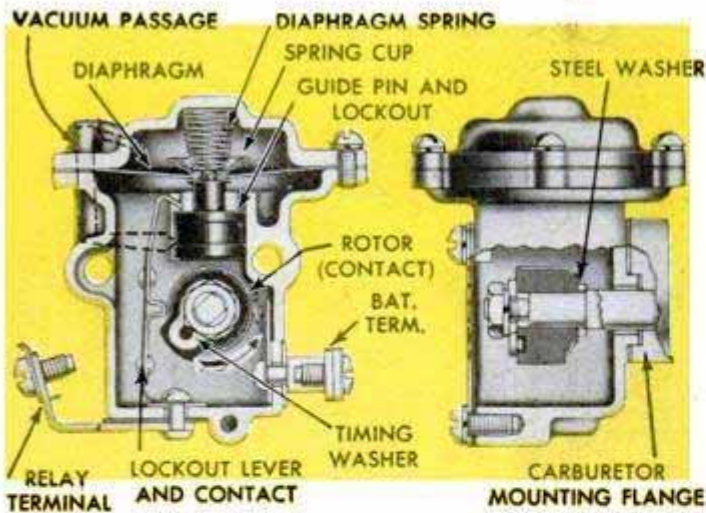
ilar in operation to the door-jamb switch except that the bulb receptacle is an integral part of the switch unit.

To control the headlight beams, a dimmer switch, photo H, alternately raises and lowers the beams with each successive depression of the switch. The latter normally is installed near the clutch pedal where it can be operated conveniently with the driver's left foot. Depression of the dimmer-switch button turns rotary contacts one full position inside the switch. When released, the spring-loaded button returns automatically to its original position. The switch is constructed so the contacts overlap, a new circuit being made before the previous one is broken. This feature prevents both beams from turning off at the same time. The switch is wired to the head lamps as shown in Fig. 3.

Heater switches, I, generally have four positions—off, high, medium and low—while most defroster switches have three positions—off, high and low. These switches contain small resistors which, by the switch action, are connected in series with the heater and defroster motors to provide speed control.

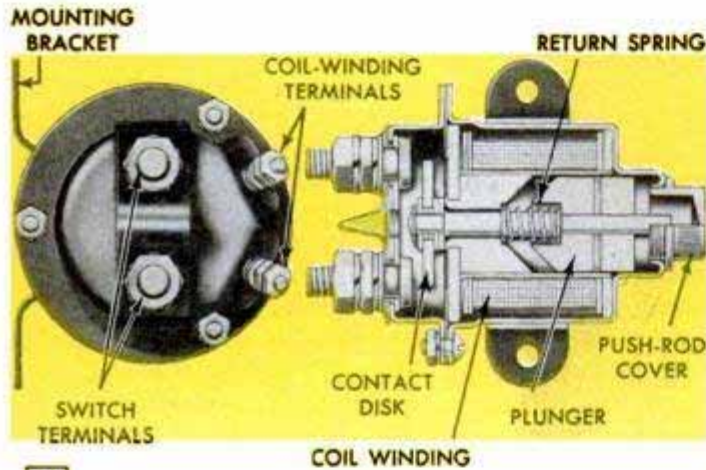
A neutral safety switch, J, is included





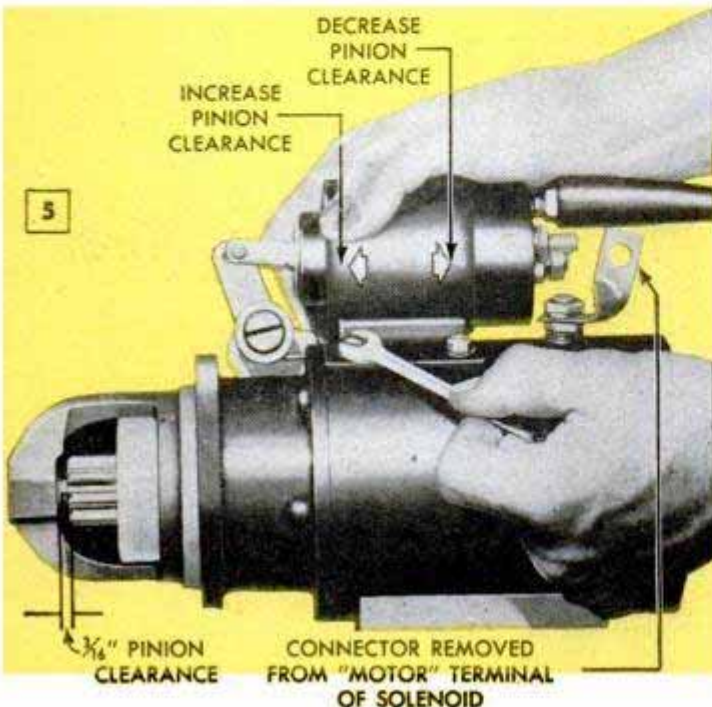
2

Above, carburetor-mounted vacuum switch is shown in cranking position assumed when throttle is open

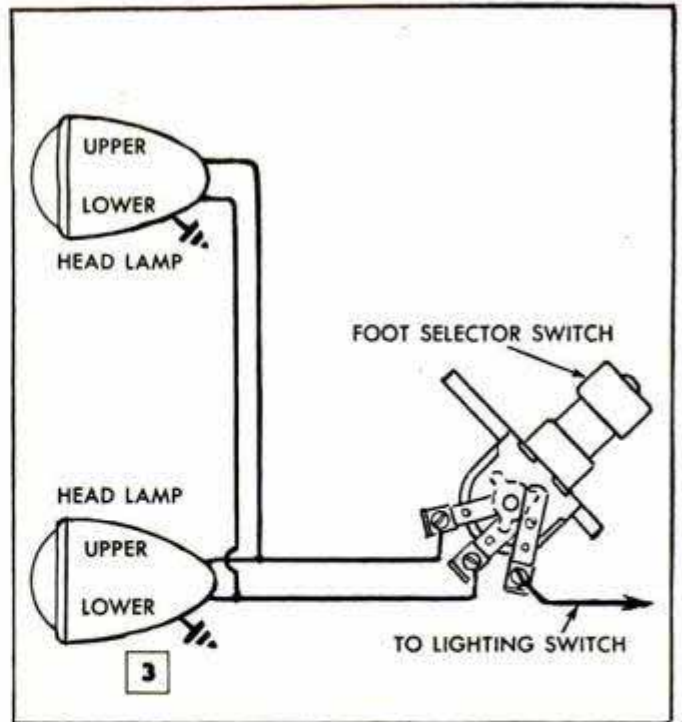


4

When magnetic field draws plunger into coil, above, contact closes circuit between battery and starter



5



3

Photos and information courtesy Delco-Remy Division, General Motors Corp.

in cars equipped with automatic transmissions. It prevents starting of the engine unless the transmission is in "neutral" or "park" position. The switch is connected in series with the starter-control circuit and its contacts are closed only when the transmission is in the proper position. Fig. 1 pictures an assortment of specialized mechanical switches built for cars having automatic transmissions.

A direction-signal switch is installed in or on the steering column just below the wheel hub so a lever projecting from the switch can be moved easily by the driver whenever a turn is contemplated. Motion of this lever closes a circuit, causing the front and rear signal lights and a pilot light to operate. A thermal interruptor included in the circuit causes the signal lights to flash on and off. As the steering wheel is returned to the straight-ahead position, the switch lever automatically returns to the "off" position, thus discontinuing the signals. In most installations the direction signals are wired so they will operate only when the ignition switch is on.

Magnetic and Solenoid Switches

These switches are most frequently used to provide remote control of the starter. The magnetic switch is employed where the starter is equipped with a Bendix or other inertia-type drive. The solenoid switch is used in conjunction with starters having overrunning clutch-type drives which must be shifted into mesh mechanically. Both types are designed to perform electromagnetically a job which previously had to be done manually with starter pedals.

The magnetic switch, Fig. 4, consists of

a brass sleeve surrounded by windings that are energized by battery current when the remote-control switch is closed. The flow of current sets up a strong magnetic field which draws an iron core, or plunger, into the winding. This motion of the plunger closes a heavy circuit between the battery and the starter. The plunger is withdrawn to its original position by a return spring.

The solenoid switch is similar in principle to the magnetic switch but is more powerful. The movement of the plunger not only closes the starter-battery circuit but also shifts the starter pinion into mesh with the flywheel ring gear. This is done by means of linkage between the solenoid-switch plunger and starter shift lever.

Vacuum Switches

The vacuum starter switch, Fig. 2, is not so widely used as the other types. It operates on vacuum from the engine intake manifold and the throttle opening. The vacuum switch usually is mounted on the intake manifold or on the carburetor. The principal use of the vacuum switch is as a "lockout" to protect the starter. In this capacity it prevents the starter from being actuated while the motor is running. Such a precaution is needed on cars having the starter switch operated by extreme movement of the accelerator or clutch pedal, where the circuit could be closed inadvertently while the engine is running.

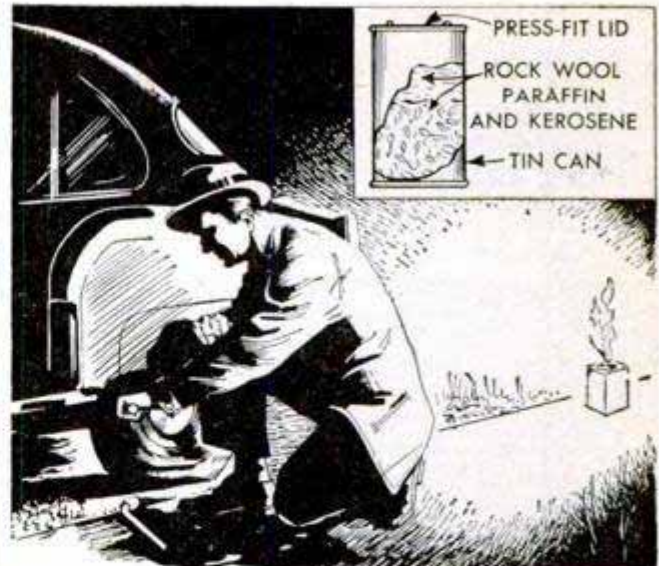
Switch Maintenance

Mechanical switches, with the exception of the direction-signal switch, do not lend themselves to maintenance and repair. In case of failure, they usually are easier and less costly to replace than to repair. Any motorist, however, can insure more trouble-free operation by occasionally checking mechanical switches on his car for loose or corroded contacts and freedom of moving parts. Mechanical stop-light switches which are exposed to road splash, for instance, are especially likely to stick or freeze in the closed position.

Direction-signal switches vary considerably in design and construction. In case of failure or improper operation, such switches should be checked exactly according to the manufacturer's instructions or turned over to an experienced automotive electrician.

The most important adjustment concerning the solenoid switch is correct cranking-motor clearance. Fig. 5 illustrates the correct method of making this adjustment. It must be made with the starter taken off the engine and clamped in a vise. Adjustment of pinion clearance is required whenever the starter has been dismantled and reassembled, or whenever the solenoid has been removed or replaced. ★ ★ ★

Emergency Flare Protects Driver While Making Tire Repairs



To give adequate protection while changing a tire at night, one motorist devised this emergency flare which will burn for more than an hour with a bright flame that can be seen for a half mile or more. He used a tall, square can of the type having a friction lid as a container for the smokeless fuel. The can should be in perfect condition with a tight-fitting lid. The fuel consists of pieces of paraffin and a small quantity of rock wool saturated with ordinary kerosene. The can is filled about half full of paraffin over which is packed sufficient rock wool to fill the can flush with the top opening. Then kerosene is poured into the can until the rock-wool "wick" is thoroughly saturated. If properly prepared, the flare can be carried in the car trunk without danger of leakage.

"Frock" Worn Over Wrist Watch Keeps Out Dirt

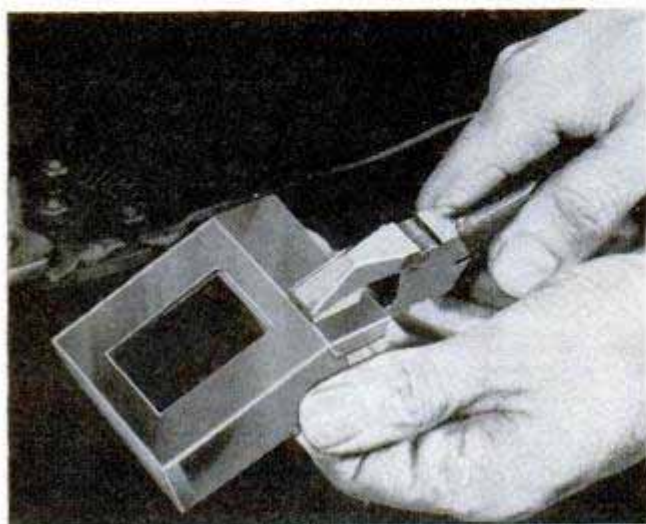
If you wish to wear your wrist watch while painting or working where it will be exposed to dust and grime, protect the watch by wrapping it with a piece of clear cellophane. Use cellulose tape to seal the ends.—R. F. Donovan, Guttenberg, N. J.



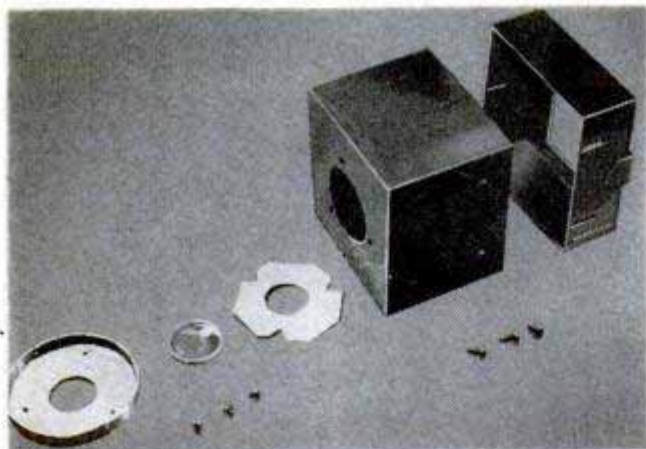
If you've often wished that you had black-and-white prints of favorite color slides, make this simple attachment and copy the slides with your camera

CAMERA ATTACHMENT COPIES

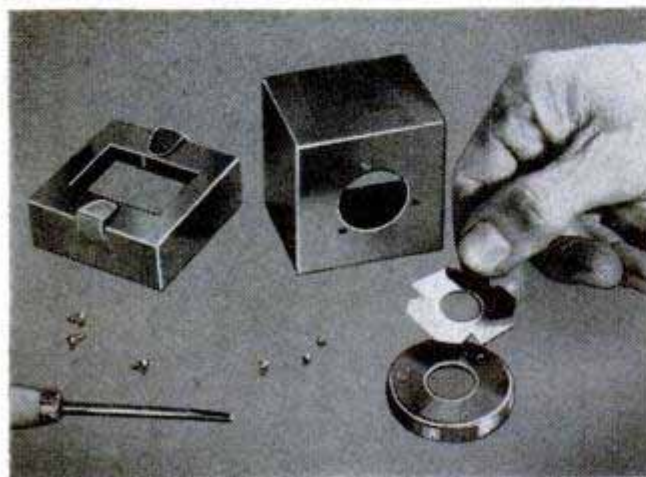
By **Walter E. Burton**



Although the original box was made of sheet metal, either cardboard or thin plywood can be used instead



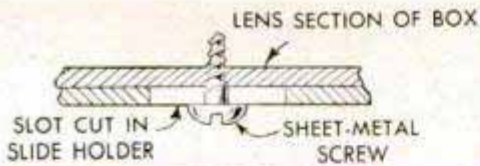
All parts of box assembly are pictured above, one shim-metal washer being inserted in lens cap. Below, note how washer which fits between cap and box is notched to clear machine screws driven as in detail



COPYING color slides is done in a matter of seconds with this copy extension which fits directly over the lens of your camera. Essentially, the attachment is a lightweight box containing a copy lens at one end and clips to hold a color slide at the other. Although the original model was designed for copying 35-mm. slides with a 35-mm. camera, varying the size of the box and the lens permits copying transparencies of different sizes. The attachment also can be used for reproducing movie frames and for photographing any small objects that can be illuminated by passing light through them. Samples of cloth and lace are typical subjects.

The sheet-metal box is made in two parts; a larger section which contains the copy lens and a smaller section, or cover, to which the transparency is clipped. The lens section telescopes into the cover to permit fine focusing, but even though the length of the box is adjustable to a certain extent, it should be made approximately the same as the focal length of the copy lens. In cross section, the box should measure slightly larger than the dimensions of the slide mounts it is intended to handle. The slide holder is anchored to the telescoping lens section with three sheet-metal screws. The latter pass through two slots in one side of the slide holder and one slot cut in the opposite side, as in the upper detail. The lower detail shows how shim-metal washers are used to provide a mount for the copy lens.

Use a good-quality copy lens preferably of the meniscus, or spectacle, type. These usually can be obtained from a dealer in surplus lenses. When the negative size of the camera is large enough, it is desirable to keep the copy image approximately the same size as the original transparency. To do this, the focal length of the copy lens must be the same as that of the camera lens. If it is shorter than that of the camera lens, an enlarged copy will be made, and if it is longer, the copy image will be smaller than the original. For example, when copying double-frame 35-mm. or bantam-



COLOR SLIDES

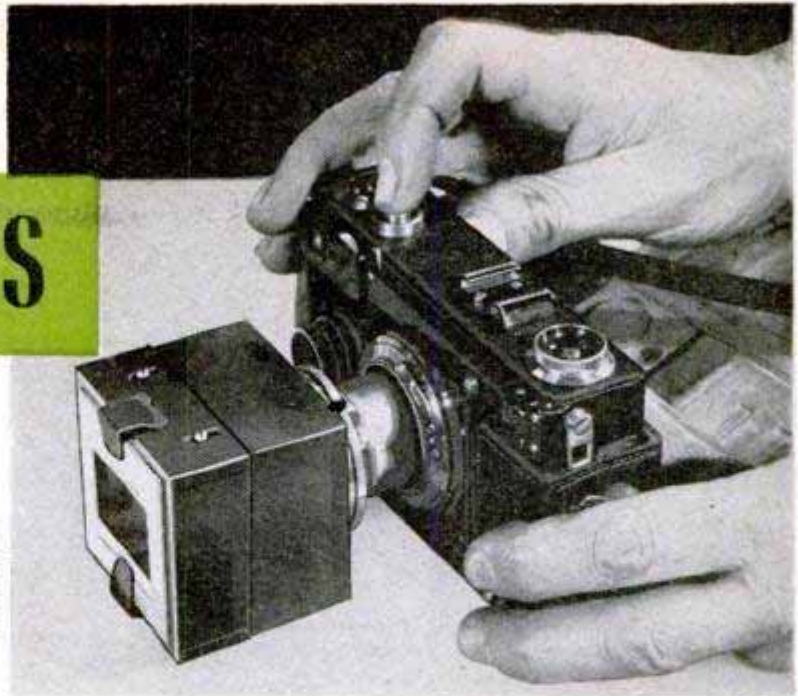
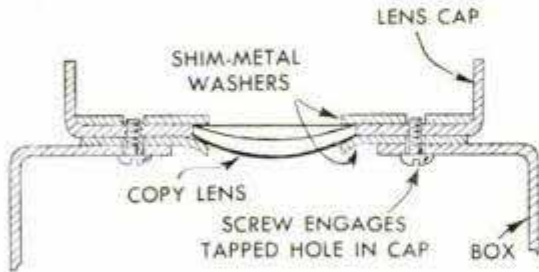


Photo above shows copy attachment in use on 35-mm. camera. Negative will be same size as transparency

size slides with a 35-mm. camera equipped with a 50-mm. (2-in.) lens, use a copy lens of 50 to 55-mm. focal length. In most cases, it is better to select the lens having the longer focal length so you will be certain of recording the entire area of the slide.

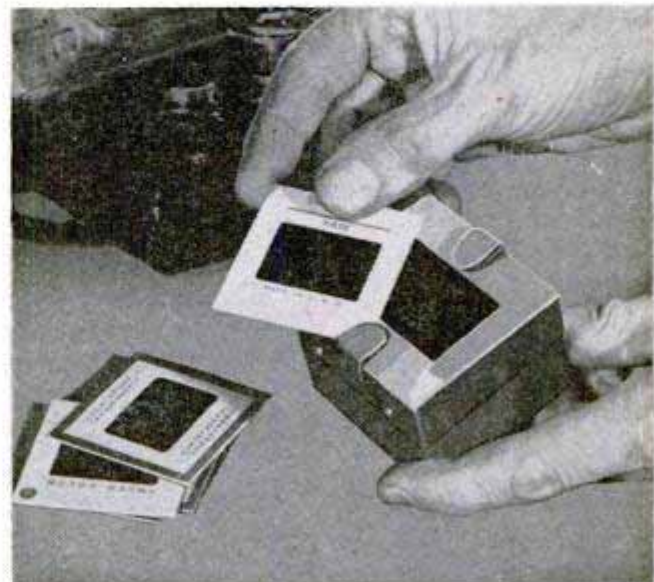
The distance from the copy lens to the slide must be adjusted carefully. This can be done by slipping a piece of ground glass under the slide clips and shimming it with cardboard strips to bring it in the same plane as the transparency. Then the lens is aimed at an object 200 ft. or more away and the telescoping box sections are moved together or apart as necessary to obtain a sharp image on the ground glass. When the image is sharp, the sheet-metal screws are tightened to lock the sections.

If you intend to copy both glass-mounted and cardboard-framed slides, adjust the box for the glass slides and use an empty cardboard frame as a spacer when copying the cardboard-framed slides, thus keeping both transparencies in the same plane. When making copies with a camera that does not have a focusing screen, set the camera lens at the infinity focusing position. The copy lens should be close to the front surface of the camera lens, but not touching it. The diameter of the copy lens should be at least as large as that of the camera lens.

To illuminate the transparency evenly, point the camera at the north sky in the daytime, or if you are copying indoors, aim one or more spot or flood lights at a non-glossy white surface, such as a large blotter. Then hold the camera so the transparency is 6 to 12 in. from the blotter. The correct exposure is determined by trial and error, but a small lens aperture (about f:16) must be used for maximum sharpness. ★ ★ ★



Above, tightening three machine screws locks parts in position. Shanks of screws engage slots in slide holder, as in upper detail. Below, clips bent from sheet metal and soldered to box hold slides in place





Drying Wet Negatives

You can dry negatives much faster if they are squeegeed to remove all surface moisture when they are hung up to dry. A windshield-wiper blade is ideal for this purpose. Roll film should first be hung in a drying position and then squeegeed as pictured in the photograph. Dry the rubber blade after each sweep, and continue the operation until there is no surface water left on the negatives. Cut film may be squeegeed in a similar manner. In this case, it is a good idea to use the fingers of the left hand to steady the film while sweeping off the water. Another method of drying cut film is to place it on a sheet of glass and run the squeegee over one side until all water has been removed. Then pick up the film, wipe off the glass and squeegee the other side. When using the latter method, you should hold one corner of the film with the fingers so that it can be picked up easily.

Popular Mechanics Bookshop

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COLLET ATTACHMENT

FOR THE METAL LATHE

By C. W. Woodson

AN INTERESTING turning project, this collet attachment for a 10-in. lathe permits rapid chucking of finished bar stock with precise accuracy. The three parts of the draw-in attachment, which are shown in Fig. 3, are readily machined on the lathe, but due to the difficulty of hardening and spring-tempering tool-steel collets it is better to purchase them ready-made. However, in the event you wish to machine a collet of mild steel or hard brass for occasional use, dimensions are given in Fig. 4.

Have at least one finished collet on hand when beginning work on the attachment, as the collet will serve as a gauge when taper-boring the closer to the correct angle, and the collet threads can be used to check the threaded end of the draw-in sleeve. In addition, the collet is necessary to determine the exact length of the sleeve in order to assure proper closing action when clamping the work in the collet. Note the cut-away detail, Fig. 6.

Start machining the collet closer, Fig. 1, by turning the No. 3 Morse Taper to fit the headstock spindle. As this may require considerable fitting, the tool-steel round used for this part should be a little longer than ordinarily necessary. After fitting the closer, slip it in the headstock spindle and drive the work with the spindle while turning and facing the large flange on the outer end. Then counterbore the center hole and turn the inside bevel to match the taper on

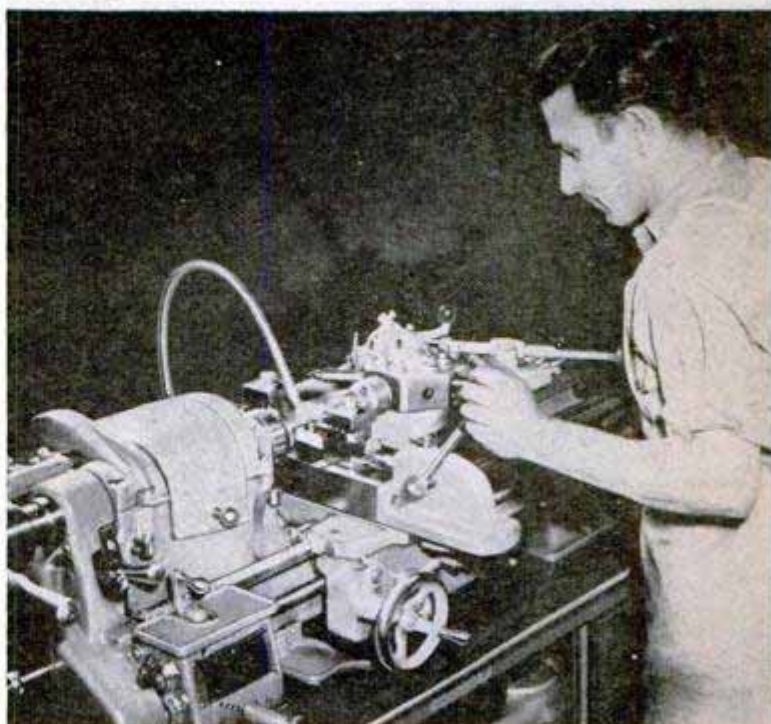
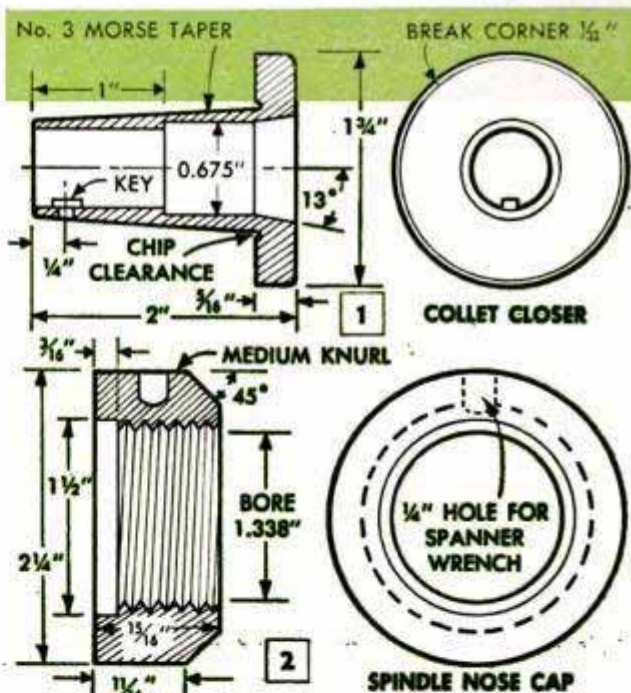
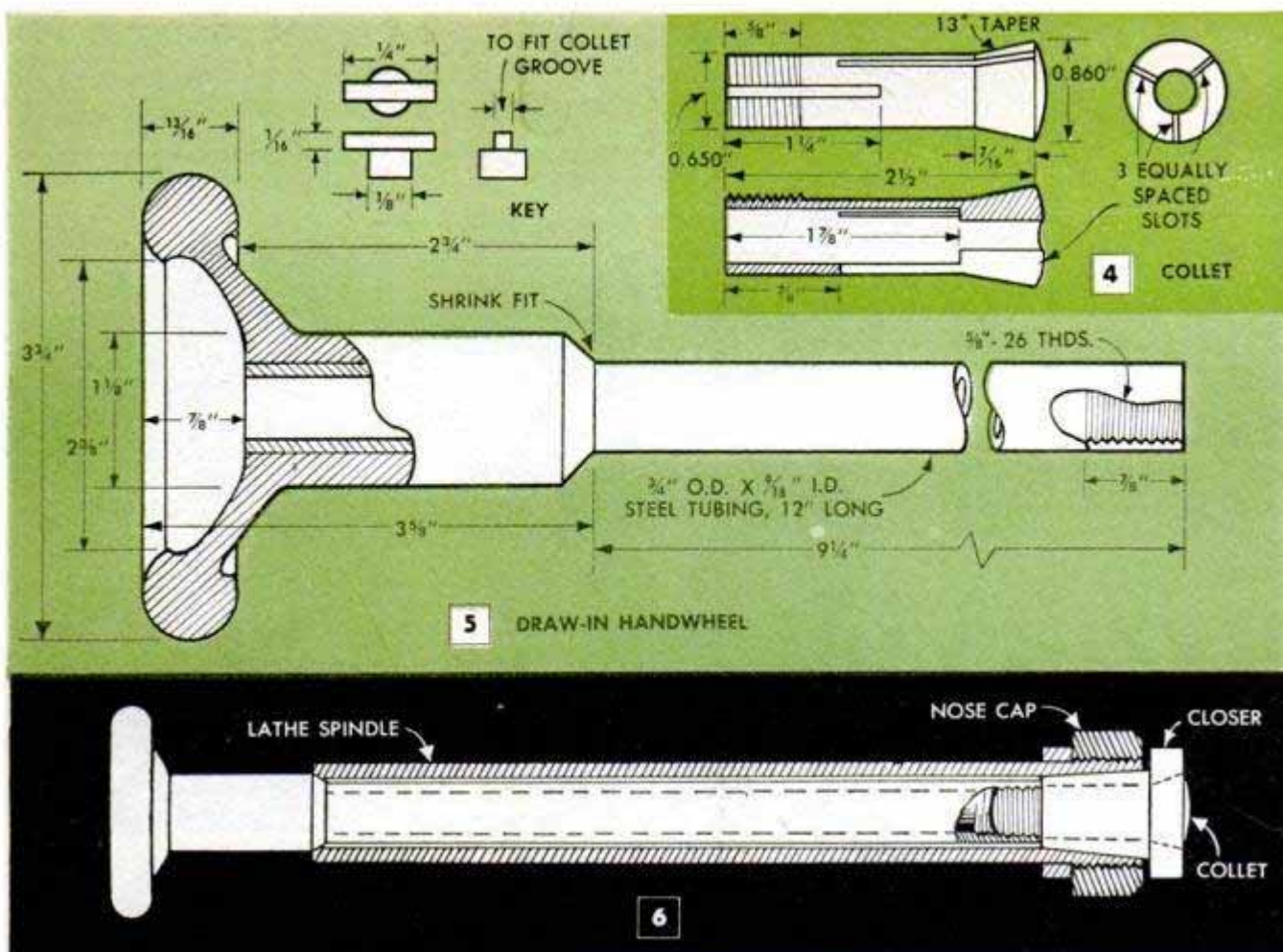


Photo courtesy South Bend Lathe Works



The drawing below shows how the finished parts of the collet attachment look and how they fit together. Note that the spindle nose cap is turned on the spindle before closer and collet are inserted





the collet head. Make the key, as in Fig. 5, and rivet it inside the tapered shank of the collet closer.

Chuck the draw-in sleeve to run dead true and cut the $\frac{5}{8}$ -26 internal threads. Run the threads with several light cuts and when nearing the finish dimension, check with the collet to determine the degree of interference between the two parts. They should engage lightly as otherwise the collet may turn in the closer when the handwheel is tightened. To locate the exact distance from the threaded end of the tube to the handwheel hub, insert the closer in the headstock spindle and slip the draw-in tube through the hollow spindle. Insert a collet in the closer, turning it into the tube, and

press the collet firmly against the closer. Mark the tube at the point where it projects from the opposite end of the headstock spindle.

Turn the handwheel and hub from a single piece of cold-rolled steel to the dimensions given in Fig. 5 and drill and ream the center hole for a shrink fit on the draw-in tube. The spindle nose cap, Fig. 2, not only protects the threaded end of the spindle while the lathe is in use, but also removes the collet closer from the spindle when it is backed off the threads. The cap is turned from a cold-rolled-steel bar and knurled for the handgrip. Then it is bored and threaded to fit the spindle. Drill a $\frac{1}{4}$ -in hole in the cap for a spanner wrench. ★ ★ ★

Barrel Partially Submerged in Pond Provides Ice-Free "Water Hole"

Precious time sometimes lost in chopping a hole through a frozen pond to obtain water frequently results in the total destruction of a burning farm building. To be ready at all times for such an emergency, one farmer creates a nonfreezing "water hole" in his pond each winter. In the fall he partially submerges a wooden barrel a few feet from the edge of the pond. Wooden members extending from two stakes driven approximately 2 ft. apart support the barrel, while a crosspiece nailed to the stakes supports the ends of two planks which

serve as a walk. The barrel is filled with a saltbrine solution so the water won't freeze and then the barrel is covered. Thus, when water is needed in a hurry, several blows with an ax against the sides of the barrel will cause it to collapse, leaving a hole in the ice in which a suction hose can be dropped.—H. H. Slawson, Chicago.

☞ When dismantling parts containing ball bearings, place the latter on a section of window screen as they are removed. This will prevent them from rolling away.

Substitute Stencil Ink

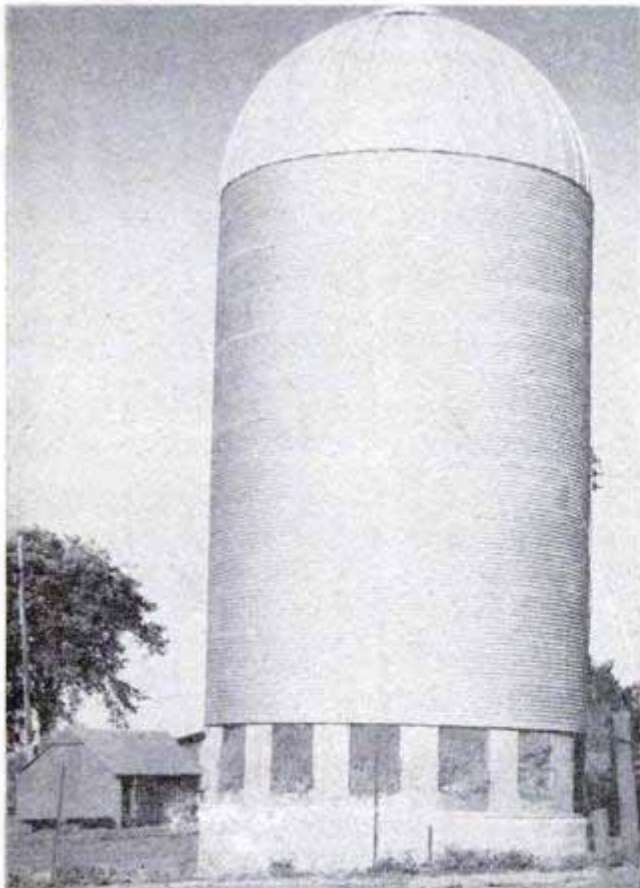


If you run out of stencil ink and have to ship cartons or crates in a hurry, buy a can of black or dark-brown shoe polish and a brush-type applicator. The polish provides an excellent substitute for the stencil ink, and because of its ready availability in a wide variety of stores it can be purchased quickly and at times when usual suppliers of stencil ink would be closed. In addition, the polish has the advantage of not flowing under the stencil when applied to cloth or especially soft wood, thus assuring a distinct, neat-appearing outline of the lettering.

G. E. Hendrickson, Argyle, Wis.

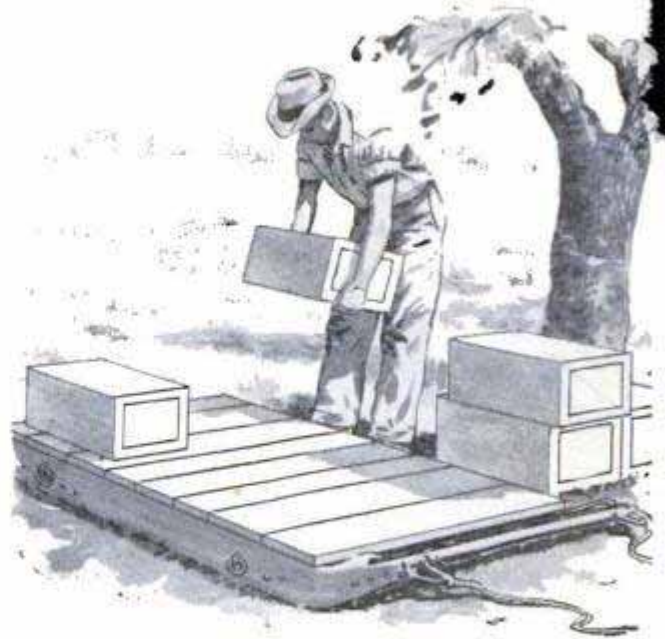
Giant Self-Feeder Containing Hay Saves Work on Dairy Farm

A dairyman near Fairfield, Iowa, has eliminated most of the work of feeding hay to his dairy herd by use of this large self-feeder. As shown in the photograph, the lower part of the feeder is made of concrete in which windows or openings are cast. As the hay is consumed at the openings, it settles down from above, thus keeping a supply available at all times.



SEPTEMBER 1952

Car Frame Provides Useful Skid For Hauling of Heavy Objects

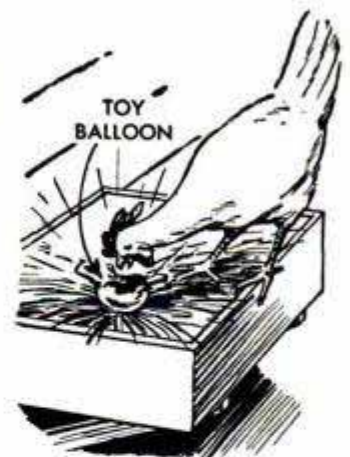


Much of the back-breaking work of moving heavy objects about a farm can be avoided by use of a rugged skid towed by a tractor. Such a skid may be made from an old car frame, which has been covered with heavy planks to provide a platform. Most car frames can be laid on the ground so that the bent ends of the frame act as runners. A skid like the one pictured is ideal for hauling sick animals from the pasture, wire fencing, sacks of feed, waterers, boxes of fruit and rolls of fencing.

A. M. Wettach, Mt. Pleasant, Iowa.

Toy Balloon Discourages Hens From Eating Eggs

Although many poultry men feel that the only cure for a hen that has the habit of eating eggs is the ax, one farmer claims that a fowl can be cured of this habit by placing an inflated toy balloon in the nest. A white, or very light-colored, balloon should be used and it should



be anchored in place. The first time a hen tries pecking at the balloon, the resulting noise when it bursts usually proves startling enough to discourage her from ever repeating the experiment.

☐ When painting a house in summer, follow the shade around the building. Direct rays of hot sun may blister fresh paint.

195



American Floor Surfacing Machine Co. photo

CUTTING OFF is done easily freehand as shown above and below. Wherever possible cut is made on right end of work for maximum support

How to Use Your

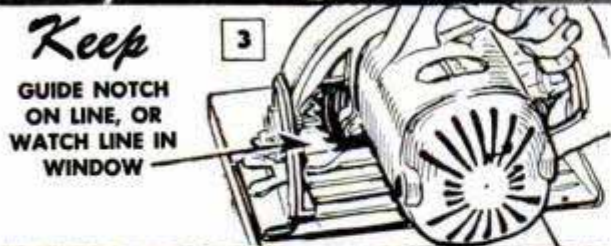
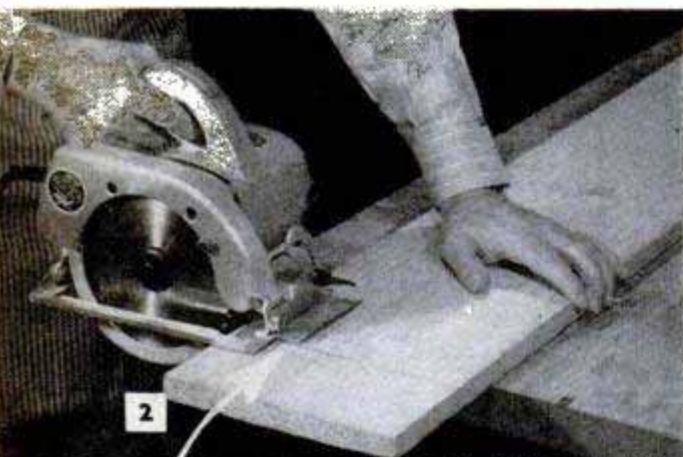
By Sam Brown

PORTABLE ELECTRIC saws, which have largely displaced the handsaw for cutting building materials, are now made in smaller, lighter models suitable for use in the home workshop. These units, equipped with blades ranging from 6 to 8 in. in dia., are especially handy for crosscutting long boards which are difficult to handle on small stationary saw tables.

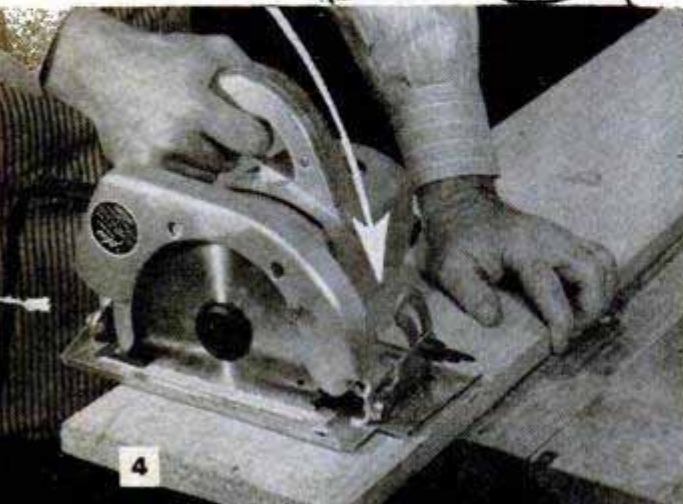
Those who contemplate building their own homes will find an electric handsaw a must for cutting framing, sheathing and roof boards accurately and speedily to the lengths and widths required. The smallest sizes having 6-in. blades will crosscut and rip 2 x 4-in. stock in a fraction of the time required for handsawing. Ordinarily, electric handsaws are used freehand, but accessory guides are available for ripping and crosscutting, also floor stands designed for converting the unit into a table saw which will do ripping, crosscutting, grooving, shaping, sanding and routing.

Crosscutting: To make this basic cut, the front edge of the base plate of the saw is placed on the work with the guide notch aligned with a pencil mark, Fig. 2. The blade is then started on the line or in the waste and the saw is pushed across the work, Fig. 4. Near the end of the cut, the guide notch runs off the work but you can still see the line through a window in the frame, Fig. 3.

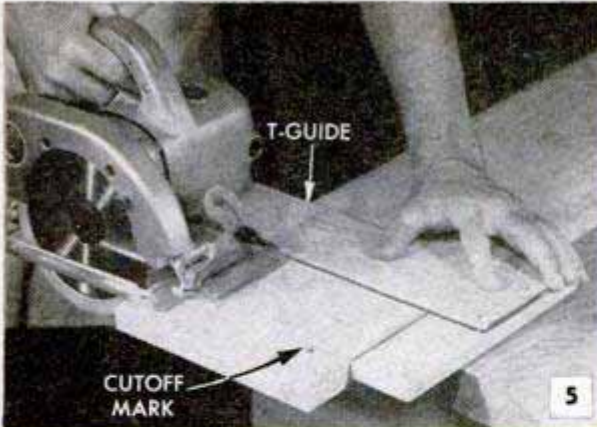
With a right-hand saw mounting, cutting off should always be done at the right end of the work. This permits the wide portion of the base plate to rest on solid wood, as shown in Figs. 2 and 4. Fig. 1 pictures a typical building operation.



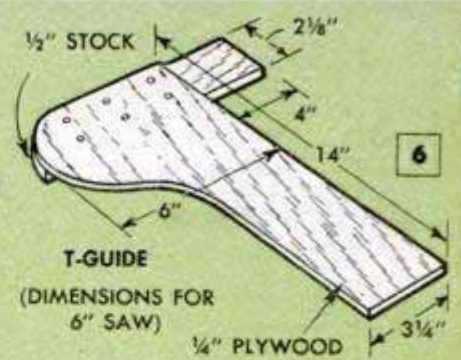
Keep
GUIDE NOTCH
ON LINE, OR
WATCH LINE IN
WINDOW



1. Right hand!



A T-GUIDE is handy for crosscutting. Guided cut is smoother



T-GUIDE (DIMENSIONS FOR 6" SAW)

1/4" PLYWOOD

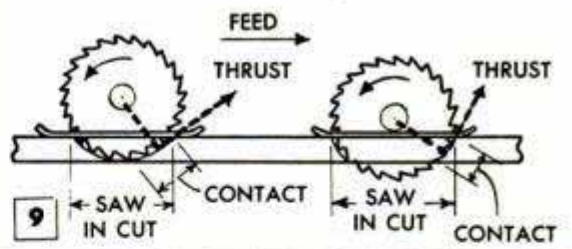
Electric Handsaw

In coming up the opposite side of the roof, however, the operator has no choice—he must support the saw on the narrow part of the base plate.

Crosscutting near the center of a board is best done with a bench setup, as shown in Fig. 7. The T-guide shown in Fig. 6 is a valuable aid for all crosscutting operations. When you make this setup make the projecting part of the T-guide head a little longer than the width of the wide part of the base plate. The first cut will trim the projection in line with the blade. After that, set the head to a pencil line, Fig. 5, to make any cut. A separate T-guide should be made for angle cuts since these cut inside the vertical cut, Fig. 8. You will have to set the saw blade fairly shallow if you use 3/4-in. support blocks in the bench setup,



ANGLE CUTS can be made accurately with a special T-guide. Use separate notch on saw

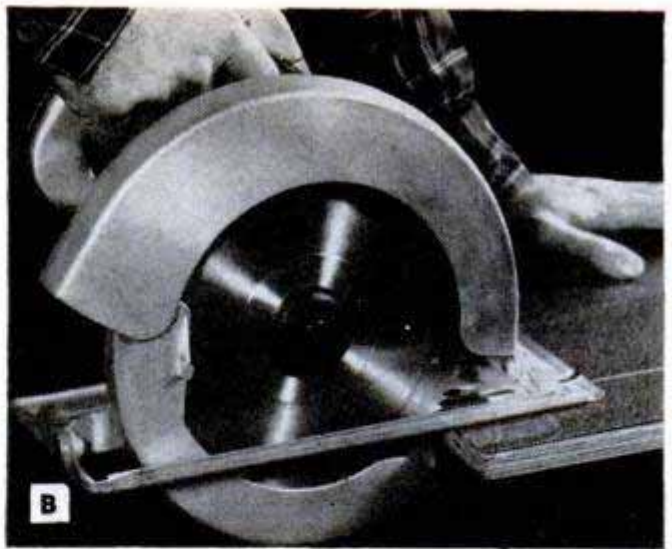
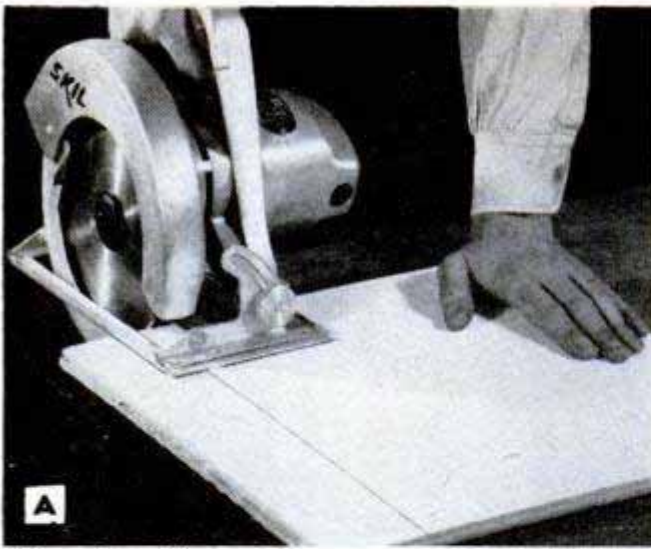


Average Specifications — ELECTRIC HANDSAWS

SAW DIA.	WEIGHT	VERTICAL CUT		MAX. 45° CUT	SPEED R.P.M.	REMARKS
		MAX.	MIN.			
4 1/2"	7 LB.	1 1/4"	0"	1"	6000	SMALLEST PRACTICAL UNIT. CUTS 1" HARDWOOD STOCK.
6"	11 LB.	2"	3/4"*	1 3/8"	5000	BEST SIZE FOR HOME SHOP. EASY TO HANDLE. CUTS 2" STOCK (EXCEPT AT 45°)
7 1/4"	16 LB.	2 3/8"	1/2"*	1 7/8"	5000	POPULAR SIZE FOR LIGHT CONSTRUCTION WORK. CUTS 2" STOCK AT ALL BEVELS
8 1/2"	18 1/2 LB.	2 7/8"	1/2"*	2 1/8"	4200	THE BUILDER'S SAW. MAKES ALL AVERAGE CUTS IN FRAMING STOCK
9 1/2"	20 LB.	3 1/4"	1"	2 1/2"	3800	HEAVY BUILDER'S SAW. BIG BLADE CUTS TIMBERS USED IN BRIDGE AND DOCK WORK

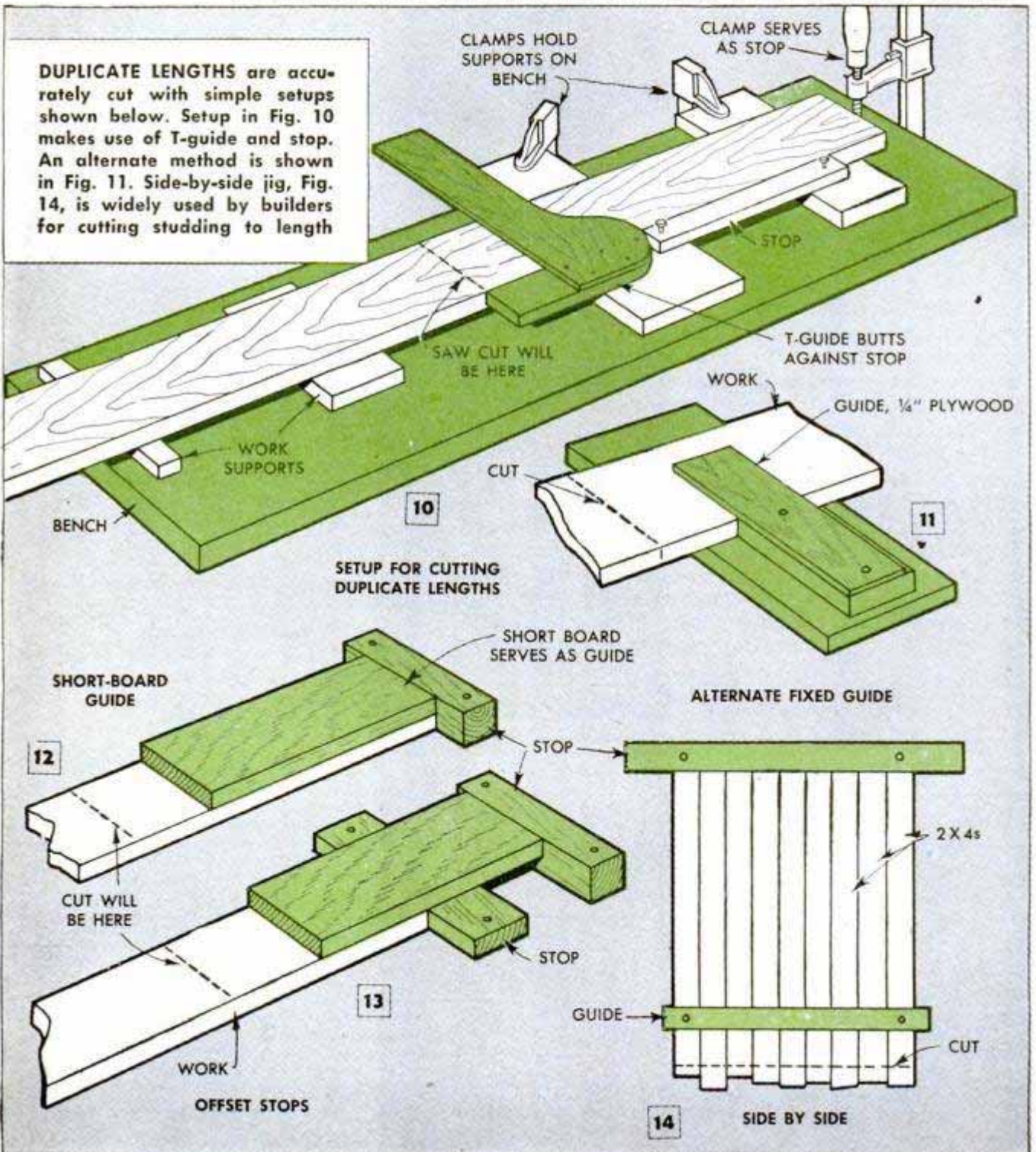
NOTE — AVERAGE SPECIFICATIONS ONLY. SOME UNITS WILL VARY

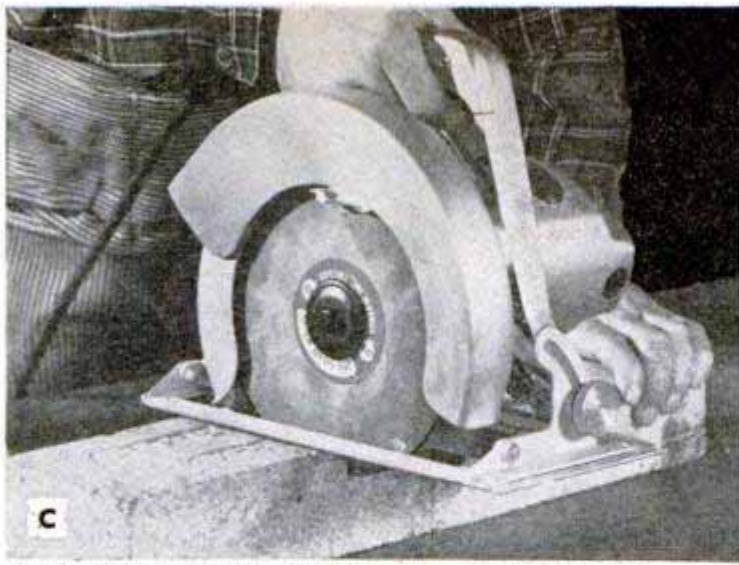
* SOME SAWS ADJUST TO ZERO



Skillsaw, Inc., photos

BUILDERS USE ELECTRIC HANDSAWS FOR CUTTING NEARLY





ALL TYPES OF BUILDING MATERIALS

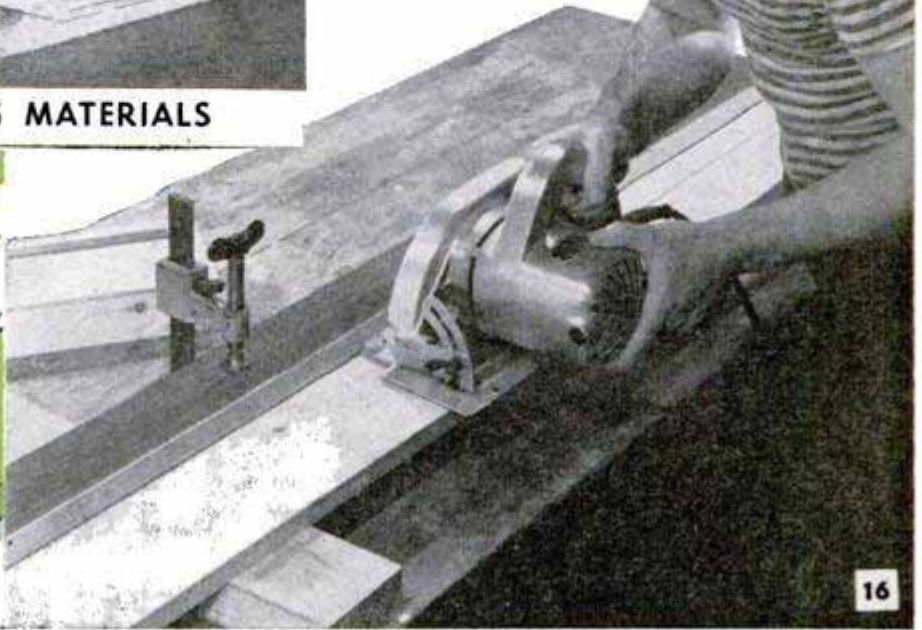
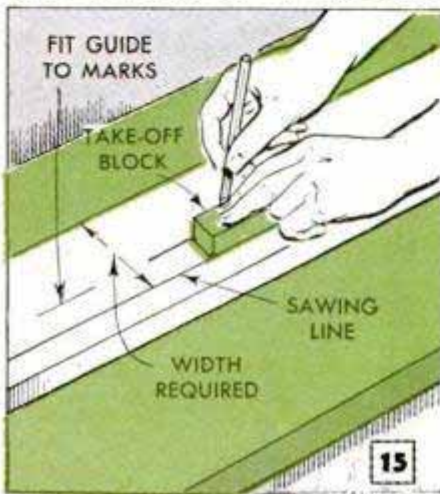


Fig. 7. In most work the support blocks should be cut from 2 x 4-in. stock.

Mechanics of cutting: Fig. 9 shows how the blade cuts. The thrust is forward and upward against the base plate. When the blade is set just to cut through the stock, it has a larger contact area and requires more power. On the other hand, the blade set to maximum depth tends to bind in the cut. For most work, a setting halfway between minimum and maximum projection is best. Because the tool is used freehand, it is highly important to keep the saw teeth sharp and correctly set. File the saw blade after each four hours of use and keep the set at $\frac{1}{64}$ in., or follow the manufacturer's recommendations for filing and setting the blade.

Duplicate lengths: If you are cutting three or four duplicate pieces, probably the best system is to mark each piece. But when you have 10 to 20 pieces to cut, it is worth-while to make a simple jig to assure uniform lengths. Fig. 10 shows a typical setup. Saw halfway through the first board and then mount the various stops as shown. In Fig. 12, the setup makes use of a short board. In Fig. 13, the arrangement is somewhat similar but uses the first board sawed as a guide in connection with offset stops.

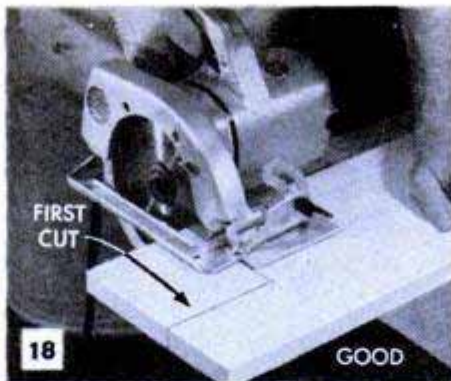
The offset is the width of the wide part of the base plate (4 in. for a typical 6-in. saw). Fig. 14 shows a simple multiple-cutting setup used by builders for cutting studding to uniform lengths. Numerous other setups can be worked out.

Ripping: Ripping cuts can be made accurately with a ripping guide, Fig. 16, or with a guide strip, Fig. 15. Ripping with a guide strip is commonly done from right to left with the narrow part of the base plate bearing against the guide, Fig. 16. To make the setup you first pencil-mark the width of the strip required. Then using a take-off block of a width equal to the width of the narrow part of the base plate, mark the stock to locate the position of the guide strip, Fig. 15. In using the bench setup with support blocks, you can saw right through the blocks or shift as you approach them, as desired.

Notching: On a notching job, always work the two cuts to keep a solid support under the saw, as shown in Fig. 17 to 22 inclusive. Note in Fig. 19 how the wrong procedure requires supporting the saw on the narrow part of the base for the final cut. To clean a circular-sawed notch, it is necessary to saw a little beyond the line, Fig. 22. Always use the blade at its maximum depth

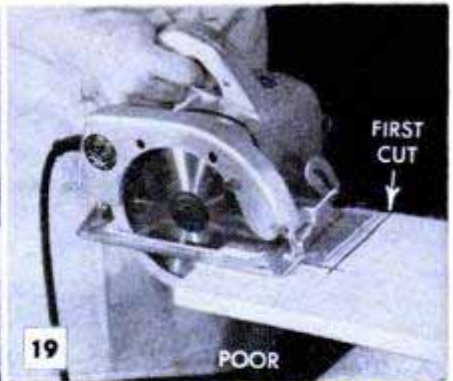


17



18

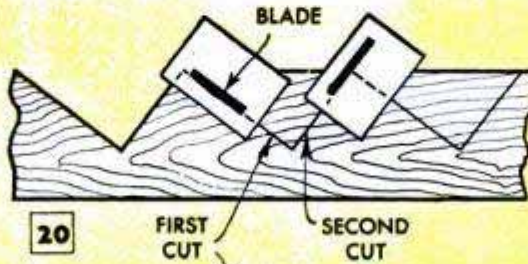
GOOD



19

POOR

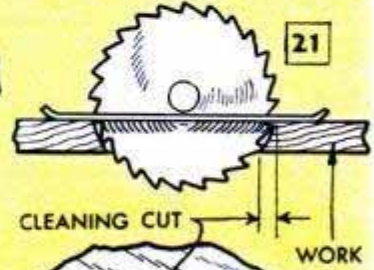
MAKE CUTS SO WIDE PART OF BASE PROVIDES SUPPORT



20

FIRST CUT

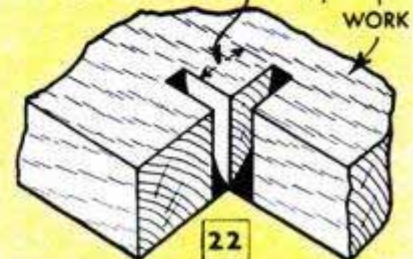
SECOND CUT



21

CLEANING CUT

WORK



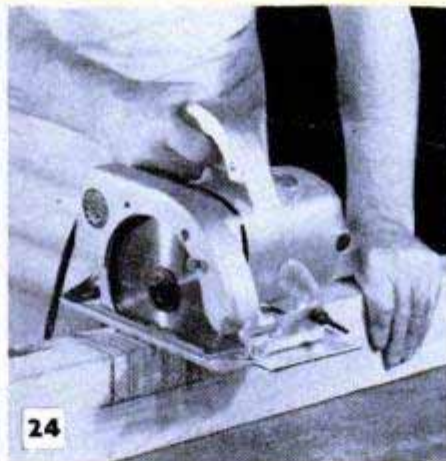
22

NOTCHING CUTS must be made in proper sequence so that wide part of base plate is supported on solid stock. Saw is set at maximum depth



23

SET SAW TO DEPTH



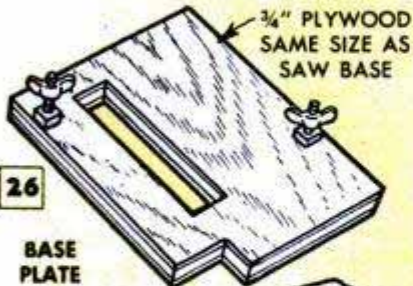
24

MAKE CUTS ABOUT 1/2" APART



25

CHISEL OUT WASTE WOOD

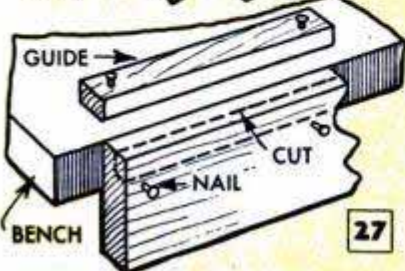


26

3/4" PLYWOOD
SAME SIZE AS
SAW BASE

BASE
PLATE

GROOVING AND RABBETING are easy operations with electric hand-saw. Cutting shallow grooves may require use of auxiliary base plate, Figs. 28 and 29, if the saw is of type that does not adjust to zero



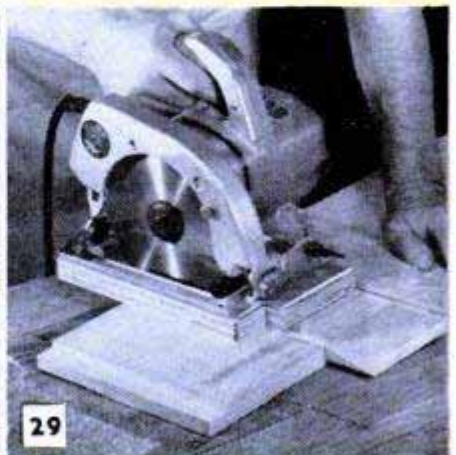
27

SETUP FOR RABBET



28

SET SAW TO DEPTH

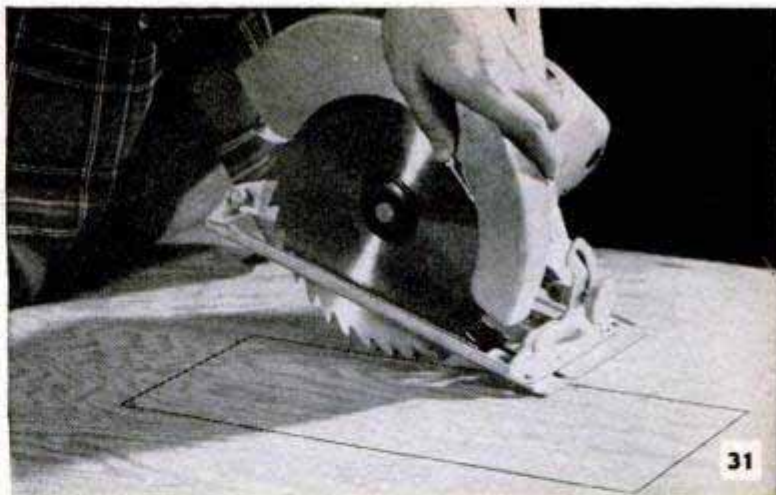


29

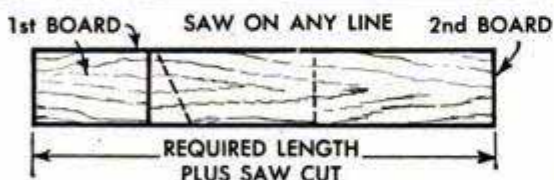
USE T-GUIDE TO SPACE CUTS



30



31

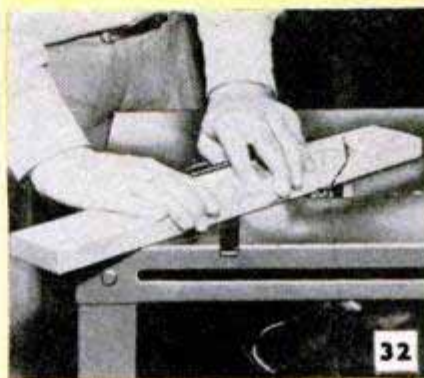


BUTT JOINTS AND POCKET CUTS are regularly made by builders. Butt joint is made by overlapping and clamping two boards as in photo above at the left. Joint will fit perfectly. Pocket cut is made by lowering saw into work

for this work in order to keep the cleaning cut at a minimum. A square-cornered notch is cut by following the procedure shown in Figs. 23, 24 and 25. Unless your saw adjusts to zero, it will be necessary to fit an auxiliary base, Figs. 26 to 29 inclusive, to cut shallow grooves. Instead of the auxiliary base, it is practical to use a $\frac{3}{4}$ -in. riser block nailed or held over the work. With this in place, use the T-guide to walk the saw kerfs across the work, as shown in Fig. 29. When you have a groove or rabbet in the edge of a board, support the work by nailing or clamping it to the edge of the bench top, Fig. 27. Then nail the guide in place and make the cut. The ripping guide also can be used for this operation.

Butt joint: Another job for the electric handsaw is the fitting of plain butt joints. Clamp the two boards or panels together to make the required length plus the saw kerf, and then saw any straight line across the assembly for a perfect joint, Fig. 30.

Pocket cut: This is another very useful electric-handsaw operation. The blade should be set at maximum depth to minimize the length of the cleaning cut. You can pivot the cut in from either the rear or front of the base, but the front pivot, Fig. 31, is perhaps the most practical for average work. The saw is backtracked a little to catch the nearest corner and then can be pushed along the guide line as in straight ripping or crosscutting.

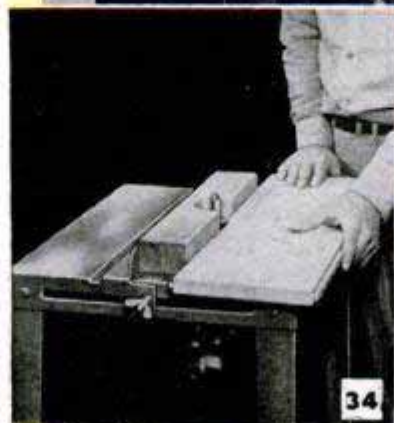


32

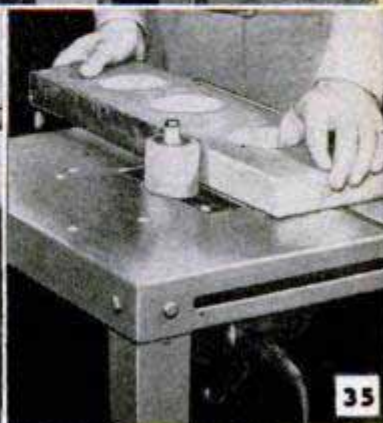
CONVERSION of electric handsaw into table saw is made possible by accessory table. Unit will perform common sawing operations, including shaping and sanding



33



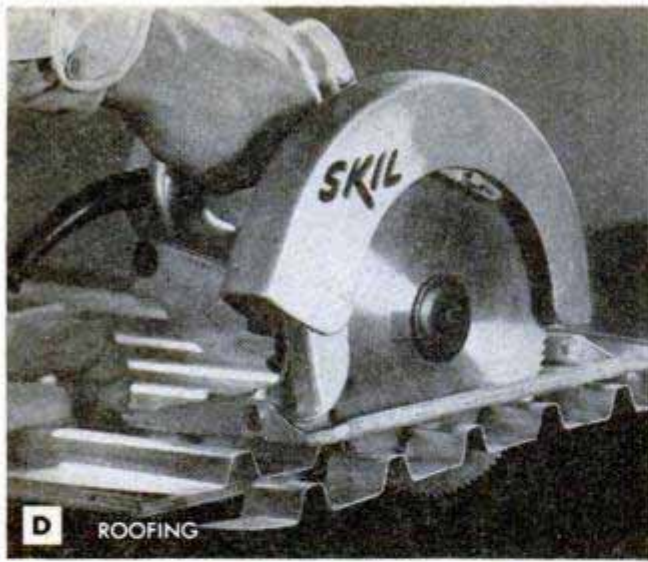
34



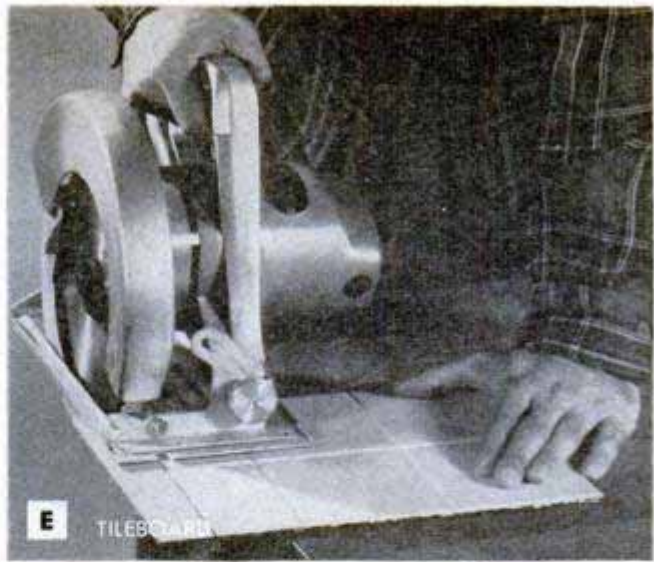
35

SHAPING

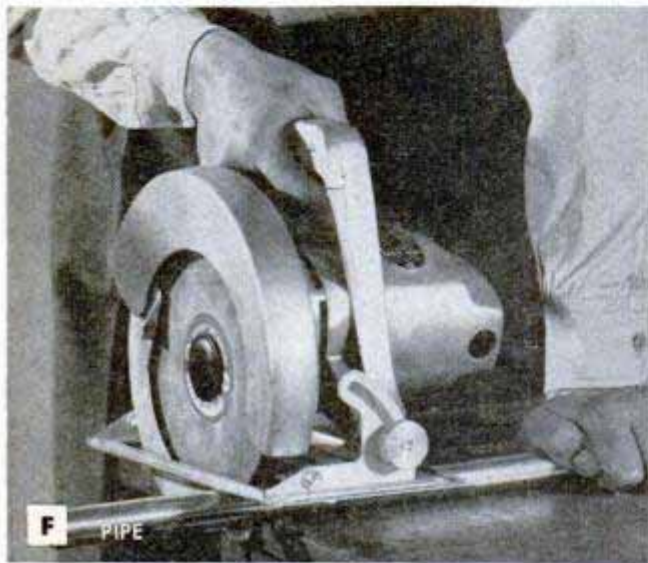
SANDING



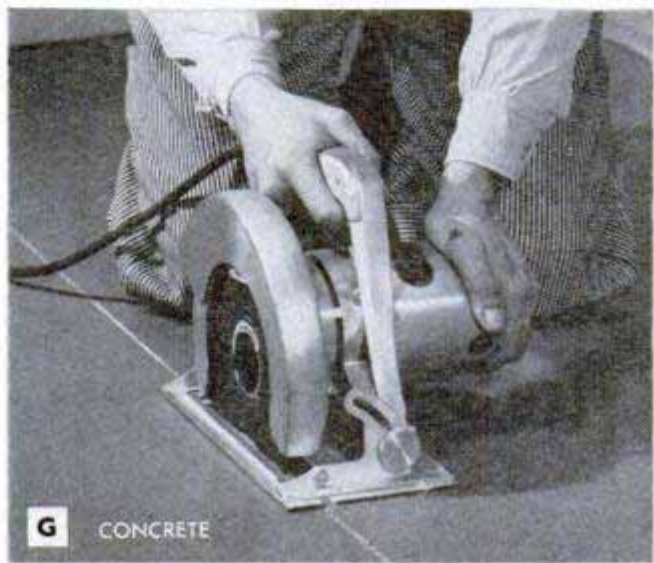
D ROOFING



E TILECUTTER



F PIPE



G CONCRETE

Then, after making two of the four cuts, it is sometimes advisable to nail a support across the pocket to keep the waste piece from falling out when the final cuts are made. The telescoping guard must be locked in the open position for this operation. If your saw does not have the guard lock, make one by tapping the frame and inserting a knurled screw to engage a hole drilled in the guard. Fit a light spring under the screw to prevent it from working loose.

Table saw: The electric handsaw can be used as a table saw by fitting it to an acces-

sory table supplied by the manufacturer. Figs. 32 to 35 inclusive show typical operations utilizing accessories which do ripping, crosscutting, shaping and sanding. These units often are the solution to the power-tool problem in the small shop. Photos A, B and C on pages 198 and 199, and also photos D to G above, show how the electric saw, operated manually, is used to cut almost any common building material, including masonry, metal and compositions. Special blades and abrasive wheels are available for cutting these materials speedily and accurately. ★ ★ ★

Oilstoning Saw Teeth After Filing Improves Performance of Blade

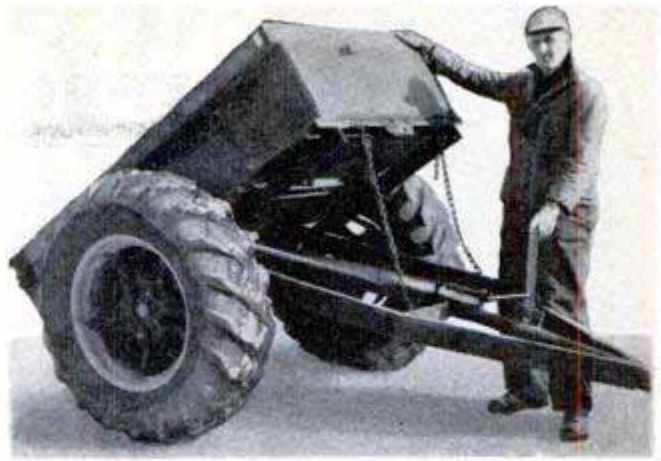
Performance of any saw blade will be much improved by oilstoning the points of the teeth after setting and filing. The same procedure also improves the cutting qualities of hollow-ground blades on which the teeth run without set. Lay the handsaw blade on a flat surface, such as a bench top, and slide the stone along the blade with the teeth, not against them. When stoning a hollow-ground circular blade be sure that the end of the stone does not ride on the raised

center portion, or hub. Use light pressure and apply the same number of strokes on each side of the blade. It is important to use a fine oilstone that is in good condition to avoid marking the saw blade or damaging the points of the teeth.

☞ To prevent battery terminals from corroding, cover them with a mixture of lubricating grease, four parts, and baking soda, one part.

Trailer Fitted With Tractor Tires Has Greater Load Capacity

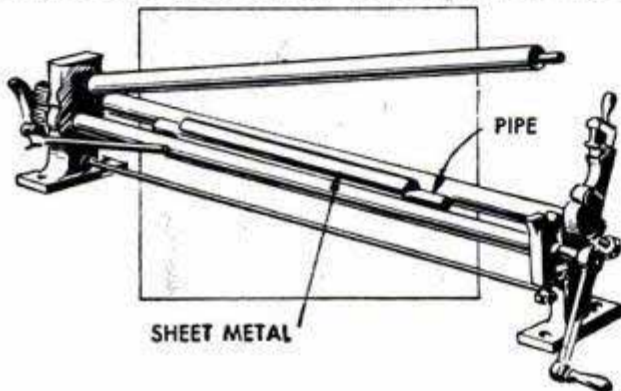
Needing an exceptionally sturdy two-wheel tractor trailer, one farmer overcame several drawbacks of ordinary trailer construction by designing and building his own and equipping it with 11.25 x 24-in. tractor tires. The big tires enable the trailer to travel in soft fields and in muddy farm lanes without miring or cutting in deeply, even with heavy loads. The trailer body was taken from a dump truck and adapted for use on the trailer frame, which was built up by using the channel side members of an old car frame with the cross braces and a tubular drawbar welded in to form a rigid A-frame. The dump body pivots at a point just back of the axle and is held in the horizontal position by a lever-actuated release pin. Chains attached to the



trailer frame limit the tilt of the body when the load is dumped.

A. E. Holden, Angola, Ind.

Separate Mandrel in Slip Roll Forms Sheet-Metal Tubing



Tubing in various sizes is formed quickly in an ordinary slip roll by using a separate mandrel, such as a piece of steel shafting or pipe. Place the pipe, or shafting, between the rolls as indicated in the detail. Feeding the sheet metal around the mandrel will form a tube of the desired size. The diameter of the tubing can be varied by tightening the slip-roll adjustment. However, the mandrel used must be slightly smaller than the diameter of the rollers.

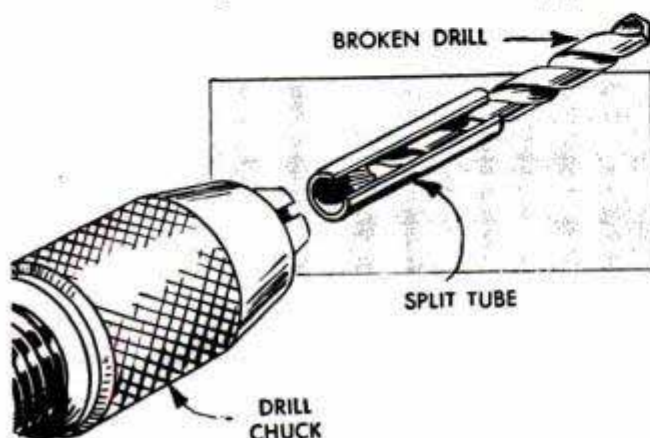
Hugh Lineback, Stillwater, Okla.

Roof Over Area Between Hog Houses Provides Shady "Breezeway"

Bridging an area between two portable hog houses, several lightweight sections of roofing, 10 and 12 ft. in length, provide a shady, comfortable "breezeway" for hogs. The framework supporting the sections consists of sheathing lumber laid over short 2 x 4 rafters and braced along the edges by 2 x 4 stringers. Sheets of galvanized roofing are nailed to the framework which, in turn, is nailed to the houses to secure them in place.



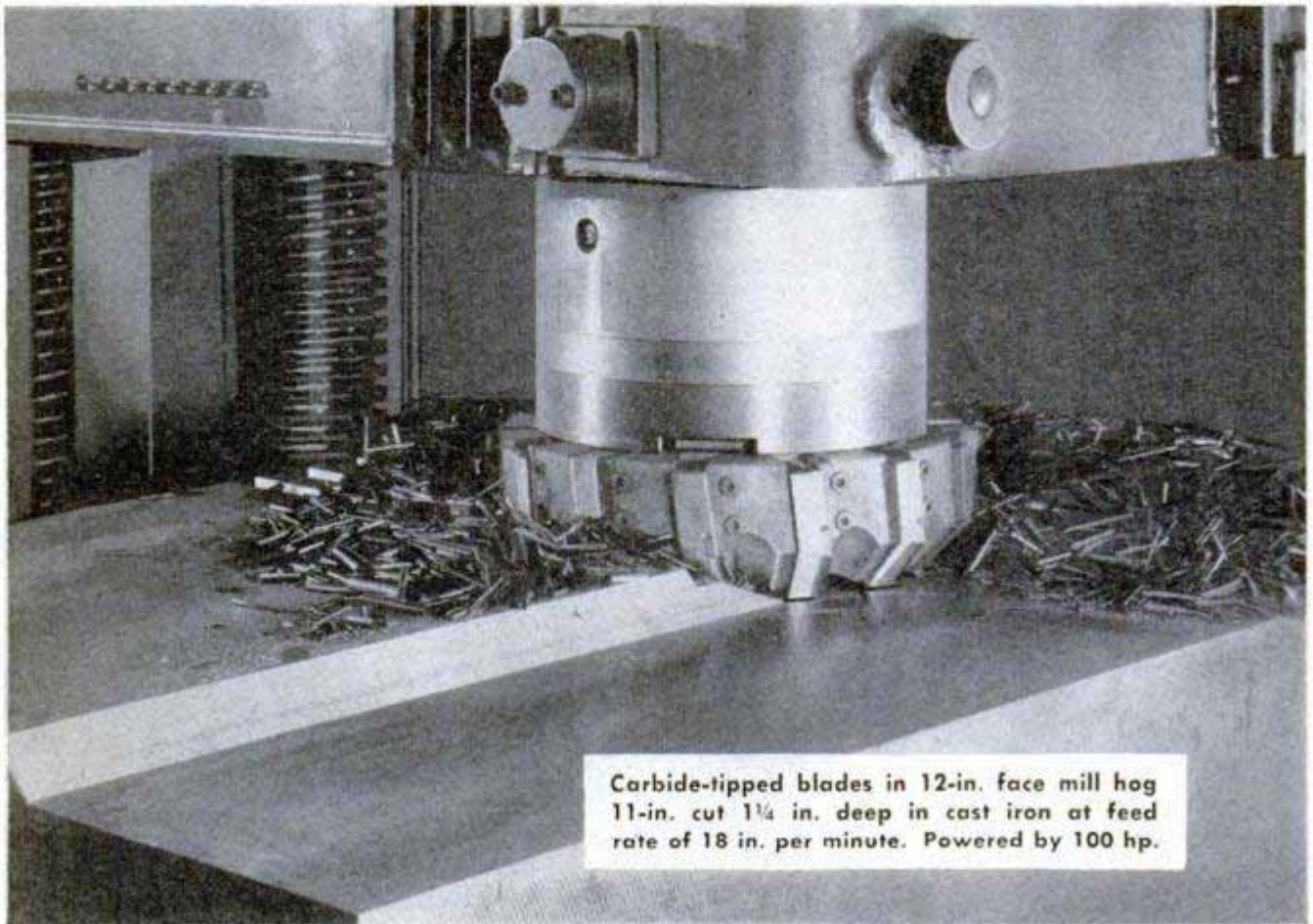
"Collet" Improved From Copper Tubing For Salvaging Broken Drills



A broken drill often can be salvaged for continued use by inserting it in a "collet" made from a length of copper tubing to permit tightening it in a drill chuck. To make the collet, select a piece of tubing that has a diameter slightly smaller than that of the drill and slit it lengthwise along one side. Similar collets of various sizes also are useful for reinforcing small drills in chucks and for preventing dowel rods or thin-walled pieces of tubing from being crushed when gripped in a vise.

W. Shields, Bloomington, Ill.

TIP YOUR TOOLS WITH ... the wonder cutting metal of



Carbide-tipped blades in 12-in. face mill hog 11-in. cut $1\frac{1}{4}$ in. deep in cast iron at feed rate of 18 in. per minute. Powered by 100 hp.

Photo courtesy The Ingersoll Milling Machine Co.

If you are planning to take on a basement subcontract to help Uncle Sam rearm for defense, tipping the cutting edges of your workshop machine tools with tungsten carbide will increase production up to 1000 percent. Carbide blanks cost but a few cents and brazing them to the tip of the tool shank is a simple job

By Wayne C. Leckey

Part I

NEARLY EVERYONE is aware of what happens when you strike a nail accidentally with your circular saw, or run your metal lathe too fast and burn the tip of the tool—the cutting edge is gone and the tool must be resharpened. But imagine being able to saw a nail accidentally, or to run a tool bit red-hot, without dulling it whatsoever! It sounds fantastic, but you can do just that with a comparatively new wonder metal called carbide, a sensational cutting alloy that has revolutionized indus-

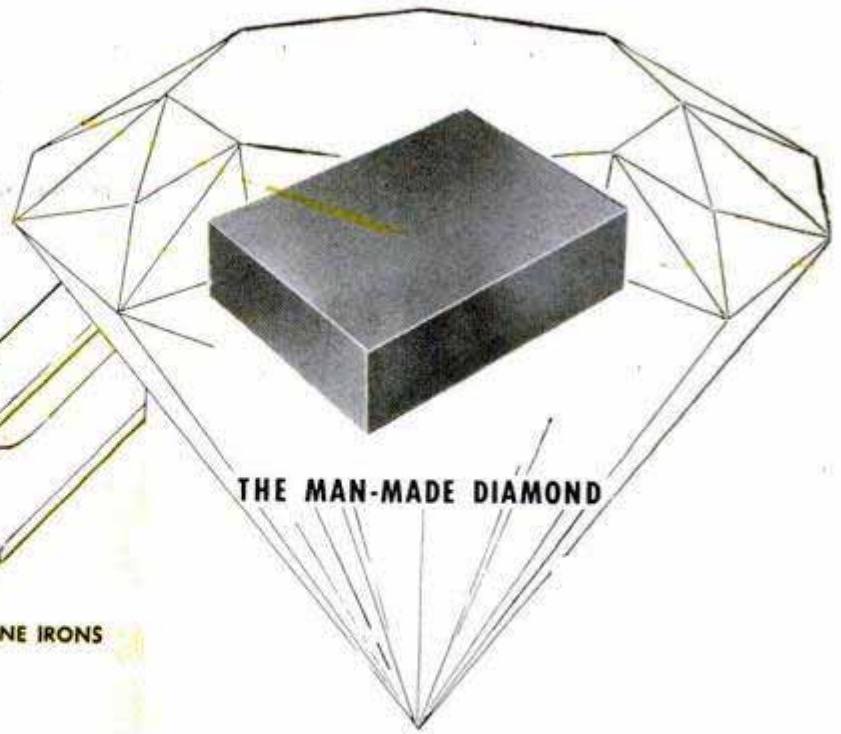
Editor's note: There is a rather acute shortage of the two metals which are needed to make carbides—tungsten and cobalt. Therefore, in the event of full-scale war, curtailment of these materials for defense needs may mean that carbide blanks will be unavailable. However, as we go to press, these blanks can be purchased without priority.

try and accounted largely for the phenomenal mass-production capacity of this country.

As the machinist knows, the performance of a metal-cutting tool and its ability to operate at high speeds is in direct proportion to its ability to retain hardness at high temperatures. As the point of a metal-turning tool, for example, is subject to extreme conditions of both load and temperature, the cutting edge wears rapidly, requiring frequent sharpening. Since temperatures as high as 1600 deg. F. occur at the point of contact and readily draw the temper from carbon-steel tools, it is easy to see why they cannot be used at high speeds or subjected to great overloads and why output consequently is correspondingly low.

In the past 50 years there have been

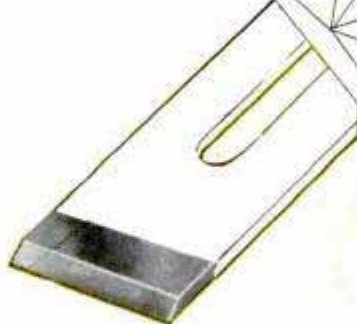
CARBIDE industry



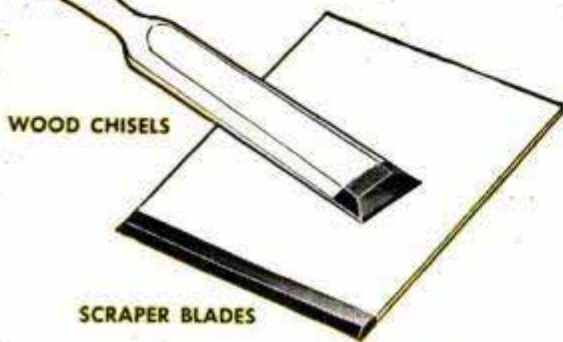
THE MAN-MADE DIAMOND



SAW BLADES



PLANE IRONS

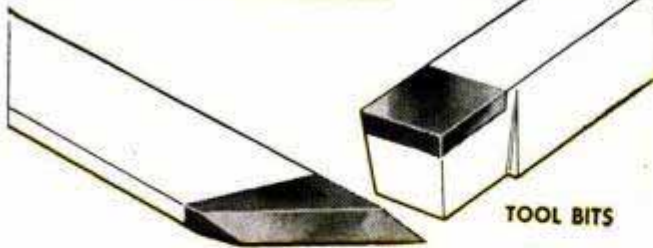


WOOD CHISELS

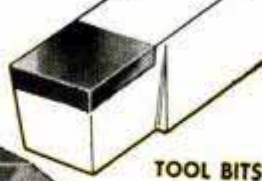
SCRAPER BLADES



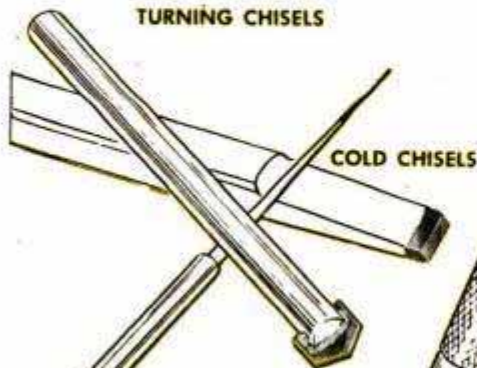
LATHE CENTERS



TURNING CHISELS



TOOL BITS



COLD CHISELS



MASONRY DRILLS

SCRIBERS

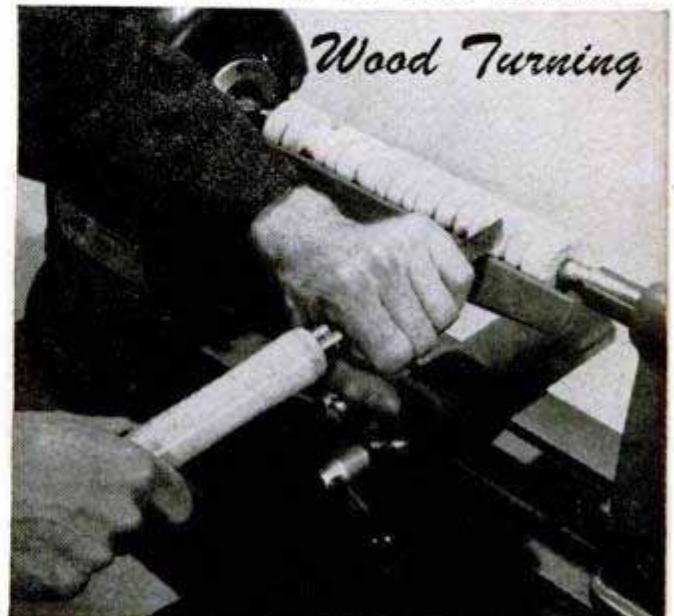


PRICK PUNCHES



Metal Turning

Capable of being operated at greater speeds than are possible with high-speed steel, carbide-tipped tool bits can be run red-hot without dulling the edge. Wood-turning chisels will hold their cutting edges indefinitely. Plastic will not "weld" when turning



Wood Turning



Planing

Your plane stays razor-sharp once tipped with cast alloy and sharpened. A laborious job by hand, drilling holes in concrete is done in a jiffy with carbide drill

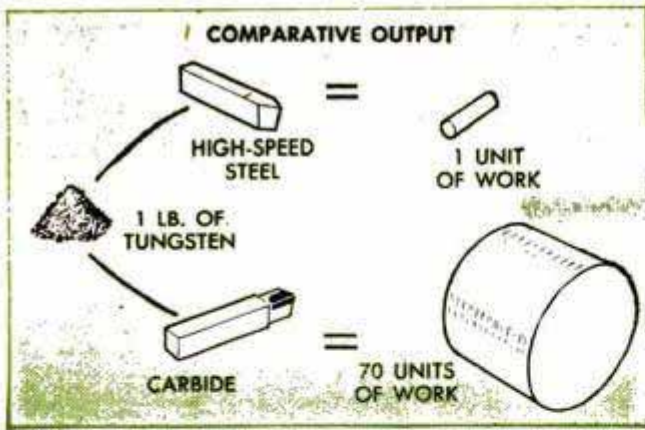


Concrete Drilling

three major developments in the field of metal-cutting tools—high-speed steel, cast cutting alloys and cemented carbides. Although high-speed and super-high-speed steels were a vast step over the use of carbon steel in the field of production, constant efforts were being made to develop an alloy of even greater productive capacity. In striving to obtain alloys that would have the ability to retain hardness at higher and higher temperatures, it was found that by combining suitable proportions of tungsten, chromium, cobalt, carbon and other metals, a property known as “red hardness” was imparted to the alloy, resulting in the cast alloys. As this property is increased, a tool can perform at correspondingly higher and higher speeds. Being superior to high-speed steel, cast alloys will function at cutting speeds about twice as great as those which are practical for high-speed steel. Thus, if 100 s.f.m. (surface feet per minute) is maximum for high-speed steel, the normal range for cast alloys would run from 100 to 200 s.f.m. Cast alloys work best under conditions where the cut is severe and the tool is heavily loaded—not so well for extremely light shaving cuts. The inherent hardness of cast alloy cannot be increased by heat treatment, as in the

TABLE OF SURFACE SPEEDS PER MINUTE

Surface Feet Per Minute	General H. S. Steel Cutting Range						General Tungst. Cutting Range						General Carb. & Cutting Range							
	40	50	60	70	80	90	100	110	120	140	160	180	200	210	300	350	400	450	500	600
	REVOLUTIONS PER MINUTE																			
1/4	611	764	917	1070	1223	1376	1528	1681	1833	2140	2444	2750	3056	3220	4184	5041	5900	6757	7614	9168
3/8	408	509	611	711	811	911	1018	1120	1223	1426	1630	1833	2037	2144	2750	3356	4000	4644	5288	6312
1/2	306	382	458	534	610	686	764	840	916	1070	1222	1376	1528	1681	2140	2596	3152	3708	4264	5128
5/8	244	306	367	428	489	550	611	672	733	856	978	1100	1222	1344	1681	2018	2356	2694	3031	3636
3/4	204	254	304	354	404	454	509	560	611	714	814	916	1018	1120	1376	1630	1884	2138	2392	2880
7/8	171	211	251	291	341	391	436	480	523	612	698	786	872	960	1184	1408	1632	1856	2080	2520
1	157	191	225	259	293	327	382	420	458	534	612	688	764	840	1037	1234	1431	1628	1825	2200
1 1/4	116	145	174	203	232	261	309	334	407	470	544	610	686	762	937	1112	1287	1462	1637	1960
1 1/2	122	151	180	209	238	267	305	326	366	428	488	550	612	674	820	966	1112	1258	1404	1680
1 3/4	111	139	167	195	223	251	277	305	332	388	444	498	552	606	732	858	984	1110	1236	1512
1 3/8	102	127	152	177	202	227	254	280	305	356	408	459	510	561	672	792	912	1032	1152	1392
1 3/4	87	109	131	153	175	197	218	240	262	306	350	392	434	476	576	684	792	900	1008	1224
2	76	95	114	133	152	171	191	210	229	266	304	342	380	418	504	590	676	762	848	1024
2 1/4	67	84	101	118	135	152	170	187	204	238	273	306	339	372	450	528	606	684	762	912
2 1/2	61	76	91	106	121	136	153	168	183	214	244	274	304	334	402	470	538	606	674	816
2 3/4	55	69	83	97	111	125	139	153	166	194	222	250	278	306	366	426	486	546	606	720
3	50	62	74	86	98	110	127	140	153	176	204	230	256	282	336	390	444	498	552	660
3 1/2	44	54	64	74	84	94	112	120	129	164	188	212	236	260	312	364	416	468	520	624
3 3/4	40	49	58	67	76	85	104	110	117	142	162	182	202	222	264	304	344	384	424	504
4	36	44	52	60	68	76	95	101	107	128	148	168	188	208	246	286	326	366	406	480
4 1/2	32	39	46	53	60	67	83	88	94	112	126	142	158	174	208	242	276	310	344	408
5	29	35	41	47	53	59	74	78	83	100	112	126	140	154	184	214	244	274	304	360
5 1/2	26	31	36	41	46	51	64	68	73	88	98	110	122	134	160	184	208	232	256	300



Comparative-output diagram shows clearly reason why cemented carbide has contributed such a phenomenal increase in production over common steel

case of high-speed steel. However, it can be ground with the same type wheels and in the same manner as required for grinding the latter. Also, as cast alloy is somewhat more brittle than high-speed steel and therefore more susceptible to breakage from shock and vibration, it is generally operated with less top and side rakes, as well as less front and side clearance angles. Marketed under such trade names as Stellite, Tantung, etc., cast alloy is manufactured in the form of either complete tools, similar in shape to a common high-speed tool bit, or small blanks for tipping purposes. Cast alloy is particularly recommended where the material being worked is wood, plastic, hard fiber or soft metal,

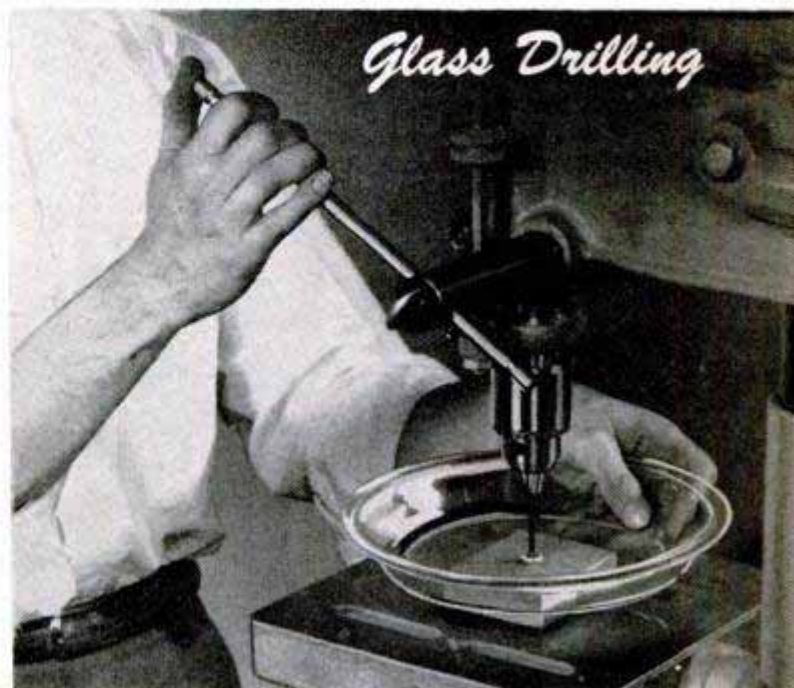
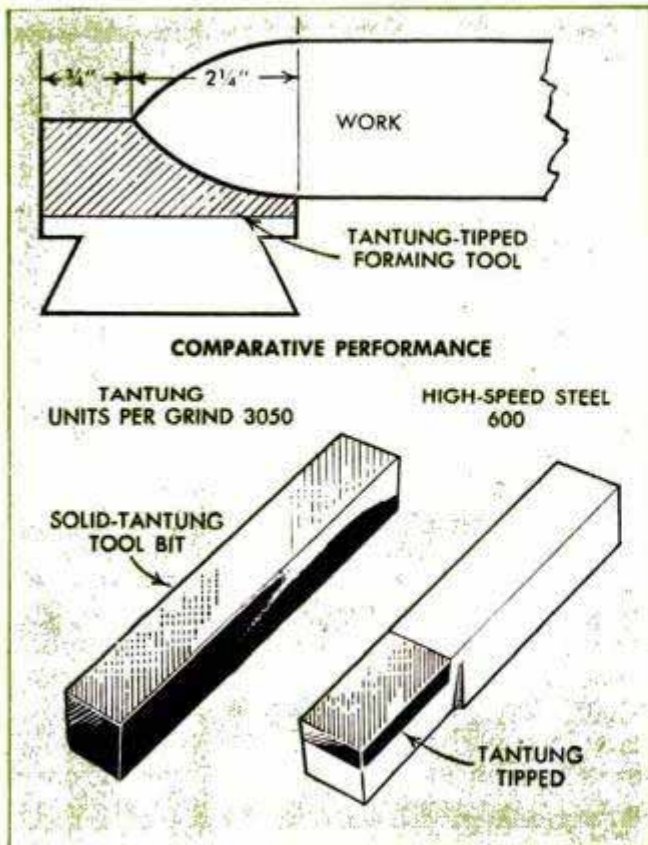
Actual manufacturer's report shows striking performance record between high-speed steel and cast alloy (Tantung) before cutting tool became dull

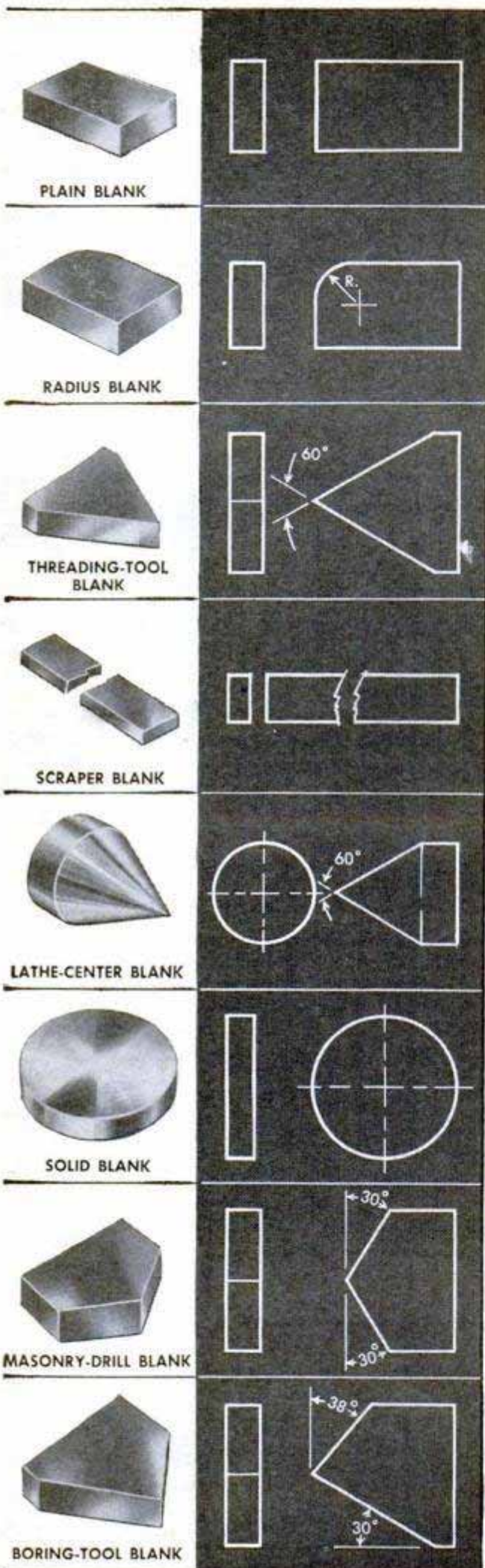


Tipped with teeth of diamond-hard carbide, your circular-saw blade will remain sharp indefinitely. Even striking a nail occasionally will not dull the blade



Above, constant sharpening of a scraper blade is not necessary when it is tipped with a carbide cutting edge. Below, slotted rod tipped with carbide blank, then ground properly and chucked in drill press, makes excellent drill for boring holes in glass and fiber





CUTTING SPEEDS TO USE FOR MACHINING VARIOUS MATERIALS

Material	Operation	Cutting-Speed Range (Surface feet per min.)
Gray cast iron	Heavy roughing	150 to 250
	General purpose	175 to 300
	Finishing	250 to 400
Malleable cast iron	General purpose	200 to 300
	Finishing	250 to 500
Steels: Carbon, low and medium alloy types, in usual hardness range for machining	Heavy roughing	125 to 250
	General purpose	175 to 300
	Finishing	250 to 350
	Precision boring	275 to 400
High manganese	General purpose	30 to 90
SAE 52100	Roughing	75 to 150
	Finishing	100 to 200
Annealed high-speed steel	General purpose	100 to 200
Stainless steel	Roughing	150 to 225
	General purpose	175 to 250
	Finishing	225 to 300
Aluminum	General purpose	500 to 1000
	Finishing	600 to 1500
Magnesium	General purpose	600 to 1500
Brass and bronze	General purpose	250 to 500
	Finishing	400 to 1000
Phosphor bronze SAE No. 64	General purpose	150 to 250
	Finishing	200 to 300
Plastics, plywood, casein products and carbon	General purpose	300 to 500
Asbestos, fiber, hard rubber, mica and hardboard	General purpose	200 to 400
Concrete, glass, porcelain, tile and transite	General purpose	100 to 200

and where it is not feasible to operate a particular machine at the high speed required for using cemented carbide.

In contrast, cemented carbide is considerably harder than cast alloy and approaches the hardness of the diamond. Capable of operating at high speeds and at a surface temperature of 1800 deg. F., the production-output potentialities are even greater, and cemented carbides consequently are employed wherever the particular machine tool can be safely operated at the high speed required. Cemented carbide consists of pure tungsten particles fused together with cobalt. These are mixed and pulverized in ball mills until the particles have been reduced to a diameter of 25 to 75 millionths of an inch. Using the processes of powder metallurgy, the powder is pressed in a carbide-lined die of suitable size and shape under pressure of 10-30 tons per sq. in. The resulting compact is fragile, but after heating to red heat in a furnace with a hydrogen atmosphere, it can be handled readily and ground, shaped or drilled. A second heating in specially designed furnaces, either hydrogen, atmosphere or vacuum, to temperatures of 2400 to 2800 deg. F. shrinks the compact and develops its full hardness of 85-93 Rockwell A. Small carbide tools often are made solid, especially when used in holders such as boring bars, but generally the carbide is

used as cutting tips which are brazed or clamped in steel-tool shanks.

Carbides as a cutting agent are by no means limited to machine-shop use — the handy man, carpenter and the craftsman in his basement shop can enjoy the use of this remarkable cutting alloy. Astounding as it may seem, the wood turner, for example, by tipping his chisels with carbide may need to resharpen them only once during a period of 10 years under normal usage. Lathe chisels tipped with carbide have been known to withstand continuous cutting 24 hours a day for a period of three months without sharpening. Those who like to work with plastic will find that the material will not "weld" to the cutting tool or burn the edge when it is tipped with carbide. Soft metals, including cold-rolled steel, can be turned freehand and at wood-turning speeds. Your power-saw blade when tipped with carbide will cut through rock maple like butter and you'll not be concerned about dulling the blade in ripping grit-covered, concrete-form boards, or accidentally striking a nail. Plane irons and wood chisels are two other excellent examples where these tools will hold their razor-sharp edges indefinitely. Hours of sharpening time can be saved by tipping paint and cabinet-scraper blades with carbide. Home-made drills tipped with carbide make play of drilling glass, porcelain, ceramics and concrete. In addition to being a remarkable cutting agent, the extreme hardness of carbide and its natural resistance to friction and corrosion make it ideal for all surfaces subject to excessive wear, such as your lathe tailstock centers and similar parts. Part II of this article will describe how easy it is to braze the blanks to your workshop tools using a small torch, and will explain how to grind the carbide tips after brazing. ★ ★ ★

Information courtesy Vascoloy-Ramet Corp.

Water Piped From Windmill Pump Cools Milk and Waters Stock



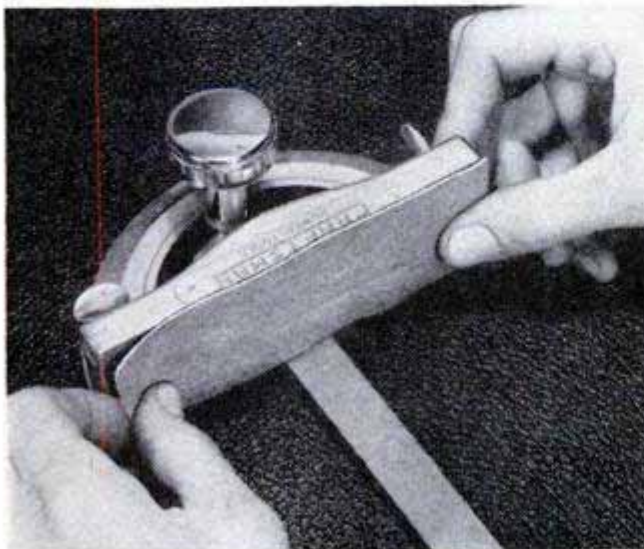
In order to cool small quantities of milk in warm weather, a farmer pipes water from a windmill pump into a large half-barrel in which a can of milk is placed. Another pipe, located several inches lower than the inlet pipe in the barrel, then carries the water into a concrete supply tank which, in turn, gravity-feeds a trough in the barnyard. With the windmill left in gear, the arrangement not only circulates cool water in the barrel continuously but also provides the stock with a constant supply of fresh water.

Joe Burkhart, Vinton, Iowa.

Hay Bales Protect Celery in Ground During Early Winter Months

One farmer uses damaged and weed-filled bales of hay to protect rows of celery in his garden during early winter months. The bales are placed end to end on both sides of a row of celery, about 6 in. from the plants, to form a continuous channel which then is capped with more bales. A bale at each end of the tunnel seals it against frost and cold air. Plants protected in this manner bleach white and stay crisp well into the winter months.

Sandpaper Facing on Miter Gauge Prevents "Creeping" of Work



Home craftsmen and others who experience trouble with work "creeping" when mitering on a circular saw can overcome the trouble by facing the miter gauge with sandpaper, which will provide a nonslip surface against the work. Attach the paper with model-airplane cement or rubber cement, or adhesive used to attach abrasive paper to sanding disks.

Henry Hanscom, Elmhurst, Ill.

☞ When using a posthole digger in heavy, clay soil, the annoyance resulting from the sticky substance adhering to the blades can be eliminated by pushing the blades of the digger into a bucket containing oil-soaked gravel from time to time.

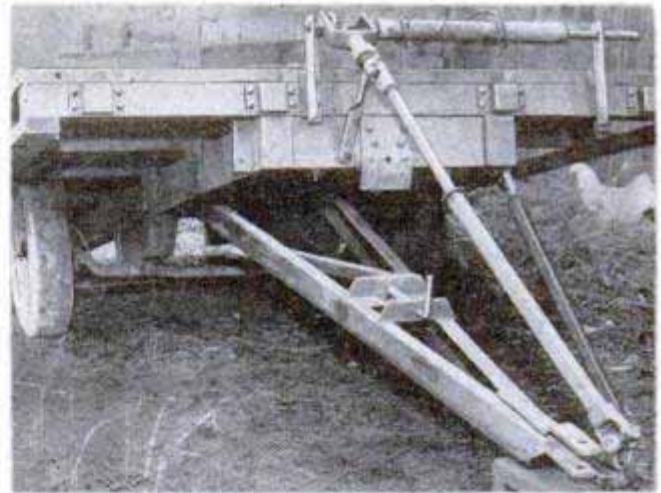
Garden Tools Stored Overhead in Racks Suspended From Ceiling



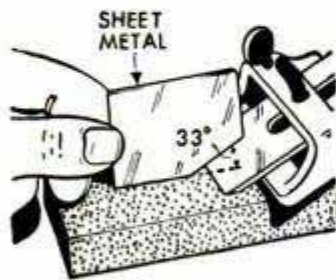
In order to store a large variety of gardening tools in a neat, orderly manner, one truck gardener devised overhead racks constructed of 2 x 4s for the purpose. Secured to a wall at one end, high enough off the floor to permit a man to walk beneath them, pairs of 2 x 4s are extended from the wall and joined together with boards to form frames which, in turn, are suspended from the ceiling by other boards. The frames are located in varying proximity to one another in order to make it possible for the tools, which may include hoes, rakes, spades, shovels and beet choppers, to be slipped in between them and stored upside down as shown. The size and number of racks necessary will be determined, of course, by both the quantity and shape of the tools to be stored. For simpler requirements, a small number of tools may be stored between two 2 x 4s extending from wall to wall across the back of a garage or shed. The tools are stored simply by slipping them up between the members and turning them a $\frac{1}{4}$ turn to hold them in place.

Loading Winch on Machinery Trailer Driven by Tractor Power Take-Off

A tractor-powered winch on a machinery trailer saves time and labor when loading heavy equipment for transport from farm to farm or from one field to another. The cable-winding drum is driven by a bevel gear mounted in a yoke and connected to a telescoping power take-off shaft. The drum shaft turns in sleeve bearings welded to angle-steel uprights which are bolted to the front cross member of the trailer frame. Note that the drum is mounted off-center on the trailer frame so that the take-off shaft will be centered when the trailer bed is tilted for loading. A spring latch holds the bed in a level position.



Gauge for Plane-Iron Holder Indicates Grinding Angle



When a fixture is used to hold a plane iron or chisel for sharpening, it often is difficult to determine the proper angle to hold the tool to obtain the correct

honing angle. On plane irons this is especially important to satisfactory performance of the cutting edge after sharpening. The problem is solved easily with a sheet-metal setting gauge. To make the gauge cut a rectangular piece about $1\frac{1}{2}$ in. wide and

3 in. long from heavy sheet metal. Cut off one corner with tin snips, the angle of the cut being equal to the angle of the bevel at the cutting edge. Then lock the iron in the holder, place it on the oilstone and slide the gauge against the iron as shown in the accompanying illustration. This will indicate the angle at which the iron should be held as it is moved back and forth across the oilstone. If the bevel is rounded the plane iron should be ground before honing.

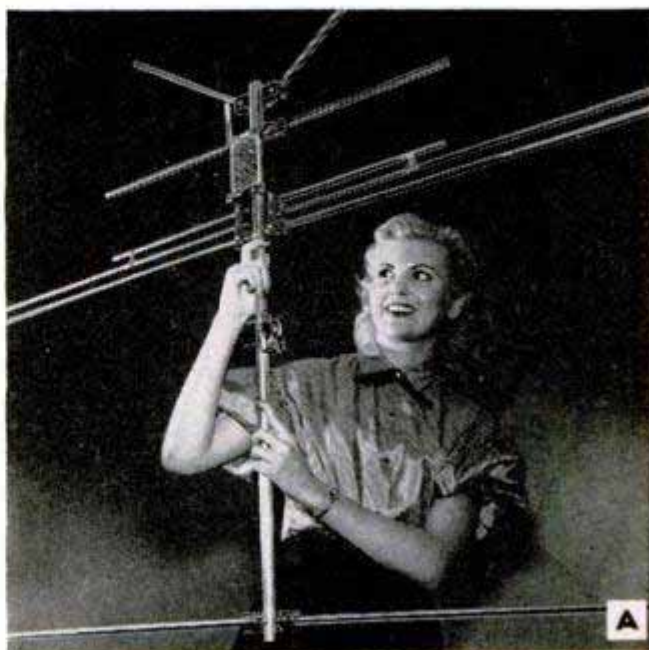
☐ A spoonful of pine oil, cedar oil or citronella added to paint, will repel bugs and insects from freshly painted areas.

TELEVISION TODAY

NOW that restrictions on television-station construction have been lifted, the sky line will soon take on a new look with the advent of UHF antennas of weird design. The one shown in photo A appeared in the recent Electronics Parts Show in Chicago. It is designed to receive both the VHF and UHF channels and is claimed to cover the entire spectrum of TV channels from 2 to 83. One of the new UHF indoor corner reflector types is illustrated in photo C.

The miniature TV receiver demonstrated by the young lady in photo B was designed by an English firm to emphasize the much larger picture provided by their 15 and 21-in.-tube domestic receivers. It consists of a cabinet built to about $\frac{1}{12}$ scale and uses a 1-in. picture tube powered externally by means of a cable connected to a standard TV chassis. A similar nonworking model has been authorized for installation in Queen Mary's dollhouse at Windsor. A number of these miniature working units have been constructed for dealers' displays and for trade exhibitions throughout the country.

A new three-station UHF translator to be installed in current G.E. television receivers is illustrated in photo D. The unit's station-selector switch and a UHF-station dial plate are mounted behind the present VHF tuning knob.



BATTERY ELIMINATOR FOR

By Lothar Stern

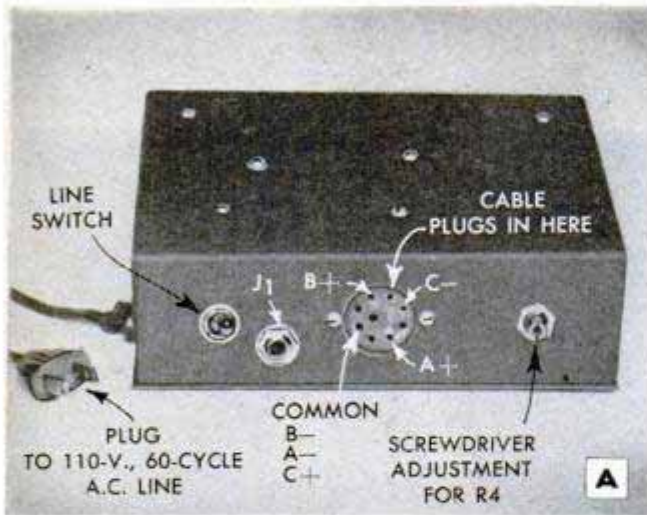
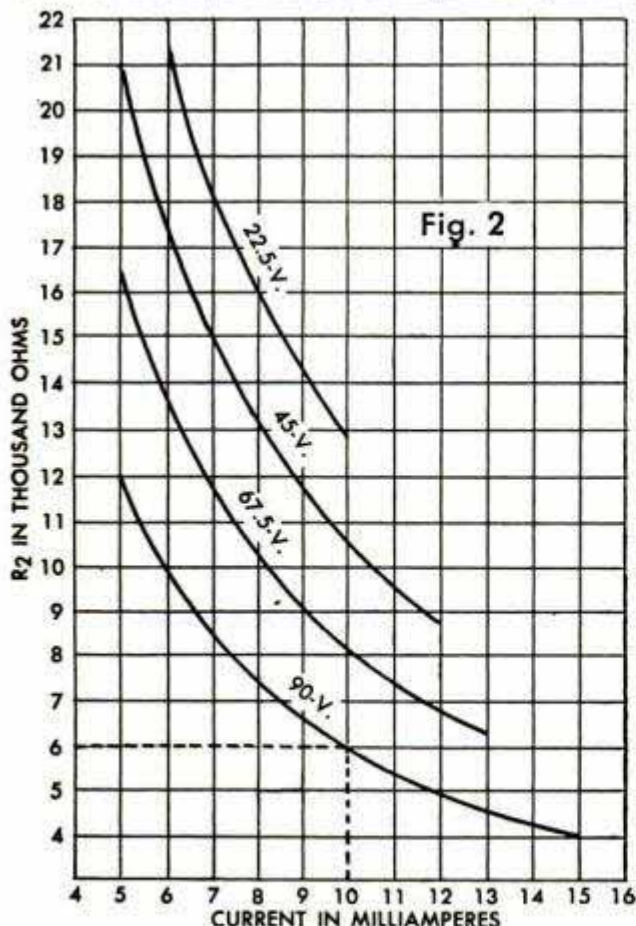


Fig. 1 RESISTANCE VALUES REQUIRED FOR VARIOUS VALUES OF FILAMENT CURRENT AND VOLTAGE

FIL. CURRENT	FILAMENT VOLTAGE			
	1.5-V.	6-V.	7.5-V.	9-V.
.05 AMP.	3000 OHMS	2880 OHMS	2850 OHMS	2820 OHMS
.1 AMP.	1500	1440	1425	1410
.15 AMP.	1000	960	950	940
.2 AMP.	750	720	712	705
.25 AMP.	600	575	570	566
.3 AMP.	500	480	475	470
.35 AMP.	420	410	400	395



THIS ELIMINATOR provides a simple, inexpensive method for operating battery sets on house current and thus extends their usefulness. It also can be used to power farm radios in areas where electrification makes battery operation no longer necessary. Only a few adjustments of the components are required to use this battery eliminator with most portables, farm sets, or civil-defense communications receivers, such as the one shown in photo B.

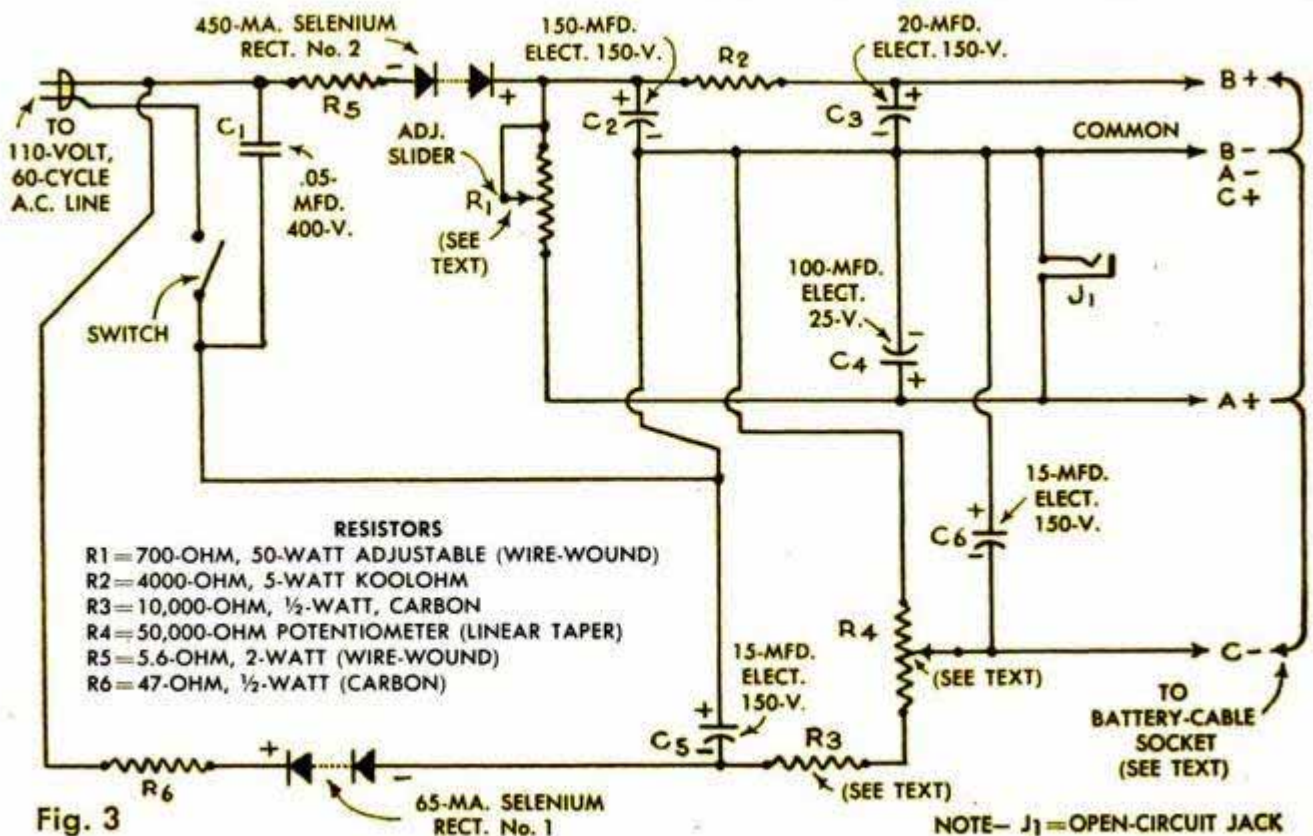
The values of the components depend upon the filament and B-plus voltages required for your particular set. You must know the number of tubes in your set; the current and voltage that the filament portion of the battery eliminator must furnish; the voltage and current required of the B-plus portion; and what bias voltage, if any, is necessary. Since these vary with different makes and models, a single eliminator unit cannot be built without including the many variable components shown in Fig. 3. Once individual requirements are determined, you can use less-expensive fixed components if you prefer to do so. All parts values for the adjustable universal model are given.

You should have the manufacturer's schematic of your set, or its Howard W. Sams Photofact folder for current and voltage data. In most battery sets the filaments of tubes will be in parallel; filament voltages and currents for each individual tube can be determined from any tube manual. If the filament circuit is in parallel, the total filament voltage is unchanged. The total current, however, is the sum total of the filament current required for each individual tube. Thus if your set uses four tubes and each requires .05 amp. at 1.5 volts, the battery eliminator must provide 2 amp. at 1.5 volts. The value of resistor R_1 determines the amount of current and voltage available for the filaments. Once you know the requirements of your set, the correct value of R_1 can be found from the table, Fig. 1. As the value of resistor R_1 is rather critical, a variable resistor is recommended and an ohmmeter should be used to set it to the correct value. After the eliminator is completed and connected to the radio, a voltmeter should be used to check the filament and B-plus voltage under load. The maximum output available here is 15 ma. (.015 amp.) at 90 volts. This output is suitable for the great majority of battery sets. By increasing the value of R_2 , the voltage output can be reduced to any desired value

PORTABLES AND FARM RADIOS

below 90 volts. The correct value for R_2 for your set can be found from the graph in Fig. 2; R_2 is not critical. The four curves in the graph represent various battery voltages. Suppose your receiver requires 10 ma. at 90 volts. Draw a vertical line from the point marked 10 on the horizontal axis until it intersects the 90-volt curve. A horizontal line to the vertical axis shows R_2 should be 6000 ohms (see dotted lines).

The C-negative biasing portion of the eliminator consists of a separate rectifier and filter system. Comparatively few battery sets require an external bias; if your receiver does not require it, the entire bias section in diagram Fig. 3 may be omitted. If required, use the adjustable-bias arrangement with values specified for R_3 and R_4 . The required bias voltage can be set with R_4 from 0 to -120 (with respect to the common B-point). All parts are mounted on a $7 \times 7 \times 2$ -in. metal chassis, as shown in photo C. An $8-32 \times 2$ -in. machine screw should be used to mount the large selenium rectifier. The type of output socket, see photo A, depends on the battery plugs used in your radio. A socket removed from your old battery pack will solve this problem. Follow whatever pin connections appear on the original. You will require the separate filament jack J_1 if a separate A-battery was used. Always be sure to turn the radio "on" before the battery eliminator. ★ ★ ★



By Frank L. Brittin



A

Operating Characteristics

- Ranges.....5, 10, 30, 100 and 200 naut. mi.
- Range Markers.....2, 5 and 25 mi.
- R.-F. Operating Frequencies:
 - Transmitting 9375 (± 55) mc.
 - Receiving (search) 9375 (± 55) mc.
 - Receiving (beacon) 9375 (± 1) mc.
- Peak Power50 kw.
- Pulse-Repetition Rate and Length:
 - Search (5, 10, 30 mi.)
800 p.p.s., 0.75 microsec.
 - Search (100, 200 mi.) 200 p.p.s., 3.5 microsec.
 - Weather (all ranges) 200 p.p.s., 3.5 microsec.
 - Beacon (all ranges) 300 p.p.s., 2.25 microsec.
(*Pulses per second)
- Pencil-Beam Dimensions:
 - Approx. 6 deg. in horizontal plane; 7 deg. in vertical plane, measured between half-power points
- Antenna Scan Rate:

	Full Scan	Sector Scan
5, 10, 30 mi.	40/min.	90/min.
100, 200 mi.	15/min.	35/min.
- WeightApprox. 175 lb.
- Power Consumption:
 - 1000 va., 400 c.p.s., 115 v.;
 - 200 watts, 28-v. d.c.
- Indicators (2)5-in. CR tubes

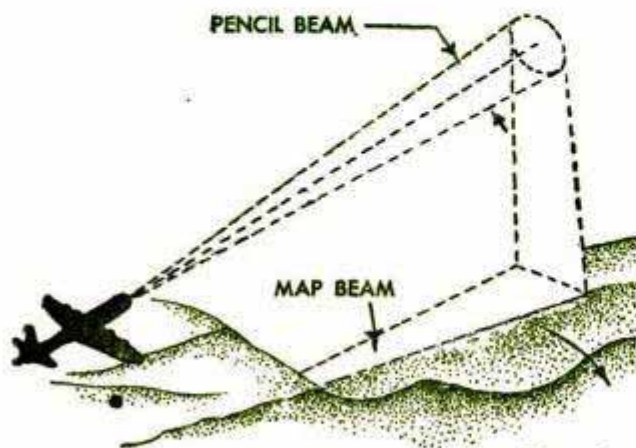


FIG. 1

SEEING-EYE radar of advanced design has already been the means of saving the crew and passengers of a Navy transport. This passenger-packed transport had just taken off in foggy weather when the control tower erred in instructing the pilot to make a right turn that would have taken him into the side of a hill. Fortunately, the plane was equipped with one of the new radar scopes for airplanes, and the pilot noticed the obstacle and made the correct turn. No statement was made as to where or when the incident occurred, except to advise that the field was not a military field.

One of these new lightweight radar collision-warning sets has been installed in the President's plane, the *Independence*, and on various military air transports. It is a marvel of compactness and efficiency and it is suitable for commercial aircraft. At the present time, however, this advanced R.C.A. equipment is being produced under Navy contract for military use only and is scheduled for production under an Air Force contract. Similar much heavier equipment has been used for some time in military combat aircraft. The advantage of this new unit is not only its light weight but also its simplicity of operation.

As a means of collision warning it will show mountains or other aircraft in the vicinity. As an accurate indicator of weather conditions, it will show the position of thunderheads and other cloud formations, thus enabling the pilot to avoid turbulent weather or to select a safe course through it. It provides a means of position location when standard landmarks are not visible; it can also pick up the signal of ground-based radar-range units.

According to engineers, the new unit permits the pilot to see a close-up view of a selected area as if he were using a powerful telescope that could penetrate through darkness and clouds. Another type of operation is that of mapping terrain. Through a special discrimination circuit, it shows the pilot the salient characteristics of the land over which he is flying.

The range of the system can be selected by the pilot for distances up to 200 miles from the plane. A selector switch permits the pilot to bring into view all obstacles and terrain within 5, 10, 30, 100 or 200 naut. mi. of his plane. When designed solely for navigation, obstacle and weather detection, the device weighs about 173 lb. before installation. It is pressurized to operate at altitudes up to 50,000 ft. and it is claimed

STEPS UP PLANE SAFETY

to be the first system of its kind to go into production that has both military and commercial application.

Signals from the radar antenna can be transmitted either in the form of a pencil beam for obstacle detection and general search or in the form of a vertical fan for mapping and navigational aid. The pencil beam, Fig. 1, has been compared to a flashlight with invisible rays which will show the pilot everything within a full circle of 400 mi. diameter. The beam can be raised or lowered to enable the pilot to look at the ground below and ahead of his plane or to measure the height of thunderheads and other clouds. The vertical fan position shows a picture of the ground up to a distance of 200 mi. ahead and to either side of the aircraft. The thin pencil beam, which is aimed horizontally, or approximately so, illuminates only potentially dangerous objects, or precipitation, which means those near or at the plane's own altitude. Thus the thin beam largely eliminates echoes from low terrain at critical times when the pilot is solely interested in seeing potentially dangerous storms or terrain at his flight altitude. Should the pilot spot a thunderstorm at that altitude, he can tilt the antenna and its beam to search for storm-free altitudes.

The three radar screens shown in Fig. 2 present a constant picture of everything in front of the airplane as it nears dangerous terrain. The warning shadow first appears



at the edge of the scope and, if no evasive action is taken, the terrain echo will invade the safety circle. When the shadow first appears along his flight path the pilot has advance warning, giving him plenty of time to climb out of danger. The range-azimuth indicator (radar scope) will show when he has reached a safe flight altitude.

Photo A shows Comdr. M. A. Mason, head of the Navy Bureau of Aeronautics Radar Section, and, right, W. B. Kirkpatrick, R.C.A. engineer, examining the simplified control box of the lightweight radar set. Photo B shows the complex arrangement of the radio and electronic components in the interior of the device. ★ ★ ★

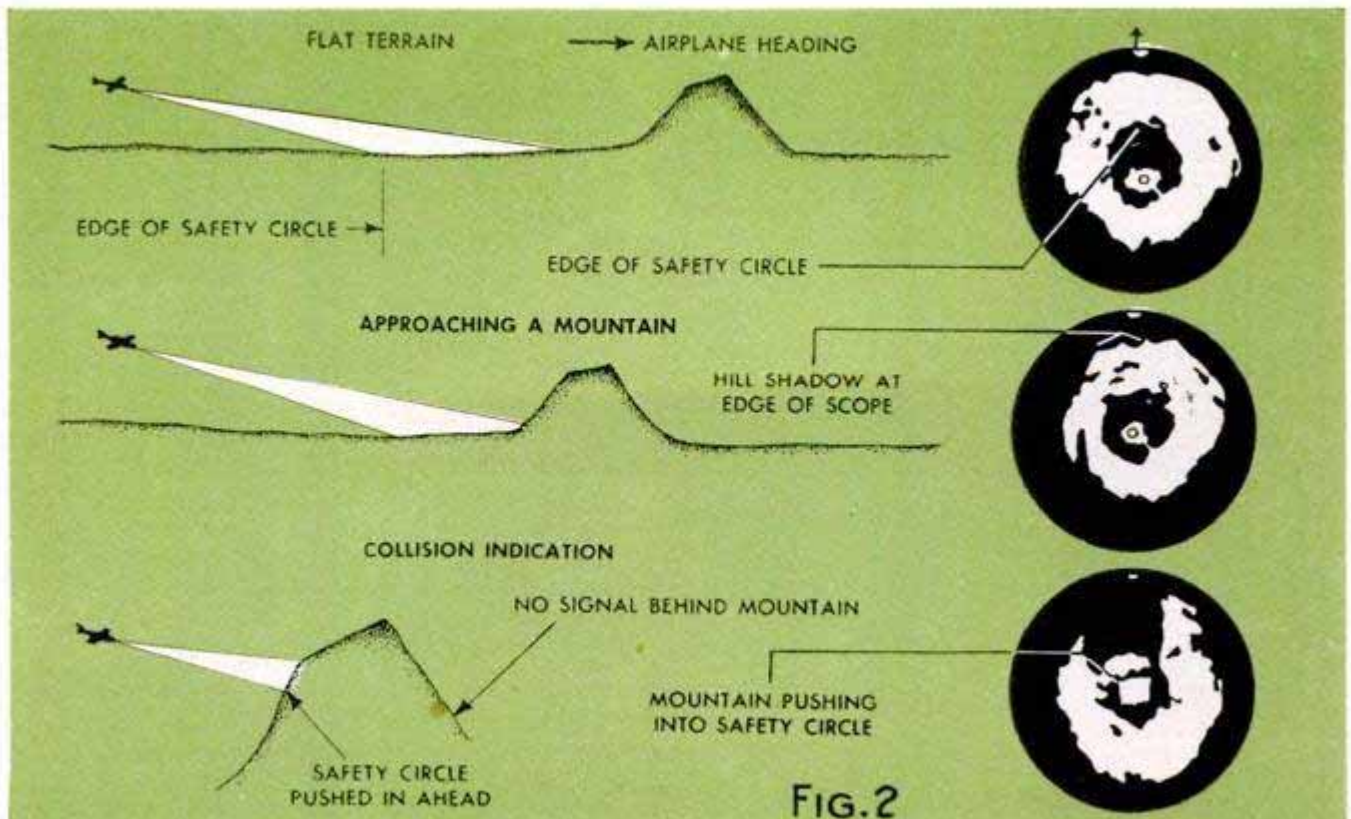
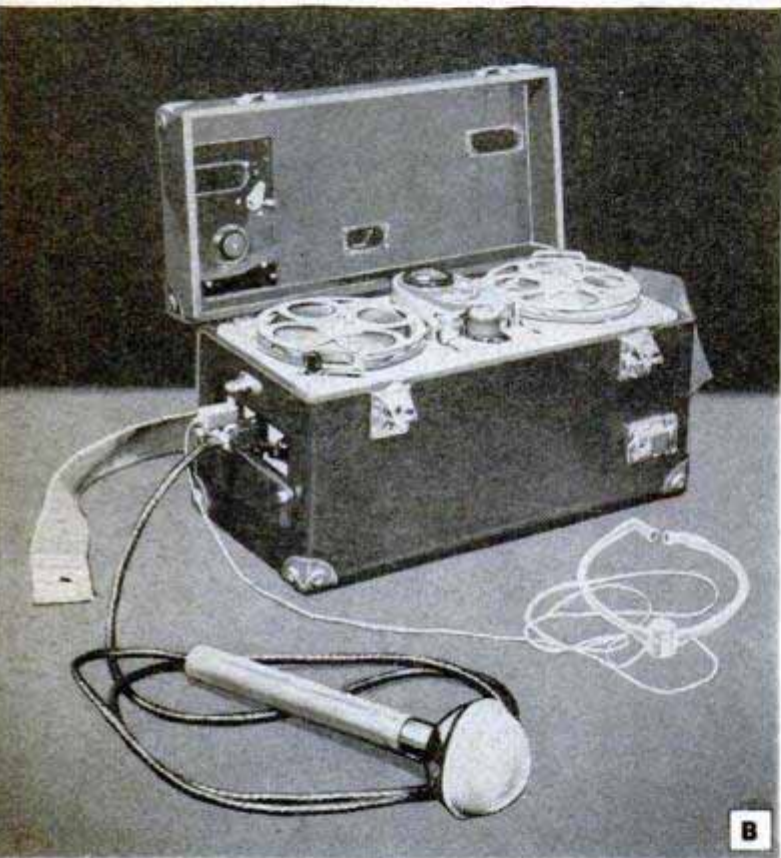


FIG. 2



A



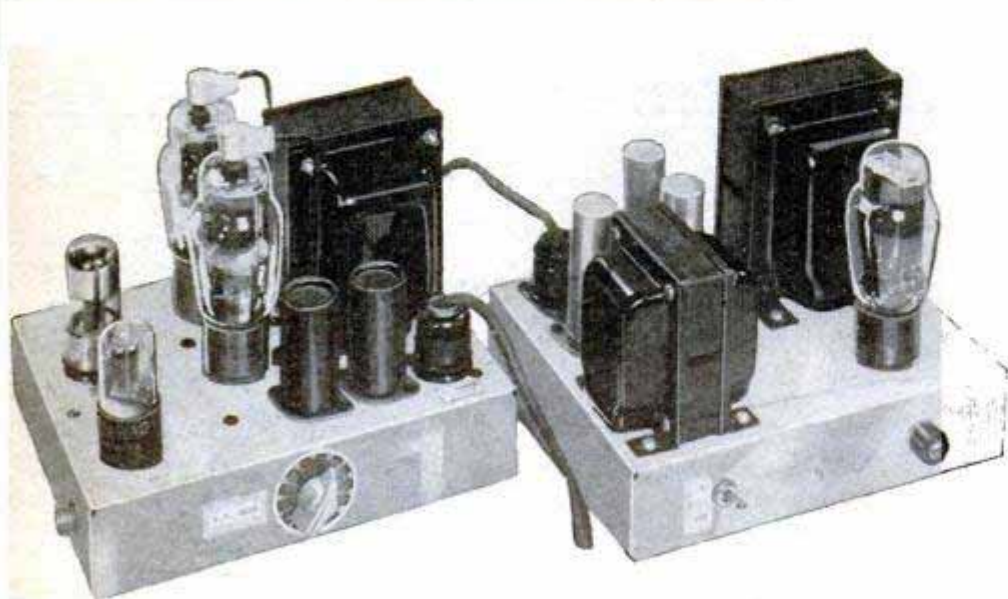
B

Adventures in Sound

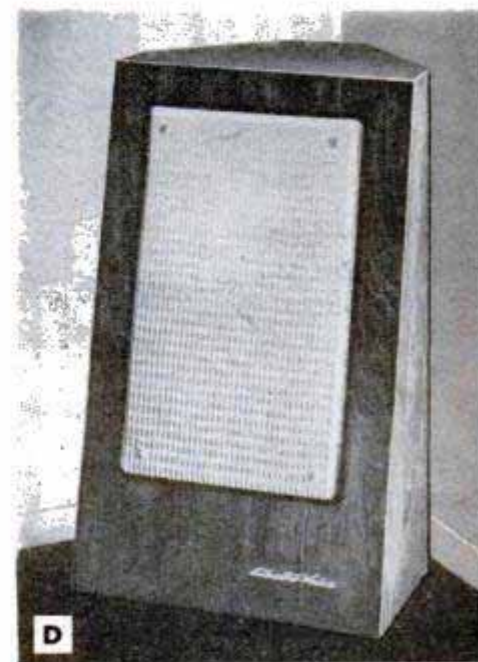
PERHAPS one of the first outstanding adventures in realistic sound reproduction was the fantastic "living presence" effects achieved in the Walt Disney movie *Fantasia*. Sound engineers have been working to obtain similar "three dimensional" effects in recording and reproduction for the music lover, teacher and high-fidelity enthusiast. Equipment recently demonstrated at the 1952 Audio Fair in Chicago employs an efficient binaural method of tape recording that seems to make recorded music originate in the room instead of in the headphones. In photo A, Eugene Carrington, a well-known sound engineer, is listening to a playback of tape-recorded music by this method. The binaural method is based on the premise that we listen to sounds with both ears—we therefore sense the location of the sounds and are able to concentrate on any one sound to the partial exclusion of others.

In recording, auditory perspective is preserved by using two microphones spaced about 8 in. apart. The output is fed through two separate channels in the recording amplifier and is recorded on two halves of a single 1/4-in. tape. In playback, each channel is fed separately into the earphones.

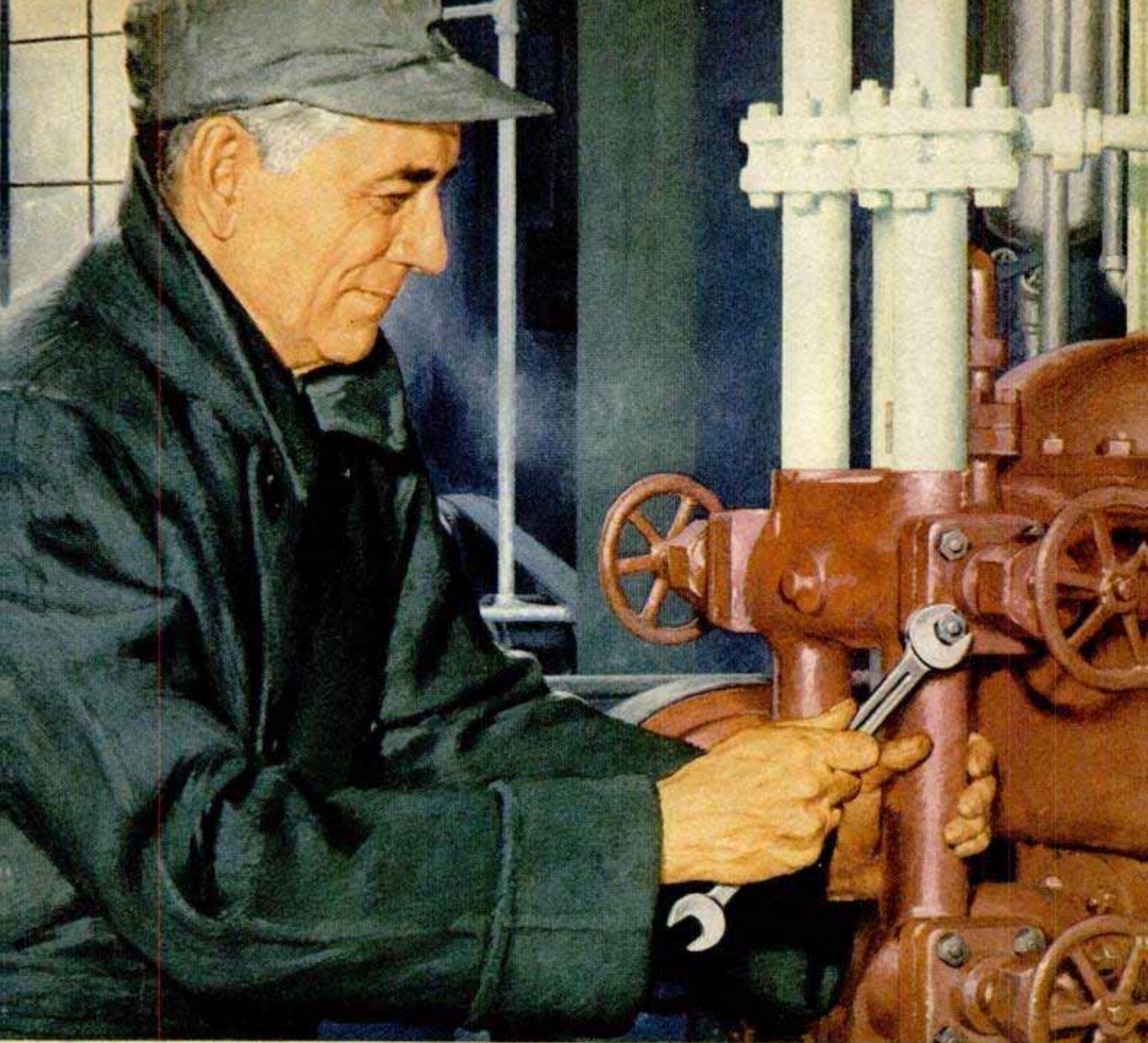
Many adventures in sound-recording reporting of on-the-scene events are heard on radio broadcasts. A lightweight, battery-operated, portable magnetic-tape recorder of English make used for this purpose is illustrated in photo B. A foundation kit for the efficient Williamson audio-amplifier unit, photo C, and the folded-horn corner enclosure for 8-in. loudspeakers, photo D, were focal points of interest to experimenters in sound who attended the Audio Fair.



C



D



PERSISTENT IN PERFECTION . .

Your goal is a perfect job. Only the best of materials, the most careful workmanship, and the finest of tools are good enough for you. And you are quick to recognize the work of other real mechanics who, like yourself, are persistent in perfection.

Perfection is the standard to which Bonney wrenches are made. Mechanics call them America's finest—unmatched for lightness, strength, balance, and precision.

Bonney wrenches are the pride of the men who make them . . . the pride of the men who use them.



Persistent in perfection, refrigeration equipment manufacturers like Carrier, Frick, Norge, York, Refrigeration Corporation of America have revolutionized the processing and preservation of food.

BONNEY FORGE & TOOL WORKS



Piston Rings wear out, too



TOUGH..but oh so gentle !

TOUGH on oil-pumping
GENTLE on cylinder walls

And there's just one thing to do about worn-out piston rings—replace them! Fortunately, piston rings warn you when they begin to wear. You start using too much oil. Your engine begins losing power. The more you delay the more you'll pay.

Naturally you want the rings that are *tough* on oil-pumping, *gentle* on cylinder walls. You want the rings that will stretch out your engine's life. You want Hastings Piston Rings—the rings that are engineered exclusively for replacement service. They *stop* oil-pumping, *check* cylinder wear, *restore* engine performance—for a long, long time—and at surprisingly moderate cost. It's the best money you can spend on your car.

Play safe. Avoid a major overhaul later on. Go to your motor specialist and ask him for a piston ring check-up now.

HASTINGS MANUFACTURING CO., HASTINGS MICHIGAN; HASTINGS LTD., TORONTO
Makers of Piston Rings, Spark Plugs, Oil Filters, Casite, Drout

HASTINGS

MOTOR-ENGINEERED PISTON RINGS

Featuring Chrome for Heavy-Duty Service





Now You've **TWICE** the Reason
to Insist on

**THE BEST HOUSE PAINT
YOU CAN BUY!**



This sketch illustrates the greatly increased value of many residential properties in the last few years.

Doubled property values give you twice the reason to protect and beautify your house with the best house paint you can buy.

Don't be fooled about house paint claims. Many house paints cost less than famous SWP. But no house paint offers so much real quality at so little cost. That's because SWP is *Weatherated* . . . field-tested and laboratory-tested to withstand all that weather and wear have to offer. Tested toughness is built into SWP to keep your house looking better *longer*. And enough SWP for the average six-room house costs less than \$45.00!

Now is the time to paint your house with SWP. Look for the familiar "Cover-the-Earth" sign . . . the sign of a friendly Sherwin-Williams dealer who will recommend a reliable painting contractor, if you wish. He can help you with *interior* decoration too . . . ask for your free copy of the Home Decorator or ask to see the Paint and Color Style Guide.

IT'S WEATHERATED

SWP House Paint is tested rigorously for its ability to resist chalking, checking, cracking, fading and dirt collection.



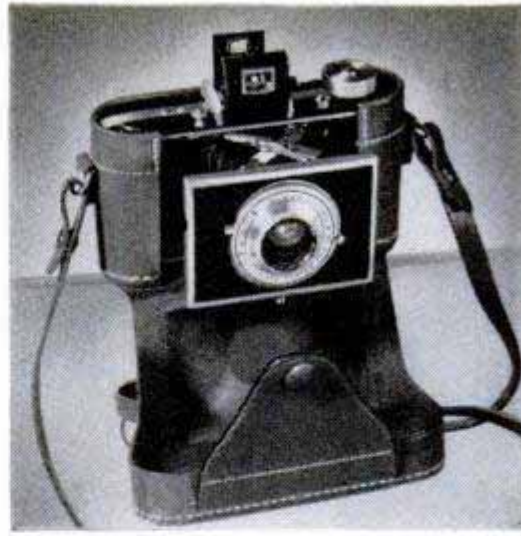
NOW is the time to paint your house with

SHERWIN-WILLIAMS PAINT

A Kodak Miniature Color Camera—there's one for every budget



Fine, extra-thrifty "miniature"—The budget-priced Kodak Pony 828 Camera gives sharp black-and-white negatives . . . superb color slides on Kodachrome Film . . . gorgeous Kodacolor snapshots. Kodak Anaston $f/4.5$ Lens (Lumenized); Kodak Flash 200 Shutter with built-in "synch." Takes 8-exposure rolls. \$31.15. Kodak Field Case, \$7.00. Pony 135 Camera for 20- or 36-exposure 35mm. film, \$35.75. Kodak Flashholder fits both cameras, \$10.55.



Smallest of the "miniatures" . . . and one of the best—The palm-size Kodak Flash Bantam $f/4.5$ Camera takes 8 exposures on black-and-white Kodak 828 Films, Kodachrome or Kodacolor 828 Film. Lens is superbly corrected Kodak Anastar $f/4.5$ (Lumenized). Flash synchronization is built into the $1/200$ shutter. Automatic film stop and body shutter release make for fast, simple operation. \$56.00. Kodak Flashholder, \$10.55. Kodak Field Case, \$7.00.

How to make the most of Autumn's

Every golden field, every fiery maple cries out to be "snapped" in color. So be sure to take along your camera—and plenty of color film—on Fall outings. You'll see great picture possibilities at every bend in the road.

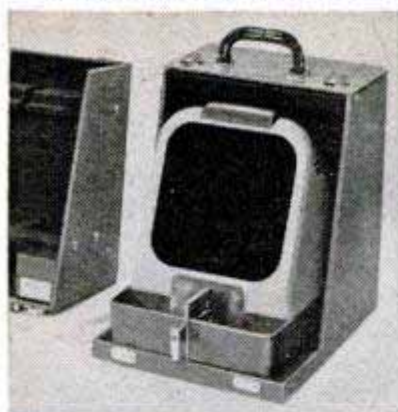


Precision range-finder "miniature"—The Kodak Signet 35 Camera, with world-famous Ektar Lens ($f/3.5$), produces sharp, brilliant color slides for projection or full-color prints with 20- or 36-exposure Kodachrome 135 Film; also clear black-and-white pictures with Kodak 135 Films. Has feather-touch shutter release bar, shutter with speeds up to $1/300$, built-in flash synchronization. \$92.50. Flashholder, \$10.55. Kodak Field Case, \$8.50.



Ultra-fast "miniature" in a new model—The Kodak Retina IIa Camera now features rapid film-advance lever, built-in flash. Also has fast $f/2.0$ coated lens in a $1/500$ shutter, range and view finder combined in a single window, automatic double-exposure prevention, film stop, and counter. Takes 20- or 36-exposure black-and-white Kodak 135 Films or Kodachrome 135 Film. \$164.10. Flashholder, \$10.55. Kodak Field Case, \$10.50.

A projector or viewer—to show your color slides at their brilliant best

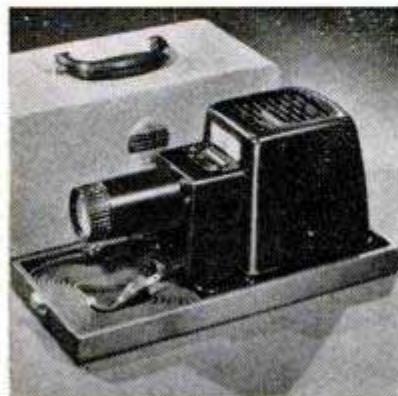


Kodaslide Table Viewer, Model A—Projector, screen, slide changer in one compact unit. Projects brilliant images even in a lighted room. Takes 75 cardboard or 30 double glass slides. \$97.50. Carrying case, \$27.50.

Kodaslide Table Viewer, 4X—Enlarges slides over four times on built-in screen. No fuss, no bother. Just snap it on and enjoy your handiwork. \$49.50. Carrying case, \$15.50.

Kodaslide Merit Projector—Budget-priced instrument for brilliant screenings. New jar-proof slide feeding; Kodak Projection Ektanon Lens, 5-inch $f/3.5$ (Lumenized); built-in elevation device; cool operation. \$26.10. Carrying case, \$9.50.

Kodaslide Projector, Master Model—Fast lenses and 1000-watt lamp can deliver more light to screen than any other 2x2-inch slide projector. Turbine-type fan cools both sides of slide. Choice of 4 projection lenses. From \$169.00. Carrying case, \$50.00.



color-picture opportunities

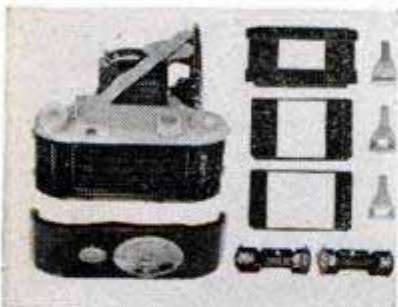
Some suggestions for the perfectionist



If you want your subject to stand out sharply against a dark blue sky in color pictures, use a Kodak Pola-Screen. From \$6.75. Kodak Pola-Screen Viewer for previewing effect, \$6.75.

Kodak Skylight Filter—“Warms up” many color pictures. \$1.65 up. To cut bluishness in flash pictures with Kodachrome Film, Type A, try *Kodak Light Balancing Filter 81C*. From \$2.07.

Inexpensive kits adapt Kodak Tourist and Reflex Cameras for Kodachrome Film—Kodak Tourist Adapter Kit for deluxe model “Tourists,” \$13.25 (left), and the Kodak 828 Adapter for Kodak Reflex Cameras, \$4.59 (right), permit picture-taking in full color on Kodachrome or Kodacolor 828 Film.



Kodak Auto-Release—Trips shutter, gets the photographer into the picture. \$3.86.



Deluxe file—Kodaslide Compartment File has 12 swing-out compartments for 240 cardboard or 96 glass slides. \$3.94.

Protects valuable slides—Inexpensive metal Kodaslide File Box holds 150 cardboard or 53 glass slides. \$1.57.



See your Kodak dealer for all your photo needs. He'll be happy to “talk shop” anytime you drop in.

Prices subject to change without notice and include Federal Tax where applicable.

EASTMAN KODAK COMPANY ROCHESTER 4, N. Y.

Kodak



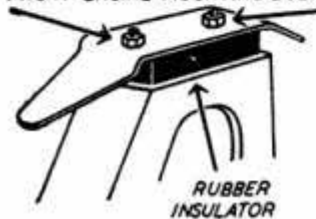
Care and Feeding of Engines

BY S. P. CORP

ALIGN THAT ENGINE

When the engine is installed in a passenger car, rubber insulators are used at each engine mounting support. Support bolts are drawn down just enough to fasten the engine securely to the frame. The rubber insulators deaden engine noises and prevent them from being transmitted up into the car.

FRONT ENGINE MOUNTING BOLTS



When engines are replaced, it is important that they be properly aligned, otherwise severe engine vibration will be felt in the car.

To correct such a condition, loosen the exhaust support brackets and all engine mounting bolts. Do not remove the bolts. Start the engine and accelerate

it a few times so that the engine will align itself. Then tighten engine mounting bolts and exhaust support brackets.

IT WON'T BE LONG

Before we talk to you again, there will be frost in the northern states. Between now and then, make these six checks to insure easy starting on the first cold morning:

1. Hydrometer-test your battery. If specific gravity is below 1.250, have it recharged. Be sure to see that battery cables are tight and not corroded. Clean cables are important to easy starting.
2. Check distributor cap for cracks. Clean cap and all wires; replace worn wires. Good ignition is vital to quick starting. Remove one wire from spark plug and hold $\frac{1}{16}$ " from engine block. Start engine. If spark jumps gap evenly, ignition is O.K. If erratic, check distributor points for correct spacing and replace any that are burned or pitted. See that all connections are tight.
3. Remove and clean all spark plugs, replacing any with cracked porcelain. Regap to car manufacturer's specifications. Install new gaskets, tighten plugs finger-tight, then use socket wrench just enough to squeeze the gasket.
4. If starter is sluggish, check brushes and commutator. A dirty starter can make the engine start hard.
5. Use a light oil for winter driving.
6. Depress clutch pedal for cold-weather starting.

INSTALL KROMEX RING SETS

To get all the winter power you need, install Sealed Power KromeX Ring Sets, specially engineered for late-model cars and trucks. Top compression rings and steel rails of oil rings have chrome faces to fight heat, friction, corrosion, and abrasion. Write Dept. G-9, Sealed Power Corp., Muskegon, Mich., for new free booklet, "MORE POWER, Less Oil, Less Gas."



What's It Like to Crash?

(Continued from page 132)

of stock cars just like yours—with a few safety devices added—do it all the time. With similar devices, Mr. Average Citizen could be equally safe in his own car. Such safety measures are the things we are testing now. They will have to be part of tomorrow's car if we're going to keep from wiping ourselves out on the highways."

For Junior, the Epping technicians have drawn up plans for a seat that is welded to the frame of the car—back end to the dashboard and low enough so that loose gear in the car will sail over his head in a crash. "Maybe he can't see out but at least he'll live to see another day."

Like the men who race stock cars, Epping technicians have removed the slides from the front seats on experimental cars and bolted all the seats to the chassis so they won't tear loose.

To prevent roof collapse in roll overs they are reinforcing the body with heavy steel uprights that, White believes, will allow a car to cartwheel a dozen times without collapsing. "Stock car racers also weld their doors shut," he says, "to keep them from popping open. While this isn't feasible for a family car, we are working on extra steel tongue locks that would work like those on emergency hatches in airplanes and do the same job. The car owner would have to keep them fastened while the car was in use."

Also like the stock-car racing drivers, all the occupants of tomorrow's car—Epping style—will wear webbed safety belts similar to those airplane passengers use. "They're not especially popular," says White, "but they certainly save lives by keeping a passenger pinned to his seat and preventing him from flying around in a crack-up." Several cars at Epping are equipped with these experimental belts, fastened to the framework and extending up at a 45-degree angle around the passenger's waist. "We've subjected them to a 4000-pound pull and they've held," the men reveal. "With three inches of play (which makes them quite comfortable) a passenger can roll with the shock, distribute his weight and keep from snapping his back as he would if the belt were tight."

One alternative to belts would be reversed seats for everyone but the driver—equally unpopular since few people enjoy riding backward. However, they work.

A lot of work at Epping will be aimed at that skull crusher, the dash panel. Buttons will be recessed so they can't bury themselves in a passenger's head and the panel

(Continued to page 226)

Savage-Stevens

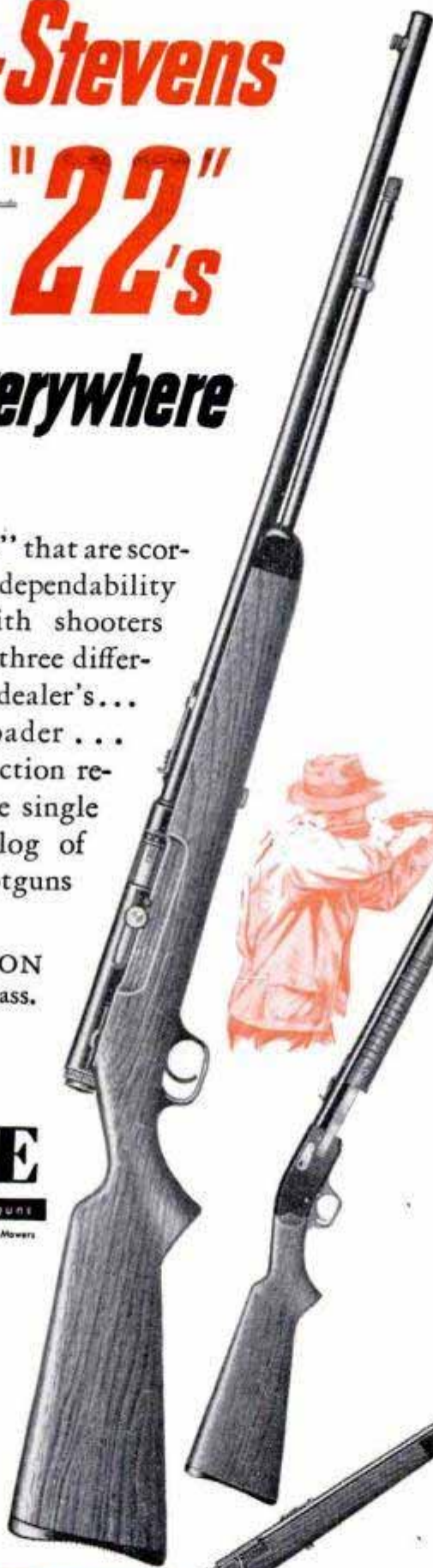


"22's"

scoring hits everywhere

Here are three "22's" that are scoring *hits* for value, dependability and performance with shooters everywhere. See these three different style rifles at your dealer's... lightning-fast auto-loader... smooth operating slide action repeater... handy, reliable single shot. Write for free catalog of Savage, Stevens and Fox shotguns and rifles.

SAVAGE ARMS CORPORATION
Firearms Division • Chicopee Falls, Mass.



STEVENS MODEL 87

.22 cal. auto-loading rifle—for shooters who want an accurate, moderately priced semi-automatic. Just the rifle for rapid firing at small running game, or for plinking fun. "15 shots as fast as you can pull the trigger." Tubular magazine. Instantly adjustable as auto-loader, bolt action repeater, or single shot rifle. MODEL 85—same as Model 87 except 6 shot, with clip magazine. Both are "three-in-one" rifle values.



Sturdy, simple action—quickly disassembled, without tools, for cleaning.

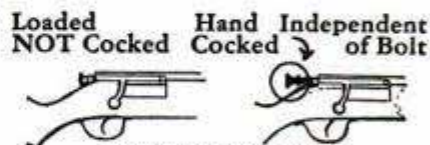
SAVAGE MODEL 29

Short forearm stroke—slide travels only 1½" in loading and ejecting.



.22 cal. slide action repeating rifle. The famous "22" with the SHORT slide action. A flick of the wrist ejects and loads cartridge smoothly, surely—without disturbing aim or rifle position. Dependable, hammerless action... one-piece bolt removable without tools for cleaning... single take-down screw... walnut stock... extra long slide handle, vertically grooved for firm grip.

STEVENS MODEL 15



SAFETY FEATURE

.22 caliber single shot, bolt action rifle. Man's size, yet correctly proportioned for youngster's use also. Hand cocking action, independent of bolt, provides maximum safety. And here are some other features: bolt handle directly over trigger for fast operation; newly proportioned stock with handsome black-tip fore-end; 24" barrel; gold bead front and open rear sight with elevator.



Here's how for home painters



A quick, neat trick for painting window frames. Simply cut newspapers to exact size of window pane, soak in water for a few seconds—and then smooth onto the glass. You'll have perfect protection for the pane . . . can paint the wood

trim in no time. You'll get best results with beautiful Devoe Trim & Shutter Colors.

A play place for children—out of a pot of paint. On basement floor or discarded table, help kids paint roads, lakes, rivers. Make houses, boats, bridges from painted pieces of cardboard; trees from small bits of painted rubber sponge. Keeps the youngsters happy and occupied on rainy days.



Easy way to keep tabs on garden tools—paint them in bright colors. Makes them easier to find lying in the grass . . . easier to identify if Junior drags them over to the neighbor's. Use Devoe Mirrolac Enamel for bright lasting colors.

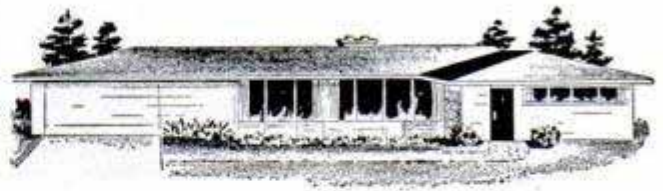
No strain to get rid of hard lumps in old paint. Mix paint . . . then cut piece of wire screen to size of can. Put screen into can and away it goes to the bottom—carrying lumps with it, leaving smooth strained paint above.



You can get all the painting accessories that you need—and many more helpful tips—at the sign of the Devoe Diamond. Why not stop in and see your Devoe Dealer very soon? You'll find his name listed in the Classified Phone Book.



Clinic for Homemakers



As a service to our readers in solving the hundreds of problems pertaining to a home—inside or out—the editors of *Popular Mechanics* invite you to present your problems to The Clinic Editor for help and advice. Address your questions to The Clinic Editor, *Popular Mechanics Magazine*, 200 East Ontario Street, Chicago 11, Ill.



Enclosing Open Foundation

Q—Our small home is built on a pier foundation, that is, the sills rest on individual piers about 24 in. high with open spaces between. We'd like to enclose this space in some way but building a continuous masonry foundation is expensive and wooden siding would rot. Isn't there a cheaper method?—R.A., W.Va.

A—Of course, the construction of a masonry foundation would result in a permanent job, provided it was built of good materials such as brick, stone or concrete blocks laid upon a footing of the required sectional size. The only other suggestion which we would consider practical is to enclose the space with a "curtain" wall of asbestos-cement board. This material is fireproof and very durable even when it is placed in direct contact with the ground. It will be necessary, however, to frame in a substantial nailing base between the piers. This should consist of a false sill directly below the permanent sill and just above the grade level. Nail in short studs between the sills and space them uniformly on centers so that the asbestos-cement board can be attached without cutting to smaller sizes.

Artesian Well

Q—What is an artesian well? Is it dug or drilled? Does the water always flow to the surface? I'm told that I can have an artesian well in this locality and that it will assure an adequate water supply for household use and also irrigation of a small garden plot. But so far the information I am able to obtain is conflicting. Can you advise?—W.M., Tex.



A—In general an artesian well is made by drilling to a water table, or water-bearing strata, from which water will be forced to the surface by hydrostatic pressure built up by an underground flow from a distant source. In the United States the term "artesian" generally is applied to wells that flow more or less continuously without the added lift supplied by a pump. So far as the possibility of bringing in an artesian well, the probable rate

(Continued to page 224)

Don't Guess About Your Future!

U.S. AIR FORCE



The Air Force needs trained Air Traffic Control Operators

Your United States Air Force is expanding rapidly. It needs **YOU** and your special technical knowledge. Your skill and "know how" can serve your country and yourself to best advantage in today's vital job of national defense.



The Air Force needs trained multi-engine Flight Engineers

Eliminate the guesswork from your future and advance in your technical field to more profitable and satisfying rewards with your U. S. Air Force.



The Air Force needs trained Ground Control Approach Operators



The Air Force needs trained Aircraft and Flight Mechanics

Here Are a Few of the Many Great Air Force Opportunities!

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- AIRCRAFT ACCESSORIES MAINTENANCE
- WEATHER • ARMAMENT SYSTEMS
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- MARINE • FIREFIGHTING
- SECURITY AND LAW ENFORCEMENT
- CONSTRUCTION

Act Now!



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 Please send me details about enlisting as an Air Force specialist.

NAME.....
 ADDRESS.....
 CITY..... ZONE..... STATE.....
 MY SPECIALTY IS:.....

Pointers for Home Painters Ceilings:

(Continued from page 222)

Before painting, loosen base plate of lighting fixtures—drape with small cloth to prevent splattering. Don't overload brush with paint.



Stand on plank across two ladders. Start in corner. Dip brush to one inch. Raise quickly. Use short, light strokes. Paint in areas about four feet square.



Use a commercial hand protector, for quick cleaning of hands when job is done. Remove stubborn paint with thinner. Wash with soap.



For storage, clean brush thoroughly with thinner. Then scrub bristles with warm water and cleaner. Rinse in clear water, comb bristles and wrap in paper and store.

JOB AFTER JOB you'll get best results with a well-tipped nylon paint brush. Durable Du Pont nylon bristles paint smoother . . . are clean and sanitary . . . never get brittle . . . don't break off even under the roughest treatment. And nylon bristles last from 3 to 5 times longer than ordinary bristles. Leading manufacturers make nylon paint brushes in all types and sizes. Look for the name **NYLON** on the handle. Be sure to pick the size brush designed for the job . . . and demand Du Pont nylon bristles.

150th Anniversary



Better Things for Better Living
... through Chemistry

The best brushes have
**DU PONT NYLON
BRISTLES**

of flow, and the necessary drilling depth are concerned, your local well-drilling contractor is in a better position to advise than we are. In general, the requirements are a deep bore, a suitable steel casing for lining the bore, and a cap or some other device incorporating a valve for controlling the rate of flow.

Unpleasant Odor

Q—We recently purchased a new bedroom suite in light blond wood and we have been puzzled by the unpleasant odor that seems to come from it, especially when the drawers in the chest and dresser are opened. Also we have the same odor in the living room of our house which has hardwood floors recently finished by the builder. What causes this and is there any remedy?—J.F., Mich.

A—We wonder if you are not referring to the odor of new finishing materials, which many individuals find disagreeable, especially in a closed room. However, there is another possibility. The odor may be caused by the slow dissipation of residues from certain chemicals used in bleaching the wood of both the bedroom furniture and the floor in the living room. There is no simple remedy that can be recommended, and probably none will be necessary in your case as the odor will dissipate in a comparatively short time, at least to such an extent that it will be no longer troublesome.

Masonry Wall Cracked

Q—My new home has cinder-block walls covered with stucco and the walls are cracked through on both sides of the house. However, the foundation has not settled or cracked and the corners of the building seem to check plumb. The stucco has loosened from the blocks near the cracks. What causes the walls to crack?—P.T., Iowa.



A—Usually there are a number of causes of masonry walls cracking in the manner you describe, but your statement that the foundation still is sound narrows the possibilities somewhat. We think it quite likely that the cracks are caused by the use of "green," or uncured, cinder blocks. A wall built of improperly cured blocks will tend to shrink along its entire length and will crack at the weakest point, which usually is near or under windows. In some cases damage resulting from such cracks is quite extensive and will require a major repair. There is little use in attempting to fill the cracks and repair the stucco until it is certain that all movement due to shrinkage has ceased. When this is so, it usually is possible to make a reasonably durable repair simply by filling the cracks with cement mortar and patching the stucco.

Nail Stains

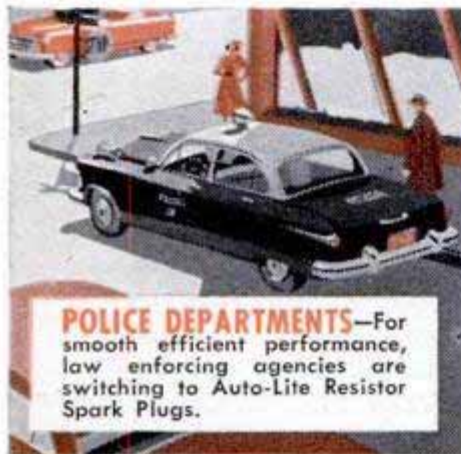
Q—My home has been painted two years and now the siding is badly streaked with brownish stains. The stain streaks seem to originate at each nail head. How can I remedy this situation before I paint, which I plan to do next spring? Is it practical to remove the present nails and replace with aluminum nails?—O.P., Ill.

A—Rusted nail heads are the cause of the trouble you describe. Before you paint again, sand each nail head to remove the rust and then coat with aluminum paint. This will take a lot of extra time and labor, of course, but the treatment is quite effective. When doing this job use a fairly coarse abrasive, such as aluminum-oxide cloth. In most cases it is not practical to attempt removing the existing nails and replacing with aluminum nails. It could be done, of course, but it would be necessary virtually to remove all the siding and replace it in order to get at all the nails. This would result in considerable damage to the individual boards. We believe that if you follow the method outlined you will have no further trouble with staining.

EXPERTS HAVE PROVED

Auto-Lite **RESISTOR** Spark Plugs GIVE DOUBLE LIFE*

...smoother performance... quick starts... greater gas savings



POLICE DEPARTMENTS—For smooth efficient performance, law enforcing agencies are switching to Auto-Lite Resistor Spark Plugs.



FIRE DEPARTMENTS—To get quick, sure starting, some of our nation's finest fire departments are insisting on Auto-Lite Resistor Spark Plugs.



CAB COMPANIES—Enthusiastic taxi firms report best performance in heavy city traffic after installing Auto-Lite Resistor Spark Plugs.



CAR ENGINEERS—After grueling laboratory and road tests, leading automotive engineers selected Auto-Lite Resistors as original factory equipment.



CAR OWNERS—Millions of car owners find Auto-Lite Resistor Spark Plugs give them advantages possible only in spark plugs with a built-in resistor.

EXPERTS have proved Auto-Lite Resistor Spark Plugs give smoother performance, quick starts, greater gas savings and *double life** . . . benefits important to every car owner. Discover for yourself these benefits by replacing your worn-out spark plugs with Auto-Lite Resistor Spark Plugs.

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio Toronto, Ont.

*Double life under equal service conditions when compared to spark plugs without a built-in resistor.

"Ignition Engineered"

AUTO-LITE

Resistor SPARK PLUGS

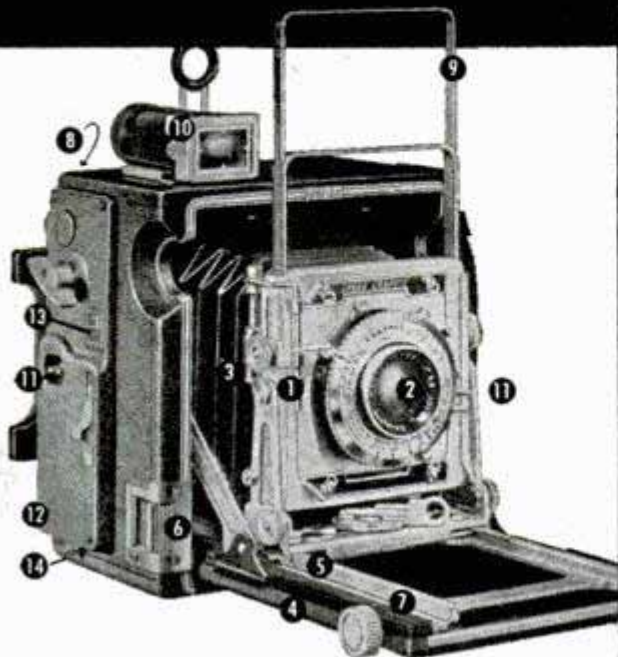


The Auto-Lite Line also includes Standard, Transport, Marine, Aircraft and Model Plane Spark Plugs.

Auto-Lite Spark Plugs—Patented U.S.A.

Tune in "Suspense!"...CBS Radio Mondays...CBS Television Tuesdays

14 Reasons Why GRAPHIC Gets Great Pictures!



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| 2. Interchangeable Lenses | 9. Open Frame Viewfinder |
| 3. Double Extension Bellows | 10. Optical Viewfinder |
| 4. Drop Bed | 11. Built-in Flash Synch. |
| 5. Folding Infinity Stops | 12. Graflok Back |
| 6. Body Shutter Release with Shutter Selector Control | 13. Direct Reading Focal Plane Shutter Speeds |
| 7. Vernier Focusing Scale | 14. Governor Selector |

Speed Graphic (illustrated) has focal plane shutter with governed speeds to 1/1000th. Crown Graphic is identical, but without focal plane shutter . . . and costs less. Both available on terms as low as \$2.50 a week from many Graflok dealers.



SEE THE POPULAR CENTURY GRAPHIC TOO!

Lowest priced of the famous Graphics—but with many prize-winning Pacemaker features—including ground glass focus; built-in flash; coated, color-corrected lens and fast shutter. 2¼ x 3¼ . . .
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itself will be made of special shock-absorbent material. Several things—among them balsa wood—are being tried. “We’re looking for stuff with a ‘slow memory,’” they explain, “that will slow down a human head without pitching it back again as does sponge rubber or leather padding.” Oddly enough, in laboratory tests an artificial skull bounced with force against a sponge-rubber pad mounted on concrete cracked wide open. When bounced on light-gauge steel raised off the floor, however, the shock was absorbed and the skull remained intact.

Though the car of tomorrow at Epping is still in the embryonic stage, experiments so far have indicated several other things it will have to have—windshields like those now being made by one car manufacturer, which are set in rubber and will pop out of their frames when given a whack from behind; breakaway steering posts that won’t spear or brain the driver when he’s rammed against them. White wants to do away with what he calls merry-go-round steering, too. “No one,” he says, “can control a modern car properly in an emergency with the steering ratio that requires complete revolutions of the wheel to veer slightly.” His car also will be stripped of protuberances like bumper guards and heavy chrome work, which in a crash often catch in the flashy protuberances of the second car and send both vehicles into violent fatal skids or flip overs. “Without such junk,” he points out, “our experiments have proven that cars will often slide past each other.”

Until people get over their fetish for chrome spears and gadgets jutting from all parts of the car, M.V.R. admits that manufacturers probably will not be able to force sanely equipped cars on the customers.

Meanwhile, they have a few tips gained from their hair-raising experiments that can save lives and limbs even in present-style cars. One man at Epping took his life in his hands and sat beside a driver who ran him through a panic stop from more than 60 miles per hour. By cradling his head in his arms and placing it firmly against the dashboard he came through in fine shape. “I felt a tremendous pressure but didn’t even sustain a bruise,” he reported. “But if I’d been just sitting there I’d

(Continued to page 228)

You Name It!

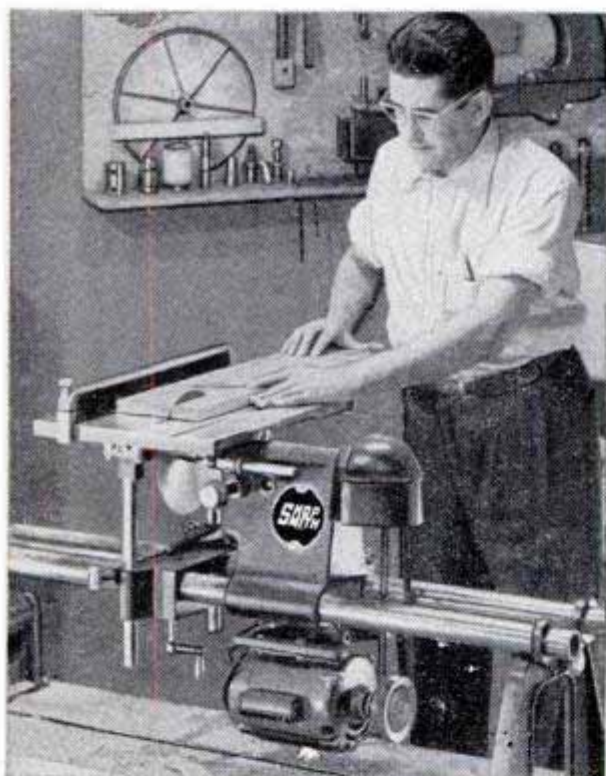
Here are the correct answers to the “You Name It!” photo quiz on pages 78 and 79:

1. Underside of spiny cactus; 2. Bud of maple tree; 3. Tree bark; 4. Rasp; 5. Aerial view of icebergs; 6. Tin foil; 7. Radiator; 8. Underside of squash; 9. Seed center of sunflower.

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have flown right out over the engine hood. Anyone sitting beside the driver who sees a crack-up coming almost unquestionably can save himself by this means if he thinks fast enough to do it."

Experiments with men and Mr. Willsoffen at Epping also have shown that the best way to sit in a car is with feet slightly apart and braced against the floor. Crossed legs are a sure invitation to hip injuries in a crack-up. The same goes for people who sit sideways and are thrown to the floor.

One of M.V.R.'s officials made a few simple changes on his Lincoln convertible which render it practically deathproof. First, out came the seat-adjusting mechanism and the seats were bolted to a cross member of the frame. A car-body repair shop made him a set of removable clamps to lock the hinged backs of the front seats while the car was in use. A safety belt for each passenger was anchored firmly to the floor of the car. A special chest strap for the seat beside the driver was installed so the passenger in that spot would not have his head pitched forward into the dashboard or through the windshield. A sheet-steel partition prevents the shrapnel in the trunk from coming through to murder anyone up front. "It is as safe," he declares, "as any convertible can be."

Fatigue, the cause of many accidents, is a continuous subject of study at Epping. Glaring reflections from the multitudinous chrome pieces on steering wheels, dashboards, hood ornaments; the ghost shadows on rakish, sloping, much-in-demand windshields; vibrations transmitted through floor boards and the hypnotism of the windshield wiper; the strain of trying to stay put under the wheel in the wide-open front seat of today's soft-riding car that heels like a sailing dinghy in a high wind on every turn—all are being measured for the wear and tear on a driver. And they cause plenty.

To prove what elimination of these hazards will do, Dean Fales, M.V.R.'s chairman, has removed them completely from his own car. Experts who have driven it claim it is the most eye-restful, untiring car they have ever had the pleasure to drive. The entire chrome dashboard is covered with flat black paint. So is the hood ornament, the chrome strip down its center, the hood itself and the wipers. The windshield is shaded by a long hood to eliminate shadows and reflections. The wheel rim has been covered with a sponge-rubber "sock" to absorb all vibration through the post. A body support and armrest covered with leather hems in the driver so he doesn't slide on turns or have to fight to stay under the wheel. "The wheel is more than just

(Continued to page 230)



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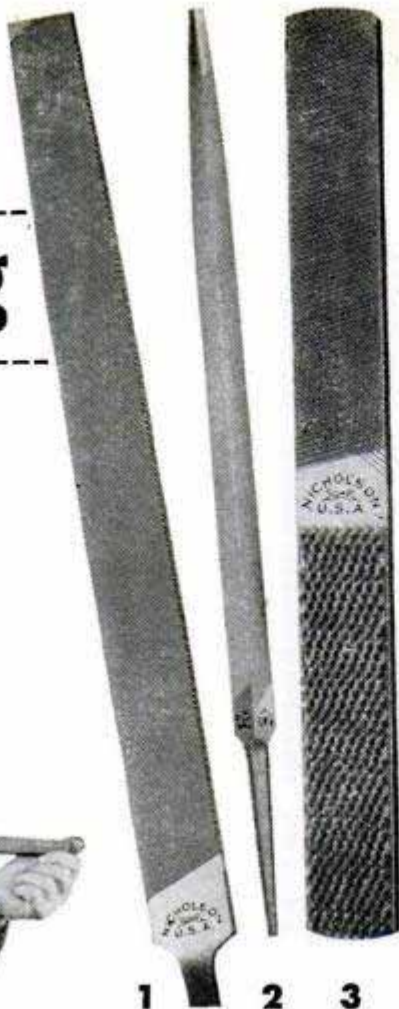
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vibration-free," Fales says. "The size of the grip has been enlarged to 1 1/8-inch diameter—just the same as ax handles and handle-bar grips. Anything smaller cuts off circulation and causes numbness—yet car buyers insist on their fancy, delicate, plastic works of art that an honest man can't get hold of."

A fatigue hazard that frequently is overlooked is about to get a meticulous examination at the Epping laboratories—carbon monoxide. Wind-tunnel tests already have shown that blowback exhaust fumes are sucked along the underside of every car by the air stream and slip in through drainage holes in the door bottoms, up beside the windows and into the car. "How many serious accidents have been caused by drivers who kept all the windows shut?" asks Andy White. "It would be interesting to know."

Right now, he's rigging up a test car with a mine safety detector in the center of the dash. When the CO in the car reaches the danger point of about .01 percent, it will trigger a red light on the panel and instantly shut off the motor.

Kerosene will be poured into the gas tanks of every style of car so they'll smoke furiously as they roar down the highway. Technicians will track the patterns of the exhaust at all speeds.

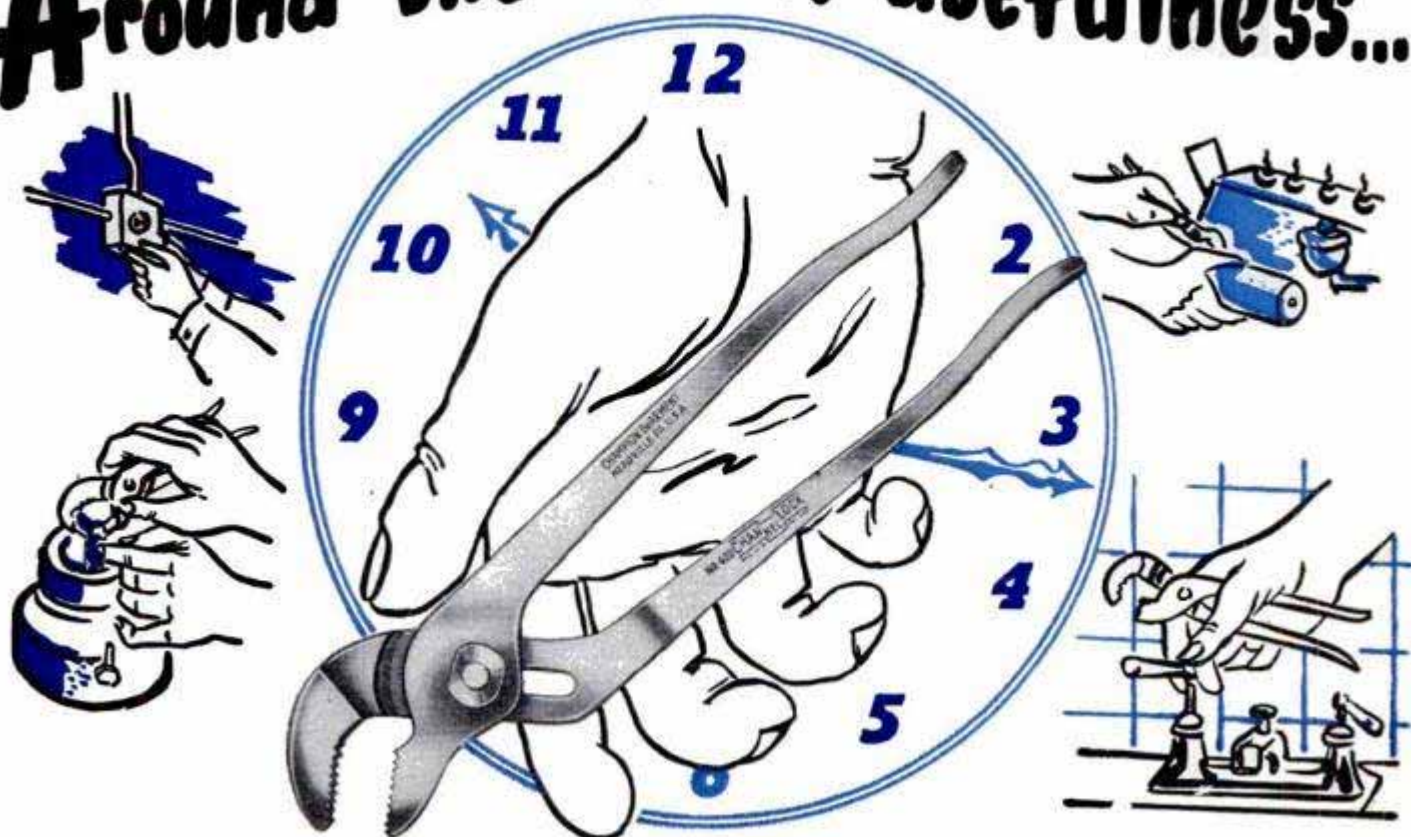
White firmly believes that monoxide, which only needs to be in a concentration of .02 percent to kill a man in a few seconds, is responsible for many persons' falling asleep over the wheel in modern automobiles that have ultrafancy air-conditioning systems. "The intake vents," he points out, "are nice and low under the headlights—right in line with the exhaust pipe of the car in front. Any man who keeps them open in bumper-to-bumper traffic is inviting death."

While monoxide fumes seldom penetrate a car in concentrations heavy enough to kill, White feels that it's almost a sure thing they are heavy enough to produce the kind of drowsiness that, in turn, produces accidents. If his road tests prove what he suspects, another suggestion will be added to the growing list of features. His goal is to make the car of tomorrow a safer, saner vehicle to carry our families and ourselves wherever we need to go without wondering whether we'll get there alive. ★ ★ ★

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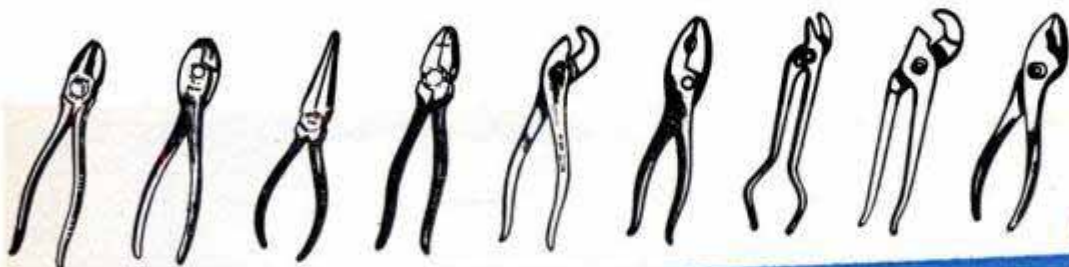
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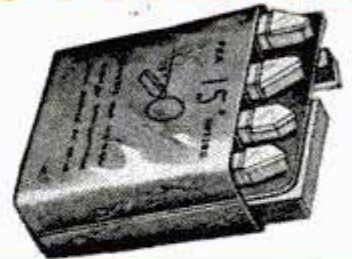
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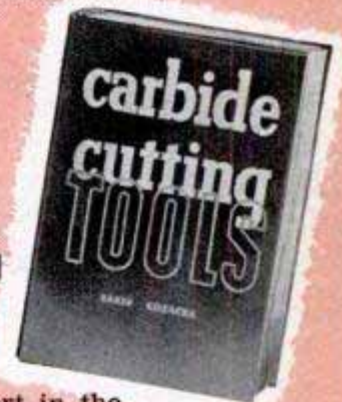
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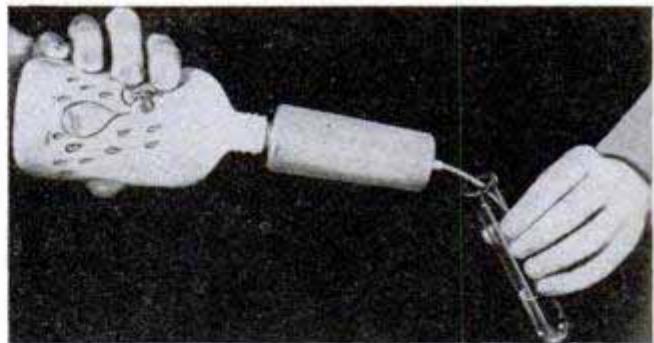


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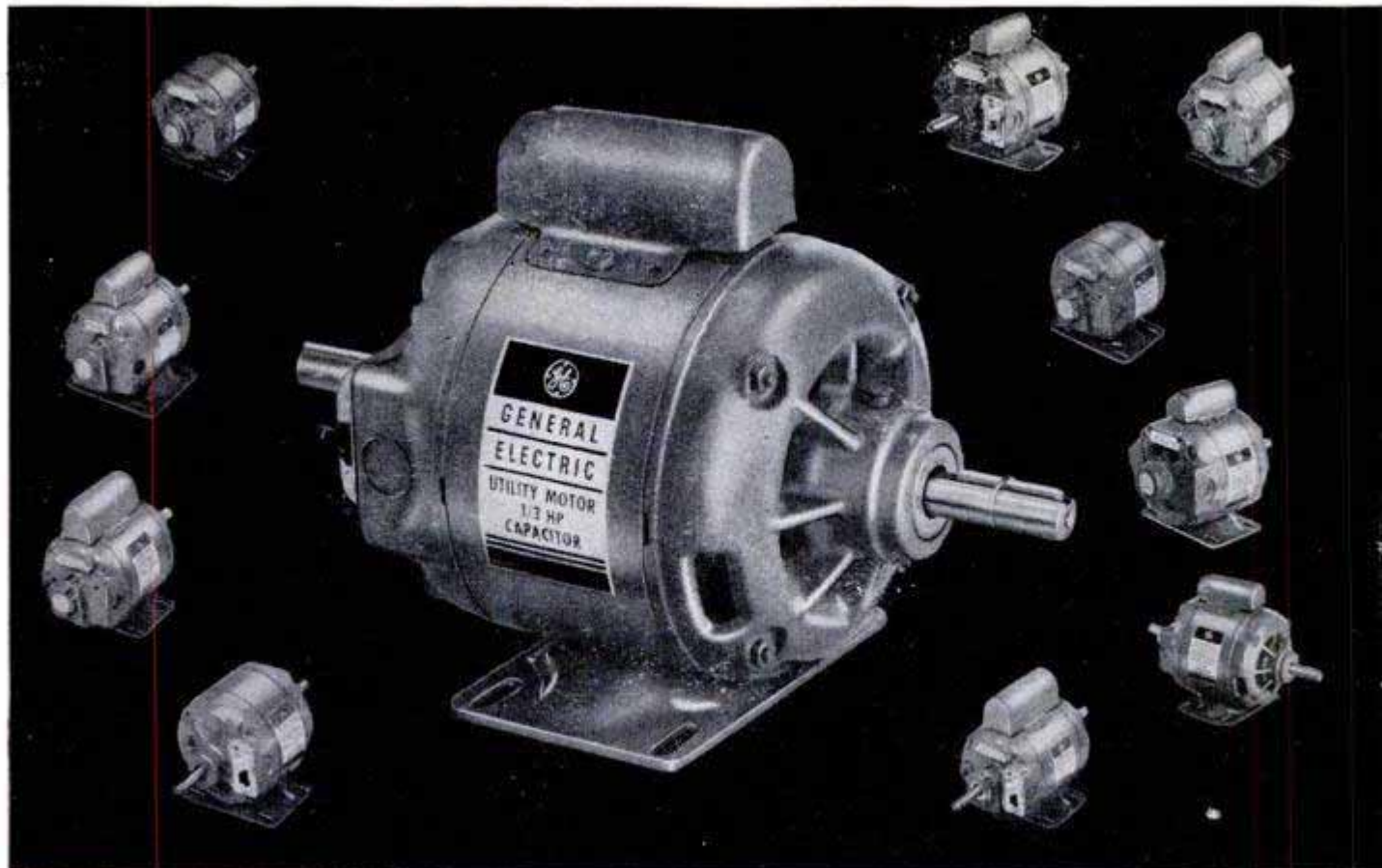
Revolver Grip Holds Ammunition

Six extra cartridges can be stored inside a plastic grip for a police revolver. A replacement for the standard grip, it has two halves which screw firmly together over the revolver handle. The extra rounds of ammunition are slipped into sockets in the base of the grip. They are held in place by a hinged metal plate.

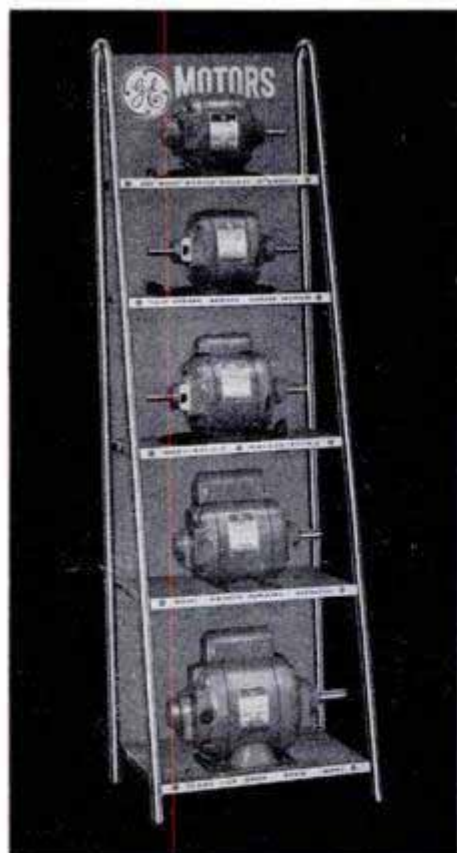


Shelf-Size Water Filter

Mineral-free water for laboratory use is provided by a compact deionization device resembling a clothes sprinkler. A squeeze of the hand forces ordinary tap water from a polyethylene bottle through a filter-stopper containing ion-exchange resins which grip and hold ionized impurities. The purifier eliminates minerals and salts of calcium, sodium, iron, magnesium and other metallic ions, as well as sulphate, bicarbonate and silicate. It supplies water suitable for use in blood chemistry, studying hydrogen ions, photographic processes, ion-free washing of laboratory apparatus, and storage batteries and steam irons. One filter purifies 20 gallons of water.



THE MOTOR YOU WANT IS A G-E MOTOR!



IT'S EASY to pick the right G-E motor for the job you want done from this G-E "Silent Motor Salesman." Look for it at your dealer's.

Whatever job you want done . . . run a lathe, pump, compressor, saw, grinder, fan, milking machine, lawn mower, you name it . . . home-made or purchased equipment . . . easy-start or hard-to-start . . . easy duty or hard duty . . . *the motor you want is a G-E motor!* Why? Because you know that G-E fractional-horsepower motors are made by the world's largest and most experienced motor manufacturer . . . made *right* to last longer with a minimum of care!

You can put your confidence in—

GENERAL  ELECTRIC

FREE!



SEND THIS COUPON TODAY!

Section 674-119, General Electric Co.,
Schenectady 5, N. Y.

Please send me a copy of your free 12-page booklet
on "How to Choose Your Motor."

NAME _____

PLEASE PRINT

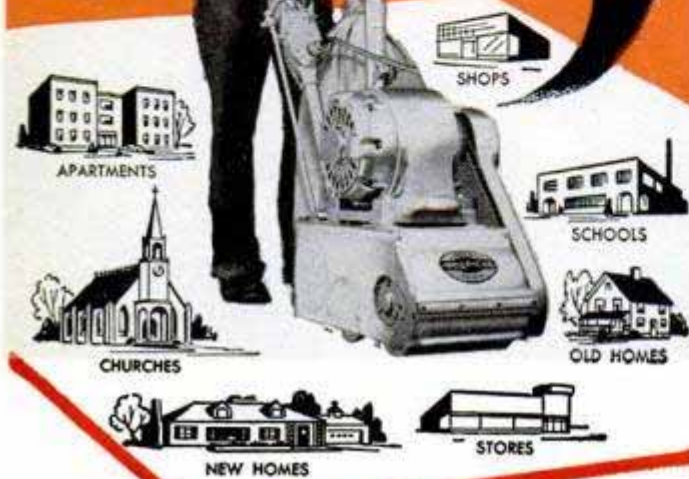
STREET _____

CITY _____

ZONE _____ STATE _____

Money-Making Jobs...

ALL AROUND YOU!



BE YOUR OWN BOSS! Big Money waiting for you today in floor surfacing! Hundreds of prospects near you! The floor next door may be your first job—and business mushrooms as folks tell others. Earn as high as \$50 and more a day sanding floors with an easy-to-run American Machine. Pleasant indoor work—steady the year round. A sound opportunity to get in something for yourself and be *your own boss!* No schooling—no experience needed. Only small investment in sander gets you started to success! Send coupon for “money-making booklet” entitled “Opportunities in Floor Surfacing”—enclose 25c in coin or stamps to cover handling.



AMERICAN FLOOR MACHINES

SEND!

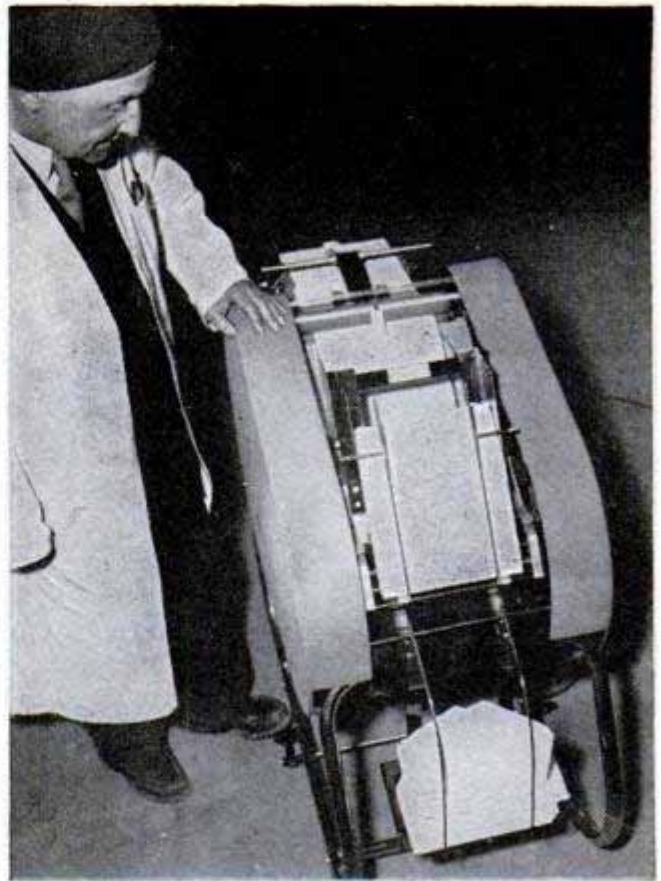
The American Floor Surfacing Machine Co.
535 So. St. Clair St.
Toledo 3, Ohio

Enclosed find 25c in stamps or coin for booklet “Opportunities in Floor Surfacing”, telling me how I can start my own floor sanding business.

Name.....

Street.....

City..... State.....



Mechanical Mail Clerk

If you have a great many letters to mail, you'll like a new German machine that folds and inserts letters in envelopes which are then sealed and stamped at a rate of 2000 an hour. Speed of the machine is controlled by a foot pedal, freeing both hands for feeding purposes.

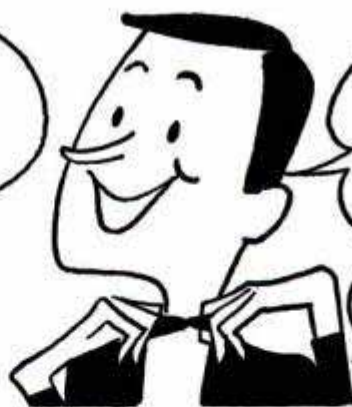


Ink Dispenser

With a new ink-bottle cap the draftsman or artist can dispense writing fluid by the drop right into his pen. The bottle top, which replaces the standard top, has a rubber bulb and a stainless-steel dispensing tube. Light pressure on the bulb brings 20 drops of ink directly into the pen.



OUR WALLS
MADE ME
WAIL!



UNTIL I
DISCOVERED
GOLD BOND
**COLOR
TEXTURE!**

YES, WE HAD DRAB,
DULL, DINGY
OLD WALLS!



I ASKED MY NEIGHBORHOOD DEALER
WHAT TO DO. HE TOLD ME ABOUT
AMAZING GOLD BOND COLOR
TEXTURE...IN EIGHT NEW COLORS!

I JUST MIXED
IT WITH TAP
WATER...



... AND BRUSHED
IT ON. IT DECORATES
LIKE PAINT
AND COVERS
LIKE PLASTER



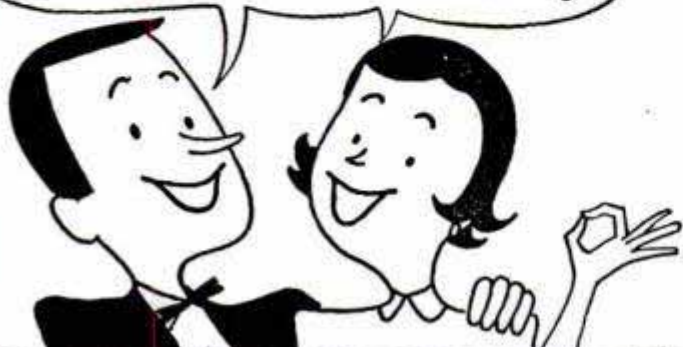
THEN I USED
A SPONGE TO
GET A DISTINC-
TIVE SWIRL FINISH



OR A ROLLER
DOES DOUBLE
DUTY. COVERS
AND TEXTURES IN
ONE OPERATION.



YOU CAN GET ENOUGH COLOR
TEXTURE FOR AN AVERAGE
ROOM FOR ABOUT **\$4.85!**



NATIONAL GYPSUM COMPANY
BUFFALO 2, NEW YORK

AVAILABLE AT
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GOLD BOND
LUMBER AND
BUILDING
MATERIAL DEALER
OR PAINT STORE

You'll build or
remodel better with

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★ MAKES MONEY
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**WELDS • SOLDERS
CUTS • BRAZES
CHARGES BATTERIES**

**Welds any thickness
of metal**

**Pays for
itself**

Robert J. Maas of
Custar, Ohio, says,
"Just the savings in
cash I made last year
by repairing and build-
ing farm equipment
more than paid off the
cost of my "Lincwelder".
Don't know how I ever
got along without it."

**FOR FARMS • GARAGES
REPAIR SHOPS**

Fast, Easy Repairs on Cast Iron and Steel



LOWEST PRICED WELDER

"Lincwelder" AC-180-C Lincoln
Arc Welder with Arc Booster . . .
sells for only \$150* . . . less than
other welders of like capacity.
(Price varies to \$156 on West
Coast). Accessories \$20 extra.



Above Left: Repairs spring tooth with
simple butt weld using "Fleetweld 47" elec-
trode. Above Right: Crack in engine block is
fixed in a few minutes with "Ferroweld"
electrode.

- **Wide Range** . . . handles $\frac{1}{16}$ " to $\frac{5}{16}$ " electrodes.
- **Simple to Operate** . . . has Arc Booster for
no stick start.
- **Easy to Install** . . . operates on 230 volt
single phase line.
- **Approved** . . . by Underwriters' Laboratories.

Build by

THE LINCOLN ELECTRIC COMPANY

The World's Largest Manufacturer of
Arc Welding Equipment
Cleveland 17, Ohio

ORDER NOW

Fill out
and mail to
Dept. 195,
The Lincoln
Electric
Company,
Cleveland
17, Ohio

- Ship me the "Lincwelder" AC-180-C and accessories \$176.00.
Enclosed is check money order
 Send me free bulletin on the "Lincwelder" AC-180-C.

Name _____

Address _____

City _____ State _____

195

It's News: Plant Bites Bug

(Continued from page 69)

bushes, for instance, are said to grow faster than ordinary under the stimulus of the extra phosphorus they absorb.

The systemics have no effect on large insects, so they are harmless to bees, ladybugs or other predatory, parasitic insects known to prey on sucking insects. This selective characteristic is very desirable. The insecticides work with the parasites that are used in biological control instead of against them.

Entomologists are hoping that the mites, thrips and other insects won't develop a resistance to the systemics similar to the resistance that some insects have acquired to DDT. A resistant housefly now metabolizes DDT into harmless products and almost seems to flourish on a diet of it. Probably the systemics won't have a similar history. When used in recommended proportions, they are so lethal that insects just don't get sick and then recover, meanwhile acquiring an immunity. They die and that's the end of them.

One new organic phosphate systemic is toxic only for a short time, a matter of days instead of weeks. It was tailor-made to fill the need for an insecticide that could be used late in the season to quell an infestation, then vanish before harvest time.

At present, the materials cost some \$30 a gallon, which is enough to treat eight acres or so of most crops. Considering that one application lasts for weeks, the price isn't excessive and probably will come down when large domestic production begins.

Today entomologists are experimenting with fluorine compounds in addition to the phosphates. They are investigating, too, a number of fluorophosphates and a new series known as carbamates. And they are working on systemic fungicides that would be taken up by the sap stream to protect an entire plant against injury by fungi.

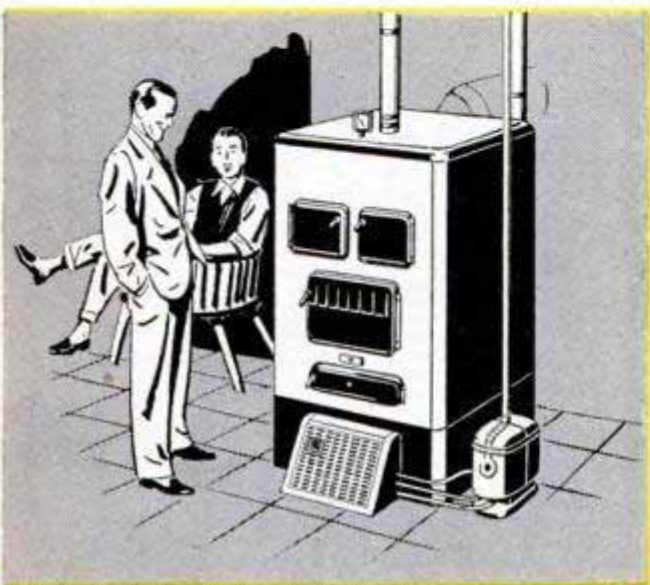
They are beginning to speculate on still other possibilities. There's a chance, suggests Doctor Metcalf, that systemics can be developed which would protect domestic animals against pests that trouble them. Harmless to the animals themselves, the insecticides possibly would be added to their ordinary food and would keep them free of ticks, lice or biting flies for weeks or months at a time. ★ ★ ★

Braille can now be printed more inexpensively by depositing plastic dots on paper of any weight instead of embossing the symbols on high-quality Manila paper, the British National Institute for the Blind reports.

Here's why— *it's so easy*
to buy

TIMKEN

Silent Automatic
HEAT



It takes so little time
to gain a lifetime of
thrifty heating comfort!

There's no fuss, no muss, no bother when you install Timken Silent Automatic Heat. Factory-trained mechanics can install a conversion burner expertly in your present furnace or boiler in less than a day. Naturally, it will take a little longer if a complete unit is needed. And there's a complete line of oil- and gas-fired furnaces and boilers, oil and gas conversion burners to choose from!

EASY TERMS AVAILABLE!
NOTHING DOWN—36 MONTHS TO PAY!

Why wait! *Now* is the time to buy the finest home improvement of all—Timken Silent Automatic Heat! You can install this money-saving, work-saving heating equipment in your present home *now* and enjoy the clean, convenient comfort of automatic heat for years to come. It's easy as one-two-three! (1) It takes only a few hours to convert your present heating plant to thrifty Timken Silent Automatic Oil or Gas Heat. (2) You can make use of easy credit terms, if desired—nothing down, up to 36 months to pay! (3) Once your Timken Silent Automatic is installed all you need do is set the thermostat—and forget it! You'll get all the heat you want—when you want it—automatically!

Take advantage of this easy way to an easier home life now! Your local Timken Silent Automatic Dealer is listed in the "yellow pages." Phone him today or mail the coupon below.

TIMKEN

Silent Automatic
HEAT

OIL • GAS • COAL

TIMKEN SILENT AUTOMATIC DIVISION

The Timken-Detroit Axle Company • Jackson, Michigan
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MAIL THIS COUPON TODAY FOR ILLUSTRATED LITERATURE!

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Please mail illustrated literature. I am interested in:

PM9



NAME _____ (type of equipment)

STREET ADDRESS _____

CITY and STATE _____

If you are a student, please check here () for special information.

CAN YOU JUDGE
AN EGG BY ITS
SHELL?



Neither Can You Judge the Safety of
a Tire By Its Outside Appearance

TO **SAVE** TIRES
and perhaps **YOUR LIFE—**

**INSIST ON
INSIDE-OUT
INSPECTION**



Your BOWES Dealer Is Equipped for Complete Inspection

The Bowes "Seal Fast" dealer is a trained tire repairman. He has the most modern equipment for the job. He will quickly and efficiently check your tires inside and out for hidden breaks that cause blowouts, small holes that gather dirt and water, resulting in tire rot. Any necessary repairs will be made by the sure, dependable Bowes method. Remember, you can't judge an egg by its shell. Insist on *inside* and *out* inspection—save tires and, perhaps, **YOUR LIFE**. See your BOWES tire repairman **NOW**—and be sure.

DRIVE IN WHERE
YOU SEE THIS
EMBLEM

BOWES



BOWES "SEAL FAST" CORP., INDIANAPOLIS 7, INDIANA

"Soup Up" Your Car?

(Continued from page 122)

torque. Edmunds will tell you that it's the application of these principles that counts, for there are no secrets in the basic data.

Second, the engineers in Detroit are constantly revising motors and many of them have tested Edmunds' equipment in their research. They often have differences of opinion that lead them to their own conclusions, and they have been known to be astounded at Edmunds' results. In the long run, they are building great volumes of cars and must make their designs fit production and price limits.

When Chrysler brought out its 180-horsepower engine, Edmunds called up all his backlog of research and experimentation to design his own manifold and other items for it. With the new additions the same engine puts out 214 horsepower with no increase in gas consumption in the city and slightly better economy in open-road driving. The 190-horsepower Cadillac engine is the newest challenge to Edmunds' skill.

Edmunds tries to stress to anybody who will listen that he doesn't make hot-rod equipment. He is only interested in getting better performance, smoother operation and more power for hills and traffic for the average driver. Through arrangements with distributors and a big mail-order company, Edmunds parts are available here and abroad. Any competent mechanic can install them with the explicit instructions. In addition, people come from all over the West to have work done in the shop. The record is held by a driver who came from Peru via the Pan-American highway to have his stock Olds improved for the Mexican road race!

Edmunds talks eloquently about his aims for better compression ratios (he gets 8.5:1 from his equipment) with better fuels and correct combustion-chamber design. He scarcely ever makes a sketch but holds long conversations with his patternmakers, who translate his ideas into wood forms.

The business of souping up automobile motors can probably cause as hot a debate as any discussion of politics with nearly as many conclusions. The back-yard motor minds create horsepower using the same principles as the mass-producer, Eddie Edmunds, and it might be a toss-up to decide who is looking over whose shoulder. More important is the fact that both are giving the stock car a run for its money. ★ ★ ★

☞ On Jan. 1, 1952, the scheduled airlines of the United States had a total fleet of 1253 aircraft.

LOOK WHAT'S NEW FOR '52!

in World Famous

LIONEL TRAINS

AND LOOK...GET A REAL ENGINEER'S CAP LIKE THIS FOR YOUNG RAILROADERS. SEE EXTRA SPECIAL COUPON BELOW



- Brand-New Diesels!
- New Train Sets!
- New Accessories!
- Plus the Realism...Advanced Engineering...exclusive features that only Lionel brings you!

Model railroaders everywhere know that only Lionel Trains look and sound *and perform* like the real thing—the only trains with real R.R. Knuckle Couplers, Die-cast Trucks, Solid Steel Wheels and built-in Two-Tone Whistle. The most realistic of smoke-puffing steam loco's, the most authentic Diesels. See them at your Lionel Dealer's...*now!*

Special and Extra Special Coupon Offers

.....GET YOURS IN NOW!

Special offer below. Extra-Special in box at right. Enclose correct amount and be sure to write your name and address clearly.

LIONEL TRAINS, P.O. Box 9, Dept. U, New York 46, N.Y.

- I enclose 25¢ for catalog offer below—
1. The new 36-page full color Lionel catalog.
 2. Rule Book (including signals) for Model Railroaders.
 3. Model R.R. Town Building Kit—Stores, etc.
- OR
- I enclose 50¢ for catalog offer above plus engineer's cap

TWO OFFERS CHECK ONE

Name _____
 Address _____
 City _____ Zone _____ State _____

EXTRA-SPECIAL COUPON OFFER!



ALL for 50¢

Official Engineer's Cap, in striped denim, plus 5 R.R. insignia emblems to wear on it, together with Catalog, Rule Book and Building Kit, all for only 50¢.

✓ Check Cap Size here

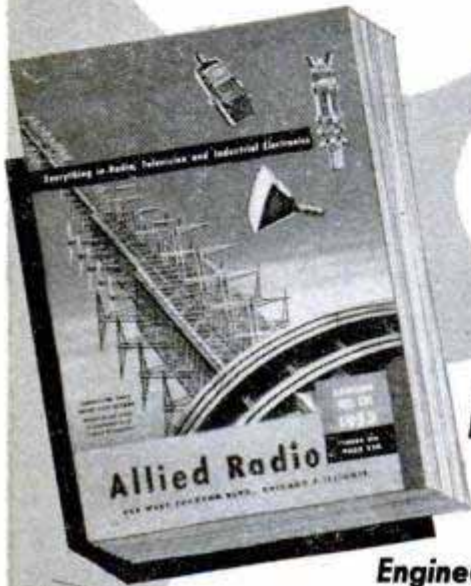
SMALL MEDIUM LARGE



World's Most Complete!
1953 ALLIED
 TV & RADIO CATALOG

FREE!

Everything in TV & Radio
 At Lowest Prices



236 PAGES
VALUE-
PACKED

Everything for
Experimenters,
Builders,
Amateurs,
Servicemen,
Engineers, Soundmen

Send for ALLIED's big 236-page 1953 Catalog, the value-packed guide to everything in TV and Radio! Latest home radios, TV equipment, Amateur supplies, High-Fidelity Sound, P.A. Systems, new recorders, test instruments, builders' kits—plus the world's largest stocks of electronic parts, tubes, tools and books.

Get more for your money—
 send today for your **FREE**
 1953 ALLIED Catalog!



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FREE
CATALOG

ALLIED RADIO

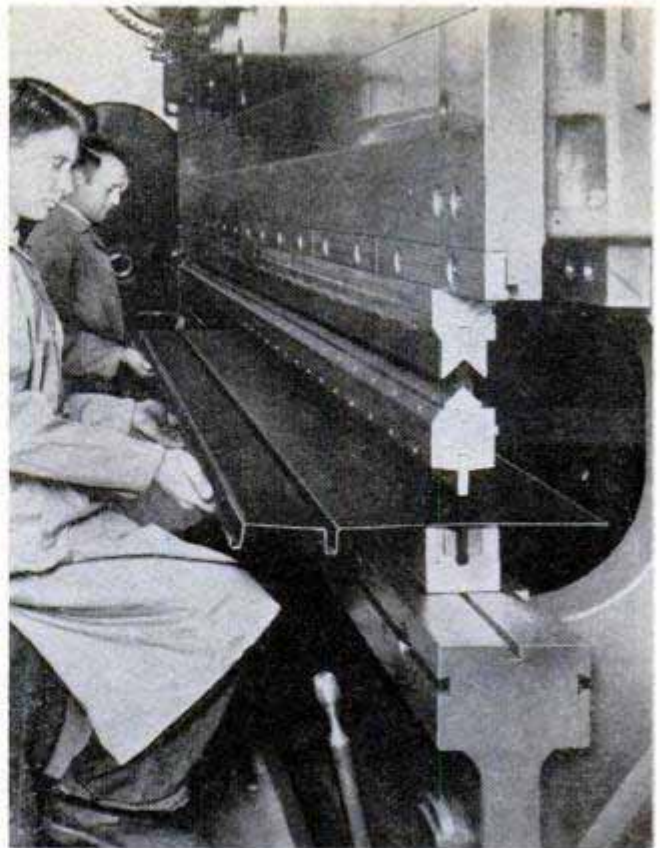
ALLIED RADIO CORP., Dept. 5-JJ-2
 833 W. Jackson Blvd., Chicago 7, Illinois

Rush FREE 1953 ALLIED 236-Page Catalog.

Name _____

Address _____

City _____ Zone _____ State _____



This machine presses out a roof deck from sheet of metal. The double-deck dies operate at high speed forming flange on the top and ribs on the bottom

The Tools That Make Tools

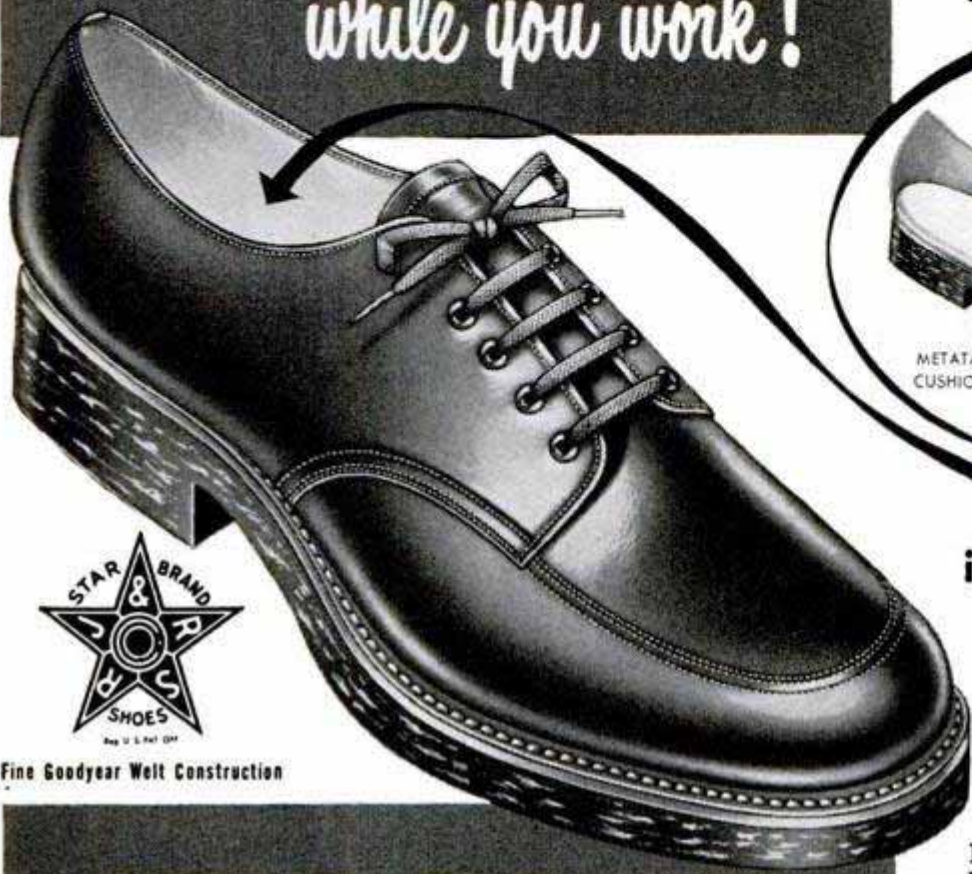
(Continued from page 103)

Milling machines were trained to cut gears in fantastic shapes, the entire process guided by an automatic feeding device. Nuts, bolts and screw machines became fully automatic, and began spewing out their products by the thousands. The turret lathe, with a different tool in each face of its many-faced turret, could drill, turn, bore, face, chamfer and recess a piece of stock without its being removed from the chuck (meantime, as the saying went, singing a rousing chorus of *Over There*).

One of the ironies of the machine-tool industry is that every time it does a bang-up job, it also bangs itself right on the head. In turning out the tools of war, it likewise had to turn out thousands upon thousands of its own progeny. Came the Armistice, and industry that had been buying thousands of machine tools to turn out planes, tanks, ships and guns, found itself with enough tools on its hands to last through 10 years of peace. The same tools that had made weapons now went to work making autos, radios and oil burners. And there were still enough left over, when the time came, to make automatic washing machines and electric refrigerators. That was another irony of the machine-tool business.

(Continued to page 244)

Your entire foot
RESTS IN COMFORT
 while you work!



Fine Goodyear Welt Construction

STAR BRAND
Cush-N-Bilt
WORK SHOE No. 286

here's how the
Cush-N-Bilt innersole
 rests your feet while you work

Resilient innersole, made of a molded cushion of extra soft sponge rubber is covered with a walking surface of genuine cowhide leather. It rises on the inside, gives snug support and comfort to the arch. Metatarsal pad massages and relaxes busy muscles. Your entire foot rests in comfort while you work!



it's new! it's different!
cushion innersoles
of sponge rubber
 absorb work shock
 reduce foot-fatigue

If you do the kind of work that's hard on the feet . . . you'll really appreciate this amazing new shoe. Specially designed to reduce foot fatigue, it has extra-soft cushion innersoles that give you the feel of pillowed comfort! Its built-in steel shank, metatarsal and "cookie" arch pads both support and rest your feet while you work. Uppers are made of pliable genuine cowhide leather; corded soles and heels are non-slip and oil-resistant. Looks like a dress shoe . . . but it's specially constructed for rare comfort, extra duty and extra long wear!

EXPERTLY FITTED by your local Star Brand shoe dealer!

- ✓ **OIL-RESISTANT, NON-SKID CORDED SOLES AND HEELS**
- ✓ **SOFT, SUPPLE FULL-GRAIN LEATHER UPPERS** (cordovan colored)
- ✓ Built in **STEEL SHANK ARCH SUPPORT** braces the arch, holds down foot-fatigue!

built for the man
 who works on
HARD CONCRETE
or OILY SURFACED
 floors, pavements, etc.

FOR DEALER NEAREST YOU, WRITE: Roberts, Johnson & Rand, DIV. OF INTERNATIONAL SHOE COMPANY - ST. LOUIS 3, MO.

FOR FASTER, EASIER SOLDERING—



Snap-on
BRINGS YOU THE NEW
VARI-HOT
Electric Soldering Iron

2-Speed Element Reaches Soldering Heat In 40 Seconds

This 110-115 volt AC-DC iron goes to work fast! Pressing the button shoots a booster charge of 100 watts within the tip—brings it to soldering temperature in just 40 seconds! Then, only 25 watts maintain normal tip temperature comparable to conventional irons drawing 100 watts. For heavier soldering jobs, full current is always available by pressing the button.

The Vari-Hot iron is light—only 10 ounces—a boon in continuous soldering operations. Adjustable rest on shaft permits laying iron down with no danger of burning surfaces. Shock-proof Durez handle. Tapered chisel type tip plated with “Vanderloy” provides extreme durability to tip. 28-32 volt AC-DC model also available for aviation use off airplane power supply.

For home shop or professional use, there is no finer iron! Not sold in stores—buy direct from Snap-on Branch (in 42 principal cities) or order direct from factory. Send remittance with order form below.

ONLY \$7.75

—at your local Snap-on branch or order direct from factory.



*Snap-on is the trademark of Snap-on Tools Corporation.

SNAP-ON TOOLS CORPORATION

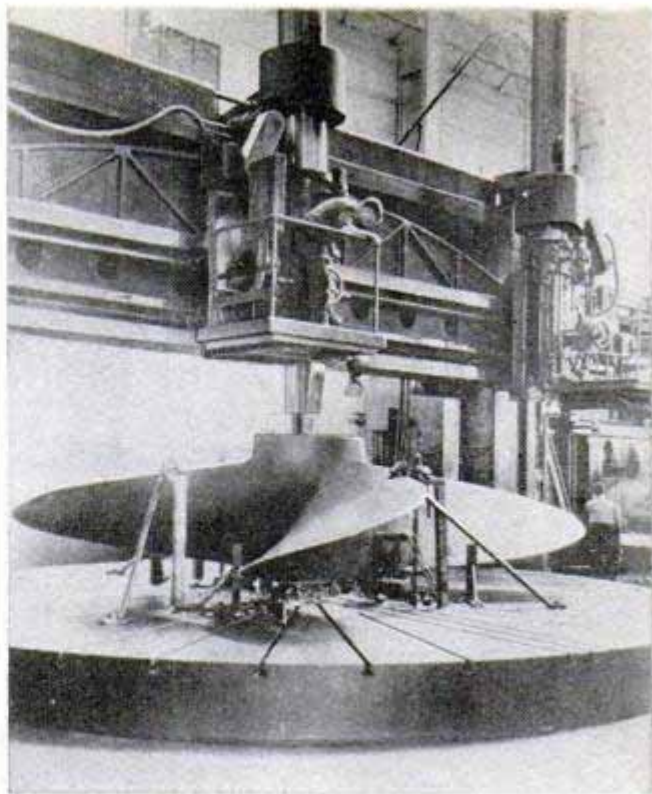
8062-I 28th Avenue, Kenosha, Wisconsin

I enclose check (or money order) for \$7.75. Send me post-paid one Vari-Hot Soldering Iron.

NAME.....

ADDRESS.....

CITY.....ZONE...STATE.....



Big propeller is bored by 25-foot vertical boring and turning mill — high-precision machine operation

Because of the great accuracy that must be built into these machines, they are so accurately made themselves they seldom wear out despite almost constant use.

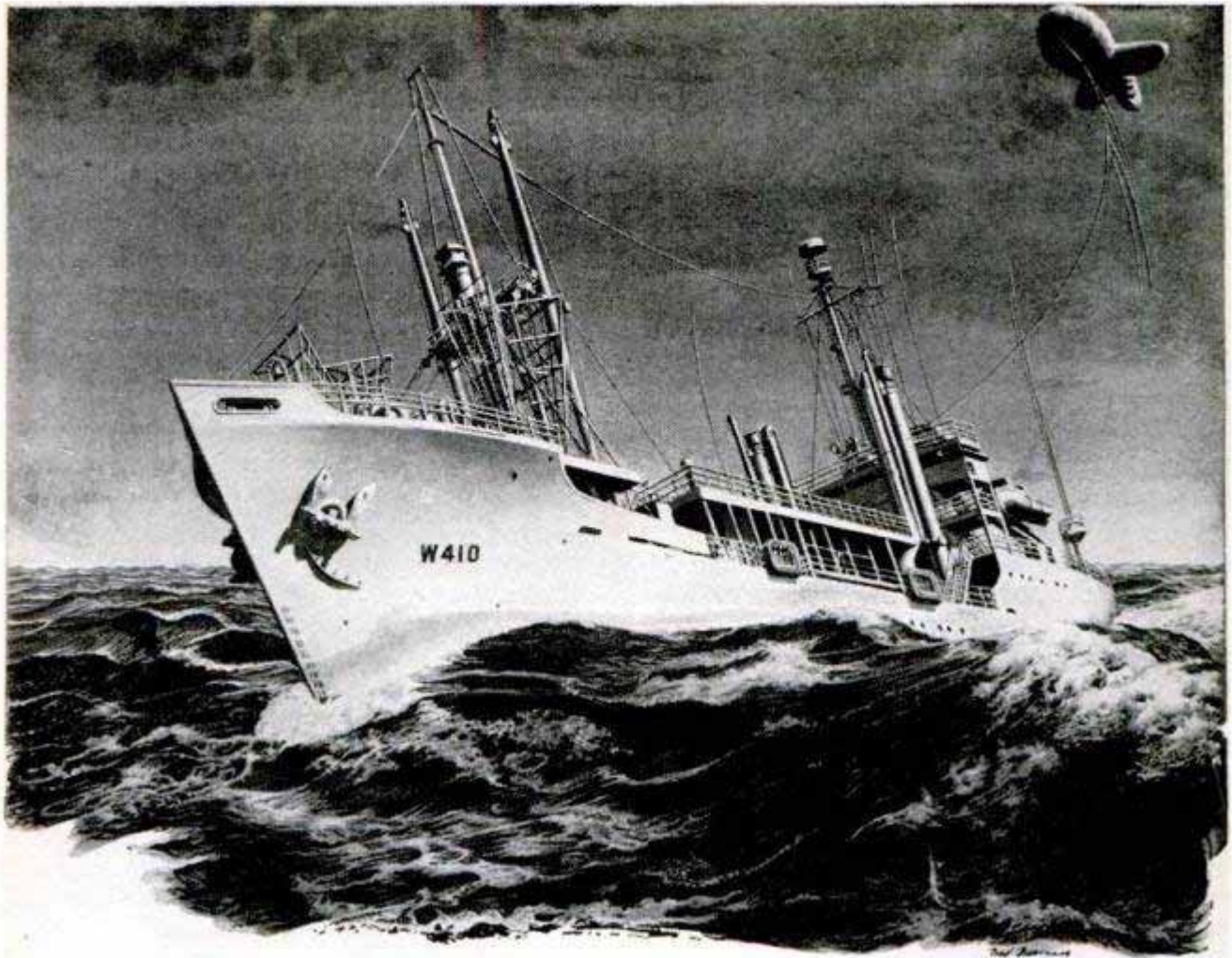
The machine-tool industry, resigned to being a “feast or famine” industry, went quietly to sleep during the famine years. When it woke up about 10 years later, it hardly knew itself. The basic arts were still there. It was still a small industry—about 250 firms and 20,000 men—but what an industry it was!

Gone were the overhead belts and pulleys. Gone was most of the grease and oil. Gone was the dangerous, backbreaking work of manhandling heavy castings. Gone was the laborious hand-feeding of cutting tools. So improved were the new machines—and consequently so complicated—that it took an engineer to understand them.

“The long lull in production was disastrous to us financially,” explains Tel Berna, general manager of the National Machine Tool Builders’ Association, “but it gave us time to look over our own shops. We have always been a skilled industry, but it suddenly dawned on us that our skilled workers were wasting more time and energy on manual labor than they were on the skills they had spent years in acquiring. So we came to the obvious conclusion that the less manual labor they had to perform, the more time they would have to use their skill.”

The result was the installation of more

(Continued to page 246)



The U.S.C.G. Cutter *Courier*—armed with Truth, not guns—will use its RCA transmitter to beam messages of hope to Iron Curtain countries, and will also be a good-will ambassador to the free nations.

Freedom's clear voice goes to sea

When broadcasting Freedom's message to Iron Curtain countries, transmitters must contend with deliberate radio interference, created to "jam" the air. Aboard the Truth Ship *Courier*, a powerful RCA transmitter fills most of one cargo hold, while a second hold contains Diesel generators which produce 1,500,000 watts. Amidship, a special deck is the launching platform for a barrage balloon carrying the antenna high aloft.

The *Courier's* radio voice will follow regular schedules, so that listeners—often tuning

in at serious risk—will know when broadcasts are coming through. These people are seeking the Truth, and want to hear it despite a thousand jamming stations built in an effort to keep Freedom's messages from penetrating the Iron Curtain.

Development of broadcast equipment for use on land and sea is only one example of RCA pioneering in research and engineering. It is your assurance of finer performance in all products and services of RCA and RCA Victor.

* * *

See the latest in radio, television and electronics at RCA Exhibition Hall, 36 West 49th Street, N.Y. Admission is free. Radio Corporation of America, RCA Building, Radio City, New York 20, N.Y.



RADIO CORPORATION OF AMERICA
World Leader in Radio—First in Television

automatic feeding devices to relieve that drudgery; more conveyors to manipulate the heavy stock; a more scientific grouping of machines so that work could be passed rapidly from one machine to the next; more safety devices to protect the workers from possible harm; more self-powered machines to eliminate dangerous belts; and—what was the industry coming to?—bright lights, fresh air, and more gaily painted machines, walls and floors. Even the massive milling machine, anchored firmly in huge concrete footings, came out in a blue-and-yellow housing that was, of all things, streamlined. The workmen loved it.

Evolution of Transfer Machine

Having rearranged their shops to provide a faster flow of stock from one machine to the next, the toolmakers now began to regroup their tools. A lathe began to feed directly into a drill press, a transfer table grabbing a piece of finished lathe work, shifting it over to the drill press and centering it automatically under the drill. When that worked out fine, they added a boring machine to the process by the simple expedient of adding another transfer table. Then, to cut down on transfer tables, they began grouping their machines in a circle, and letting one table—*are you getting dizzy?*—pass the work around to each ma-

chine, an automatic feeder passing in new stock as an automatic conveyor carried away the finished work.

Today at Ford Aircraft Corp., to name but one of a dozen producers, a single transfer machine passes an aluminum airplane cylinder head to 19 separate machine tools which bring to bear upon it 99 different cutting tools.

There is only one thing that prevents the carrying of the transfer-machine idea to even more fantastic lengths—the failure of a single cutting tool can tie up the whole works. Most manufacturers still prefer to schedule their work so that the failure of any one machine or cutting tool will not stop the rest. Otherwise, as the machine-tool makers will assure you, the dream of pouring a hopper full of various ores into one end of a mill and having a finished car, untouched by human hands, come out the other is a possibility today.

In case the transfer machines have you in a whirl, consider the electronic machine-tool operator. This eerie machine records on tape every move made by a skilled workman in producing a finished part. Then, just as a tape recording can faithfully reproduce a piece of music over and over, so can this tape reproduce the workman's skill in piece after piece. If this is not enough,

(Continued to page 248)



**Go high, wide and handsome on
the world's best motorcycle!**

HARLEY-DAVIDSON

HYDRA-GLIDE®

For the greatest sport in the world, spine-tingling thrills and pleasure-packed adventure, ride a Harley-Davidson. If you've ever broken a frisky colt, or hankered to, you know what we mean. You'll make the dirt fly at field meets, club events and endurance runs.

You'll pal with the greatest bunch of red-blooded, fun-loving guys and gals in any sport. Go barreling along over highways and byways. Get going . . . see your dealer and take a buddy along. Or send 25 cents for illustrated literature and a copy of the ENTHUSIAST Magazine, filled with exciting action pictures and stories. HARLEY-DAVIDSON MOTOR CO., Dept. P, Milwaukee 1, Wisconsin.



DO IT TODAY! SWITCH TO

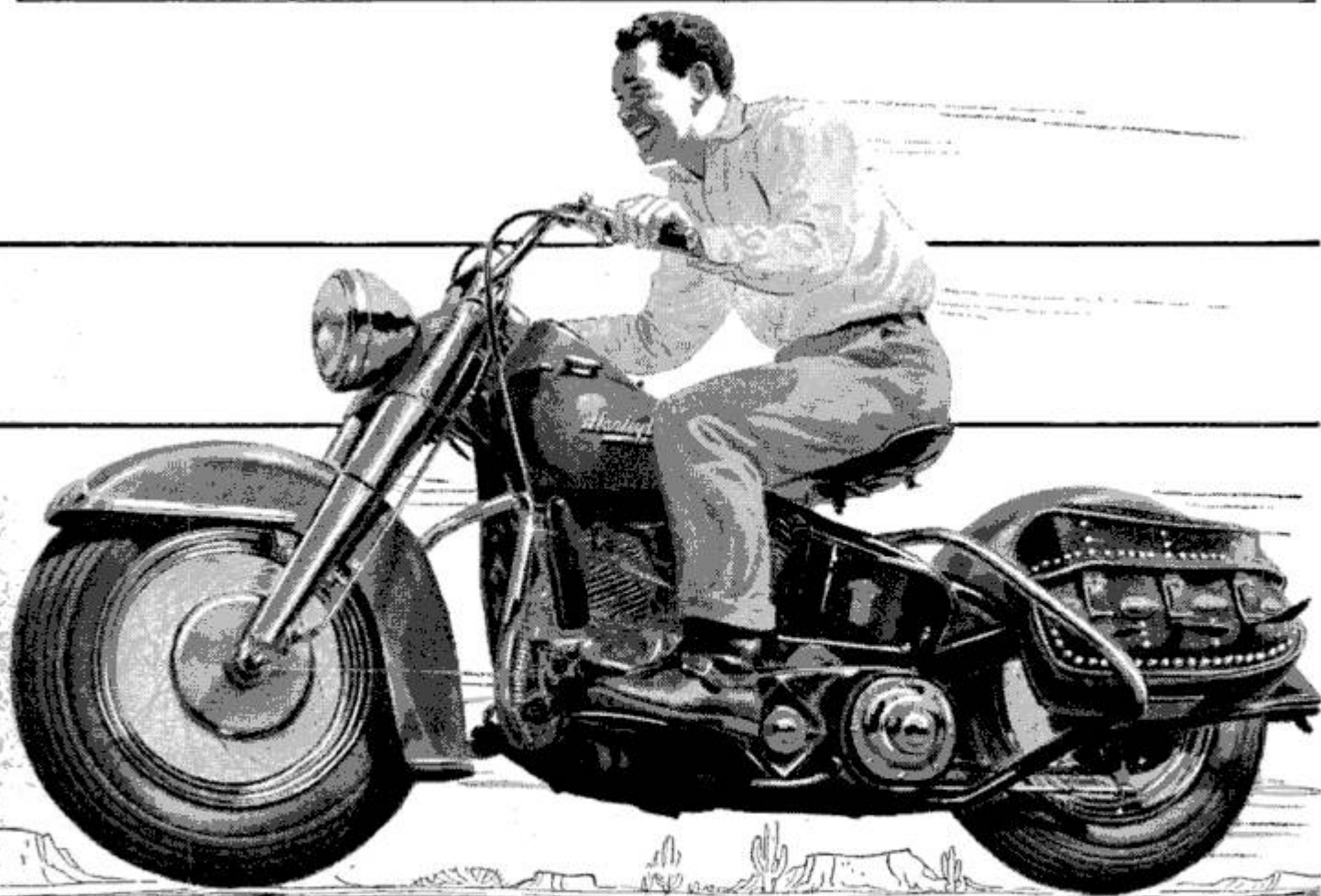
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KENTUCKY CLUB



*"Look! Another man switched to Kentucky Club—
the thoroughbred of pipe tobaccos."*

Notice how much better your pipe tastes—how much fresher your mouth feels when you switch to Kentucky Club. Look for the blue tin with the picture of the red-coated rider. Send for free catalog showing fine pipes and how to get them at big savings. Mail Pouch Tobacco Co., Wheeling, West Va. Dept. 94





"One double fudge sundae...
and a tube of 'DUCO' CEMENT!"

Fix it for keeps WITH DU PONT DUCO CEMENT

REG. U.S. PAT. OFF.



DOLLY LOST HER HEAD? ... It's
no great catastrophe!
Put her back together
with "Duco" Cement.



**REPLACE A COM-
PACT MIRROR**
with easy-to-use
Duco" Cement and
it will stay in place
for keeps.



**UMBRELLA
HANDLES** will come
off ... but they go
back on permanently
when fixed with
"Duco" Cement.



**MAKE FISHING
LURES** and secure
loose line guides with
tough, waterproof
Du Pont "Duco"
Cement.

**STRONG, TRANSPARENT
FLEXIBLE, WATERPROOF**



**BETTER THINGS FOR BETTER LIVING
... THROUGH CHEMISTRY**

Massachusetts Institute of Technology will compute mathematically the path a cutting tool will have to make to produce a desired part, record these computations on a piece of tape (one computation for each .0005 inch of tool travel!) and feed this tape to the electronic machine-tool brain!

Today there is only one limit on the size of the work that can be turned out by the machine-tool industry. That limit is best described in a question: If we build it, can you carry it away?

For instance, down in New Castle, Pa., the United Engineering and Foundry Company recently gave birth to Big Ajax, a single prodigious casting weighing a staggering 472,000 pounds. The pit in which it was cast was big enough to make a basement for a big house, and two months after the metal was poured the casting was still shimmering in a thousand-degree heat wave. Two huge overhead cranes, each big enough to snatch up a locomotive, picked it up when it was finally cool, using a hoisting cradle made of chains so massive that each link was six feet long and thick as a telephone pole.

There is something mighty fine about that picture. Puny little man — it would take 50 of him to lift one link of his chain — walking away with 472,000 pounds of casting. But watch him now! He takes that casting and machines it with the same ease that the machine-tool worker of 1902 would machine the bed of a printing press. When Big Ajax finally becomes the frame of a forging press, his hundreds of parts will fit together in a towering mass of steel so accurately assembled it will take an electronic scanner to discover an error as great as you will find in a precision-built wrist watch.

Engineers Held Their Breath

Yes, the machine-tool men could handle Big Ajax with ease, but could he be hauled away? Fortunately, he could, though engineers held their breath while they calculated what he might do to some of the railroad bridges and trestles he would have to cross. A special flatcar, one of the two in the United States, with 24 wheels arranged to distribute the weight evenly along its 90-foot length, was brought in. Ajax settled down for his trip, and so did a few railroad ties, but it was a close squeak. What if he needs a big brother, say one twice his size?

That is not a hypothetical question. The 20 machine tools mentioned earlier are of a breed that doesn't know when to stop growing. They started in life as a blacksmith's hammer, their size being limited only by the smithy's brawny arm. They

(Continued to page 252)

BUILD YOUR OWN ARC WELDER OR LIGHT PLANT

DELCO D-C GENERATOR

Save \$250 to \$500



\$15.50 Instruction included. Rated 200 Amps, 28 Volts, 2300 R.P.M. Ship. approx. 30 lbs. Stock No. 707.

PRICE F.O.B. K.C., MO.

CONVERTS TO ARC WELDER 200-250 AMP. OR LIGHT PLANT CAP. LOAD 5000 WATTS

Stock No. 711 D. C. Generator R-1 Jack & Heintz, rated 300 Amp. 30 Volts. Gov't cost \$300.00. Instruction for converting to welder or light plant incl. Also instructions and diagram for converting the R-1 or Delco generator to Combination Welder and Light Plant Included. Only **\$25.50**

Carbon Pile GENERATOR VOLTAGE REGULATOR
For use with 24 or 32 Volt D.C. Generators. Also recommended for the P-1 and R-1 type generators in "build your own" Light plant. Only, postpaid. **\$6.95**

R-21 HEAVY DUTY RHEOSTAT
Brand New for regulating voltage on ELECTRIC WELDERS, model trains, electric blankets, lights, control photoflood lamps, etc. Rated 16-32-ohms. Size 3 1/2" x 2 1/2" postpaid. **\$6.95**

WEAVERS HYDRAULIC HAND PUMP
BRAND NEW INCL. BUILT IN CHECK & RELIEF VALVE. For hydraulic jacks, presses, hoist, etc. For operating hydraulic cylinders to pump oil or hydraulic fluid under pressure, and is capable of delivering 1000 lbs. pressure. Wt. 10 1/2 lbs. A **\$9.95** (add \$50.00 val. Instr. incl. Price)

Valuable Gears — Bargains — Speed Reducers
10-1 or 5-1 ratio, 90 degree angle. Shaft driven 1/2" spline shaft with 3 mounting holes 5/16". Gears held in forged and machined aluminum housing with two needle bearings, one bronze bearing, and three high speed shielded bearings. Rated **\$5.95** postpaid

TREMENDOUS GEAR BARGAIN
Equipped with ball bearings on all shafts. There are 3 shaft connections. The angle shafts are 60 degrees to right and left. Gear-1 ratio Drive will transmit 10 H.P. Ideal for various farm attachments & other machinery. Wt. 10 lbs. Price. **\$7.50**

New Ampidyne MOTOR GENERATOR. Use as 24/32 D.C. motor, pulls 1/2 HP. Applicable for 110 V. A.C. by simple change in connection. Applicable to independent and rural lighting. Instructions incl. Wt. 30 lbs. Cost over **\$7.50**

SENSATIONAL SELSYNS
Two or more connected together, work perfectly on 110 V. A.C. For weather vanes, rotating directional antennas or controlling distance operations. Complete with diagram and instructions. Wt. 3 1/2 lbs. PER PAIR **\$7.95** Postage paid

Hydraulic Solenoid Control Valve
BENDIX, No. 81560 24V. D.C. For remote control operation and to operate one single action or double action hydraulic cylinders with 24 V. D.C. Recommended pressure 800 to 1500 P.S.I. connections are .550"-18thd. Also applicable for 115 V.A.C. Instructions, Diagrams & Data incl. **\$3.50 ea. \$6.50 pair** value.

BRAND NEW KIDDER HY-PRESSURE CYLINDER
Valve and safety locking pin. Applicable as tire inflator, fire extinguisher, spray painting, life raft, etc. Shatterproof. Size 1 1/2" x 2 3/8". Wt. 3 lbs. (add 50c Postage) **\$2.95**

RIGHT ANGLE DRIVE with 1 to 1 ratio through 90 degree bevel gears. Drive and take off shaft are 3/8" dia., Self lubricating. Size 3 1/2" x 2 1/2" x 1 1/2". Rated 1/2 H.P. at 1750 R.P.M. Ideal for use with power tools, etc. Has three mounting holes on 1-5/16" center. Price. **\$3.50** paid

CUNO OIL FILTER — Brand New
Aircraft type. Filters oil without cartridge replacements. Just turn handle and cartridge is clean. Standard 3/4" inlet and outlet ports to accommodate 12 gallons per minute. STOP CHANGING OIL. Instructions **\$4.95** post-incl.

ELECTRIC MOTORS
Stock No. 1CA24 is 1/2 H.P. 24 V. D.C. R.P.M. 2500 Gov't cost **\$5.50**
New Gov't cost **\$75.00**
Stock No. 2832 is 1/4 H.P. 28 V. D.C. R.P.M. 4000 with simple instructions to convert to 28-32 Volt A.C. Gov't cost **\$3.95**
\$82.84. New **\$3.50**
Stock No. 4949 is 1/8 H.P. 24 V. D.C. 2000 R.P.M. Mfg. by Pesco applicable for 115 V. A.C. Instructions incl. Base **\$3.50** mounted
DELCO MOTOR 6 Volt DC handles 6" fan blade. Use as windshield wiper, toy application, etc. Shaft is 1/2" in dia., 1 1/4" long. Size 5"x3" two mounting studs. 1200-2000 RPM New **\$2.35** (add 50 cents postage)

ECLIPSE MOTOR & GEAR UNIT
Brand New including 24V. D.C. Motor. Gear ratio 4:1. Can be adapted for 2:1, 40:1 & 20:1. Ideal for GARAGE DOOR OPENER, HOIST, PUMP JACK, HAY-LIFT, LAWN MOWER DRIVE, DRIVE FOR POST DRILL, etc. Gear unit applicable for 110 A.C. Diagrams & instructions incl. Gov't cost \$221.00. Wt. 23 lbs. **\$9.95** f.o.b. only. **\$9.95** KC.Mo.

BEAM ROTATOR MOTOR
Brand New with complete operating instructions for use on 110V. 60 cycles. Powerful highly geared motor for TV aerials, ham, FM, etc. Light weight, rugged. Ideal for operating ventilating louvers, furnace dampers, and check drafts. Including instructions. **\$7.95**

VICKERS CONSTANT DIS-PLACEMENT HYDRAULIC PUMPS. Brand New Stock No. PP-713-20. For any type liquid pumping job. 375 gal. per hr. at 3750 R.P.M. 1000 P.S.I. .410 cu. in. per rev. Gov't cost \$100.00. **\$17.50** post-data and instr. incl.

VACUUM AIR HYDRAULIC GENERAL PURPOSE PUMP. Large volume heavy duty, for water, oil, insecticides and as AUTOMOBILE DRAIN-CASE PUMP. Capacity 150 G.P.H. will draw 26" mercury. With high overload factor. For direct drive, readily replaced with a pulley. 3/4" pipe thread. Data & instruction incl. Stock #75. Wt. 12 lbs. **\$15.50** Now.

Adel Self-Priming ELECTRIC PUMP
For pumping light oils, oil burners, fluid metering, fuel pump, tool post grinder, coolant, pressure lubricating pump, etc. 1/30 H.P. rated 1200 R.P.M. Applicable for 24 V. D.C./A.C. or use on 110 Volt A.C. Size 6 3/4" x 3 1/2" x 3 1/4". rated 3 G.P.H. Diagram and instr. **\$9.95** post-incl. \$50.00 val.

ROTARY PUMP For pumping WATER FROM LILY POOLS, OR BASEMENTS SUMPS, pumping lubricants. Applicable for Garden & lawn sprayers. For use with hydraulic cylinders, vacuum, in dental lab, etc. Capacity 180 G.P.H., 200 lb. pressure, 29 in. vacuum. 500 to 3000 R.P.M. Steel shaft Std. 1/2 in. (Add 150c Stock #101. Instr. incl.) **\$6.95** postage

PESCO CENTRIFUGAL HEAVY DUTY PUMP
Including built in motor. Applicable for 24 V. D.C./A.C. or 110 V. A.C. The motor is explosion proof constructed for gasoline fuel, oils, water, fuel booster, etc. 3/4" hose connection. Rated capacity 400 G.P.H. Instructions incl. Gov't cost \$172.00 **\$9.95** Stock #659

PESCO FOUR VANE ROTARY LARGE VOLUME UTILITY PUMP
For Water, Oil, Insecticides, etc. including built in relief and by pass valve. Capacity 400 G.P.H. 1/2" drive spline shaft. 3/4" pipe inlet and outlets. Rotates either direction or in any position. Engineering data incl. **\$7.95** post-Stock #600 only

INSECTICIDE PUMP SPRAYER AND FIRE EXTINGUISHER. Four Gallon size includes approx. 3 ft. of high pressure hose with fine mist nozzle. Used, good condition built to give years of heavy duty service. Wt. 15 lbs. **\$2.95** ea. add postage

HYDRAULIC FLUID Mfg. by R. M. Hollinghead or Saenoy Vacuum to exact Gov't spec. **\$1.75** Per gal. Wt. 10 lbs. Add postage.

HYDRAULIC PRESSURE GAUGE for high pressure hyd. systems Range 0 to 2000 P.S.I. 2 1/4" dia. 1 1/4" deep. Con- **\$3.50** Post-connections are 1/2"

ROMEC WOBBLE PUMP. Hand lever operated. Ideal for camp, farm, ranch, for fuel transfer to boat, etc. New **\$8.50** post-paid

VOLTMETER D.C. The basic element of this meter is 30 Volt DC Voltmeter with zero center. Internal resistance is 300 Ohms. Dial may be easily calibrated to **\$3.50** post-paid D.C. Volts. New. Price **\$3.50** post-paid

Stratopower Constant Displacement HEAVY DUTY PUMP
For operating Hydraulic cylinders, hydraulic motors on tractors, Bulldozers, Construction machinery, Lift trucks. For fuel or oil transfer. Industrial applications, etc. Delivers up to 400 G.P.H. at 3750 R.P.M. Rated 1250 to 1400 P.S.I. 3750 to 4500 R.P.M. HAS BUILT IN RELIEF AT HEAD. Rotation either direction without adjustment. \$100.00 value. Engineering data and instr. **\$15.50** incl. Stock #37. Wt. 8 lbs.

Stock No. 512
Double action hydraulic cylinder 2 1/4" Bore, 4" Stroke, Dia. 3/4" shaft including built in Hydraulic control valve which may be operated with rod or lever. Clevis mounting. Overall length shaft retracted 14". **\$9.95** f.o.b. value. Wt. 9 lbs. **\$9.95** KC. Mo.
Stock No. 472 — Double action with built in overload relief. 1" bore, Stroke 4". Shaft 7/16" dia. Length 8 3/4". A tremendous **\$4.50** post-bargain

Stock #575 — Single action 2 1/4" Bore, Shaft 2 1/4", 6" stroke hydraulic or air operated. Use as snubber or brake. **\$5.95** f.o.b. \$35.00 value.

Stock #303 — Double Action 2" Bore, Stroke 1 1/4". Dia. 1 1/2". Overall length shaft retracted 23". 2000 lbs. capacity with 1000 PSI gives 2800 lbs. with our f.o.b. Stratopower. Wt. 14 lbs. **\$14.95** KC. Mo.

Stock No. 12 Hydraulic Cylinder Double Action output 12500 lbs. with 1000 P.S.I. input. Gives 17584 lbs. with our STRATOPOWER PUMP 1400 P.S.I. or will produce 34168 lbs. with 3000 line pressure. Can also be operated on low pressure system. 4" Bore, 10 3/4" Stroke 1-5/16" Shaft, clevis mounting. O. Gov't cost **\$25.50** f.o.b. \$300.00. **\$25.50** KC. Mo.

PESCO HYDRAULIC FLOW EQUALIZER & PRESSURE BALANCER VALVE. Brand New. Guarantees equal flow and equal pressure for Two cylinders or Two systems. Capacity 360 G.P.H. 1500 P.S.I. Data & instructions incl. A **\$75.00** value. **\$14.50** post-paid Stock 1-D-397 only

HYDRAULIC CONTROL VALVES
Adel Precision #B-10329. For controlling 2 single action or 1 double action cylinder. Including toggle lever. When lever is in one direction it puts pressure on one cylinder connection and opens exhaust, from opposite cylinder. When lever is released it returns to the neutral position and locks **\$8.95** Post-VICKERS. Brand new.

VICKERS Four Way Hyd. Control Valve #137
For two double action cylinders allowing operator to raise or lower the both cylinders simultaneously or raise one and lower the other at predetermined rate **\$14.50** post-and speed.

FOUR WAY HYDRAULIC CONTROL VALVE
Poppet type Valve shuts off on neutral position. Has 3/4" A.C. Tube ports -9/16- 20 thread, capacity 1500 P.S.I. Brand new **\$5.95** post-Stock #1032.

PESCO PRESSURE AND RELIEF CONTROL VALVE. Brand new. Designed with 3 ports and external pressure adjustment. Relief valve is spring loaded, and adjustable for controlling pressure regulation. Has two ports for normal flow, one for relief line to fluid supply or to pump inlet. No. 575. Engineering data incl. A terrific bargain! Only **\$4.95** post-paid

Large Volume hydraulic pressure relief valve. 3/4" ports, spring loaded. Range 1250 P.S.I. adjustable up to 3000 P. S. I. **\$4.95** postpaid Brand New.

FOUR WAY VALVE
Solenoid operated on 24 Volt DC. Applicable for 115 V. A.C. Off in neutral position. For operating double action hyd. cylinders, remote control, etc. Has 1/4" tube ports. Instructions incl. Brand New **\$8.95** post-Stock #324

VICKERS PRESSURE RELIEF VALVE. Brand new adjustable for protecting hydraulic systems using positive displacement pumps. 1/2" AC tube size tapped 3/4-18 thread. Stock No. 501 **\$5.50** Postpaid.

VICKERS UNLOADING VALVE Brand New—By passes full amount output of the pump while the cylinder is not in operation. Takes starting load off of electric motor driving the pump. 1/2" AC TUBE PORTS **\$8.95** post-(3/4"-18" thread. Price.

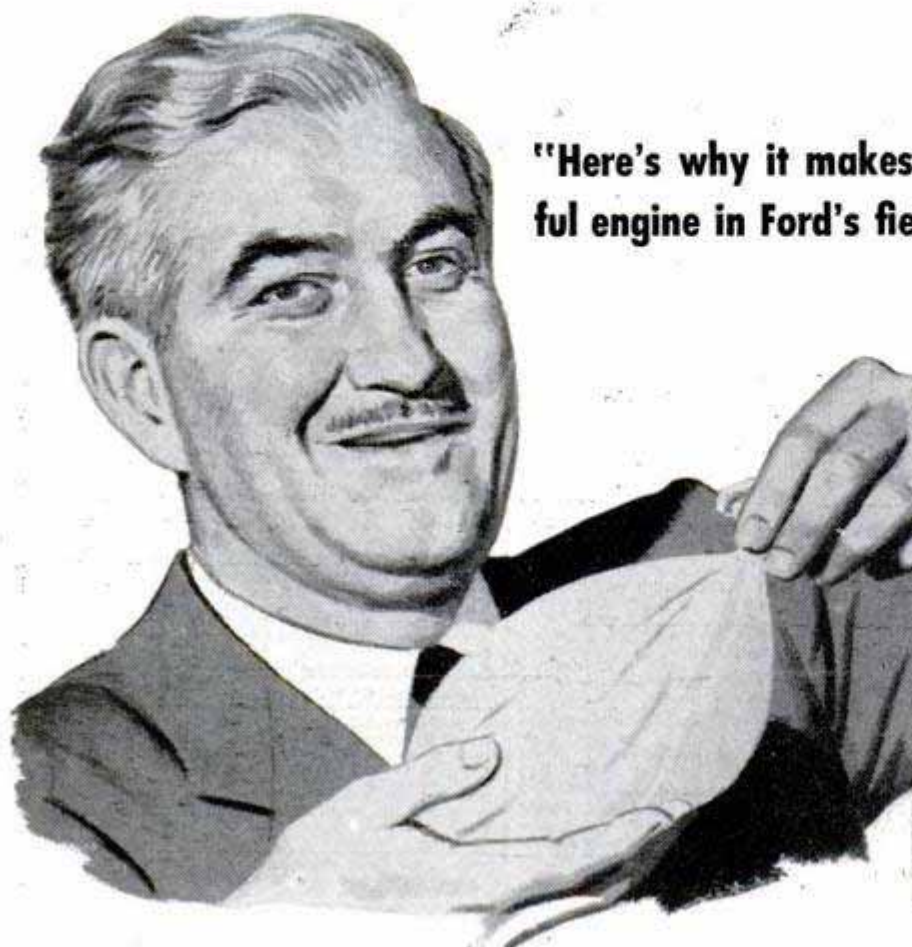
Hydraulic Accumulators — Bendix Ball Type. Dia. 5 1/2". Built to stand 2000 P.S.I. Stock #A-65. Wt. 4 lbs. only **\$6.95**
BENDIX ACCUMULATOR. Ball Type. Dia. 10 1/2". Built to stand 2000 P.S.I. Wt. 13 lbs. Stock #A-85. Only **\$15.50**



GENERAL SALVAGE CO., 2922 E. 27 St., Dept. 729 Kansas City, Mo.

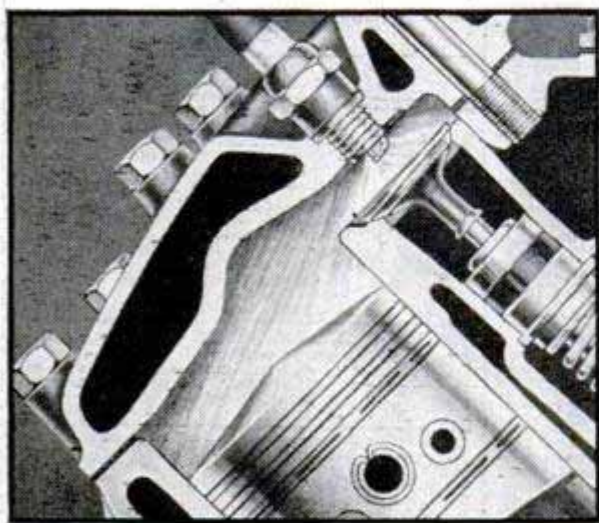
Higher Compression boosts

"Here's why it makes the Ford V-8 the most powerful engine in Ford's field," says Dr. Roy K. Marshall*



"When I fill a balloon with just enough air so that its shape is filled out, I find pricking it with a pin causes the air to leak out slowly. Now if I take the same amount of air and compress it in a smaller space by squeezing the balloon, I find pricking it

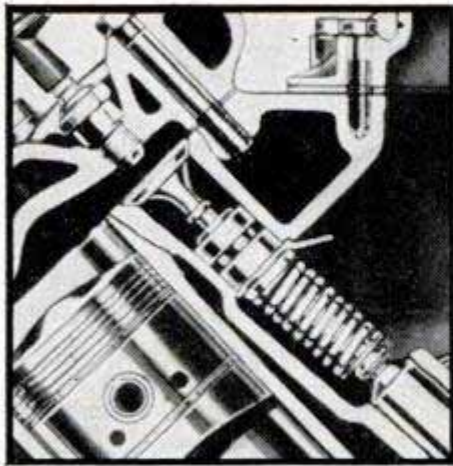
causes the balloon to pop. That's because the tiny molecules of air have been pushed closer together. When I pricked the balloon, in their rush to get out of cramped quarters they forced themselves through the hole much faster (and with more force, too)."



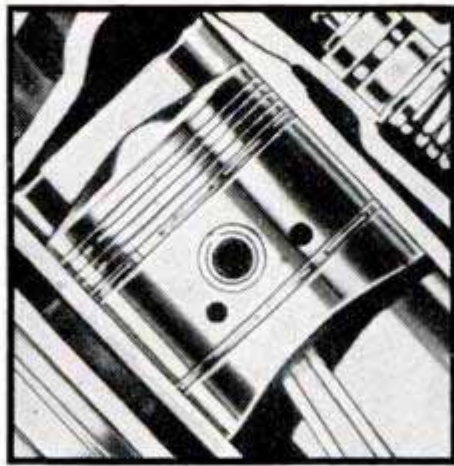
"This experiment is a very simple explanation of what we mean when we speak of the Ford Strato-Star V-8's higher compression. With Power-Contoured Combustion Chambers and new high-lift valves, Ford engineers have made it possible to feed gas more quickly into the cylinders and pack it in more tightly. This higher compression is the big reason for the greater horsepower in the 1952 Strato-Star V-8. And you get it with the economy of regular gasoline."

**Noted science editor, educator and TV commentator, Dr. Marshall is nationally famous for his simplified explanations of complicated things.*

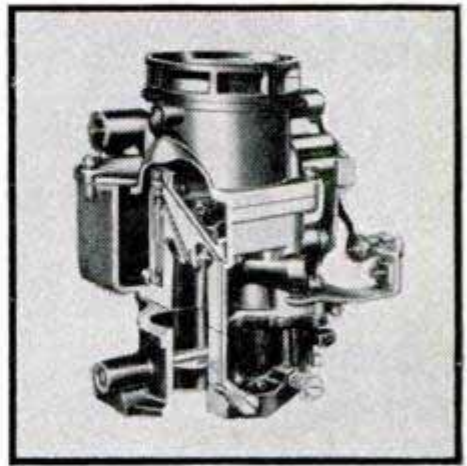
FORD V-8 Power!



Free-turning Valves. "Ford's unique low-friction valve keepers permit free-turning of the valves. This automatic rotation minimizes warpage, wear and sticking."



Super-fitted Aluminum Alloy Pistons. "Ford's pistons are exceptionally efficient. Their lighter weight means less shock on main and rod bearings. Controlled expansion keeps clearance between piston and cylinder walls precise at all times."



Dual Downdraft Carburetor. "The V-8's carburetor is actually two units in one. This design gives greater air velocity for better vaporization of the fuel into a more combustible mixture from idle through highest speeds."

*You can pay more . . .
but you can't buy better!*

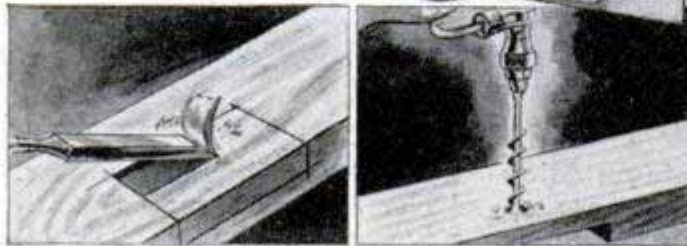
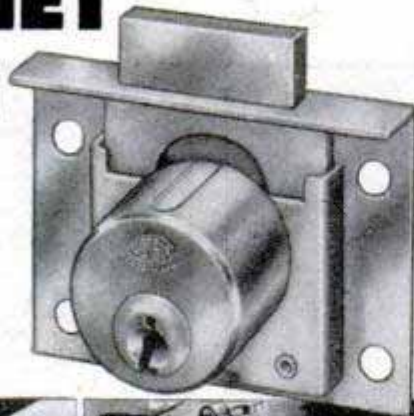


FORD V-8 FACTS

- *It's the only V-8 in the low-price field.*
- *It's the type of engine offered in America's finest cars.*
- *Ford has been building V-8's for 20 years and has built more than all other makers combined.*

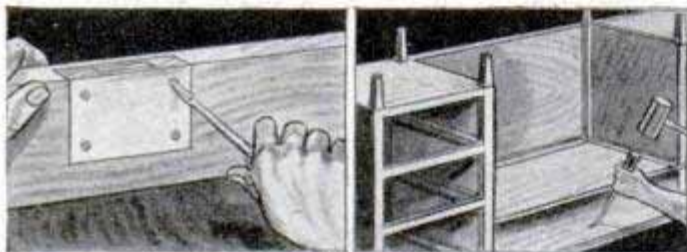
White sidewall tires optional at extra cost. Equipment, accessories and trim subject to change without notice.

It's Easy to Install a **CABINET LOCK!**



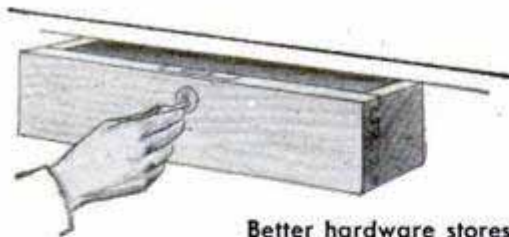
1. Mark out, and mortise door or drawer to receive lock.

2. Drill one hole.



3. Screw on the lock.

4. Cut hole to receive bolt, or attach strike, if desired.



Better hardware stores everywhere have Corbin Cabinet Locks for all your cabinet work including

**DESKS, DRAWERS, CHESTS,
WARDROBES, GUN CASES,
CABINETS, TOOL BOXES**

Get the Corbin Cabinet Locks you need soon. They keep valuable papers secure . . . protect your guns and tools . . . keep children away from harmful medicines and caustics.



Corbin Cabinet Lock Division
The American Hardware Corporation
New Britain, Connecticut, U. S. A.

could be used for pounding out everything from horseshoes and plowshares to copper pots and pans, and even for punching holes in metal. With the addition of power, they became drop hammers, punch presses and stamping machines that could produce everything from tin cups to steel helmets and car frames and bodies. By 1940 they had grown to prodigious size, spitting out crankshafts, axles, molded tank armor and shell cases. Engineers thought they had grown up. Actually, they were just creeping out of diapers.

As, for instance, the extrusion press at the Aluminum Company of America's Lafayette, Ind., works. This press can bring to bear upon a solid block of heated aluminum a pressure equal to the weight of 156 loaded coal cars. Under this weight the aluminum turns to the consistency of butter (actually it remains as hard as ever, even while yielding like butter) and flows into every crevice of a die that can be as much as 90 feet long. To make a pipe 20 inches in diameter by 100 feet long, the giant press has but to lean on a billet containing the necessary amount of metal and the pipe will come squirting past the die like a string of macaroni.

Or take an airplane wing with its hundreds of rivets and machined parts. Split it in half lengthwise and make a die of each half. Insert the die beneath a hydraulically operated press. Squish! Squish! There are the two halves with all their hundreds of parts. Joined together they make a wing as light and smooth as ever, and capable of supporting a Diesel locomotive at the extreme tip.

Want some more? Well, just in case either half of this wing, or any other part that might be produced, should be warped a little, the machine-tool makers have another machine to true it up. This new machine, which is still nameless, can do a two-way stretch job—get this—using a three-million-pound pull in any direction, or in several directions at once, to bring the extruded part back into line.

Working an Alloy Like Clay

More than that, they have machines that can take the hardest alloy that you can imagine, spin it around a few times and stretch it out just as ancient potters could take a lump of soft clay and stretch it into a bowl on a potter's wheel. This "rotary draw former" is being used in sizes up to 100 tons by Pratt & Whitney, General Electric, General Motors and several other companies engaged in turning out parts for jet engines. It was designed by C. J. Bath, president of the Cyril Bath Machinery

(Continued to page 254)

Compare FEATURES . . . PRICE!

CRAFTSMAN REG. U. S. PAT. OFF. Tilting Arbor Bench Saw

Saw Only
\$60.00*
Cash

With blade, miter gauge,
rip fence, two pulleys,
V-belt — \$6.00 Down



BALL BEARINGS
Double row of grease-sealed precision ball bearings NEVER need lubrication! These "Super-lubricated" bearings give you a smooth, easy-running arbor that needs no attention . . . that maintains accuracy . . . and that takes less power.

Complete Outfit
\$125.00*
Cash

With guard, motor,
extensions, bench,
light and Powr-Panl
\$12.50 Down



FLOATING DRIVE
Greatest improvement in tilting arbor saws in years! Floating motor mount smothers vibration, makes tilting easier, protects motor from sawdust, controls belt tension. Motor easily removed.



Handy Accessories for Your Bench Saw

New CRAFTSMAN Molding Cutter Head, \$4.98, and Cutter Bits (styles \$2.50 per set, up). Make your own moldings! Head made from machined piece of cold rolled steel. Vise grip safety lock for safe operation, easy blade replacement. Self-aligning blades. With Allen wrench. Fits most bench saws with 1/2, 3/8, or 3/4-in. arbors. 1-in. wide bits cut styles as shown.

Sears Easy Payment Plan makes it easy for you to buy your Bench Saw NOW . . . pay for it as you use it!

CRAFTSMAN Carbide-tipped Saw, \$10.95 and up. New! Safer — has only 8 teeth projecting only .020 in. above non-cutting edge. Tungsten carbide tipped blades last 20 times longer than ordinary circular saw blades! No need to resharpen at frequent intervals. For ripping, cross-cutting or mitering. 5 3/8 to 10-in. diameters; all arbor sizes.

Plus all these other Features

Big 20x17-inch table of cast semi-steel . . . larger area than any other saw we know of in this price range. Precision ground surface, machined sides. Replaceable insert for dadoing, sanding, grinding. Grooved on both sides of blade for miter gauge.

ONE wheel controls BOTH angle and depth of cut. High-speed tilting adjustment; high-speed depth adjustment. No locking device needed. Automatically maintains correct tilt and depth.

ONE lever locks fence BOTH front and back . . . squares fence against table for perfect alignment.

Included with Saw: 8-inch combination blade (1/2-in. bore) which gives maximum 2 1/2-in. depth of cut, tilts any angle to 45°; miter gauge; rip fence; machine and motor pulleys; V-belt; motor mount.

Complete Outfit as shown: Saw; saw guard assembly; CRAFTSMAN 1/2-H.P. 3450 R.P.M. capacitor motor (110-120 volt 60-cycle AC); 2 table extensions; tool bench; tool light; remote-control Powr-Panl. Come in, see this saw at your Sears Retail Store today.

*The Sears retail store nearest you will furnish exact prices which will not exceed O.P.S. ceiling prices.

CRAFTSMAN Hand and Power Tools by **SEARS, ROEBUCK and CO.**
Famous for fine quality . . . precision performance . . . low price!

The Best

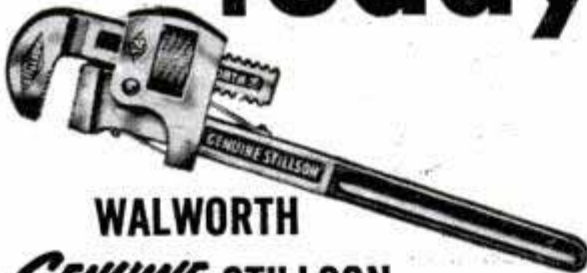
IN 1869...



DANIEL C. STILLSON

WALWORTH
GENUINE
STILLSON

The Best today



WALWORTH
GENUINE STILLSON

Daniel C. Stillson invented the famous Stillson Wrench while an employee of the Walworth Company in 1869. Walworth has continuously manufactured and improved this famous wrench since that time. Today's GENUINE Stillson is better . . . stronger than ever before, thanks to its original unbeatable design, and the latest metallurgical improvements.

Get a Walworth GENUINE Stillson from your dealer today!

The Stillson Diamond Trade Mark
identifies the
Walworth Genuine Stillson



*No shop is complete without
Genuine Stillson Wrenches*

WALWORTH

New York, N. Y.

VALVES . . . PIPE FITTINGS . . . WRENCHES

Company, and is just another example of what machine-tool makers can do when they let their imaginations rove from the orbit that was regarded as fixed in the magic year of 1902.

What about the basic arts? What happened to the lathes, planers, shapers, milling machines and drills?

Toolmakers had been cutting metal in their own happy way for a hundred years and everyone was satisfied. Then came World War II. What had been good enough before was no longer good enough. One tremendous mountain of metal had to be cut up into war machines and the existing tools just couldn't do it. There were two ways of solving the problem—they could double the machines in existence, or they could double the production of existing machines. As it turned out, they did both, and then some.

Take the matter of the cutting tool, for example. For so many years that it was taken for granted, a piece of steel only slightly harder than the workpiece was used as a cutting tool. Plowing its way through solid metal, this tool would become so hot that even with all kinds of liquid coolants pouring over it, its cutting edge would soften, wear away, or even snap off completely. It could only move through metal so fast before becoming white hot, a condition that made it as soft as the metal it was cutting. The result was a breakdown of the tool, a shutdown of the machine while awaiting a new tool or the sharpening of the old, and a serious hitch in production all the way down the line. Since this was a condition that had existed since the days of the first machine tool, most machine-tool men were resigned to the fact that it would always exist.

Fortunately, there were a few who thought otherwise. They began with the idea of creating a tool that would last longer. What they ended up with was a tool into which was brazed a cutting point made of tungsten carbide. This little block of metal was so hard that it not only resisted the heat of friction created by cutting but preserved its keenness even when the speed of a machine was increased by as much as 300 percent. The result was that all machine tools that could use tungsten-carbide cutting tools did so, shifting into high gear and reducing to minutes work that had previously taken hours. The hobbing machine, a freak cousin of the milling machine, now could cut teeth in a gear blank as big as a merry-go-round in about the same time that its 1902 ancestor could cut a transmission gear for a single-cylinder horseless carriage.

(Continued to page 256)

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More than that, the harder, sharper cutting tools made possible the use of improved alloys being developed by the metallurgists. Some of these alloys, such as those used in the intense heat of jet engines, are hard enough to fold up an old-style cutting tool on contact. Now a strange race is on—the metallurgists seek still harder, more durable metals while the tool-makers, resolved not to get caught short again, seek even harder, sharper tools.

With each improvement in machine tools, new skills and techniques had to be mastered. This worked two ways. As giant tools became more and more automatic, some jobs that had called for the utmost skill on the part of the operator were reduced to button-pushing. This opened whole new fields to the unskilled or semi-skilled worker, a fortunate thing because the production of machine tools—a matter of months—far exceeded the production of skilled workers—a matter of years.

Challenge to Workers

On the other hand, skilled workers were confronted with fantastic challenges and opportunities. Upon them depended the production and maintenance of the complex monsters demanded by their highly technical trade. Although button-pushing would run the machine once it was made, the making of it was still dependent upon the basic arts, the mastery of which did not come from button-pushing. The machine-tool man of today has to master all the tricks of his 1902 predecessor and support them all with a working knowledge of metallurgy, engineering and the new processes constantly appearing in shops elsewhere. Also, to his job he must bring an active imagination capable of foreseeing new ways of improving his work even when it means inventing still-newer machines.

One of the brightest rays of hope in this respect does not come beaming out of the machine-tool shop at all but from the home workshop. The thousands of men who came under the spell of machine tools during World War II could not shake off the fascination when they returned to their regular jobs after the emergency. There is something wonderfully satisfying about doing beautiful precision work. Some say it is because a perfectly machined piece of work is as close to perfection as man can come. Whatever the cause, there has been an astounding, almost overwhelming, increase in power tools in the home workshop. To give just one example, in 1947 Robert and Frank Chambers set out to sell a multipurpose home-workshop tool invented by Dr. Hans Goldschmidt. Called

(Continued to page 258)

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It's the right tile to lay over a wood floor! Gold Seal Inlaid Linoleum Tile is *flexible* . . . takes the up-and-down movement of the average wood floor without a strain. Can't snap, chip, or shatter, as brittle tiles do!

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the Shopsmith, the tool could become, with a few simple adjustments, a wood lathe, circular saw, vertical or horizontal drill press, and disk sander. With extra equipment it could be converted into a jig saw, mortiser, drum sander, jointer-shaper, buffer, or any number of other machines. They started out with 10 handmade models priced at \$200 (since reduced) and in their first year of operation achieved sales of more than \$3,000,000.

They are not alone in their success. Manufacturers of power drills with multi-purpose attachments for sawing, sanding and buffing are enjoying a phenomenal boom. Power saws, metal-working lathes and all manner of other tools are moving into the home in unprecedented numbers. Machine-tool makers have found a gold mine in the home workshop, and the home workshop has found a gold mine in power tools. Incidentally, the same accuracy and quality goes into the manufacture of home tools as in the making of production models, for one very good reason—precision-built machinery assembles so much easier than cheap stuff that manufacturers can't afford to produce anything but the best.

So as the machine-tool industry moves into its next 50 years, it is proceeding in two directions. In industry the tools are becoming so gigantic and complex that

their cost is running into millions of dollars for one machine. In the home workshop they are becoming so inexpensive that every home craftsman can afford them. Strangely enough, both the industrial tools and the home tools are the product of a new philosophy that guides the machine-tool makers. That is the philosophy of better and better products at lower and lower costs. Gone is the mistaken idea that a machine tool is still good if it is still in good working order. Today it is good only if there is no other machine that can do the work better and cheaper. No matter if the new machine costs many thousands of dollars, if it can produce a better airplane in less time and at less cost, then all the other machines become obsolete. They must make way for the new king.

With this kind of enlightened thinking, the marvels yet to come are more staggering than those so faithfully reported by *Popular Mechanics* since 1902. But, and this is the wonderful thing about it, no matter how fantastic the machine-tool world might become, its roots from now on will be firmly planted in the home workshop. Instead of being led by a few brilliant scientists, it will be supported by the ingenuity of millions of home craftsmen. On that healthy foundation, the prospects for its future become unlimited. ★ ★ ★

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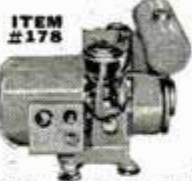
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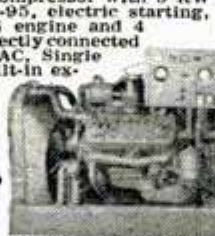
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ITEM #178
citer. Air tank for the 60 cu. ft. compressor is mounted above generator. Control panel contains AC voltmeter, ammeter, circuit breaker, terminals, oil pressure and water temperature gauges, battery ammeter, ignition switch and start button. Complete unit mounted on steel skid. Shipping wt. 1000 lbs. An outstanding buy. F.O.B. Chicago.

Item #178—350 watt—110 volt—60 cycle A.C. direct coupled to 1 cylinder Mico engine. 125.00

Item #343—Model 60 Fordair Compressor with 5 KW Generator. Consists of a Ford V-8, electric starting, liquid cooled gas engine with 4 cylinder and 4 compressor cylinders. Engine directly connected to a 5KW, 120 Volt, 60 Cycle AC, Single Phase Katlight generator with built-in ex-



995.00

Item #201—PE 95-G—10 KW—110/220 Volt 60 Cycle A.C.—Single Phase. Totally enclosed. Onan generator direct coupled to Willys Jeep, 4 cylinder, water cooled engine, push button start. Instrument panel with engine and generator instruments, circuit breaker, controls, etc. Uses 8 volt car battery. (Battery not incl.) Skid mounted. Ship. wt. 1500 lbs. F.O.B. Chicago.

Item #345—5 KW—120/240 Volt—60 Cycle, AC—Single Phase—Onan self-excited generator direct coupled to an Onan V-4 liquid cooled, 4 cylinder, 4 cycle, gas engine with oil bath air cleaner, governor, 12 volt electric starting circuit. Control panel contains

an AC voltmeter, 2 AC ammeters, start-stop buttons, engine oil pressure gauge, and panel light switch. Complete unit totally enclosed and skid mounted. Ship. wt. 800 lbs. F.O.B. Chicago. 595.00



ITEM #183

Item #183—3000 to 4000 WATT GENERATOR SET — FEATURES — Power for your home or business. Simply connect to power panel or house circuit. • Constant voltage regardless of load. • Push button start or stop. • Easily made full automatic start or stop. SPECIFICATIONS—Size 19" x39" x48". Steel skids, weatherproof housing, requires no building. Wt. 725 lbs. • Hercules 4-cyl. 10 HP gasoline engine. Load governor. Oil filter. Quiet muffler. 6-volt starter, gen-



ITEM #300

erator. • Hobart 115 volt, 60 cycle, 3,000 to 4,000-watt generator. Furnishes either single or three-phase power, 2 or 3 wire. • Panel contains oil gauge, voltmeter, ammeter, circuit breaker, voltage regulator, start button. Today's Cost Over \$1,200.00. SALE PRICE, F.O.B. Chicago. 465.00

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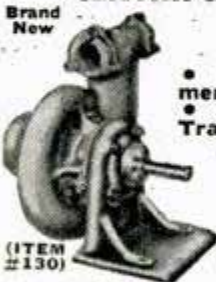
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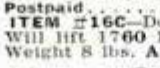
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ITEM #127

ITEM #127—Double acting hydraulic cylinder, 1" bore, 1" stroke, 1/2" diam. shaft, 1/4" tubing thread ports. Over-all length closed—6 1/2". Clevis mounting at both ends. Perfect for clamping and feeding. 5.95



ITEM #166

ITEM #166—Double acting hydraulic cylinder, 1 1/2" bore, 26" stroke. Will lift 1760 lbs. with 1000 PSI line pressure. Weight 8 lbs. A \$55.00 value. Now only. Postpaid. 16.95



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ITEM #6

ITEM #6—Double action hydraulic cylinder, 3" bore, 24" stroke, will lift 7070 lbs. with 1000 PSI line pressure. Steel barrel, 1 1/8" stainless steel shaft. 28.00



ITEM #29KJ

ITEM #29KJ—Gear Type Hydraulic Pump. Ideal in industrial applications and for operating all hydraulically powered farm implements including loaders, stackers, swathers, plows, etc. Delivers 1000 PSI (may be set at lower PSI if desired). 12 GPM at 400 RPM. Maximum operating speed 800 RPM—rotation counter clockwise. Has built-in relief valve, permanent or torque bar mounting, 1" diameter shaft, 3/4" pipe tap inlet, 1/2" pipe tap outlet. Ship. wt. 22 lbs. F.O.B. Chicago. 45.50

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CONTROL OIL-PUMPING

WHERE IT STARTS—REPLACE WITH

FEDERAL-MOGUL

OIL CONTROL BEARINGS



Ice-Cube Airport

(Continued from page 138)

blasting caps in the air near by. Sure enough, the geophones registered the shock waves in the ice. But Ewing and Press noticed something else, too. Where the ice was thin, the vibration frequencies were short and fast. On thick ice they were longer and slower.

At this stage the Air Force stepped in, financing more tests on Lake Superior and then a full-blown experiment from a base at Barter Island, just under the Arctic Circle. As finally evolved, here's how it works: A plane flies out over the ice field to a spot that looks good for a base or landing strip. As the plane circles, a crew member parachutes down several geophones specially equipped with radio transmitters to broadcast whatever the geophone hears. Next, a small explosive charge, timed to go off just above the surface of the ice, is tossed from the plane.

The shock waves transmitted to the ice by the exploding bomb are picked up by the geophones and broadcast to the plane. The comparative velocities of the sound waves give the thickness and strength of the ice. Within minutes the crew knows just what the ice below will support.

The scientists also used geophones to measure ice drift. Spotting them at varying distances from each other, they would cut a hole in the ice and lower an explosive charge on a wire. When the charge went off, each geophone would pick up the train of shock waves at split-second differences in time. Knowing the bomb's exact location, they could calculate just how far, how fast and in what direction the ice was moving.

A phenomenon that gave the scientists trouble, and has long plagued explorers, is the "gray out" or "white out." It's a low-hanging mist that hugs the ground and looks for all the world like a smooth snowy surface. A man traveling on the ice pack stands a chance of walking into an ice wall or disappearing into a hole.

Despite these hazards, the mystery that long closed the Arctic off from the rest of the world is being torn away. Air transport has made wide and fast travel through the ice country possible. Each successive expedition is affirming Fridtjof Nansen's early claim, based on 11 years' experience north of the Arctic Circle, that the Arctic is generally among the least stormy regions of the world.

No longer regarded as just a daring goal—with reaching it considered an end in itself—the mythical North Pole has become a roadside sign for global travel. ★ ★ ★

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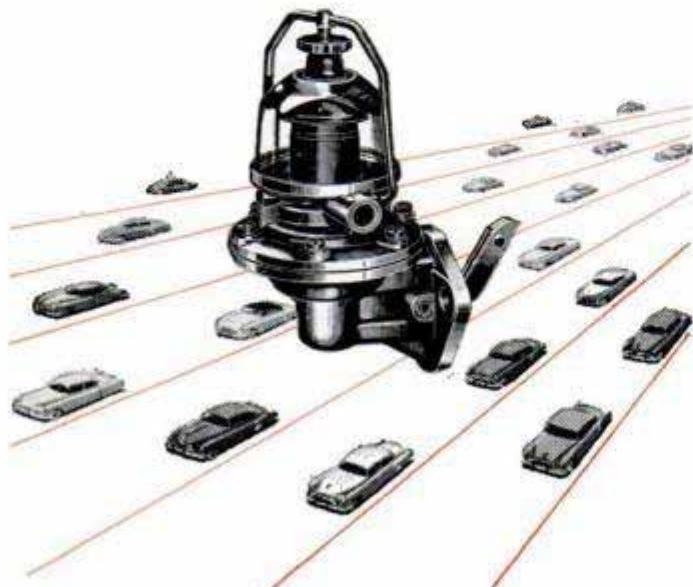
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AC SPARK PLUG DIVISION GENERAL MOTORS CORPORATION

The Owners Report on the 1952 Nash

(Continued from page 94)

car that will outclass them all."—Lincoln, Ill., owner.

"For day-long trips, the Ambassador is the most comfortable car I've ever driven. But I wish it were about four inches narrower."—Elmwood Park, Ill., plant superintendent. (Many owners of other makes also complain to us that U.S. cars are too wide and bulky.)

And now for my own test of the Nash Ambassador: From the Nash factory at Kenosha, Wis., this test included normal city driving through Chicago, Indianapolis, Denver and other cities, some rough-road testing on detours and roads washed out by floods, a number of miles in the mud on roads being repaired in southern Utah, several hours of rainy weather and desert conditions in Utah and Nevada, as well as climbing over Loveland Pass (11,992 feet) and Vail Pass (10,601 feet) in the heart of the Colorado Rockies, then via Zion National Park through Las Vegas to Los Angeles, a distance of 2765 miles including some off-highway testing.

The model tested was the Ambassador Custom Golden Airflyte four-door sedan. It has a 121¼-inch wheelbase and was Hydra-Matic equipped. (Nash also offers a three-speed transmission and an overdrive unit if desired.)

The 6-cylinder overhead-valve engine with a high compression ratio of 7.3:1 develops 120 horsepower and has a displacement of 252.55 cubic inches. The engine is extremely free of vibration. The carburetor and manifold are mounted on the right side of the engine, with unconventional horizontal carburetion.

The car is economical (see economy chart). Nash advertises that regular gas is satisfactory and I found it to be so. I could not make the car "ping" on regular gasoline, nor was there any evidence of overheating in the mountains, the desert and at high speeds across the Midwest when the temperature was over 100 degrees.

Roadability is above average and the front suspension system, (new on the Ambassador and Statesman this year) gives a smooth, comfortable ride with minimum sidesway on corners. Nash uses coil springs in the rear instead of leaf springs and the handling of the car over all kinds of roads changed my ideas about rear coil springing, which I had disliked previously.

The car has average acceleration to about 60 miles per hour, but acceleration above 60 is particularly good. It cruises easily

(Continued to page 264)



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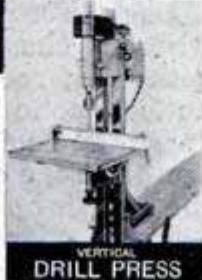
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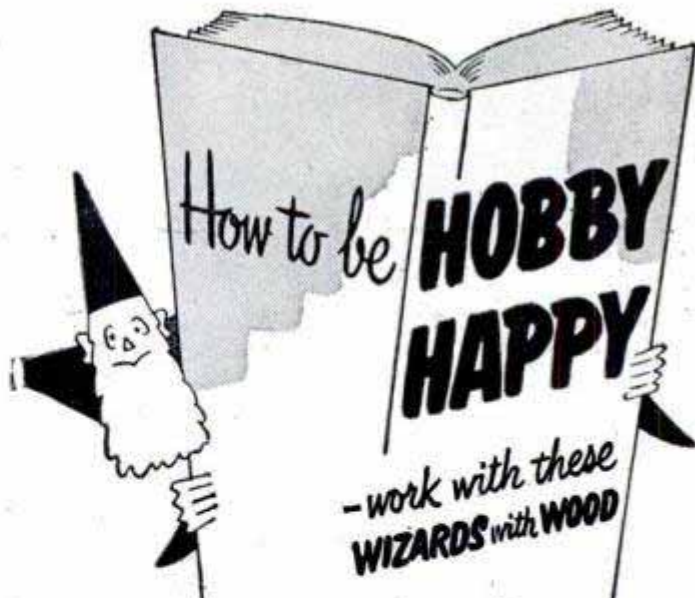
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at 80 to 90 miles an hour by speedometer which is fast by about 7 percent. Top speed of 102-104 miles per hour was indicated by the speedometer and could be maintained for miles on long, open stretches.

I like the narrow but long (28 inches) instrument panel. There is a sponge-rubber cushion across the entire front of the dash which, while rather narrow, does serve as a crash pad, offering some protection in case of accident.

The body is roomy and has excellent head clearance. You can get in or out without knocking your hat off. Forward vision is fine, through a wide, curved, single-piece windshield. Rear vision is good, as the back

1952 NASH GOLDEN AIRFLYTE SPECIFICATIONS

	Statesman	Ambassador
ENGINE		
Type	6 cyl., in-line, L-head	6 cyl., in-line, OHV
Bore and stroke.....	3 1/8 in. x 4 1/4 in.	3 1/2 in. x 4 3/8 in.
Piston displacement	195.58 cu. in.	252.55 cu. in.
Brake horsepower	88	120
Compression ratio	7.0:1	7.3:1
Transmission	3-speed conventional; conventional with overdrive or 4-speed Dual-Range Hydraulic Drive optional	
GENERAL		
Steering ratio	20:1	20:1
Steering wheel, lock to lock.....	3 1/2 turns	3 1/2 turns
Turning radius	21 ft., 2 in.	22 ft., 4 in.
Brakes	Conventional hydraulic with riveted linings	
Tire size	6.70 x 15	7.10 x 15
Recommended tire pressure.....	24 lb.	24 lb.
Weight (4-dr. sedan, unladen).....	3045 lb.	3480 lb.
Wheelbase	114 1/4 in.	121 1/4 in.
Tread, front	55 1/2 in.	55 1/2 in.
Tread, rear	59-11/16 in.	60 1/2 in.
Height overall (unladen).....	61 3/4 in.	62 1/4 in.
Width overall	78 in.	78 in.
Length overall	202 1/4 in.	209 1/4 in.
Road clearance	7 1/2 in.	8 in.
CAPACITIES		
Oil	5 qt.	6 qt.
Water	15 qt.	18 qt.
Gasoline	20 gal.	20 gal.
INTERIOR DIMENSIONS		
Front-seat width	65 in.	65 in.
Rear-seat width	64 1/2 in.	64 1/2 in.
Headroom, front	37 1/2 in.	37 1/2 in.
Headroom, rear	36 in.	36 in.
Legroom, front	41 1/2 in.	41 1/2 in.
Legroom, rear	37 3/8 in.	37 3/8 in.

window wraps around each side. The vision directly in front of the wheels is excellent because of the sloping hood.

As optional equipment Nash cars have an Airliner reclining seat for passenger rest on long drives. The bed feature is another detail that appeals to vacationists, tourists and sportsmen.

Nash is a pioneer in unit construction, whereby chassis and frame are welded together. It reduces squeaks and rattles (I noticed none in my 2765-mile Nash test) and in an accident it affords better protection than the conventional design in which the body is bolted to the chassis.

The Bendix servo-type brakes showed no

(Continued to page 266)

SURPLUS MACHINE SHOP TOOLS AT PRICES YOU CAN AFFORD

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SET 9E

15 Different Size High Speed Morse Taper Shank Drills up to 9/16" with No. 1 and 2 tapers. New and used. \$50 value. Priced at only... **\$6.49**

SET 20 Different Size High Speed Morse Taper Shank Drills from 1/4" to 1". New and used. \$70 value. Priced at only... **\$12.95**

SET 10 Different Size High Speed Morse Taper Shank Drills from 1/2" to 1 1/4". New and used. \$50 value. Priced at only... **\$9.95**

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SET 20 Different Size High Speed Straight Shank 16E Chucking Reamers up to 1 1/2". New and used. Priced at only... **\$7.95**

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SET 5 different size cutters. Can be used as mounted milling 4E cutter or circular saw. All with 3/8" and 1/2" shanks, widths up to 1 1/4", dia. up to 1". New and used. Ppd. Priced at only... **\$3.95**

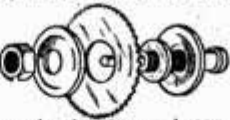


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SET 6 different size high speed Slitting Saws, 5 pcs. 2 3/4" dia. x 1" arbor, plus 1 pc. 5" dia. x 1 1/2" arbor. Thickness from .040 to .071. Cuts wood, aluminum, brass, steel, etc. PLUS SPECIAL MANDREL which enables use of saws in 1/4" or 1/2" electric drill. \$25 value. PPD. Only... **\$4.95**



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100 MOUNTED POINTS

SET 1/8 and 3/32 shanks, as-21E sorted shapes and sizes... **\$8.98**



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SET 4 right hand H. S., 3/8" straight shank End Mills up to 3/8" dia. **\$3.98**

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SET 14 different pcs., as above, PPD... **\$8.79**

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Carbide tip goes through any masonry. Set of 5 bits containing two 7/32" & three 1/4", all five, \$10 value, only... **\$2.75**



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Here is a tool that will do the work of a left, right and straight tool holder, plus a boring bar, all for a fraction of its original cost, post paid to you.

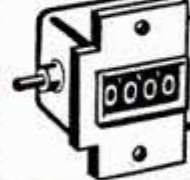
TOOL A takes a 5/16" sq. bit or 5/16" dia. boring tool. Shank size 9/16"x1"x4 1/4". PPD. Only... **\$3.29**

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evidence of fading at high speeds or in the Rocky Mountains. Drums are 10 inches in diameter with an unusual application on the front brakes, there being two widths of lining—the primary shoe has 2-inch lining and the secondary shoe 2½-inch lining. I do not like the location of the narrow brake pedal. It is too far on the right and too close to the foot throttle. In automatic-transmission cars, I can't understand why manufacturers do not move the brake pedal to the left of the steering column for use with the left foot.

The heating and ventilating system is efficient and convenient. Just in front of the windshield is a wide slot for entry of air.

While the location of the cigarette lighter in front of the steering column didn't bother me as a nonsmoker, my passenger was disturbed each time he had to reach across the car to use it.

The glove compartment is a sliding drawer mounted in the center and is a good arrangement. The radio is also in the center of the instrument panel with speakers on either side.

I like the quick-acting handles which require only two turns to open or close the windows and the attractive, curved armrests which also serve as door handles.

The driving position is extremely comfortable and the seats are wide. The cush-

ions are deep and long enough to give good support under the knees. There is little body rumble or wind noise even at high speeds.

The starter switch on the Hydra-Matic model is operated by lifting the shift lever. The indicator must be in neutral (N) position before the engine will start. This is a safety feature that I like.

The Hydra-Matic transmission is the new Dual-Range unit. Driving position No. 4 provides four forward speeds for normal driving. Below 60 miles an hour, quickly depressing the throttle automatically shifts the unit down to third speed. In driving position No. 3, fourth gear is locked out for quick acceleration, city driving and hilly country.

Low gear is available for extremely heavy pulling and for braking assistance. Low and reverse positions are side by side, which makes it easy to rock the car in mud or snow.

The hub of the steering wheel is large and partially obstructs the numerals on the gearshift quadrant. Either the hub should be smaller or the quadrant raised so that it can be seen more easily, as even a tall person must lean forward to see the entire quadrants.

In a terrific rainstorm between Price,

(Continued to page 282)

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IT SMELLS GRAND



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(FOR THIS YOU'VE YEARNED!)

IT PACKS RIGHT



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NOW YOU HAVE EARNED

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It has Infinite Speeds 0 to 550, Reverse, Automatic Overload Protection; Adjustable Torque up to 180 inch pounds. 5/8" Input and Output Shafts. It will handle 1/2" to 1 1/2" H.P. Motor. Case measures 7 1/2" long, 7" high 6 1/2" wide. **VALUE OVER \$300.** Shipping Wt. 25#. On C.O.D. Orders we require a 10% only **\$54.50** Deposit. Fob. Chicago

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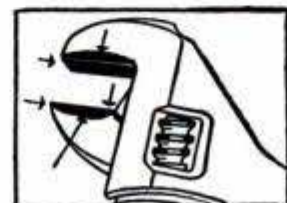
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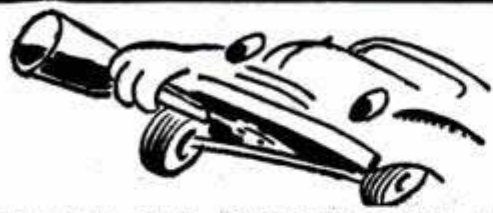
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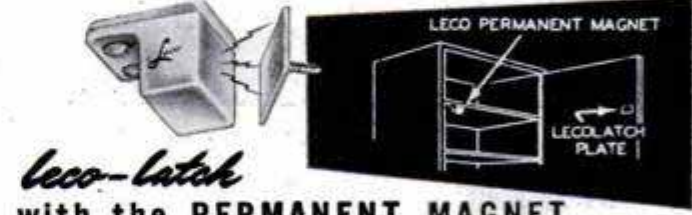
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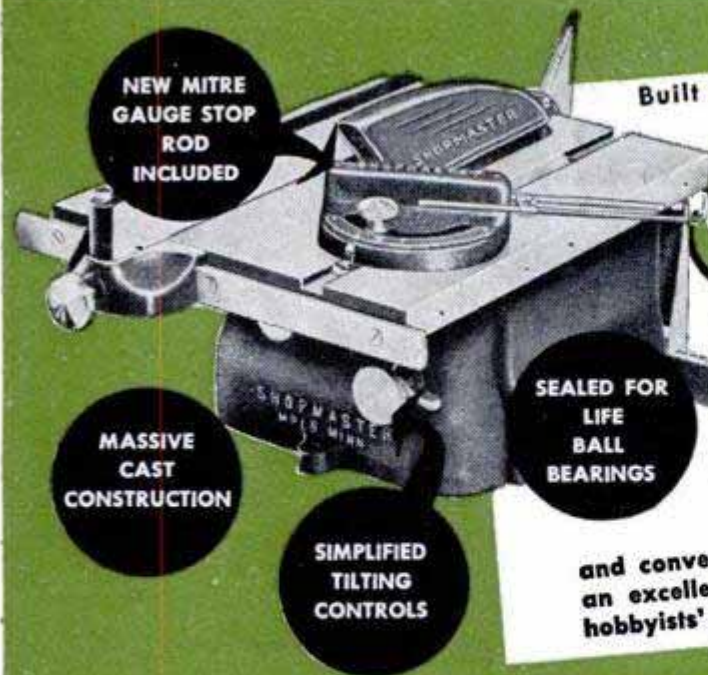
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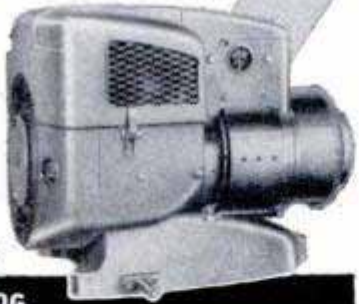


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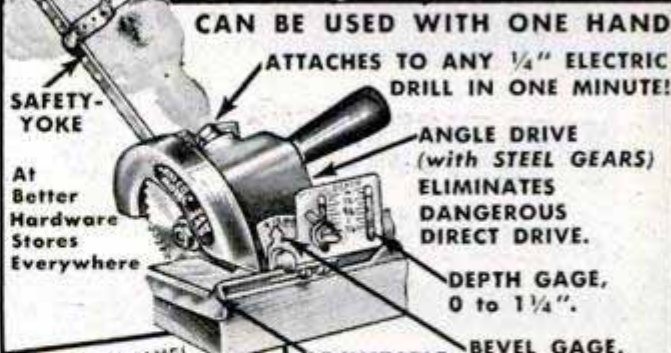
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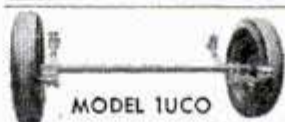
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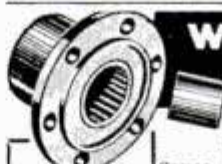
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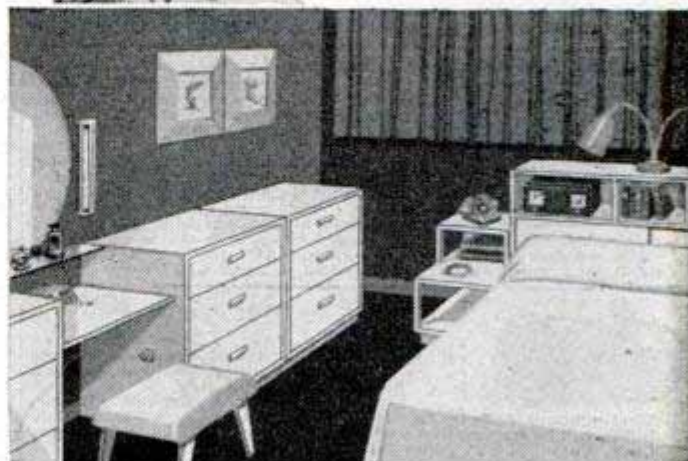
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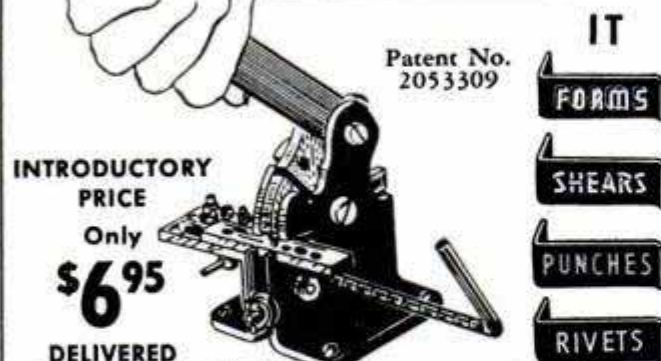


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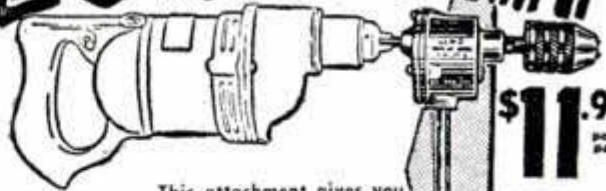
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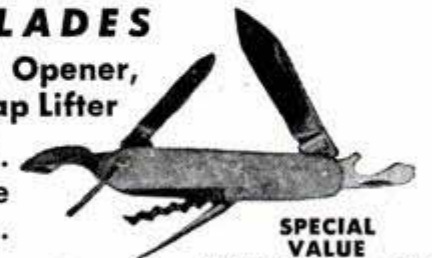
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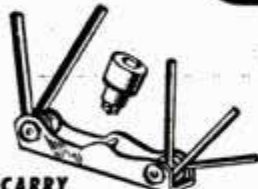
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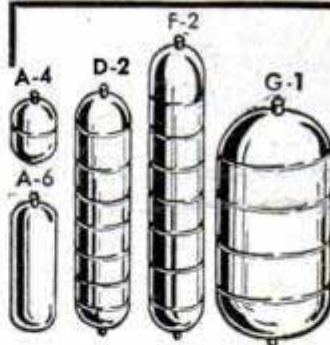
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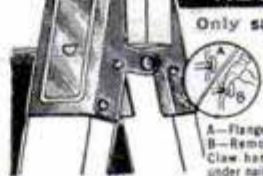
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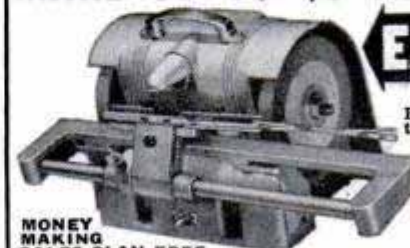
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The Owners Report on the 1952 Nash

(Continued from page 266)

Utah, and Zion National Park, I found that water seeped in at one corner of the windshield, but I've never driven in a worse storm. We drove over dirt and gravel roads for many miles and the car handled very well on the slippery, muddy roads. We did find that with no pan there was little protection under the engine. In the severe rainstorm, water and mud splashed up on the engine—so much, in fact, that twice when we stopped, the starter would not operate until the solenoid plunger was cleaned. Better shielding of the electrical units from below the engine should be provided for all-weather efficiency.

The steering ratio is satisfactory, with $3\frac{1}{2}$ turns from lock to lock. The turning radius is long, because of the skirted front wheels. I would prefer a shorter turning radius, eliminating the front-wheel skirts.

The outside door handles are new and different. Squeezing the handle opens the door. I am not sure how they would operate in freezing weather.

The spare tire is carried in a recess in the trunk floor—a satisfactory position unless the trunk is filled with luggage when you need the tire. I would prefer it mounted vertically. Luggage space is large and the jack is neatly clamped to the body side, thus eliminating rattles.

I found the 20-gallon gas tank (and Nash needs it far less than some others) to be a fine feature, especially when driving at night over mountain and desert highways where service stations are not too numerous. The gas-filler cap is concealed under a hinged lid above the right taillight.

The 1952 Nash is a sound, well-engineered automobile with many excellent and several exclusive features. I'm still looking for the car that has no faults—and probably looking in vain—but Nash has many features I'd certainly want incorporated in my ideal passenger car. ★ ★ ★

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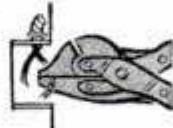
... powerful parallel jaws and extra leverage prevent rounding corners.

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5. UNKINKS WIRE

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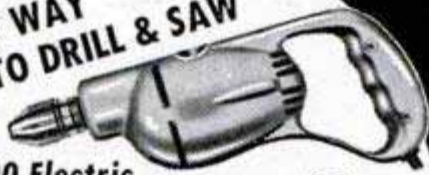
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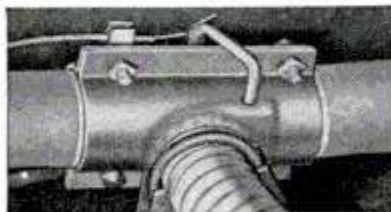
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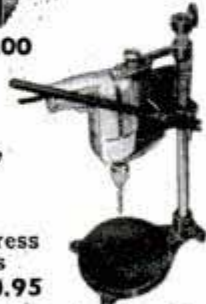
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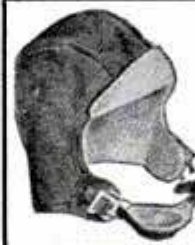
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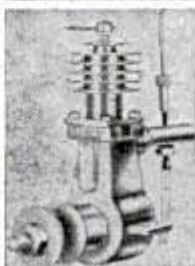


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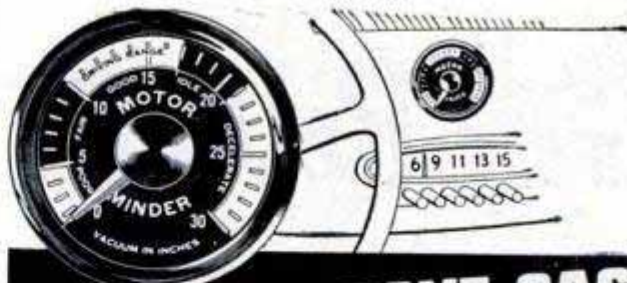
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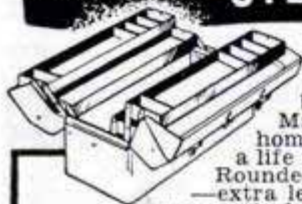
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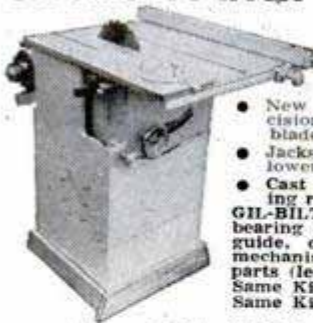
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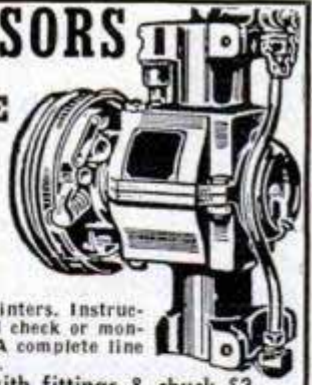
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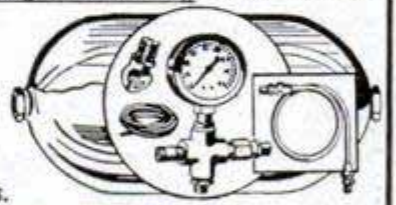
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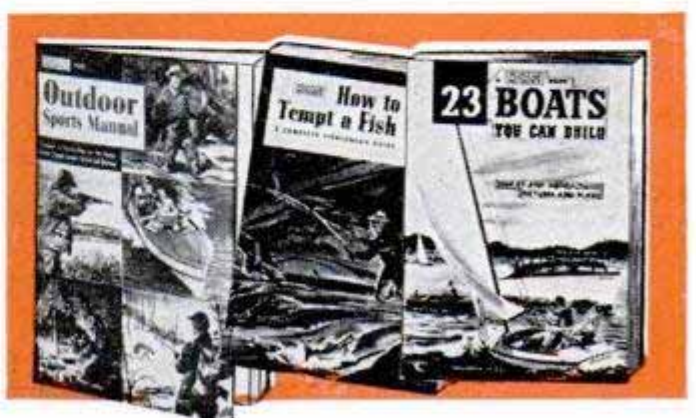
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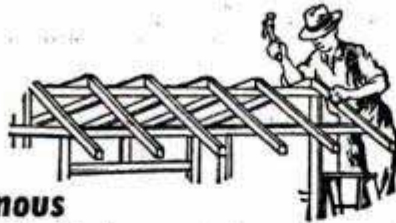


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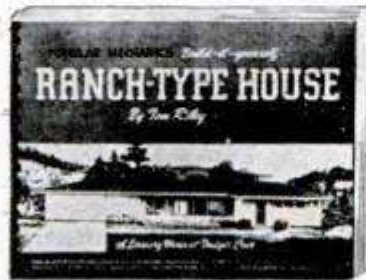


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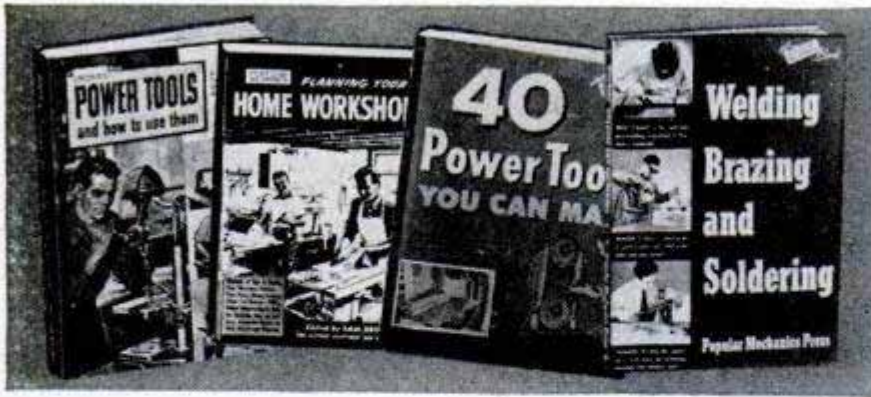
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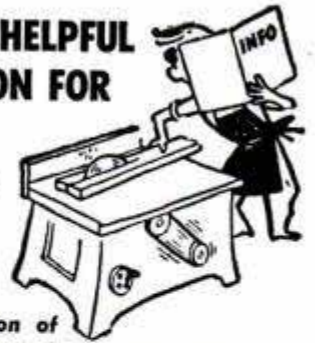


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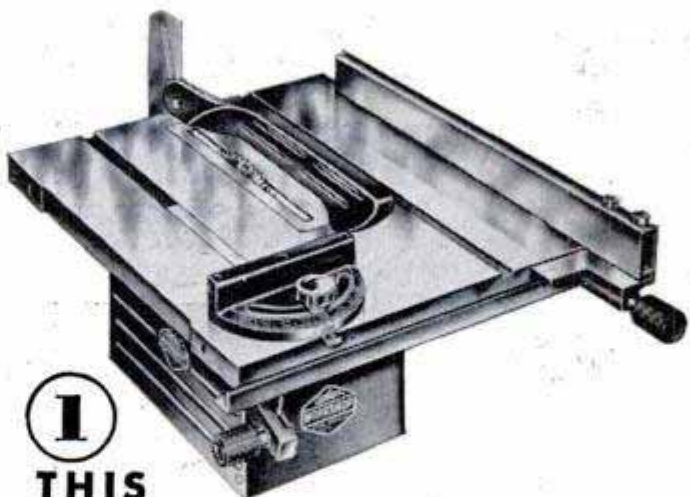
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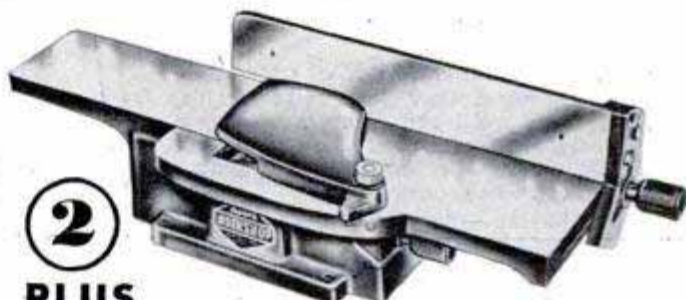
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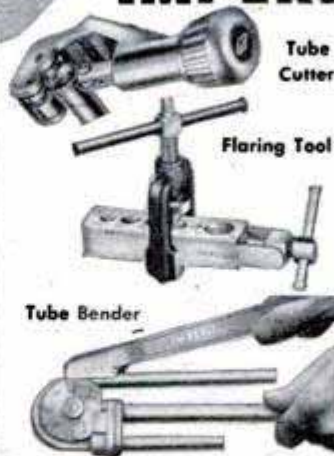


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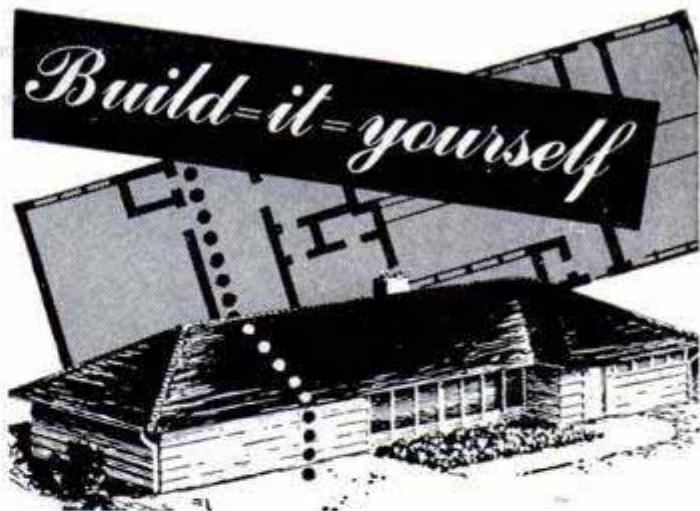
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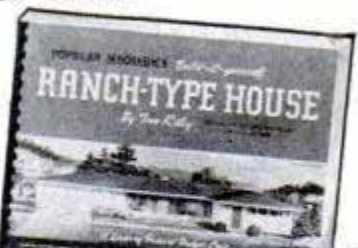
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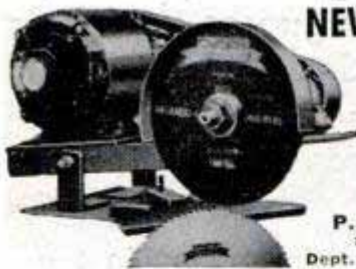
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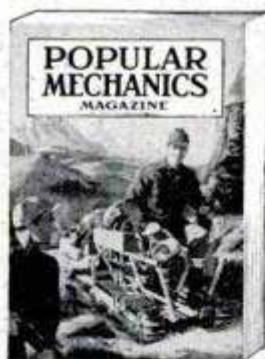
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A Scientist Diagnoses the Flying Saucer

(Continued from page 95)

signal is 5000 megacycles. There appears to be a definite connection between the anomalies in the two systems.

There is one interesting aspect in the reports on the flying saucers. About 100 years ago the famous Durham lights appeared over northern England. The century before, "lights" were seen by the French. Now, Americans are seeing weird lights, calling them flying saucers and attaching wholly unjustified significance to them.

The curious angle to these apparitions is that in every case the lights were seen by the people of the leading nation of the world at the time. When France was a great power, her people saw them. When England was dominant in the world, the English saw them. Today, the United States is in its prime and we see them.

It may well be that people who have most to lose from a change are the very ones most likely to see mirages. Perhaps a psychologist will explain why the inhabitants of the leading power in the world are most susceptible to strange sights in the sky.

Up to this point we have only mentioned the lights which appear at night. Flying saucers have also appeared in the daytime. But in every case the source was found to be a meteorological balloon, a very high flying aircraft or particles of dust or spiders which float lazily through the air in the general vicinity of the sun. The daytime appearances of these objects have not been a problem—the problem is strictly one of the night lights and these can be explained as mirages.

The next time you hear or read of flying saucers ask yourself a question: Why do not the people of the other countries see these objects? With the answer will come an understanding which will remove the fear and hysteria the flying saucers have engendered. ★ ★ ★

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We like it because we know that deep *pride* in things well made goes way back into the factories and is reflected in the fine products we have to choose from when we go to buy the things we use in our homes or on our persons.

We like it because we know that pride is a spur to make better merchandise; and that it is the driving power that keeps men striving each to outdo the other in new ideas, new and better ways of doing things. The end result is a steady stream of new and better means to make life comfortable; more and better jobs for us to earn the means of buying them.

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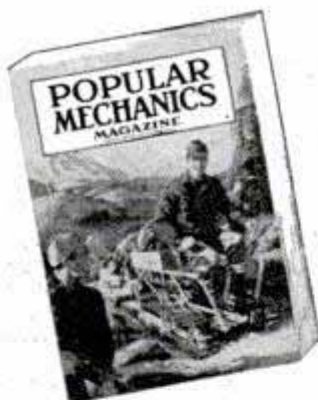
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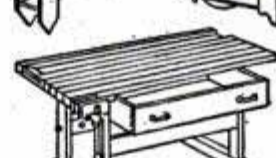
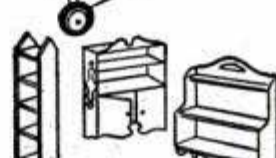
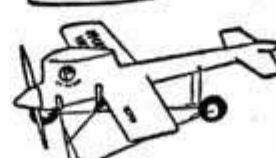
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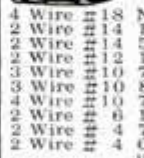
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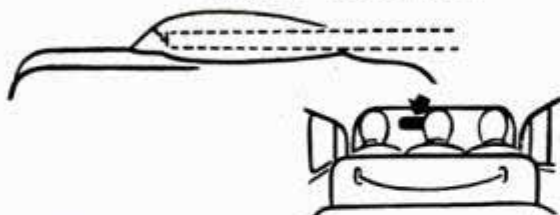
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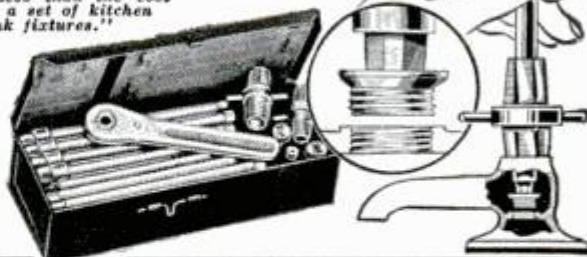
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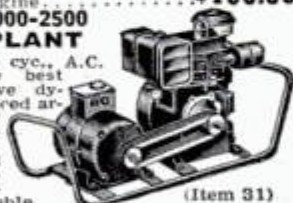
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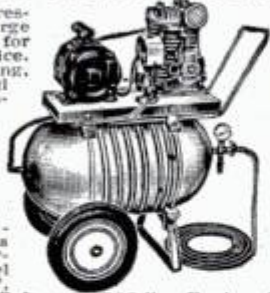
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COMPLETE OUTFIT. Compressor, pressure tank 6x24", air gauge, air chuck, 20 ft. hose, pop valve, copper tubing with 4 brass flared fittings for connecting compressor to tank, 4-way cross and 3 nipples. **\$32.45**
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Equipment less Compressor Tank only with 6x24" tank **\$12.45** 6x24" **\$ 6.25** with 12x24" tank **\$19.95** 12x24" **\$14.50**

MODEL 200 COMPRESSOR

2 1/2" x 2", 2.55 to 4.80 c.f.m. up to 150 lb. pressure. Operates with 1/2-1 1/2 HP motor. **\$27.95**
Special Price
Shipping wt. 24 lbs.

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2 cylinder 2 1/2"x2". 5.10 to 8.50 c.f.m. up to 150 lb. pressure. Operates with 1/2-3/4-1-1 1/2 HP motor. **\$54.50**
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1/2 H.P. heavy duty capacitor motor. AC 110/220 volt, 60 cycle, 2x1 3/4 inch piston type compressor, splash feed lubrication. 14"x32" tank, automatic pressure switch, CFM 2.8 at 100 lb. pressure, or 150 lbs. pressure for intermittent duty. Check valve, safety valve, air regulator with gauge and filter, 20 ft. air hose with air chuck for inflating tires. V. belt drive. Mounted on 2 wheels, ball bearing, with 2"x8" semi-pneumatic tires. Portable with handle. Shipping wt. 150 lbs.



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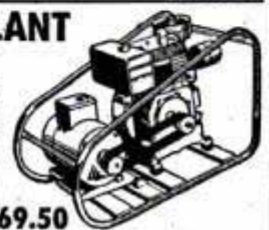


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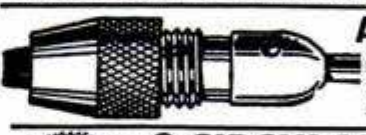
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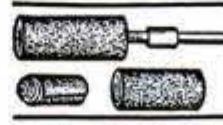
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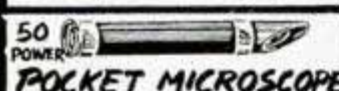
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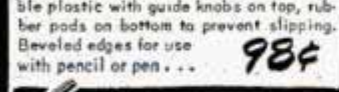
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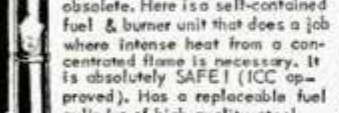
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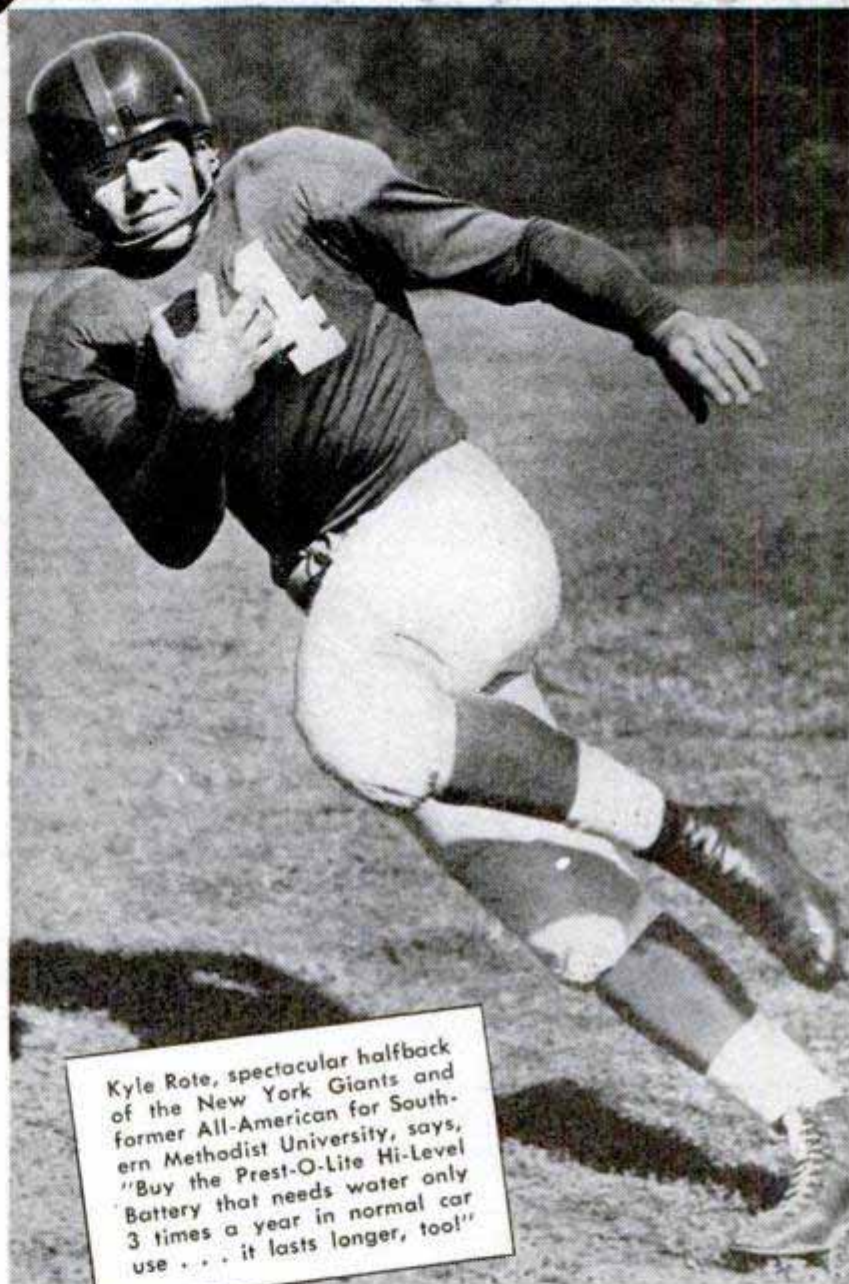
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