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VOL. VIII. NO. 10

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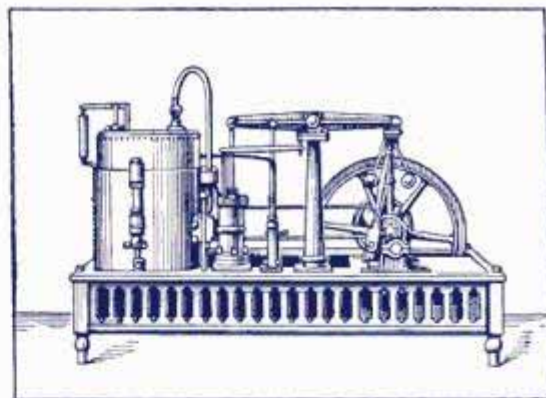
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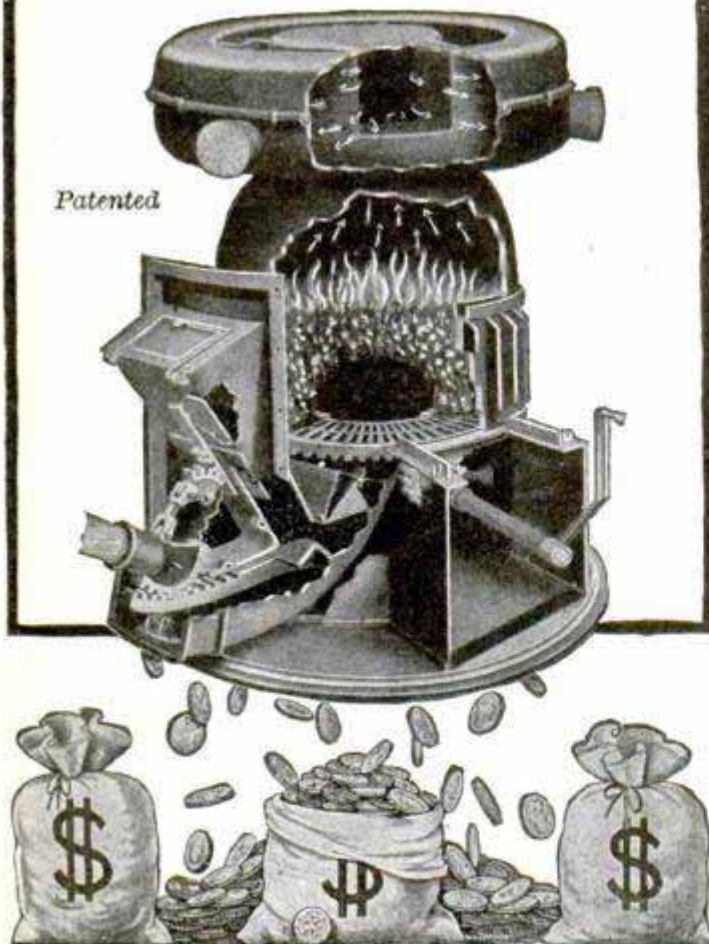
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Illustration shows furnace without casing, cut out to show how coal is forced up under fire.

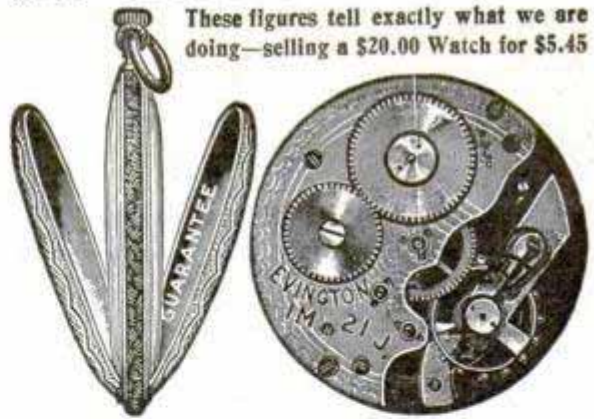
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Mr. Dealer, Write for our Proposition of Profit to YOU.



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WING PIANOS are made in our own large factory—of choice materials throughout, by very experienced workmen. This explains their great durability.

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Wing
Piano**

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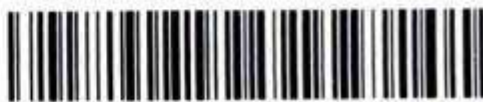
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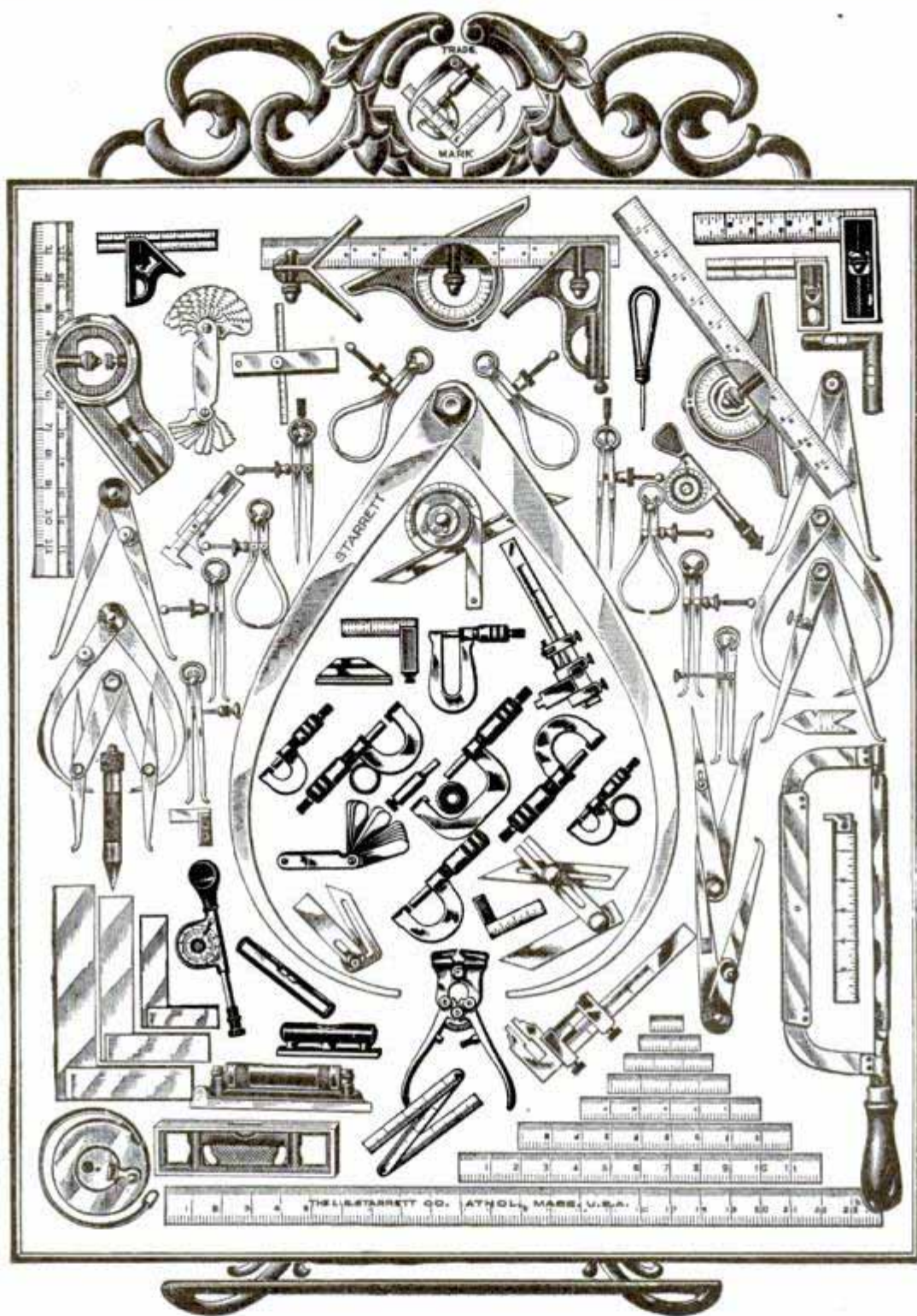
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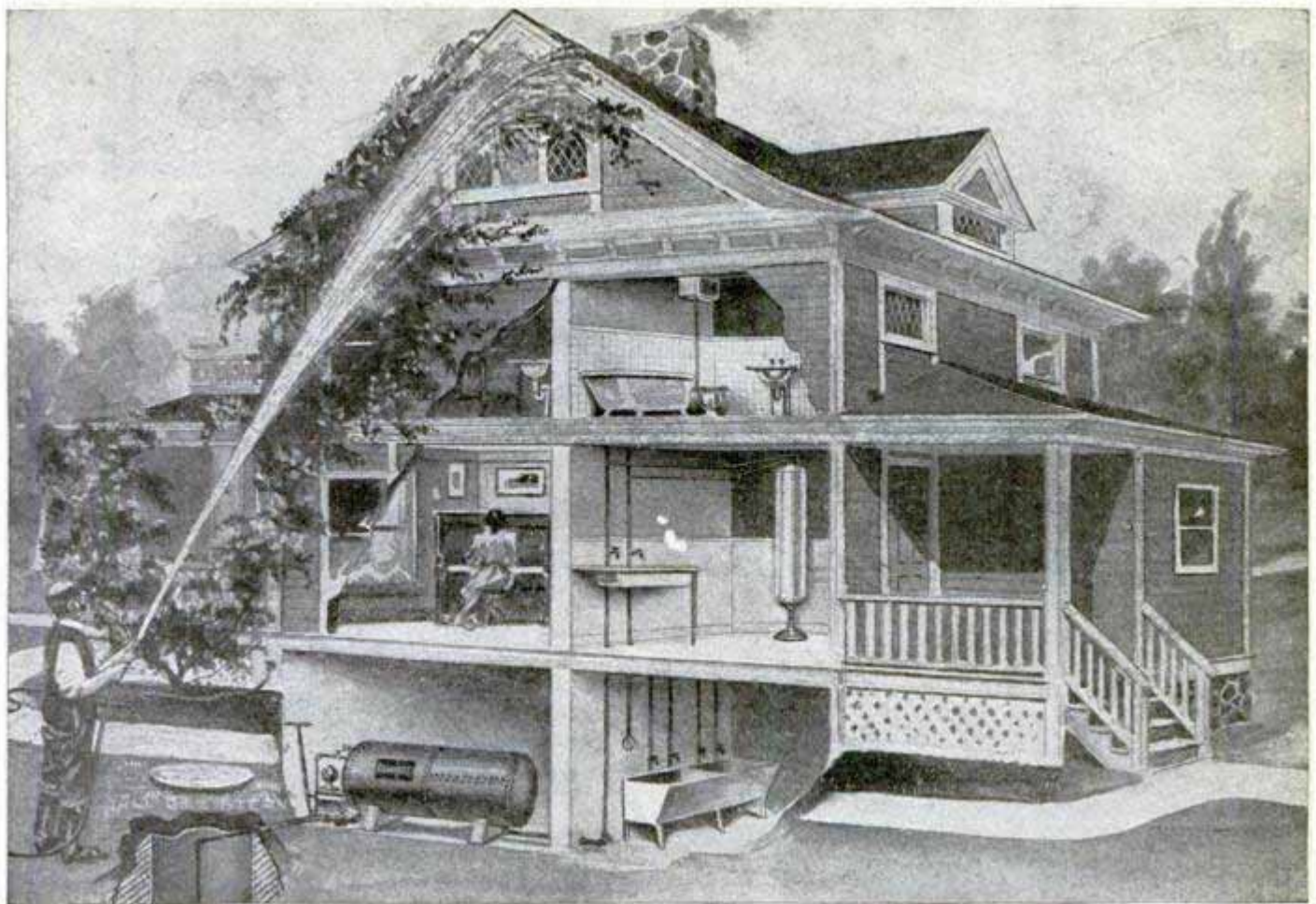




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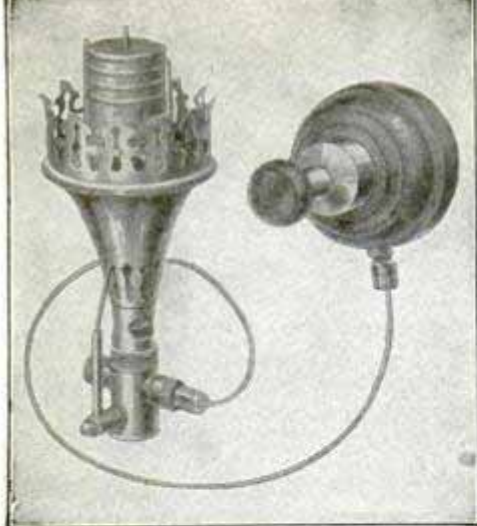
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Every sea-going vessel is compelled to carry a tested and proven accurate chronometer. This chronometer, which often costs thousands of dollars, is under the watchful care of the officer responsible for the navigation of the ship. No one but he is allowed access to it. He guards it against every change of atmosphere and temperature, all jars, and jolts — everything that could possibly affect its time-keeping qualities, for upon its accuracy safety largely depends. Without it, locating the position of the ship would be impossible and disaster almost certain.

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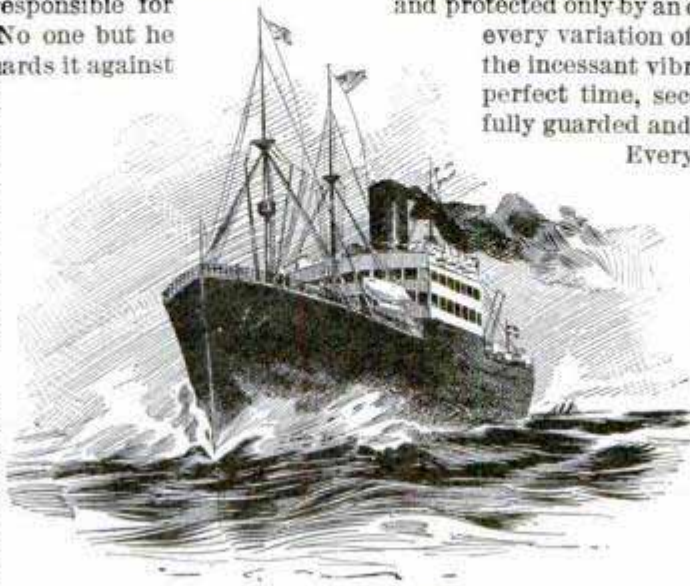
Fahrenheit, and kept for hours in a refrigerator below freezing point.

South Bend Watches carried upon long sea voyages and protected only by an ordinary watch case, exposed to every variation of position and temperature and the incessant vibration and roll of the ship keep perfect time, second for second, with the carefully guarded and accurate ship's chronometer.

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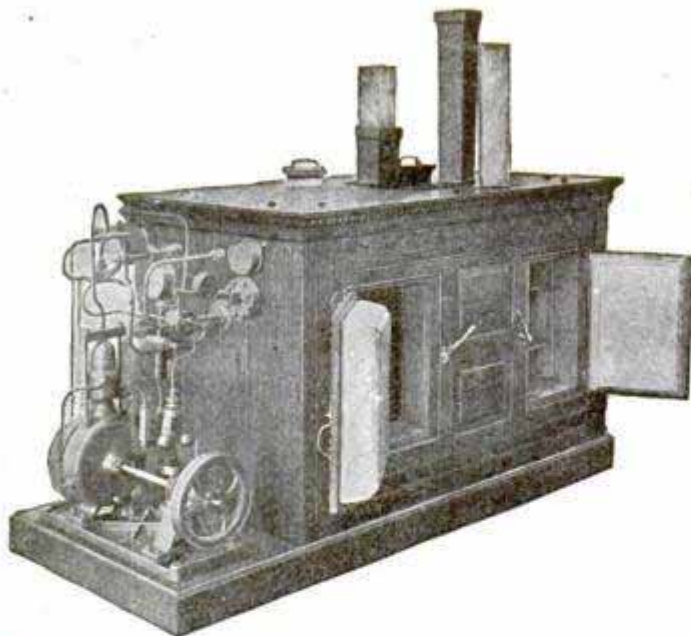
If perfectly satisfied, pay to the express agent one-fifth of the price and remit the balance to us in eight equal monthly payments. We pay all transportation charges. Every diamond is guaranteed and is exchangeable at full price for more expensive goods. Bank references upon request. Ask for Catalogue No. 3

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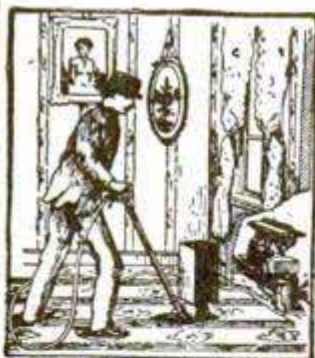
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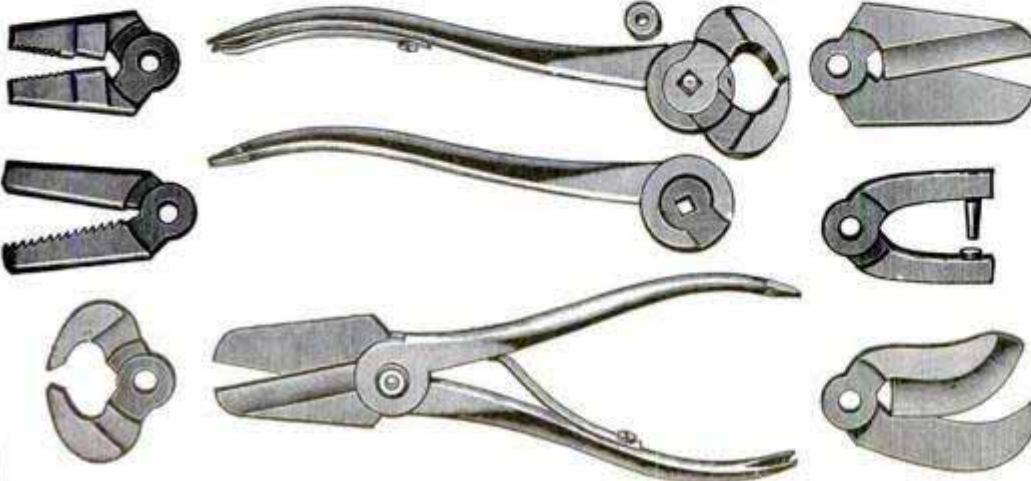
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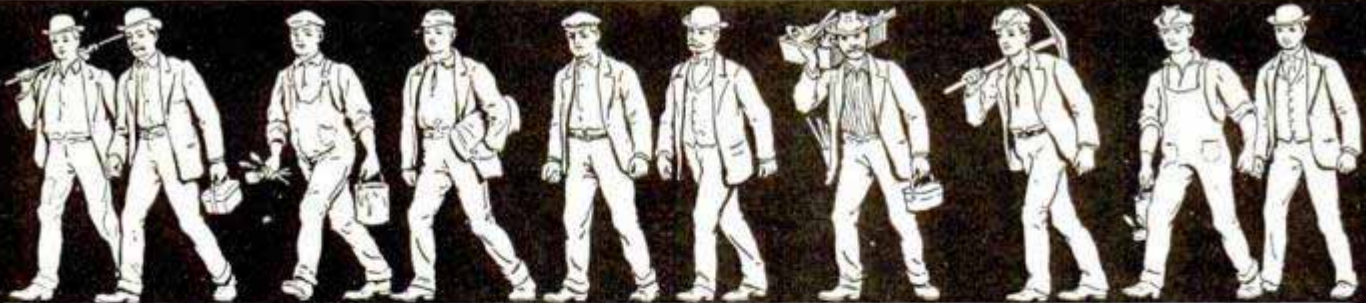
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POPULAR MECHANICS

Vol. 8. No. 10

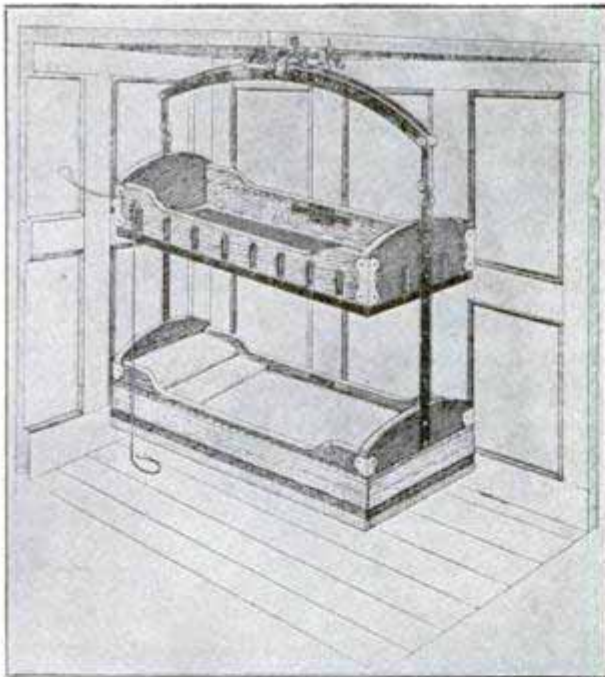
CHICAGO, OCTOBER 1906.

10 Cents a copy
\$1.00 a year

COMFORT ON THE SEA

SELF-LEVELING STEAMER BERTH PREVENTS SEA-SICKNESS

A new type of berth for ocean steamers is said by the Shipping World, London, to have successfully demonstrated its claim to save the occupant from sea-sickness. It is constructed on the self-leveling principle. Of a recent test the report states: "During a northwest gale with a very heavy head sea, the bunk kept in a horizontal position, notwithstanding the ship pitched heavily as she passed over each sea. Although the berth was fixed in the fore cabin, a narrow



Self-Leveling Berth

space in the ship's bows, where every motion would naturally be felt, the steward reported that to anyone occupying the bunk even the bumping was unnoticeable. On another occasion a lady and two children, who were very sick, occupied the bunk, and in a few minutes the sickness stopped, and neither of them suffered from it during the remainder of the passage.

FOLDING DECK SHELTER FOR OCEAN PASSENGERS

Patents have been granted in Germany and England on a simple but extremely



Shelter in Position

serviceable device for the comfort of ocean passengers. It is a wind-shelter consisting of a partition extending from one deck to the next, and extending out from the cabin for about 3 ft. It makes a sort of room open on the side next the sea. When not desired, the shelter, which is hinged at the top, is swung up out of the way. The North German Lloyd express steamers are being equipped.

The only steam railway in operation in Alaska at the present time is a 55-mile road at White Pass. Others are under construction, however, the most important to be 463 miles long.

WRECK OF THE DULUTH-SUPERIOR INTERSTATE BRIDGE

Second Longest Draw in the World--Cost a Million Dollars--How the Fixed Span Was Moved to Clear the Channel

The 5,000-ton steel package freighter "Troy," entering the upper harbor at Duluth early on the morning of August 11, whistled for the Duluth-Superior bridge at the usual point, so states the captain, and kept calmly on its way at a speed of about four miles an hour. The bridge was always slow in opening and at first Captain Murray thought little of it, but when his vessel was dangerously near and the bridge was not yet swinging, he blew alarm signals and backed at full speed. Just then the ponderous structure swung one-third open and the "Troy" struck it about 20 ft. from the center pier. Whether the bridge-tender was too slow, or whether the captain of the "Troy" was too fast is an unsettled question, but with a horrible grinding and crashing of buckling steel, the noble structure collapsed and sank into the channel waters. First the end of the span on the Superior side went down and a second later the end of the span on the Duluth side. The wrecked bridge completely blocked the channel and tied up 35 ships.

The draw-span of the Duluth-Superior bridge was 500 ft. long—the second longest in the world—and the cost of the structure, which is the property of the Great

Northern railroad, was \$1,000,000. The damage is estimated at \$100,000. Both ends of the bridge were completely submerged, and the Superior end was badly broken.

Naturally the first question was how to clear the channel of wreckage so ships could pass in and out of the upper harbor. It will be at least seven or eight months before the bridge will again be in working order and the only thing that could be done was to move the fixed span. This span weighs 800 tons and is 230 ft. long; in just 89 hours it had been moved to a temporary pile support.

Four large scows were taken under the fixed span and sunk; then a timber support was built up to the bridge stringers, the water was pumped out of the scows, and as they rose they lifted the 800-ton, 230-ft. steel span from its stone piers. Two tugs towed the strange load to the support prepared for it. The scows, it is said, have a carrying capacity of four times the weight of the bridge. When the structure was at last out of the way, a channel of 170 ft. with 25 to 30 ft. of water and a 230-ft. channel with 19 ft. of water were clear for use. Under present conditions only one boat can make the passage at a time.



TEST AT NIAGARA FALLS CAUSES SCARE

About 1 o'clock in the morning recently, police headquarters received an excited telephone message that a pleasure launch burning a red light was in the rapids above the falls and was being swept rapidly to destruction. The relief crew with life-saving apparatus hurried to the scene in a patrol wagon, where a crowd had already gathered, but arrived just in time to see what appeared to be a good sized boat pass over the crest. Investigation revealed the fact that the power company, in order to secure data on the exact speed of the current at various points, had constructed the craft, put in a long-burning red light and towed it out into the river at a safe distance above the falls and then set it adrift.

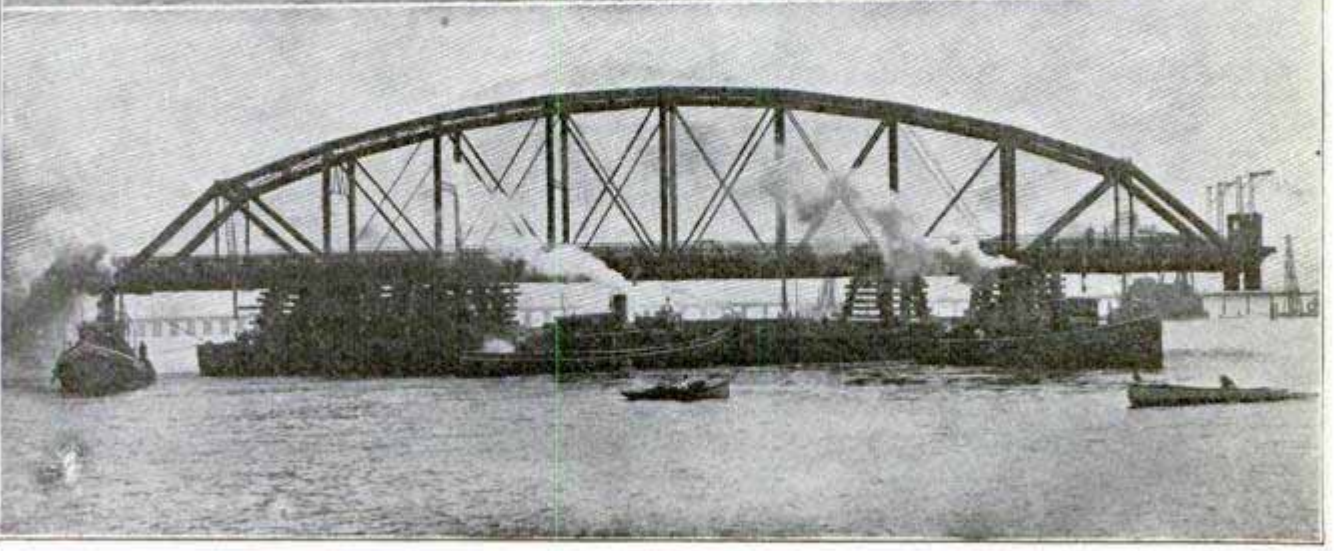
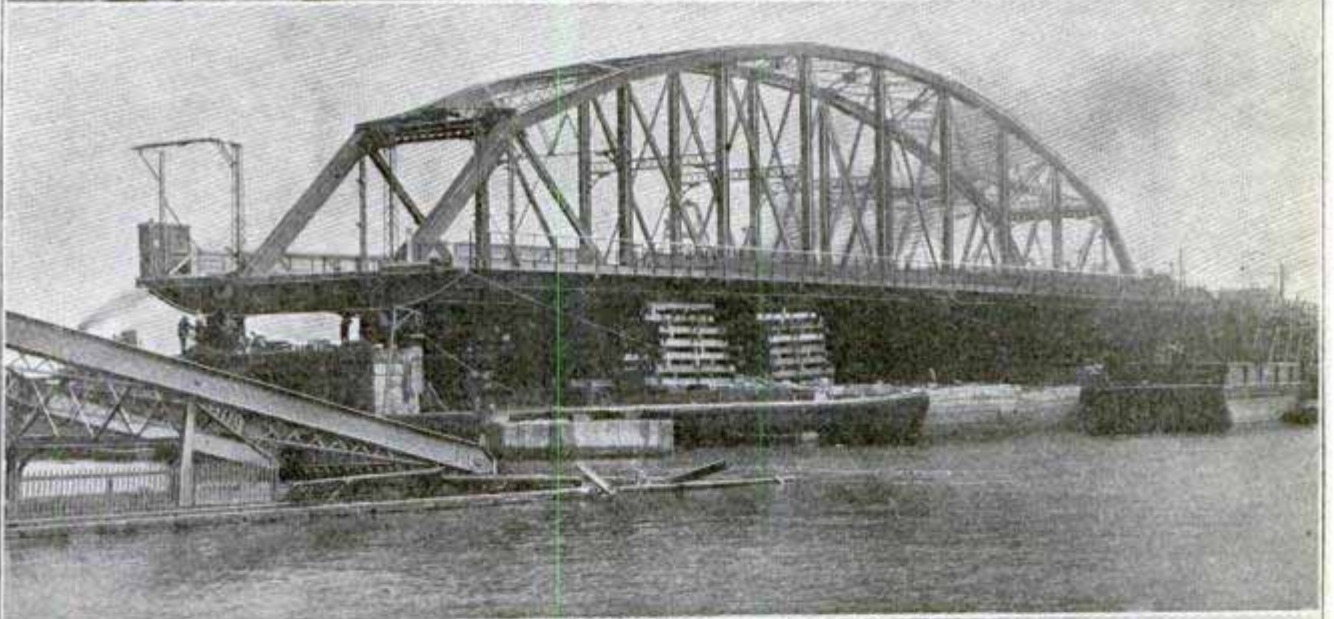
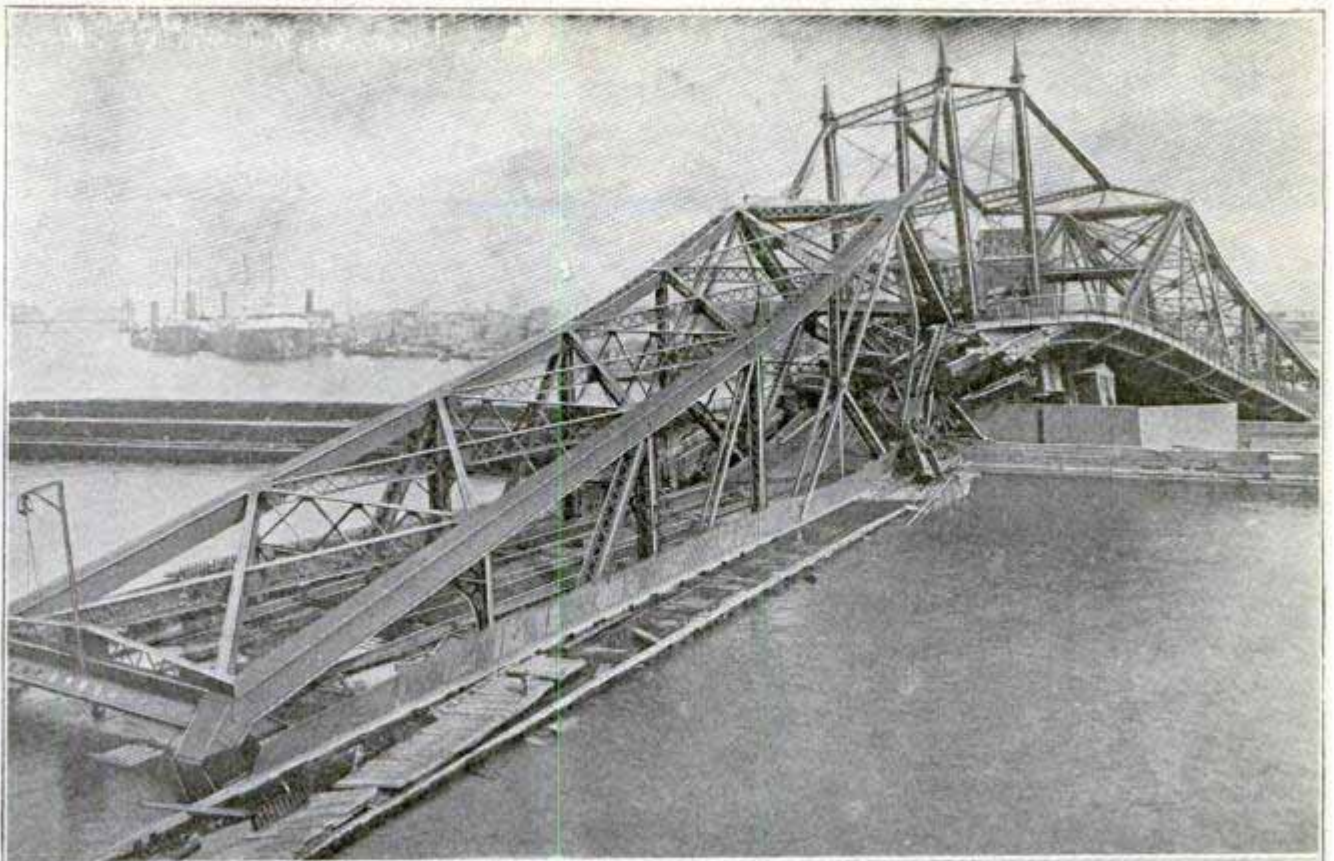
PAINTING STATUE OF LIBERTY

The Statue of Liberty on Bedloe's island is being painted by the Government at an expense of \$63,000. Eighteen years' exposure to salt air has seriously corroded the bronze. The electric lights in the torch will be enlarged and an electric elevator installed.



THROWING STREET CAR SWITCHES

The general manager of the street railway at Clinton, Ia., has introduced a decided improvement on his cars. A small round hole is cut in the platform directly over the rail, through which the motorman puts the switch-iron with which he turns the point of the switch. This saves opening the front window or leaving the car.



ORDERING MEALS BY TELAUTOGRAPH

The telautograph, the electrical device for transmitting writing to a distance, has been installed in a Cincinnati hotel for the use of guests in ordering their meals. The guest writes his order and it is immediately transmitted from the dining room to the kitchen. Each order has a duplicate, and aside from the time and labor saved, all dispute as to mistaken orders is avoided, unless the guest writes in hieroglyphics.

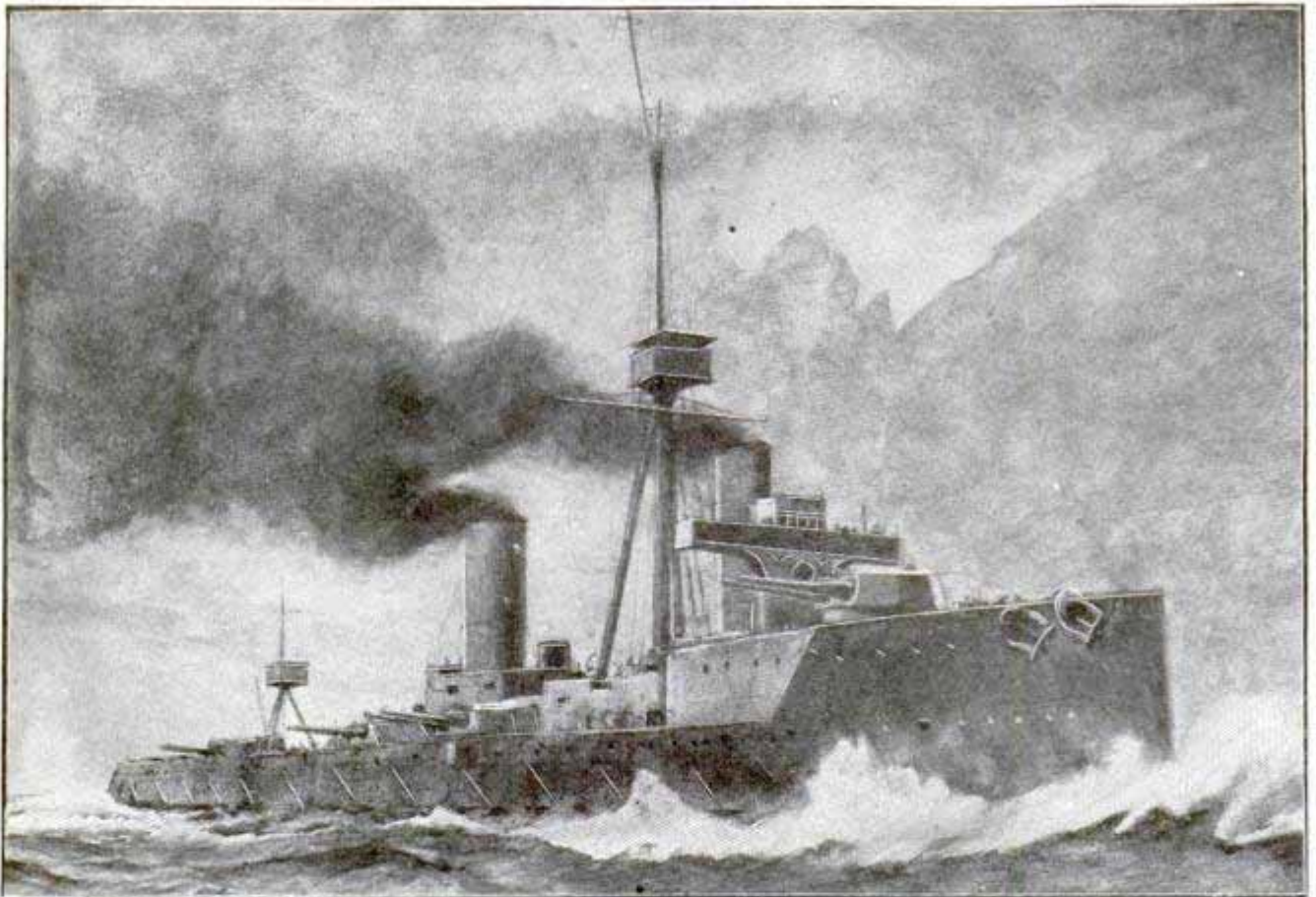
TOBACCO WITHOUT NICOTINE

A German cigar manufacturer has invented a process by which the tobacco is given a treatment which extracts a large part of the nicotine. The extraction is not entire, for about 1 per cent still remains. The flavor of the cigar is said to be unimpaired. The cigars are labeled "free of nicotine."

HAS PEARY PERISHED IN POLAR QUEST?

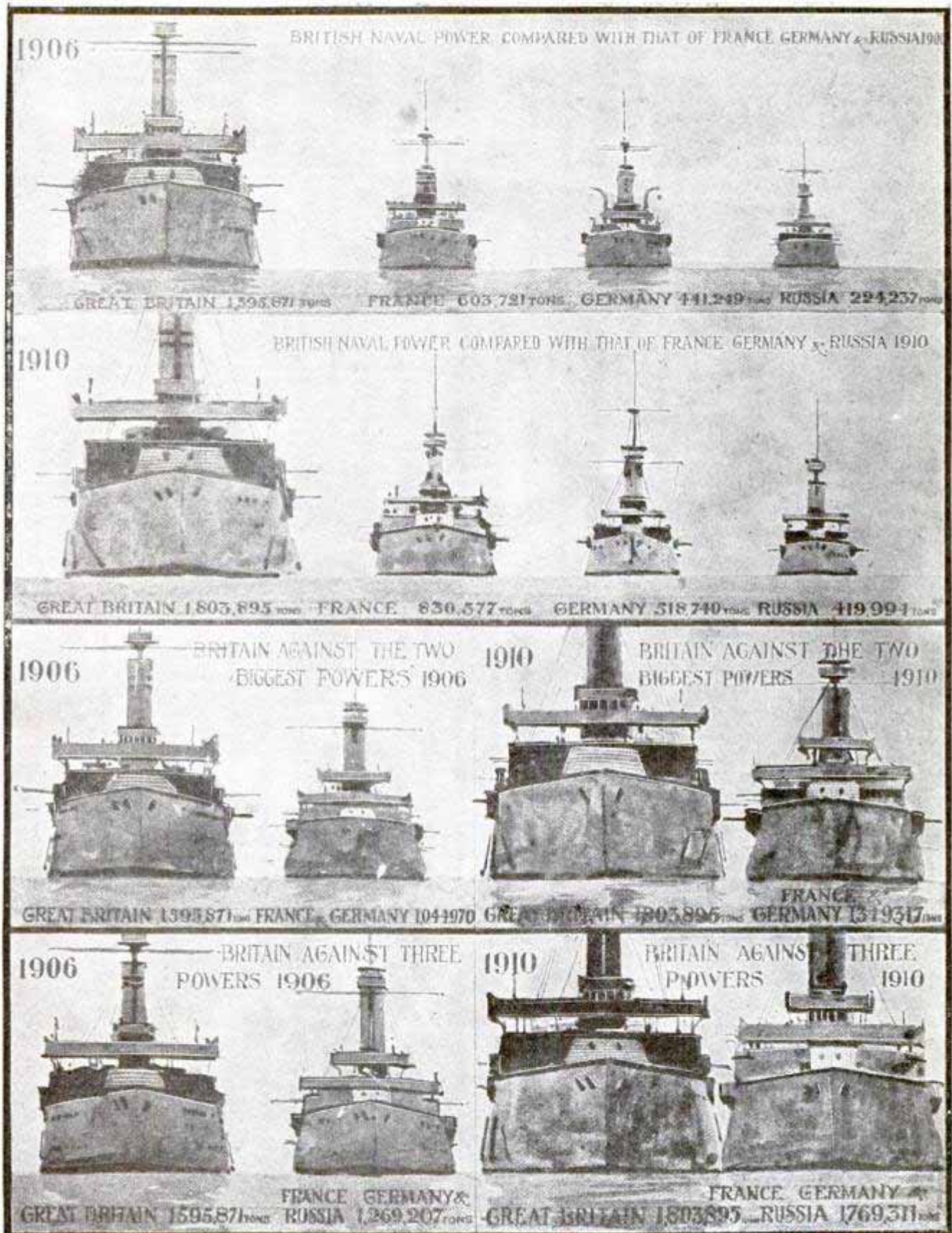
Grave apprehensions are entertained by naval officers as to the safety of Captain Robert E. Peary, who sailed on the ship "Roosevelt" July 16, 1905, for Arctic regions in another attempt to discover the pole. No tidings of the vessel have been received and as the storms of the far North have been unusually severe the past season and the ice heavy, it is feared it has been ground to pieces.

Peary's plan was to go to the farthest point of land north of Cape Sabine possible—within 500 miles of the pole—and during the summer of the present year make the final dash over the ice, relying on dogs and Esquimaux as his aids. The trip should have taken no more than six weeks. Peary began his Arctic explorations just 30 years ago. Other trips were made in 1886, 1891, 1893 and 1898, each being fraught with terrible hardships.



"DREADNAUGHT" IS MONARCH.—Great Britain's powerful fighting-machine, which surpasses every other existing vessel, is now ready for her steam trials. The vessel's dimensions are as follows: Displacement, 18,000 tons; length, 520 ft.; beam, 82 ft.; draught (mean), 26½ ft.; armor belt, 11 in.; speed, 21 knots. The armament comprises ten 12-in. guns and twenty-seven 12 pounders. Eight of the 12-in. guns can fire on the broadside, six ahead, and six astern. The vast beam of the warship was necessitated by her heavy armament and with her great length gives her a peculiar appearance. The funnels are oval.

ENGLISH NAVY IN 1906 AND 1910



The great advantage in point of tonnage of the British navy over the two other largest powers is graphically set forth in the accompanying pictures. The naval ap-

propriation has steadily increased each year, rising from \$52,650,000 in 1880, to \$166,955,000 in 1906. The program includes three battleships of the "Dreadnaught" type.

TARRED MACADAM STREETS



Fig. 1



Fig. 2



Fig. 3



Fig. 4



Fig. 5



Fig. 6

Fig. 1--Sweeper Cleaning Street. Fig. 2--Putting on the Tar With a Sprinkler. Fig. 3--Spreading Tar With Brooms. Fig. 4--Covering Tar With Finely Crushed Stone. Fig. 5--Finishing With Steam Roller. Fig. 6--The Completed Roadway.

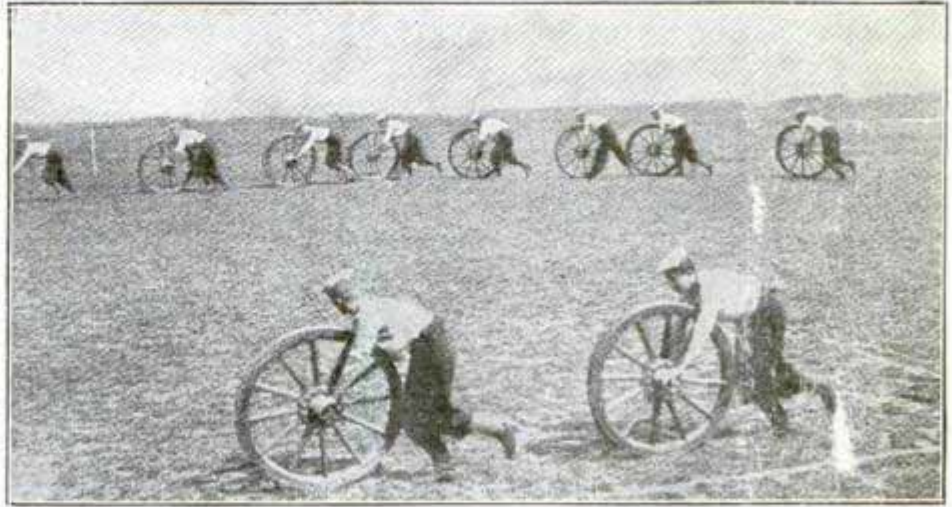
Considerable attention is being directed by people interested in improved streets and highways to the system of treating macadam roads to a coating of tar. The system originated in France in 1896. Engineers have pronounced it a success, and that repairs are reduced 25 per cent in one case, and the life of the paving probably extended from 6 to 12 years in another.

The advantages are freedom from noise, mud, dust and the necessity of sprinkling. The process is simple and requires no special apparatus. The street—which must be macadam paved—is first swept clean of dust

and enough hot tar poured on to fill all cracks and soak into the surface evenly. If a rain occurs during the work, operations cannot be resumed until the street is perfectly dry again. A thin layer of fine, clean stone screenings is next spread to absorb any surplus tar and the road rolled with a steam roller. It is then ready for use. From $\frac{1}{4}$ to $\frac{1}{2}$ gal. tar per square yard is required, and the additional expense is 1 cent per yard for screenings, and 3 to 4 cents for all labor, including rolling. A 16-ft. roadway can be treated for \$400 per mile.

TEACHING NAVIGATION WITH WAGON WHEELS

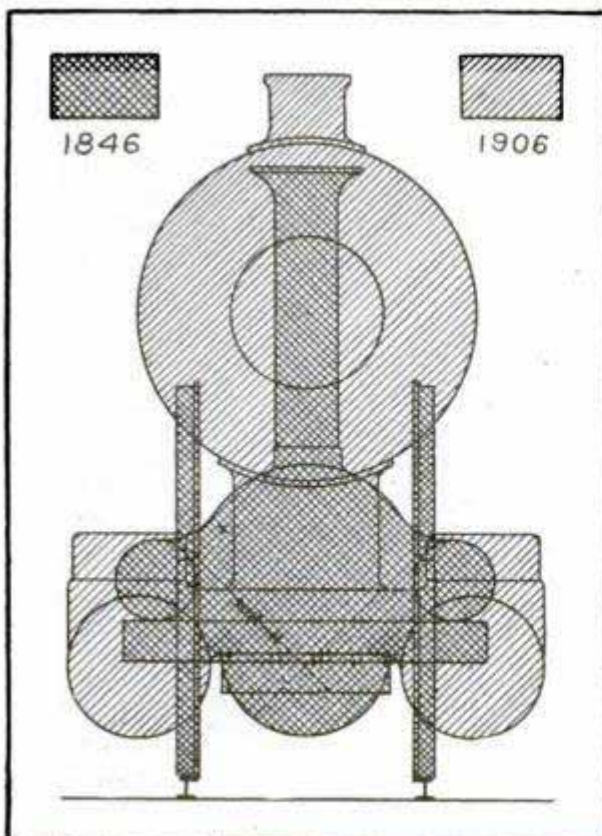
An open field would not suggest itself as a place to learn the movements of a fleet at sea. The illustration looks much more like some physical culture contest. In order to make the sailors in the British navy familiar with fleet maneuvers the men are each given a small wagon wheel and designated as some vessel in a squadron. They then go through all the various evolutions of ships at steam tactics, pushing their wheel into the position which their "ship" has been ordered. The illustration shows the men executing the order "Single line ahead"; two divisions.



The "Fleet" Maneuvering

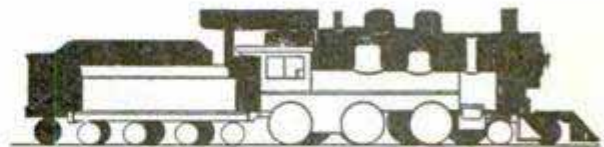
INCREASING POWER OF LOCOMOTIVES

The American locomotive keeps on growing. Each year the track superintendent says the limit has been reached, and they cannot stand anything bigger and heavier, and each year he has to get busier and take



tion. The average tractive power of freight locomotives in 1896—10 years ago—was 13,900, while today it has increased to 31,500. This condition means correspondingly increased train loads.

The demands for air have increased to such an extent as to represent quite a large percentage of the boiler capacity for its production. It has been found that under normal working of a large freight locomotive, hauling a train of 65 cars, 50 of which were air-braked, at 20 miles per hour, the simple air pump requires approximately 6 per cent of the steam generated. If a portion of this can be saved by compounding, such saving should not be overlooked. Tests which have been made show an economy for the compound pump of 60



White 1880--Black 1906

per cent over the single pump. Mr. Ball adds:

"We shall be required to develop the mechanical stoker, compounding and superheating will be prosecuted with greater vigor than ever. The use of a feed-water heater may be resorted to, and among the smaller items, undoubtedly the compound air pump will be used, and perhaps the variable exhaust nozzle. We now have engines that will run successfully from

terminal to terminal, and have reached a plane in the economical maintenance of our locomotives whereby the use of the foregoing fuel-saving devices will make more apparent than heretofore the economies resulting therefrom." For the intelligent inventor who will study the conditions and requirements, there is an attractive field for work.

REFRIGERATION ON THE SEAS

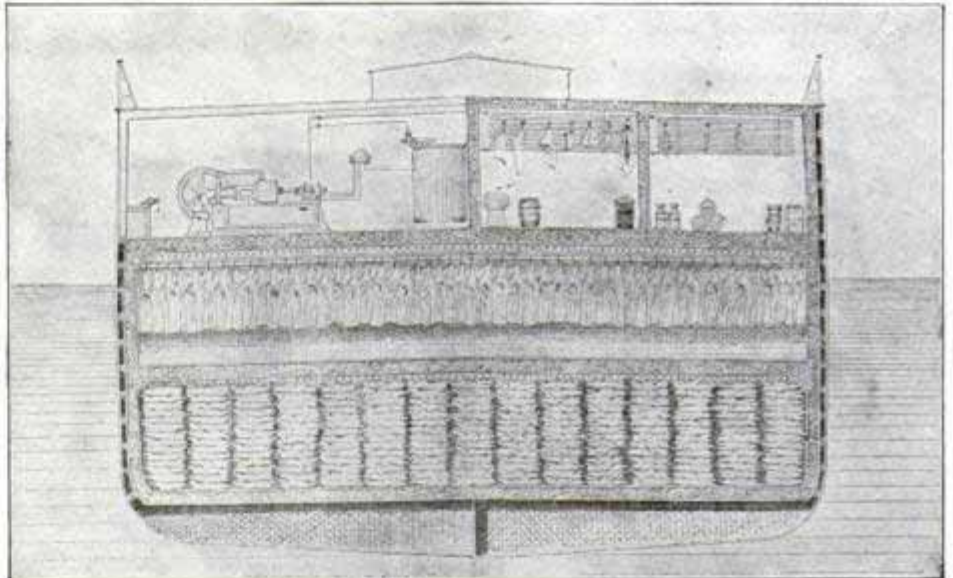
Distance no Longer Barrier to Markets

Refrigeration was first applied to steamers in 1880 and since that time its use has become so general as to be absolutely indispensable. To commerce it gave new impetus and made international trafficking in many food stuffs profitable.

New Zealand owes much to mechanical refrigeration. In 1882 she exported to England 8,839 carcasses; in 1884, 412,349 carcasses; in 1891, 1,906,002 carcasses; and in 1900, 3,154,799 carcasses, says the Illustrated London News. During 1900 Australia exported to England 943,688 sheep and lambs and 279,953 quarters and pieces of beef.

There are 40 meat freezing works in New Zealand and Australia, and 140 refrigerating ships plying between Australia and British ports. The average temperature of a steamer's hold or a cold storage is 16° to 20° Fahr. or 12° to 16°

of frost. One of the largest London cold storages holds 200,000 sheep and the firm has delivered 40,000 carcasses in one week. The refrigerating process, briefly, is as follows: Ammonia gas is condensed by powerful machinery until it is liquefied. It is then driven along pipes until it reaches a point where it is suddenly made to expand by being forced through small apertures. At the moment the gas assumes its original bulk it absorbs a great amount of heat, and thus produces intense cold in the surrounding atmosphere. The gas is condensed once more, again made to expand, and so the process goes on in regular rotation. The same material may be used again and again for an almost indefinite period. The hoar frost on the outside of the expansion pipes arises from the freezing of the



Cross Section of Cold Storage Cargo

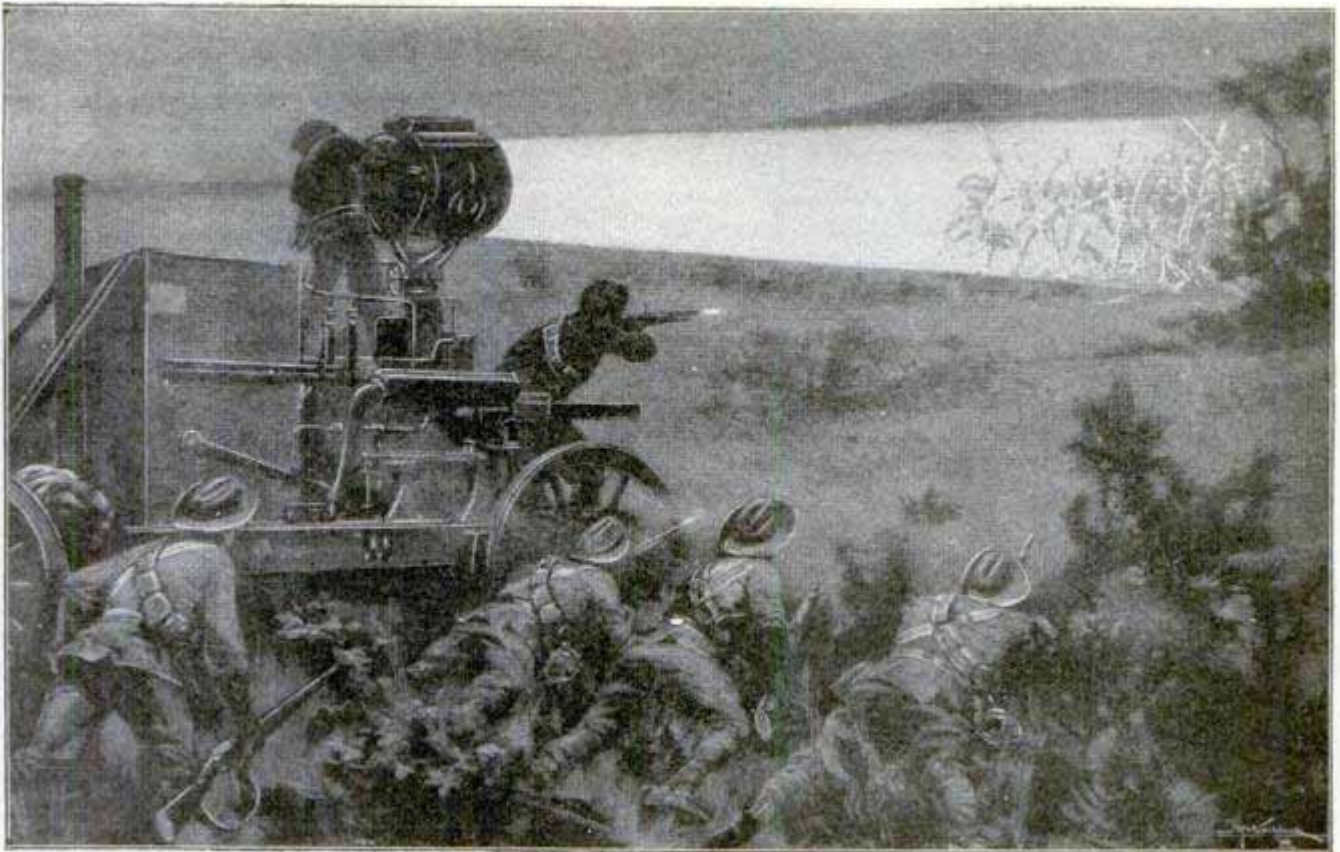
more or less moisture contained in the air.

A monster cargo of New Zealand products was recently unloaded at one of the London docks. The cargo comprised 81,920 frozen carcasses of mutton and lamb, 220 frozen quarters of beef, 777 cases of frozen kidneys, hearts, etc., 90 casks of casings, 43,605 boxes of butter (56 pounds each), 8,350 crates of cheese (56 pounds each), 35 frozen carcasses of pork, 1,000 cases of tinned meats, 11,550 bales of wool and skins, 200 sacks of grass seed, 1,100 casks of tallow and pelts, and 2,800 cases of fruit, all unloaded in just eight days.



Perfectly Preserved

The approximate speed in miles per hour of a railroad train on tracks of standard length rails is equal to the number of rail joints passed in 20 seconds.—Trautwine.



THE SEARCHLIGHT IN WARFARE

During the recent revolt of the Zulus against the British in Natal, South Africa, a terrible and striking demonstration of the great gulf between barbarian and modern methods of warfare was afforded. Four years ago the young men of the Bukulusi tribe conquered a band of Boers and got the swell head over it. Since then the unrest has been developing and under the leadership of the rebel chief Bambaata the natives prepared themselves for the uprising. They were several thousand strong and their fight-

ing was characterized by great courage, but against the equipment and military training of the British was hopeless from the start. The Zulus were killed by the hundreds in almost every engagement. In many instances electric field searchlights were used by the British and terrifying indeed to the superstitious savages it was to have the fierce white glare thrown upon them just as they were stealing up for a midnight attack, rendering them fair targets for deadly marksmanship.

MAY BUILD DAM ON CREST OF HORSESHOE FALLS

The proposed construction of a dam almost on the crest of the Horseshoe Falls is bold enough to startle even 20th-century engineers. And yet such a dam is being seriously considered, and Alton D. Adams, in the *Electrical Review*, gives details of the subject.

As will be readily understood the dam has become necessary on account of the rapidly decreasing amount of water which is passing over the falls. The great power plants at Niagara on the Canadian side are becoming alarmed at the diversion of water farther up the river and which is likely to be still greater when the new power com-

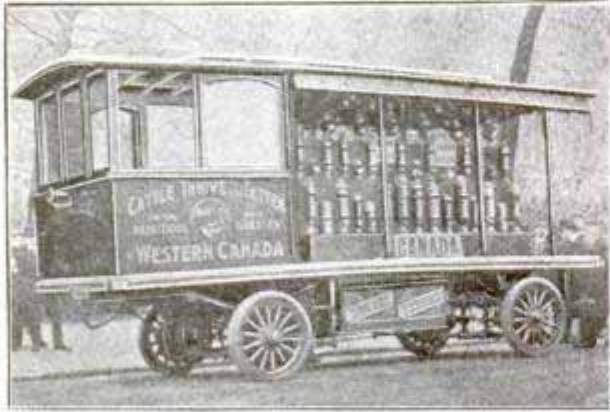
panies succeed in getting permits to operate.

Already two dams have been thrown out into the river above the falls on the Canadian side, one 780 ft. long, extending out 375 ft.; and the other 900 ft. long, running out diagonally with the farther end 600 ft. from the shore of Queen Victoria park.

The proposed dam would be from 1,000 ft. to 1,700 ft. long and nearly parallel to the crest line, would be submerged when completed and form a minor cataract. It would be constructed of stone and cement and securely anchored to the rock bed of the river. At this point the river flows about 25 ft. per second.

ADVERTISING CANADA IN ENGLAND WITH A MOTOR CAR

A motor car, built in the United States, and loaded with tempting visions of the rich products of Canadian farms, has been sent to England by the Canadian govern-

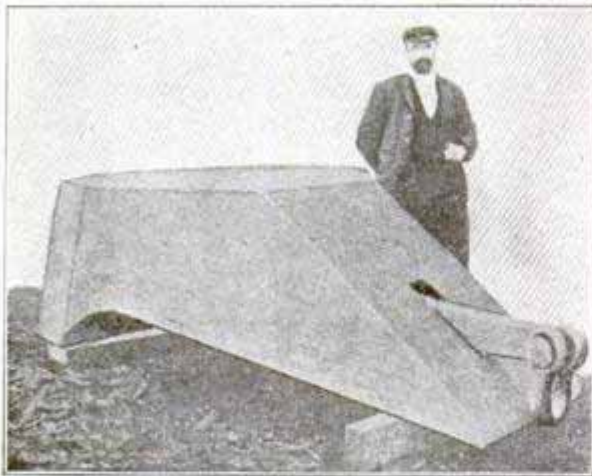


Canadian Exhibit for Foreign Lands

ment. The car has already traveled 1,000 miles among the towns and hamlets and will go to Ireland later, visiting county fairs. The scheme is declared a great success.

MOORING ANCHOR FOR ALL GROUNDS

The English wedge-clump mooring anchor illustrated will hold firmly in all grounds, it is said, and does not skid, shoe or drag. It is specially adapted, says the Shipping World, London, for shingle or sandy anchorage, and holds in places where mooring screws, anchors, and other appliances have



Wedge-Clump Mooring Anchor

failed—where the surface anchorage ground is sludge and shingle with smooth subsoil of the MacAdam order, and where the scope of the mooring chain is very limited.

CARGO OF ROAST DUCKS

One of the strangest consignments ever landed at New York was the cargo of 8,000 roast ducks, all the way from Shanghai. The ducks were roasted in China according to Chinese methods, and were three months on the way. As the ship had no cold storage and sailed by way of the Suez Canal, the fact that the ducks were aboard was no secret. In coming through the Indian ocean a great storm broke open the 100 big cases of pepper, so between the two the unfortunate crew had a cruise which was something to remember.

SANTOS DUMONT TRIES AERO- PLANE

Santos Dumont is now experimenting with aeroplanes. His machine is 30 ft. long, with wings of bamboo and silk, 40 ft. spread. The backbone is steel; the propeller is behind and the rudder in front. A 24-hp.



Santos Dumont's New Aeroplane

gasoline engine furnishes the power. He has thus far made no notable records in its operation, and must do something worth while or yield first place to Comte de La Vaulx, whose airship is scarcely half the size of Dumont's, and which has remained high in air for eight hours at one time. In this craft the propeller is in front and the rudder behind.

ORDERS 130 LOCOMOTIVES

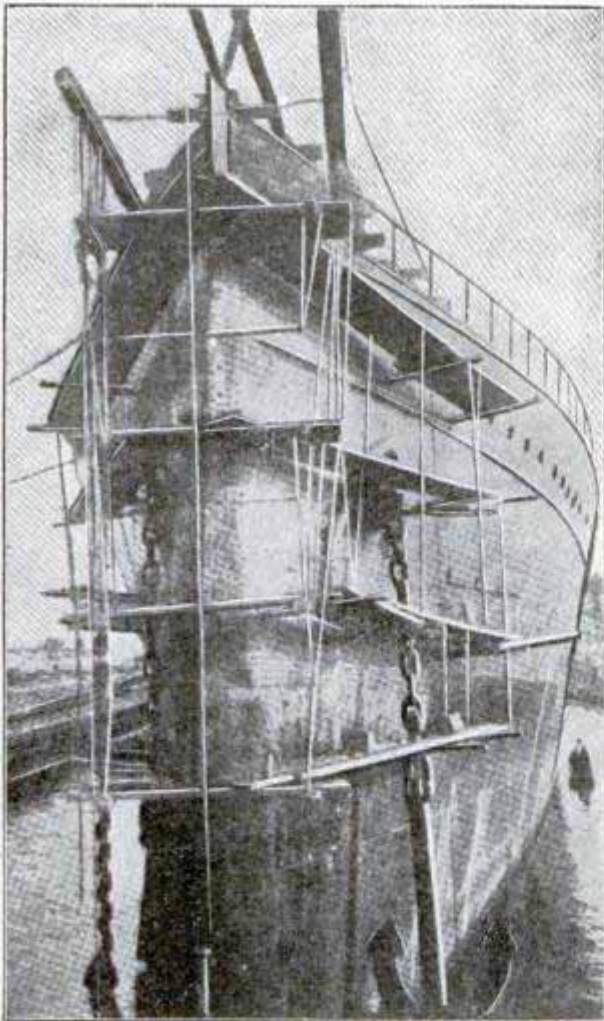
One of the largest single orders for motive power ever given was placed recently by the Burlington road. It calls for 130 locomotives, which will weigh in all over 48,000,000 lb., and if coupled together would reach almost two miles. The 100 freight engines weigh 368,000 lb. each, are 73 ft. long, and carry 8,000 gal. water and 16 tons of coal. They are 2-6-2 high speed.

AMERICA BUSY AND PROSPEROUS

The unprecedented volume of business of the past year is not only being maintained, but is increasing. The Government reports show even greater crops this year than last. The great iron, car and locomotive works already have orders which will keep them busy far into the summer of 1907. The railroad report for the fiscal year ending June 30, from 45 roads with 73,000 miles, all show an increase in gross earnings except two—one a little coal road and the other a lumber road where the timber is exhausted. The increase in gross receipts is \$100,000,000, or 13 per cent. This year 3,500,000 tons of rails will be rolled, and the prospect is for over 4,000,000 tons next year.

ACCIDENT TO THE "DEUTSCHLAND"

When the great German liner "Deutschland" went in collision at Dover she suffered injuries which will cost \$300,000 to repair.

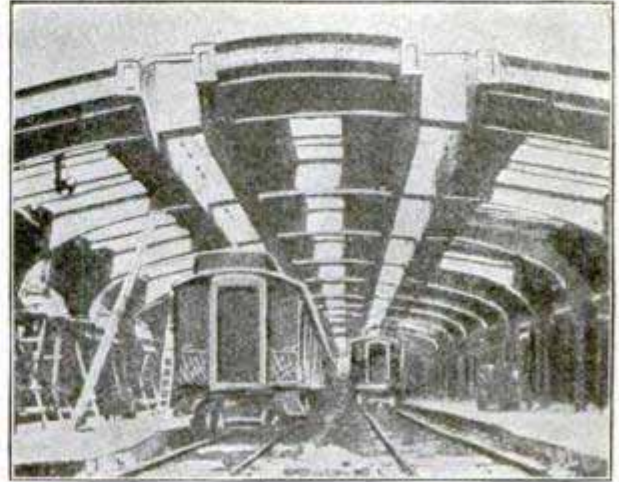


Repairing the "Deutschland"

A SMOKELESS DEPOT

Greatest Boon to Travelers in Years

At least one American railroad has waked up to the intolerable nuisance with which the traveling public everywhere is subjected, and has built a common-sense train



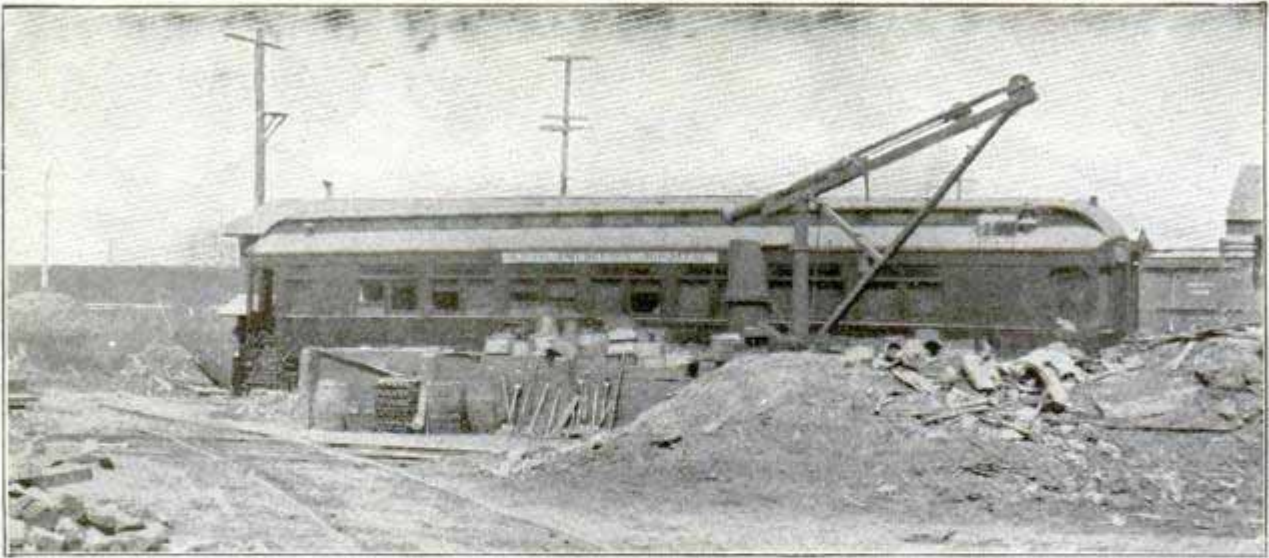
Common Sense Train Shed

shed. It has not cost any more than any other equally good, in fact is not at all expensive, and only a fraction as costly as the old style high arched roofed depots so generally constructed.

This new, sane depot is at Hoboken, N. J., and has a low roof built of steel girders and glass. The improvement consists in leaving a slot in the roof extending its entire length over the center of each track. No matter where a locomotive chances to stop, the top of its smokestack projects slightly into the opening, and the air brake pump can exhaust through the stack to its heart's content and nobody will care. The overzealous fireman who likes to see the steam blowing off can now work his shovel overtime, but neither escaping steam nor clouds of gas and smoke can annoy his fellow men. The slot is 2½ ft. wide and all the exposed metal is covered with cement, so the gases cannot harm the structure.

The smoke nuisance in depots is by far the most annoying and unnecessary of all discomforts of present day railway travel. Our illustration is by courtesy of Railway and Locomotive Engineering.

In the hope of increasing the value and promoting the development of her colonies, Germany has established a school for training young men for life there. Every phase of farming and gardening is taught, also makeshifts for emergencies, etc.



CONDEMNED TOURIST CAR BECOMES HOSPITAL

Where Hundreds of Surgical Cases Were Treated After San Francisco Disaster

The old tourist car, No. 2500, had seen the seamy side of life in the transportation business. For many years it had carried a fluctuating tide of humanity back and forth across the American continent. Usually its passengers had been from the great middle class, which in America is synonymous with moderate means:—the homeseeker, the tourist, the excursionist, the healthseeker, or those drawn from their abiding places by some untoward event. Not that the crowds had been sad ones. Ah, no! The merriest and warmest-hearted people of all had traveled on No. 2500 and the fun was always spontaneous and without the formal restraint that a berth in the splendid and luxurious Pullmans imposed.

But there had been pathetic incidents: Now a woman with her babies going West to seek the husband who had not written her for months; once an old couple who had converted their earthly possessions into cash and were bound for California to stake it all on the health of their one boy—a hopeless consumptive; and again a little lone girl whose father lay in a grave in a mining-camp in the Nevadas and who was traveling eastward to find new friends. And ever the great-hearted people in the tourist car had rallied around these unfortunates and cheered them on their way, sharing the food cooked on the little stove at the rear of the car, or inventing games, or singing songs. And now No. 2500 was out of it all; condemned as worthless and shunted off on a siding at San Francisco to gradually fall into decay from non-use.

The gay crowds, the sympathetic people, the international influx and exodus were thronging into other cars of more modern construction. As the darkness of night lightened into the gray of dawn early on the 18th of April, 1906, a string of these new cars crawled out of the yards, past No. 2500, in all their pride of fireproof construction and new paint; ere long the slumbering passengers would begin to rouse and call their gay greetings. Would No. 2500 never again have part in life?

* * * *

A few hours later San Francisco, earthquake wracked, was burning; the throes of Nature's convulsion had been transmitted to humanity, the number of the injured was increasing and there were few places of refuge or shelter. Then No. 2500's service was renewed. Swiftly the car was transformed into an emergency hospital. Operating tables, surgical instruments, medical stores, lavatories, etc., were hastily installed and a force of surgeons and trained nurses were assigned for duty by the railroad company. Then once more the people thronged to No. 2500; maimed, crippled, on the brink of death, they were brought in and cared for. Over 600 in all, it is estimated, were treated and then sent on to the larger institutions. The old tourist car earned a new name; it became the "Good Samaritan," and now that the earthquake sufferers are all cared for its period of activity is not finished. The company still maintains it as an emergency hospital and whenever there is an accident in the switching yards or vicinity the

victim is first brought to this car to receive temporary and oft-times life-saving ministrations before he is sent to a hospital.

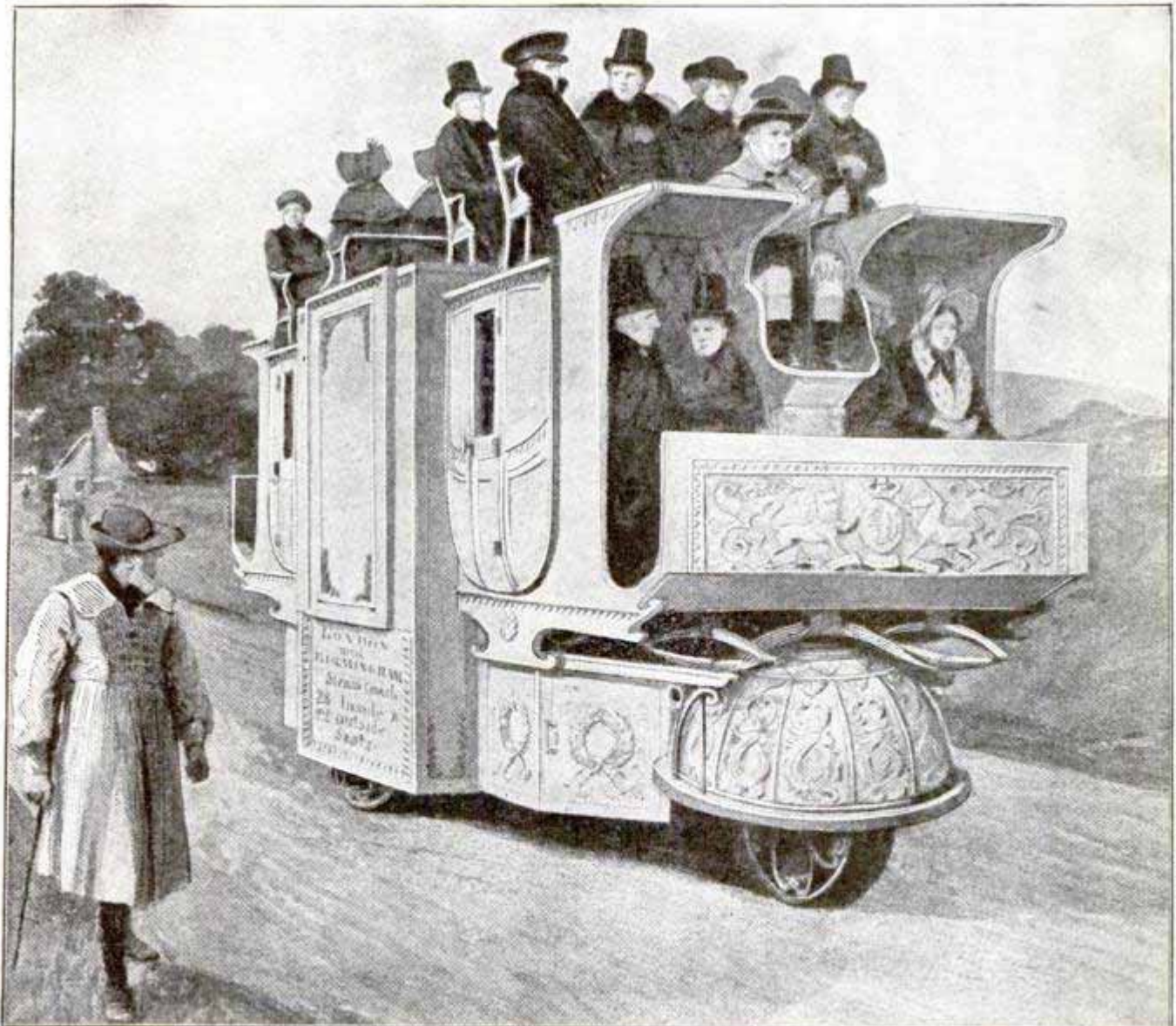
JAPS WON VICTORY BY 'PHONE

Nothing about the Russian-Japanese war was more remarkable than the manner in which the Japs used the telephone. Marshal Oyama, 20 miles in the rear at the battle of Mukden, deployed his troops entirely by means of the 'phone. After the Japs had taken 203-Metre Hill and begun the bombardment of Port Arthur, they built a bomb-proof for the use of the chief of artillery, strung wires to the point and from this place, whence he could see the warships in the harbor and the doomed city, the guns were commanded by 'phone with such accuracy that the fortress was taken. And these are only a few instances drawn from a large number.

AN ELABORATE MOTOR-BUS OF 1832

The practicability of the horseless vehicle was established as early as 74 years ago and the elaborately decorated monstrosity shown in the illustration was in successful operation between London and Birmingham, England. The machine, which was steam propelled, was built by one Wm. Church, and resembled a double stage-coach. It had accommodation for 28 passengers inside and 22 outside.

The car was sufficiently successful to provoke legislation in regard to machines of the kind. Popular prejudice was against it and such excessive road tolls were imposed as to make the use of the 'bus far from profitable. Also, the railroads secured a law providing that a man with a red flag by day and a red lantern by night keep 100 yd. in advance of every motor carriage running on a street or highway.



Steam Chariot of 1832--Carried 50 Passengers

THE MANUFACTURE OF DENATURED ALCOHOL

What it is Made From--How Produced--Government Restrictions--Expert Chemist's Advice to Prospective Manufacturers

By Carl Shelley Miner

Probably no piece of legislation in the last decade has created such wide-spread interest, and even excitement, as the Free Alcohol Bill. The public has demanded information about every phase of it. The daily papers, trade journals and magazines have found the subject good copy and have filled their columns with stories, the most notable characteristic of which has been a vast optimism in regard to the future of this "new industry," the manufacture of denatured alcohol. The impression has gone abroad that alcohol may be profitably manufactured from almost any sort of vegetable material, in almost any place, by almost anybody. Wildly exaggerated statements as to the yields from various materials, probable prices and extent of markets have been made, and the result has been to induce a sort of alcohol madness in the public. About one in every ten men has a plan for manufacturing denatured alcohol, and all of them want information to help them plan definitely. This magazine has received scores of letters of inquiry about the process of manufacture, availability of materials and, in fact, every other phase of the whole question. It is in the hope of answering as many as possible of these inquiries that this article is written.* I shall try to enumerate the materials from which alcohol may profitably be produced, to describe briefly the process of manufacture, and to give the prospective manufacturer an idea of the essentials to be most considered in making his plans.

NOT A NEW INDUSTRY.

One thing should be thoroughly understood, that the manufacture of denatured alcohol is not a new industry. The Free Alcohol Bill did not open the market to a new product; it merely enlarged the market of an old one. The manufacture of denatured alcohol is only the manufacture of alcohol. The process of denaturing is no more complicated than the process of

putting cream into coffee. The government decides on a suitable denaturing agent, probably wood alcohol, and the manufacturer mixes it with his product under the supervision of a revenue officer. In view of this fact, it is obvious that the man who enters this field must be prepared to meet the organized competition of the distillers. Worse, it is even rumored that Standard Oil is to take over the large distilleries and attempt to control the alcohol market. However, the raw material is so abundant and so varied that no such thing as cornering it is possible. Roughly speaking, any material containing starch or sugar is a source of alcohol. Many processes have been patented for producing alcohol from cellulose, which includes wood fiber, straw, leaves, etc., but none of them have been successfully operated, although it is said that a company in the south is now producing alcohol from sawdust. It is, however, safe to say that this method will not affect the alcohol market for many years.

SOURCE OF ALCOHOL.

The great source of alcohol in this country is corn, and there seems to be little reason for believing that it will not continue to be. On this account, it will be taken as a type, and the process of manufacturing alcohol from it will be described, and then the variations from that process, necessary for the use of other materials will be discussed. The first step in the process is to change the starch of the corn into sugar, for it is only after this change that the fermentation which produces alcohol can take place. The corn, in either a whole or ground state, is mixed with a little water, and heated by steam, sometimes under pressure, sometimes with the addition of a small amount of acid, until the starch is thoroughly gelatinized, which means that the starch cell is completely disintegrated, so that the malt used to transform the starch into sugar can act more readily. A thick paste is formed, such as the housewife uses for a starch pudding. The mass is then cooled to about 140° F., and some barley malt, made to a cream with a little water, is added. The diastase,

*Should any of our readers wish information which this article does not furnish, the author will be very glad to answer any letters addressed to him, at the Bryant-Miner Laboratories, 353-357 Dearborn street, Chicago.

an unorganized ferment contained in the malt, acts on the gelatinized starch, transforming it into maltose, or malt sugar, and dextrin. It is important that this process shall be carried on under exact temperature conditions, for, on this point depends the relative amounts of maltose and dextrin formed, and it is very important to produce as much maltose as possible, in order to get a satisfactory yield of alcohol. When a small amount of the solution, tested with iodine, shows that the starch has all been acted upon, the solution is cooled to about 70° F. For this purpose air, water, or a combination of the two, may be used.

When the proper temperature has been reached, a little yeast is added, and the solution is allowed to ferment. It seems scarcely correct to say "allowed" here, for the fermentation must be carefully controlled, and it is here that the experienced manufacturer has the great advantage. He has found, by careful experiment, the most satisfactory conditions for producing the largest yield of alcohol. The yeast he uses is a pure culture which produces more alcohol and fewer by-products, fusil oil, etc., than ordinary yeasts. In some cases, he even employs a zymotologist, yeast expert. If he uses a pure yeast culture, he keeps his fermentation vats, and the room containing them, scrupulously clean, to prevent the introduction of wild yeasts. Since alcohol is lighter than water, the progress of the fermentation may be kept track of by means of a hydrometer, an instrument for showing the weight of the liquor.

FERMENTATION AND DISTRIBUTION.

The fermentation is usually completed in from 30 to 40 hours. By this time the sugar and much of the dextrin, has been converted into alcohol and carbon dioxide. The carbon dioxide gas given off during the fermentation is occasionally collected, under pressure, in large tubes, and used for soda fountains, etc., but this has not proved very profitable, and is very seldom done. The liquor now contains from 8 to 12 per cent of alcohol which must be separated from the solid unfermented materials and from the water and the by-products of fermentation. The separation is effected by distillation. The alcohol boils at a lower temperature than the water, and begins to distill over first. The process is not simple, however, for mixtures of liquids are hard to separate even when their boiling points lie far apart, as in the case of alcohol and water. At a temperature

a little higher than the boiling point of alcohol a mixture containing much alcohol and very little water distills over, but, as the temperature increases, the amount of alcohol in the distillate gradually decreases, and the amount of water increases, until the boiling point of water is reached, by which time the alcohol has all distilled over, leaving the solid matter, some water, behind. The solid material is either dried and sold for cattle food, or is fed to cattle at the distillery, in a wet state. The distillate is now much richer in alcohol than the original solution, but is not yet marketable. Formerly, it was redistilled until it was of the desired strength.

The modern distiller, however, has a rather complicated form of still which produces 95 per cent alcohol by a single distillation. This still is too complicated to admit of description here, but its principle is the condensation of the vapors within the apparatus, and their re-evaporation by hot ascending vapors, so obtaining repeated distillation in a single still. The distillate is an alcohol of 90 to 95 per cent strength.

Such, in brief, is the method of manufacturing alcohol from corn. There are, of course, many details which it is impossible to consider in an article of this length, but this description covers the essential points of the process. The yield will average about 2½ gal. of 95 per cent alcohol, and approximately 15 lb. of feed from a bushel of corn. This feed is worth, roughly, 1 cent a pound, so that the alcohol can be produced at a cost of 14 cents a gallon for raw material, when corn is 50 cents per bushel. The expense of production will vary with the size of the plant, price of labor, etc., so it is variously estimated at from 2 to 5 cents per gallon.

POTATOES, MOLASSES AND BEETS LARGELY USED.

In Germany, potatoes are largely used for the manufacture of alcohol and the process is almost identical with the process for corn. In this country, unless the price of potatoes drops materially, they can not compete with corn as a source of alcohol.

Molasses and the residues from beet sugar are much more likely to be profitable for this purpose than potatoes. Much of the molasses is manufactured so far from trade centers, that freight charges make it—or at least the lower grades of molasses—a waste product. This material may be easily fermented and gives a good quality of alcohol. Alcohol from this source is manufactured

in Cuba for from 12 to 15 cents a gallon. Porto Rican molasses is already being imported into this country so as to be profitably used as a source of alcohol. The process of manufacture is simpler than in the case of corn, for the fermentable material is sugar, and no preliminary malting is necessary. It is sufficient to thin the molasses until it contains from 16 to 20 per cent of sugar and add the yeast.

Fruits, and many kinds of vegetable waste, can be turned into alcohol, but at present most of them can be more profitably used for other purposes. Any of the cereals, many starchy materials such as cassava, rice waste, etc., are sources of alcohol, but on account of their price, it seems unlikely that they will be used in its manufacture.

ADVICE TO PROSPECTIVE MANUFACTURERS.

The man who is preparing to manufacture denatured alcohol must take many things into consideration. First, has he the raw material, containing starch and sugar at a sufficiently low cost? Take corn as a basis, and calculate whether the starch or sugar in the material in question costs more or less than the starch in corn, considering that starch contains 60 per cent of starch. If the material is anything out of the ordinary, so that its composition is not known, have it analyzed, not only for its value as a source of alcohol, but also for the value of the residues that will remain after the alcohol has been distilled. If the material proves suitable, then, is it available in sufficient quantity? The revenue authorities have decided to license no distillery that produces less than 250 gal. of alcohol per day. Questions of markets, transportation, etc., must, of course, be considered. Most important of all, is the probable price that alcohol will bring, and that is quite impossible to prophesy. The demand for denatured alcohol is not going to be as large at the start as many suppose. The papers have recently published an interview in which Commissioner Yerkes is quoted as saying that alcohol is very little used in Europe for power and light. If this is true in countries where denatured alcohol has long been available, it seems probable that it will be some time before it will successfully compete with gasoline as a source of heat or power in this country. There are, however, many other uses to which it may be put, which have been overlooked. Such a one is the

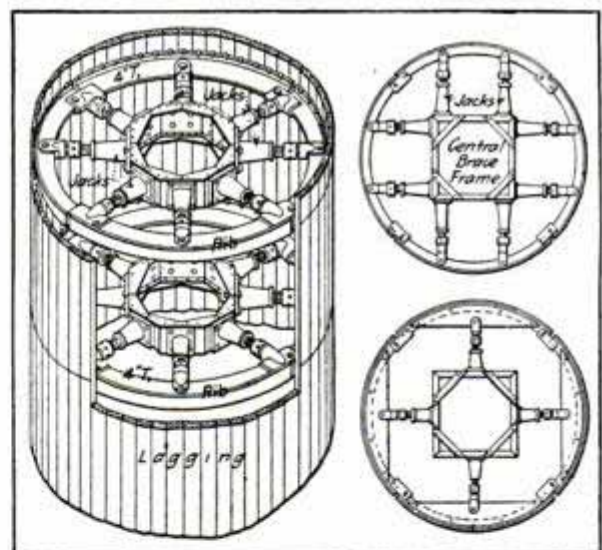
manufacture of artificial silk, which in France makes a market for an enormous amount of alcohol.

The possibilities of this business of manufacturing alcohol are so great that very many people will probably rush into it without looking into the matter carefully, but there is no doubt a great chance for the man with small capital who wants to engage in manufacturing and who is willing to give his best efforts to bringing his process to the highest degree of efficiency.

EXTENSION JACKS FOR CAISSONS

The old method of making caissons has several disadvantages. The large steel hoops used for supporting the sides are very difficult to put in place and the increased size of the shaft which is necessary with this form of support, often leads to settling of buildings or other structures in the immediate vicinity.

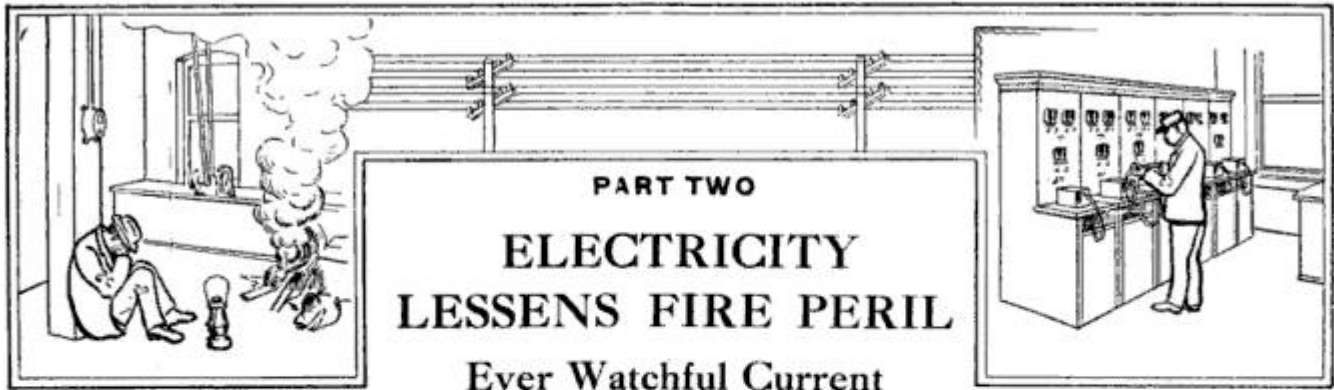
To overcome these objections, a leading Chicago engineer has designed the extension jacks shown in the accompanying illustration. By using these jacks the shaft



Caisson Supported by Jacks

may be excavated even a trifle smaller than the desired size and the jack screws being then screwed out compress the earth around the sides thereby preventing any displacement or settling. In filling the caisson with concrete each jack may be readily slackened and shifted upward or if necessary the jacks and ribs can be left in place.

Experiments with railroad jag spikes (spikes whose sides are jagged or notched) proved that they can be extracted with less force than the ordinary plain ones.



That Reports Disorders of All Protective Devices and Watches Watchmen

Editor Spends a Night with the Operator

"One-forty-three is late two minutes," said the fire alarm operator, as he glanced at the time sheet on his desk.

"Watchman must be asleep again," remarked the line inspector at his side. "It was only last week that we had to go out there and wake him up, and it is a common occurrence to have his number come in late. Perhaps it will come in after a minute or two."

The two men sat watching the row of instruments, which told a silent though significant story. It meant that the watchman in a factory, some two miles away, had failed to perform his duty.

On each floor of the factory, and in the storage shed at the rear of the building, were placed the watchman's boxes, belonging to the fire alarm company, and these boxes were all connected by wires to the central office, where the men were anxiously awaiting the signal. These boxes have a lever at one side, which, when pulled down by the watchman, revolves a notched contact wheel, thereby interrupting the circuit and sending a signal to the central office, where it is recorded on paper tape by a ticker.

As the watchman is required to pull each box at a certain specified time, he is obliged to visit all parts of the premises several times during the night, and is thus in a position to discover any fire which may happen to break out. In case of fire he is instructed to break the glass in the box, and then pull the lever. This sends two signals instead of one and notifies the fire alarm operator, who then sends in the city alarm.

When the watchman fails to pull any box at the right time, it shows that he has gone to sleep, or is in some other way neglecting his duty, and when this happens, the fire alarm company sends a man out to the building, after first waiting a few minutes to

give the watchman a chance to correct any delay which could not be avoided.

"Well, it looks as though I would have to go out there," said the line inspector, as the minutes dragged by without any signal coming in. "Shall I go out to one-forty-three?" he inquired of the superintendent, who had just entered. "The watchman out there is five minutes late, but may pull the box any minute."

"Well, don't take any chances. Start at once, and report over the line as soon as possible."

The line inspector picked up his portable 'phone outfit, which enables him to communicate with the central office at all times by connecting to any of the company's lines, and left the office.

He had been gone only a few minutes when one of the instruments started to "come in."

Click — click-click-click-click — click-click-click.

"There's one-forty-three coming in now," said the superintendent. "Charlie will have his trip out there for noth—"

Click — click-click-click-click — click-click-click.

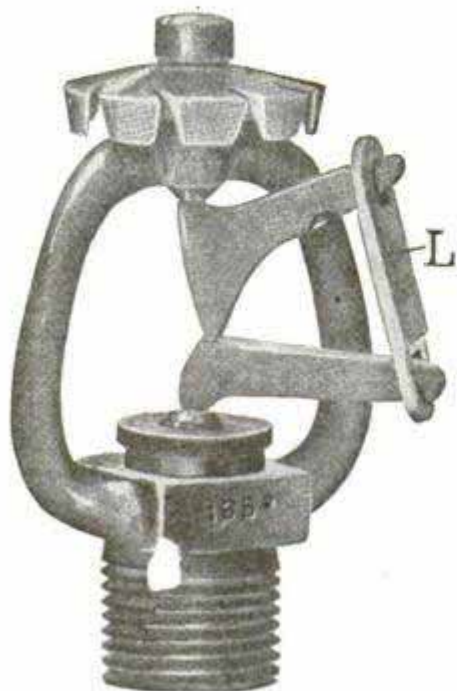
"One-forty-three, *fire!*" The operator wheeled 'round in his chair and made a dash for the sending key which signals the main office of the city fire department, and in fifteen seconds the apparatus of six engine companies was thundering through the streets on the way to the blazing factory.

The first signal of one round was the regular watchman's call, but when two rounds came in it showed that the watchman had discovered a fire and had broken the glass in the box and pulled the lever. In a few seconds the instrument began clicking again.

"One-forty-three, thermostat," said the

operator, as he looked at the clock and entered the report in the record book.

"Thermostat, is it? Well, that shows the advantage of having the automatic equipment. Even if the watchman had neglected



Automatic Sprinkler Head

his duty entirely, the thermostats would have given us the alarm. There will probably be a sprinkler alarm very soon now."

The thermostats, which are distributed over all parts of the factory, consist of small copper terminals held by a fusible solder which melts at about 160°. They are all connected by wires to a transmitter-box and when any excessive heat melts one or more of them the circuit is broken and releases a magnet in the transmitter-box. This allows a clockwork to revolve a notched contact wheel two revolutions, thus sending to central office the regular thermostat signal of two rounds.

The automatic sprinkler heads work in somewhat the same manner. They are distributed over all parts of the ceilings, being spaced about 8 or 10 ft. apart, and are all connected to a system of water pipes. A small plug, or stopper, in each head prevents the water from flowing out normally and is kept in place by two toggle levers connected by a link (shown at L in cut). The link is made of two pieces of metal soldered together by a very fusible solder which melts at 165°. When the solder on the link melts, the pressure of the water pulls the two halves of the link apart, and forces the plug out. The water then rushes from the opening at the rate of a barrel a minute, and, striking the deflector at the

top, is spread in all directions, thus drenching everything in the vicinity, and in many cases entirely extinguishing the fire.

When a sprinkler head goes off, the flow of water through the pipe opens a check valve in the line and, by suitable electric connections, a circuit is thereby broken, which circuit connects to the transmitter-box mentioned above. This releases a second magnet in the transmitter-box and the fact of the open sprinkler is thus made known to the operator at the central office.

The water from an open sprinkler head continues to run until the supply tank is exhausted, or until some one shuts it off, but the valve for this purpose cannot be closed without sending a trouble signal to central office. If it were not for this, the valves might be closed for some purpose and then left in that condition, a state of affairs which would make the whole sprinkling system unreliable.

"What's coming in on that wire now?" inquired the superintendent.

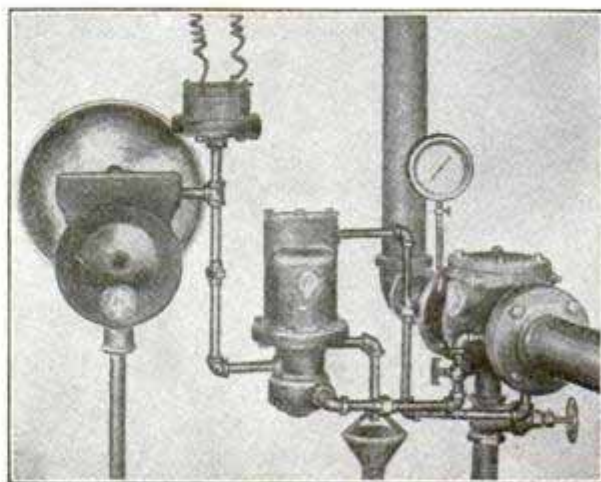
The operator went over and examined the tape. "Sprinkler alarm."

"Watchman's alarm, thermostat, and sprinkler alarm, all in less than two minutes! Must be quite a fire, and in a place like that, if not checked quickly, will soon be past all control."

There were several minutes of silence then, interrupted only by two or three watchman's calls from other places, all of which were punctual.

At last one-forty-three came in again. "Sprinkler valve shut off," exclaimed the operator.

"What! The sprinkler valve shut already? Can't be much of a fire, or else—" the superintendent reached for the telephone directory. "Somebody might be tampering with the sprinkler system."



Sprinkler Head Alarm

"What place near there would be open at this time of night?" he said, half to himself, as he began turning over the leaves of the directory. "We've got to find out how things are going out there."

But his search was soon interrupted.

Click — click-click-click-click — click-click-click. One round; that was the regular watchman's signal, if given at the proper time, but it now indicated that one of the line men desired to communicate with the central office. The superintendent picked up a telephone and plugged into the instrument.

"Hello, Charlie! What's the matter out there?" A brief pause, and then, "What's that? The watchman tried to put out the fire himself? Well, this will teach him to pull the box immediately the next time he discovers a fire. The fire is all out, is it? All right. Good-bye," and thus ended the state of excitement which started by the failure of a signal to come in at the proper time.

The factory in which this fire occurred was occupied by furniture manufacturers, who had stored large quantities of excelsior and unfinished furniture parts in the room where the fire started. The men had been careless in allowing the excelsior to become scattered around loose and it is evident that the flash heat produced by the combustion of this material was sufficient to fuse the thermostat and two sprinkler heads before the fire had gained much headway.

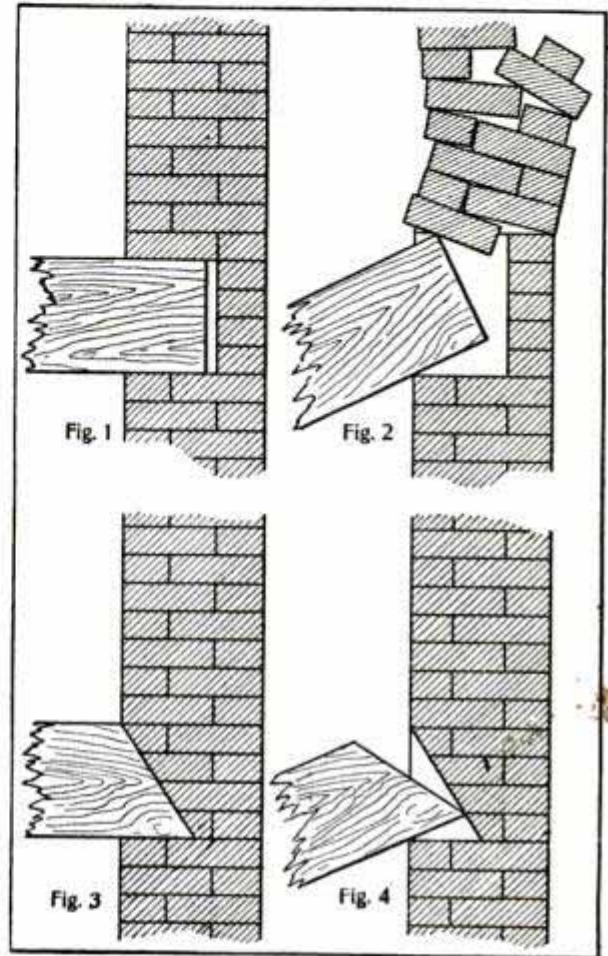
The timely arrival of the fire department then prevented any further danger, and quickly subdued a small spreading flame, which, had it not been extinguished, might have set fire to quantities of turpentine and other inflammable material close by.

The direct cause of the fire was never ascertained, although every effort was made to discover any possible clue that would lead to its solution. It seems that the watchman discovered the fire when it was a comparatively small flame and becoming excited, tried to put it out instead of pulling the box, but as fast as he would extinguish it in one place the flames would spread in several other directions, until the whole room was ablaze. He then pulled the box, with the results previously described, but had he failed to do so, the thermostats would have given the signal before it was too late.

Vaseline with a small amount of powdered gum camphor added and heated over a slow fire will keep tools from rusting.

SQUARE END TIMBERS A SOURCE OF DANGER DURING A FIRE

The accompanying illustration shows the advantage of using beveled timbers in brick walls. The timber shown in Fig. 1 in falling will overturn the wall as shown in Fig.



Beveled Timbers Best

2, while the beveled timber shown in Fig. 3 will fall out easily as shown in Fig. 4. The importance of observing this precaution is shown by the reduction in the insurance rates of buildings having the beveled timber construction.

GOOD WAY TO CUT BOTTLES

Turn an eye, large enough to take the size of the bottles you wish to break, on one end of a $\frac{1}{2}$ -in. iron rod and leave a handle about $2\frac{1}{2}$ ft. long. Put the tool in the fire and heat to a shade over red, says a correspondent of the Blacksmith and Wheelwright. Put the hot eye of the tool over the bottle to the point where you wish it cut; turn the bottle around a few times, then take it out of the eye and dip it in cold water, and the cut will be just where you intended.

LOCOMOTIVE WIND SPLITTERS

Radical Changes in Appearance Growing Out of High Speeds

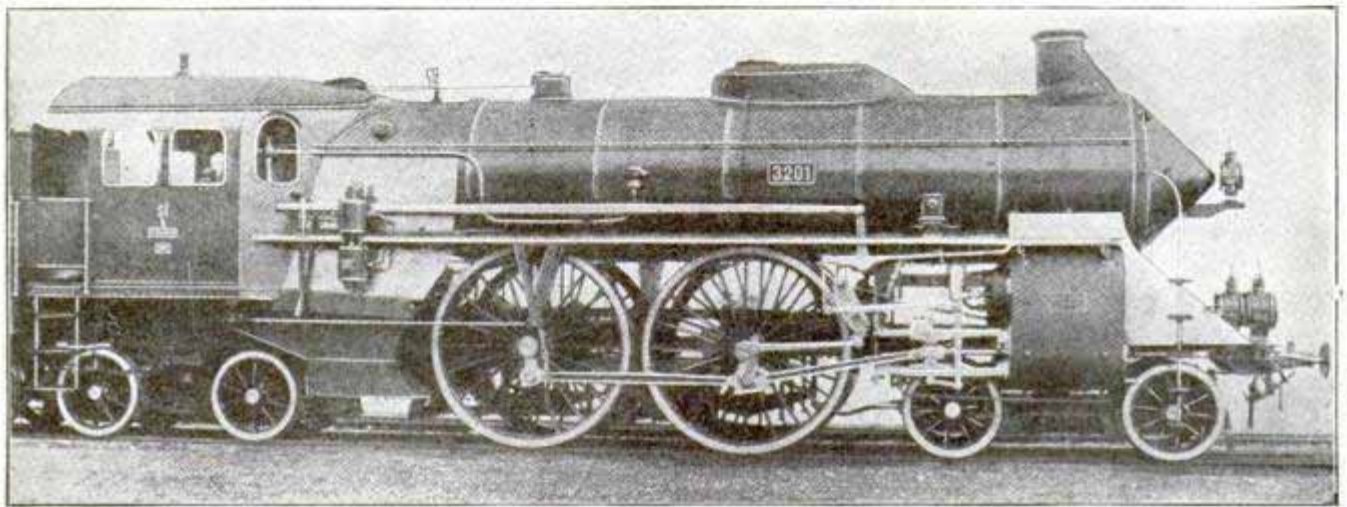
Locomotives with "beak casings," which now instantly catch the eye, may soon become so common as to attract no unusual attention. For the past 20 years the smokestack has been steadily shrinking in size and disappearing into the as steadily increasing boiler, until now in the latest American and Continental engines the "upper works" of cab, dome, sand box and stack are being brought closely to one level.

Much more attention has been given abroad to the subject of atmospheric resistance when running at high speed than

A HICKORY CONVENTION

Delegates from the several thousand firms in this country using hickory in their manufacturing held a convention to discuss what they should do about it. They frankly admit it is a hard proposition, and conditions are actually alarming.

It was found that 250,000,000 ft. of hickory is being consumed each year, and the end of the supply is already within sight. While maple users are substituting ash, there appears no available substitute for hickory to any extent. A committee of 15, one each from as many different lines of manufacture, was appointed to make plans for conserving the remaining supply and encouraging planting.



Bavarian Locomotive--Speed 90 Miles an Hour

here, but American builders are likely to adopt the same measures in the near future. The theory is admitted, but the practice has not yet been adopted. The illustration, from the *Railway Age*, is of a large and latest built locomotive, turned out at the works at Munich, for the Bavarian State Railways. With the exception of the wind-splitting features it will be noted as following American lines more closely than has heretofore been adopted by foreign builders. The front end, however, still suggests a small boy who has just shed his front teeth.

The only woman captain on the Great Lakes is Mrs. Ogden McClurg, of Chicago, the Government recently bestowing the rank. She commands the 74-ton steam yacht "Sea Fox."

It is estimated that the cement kilns now in operation in the United States can produce 129,000 bbl. per day.

WATER ANCHOR FOR BALLOONS

A water anchor of French invention has been tested in several recent balloon trips made by Dr. Julian P. Thomas, the New York aeronaut. The anchor consists of a cone-shaped canvas bag holding 200 gal. of water and being attached at its mouth to a wooden hoop. When not in use the anchor is hung at the side of the basket. A rope 150 ft. long is attached to it. The anchor was used successfully when the balloon dropped into the Hudson river recently, and again during a 225-mile balloon voyage made by Dr. Thomas and Roy Knabenshue. In the latter voyage a new guide rope proved of great advantage, enabling the aeronauts to descend wherever they liked, for meals or to get their bearings. The long trip was made without mishap.

The harder a metal is, the less friction it produces.

EXPERT ON FIREPROOFING

Gen. Wm. Sooley Smith says that slow combustion of buildings can be secured by carefully whitewashing the inside and outside with fireproof material laid on with a brush. Fire departments claim that they can extinguish almost any fire if only it is prevented from spreading too much before they can bring their engines into play. It is of the utmost advantage to protect each building from the danger of taking fire in case of the burning of its neighbors, and this can be at least measurably done by the whitewashing suggested.

The essential characteristics of a fireproofing material for buildings are:

First—It must itself be incombustible.

Second—It must be as nearly as possible a non-conductor of heat.

Third—It must be strong and durable.

Fourth—It must endure heating to redness and plunging into cold water without cracking.

While there are many so-called fireproofing materials in use for which these qualities are claimed, there was, up to a very recent period, not one of them that was a good non-conductor of heat, and that would stand heating to redness and being plunged into cold water while red hot without flying to pieces.

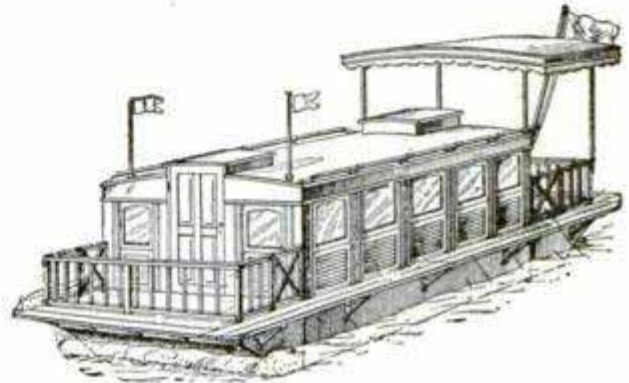
GASOLINE MOTOR FREIGHT BOATS

From the gasoline launch to a well developed freighter is a logical progression, and vessels of this type are rapidly increasing. Several have been built on the model shown

in the illustration, which is 120 ft. long, 21 ft. 8 in. beam, and draws 4 ft. 6 in. The engine is 4-cylinder, each 11 in. diameter by 13 in. stroke, and weighs 11 tons. A recent trip of 230 miles was made without a single stop. In still water a speed of 9 miles an hour is attained on 9 gal. of gasoline per hour; or one gallon per mile per hour. Boats of this class are intended for use on inland waters, although one is running in the Gulf, out of New Orleans.

HOUSEBOAT WHICH FOLDS UP

A Canadian inventor has produced a houseboat in which the roof can be raised while the sides and ends of the cabin are



Folding Houseboat

folded down on the deck. The roof is then lowered and the boat occupies very little space. For passing under low bridges where otherwise the boat could not go, the device is convenient, as the folding process requires but little time.



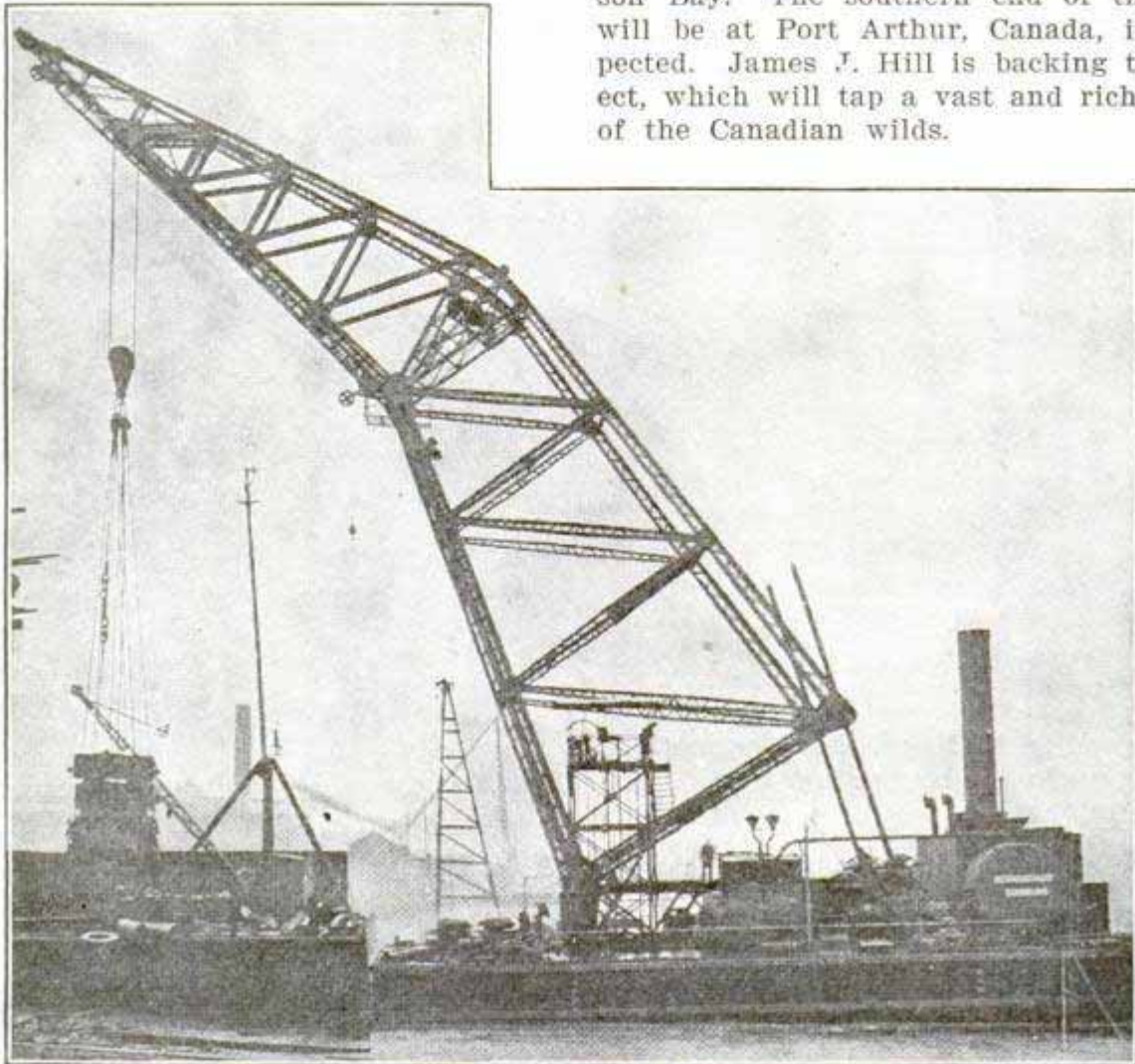
Gasoline Freight Boat for Inland Waters

GIGANTIC FLOATING CRANE

The building of a vessel, or any other large construction which exceeds in size all its predecessors, always involves more or

SURVEYING FOR SUPERIOR-HUDSON BAY CANAL

Two surveying parties are now engaged in running lines north and south for a canal to connect Lake Superior and Hudson Bay. The southern end of the canal will be at Port Arthur, Canada, it is expected. James J. Hill is backing the project, which will tap a vast and rich section of the Canadian wilds.



Floating Crane for Handling Huge Vessel's Machinery

less machinery and equipment of proportions until then unheard of and is apt to set a new standard for many and varied lines of industry. The new mammoth Cunarders, "Lusitania" and "Mauritania," now building, have not been behind in this respect. Our illustration shows a gigantic floating crane being used in fitting the "Mauritania" with her boilers and machinery.

The crane is mounted on a barge 90 ft. long and 77 ft. beam which has four sets of propelling machinery and a speed of six miles an hour. The crane will lift 140 tons at an outreach of 44 ft. beyond the front of the pontoon. Two other lifts are of 5 tons and 20 tons capacity.

The railways of Great Britain employ 600,000 men, of whom 200,000 are engaged in track repairs.

WIRELESS BLOCK SIGNAL SYSTEM FOR SEAS

A wireless block signal system for the seas is declared to be possible through a new apparatus which acts over a short radius, even as short a distance as a half-mile, the field of operation being limited at will. The device could be used to notify a vessel of the proximity of other vessels in a fog or heavy weather, and so prevent collisions.

It is said that a stream of water discharged under several hundred pounds pressure will resist the blow of an ax. The ax rebounds from the water as it would from a bar of steel.

FUTURE SUPPLY OF TELEPHONE POLES

Present Annual Requirement for Renewal Alone 2,650,000 Poles--Demand Increasing

At the present time there are about 800,000 miles of pole line (telephone and telegraph) in operation in the United States. By far the greater part of this mileage is located in the East, but the linking up of the cities, villages and rural districts of the West is proceeding at such a rapid rate, while the increase of mileage in the East has by no means reached its limit, that it is safe to declare that the greatest growth of the telephone system is still before it. With this prospect the question concerning the pole-line construction companies, is the future source of supply of poles, timber for cross-arms and insulator pins. The Year-

several of the oaks are used. For cross-arms, longleaf, shortleaf, and loblolly pines of the South and Norway pine of the North are used; also cedar, cypress, spruce and red fir. For insulator pins, black locust is the best of all woods, but the supply has been so depleted, other woods as substitutes are being tested.

As a measure against future distress from scarcity of poles both the government and the telegraph and telephone companies are carrying on extensive experiments in the preservative treatment of poles, tending both to lengthen the term of service of the pole and also to adapt new species to this pur-



Treating Chestnut Poles by Tank Method



Treating White Cedar by Brush Method

book of the Department of Agriculture for 1905 says:

"Assuming that the 800,000 miles of pole line are constructed on a basis of 40 poles per mile, and that each pole contains an average of 20 cu. ft., it will be seen that there are now in use 32,000,000 poles, representing 640,000,000 cu. ft. of timber. If the average length of life of these poles is 12 years, there are annually needed, for the maintenance of the present lines alone, over 2,650,000 poles, containing approximately 53,000,000 cu. ft. of timber; and if it requires 60 years to grow a pole, to maintain the supply there should be five poles growing for every one in use, or 160,000,000 poles for renewal merely, besides what the extension of business will call for."

The timbers chiefly used for poles are chestnut and Northern, Southern and Idaho cedar. Also, longleaf and shortleaf pine, red cedar, cypress, redwood, locust, catalpa and

pose. Three treatments have been employed in these tests, two of which, the brush and the tank treatments, have proven practicable. Preliminary experiments were concerned with the seasoning of the poles. It was found that those cut in the winter dry more regularly and at the end of six months are better seasoned than those cut in the spring and summer. Also, that soaking in water for from two to four weeks hastened the rate of subsequent seasoning. Shrinkage was found to be less with air seasoning than with the application of artificial heat.

In nearly all parts of the country the section of the pole subject to early decay is the part immediately above and immediately below the ground line; therefore, this is the part on which the preservative is used. The brush method consists in applying from one to three coats of preservative to the outside of that part of the pole between 2 ft. and 8 ft. from the butt, the time between

applications ranging from a few hours to two days. Poles treated were weighed, examined and tested in every way possible.

The tank method consists of soaking the butts of the poles in tanks so constructed that the poles lay at an angle of about 20°. The butts of the poles are immersed for a distance of about 8 ft. in a tank containing cold preservative, which is gradually heated by a fire underneath the tank until a temperature of from 240° to 270° F. is reached. This temperature is maintained for about five hours, when the fires are drawn. The poles are left in the tank for several hours after the preservative has become cold, so that the entire treatment consumes about 24 hours. By this method a penetration of about 1/2 in. is obtained.

The cost of a green pole at the setting hole may be put at \$5; of a brush-treated pole, \$5.40, and of a tank-treated pole, \$5.65. The

<u>20 YEARS SERVICE</u>	{ Estimated Life of Tank-Treated Pole
<u>19.1 YEARS SERVICE</u>	{ Time Pole Must Last To Pay For Tank Treatment
<u>16.3 YEARS SERVICE</u>	{ Estimated Life Of Brush-Treated Pole
<u>12.6 YEARS SERVICE</u>	{ Time Pole Must Last To Pay For Brush Treatment
<u>12 YEARS SERVICE</u>	{ Estimated Life Of Green Pole

Diagram Showing Value of Treatment

average life of the green pole is about 12 years; of a brush-treated pole, 16 years, and of a tank-treated pole, 20 years. By applying a formula for calculating the annual charge on an expenditure occurring now and recurring regularly, we find that with interest at 4 per cent the annual charge for a green pole is \$0.5328, for a pole treated by the brush method \$0.4634, and for a pole treated by the tank method \$0.4157. A comparison of these annual charges shows that by using a pole treated by the brush method instead of a green pole an annual saving of about 7 cents is effected, while if a pole treated by the tank method is used the annual saving will be about 12 cents. The difference between the annual charges for poles treated by the brush and by the tank method is 4 cents.

These small savings may seem insignificant in themselves, but if we apply them to the 32,000,000 poles in use we have the following figures as the annual saving by using treated poles instead of green poles:

By brush method.....\$2,240,000
By tank method..... 3,840,000

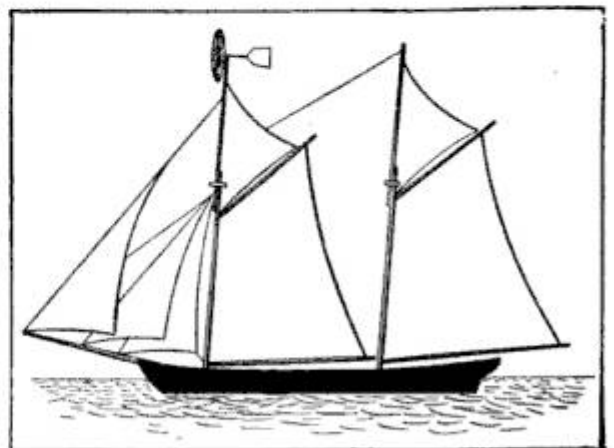
These savings represent the value at the setting hole of 415,000 poles if treated by the brush method and 678,000 poles if treated by the tank method.

In setting the poles with a view to noting the effects of the preservative, 300 seasoned 30-ft. cedar poles and the same number of chestnut poles, some treated and some untreated, were used in a Georgia telephone line, a section of the country where wood decays rapidly and therefore results could be obtained in the shortest possible time. A treated pole was placed between a green and unseasoned pole in every instance so that conditions are uniform and fair. Several years must elapse before conclusions can be drawn, but the importance of the work and the results already obtained are such as to warrant increased endeavor along this line.

WINDMILLS ON SAILING SHIPS

Work the Pumps While the Men Sleep

Ocean going sailing vessels, those which have no steam or gasoline engine power for hoisting purposes, can now be supplied with a pumping outfit operated by one or more windmills. There is always more or less leakage in even the best boats, and the bilge pump is as necessary an adjunct as the compass. On most sailing vessels these pumps are worked by hand, the process being very monotonous and tiresome. The windmill apparatus, which is a patented affair, can be placed either at the top of the mast on schooners which have their fore-topmasts down, or two or three feet abreast of the main or mizzen masts, and clear of the sail and boom. The pumps already in use can be utilized for the new system, which is specially recommended for lightships and other anchored craft.

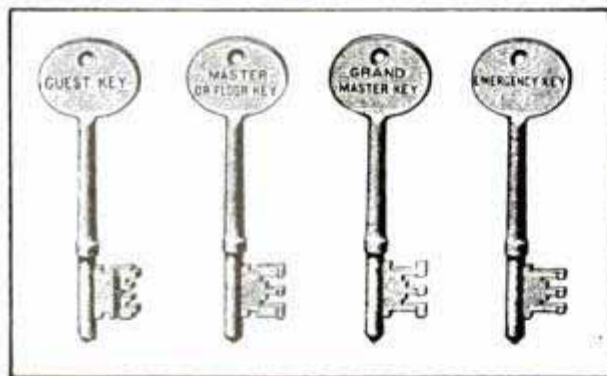


Windmill for Operating Bilge Pumps

A windmill on a ship would look as unusual as an anchor on a barn, but the idea is so practical it is likely to come into general use on vessels which use sails entirely for propulsion.

A LOCK WITH FOUR KEYS

An improved type of hotel lock, which has recently been placed on the market, is provided with four different keys, as shown in the illustration. The first, or guest key, will unlock the door from the outside, only when not locked with any of the other keys. From the inside, however, it will operate at all times, and when the door is locked from that side the knob on the other side cannot be turned. The stationary knob then indicates that the room is occupied, so that the maid will not unnecessarily awaken or disturb an occupant by inserting the master or floor key in the lock. When the door is locked from the inside by the guest key,



Four Keys for Hotel Locks

the key cannot be taken from the lock, thus always insuring the key being in the lock in case of fire or other emergency.

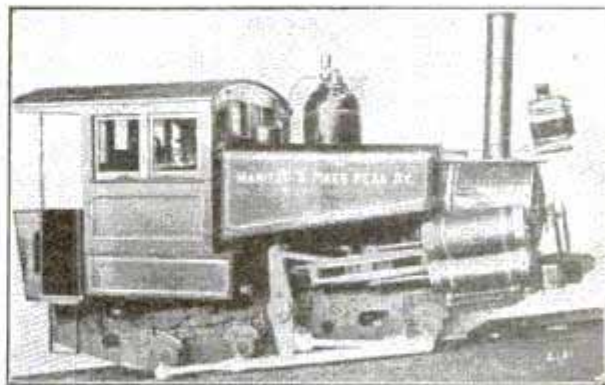
Next in order is the master or floor key, designed for a maid's use, and operative on the locks of all rooms on a floor when not locked on the inside.

Then comes the grand master key, which throws the locks on all rooms in the hotel when not locked on the inside.

The fourth style of key is the emergency key, by the possession of which the locks on all room doors in the hotel can be unlocked from the outside, even when locked from the inside with the guest key in the lock. This key is designed exclusively for the use of the proprietor or manager, and kept, for instance, in the office safe, accessible only to the owner or his designated representative, for use only in case of great necessity, as, for example, fire, sickness, suicide or other unnatural occurrence in the room.

NEW RACK LOCOMOTIVE FOR PIKE'S PEAK

The rack railway up Pike's Peak has received a new locomotive. It will burn oil instead of coal, the fuel tanks holding 325

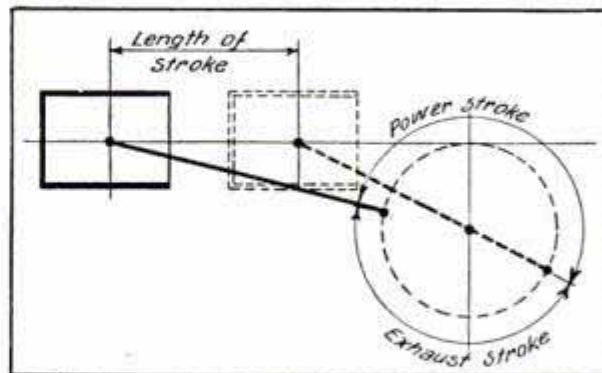


Rack Locomotive that Burns Oil

gal. The engine weighs 60,000 lb.; is equipped with hand, steam and water brakes, and has a tractive power of 25,284 lb. The maximum grade on the line is 25 per cent.

A NEW CRANK MECHANISM FOR GAS ENGINES

In gas engines as usually constructed (i. e., with the crankshaft on the center line of the cylinder) the power stroke and exhaust stroke are both equal, the angle of each being 180° ; but in a crank mechanism recently patented and shown in the accompanying sketch the power stroke is considerably longer. This is accomplished by placing the crankshaft off center, as shown, and if this arrangement is not detrimental to



Motion Diagram of Crank Mechanism

the wearing qualities of the cylinder, it may possibly prove a great advantage in future gas engine construction.

A sensitive thermopile and galvanometer will detect the heat radiated by a candle two miles away.

DANGERS OF CITY LIFE

The danger of sudden death from hostile savages and dangerous beasts that infest an African jungle is not necessarily as great as those which overtake the strenuous dweller in a great city. Every time he walks a business street he is in peril from dangers he seldom or never sees and of which he has no knowledge.

Beneath the sidewalks are steam boilers weakened by long use and over-work which may let go at any minute; and stores of dangerous explosives and chemicals; likewise accumulations of gas which only wait the moment when some electric wire emits the spark that sets it off. Towering above his head rise story on story of lofty skyscrapers, with hundreds of open windows from any of which a careless occupant may drop some article that in its fall of two or three hundred feet becomes as deadly as a cannon ball.

Painters and window washers may drop pails or tools, and frequently lose their own lives and endanger others when they miss their hold, or some rope breaks and drops them into the street below. The wonder really is that the fatalities are so few.

The transportation systems, however, are the ones with the big death list to their account. Were all the people who are killed in a single month by teams alone to lose their lives in a fire or railway accident, the daily papers would devote columns to the event. Occurring one at a time the fatal incident causes no excitement and receives only a few lines in an obscure part of the paper.

Chicagoans perhaps take more chances than residents of other cities, or it may be for other reasons that its death roll from street accidents are larger than in any other city in the world, in proportion to population. During the first seven months of 1906 there were killed 259 persons, while 2,671 were injured. Last year's record was 425

killed and 4,535 injured. For this year the causes of death are divided as follows: Trains killed 138, street cars 75, teams 59 and automobiles 7.

TUNING PIANOS BY TELEPHONE

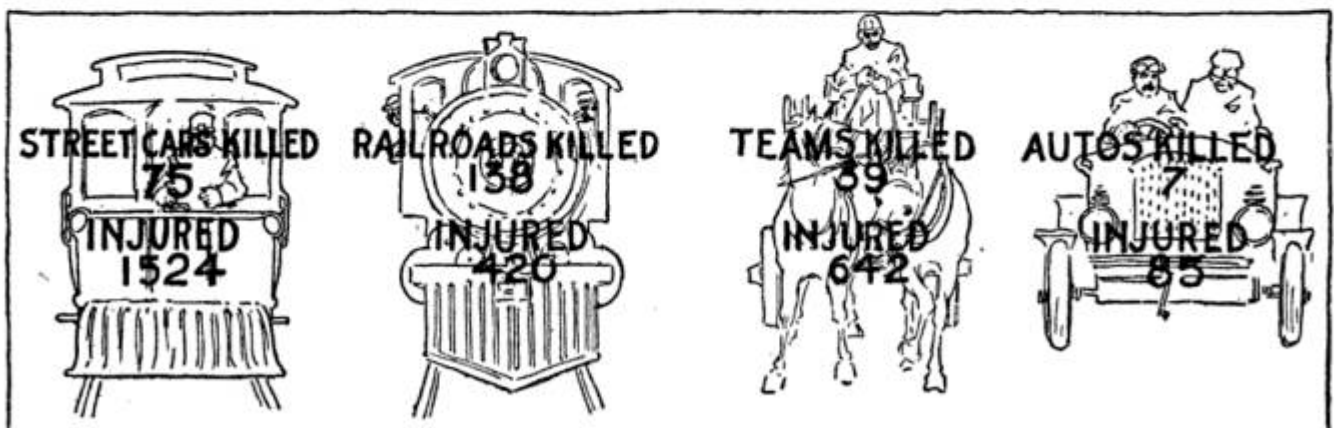
Among the increasing number of uses to which the telephone is put is that of tuning pianos, even at long distances. A man at South Bend, Ind., called up a piano tuner at Wabash, Ind., 64 miles distant, advising him that a new instrument needed tuning. The tuner told the owner to sound the instrument, which was near the phone, and then gave directions for changing the tension. The piano was then sounded again and pronounced in perfect order.

ELECTRICITY AS A FIRE HAZARD

The newspaper reporter has long found an easy and plausible excuse for city fires in the stereotyped "crossed electric wires." In the earlier days when less attention was paid to careful wiring and insulating materials were of an inferior quality, and electricians were less competent and experienced, there doubtless were frequent grounds for the charge.

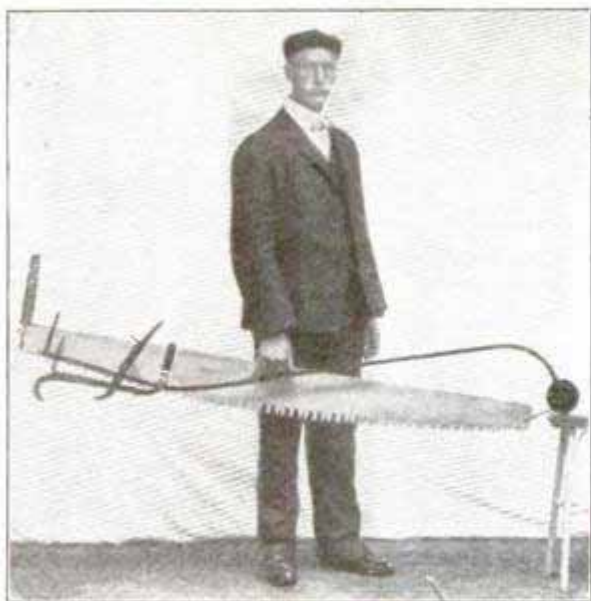
Largely through the work of the Fire Underwriters, restrictions and requirements have become standard which safeguard electric wiring to such an extent that the old hoodoo is fast becoming obsolete. For instance, in New York city the fire losses from 1902 to 1905, inclusive, which were traceable to defective wiring or other electrical causes, were only 361 cases with a total loss of \$207,610. The electrically caused fires were only 1.34 per cent of the whole, and the losses 1.15 per cent of the whole.

Turpentine is better than oil for use when drilling hard steel, saw plate, etc.



Seven Months' Record in Chicago

ONE-MAN HAND SAWING MACHINE



Worked with Coil Spring

A one-man sawing machine, which, it is said, will cut a cord of wood in 40 minutes and does better work in operating the saw than where two men are required, is a recent invention. The machine is operated by a double acting coil spring adjustable to suit either the weakest or the strongest man. The coil spring is 10 ft. in length and 1 in. in width and pulls when the operator feeds and feeds when the operator pulls.

With this invention one man can fell trees either on rough or on level ground and then cut the timber into logs or wood. The machine is attached to a tree or log in a second's time ready for operation and the saw cuts straight into the timber from the first stroke. It may be used with either a short stroke or with a full sweep. The machine weighs 8 lb.; any sized cross-cut saw is used in it.

HOW AN ACETYLENE GENERATOR WORKS

Intense Light Possessing the Physical and Chemical Properties of Sunlight

The light coming from the sun consists of several colors, which may be readily separated by passing it through a triangular prism of glass. The colors thus formed are the same as those found in the rainbow, and are known as the solar spectrum. All of these colors have a certain effect on the eyes and the proportion of each that enters into the composition of sunlight has proved to be the most conducive to good vision. For this reason the light from kerosene or gas is inferior to daylight, as it contains an excess of red and yellow light and has practically no violet light.

The violet rays are the chemical rays and possess all the health-giving and germ-destroying properties which make sunlight so beneficial and desirable. They are also the rays which cause plants to grow, and for this reason plants cannot be raised by gas light or any other light lacking in violet rays.

The electric arc-light while possessing an abundance of violet rays, is very unsteady and produces an unconscious eye strain which is very fatiguing to the nerves. This is especially true of alternating current arc-lights, where the fluctuations may be readily seen by rapidly moving any bright object such as a coin or pen knife, the effect being very similar to that of moving pictures.

The acetylene light, unlike the electric arc-light, is very uniform and still has the desired violet rays which make it resemble sunlight.



The effect of these rays is apparent in the accompanying illustration, which shows two lilies raised under exactly the same conditions, except that one received sunlight by day and acetylene light during the night, while the other received only the rays of the sun.

The superior light of acetylene is not the only advantage it has over ordinary city gas. The former is much cleaner as it produces no soot or smoke, when working properly. It also produces less heat for the same amount of light, and consumes much less oxygen. There is prac-

tically no danger of asphyxiation from acetylene, as it is less poisonous and of much stronger odor than city gas, and the danger

of fire is now so much less than when the first crude experimental devices were in use, that the National Board of Fire Under-

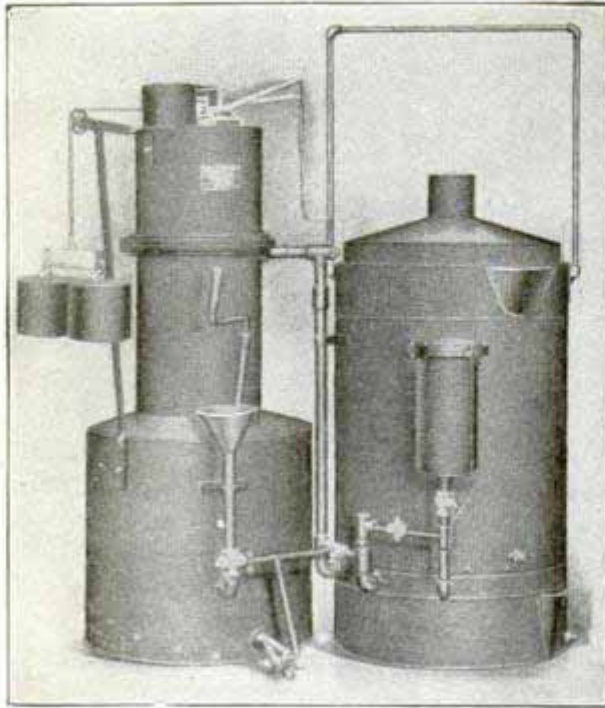


Fig. 2--A Generator

writers no longer make an increase in the insurance rate when acetylene apparatus is installed.

The properties of calcium carbide are now so well understood that all the objections, which were so obvious in the earlier generating apparatus, have been overcome. Instead of dropping water into the carbide, as was formerly done, the carbide is dropped into the water.

The parts of a modern generator are shown in Figs. 2 and 3. The carbide is contained in a hopper, A, and drops on a revolving disc, B, the movement of which causes the carbide to fall over the edge and drop into the water below. The disc is turned by means of the clockwork motor, C, which derives its power from the weights, D.

As the carbide drops into the water it forms acetylene gas, which rises to the surface and passes into the gas holder, as indicated by the small arrows. In order to prevent residuum from accumulating in the water chamber, an agitator, E, is provided. It is made of a heavy wrought-iron bar, constructed in the form of two paddles, which are attached to an upright rod, the end of which is formed into a crank in a convenient position for turning.

As the gas passes into the gas holder, the tank, F, is slowly raised until it nearly reaches the top, when the chain, G, raises the lever, H, and stops the motor. This

stops the disc, B, and thus prevents any more carbide dropping into the water. Some machines have a second lever which operates a little later, should the first one fail to work properly.

The position of the weights is a fairly accurate indicator of the amount of carbide contained in the hopper, as the amount that is fed depends on the movement of the weights. An interference device, which locks the motor when the hopper is not properly closed, prevents any mistake in operating.

As the gas leaves the reservoir, it goes through the filter, J, where it passes through several thicknesses of felt, thus removing all particles of lime, dust or other physical impurities in the gas, which would possibly clog up the burners. These impurities in the gas were responsible for the smoky lights in the earlier acetylene apparatus.

A general view of the piping and installation is shown in Fig. 4. The generator, usually placed in the basement, supplies all the burners, which are connected by pipes in the same manner that city gas is used. The cost of the entire apparatus for a residence is about \$150, and the running expenses are about \$15 a year.

The discovery that has made the acetylene light a success commercially is that of Moissan, who first produced calcium carbide by the chemical combination of lime

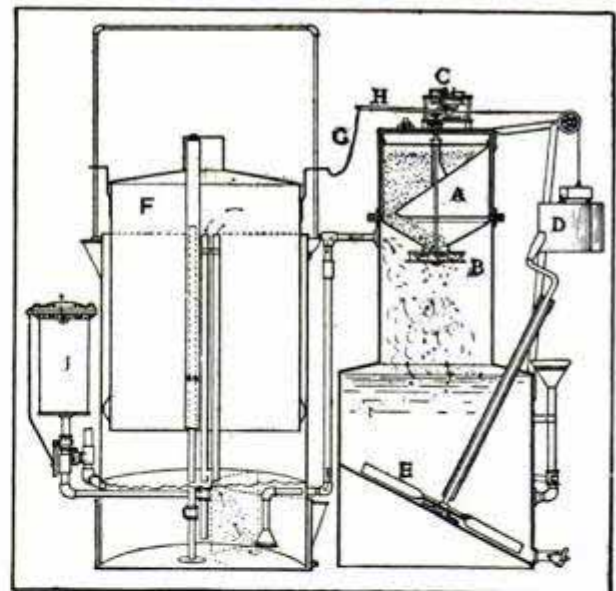


Fig. 3--Section of Generator

and charcoal. The two ingredients, on being mixed together and heated in an electric furnace, unite to form calcium carbide, which consists of one atom of calcium and two atoms of carbon (CaC_2).

When this substance comes in contact with water, which is composed of hydrogen

and oxygen (H₂O), the calcium displaces part of the hydrogen, which then unites

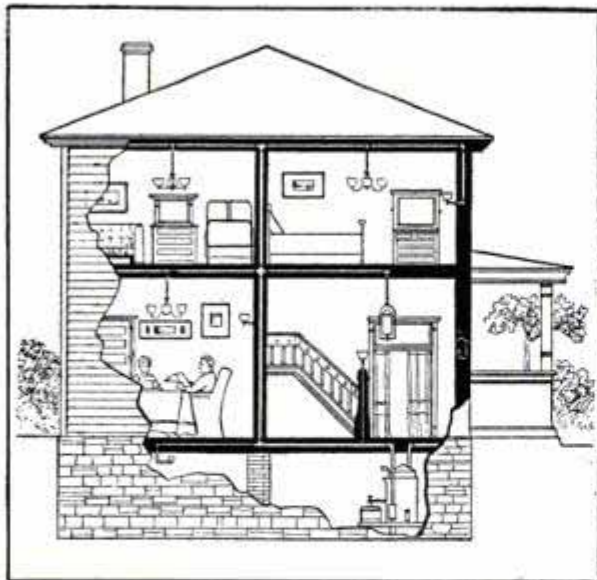


Fig. 4.--Acetylene Illumination Installation--Generator in Basement

with the carbon and forms acetylene gas ($\text{CaC}_2 + 2\text{H}_2\text{O} = \text{C}_2\text{H}_2 + \text{Ca}(\text{OH})_2$).

Calcium carbide is also made with lime and coke, or lime and coal dust. The mixture is put into a crucible surrounded by a wall resting on a metal plate, which acts as an electrode. A large carbon rod passes through the cover and acts as the second electrode. A current of several hundred amperes is then passed through the mixture, which unites at a white heat to form calcium carbide.

WHEN NAVIGATION OPENS ON THE YUKON

The arrival at Dawson of the first river steamer after its tortuous journey of 1,800 miles from the sea, is always the great event of the year. Its coming is eagerly watched for, and the welcome whistle of the first boat draws the people by hundreds to the dock. Although communication with the outside world is maintained through the winter by means of sleighs, the river transportation is depended on for the bulk of the freight traffic, and will be until more railroads are built. The ice went out this year on May 11, and in ten days the river was clear.

The growth of the North in the next ten years will astonish the world, for this expanse of country of thousands of miles is destined to be inhabited by man and it will eventually supply all his needs.

The soil is now beginning to produce just as man tills it, growing all the vegetables

and many of the grains. The earth is producing coal, copper, gold, and many other metals are being discovered steadily, while the railway companies are driving their steel rails over mountain and valley, tapping the heart of the rich country.

At Dawson we have opened today a narrow gauge line of road which connects with the Forks (12 miles), a mining center, and by fall will be extended 30 or 40 miles more and eventually will reach 75 miles from town. Heavy dredging machinery is being shipped here and this phase of mining has proven to be very cheap and thorough, and a safe investment. The ground is unfrozen in many places which makes it easy to operate, and the frozen parts are quickly thawed out with "steam points" in advance of the dredges.—Contributed by C. W. Tennant, Dawson, Y. T., July 16, 1906.

NIAGARA POWER MILKS COWS

A pole line for power transmission from Niagara Falls back into the state passes over and along hundreds of farms. The farmers are taking advantage of the opportunity to use electric power, which in this case is cheap, for many of the daily occupations. One farmer, who has installed a milking machine in his large dairy, is using current generated at the Falls, cutting and grinding feed, milking, cooling the milk by mechanical refrigeration, and churning into butter.

Really inventions are coming to such a pass that one is almost in doubt as to which is the greater wonder—the Falls themselves, or the many utilities which are made possible by the great power plants at Niagara.

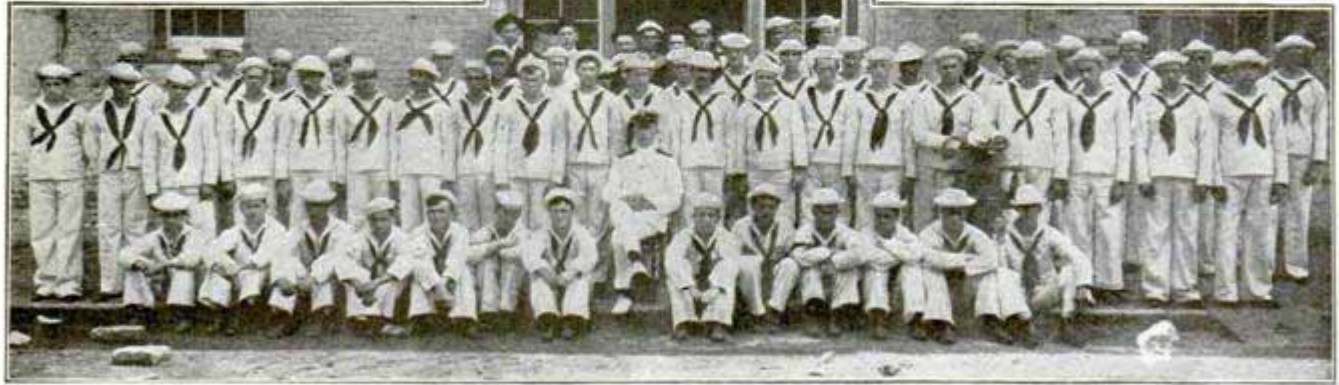
SIGN CHECKS WITH THUMB MARKS

Instead of the cross mark used by illiterate persons as a signature for many years, an impression of the right thumb is to be substituted. No two thumb marks are alike and therefore there would be less chance for forgery than when the cross mark is used. Large concerns employing many illiterate men—chiefly foreigners—have lost thousands of dollars through forged pay checks; losses the thumb impression system will at least materially decrease. Banks always take a description of the depositor, but even this does not protect against forgery where the cross is used, as persons frequently change in appearance. The lines of the thumb do not change.

THE ARTIFICER SCHOOL OF THE NAVY

Where Young Mechanics
Receive Special Train-
ing for Work on
Battleships
at Sea

Must be Able to Make
Repairs Without the
Usual Machinery
Found on
Shore



Graduating Class, June, 1906

This school was established at the Navy Yard, Norfolk, Va., on the 10th day of December, 1902, since which time fourteen classes have completed the course of instruction. The aim and purpose of the school are to give such instruction and training to enlisted men possessing trades of blacksmith, painter, plumber and fitter, shipfitter, carpenter's mate, and shipwright, as will fit them for duty on ships afloat.

The faculty consists of the naval constructor of the Navy Yard, as head of the school, assisted by a chief carpenter of the Navy, in direct charge, and five civilian instructors, who are practical mechanics representing the respective trades taught, and especially selected as to their fitness for this duty from among journeymen employes of the Navy Yard.

The men who are sent to the school for instruction usually have some knowledge of the use of tools in their respective trades, or show considerable aptitude for some particular trade. Many civilians are examined in the school and at the recruiting stations for enlistment in the artificer branch of the Naval service, and quite a number of men who have served one or more enlistments in the seaman or other branches, and who, prior to their entry into the Navy, had worked at some of the above mentioned trades, or who have shown aptitude for one of the trades during their service, are assigned to the school for a course of instruction, and often prove to be excellent mechanics.

The buildings assigned to the school for workshops are well adapted for that purpose, with good light and ventilation, and comfortably heated in winter. In the main building are located the headquarters of the school, carpenter shop, paint shop, lecture room, and model room. The model room is provided with all types of hand pumps and water closets, for the instruction of the plumbers' class, and contains also an anchor engine, hawse bucklers, a pneumatic "Long Arm System" watertight door, with air compressor plant complete for operating it; two hand closing watertight doors, capstan, model hatch, air port, and other minor interior fittings used on board ships. There is a 38-ft. iron hull model of the armored cruiser type in this room, which was built by the successive classes while under instruction. The interior structural work of this model is similar to that of an armored cruiser, though not built to scale; the outside plating is put on with screws instead of rivets, so the plates may be readily removed to admit of interior observation. The plumbers and fitters and shipfitters are located in the inside fitters' shop, where the plumbers are provided with all necessary forges, benches, bending tables, etc., and the shipfitters have a conveniently arranged shop, supplied with lathes, drill presses, a double headed shaper, good vice benches, and such other tools as they would be likely to use on board ships. In the blacksmith shop the men under instruction use hand forges, such as are used on ships.

Three months are allowed to complete the course. The time is devoted entirely to instructing the men in practical work comprising their respective trades, and on work they will be most likely to encounter when assigned to duty on sea-going ships. The instruction given here necessarily differs very materially from that given in an ordinary mechanical training school, since it is not general, but for the purpose of training the men to perform a specific class of work, viz., making repairs to, and maintaining in an efficient condition, the hull and all interior fittings and auxiliaries of a modern man-of-war; as there is no available space in a man-of-war to carry an assortment of power machinery, except small lathes and other iron working machines, it is, of course necessary that a large part of the work be done by hand; therefore the carpenters and shipwrights are required to get out all their work by hand. The blacksmith class are given hand forges, and not allowed to use a steam hammer. The members of the plumbers' class are required to cut all their pipe and threads with hand dies; the shipfitters must shear their plates with a sledge and cold chisel, and drill most of the work with the ratchet.

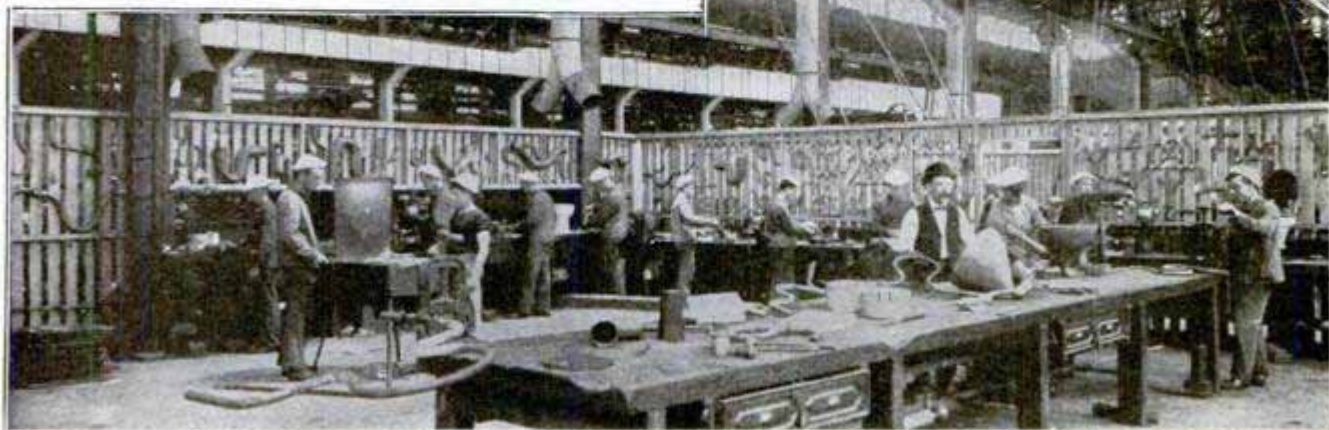
A general outline of the instruction given in the different branches of the school is as follows:

Blacksmith Class—Welding in the different ways, "jumping on" pieces, working angle iron, making shackles, chain, bolts, rivets, mast bands, eye bolts, pad eyes, iron work for blocks, and fittings likely to be required on board ship, that would have to be made at a forge. In addition to the above, blacksmiths are given special instruction in the operation of anchor and windlass engines, and in shackling and unshackling anchor chain.

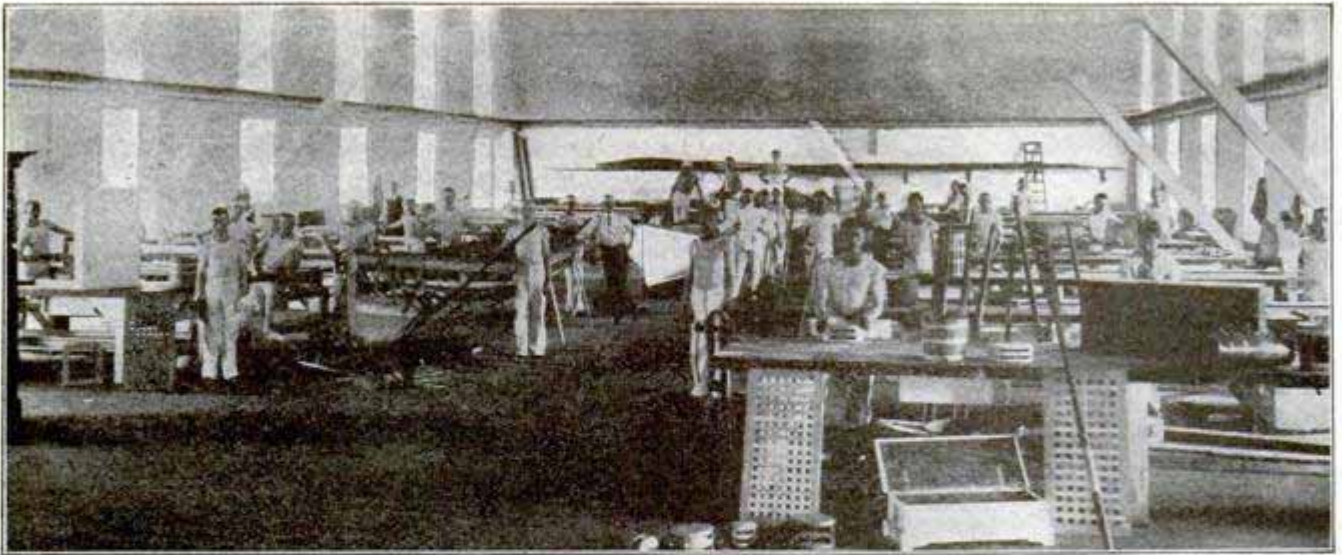
Shipfitter Class—Fitting angle iron and plates, riveting, chipping, calking (iron and

steel), drilling and tapping, putting on hard and soft patches, care and maintenance of manholes, power and hand-closing watertight doors, valves, etc.; making repairs to, and operating anchor and windlass engines, machine work on lathe, shaper, and drill press, cutting threads on pipe and bolts with hand dies, the use of the red lead gun, and stopping leaks with cement and otherwise. They are required to fit plates and other parts of the structural work on the hull model of the armored cruiser in the model room, to familiarize themselves with the interior and under-water arrangement of frames, longitudinals, outside and inner-bottom plating, watertight bulkheads, etc.

Plumber and Fitter Class—Lead work, pipe fitting, pipe bending, sheet brass, galvanized and black sheet iron working, brazing, working copper pipe, and tin work, overhauling the different makes of hand pumps and water closets used in the Naval service, cutting threads on bolts and pipe with hand dies, driving rivets, and calking metal. The class is given lectures on the pumping and drainage system, method of sounding compartments, and precautions to be taken for the prevention of galvanic action on the hull and fittings, and maintenance of the sanitary arrangement. They are also required to keep a journal, in which they collect much valuable information on the general plumbing arrangement of ships.



Plumbing Class at Work



Learning to be Ship's Carpenters

Carpenter's Mate and Shipwright Class—Carpentry, cooperage, joiner work, block making, repairing boats and boat gear, spars, oars, etc.; calking seams in wooden decks, and cutting threads on bolts with hand dies.

Painter Class—Painting iron and wood work inside and outside, cabin and hard wood work, and mixing all kinds of paints and stains by the different formulæ as used in the Naval service. They are also required to keep a journal, in which they gather from time to time much valuable information on ship painting generally.

In addition to practical instruction, all the classes are given lectures on the nomenclature of parts and fittings of ships, the method of sounding compartments to detect the presence of water, taking the draught of a ship, determining locations by the system of compartment numbers as used on ships of the Navy, and various other subjects relating to the care and preservation, maintenance and operation of watertight doors, hatches, ventilation systems, etc.

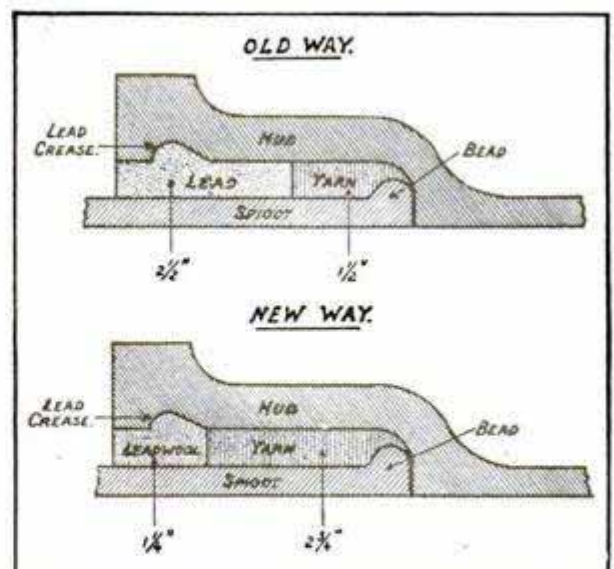
The fifteenth class now under instruction has a total membership of 45. The last class completing the course May 31, 1906, had 34 men to qualify in their respective branches, which consisted of blacksmiths, painters, carpenter's mates, shipwrights, plumbers and fitters, and shipfitters. Since the establishment of the school certificates of graduation have been given to 479 men, of whom 54 were blacksmiths, 73 carpenter's mates, 136 shipwrights, 28 shipfitters, 90 painters, and 98 plumbers and fitters. These men were sent to sea-going vessels to perform the duties of their respective rates.

When drilling, turning or reaming malleable iron, use kerosene oil.

LEAD WOOL FOR CALKING PIPES

A new method of making pipe joints has recently been developed in Germany and is now coming into use in this country. The discovery that has made this method possible is that of manufacturing lead wool, a material consisting of small thread-like strands of lead. This strange, spongy substance requires no melting, but is simply stuffed into the cavity between the pipes and then hammered, much as the dentist's gold is hammered in filling a tooth.

In this process the preparation of the mold and the operations of melting and pouring are obviated, and much less lead is required in making the joint, as may be seen in the illustration. Another advantage



is that while the hot lead contracts in cooling, thereby leaving spaces between the lead and the pipe, except in the immediate vicinity of the calked portion, the lead wool fills the entire cavity and makes a perfectly tight joint.

All the articles appearing in this department are reprinted in book form at the end of each year.

SHOP NOTES

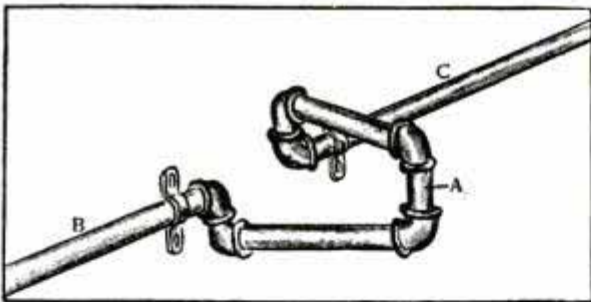
Contributions to this department are invited. If you have worked out a good idea or know of one, please send it in.

LAYING OUT AN ANGLE WITH SCALE AND DIVIDERS

To lay out any angle without other tools than a scale and dividers, strike an arc with a radius of 3.58 in. and count every $\frac{1}{16}$ in. on the arc a degree. For many purposes a radius of $3\frac{1}{16}$ in. will do, the error being one degree in 360.

EXPANSION JOINT SUBSTITUTE

As long steam pipes change their length a considerable amount, due to the expansion and contraction which takes place during changes of temperature, an expansion joint is needed to take up this motion, which would otherwise break a fitting or cause a



Expansion Joint Made of Pipe and Fittings

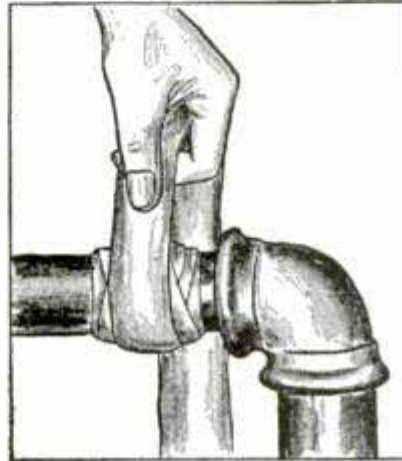
leak. When an expansion joint is not available, however, the device here shown will prove an excellent substitute. The nipple, A, is of such a length that the center lines of pipes B and C will coincide. Four common ells and two street ells will be the only fittings required, the cost of which will compare favorably with an expansion joint.—Contributed by Frank J. Borer, 230 Rankin St., Elizabeth, N. J.

CEMENT FOR WOODWORK

The following cement will be very hard when dry, and will adhere firmly to wood: Melt one ounce of rosin and one ounce of pure yellow wax in an iron pan, and thoroughly stir in one ounce of Venetian red until a perfect mixture is formed. Use while hot.

ANOTHER QUICK REPAIR FOR LEAKY PIPE

To repair a leaky pipe with the pressure on, simply wrap the inner tube from a bicycle tire around the leak,

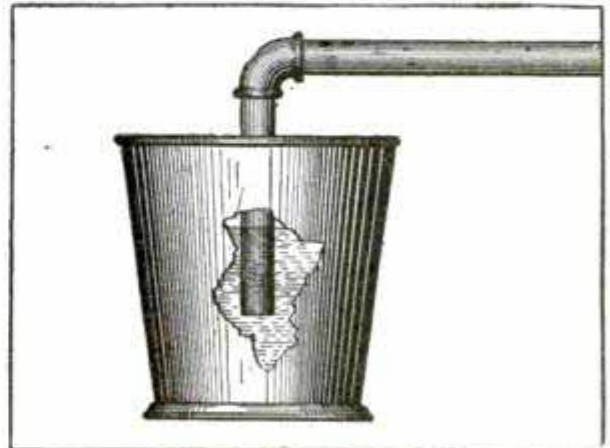


stretching the rubber tightly and winding around the pipe in a manner similar to that employed by physicians in bandaging a limb. Continue in this way until the leak stops, and then tie a knot in the rubber. This repair will often hold for years, and it only takes a few minutes to apply it.—Contributed by F. D. Munger, Oconomowoc, Wis.

tie a knot in the rubber. This repair will often hold for years, and it only takes a few minutes to apply it.—Contributed by F. D. Munger, Oconomowoc, Wis.

WATER MUFFLER FOR GASOLINE ENGINE

A pail of water makes a very simple but most effectual muffler for a gasoline engine. The illustration shows how it is used. The pail is partly filled with water and the end

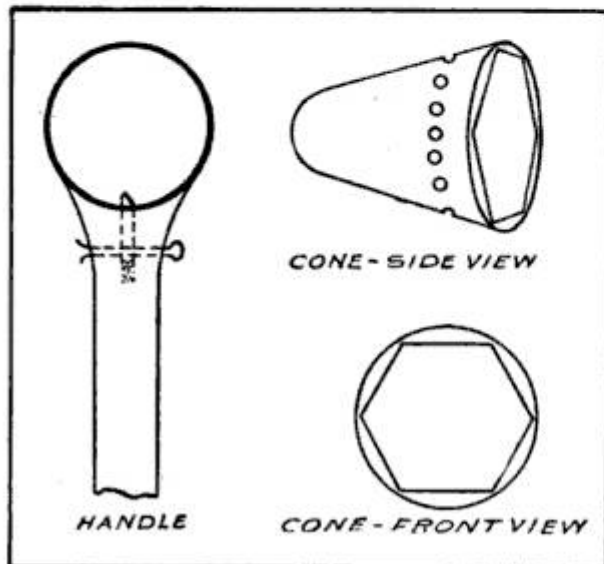


Cheap Gas Engine Muffler

of the exhaust pipe is carried below the surface, thus causing the exhaust to bubble up through the water.—Contributed by Walter Weber, 643 W. 46th St., Chicago, Ill.

INEXPENSIVE AND USEFUL RATCHET WRENCH

The ratchet wrench illustrated was originally designed for use in car repair work for removing nuts from the bolts of split gears, but is also useful for removing square or hexagonal nuts so located that they are hard to get at.



Details of Ratchet Wrench

A cone-shaped device takes the place of the jaws in the ordinary form of wrench. This cone on the interior is hollowed to the form of a hexagonal pyramid which will fit most of the nuts generally in use. The cone fits into a circular opening at the end of the handle. A small steel pin inserted in the handle and held in place by a split key serves as a ratchet and engages with small indentations in the surface of the cone, says the *Electric Railway Review*. The wrench will work either right- or left-handed, depending on which side of the opening in the handle the cone is inserted. It is said that this wrench can be made for about 75 cents.

HORSEPOWER OF A GAS ENGINE REDUCED BY HIGH ALTITUDES

A gas engine giving 10 hp. in Chicago will give only 8 hp. in Denver and if moved to the summit of Pike's Peak would give only 5 hp. This is due to the difference in atmospheric pressures of the places mentioned.

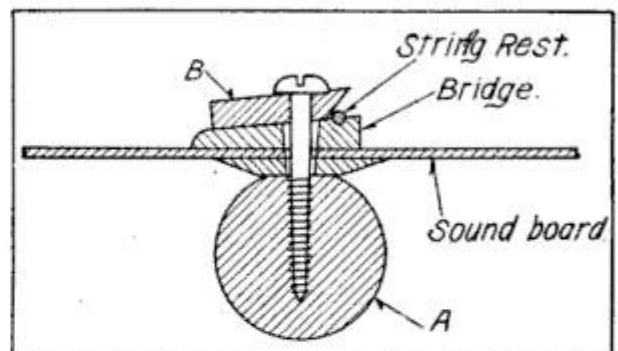
Other conditions remaining the same, an engine while consuming the most gas will give the most power. By consuming, in this case, is meant actual combustion and not simply the wasting of gas which occurs when the mixture is too rich.

In Denver, where the atmospheric pressure is less than in Chicago, the amount of air taken into the cylinder during each cycle will be correspondingly less and will therefore be unable to support the combustion of as great a quantity of gas. The amount of compression is reduced as well and this also results in loss of power.

FASTENING ON A GUITAR BRIDGE

The method I adopted for gluing on a guitar bridge I believe is original and a valuable kink for those players placed in a similar position. Soon after purchasing the instrument the bridge became detached, there being a tremendous strain exerted by the strings, and it was returned to the dealer to be repaired. He glued it on and in addition put in two screws with nuts, one at each end of bridge; yet it again came off soon afterward. As the dealer ran a first-class repair shop, I decided that it would be useless to go elsewhere, but to try the job myself.

I cut off about 6 in. of the largest diameter hardwood curtain pole I could find and planed a flat surface about $\frac{3}{4}$ in. wide. Into this I drilled six holes a trifle smaller than the root diameter of a $\frac{3}{8}$ -in. wood screw having a round head, and at a distance apart corresponding to the holes in bridge. This block, A in sketch, was inserted in the sound hole of the instrument and placed under the string holes. Placing a strip of wood, B, drilled with corresponding holes, under the heads of the screws,

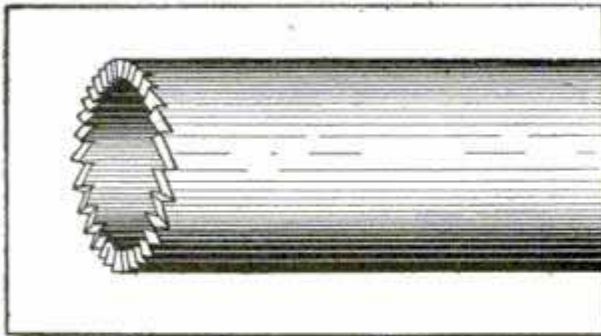


Gluing Bridge on Guitar

they were screwed into the block as hard as possible. Of course, the glued surfaces of bridge and sound-board were first cleaned with sandpaper and slightly warmed. By this method I secured a pressure impossible by any other means adaptable to the conditions, and costing practically nothing. Of course, any block of hard wood would answer the purpose, but curtain poles happened to be plentiful at the time.—Contributed by R. E. Bates, Mansfield, Mass.

HOW TO DRILL BRICK, CEMENT, STONE, ETC.

Seeing an article in Shop Notes describing a method of making a drill for small holes in brick and cement, reminded me of a drill for making larger holes, which I have used



Drill for Brick

with great success in perforating walls over a foot thick.

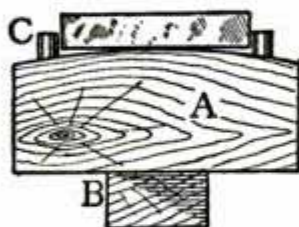
All that is needed is a piece of $\frac{3}{4}$ -in. gas pipe with the end cut off square and cut with teeth as shown in the sketch. The teeth may be cut with a three-cornered file, and should be of a liberal number and all the same length so that each tooth will do its share of cutting.

In using this drill strike light, quick blows with a machinist's hammer, at the same time revolving the pipe.

If a very deep hole is to be drilled, use a short pipe at first to get the hole started, finishing with a longer piece, and if the teeth become very dull, remove the drill and sharpen with a file.—Contributed by Stoke Richards, Santa Clara, Cal.

DEVICE FOR FILING FLAT

In filing flat—a very difficult operation—the device illustrated will be found convenient. The illustration is an end view.

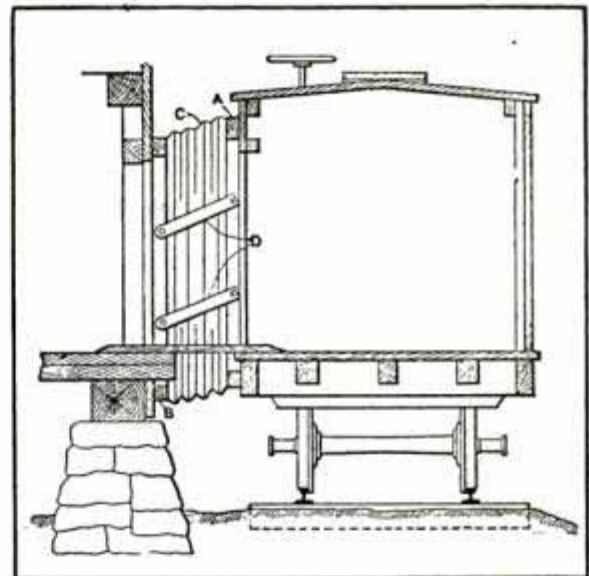


A block, A, of metal or wood and slightly rounded on the top is caught in the vise by the part B. Pins, C, hold the piece to be filed on the rounded top as shown. The file is worked backwards and forwards on the work, says the Model Engineer, London, and the rounded top allows the job to rock to accommodate the motion of the file, and no difference how the file is pushed about, one is always filing flat.

COLD WEATHER VESTIBULE FOR SHIPPING ROOMS

In transferring freight from the shipping room to a box car in winter so much cold air enters with the opening of a door that it is often uncomfortable to work in the room. One company, says Machinery, got around this difficulty by devising a handy vestibule which folds up bellowslike against the side of the building when not in use. The device is shown in the sketch.

A light rectangular framework, B, surrounding the shipping door is fastened to the outer wall. A similar framework, A, is connected to this by two swinging arms, D, on each side, and between these two frames is fastened the tube, C, of heavy close-woven duck, or some other similar material. When the box car is in place, the weight of the outer framework, A, acting on the arms, D,



The Vestibule in Place

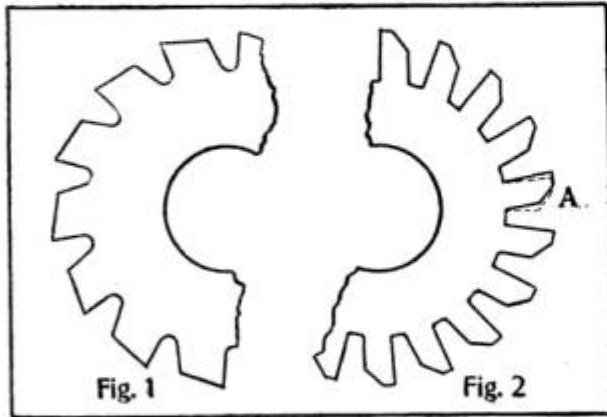
tends to hold it firmly against the side of the car, thus forming an enclosed passageway between it and the building tight enough to prevent the wind from entering to any great extent.

TO CLEANSE MERCURY

Put a 10 per cent solution of nitric acid in an iron ladle and add the mercury. Place the ladle over a blacksmith's forge, says Machinery, until the nitric acid boils. The dirt will rise to the top and the mercury, perfectly clean, remain at the bottom. Do not let the mercury boil, the fumes are poisonous.

HOW TO MAKE A MILLING CUTTER WITHOUT BACKING

The ordinary milling cutter, shown in Fig. 1, has the teeth backed off, or, in other words, cut away for clearance between the tooth and the work at all places except the cutting edge. This is a condition that is



Backed and Unbacked Milling Cutters

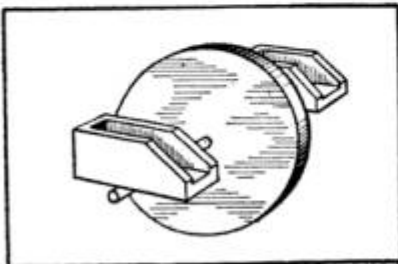
necessary in all machine tools, and is usually very difficult to obtain. This is especially true of milling machine cutters where the backing is usually done by hand in a special lathe, or in very expensive machines used by tool manufacturers.

To obviate the necessity of backing, the cutter can be made as shown in Fig. 2. Then when it is tempered the teeth will spring back, as shown exaggerated at A, and give a slight clearance at the backs of the teeth.—Contributed by L. G. Harren, 14 Barnett St., New Haven, Conn.

SPARK PLUG EFFICIENCY

A spark plug that emits a long-distance spark outside the cylinder, will not always do the same within the cylinder in the middle of a highly compressed charge, says the Automobile. It may be weak or fail entirely at the critical time. The vigorous spark is the effectual one.

ONE MAN TO CARRY LONG LADDER



for adjustment to the ladder's width and

One man can carry a long, heavy ladder with ease by using the device illustrated herewith. Little blocks slide along a shaft

into these blocks the ends of the rails fit. Then by taking the other end of the ladder, one can wheel it to any point desired. The wheel should be made of a piece of plank.

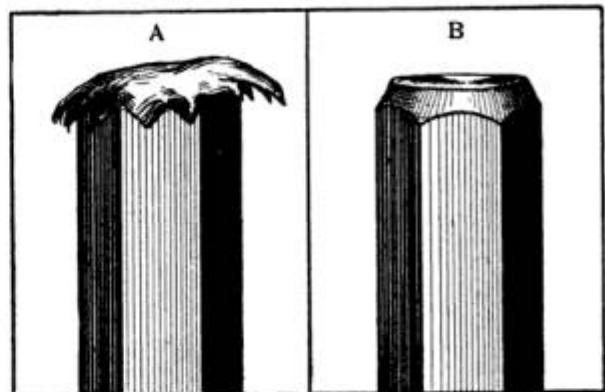
INFLATING AUTO TIRES

For the proper inflation of auto tires a good registering pump is necessary. Press the valve in with the pin in the cap to make sure it does not stick. Raise the pump piston to the top of the cylinder and push all the way to the bottom, says the Automobile, giving full steady strokes. Each time the plunger descends the gauge pointer will fluctuate more or less beyond the center of equilibrium, according to the rapidity of the stroke. To find the constant pressure, a full, slow stroke should be given, and near the end the plunger should be held stationary, equalizing the pressure in the pump and tire. The gauge pointer will then slowly find its balance and remain stationary, pointing to the figures of the real pressure in pounds.

If the tire is inflated with air at 68° F., the increase of pressure by reason of the temperature of the air in the tire being raised by frictional heat will not be sufficient to cause it to burst.

TO PRESERVE HEADS OF STEEL TOOLS

When the head of a cold chisel or other tool becomes flattened as shown at A, do not continue using it but heat to a dull



Effects of Crystallization

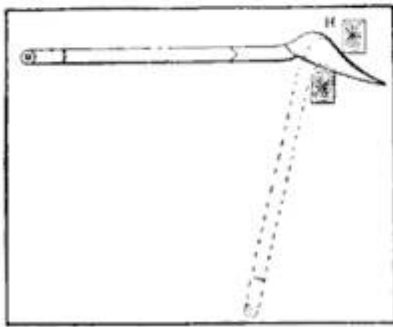
red and then dress the head as shown at B. Simply grinding the head, without heating, will not be satisfactory, as the steel is usually crystallized at the flattened end and it is necessary to heat it in order to restore its original life and strength. For this reason the heads of steel tools should be heated occasionally whether flattened or not.—Contributed by Hiram Stitt.

CEMENT FOR SLATE

Switchboards and other articles made of slate, which have become cracked, can be repaired by using a cement made of slate dust and a solution of silicate of soda. If this is worked thoroughly into all the cracks and given a smooth surface it will hardly be noticed when dry and will not crumble or break.—Contributed by Raymond W. Johnson, Wade Park and E. Madison Aves., Cleveland, O.

HOME-MADE ASH-HOE

A worn-out firing scoop makes a light and convenient ash hoe, says a correspondent of the Engineer's Review. Heat the scoop red hot at the point indicated at H in the illustration, having previously prepared a place for bending, as shown. Bend, bringing the handle into the position indicated by the dotted lines, and let the scoop cool. Remove the old shovel handle and replace it with a long hoe handle, which rivet in place.



COLORINGS FOR CEMENT BLOCKS

For red sandstone add 22 lb. of an aggregate iron oxide, called mineral paint, to each barrel of the dry mixture of cement. For lighter shades use less of the coloring matter.

To get a brown shade add Germantown lampblack to the above. For a pleasing gray use the lampblack alone, 2 lb. to the barrel of cement.

A good blue is produced by using 19 lb. of ultramarine to a barrel of cement, and for green use 23 lb. of the ultramarine.

For yellow use 23 lb. of yellow ochre to a barrel of cement; use the same quantity of brown ochre to procure a good brown.

In using these coloring materials mix in a dry state till no streaks are visible, then add water and mix and tamp as before. While the blocks are moist the color will be much darker than when they are dry, it must be remembered.

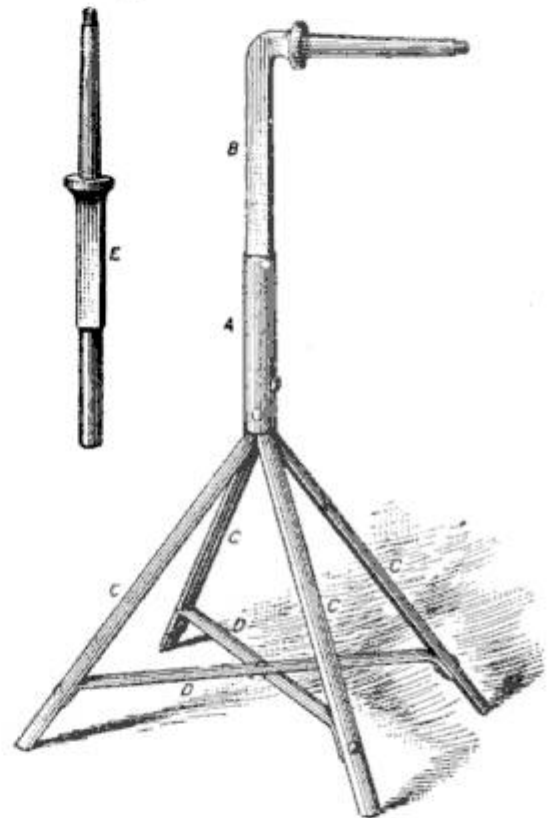
Always use the least amount of coloring possible to give a good shade, warns the

American Carpenter and Builder, as most of the pigments used are of a clayey nature, ill-adapted to stone making.

WHEEL STAND FOR THE SHOP

When working with wheels, washing, painting, or striping them, a wheel stand is a handy device to have in the shop.

To make a wheel stand cut off an old $\frac{3}{8}$ -in. axle, B, 18 in. from the shoulder and bend it $1\frac{1}{2}$ in. from the shoulder, leaving the front round, a little higher than the collar so the wheel will not run off. Make the other end to fit 6 in. into an iron pipe, A, 8 in. long.



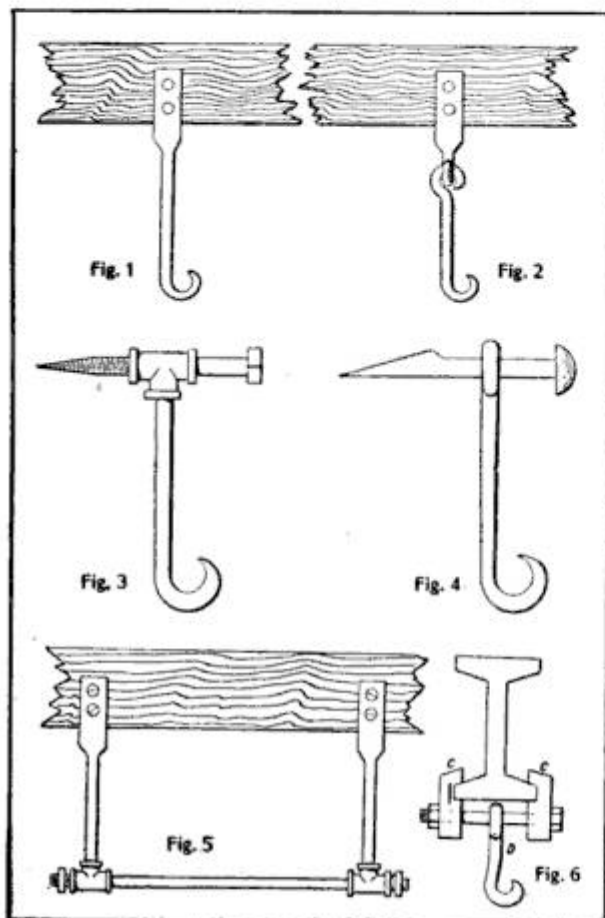
Home-Made Wheel Stand

Make the feet of four pieces of old 1-in. tire, C, 18 in. long. Swage 2 in. of one end of each foot to fit into pipe A from below and bolt together with $\frac{3}{8}$ -in. stove bolts. Take two pieces, D, 23 in. long, and swage and bend them off $1\frac{1}{2}$ in. at both ends to fit against the legs. Rivet them together where they cross at the center. This will leave the round side of the tire up, says the Blacksmith and Wheelwright. The straight piece, E, can be substituted for B and used for face striping spokes. The paint glass may be laid on the end of the hub for convenience.

The electrical conductivity of distilled water is 6,754,000,000 times less than that of copper.—Culley.

HANGERS FOR SUPPORTING PIPE

For supporting pipe do not use a hanger like the one shown in Fig. 1; it is liable to bend off at A, being affected by the expansion and contraction of the pipe. This defect, says the Engineers' Review, can be



Several Forms of Pipe Hangers

overcome by the method shown in Fig. 2.

Two simple hangers that give good satisfaction are shown in Figs. 3 and 4, while where several pipes of small diameter are run together, the hanger shown in Fig. 5 is good. Hooks like those shown at C C in Fig. 6 can be used where I-beams instead of wood joists are used. A hook should be made at the top of the binding bolt at D.

CEMENT FILLING FOR COMMUTATORS

The shellac and plaster-of-paris cement commonly used for commutators soon deteriorates as a result of the heat. A better cement, and one which will not carbonize, can be made by mixing plaster-of-paris and a solution of silicate of soda.—Contributed by Raymond W. Johnson, Cleveland, O.

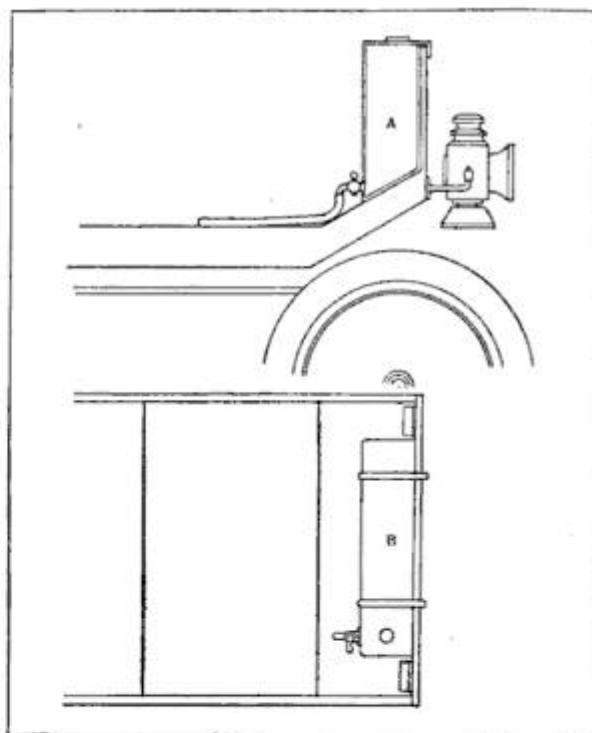
The popular notion that hot water freezes more quickly than cold with air at the same temperature is erroneous.—Trautwine.

SOLDERING ALUMINUM

For soldering aluminum make a solder of 80 per cent tin and 20 per cent zinc, using stearic acid as a flux. Tin the surface of the aluminum with this solder, moving the copper bit backwards and forwards over the metal and flowing the solder, says Machinery. The film of oxide that prevents the ready soldering of the aluminum can then be cleaned off and the metal soldered with either the above-named solder or tinsmiths' solder.

GASOLINE STORAGE TANK FOR STEAM AUTOMOBILES

Owing to the reduction in price of steam runabouts, there are at present a great number in use all over the country; one fault is the limited storage capacity of the gasoline tank, which furnishes fuel for about 25 to 30 miles. To reduce the possibility of running short of gasoline on the road, I have designed and constructed with great satisfaction a tank to hang on the inside of the dashboard, between the gauges. The same should be constructed of copper with crimped edges, and hung on iron bands bent



Storage Tank for Automobile

as per the drawing. Have a screw filling cap on top and a tap with short hose on the bottom. The tank can be filled and emptied in its position on the dashboard by use of the hose.

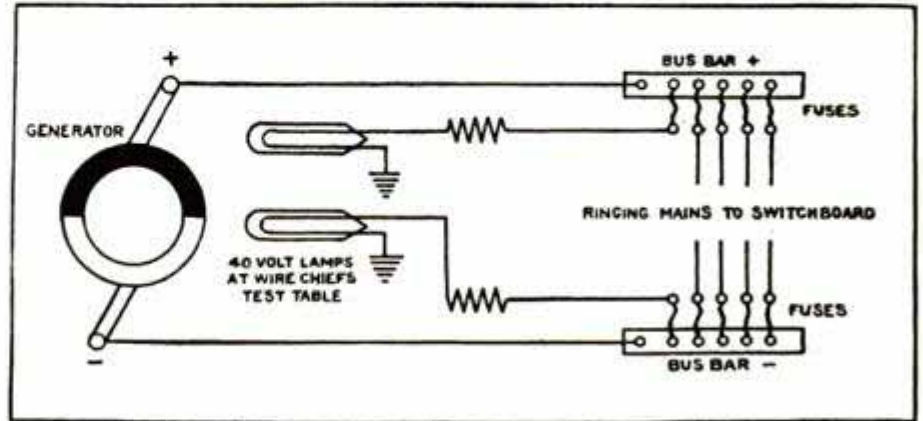
In the drawing A is an elevation and B

a plan view of the tank in position.—Contributed by Prentice P. Avery, Box 311, Ridgewood, N. J.

VOLTAGE INDICATOR FOR SELECTIVE RINGING GENERATORS

Constant voltage of the ringing generator is an important matter in exchanges where selective ringing is used on subscribers' lines. A good indicator for showing the variation in voltage is made of lamps placed so as to be constantly under the observation of the wire chief, says the American Telephone Journal. The indicator may be installed as follows:

Connect two switchboard lamps, one to the positive lead and the other to the negative lead as shown in the sketch, inserting the resistance between the lamp and the ringing main. Mount the lamps on the wire chief's test table so that he will see them every time he looks up. As he becomes accustomed to making observation he will be able to detect the slightest variations in pulsations or brilliancy of the lamps. Two 40-volt lamps connected in this way through a 400-ohm resistance have been burning steadily for two months and are as bright as ever.

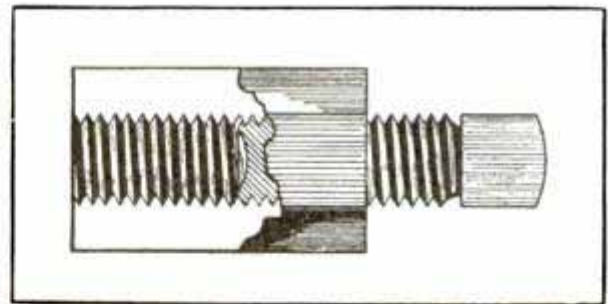


Indicator Lamps Connected

outside of the curve being of the same length as before and the inside shorter.

HOW TO REMOVE OLD STUDS

While repairing a pump in the plant where I am employed, I had occasion to remove and replace numerous studs on the same.



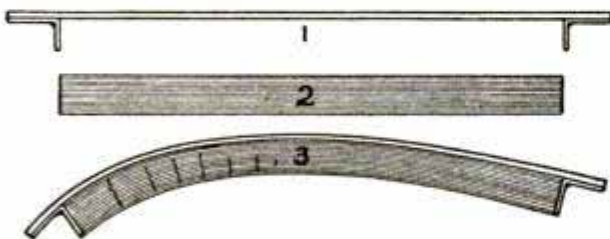
Device for Removing Studs

When there is no shoulder on the stud, a common way to remove it is to use two nuts and by jamming one against the other the stud may be turned by working a wrench on one of the nuts. But in the case of the pump this method could not be used, as the studs, which were all $\frac{5}{8}$ -in. diameter, were so close together that there was no room to work a wrench.

I then made the device shown in the sketch. A long nut is made out of hexagon steel and tapped to fit the studs. A set screw is then placed in the nut, and when this is screwed up tight against the end of the stud, the friction of the nut is greater

BRACKET FOR USE IN BENDING WOOD

The best woods for bending are ash, hickory, white oak and elm. Ash after being subjected to a steam bath is very pliant and is used extensively for handles. The tight bark or pigment hickory is the best species of this wood for bending, though select parts of three others—peccanut, mocktanut and



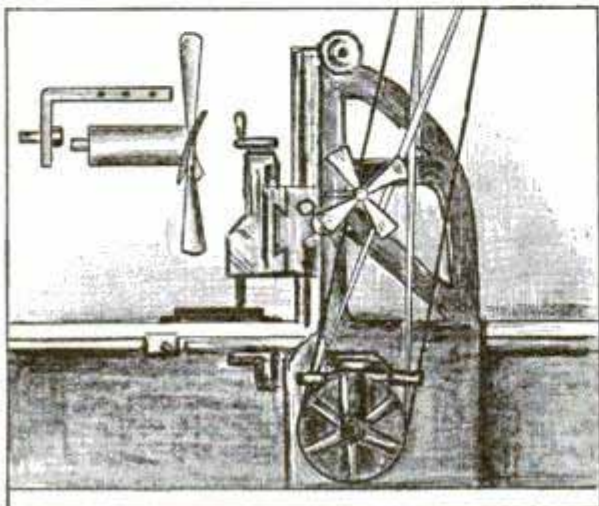
Bracket in Use

shellbark—are used also. White oak when treated by steam bends readily and the bending qualities of elm when given the same treatment are said to excel all others.

than that of the casting which holds the stud. A wrench may then be used on the long nut, which projects above all the studs, thus allowing a complete revolution of the wrench.—Contributed by John Weldon, 433 Columbia St., Brooklyn, N. Y.

VENTILATING FAN FOR THE SHOP

Make a fan of galvanized iron, screw it to a wood pulley and drive a brass tube through the center of the pulley. Tool a piece of cold rolled $\frac{1}{2}$ -in. stock, cut a thread on each end and bolt it to a piece of iron,



Home-Made Ventilating Fan

which in turn bolt to the planer gib. Drill several holes in the iron so the fan can be set over when raising or lowering the head. In the case illustrated the belt is at an angle. This fan could be applied to any power-driven machine, or all of them could be supplied with fans.—Contributed by A. Churchill, 832 E. 32nd St., Portland, Ore.

A SIMPLE HOME-MADE JACK

In putting a new base under a dynamo a jack was necessary for lifting the machine, and the one illustrated was improvised. A $\frac{3}{4}$ -in. bolt 8 in. long, threaded its entire length, and a nut and a piece of pipe were the materials used.

The head of the bolt was placed on the floor beneath the dynamo. Then, by screwing upon the nut, the dynamo was lifted a



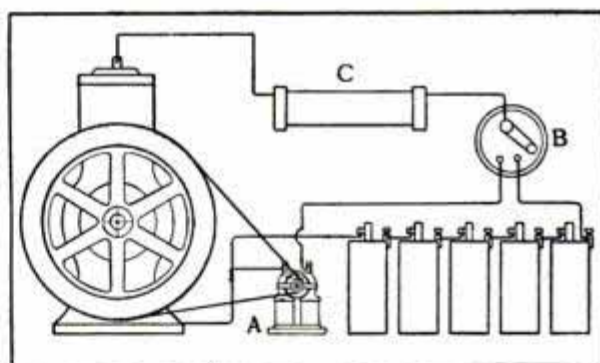
Handy Jack

certain amount, and blocked in position. The jack was then raised higher by placing blocks beneath the head of the jack, and the dynamo was again lifted. This mode of lifting was continued until the dynamo was raised sufficiently high to permit of inserting the new base and the removal of the old one.

For the nipple a piece of 1-in. pipe was used, says the Engineers' Review, and stood the strain nicely. A washer between the nut and the nipple improves the jack, and the head of the bolt should rest in a countersunk plate to keep the bolt from traveling.

WIRING FOR GAS ENGINE

It is often difficult to start a gas engine which is ignited by a dynamo and for this reason batteries are used in connection with the dynamo. In the wiring diagram shown in the sketch A is the dynamo, B a two-point switch, and C the spark coil. This wiring is intended for use with make and break engines and will not do for jump-spark engines.



Wiring for Gas Engine

To start the engine place the switch on the right-hand point. This throws the batteries in the circuit, and allows starting the engine with very little effort. Then after the engine has run a few seconds the switch can be turned to the left-hand point, thus throwing out the batteries. With such small demands the batteries will last a long time.—Contributed by H. H. Fountain, 207 9th St., Brooklyn, N. Y.

Greasing the molds, or painting them with coach varnish twice a month will keep cement blocks from sticking. Use the best grade of black coach varnish.

In 1905 the copper product amounted in value to \$137,498,727. This is the largest product of copper ever recorded in the United States.

TAR ON THE HANDS

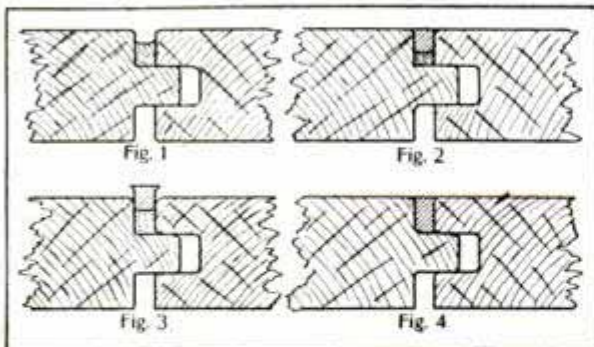
An exchange recommends rubbing the hands with the outside of fresh orange or lemon peel, and wiping dry immediately. It is astonishing what a small piece will clean. The volatile oils in skins dissolve the tar, so that it can be wiped off.

HOW TO PUTTY CRACKS IN FLOORS

Some of the readers of Shop Notes may have had trouble in filling cracks in floors, previous to painting. It seems that no matter how tightly the putty is pressed in with the putty-knife, it will rise out of the cracks and project above the surface of the floor a few days after the paint has been applied, thus producing a very undesirable appearance.

This is usually caused by the presence of dust in the cracks and by applying too much pressure to the putty. As it is almost impossible to fill the cracks without applying considerable pressure to the putty, it becomes necessary to remove the dust or dirt. The necessity of this operation is illustrated in the accompanying sketch. Fig. 1 shows a crack in the floor with a quantity of dust at the bottom. This dust is compressed by the application of the putty, as shown in Fig. 2, and as the compressed dust is somewhat elastic, it tends to expand to its original volume. This results in raising the putty from the cracks as shown in Fig. 3.

In order to prevent this defect, run the pointed end of a file or other pointed object



Correct and Incorrect Methods of Putting Cracks

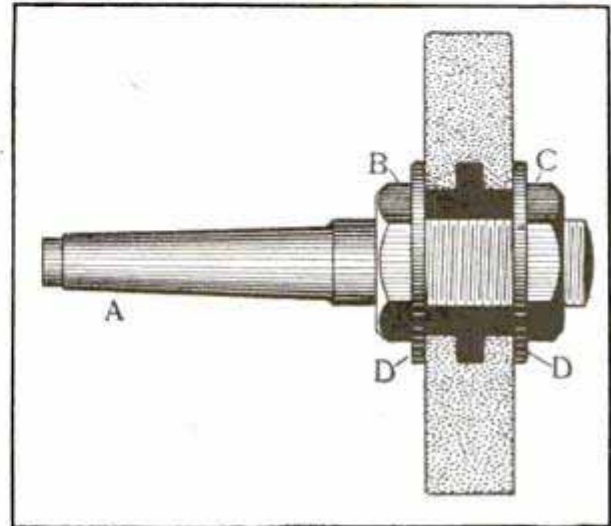
through all the cracks, thus removing all the dust. Then apply turpentine to the cracks by means of an oil can. This soaks into the wood and causes the putty to stick better, at the same time softening the putty and allowing it to fill all parts of the cracks as shown in Fig. 4. Cracks puttied in this

way will remain filled for years and will be practically invisible.

EMERY WHEEL HOLDER FOR LATHE

Having a lathe and emery wheel, but not a wheel holder, I devised the following center for holding the wheel in the lathe:

My emery wheel is 1 in. thick and has a 1-in. hole, so I turned a piece of soft steel



Center with Emery Wheel Attached

1 in. in diameter and 6 in. long to fit the center hole in the lathe, as shown at A in the cut. The other end was threaded for the nuts, B and C, one of which, B, was pinned to the shaft. Both nuts were supplied with washers, D D, as shown.

If desired, a straight piece of steel may be used in place of the tapered piece, but it will then be necessary to either use a chuck or make center holes in each end and use a dog.—Contributed by Donald Reeves, Oak Park, Ill.

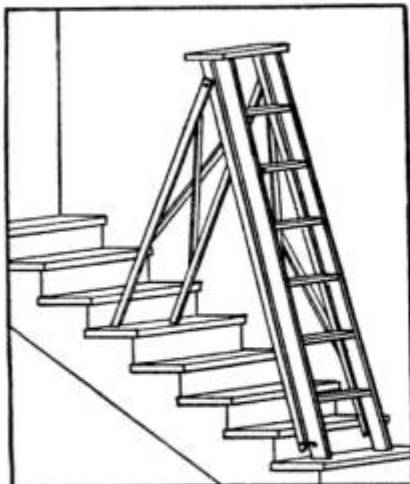
STRENGTH OF WOODEN TANKS

The hoops on a wooden tank determine its strength. Flat hoops are less satisfactory than round. Round hoops do not rust so quickly, and are not weakened so much by a little rust as are flat hoops; also, when the tank swells, they are not apt to burst, but sink into the wood, instead.

Cypress, cedar or white pine, free from imperfections and thoroughly dry, are the species of wood advised by the fire insurance authorities for cylindrical wooden tanks. Michigan pine, free from sapwood, is most durable where the tank is exposed to freezing.

STEP LADDER FOR STAIRS

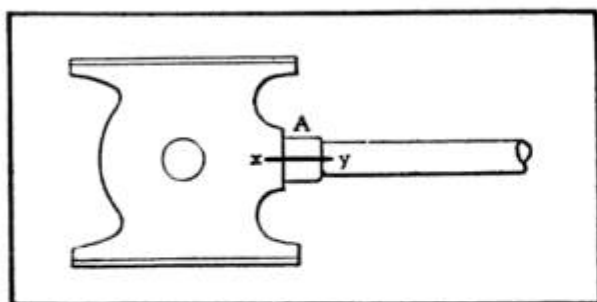
An ordinary step ladder cannot be used on stairways, but by adding the attachment here shown it can be used in that position with perfect safety. Fasten on an extra pair of legs somewhat shorter than the original legs and arrange so that either pair may be used when wanted.



Hooks and eyes may be used on the long legs to hold them against the ladder when using on a stairway, thus making the device easier to move up and down stairs.—Contributed by John Weldon, 433 Columbia St., Brooklyn, New York.

LOOSE PISTON ROD INDICATOR

It sometimes happens (in fact, quite often) that when a piston rod is screwed into the crosshead it will work loose and commence backing out while the engine is running. The clearance is often very small and generally the first hint the engineer gets of something being wrong is a gentle tap, tap, tap of the piston on the cylinder head. In cases where an engine gives this kind of trouble, the expedient illustrated in the sketch will prove useful, says a corre-



Loose Piston Rod Expedient

spondent of Power. Here A is a jam-nut and X Y is a black stripe of paint, say, $\frac{1}{2}$ in. wide, drawn across the crosshead boss, the jam-nut and along the side of the piston rod. This stripe can be seen quite plainly while the engine is in motion, and if the rod or nut commences to turn, the broken stripe will be noticed immediately.

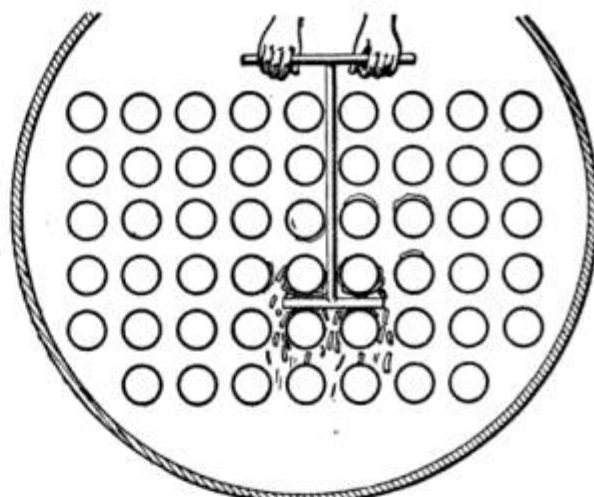
READING THE WEIGHT OF AN ANVIL

The figures on an anvil indicating its weight form a puzzle to many a smith and mechanic who has not learned how to read them. The figures state the number of gross hundredweight of 112 lb., quarters of hundredweight and the extra pounds, says the American Blacksmith. For instance, the figures 2-1-18 on an anvil mean two hundredweight of 112 lb. each, or 224 lb., plus one quarter hundredweight, or 28 lb., plus extra pounds, 18, amounting in all to 270 lb.

DEVICE FOR CLEANING BOILER TUBES

A simple and good device for cleaning scale from boiler tubes may be made as follows:

To a piece of $\frac{3}{4}$ -in. rod, 18 in. long, weld an angle or cross bar at either end, the bottom piece to be 8 in. long and made square



Scale Cleaning Device

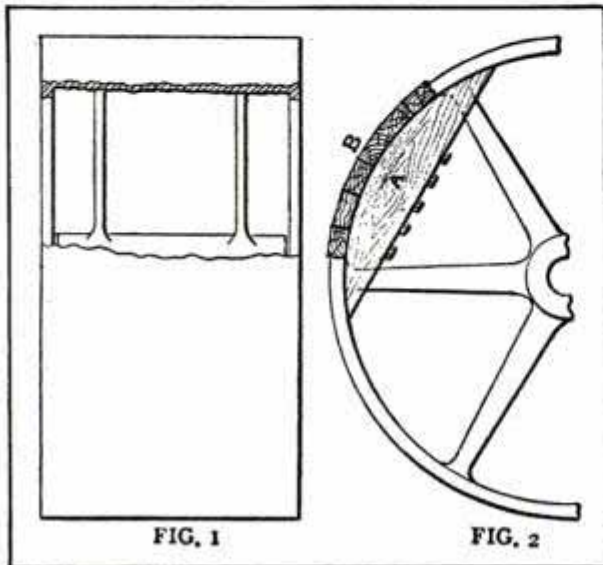
to cut the scale, says the Engineers' Review, and the upper piece 12 in. long to serve as a handle.

In using the tool, the bottom or shorter end is shoved down between the tubes and is then used auger fashion. By so doing, the bottom bar is turned crosswise to the tubes, which pushes the scale out from both rows of tubes on either side. By moving along the tubes one is able to clean the entire lot in a very short time. This device removes the scale from the top and bottom tube at the same time, letting the scale fall to the bottom of the boiler, where it can be easily removed.

In tapping out nuts or cutting threads with a die, use good lard oil.

TEMPORARY REPAIR FOR A LARGE PULLEY

A novel method of making a quick repair for a large pulley was used in a large textile finishing plant, where a pulley 84-in. diameter and 36-in. face suddenly broke, at



Repair for Pulley

a time when the plant was behind in orders, and simply had to run in the shortest possible time. None of the supply houses in the vicinity could furnish a new pulley of the required size, so the master mechanic had to make a temporary repair, which is described by a correspondent of the American Machinist as follows:

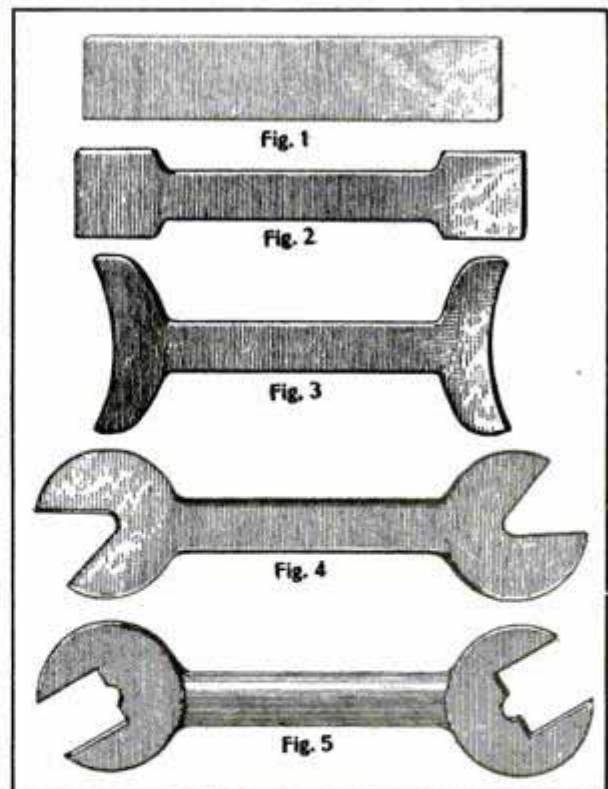
The piece of pulley rim broken out was approximately the section between two sets of arms, and was roughly from $2\frac{1}{2}$ to 3 ft. across, as shown in Fig. 1. As the rest of the pulley seemed to be in good condition, he had the carpenters get out some 3x12-in. ash, and prepare four pieces to fit the inside of the pulley rim as at A, Fig. 2. These were placed on each side of the arms, and each pair well bolted together, clamping them firmly to the arms. Some pieces of 4-in. ash were then sawed 36 in. long, and bolted to and across the pieces of 3x12, allowing the bolts to pass down between the pieces, countersinking the heads and using nuts and washers underneath. B, Fig. 2, shows the pieces in place. In the meantime a small engine had been moved into a convenient position for driving a section of this shaft, and the pulley and the cross slide from the shop planer had been rigged to hold the tool for turning, so it was a matter of a few minutes only to turn off the section of wood down to the size of the pulley.

Then the nearest coupling was loosened, and the pulley and section of shaft removed to some convenient horses for balancing. It took 136 lb. of lead to do this, and as it was run in between the pieces of 3x12 ash, there was little fear of its getting loose.

After erection, the main belt was replaced and the plant ran on the same as usual for over two months before it was removed to be replaced by the new pulley, and even then it seemed just as good as the day it was repaired.

HOW TO FORGE A GOOD WRENCH

The directions for forging this wrench, as given by a correspondent of the Blacksmith and Wheelwright, are as follows: First take a file or good buggy spring, according to the size of the wrench wanted, as in Fig. 1. Forge this down 1 in. or $1\frac{1}{2}$ in. from the end, as shown in Fig. 2. Then forge a T on each end and keep the corners round (Fig. 3). Then turn each T on the horn of the anvil and bring one end around a trifle farther than the other, as in Fig. 4. In finishing trim off the ends and square up to suit the nut (Fig. 5). In this way



Forging a Wrench

the grain of the steel is forged around each prong, thus making it a good, strong wrench. Never punch a hole and cut it out, as this will make the prongs cross-grained.

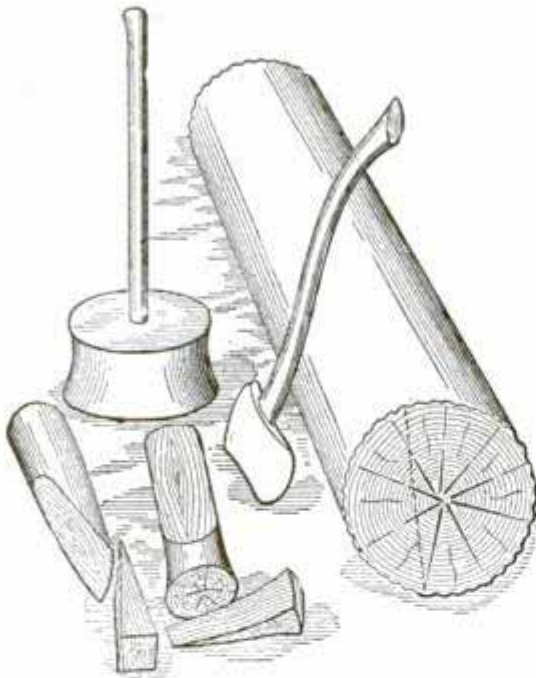
CEMENTING A WATCH CRYSTAL

Anyone can cement a loose watch crystal in place and so avoid the necessity of going to the jeweler's with it. Remove the bezel from the case, place the crystal in position and melt enough sulphur flour to run in around the glass. Heat the bezel and crystal over an alcohol lamp until the sulphur runs down in the groove and around the glass, then let it cool. When cooled, remove all the sulphur that remains outside the groove. This makes a water and dust proof joint and also holds the crystal firmly.—Contributed by M. D. Schaefermeyer, Hayden, Colo.

THE RAIL-SPLITTER'S KIT

A rail-splitter's outfit, such as was used by Abraham Lincoln, is shown in the accompanying illustration. The kit consists of several ironwood wedges (tough wood with a fine grain); a couple of iron wedges to start the splitting process, an ax and a "beetle." The "beetle" (shown in the background) is usually made by the rail-splitter himself, says Wood Craft, and is used for driving the wedges.

In splitting rails, the ax is struck into the end of the log and the two iron wedges

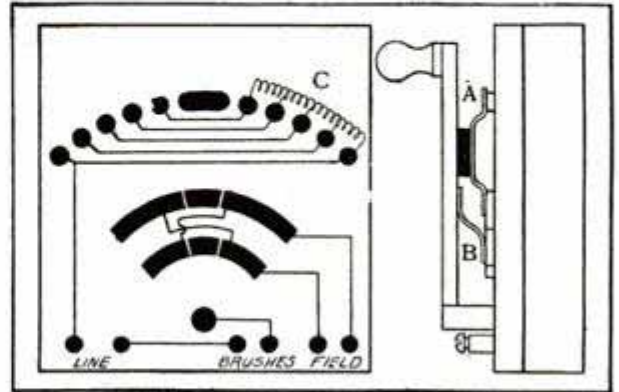


For Splitting Rails

are then driven into the opening made. As the opening extends along the length of the log the wooden wedges are driven in until at last the log is in two parts. These large pieces are cut up into smaller ones in the same way.

HOW TO MAKE A REVERSING RHEOSTAT

A reversing rheostat for changing either the direction or speed of a motor by the operation of one handle can be made by following the diagram shown in the sketch. A and B are copper contacts, A being insu-



Reversing Rheostat

lated from the handle and B connected to it. The resistance coils, C, give the necessary resistance for decreasing the speed.

When the handle is in the center the motor will not move, but when moved to either side the motor will revolve, the direction of the revolution being changed by swinging the lever over to the opposite side.—Contributed by Donald Reeves, Oak Park, Ill.

POWER FROM WINDMILLS

While windmills, as far as we can determine, have very rarely been used for compressing air, there is no reason, however, why they should not be adapted to this purpose. A windmill with a 12-ft blade is commonly rated at 2 hp., and one with a 16-ft. blade is rated at 4 hp. If this power were utilized for compressing air, the results obtained would be as follows:

- 2 hp. will compress 9.6 cu. ft. of free air per min. to 100 lb. gauge.
- 2 hp. will compress 11 cu. ft. of free air per min. to 80 lb. gauge.
- 4 hp. will compress 19 cu. ft. of free air per min. to 100 lb. gauge.
- 4 hp. will compress 22 cu. ft. of free air per min. to 80 lb. gauge.

The above results were calculated on the assumption that 15 per cent be allowed for friction in the air compressor, but as stated by a correspondent of Browning's Industrial Magazine, the allowance for an apparatus of this kind should probably be greater.

It is not considered practicable to use wind power for the generation of electricity.

HOW TO MAKE A SUN DIAL

As sun dials are coming into use again, it might interest the readers of Shop Notes to know how they are made. In making a sun dial it is very important that the angle of the screen or upright piece (see Fig. 1), should be equal to the latitude of the place

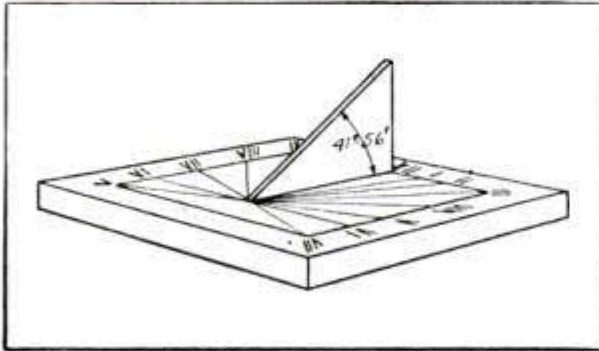


Fig. 1--Sun Dial for Latitude of Chicago

where the dial is to be used. A sun dial which will give the time accurately in one locality, will therefore be inaccurate when moved either north or south any considerable distance. For instance, the dial shown in Fig. 1, which is designed for use in Chicago, would be unsuitable for New Orleans, but if moved straight east or west its time-keeping qualities would not be disturbed.

The latitude of any place can be found by consulting suitable maps. The correct angle for Chicago is $41^{\circ} 56'$ or practically 42° , and for New York it is $40^{\circ} 43'$. The object of making the angle of the screen equal to the latitude, is to have the edge of the screen parallel with the earth's axis, a condition absolutely essential in an accurate dial. It is therefore necessary that the dial, after being made, should be placed in an exactly horizontal position and also that the screen should point directly north and south, the large end being placed toward the north. The screen should also be set exactly perpendicular to the face of the dial.

The material of the dial may be metal, well-seasoned wood, or any other substance which will not warp or change its shape, and it can be made with a round or square base, as may be desired. In marking the divisions of the hours there are two general methods; one in which the divisions are determined by trial and the other in which they are calculated by mathematics and geometrical constructions.

In the former method the dial is placed in the sun in the correct position and the edge of the shadow marked at the end of

each hour. It is necessary to take a reading each hour because the spaces are not all equal, as in a clock, but are shorter at noon and longer in the evening and morning, as shown in Fig. 2. While the consecutive hour spaces are not equal they are all symmetrical from the 12 o'clock mark in the center. Thus the space from 12 to 1 is equal to the space from 11 to 12; 10—11 is equal to 1—2; 9—10 equals 2—3, etc. This rule may be applied in checking the results to see that they are accurate.

The latter method, although more ingenious, is not practical, as the theoretical results obtained by calculation are subject to sources of error such as refraction. It is well known that the sun is visible for some time after it has set, this phenomenon being due to the bending of the rays as they pass obliquely through the atmosphere, and the theoretical division of the spaces on a dial will therefore be inaccurate.

The correct divisions of the hours being

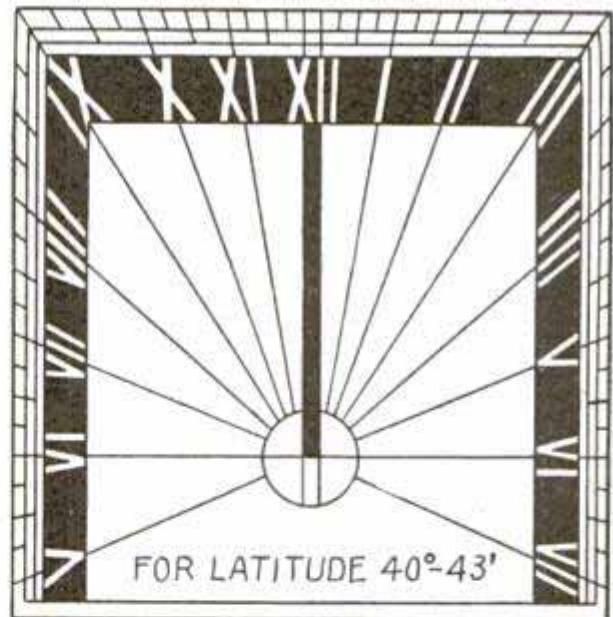


Fig. 2--Dial Spaced for Latitude of New York

obtained, they may be either painted or scratched on the surface of the dial, which will then be complete. If desired, the half and quarter hour divisions may also be marked, although they may be readily calculated by the eye when not so inscribed.

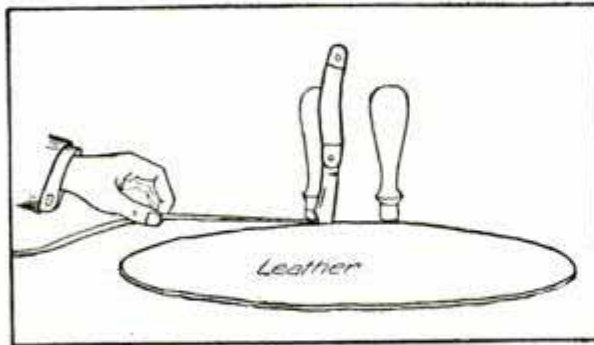


To soften putty on glass and frames of windows, paint it over with nitric or muriatic acid. In an hour's time it may be easily removed.

CUTTING A BELT

A driving belt 8 ft. long, for a lathe, was cut out of a piece of leather 6 in. square by a mechanic by the following method:

The corners were cut off, leaving the

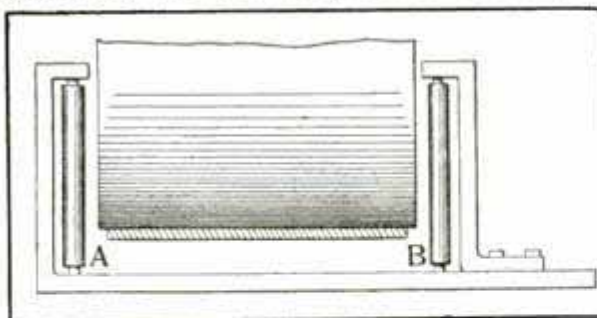


Cutting a Small Belt

leather circular. Then he cut around the circumference for about 1 in. to the required width of the belt, and fixed a bradawl in a bench, with a knife opposite, at a distance of the width ($\frac{3}{8}$ in.) of what he wished the belt to be, and another bradawl to steady the cut through, as indicated in sketch, and placing the end of the belt which he had cut between knife and bradawl, drew the whole belting between this space, the knife cutting the belt to an even width.

GUARD FOR BELT

To prevent a belt from swinging and striking the frame of the generator, a correspondent of the Engineer's Review at-



Guide for Belts

tached a guard as shown in the illustration. The guard is made from $\frac{1}{2} \times 1\frac{1}{2}$ -in. iron; the rollers, A and B, are made of $\frac{3}{4}$ -in. pipe and are set with about $\frac{1}{2}$ in. clearance on each side when the belt is standing.

For filling holes in castings, use a metal made of 9 parts lead, 2 parts antimony and 1 part bismuth. This metal expands in cooling.

AIR CUSHION IN BELT

In a plant where a 57-k. w. generator was used as a motor to drive a line of shafting, the paper pulley on the motor being 16 in. by 12 in.; the pulley on the line shaft, 72 in. by 12 in., making 190 r. p. m.; the belt of five-ply rubber of good quality and the distance between centers about 17 ft., a pounding occurred at a certain point at each revolution of the belt, increasing in force each time. It was not convenient to stop the motor, and though the belt was not loose, a tightener was applied as indicated in the sketch, in the hope of stopping the pounding, but without success.

At noontime, when the motor was stopped, examination showed that the outer layers of canvas and rubber were detached for almost the entire length of the belt, while the edges still held together, and a cushion of



Location of Tightener

air a foot long and $3\frac{1}{2}$ in. thick had formed in the interior of the belt, causing the pounding. The belt was then perforated with a $\frac{1}{2}$ -in. belt punch throughout its entire length, the holes being located a foot apart and staggered. This did not stop the pounding immediately, but gradually diminished its force until only a click could be heard, says a correspondent of Power, and for many days after one could feel the air being forced out through the holes at one point.

The heat of one pound of coal will convert from five to eight pounds of water into steam in ordinary locomotive practice.

TO KEEP CONTENTS OF WOODEN PAILS FROM TASTING OF THE WOOD

Water or anything else for "internal use" kept in a wooden pail is apt to taste of the wood. To prevent this, says the Practical Carpenter, fill the pail with boiling hot water and let stand until the water is cold; then empty the pail and wash the inside with a solution of soda in lukewarm water, with a little lime added, after which scald the pail and rinse carefully.

SACKHOLDER FOR VEGETABLE PICKERS

A sackholder which I improvised last year, when something of the kind seemed a necessity, is shown in the accompanying illustration. I raise many acres of winter vegetables and employ many pickers, and



Tripod Sackholder

the holder saves time and labor. When the sack is full, a pull on one leg of the tripod lets the whole weight of the sack on the ground, and it may then be easily unhooked from the filler. In large acreage, there should be one holder at each side of the patch.—Contributed by Chas. H. Sebree, Monrovia, Cal.

HOW TO MAKE POISON FLY PAPER

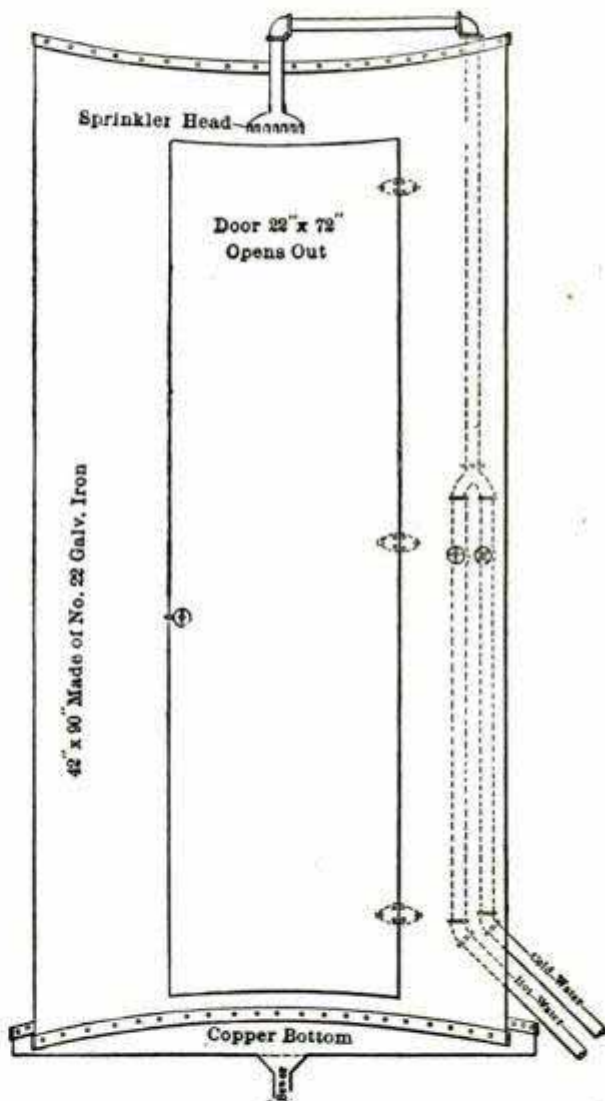
Take 1 lb. quassia chips, put them into 2½ qt. water and let stand for 24 hours. Then pour off the liquid and boil it down to 1 qt. Now put the same chips used before into 1½ qt. water and boil down to 1 pt. Pour off the liquid while warm and put in 10 oz. dark brown sugar. When the sugar is dissolved, mix the two liquids. When cool, soak pieces of blotting paper in the liquid for a minute, then take them out and drain and dry them. The paper can be laid away for use at some future time, if desired. To use, place a piece of

the paper in a small plate, put a little water on it and set it wherever convenient.—Contributed by F. S. Cummings, 289 Forsyth Av., Detroit, Mich.

DETAILS OF HOME-MADE SHOWER BATH

The home-made shower bath for factories described in Shop Notes for June, 1906, interested so many people and elicited so many inquiries that we publish the accompanying sketch giving further details of its construction.

The bath consists of a cylindrical casing 42 in. in diameter and 90 in. high, made of No. 22 galvanized iron. The casing is intended to rest in a copper tray or bottom



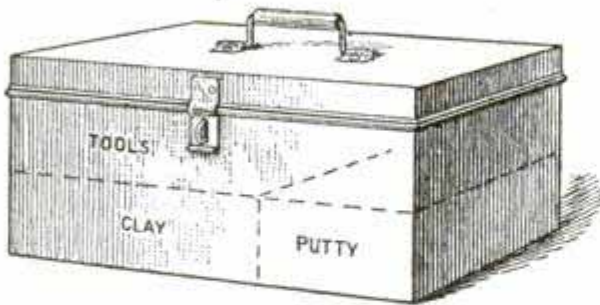
Convenient Shower Bath

which is connected with the sewer and prevents water from overflowing upon the floor.

At the top of the casing is a shower head with hot and cold water connections. In the side of the casing is a door 22 in. x 72 in., which opens out.

CHEST FOR STOVE JOBBER'S KIT

For carrying the stove jobber's kit a small metal chest, such as illustrated, is most convenient and suitable. The top part is for the tools, comprising one brace with chuck and drills, center and rivet punches, cold



A Handy Kit

chisels, screwdriver, hammer, pliers, hand snips, files and a small trowel.

The bottom, says a correspondent of the Metal Worker, has spaces for fire clay and stove putty and compartments for wire, stove bolts and similar supplies.

PORTABLE FORGE FOR THE SHOP

The accompanying illustration shows a portable forge, which was designed and constructed in one of the large railway shops, where it has proved to be very useful and convenient.

Either coal or charcoal can be used for fuel, says the Railway Review, and by

making slight alterations and adding a suitable tank, oil may be used.

The top frame, a plan detail of which is shown in the illustration, should be made of $\frac{1}{4}$ -in. sheet steel, but the hood may be made of lighter material. The device is intended for use in shops where compressed air is used, which can be supplied by means of nipples permitting a coupling direct to the compressed air connections.

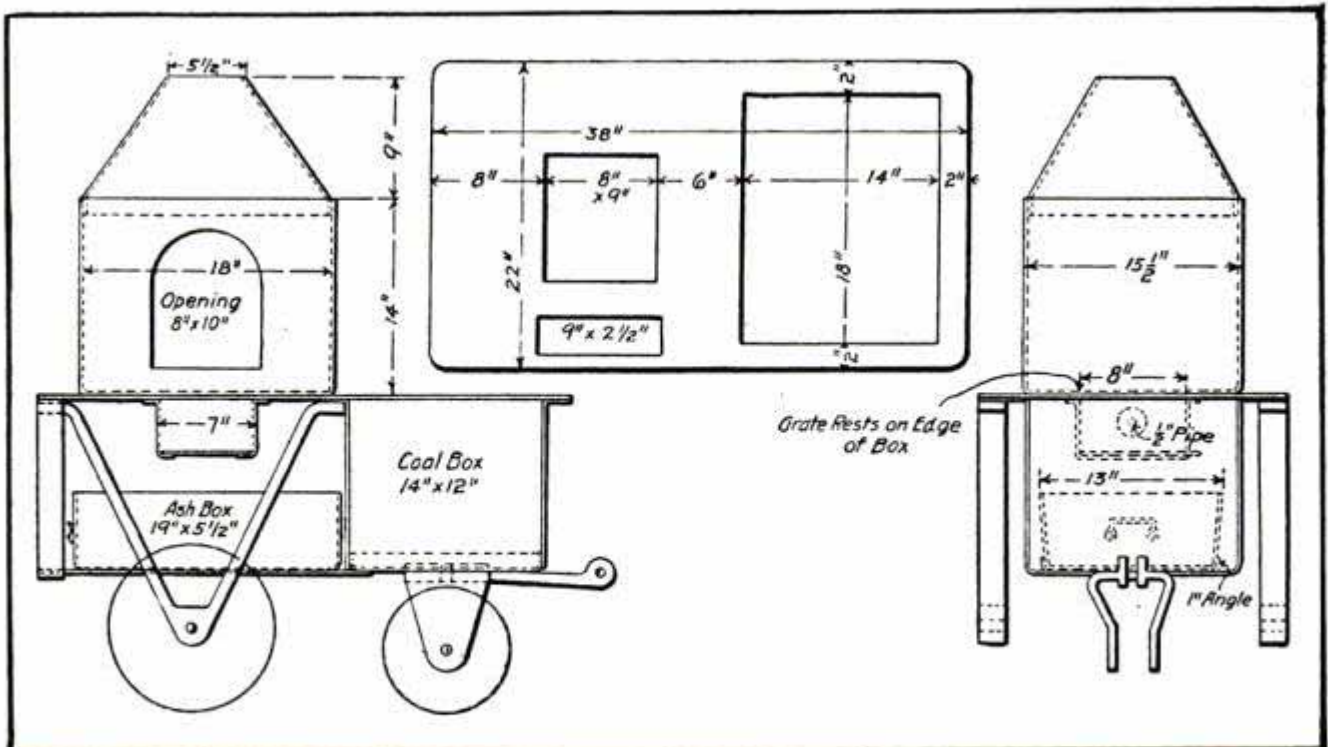
FASTENING STEEL TOOLS IN THEIR HANDLES

When the steel tool comes out of its handle, fill the handle with powdered rosin and a little rottenstone, says the Practical Carpenter, then heat the tang of the tool red-hot and push it into the handle. When cold the tool will be held firmly in place.

TO REMOVE DISCOLORATION FROM IRON AND STEEL

When iron or steel has been colored blue by exposure to heat, try rubbing it lightly with a sponge or rag dipped in sulphuric, nitric or hydrochloric acid, until the discoloration is removed. Then wash the metal, dry by rubbing, warm it and give a coat of oil so it will not rust.

When boilers leak along a seam or about a flue, try putting a pint of cornmeal in the boiler.

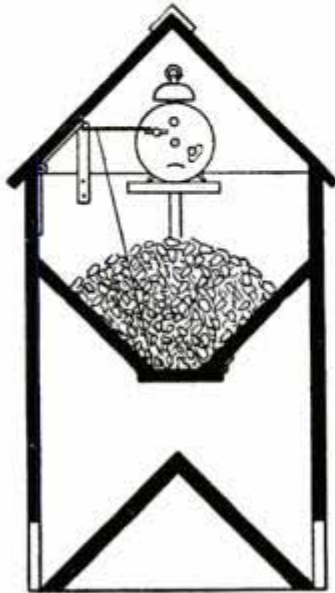


Home-Made Portable Forge



ALARM CLOCK CHICKEN FEEDER

An automatic hen feeder, which will discharge the necessary amount of corn or other feed at any desired time, can be made by using an alarm clock as shown in the sketch.



A small wire trigger rests on the winding key and supports the swinging bottom of the food hopper by means of a piece of string which connects the two. When the alarm goes off the trigger drops and allows the door to open, thus discharging the contents of the hopper.

tents of the hopper.

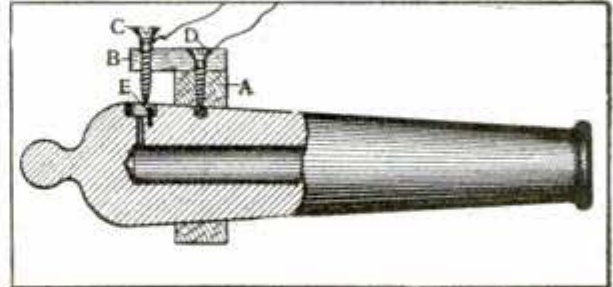
After the device has been in operation for some time the hens will run to the feeder whenever the bell rings.—Contributed by Dr. H. A. Dobson, Washington, D. C.

HOW TO DISCHARGE A TOY CANNON BY ELECTRICITY

A device for discharging a toy cannon by electricity can be easily made by using three or four dry batteries, a switch and a small induction coil capable of giving an $\frac{1}{8}$ -in. spark. Fasten a piece of wood, A, to the cannon, by means of machine screws or, if there are no trunnions on the cannon, the wood can be made in the shape of a ring and slipped on over the muzzle. The fuse hole of the cannon is counterbored as shown and a small hole is drilled at one side to receive a small piece of copper wire, E. The wood screw, C, nearly touches E and is connected to one binding-post of the induction coil. The other binding-post is connected with the wood screw, D, which conducts the current into the cannon, and also holds the pieces of wood, A and B, in position.

When the cannon is loaded, a small quantity of powder is placed in the counterbore, and the spark between C and E ignites this and discharges the cannon. A cannon may

be fired from a distance in this way, and as there is no danger of any spark remaining after the current is shut off, it is safer



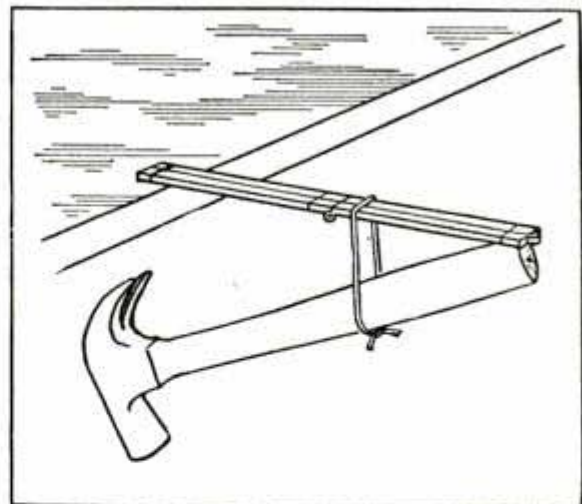
Electrical Attachment for Discharging Toy Cannon

than the ordinary cannon which is fired by means of a fuse.—Contributed by Henry Peck, Big Rapids, Mich.

EXPERIMENT WITH TWO-FOOT RULE AND HAMMER

An example of unstable equilibrium is shown in the accompanying sketch. All that is needed is a two-foot rule, a hammer, a piece of string, and a table or bench. The experiment works best with a hammer having a light handle and a very heavy head.

Tie the ends of the string together, form-



Equilibrium Experiment With Hammer and Rule

ing a loop, and pass around the hammer handle and rule. Then place the apparatus on the edge of the table, where it will remain suspended as shown in the sketch.—Contributed by Geo. P. Schmidt, Culebra, Porto Rico, W. I.

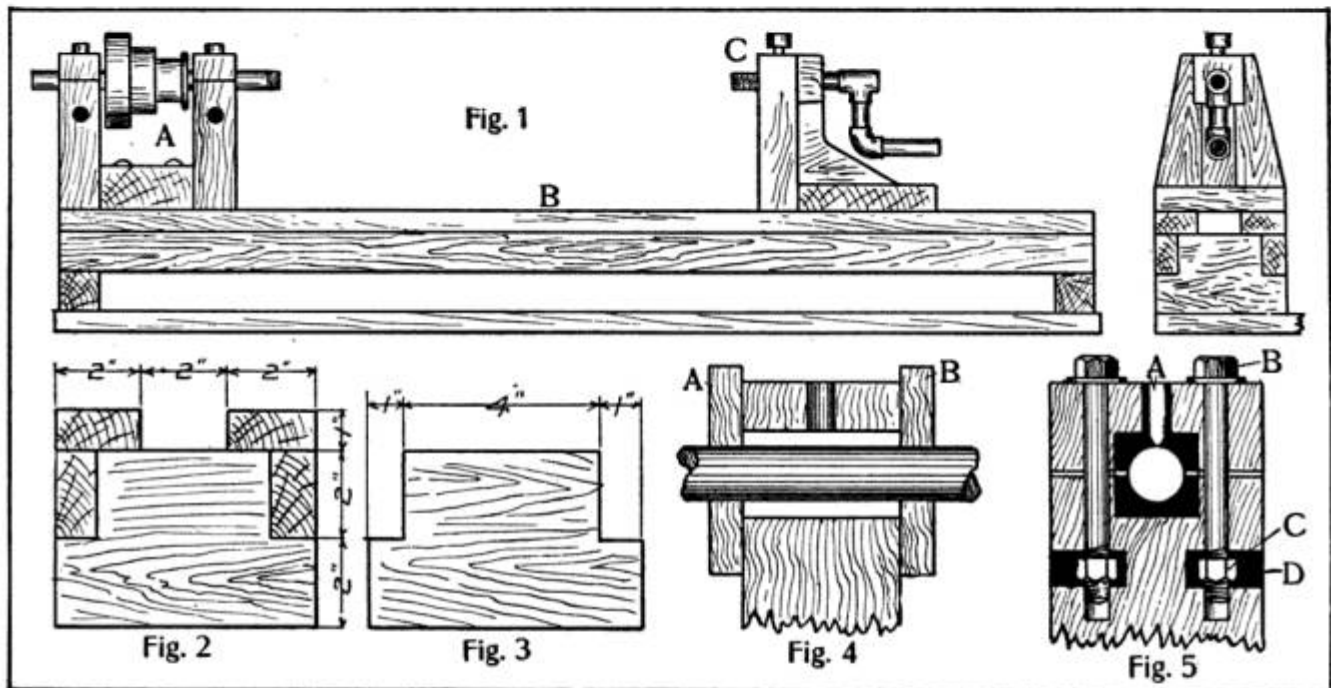
HOW TO MAKE A LATHE

A small speed-lathe, suitable for turning wood or small metal articles, can be easily made at very little expense. A lathe of this kind is shown in the cut (Fig. 1), where A is the head stock, B the bed and C the tail stock. I run my lathe by power, using an electric motor and counter shaft, but it could be run by foot power if desired. A large cone pulley would then be required, but this could be made in the same manner as the small one, which will be described later.

The bed of the machine is made of wood

The notches for this purpose may be about $\frac{1}{8}$ in. pitch and $\frac{1}{8}$ in. deep. Place pieces of wood against the ends of the bearing as shown at A and B, Fig. 4, and drill a hole in the top of the bearing as shown in Fig. 4.

The bearing is then ready to be poured. Heat the babbitt well but not hot enough to burn it and it is well to have the shaft hot, too, so that the babbitt will not be chilled when it strikes the shaft. If the shaft is thoroughly chalked or smoked the babbitt will not stick to it. After pouring,



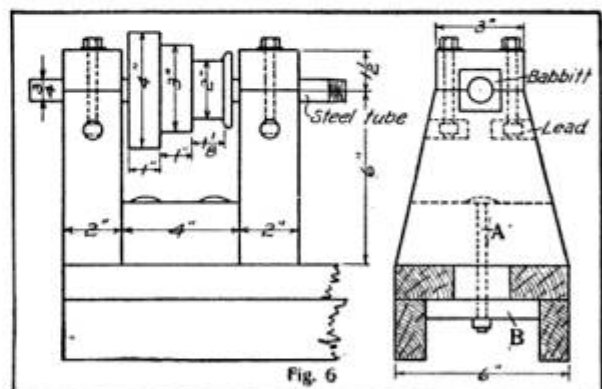
Assembled Lathe Bed and Bearing Details

as shown in Figs. 2 and 3, hard wood being preferable for this purpose. Fig. 2 shows an end view of the assembled bed and Fig. 3 shows how the ends are cut out to receive the side pieces.

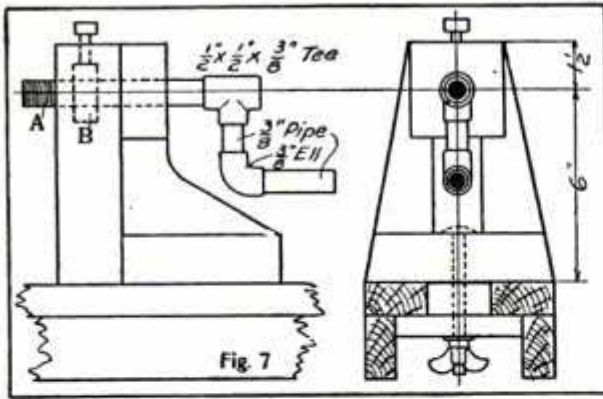
The head stock, Fig. 6, is fastened to the bed by means of carriage bolts, A, which pass through a piece of wood, B, on the under side of the bed. The shaft is made of $\frac{3}{4}$ -in. steel tubing about $\frac{1}{8}$ -in. thick, and runs in babbitt bearings, one of which is shown in Fig. 5.

To make these bearings, cut a square hole in the wood as shown, making half of the square in each half of the bearing. Separate the two halves of the bearing slightly by placing a piece of cardboard on each side, just touching the shaft. The edges which touch the shaft should be notched like the teeth of a saw, so as to allow the babbitt to run into the lower half of the bearing.

remove the shaft and split the bearing with a round wooden tapered pin. If the bearing has been properly made, it will split along the line of the notched cardboard where the section of the metal is the smallest. Then drill a hole in the top as shown at A, Fig. 5, drilling just deep enough to have the point of the drill appear at the



Head Stock Details



Details of Tail Stock

lower side. This cavity acts as an oil cup and prevents the bearing from running dry.

The bolts, B (Fig. 5), are passed through holes in the wood and screwed into nuts, C, which are let into holes, D, the holes afterwards being filled with melted lead.

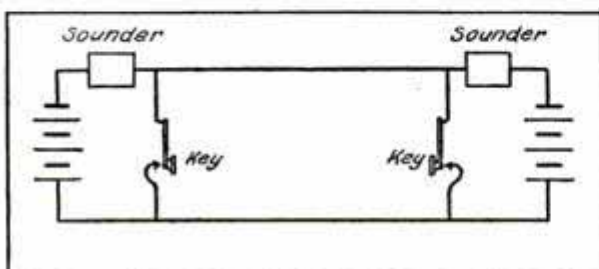
This type of bearing will be found very satisfactory and might be used to advantage on other machines. After the bearings are completed the cone pulley can be placed on the shaft. To make this pulley cut three circular pieces of wood to the dimensions given in Fig. 6 and fasten these together with nails and glue. If not perfectly true, they may be turned up after assembling, by rigging up a temporary tool rest in front of the head stock.

The tail stock (Fig. 7), is fastened to the bed in the same manner as the head stock, except that thumb nuts are used on the carriage bolts, thus allowing the tail stock to be shifted when necessary. The mechanism of the center holder is obtained by using a $\frac{1}{2}$ -in. pipe, A, and a $\frac{1}{2}$ -in. lock nut, B, embedded in the wood.

I found that a wooden tool rest was not satisfactory, so I had to buy one, but they are inexpensive and much handier than home-made tool rests.—Contributed by Donald Reeves, 6453 Iowa St., Oak Park, Ill.

SIMPLE OPEN-CIRCUIT TELEGRAPH LINE

By using the circuit shown in the sketch for short-distance telegraph lines, the extra switches and wiring found in many circuits

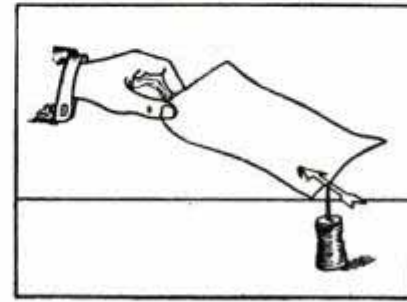


Simple Telegraph Line

are done away with. Closing either key will operate both sounders, and as the resistance of the sounders is very high the batteries do not run down for a long time.—Contributed by A. D. Stoddard, Clay Center, Kan.

HOW TO MAKE AN ELECTROSCOPE

An electroscope for detecting electrified bodies can be made out of a piece of note paper, a cork, and a needle.



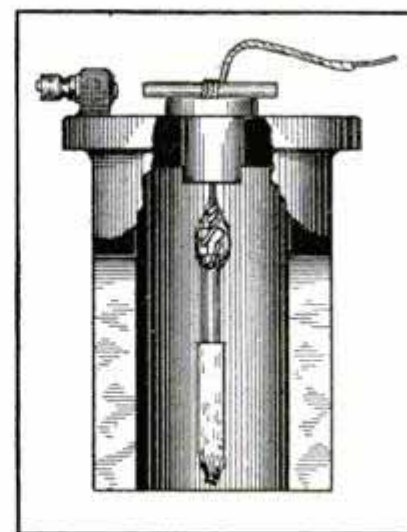
Push the needle in the cork, and cut the paper in the shape of a small arrow. Balance the arrow on the needle as shown in the sketch, and the instrument will then

be complete.

If a piece of paper is then heated over a lamp or stove and rubbed with a piece of cloth or a small broom, the arrow will turn when the paper is brought near it.—Contributed by Wm. W. Grant, 68 Kaye St., Halifax, N. S., Canada.

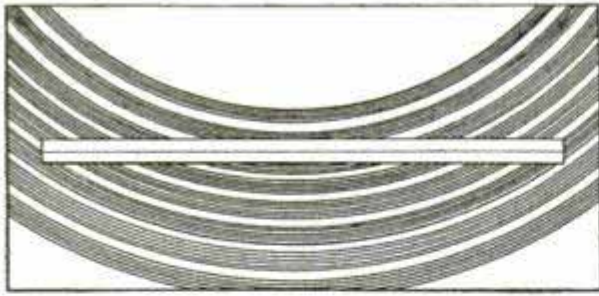
TO USE OLD BATTERY ZINCS

When the lower half of a battery zinc becomes eaten away the remaining part can



be used again by suspending it from a wire as shown in the cut. Be sure and have a good connection at the zinc binding-post and cover same with melted paraffin. This prevents corrosion which would otherwise occur

from the action of the sal ammoniac or other chemical. The wire may be held at the top by twisting around a piece of wood or by driving a peg through the hole in the porcelain insulator.—Contributed by Louis Launderbach, 174 N. 7th St., Newark, N. J.



AN OPTICAL ILLUSION

The accompanying illustration shows a perfectly straight boxwood rule laid over a number of turned brass rings of various sizes. Although the effect in the illustration is less pronounced than it was in reality, it will be noticed that the rule appears to be bent, but sighting along the rule from one end will show that it is perfectly straight.

The brass rings also appear distorted. The portions on one side of the rule do not appear to be a continuation of those on the other, but this can be proved by sighting in the same manner as before.—Contributed by Draughtsman, Chicago.

A SIMPLE ACCELEROMETER

A simple accelerometer for indicating the increase in speed of a train, was described by Mr. A. P. Trotter in a paper read before the Junior Institution of Engineers of Great Britain. The device consists of an ordinary 2-ft. rule, A, with a piece of thread tied to the 22-in. mark, as shown in the sketch, and supporting the small weight, B, which can be a button or other small object.

The device thus arranged and placed on the window sill of the car, will indicate the acceleration and retardation as follows: Every $\frac{1}{2}$ in. traveled by the thread, over the bent portion of the rule, indicates an increase of or decrease of velocity to the extent of 1 ft. per second for each second. Thus if the thread moved $2\frac{1}{4}$ in. in a direction opposite to the movement of the train, then the train would be increasing its speed at the rate of $4\frac{1}{2}$ ft. per second.

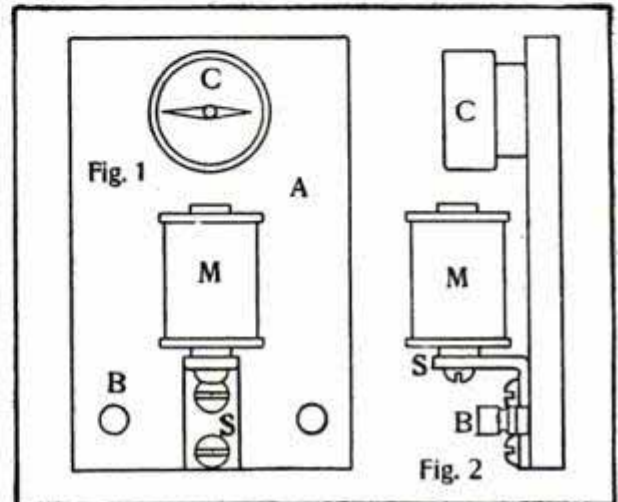
If the thread is tied at the 17-in. mark, then each half inch will represent the miles



per hour increase for each second. Thus if the thread moves one inch, it shows that the train is gaining 2 miles an hour each second.

HOW TO MAKE A GALVANOSCOPE

To make a galvanoscope for detecting small currents of electricity, a magnet, M; compass, C; two binding-posts, B B, and a base, A, of wood, all as shown in Fig. 1 (top view), will be required. In Fig. 2 (side view), S S are supports to the magnet, M, which should be $\frac{1}{2}$ -in. from the



For Detecting Small Currents

compass, C. This galvanoscope will detect the weakest current.—Contributed by John H. Jensen, 2537 N. Chadwick St., Philadelphia, Pa.

ANTIDOTE FOR SQUIRREL PEST

To the owner of a garden in a town where squirrels are protected by law, life in the summer time is a vexation. First the squirrels dig up the sweet corn and two or three replantings are necessary. When the corn is within two or three days of being suitable for cooking, the squirrels come in droves from far and near. They eat all they can and carry away the rest. When the corn is gone cucumbers, cabbages, etc., share the same fate, being partly eaten into. At the risk of being arrested for killing the squirrels I have used a small target rifle morning and night, but during my absence the devastation went on steadily. Last year they destroyed my entire corn crop. Traps do no good; can't use poison, too dangerous. But I have solved the difficulty; it's easy.

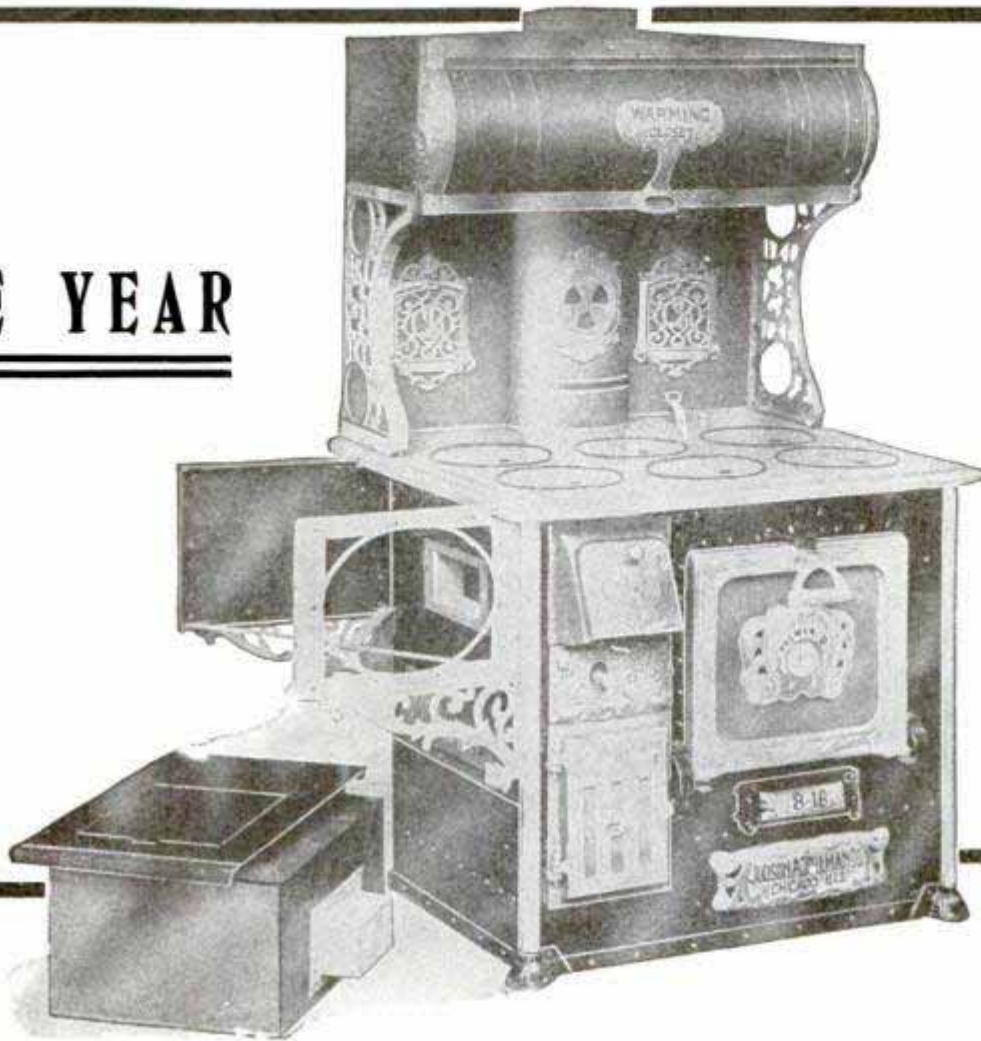
Shake cayenne pepper over the various vegetables which are being ruined, and observe results.

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STANDARD OF THE WORLD

OLD "GB," THE MAN AT "X."—"Old Greg," the man who signed "GB" at the "X" yard office, had things all his own way on the string at night. He made life miserable for everybody, from the dispatcher at "DI" down to the "OS" ham at "SU."

Swift! Well, I should say so; and none too smooth, either. He just would not come down—not him.

"Take it or get off the wire," he'd say, after you broke two or three times, and every time you broke after that you would get a new name, which generally would not please you very well. It was just impossible to keep out of a "scrap" with him. He seemed to be down on everybody, and nobody had any love for him.

One thing about "Greg," you just couldn't "break him up;" there was no use to try. Everybody did try, though (after they found there was no use of being gentle with him), and "fired" it at him with might and main, only to get that exasperating "GB" when they closed the key, and it always sounded as spiteful as could be, especially if a fellow had sent faster than he had ever done before.

It might not have been so bad if he had not bragged about it, which he did continually.

"Oh, you ham!" he would say, when you were just killing yourself sending to him.

"Why don't you hurry up?" and again, "I wish there were some operators on this road!"

Well, he had us all going his way; there was no use denying it. We could not do a thing with him, so we just had to take it all in the best manner possible. He appeared to get worse all the time, and imposed on some of the boys he appeared to have a spite against until they were about ready to quit. The man at "HF" he did a lot of work with finally had to lay off; they had so much trouble.

He had been gone about two weeks, when he returned to work and called me up one night. He told me to ground the wire south a few minutes. Then he told every operator on the line to get ready for some fun, and watch "GB," as he had a job fixed up for him. He had been up to New York while he was laying off, and had

brought a friend of his home who was considered one of the swiftest press operators in the city. He was going to get after "Old Greg" and give him a warming up that would last him for all time. We all waited excitedly for the fun to commence. Finally "Greg" opened up on the wire; he was in one of his worst moods, and by the time he got to "HF" he was trying to tear the wire down, and he "fired" some half a dozen messages at them fiercely, one after another. There was a pause after he finished, then the key opened and "OK" dragged out slowly, very slowly, as if he had all night to work in. The man at "HF" began a message. "What do you think you are doing—going to a funeral?" asked "Greg," breaking in.

"Oh, I don't know," came the reply from "HF," in the same slow way, and he started ahead again as slow as ever. This was too much for "Greg."

"Call the operator," he said, breaking in again.

"Now, I wonder what you want?" said the man "HF."

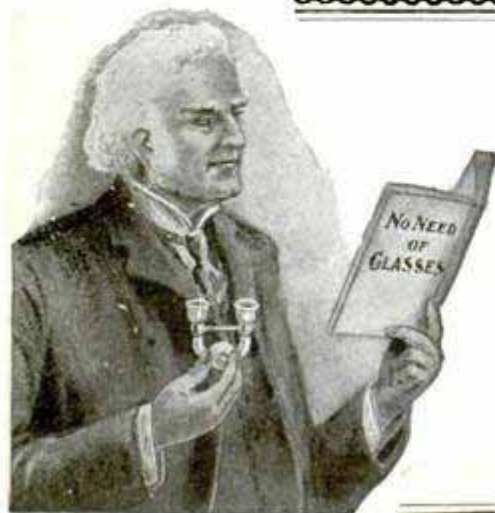
"I want somebody who can send that work; if there's no one there to do it, mail it," came the reply, sharply.

"Oh, I can send it, but I hate to be broke so much," said "HF."

Well, what "Greg" said to him wouldn't stay on paper in any kind of ink. He was right in the middle of a lecture on the "Cheek of Hams" when, all of a sudden, something happened to the relay and sounder which seemed to make them tumble over each other. Then the sounder got up and began to walk around over the table; it sounded like forty geese all cackling at once. Then it appeared to settle down into one place, rocking from side to side, and the noise changed, and resembled the sound of a nest of bumble-bees when they are first stirred up. It was good "stuff," too—clear as a bell; it flashed through your mind like a dream.

Something was surely wrong at "X." Where was "GB?" Why didn't he break? Nobody could put that stuff on paper. Every man on the line listened eagerly as message after message flashed

(Continued on page 1058.)



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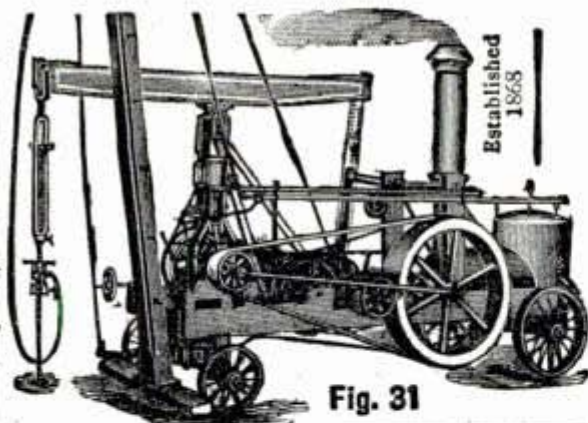


Fig. 31

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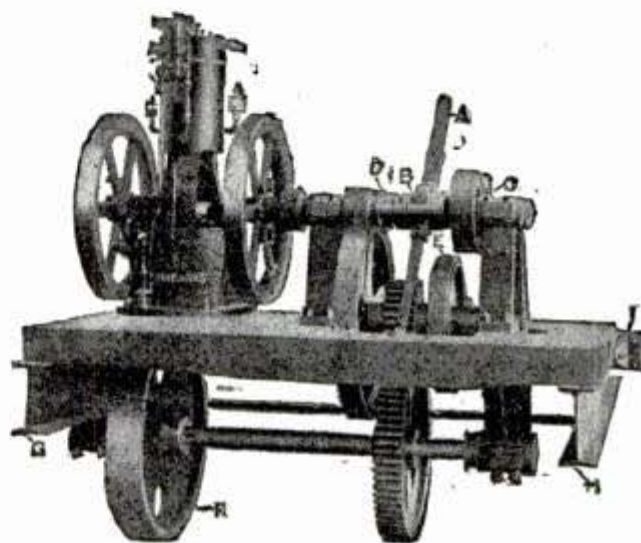
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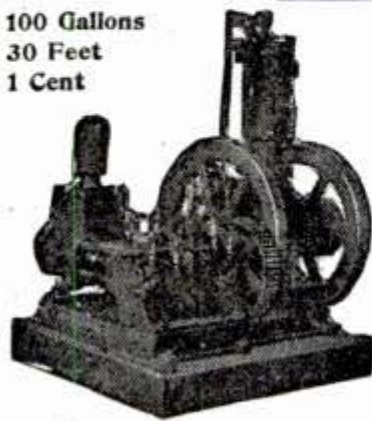


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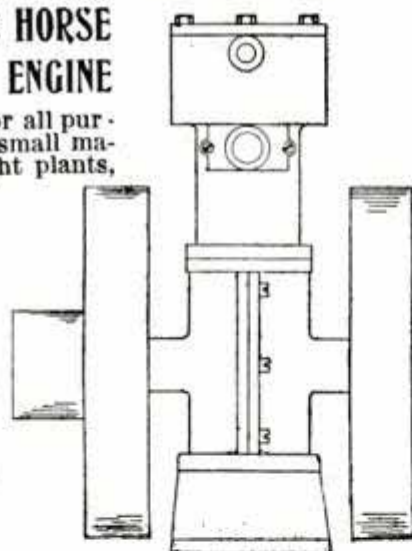
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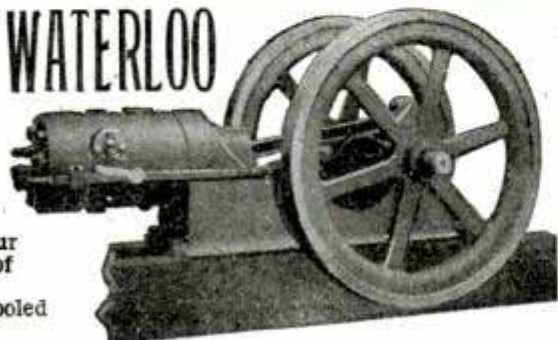
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(Continued from page 1056.)

away; there was a big bunch of them; they had let them accumulate for the occasion. Finally the last message was finished, the work was done, the key closed with a snap and the sounder quivered and lay still. With strained ears every man along the line listened as the seconds slipped away—five, ten, fifteen—then, just as everybody was beginning to feel good, and the laugh was about to be flung from call to call, the key opened with a click, and in that unconcerned manner, which no man could ever imitate, "GB" flashed out upon the line and the key closed again.

A strange and oppressive stillness settled upon the wires; all night their throbs were dull and heavy; even the dispatcher appeared to have lost interest in his work, while the chatter of the "OS hams" on the W. U. wire was changed to silence.

The next night a new man reigned at "HF"; a strange voice was upon the wire. The press man from New York failed to come around and shake hands with the boys before he went back to the city. We learned afterward that "GB" was considered the swiftest press operator in the country, and was only doing a little railroad work to rest up. He happened to know and recognize the press man who tried to burn him that night, and sprang the story on him when he went back to the city. As for that man who worked at "HF" that night, he has not been heard of since. If anybody knows where he is we would like to have his address. He signs "MC." and they call him Mack for short.—Railroad Telegrapher.

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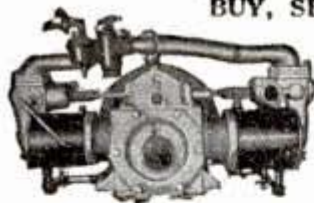
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GASOLINE ENGINE EXCHANGE

BUY, SELL AND EXCHANGE NEW AND SECOND-HAND



**AUTOMOBILE
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Gasoline Engines

We sell New Engines, taking Old in Exchange, allowing full market value. 100 first-class, second-hand engines on hand. Write for Catalogue. Lowest Prices. Largest Assortment in America. **GASOLINE ENGINE EXCHANGE, 842 S. 18th St., St. Louis, Mo.**

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SHAPERS AND DRILL PRESSES ::::

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GAS COAL ECONOMY.—The power efficiency of certain soft coals when used in the gas producer plant is two and one-half times greater than when used in an ordinary steam boiler plant. This is shown by geological survey tests, which also develop that the softest grades of bituminous coal and lignite are equal in power production with the best grades, even surpassing anthracite for some purposes. The peat of New England may also be utilized in the gas producer plant and save the factories there one-third of the \$50,000,000 annual coal bill for manufacturing purposes. Authorities in the geological survey claim that the use of producer gas would add hundreds of years to the duration of the American coal reserve.

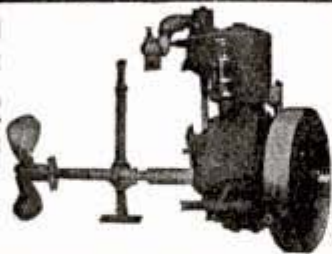
LIVE WIRE CAUSES "MURDER" MYSTERY.—When William Hoch, a New York saloonkeeper, was found dead behind his bar appearances pointed strongly to foul play. After a fruitless search for clues by the detective force, a friend of the dead man declared he had a theory in regard to the death and desired to demonstrate it.

He went to the spot where the body was found, mounted a chair and showed how in turning off the electric lights, as was his custom every night, his friend had once received a shock that caused him to exclaim in pain. Just as the theorist was demonstrating the matter there was a flash and a puff of smoke and he fell on the floor unconscious. It took an hour to resuscitate him and the detectives were convinced that the live wire had caused Hoch's death.

The man with the muck-rake is behind the times—he should use a steam shovel.—Steam Shovel News.

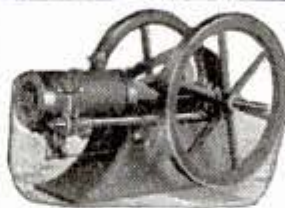
High-grade **MARINE** and **AUTOMOBILE ENGINES**
2 to 30 H. P. 2 and 4-cycle,
latest improvements; best material;
lowest prices. Also sell castings,
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State your want.
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Simple, Reliable and Economical
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COLUMBUS MACHINE CO.,
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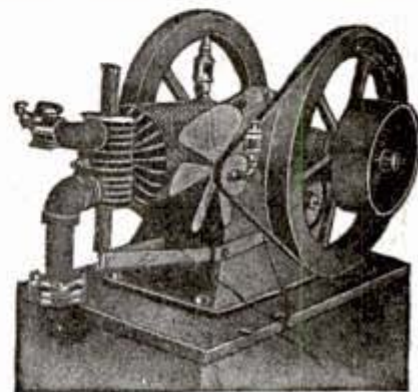
Sizes 2 to 80 H.P. Stationary or portable. Best regulated governor. Speed can be changed while running. Vertical valves, therefore no side wear. Agents wanted. Write for catalogue.

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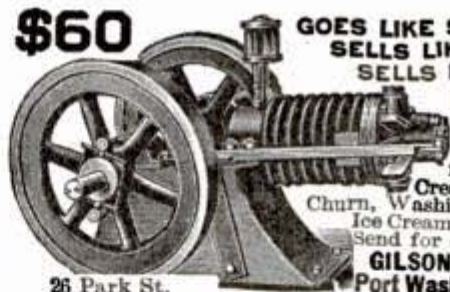
Bore 6x6 inches.
Plenty of cooling surface. No engine ever constructed with so few working parts. You can hold your hand on the flanges after it has been working all day.

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Gasoline tank in base or outside.



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\$60



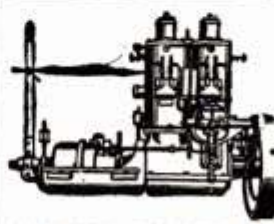
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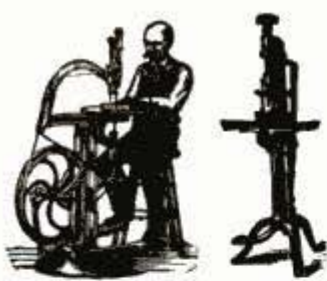
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**GENERATOR SETS, PUMPS,
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Foot, Hand and Light Power

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SMALL MOTORS All Variable Speed

Alternating dental and jewelers' motors...	Each \$25.00
Direct current " " " " " "	22.00
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Alternating current friction drive motors for Gordon Presses, 100 to 2,000 impressions per hour.....	60.00
Same motor wound for direct current.....	40.00

These motors are the newest improved variable speed motors, and guaranteed for two years.

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HEATING AND VENTILATION.**

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CEMENT BLOCK MACHINE 100 BLOCKS A DAY **\$10**

MOLDS for Cisterns, Silos, Fence Posts, Drain Tile. Write today for particulars.

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SAVE MONEY by using **Reed's Carborundum grinding stand**. Costs less than any other and does away with counter-shafts. Cast iron boxes reduce cost of maintenance over 1/2; has loose pulley, and dust-proof over-hanging bearings. **Luther Bros. Co., 25 Poplar St., North Milwaukee, Wis.,** sole makers of hand and foot power grinders and sharpeners fitted with Carborundum Grinding Wheels.



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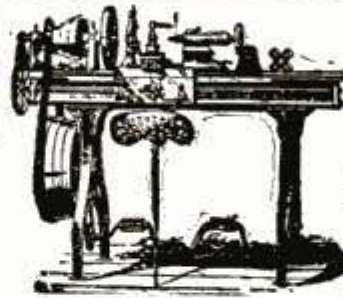
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**\$40 to \$75
A WEEK**

Can be made with one of these

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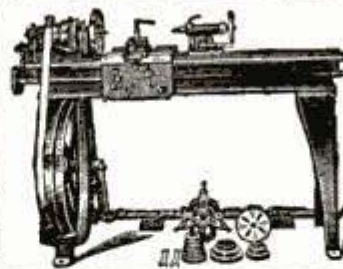
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List price, \$65.00 and up according to size. When ready to buy send for Lathe Catalog and prices

W. F. & John Barnes Co.
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THE CONTRACTOR'S SOLILOQUY.

"To cut or not to cut, that is the question—
Whether 'tis not better in the end
To let the chap who knows not the worth
Have the work at cut-throat price, or
To take up arms against his competition
And, by opposing cut for cut, end it.
To cut, and, by cutting, put the other cutter
Out of business; 'tis a consummation
Devoutly to be wished. To cut, to slash,
Perchance myself to get it in the neck—
Ay, there's the rub; for when one starts
To meet the other fellow's price, 'tis like as not
He's up against it good and hard.
To cut and slash is not to end confusion
And the many evils the trade is pestered with;
Nay, nay, Pauline; 'tis but the forerunner
Of debt and mortgage such a course portends.
'Tis well to get the price the work is worth
And not be bullied into doing it
For what So-and-So will do it for.
Price cutting doth appear unseemly
And fit only for the man who knows not
What his work is worth, and who, ere long,
By every stress of making vain comparison
'Twixt bank account and liabilities,
Will make his exit from the business."
—Electrical Contractor.



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**ELEVEN-INCH SCREW
CUTTING LATHE**

For foot or power as wanted. Has power cross feed and compound rest. A strictly high-grade modern tool. We also build a 9-inch lathe. Descriptive circulars of each lathe upon request.

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**MY REVISED LIST OF MACHINERY
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The newest, cleverest and most satisfactory in use, and the first to be offered at so reasonable a price that every up-to-date mechanic could buy tools of their quality and character. Other tools are very good tools, but, "Yankee" Tools are better. Sold by leading dealers in tools and hardware. Ask dealer to see them.



Ratchet Screw Driver No. 10 and 11. (8 Sizes.)



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Our "Yankee Tool Book" tells all about them. Sent free on request by

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Sharpen the teeth

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The GRAMMES CIRCULAR SAW VISE—is a swivel vise—swings three-fourths of a circle—gives the one and only accurate position for filing any circular saw or cutter.

All iron—unbreakable—non-vibrating—gives the filer perfect control—and it cannot possibly injure the saw or cut at the wrong angle.

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A free month's trial for to test it out—you can save enough in that time to pay the \$5.50 it costs.

If you file at all—here's the only vise your men will use after they try it once.

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GASOLINE SOLDERING IRON AND BLOW TORCH



For any work, in any situation, and in many where its peculiar convenience and efficiency pays for it in a single job, this little tool has won a host of friends. Let us send you a decidedly fetching little booklet that tells really wonderful story in a few brief pages. Shall we do so?

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One Pipe Cutter,
One Wrench. All for handling pipe from 1/4 to 1 inch.

ON RECEIPT OF \$10.50

Send for Catalogue of Complete Line,

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1 1/2 horse, but tested to 3 3/4 per cent above rated power. DON'T buy a CHEAP engine; it doesn't pay. Buy the simplest, strongest and best designed engine at the lowest possible price; that's right, we build them.

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Our wrench has more uses than any other wrench made, and can be used as a pipe wrench, thread cutter, or nut wrench. For cutting threads it has 3 different dies.

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THOROUGHLY RELIABLE
Adapted for Pleasure and Utility

Will run faster than an auto and cost of maintenance
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DELIVERY ATTACHMENT in daily use by leading business
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DIFFERENCE IN DINING.—In England nothing is allowed to interfere with one's dinner; in America no dinner is allowed to interfere with one's business. The one regards health above money; the other money above health—and everything else. It is time that Americans learn that there is little happiness connected with wealth when handicapped by indigestion and dyspepsia.—Hotel World.

ENGINE SAID TO CREATE POWER.—An engine that actually creates power is claimed to have been invented recently, the "created" power being obtained from four immense flywheels on the driving shaft. Each wheel connects with the shaft in turn and releases automatically, after having driven it five revolutions; an ordinary steam engine being used for the purpose of keeping the flywheels in motion. The engine has no direct connection with the driving shaft which receives all its power from the momentum of the flywheels. It would be ridiculous to suppose that the power produced would be greater than that expended in overcoming the inertia of the flywheels.

It is true that a body in motion tends to stay in motion and that the revolution of a heavy flywheel will transmit considerable power, but it is also true that a body at rest tends to stay at rest and for this reason it would require a great amount of power to start the flywheels. The heavier the flywheels, the more power they would transmit, but they would also require more power to accelerate their motion.

MOTORCYCLES
\$40.00 UP

Send for list No. 102 of seventy machines. Our 1906 catalogue of engines, castings, frames and accessories should be in the hands of every motorcycle dealer, rider and prospective purchaser. **SEND FOR IT.**

HARRY R. GEER CO.
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PUZZLES 3 Horse Shoe pocket piece puzzle. Carry it for luck and an entertainer. 10c a set, 3 sets for 25c, with Booklet of all good puzzles.

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AUTOMOBILES \$100 AND UP

We will mail our large Illustrated Bargain Sheet of new and slightly used Automobiles on receipt of your name and address. This sheet shows accurate photographic views of more than 50 Automobiles offered as low as \$100. Write plainly to

H. GRAHAM CYCLE CO., Inc.

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601-603-605 Madison Street, CHICAGO, ILL.

BURN IT OUT

The soot in your cylinders quickly removed by treating with..... **NO-KO-RODE**

Saves Gasolene. Increases Power.
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A chemical compound which mixes with the gasolene and completes its combustion. Cheap, Powerful, Active. Enough to treat 50 gallons sent by mail on receipt of 50 cts. Money refunded if it does not prove to be all I claim for it.

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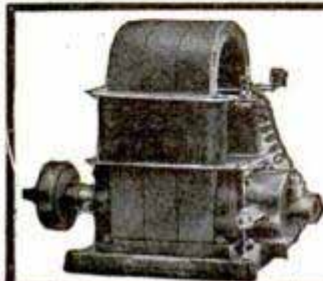
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This includes all parts by which anyone can easily make a powerful, durable motorcycle. Weight 48 lbs. Bolts to frame. Speed 2 to 30 miles an hour. A hill climber. Hundreds in use, send stamp for outfit catalogue.

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IGNITING DYNAMOS and MAGNETOS

The most Reliable Sparkers on the Market.

Take the Place of Batteries



Jump Spark Coils

FOR ALL PURPOSES
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HOW TO ENCLOSE A STAMP.—"There's only one decent way to enclose a stamp for a reply," said the head of the correspondence department of a large business, "and that is to use one of the stamps from the outside rows of a sheet with a blank margin that can be stuck upon the letter and leaves the stamp ready for use. Any other way either loses the stamp or else spoils it for use."

"But I found today a trick that is pretty good. Most people enclose the stamp by sticking it down at one corner, and then you have to paste that corner down when you use the stamp. The new trick is to wet the stamp in a little space in the center and stick it there. It pulls off easily, yet when you use the stamp all the edges have gum enough to stick and the little loose place under George's nose doesn't show."

RUSSIANS SEEK JAPAN.—A traveler who has just arrived at Moji from Vladivostock is reported to have said that a strict vigilance is now being exercised at Vladivostock against Japanese ships in view of possible escape to Japan of the leaders and men of the rebellion which has quite recently been suppressed. There are five Russian torpedo-boats in the harbor but none of her warships.—Japan Times.

More Power for Your Auto

If you have an Apple Battery Charger to keep your batteries full. It automatically generates a current that produces hot sparks to meet every charge. If you have ignition troubles write us today for full information.



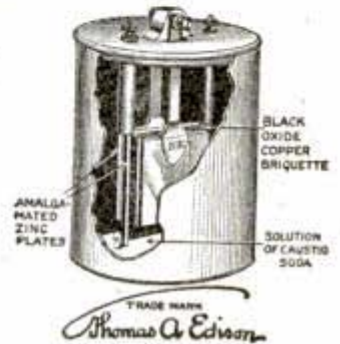
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EDISON SPARK COIL for igniting Gas, Oil, Distillate, Crude Oil and Gasoline Engines. The Edison Cell is the cheapest form of battery energy, the Edison Coil is the most saving of battery energy. Combined they give the most sparks for \$1. Send for new prices and book, "Battery Sparks," which explains.



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WHY NOT STOP YOUR TROUBLES?
A "Wizard" Tubular Does It.

Armature incased in WATER-PROOF non-corroding brass tube.

All brass screws. Friction, Belt or Governor drive.

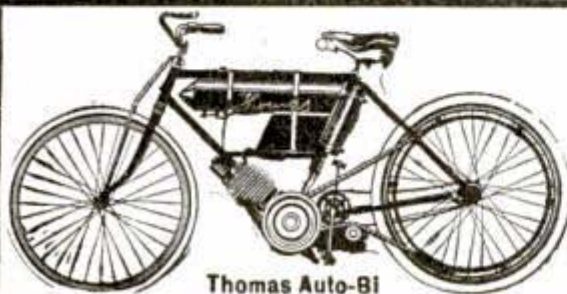
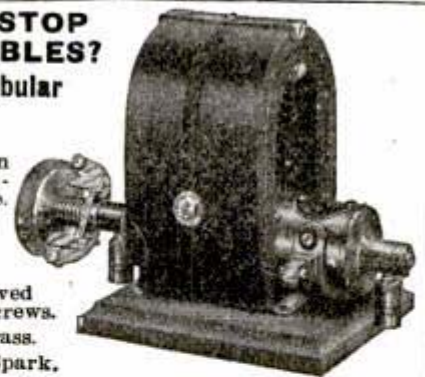
Brush-holders removed without loosening screws.

All parts polished brass.

Contact and Jump Spark.

A TRIAL WILL CONVINCEN YOU. Most popular and satisfactory Magneto on the market. Price as popular as machine. Governor does away with Batteries and Switches.

HERCULES ELECTRIC & MFG. CO., INDIANAPOLIS, IND.
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PRICE

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THREE HORSE POWER

GRIP CONTROL 5 TO 40 MILES PER HOUR. 100 MILES FOR TWENTY CENTS

LIVE AGENTS WANTED

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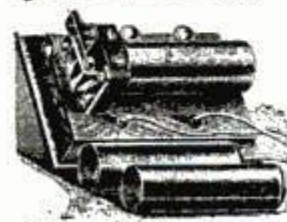
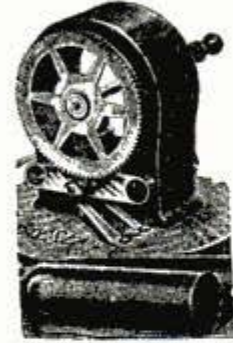
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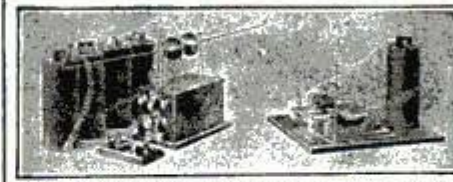
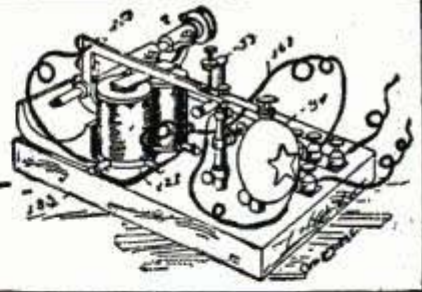
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\$1.15 \$1.25 \$2.75
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Farr Telephone and Construction Supply Co.
 TELEPHONES AND ELECTRICAL SPECIALTIES
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Learn Electricity at Home, with improved apparatus. Own your own Laboratory. We offer a Complete Electrical Laboratory with Illustrated Manual of Instructions at a price within the means of all. Write for our proposition and a copy of the Manual. **COLUMBIA SCHOOL SUPPLY CO.** Indianapolis, Ind.



WIRELESS TELEGRAPH

"Telimco No. 2," complete experimental outfit, comprising one inch spark coil, balls, key, 75 ohm relay, Coherer and autom. decoherer, 5 cells battery, wiring, connections, instructions, diagrams, etc. Will work up to a mile. Price \$13.50. Agents wanted. New Catalog of European and American Electrical Novelties.

ELECTRO IMPORTING CO., 87 Warren St., New York.

FINE ENGRAVING ON PIN HEAD.—A St. Louis expert succeeded in engraving all the figures from 1 to 9, the letters of the alphabet and his own name, Eugene Wrenger, on the head of a common steel pin, the surface being a little less than five-sixty-fourths inch in diameter. The head of the pin was flattened and made perfectly smooth and while the engraving was being done the pin was held in a strong vise. The surface was then marked off by an instrument that locates 960 parallel lines on a surface 1 in. wide. The engraving was done with a 4-in. penstock holding a piece of fine tempered steel the points of which are keener than a razor. The engraving cannot be discerned by the naked eye. The pin is in a Philadelphia museum.

Despondent over the fact that he had worked four years on an invention only to find that another had patented the same thing, John Klubink, a mechanical engineer, attempted suicide by jumping into the Harlem River. He fought off the rescuers, but finally was taken to the Lincoln Hospital.

An Austrian inventor, Richard Szigmondy, is reported to have made a new kind of window glass whose chief peculiarity is that it prevents the passage of nine-tenths of the heat of the sun's rays.

It is well known that ordinary window glass allows nearly all of the heat derived from the sun to pass through, but, on the other hand, intercepts all heat coming from nonluminous sources, such as a stove or the heated ground. This is the reason why heat accumulates under the glass roof of a hothouse.

If covered with Szigmondy's glass a hothouse would, it is claimed, become a cold house, since the heat could not get into it. One advantage set forth in favor of the new glass is that a house whose windows were furnished with it would remain delightfully cool in summer. But in winter, perhaps, the situation would not be so agreeable.

\$3.50 EACH (former price \$6.00)

We are closing out the last of a job lot of P. W. motors at a sacrifice price of \$3.50 each, complete, ready to run. These are bi-polar motors, with laminated armatures and bronze bases. Will develop about 1-40 horse power. They run well on from 1 to 6 cells dry battery. A great bargain and there are only a few left. **ORDER TO-DAY** if you want a good motor cheap. **PARSELL & WEED, 129 W. 31st St., N. Y. City.**



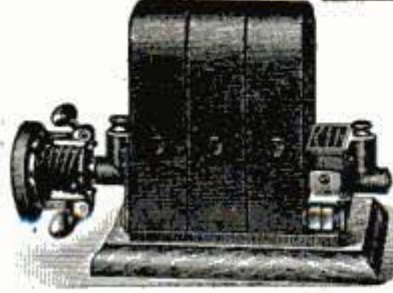
WHEN YOU WANT ANYTHING AND DON'T KNOW WHERE TO FIND IT WRITE POPULAR MECHANICS

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Are Right. HOW ABOUT YOU? Save 30% to 100%
 Every style of enclosed fuses refilled. Do not let your engineer or electrician throw them away. Catalogue of net prices sent on request.
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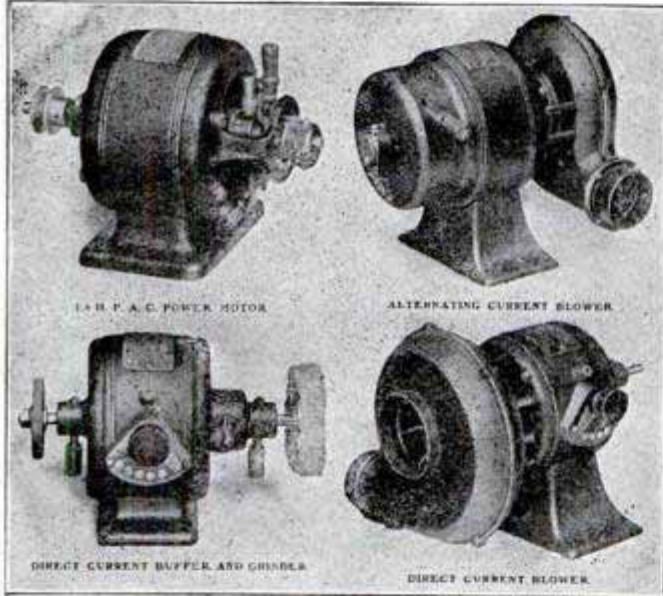
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2. Select a good patent attorney, pay him \$5 to find out whether your invention is new and patentable, and have him send you copies of the patents which he finds most closely resembling your invention.

3. If there are real differences between your invention and those shown in the patents sent you, and your invention is better than the others, apply for a patent as soon as possible. If, on the other hand, the differences are slight or superficial, and do not add to the commercial value of the article, don't waste any money in getting a patent.

4. If you cannot afford to apply for a patent, give an interest in your invention to some good business man who will furnish the necessary money to get the patent and build a satisfactory model or sample of your invention.

5. After you have applied for a patent and made a model or sample, prepare either to manufacture and sell your invention yourself, or to sell the patent to some one who will do so. Find out what it will cost to manufacture the invention in quantities, what such things usually sell for to jobbers, retailers and the public. This information is valuable in negotiating the sale of the patent and should be full and accurate.

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—A cub reporter on the New York Sun, after a fruitless attempt to get telephone connection, went out and in his desperation compiled the following indictment:

The Company.—Their line is gone out to all the earth and their words to the end of the world. Ps. xix:4.

Trunk Wires.—Thy land shall be divided by line. Amos vii:17.

The Service.—Prepared for an hour, and a day, and a month and a year. Rev. ix:15.

They were employed in that work day and night. 1 Chron. ix:33.

Monopoly.—We have no might against this great company. 2 Chron. xx:12.

Now, shall this company lick up all that are round about us? Num. xxii:4.

Threatened Competition.—See! There come people down by the middle of the land, another company come along! Judges ix:37.

The New Zones.—The great city was divided into three parts. Rev. xvi:19.

Charge the people. Exod. xix:21.

A daily rate for every day. 2 Kings xxv:30.

And kept back part of the price. Acts v:2.

"Information."—Is there any number? Job xxv:3.

I know not the numbers thereof. Ps. lxxi:15.

Search may be made in the book of the records. Ezra iv:15.

He telleth the number. Ps. cxlvii:4.

His number is 666. Rev. xiii:18.

I understood the number. Dan. ix:2.

The Call.—When I call, answer me speedily. Ps. cii:2.

I called him, but he gave me no answer. Cant. v:6.

Then they waited according to their order. 1 Chron. vi:32.

Call now, if there be any that will answer thee! Job v:1.

Where is the receiver? Isa. xxxiv:18.

Let every man be swift to hear and slow to speak. James i:19.

Thou didst call me. 1 Sam. iii:6.

The Conversation.—Call thou and I will answer, or let me speak, and answer thou me. Job xiii:22.

They would not take hold of his words. Luke xx:26.

Ye have heard my conversation in time past. Gal. i:13.

We use great plainness of speech. 2 Cor. iii:12.

Except ye utter words easy to be understood, how shall it be known what is spoken? for ye shall speak into the air. 1 Cor. xiv:9.

I had rather speak five words with my understanding than ten thousand in an unknown tongue. 1 Cor. xiv:19.

The Interruption.—I said in my haste, "I am cut off." Ps. xxxi:2.

There is no speech nor language. Ps. xix:3.

If he cut off, and shut up, who can hinder him? Job xi:10.

There are so many kinds of voices in the world. 1 Cor. xiv:10.

Thou hearest the sound thereof, but canst not tell whence it cometh. John iii:8.

Put off the former conversation. Eph. iv:22.

(Continued on page 1668)

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(Concluded from Page 1066)

I will cut him off. Lev. xvii:10.
A dreadful sound is in his ears. Job xv:21.
The sound of the grinding is low. Eccles. xii:4.
Who hath stretched the line upon it? Job xxxviii:5.
Cut off his branches. Dan. iv:14.
Rebuke the company! Ps. lxxviii:30.
Thou and all thy company. Num. xvi:16.
Be damned! Mark xvi:16.
What a word is this! Luke iv:36.
Forget it! Prov. iv:5.
Evil-doers shall be cut off. Ps. xxxvii:9.
They went to their own company and reported. Acts iv:23.
The Party Wire.—Line upon line, line upon line. Isa. xxviii:10.
Both parties shall come before. Exod. xxii:9.
While they are yet speaking I will hear. Isa. lxxv:24.
Not to boast in another man's line. 2 Cor. x:16.
Pay Stations.—Will they not pay toll? Ezra iv:13.
It shall not be lawful to impose toll. Ezra vii:24.
Thou hast nothing to pay. Prov. xxii:27.
Wherefore kick ye. 1 Sam. ii:29.
Twenty and three. Judges x:2.

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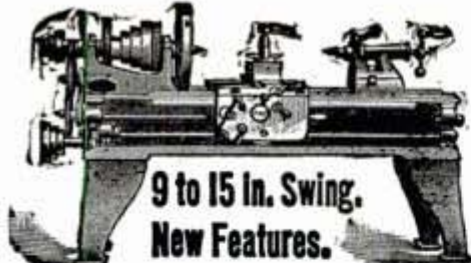
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BUSINESS BOOMING AT SAN FRANCISCO.—

Our own correspondent there writes as follows: Reliable facts and figures regarding the rehabilitation of San Francisco show a very encouraging degree of progress. In July the population was 365,000, despite the tremendous exodus immediately following the great disaster. At that time the number of people receiving relief in San Francisco had been reduced from 225,000, during the first week, to 17,000. Hotel accommodations are now very satisfactory and are constantly improving. The labor supply, however, is inadequate to meet the constant and increasing demand for men. There is a great demand for ordinary laborers, and in all departments of the building trades. In fact, in view of the great demand for workingmen by the different railroad companies for general construction work, and by the farmers, ranchers, fruit growers, vineyardists and others to aid in the work of harvesting the products, a general labor famine is feared.

In the state of California conditions indicate one of the most prosperous years in the "Land of Sunshine." Crops are exceptionally heavy, especially grain. Reports from mining districts indicate a greater output of mineral wealth than for several years past.

July building permits issued number 470, value \$3,514,000; real estate transfers, 610; building contracts recorded, 132, value \$1,282,506; bank clearings, \$160,631,793.87, increase over July, 1905, 8 1/4 per cent; tonnage of the port of San Francisco, 63,489; class "A" buildings being rehabilitated, 35; class "A" buildings now occupied, 18; permanent buildings under construction in the burned district, 66; temporary structures in burned district, 4,500; firms doing business in burned district, 6,000; number of men doing construction work, 25,000; average number of debris cars moved daily, 100.

CARL MEYERS, the balloon expert, has been giving some demonstrations this summer with his new airship. While 3,000 ft. in the air at Peoria, Ill., recently, one of the rudders broke and Mr. Meyers had a narrow escape.

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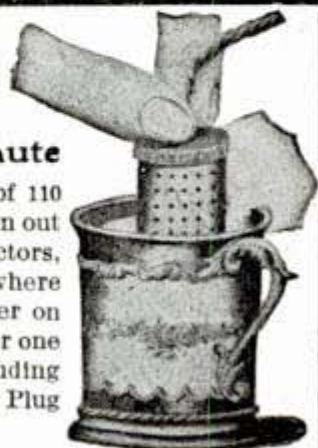
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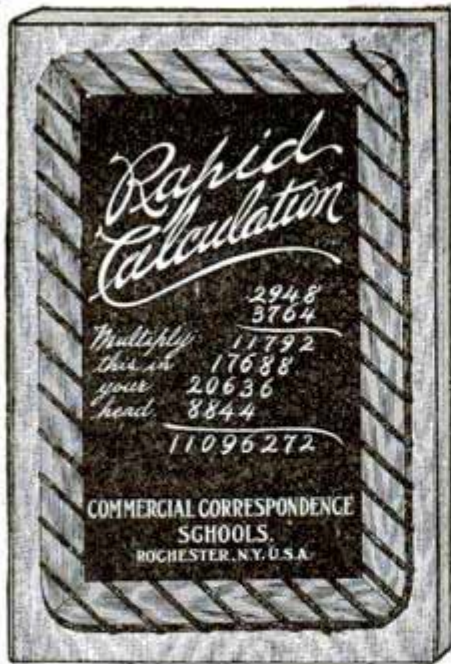
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WHY THE CYPRESS LOGS SANK.—Southern lumbermen take great delight in a story of certain scientific gentlemen who were sent by the government at Washington to study the growth and uses of the bald cypress at a time when cypress lumber was comparatively new to the market. They went direct to a large camp, presented credentials to the superintendent and watched with minute care the processes of cutting the timber and floating it down stream.

Cypress is a light, spongy wood that grows in swamps and absorbs water readily. The scientific gentlemen requested the superintendent to throw some logs into the river separate from the main rafts and followed their progress down stream in a boat. After floating south for some distance the logs with one accord sank. Much surprised, the scientific gentlemen returned and followed another consignment. The phenomenon was repeated; at a certain distance from the camp all the logs sank.

The gentlemen from Washington, being very scientific, did not think to question the unlettered superintendent about the power of cypress to become water logged, but after numerous observations and much comparing of notes reported to their department the startling discovery that cypress floated north of a certain parallel of latitude and south of it invariably sank. Of the cause they were not yet certain, but hazarded the suggestion that it might lie in the rotary motion of the earth, increasing in speed as the logs approached the equator until it was powerful enough to draw them under.

MEXICO ALL RIGHT.—Notwithstanding the frantic scareheads of some American yellow dailies recently when news was scarce, there seems no grounds to question the safety of Americans in Mexico who behave themselves. The alleged "anti-foreign movement" is effectually exploded by the Mexican Daily Herald, a newspaper printed in English at the City of Mexico, and an authority among Americans there.

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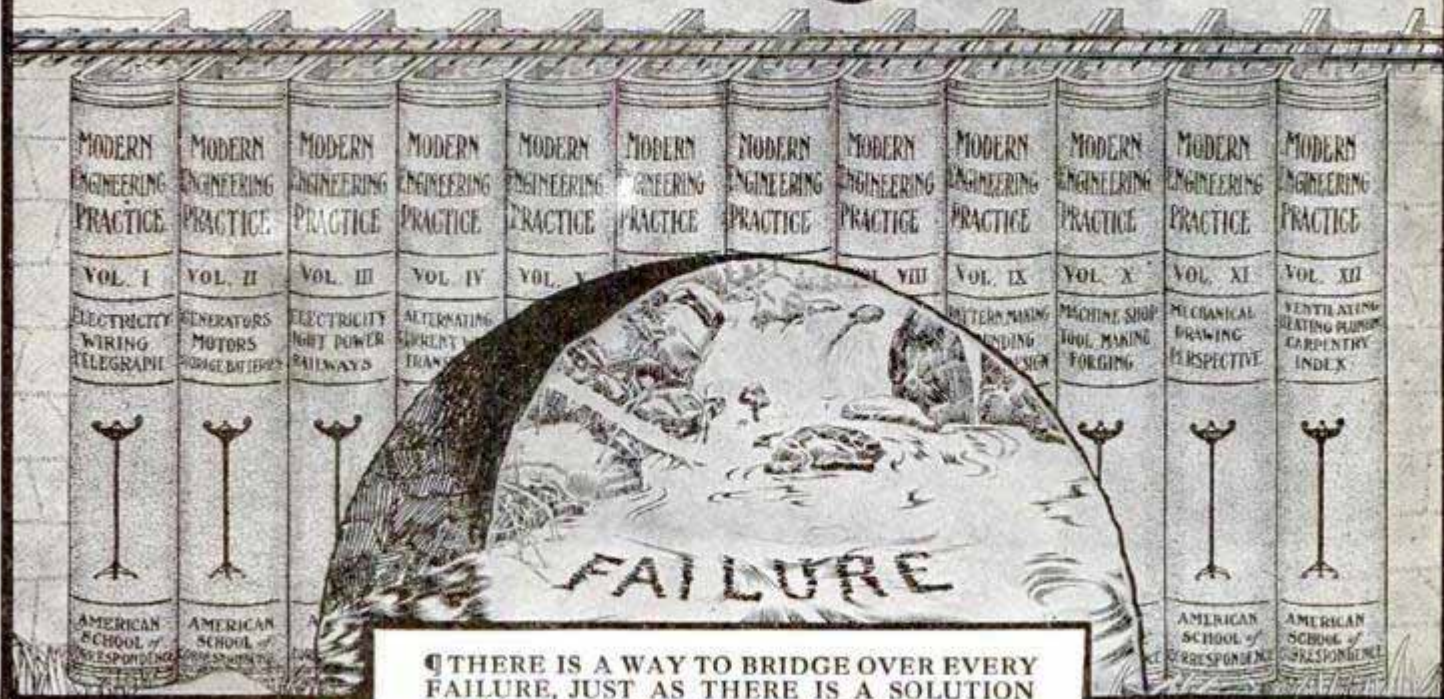


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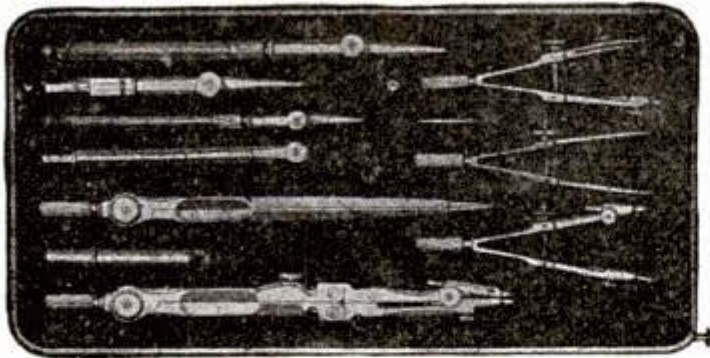
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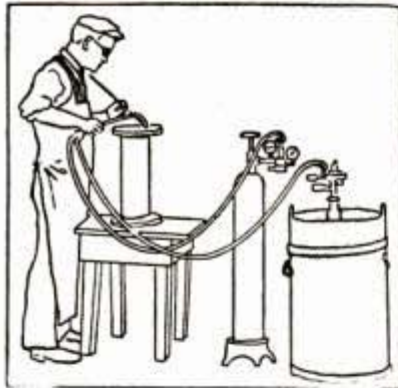
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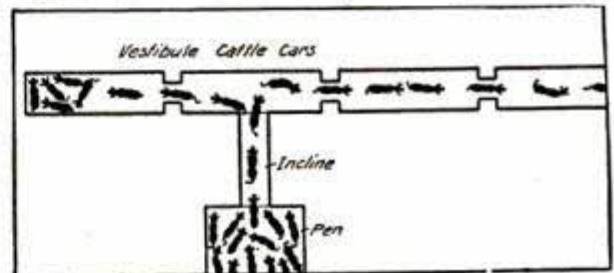
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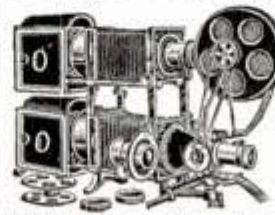
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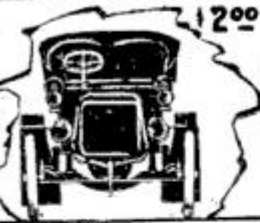
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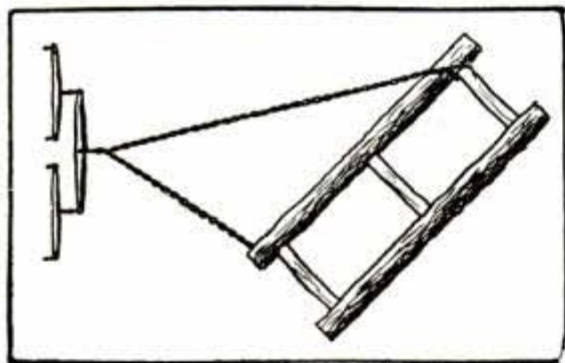
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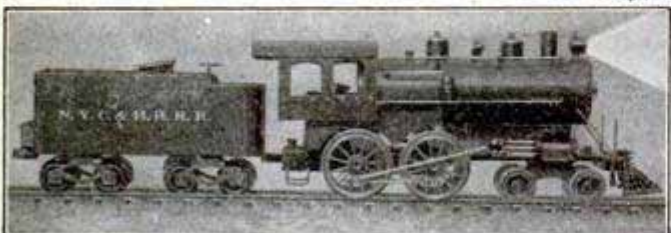
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iron pipe of the
same size bore.
Extra threads, A,
are cut on the out-
side of the end
which receives the
iron pipe to allow
using a larger pipe
if necessary.



Fig. 1

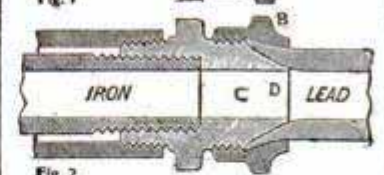


Fig. 2



Fig. 3

Solderless Coupling

The nut, B, is first slipped
over the end of the
lead pipe, which is
then flared out at
the end to fit the
center piece, C.
The nut is then
screwed up tight on the center piece, the small
threads, D, serving the double purpose of holding
the lead pipe from pulling out and preventing a
leak at the joint.

The same design is applied to the coupling for
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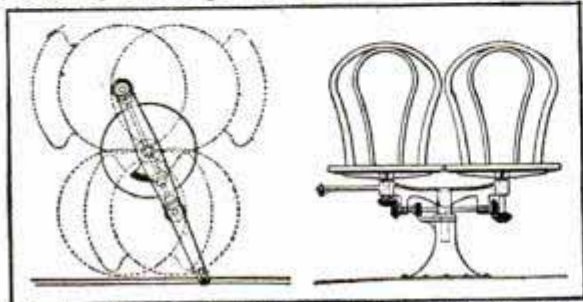
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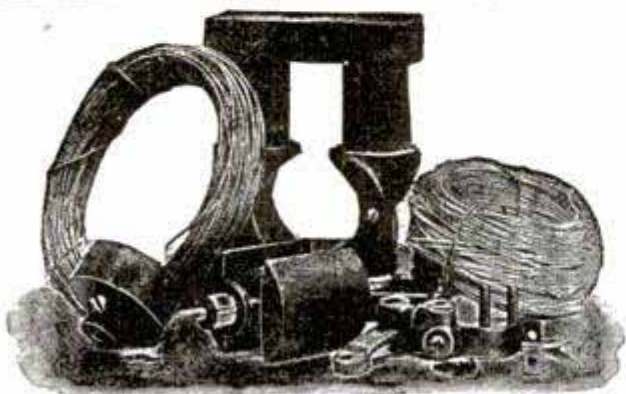


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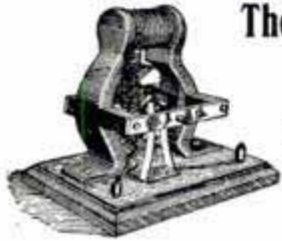
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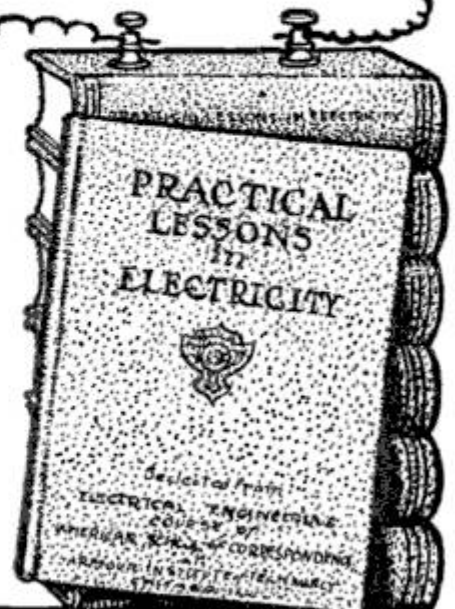
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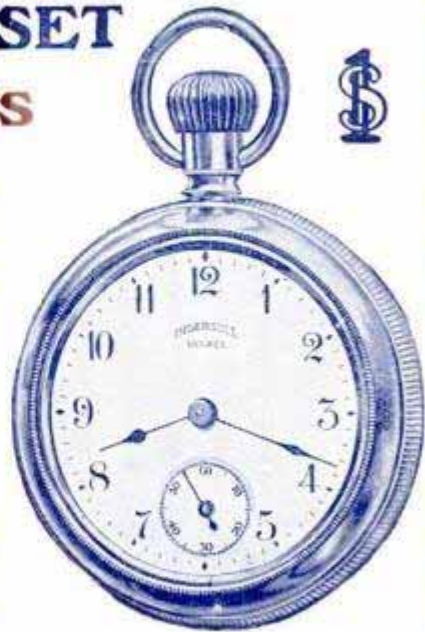
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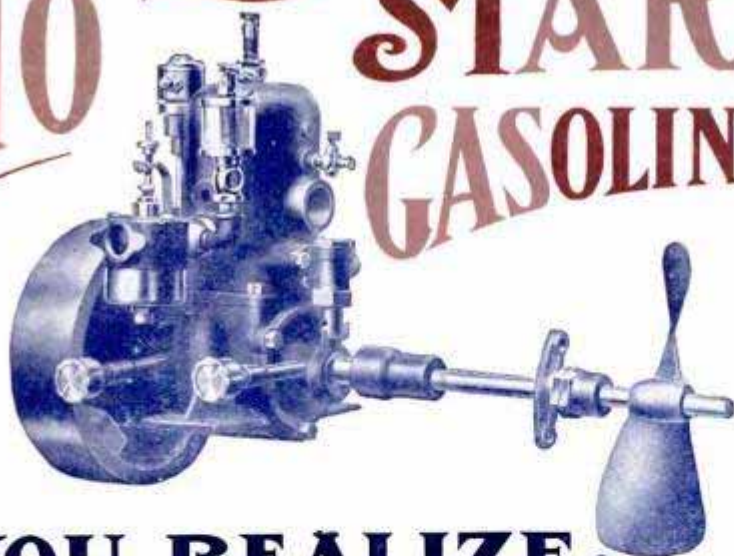
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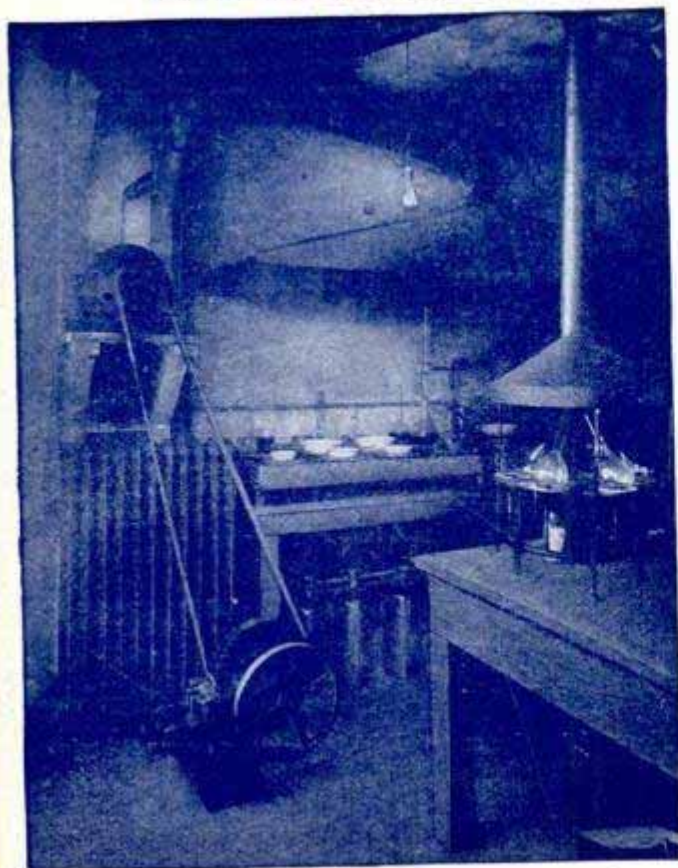
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