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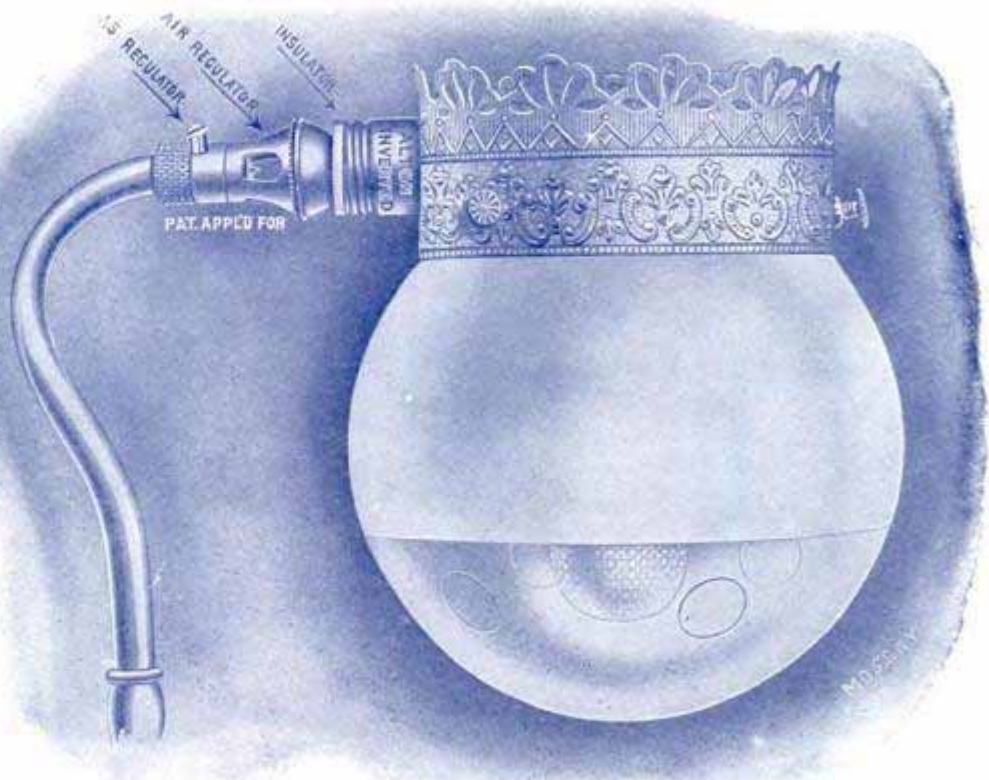
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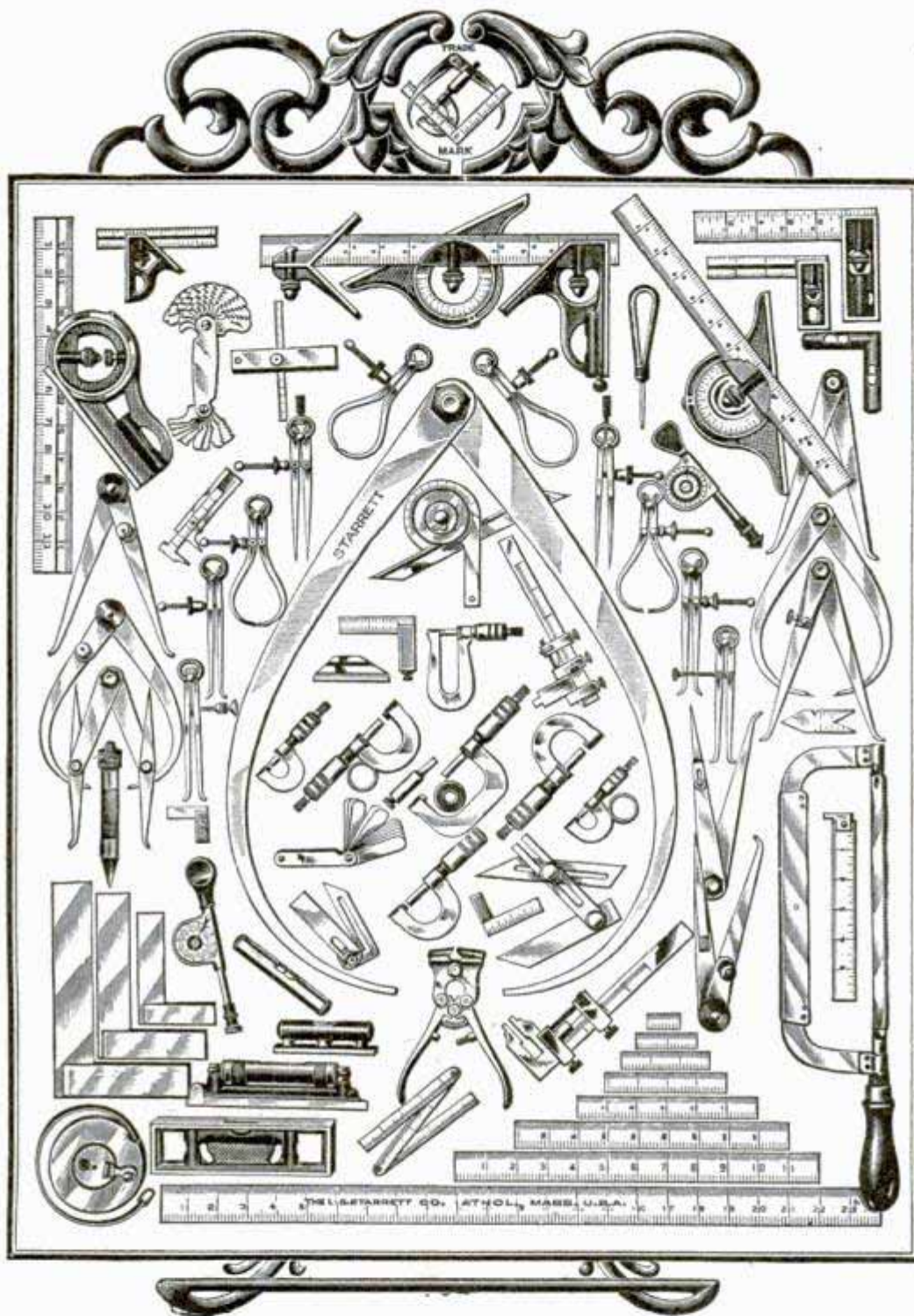
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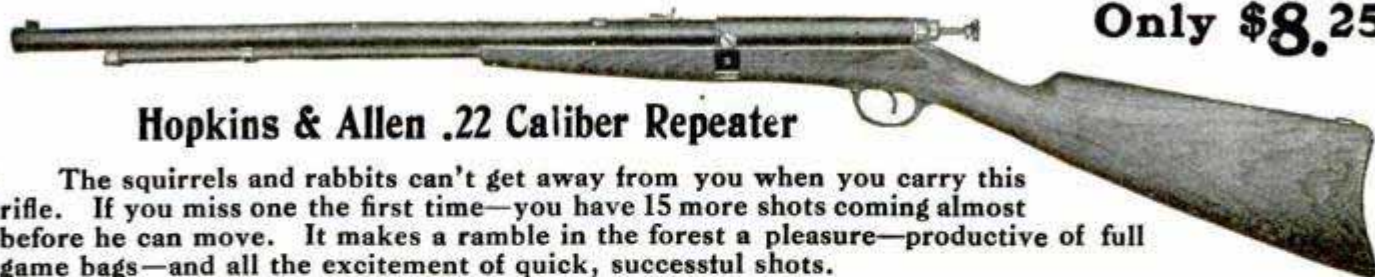
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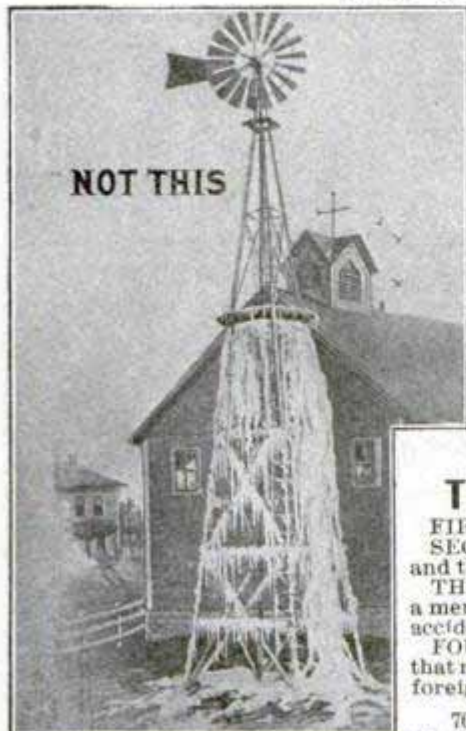
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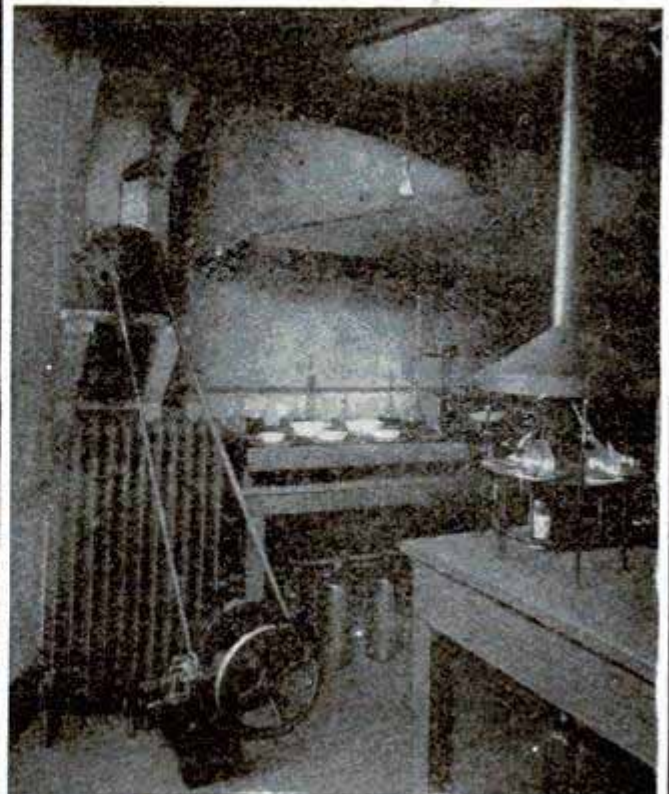
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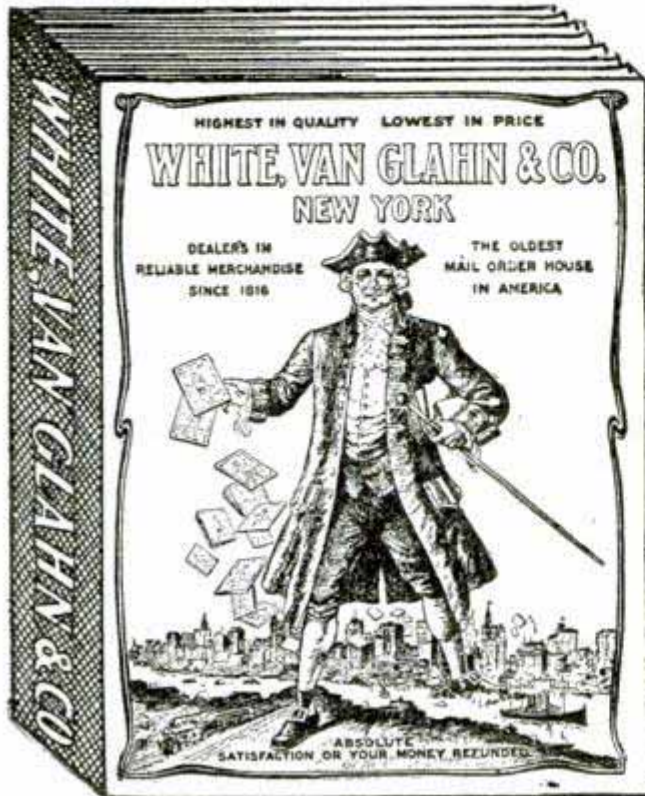
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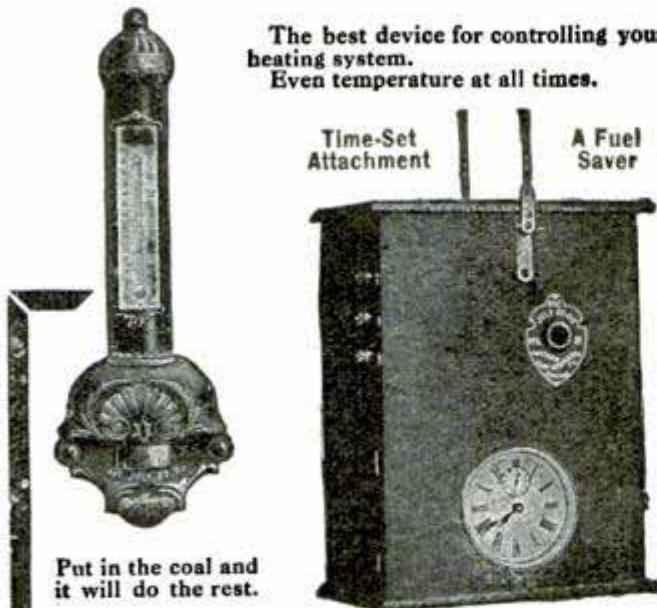
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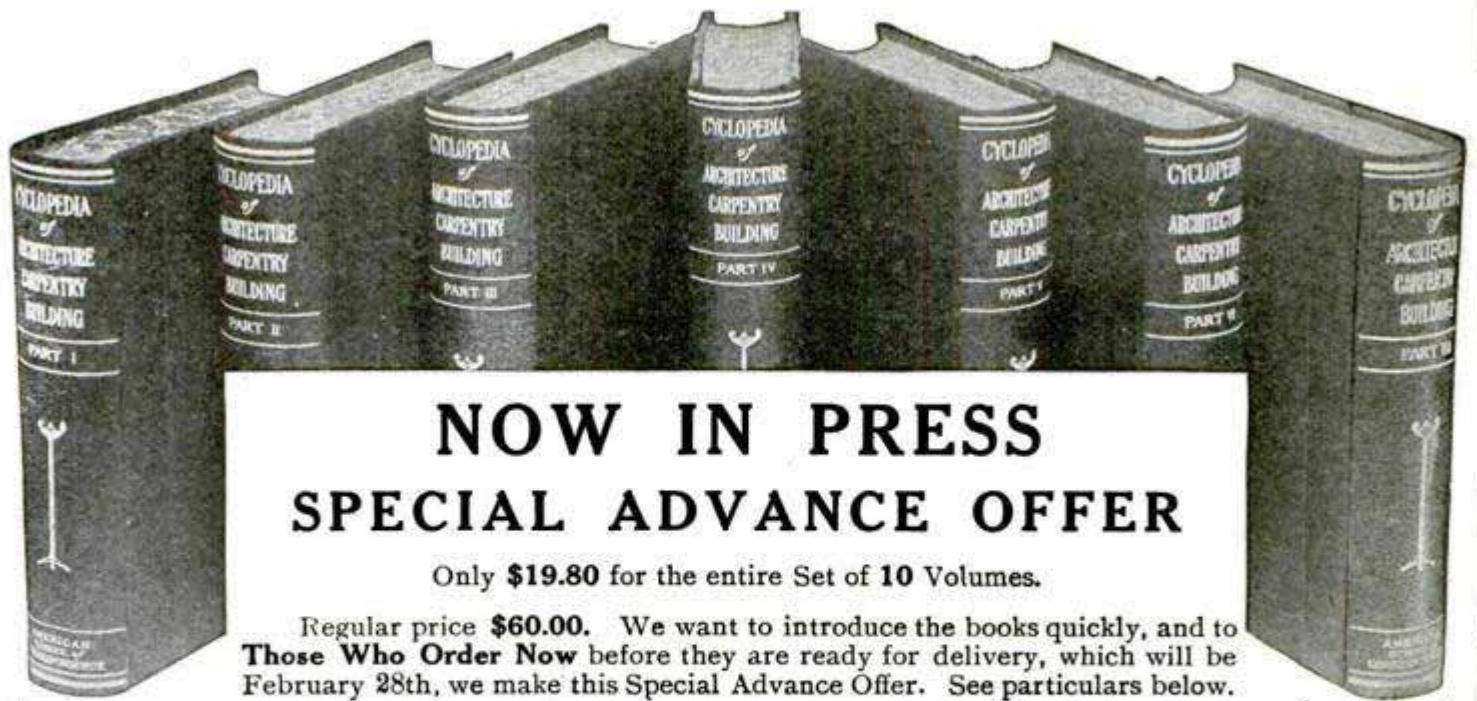
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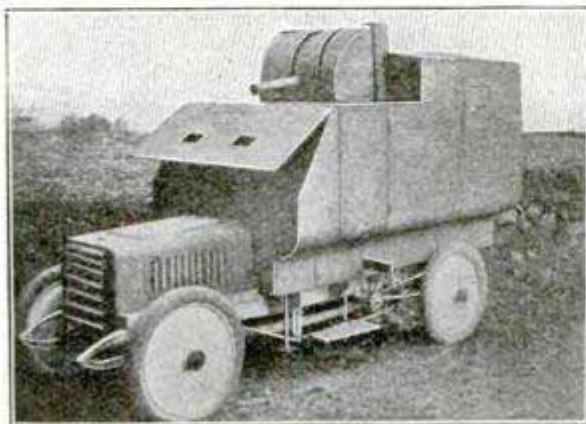
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SCALDING WATER USED TO KEEP TRACKS OPEN

In building the new railroad across the Isthmus of Tehuantepec, engineers encountered a difficulty not included in previous experience. The new road extends from Salina Cruz on the Pacific coast to Coatzacoalcos on the Gulf of Mexico. The country traversed is marvelously fertile and the tropical growth sprang up faster than the construction work proceeded. Boiling water was used to check the vegetation and a part of the maintenance of the line consists in frequently scalding the railway.

GERMAN MILITARY MOTOR CAR

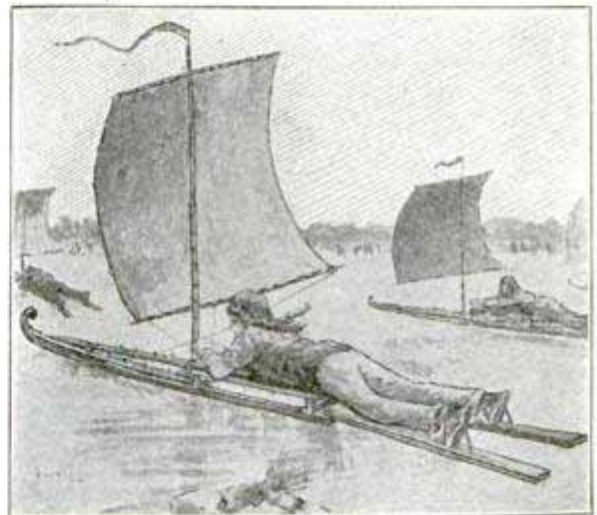
The latest armored motor-car built for the German army is illustrated below. It carries one rapid-fire gun of larger size than in any previous car. The car was built from plans largely designed by the German Emperor himself. Details of the outfit are kept secret.



Kaiser's Own Plan

RUSSIAN ICE BOAT

The latest Russian ice boat is being built along lines quite different from the usual American type. The sail is



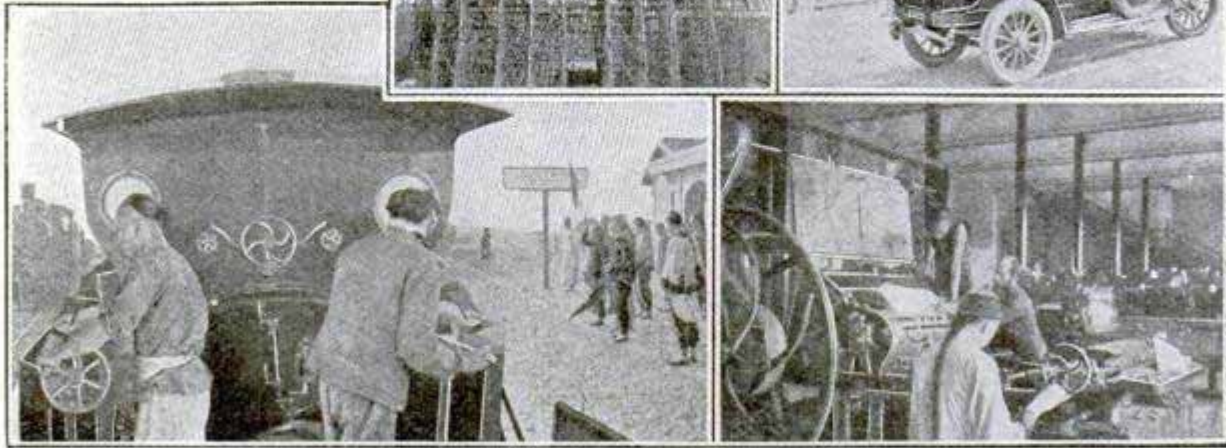
"He Rides Stretched at Full Length"

comparatively small, and the operator steers by means of two rudders, one fastened to each float, while he rides stretched at full length as seen in the illustration.

COMMERCIAL VALUE OF TECHNICAL EDUCATION

Germany leads the world in the size and excellence of its trade schools, and it is these institutions which are largely responsible for the high standard which attaches to the words "Made in Germany." Canada, which is rapidly developing manufactures, has caught the spirit of technical instruction and the government has now signified its intention to co-operate with resident manufacturers in establishing trade schools.

The Awakening of China



Mechanical Development in China--Lofty Scaffold Erected in Repairing Building Destroyed by the Boxers--State Official in Automobile--Native Enginemen--Modern Printing Machinery Operated by Natives

Western ideas, customs and methods are being adopted in China to an extent and at a rate but little realized by the rest of the world. Native Chinamen are constructing and operating telegraph, telephone and railway lines equal in results to the best European systems. To the land where printing was first an art have come the latest and fastest American presses, which are driven by electricity and worked by natives. The automobile has ceased to be a curiosity and become a utility. The army is being instructed in the most approved tactics of the world powers. Each month large numbers of students in mechanics, engineering, science, and art are returning to their own land from all parts of the world whither they have been sent to study and learn, to become instructors and constructors of the New China.

CHIMNEY 506 FEET HIGH

The highest and largest chimney in the world will be built for the smelting works at Great Falls, Mont. It will be 506 ft. high with an inside diameter at the top of 50 ft., and outside diameter at bottom of 75 ft. The chimney will

be of brick, cost \$200,000 and weigh over 16,000 tons, with a capacity of 4,000,000 cu. ft. of gases per minute. The interior will be lined with acid-proof brick laid in acid-proof mortar.

CEMENT CARGO TURNED TO STONE! AT SEA

A strange accident befell the "Socoa," bound from a European port with a full cargo of cement for use in rebuilding San Francisco. When off the Lizard, near the stormy Cornwall coast, the "Socoa" struck a sharp point of rock, which tore a large hole in the hull and penetrated some distance. The vessel thus remained fastened as if upon a pivot.

When the salvage crew arrived to see about taking the "Socoa" from her dangerous position, the men found that water had entered the hold causing the cement to set and fix itself around the ragged rock penetrating the ship's side. The entire cargo has become as hard as stone and the ship is anchored to withstand the ages. Her rigging and upper wooden works were dismantled, but the hull remains fast to the rock,



SUCCESSFUL WORK OF HOME-MADE DITCHER

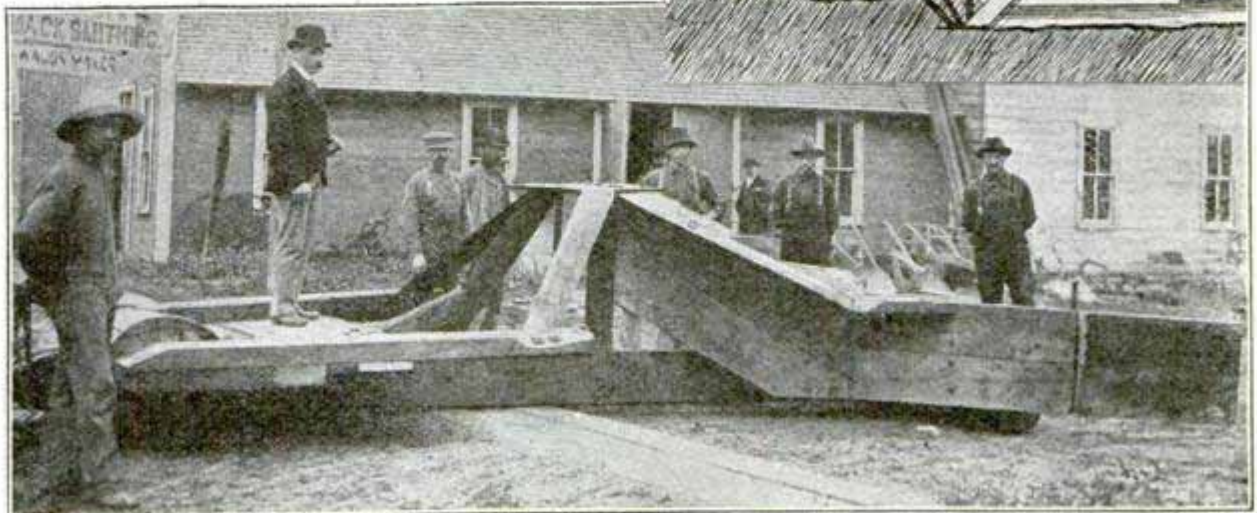
Seventy Rods of Big Trench Made Per Day With 48 Oxen--Plow Turned Up-Side-Down and Transported on Its Own Rollers

Six miles southeast of Greeley, Colo., a seepage ditch was made recently by methods which smacked of those employed 50 years ago, but by means of which the cost to the owner of the ditch was only one-third as great as it would have been had he employed a modern dredger in making it.

By the combined strength of 48 head of oxen a wooden plow was dragged through marshy land making a trench 3 ft. wide on the bottom, 8 ft. wide at the top and two miles in length, into which the seepage water was drained and carried to the Platte river.

The oxen traveled on the firmest ground in the marsh, which, however, was hardly able to support the weight of a man. Two big wooden steel covered staples called a crab were driven in the swamp and a wire cable, 1 in. in diameter, passed around the crab and was paid out for several hundred feet.

The cable then passed over a pulley fastened on the front end of the "ditcher" or plow and the other end of the cable was attached to an evener, to which the cattle in pairs were yoked with chains. As the four dozen animals walked, the big plow ripped up the sod at a great rate as it was dragged up to the crab, which was then moved ahead and the operation repeated. Two heavy wheels are arranged on the top of the crab and when necessary to remove it from place to place the crab is turned upside down and pulled by oxen to the desired location. A man sat on the plow to keep its big



Ditcher Up-Side-Down Being Drawn on its own Rollers



Completed Ditch

knives clear of debris and the outfit dug 70 rods of ditch a day. The picture of the plow shows it upside down, in which position it can be transported from place to place on its own rollers.

HIGH-GRADE STEEL FROM SCRAP IRON

Probably the greatest discovery that has been made in the steel industries in recent years is the manufacture of high-grade tool steel direct from ordinary scrap iron by means of the electric furnace. In one of the steel works in Germany the process has been in operation since February, 1906, but has until recently been kept a secret.

While the cost of materials for making crucible steel is from \$20 to \$80 a ton, the cost of the old scrap and rubbish used for electric steel averages only \$12 a ton.

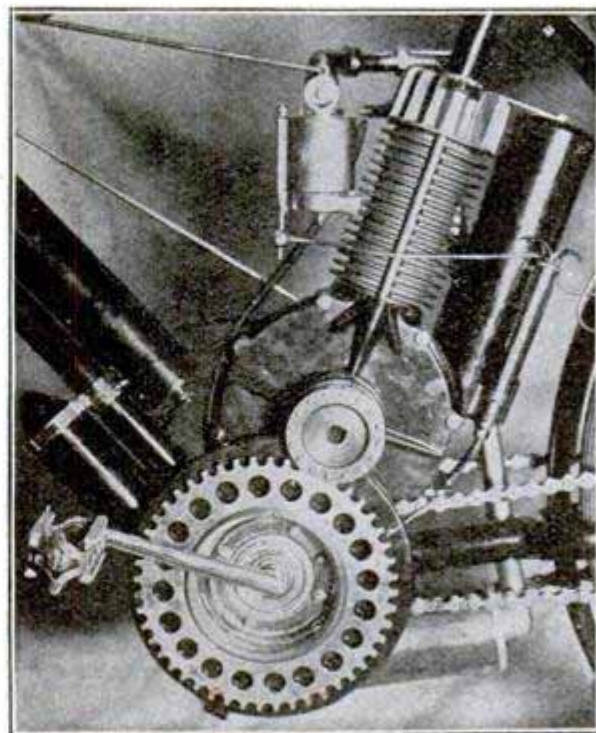
The rubbish is first melted in a tilting furnace or oven, constructed similarly to those ordinarily used in our American smelting works. After being thoroughly reduced to a fluid state it is poured and conveyed in a retort by a traveling crane to the electric oven, which has a capacity of from 1½ to 2 tons. In this oven the necessary quantities of carbon, manganese, chrome, silicum, nickel, tungstate, arsenical iron, etc., are added, to produce any kind or quality of steel desired. The whole process of production takes from 2 to 2½ hours.

Not only is the electric process much cheaper, but the electric steel surpasses greatly that of any crucible steel ever made, both in quality and chemical

purity. By this process the steel is freed and kept clear of all gas and bubbles, which has never been possible by the old methods. Electric steel is more easily worked because of its superior purity, and permits the introduction of from 20 to 30 per cent more carbon than in the crucible steel. It can be forged easier, is not easily affected, like the crucible steel, by the damaging influence of overheating; it is stronger and offers a much greater resistance to wear and tear.

NOVEL ROLLER GEAR FOR MOTORCYCLES

Undoubtedly one of the most radical changes that have been made in motorcycles for the season of 1907 is the entire elimination of the short motor drive chain, that was most given to stretch and wear. In its place there has been substituted a roller gear drive which is simplicity itself—merely a roller pinion gear affixed to the drive shaft of the motor and which engages with a hardened steel gear wheel or sprocket mounted on the countershaft cup, the sprocket embodying the Indian brass friction or compensating rings, which are of double the usual size.



New Roller Gear

The roller pinion consists of fourteen hardened steel rollers mounted on hardened pins which are held in place by one ring and so arranged that any pin or roller may be replaced in no time at all. Both the roller and its engaging sprocket are enclosed in a

dust-proof gear case and continuously run in an oil bath. As will be seen from the accompanying photograph the whole idea is wonderfully simple and well executed and presents a neat and compact appearance without sacrificing strength.



The above illustration shows one of the three-wheeled delivery motor cars used by the Evening News, London, for the rapid distribution of its papers about the city.

ELECTRICITY FOR SURGICAL OPERATIONS

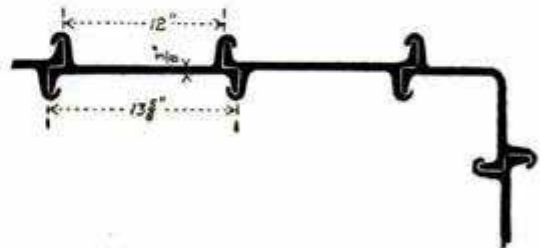
Dr. Tuffler, of the Beaujon Hospital, Paris, announces a successful use of electricity in producing a sleep of insensibility, which can be maintained, and in the administration of which the heart is not affected. He is hopeful it will do away with anesthetics.

SMELLING FOR A LIVING

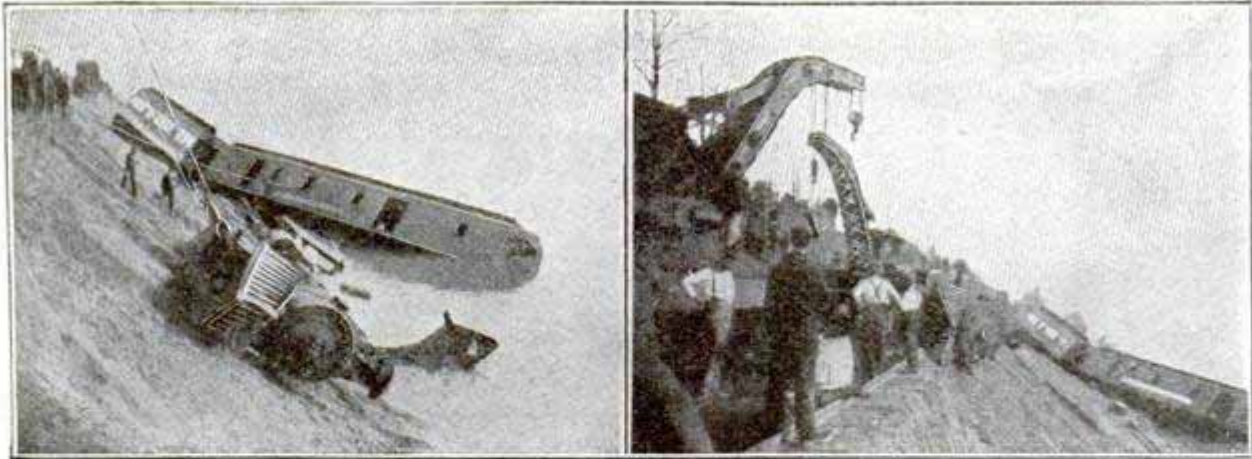
A new occupation has been developed in London and already is being successfully worked. The requirement is a sensitive sense of smell, and a little practise makes the detector quite proficient. He inspects the gas pipes and fixtures of a building and charges 18 cents for each leak he discovers. Some of the men earn \$15 per week.

INTERLOCKING STEEL SHEET PILING

The latest thing in steel sheet piling for cofferdams, caissons and foundation work is a modified form of I-beam the flanges of which interlock with each other. Piles with web $\frac{1}{2}$ -in. thick



weigh 40 lb. per square foot. A hole is punched in the end of each pile for the insertion of a hook in pulling the pile out if desired.



WORK OF THE WRECK-CLEARING CREW

No army or city fire department has a better organization than the wreck-clearing crew of a large railroad system. In these days a small number of men are required as compared with a few years ago, for a few experts with steam cranes can do in one hour what formerly required 50 or 100 men an entire day. The crew are given other work, but not far from the wrecking car in which steam is kept up constantly; and a call to go out can

usually be responded to in 15 minutes during the day or 30 minutes at night. The train usually consists of one locomotive and four cars; the crane car, one for ropes, tackle and tools, one with extra trucks, and the boarding car equipped with kitchen and dining room and constantly stocked with food supplies, not only to serve its own crew but a large additional force if necessary. A modern wrecking crane will lift from 75 to 100 tons.

KNOCK-DOWN BARRELS

At last a practical knock-down barrel is available, and they are now being made in large quantities and shipped to the West Indies and Central America. They will return filled with pineapples, bananas, other tropical fruits and vegetables. The barrels are regular size but first made in longitudinal halves, in which shape they are "nested" for shipment, the parts of 10

barrels occupying only the space required for one barrel when erected. The barrel is preferred for shipping because one man can roll one where two men are required to lift a box containing the same weight.

The illustrations from the American Exporter show the process of assembling the parts, which can be done with cheap labor.

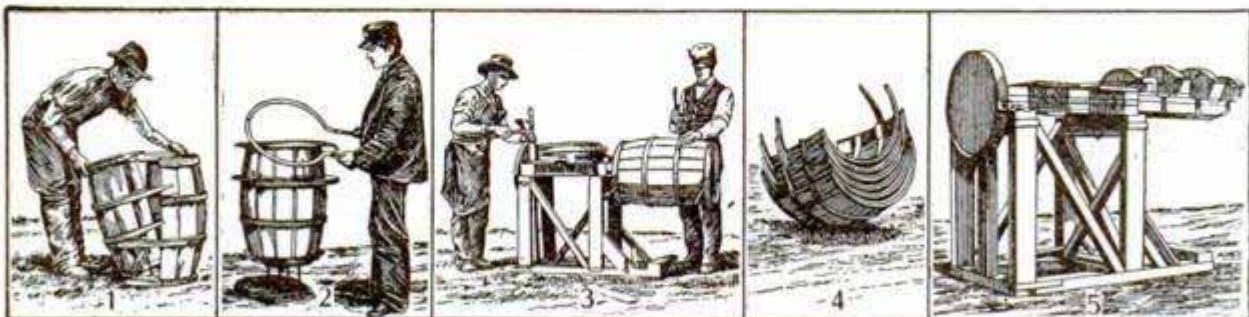
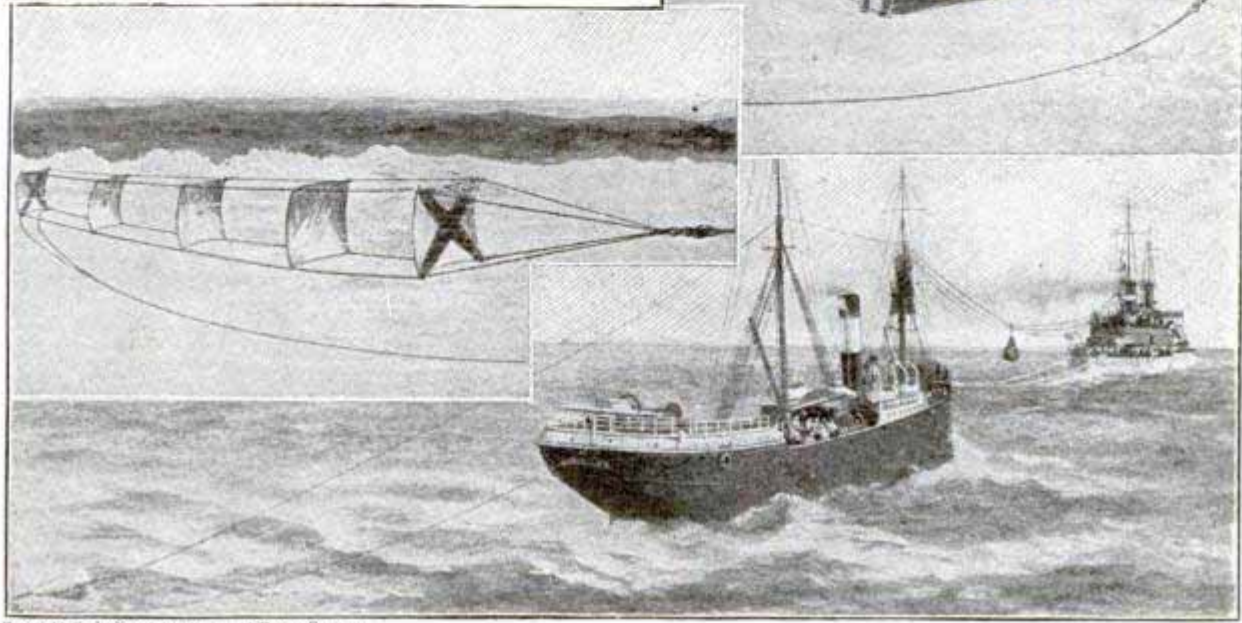


Fig. 1—Setting up the two Halves. Fig. 2—Clamping the Barrel Together. Fig. 3—Making the Bulwarp Hoop and Nailing the Barrel Together. Fig. 4—Barrels Nested for Shipment. Three in a Bundle. Fig. 5—Form for Nailing Barrels Together.

SEA ANCHORS FOR COLLIERIES

[Extracted from a paper by Spencer Miller, read before the Society of Naval Architects and Marine Engineers.]

Coaling a battleship at sea is one of the achievements of recent years, and means a great deal more than the



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New Sea Anchor at Left--Old Type Sea Anchor at Upper Right--Collier in Tow of Battleship which is Coaling in Mid-Ocean--Collier has her Sea Anchor out

average reader would suppose. Without fuel these sea-monsters are more helpless than the clumsiest little fishing smack, and would immediately fall an easy victim to the enemy. The time spent and the fuel consumed in making a coaling port and returning to her former station might easily spell defeat; hence great coal ships now accompany all naval fleets in times of active service.

As the two vessels cannot make fast to each other on the high seas a system of aerial tramway has been used to convey the coal in bags or buckets from one ship to the other. This is accomplished by means of immense towing lines from stern of battleship to bow of collier, while the cableway leads from the mastheads. To keep the cableway taut a wire rope is passed from the collier's foretopmast to maintopmast, and then over the stern for 1,700 ft. At the end is fastened one or two sea-anchors as required. These sea-anchors

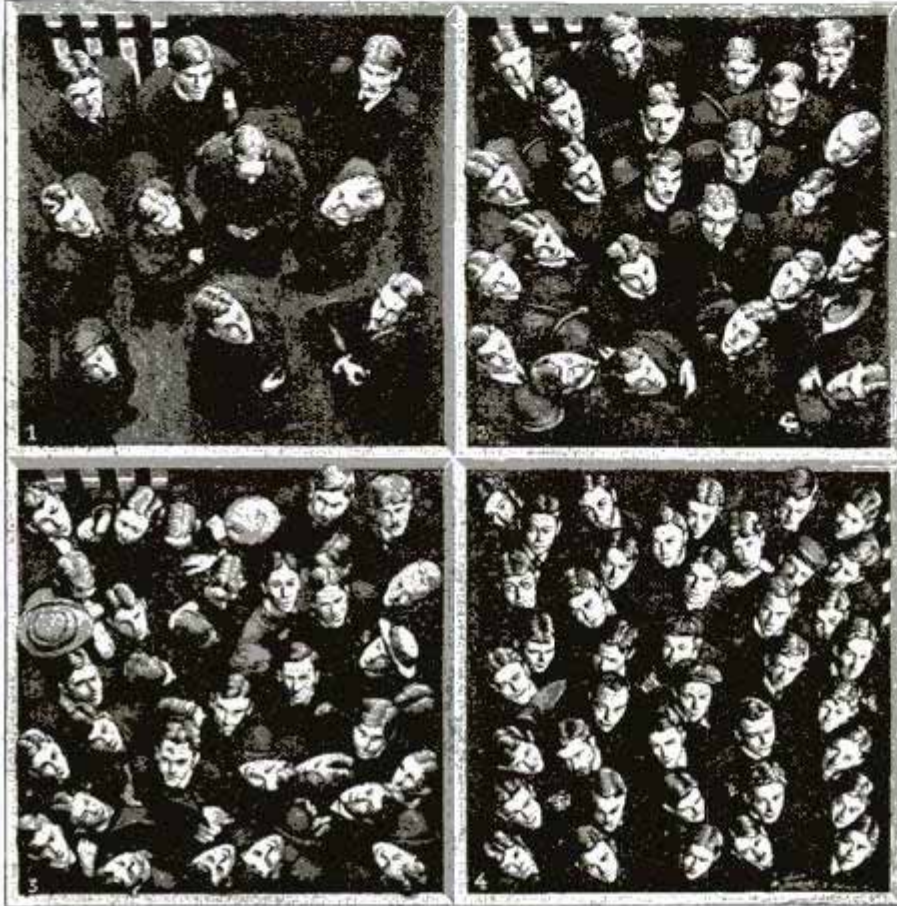
are from 5 ft. to 9 ft. in diameter at the mouth and taper to a point. They are really great canvas bags with sufficient cork attached to float them; and exert a pull ranging from 102 lb. for a 5-ft. anchor at a speed of 1 mile per hour up to 65,240 lb. for a 9-ft. anchor at 14 miles. An anchor pull of 12,500 lb. is required to support buckets carrying 1-ton loads.

What is termed the new or multi-plane sea-anchor seems likely to supersede the conical, which has a faculty of diving, turning and getting all "balled up" at the most inopportune moment. The new anchor consists of five 4-ft. canvas squares, weighs 325 lb., exerts a straight and steady pull, is easily launched and recovered, and altogether is much better behaved.

A perfect vacuum is a perfect insulator, although a partial vacuum conducts electricity much better than air at atmospheric pressure.

WHAT SPEED COSTS

In order for the big Cunard liners to gain their $1\frac{1}{2}$ knots greater speed than the "Kaiser Wilhelm II's," Germany's fastest ship, necessitated the



following extra equipment: Six boilers, 68 furnaces, over 52,000 sq. ft. of heating surface and the development of 30,000 additional horsepower. The increase in dimensions necessary is: Length, $78\frac{1}{2}$ ft.; breadth, 16 ft.; depth, 4 ft.; displacement, 12,000 tons. The use of turbines, however, eliminates many difficulties.

WATERWAY MONTREAL TO NEW YORK

A Canadian company with \$8,000,000 capital proposes to join an American company in establishing an all water route between Montreal and New York city. In connection with this work the Canadian company plans a 100,000-hp. power plant to utilize a water power near Montreal.

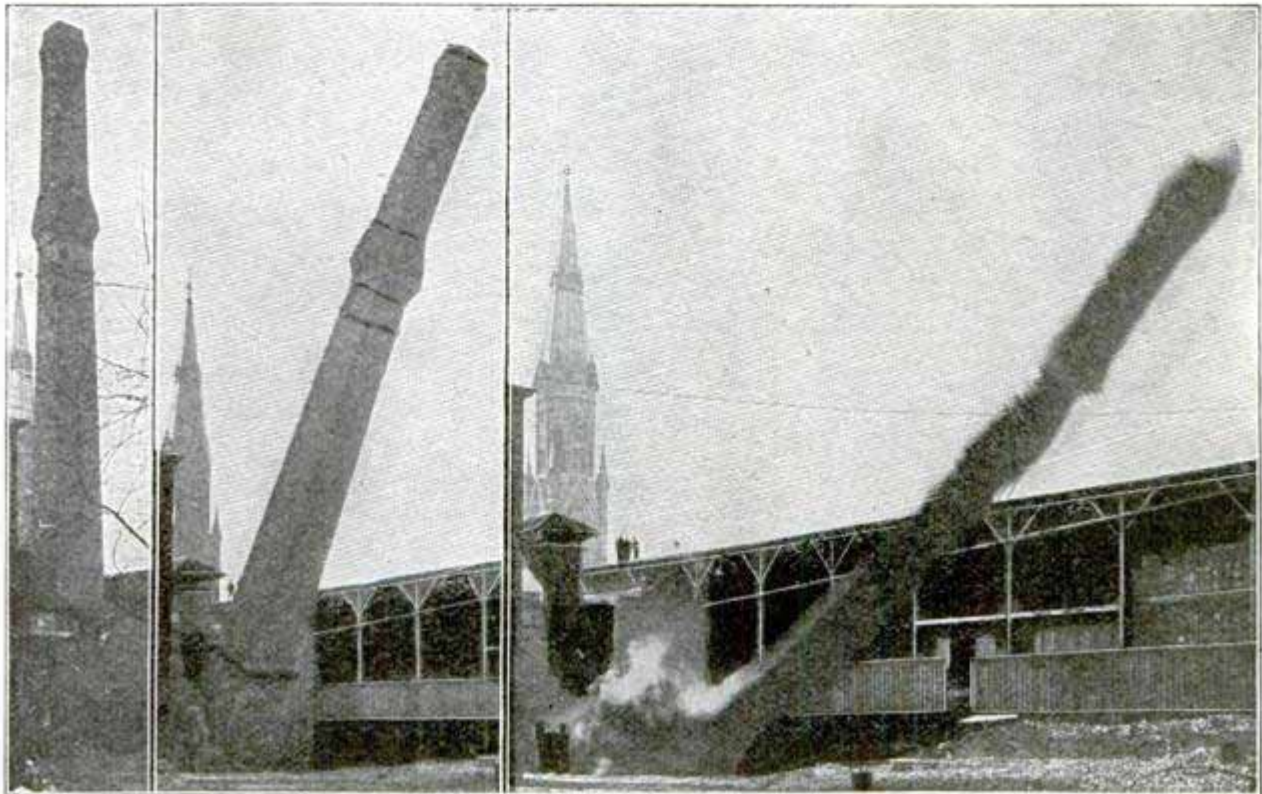
THE WEIGHT OF A CROWD

French and American engineers differ in their estimate of the factor of safety in public halls and other constructions to be occupied by standing crowds. Prof. Johnson, of Harvard, in 1904 estimated the maximum load at 160 lb. per square foot.

In the discussion of two years past, experts of several countries placed the weight at widely different figures, ranging all the way from 40 lb. to $143\frac{1}{2}$ lb. per square foot. This led Prof. Johnson to make additional experiments, which he did by constructing a wooden case with a floor area of 36.25 sq. ft. The compartment rested on scales for accurately weighing the loads. The four illustrations show: Fig. 1, 10 persons weighing 1,462 lb.; Fig. 2, 20 persons weighing 2,915 lb.; Fig. 3, 37 persons weighing 5,372 lb. In Fig. 4 are 40 persons crowded into the same space with a total weight of 5,800 lb., and presents a condition such as commonly occurs when great crowds gather, as on the occasion of parades, or in those portions of halls where standing room is allowed.

At present no builder would think of erecting a residence for sale without hardwood floors. The rapidly advancing price of hard wood, however, and the constant labor necessary to keep such floors presentable are likely to greatly reduce its use. In many banks, offices and public places the hardwood floors are being covered with linoleum.

BRINGING DOWN A 165-FT. STACK



Courtesy of Henry Bastrin & Sons

Three Stages of the Falling Chimney

The 165-ft. brick stack which 30 years ago was the tallest structure in Milwaukee was recently razed to make room for a new plant. The stack weighed 505 tons, contained 184,000 brick and was 10 ft. 6 in. square at the base. On account of boiler rooms and other buildings on three sides it was necessary to drop the stack within a comparatively narrow space, and to tear down from the top meant loss of the bricks.

The chimney was first undermined

on one side, 20 jacks being placed to support the load, then the jacks were removed one at a time and oak timbers substituted with a greased skidway at the bottom. When all was ready a cable and windlass withdrew the skid. The stack remained intact for one-third the distance to the ground, as seen in the second view, then broke off about 40 ft. from the top, as shown in the right hand view; the upper section struck the ground perceptibly later than the lower section.

TARRED GRAVEL FOR ROADS

A new elastic road covering is being tested in Switzerland with gratifying results, it is said. Fine gravel is freed of all earthy matter; then, in a special machine, heated and every particle coated with tar. It is then put up in heaps and left for from eight to ten weeks, fermentation occurring in the meantime, causing the tar to penetrate

the pores of the stone. This macadam is put on the roads in dry weather, using no water in smoothing it down with steam rollers and observing great cleanliness in handling it. For 28 bu. of gravel only 44 lb. of tar is required. A road was tested with a six-horse wagon, loaded with ten tons, to the satisfaction of all concerned.

Wireless Telephonic Communication has been held between Berlin and Nauen, Germany, a distance of 24 miles. It is said that the conversation was perfectly intelligible and also, that the field of successful operation will be illimitable. A microphone was used in connection with wireless telegraphy apparatus.

Search for the North Pole will again be undertaken by Commander Robert E. Peary, he says, but this time he will direct the expedition from the ship or winter quarters, at the north end of Grant Land, sending out sledge parties to cover the intervening 450 miles to the Pole.

The English Channel Tunnel is the next great engineering work in prospect. A bill providing for a submarine railway, lighted and operated by electricity, between Dover, England, and the French shore will be brought up before the British parliament at its next session. The project involves an expenditure of \$80,000,000.

Milk Bottle Exchange.—Milkmen frequently get bottles belonging to other dealers than their own. At the exchange the milkman receives one cent apiece for these bottles and may obtain his own company's bottles at two cents each.

Engineering Needed at Cornell.—It seems a surprising though sad commentary that a club house costing half a million dollars, and occupied by embryo engineers, should burn and cause the death of seven men. While these students were passing severe examinations on tensile strengths of beams, and safety factors in bridges, many of them were sleeping in a fire trap.

Motor Trucks in St. Bernard Pass.—The monks of the famous St. Bernard Pass now use motor trucks instead of dogs and horses, as of old, to bring their supplies from the valley to the monastery on the mountain heights above the snow line. The authorities, however, fearing the autos may scare horses on the narrow pass, have ordered the monks to hitch horses to their cars.

Christmas Gold Coins.—The demand for gold coins is so great at Christmas time that the government mints are busy weeks ahead of time preparing for it. Many persons send gold coins as gifts and many firms pay off in gold at that time. Eagles, five-dollar and two and a half-dollar pieces are called for most.

The Manufacture of Real Diamonds as claimed by a French chemist consists of packing pure iron and pure charcoal in a carbon crucible, heating it in an electric furnace to 700° F., then plunging the crucible into cold water. The outer surface of the mass solidifies first and by the process of solidification of the liquid iron within, the carbon is squeezed out like water and crystallizes into diamonds.

Cape Cod Canal.—At last a short cut from Boston to New York by water seems probable. The project is to cut a canal from Buzzard's Bay on the south to Barnstable Bay on the north, a distance of eight miles. The channel would be 125 ft. wide at the bottom, 250 ft. wide at the top, with a depth of 25 ft. at low water. The canal will take three years to build, cost \$10,000,000 and shorten the outside water route from Boston to New York by 120 miles, or about six hours.

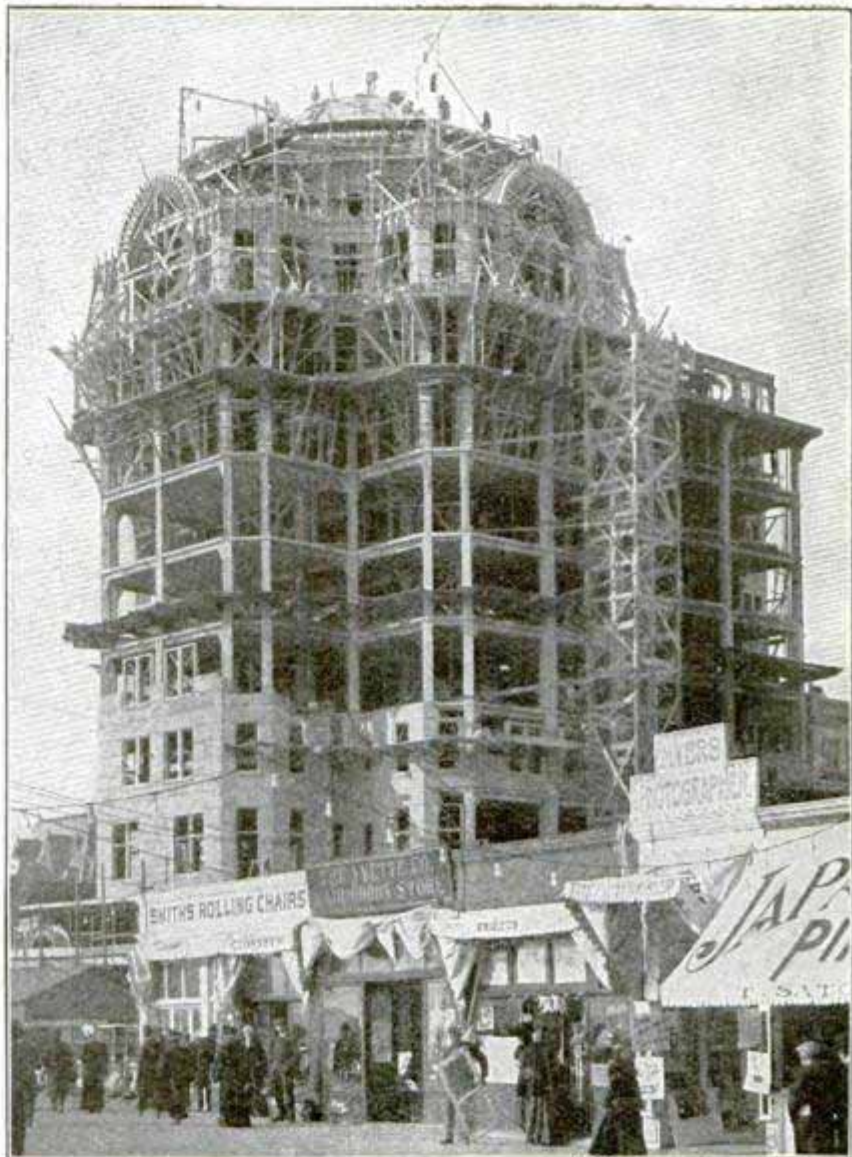
Railroad Accidents and Operation.—The accidents to passenger trains during the past few weeks in which two disasters alone cost over 100 lives, emphasize the force of our statement in a recent issue. We quoted from sources which cannot be questioned, that the percentage of fatalities is more than twice as large as ten years ago. In the two big wrecks recently, had steel coaches instead of flimsy wooden shells been used the number of killed would certainly have been greatly reduced.

BIG FIREPROOF HOTEL BUILT OF CONCRETE

A 12-story fireproof hotel has been built at Atlantic City in which no wood is used except for part of the interior finishing; the structure proper is concrete, tile and steel.

The first pile for the foundations was driven on September 10th and on December 15th the concrete roof was completed. The framework is structural steel and the walls and floors are reinforced concrete. A concrete dome three stories high surmounts the building.

In the work, rapidity of construction, economy, exterior appearance, fireproofness and the avoidance of undue noise were important considerations. These were believed to be well met by the combination of reinforced concrete and hollow tile construction.

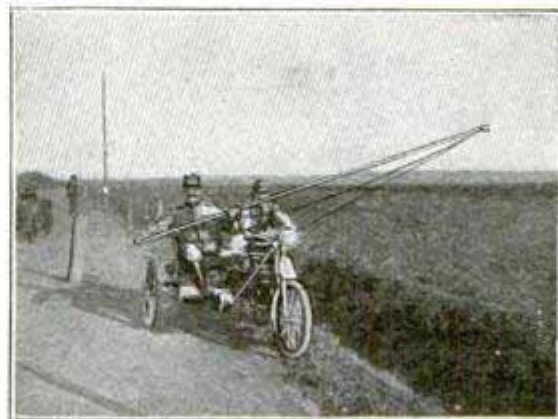


Courtesy Trussed Concrete Steel Co.

Built of Steel and Concrete

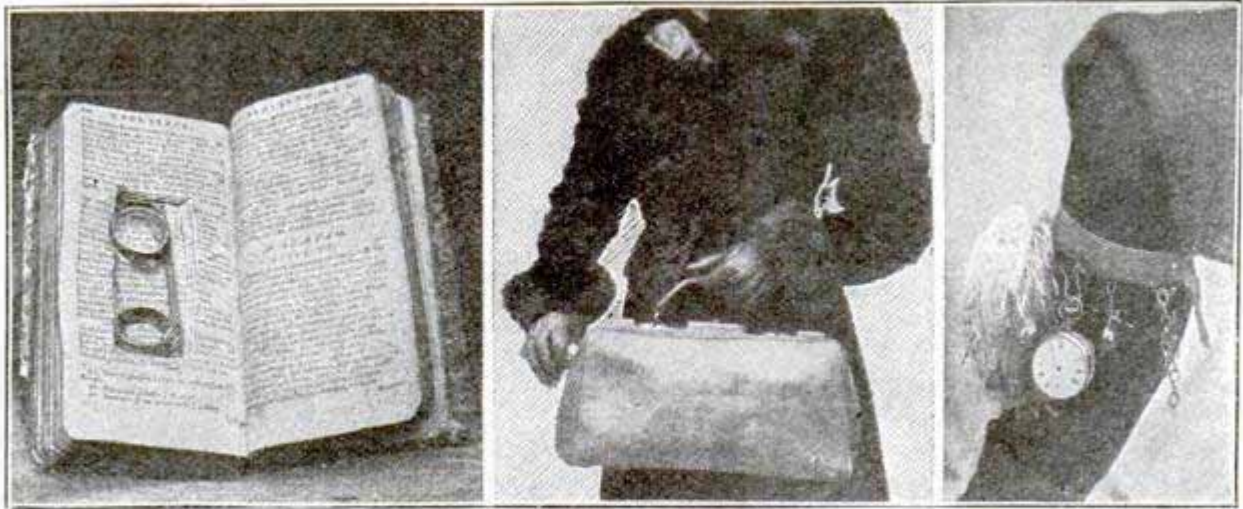
MOTOR CAR FOR ARMY TELEGRAPH CONSTRUCTION

The signal service of the Austrian army have adopted a 3-wheel motor car for emergency telegraph and telephone construction. One man operates the car while the other feeds out the wire from a reel fastened in front of him. A pole with a U-shaped guide at the end is used to raise the wire or when held horizontally deposits the wire along the side of the road. The system is said to enable a more rapid construction of lines than has ever been attained in any other way.



Stringing Wire

INGENIOUS SHOP-LIFTING APPARATUS

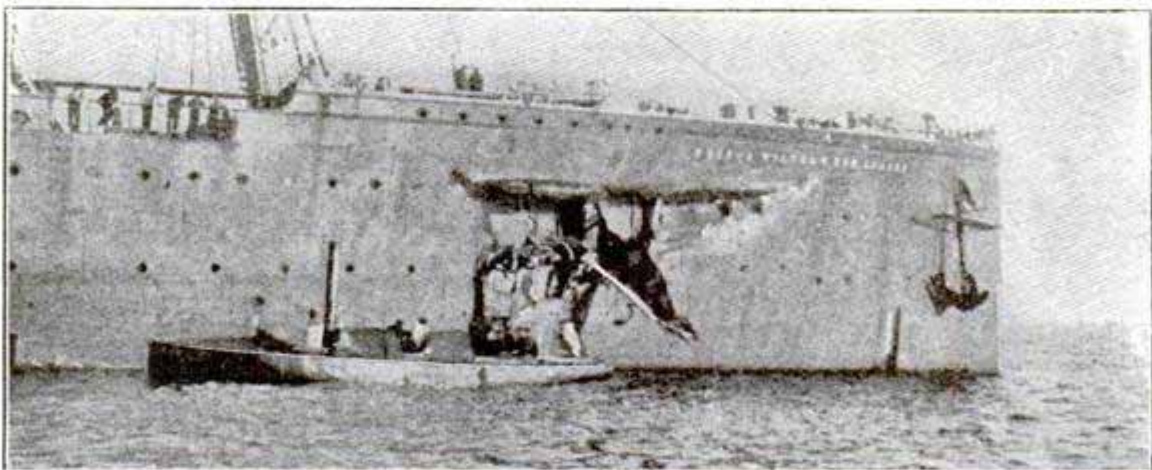


Book with Spaces for Jewels--Dummy Hand Bag with Secret Compartment--Garters with Goods Hung on Hooks

The art of the shop-lifter has been reduced to a science in which many mechanical devices are employed to facilitate the work and conceal the stolen goods. The London police recently made an arrest of a female expert who was literally covered from head to foot with evidences of theft, and without any one of the several dozen articles being visible to the keen-eyed store detectives.

In her hair were valuable pieces of small jewelry; under the skirt was a well filled bag easily reached through a false pocket; a book carried under the arm had been prepared with spaces to hold rings and gems; a dummy hand

satchel had a trap door at one end held shut by means of a spring. Her garters were sewed with spring hooks and clasps for hanging various articles; a slit in the skirt enabled easy access, while a piece of wax attached to the sole of the shoe next the heel enabled the picking up of jewelry after it was dropped to the floor. What appeared to be an innocent cuff ornament was really a spring-clip that dexterously picked up articles on the show case while the hand was in full view. On the person of the shop-lifter described were found 47 articles having a total value of several hundred dollars—the result of one day's operations.

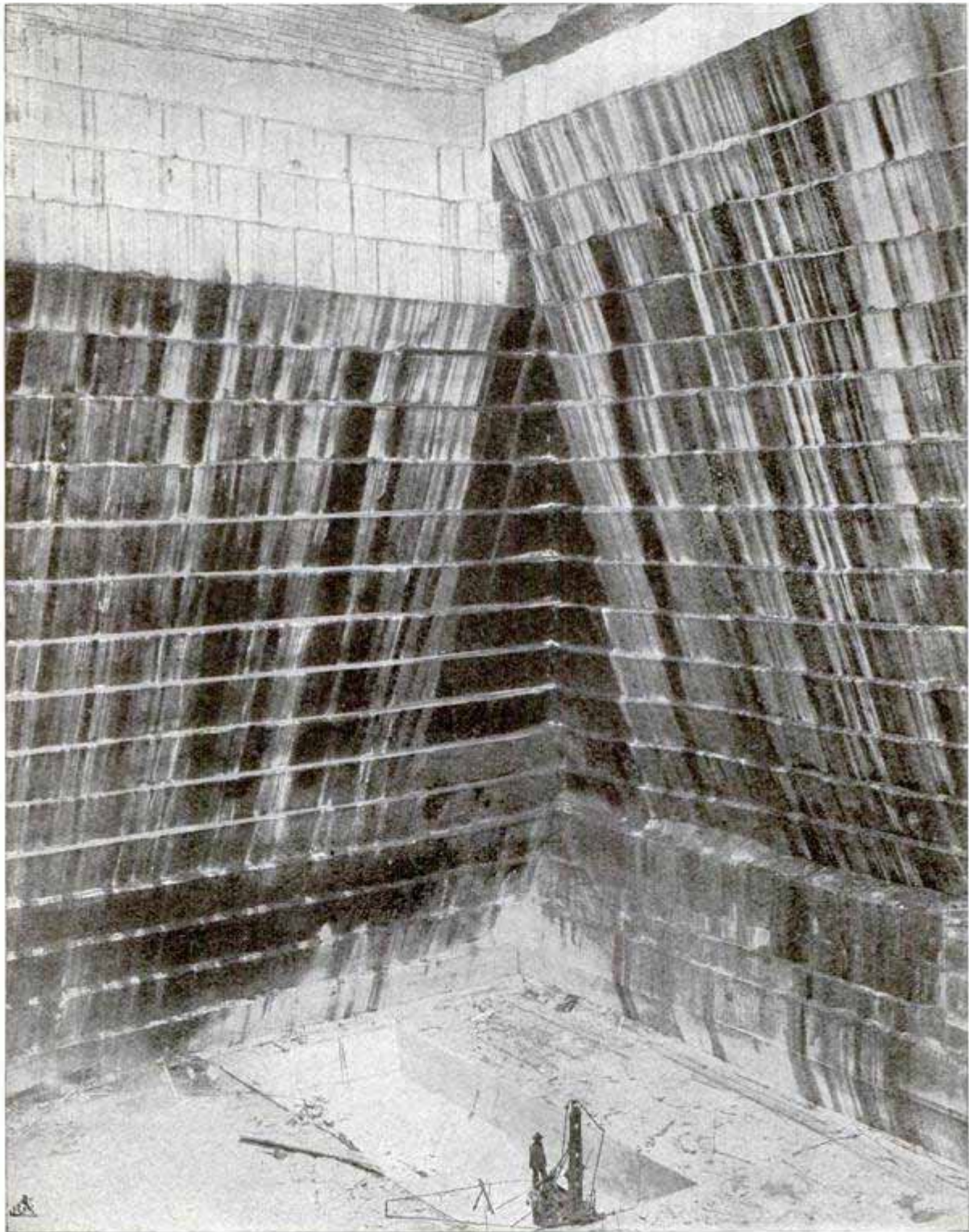


THE "KAISER WILHELM DER GROSSE" after the collision with the "Orinoco" off Cherbourg. Some 60 sq. yds. of the "Kaiser Wilhelm's" bow were torn away, the damage amounting to \$200,000. Five passengers were killed and one injured. That the results were no worse is surprising.

QUARRYING MARBLE IN GEORGIA

Georgia marbles are being used in all parts of our own country as well as exported to Europe and Canada. The yearly production of these works is very large, a single quarry taking

out as high as 500,000 cu. ft. The marble is cut by means of stone channeling machines, gadders and rock drills. Machines of latest improvement have cut as high as 21 ft. 8 in. in 20



Courtesy Sullivan Moly Co.

Quarry from which marble has been removed to a depth of 175 ft. Note the manner in which the corner and sides have been cut back into the hill by the Swivel Head Channelers.

minutes, which would be at a rate of 650 sq. ft. in a 10-hour day. For ordinary machines, however, 80 to 90 ft. is considered a good day's work of 7½ hours.

Frequently the high grade marble

extends under a hill with cheaper stone overlaying. In such cases the practice is to cut back into the hill as the excavation grows deeper, leaving an overhanging wall such as is shown in the illustration.

AFRICA PROMISES GREATEST ELECTRICAL UNDERTAKING EVER ATTEMPTED

Transmission 600 Miles at 150,000 Volts Planned

Darkest Africa will soon become the lightest place in the world if the stupendous undertaking now planned is carried out. The Victoria Falls on the Zambesi have a breadth of 5,400 ft. and a drop of 330 ft., with millions of horsepower going to waste daily as the waters plunge into the gorge below.

The plan is a daring one and contemplates long distance transmission of 600 miles, which is nearly four times the longest transmission line at present, with a voltage of 150,000 carried on bare cables. The present chief market for power would be Johannesburg.

The initial construction contemplates a power house of 50,000 hp. at the bottom of the gorge just below the falls.

When the local agents of the Zambesi power company in Chicago and other large American cities are selling

current transmitted by wireless from Victoria Falls it will cause no greater wonder than wireless telegraph does now; and the power transmission is really a more likely accomplishment than the telephone seemed not many years ago.

HOLLAND'S HARMLESS SUBMARINE

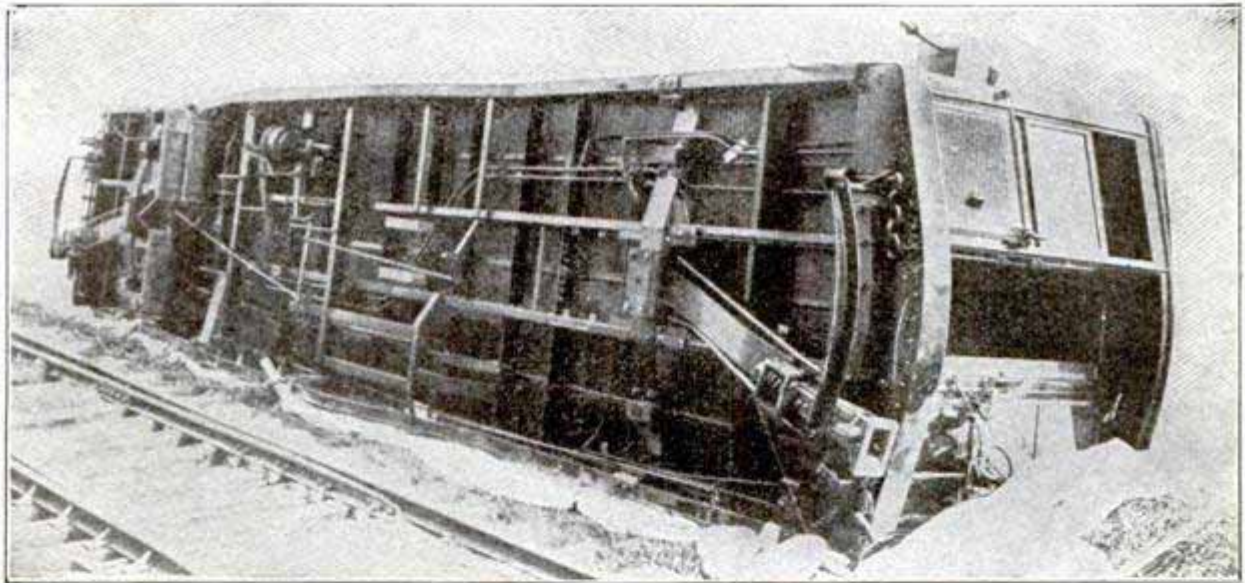
Holland, the well known authority on submarines, announces his expectation to shortly complete plans for a new craft which will not be a destroyer but will win by putting a vessel out of commission without loss of perhaps a single life. He declares it "will be the real thing in submarines, and the chief instrument in doing away with wars." All of which has a very pleasing and Utopian sound.



Victoria Falls, 5,400 Ft. Wide Compared With Oxford St., London

STEEL PASSENGER CARS BOUND TO COME

"It is true that present passenger coaches are somewhat longer and much heavier, and will resist impacts that would have wrecked cars built ten or fifteen years ago. It is true, also, that they are operated at much higher speeds, and while it may seem a broad statement, our average passenger coach today is relatively no stronger than the cars of our forefathers. If this is doubted a perusal of the newspaper reports of a few wrecks in late years will suffice. For high-speed service it is practically essential to use a steel car, if the safety of the passengers is desired. The splinters from the old wooden warships in time of action killed more men than the cannon balls. We have been over the Spanish fleet scare for some years and do not expect anyone to fire 13-in. shells at our cars, yet in a collision the conditions are not dissimilar. The force of impact will splinter the sills, posts and side plates, and a passenger caught in the wreckage has not much chance, particularly with the addition of fire. In the steel car the passengers may suffer contusions, but these are cheaper, from a claim department standpoint than an amputated limb. Aside from the question of accidents, steel passenger cars should be a good investment. The repairs are less; the life much longer; and the cost and weight of a steel passenger coach very near that of a wooden car built to the same specifications."—J. F. MacEnulty before the New England Railway Club.



Steel Passenger Car After Wreck—Note Its Good Condition

Steel freight cars have now been in use about eight years. Of 225,000 freight cars ordered from nine of the car builders in 1895, two-thirds were steel. The steel freight car was first built to enable the carrying of loads unsafe in cars constructed of wood. Soon it was found the repairs were greatly less than on wooden cars, and that a steel car could go in a wreck and be repaired for \$50 which would have absolutely destroyed a wooden car.

One instance will illustrate this point: Several cars, each containing 50 tons of ore, ran three miles down a 4 per cent grade, and with the engine jumped over the end of a switch-back, the cars and engine going by actual measurement 422 ft. before striking the ground; the point of contact was frozen ground, the drop being 53 ft. from track level. The engine and cars then rolled 516 ft. The cost of repairing the bodies of these seven cars was only \$350 each. A

wooden car under similar circumstances would have been nothing but kindling wood. There would have been the usual bonfire to recover a few dollars' worth of truss rods, grab irons, etc.

A wooden passenger coach today may be likened to a man-of-war of a century ago, when the flying splinters killed more men than bullets and cannon balls. The battleship of today is planned to avoid the use of wood wherever possible, and when one goes into action the decks are cleared of everything which can possibly be removed.

In the wrecks of passenger trains of the past few years, the greatest loss of life has not been from cars rolling down high embankments, nor going through bridges to a watery death; but on level ground, where the helpless victims have been burned to death before the eyes of lookers-on, who were helpless to render aid.

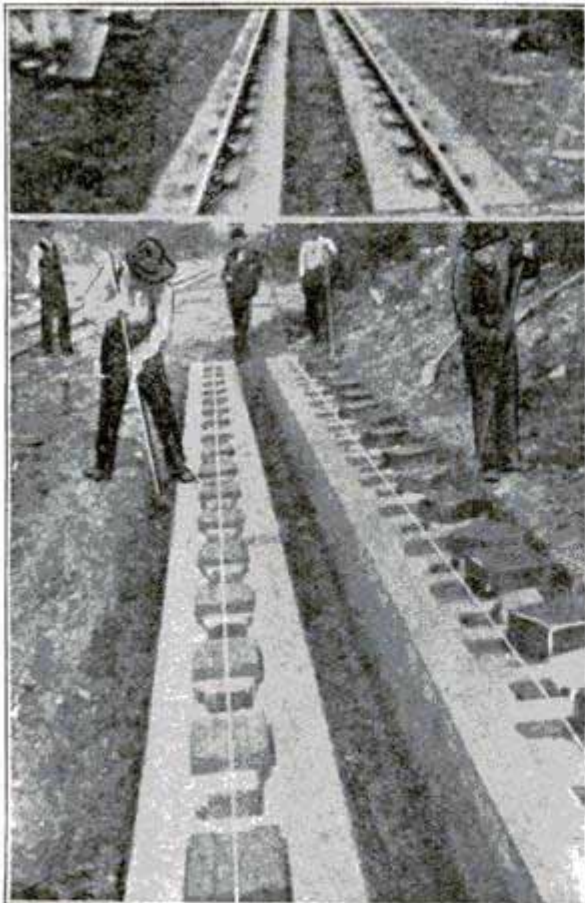
How much longer will this condition be allowed to continue?

NEW CONCRETE BASE FOR RAILS

For several years past many street railways in England have laid their rails in longitudinal beams of concrete instead of on wood cross-ties. The same method was also used in Detroit to some extent. In both cases the base of the rail was embedded in the concrete while soft and when it hardened

the rail was literally fastened as solid as a rock.

An adaptation of this system is described in *Municipal Engineering*. The longitudinal concrete base is used, but at frequent and regular intervals square holes are left in the top. Into these holes, blocks made of hard burned vitrified clay are inserted, the top of the block being grooved to fit the base of the rail and hold it. Blocks of wood may be substituted and the rail spiked as on a cross-tie. After the rail is in place tar is poured to fill the cracks and prevent the admission of water.

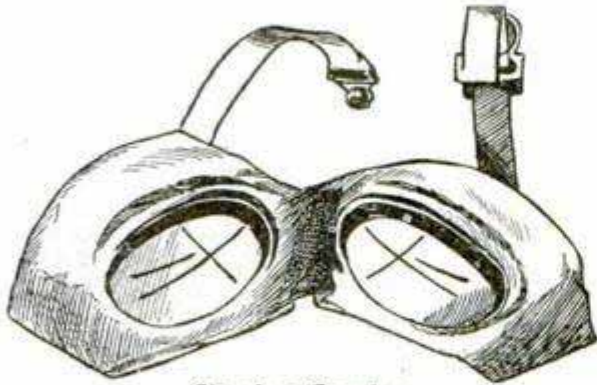


Concrete Track Base

GLASSLESS GOGGLES

Glassless goggles for automobilists is the very latest in the novelty line, a French eye specialist having hit upon the idea in eye protection which, it is claimed, will eliminate the disadvantages of the present type. Instead of glass the lenses are made of thin sheets of steel, in each of which are three narrow slits, one being cut horizontally, intersected near the nose by a perpendicular slit, the junction of the two slits forming a right angle. Below the horizontal slit is another slit, which is cut a slant toward the outside of the lens. The efficiency of these slits is based upon the scientific principle that an opening of a small diameter has the same effect upon the lum-

inous rays as the central point of a convex lens. If the eye is placed near to the opening the angle taken in is very

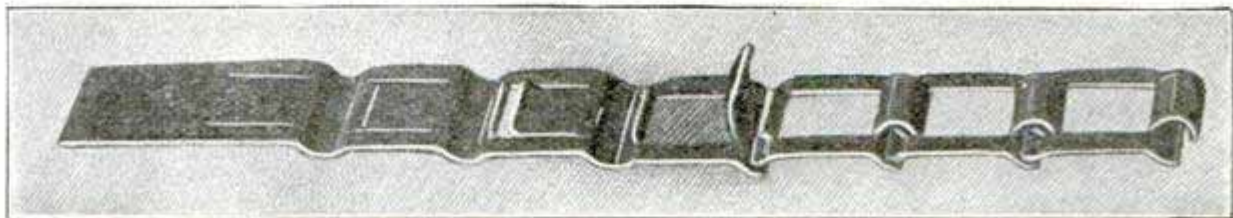


Glassless Goggles

large and proportionate to the diameter of the opening. The vision obtained through the slits is claimed to be brighter and sharper than through ordinary goggles, while blurred sight caused by rain, mud, dust and steam, is entirely eliminated. It also is impossible for flying stones to break them as with goggles with glass lenses. From a medical point of view the new goggles prevent swelling and conjunctivitis.

A NEW DETACHABLE SPROCKET CHAIN

The illustration shows the evolution of a new detachable sprocket chain, which is so designed that it can be made from flat stock by punching and forming in a single machine. The stock enters the machine from one side in the form of a long steel ribbon and emerges from the opposite side in the form of finished chain, ready for hardening. As the chain leaves the machine it is automatically wound on a large reel, controlled by an ingenious feed mechanism, which winds the chain as fast as it is made.



New Detachable Sprocket Chain

ELECTRIC ROAD BUILT IN A NIGHT

In a frantic effort to get an electric line 2,000 ft. long in operation before an injunction could be issued, a street railway company in Cleveland constructed the most unique trolley line ever seen.

The track was laid on top of the pavement, no ties being used, and the rails held in place by iron braces. To dig holes and erect trolley poles would



A Mushroom Track

have required several days, so 4 by 6-in. planks built in the form of a gallows were used for poles. The bottom of the "pole" rested in a barrel of cinders and each pole was tied and guyed to a wagon loaded with stone or sand. The scheme was clever, but the injunction arrived just in time to put the road out of business before the first car could be run. There were four other tracks already on the same street.

LEANING SKYSCRAPERS

Consternation prevailed for a time recently among the hundreds of occupants of a Chicago skyscraper when the discovery was announced that the 17-story structure was 14 in. out of plumb. Fears were allayed by the city building department's statement that the structure had been in that condition for months.

Inquiry disclosed the fact that not a skyscraper in Chicago which is a year or more old but is more or less out of plumb owing to the yielding character of the earth underlying the city. An inspection is made every two months and records carefully tabulated by city inspectors.

UTILITY OF THE SEISMOGRAPH

The seismograph, that intensely sensitive recorder of vibrations in the earth's crust announced in many widely remote parts of the world a recent earthquake in Chile, hours in advance of any telegraphic news. These records are extremely interesting, and valuable as a matter of history, but have not thus far been of any particular utility.

The director of the observatory at Laibach, Austria, now suggests a very practical use. He calls attention to the fact that the roof of the Charing Cross railway station fell without warning the day after the observatory in his charge reported a great earthquake; and he recommends that hereafter when severe shocks are recorded that examination be promptly made of all large buildings which might be affected by the disturbance.

1907 MOTOR BOAT RACE

The racing event for motor boats this year will be the long distance race from New York to Bermuda, a distance of 778 miles. The start will be on June 8 under the auspices of the Motor Boat Club of America. Boats must not be less than 39 ft. length nor more than 60 ft.; carry a small sail, five men and stores for 30 days.

THE 40 STYLES OF CHAIRS

There are 40 distinct styles of chairs embracing the period from 3000 B. C. to 1900 A. D.—nearly 7,000 years. Of all the millions of chairs made during the centuries, each one can be classified under one or more of the 40 general styles shown in the chart. This chart was compiled by the editor of *Decorative Furniture*. The Colonial does not appear on the chart because it classifies under the Jacobean and other styles. A condensed key to the chart follows:

Egyptian.—3000 B. C. to 500 B. C. Seems to have been derived largely from the Early Asian. It influenced Assyrian and Greek decorations, and was used as a motif in some French Empire decoration. Not used in its entirety except for lodge rooms, etc.

Grecian.—700 B. C. to 200 B. C. Influenced by Egyptian and Assyrian styles. It had a progressive growth through the Doric, Ionic and Corinthian periods. It influenced the Roman style and the Pompeian, and all the Renaissance styles, and all styles following the Renaissance, and is still the most important factor in decorations today.

Roman.—750 B. C. to 450 A. D. Rome took her art entirely from Greece, and the Roman is purely a Greek development. The Roman style "revived" in the Renaissance, and in this way is still a prominent factor in modern decoration.

Pompeian.—100 B. C. to 79 A. D. Sometimes called the Grecian-Roman style, which well describes its components. The style we know as Greek was the Greek as used in public structures. The Pompeian is our best idea of Greek domestic decoration. Pompeii was long buried, but when rediscovered it promptly influenced all European styles, including Louis XVI, and the various Georgian styles.


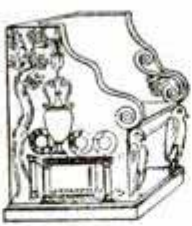

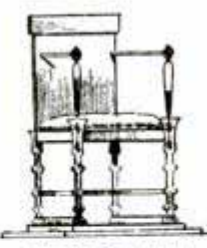





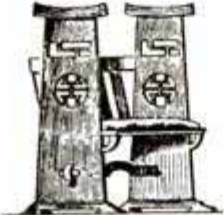










Byzantine.—300 A. D. to 1450 A. D. The "Eastern Roman" style, originating in the removal of the capital of the Roman Empire to Constantinople (then called Byzantium). It is a combination of Persian and Roman. It influenced the various Moorish, Saracenic and other Mohammedan styles.

Gothic.—1100 to 1550. It had nothing to do with the Goths, but was a local European outgrowth of the Romanesque. It spread all over Europe, and reached its climax of development about 1550. It was on the Gothic construction that the Northern European and English Renaissance styles were grafted to form such styles as the Elizabethan, etc.

Moorish.—700 to 1600. The various Mohammedan styles can all be traced to the ancient Persian through the Byzantine. The Moorish or Moresque was the form taken by the Mohammedans in Spain.

Indian.—2000 B. C. to 1906 A. D. The East Indian style is almost composite, as expected of one with a growth of nearly 4,000 years. It has been influenced repeatedly by outside forces and various religious invasions, and has, in turn, influenced other far Eastern styles.

Chinese.—3500 B. C. to 1906 A. D. Another of the ancient styles. It had a continuous growth up to 230 B. C., since when it has not changed much. It has influenced Western styles, as in the Chippendale, Queen Anne, etc.

















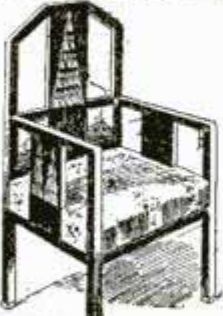
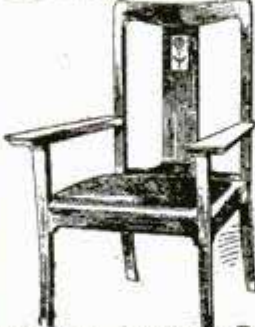

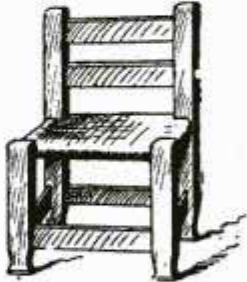
 <p>EGYPTIAN</p>	 <p>GRECIAN.</p>	 <p>ROMAN.</p>	 <p>POMPEIAN.</p>
 <p>BYZANTINE.</p>	 <p>GOthic.</p>	 <p>MOORISH.</p>	 <p>INDIAN.</p>
 <p>CHINESE.</p>	 <p>JAPANESE.</p>	 <p>ITALIAN GOTHIC.</p>	 <p>TUDOR.</p>
 <p>RENAISSANCE ITALIAN 15th Century</p>	 <p>RENAISSANCE ITALIAN 16th Century</p>	 <p>ITAL. REN. 17th Century</p>	 <p>SPANISH RENAISSANCE</p>
 <p>DUTCH RENAISSANCE.</p>	 <p>GERMAN RENAISSANCE</p>	 <p>FRANCOIS I</p>	 <p>HENRI II.</p>

Japanese.—1200 B. C. to 1906 A. D. A style probably springing originally from China, but now absolutely distinct. It has influenced recent art in Europe and America, especially the "New Art" styles.

Italian Gothic.—1100 to 1500. The Italian Gothic differs from the European and English Gothic in clinging more closely to the Romanesque-Byzantine originals.

Tudor.—1485 to 1558. The earliest entry of the Renaissance into England. An application of Renaissance to the Gothic foundations. Its growth was into the Elizabethan.

Italian Renaissance, Fifteenth Century—1400 to 1500. The birth century of the Renaissance. A seeking for revival of the old Roman and Greek decorative and constructive forms.

			
LOUIS XIII.	ELIZABETHAN.	JACOBEAN.	WILLIAM & MARY
			
QUEEN ANNE.	LOUIS XIV	GEORGIAN.	CHIPPENDALE.
			
LOUIS XV.	HEPPLEWHITE.	LOUIS XVI.	SHERATON
			
R. & J. ADAM.	EMPIRE.	BRITISH NEW ART.	L'ART NOUVEAU
			
MODERN AUSTRIAN	SCOTCH NEW ART	ARTS & CRAFTS	MISSION

Italian Renaissance, Sixteenth Century—1500 to 1600. A period of greater elaboration of detail and more freedom from actual Greek and Roman models.

Italian Renaissance, Seventeenth Century—1600 to 1700. The period of great elaboration and beginning of reckless ornamentation.

Spanish Renaissance.—1500 to 1700. A va-

riation of the Renaissance spirit caused by the combination of three distinct styles—the Renaissance as known in Italy, the Gothic and the Moorish. In furniture the Spanish Renaissance is almost identical with the Flemish, which it influenced.

Dutch Renaissance.—1500 to 1700. A style influenced alternately by the French and the

Spanish. This style and the Flemish had a strong influence on the English William and Mary and Queen Anne styles, and especially on the Jacobean.

German Renaissance.—1550 to 1700. A style introduced by Germans who had gone to Italy to study. It was a heavy treatment of the Renaissance spirit, and merged into the German Baroque about 1700.

Francis I.—1515 to 1549. The introductory period when the Italian Renaissance found foothold in France. It is almost purely Italian, and was the forerunner of the Henri II.

Henri II.—1549 to 1610. In this the French Renaissance became differentiated from the Italian, assuming traits that were specifically French and that were emphasized in the next period.

Louis XIII.—1616 to 1643. A typically French style, in which but few traces of its derivation from the Italian remained. It was followed by the Louis XIV.

Elizabethan.—1558 to 1633. A compound style containing traces of the Gothic, much of the Tudor, some Dutch, Flemish and a little Italian. Especially noted for its fine wood carving.

Jacobean.—1603 to 1689. The English period immediately following the Elizabethan, and in most respects quite similar. The Dutch influence was, however, more prominent. The Cromwellian, which is included in this period, was identical with it.

William and Mary.—1689 to 1702. More Dutch influences. All furniture lighter and better suited to domestic purposes.

Queen Anne.—1702 to 1714. Increasing Dutch influence. Jacobean influence finally discarded. Chinese influence largely present.

Louis XIV.—1643 to 1715. The greatest French style. An entirely French creation, marked by elegance and dignity. Toward the end of the period it softened into the early Rococo.

Georgian.—1714 to 1820. A direct outgrowth of the Queen Anne, tempered by the prevail-

ing French styles. It includes Chippendale, Hepplewhite and Sheraton, but these three great cabinetmakers were sufficiently distinct from the average Georgian to be worthy separate classification.

Chippendale.—1754 to 1800. The greatest English cabinet style. Based on the Queen Anne, but drawing largely from the Rococo, Chinese and Gothic, he produced three distinct types, viz.: French Chippendale, Chinese Chippendale and Gothic Chippendale. The last is a negligible quantity.

Louis XV.—1715 to 1774. The Rococo period. The result of the efforts of French designers to enliven the Louis XIV, and to evolve a new style out of one that had reached its logical climax.

Hepplewhite.—1775 to 1800. Succeeded Chippendale as the popular English cabinet-maker. By many he is considered his superior. His work is notable for a charming delicacy of line and design.

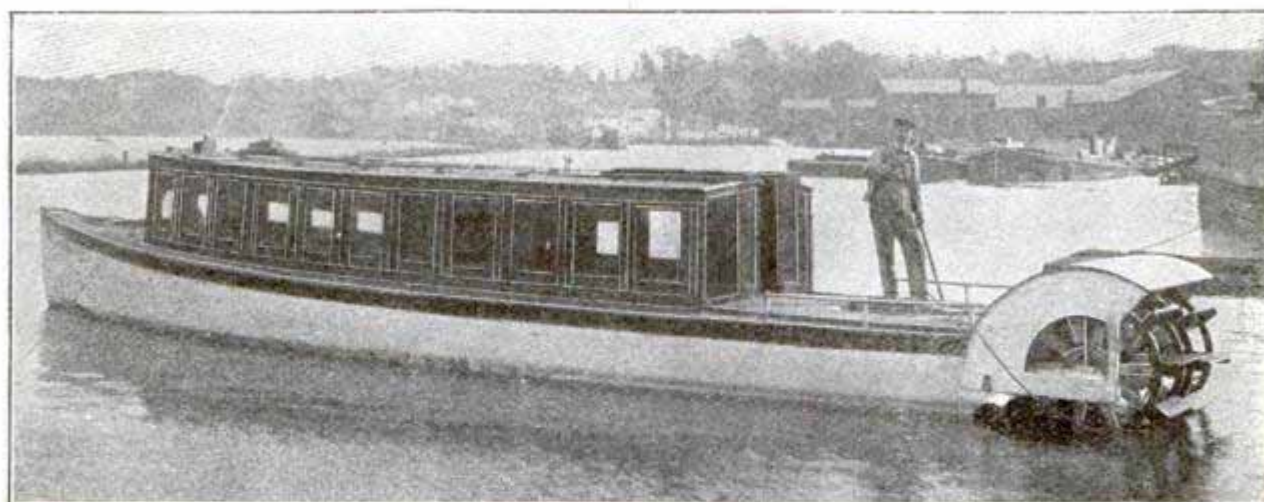
Louis XVI.—1774 to 1793. The French style based on a revival of Greek forms, and influenced by the discovery of the ruins of Pompeii.

Sheraton.—1775 to 1800. A fellow cabinet-maker, working at same time as Hepplewhite. One of the Colonial styles (Georgian).

R. & J. Adam.—1762 to 1800. Fathers of an English classic revival. Much like the French Louis XVI and Empire styles in many respects.

Empire.—1804 to 1814. The style created during the Empire of Napoleon I. Derived from classic Roman suggestions, with some Greek and Egyptian influences.

New Arts.—1900 to date. These are various worthy attempts by the designers of various nations to create a new style. Some of the results are good, and they are apt to be like the "little girl who had a little curl that hung in the middle of her forehead," in that "when they are good they are very, very good, but when they are bad they are horrid."



Courtesy Potter Mfg. Co.

STERN WHEEL CRUISER

With a draft of only 10 in. the 48-ft. cruiser illustrated affords cruising facilities unusual in shallow-water boats. The beam is 10 ft. and the head room in the cabins is 6 ft. 3 in. The

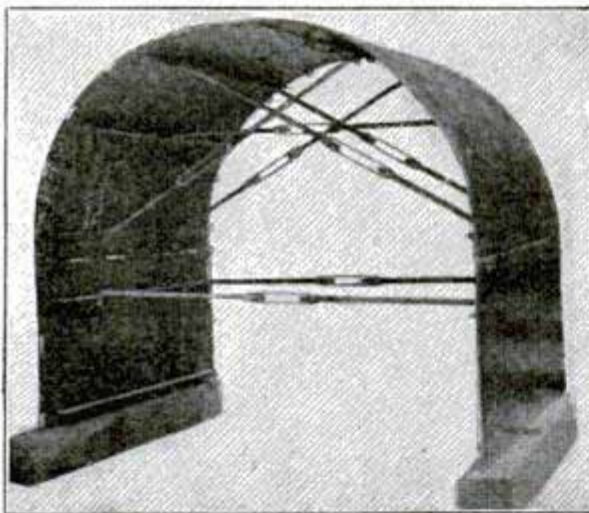
main cabin finished in California red-wood divides into two commodious sleeping rooms by means of curtains. The berths are made up from the seats. A fresh water tank containing 80 gal.

is carried forward with a large ice box.

The motors are double cylinder 5 in. by 5 in., driving two paddle wheels of 5 ft. diameter; paddle wheels are independent of each other and reverse. The boat will ride a fairly heavy sea, but was built for cruising in rivers and into lakes where weeds would render a propeller inoperative.

STEEL FORM FOR CONDUITS

A recent invention calculated to expedite the construction of concrete conduits is called the collapsible steel centering. It consists of plates of sheet steel bent to form the exact size of the conduit or sewer which is to be built. Steel rods brace the form while the concrete is poured and setting; then



Section of Form

the turnbuckles are unscrewed and the form taken down and moved away. Fifty lineal feet are sufficient to keep the work going.

SEA SALT STOPS STREET DUST

Salt extracted from sea water has been recommended by a Bordeaux chemist for laying road dust. The sea water is placed in great shallow troughs and evaporated by the sun's action. The different salts crystallize in order of insolubility, chloride of sodium being the first to separate, while the others, more soluble, accumulate in the remaining water.

A few quarts of this "mother sea water" are used to a ton of ordinary water for sprinkling roads. The sea salt absorbs the moisture from the atmosphere, thus dampening the dust. The method would be inexpensive and practicable for places not far from the sea.

OUR 20,000-TON BATTLESHIP

Ten designs were submitted by builders and one was prepared by the Bureau of Construction for the proposed 20,000-ton battleship; Secretary Bonaparte has recommended to congress the department's own plan. Comparison naturally will be made with the "Dreadnaught," which shows our new battleship to be 10 ft. longer—510 ft.—3 ft. more beam and 2,000 tons greater displacement; coal capacity is 400 tons less, equipment of 12-in. guns is the same, but the armor belt extends farther forward and aft.

NEW RAILWAY EQUIPMENT IN 1906

New railway equipment ordered during 1906 was a little less than the previous year but makes a good showing. The Railway Age compiles the following figures:

Locomotives	5,642
Passenger cars.....	3,402
Freight cars	310,805
Miles track built.....	6,067

Texas built the most track, 701 miles, and Massachusetts the least, 4½ miles.

LAUNCH EARNS \$600,000 A YEAR

The most profitable boat in the world, if not the best paying commercial craft ever built, is the \$15,000 launch belonging to the water department of New York city. It is constantly in operation night and day along the water front and collects tolls from vesselmens who help themselves to city water from street hydrants. The boat collects \$600,000 a year.

A PERISCOPE FOR THEATERS

The women still persist in wearing high hats in the Paris theaters and in self-defense the men are using an invention like the periscope of a submarine. The device which is called

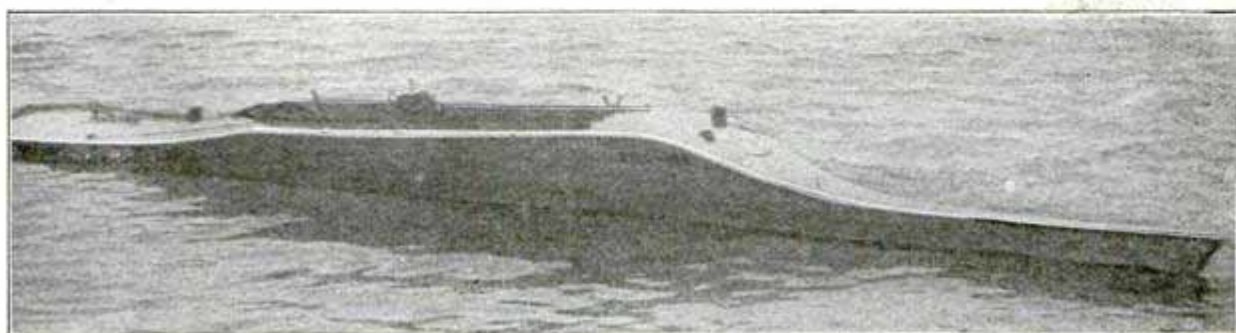


Where the Line Crosses Another Road's Shops

“The Giant’s Eye” resembles an ordinary cane, but is really a tube in which are lenses and mirrors. When raised the lens at the upper end is pointed at the stage while the man looks into another lens at the lower end of the tube.

NOVEL TYPE OF MOTOR BOAT

The motor boat “Sho-Me” illustrated herewith is more unusual than beautiful, and while built for fast moving would be a doubtful proposition in heavy weather. The Motor Boat says it is owned in Daytona, Fla., and made a record of 3:52 over a measured mile course.



The “Sho-Me,” Built for Speed

RAILWAY OVERHANGS PACIFIC

Between San Francisco and Santa Cruz, along the shore and overlooking the mighty Pacific, a remarkable piece of railroad construction is being carried on. The distance is only 85 miles, but San Pedro mountain, rugged and precipitous, has stood a formidable obstacle in the way of other projected shore lines.

At this point, preparatory to active construction, surveyors were lowered over the edge of the cliffs, hundreds of feet above the breakers of the angry Pacific, to lay the grade line. Then followed workmen, clinging to the cliff while like

giant woodpeckers they drilled small holes and charged them with dynamite.

At last a broad shelf was blasted out along which is being laid the track of the Ocean Shore Railway. The work in this region alone cost nearly \$1,000,000.

Other railroads fought against the new line in every possible way and made it very difficult to get into San Francisco. A long high trestle carries the line over the shops of another company into the heart of the city.

Astronomers are trying to photograph the sun’s corona without an eclipse, from the Janssen Observatory on the summit of Mont Blanc.

THE FOUNDING OF BELLS

Requisite Qualities of the Metal--Methods of Casting--Testing and Tuning

In the sound-bow of a bell—that part of the circumference struck by the clapper—is found the most cosmopolitan of all expressions. The bell speaks the same language of joy, sorrow, or alarm to all nations. And the romance that has emanated from bells since our earliest records of their use in Egypt and Assyria extends even into their manufacture. The use to which the bell will be put determines the compound of metals its maker will select.

The bell-metal commonly used is an alloy composed of 80 parts copper and 20 parts tin, but every bell founder has

his own variation of this formula, and in the product experience counts for a great deal. The metal is of a yellowish-gray color, hard, brittle and sonorous; a fracture in it shows a fine grain. The copper used, where quality of tone is desired, must be commercially pure, as the presence of lead, even in minute quantities, affects the tone. The larger the proportion of copper in the alloy the graver and deeper the tone of the bell; while by adding tin, zinc or iron a sharper tone results. Silver gives sweetness to the tone and many very old church bells contain a large amount

of that metal. In some cases church bells have been cast from jewelry, coins and ornaments contributed by worshippers.

In the bell foundry the proportionate re-

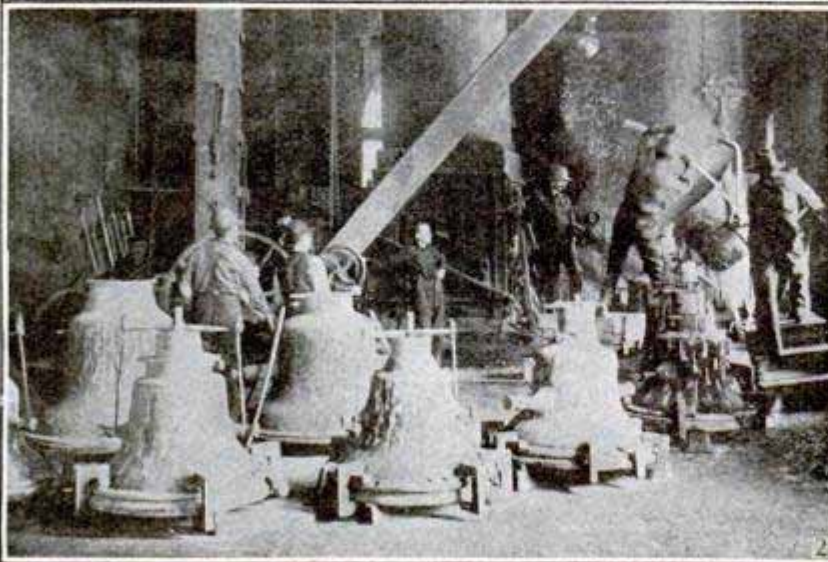


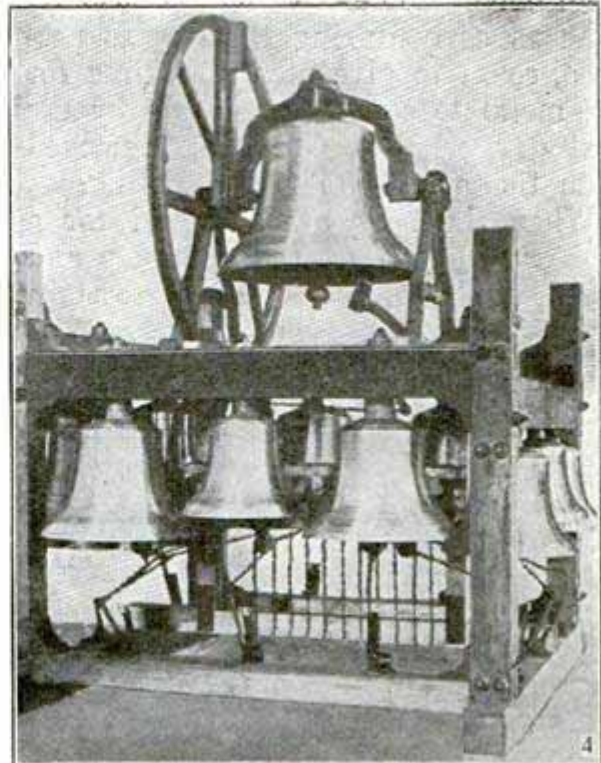
Fig. 1--Moulds. Fig. 2--Pouring the Casting.
Fig. 3--Testing a Chime Bell

quirements for a bell are worked out mathematically, a suitable pattern board procured and a draft made which shows the inside diameter of the bell at the shoulder just half the

mouth diameter; the thickness of the bell through the sound-bow, one-fourteenth of the mouth diameter; the waist thickness, half the sound-bow; the shoulder thickness, a third of the sound-bow; and the height of the bell, about 11 times the thickness of the sound-bow.

According to this lay-out, two sweep-boards are fashioned, one called the "core" sweep and the other the "case," or outer sweep. Two iron flasks are provided, also, called the "case" and the "core." The case is an inch or two larger than the required finished mould and in it the outer shape is moulded. The core is an inch or two smaller than the required finished mould and on this the inner shape is moulded. These moulds are shown in Fig. 1, the cope or case with its wide part up and the core with its wide part down. The moulds are each swept up with a rough loam coating on the casting surface and the outer mould receives an impression of the inscription which is to appear on the bell in raised letters, after which it is slicked over.

The moulds are next closed and set around in order under a large crane ready for casting, and here there is a marked difference between our method and the European. It will be noticed that these iron flasks have numerous holes which are provided for a two-fold purpose—to make the loam coating adhere better and to allow the gas which is generated during the few seconds required for the pouring to escape through these "vent" holes and burn itself out. The European method is to sweep up the moulds over brick cores in a pit, and then over this to sweep a bell of clay, and over this—beginning with the smooth coat—they lay on the outer loam form. When the moulds are done, they lift off the outer mould, break up the clay bell, replace the outer mould and then pack the whole in the pit by pressing down the dirt previously excavated and then weighting it down. Nothing shows above the foundry floor level but the "heads" or "gates," into which the



Chimes and Keyboard for Playing Them

molten metal is poured. There is always danger of gas explosion by the European method. By our method this danger is reduced to practically nothing because all our casting is done above ground and in a way that allows the gas to burn out.

Figure 2 shows how the metal is poured into the casting when prepared and also shows moulds ready for casting set under the big crane previously

mentioned. The casting is usually done as early during the day as possible, so as to give plenty of time for the metal to slowly cool down by the next day, when the bells are removed from the moulds to finish cooling.

When the bells are intended for a peal or chime, they are lifted up and tested, as shown in Fig. 3, to ascertain their accuracy of pitch and if they are

a little off, mechanical tuning brings them to standard. Bells for tower clocks or for fire alarm use or for a church or a school tower, used singly, are not tuned, as individuality of tone in such bells is desirable.

Figure 4 shows how a chime of bells is set up and Fig. 5 shows the lever keyboard with which the chime is played.

WOMAN CARPENTER WHO BUILT HER OWN HOUSE

A woman who is an expert carpenter, as well as a brick mason and a painter, is not often found among the fair daughters of Mother Eve. California, however, possesses such a woman, and she lives in Emeryville, one of the suburbs of the city of Oakland—just across the bay from San Francisco.

This woman is a widow, 35 years of age, and her name is Mrs. Bertha Bissell. She has, within the past few months, built, with her own hands, a very neat little one-story cottage containing five rooms and a porch. This building is what is known as a "box cottage"—25 by 15 ft.—containing a parlor, bed-room, dining-room and kitchen. At the front end is a narrow porch.

All this work was done by Mrs. Bissell without the least assistance from any one. She drew the plans herself, and built accordingly. About 18 years ago Mrs. Bissell assisted her husband, who was a skilled carpenter.

"All the plans I drew, and every piece of lumber in the building was measured, cut and put in place by my own hands," said Mrs. Bissell, "and so I know it was done right. There stands the cottage to speak for itself."

She added: "I wouldn't have any carpenters or men to help in this work, as I knew I was well capable of doing all the work myself. No, I had no

assistance whatever. I laid the foundation, built the frame, put on the roof, painted inside and out, put in the windows and hung the doors. I think that's not so very bad—for just a woman."

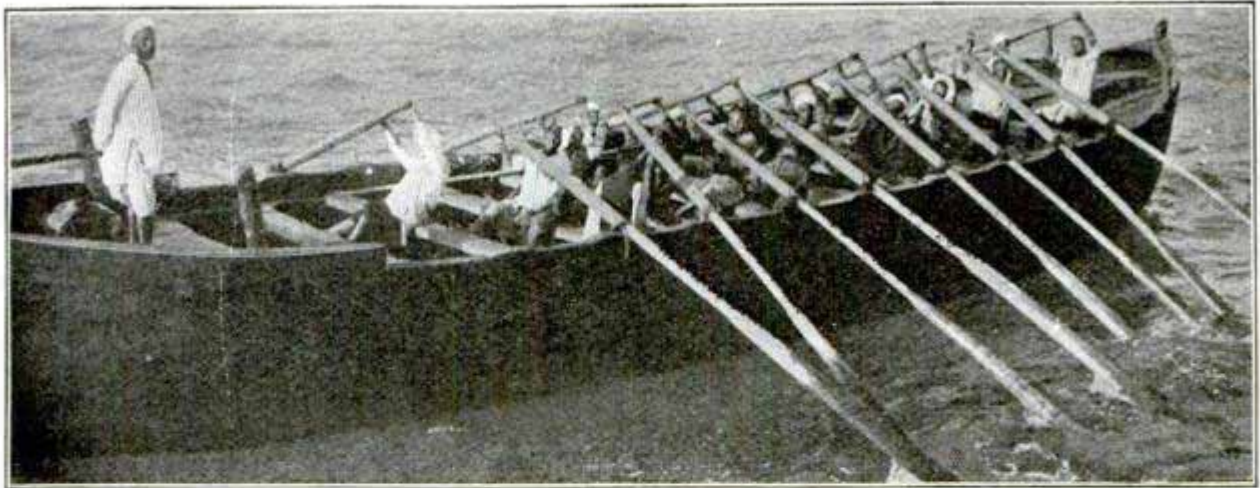


House Built by a Woman

SIGNALING DEPTH OF HARBOR WATER

A Scotch port has an ingenious station for signaling to in-coming and out-going vessels the depth of water in the fairway. A mast on top of a small rectangular building has a vertical cable on either side, one carrying four large balls at specific distances, the other three. Each ball represents a foot of water and it is raised and lowered on the cable by a float in the harbor connected to gearing in the signal house. At high tide all seven balls are visible, but as the tide falls, one by one the balls disappear.

At night a system of powerful lights in the face of the building is used. These lights are automatically turned on and off at the correct time.



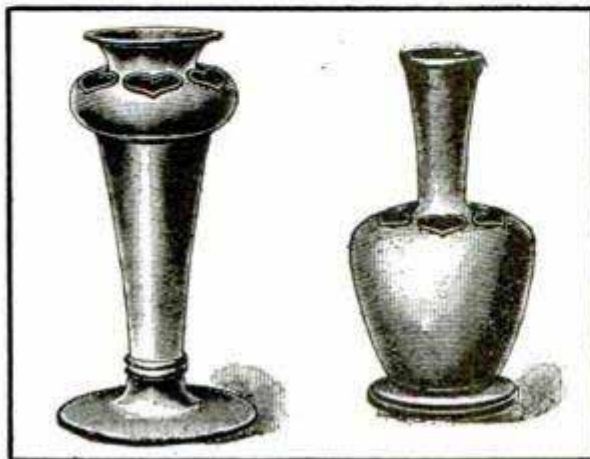
MOROCCO MOTOR SURF BOAT--A Sort of Modern Roman Galley Ship--The Men Stand Up to Pull and Fall Back upon the Seat at the End of the Stroke

CUTTING CHRISTMAS TREES NOT WASTEFUL TO FORESTRY

Most of the evergreens cut for Christmas trees would probably never make good timber and the species usually cut for that purpose have little other economic value. Many are open grown branchy trees that may actually have been a nuisance and it is the general opinion of foresters that there are few uses to which these small fir trees could be put which would contribute so much to the happiness and good of mankind as their use for children on Christmas day.

VASES WITH SIDE OPENINGS

Among the new novelties shown by London jewelers are silver vases for flowers, with openings on the side as

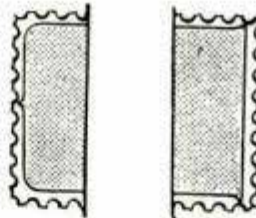


Gives a Pyramid Effect

shown in the illustration. This arrangement admits of a pyramid effect in one or more colors, according to the blossoms selected for the display.

HOW TO ENCLOSE A STAMP

On page 1066 of the October number I read "How to enclose a stamp," but think the following a better method. With a pair of scissors or knife, which should be found on every desk, cut two slits on margin of paper as per illustration and tuck stamp in. This avoids moisture or mutilation of stamp.—Contributed by Mrs. H. J. Morton, 40 Campbell Park, Chicago.



PLAN TO EXTEND CHICAGO DRAINAGE CANAL

It is planned to extend the Chicago drainage canal through Joliet and two miles below to Braden's road and there establish a \$1,000,000 power plant capable of developing 40,000 hp. It is estimated that the revenue from this plant would approximate \$500,000. Joliet would have an inland harbor averaging 200 ft. in width and 24 ft. deep. The extension of the canal, aside from the power plant, would cost \$1,000,000.

HOW GLASS BOTTLES ARE MADE

By E. E. Andrews

The manufacture of glass bottles, such as we see everywhere nowadays, is a very interesting process. There is a certain large firm near Chicago which turns out over a quarter of a million of these bottles every day and furnishes employment for hundreds of people. In this factory the glass is melted and the bottles blown around two furnaces. The larger of these is a continuous or tank furnace, constructed as shown in Fig. 1, which is a longitudinal cross section of the furnace. Its dimensions are 75 ft. long by 16 ft. wide and the

furnace, but must be recharged with fresh material each time after one charge has been used. It takes about three days to melt a charge in one of these pots, so, in order to avoid loss of time, two sets of pots are used, one set being filled with melting glass materials while the other contains molten glass which is being used.

The materials used in these furnaces are a very pure white silica sand, quicklime, soda ash and saltpeter. When heated together the soda ash, quicklime and silica flux together to form a transparent glass which has a deep green color owing to the presence of a small amount of iron in the sand. The addition of the saltpeter, however, oxidizes the iron so that the color

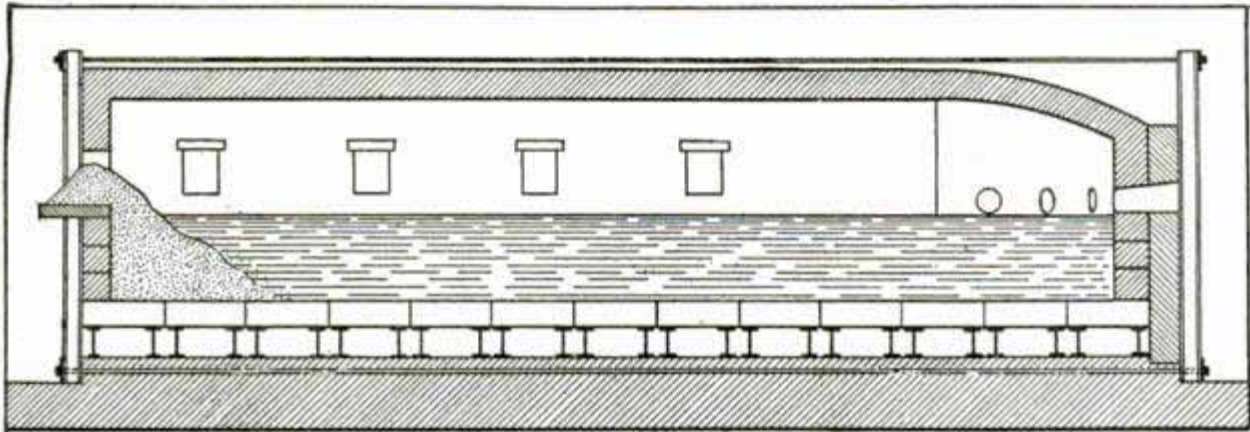


Fig. 1--Continuous Glass Furnace

molten glass lays over the entire length to a depth of 5 ft.

The glass materials are charged in at the rear door and are quickly melted by the intense heat of a blast of burning gas which is forced in through the openings in the side. After the glass is melted the flame plays over it and renders it very hot, thus burning out the impurities and refining the glass. As it passes down the tank the molten glass cools somewhat and is withdrawn at a bright yellow heat through the openings at the lower end.

The other furnace consists of a number of queerly shaped pots (Fig. 2) arranged in a circular brick tower with their necks sticking out through the wall. A gas flame is used to heat these pots, also, which do not yield a continuous supply of glass as does the tank

becomes a very light green, and this slight tinge is neutralized by a little manganese dioxide which, alone, would give a pink color to the glass. The molten glass corrodes the fireclay pots and furnace lining very rapidly, so that the furnace must be relined every year, while the life of a pot is only three to four months.

The method of treating the glass after melting is the same in both furnaces. The bottles are blown into cast iron dies (see Fig. 3) and in order to make a complete bottle a number of men are required, each doing a special part of the work. A glass blower stands in front of each opening, equipped with a small iron tube about 3 ft. long and $\frac{1}{2}$ in. in diameter. He dips his tube in the glass, collects a small ball of it, pulls it out and blows it a little, mean-

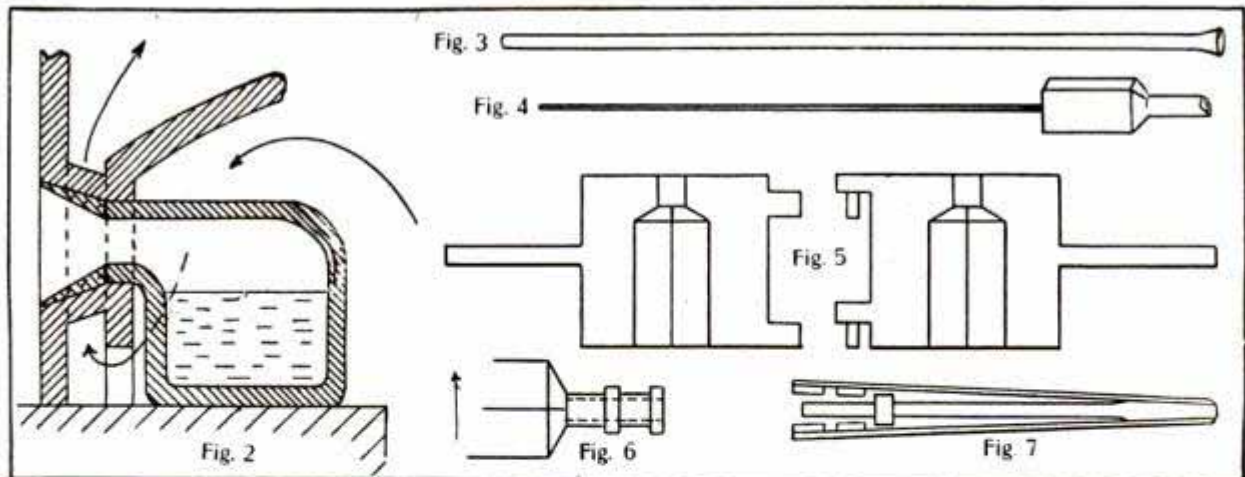


Fig. 2--Single Pot in Pot Furnace. Fig. 3--Blower's Pipe. Fig. 4--Holder for Hot Bottles. Fig. 5--Die. Fig. 6--Neck of Bottle. Fig. 7--Tongs for Shaping Neck.

while rolling it back and forth on a smooth iron plate until it becomes cylindrical in shape; then he puts the still hot glass cylinder in a die, which is opened to receive it and is closed on the glass. This die somewhat resembles a common waffle iron and when the blower applies a little air pressure the plastic glass expands inside it to form a bottle perfect in every part save the neck.

A man operating the dies now removes the bottle ready for another blow and a boy slips the hot bottle into a metal pocket at the end of an iron rod and places it in a small reheating furnace where the neck is heated to redness by an oil flame. A third man then seizes the rod and grasps the hot neck in a specially shaped pair of wooden tongs. These tongs have a tongue just fitting into the neck of the bottle and two jaws with notches corresponding to ridges desired on the exterior of the neck so that when the bottle is rotated in these tongs the neck is given any desired shape.

The glass after this treatment is extremely brittle and the bottles would be very easily broken. To overcome this defect they are placed in large pans and after being heated nearly to dull red are allowed to cool very slowly while passing through a long brick flue. After this thorough annealing, the cool bottles are packed and shipped.

Hammering or vibrating a steel magnet diminishes its magnetism.

DEEPENING THE RHINE

The river Rhine between Mannheim and Strassburg, Germany, is to be deepened so as to be navigable all the year round. In its present state for a period of from 100 to 200 days vessels are unable to pass up the river to the extensive stone docks at Kehl and Strassburg on account of low water. In 1904 the river was only navigable during 150 days. Traffic up the river has increased from 11,513 tons in 1892 to 807,194 tons in 1905. Cost of transportation from all ocean points into southwest Germany and Switzerland is reduced by bringing freight up the Rhine to Strassburg. The cost of the improvement will be \$3,212,000.

RIPENING BANANAS BY ELECTRICITY

An English electrical expert has discovered a means of ripening bananas to order. The bunches are



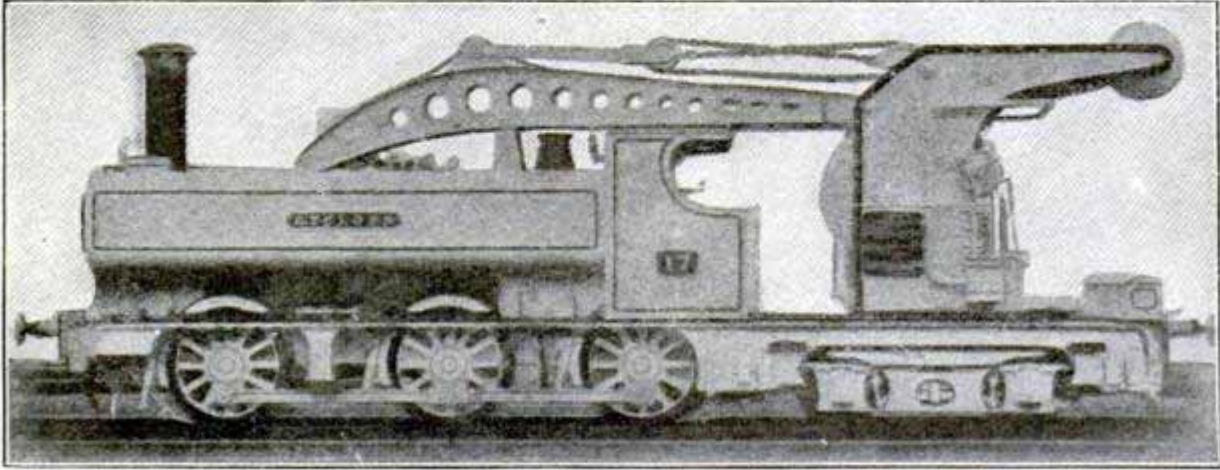
hung in an airtight glass case in which are a number of electric lights. The artificial light and heat hasten the ripening process in proportion to the number of lights turned on. Records have been made which enable the operators to make delivery of any desired quantities at any agreed date.

LOCOMOTIVE CRANE

A novel piece of wrecking machinery has been built by the Great Western Ry. of England. It combines a locomotive and crane in one, the engine

LIFE-SAVING VEST

An English inventor walked to the bank of a deep lake in a public park in London and threw himself into the water. Before the life saver stationed



English Locomotive Crane

weighing 88,000 lb. and the crane 55,000. The length over all is 39 ft., and the lifting capacity 9 tons over a 12-ft. radius.

TIN ROOF RESISTS FIRE

The enduring qualities of a good tin roof when subjected to intense fire are described in the Metal Worker by a Baltimore correspondent, in an article on the behavior of various types of roofing during the big conflagration in 1904. He says:

The New Assembly Rooms, so-called, were covered many years ago, probably 50 years, with tin. The building caught fire about 6 p. m. and burned under and along the edges of the sheathing for hours, being extinguished and starting in new places. I watched it for two hours, and the building did not succumb until 3 o'clock the next morning, nine hours afterward, and then the tin roof lay all over the ruins, having fallen with the walls. It lay there for days, until the rebuilding began. Good tin for roofing is the lightest, easiest repaired and the neatest roofing material that can be used; it is lightning and storm-proof and a fire retardant and fire confiner.

on the ground could reach him the man had lit a cigar and was calmly reading a paper. It was his novel way of demonstrating the life-saving qualities of his "balloon vest," the lining of which contains a rubber bag passing around the body. This bag can be inflated by means of a rubber tube and mouthpiece, a check valve prevent-



The Balloon Vest

ing the escape of the air. The buoyant power of the bag of air is sufficient to keep the arms and head above water.

A residence on the Hudson river has a noise-proof chamber 22 ft. square blasted out of the rock beneath its foundations. The room is fitted up for chess playing and was necessitated by the whistling of the river craft.

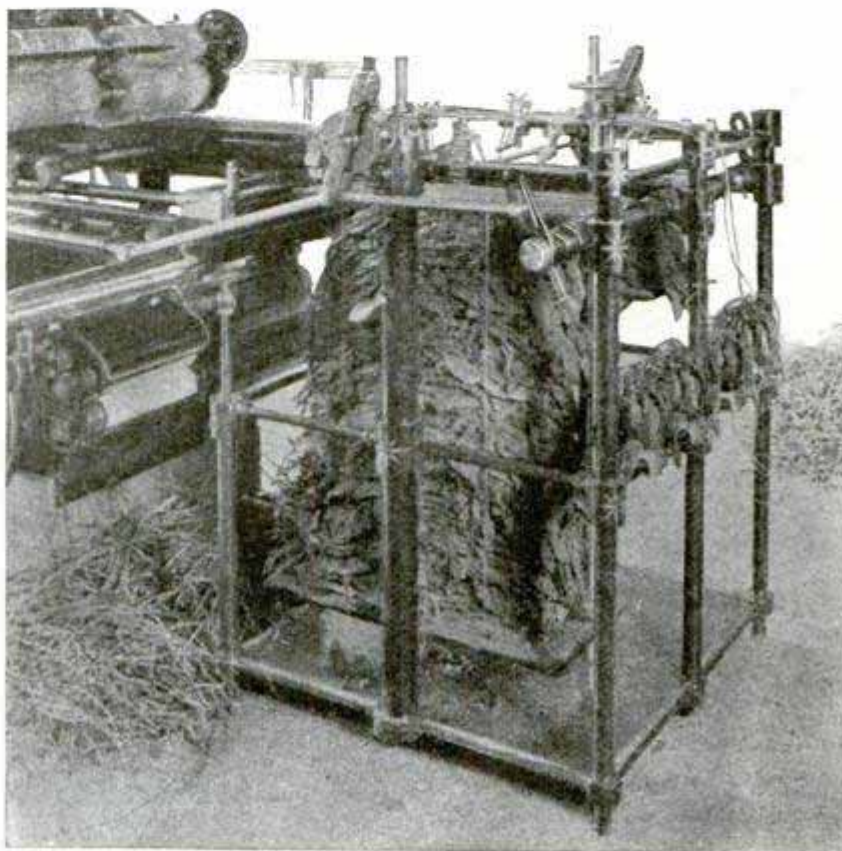
TOBACCO STEMMING MACHINE

There are 400,000,000 lb. of tobacco stemmed each year in this country alone; and practically all of it stemmed by hand, requiring the services of 200,000 employees.

For over 40 years past inventors have been spending their time and fortunes in what seemed the hopeless attempt to design a machine which would do this work. One Chicago inventor has worked steadily for 14 years and has just won hard earned, but gratifying, success in the machine illustrated.

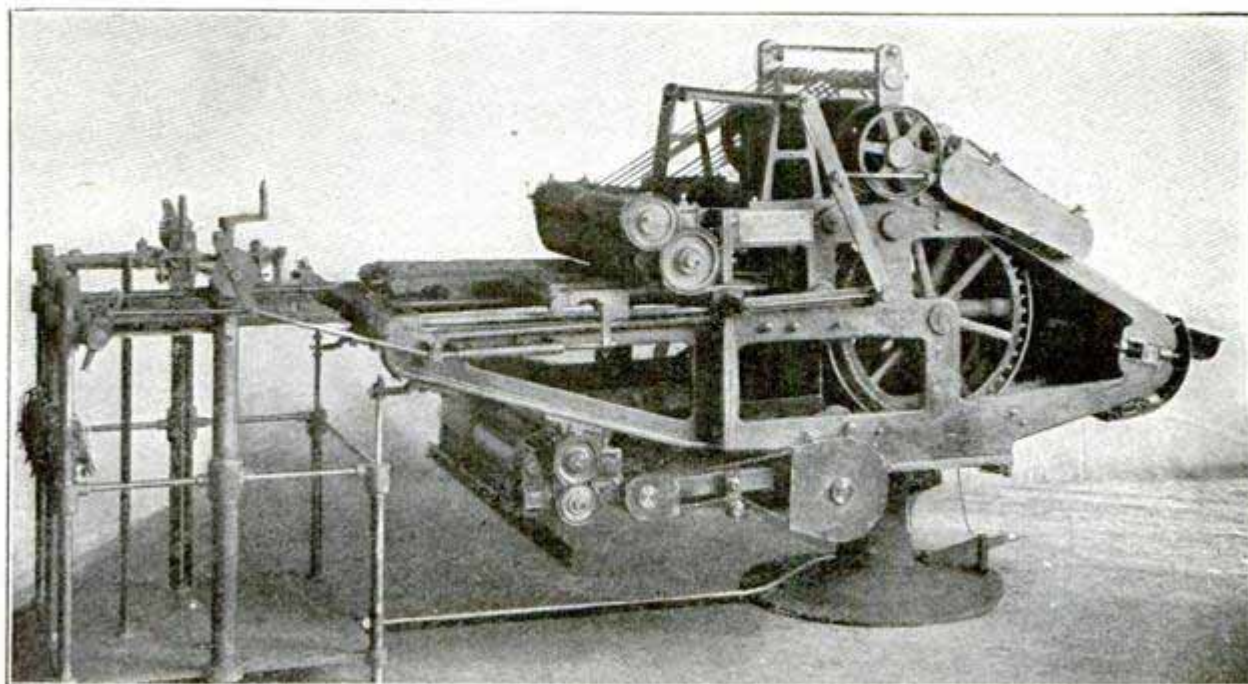
The leaves to be stemmed are fed into the machine, one at a time, by unskilled labor and—the machine does the rest, removing the stem, cleaning the leaves, counting each one, throwing out the stem in one pile, and laying the leaf in another which when big enough constitutes a bale. From 70 to 140 stripped leaves constitute a pound. One experienced

feeder or two green men will feed the two sides of the machine and run through 1,200 leaves per hour. The machine removes from tobacco manufacturing one of the hardest and most



Discards Stems; Piles up Leaves

unpleasant features of the work and at the same time effects a saving of 300 per cent in the cost of the work.



FIGHT FOR LIFE IN SUBMARINE

How the Crew of the French Boat "Lutin"
Met Their Fate

It is known that the men of the ill fated submarine "Lutin" fought desperately for their lives before being drowned, says the London Express. It will be remembered that the submarine went out in rough weather, and was followed by the tug "Iskeul." After three dives Capt. Fepoux signaled to the tug that he was about to drop 48 ft. for a fourth dive.

The water ballast was taken on board and the submarine disappeared in the waves. When it had arrived at a depth of 48 ft. (as the manometer showed him), the captain ordered the valve to be shut. The sailor whose duty it was did so, but when the valve was two-thirds shut the sluice stopped, and the sailor, thinking it was closed, left it.

The captain then ordered water to be pumped out, and his orders to that effect are noted on the log. But the valve was open, and the water continued to pour in and the submarine to sink deeper.

Then the turbine was set working, but under the pressure of the water six holes were torn in the sides of the "Lutin," the accumulators were paralyzed, and the wretched sailors worked feverishly in an inky darkness, broken now and again by a flash, as one short circuit after another occurred. In the dark the men felt their way to the compartment forward, for the turbine in the stern would not hold its own against the inrush of water. They reached the forward compartment, closed the partition, and fought feverishly for life.

Then the lead weights of the fore part were set free, and the "Lutin" made a sudden leap above the surface of the water. The sailors on board the "Iskeul" saw her leap out of the water prow upwards, like a dolphin at play, and plunge down again for the last time.

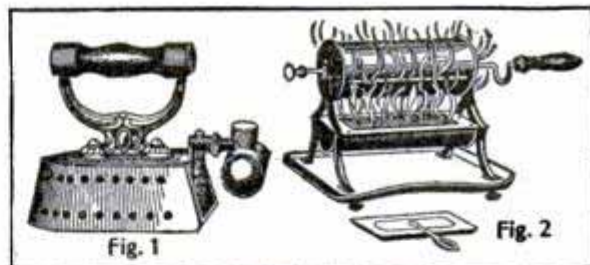
The sailors on board the fated ship tore their shirts and clothes, and in their frantic fight for life tried to stop all openings until the "Iskeul" should bring help.

It was exactly 10:30 when the water stopped the clock in the stern. The clock in the tower stopped at 11:25. For nearly an hour the fourteen sailors must have waited for the help which did not come, and then they made one last desperate bid for safety. They opened the hood (capot), but the water rushed in like a mill sluice, and all was over.

The cause of the disaster is believed to have been a little stone the size of a walnut, which became fixed in the valve and prevented it from closing properly.

DOMESTIC ALCOHOL HEATERS

Now that the denatured alcohol bill has become effective we may expect American manufacturers will not be long in putting on the market many of the household conveniences which



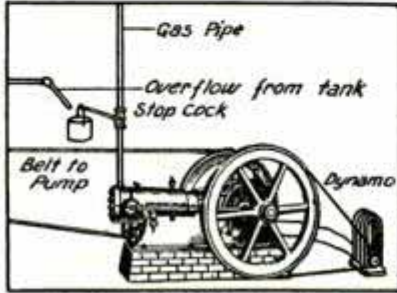
have been in general use in Germany for years. There a large assortment of heaters, cookers, lamps and other household articles are considered indispensable. Fig. 1 shows a German flatiron with alcohol burner, and Fig. 2 is an alcohol burner for roasting coffee.

Smoking pipes made from the curved stem of the calabash are said to give a pleasing softness of flavor peculiar to themselves. The cheaper pipes are lined with tin; others with meerschaum, and they sell from 97 cents to \$62. Our South African consul recommends calabash growing and pipe manufacture as a profitable industry.

SHOP NOTES

An Automatic Pump Regulator

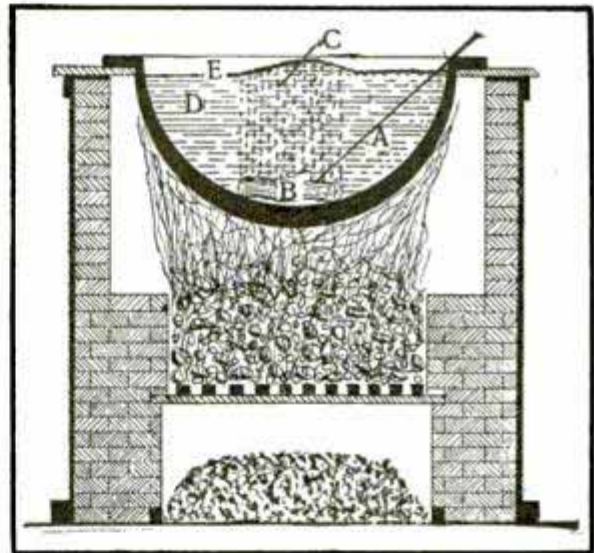
To regulate the water level in a tank supplied by a pump that is run by a gas engine, simply fasten a tin pail on the stop - cock handle and run an overflow pipe from the tank to the pail. After starting the engine the operator may leave it and allow it to stop itself, as it will run without attention until the water from the overflow pipe shuts off the gas.—Contributed by Paul Green, R. F. D. No. 5, Columbus, O.



was then moved up and used as a tool holder.—Contributed by C. R. McGahey, Florence Hotel, Atlanta, Ga.

Reclaiming Thick Tin or Lead

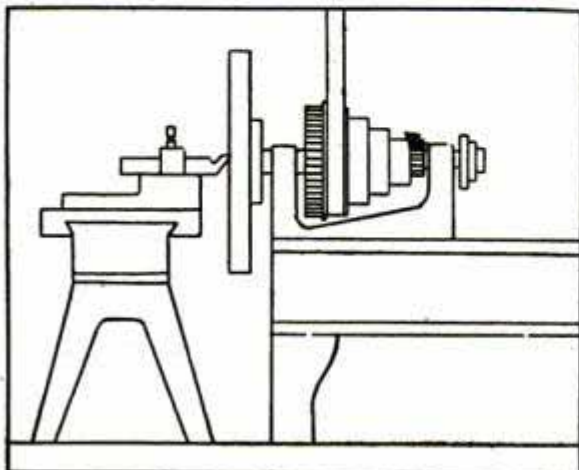
A method of reclaiming thick tin or lead which is used in the majority of establishments manufacturing solder or other white metals, says the Brass World, is both simple and effective. It is to introduce a stick of green



“Boiling” the Metal with Green Wood

Turning Large Work in a Small Lathe

Having occasion to face up a large casting which was too large to finish in the largest lathe in our shop, we accomplished the job by removing and reversing the head on the lathe and fastening the casting on the face plate, as shown in the sketch. A small lathe



Using Two Lathes on a Large Job

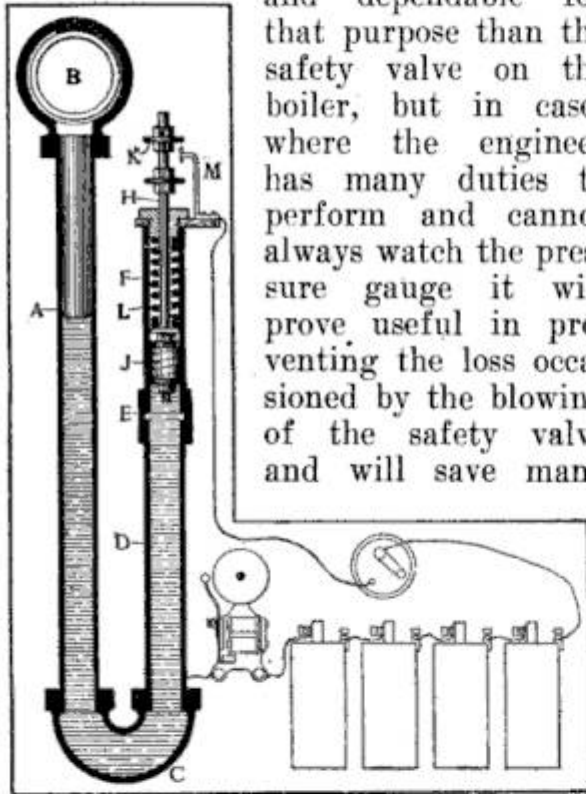
wood into the kettle and allow the gases that are driven off from the wood to bubble up through the molten metal. In Fig. 1 is shown a sketch of such a process. The metal must be below a red heat, as the oxidation is very great at such a temperature. It would be impossible to reduce the oxide under these conditions as fast as it is formed. The right heat for the operation is somewhat over the actual melting point of the metal, but below a red heat.

The stick of green wood is used because gases are given off which act beneficially in the reduction of the oxide. Dry wood does not give as good results. By means of a steel rod, A,

the stick of wood, B, is pushed down to the bottom of the kettle and the metal, D, allowed to boil through the expulsion of gases, C, until it runs freely. Some considerable dross, E, forms on the top of the metal, but this is readily skimmed off. The operation usually takes several hours for ordinary thick lead or tin.

A Pressure Indicating Device for Boilers

This device is intended to give an alarm when the pressure in a boiler becomes either too high or too low. It is not intended to prevent boiler explosions, as it would be less efficient and dependable for that purpose than the safety valve on the boiler, but in cases where the engineer has many duties to perform and cannot always watch the pressure gauge it will prove useful in preventing the loss occasioned by the blowing of the safety valve and will save many



High and Low Pressure Indicator

delays caused by the pressure running down.

A piece of 1-in. pipe, A, is connected to the steam line, B, and is fitted with a return bend, C, at the lower end. Another piece of 1-in. pipe, D, is fitted with a coupling, E, into which is screwed a piece of heavy brass tubing, F. The piston rod, H, is made of $\frac{3}{8}$ -in. round steel and is threaded at both ends. The piston, J, is made by compressing any suitable packing between

two heavy brass washers, held together by nuts on the piston rod.

When the pressure becomes too high or too low the spring, L, is either shortened or allowed to lengthen, thus completing the circuit with the brass contact, M, through the brass washers, K. The object of using two pipes with a return bend instead of a single pipe, is to prevent the escape of live steam around the piston. This construction is also favorable to good lubrication, as a considerable amount of heavy oil may be poured into the pipes, thus keeping the piston well lubricated.

To set the contacts, adjust the upper washer so that it just touches the contact M when the steam in the boiler is at the lowest working pressure. This can be done when first steaming up in the morning. Then run the pressure up until the safety valve is nearly ready to pop and adjust the lower washer to just touch the contact. With the electrical connections as shown the device is then ready for use.—Contributed by A. G. Ward, Peebles and Edgerton Aves., Wilkensburg, Pa.

How to Level Furniture

In setting up bookcases and similar stationary furniture it is almost always necessary to use wedges to square them. A shingle is the best kind of a wedge and the carpenter's method is to drive it under as far as it will go and break or cut off the projecting portion. A better way is to split a hard wood shingle into $1\frac{1}{2}$ -in. wide strips and cut these strips into 3-in. lengths, thus obtaining a series of graduated wedges. By driving one of these, which will nearly level the furniture, butt foremost, another thinner one may be driven thin end foremost, which will level the furniture and make the bearing surfaces parallel. If necessary, a small block may be used as a base, or several of the thicker wedges may be used, alternating thin edge and butt and always using two or multiples of two.—Contributed by Dr. Chas. Everett Warren, North Easton, Mass.

Regulation of Fan Blower

It is a peculiar function of a fan blower that instead of always delivering a fixed volume of air, regardless of requirements, it automatically increases the volume as the resistances are decreased. On the other hand, if the blower be in operation with a fairly free outlet, in excess of its capacity area, and that free area be decreased, the pressure produced will immediately rise, thus tending at once to overcome the increased resistance. Therefore, if a certain maximum pressure is known to be required, the fan may be so speeded as to give this at such times as the conditions demand; while at other times, when less pressure or volume of air is required, proper manipulation of the blast gate will economize power.

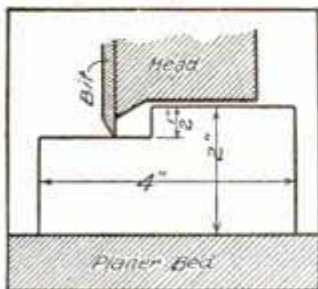
To Make a Good Rust Joint

Measure by weight 2 parts flour of sulphur, 1 part powdered sal ammoniac and 80 parts iron borings, and mix to a paste with water. This cement will set quickly.

For a slower setting but much stronger cement use 200 parts iron borings, 1 part flour of sulphur and 2 parts sal ammoniac, measuring by weight as before.—Molesworth's Pocket Book of Engineering Formulæ.

How to Set a Planer Bit

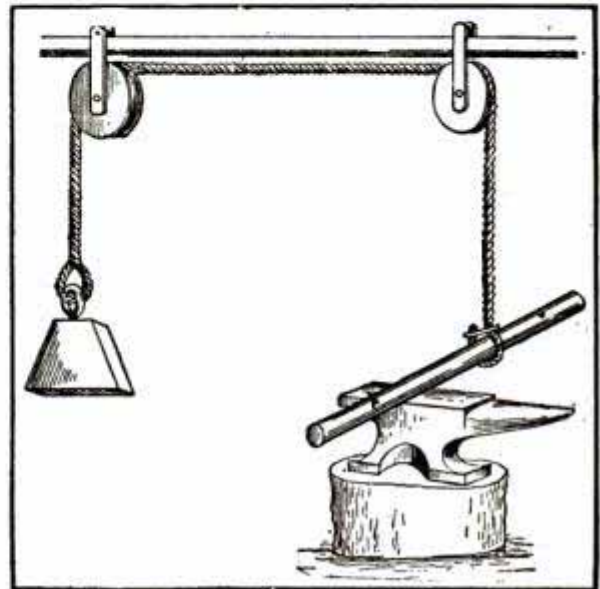
A very simple and accurate method of setting planer bits consists in using two fiber blocks about 1 in. thick and of the general dimensions shown in the sketch. By placing one of these at each end of the head and



raising the bed, the bit may be set by lowering it until it just touches the fiber block at each end.—Contributed by W. J. Rout, 1426 E. Rich St., Columbus, O.

Blacksmith's Device for Holding Work

The illustration shows a handy billy or hold-up recommended by a correspondent of the American Blacksmith.

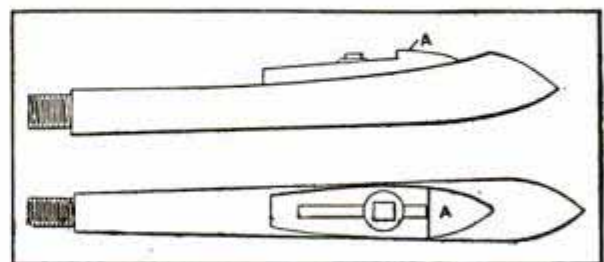


Counterweight for Heavy Work

It consists of two pulleys over which a rope is passed. A weight on one end of the rope counterbalances the work to be held up. It is a very handy appliance, as work can be so easily manipulated with it and the slightest lift adjusts it on the anvil.

Pipe-Pulling Device

A handy device is a tool for pulling sections of pipe out of the ground. The tool must be made to suit the size



Tool for Pulling Pipe

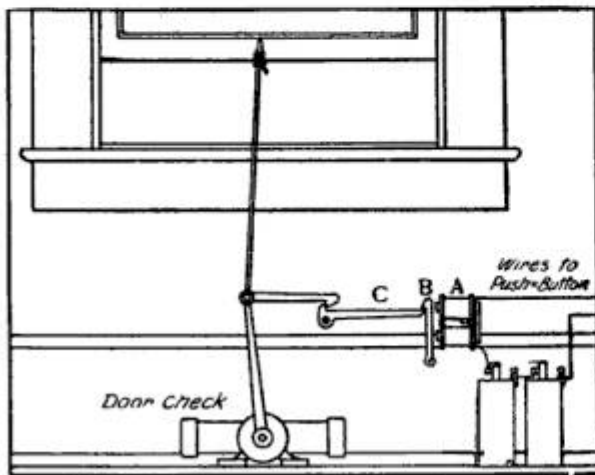
of the pipe inside and the sketch indicates its construction.

The tool is secured into a piece of pipe of proper length, says Machinery, and pushed down in the hole until the

end enters the hole in the pipe to be pulled out. When the pull is made, the part A slips down, wedging in the pipe, and pulls the pipe out.

Electric Window Closer

The sketch herewith shows a device that I have used for the past two years for closing my bedroom window at



Closing Window by Electricity

night without getting up. An ordinary door check is connected to the window by a small chain and is operated by an electric releasing device as shown. When the circuit is closed the magnet, A, attracts the armature, B, and releases the trigger, C, thus allowing the door check to close the window. The push button for closing the circuit may be located in a convenient position for operating from the bed.—Contributed by A. L. Macy, 231 W. 40th St., New York, N. Y.

Quick Method of Removing Paint From Buggy Body

Mix equal parts of turpentine and kerosene oil and put the mixture into a spring bottom oil can. Spread a layer of old newspapers over the body and spray the mixture over them. Put on from four to six layers of paper in this way, spraying each. Then set fire at one corner and follow up with a wide knife. This method will remove the paint in less than an hour where the old way would take a day. More-

over, it will leave the scratch coats intact and never injure the body like burning with a lamp.—Contributed by J. C. Blake, Harvard, Ill.

How to Protect Rubber Gaskets

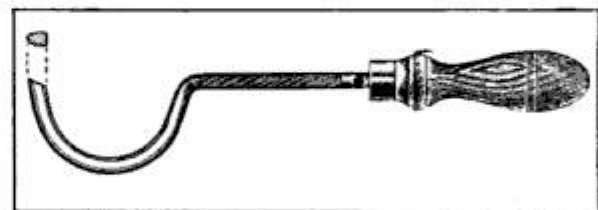
To keep rubber gaskets in shape and also to keep them from blowing out of boiler-feed pumps when pumping against high pressure, cut out two pieces of ordinary wire netting the same size as the gasket, and place one on each side of it and bolt in place. Gaskets protected in this way can be removed and put back again several times without injury, says Power, and have proven satisfactory even on man-hole covers.

Cost of Excavation by Hand

The cost of excavating earth with pick and shovel and loading it is about 40c per cubic yard for hardpan; 20c for tough clay; 15c for ordinary clay, gravel or loam; and 12c per cubic yard for light, sandy soil—wages being reckoned at 15c per hour in each case.

Cutting Oil Grooves in Babbitt

If oil grooves are cut with a hammer and chisel in thin babbitt, the blows are apt to loosen the babbitt so that the pound in the bearing cannot be stopped. To avoid blows take a round file, draw out the end to a U



For Cutting Babbitt

section, put a crook in it, as illustrated, and use it like a carver's gouge. Leave the file handle on the tool.—Contributed by Wm. E. Jackson, 18 N. Washington St., Tarrytown, N. Y.

How to Make Bronze Ink

A good bronze ink for show cards or similar purposes may be made of the following ingredients:

Honey	dr. 1
Alcohol	dr. 1
Mucilage	oz. 1
Water	oz. 8
Bronze	oz. 1

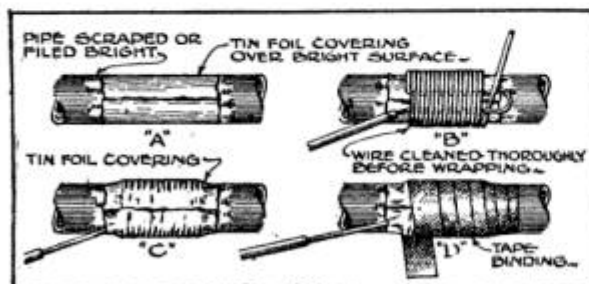
The bronze may be any one of the colored powders found on the market. Rub the honey, spirit and mucilage together in a mortar, then add the water. Shake before using.

Wetting Ashes in Furnace

For a long time I was bothered by fine ash dust floating about the furnace room in the basement of my residence until I hit upon the following plan. I bent a piece of small pipe to fit the shape of my ash box under the grate, and drilled about 20 pinholes. This was then connected to city water supply, a valve being placed conveniently near the furnace. While shaking I turn on the water which sprays the falling ashes and absolutely prevents any dust either then or while they are being removed.—Contributed by W. K. J., Chicago.

Unsoldered Ground Connection

A fairly reliable wrapped joint made without soldering is shown in the illustration herewith, from Telephony. The pipe is first scraped and then covered with a layer of tin foil as shown at A. The ground wire, with its insulation removed for a length of several feet,

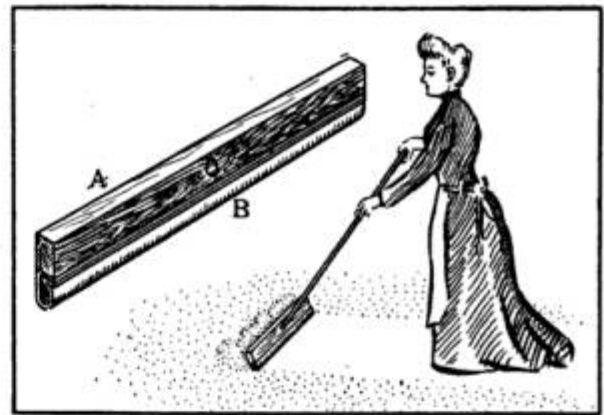


Wrapped Joint Without Soldering

is now tightly bound around this prepared surface as at B, its free end being drawn under the turns of wire by means of a loop formed as illustrated. This keeps the turns of wire from loosening and does away with the necessity of soldering. To insure a good connection and prevent corrosion, another layer of tin foil is applied and the whole is covered with a binding of adhesive tape.

Device for Cleaning Hardwood Floors

People who have hardwood floors in their homes are, as a rule, continually bothered with the dust that accumulates. I have had a good deal of experience with them, and I find that the dust can be very simply removed by this little device: Take a piece of wood, A, about 2 ft. long and tack a



Wiping up Hardwood Floors

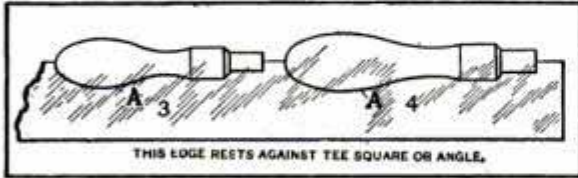
piece of flannel, B, along one edge. Then bore a hole in the middle and insert an old broom handle.—Contributed by Clifford B. Brainerd, Chevy Chase, Md.

To Gild on Granite

Apply a coat of size and let it dry; then apply several coats of size and very fine bolted whiting mixed together to form a paint. Let each coat dry, then rub each with very fine sandpaper, says the Master Painter. Then apply the gold size, evenly and thinly, and after that the gold leaf as usual. The same instructions apply for marble.

Template for Drawing Machine Handles

A celluloid template is of great help in drawing machine handles, says Machinery. Make two templates, one containing profiles of the four smaller sizes and the other containing the three



larger sizes. If there is a forming tool for each size it is an easy matter to make the templates and thereby have the drawings the same outline as the formers. They not only facilitate drawing, but also allow of a proper section for each requirement. The outline, A, of the lower half of the handles is scratched on the templates and is filled in with black wax.

Emergency Repair for Broken Wheel

The accompanying illustration shows how repairs are sometimes made when a wagon wheel breaks down in the mountains. A correspondent of the Blacksmith and Wheelwright, who witnessed the operation,



describes it as follows: This wheel went all to pieces and buckled over the opposite way from which it was dished, bringing things to a standstill instantly.

Some lava blocks were collected from the mountain side, the wheel raised clear of the ground, removed from the axle and straightened up. Then four poles were cut, each equal in length to the diameter of the wheel. The poles were then each hewed flat on one side, almost one-half of each being cut away.

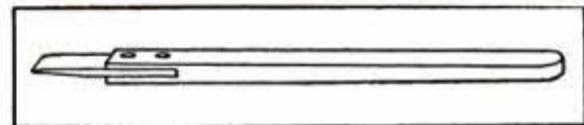
Two of the flatted sticks were then placed on opposite sides of the hub, and fastened there, parallel to each other, by tightly wound hay wires,

placed around the flatted sticks and the spokes, close to the felloes. In this repair the poles were used only to resist the lateral strains as the spokes were still strong enough to support the load.

So well did the wheel stand up to its work after "first aid" had been administered that the driver not only made his way with his load to Boise, 20 miles away, but he also made another entire trip into the mountains and return, loading both ways, 65 miles in both directions, while the wheelwright was getting a new wheel ready for him.

How to Make a Glue Spreader

Narrow strips of leather tacked or tied into a cleft stick make excellent glue spreaders that can be thrown away when their purpose has been served. In order to get into a narrow crevice or other inaccessible part of the object being glued, it is well to sharpen the



Glue Spreader

leather in the form of a wedge, as shown in the sketch.

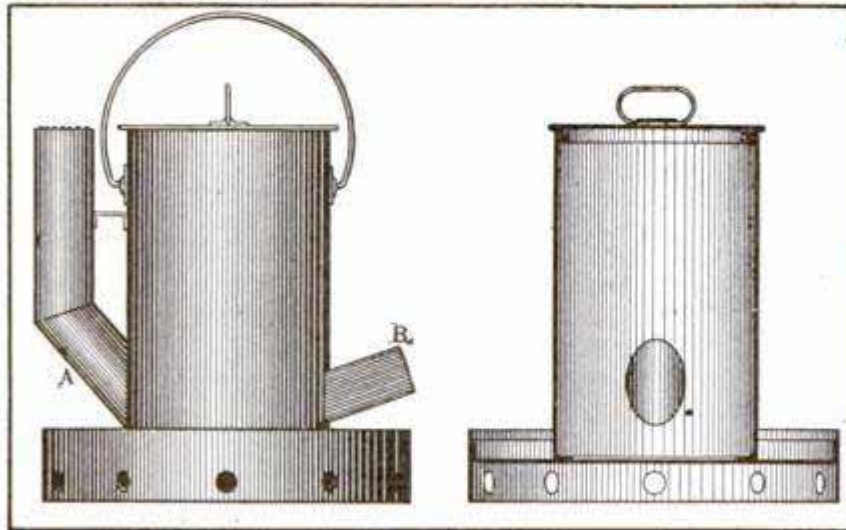
This device will be found much better than a brush, as it scrapes off the superfluous glue and does not leave a gob on the work.—Contributed by Dr. C. E. Warren, North Easton, Mass.

Why Wooden Tanks Taper

In the manufacture of tight barrel staves, of oak, for example, one of the greatest problems is that of trying to keep a barrel from drying out and falling to pieces, or at least springing leaks as the wood warps. That is the reason why the barrel has to have a bilge so that steel hoops can be tightened from time to time as the wood shrinks. It is the reason why tanks are made larger at the bottom, it is the reason why flooring is made in such narrow widths.

Quick Repair for Enamel Ware

To stop a hole in enamel ware, bore the hole out large enough to allow a

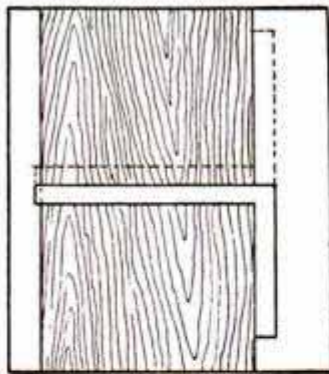


Outside and Sectional Views of Furnace

copper rivet to be inserted and rivet it down tight, being careful not to crack the enamel. An ordinary harness rivet will answer the purpose about as well as anything.—Contributed by G. A. Dale, Virginia, Ill.

How to Test a Square

There are several methods of testing a square, but probably the simplest and most accurate one is shown in the accompanying sketch. Place the square against the straight edge of a plank as shown and draw a line along the edge of the square. Reverse the position as shown by the dotted lines and redraw the line. The two lines should coincide.—Contributed by Carson Birkhead, Indianola, Miss.



If the air had been as good a conductor of electricity as copper, says Prof. Alfred Daniell, we would probably never have known anything about electricity, for our attention would never have been directed to it.

Charcoal Soldering Furnace

The accompanying illustration shows a very economical soldering furnace that I constructed out of sheet iron. While the general design is similar to other furnaces of the kind, there are certain details in the construction which have a marked effect in the efficiency and convenience of operating. The chimney connection, A, instead of being horizontal as in many furnaces, is inclined as shown, in order to prevent its being filled up with ashes and the

hearth, B, is inclined so that the ashes will not come out. The chimney should be provided with a piece of wire gauze to keep sparks from coming out when the furnace is being used on roofs or where there is danger of fire. If a piece of tin or sheet iron is placed on top of the chimney the fire will keep over night. The furnace I made is 15 in. high.—Contributed by Horace Cubberly, 1509 Central Ave., Kansas City, Mo.

Tribute to the Stationary Engineer

In an address to an association of stationary engineers, the Hon. H. V. McChesney said:

"I know something of the character of the work of a stationary engineer, and that it is not in the limelight of the public gaze like that of the man who runs a locomotive. Usually great walls hide you from the public gaze. Your work is not spectacular, yet who shall say that because of that it contributes any the less to the world's progress, or the comfort and happiness of the race? There is a quiet dignity about the stroke of a powerful stationary engine and the noiseless revolution of the great fly-wheel that commands respect. To me it somehow seems to be typical of the great moral and

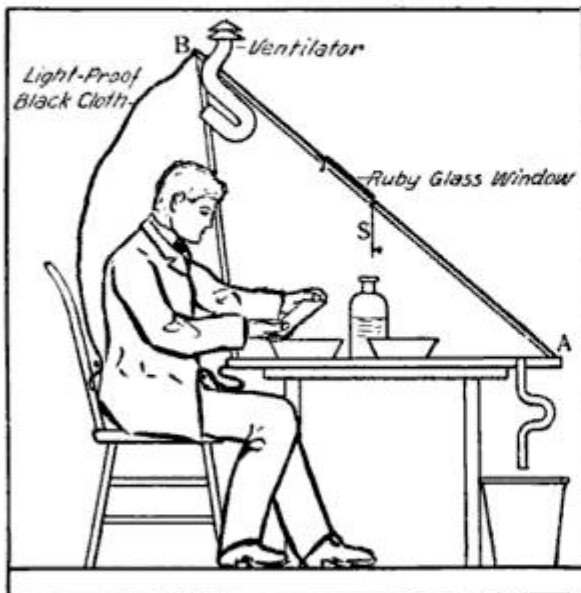
patriotic strength of the republic that we all love so well. In the mills, the factories, the foundries and machine shops of this country these great engines responding to your trained touch, turn the raw material of the field and mines into the finished product of commerce. Thus your work commands the admiration of all."

A Portable Dark-Room

Many amateur photographers who cannot have a regular dark-room will find the device here illustrated very useful and convenient. If desired it may be constructed so as to allow folding up when not in use, by using hinges at A and B and making the sides flexible.

The bottom and frame are made of wood and the walls are constructed of light-proof cloth, formed by gluing black paper between two pieces of black cloth. The back should be full enough to allow plenty of room for the operator and the cloth should be tied securely around his waist to exclude every possible ray of light.

It is well to paint the whole interior a dull black, so that any small leakage of light will not be reflected. The ventilating tube and drain pipe should be bent as shown, to exclude the light, and the ruby glass should be carefully fitted for the same purpose. It is also

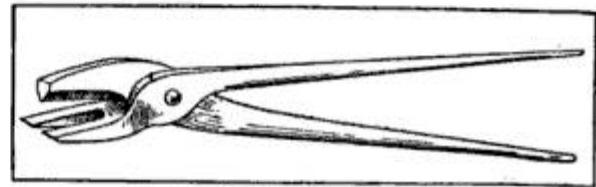


Developing Plates in Portable Dark-Room

desirable to have a hinged shutter, S, to cover the ruby glass while waiting for the plate to develop. This is to prevent any unnecessary exposure to the ruby light, as any light, no matter how colored or subdued, has some effect on the sensitive plate or film. The drain pipe shown on this outfit may be omitted if desired, although it is convenient at times and gives a better circulation of air.—Contributed by Stewart H. Leland, Box 526, Lexington, Ill.

Handy Blacksmith Tongs

A pair of tongs for handling all kinds of stock, round, square, octagonal and flat, is made, as shown in the accompanying engraving. The lower



Handy for All Kinds of Stock

jaw is divided or forked, as shown, while the upper jaw is V-shaped. These tongs are made the same as the ordinary style tongs, except that the lower jaw is flattened and then split. It will probably require more stock for this than in the ordinary jaw, and will need to be allowed for when cutting the stock. It is understood, says a correspondent of the American Blacksmith, that these tongs must fit the work the same as ordinary tongs.

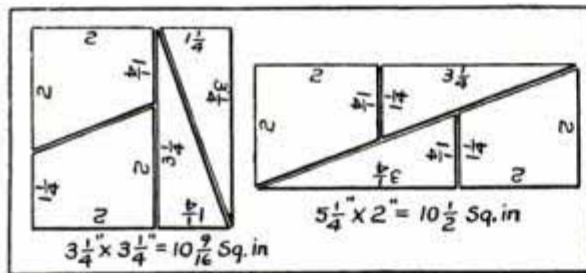
Device for Hanging a Door

A very useful device for lifting heavy articles, setting up or leveling furniture and especially for hanging or unhooking a door is made from a 1-in. strip of hard wood about 3 in. wide. Nail a 1-in. cleat across it about 3 in. from one end and bevel this end from the cleat side across the end. The strip should be at least 18 in. long. An oak barrel stave, by the way, is good for the purpose. In using put the beveled end under the door or whatever is to

be raised. Then step on the other end of the lever, the fulcrum being the cleat, which is of course on the under side. Do not use your whole weight if the hinge sticks, but give it a number of light jerks, teetering the lever up and down. The lever should be placed as near the hinge edge of door as possible. This leaves both hands free to manage the door. In hanging a door let it rest on the beveled end of the lifter and raise it with the foot on the lever end until it is high enough to clear the pins guiding it to place with the hands and then letting up on the lever.—Contributed by Dr. Chas. Everett Warren, North Easton, Mass.

To Increase the Area of a Rectangle

In the January number I noticed an article describing a method of covering a 12-in. square hole with a 9-in. by 16-in. board. The following diagram



not only shows how to saw a rectangular board so as to form a square, but also shows how to increase the area.

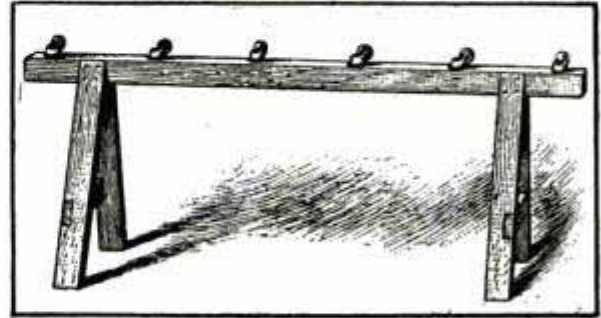
On a piece of heavy drawing paper, lay out accurately a perfect rectangle, $5\frac{1}{4}$ in. long and 2 in. wide, having an area of $10\frac{1}{2}$ sq. in. Cut the rectangle in four pieces, according to the diagram, and mark the dimensions on each piece as shown. Then match the pieces together to form a $3\frac{1}{4}$ -in. square, thus producing $10\frac{9}{16}$ sq. in. from $10\frac{1}{2}$ sq. in.

This operation may perhaps suggest great possibilities to the minds of many readers.—Contributed by G. D. Woodruff, Chicago.

Flames and currents of very hot air are conductors of electricity and will discharge an electrified body.

A Sheet Metal Carrier

The shop which is equipped with small conveniences for facilitating work and reducing the labor is apt to cheapen substantially the cost of production, says a correspondent of the Metal Worker. Those who have had occasion to work on large sheets, either



Sheet Metal Carrier

to punch them for riveting or to cut them to shape with shears where the assistance of a helper is required, know what a tiresome task this sometimes becomes. Tiresome alike to the helper who is holding the weight of the sheet and to the workman who must manipulate it under a punch, shear or some other tool. For this kind of work a carrier, such as the one illustrated, has many advantages. It consists of a long trestle like the carpenters use, in the top of which at close intervals are large, easy running turning casters. These trestles are made of a suitable height to carry work in punching, shearing or along the bench on which the workman is engaged, and the sheets are held rigidly at the proper height and level, but can be moved with little exertion.

How to Sharpen a Lawn Mower

Since nearly all lawn mowers are constructed on similar principles, remove the outer drive wheels, change the pinions and replace the wheels. This causes the cutter to rotate backwards when the drive wheels revolve. Then raise the stationary cutter by tightening the front bolts. Form a thick paste of powdered emery and

oil, and apply to the revolving cutter. To sharpen, simply turn one of the drive wheels, and in a short time the cutters will have perfect edges.—Contributed by Clifford R. Wolf, 127 W. Nixon St., Cincinnati, O.

Table of Contrasting Colors

The following table is familiar to painters, but for beginners or those having occasion to select colors for their house it will be found useful:

Table of Contrast.

Yellow contrasts—
Purple, Russet and Auburn.
Red contrasts—
Green, Olive and Drab.
Blue contrasts—
Orange, Citrine and Buff.

Table of Harmony.

Yellow harmonizes with—
Orange, Green, Citrine, Russet, Buff and Drab.
Red harmonizes with—
Orange, Purple, Russet, Citrine, Auburn and Buff.
Blue harmonizes with—
Purple, Green, Olive, Citrine, Drab and Auburn.

To Make a Solid Auto Tire

In cases of emergency a very good substitute for the pneumatic inner tube of an auto tire can be made as follows: Take a quantity of ordinary garden hose, not too badly worn, and cut it into lengths just long enough to go once around the rim on the inside of the tire casing. Through each short length of hose draw a piece of rope sufficiently large to fit it snugly.

After these are ready, take four or five (depending on the size of the hose) and bind them together with stout cord from end to end. This bundle must then be wrapped tightly with a strip of old carpet or burlap. Enough of this material is put on to make the entire bundle fit snugly into the outer casing. It is then ready to be applied to the wheel in the usual manner. Be careful to make the ends come together closely, and to have it fit the casing very snug.

After the tire has been used for a

short time, take out the filling and add more carpet or burlap. This will keep it up to the size of the casing, and prevent unnecessary wear. I used one of these home-made tires recently while the good one was being repaired, and always carry one in my auto.—Contributed by Dr. N. R. Gordon, Springfield, Ill.

Testing Constructions with a Hydrostatic Level

A Massachusetts man who was having a 60 by 100-ft. shop erected wished to test the accuracy of construction. At each corner of the walls he placed a water pail and also placed one midway of each 100 ft. wall. Then he placed 100 ft. of piping midway between the two rows of pails and ran branch pipes from it crosswise to connect each pair of pails with the main pipe line and, through this, with the other pails. Water was poured into the system and when the liquid assumed its level in the six pails, says the American Machinist, it was found that one corner of the building was one-quarter inch low. The leveling instrument previously used was then tested and found to be slightly defective.

To Make a Ghost Picture

Drape the subject in a sheet and photograph him against a plain background out-of-doors. Give only two-thirds the time necessary for a normal exposure, says the Photographic Times. Remove the subject, and then, without changing the camera, expose the same plate at the background for the remaining third of the time. If the background has some prominent lines in it, such as a fence, a gate, or tree, the effect will be greater. The ghost will appear nearly transparent.

The first distillery for the manufacture of denatured alcohol opened at Peoria, Ill., December 1. The plant's capacity is 8,000 bu. a day, or about 40,000 gal.

Practical Mechanical Movements**PART TWO**

The following completes the interesting list of practical mechanical movements as shown in the accompanying illustrations:

47. Link-motion for locomotives. The slotted link is moved up and down over the wrist-pin block by the lever and connecting rod; the lever, locking in the toothed sector, allowing for a close connection to the valve stem by a lever and short connecting rod.

48. Valve-motion and reversing-gear. The slotted link receives a rocking motion from the eccentrics and rods, and is thrown from its center either way for forward or backward motion of the engine by the lever secured thereto.

49. Safety stop for elevators. When the cable breaks, the bow spring will force the plungers secured to the bell-crank levers outward into engagement with the racks.

50. Mangle-rack, guided by rollers and driven by a lantern half pinion. The long teeth in the rack act as guides to insure a tooth mesh at the end of each motion.

51. Breast-wheel. The power of this wheel equals about forty per cent of the value of the waterfall flowing through the gate.

52. Single-acting pumping-beam. Parallel motion is received from a sector beam. The cylinder is open and the piston is lifted by the weight of the pump rods on the other end of the beam. Movement of the piston is reversed by atmospheric pressure.

53. A gyroscope or rotascope. The outer ring is fixed to a stand. The intermediate ring is pivoted vertically therein. The inner ring is fixed in the intermediate ring at right angles thereto, and the globe is pivoted at right angles to the inner ring.

54. Wheel-work used in the base of a capstan. The central gear is fast to the shaft. The intermediate pinions

are loosely mounted upon a frame secured to the drum. The gear ratchet ring runs on the shaft.

55. Scroll gears. For increasing or decreasing the speed gradually during one revolution.

56. Pantograph. For reducing or enlarging copies of drawings. The free ends of the arms are provided with drawing instruments which are adjustable. The point of connection between the two intermediate arms is fixed.

57. Diagonal catch and hand gear used in large blowing and pumping engines.

58. Ball and socket tube joint.

59. Toe and lifter working puppet valves in steam engines. The lower arm or toe is secured to a rock shaft operated from the engine shaft and is adapted to raise and lower the lift or upper arm which is secured to the valve rod.

60. A rotary engine. This engine has two abutments and two inlet and exhaust ports.

61. A horse-power tread-wheel. The horse is placed below the shaft and between the spokes which are arranged at the sides of the wheel.

62. A four-way cock.

63. A swape, or New England sweep. The weighted end of the pole overbalances the bucket so as to divide the labor of lifting the water.

64. Ordinary screw-propeller.

65. Chain-pump.

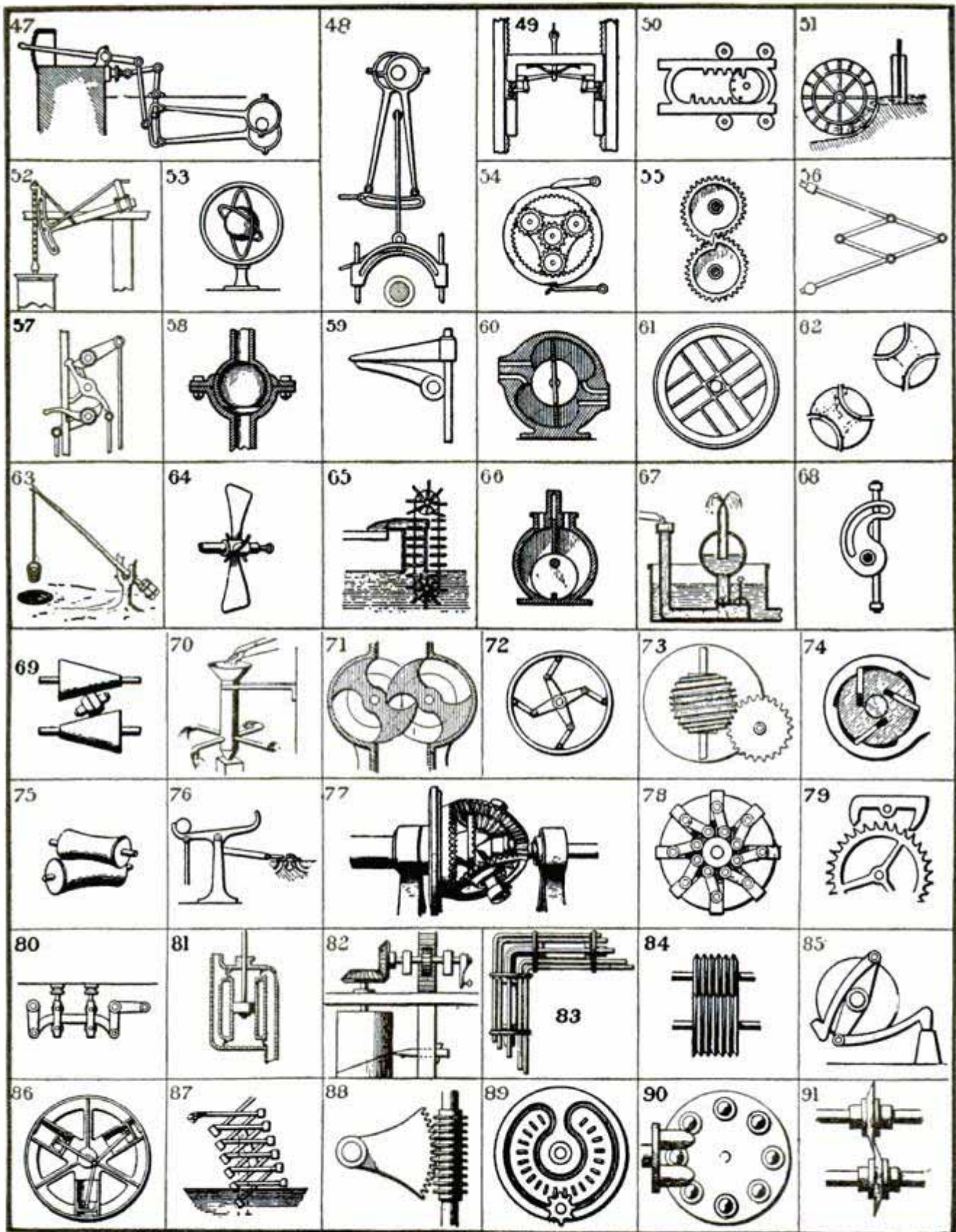
66. Rotary engine, in its simplest form.

67. Hydraulic ram. The "Montgolfier" idea for a fountain supplied by a water ram.

68. Means whereby rectilinear motion of variable velocity is imparted to a vertical bar by turning a shaft having a curved slotted arm thereto.

69. Friction gear. Variable speed is obtained from the pair of cone pulleys, one of which is the driver. The intermediate double-facer friction pinion is moved from one end to the other of the cones.

70. Barker wheel. The reaction of



the water escaping from the tangential orifices at the ends of the arms under the pressure of the water-head in the hollow shaft gives impulse to the wheel.

71. "Root" rotary blower. The extended surface of the periphery of the

wheels allows them to run loosely in the shell without friction, and with very small loss by air leakage.

72. An elastic wheel having a steel spring tire with jointed spokes.

73. Globoid spiral gear-wheels. The revolution of the globoid gear

gives a variety of differential motions to the spur gear, as it swings between the limits practicable with the globoid teeth.

74. Ratchet head with spring pawls.

75. Means for transmitting rotary motion to an oblique shaft by means of contracting drums having concave faces.

76. A reversing movement for a pump valve. The piston rod trip carries the ball frame beyond the level, when the ball rolls across and completes the valve throw.

77. Multiple speed-gear in line of shaft. The small intermediate gear is secured to the small shaft. The central intermediate gear is secured to the large shaft, while the large intermediate or end gear is fixed to the bearing. The side beveled pinions are revoluble with the large shaft. With this device speed may be increased or decreased on a continuous line of shafting according to the relative number of teeth in the different gears.

78. Toggle joint cam movement, for throwing out a number of grips at once, by the movement of the jointed ring within the disk.

79. Anchor escapement for clocks.

80. Cam-bar valve-movement. The horizontal movement of the cam bar by the bell crank lever alternately moves the two valves.

81. Double acting lift and force pump.

82. Rack and pinion movement for tracing spiral grooves on a cylinder.

83. Right angle shaft coupling. A number of right-angle steel rods move freely in perforated guide flanges on the ends of shafts that are arranged at right angles. In this manner motion may be imparted from one shaft to the other.

84. Grooved friction-gearing.

85. Revolving rapid blow-hammer.

86. Rotary multi-cylinder engine. The cylinders revolve with the fly-wheel and the crank to which the pistons are secured is eccentric thereto.

87. Pendulum water-lift.

88. Means whereby a rectilinear vibrating motion may be imparted to a spindle having an endless worm gear, by a spur-gear sector.

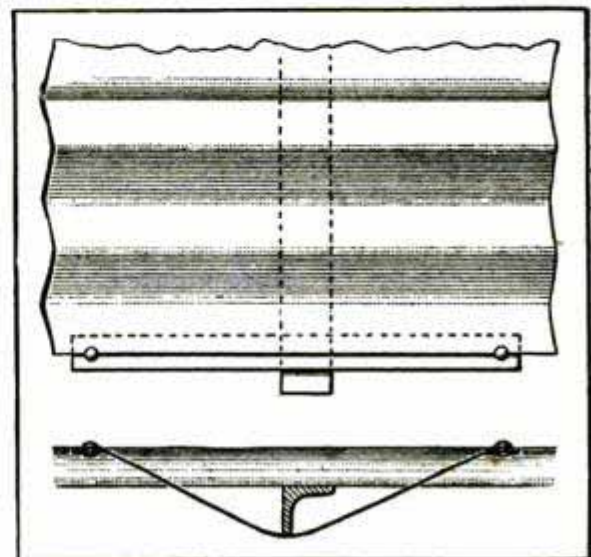
89. Mangle-wheel with equal motion forward and return. The end of the shaft of the pinion is slidably mounted within the groove and retains said pinion in mesh.

90. Tin-tooth wheel and pinion.

91. Disk shears.

Fastening Corrugated Sheet-Iron Roofs

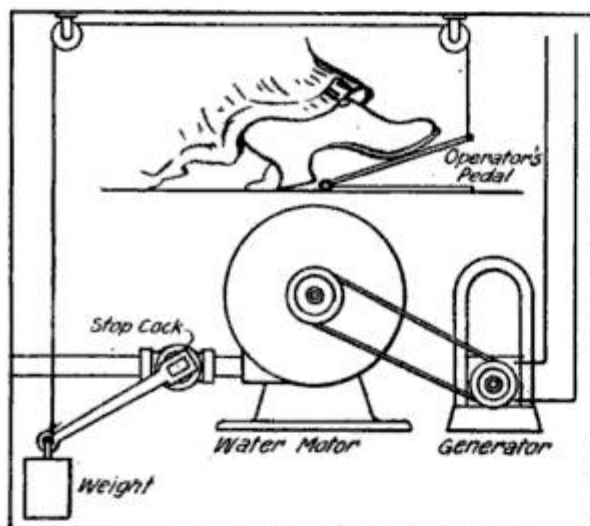
Roofs of sheds and other structures requiring lightness of construction combined with fire-resisting qualities are often made of a combination of structural steel shapes with a corrugated iron roof attached directly to the steel, says the Metal Worker. In this way a roof can be obtained which is made entirely of metal that can be easily removed if occasion should require. It often happens, though, that there are no adequate means for fastening sheets to the iron. Of course, if the sheets were riveted directly to the angle irons, the expansion and contraction would tend to make the rivet hole enlarge continually. In the accompanying illustration is shown a type of fastening which has been found to work satisfactorily in many cases where corrugated sheets were fastened to iron angles. A piece of trap iron is riveted at one end to the



ridge of the corrugation on the under side and passed under the angle iron and then again riveted to the ridge of the corrugation at the other end. In this way expansion of the sheet is allowed for and at the same time there is little or no danger of water passing through the rivet hole. With roofs of this character it is often the practice to make the span between purlins of considerable length, as the corrugations give to the roof a stiffness which will support a fairly heavy weight of snow.

Water Power for Central Generators

Any telephone exchange using hand generators for ringing up subscribers, will find a water motor much more



Operating a Water Motor

convenient, as the operator only needs to press the foot lever to ring up and the bell will continue ringing as long as the lever is held down. Another advantage is that the motor and generator may be placed at some distance from the switchboard, thus doing away with all noise.—Contributed by Ora S. Harmas, Fennimore, Wis.

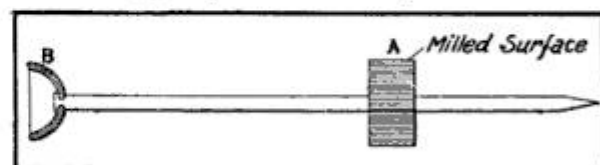
How to Paint a Buggy in a Small Shop

Many a painter is sometimes at his wits' ends just how to handle certain

work in his rather small shop, says the Canadian Implement and Vehicle Trade. If he takes time to study out the right plan he will have no trouble. Say, for instance, the job is a buggy—first take off the shafts, then block the front and rear axle up in the part of the shop where they can have the best light. Then dust out the lining of the top and sponge off the rubber or leather and clean the bows and the shifting rail. The cushion, carpet, side curtains and storm aprons should be removed to the platform and cleaned. Then, wash out the inside of the body. The wheels having been removed, wipe off the axle arms with strips of burlap. Clean all the grease spots, using a piece of cloth saturated with turpentine, dipped in a little pumice stone to quicken the work. Rub the body over lightly with pumice and felt. This removes the grease spots, dirt, etc., and makes the surface ready for the varnish. One mistake some painters make is to touch up too many and too unnecessary places. Touch up only where required and in doing so touch the right spot without smearing the surrounding surface. Mix the match color to dry with a gloss sufficient to reflect more light than it absorbs. When dry color will not have changed from its appearance, when first applied.

Handy Small Screwdriver

A handy small screwdriver with a good "grip" is made as shown in the sketch from 3/32-in. steel wire, about 4 in. long, says Machinery. Part A is



Has a Good Grip

made of brass $\frac{1}{2}$ in. in diameter and $\frac{3}{8}$ in. thick, knurled on the edge. The cup piece, B, is of brass, also, dished as shown.

FIRELESS COOKER FOR U. S. ARMY

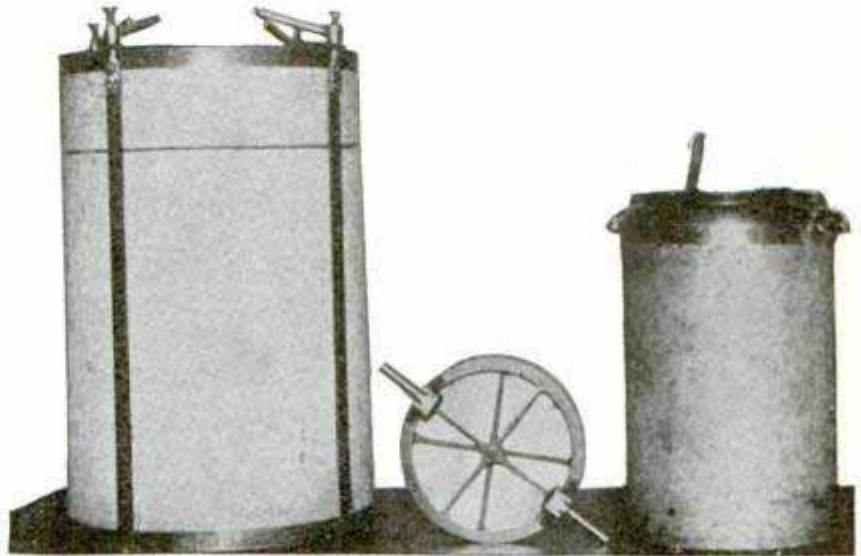
Keeps Foods Hot All Day in Zero Weather

The greatest improvement in years, and perhaps in the entire history of the commissary department of the U. S. Army, has been achieved by Maj. A. W. Davis, purchasing officer at St. Louis. The idea had been experimented with for months, when Major Davis was assigned the task of perfecting it. The army fireless cooker is a more valuable acquisition in many ways than even some new brand of powder.

None but the soldier knows the weariness of waiting often three hours for the evening meal to be cooked, at the close of an all day's march during which he has fed on hard tack and cold water. In times of war the smoke from a camp fire would betray the presence of a company whose success depended largely on secrecy of movement, and then the soldier may have to subsist for several days at a time entirely on cold rations. All this is to be changed. No matter how long the march, how cold the weather or how exposed the camp, when the order to halt is given a hot meal of meat, vegetables and coffee can be served within 10 minutes.

The fireless cooker is an aluminum cylinder covered with several layers of wood veneer between which is packed magnesia. The covers fasten on so tightly the contents are hermetically sealed. The kettle is 26½ in. high, 17½ in. in diameter and when filled with food weighs only 150 lb. Two of them can be packed by one mule, and one kettle contains a hearty meal for a hungry company of 85 men. The process is simple: Just before breaking camp the uncooked food is placed in the kettle and heated to 212°. The cover is then screwed on and the

kettle placed in the jacket. The contents will be ready to eat in 6 hours and will remain warm for 24 hours. In a severe test one of the cookers was heated and put in a cold storage where the temperature was 5° below zero, and when taken out after 16 hours had



To Provide Quick Meals for an Army

a temperature of 106°. The quality of the food is also greatly improved by the process.

AUTOMATIC ELECTRIC PUMPS FOR RAILROAD WORK

One of the large railroads has put in an automatic pumping outfit for filling a locomotive water tank. The work is done with electric motors taking current from an electric power company. When the water in the tank falls to a certain level the pumps start automatically and stop when the tank is nearly full. This arrangement enables a constant water supply whether drawn upon seldom or frequently, and with no attention except inspection and oiling two or three times a month.





FOUNDRY WORK AT HOME

Part II--How to Make a Mold

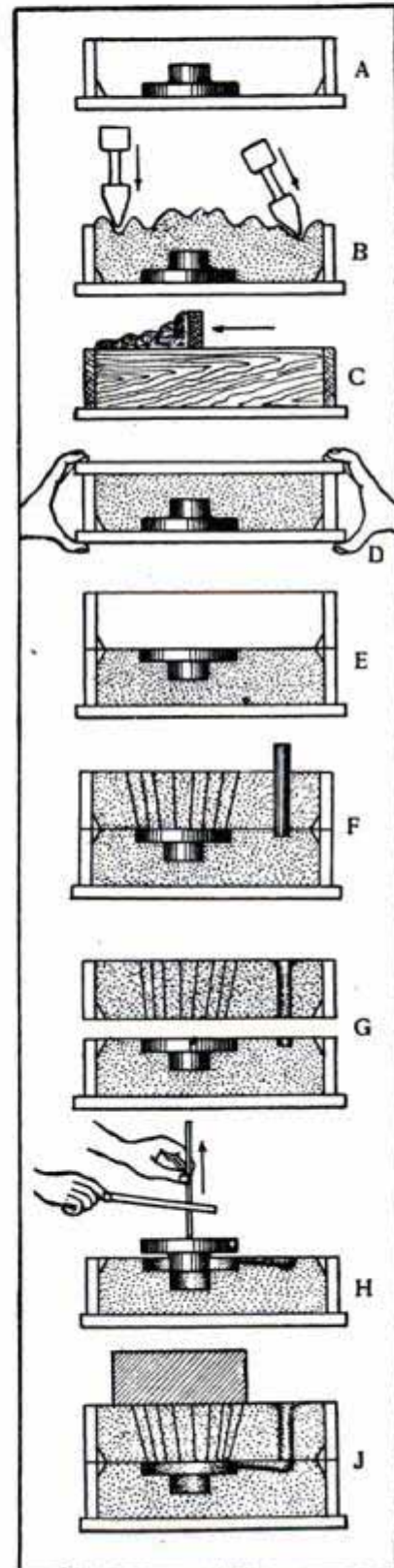
Having finished making the flask and other equipment, as described in a previous chapter, everything will be ready for the operation of molding. It would be well for those who have never had any experience in this line, to visit a small brass foundry, where they can watch the molders at work, as it is much easier to learn by observation; but they must not expect to make a good mold at the first trial. The first attempt usually results in the sand dropping out of the cope when it is being lifted from the drag, either because of insufficient ramming around the edges or because the sand is too dry.

A good way to tell when the sand is moist enough is to squeeze it in the hand. If it forms into a cake and shows all the finger marks it has a sufficient amount of moisture, but if it fails to cake and crumbles up it is too dry. An ordinary watering pot will be found useful in moistening the sand, but care should be taken not to get it too wet, or the hot metal coming in contact with it when the mold is poured will cause such rapid evaporation that the mold will "boil" and make a poor casting. A little practice in this operation will soon enable the molder to determine the correct amount of moisture.

When molding with sand for the first time it will be necessary to screen it all before using it, in order to remove the lumps, and if water is added the sand should be thoroughly shoveled until the moisture is evenly distributed. The sand is then ready for molding.

The operation of making a mold is as follows: The lower half of the flask, or "drag," and the pattern to be molded are both placed on the cover board as shown at A. A quantity of sand sufficient to completely cover the pattern is then sifted into the drag, which is then filled level with the top with un-screened sand. This is rammed down slightly with the rammer and then more sand is added until it becomes heaped up as shown at B. It is then rammed again as before.

It is impossible to describe just how hard a mold should be rammed, but by observing the results the beginner can tell when a mold is too hard or too soft and thus judge for himself. If the sand falls out of the flask when lifting the cope, or if it opens



Making a Mold

up or spreads after it is poured, it shows that the mold has been rammed too little, and if the surface of the sand next to the pattern is cracked it shows that the mold has been rammed too hard. It will be found that the edges of the mold can stand a little more ramming than the middle. In finishing the ramming, pound evenly all over the surface with the blunt end of the rammer.

After ramming, scrape off the surplus sand with a straight-edged stick, as shown at C, and scatter about $\frac{1}{8}$ in. of loose sand over the surface for a good bearing. Place another cover board on top, as shown at D, and by grasping with both hands, as shown, turn the drag other side up. Remove the upper cover board and place the upper half of the flask, or "cope," in position, as shown at E.

In order to prevent the two layers of sand sticking together, the surface of the sand at E should be covered with coal dust. This is done by shaking the coal dust bag over the flask, after which the dust on the pattern may be removed by blowing. The cope is then filled with sand and rammed in exactly the same manner as the drag.

After the ramming is done a number of vent holes are made, as shown at F, from the surface of the mold to the pattern, in order to allow the escape of air and steam when the mold is being poured. These vent holes may be made by pushing a wire about the size of a knitting needle down through the sand until it touches the pattern. The "sprue," or pouring-hole, is next cut, by means of the sprue cutter shown at the right, which consists of a piece of thin brass or steel tubing about $\frac{3}{4}$ in. in diameter.

Now comes the critical part of the molding operation—that of lifting the cope from the drag. It is here that the amateur often becomes discouraged, as the sand is liable to fall out of the cope and spoil the mold, but with a little practice and patience the molder

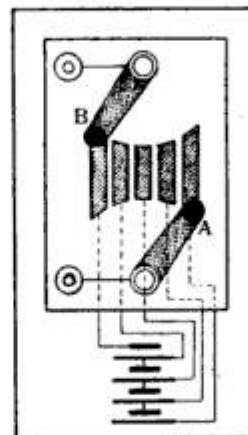
can lift the cope every time without breaking it, as shown at G.

The next operation is that of cutting the gate, which carries the molten metal from the sprue to the opening left by the pattern. This is done with a spoon, a channel being cut about $\frac{3}{4}$ in. wide and about $\frac{1}{4}$ in. deep. The pattern is then drawn from the mold, as shown at H, by driving a sharp-pointed steel rod into the pattern and lifting it from the sand. When a metal pattern is used a thread rod is used, which is screwed into a tapped hole in the pattern. Before drawing it is well to tap the drawing-rod lightly with another larger rod, striking it in all directions and thus loosening the sand slightly from the pattern. Some molders tap the pattern gently when withdrawing, as shown at H, in order to loosen any sand which has a tendency to stick.

After drawing the pattern, place the cope back on the drag, as shown at J. Place a brick or other flat, heavy object on top of the mold above the pattern, to prevent the pressure of the melted metal separating the two halves of the mold, and then pour. The operations of melting and pouring will be described in the next chapter.

Battery Switch

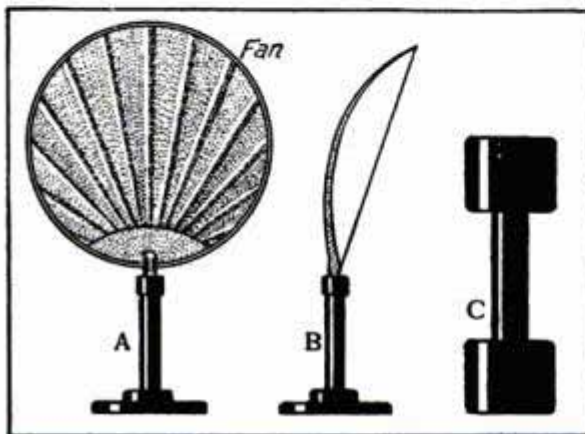
In cases where batteries are used in series and it is desirable to change the strength and direction of the current frequently, the following device will be found most convenient. In my own case I used four batteries, but any reasonable number can be used. Referring to the figure, it will be seen that by moving the switch, A, toward the left the current can be reduced from four batteries to none, and then by moving the switch, B, toward the right the current can be turned on in the opposite direction to the desired



strength. In the various positions of these two switches the current from each individual cell, or from any adjacent pair of cells, may be used in either direction.—Contributed by Harold S. Morton, 3851 Lyndale Ave. North, Minneapolis, Minn.

More Uses for Pipe Fittings

It seems that the number of useful articles that can be made from pipes



Lamp Shade and Dumb Bell Made from Pipe Fittings

and fittings is unlimited. The sketch shows two more that may be added to the list. A and B are front and side views of a lamp screen and C is a dumbbell. The lamp shade is particularly useful for shading the eyes when reading or writing and, if enameled white on the concave side, makes an excellent reflector for drawing at night, or for microscopic work.

The standard and base, which con-

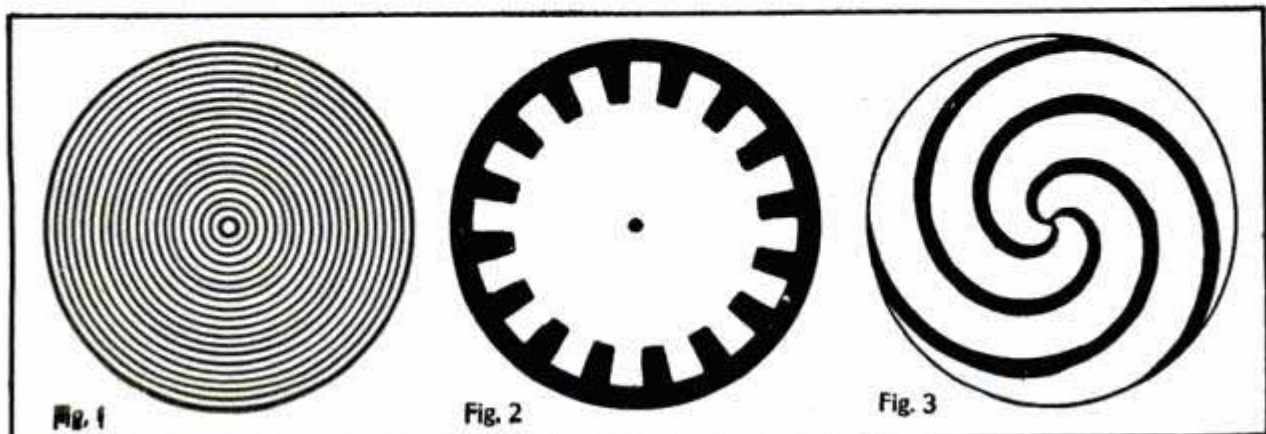
sists of an ordinary pipe flange bushed down to receive the upright nipple, are enameled a jet black, and if the device is to be used on a polished table, a piece of felt should be glued to the bottom. A good way to hold the fan in the nipple consists in using a small wedge.

The dumbbells are made of short pieces of $\frac{3}{4}$ -in. pipe with $1\frac{1}{2}$ -in. couplings fastened to each end by pouring melted lead in the space between the pipes and the couplings. The appearance is greatly improved by enameling black, and if desired the handles may be covered with leather.—Contributed by C. E. Warren, M. D., North Easton, Mass.

Optical Illusions

By giving the page a revolving or rinsing motion the figures appear to rotate. The best effect will be produced by laying the book down flat on the desk or table and revolving, first in one direction and then in the opposite direction, in such a way that any given point on the page will describe a circle of about $\frac{1}{2}$ in. diameter. Fig. 1 then appears to rotate in the same direction as the revolution; Fig. 2 appears to revolve in the opposite direction, and Fig. 3 appears to revolve sometimes in the same direction and at other times in the opposite direction.

A curious effect can be produced with Fig. 1 by covering up Figs. 2 and 3 with a piece of plain paper and laying

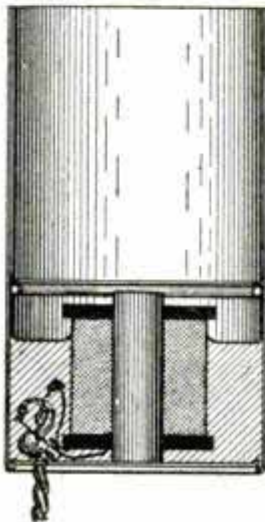


Move Rapidly with a Rinsing Motion

a coin or other small object on the paper. If the vision is then concentrated on the coin or other object while same is being revolved, Fig. 1 will be seen to rotate.

A Home-Made Telephone Receiver

A telephone receiver that will do good work and which may be built very cheaply, can be made as follows: For



the case use an ordinary $\frac{1}{2}$ -lb. baking powder box with a piece of heavy wire soldered on the inside, $1\frac{1}{8}$ in. from the bottom. For the magnet use a piece of round hardened steel about $\frac{3}{8}$ in. in diameter and $1\frac{1}{4}$ in. long. If desired, a piece of an old round file may be used for the magnet

core, which should be magnetized previous to assembling, either by passing a current of electricity around it, or by direct contact with another magnet. The steel core should be wound with about 250 ft. of No. 36 insulated wire, the ends of which should be soldered to a piece of lamp cord, passed through a hole in the bottom of the can and knotted inside to prevent pulling out.

A disc of thin sheet-iron, such as is used by photographers for tintypes (Ferrotypes), should be cut to the diameter of the can, taking care not to bend the iron. The magnet should then be placed in the bottom of the can in an upright position and enough of a melted mixture of beeswax and resin poured in to hold it in position.

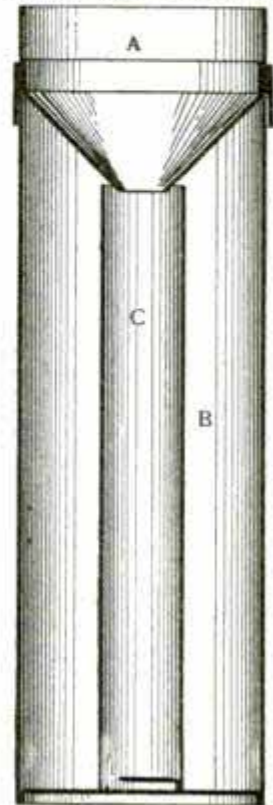
While the wax is still in a plastic condition the magnet should be located centrally and adjusted so that the end will be $\frac{1}{8}$ in. or less below the level of the top of the copper ring.

After the wax has hardened the disc is slipped in and fastened tightly by a ring of solder when the instrument is ready for use

How to Make a Rain Gauge

An accurate rain gauge may be easily constructed from galvanized iron, as shown in the sketch herewith.

The funnel, A, overlaps and rests on the body, B, and discharges into the tube, C, the area of which is $\frac{1}{10}$ that of the top of the funnel. The depth of the water in C is thus ten times the actual rainfall, so that by measuring it with a stick marked off in tenths of an inch, we obtain the result in hundredths of an inch.



A good size to make the rain gauge is as follows: A, 8 in. diameter; C, $2\frac{53}{100}$ in.; length of C, about 20 in. It should be placed in an exposed location, so that no inaccuracy will occur from wind currents. To find the fall of snow, pour a known quantity of warm water on the snow contained in the funnel and deduct the quantity poured in from the total amount in the tube.—Contributed by Thurston Hendrickson, Long Branch, N. J.

An experienced photographer uses blacklead for grooves about a camera or holder. A small quantity is rubbed well into the grooves and on the edges of shutters that refuse to slide easily with gratifying results. Care must be taken to allow no dust to settle in the holders, however.

The Colorado river broke its banks again December 9 and the Salton sea is rising once more, reminding one of Mulligan's "off again; on again; off again."

REBUILDING THE PALACE HOTEL, SAN FRANCISCO

Remarkable Construction that Refuses to Fall Down

The Palace Hotel, San Francisco, was as well known as the city. It was 300 ft. by 225 ft., seven stories high and a noble type of the architecture of its time—1870.

Fig. 1 shows how it looked after the quake and fire. It is now being torn down, the contractors receiving \$30,000 for the work and all salvage, estimated to be worth, at least, \$20,000 more.

The building was perhaps the most solid construction in the city. The brick were laid in a mortar composed of lime and cement, with strips of Norway iron and steel cables at frequent intervals. This mortar is too hard to be scraped by the brick cleaning machines. The supports included 100 pillars weighing 7 tons each.



"Palace" Partly Down

After being cracked with dynamite sections of the walls are pulled down by big hoisting engines and 1½-in. steel cables exerting a pull equal to the



The "Palace" After Quake and Fire

strength of 10,000 men. Even then the strips of wall remain unbroken on the ground and require picks and sledges to loosen the bricks. There are 10,000,000 brick in the building and the debris will fill 80,000 wagons.

Laborers digging below the surface of the sidewalk are frequently compelled to desist because of fires which are uncovered. In many places a combination of wood, plaster and mortar had formed a sort of charcoal, which, secluded from the air by piles of debris, has been smouldering ever since the fire—the 18th of last April. Boiling water and steam is often found in these pent up places. The very sand seems to pulse and throb with heat, and the crowds of laborers have to be on the constant lookout to avoid being burned or scalded.

Green wood is a fairly good conductor of electricity; heated and dried it becomes an insulator; baked to charcoal it becomes a good conductor, and burned to charcoal it becomes an insulator again.

Specify These Brands

Don't select your ROOFING TIN on hear-say. Specify the weight of coating as well as the Brand when you're ready to select your roof covering, and you'll get exactly what you pay for; while the life of the roof will depend largely upon the selection you make. Our brands are enumerated below.

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AAAAA
40 POUNDS COATING

32 POUNDS COATING

AMERICAN OLD STYLE
AAAA
35 POUNDS COATING

AMERICAN
NUMETHODD
B
40 POUNDS COATING

First specify,
then watch
for these Brands
and you're sure
to get exactly
what you order

AMERICAN
NUMETHODD
D
30 POUNDS COATING

AMERICAN OLD STYLE
AAA
30 POUNDS COATING

AMERICAN OLD STYLE
AA
25 POUNDS COATING

AMERICAN
SPECIAL
15 POUNDS COATING

AMERICAN OLD STYLE
A
20 POUNDS COATING

AMERICAN
EXTRA
12 POUNDS COATING

AMERICAN
IC
8 POUNDS COATING

AMERICAN
NUMETHODD
F
20 POUNDS COATING

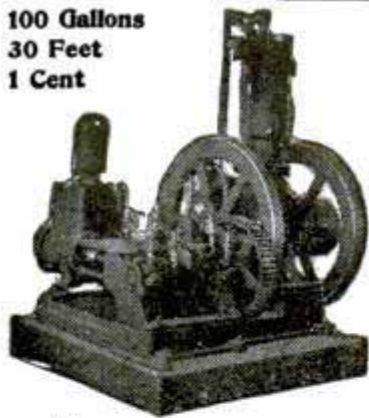
AMERICAN
IX
8 POUNDS COATING

American Sheet & Tin Plate Company,

FRICK BUILDING,

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100 Gallons
30 Feet
1 Cent



Fairbanks-Morse Domestic Water Supply

Provides all the conveniences of city water works at moderate cost.

Gas, Gasoline or Kerosene Engines for all purposes from 2 h. p. up.

Cut out complete advertisement and send to

Fairbanks, Morse & Co.
Monroe Street, Chicago, Ill.

Please send me Illustrated Catalogue No. W 449 Gasoline Engines.

I may want.....h. p. to.....

Name..... Street No.....
Town..... State.....

DUTIES OF A LOCOMOTIVE ENGINEER.—Michael Dean, for twenty years an engineer, tells of his duties in Railroad Men. He says:

Our time card shows twenty superior class trains that we have to keep clear of. To do this with an eighty-five car train requires good judgment and close figuring of time, as well as thorough familiarity with your engine and the grades of the division.

Now, to give an idea of some of the troubles that an engineer has to contend with: On a recent trip with sixty-five loaded cars, I received a message from the trainmaster asking the cause of slow time I was making, and this was my reply: "Heavy train, heavy head wind, nursing a hot driving box, engine foaming, and a green fireman." So you see I had my troubles that trip.

An aggravating thing the engineer has to contend with is the fool who insists on staying on the track until the bunter beam almost touches him and then steps off and gives you a friendly grin. It is very trying on an engineer's nerve, for the time being, when an accident occurs that takes a human life. One of our old engineers on this division has had seventeen fatal accidents, while I have never, in twenty-seven years of active service as fireman and engineer, injured either passenger or fellow-employee to any appreciable extent.

I was placed in a very trying position one night while hauling the Knickerbocker Special east (the Knickerbocker is the fastest train on the road), while approaching a station at the foot of a steep grade, around a curve, the station being a regular stop for the train. In shutting off steam preparatory to making the stop I discovered that my throttle lever had become disconnected from the throttle valve, thereby leaving me helpless to shut off steam as far as the throttle was concerned. There I was going sixty miles per hour, eight coaches of passengers, and obliged to make a regular station stop with probably a red block less than a mile ahead. Something had to be done, and done quickly. I pulled the reverse lever on center and stalled her down with the air brakes. When I got the train stopped I found I had made a fairly good station stop. I then hastily examined the defective throttle, found the trouble was inside the boiler where it could not be remedied without serious delay. When the station work was done and I got the "all right" signal from the conductor, with the assistance of my fireman, I forced the reverse lever in the forward motion and ran to the terminal, twenty-three miles, on time. The only delay in getting to the roundhouse was caused by waiting for an-

other engine to couple on ahead of mine before cutting loose from the train, to help hold her when released. The last ten miles to the terminal was up a heavy grade, which was, of course, in my favor, and by reducing the boiler pressure it was easy to make the terminal stop.

TELEPHONE IN CACTUS CENTER.

There's a telephone in Cactus—it's a new, long talk machine.
And the girl who operates it is a reg'lar fairy queen;
The comp'ny sent her in here fer to run the thing in style.
And she's got the cowboys locoed, clear from here to Forty Mile.

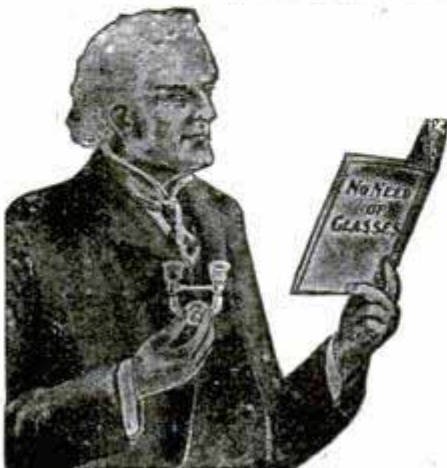
She wears a janglin' bracelet, and a rollin' mass of hair
And when good looks was passeled she was handed out her share;
She sets there in her glory, in her awe-inspirin' togs,
And she knows that she's the ruler in this land of prairie dogs.

The boys they come a-ridin' from the corners of the range,
And they moon around in Cactus, and they're actin' mighty strange;
They have cut out cyards and drinkin', and they make a plum mean fuss,
If a puncher who's forgitful rips a loud, resoundin' cuss.

They flock up to the office, and they spend their hard-earned dough,
A phonin' off to cities where there ain't no folks they know;
It's money fer the comp'ny, but it breaks the boys like sin,
For, unlike their gamblin' pastimes, there is nary chance to win.

So, unless the girl flits eastward, there'll be trouble here this fall,
For the roundup season's comin', and we can't get help at all;
It's Hades, ain't it, pardner, when one woman, in her pride,
Gits a county full of cowboys roped and throwed, and then hog-tied!

—Denver Republican.



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Improved
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for a genuine Edison phonograph, equipped with Mr. Edison's best reproducer—the model C—the identical new style copper diaphragm reproducer used on the highest priced Edison outfits!

\$10.00 for an instrument that plays the perfect Edison gold moulded records — the identical records used on all the highest priced Edison phonographs.

\$17.50 for the beautiful Edison outfit No. 1, equipped with a great, fine flower horn, an outfit that we can surely recommend in every way.

\$27.50 —only \$27.50—for the magnificent outfit No. 5, as illustrated above—the leader of all our outfits. Far, far superior to other talking machine outfits sold at three and four times the above price—only \$27.50 and you have the best, the very best.

\$2.00 a Month

and upwards now pays for a genuine 1907 Model Edison outfit — and THE ROCK-BOTTOM PRICE without even interest on payments. — Not a cent in advance.

For Cash in Full: Many persons pay cash for purchases are getting the Edison Phonograph on free trial, and then offer to send cash in full with some discount for cash. We must repeat our announcement that the rock-bottom figures make it impossible to allow any additional discount for cash.

Get the Machine on Free Trial anyway. Later you can decide whether you want to send cash in full or take advantage of our easy terms.

The trial must convince you that the Edison is the very highest attainment in the phonograph — unequalled in volume, clearness and evenness; unapproached in sweetness and accuracy.

Mr. Edison has protected by patents every device that was worth while, so that the Edison stands today unapproached by any in perfection.

Thomas A Edison

Free Trial

To prove the superiority of Mr. Edison's own machine, with its new copper diaphragm reproducer, the high speed, hard wax, gold moulded records, and beautiful new flower horn, we will ship any responsible party your choice of an outfit on trial without deposit of any kind. Returnable at our expense. If satisfactory—if more than satisfactory after trial at your own home, remit cash in full, or a small first payment and the balance on monthly terms, just as the purchaser prefers.

Catalogue
on request

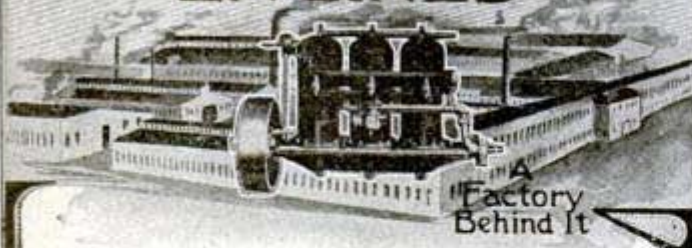
Sign this coupon and get the Edison catalogs of outfits, the catalog of 1500 Edison gold moulded records, and the great circular of our outfit No. 5, all without charge, prepaid. A letter is not necessary, just sign the coupon and mail in an envelope. An early response is specially solicited.

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149-150 Michigan Avenue, Suite 1262, Chicago**
Without any obligation on me, please send me free, prepaid, your catalog of Edison phonographs, your free circulars of the great outfit No. 5 and terms of payment.

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Perfection attained. One practical reason back of so strong a claim is this:

Fourteen different engines of recognized reputation—twelve made in America, two from abroad—were installed and kept running in our experimental department constantly for ten months, under the eyes of experts of known ability.

The best features of each of the fourteen engines are found in our new construction. Every weak point has been kept **FERRO** Auto-Marine Engines out of the FERRO of 1907.

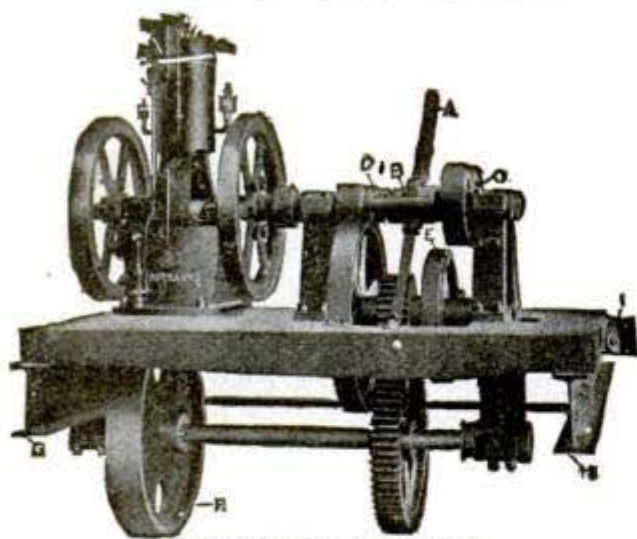
Our catalog will prove to any prospective purchaser that our engine is superior to any other engine made. For your personal interest consult the standard of perfection we have established.

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FAIRBANKS GAS ENGINES



TURNTABLE OUTFIT

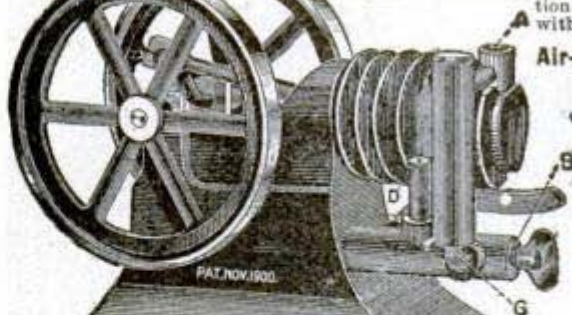
use manufactured, natural or producer gas, gasoline, alcohol, or distillate as fuel; there are six distinct types ranging from 1 to 100 H. P., including stationary, portable and marine, of both two and four cycle. We send experts to make direct connections of these engines to pumps, compressors, generators, hoists, etc. We are also headquarters for Scales, Trucks, Transmission, Valves, Railroad, Factory and Mill Supplies, Machine Tools, etc. Write us for catalog.

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- Hamburg; London; Paris.

PARADOX GAS ENGINE

A Toy Engine run by illuminating gas. Attach the engine by rubber tube to an ordinary gas burner, and light gas. Costs less than 5c a day for gas. It runs with an explosion at each revolution. Will not run with natural gas.



Air-cooled Motor
Price, complete, \$2.50
Delivered, prepaid, \$3.00
Send for Circular

PARADOX GAS ENGINE CO. 102 Asylum St. Hartford, Ct.

CHIPS FROM THE WOOD-WORKER.—The following are from that excellent publication, the Wood-Worker:

As to wheels in the head—well, maybe a fellow had better have wheels than a vacant place.

Gumption, grit and go are three good elements that most any man can acquire if he will only strive hard enough and long enough.

Do you ever stop to think that a belt as well as a pulley may be out of balance, and in consequence not do as smooth work as it should.

Many a good job of wood work is spoiled by a poor job of varnish. Wonder how many jobs of poor wood work have been saved by good varnish?

We all believe in and indirectly practice profit-sharing in a way, but the trouble is we can't always agree on what share of the profits of the business each should have.

The amount of stuff you get through a planer is one thing, and the way it looks when you get through is another, and frequently a more important consideration, than the first.

There is a difference of opinion as to whether two or more knives on a head can be made to cut. There is probably also a difference which comes from the man and manner of setting, too.

Yes, a foreman should use his brains more than his feet, but he should not sit around too much while doing it. In other words, it is a good thing to keep both feet, hands and brains in training.

When a salesman strives to sell you either machinery or supplies by offering some kind of graft, take it for granted that there is something wrong either with the salesman, if not with the stuff he has to sell.

Sometimes a foreman gets bossy around the engine room just to show that he can, and at other times because an incompetent engineer makes it necessary. In the latter case it might be a good idea to change the tactics and get a new engineer.

There is still room for argument in favor of "face up" and "face down," but we all agree that the important thing is to have the face properly finished no matter which way it is done. That's what the buyer looks at—the finish. He does not inquire whether it is done "up" or "down," just so it's done right.

MADE FIREWOOD OF \$1,000 TREE.—Walnut at present is almost inprocurable. Manufacturers are even sending out representatives to buy up old walnut fence rails, and are paying good prices for them, too. Many walnut trees now standing would bring \$800 and \$1,000 apiece from the right parties. This state of affairs has been widely published, and yet there seems to have been one farmer who never heard of it. He appeared in Leavenworth, Kansas, not long ago with two loads of firewood and said he had several loads more, having cut them all from a single walnut tree. He sold the fuel at \$4.50 a cord!!!

INVESTING BRAINS.—Many a man stands around telling what he would do if he had capital, when a little brain power properly applied would bring him the much desired results. The best way to interest capital is to demonstrate surpassing ability in one's chosen line.

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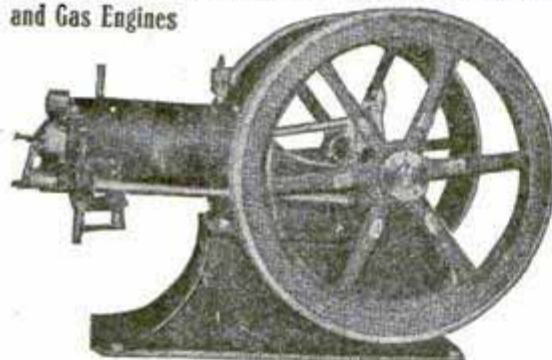
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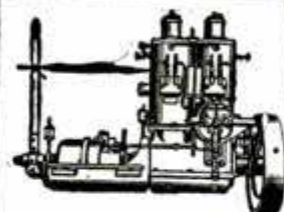
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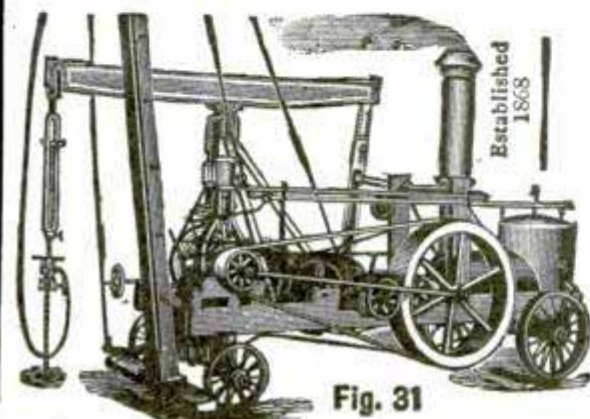


Fig. 31

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Tell us about the formations, depth, diameter holes; will send printed matter and can save you money.

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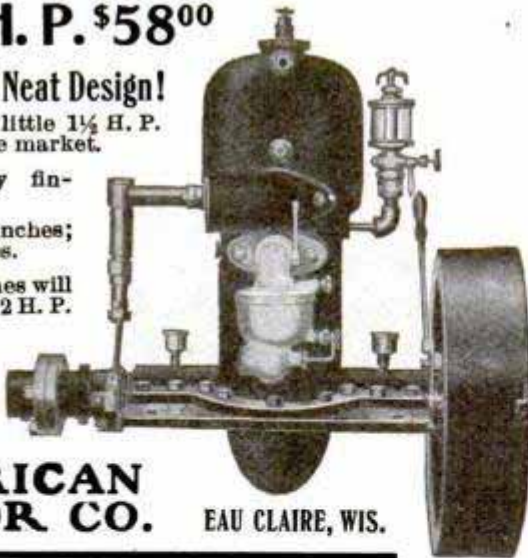
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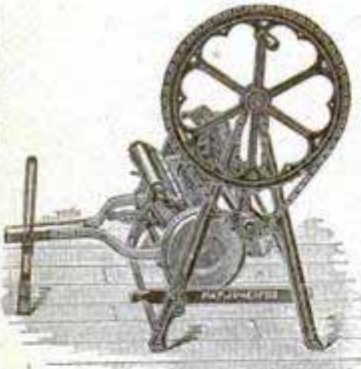
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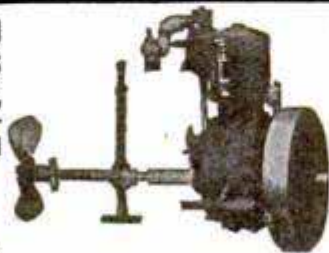
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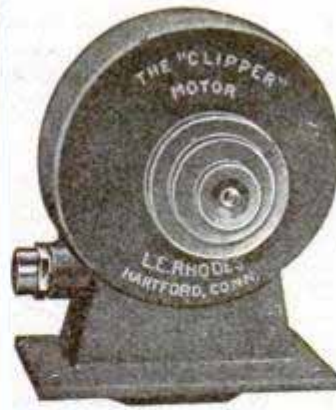
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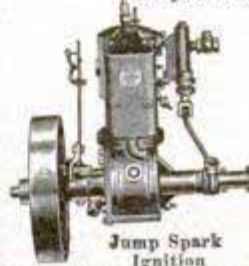
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HE GOT A REPLY.—Several years ago a country dealer, by the name of Parsons, came to the city to buy from a wholesale firm a bill of goods for his country store. After coming down-stairs and while waiting for his goods to be packed, he noticed several men using a speaking tube.

After a while his curiosity got the better of him and he asked the proprietor what the thing was. "A speaking tube," said the proprietor. "Speak to someone upstairs and see how it works."

"What will I say?" queried the dealer, going over to the tube.

"Oh, say anything you like," replied the proprietor.

"Hey!" shouted the dealer. "Are the goods Mr. Parsons, of Williamsville, ordered, ready?"

"Yes," was the response from upstairs, "the goods are ready, but we are looking the old skinflint up. We think he is kind of shaky."

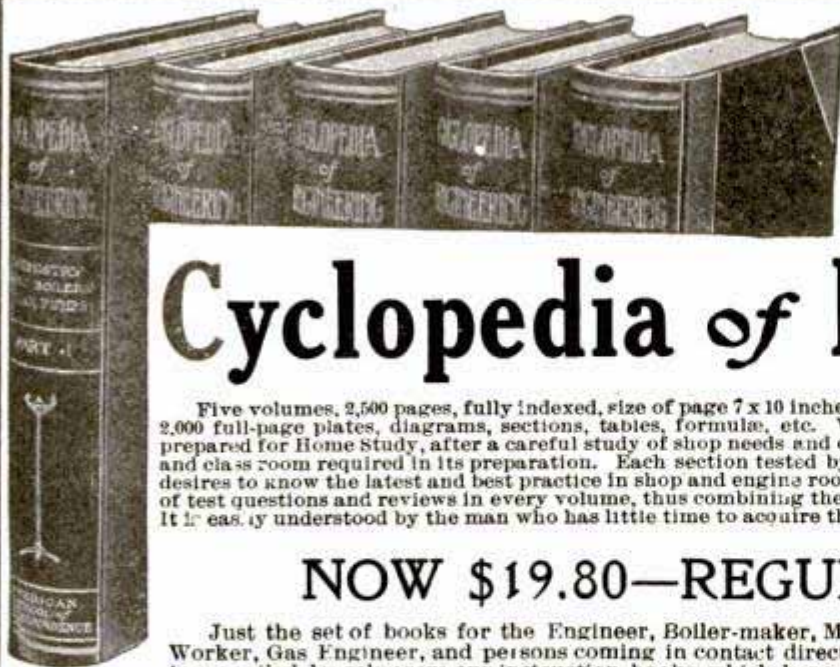
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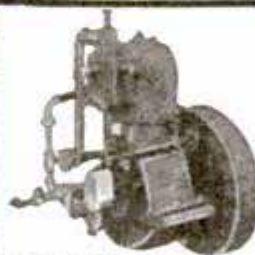


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Shipped crated.
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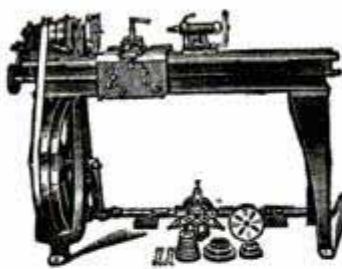


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By R. E. Marks, in Railway and Locomotive Engineering.

There was a new superintendent on the Cross Cut & Pumpkin Valley Railroad, who was long on a liking for things scientific, reports of tests, college bred engineers and other things, but he was somewhat shy on good practical experience in actual railroad work. His aunt's husband on his mother's side was a big stockholder, and so such a little thing as lack of experience didn't stand in the way of his selection for the place.

One of his first visits to old man Johnson's division brought him the painful discovery that not an engine on the road was even drilled for an indicator, much less had cards been taken at regular intervals to study the steam distribution. So he turned some of his young college friends loose on the job, and three of the engines were forthwith prepared for an exhibition of what an engine really ought to be. Johnson kept tabs on the cost of the changes, but wisely kept this to himself.

Of course they found the engines all wrong, valves didn't have enough lap, quadrant didn't have notches thick enough to graduate the cut-off to six decimal places, valve wasn't of the best type, and the cards looked like anything but a Corliss indicator diagram. Too much oil was being used according to the best practice of the Great Air Line and, in fact, pretty much everything seemed to be going straight to the bad. After they had the engines down fine they prepared for the great tests with seventeen students to check every exhaust, watch for signs of smoke, count the shovels full of coal to the mile, and measure out the oil with an eye dropper. Then came the report. And that wasn't all, either, for the super (most forgot to say his name was Smart) had been gathering in a good sized bundle of reports from all over the country on the results obtained from modern roads where men were not tied down to old traditions, etc., etc.

(Continued on page 264.)

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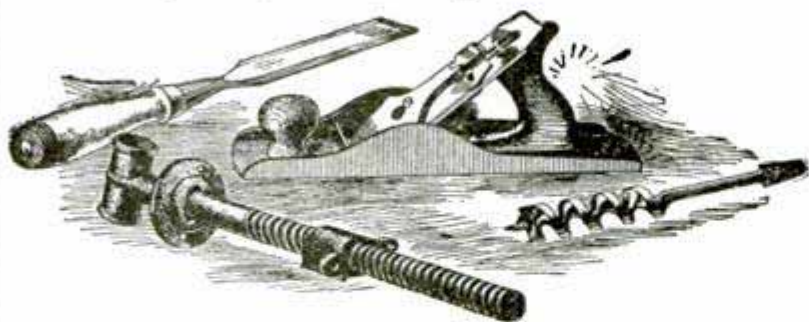
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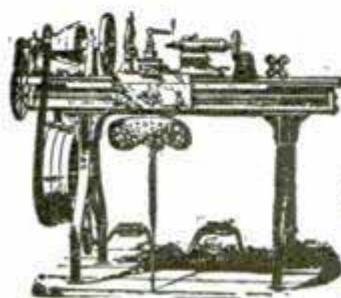


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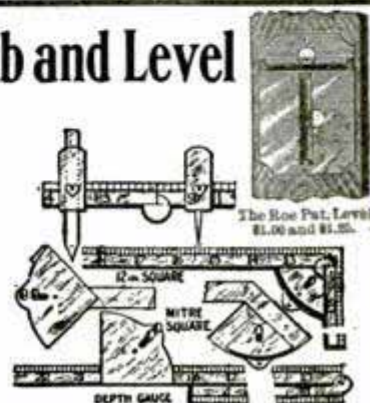
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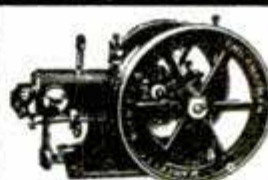
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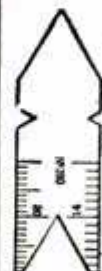
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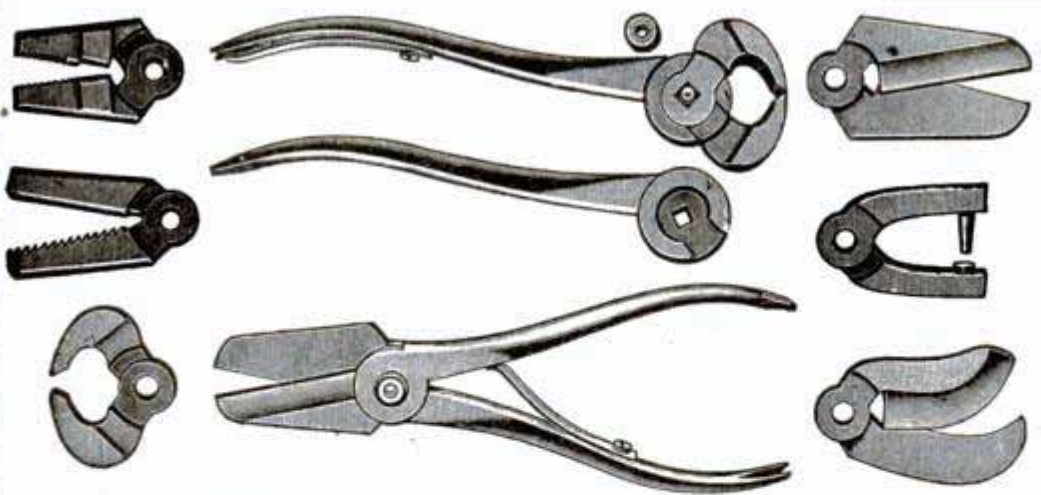
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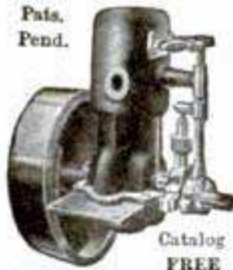
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SOLD UNDER 5 YEAR GUARANTEE.

St. Clair Motor Co., Dept. 34 Detroit, Mich.

(Continued from page 262.)

Then came the day of reckoning, and Johnson caught it in the solar plexus. Smart called him into a directors' meeting and proceeded to show them the reasons for their road not being a through trunk line and the way to get into that enviable condition.

"Mr. Johnson, we are trying to discover the weak points in the motive power department, and, as you know, have had a few tests made from some of our engines to determine the reasons for the lack of economy in fuel consumption, in oil and in other things. I also have here other tests, from other roads, showing a much greater economy than we are showing, as well as one from the Jigger Valve Gear and the Back Action Valve which you refused to try. I trust that you will be able to explain your position in the face of these facts, as we are very anxious to retain all our old men if they will assist in bringing about a new order of things that make for the betterment of the road.

"Now here are the tests from engines numbers 16 and 20, after changing so as to make a proper card, and compared with the same engines before the change. They are now hauling 23 cars up the hill against 20 before the change, and burning less fuel by 5% per cent. Can you explain that, Mr. Johnson?"

Then it was Johnson's inning.
"Perhaps not to your satisfaction, Mr. Smart, but the gentlemen here may see a streak of light in a few remarks I feel called upon to make. You forgot to tell them that engines 16 and 20 were here; tires in bad shape, cylinders wanting boring,

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Something Altogether New All progressive and up-to-date Mechanics, Machinists, Carpenters, Bricklayers, Masons, Plumbers, Millwrights, Road Supervisors, Track Foremen, Surveyors, Architects, Civil Engineers and others will find this an INDISPENSABLE INVENTION. A CIVIL ENGINEER THAT YOU MAY HAVE WITH YOU AT ALL TIMES.

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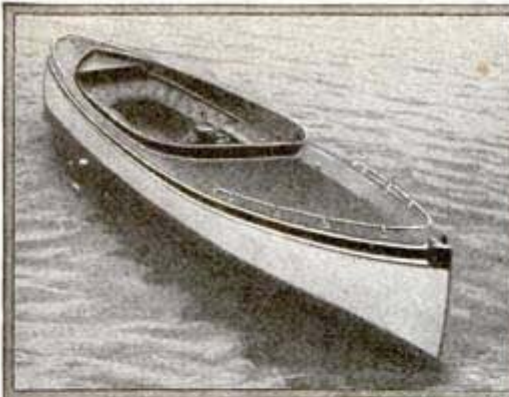
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(Continued on page 266.)

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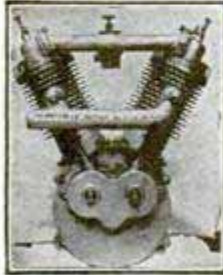
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(Continued from page 265.)

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"Then there's the anti-friction back action valve. Fine thing for the maker, and looks as though it ought to work out all right, but it don't. Our neighbors on the Q. T. & X. have some of them and they are lucky if they run three days without facing. Sounds like a fairy story, and I wouldn't dare say this if I hadn't been over there and seen them doing it. Got the facts from the foreman. Sometimes get more facts there than you do of the master mechanic or even higher up.

"If you want my job for some of your notebook fiends with the indicator bug in their heads, it's yours any time, but if the gentlemen here want dividends, that's another matter. Reports are fine things when they tell the whole truth, and that's what mighty few of them ever do. Don't intend to deceive in all cases, but there's mighty few of them that don't wander over the line of naked truth, unintentionally. Reports made with everything doctored up especially for the occasion are of no earthly use to the directors of this or any other road. All of these roads that Mr. Smart has cited are paying more than we are for the hauling of their freight. Their annual reports show this. Some of them are paying as high as \$3,000 an engine more than we pay for the same capacity for the sake of a few frills and trimming that will make pretty indicator cards, but it's been my experience that indicator cards don't pull trains over the road for a cent. I don't care what the cards from my engine look like, or whether they will even make a card if they are hauling coal over

(Concluded on page 268.)

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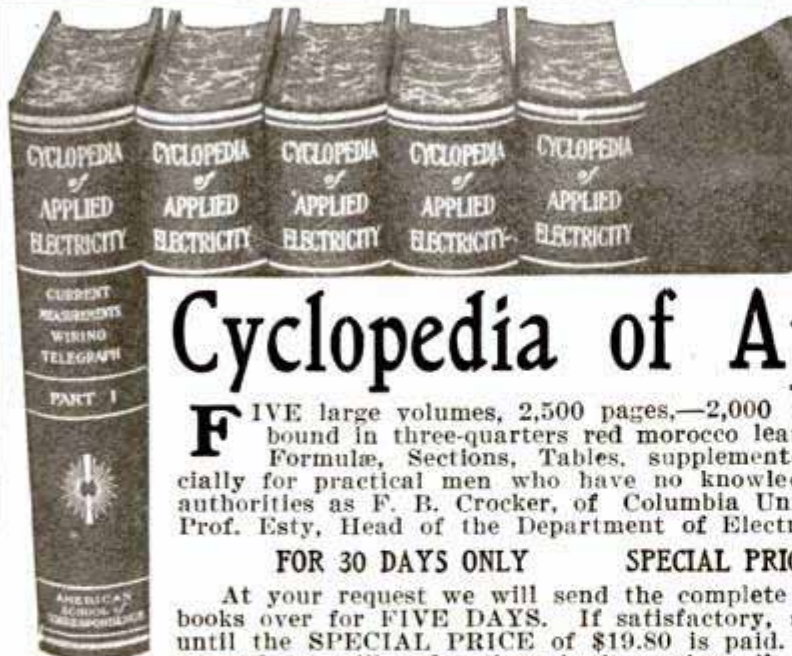


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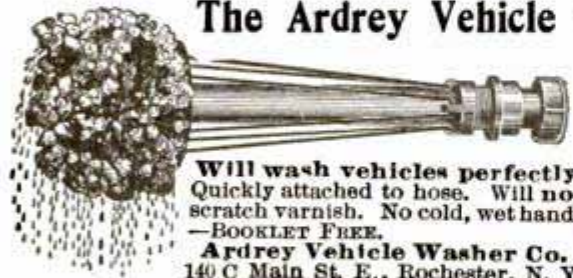
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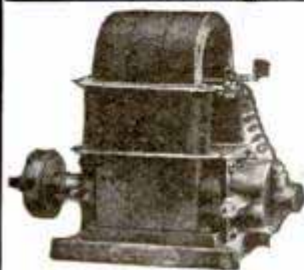
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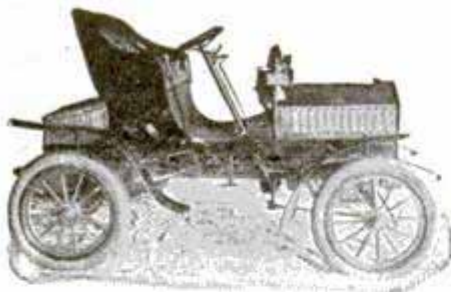
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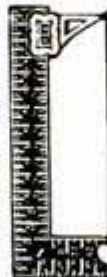


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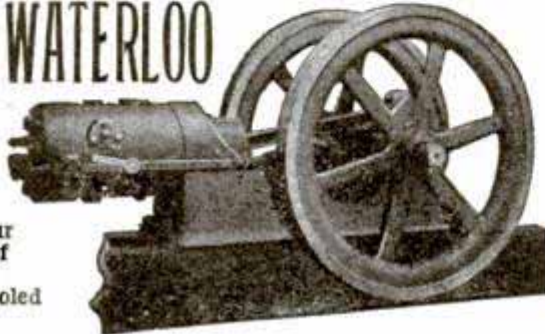
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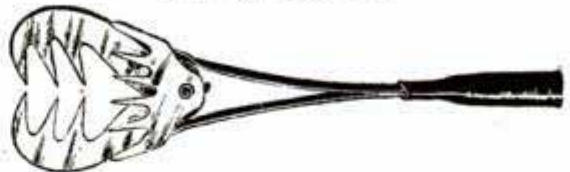
the road at less cost than the other fellow is doing it. They can use double the oil, use more coal if necessary, but what interests me is the total cost of getting that train over the road. This means cost of repairs, number of hours' delay and getting there on time, as well as coal and oil.

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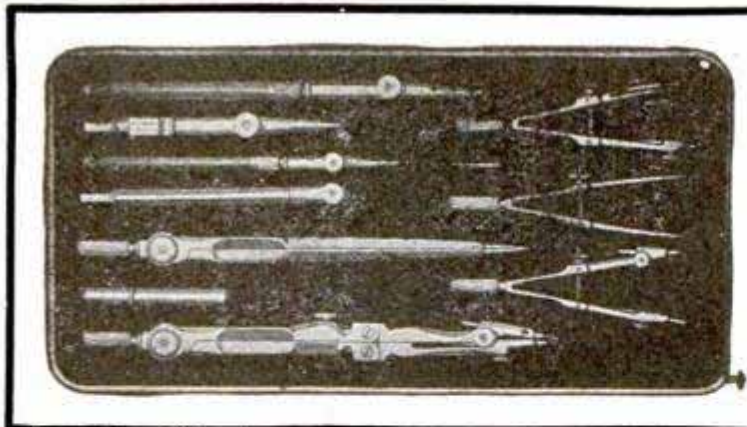
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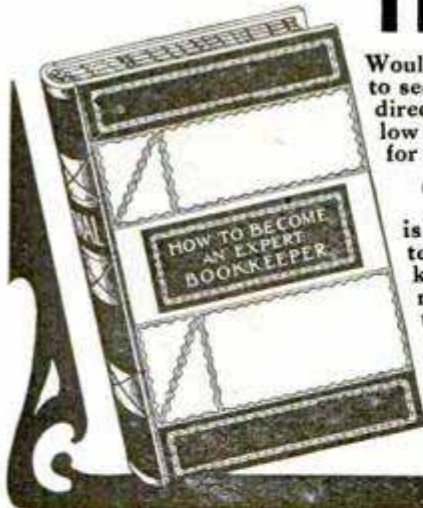
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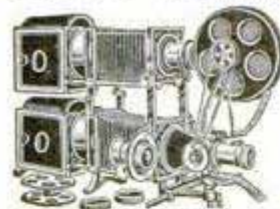


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BOYS WILL BE BOYS.—Two special apprentices being sent down the line, employed a few minutes of excess time at an eating station by strolling up ahead to "look her over." After regarding their inspection a few moments the engineer leaned out and said:

"Well! Do you think you'll buy her?"

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"Say! Mister. Is it hard to run an engine?"

And by the time the engineer reached the crank pin and found it cold as ice, the grinning young devils were safely out of reach.—*Railway Review.*

NEW ANESTHETIC.—According to a Birmingham newspaper, quoted by Consul F. W. Mahin, a new drug, called stovaine, has come into use in England and abroad, to prevent pain in surgical operations. It does not produce unconsciousness. A patient who has nerves strong enough can watch a surgeon operate while under its influence. Stovaine is injected into the lumbar region of the spinal canal and acts on the roots of the nerves entering the spinal cord. The injection produces a certain amount of shock, as well as occasional sickness and headache. How long the effect of this anesthetic will last is not stated, nor whether further injections may be made during an operation. Presumably, the duration of the effect is not great, and only one injection is deemed prudent, for a recent instance is noted of a surgeon speeding an operation to the safety limit in order to outstrip the recovering nerves.

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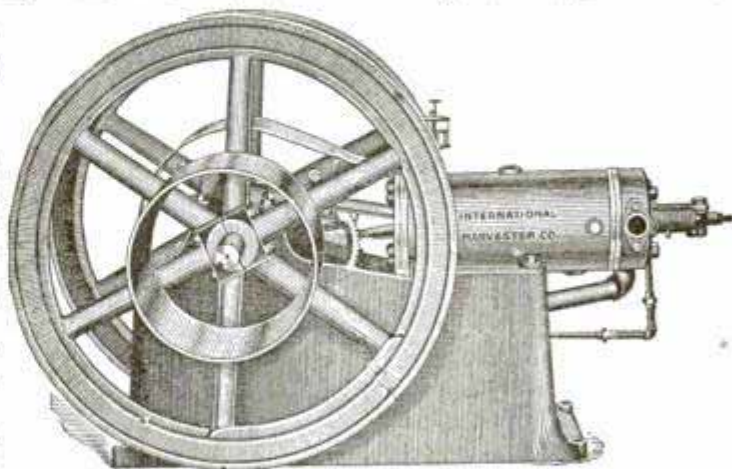
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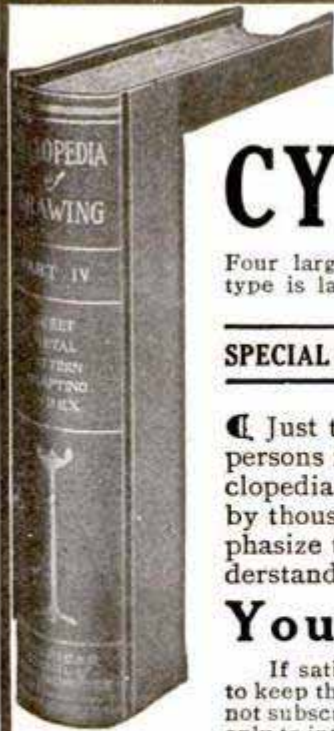
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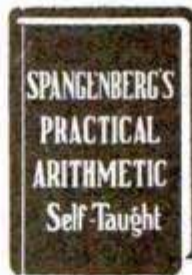
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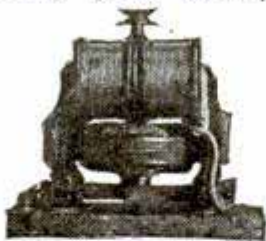
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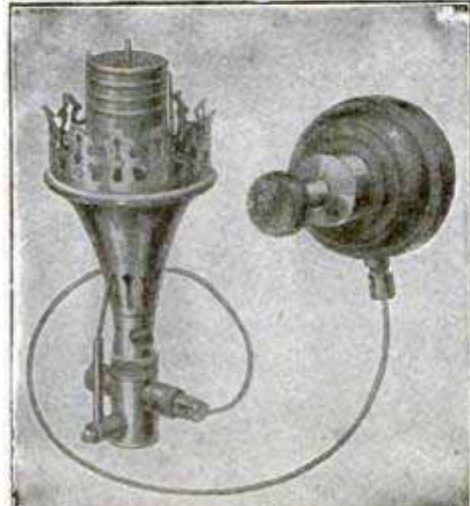
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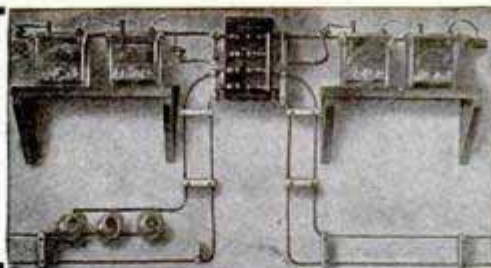
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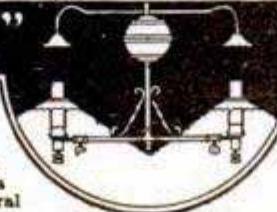
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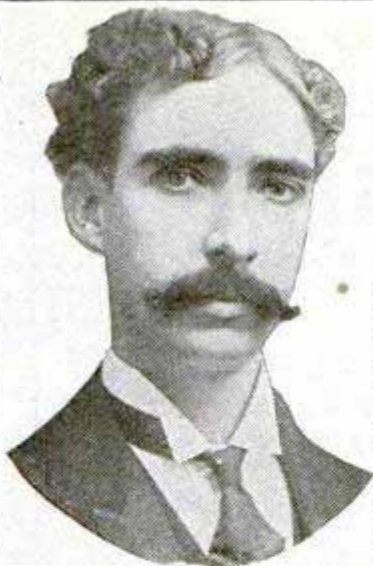
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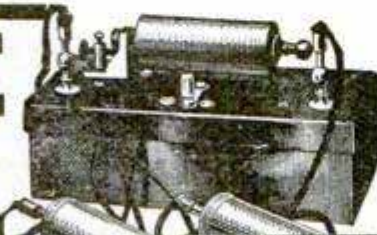
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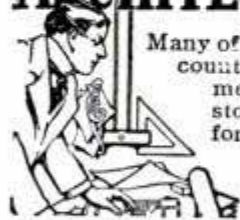
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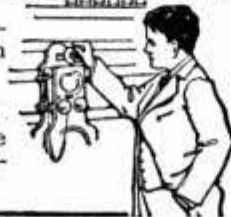
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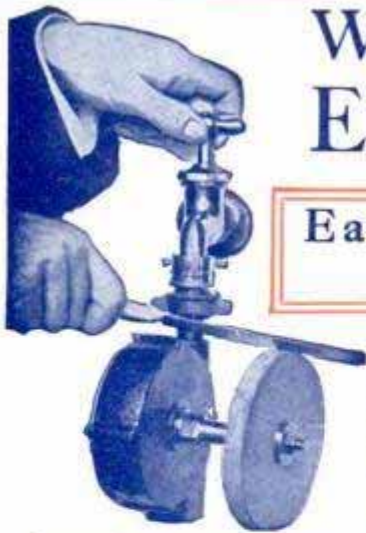
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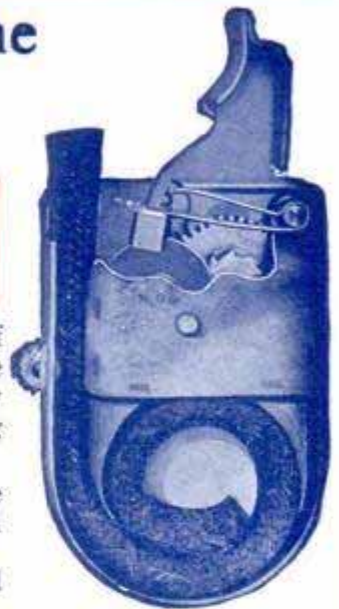


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