

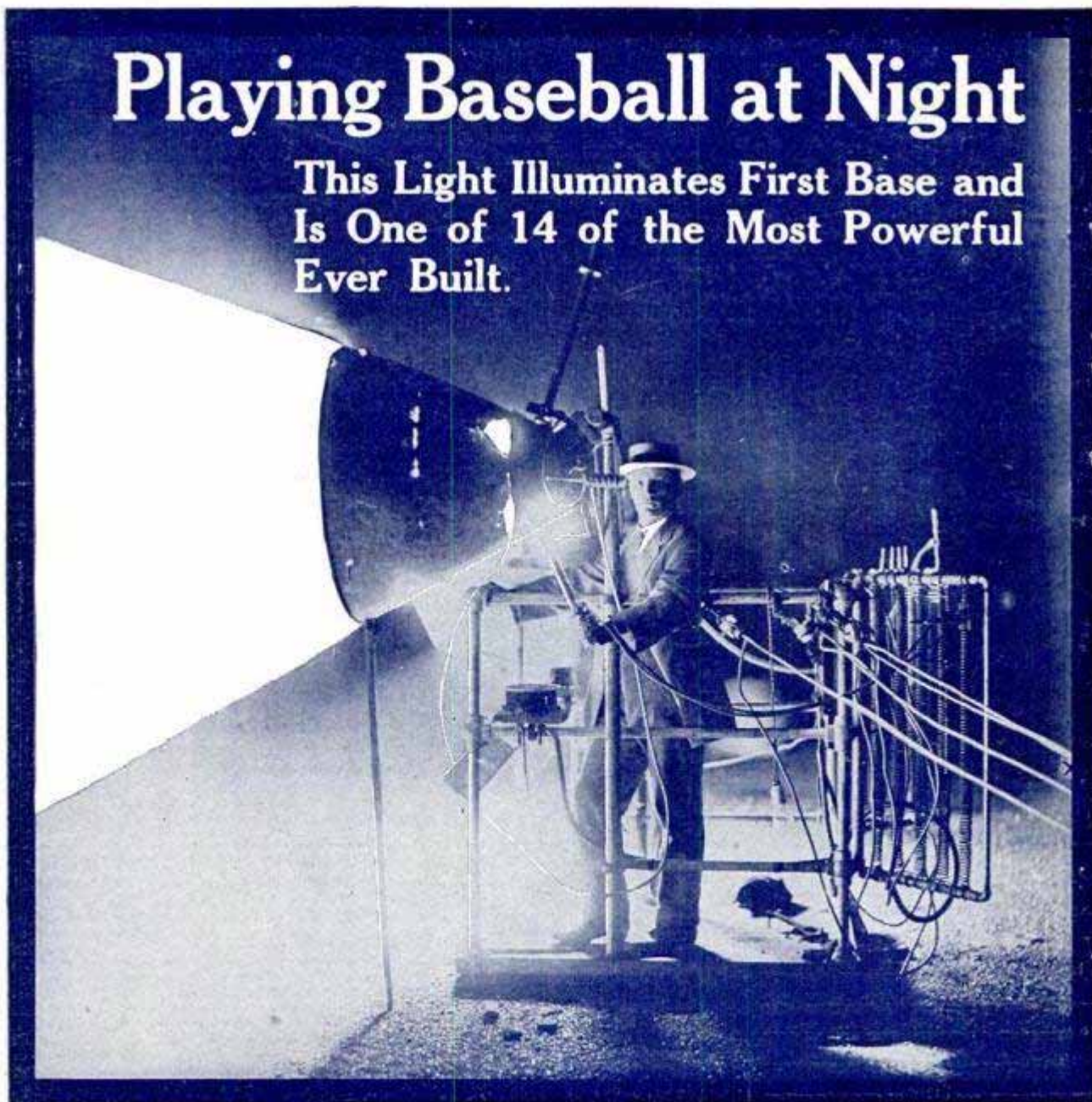
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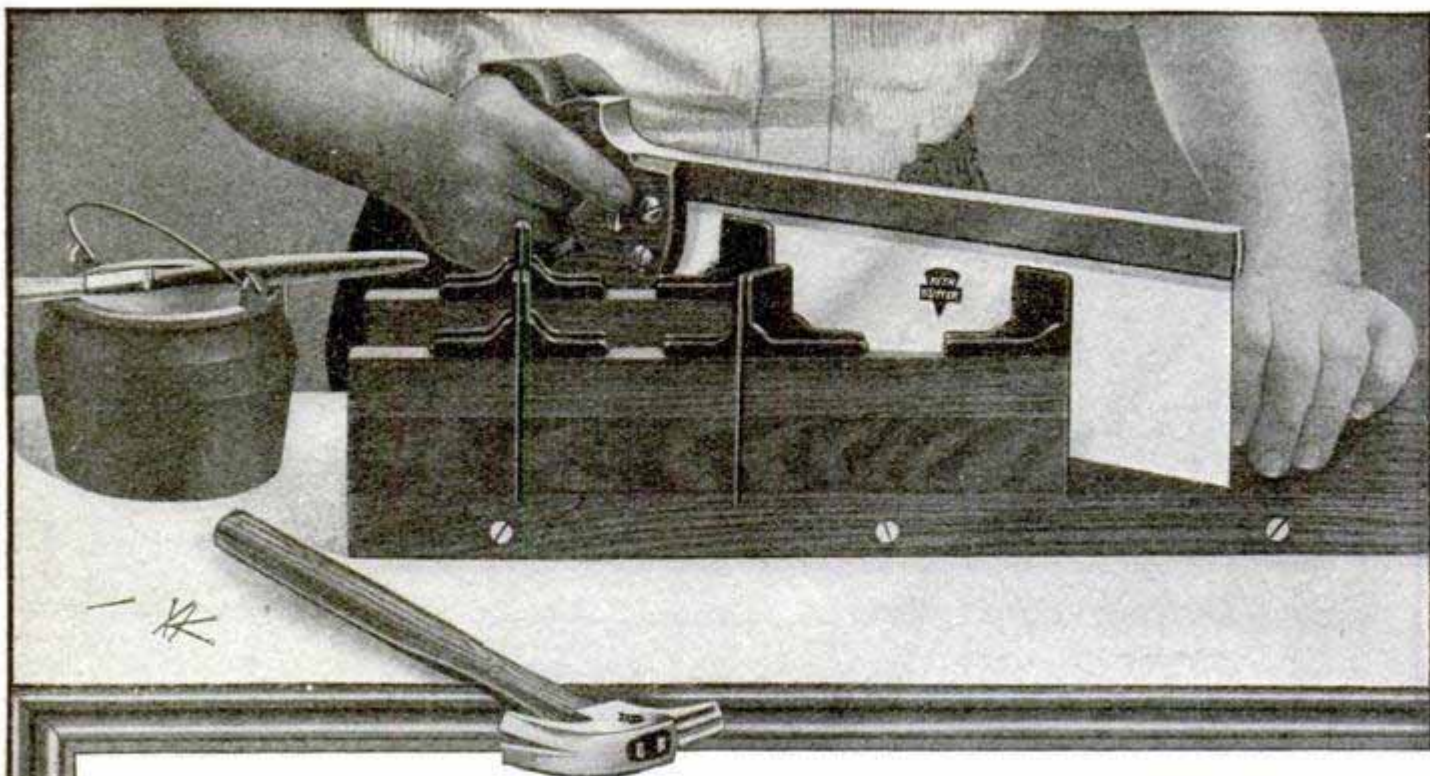
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Contents for August, 1909

Baseball at Night under Powerful Electric Lights	129	Future Aerial and Sea Warfare.....	178
Battleship Sinks Submarine.....	130	Steam Type of Locomotive Driven by Electricity..	180
Collapse of \$200,000 Concrete Bridge.....	131	Proposed International Wireless Weather Re-ports	181
Device Sprinkles 5 to 90 Ft. Wide.....	132	A Brick Conveyer for Pavers.....	181
Battleships Cheaper than Battle.....	132	Motorists Practice on Moving Dummies.....	181
House Wrecked by Acetylene Explosion.....	132	Whitewash as a Fire-proofing Material.....	181
Remarkable Accident to the Canadian Lock at Sault Ste. Marie.....	133	Reclining Porch Swing.....	182
Paying the Turkish Army.....	136	Reprimanding on the Sly.....	182
Killing Echo in Great Auditorium.....	137	Ships with Conjugated Hulls Tried Long Ago.....	183
Bottling and Testing Air.....	138	Text Book for Burglary Apprentices.....	183
Growing Corn Cobs for Pipes.....	138	Measuring Oil and Filling Cans by Machinery.....	184
Life Preservers for Rowers.....	139	Efficient System of Street Signs.....	184
Opening the Alaska-Yukon-Pacific Exposition.....	139	Curtains as Burglar Alarms.....	185
Scenes in the Transvaal.....	140	Electrically Operated Watertight Doors for Ships..	185
Auto Fire-Engine of Alameda, Cal.....	140	Aerial View of Large Car Barn.....	187
Armored Military Bicycle.....	142	Staff System of Transmitting Train Orders.....	187
Sunken War Vessel Found in Delaware River.....	142	An Ingenious Water "Thriller".....	188
The "Zeppelin's" New Home.....	142	A Multi-Tone Auto Horn.....	188
Enormous Pipe Lines Made of Wooden Staves.....	143	The Neglect of Freight Cars.....	189
London Dog Ambulance.....	144	Treadle Skates for Soldiers.....	189
Galvanized Wire Fish Net.....	144	Beveled Brick for Hillside Pavements.....	189
Balloon Pays Visit to Big Liner.....	144	Flying-Machine with Ventilator-Like Planes.....	190
Portable Battery Fan.....	144	The Frog Industry of France.....	190
The Great Scientific Industry of Old Sweden.....	145	Interesting Magic-Lamp Trick.....	191
Pointers on Ballooning.....	146	Uncle Sam's New Lifeboat.....	192
An Old Timer of Nevada Deserts.....	147	May Use Electric Power on Canadian Railway.....	192
The New Game "La Funda".....	148	New Scotland Canal Project.....	192
Electric Auto Runs X-Ray Apparatus.....	148	Safety Shoes for Convicts.....	193
Barnyard Sounds with Moving Pictures.....	148	The Source of Rope and Its Manufacture.....	195
Fishing Boats—Typical Scenes in Holland.....	149	The Beginning of a Mosquito.....	198
Collapse of a Balloon.....	150	Correspondents' Directory.....	198
Curing Tobacco with Gas Heat.....	150	Steel Wharfboat for Memphis.....	198
In Search of Wood; Gets Dynamite.....	150	The Ropewalk (Poem).....	199
Time and Its Measurement.....	151	Small Motors in Graduated Sizes.....	200
A Wireless Block Signal System.....	159	To Search for Explorer Cook.....	200
Old Locomotive or Tram.....	160	The First French "Dreadnought".....	200
Unique Tank-Moving Feat.....	161	Editorial by H. H. Windsor.....	201
The Power of Radium over Vegetable Growth.....	162	Arch-Shaped Tree Growth.....	202
Lock Construction on the Red River.....	162	Wellman May Attempt Flight to Pole in August..	203
Uruguay Has Armed Post Office Tender.....	163	Buried Alive.....	205
Breasting Waves of Steel Ocean.....	163	How to Make a Mission Couch.....	206
Gentlemen's Wardrobe.....	164	Motorcycle Train Delivers Dynamite.....	207
Machine Converts Stone or Brick Pavements into Asphalt	164	Modern Rain-Making Apparatus.....	208
Clock without Wheels or Pendulum.....	165	Troubles of the French Navy.....	208
Dispersing Fog by Mechanical Means.....	166	Gibraltar's Searchlight Battery.....	209
Canada to Have Navy.....	167	Mysterious Wireless Buzz Caused by Induction of Telephones	209
Photographing by Light from "Living" Lamp.....	167	Miners' Home in Idaho.....	210
War of Extermination on English Sparrows.....	168	What Grade Elevation Has Meant for Chicago.....	210
Cask Floated Past the Pole.....	170	Buzzards in Vera Cruz.....	211
Coffee Mill Driven by Bicycle Power.....	170	Airship War Stations Along Atlantic Coast.....	211
Private Electric Lighting Plant for \$550.....	171	Funeral Trains and Cars in Mexico City.....	212
England's Tribute to U. S. Navy.....	174	Pontoon-Tug Boats to Raise Ships.....	212
Highest Bridge in California.....	175	Barn Blown Over House.....	213
Train Fire in England.....	176	Aeroplanes to Fight Dirigibles.....	213
Using a Ring Life Preserver.....	176	Great Australian Railway Station.....	214
Philippine Sugar Mill.....	176	The First Friction Wagon Brake.....	214
Store Arcade Built Over Concrete Bridge.....	177	Eucalyptus Piling Proof Against Teredo.....	215
The Value of City-Owned Water-Fronts.....	177	Smokeless Powder Bursts Rifle.....	215
The Dining Room of a Circus.....	178	Sliding Log Tears Through Tree Trunk.....	215
		Fifty Years of Progress.....	215

(CONTINUED ON PAGE 6.)

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This One



Contents—Continued

Combination Chair for Infants and Adults.....	216
Raising British "Gladiator" a Failure.....	216
The National Balloon Race.....	216
Motor Driven Speed Lathe.....	216
Reinforced Concrete Water and Sewer Pipe.....	217
Wireless Telephone on Battle Fleet a Total Failure.....	218
Bird Hangs Self in Almost Human Fashion.....	219
Great Hydro-Electric Company Operates 110 Cotton Mills.....	220
The Yosemite Valley Balanced Rock.....	221
Submarine Blasting.....	222
How to Make a Dresser for Child's Play Room.....	223
New Metal Combination.....	224
Concrete Construction Nothing New.....	225
Printing in Colors on Wood.....	225
Remarkable Tide-Predicting Machine.....	226
Pittsburg Builds Small Amazon Steamers.....	226
Electric Buzzer to Cut Light Bills.....	226
Safety Device for Short-Circuiting Third Rail.....	227
Sounding Machine with Patent Depth Gauge and Outtrigger.....	227
Quality of Butter in Storage.....	228
Curious Wireless Mistake.....	228

SHOP NOTES

Preserving Telephone Poles.....	229
A Kink for the Electric Arc Light Trimmer.....	230
Gasoline Stove for Camping.....	230
Etched Labels on Bottles.....	230
Extension Handles on a Wheelbarrow.....	231
Pipe-Cutting Outfit for a Traveling Machine Man.....	231
A Drill Driver for Small Drills.....	232
Lining a Photographer's Sink with Sheet Lead.....	232
Carrying a Long Ladder.....	233
Feed Box for Horses.....	234
Spring to Hold a Music Book Open.....	234
How to Keep Lumber Inventories.....	234
Home-Made Pneumatic Elevator.....	235
Repairing the Pearl on a Knife Handle.....	236
How to Remedy a Loose Wood Screw.....	236
How to Remove Heavy Wall Paper.....	236
Temporary Repairs on a Leaky Automobile Radiator.....	236
A Spacing Center Punch.....	237
Setting a Big Spire.....	238
Aid in Cutting Keyways.....	238
Platform Wagons for Hauling Silage Corn.....	238
Adjustable Chain Clamping Bolt.....	239
A Metal Polishing Paste.....	239

Turntable Made from a Wagon Wheel.....	239
Dirigible and Glider Framing Wood Tests.....	239
Stairway for a Limited Space in a Barn.....	240
Telephone Line Broken Behind the Test Connector.....	240
An Automatic Siphon.....	240
Home-Made Knife Sharpener.....	241
Extension Tool for Cutting Keyways.....	241
How to Make a Blacksmith's Rule.....	242
How to Harness Mine Horses.....	242
The Causes of Failures in Making Concrete Sidewalks.....	243
Fusing and Welding by Gas and Air.....	245
Small Tapping Machine.....	245
Heating Water with an Electric Iron.....	246
How to Wedge a Hammer Handle.....	246

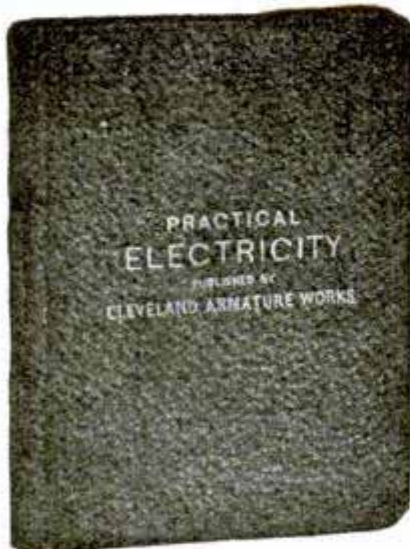
AMATEUR MECHANICS

How to Make a Sailing Canoe.....	247
A Home-Made Hand Vise.....	249
Proper Design for a Bird House.....	249
Boomerangs and How to Make Them.....	250
How to Make Water Wings.....	250
How to Make an Ammeter.....	251
How to Make an Equatorial.....	252
Electric Light Turned On and Off from Different Places.....	253
How to Make a Bunsen Cell.....	254
One Way to Cook Fish.....	254

RECENT PATENTS

Rocker Churn.....	255
Umbrella Supporter.....	255
Fan Driven by Rocking-Chair Movement.....	255
Device Turns Down Electric Lights.....	255
Practice Piano Keyboard.....	255
To Produce Reinforced Pulp Board.....	255
Utilizing Water Power on an Island.....	255
Comfortable Safeguards for Roofers.....	255
Sewing-Machine Apron.....	255
Electric Mouse Trap.....	256
Support on Which to Pile Barrels.....	256
Hitting Bullseye Starts the Car.....	256
Handhold for Bathtub Rims.....	256
Golf Practice Net.....	256
Napkin Holder for Children.....	256
Sanitary Dog Kennel.....	256
Stretcher-Sack for Shipboard or Land.....	256
Apparatus for Steering Vessels.....	256

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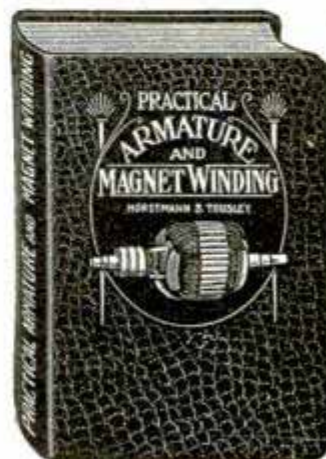
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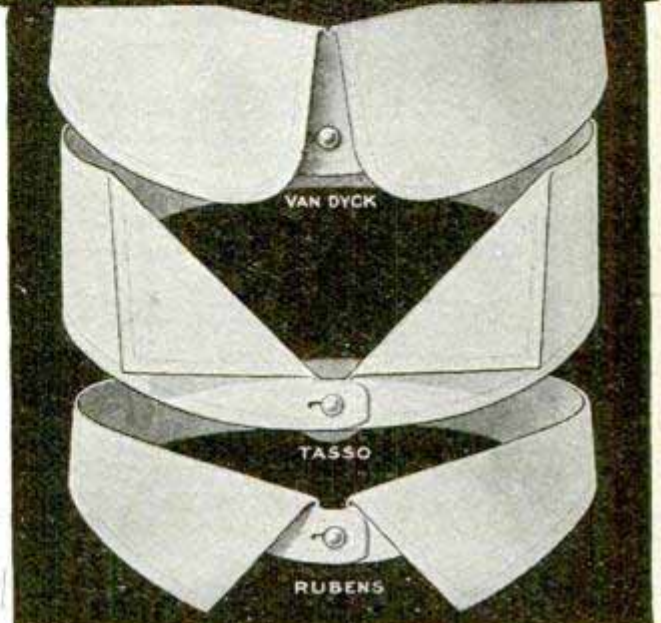
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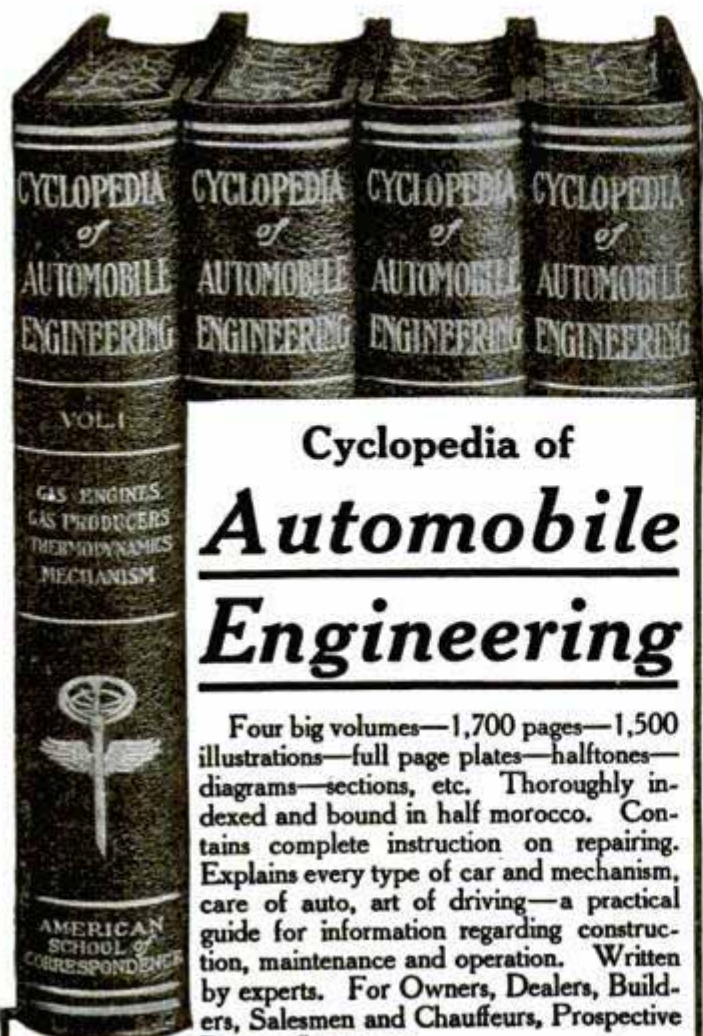
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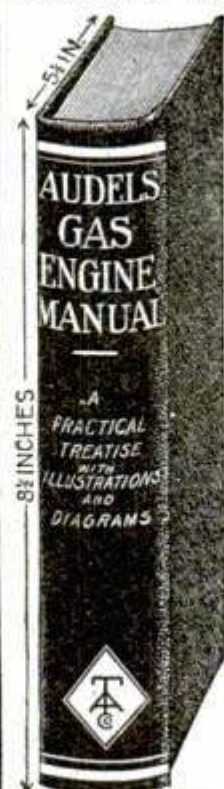
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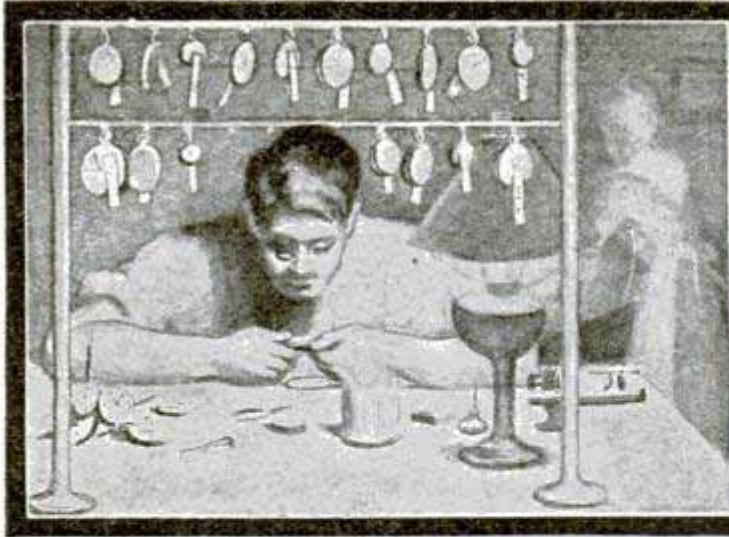
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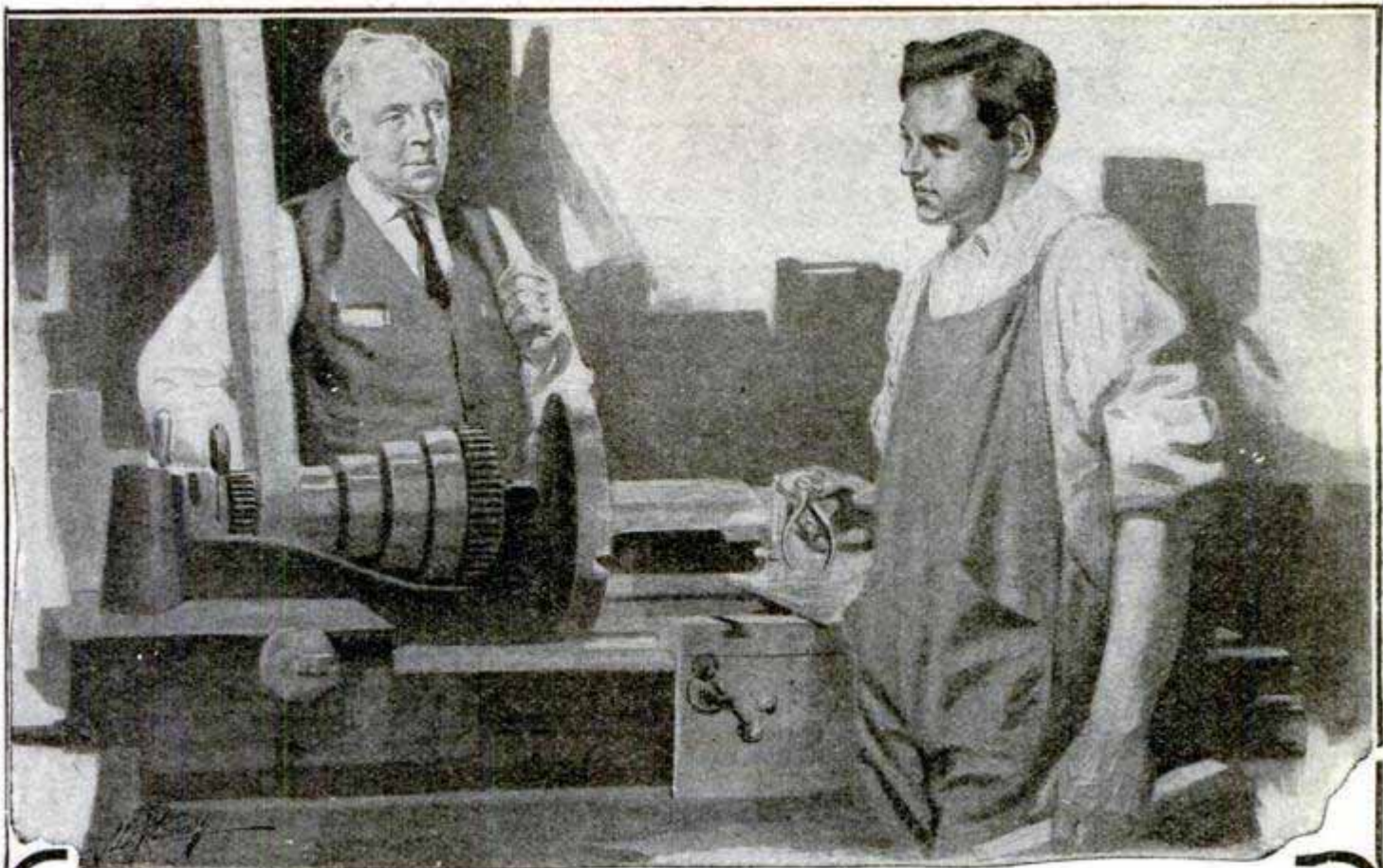
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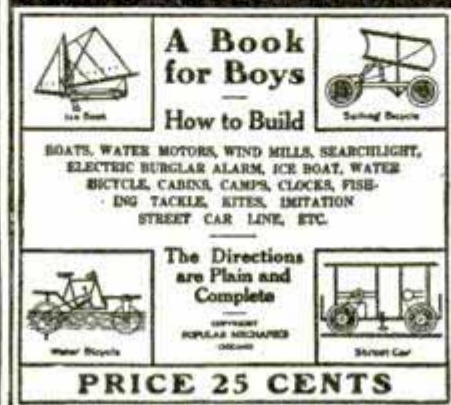
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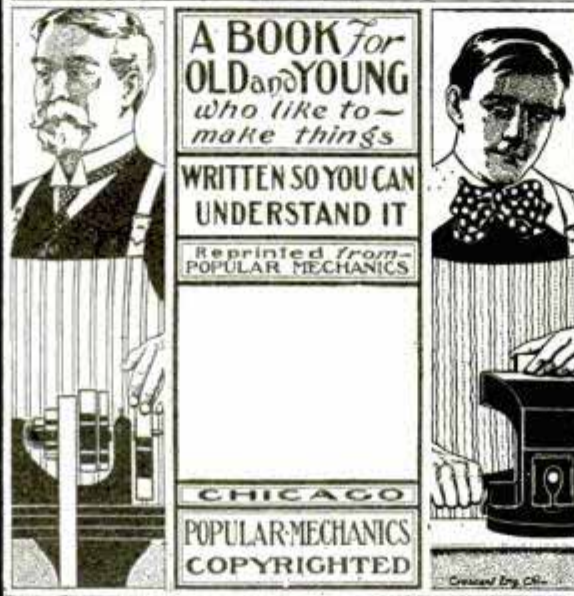
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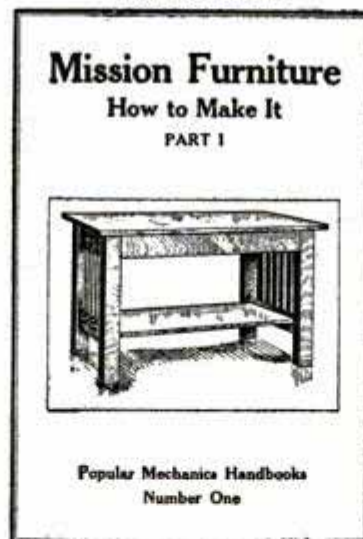
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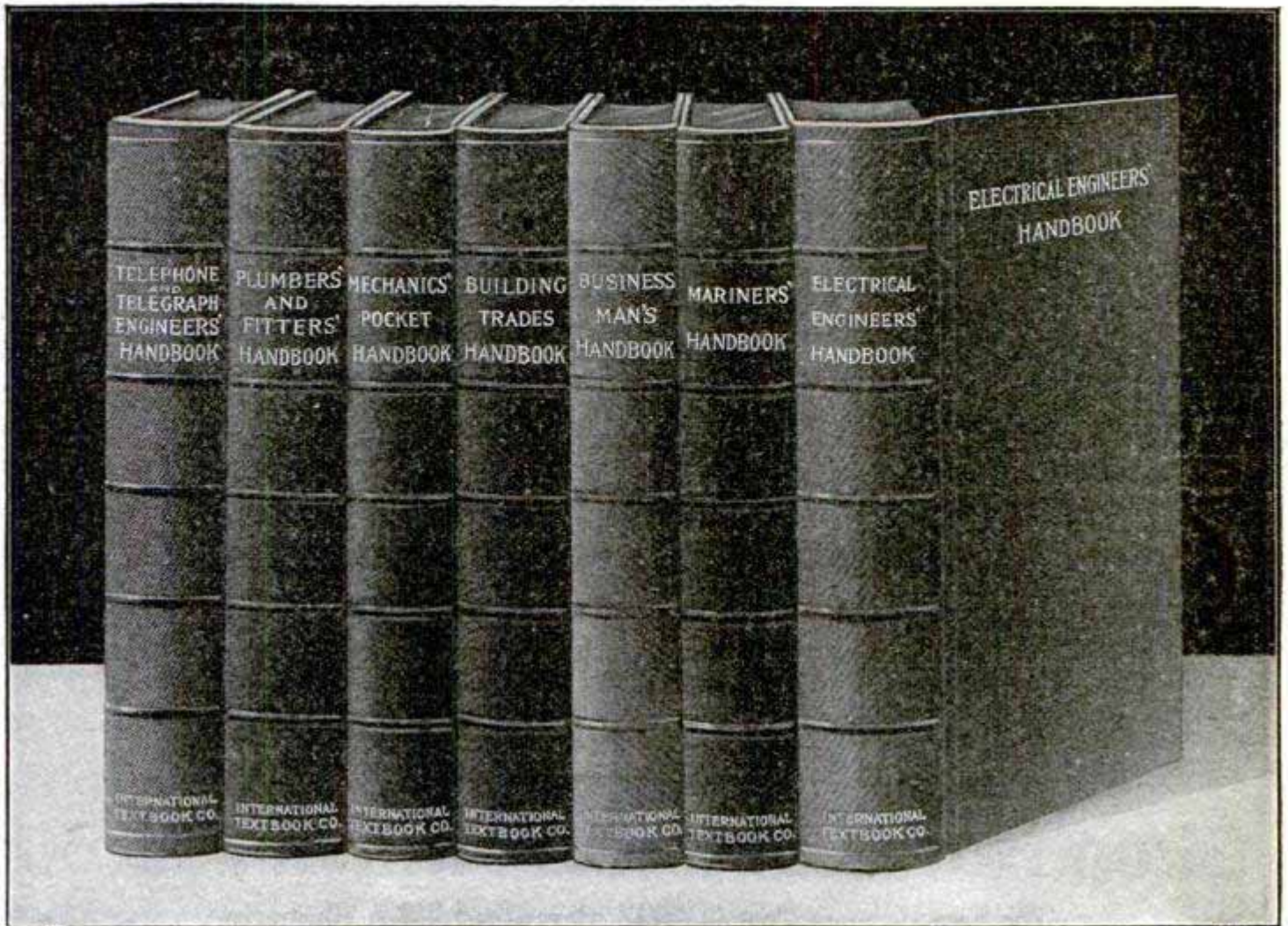
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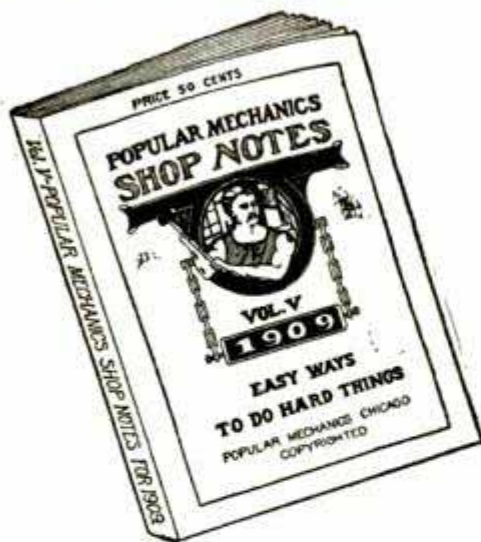
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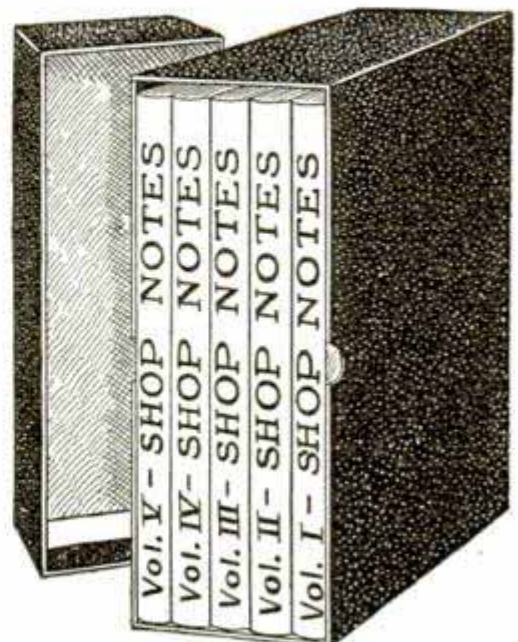
228 pages; 580 illustrations

Vol. IV. Shop Notes for 1908

212 pages; 536 illustrations

Vol. V. Shop Notes for 1909

224 pages; 461 illustrations



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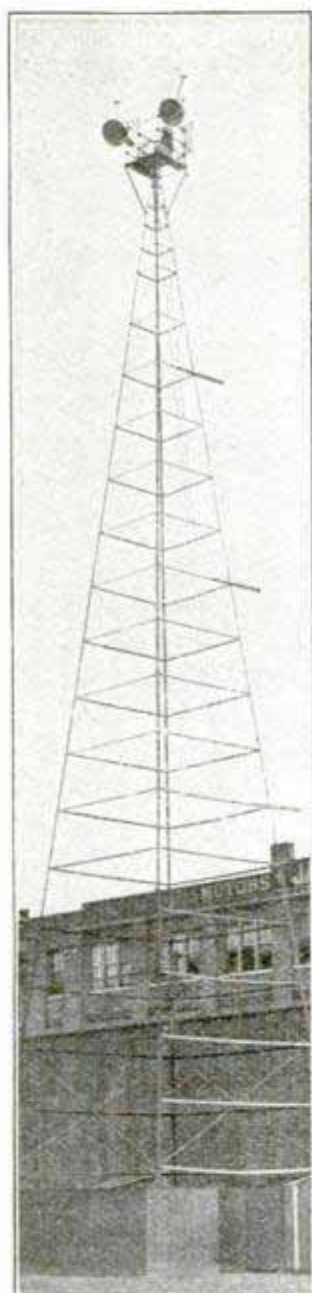
Written So You Can Understand It

Vol. 12

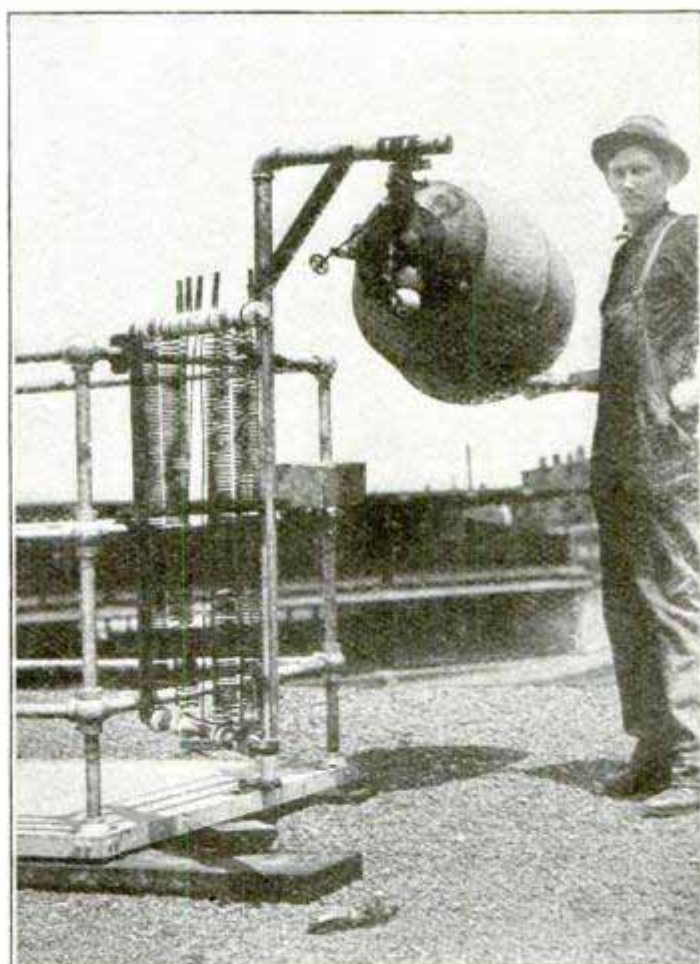
AUGUST

No. 2

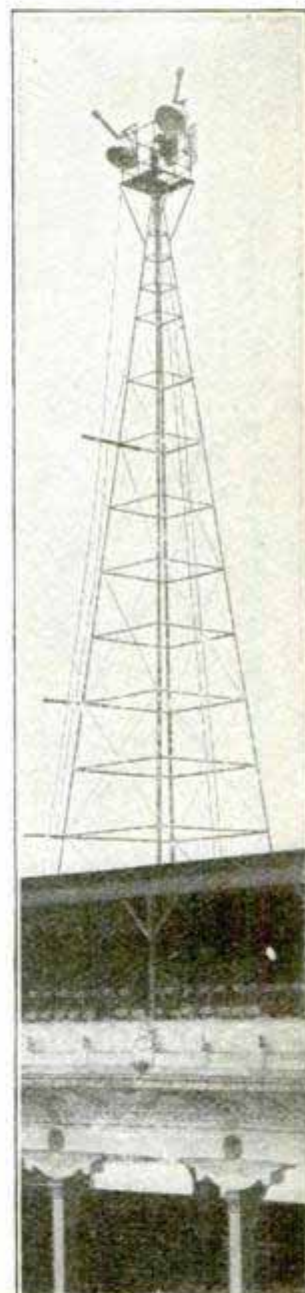
BASEBALL AT NIGHT UNDER POWERFUL ELECTRIC LIGHTS



Light to Right
Field



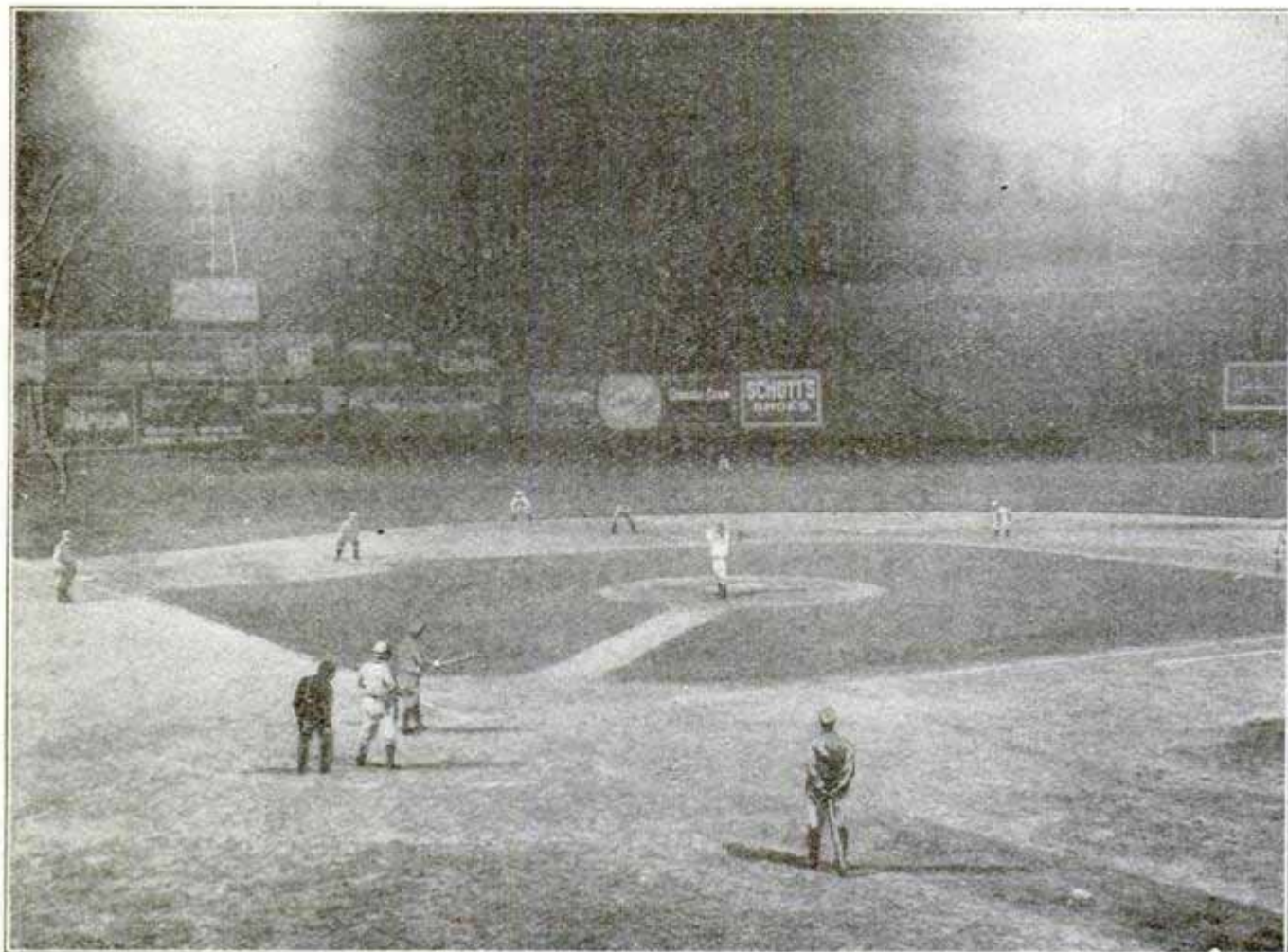
Close View of Lamp on Roof of
Grand Stand



Illuminates Home
Plate

A small-sized fortune has been expended in Cincinnati in the construction of a remarkable illumination scheme for lighting the National

League baseball park of that city in such a manner as to make ball games possible at night. The chief problem was not in providing sufficient illum-



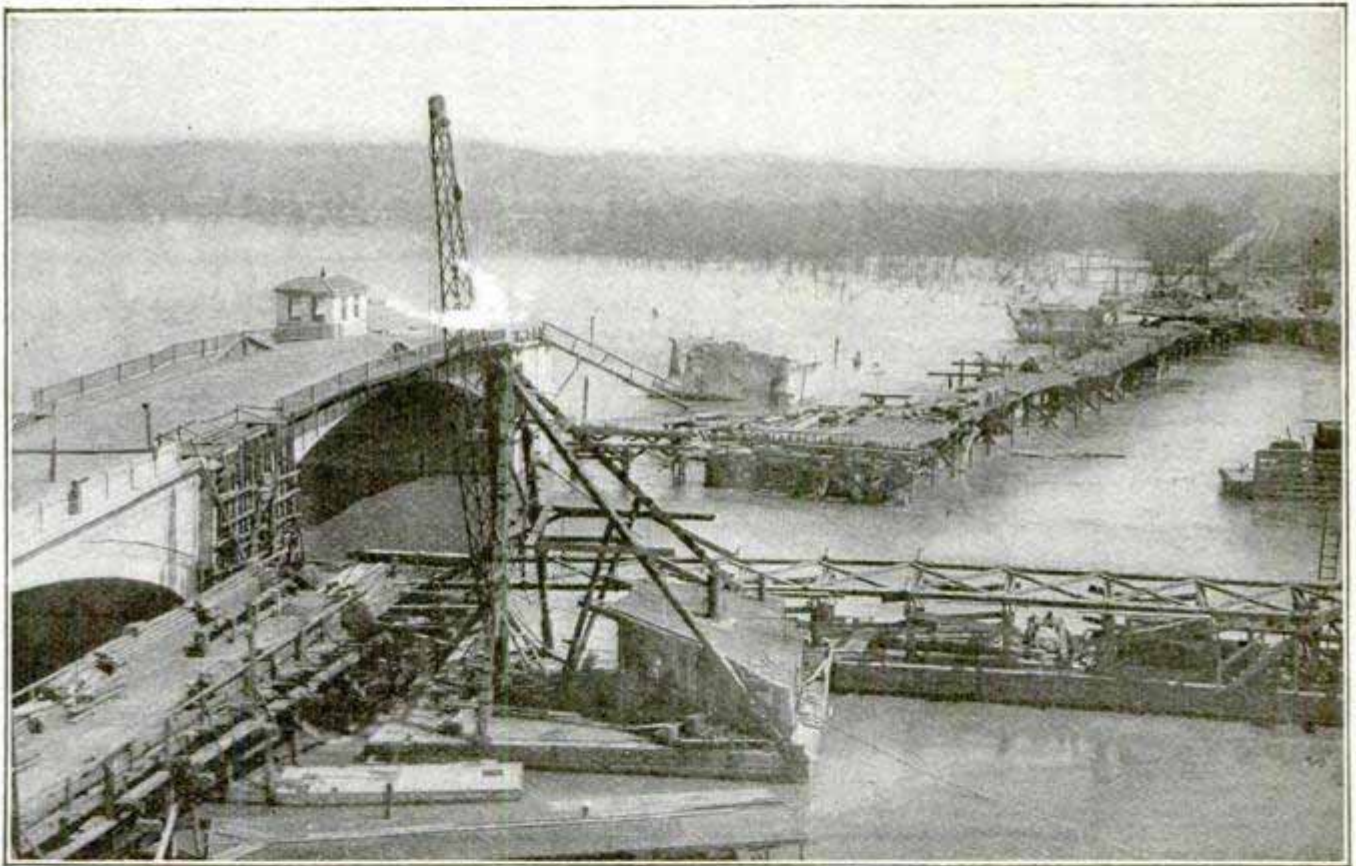
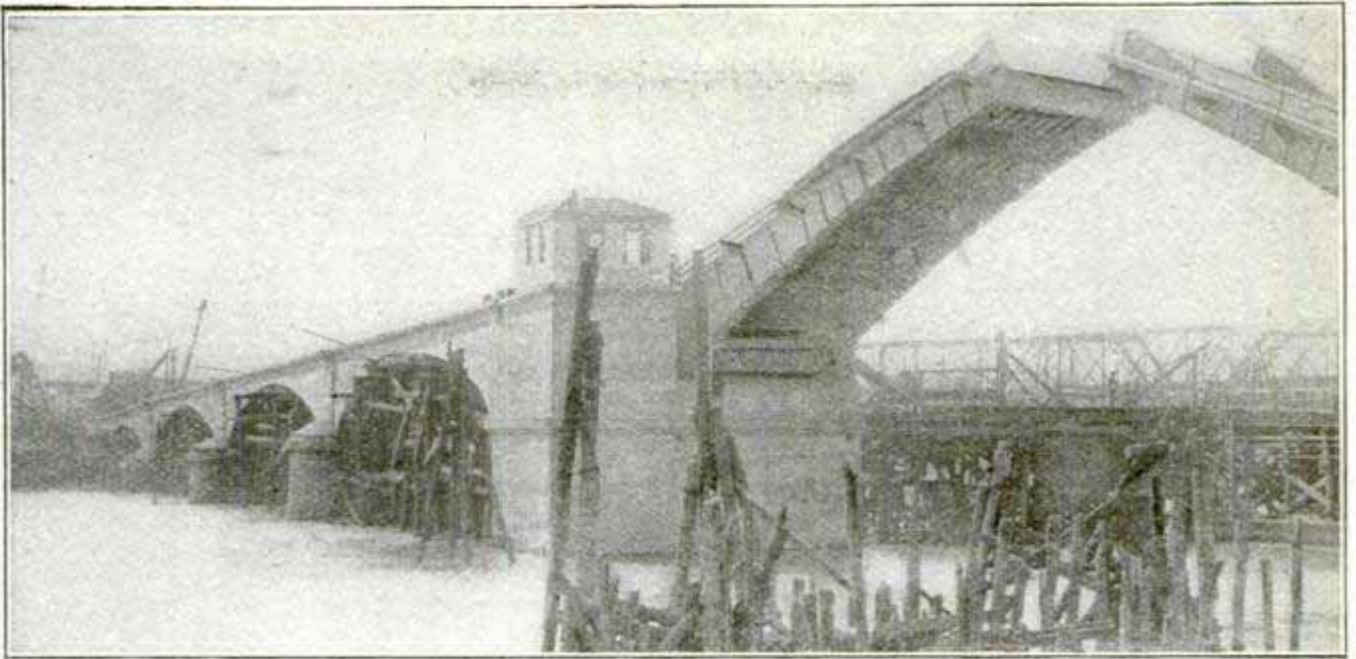
From Photograph Taken at 10 P. M., Showing Field as Light as at Noon

ination, but to provide it in such a way that none of the centers of illumination will blind the players.

The plant which converts night into day is composed of 14 powerful carbon lamps, fed by a 250-hp. dynamo installed on the ground. All the lamps encircle the field, arranged in such a way that the glare does not blind. Ten of the lights are arranged on 5 towers, two lamps on each, and the other four are operated from the roof of the grand stand and the top of the bleachers. The towers are 100 ft. high. The lamps are composed of a bell-shaped galvanized iron hood in which burns an arc from carbons $1\frac{3}{8}$ -in. in diameter. No lenses of any kind are used to concentrate the rays, but it is claimed that the intensity is about 5 times more powerful than any other artificial light known—so powerful, in fact, that no instrument has been found that will register it. Night baseball, endurance races, and outdoor meets of all kinds are to be held there.

BATTLESHIP SINKS SUBMARINE

The Russian submarine, "Kambela," was rammed by the battleship "Rostislav" during night maneuvers in the Black Sea in June, 20 of the crew being buried alive. The battleship squadron, without lights, was stealing in toward the harbor when the vessels were located a few miles out by the "Kambela" shortly before midnight. The submarine, running half submerged, passed half a cable length to port of the leading ship, and theoretically put it out of action with a torpedo. Then, without any apparent reason, the "Kambela" swerved across the path of the "Rostislav" and was caught squarely by her ram, sinking immediately in 160 ft. of water. Captain Bielikoff, the commander of the flotilla, and 19 officers and men went down with the little vessel. A lieutenant and three sailors who were on the deck swam away from the boat and were saved.



COLLAPSE OF \$200,000 CONCRETE BRIDGE

The reinforced concrete bridge over the Illinois river at Peoria, Ill., costing \$200,000, collapsed on May 1, only a short time after its completion. The total length of the bridge including the 200 ft. of approaches, was 1,124 ft. The first span was 110 ft. long, the draw 135 ft., and the remaining sections 125 ft. each. The cost of the structure complete represented an out-

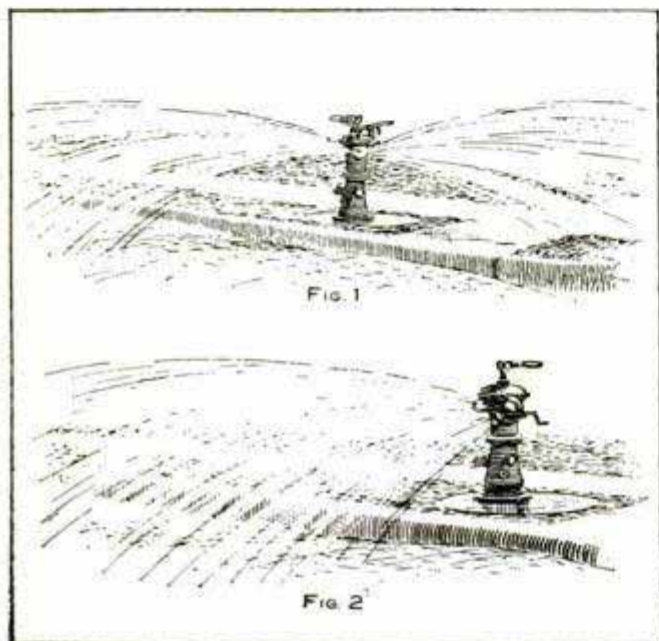
lay of \$215,000, of which \$150,000 was for the concrete portion of the work.

The three spans east of the draw were the ones to fall. Eye witnesses of the collapse say that the first pier beyond the draw was the first to give way, dragging the second span and pier and the third span with it. The cause of the disaster was attributed to the fact that bedrock had not been

reached by the piling on which the piers were constructed. It is supposed that what was believed to be bedrock was only a thin stratum of rock overlying a bed of sand. This gave way, the piling slipped, and the disaster resulted.

DEVICE SPRINKLES 5 TO 90 FT. WIDE

A sprinkling head that will sprinkle 4 or 5 ft. of a pavement, an entire pave-



Sprinkling One Side and Both Sides — Showing Force of New Sprinkling Head

ment 90 ft. wide, or both sides and not the center of such a pavement, is shown attached to a fire hydrant in these illustrations. It can be attached to any kind of sprinkling wagon, automobile or street car now in use, but unlike the ordinary kind of sprinkler, it does not depend upon the force of gravitation to spread the water. Instead, the water is driven from the sprinkling head by power from an air pump connected to the axle of the vehicle to which the head is attached.

The sprinkling head comprises a circular water chamber, to the sides of which are attached two spraying valves capable of being operated independently of each other, and so adjustable that the water can be thrown as fine spray or a heavy stream. The width of the stream is also under perfect control, so that the operator can sprinkle a narrow strip of the street, the whole

width of the street, or the street on both sides of car tracks without throwing water on the pavement between them.

BATTLESHIPS CHEAPER THAN BATTLE

The Navy League, which has branches in practically every section of the United States, uses as its chief argument for a larger and more powerful navy the cost of actual war.

"The war with Spain cost our government over \$4,000,000 per day. It is estimated that a war with a great power would prove many times more costly, probably averaging \$10,000,000 per day, the cost of one "Dreadnought." Consequently a navy offers cheap insurance against the mere material cost of war, to say nothing of the huge losses in industrial circles."

It is beyond dispute that England's navy, although a huge expense, has so far saved that country from war with a great continental power.

HOUSE WRECKED BY ACETYLENE EXPLOSION

From some unknown cause, an acetylene lighting apparatus in the basement of this house at Ogden Centre, Mich., exploded with the result shown. The



Completely Wrecked by Acetylene Gas

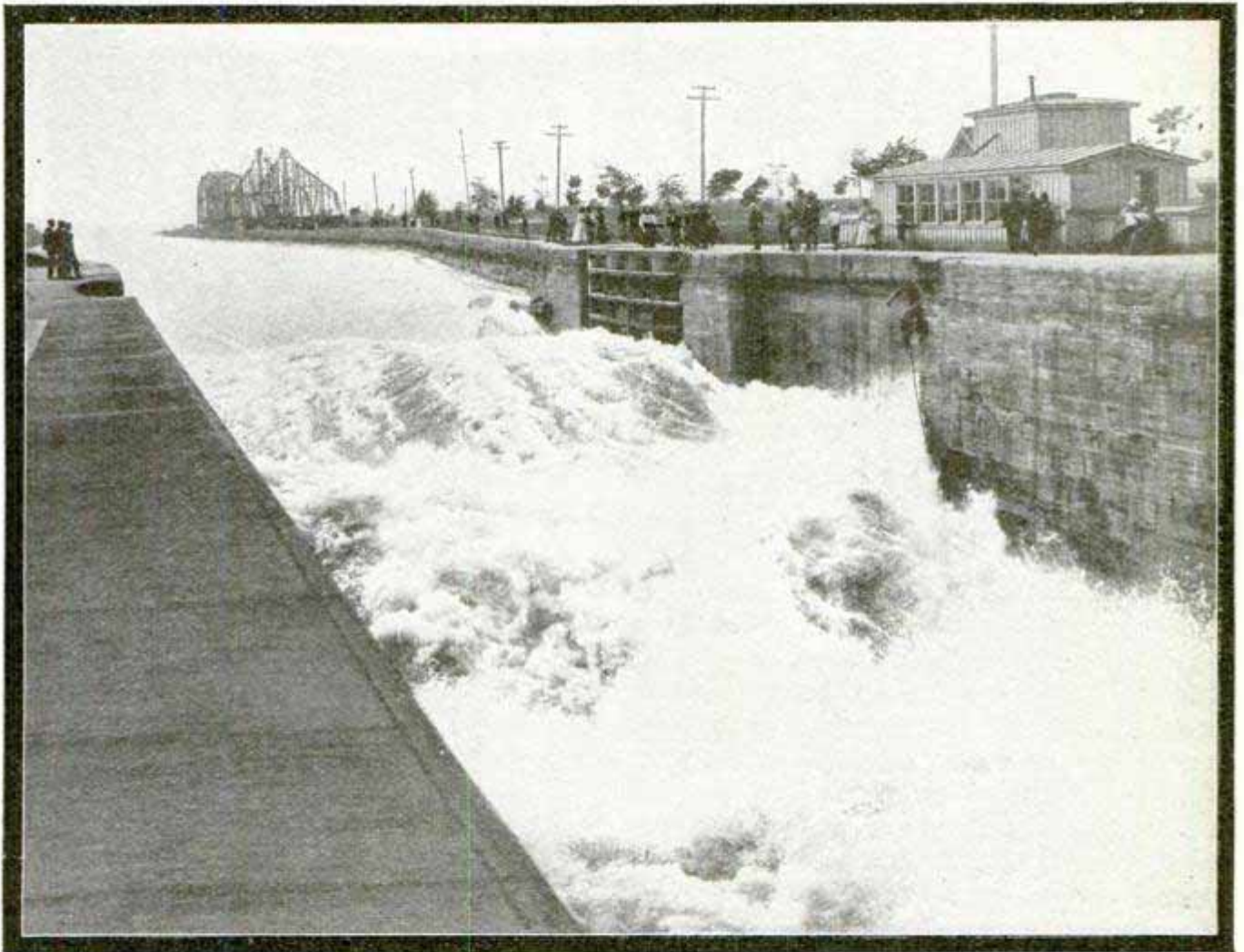
physician who occupied the house was instantly killed, while members of his family and several guests in the house at the time were only slightly injured.

REMARKABLE ACCIDENT TO THE CANADIAN LOCK AT SAULT STE. MARIE

Disaster Dreaded for 50 Years, Happens, But Event Affords Valuable Experience for Panama Canal

By A. F. Knox, Editor The Evening News, Sault Ste. Marie, Mich.

[At no point in the world does so large a tonnage pass as through the locks at the "Soo." The St. Mary's river connecting Lakes Superior and Huron has a fall of 16 ft. at this point, in about 1 mile. On either side of the river magnificent canals and the largest locks in the world have been built by the United States and Canadian governments. No toll is charged and vessels are free to use whichever locks are most convenient. The present signal code from bridge to engine room, of 1 bell to stop (if going), or 1 bell to start, if engines are not working, is responsible for the accident. Safety signals were recently described in this magazine, by means of which the order, expressed in words "ahead," "stop," "full speed ahead," etc., are simultaneously displayed in pilot house and on the bridge, and in the engine room. With such an equipment, the present confusion due to failure to hear bell, or uncertainty due to a countermand signal following close on the original signal, would be impossible.—Editor's Note.]



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Upper End of Lock after Gates Went Out

Since navigation around the rapids in the St. Mary's river by canal and locks began, more than 50 years ago, speculation has been rife as to what would happen if, through an accident to one of the huge gates which holds back the waters of Lake Superior, the flood should be released and come surging through the canal. The answer was supplied on Wednesday, June 9th, when the freighter "Perry G. Walker"

rammed the lower gate of the Canadian ship canal at the Soo and precipitated the dreaded condition which, up to that time, engineering science had met in theory only.

The disaster came about one o'clock in the afternoon. The lock chamber of the Canadian canal which is 80 ft. wide and 1,000 ft. long was at the upper, or Lake Superior level, approximately 20 ft. above the lower, or Huron level.

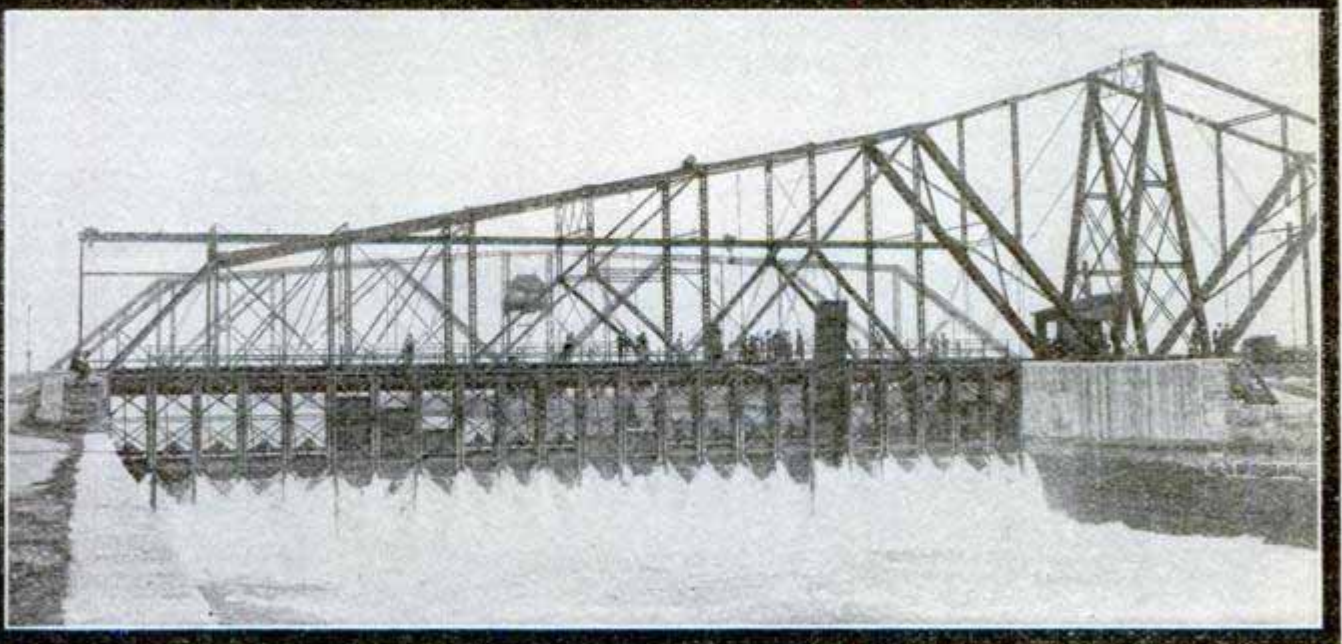
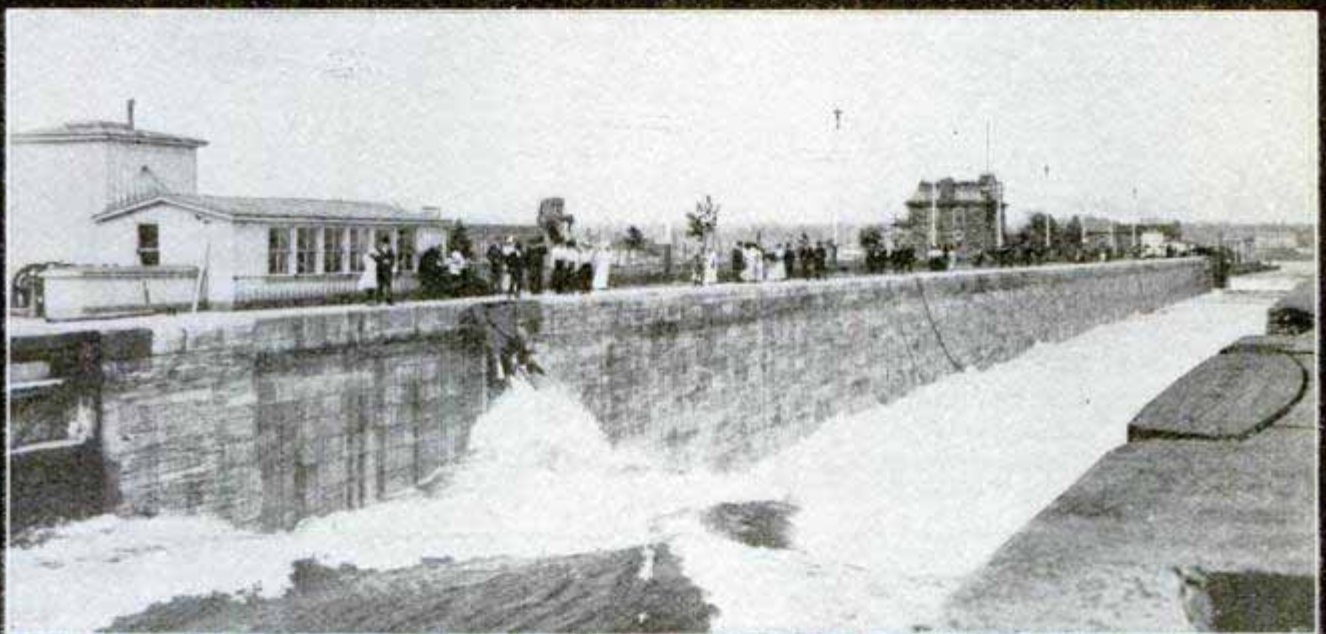
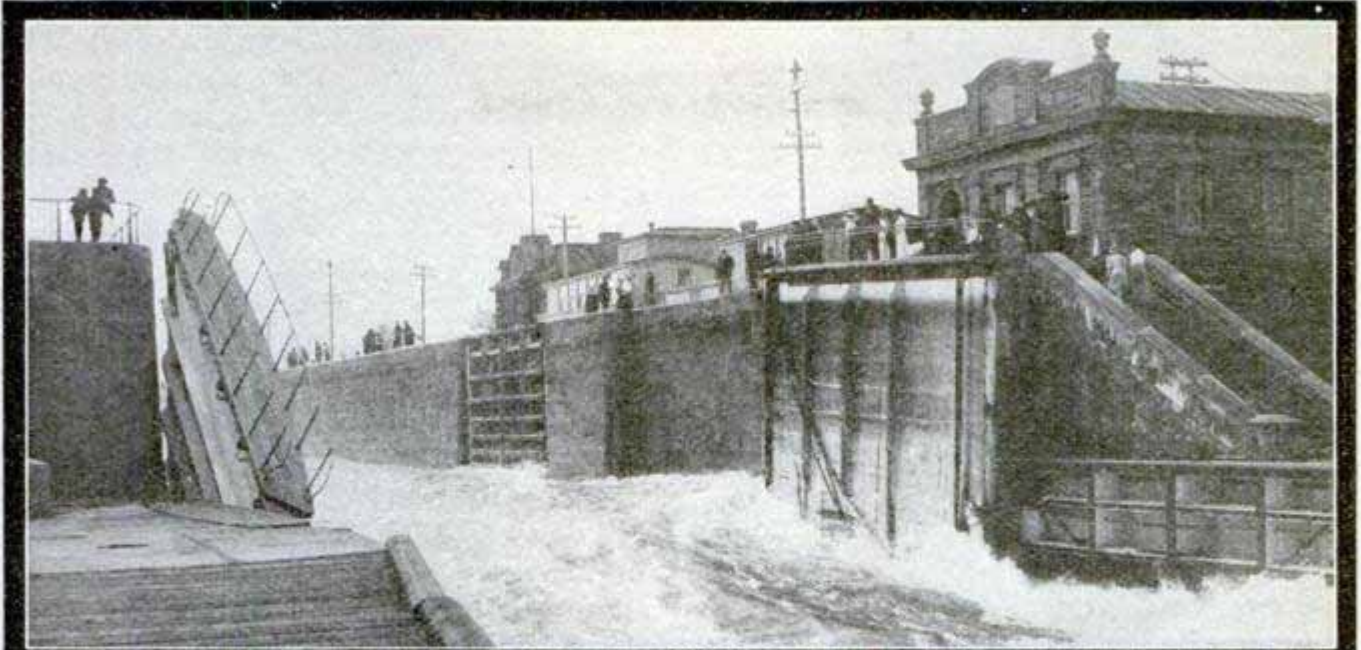
The upper gates were open. The Canadian Pacific passenger boat, the "Assiniboia," one of the largest on the lakes, was in the chamber, locking down. Through the open upper gates the Pittsburg Steamship company's freighter, the "Crescent City," was just entering. Nearing the lower entrance to the lock was the steamer "Walker," maneuvering for a position just below the lock, preparatory to locking up, when the "Assiniboia" and the "Crescent City" had emerged. Up to this point everything had proceeded precisely according to the rule never broken for a half century of canal navigation in the St. Mary's river. But the inevitable human equation here entered, precipitating a disaster which narrowly missed being one of the most serious in loss of life and property, in the history of lake navigation. When the "Walker," moving slowly, had approached as near to the lock as was permitted, the captain signalled his engineer to reverse his engines. The signal was misunderstood and the engines, instead of being reversed, were set in motion, full speed ahead. The "Walker's" captain declares he frantically repeated his previous signal to back up, and finally sent a deckhand on the run for the engine room to convey the order. However, when the order was finally obeyed, the big ship was under strong headway and before her speed was appreciably checked, she collided with one of the lower lock gates, smashing it down before her, and instantly releasing the waters held in check.

The resultant scene was dramatic, and for the hundreds of passengers who crowded the decks of the "Assiniboia," intensely exciting and filled with danger. The first rush of water, fortunately, pushed the "Walker" to one side and, riding the crest of the flood, the great lake passenger liner swept by her at racing speed, striking the "Walker" a glancing and ineffective blow on the quarter as she passed. The "Crescent City" caught, when the accident came, directly over the upper breast wall of the lock, dropped as the waters swept

out from beneath her, until she balanced on the wall with her bows pitching forward. Instantly, she was picked up by the hurrying flood which swept down from above, and staggering from side to side, plunged into the lock chamber, her bow actually striking the bottom of the lock as she lunged forward. Toward the lower end of the lock the "Crescent City" came with tremendous speed, encountering a half-opened lower gate, which rammed a hole in her bow big enough to admit a team of horses. On she sailed with the waters roaring about her, soon overtaking the "Assiniboia" which had dropped an anchor in an effort to check her headway, and delivering a blow which fortunately glanced off without doing great damage. Escaping the flood and in a sinking condition, the "Crescent City" crept alongside a pier and gently sank to the bottom. In the meantime, the "Assiniboia" had grounded and her cargo had shifted, giving her a heavy list, and the "Walker" helpless, with rudder out of commission, spun about on her axis in the swift current which poured out of the locks. Tugs rushed to the assistance of both vessels, and soon maneuvered them to points of safety.

In the ship canal the waters of Superior raced through unimpeded, converting the lock chamber into a very maelstrom, with two distinct falls and a whirlpool. The accompanying pictures but imperfectly convey the impressiveness of the scene.

Above the canal lock on the bank of the upper approach stood the movable, or emergency dam, specially constructed for just such a catastrophe. It had been unmoved for so long a period that the mechanism for swinging it into place was found useless and a team of horses supplied the motive power which finally swung the heavy structure across the canal. From the platform of the dam are suspended heavy steel frames swinging on hinges. These frames when lowered into the water on the up-stream side, rest against a concrete sill built in the bottom of the canal. When the frames had been low-



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1—Lower End of Lock, Showing Broken Gates; 2—Lock Looking Downstream (Upper Gates Are Gone);
3—Emergency Dam Swung into Place Showing the 23 Gates for Shutting Off the Water Gradually

ered, which consumed several hours, wickets, or leaves of steel, constructed to travel in the frames were lowered into position, one at a time. In this way it was designed to gradually reduce the flow. No particular difficulty was met until the last wicket was reached. This one, unfortunately, while being lowered into place, met with some obstruction, and could not be forced into position. In attempting to pull the wicket up and remove the obstruction, the frame was bent, rendering it useless until repaired. Square timbers were then resorted to, two long pieces being placed upright on either side of the injured frame and shorter pieces were forced down, across the

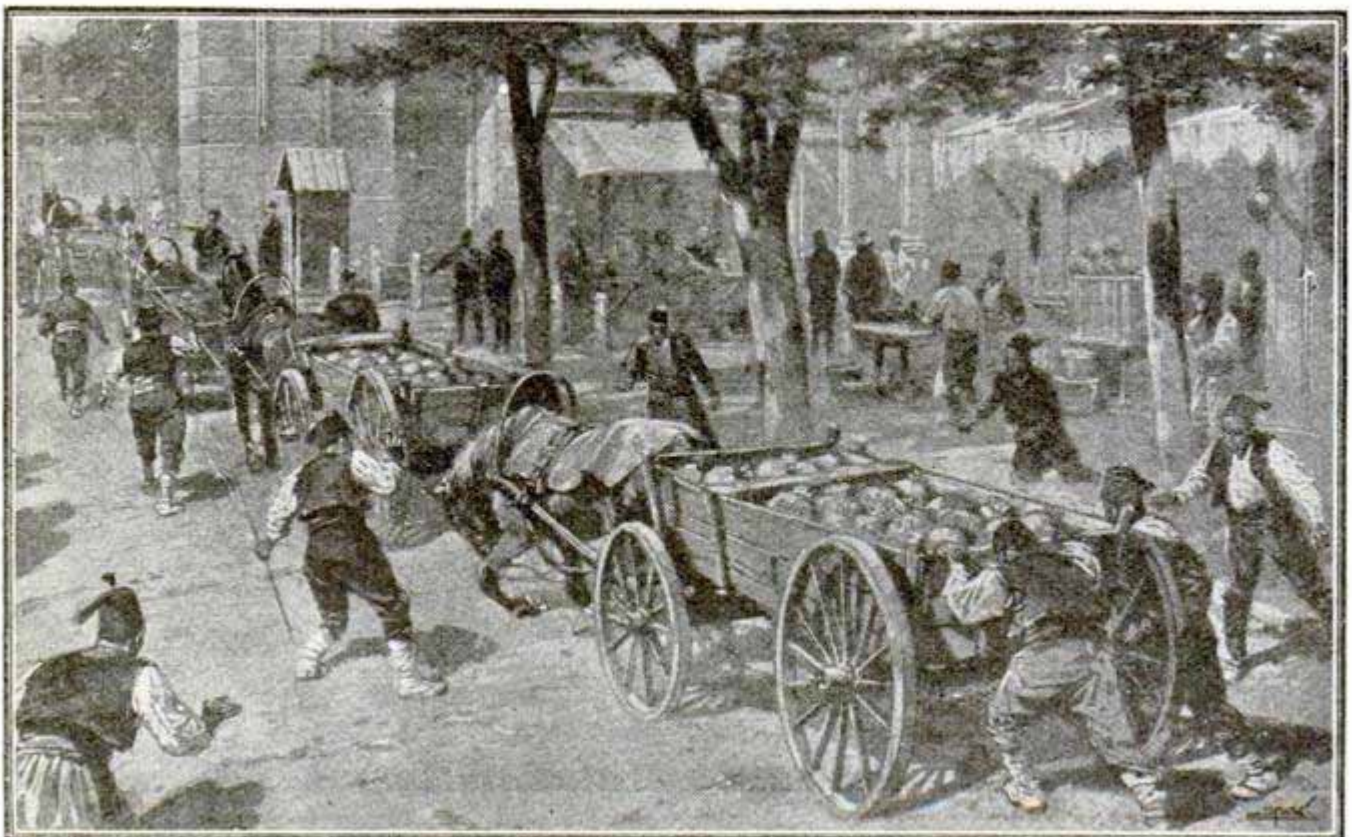
face of the opening, on the up-stream side. This expedient was successful and the flow of water stopped. The upper guard gates, which fortunately escaped injury, were then closed, and the problem of flood control, due to an accident to lock gates solved.

The importance to canal navigation of the demonstration of the effectiveness of the type of dam used on both Sault canals for such an emergency, may hardly be exaggerated, especially in view of the similar problem which must be solved at Panama. The success of the Canadian canal officials robs the opponents of a lock canal at the isthmus of a most formidable argument.

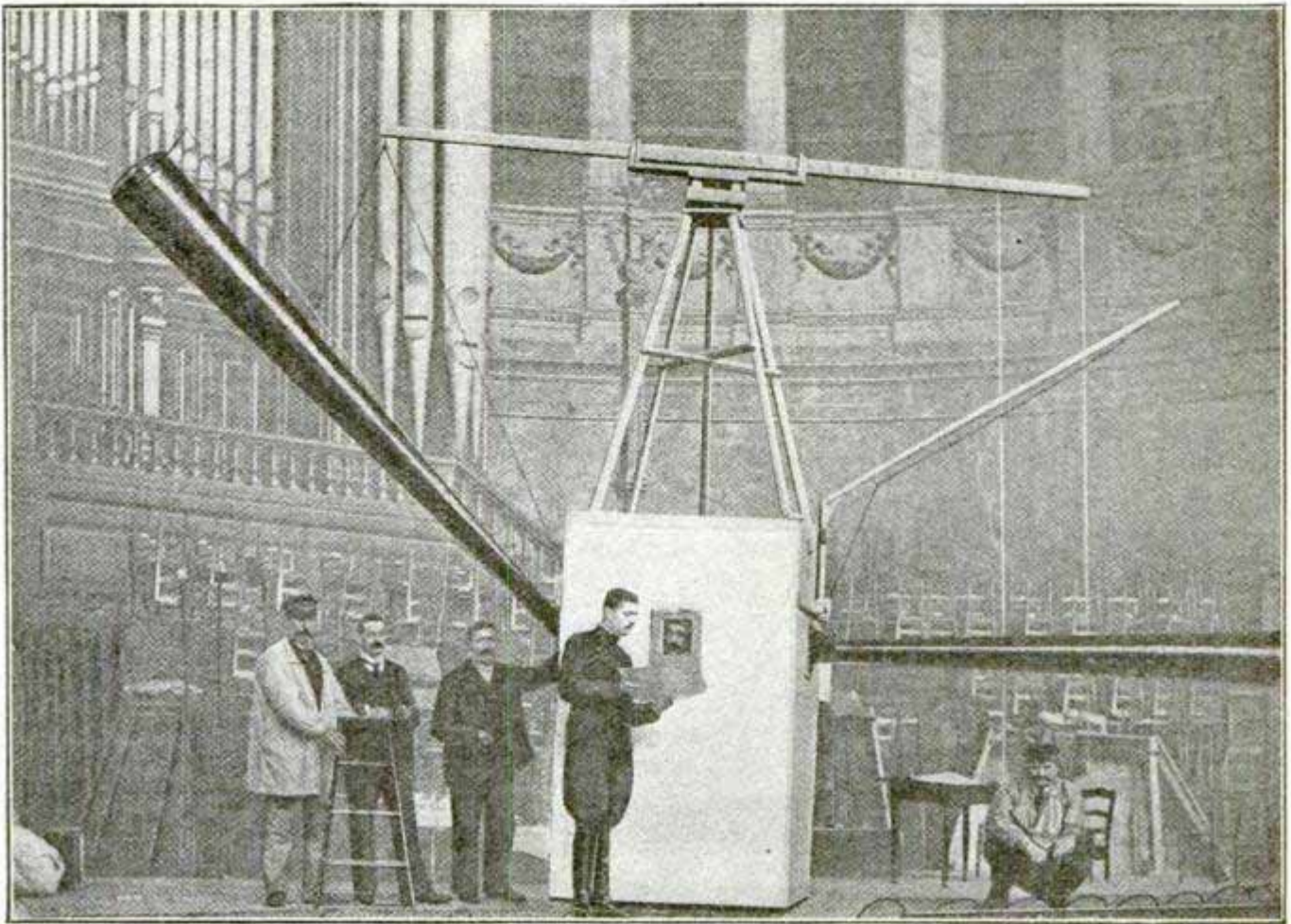
PAYING THE TURKISH ARMY

The task of delivering the pay of any part of the Turkish army is stupendous, as is shown in this illustration. Eight cartloads of silver coin, four of which are shown in the illustration, were recently conveyed from the Ottoman bank to Seraskerat to pay the soldiers who took part in the recent dis-

turbances. These wagons were not guarded, the bags of coin bumped and rattled on the loose boards, the horses stumbled with the weight, and on-lookers ran forward and pushed. Every Turkish soldier gets a "medjidieh" a month, which is 100 piasters, equal to \$4.50.



Cartloads of Money for Turkish Army



Device Used to Locate Source of the Echo

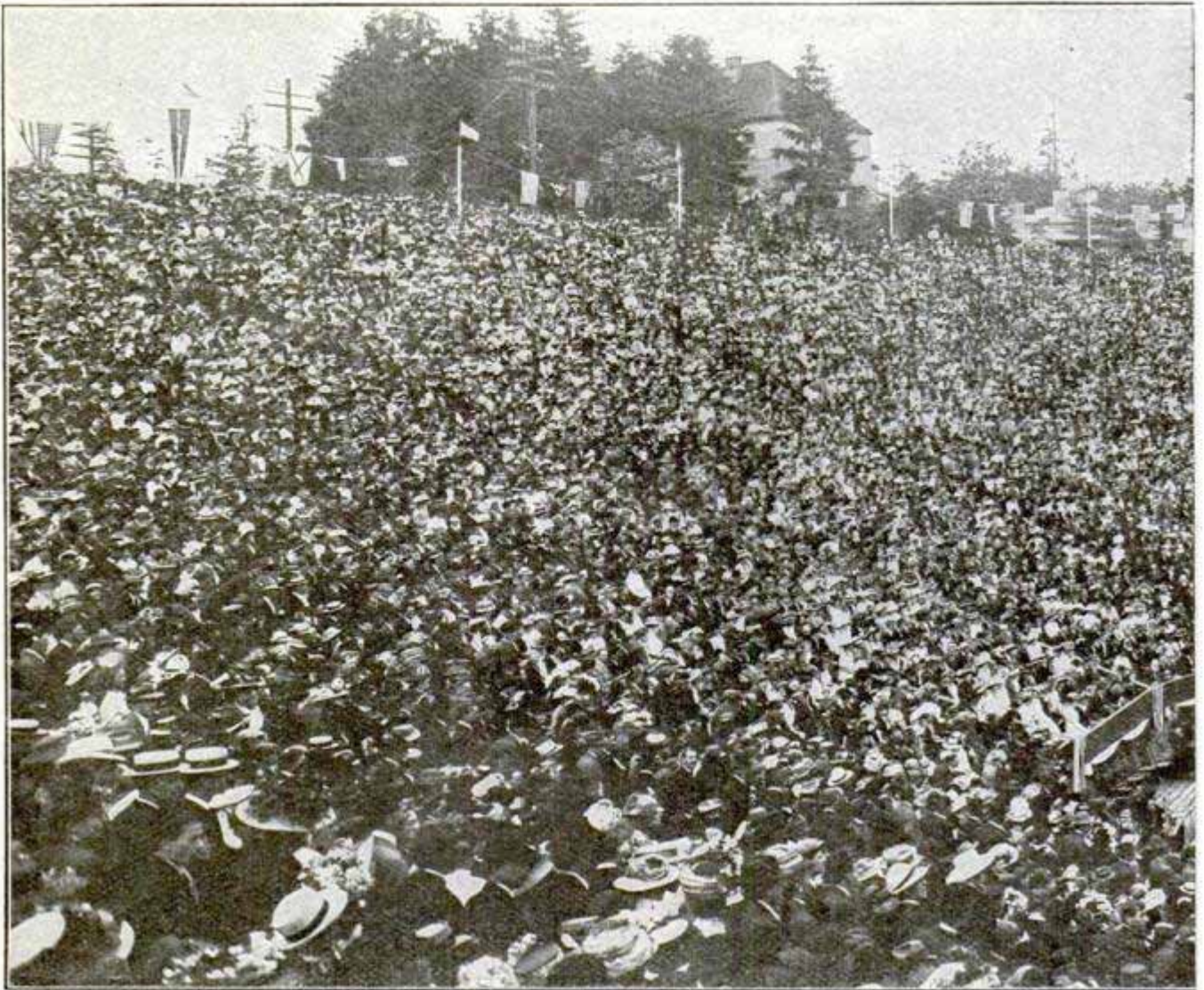
KILLING ECHO IN GREAT AUDITORIUM

The great hall of the Trocadero, in Paris, for several years made almost impossible for lectures and other attractions because of the echo, has now as fine acoustic properties as any auditorium in the world, this being brought about by the ingenious method here narrated.

In building the hall, the architect relied upon the principle that the laws of the transmission of wave sound are comparable to those which govern the transmission of luminous waves. The concave arches placed over the organ and stage were especially studied in order to reverberate the sound in steady volume, but the result, although perfect as to diminishing sound, was disastrous to the human ear, as it produced the deplorable echoes.

The work of remedying the evil was undertaken by M. Gustave Lyon, and in less than a year the problem was solved, but it was not until a few months ago that the echo was finally

absorbed. When the parts of the hall in which the echo was heard had been ascertained, the positions of the spaces on the orchestra vault which reflected the sound were found, first mathematically, then by means of the sound-proof box and the horn-like tubes shown in the illustration. The next problem was to determine how to absorb the echo, and this was determined by the aid of a large concave mirror, used to deflect sound towards observers. Before this mirror were placed bands and panels of various fabrics, but at first these did not prove satisfactory. Later, it was discovered that when two screens were interposed before the mirror, with air spaces between each and between the mirror, the echo was suppressed. Therefore this idea was adopted, such fabric screens were hung or billowed over the surface of the vaulted ceiling, and the echo, for so many years such an aggravating factor, was heard no more.



Section of Vast Throng Present at the Opening

BOTTLING AND TESTING AIR

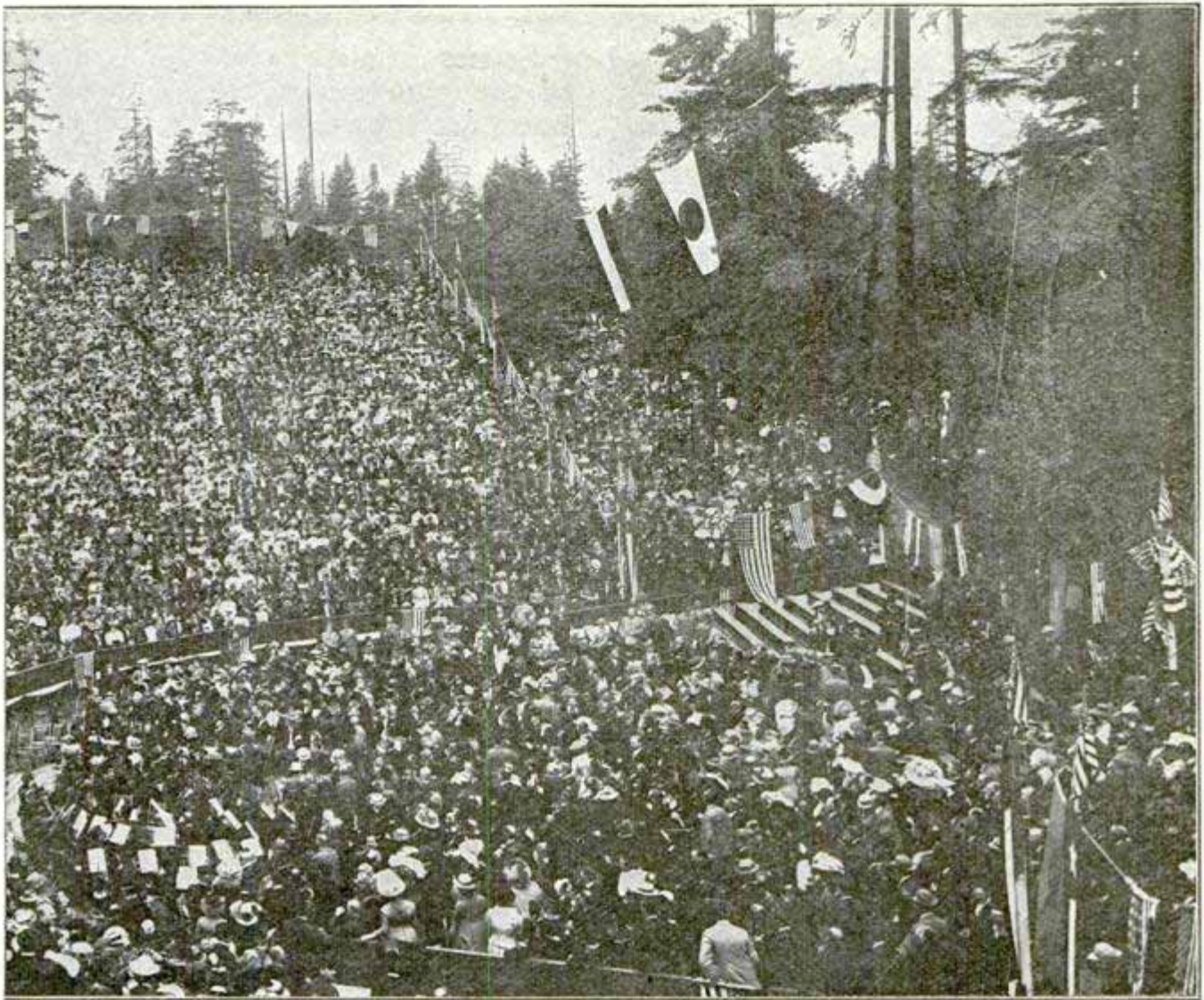
The idea of bottling samples of air in factories and industrial buildings and carrying it away to be scientifically tested in laboratories, a procedure often resorted to with liquids, would have been derided a few years ago, but it is regarded in a different light today.

A paper, read by W. J. A. Butterfield at a meeting of the English society of public analysts in London, explained just how it is done. A bottle from which all air has been withdrawn is taken into the factory and a sample of air sucked into it. A stopper is then quickly inserted and the bottle sealed with a rubber band, after which it is packed in a suitable box and sent to the laboratory. The bottles are sent through the mail in perfect safety, only about 4 in every 1,000 arriving in bad condition. At the laboratory is appa-

ratus for the complete analysis of the samples, including the exact amount of carbon dioxide present, etc. Fire-damp in the air of mines is shown by drawing the sample of air over a spiral of platinum wire.

GROWING CORN COBS FOR PIPES

A certain kind of corn was planted by many farmers in the west and east this year which will produce a cob especially adapted to the making of corn-cob pipes. It is a new source of revenue, according to the New York Times, and one which has gradually been developed during the last few years until a cob has been produced which is ideal for pipe making. The grain of the corn will be marketed as usual, but the perfect cobs will be carefully cut into proper lengths, the sur-



of the Alaska-Yukon-Pacific Exposition

face smoothed and polished, and the soft inner pulp bored out by specially constructed machinery.

Corn-cob pipes have been steadily growing in favor, even among city smokers. A set of corn-cob pipes, in a nest of six, with amber mouthpiece and mounted in silver, now sells for about \$7.50.

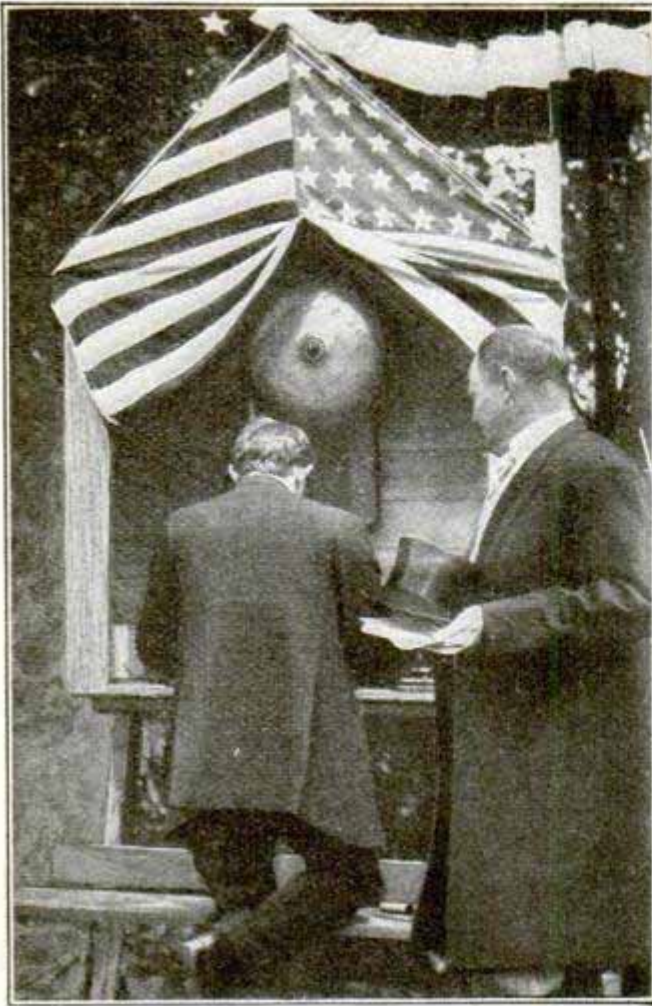
LIFE PRESERVERS FOR ROWERS

The commissioners of the District of Columbia have under consideration a suggestion that each occupant of the small rowboats that ply on the Potomac and other waters in the District limits be required to wear a small life preserver. A large number of drowning accidents brought forth this drastic idea.

OPENING THE ALASKA-YUKON- PACIFIC EXPOSITION

No great exposition in any part of the world was ever opened under more pleasant and satisfactory conditions than was the wonderful exposition of the Northwest. Its entire display, its artistic buildings, grand natural scenery, and the nature of its exhibits are truly typical of a part of the country that, only a few years ago a wilderness, has now become one of the most important parts of the vast territory under the American flag. But nothing is more truly typical of its people than the completeness of the exposition at the time of its opening, attesting most strenuously to the energy exerted and the excellent marshaling of the forces.

One illustration shows the president of the exposition notifying the president of the United States that all is



Opening the Exposition

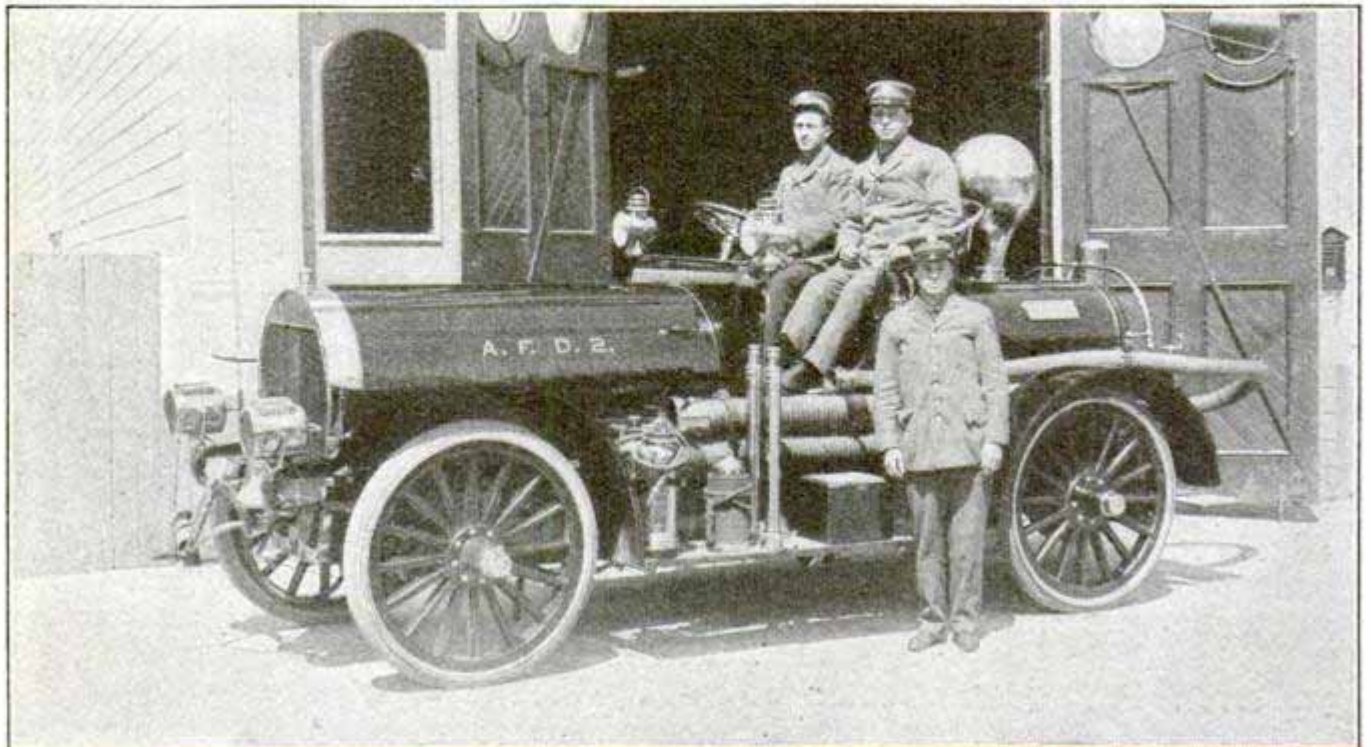
ready and waiting for him to touch the golden key that officially opened it. The other, which is published in two sections, gives some idea of the vast throng present the opening day.

SCENES IN THE TRANSVAAL

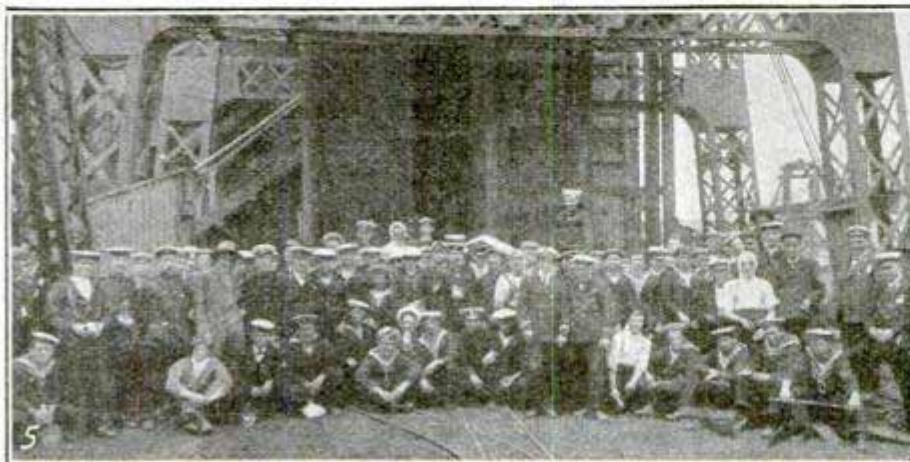
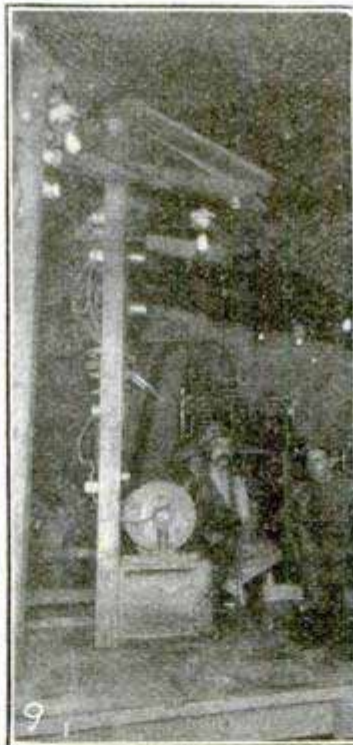
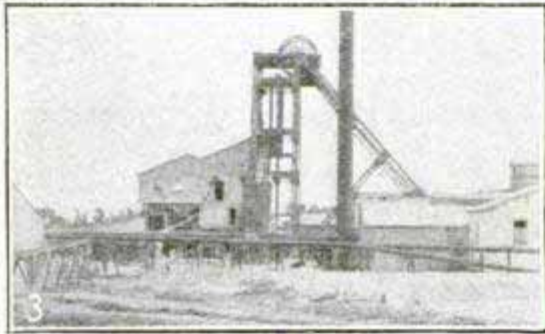
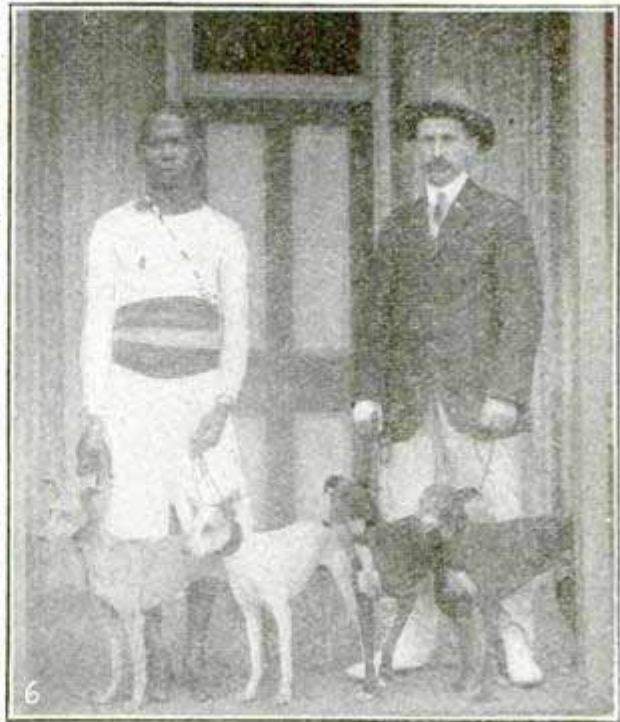
Scenes in the Transvaal, especially of the gold mines around Johannesburg, are shown in the set of illustrations on the opposite page. Number one is a company of Transvaal cadets on the march; No. 2, an inclined shaft of village-deep gold mine, showing both white and black miners; No. 3, machinery at the mouth of a gold mine; No. 4, drilling machine and crew 1,200 ft. underground; No. 5, British marines grouped around headgear of Johannesburg mine; No. 6, mine owner with dogs and attendant; No. 7, hauling engine 2,300 ft. deep in shaft; No. 8, working in a Johannesburg rock-cut sewer; No. 9, electric pump located 1,700 ft. down.

AUTO FIRE-ENGINE OF ALAMEDA, CAL.

The automobile fire-engine shown in this illustration is part of the fire-fighting apparatus of Alameda, Cal. Driven by a 4-cylinder engine it has a speed of 40 miles an hour, and a pumping capacity of 628 gal. per minute through two 600-ft. lines of hose. Standing by its side is A. H. Van Cott, the engineer, and on the seat are Harry Knouff, assistant engineer, and B. Steinmetz, a fireman.



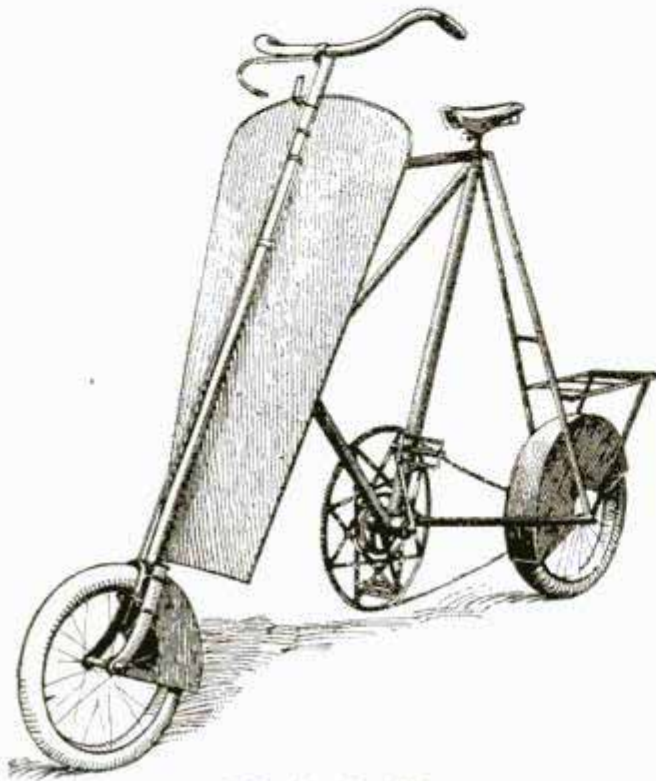
Auto Fire-Engine of 628-Gal. Capacity



Mining Scenes in the Transvaal, South Africa

ARMORED MILITARY BICYCLE

Now that automobiles have far supplanted bicycles in all kinds of service where cost is not a vital restriction, it



Bicycles for War

seems rather late to armor them for military purposes, yet this is the latest design of such a machine. The iron shield protects the rider's lower extremities from rifle fire, unless running away from the enemy. The upper part of the body, hanging low over the handle bars, does not offer an easy mark to hit when running swiftly.

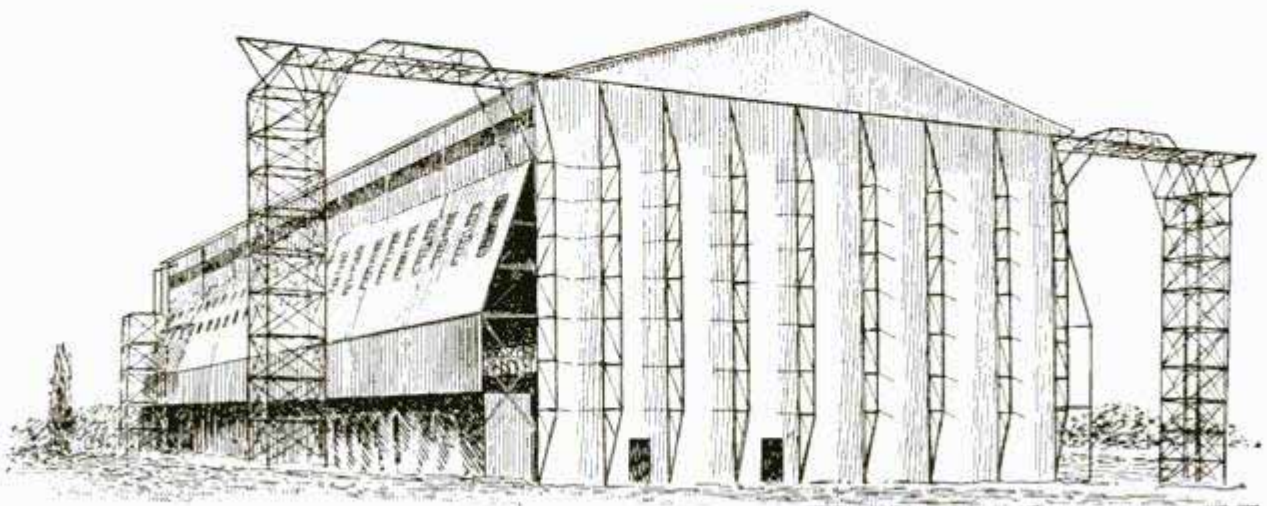
SUNKEN WAR VESSEL FOUND IN DELAWARE RIVER

Government officials believe that a sunken vessel recently located in the Delaware river near Fort Mifflin will prove to be an English war vessel, loaded with guns and treasure, which went down in 1812. While the government boat "Cataract" was working in the vicinity, the suction pump became clogged, and when it was brought to the surface, it was found to contain several fancy helmets, such as were worn by the English soldiers, and equipment of other descriptions.

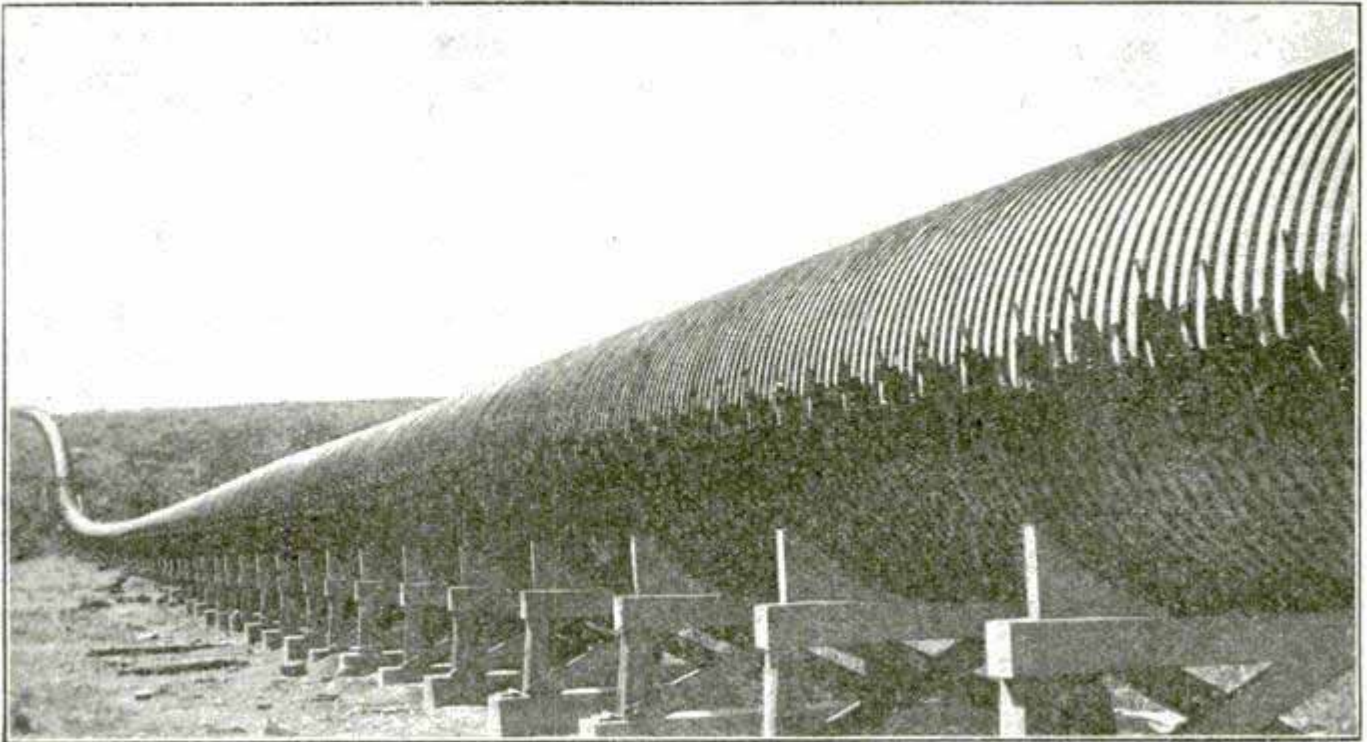
It is known that such a ship sank near that point and that it contained gold for the payment of the English soldiers in the war of 1812, as well as war equipment.

THE "ZEPPELIN'S" NEW HOME

The huge structure shown in this illustration is the new home of the Zeppelin airship at Metz, Germany. The steel framework at the sides is presumably to aid in the landing and launching of the great aerial craft. An English magazine, in commenting on the structure, does not know just what it should be called. If an airship is a ship, then "dock" would be the word; if classed with the fowls of the air, it should be "cage;" and if considered as a motor-driven vehicle, "garage."



Housing a Great Airship



Not a Prehistoric Reptile, But a Modern Pipe-Line Monster

ENORMOUS PIPE LINES MADE OF WOODEN STAVES

The water pipes of centuries ago were made of wood and during recent years modern methods have caused a revival of the industry. In earlier years wood pipes were made from logs by the slow and rather uncertain process of boring. Such pipes were only used for low pressure service. Today, wooden pipes are made of selected staves, manufactured with mathematical accuracy, each stave being a perfect segment of the whole circle.

Douglas or Oregon fir, obtained in Oregon and Washington, is the wood best adapted for the manufacture of such pipe, this timber, when saturated with water and protected from outside influences, being practically everlasting.

Two methods are used in banding the staves into pipe, one of them being the banding of sections from 8 to 16 ft. long with wire spirally wound by machinery, known as machine-banded pipe. The second method is the placing of individual bands of mild steel, provided with a threaded end, nut, washer, and shoe, around the pipe, each band being tightened separately. This method is used in the pipe line illustrated, which has an inside diameter

of 65 in., and carries water under a head of 110 ft. The line is at Titan City, Idaho.

Nearly 11,000 ft. of this type of stave pipe, 8½ ft. in diameter, has also been placed in operation to furnish water for the turbines of the electric plant that furnishes the power to draw the trains of the Great Northern railroad through its tunnel in the Cascades. The plant develops 16,000 hp. The maximum head carried by the pipe is 168 ft.

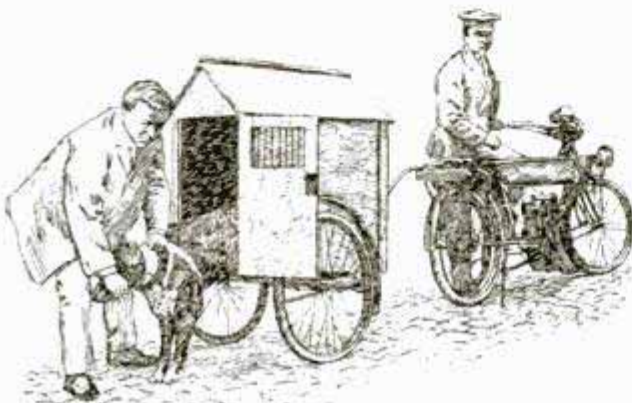
The wooden pipe for this line was delivered on special railroad trucks, and consisted of 65 cars of staves of 1,500,000 ft., board measure. The steel bands, weighing nearly 2,000,000 lb., were carried by 37 cars. The malleable cast-iron shoes required for anchoring this enormous continuous pipe line required five large cars.

Wood stave pipe of the machine-banded type is made at the factory in sizes from 2 to 24 in. inside diameter. The selected staves are placed in forms from 8 to 16 ft. long, the matched edges of the staves being closely joined to make perfectly watertight seams. A section is then placed in a specially made machine which spirally winds the wire on the pipe under heavy tension

and with accurate spacing. Heavy mild steel galvanized wire, especially made for the purpose, is used for the banding, the size varying according to the size of pipe and the pressure it is to carry. The outside surface is given a coating of tar and asphalt as a protection to the wood and banding.

LONDON DOG AMBULANCE

London has several animal hospitals to which the Londoner sends his dog, cat, horse, or donkey when emergency

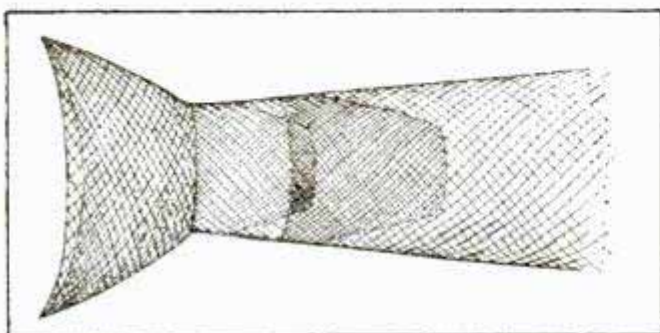


Caring for Pets in London

requires. Nearly all of these have ambulances of different types and sizes to accommodate the different kinds of animals, and they answer "hurry" telephone calls in the same way as ambulances for humans. The outfit shown in this illustration is for dogs or cats. A box in the form of a dog kennel is mounted on two bicycle wheels, and this is pulled by a motorcycle.

GALVANIZED WIRE FISH NET

This illustration, which at first sight might be taken for a new kind of gas mantle, shows one of the latest ideas in fish nets. It is made of galvanized



A Steel Fishing Net

steel wire, which is more durable than the ordinary net of twine, and is intended for catching catfish, eels, and other river and small-lake fish.

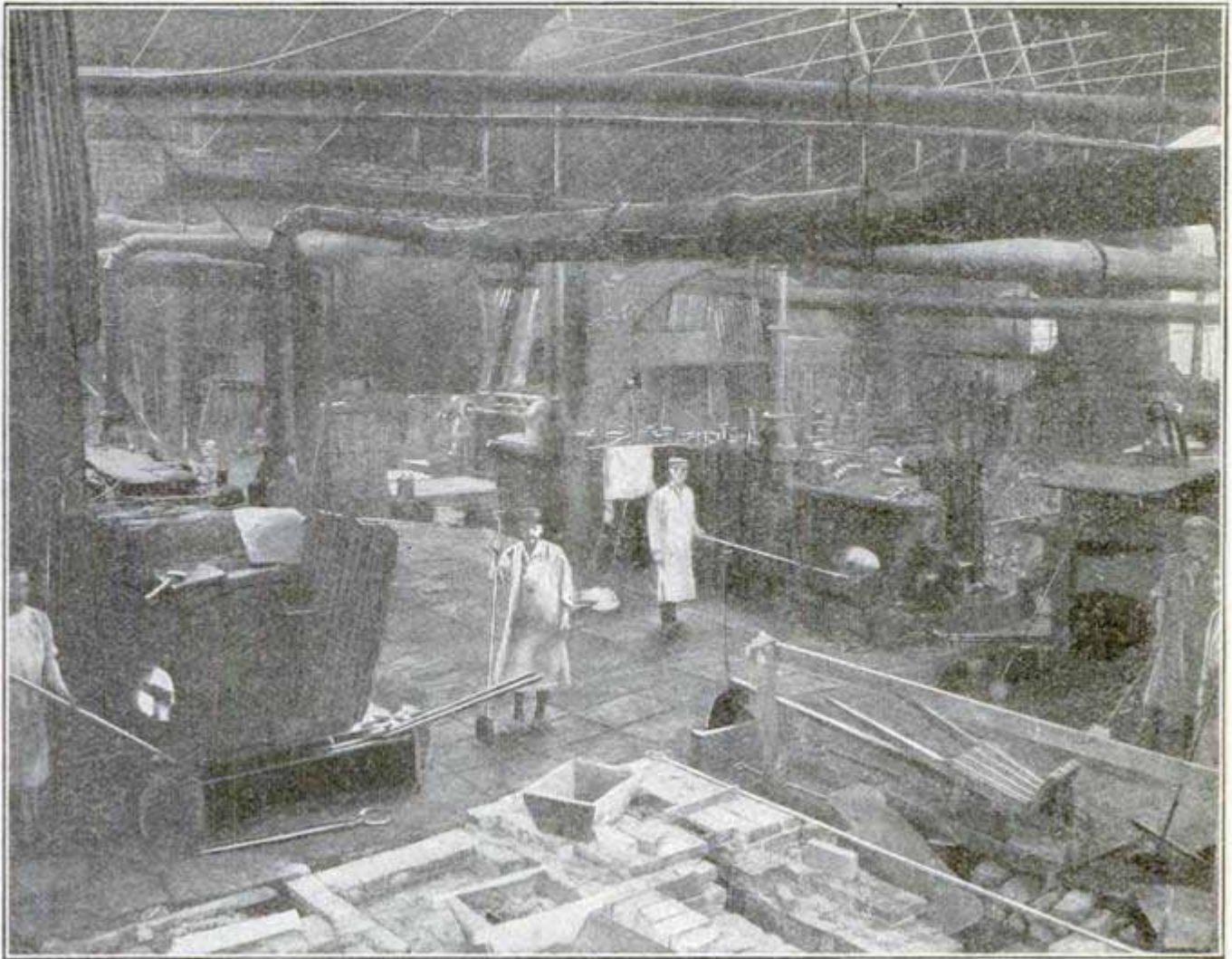
BALLOON PAYS VISIT TO BIG LINER

Passengers of the trans-Atlantic liner "Potsdam," bound from Rotterdam and Boulogne to New York, were paid a visit by a balloon while on the open ocean off the coast of Belgium. The steamer was about two hours out from Boulogne when the balloon was sighted. It appeared to be descending so rapidly that preparations were made to lower a boat and rescue the occupants when it dropped into the water. It swept downward and toward the "Potsdam," approaching so close as to almost foul the rigging of the foremast, but sand was thrown out and it rapidly rose again. Two men were in the car.

PORTABLE BATTERY FAN

An electric fan, which rises from a jar like a plant and is driven by a battery within the jar, is the invention of a Philadelphia physician. It can be picked up and set on a table or chair in any room and is carried from place to place as its services are demanded. The electric battery will drive it 50 hours without recharging, and as this can be recharged for 50 cents, the cost for power is but one cent an hour as compared to the three cents an hour that direct current from an electric-light service would cost. The price of such an outfit is about \$15.





Courtesy American Wire Rope News

THE GREAT SCIENTIFIC INDUSTRY OF OLD SWEDEN

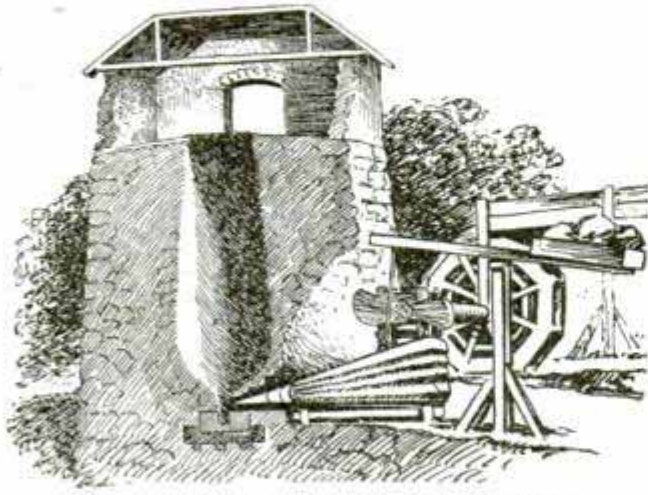
Swedish steel stands foremost in quality in the world's production. This is partially due to the long history of steel and iron-making in Sweden and to the government supervision and fostering of the industry. The superiority is mainly due to the excellent quality of ore produced which averages 68.05 per cent iron. Another reason is that all the smelting is done with charcoal, which being practically free from phosphorus and sulphur, has a beneficial influence in the quality of the iron. The small charges which are necessary owing to the small capacity of the average steel works in that country, coupled with extreme care and good judgment, enable them to produce a better quality of steel.

The Swedish iron industry extends back to the 12th century, and Sweden is really the place where the industry

was cradled. The development of the industry in Sweden went hand in hand with the perfecting of the steel blast furnace which is such an essential part of steel-making to-day. The country's first steel company was founded about 1225, but the year 1400 marks the real beginning of iron-making in Sweden. The personality of kings entered into its progression. Gustavius I and Charles IX, who fully appreciated the value of the iron deposits of their country, fostered the industry and soon put it in first place in iron producing. Gustavius I personally owned and operated the famous Finspongs Works and Blast Furnace and manufactured the first iron cannon there in 1555.

In the early stage of the industry, most primitive methods were used. Ore was mined by burning wood on the rocks, after which the ore could be

broken loose with a hammer. In 1729 gunpowder and hand drills were introduced. Pneumatic tools are now used. Generally, at this time, steam engines



Swedish Blast Furnace, 17th Century

are the hoisting power, displacing horse and water power.

The first blast furnaces were very rude, being made of clay, timber and fireproof material. The blast came from a common blacksmith's bellows which was operated by water power as shown in accompanying sketch. Charcoal was and is still used altogether in steel-making.

Sweden exported 3,065,000 tons of iron ore in 1904. Bessemer steel achieved its present high world reputation in Sweden. It was first produced there in 1858.

POINTERS ON BALLOONING

Charles J. Glidden, the well known automobile tourist and international balloonist, in an article in the aeronautic magazine "Fly," gives a few pointers on ballooning that are of the greatest interest and educational value to persons contemplating short balloon flights.

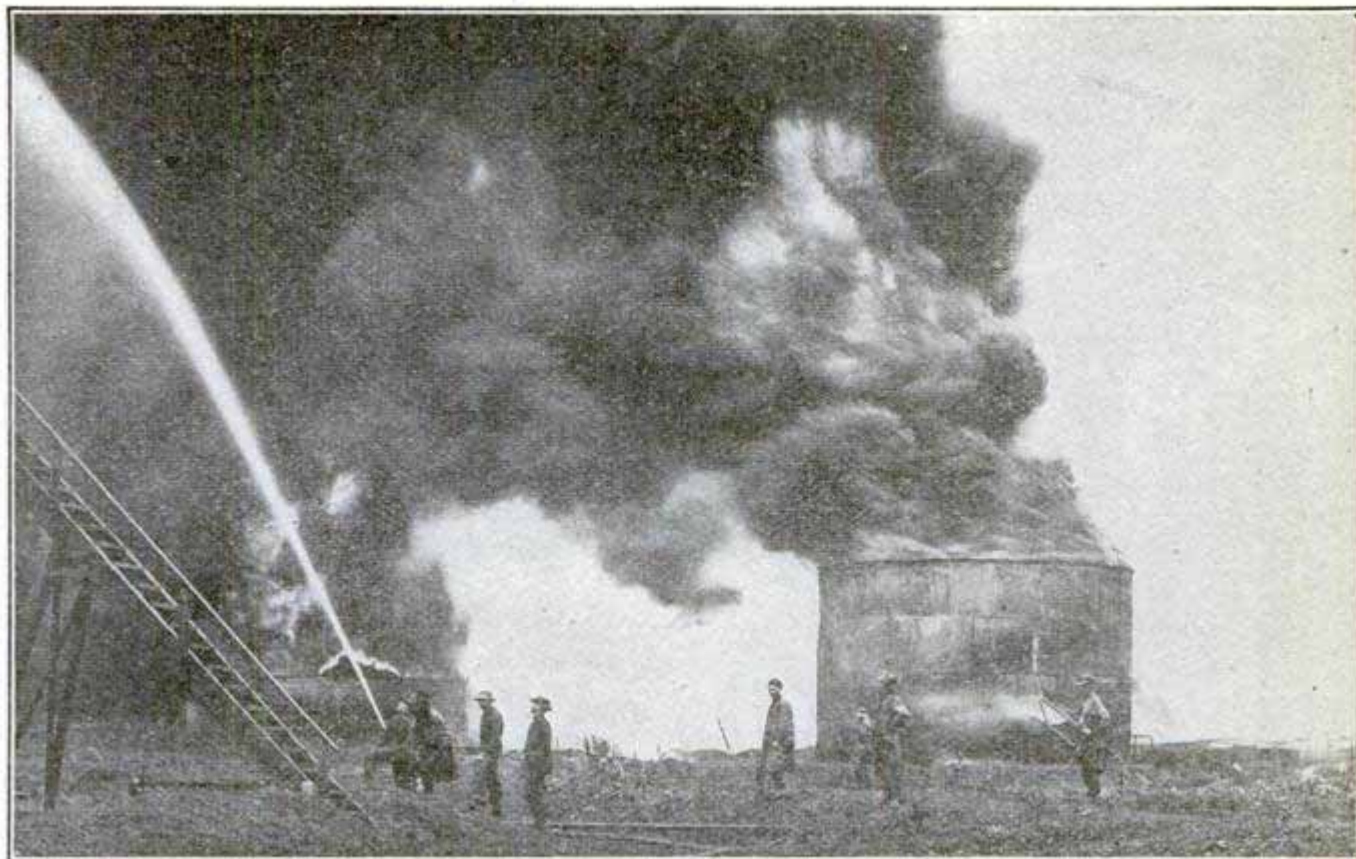
"Before starting," says Mr. Glidden, "the balloon is balanced by adding to or taking from the basket sand, until it will rise in the air when released at a speed that will clear all surrounding obstructions. It will then ascend from 1,000 to 2,000 ft., and, if nothing is done, immediately descend to the earth, ending the voyage. This descent is caused by loss of gas owing to expansion, the

gas flowing out through the appendix at the bottom of the balloon. This flow, if obstructed, will cause the balloon to explode. To stop this descent it is necessary to lighten the load, and sand in quantities varying from a few ounces to a pound is thrown out, this work being continued according to the changes of temperature.

"Approaching a forest or small body of water, the balloon begins to descend, rising again immediately the open country is reached. The wind will cause the balloon to rise up over a mountain, and fall after the crest of the peak is passed. Over a city, the cool air rising from the shaded lanes and streets has a tendency to draw the balloon downward, so sensitive is it to the changes.

"In landing the greatest skill of the pilot is required, and to remove all elements of danger at least 50 lb. of sand should be on hand for immediate use. Seeing a clearing, probably 4 or 5 miles away, the balloon should be allowed to gradually settle to a lower level. When over the selected spot, the valve should be opened a little to hasten the descent. The moment the trail rope begins to drag, the descent and movement along in the wind will be checked. Often, the trail rope will stop the balloon 100 ft. in the air. If not, when about 50 ft. from the ground the anchor is thrown out and the valve opened, the balloon dropping gently to the ground. When about 20 ft. from the ground, if the wind is blowing, the rip cord should be pulled, this action tearing off a piece of the balloon 7 in. wide and 19 ft. long and allowing the gas to immediately escape.

"Once, at an elevation of 3,300 ft., I allowed the balloon to take its own course and gradually reach the earth. We dropped at the rate of 330 ft. per minute, traveling $3\frac{1}{2}$ miles in 10 minutes. The highest elevation I have attained has been $1\frac{3}{4}$ miles, but it is much pleasanter sailing along at an elevation of about 2,000 ft., within speaking distance of people on the crust of the earth and a clearer view of many interesting objects.



Oil Tank Fire in Pennsylvania—Loss, \$200,000

“Suitable weather should be selected for ballooning, as for pleasure yachting. One would not think of going out in a squall and sailing among the rocks. The weather map should be studied and ascensions made with the low pressure at least 300 miles away. The sun playing hide and seek behind the clouds, causes the balloon to rise and fall rapidly. On account of the absence of the sun, the balloon is more easily managed at night, with the loss of very little sand. But a plunge in the dark is not desirable unless the moon is shining brightly. The best time for an ascension for amateurs is as many hours before sunset as the balloon is likely to remain in the air. This depends upon the quality of gas, size of balloon, and amount of sand carried. There is sufficient time after a sunset landing to pack the balloon for shipment before it is dark.”

“Big Bill,” a huge crocodile in the Bronx Zoo, had several cavities in his teeth filled, 17 men being required for the operation.

AN OLD TIMER OF NEVADA DESERTS

This is a specimen of the common rattler—one of the terrors of our western deserts. This one roamed the desert of southern Nevada for about 8 years as the number of rattles attached to his tail shows. This snake is of the fighting kind if molested or run upon; but in the same family there are other snakes even more deadly. The side-winder is more treacherous,



A Dead Desert Rattler

for when he starts to battle no one knows just where he will strike, as his course is at an angle or frequently in a zig-zag direction.

THE NEW GAME "LA FUNDA"

The resurrection of the ancient game of diabolo occurred in Paris and spread all over the world, being exceedingly popular for a couple of seasons. A new



New Ball-Tossing Game

game known as La Funda has now taken Paris by storm, and in all probability it will spread to other countries as did diabolo. It consists of throwing a ball with the net shown in the illustration and catching it as it comes down. The ball can be thrown to a considerable height and to catch it as it falls the player must be very expert.

ELECTRIC AUTO RUNS X-RAY APPARATUS

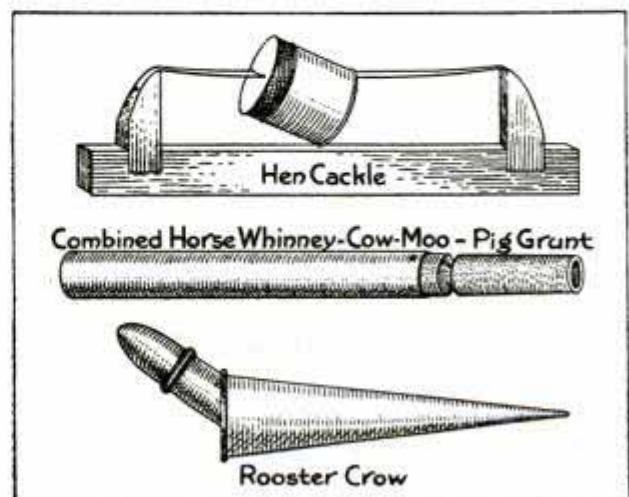
The harnessing up of an electric automobile to X-ray instruments is an idea of Dr. H. T. Edwards, director of St. Luke's hospital, South Bethlehem,

Pa., which he has carried out to perfection.

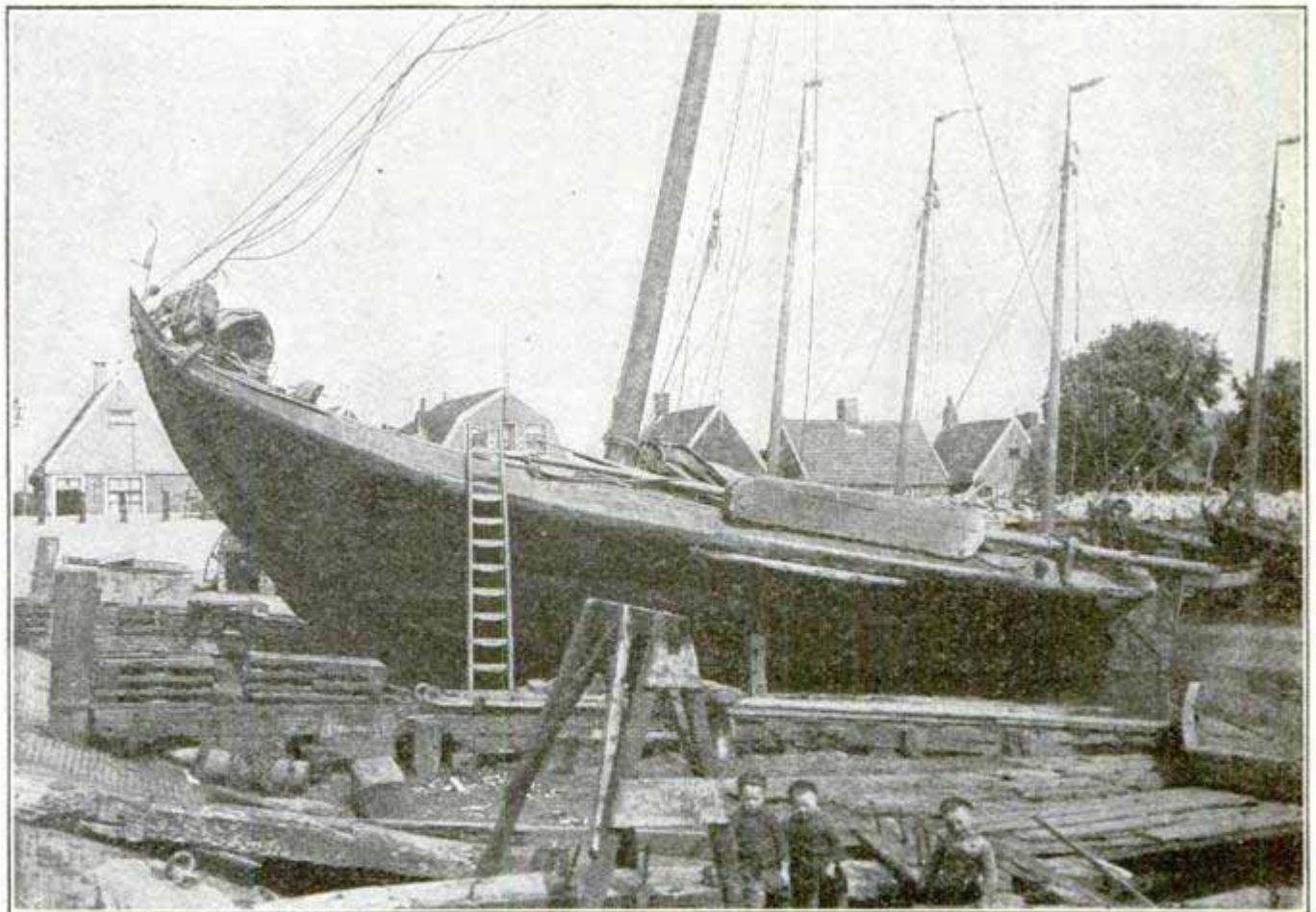
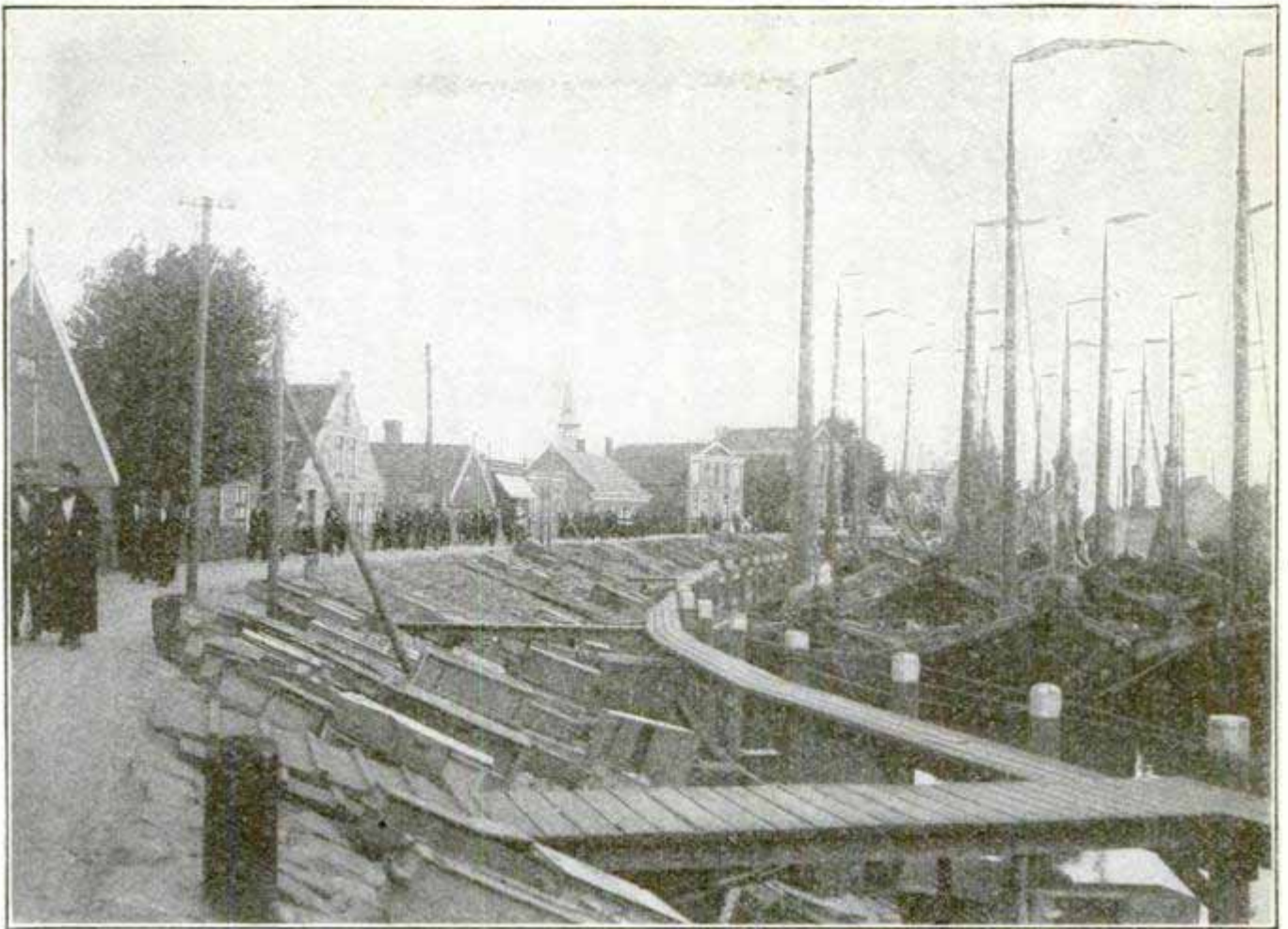
"I am putting the idea into daily operation," says Dr. Edwards, "and it works perfectly. Its simplicity makes it most available for general adoption, and I am quite confident that I can develop the idea into a valuable asset for physicians. The current consumption of my automobile costs about \$5.00 a month, and by an additional outlay of less than \$150, I secure an X-ray plant that will do the work of a coil, rectifier, etc., costing over \$500. Also, when you consider that the idea makes an ever-ready portable X-ray outfit possible, it is doubly worth considering."

BARNYARD SOUNDS WITH MOVING PICTURES

The cry of the public that moving pictures are not as real as they might be, because of the absence of the sounds that would attend the movements or display in real life, is causing moving-picture concerns to devote considerable energy toward filling the demand. Now, many moving-picture sets are provided with excellent mechanical devices to imitate the sound required, no better example of which can be given than this set of barnyard-animal imitators. The first is a device which gives a realistic imitation of hens cackling, the second gives a combined horse whinney, cow moo, and pig grunt, and the third a rooster's crow.



For Imitating the Voices of Animals



Fishing Boats—Typical Scenes in Holland

COLLAPSE OF A BALLOON

Quick work by an amateur photographer made possible the publication

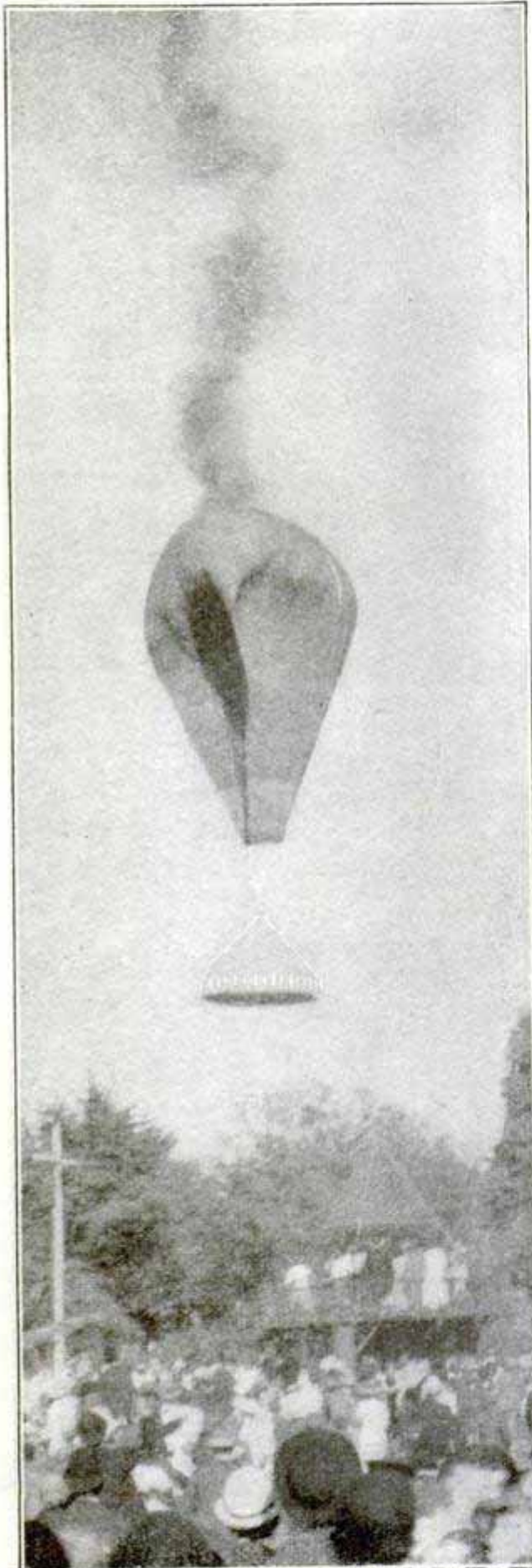


Photo by Geo. Buchan

of this photograph. The aeronaut had hardly left the ground and the balloon risen to a height of 300 ft. when the great gas bag burst from top to bottom. It fell rapidly enough for the parachute to open, and the aeronaut reached solid ground in safety. He is obscured by the trees in the illustration.

CURING TOBACCO WITH GAS HEAT

Curing tobacco with the heat from gas stoves has been successfully tried out by a tobacco company in Dayton, Ohio. Two stoves were placed in tightly closed sweating rooms with 2,000 lb. of tobacco, piled on low platforms. For one week a temperature of 90 deg. was maintained steadily, the sweating of the tobacco keeping it at a temperature of 120 deg. The tobacco was then re-piled and the room kept at a temperature of 80 deg. for a second week, the sweating continuing to keep the tobacco at the 120 deg. temperature provided by the 90 deg. heat the first week. At the end of the second week the tobacco was again re-piled and kept at the same temperature for 10 days longer, at the end of which time it was found to be a fine dark brown color, with the leaves well curled and folded.

The stoves were fed on natural gas, the cost per week being \$2.10. The stoves required no attention, and the temperature did not vary more than 3 deg. each week.

IN SEARCH OF WOOD; GETS DYNAMITE

While a resident of North Tonawanda was gathering driftwood along the Niagara river, he jabbed his pike-pole into a case containing a dozen 8-in. sticks of dynamite and dragged it ashore. On opening the box to see what it contained, he became almost paralyzed with fright at the thought of what might have been the consequences if his iron-shod pole had come in contact with the explosive itself.

TIME AND ITS MEASUREMENT

By James Arthur

[Mr. Arthur is an enthusiastic scientist, a successful inventor and extensive traveler, who has for years been making a study of clocks, watches, and time-measuring devices. He is not only a great authority on this subject, but his collection of over 1500 timepieces gathered from all parts of the globe has been pronounced the finest collection in the world. Mr. Arthur is a pleasing exception to the average business man, for he has found time to do a large amount of study and research along various scientific lines in addition to conducting an important manufacturing business in New York City, of which he is president. Mr. Arthur is 67 years of age. This chapter completes the historic features of the subject, with introductory remarks on the world's view point, and the three broad classes of time-measuring devices. The following two chapters will trace the steps of progress to date and will introduce the world's next probable big step in time measuring.—Editor's Note.]

Time, as a separate entity, has not yet been defined in language. Definitions will be found to be merely explanations of the sense in which we use the word in matters of practical life. No human being can tell how long a minute is; only that it is longer than a second and shorter than an hour. In some sense we can think of a longer or shorter period of time, but this is merely comparative. The difference between 50 and 75 steps a minute in marching is clear to us, but note that we introduce motion and space before we can get a conception of time as a succession of events, but time, in itself, remains elusive.

In time measures we strive for a uniform motion of something and this implies equal spaces in equal times; so we here assume just what we cannot explain, for space is as difficult to define as time. Time cannot be "squared" or used as a multiplier or divisor. Only numbers can be so used; so when we speak of "the square of the time" we mean some number which we have arbitrarily assumed to represent it. This becomes plain when we state that in calculations relating to pendulums, for example, we may use seconds and inches—minutes and feet—or sec-

onds and meters and the answer will come out right in the units which we have assumed. Still more, numbers themselves have no meaning till they are applied to something, and here we are applying them to time, space and motion; so we are trying to explain

three abstractions by a fourth! But, happily, the results of these assumptions and calculations are borne out in practical human life, and we are not compelled to settle the deep question as to whether fundamental knowledge is possible to the human mind. Those desiring a few headaches on these questions can easily get them from Kant and Spen-

cer—but that is all they will get on these four necessary assumptions.

Evidently, man began by considering the day as a unit and did not include the night in his time keeping for a long period. "And the evening and the morning were the first day" Gen. 1, 5; "Evening and morning and at noontide," Ps. LV, 17, divides the day ("sun up") in two parts. "Fourth part of a day," Neh. IX, 3, shows another advance. Then comes, "are there not twelve hours in a day," John XI, 9. The "eleventh hour," Matt. XX, 1 to 12, shows clearly that sunset was 12



James Arthur

o'clock. A most remarkable feature of this 12-hour day, in the New Testament, is that the writers generally speak of the third, sixth and ninth hours, Acts II, 15; III, 1; X, 9. This is extremely interesting, as it shows that the writers still thought in quarter days (Neh. IX, 3) and had not yet acquired the 12-hour conception given to them by the Romans. They thought in quarter days even when using the 12-hour numerals! Note further that references are to "hours;" so it is evident that in New Testament times they did not need smaller subdivisions. "About the third hour," shows the mental attitude. That they had no conception of our minutes, seconds and fifth seconds becomes quite plain when we notice that they jumped down from the hour to nowhere, in such expressions as "in an instant—in the twinkling of an eye."

Before this, the night had been divided into three watches, Judges VII, 19. Poetry to this day uses the "hours" and the "watches" as symbols.

This 12 hours of daylight gave very variable hours in latitudes some distance from the equator, being long in summer and short in winter. The amount of human ingenuity expended on time measures so as to divide the time from sunrise to sunset into 12 equal parts is almost beyond belief. In Constantinople, to-day, this is used, but in a rather imperfect manner, for the clocks are modern and run 24 hours uniformly; so the best they can do is to set them to mark twelve at sunset. This necessitates setting to the varying length of the days, so that the clocks appear to be sometimes more and sometimes less than six hours ahead of ours. A clock on the tower at the Sultan's private mosque gives the impression of being out of order and about six hours ahead, but it is running correctly to their system. Hotels often show two clocks, one of them to our twelve o'clock noon system. Evidently the Jewish method of ending a day at sunset is the same and explains the command, "let not the sun go down upon thy wrath," which we

might read, do not carry your anger over to another day. I venture to say that we still need that advice.

This simple line of steps in dividing the day and night is taken principally from the Bible because everyone can easily look up the passages quoted and many more, while quotations from books not in general use would not be so clear. Further, the neglect of the Bible is such a common complaint in this country that if I induce a few to look into it a little some good may result, quite apart from the matter of religious belief.

Some Chinese and Japanese methods of dividing the day and night are indicated in Fig. 1. The old Japanese method divides the day into six hours and the night also into six, each hour averaging twice as long as ours. In some cases they did this by changing the rate of the clock, and in others by letting the clock run uniformly and changing the hour marks on the dial, but this will come later when we reach Japanese clocks.

It is remarkable that at the present time in England the "saving daylight" agitation is virtually an attempt to go back to this discarded system. "John Bull," for a long period the time-keeper of the world with headquarters at Greenwich, and during that time the most pretentious clock-maker, now proposes to move his clocks backward and forward several times a year so as to "fool" his workmen out of their beds in the mornings! Why not commence work a few minutes earlier each fortnight while days are lengthening and the reverse when they are shortening?

This reminds me of a habit which was common in Scotland,—"keeping the clock half an hour forward." In those days work commenced at six o'clock, so the husband left his house at six and after a good walk arrived at the factory at six! Don't you see that if his clock had been set right he would have found it necessary to leave at half past five? But, you say he was simply deceiving himself and acting in an unreasonable manner. Certainly, but the average man is not a reasonable being,

and "John Bull" knows this and is trying to fool the average Englishman.

Now, as to the methods of measuring time, we must use circumstantial evidence for the pre-historic period. The rising and the going down of the sun—the lengthening shadows, etc., must come first, and we are on safe ground here, for savages still use primi-

tive methods like setting up a stick and marking its shadow so that a party trailing behind can estimate the distance the leaders are ahead by the changed position of the shadow. Men notice their shortening and lengthening shadows to this day. When the shadow of a man shortens more and more slowly till it appears to be fixed, the

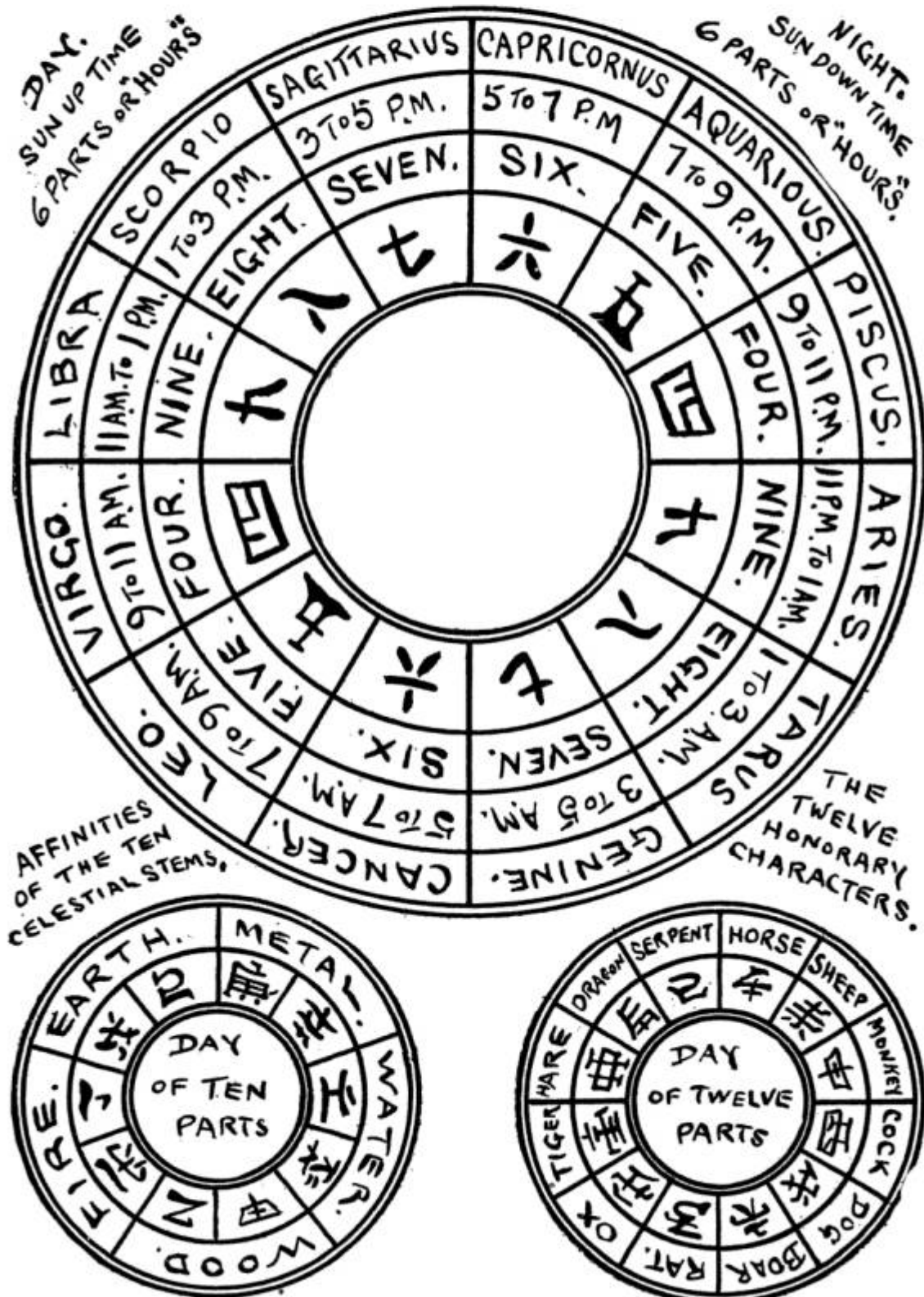


Fig. 1—Interpretation of Chinese and Japanese Methods of Time Keeping

observer knows it is noon, and when it shows the least observable lengthening then it is just past noon. Now, it is a remarkable fact that this crude method of determining noon is just the same as "taking the sun" to determine noon at sea. Noon is the time at which the sun reaches his highest point on any given day. At sea this is determined generally by a sextant, which simply measures the angle between the horizon and the sun. The instrument is applied a little before noon and the observer sees the sun creeping upward slower and slower till a little tremor or hesitation appears indicating that the sun has reached his height,—noon. Oh! you wish to know if the observer is likely to make a mistake? Yes, and when accurate local time is important,



Fig. 2—Portable Bronze Sundial from the Ruins of Herculaneum

several officers on a large ship will take the meridian passage at the same time and average their readings, so as to reduce the "personal error." All of which is merely a greater degree of accuracy than that of the man who observes his shadow.

The gradual development of the primitive shadow methods culminated in the modern sundial. The "dial of Ahas," Isa. XXXVIII, 8, on which the sun went back 10 "degrees" is often referred to, but in one of the revised editions of the unchangeable word the sun went back 10 "steps." This becomes extremely interesting when we find that in India there still remains an immense dial built with steps instead of hour lines. Figure 2 shows a pocket, or portable sundial taken from the ruins

of Herculaneum and now in the Museo National, Naples. It is bronze, was silver plated and is in the form of a ham suspended from the hock joint. From the tail, evidently bent from its original position, which forms the gnomon, lines radiate and across these wavy lines are traced. It is about 5 in. long and 3 in. wide. Being in the corner of a glass case I was unable to get small details, but museum authorities state that names of months are engraved on it, so it would be a good guess that these wavy lines had something to do with the long and short days.

In a restored flower garden, within one of the large houses in the ruins of Pompeii, may be seen a sundial of the Armillary type, presumably in its original position. I could not get close to it, as the restored garden is railed in, but it looks as if the plane of the equator and the position of the earth's axis must have been known to the maker.

Both these dials were in use about the beginning of our era and were covered by the great eruption of Vesuvius in 79 A.D., which destroyed Pompeii and Herculaneum.

Modern sundials differ only in being more accurately made and a few "curiosity" dials added. The necessity for time during the night, as man's life became a little more complicated, necessitated the invention of time machines. The "clepsydra," or water clock, was probably the first. A French writer has dug up some old records putting it back to Hoang-ti 2679 B.C., but it appears to have been certainly in use in China in 1100 B.C., so we will be satisfied with that date. In presenting a subject to the young student it is sometimes advisable to use round numbers to give a simple comprehension and then leave him to find the overlapping of dates and methods as he advances. Keeping this in mind, the following table may be used to give an elementary hint of the three great steps in time measuring:

Shadow time, 2000 to 1000 B. C.

Dials and Water Clocks, 1000 B. C. to 1000 A. D.

Clocks and watches, 1000 to 2000 A. D.

I have pushed the gear wheel clocks and watches forward to 2000 A.D., as they may last to that time, but I have no doubt we will supersede them. At the present time science is just about ready to say that a time measurer consisting of wheels and pinions—a driving power and a regulator in the form of a pendulum or balance, is a clumsy contrivance and that we ought to do better very soon; but more on this hoped-for, fourth method when we reach the consideration of the motion on which we base all our time keeping.

It is remarkable how few are aware that the simplest form of sundial is the best, and that, as a regulator of our present clocks, it is good within one or two minutes. No one need be without a "noon-mark" sundial; that is, every one may have the best of all dials. Take a post or any straight object standing "plumb," or best of all the corner of a building as in Fig. 3. In the case of the post, or tree trunk, a stone (shown in solid black) may be set in the ground; but for the building a line may often be cut across a flagstone of the footpath. Many methods may be employed to get this noon mark, which is simply a north and south line. Viewing the pole star, using a compass (if the local variation is known) or the old method of finding the time at which the shadow of a pole is shortest. But the best practical way in this day is to use a watch set to local time and make the mark at 12 o'clock.

On four days of the year the sun is right and your mark may be set at 12 on these days, but you may use an almanac and look in the column marked "mean time at noon" or "sun on meridian." For example, suppose on the bright day when you are ready to place your noon mark you read in this column 11:50, then when your watch shows 11:50 make your noon mark to the shadow and it will be right for all time to come. Owing to the fact that there are not an even number of days in a year, it follows that on any given yearly date at noon the earth is not at

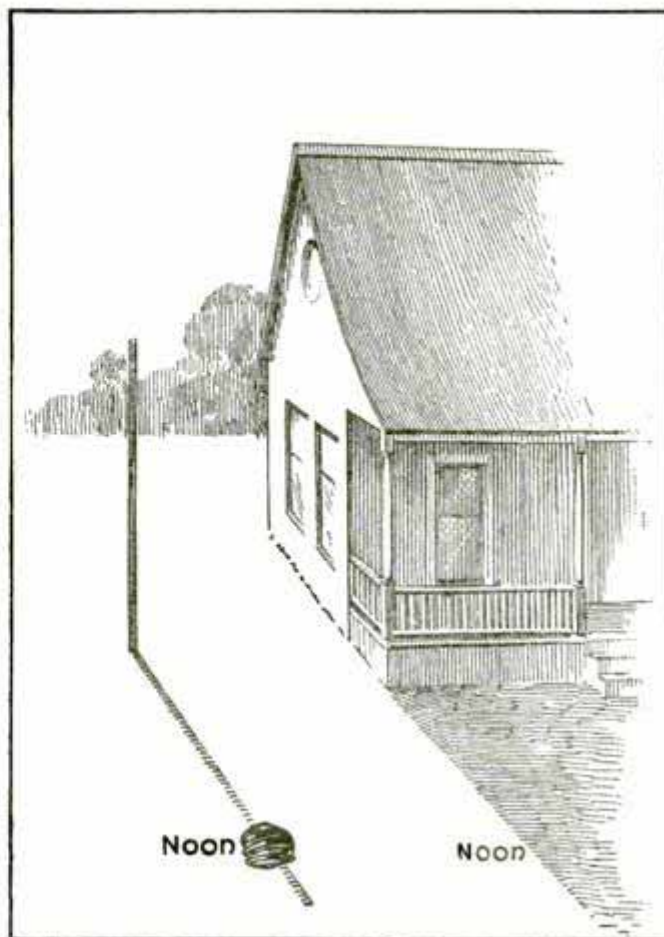


Fig. 3—Noon-Mark Sundials

SUN ON NOON MARK, 1909

Date	Clock Time	Date	Clock Time	Date	Clock Time
Jan. 2...	12:04	May 1...	11:57	Sept. 30...	11:50
" 4...	12:05	" 15...	11:56	Oct. 3...	11:49
" 7...	12:06	" 28...	11:57	" 6...	11:48
" 9...	12:07	June 4...	11:58	" 10...	11:47
" 11...	12:08	" 10...	11:59	" 14...	11:46
" 14...	12:09	" 14...	12:00	" 19...	11:45
" 17...	12:10	" 19...	12:01	" 26...	11:44
" 20...	12:11	" 24...	12:02	Nov. 17...	11:45
" 23...	12:12	" 29...	12:03	" 22...	11:46
" 28...	12:13	July 4...	12:04	" 25...	11:47
Feb. 3...	12:14	" 10...	12:05	" 29...	11:48
" 26...	12:13	" 19...	12:06	Dec. 1...	11:49
Mar. 3...	12:12	Aug. 11...	12:05	" 4...	11:50
" 8...	12:11	" 16...	12:04	" 6...	11:51
" 11...	12:10	" 21...	12:03	" 9...	11:52
" 15...	12:09	" 25...	12:02	" 11...	11:53
" 18...	12:08	" 28...	12:01	" 13...	11:54
" 22...	12:07	" 31...	12:00	" 15...	11:55
" 25...	12:06	Sept. 4...	11:59	" 17...	11:56
" 28...	12:05	" 7...	11:58	" 19...	11:57
Apr. 1...	12:04	" 10...	11:57	" 21...	11:58
" 4...	12:03	" 12...	11:56	" 23...	11:59
" 7...	12:02	" 15...	11:55	" 25...	12:00
" 11...	12:01	" 18...	11:54	" 27...	12:01
" 15...	12:00	" 21...	11:53	" 29...	12:02
" 19...	11:59	" 24...	11:52	" 31...	12:03
" 24...	11:58	" 27...	11:51		

The above table shows the variation of the sun from "mean" or clock time, by even minutes.

the same place in its elliptical orbit and the correction of this by the leap years causes the equation table to vary in periods of four years. The centennial leap years cause another variation of 400 years, etc., but these variations are less than the error in reading a dial.

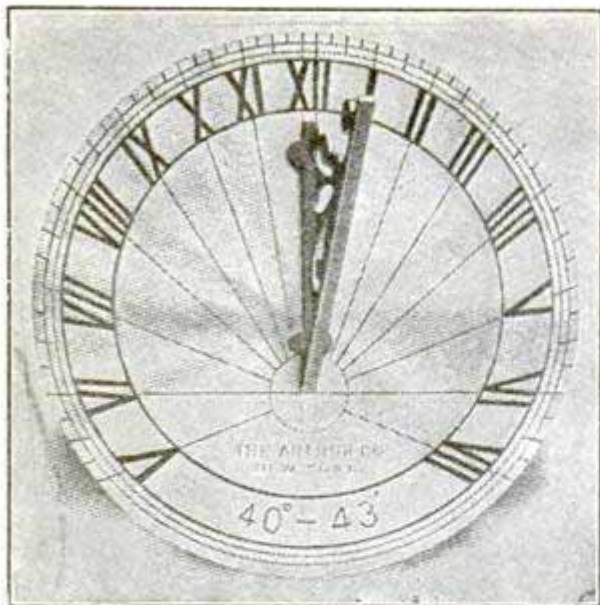


Fig. 4—12-Inch Modern Horizontal Sundial for Latitude 40° — $43'$

The reason that the table given here is convenient for setting clocks to mean time is that a minute is as close as a dial can be read, but if you wish for greater accuracy, then the almanac, which gives the "equation of time" to a second for each day, will be better. The reason that these noon-mark dials are better than ordinary commercial dials is that they are larger, and still further, noon is the only time that any dial is accurate to sun time. This is because the sun's rays are "refracted" in a variable manner by our atmosphere, but at noon this refraction takes place on a north and south line, and as that is our noon-mark line the dial reads

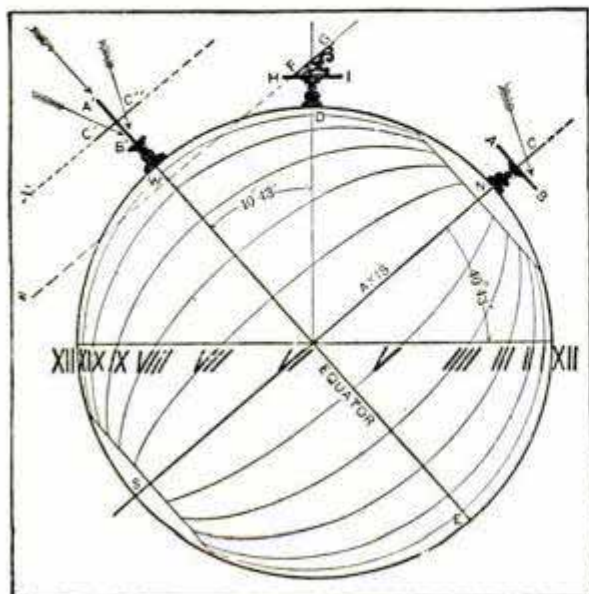


Fig. 5—The Earth, Showing Relation of Dial Styles to Axis

correctly. So, for setting clocks, the corner of your house is far ahead of the most pretentious and expensive dial. In Fig. 4 is shown a modern horizontal dial without the usual confusing "ornamentation," and in Fig. 5 it is shown set up on the latitude of New York City for which it is calculated. This shows clearly why the edge FG of the style which casts the shadow must be parallel to the earth's axis and why a horizontal dial must be made for the latitude of the place where it is set up. Figure 6 is the same dial only the lines are laid out on a square dial plate, and

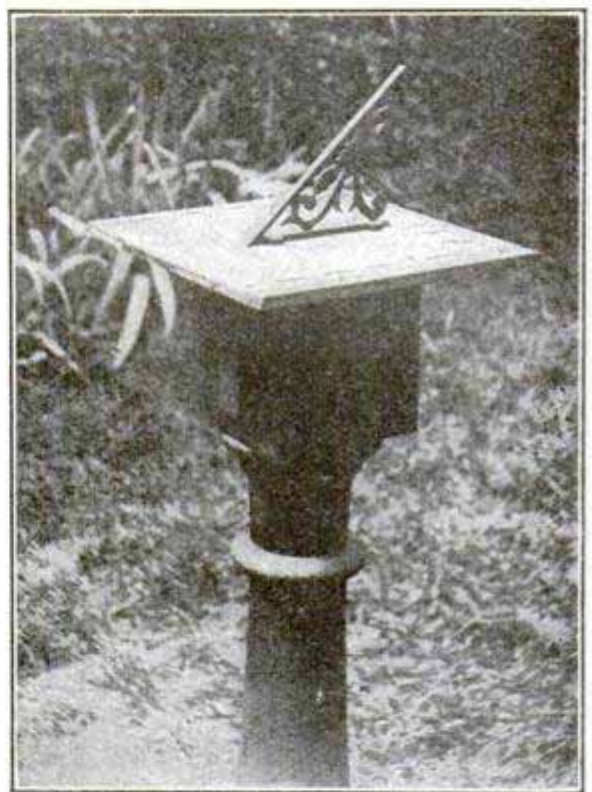


Fig. 6—Modern Sundial Set Up in Garden

it will give your young scientific readers a hint of how to set up a dial in the garden. In setting up a horizontal dial, consider only noon and set the style, or 12 o'clock line, north and south as described above for noon-mark dials.

A whole issue of Popular Mechanics could be filled on the subject of dials and even then only give a general outline. Astronomy, geography, geometry, mathematics, mechanics, as well as architecture and art, come in to make "dialing" a most charming scientific and intellectual avocation.

During the night and also in cloudy weather the sundial was useless and we read that the priests of the temples and monks of more modern times "went out to observe the stars" to make a guess at the time of night. The most prominent type after the shadow devices was the "water clock" or "clepsydra," but many other methods were used, such as candles, oil lamps and in comparatively late times, the sand glass. The fundamental principle of all water clocks is the escape of water from a vessel through a small hole. It is evident that such a vessel would empty itself each time it is filled in very nearly the same time. The reverse of this has been used as shown in Fig. 7, which represents the "time-boy" of India. He sits in front of a large vessel of water and floats a bronze cup having a small hole in its bottom in this large vessel, and the leakage gradually lowers this cup till it sinks, after which he fishes it up and strikes one or more blows on it as a gong. This he continues and a rude division of time is obtained,—while he keeps awake!

The most interesting of all water clocks is undoubtedly the "copper jars dropping water," in Canton, China, where I saw it in 1897. Referring to the simple line sketch, which I make from memory, Fig. 8, and reading four Chinese characters downwards the translation is "Canton City." To the left and still downwards,—*"Hon-woo-et-low,"* which is,—*"Copper jars dropping water."* Educated Chinamen inform me that it is over 3,000 years old



Fig. 7—"Time-Boy" of India

and had a weather vane. As they speak of it as "the clock of the street arch" this would look quite probable; since the little open building, or tower in

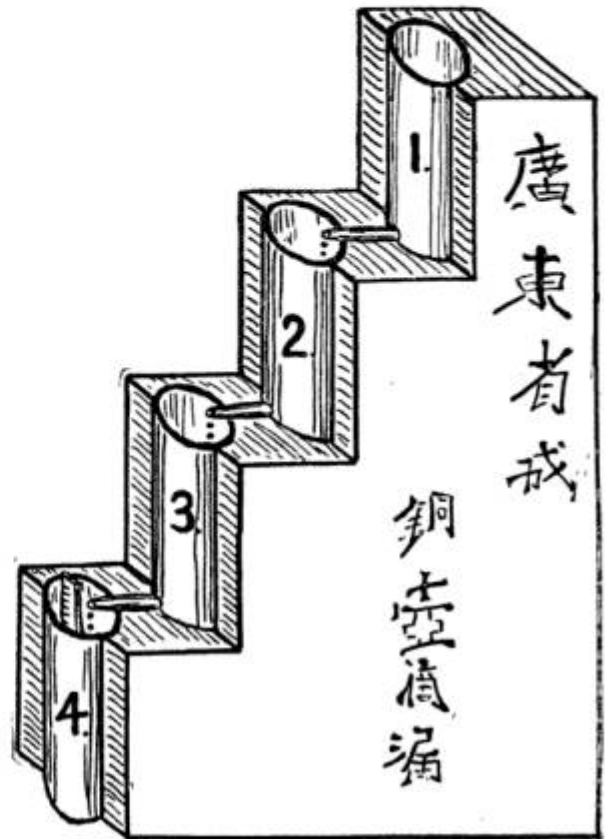


Fig. 8—"Hon-woo-et-low" or "Copper Jars Dropping Water"—Canton, China

which it stands is higher than surrounding buildings. It is, therefore, reasonably safe to state that the Chinese had a *weather and time station* over 1,000 years before our era. It consists of four copper jars partially built in masonry forming a stair-like structure. Commencing at the top jar each one drops into the next downward till the water reaches the solid bottom jar. In this lowest one a float, "the bamboo stick," is placed and indicates the height of the water and thus in a rude way gives the time. It is said to be set morning and evening by dipping the water from jar 4 to jar 1, so it runs 12 hours of our time. What are the uses of jars 2 and 3, since the water simply enters them and drips out again? No information could be obtained, but I venture an explanation and hope the reader can do better, as we are all of a family and there is no jealousy. When the top jar is filled for a 12-hour run it would drip out too fast during the first six hours

and too slow during the second six hours, on account of the varying "head" of water. Now, the spigot of jar 2 could be set so that it would gain water during the first six hours, and lose during the second six hours and thus equalize a little by splitting the error of jar 1 in two parts. Similarly, these two errors of jar 2 could be again split by jar 3 making four small variations in lowest jar, instead of one large error in the flow of jar 1. This could be extended to a greater number of jars, another jar making eight smaller errors, etc., etc. But I am inclined to credit our ancient Chinese inventor with the sound reasoning that a human attendant, being very fallible and limited in his capacity, would have all he could properly do to adjust four jars, and that his record would average better than it would with a greater number. Remember, this man lived thousands of years before the modern mathematician who constructed a bell-shaped vessel with a small hole in the bottom, and proportioned the varying diameter

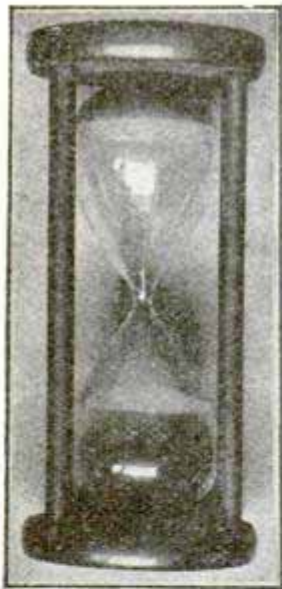


Fig. 9—Modern Sand Glass or "Hour Glass"

in such a manner that in emptying itself the surface of the water sank equal distances in equal times. The sand glass, Fig. 9, poetically called the "hour glass," belongs to the water-clock class and the sand flows from one bulb into the other, but it gives no subdivisions of its period, so if you are using one running an hour it does not give you the half hour.

The sand glass is still in use by chairmen, and when the oldest inhabitant gets on his feet, I always advise setting a 20-minute glass "on him."

In the "Tower of the Winds" at Athens, Greece (Fig. 10), we have a later "weather bureau" station. It is

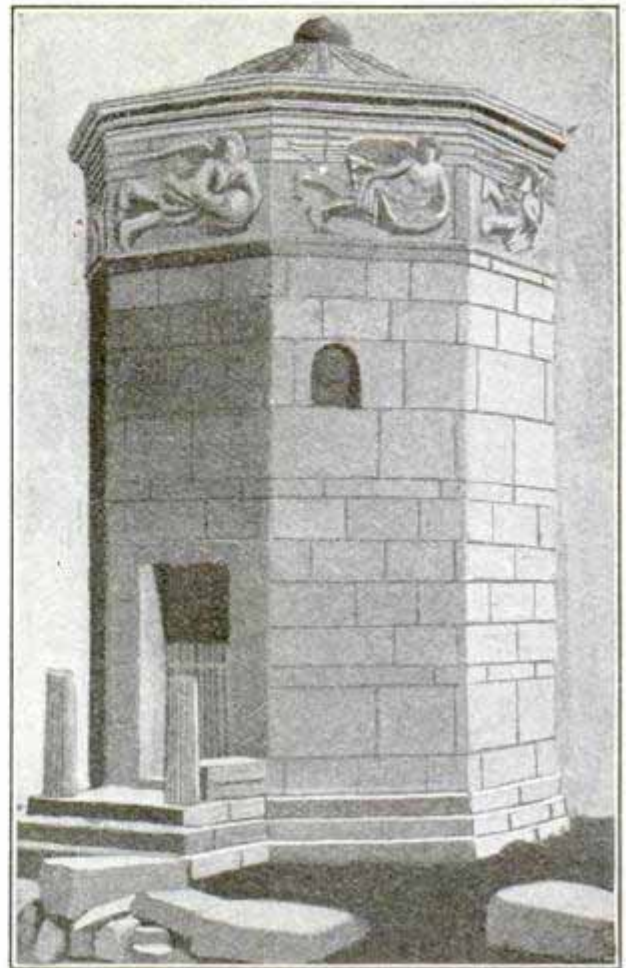


Fig. 10—"Tower of the Winds"—Athens, Greece

attributed to the astronomer Andronicos, and was built about 50 B. C. It is octagonal in plan and although 27 ft. in diameter and 44 ft. high, it looks like a sentry box when seen from one of the hills of Athens. It had a bronze weather vane and in later times sundials on its eight sides, but all these are gone and the tower itself is only a dilapidated ruin. In making the drawing for this cut, from a photograph of the tower, I have sharpened the weathered and chipped corners of the stones so as to give a view nearly like the structure as originally built; but nothing is added. Under the eaves it has eight allegorical sculptures, representing wind and weather. Artists state that these sculptures are inferior as compared with Grecian art of an older period. But the most interesting part is inside, and here we find curious passages cut in solid stone, and sockets which look as if they had contained metal bearings for moving machinery. Circumstantial evidence is strong that it contained a complicated water clock

which could have been kept running with tolerable accuracy by setting it daily to the dials on the outside. Probably during a few days of cloudy weather the clock would "get off quite a little," but business was not pressing in those days. Besides, the timekeeper would swear by his little water wheel, anyway, and feel safe, as there was no higher authority wearing an American watch.

Some very interesting engravings of Japanese clocks and a general explanation of them, as well as a presentation of the Japanese mental attitude towards "hours" and their strange method of numbering them may be expected in the next chapter.

(To be continued)

THE FIRST PIPE LINES

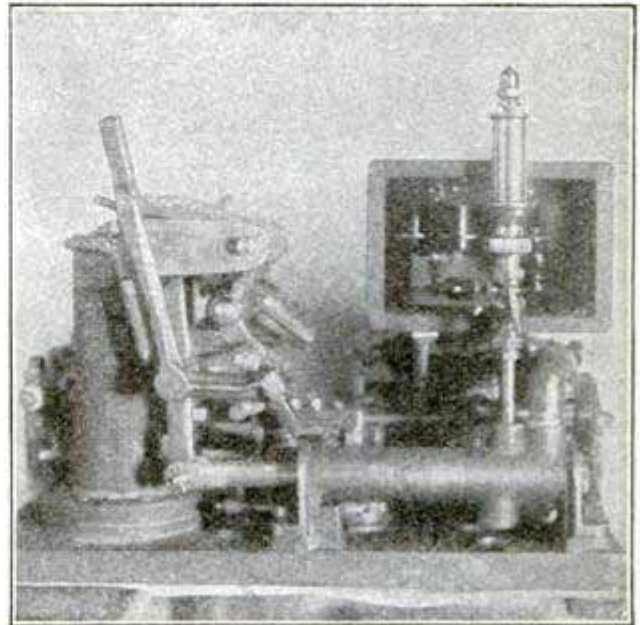
The first pipe line was built in 1815 when William Murdock, the discoverer of lighting with illuminating gas, installed a piping works to convey gas through shops near Birmingham, Eng. The line consisted of old musket barrels, bought at the close of the long European wars. The first pipe line in America was constructed at Fredonia, N. Y. in 1824 to illuminate the village inn in honor of the visit of General de Lafayette. The first natural gas plant was built in America in 1872, and consisted of $5\frac{1}{2}$ miles of pipe line 2 in. in diameter, laid at Titusville, Pa.

Today pipe lines hundreds of miles long, carry gas, oil, water, and steam, some of the lines being six or more feet in diameter.

By law, an Englishman's property extends upward to the skies. What will this mean in aerial navigation?

A WIRELESS BLOCK SIGNAL SYSTEM

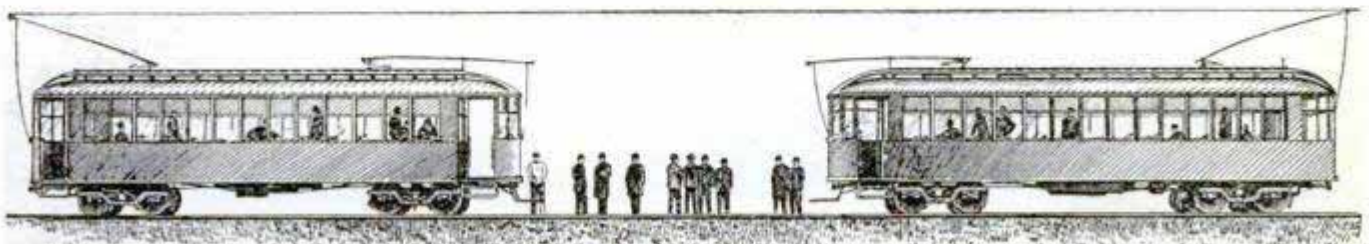
A new system of block signaling and train control has followed close upon the heels of wireless telegraphy and is founded on the same basic principle.



Wireless Block System Apparatus

This system has dispensed with signal posts, used by practically every other system. Hertz discovered that electric oscillations produced in a common circuit create a disturbance called an electric wave in the surrounding ether. This—the principle of wireless telegraphy—has furnished a medium to span the gap between the rails and a moving train and is something inventors have long sought. This new system is practicable for both steam and electric lines.

Naturally, to make this connection between the train and the track there must be two parts to the system, one on the track and another on the train. The connection is made thus: A generator at the end of each block generates an electric or wireless wave and



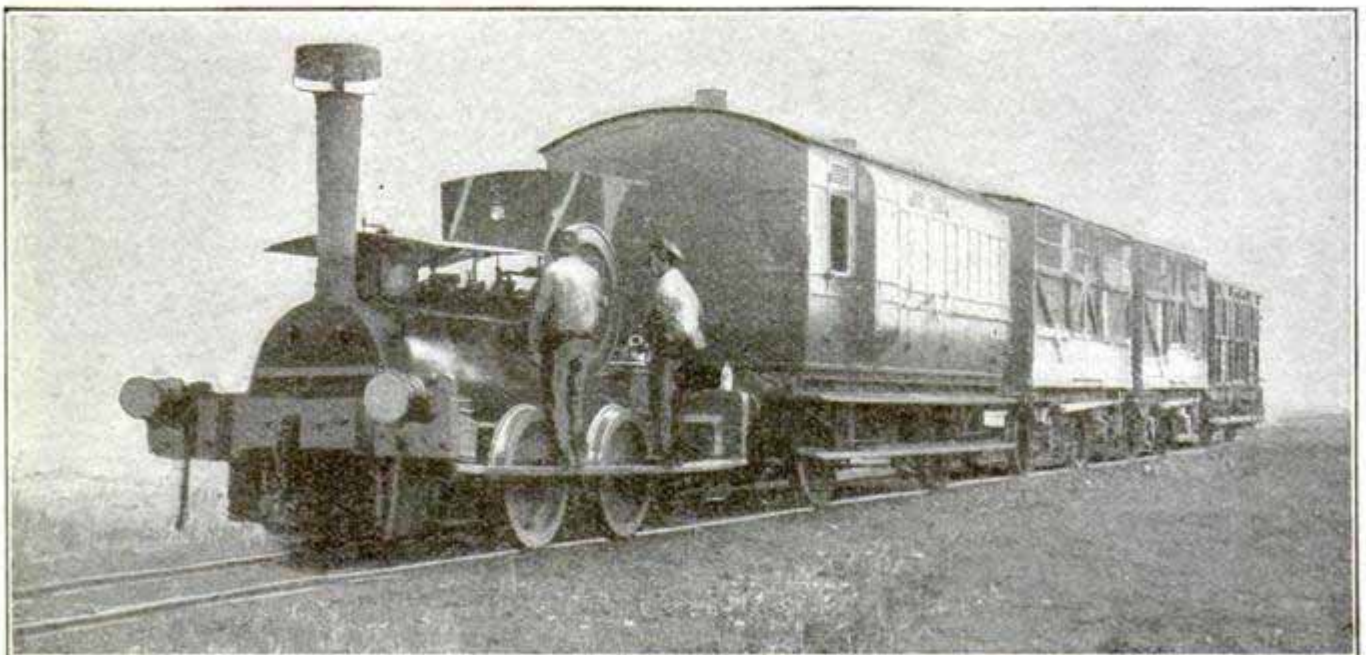
Cars Stopped by Wireless Block System

sends it continuously along a wire laid on the ties midway between the rails. These waves can be controlled and are confined to the area of the track. Hence the space above and between the rails is constantly filled with radiations of the electric wave and it may easily be seen that a train going over this block of track with an apparatus to catch the impulses of the wave will make a connection between the moving train and the track. For this purpose the train is provided with a pair of parallel rods, called antennae, about 8 in. above the rail, which receive the wave impulse and carry it to a device in the engineer's cab, which has automatic control over the train. This connection is made and broken twice each second by two revolving coherers and sends an "all's well" click to the engineer each time. This condition continues so long as the block ahead contains no train. The moment one train, or car, approaches another on the same track, within a pre-arranged distance, the waves cease, the steam is shut off and the air brake is applied automatically; at the same instant a whistle in the cab sounds. The engineer may be helpless or dead, but the trains come to a standstill, regardless of his condition. Should the system get out of order, or be tampered with, the train stops and the danger whistle blows. The engi-

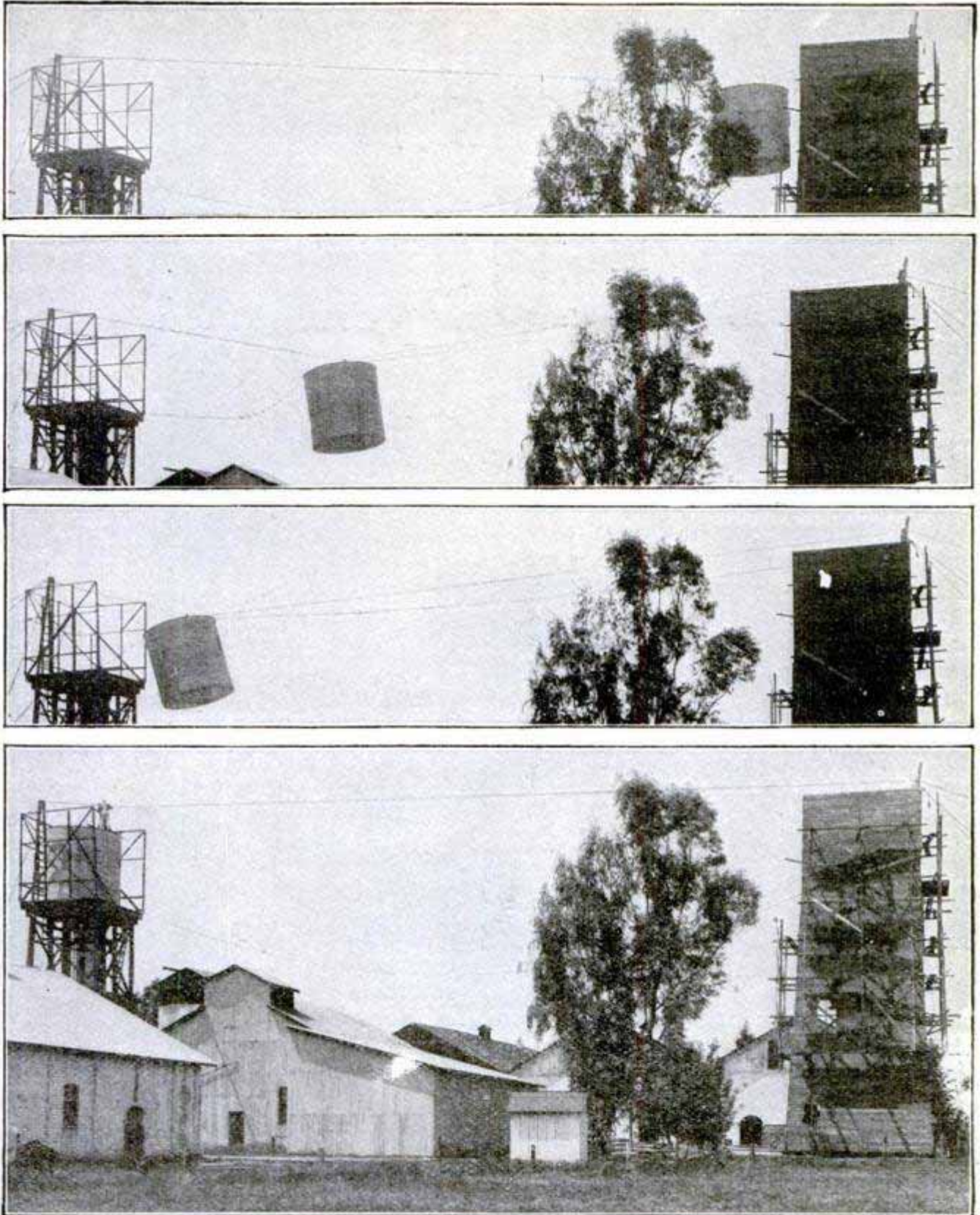
neer may start the engine and run along under control after a complete stop has been made, but the whistle continues to blow until the trouble is remedied or the track ahead is cleared, as the case may be. The device which controls the engine automatically occupies a space of only 2 ft. square in the engine cab.

A hair-raising demonstration was recently made for the benefit of railroad experts, on an interurban electric line running out of Chicago. Two large electric cars were headed toward each other on a single track, and brought up to a speed of 30 miles an hour each. The front platforms were unoccupied, the motormen being seated inside the car with the demonstrators. In this case the blocks had been arranged so as to allow them to approach within a few feet, at a point immediately in front of the spectators. At a speed of 60 miles an hour the cars drew together, and a tremendous smash seemed inevitable, but at the critical moment the power was cut off, the air brakes did their work, and the cars stopped only a few feet apart.

Major Baden Powell insists that the problem of aerial rules and regulations in and between countries must be solved within the next four years.



Old Locomotive or Tram, Oxford and Allegheny Railway—Locomotive Has Single Cylinder and Fly Wheel



Courtesy B. W. Henning

UNIQUE TANK-MOVING FEAT

This moving-picture set of illustrations was taken while a 20,000-gal. wine tank, weighing 2 tons, was being moved in a unique manner from one tower to another. The tower upon which it had stood at the Fresno winery in California had become so rotten that a new one was constructed

for it. When the time to move it came, however, it was found that the old tower was not strong enough to hold the weight of the tank if lowered over the side, therefore it was run across to the new tower on a cable, in the manner shown. The towers are 200 ft. apart, and the tank made its journey 75 ft. above the ground.

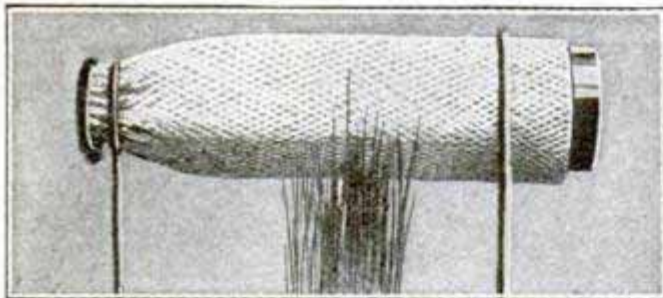
THE POWER OF RADIUM OVER VEGETABLE GROWTH

One of the greatest difficulties in the use of radium is in the fact that it has both the properties of healing and de-



Plant Growth Retarded by Radium

veloping disease, according to the duration and method of directing its rays. This property is also seen in its effects upon vegetable life. Prof. Stuart Gager, of the University of Missouri, who for some time has been experimenting with radium in connection with plants, finds that if the strength of the radium, the duration of exposure, and other conditions are suitable, the response to the rays is an excitation of function; while if the radium is too



Gas Mantle Experiment

strong and the exposure too prolonged, the result is retardation or complete death.

The effect of duration of exposure on the germination and growth of lupins is shown in one of the illustrations. The activity of the radium employed

was 1,800,000, that is, it had a radio-activity of that amount. The seeds used were dry. The exposure to the radium rays of the growth in the first pot, starting from the left, was 72 hours; to the second, 50 hours; to the third, 26 hours; and to the fourth, no exposure to the rays at all. The illustration demonstrates that the effect in retarding growth varies with the exposure. However, by creating a radioactive atmosphere in a bell jar over lupin seeds already germinated, it was found that the result was acceleration of growth.

The second illustration shows an experiment which was suggested by the fact that incandescent gas mantles contain a large percentage of thorium, a radio-active substance. On the surface of soil in a pot was sown a row of timothy seed, and over this row, and at right angles to it, was suspended a fresh, unburned mantle. Germination and subsequent growth were both retarded by the rays from the mantle.

LOCK CONSTRUCTION ON THE RED RIVER

These illustrations show the concrete piers of a lock and dam now building in the Red river, 15 miles north of Winnipeg, Manitoba. The purpose of the construction is to raise the water in both the Red and the Assiniboine rivers to an additional height of from 6 to 8 ft., making navigation possible for many miles further than ever before on these rivers.

In the foreground of the first illustration is shown the lock, which is wide enough to allow the boats to pass easily. The concrete piers are seven



Photos by Avon MacDonald

in number. Curtains will fit between each pier and a bridge will cross over them. Each pier has a concrete ice-breaker on its upstream side.

The first illustration was taken while the river was frozen over in April of this year. The second was taken later in the season and shows about 2 ft. of water rushing between the piers. The work is expected to be completed in the summer of 1910.

URUGUAY HAS ARMED POST-OFFICE TENDER

The little vessel shown in this illustration is called the "Correo del Uruguay." It has just been built for the Uruguayan postoffice service for the special purpose of meeting the mail steamers from Europe in Montevideo roads, and taking off the mails. She is 97 ft. long, and has a beam of 14 ft. 6 in. The hull is exceptionally strong, being built of galvanized steel. It is divided into seven compartments by six water-tight bulkheads, and is fitted with a strong rubbing piece all the way around to enable her to lie alongside the mail steamers in rough weather.

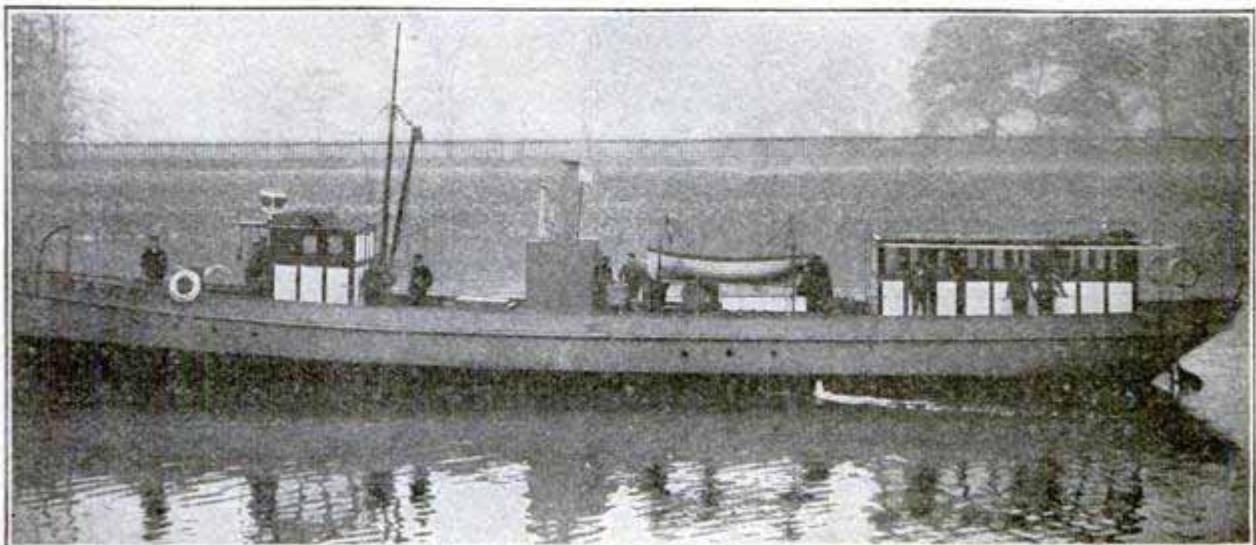
The little ship is perfectly equipped for her task, and also carries a quick-firing gun on her forward deck. All parts of the vessel are lighted with electricity, and a small but powerful searchlight is installed on the roof of the pilot house. Her speed is 15 miles an hour.



Courtesy London Illus. News

BREASTING WAVES OF STEEL OCEAN

One of the most popular as well as remarkable features of one of London's great amusement parks is the "witching waves" concession. It consists of an imitation ocean, the surface being of flexible steel plating, so designed that it can be made to rise and fall as do real waves. Small cars, with very small wheels or rollers, and seating as many as three persons, run upon the undulating surface. The passengers themselves steer the cars, and the motive power is furnished by the swelling and falling of the steel waves. The concealed mechanism, which imparts the flowing motion to the flexible steel, is very ingenious.



Courtesy Yarrow & Co., Glasgow

To Pick Up Mails in Montevideo Roads



GENTLEMEN'S WARDROBE

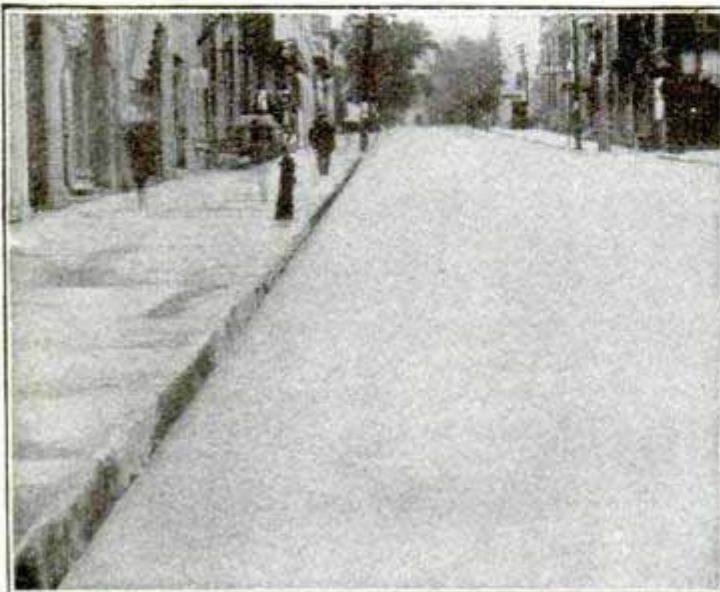
This wardrobe is designed to fill all the requirements for wearing apparel in a gentleman's room. In one compartment are five drawers for the storage of linen and other of the smaller articles worn by men, as well as an open shelf for hats. The other compartment contains hangers for coats and trousers, and is large enough to accommodate several suits. A rack on the inside of one of the doors provides a place for umbrellas and sticks.

MACHINE CONVERTS STONE OR BRICK PAVEMENTS INTO ASPHALT

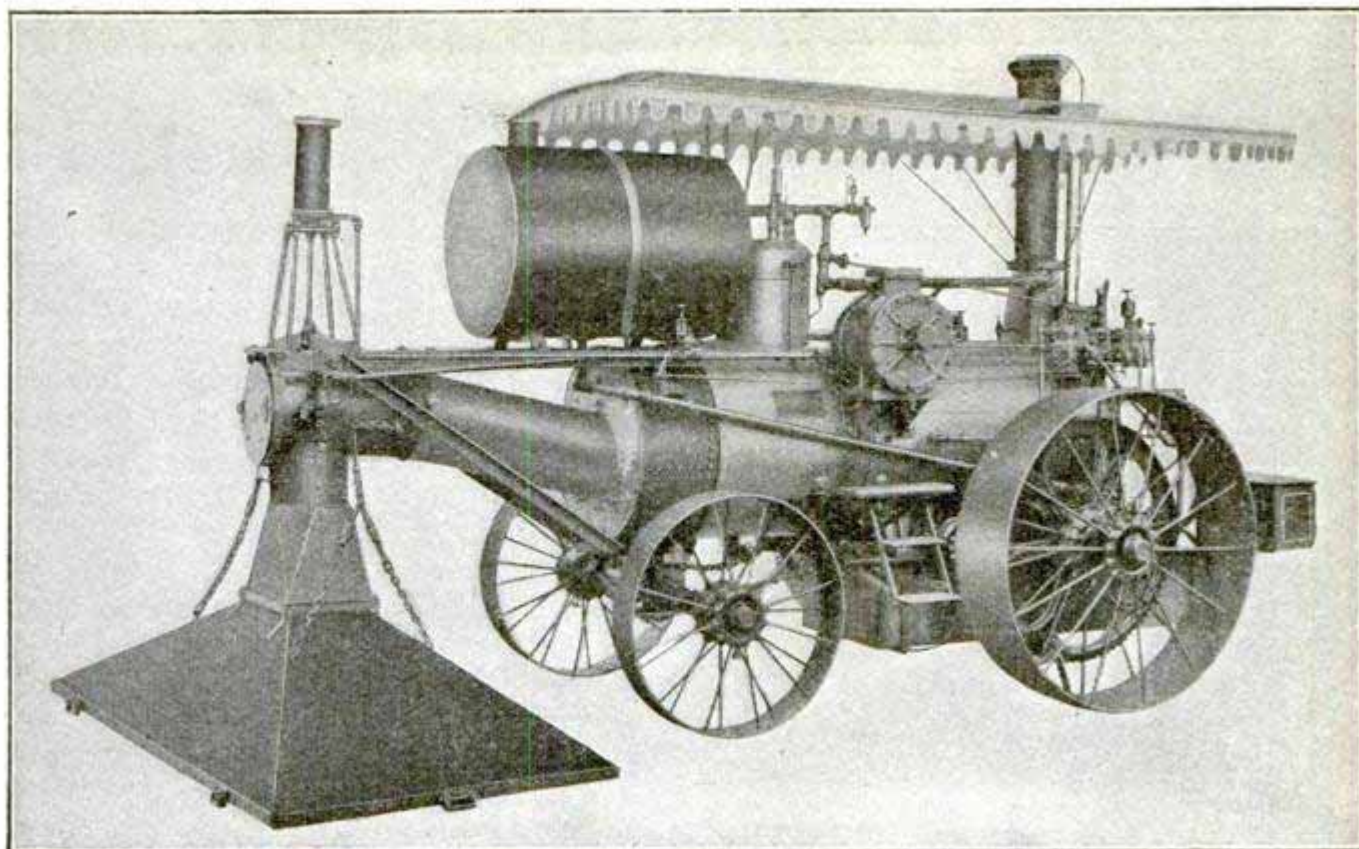
In the older cities of the country stone or brick pavements were laid before asphalt was known. To substitute asphalt by the ordinary methods has necessitated the taking up of the granite blocks, bricks, cobblestone, or other hard materials and substituting concrete foundations; but this machine uses such old pavements as the foundation on which to lay a surface of asphalt.

This is accomplished by heating the old surface with a large and continuous blast of heated air from the machine. Immediately over this heated surface is applied a coat of melted asphalt or other bituminous cement, the heated condition of the stone causing perfect adhesion. No flame is permitted to come in contact with the stone, so that no part of it becomes overheated and cracked. A final layer of asphalt completes the undertaking, thus converting the old, rough pavement into a smooth and noiseless thoroughfare.

The same machine is used for resurfacing or patching wornout asphalt pavements. The fact that the method of heating used brings the old and new material to the same temperature, and to a proper vulcanizing point just be-



Two Views in Same Street, Showing New Paved Portion and Old Paved Section



Machine Lays New Pavement over Old Successfully

fore being tamped, smoothed, and rolled, makes a perfect weld instead of a patch, the repaired part becoming a part of the whole and indistinguishable from it.

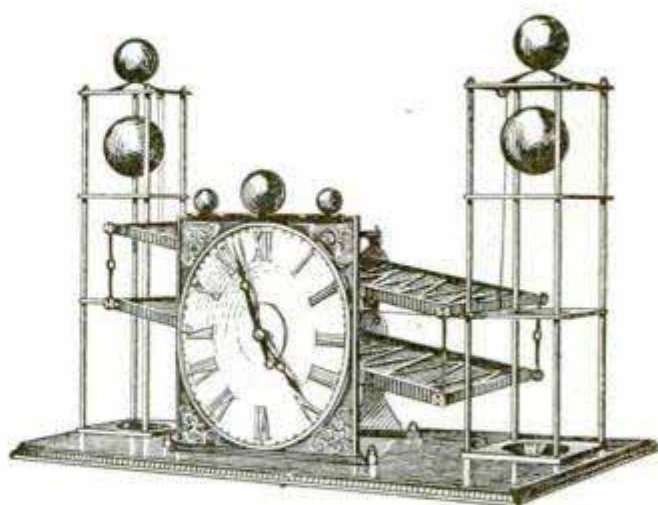
CLOCK WITHOUT WHEELS OR PENDULUM

A clock without wheels or pendulum would seem as helpless as a bird without wings, yet this ingenious clock runs without them and keeps excellent time. It consists solely of two inclined plates with zigzag tracks and the clock framework supporting them. A perforated disc connected with the shaft which journals in the frame, and two ball weights suspended in each tower and connected by means of a cord to the shaft successfully furnish the motive power.

These weights are raised once a day. One-fourth inch steel balls rolling on the inclined plates take the place of the pendulum and gearing. Each steel ball rolls over the two plates in just one minute of time. From the lower plate the ball drops into the lower hole of the perforated disc above mentioned,

this action releasing the disc, which is always under tension imparted to it by the two ball weights.

The disc carries 30 balls, and, when released by the ball rolling into it from the lower plate, turns the space of one hole, or one minute, bringing the uppermost of the 30 balls it contains in position to roll onto the top plate. The ball then begins its zigzag course down

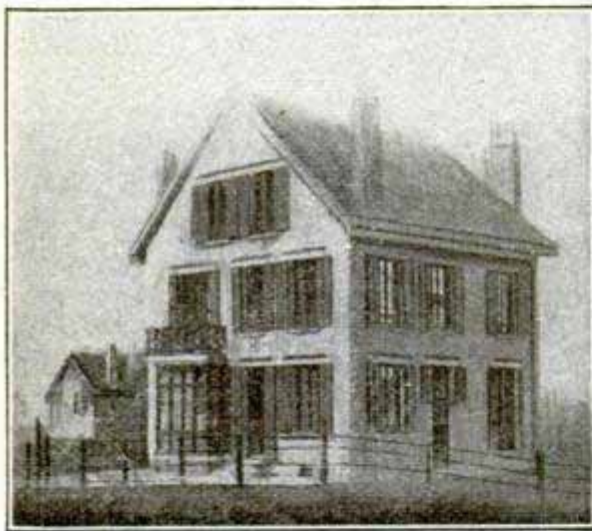
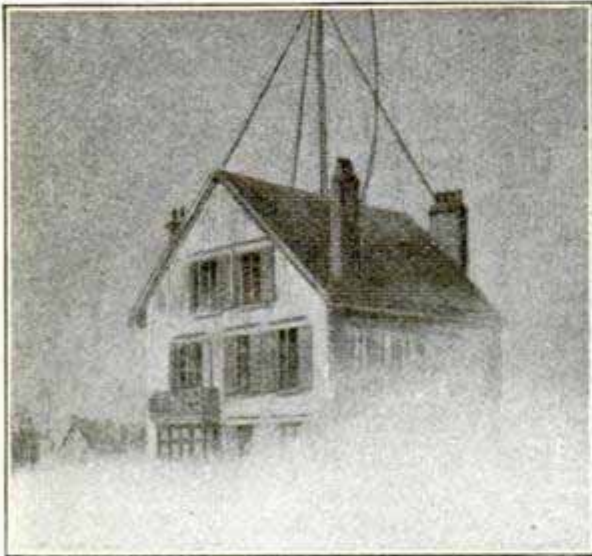


Clock Runs without Gearing

the two inclined plates as did the preceding ball, each of the 30 balls rolling over the plates once every 30 minutes.

DISPERSING FOG BY MECHANICAL MEANS

Two systems of dispersing fog are being experimented with by M. Dibos,



Showing Fog Bank Dissipated by Hertzian Waves

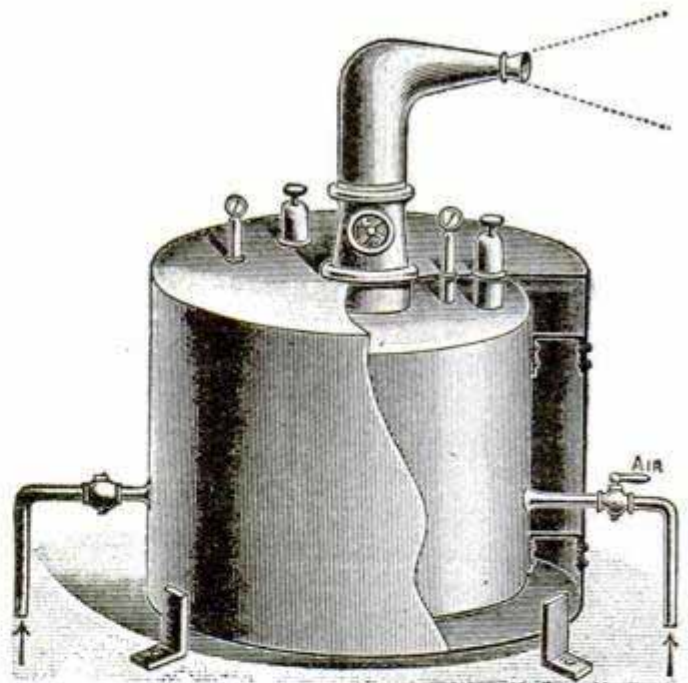
a French scientist. One system is similar to that which has been developed by Sir Oliver Lodge in England, and embodies the discharge of Hertzian waves into the fog. The other system is the projection of warm air into the fog, and so far both have attained about the same results.

The latter system was developed after observing, while taking a chance stroll along the docks at Calais on a foggy day, that the warm air from the stoke holes of the ships were making rifts in the fog for distances extending 100 ft. He therefore devised the apparatus shown in one of the illustrations and by its aid succeeded in making a rift of 400 ft. in the fog. Compressed air

is driven into the central cylinder of the apparatus where it is heated and then projected into the fog.

Not content with the results of this system, M. Dibos next began experiments with Hertzian waves. On the roof of his villa at Wimereux he arranged an antenna with an electric tension of 140,000 volts at its extremity. During a thick fog which could not be penetrated by the eye for more than 6 ft. he succeeded with this apparatus in making rift zones of from 350 to 450 ft. around his villa. The illustrations show the appearance of the house as the fog was being dispersed.

M. Dibos is now attempting to combine the two systems, thereby hoping to disperse fog for distances of 800 or 1,000 ft. His experiments are being watched with great interest, as some practical means of dispersing fog surrounding ships, in the neighborhood of signal towers and posts on railway systems, and in congested parts of cities



Hot-Air Fog-Dispersing Machine

that suffer often and seriously from their effect, would be of the greatest service.

Several residents of Berlin have ordered a dirigible airship for pleasure trips.

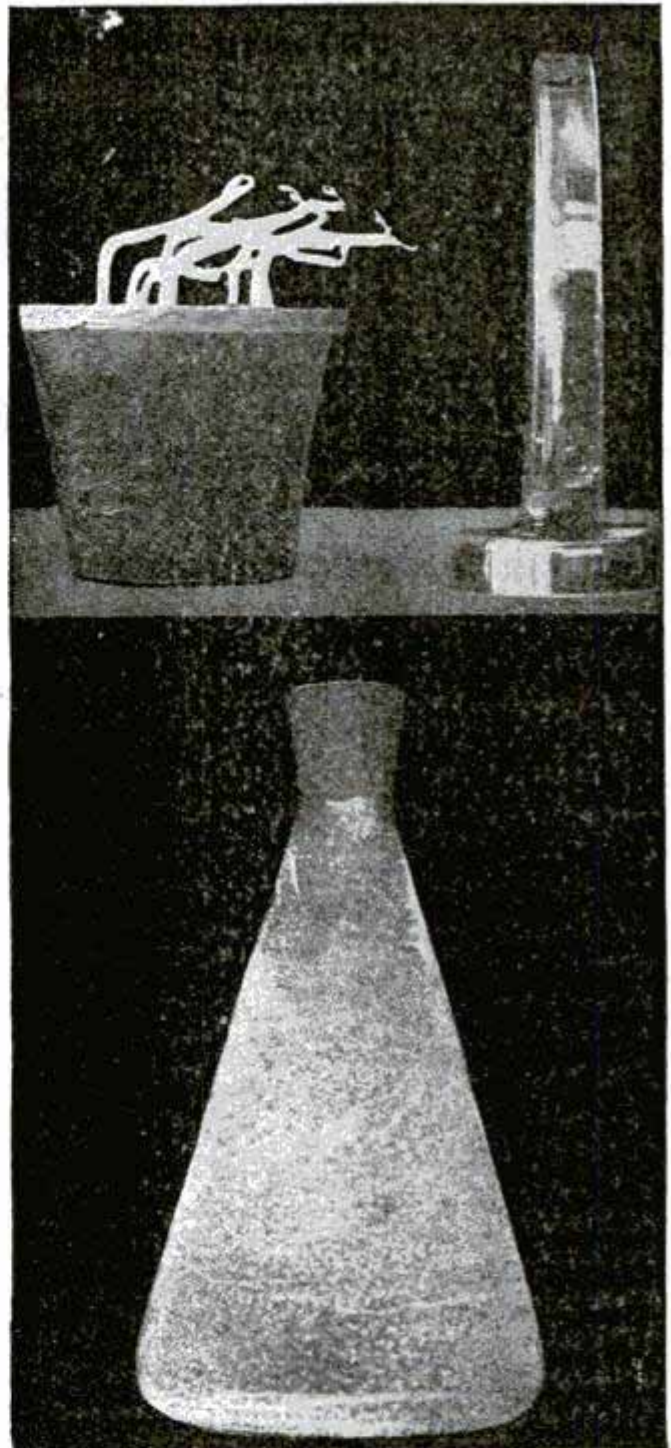
CANADA TO HAVE NAVY

England's fright over the possibility of an attempt to invade her shores by Germany, the talk of the colonies coming to her aid by the building of "Dreadnoughts," and the imperial defense conference held in London in July, have caused Canada to decide to come to the mother country's assistance, but not with "Dreadnoughts," if England will acquiesce. Instead, she wishes to build 8 cruisers, 10 torpedo boats, and 10 destroyers, forming a fleet that will stay in American waters in times of peace and go to England's assistance in times of war. The Canadian government is prepared to pay immediately one-fifth of the cost for laying down the whole fleet, and the other four-fifths is to be guaranteed to be paid within the next five years. Such a fleet would cost Canada from \$15,000,000 to \$25,000,000.

PHOTOGRAPHING BY LIGHT FROM "LIVING" LAMP

The beautiful phenomenon known as phosphorescence of the seas, due to the light given out by certain of the lower organisms, is also exhibited by many plants. Meat, at the state of beginning decomposition, as well as rotten wood and withered leaves, possesses a luminescence readily perceived by the eye when at rest. This phenomenon is due to bacteria, that is, to vegetable organisms settling on the surface of the substance in order thence to spread to other bodies.

Professor Molisch, of the University of Prague, who has closely investigated such phenomena, finds that the luminosity of living organisms is a chemical process giving rise to the formation of a hypothetical substance in the interior of cells, which, in the presence of free oxygen and water, becomes luminous. He has succeeded in preparing with a glass flask filled with sterilized gelatine vaccinated with a culture of luminous bacteria, a "cold lamp," which, although of less intensity than the flame of the smallest candle, perfectly suffices for scientific and photographic purposes.



Courtesy Knowledge & Scientific News, London

"Living" Lamp of Luminous Bacteria

One illustration shows pea germs attracted by this "cold lamp" or "living" light. Another shows the "living" lamp photographed in its own light. The most striking difference between this living light and the light given out by other illuminants is the total absence of heat rays. Nature thus realizes the ideal of modern engineering in this production of light without heat.

A woman's hat was recently made from the skins of eight large rattlesnakes.

WAR OF EXTERMINATION ON ENGLISH SPARROWS

In the rural districts at least, there is no sentiment in favor of the English sparrow. The farmers would exterminate the pest without mercy. As scientists who have studied his habits will tell you, this feathered nuisance is a quarrelsome, vicious, crop-destroying thief and the only voices raised against his extermination are the voices of inexperienced sentimentalists. Various plans have been suggested by the friends of the farmer and horticulturist to mitigate the nuisance, but the really practical solution of the problem must be credited to an Englishman, long resident in America, Mr. James Hunt, of Moorestown, N. J.

Mr. Hunt has known the sparrow from intimate acquaintance with him in England, and he has used his early acquired knowledge to bring to the war that he has waged in Moorestown a variety of deadly machines and devices that are well known in Europe, but have not been tried here. Also he has adopted ideas that have found favor in England, where the sparrow is now regarded as much of a nuisance as he is here. One of these ideas is the organization of Sparrow Clubs, and another is the enlisting of all the boys in the neighborhood in the ranks of the sparrow killers.

It may be imagined with what zeal boys will enter into such a work as this. The sport of bird-nesting is a craze with the average boy, but he nests in fear of the wrath of parent and Sunday School teacher, who regard the despoiling of the home of the feathered innocent with horror. But here comes a philanthropist who not only begs the boys to rob the sparrow of his habitation and of his offspring, but actually offers a reward for the production of the evidence of such despoiling. The plan in Moorestown has been to offer the following gifts to the sparrow hunters:

	Per Doz.
For the heads of mature birds.....	10 cents
For the bodies of nestlings.....	8 cents
For eggs.....	6 cents

To encourage adults to join in the

war, prizes were offered to those destroying the most birds, with an annual supper, at which prizes were distributed and speeches made.

Of the many devices that have been used in the war, the most interesting is one called the "clap-trap" with which thousands of sparrows have been caught. A dark still night is selected for the work and the net, which is simply a mesh of strong twine stretched on parallel poles, is taken to where the birds are roosting in the ivy-covered walls of a church or in the bushes. One of the poles is rubbed against the place where the birds are sleeping, the other pole being kept a foot or so away. The frightened birds flock from the roost, the outside pole is clapped around so as to enclose them in the net as they fly from the roost, and the rest is a mere matter of putting them out of their misery quickly. A variation of the process is to hold the entire net away from the roosting place and hold a strong light behind it. An assistant then stirs the birds up with a pole and they fly into the net where the light attracts them.

"During the present war," says Mr. Hunt, "I caught and killed 82 sparrows in half an hour by means of this useful net. They were roosting in the ivy growing around the Episcopal Church. At another time I caught 118 birds; on still another occasion 55 and a little later 45 more, making a total of 300 birds in three hours."

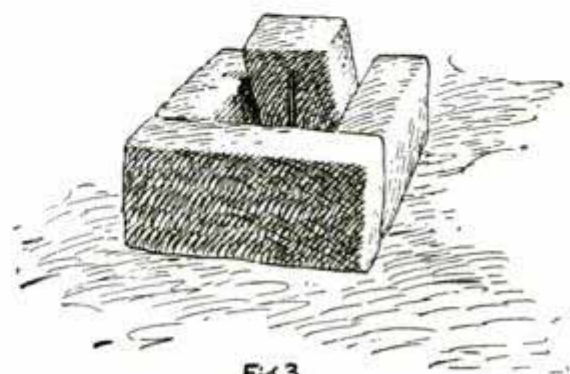
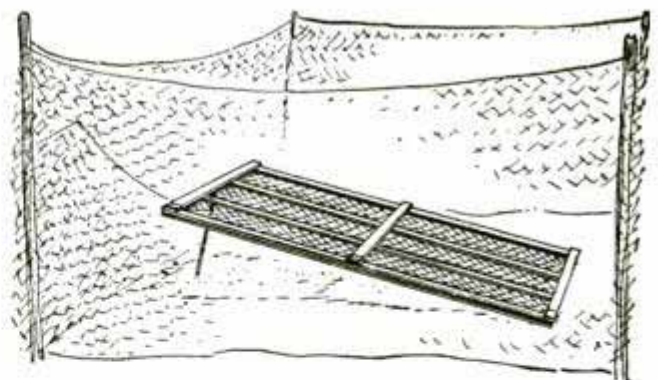
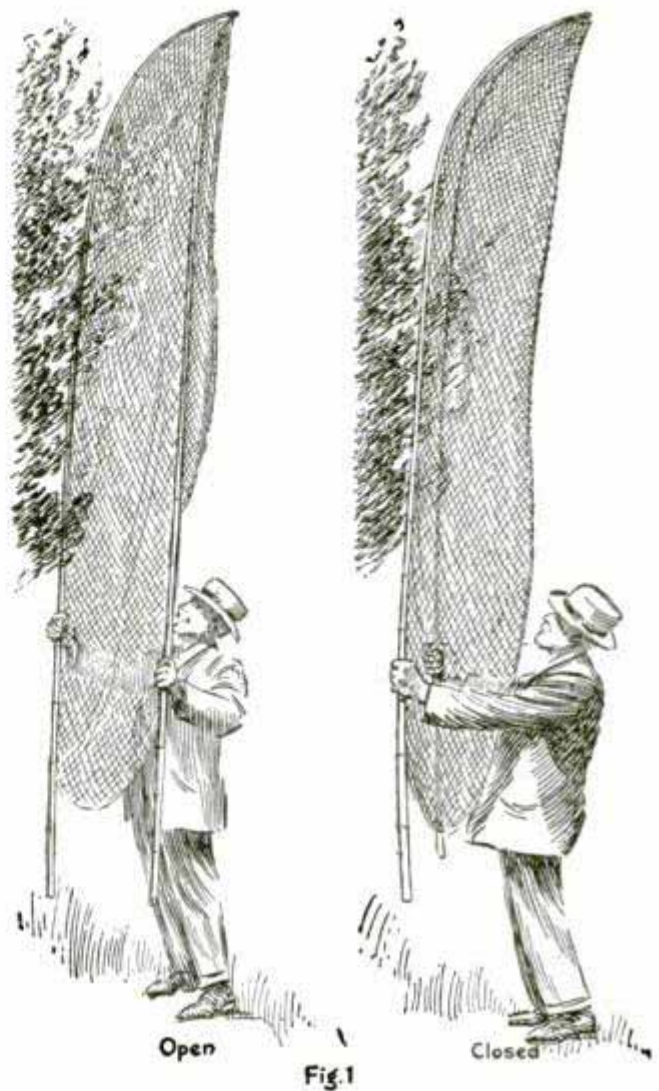
The boys take kindly to the clap-trap method of catching the sparrows and soon learn how to use the net that is adapted for daylight trapping. Two nets used are about 4 yd. long by 3 ft. or so wide. The nets are laid on level ground with an open space of 6 ft. between them, on which feed is spread. The experts who have carried on the war at Moorestown recommend patience and cunning in using the day net. To make a fine haul, they say it is necessary to keep feeding the birds and leaving the nets alone until the sparrow begins to regard the vicinity

of the trap as a free lunch establishment. They will then gather in greater and greater numbers until the ground between the nets is almost covered with them. Then a long line is pulled and under the leverage of short rods the nets clap together too quickly for the birds to escape, and in this way as many as seven dozen sparrows can be caught at a time, with one pull of the line.

Here are some additional hints given by Mr. Hunt, culled from his experience in the sparrow war: Poison should be used very carefully, or chicken or other life may be sacrificed. The best plan is to soak small wheat grains in poisoned water after which they may be used wet or dry. Bread crumbs or any other suitable feed may be used, but wheat or oats are the best. Wheat or any other feed may be well soaked in strong alcohol and those who have tried this say it makes the sparrows easy victims.

The pyramid trap is made with straight sticks and string. The end of the sticks cross one another and strings are made fast at the four bottom corners of the trap and are brought up over the ends of the sticks and made fast on top, twisted together with a short piece of stick. The top of the trap is covered with a light piece of board that can be slipped on one side to permit the arm being put through to catch the captives.

The basket trap is a deadly one when young sparrows are about. The trap is made with fine willows. The bottom may be of wood, or plaited willows and the rods form the outside of this circular trap, the fine ends being turned over to form a kind of funnel toward the bottom of the trap. The funnel slopes gradually so that feed can be placed upon it and the birds easily run up and down upon it. The end of the funnel goes near enough to the bottom of the trap to permit the birds getting under and into the bottom of the trap. The brick trap is a simple device, but it catches only one bird at a time and wholesale catching and killing is the better way.





This Cask Has Been Where Never Man Was

CASK FLOATED PAST THE POLE

Some ten years ago Rear-Admiral Melville and Henry G. Bryant, now president of the Geographical Society of Philadelphia, set 50 casks adrift on Bering Strait off the northwest coast of Alaska. This barrel is one of them and after being adrift for 10 years it was picked up last November off the coast of the island of Sora, which is north of Norway. The passage of the cask into the Atlantic proves that there is a drift flowing northeast through the Arctic waters. It is believed that the cask in its long journey must have passed close to the Pole.

COFFEE MILL DRIVEN BY BICYCLE POWER

A Kansas City grocer has an ingenious arrangement by which he grinds coffee for his customers and gets healthy exercise at the same time. When considerable coffee is to be ground, he props his bicycle up as

shown in the illustration, connects its rear wheel by pulley to the coffee grinder, and stations a boy at the hopper to pour the coffee in. He then mounts the bicycle and begins to tread slowly, as if climbing a steep hill, then gradually increases his speed and bends low over the handle bars until the coffee mill is fairly humming.



Bicycle Power Plant

PRIVATE ELECTRIC LIGHTING PLANT FOR \$550

Installation, Care and Operation of Plant—Competent Person Must Install Apparatus and Do the Wiring—Instructions Furnished by Companies from Which Storage Battery and Engine Are Purchased Must Be Closely Followed—Cost of Operation Is Practically the Cost of Gasoline to Run the Engine

In the following pages is completed an article, condensed from data compiled by T. H. Amrine, of the Illinois University engineering experiment station, giving a concise idea of an inexpensive plant for the private electric lighting of a home. The matter published in the July issue dealt with the selection of fixtures, plan of lighting, estimate of cost, and how to determine the requirements for and the size of the plant. This part deals with the installation, care and operation of such a plant.

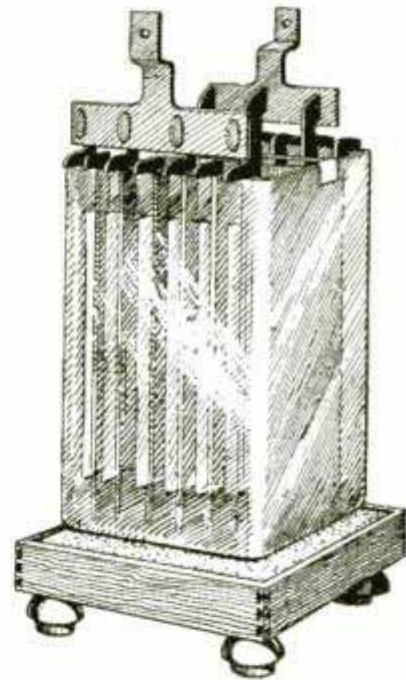
Part II

Before attempting to use such a plant, full and complete instructions should be obtained from the various companies for the care and operation of the apparatus supplied by them. This is especially essential for the engine and storage battery. All dynamos such as are used for charging a battery are near enough alike so that instructions for the care of one dynamo would apply equally to all, but gasoline engines and storage batteries differ enough to require explicit instructions from the company furnishing them.

It is presumed that a competent person will be obtained to install the apparatus and do the wiring. Such a person can be found in any small city, and it will be more satisfactory to employ him than for a novice to attempt the work. It is seldom, however, that even a man who is perfectly competent to install the machines and do the wiring knows much about storage batteries. It would be well, therefore, to insist that he follow the general directions here given.

The engine, generator, and switch-board should be installed, tested and ready to operate before the storage battery arrives. The cells of the battery should then be unpacked and assembled according to the directions furnished by the company. A strong set of shelves should be built upon which to place the battery, and it should be remembered in building them that

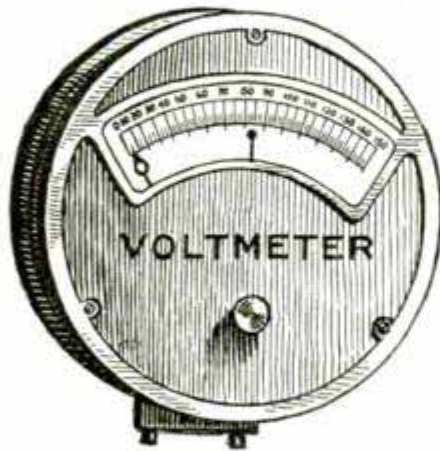
nails and bolts are soon corroded and weakened by the acid fumes. These shelves should also be arranged so that there is plenty of room around the battery for an easy examination of the plates and testings of the voltage and density of the electrolyte. If the cells are placed in two rows, one on top of the other, there should be a space of at least 1 ft. between the top of the lower cells and the bottom of the top shelf. Wooden trays and insulators are usually supplied by the company furnishing the battery. Each of these trays is filled with sand and placed upon four of the



One Cell of Battery

insulators. The battery jar is then set upon the sand, and adjusted so that it is level and has a bearing over the entire bottom. The cells are connected so that the positive plate of one cell is connected to the negative plate of the next through the entire battery. Great care must be taken to connect the positive plate of the first cell of the battery to the positive terminal of the dynamo. They are easily distinguished from each other, as the positive plate of the battery is of a dark brown color and the negative a sort of yellowish gray

color. The positive terminal of the dynamo can be found by tracing back from the switchboard voltmeter. Have the dynamo running and connect the



voltmeter to the dynamo terminals so that it reads in the proper direction, then trace from the voltmeter terminal marked "+" back to the dynamo. The terminal to which it is traced will be the positive one. Care should be taken that this terminal leads to the end of the battery having the first plate of a brown color.

The acid solution, or electrolyte, should in no case be put into the jars until everything is ready to begin charging the battery. After the solution is put in, the engine and dynamo are started up and the rheostat adjusted until the proper charging current is indicated upon the ammeter. As a precautionary measure, it is well before closing the switch to the battery, to adjust the rheostat until the voltmeter reads about 30 volts. Then the switch is closed and the rheostat adjusted until the battery is charging at its 10-hour rate.

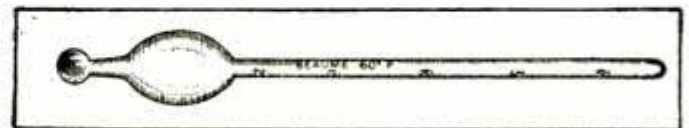
In the case of the 40-ampere-hour battery, this would be approximately 4 amperes. The electrolyte, which should be obtained ready mixed from the battery company, should show a specific gravity of about 1.17 at the beginning of the charge. The charging should be continued for 10 hours a day for about 3 days, or until the electrolyte bubbles freely. The specific gravity of the solution and the voltage of the cells will then have reached stationary values at about 1.2 specific

gravity and 2.5 volts. During this charge the current should be kept at a constant value of about 4 amperes by the adjustment of the rheostat. The battery may then be used for lighting until discharged down to about 2 volts per cell, after which it should be given another thorough charge. This system of moderate discharge and thorough charge should be kept up for two or three cycles of charge and discharge, after which the battery should be in a first-class condition.

These general instructions apply to almost any type of battery, but if explicit instructions for the preliminary treatment of the battery are furnished by the storage battery company, they should be followed closely instead.

After the preliminary treatment of the cells the battery may be charged at any convenient time, no matter whether fully discharged or not, but there are two things that must always be borne in mind. The first is that the cells must not under any circumstances be discharged below 1.8 volts per cell and preferably not below 1.9 or 1.95 volts. If discharged to a too low voltage a harmful white sulphate forms upon the lead plates. This sulphate always forms when the plates are being discharged, but if the discharge is not carried too far, it is destroyed or reduced when they are charged again. The second precaution is to be sure that the battery gets a thorough charge up to 2.5 or 2.6 volts per cell every week or so. This will reduce the sulphate that has formed on discharge and will keep the cells in good condition.

The voltage and the density, or specific gravity of the electrolyte of each



Hydrometer

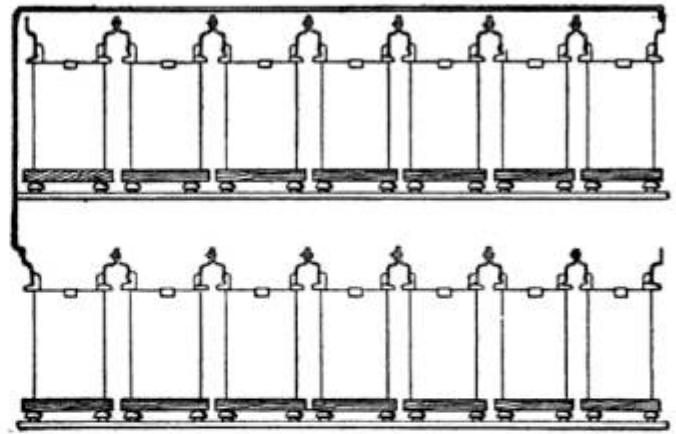
cell, should be observed at least every two weeks and the battery company notified and asked for advice if either seems to show unusual values. Two devices are required for this purpose, one being a hydrometer and the other

a voltmeter. The hydrometer, which is a small glass instrument similar in appearance to a thermometer, is placed in the solution between the plates of the cell, care being taken that it floats free of the plates. It will sink so that more or less of its stem is immersed in the liquid. This stem has a graduated scale and the reading taken at the surface of the liquid gives the density, or specific gravity of the electrolyte, that is to say, how many times heavier it is than pure water. The voltmeter needed will measure up to about 3 volts and is portable. It is used for determining the voltage of each individual cell.

As has been stated above, the voltage per cell should vary from 1.8 volts at the lowest allowable discharge to about 2.6 volts in the fully charged condition, dropping to 2.2 or 2.3 when the charging current is stopped. The specific gravity should not fall below about 1.18 when discharged nor be above 1.24 when fully charged. When the batteries are well cared for, the density will usually remain about correct, if periodically filled up with pure water to supply the loss by evaporation. It is best to use nothing but distilled water for the cells, but if not obtainable, good, pure filtered rain water may be used, and the battery should be charging at its normal rate when filling them up, this causing the water to mix more quickly with the electrolyte and preventing the harmful results caused by having the electrolyte of non-uniform density.

The battery should not be allowed to stand idle after discharge has taken place. Put it on charge as soon as possible after it has dropped to a voltage of about 1.9 volts per cell. Sediment should not be allowed to collect in the bottoms of the battery jars. If it does, the cell should be fully charged, removed from the battery, the electrolyte drawn out, and the sediment removed.

The color of the plates gives a good indication of their condition, and should be carefully watched. When first set up the negative plates are a yellowish gray and the positive dark brown, as



Arrangement of Batteries on Shelves

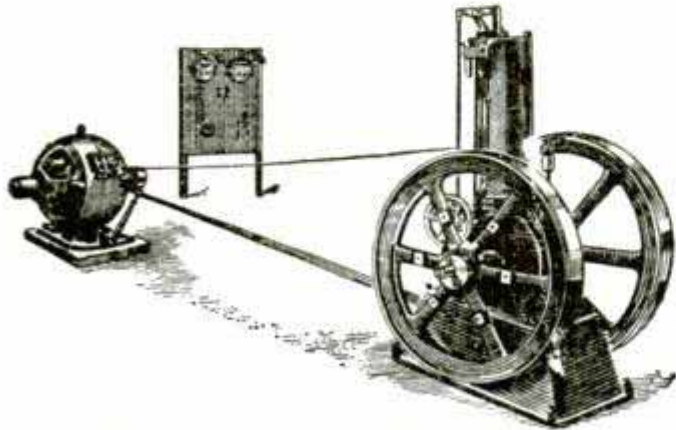
already mentioned, usually spotted with whitish or reddish gray substances. These spots are sulphate and should disappear when the cell is fully charged. When in good operating condition the positives are dark red, chocolate or plum color, becoming nearly black when charged. If fully discharged, the whitish or reddish patches of sulphate appear. The negatives are a sort of pale slate color that becomes darker as the plates are charged. When in good condition the surface of the positive plates is soft and the color will rub off on the finger. When in bad condition the surface is usually hard.

Voltmeter reading of the cells should be taken while the battery is discharging in order to get a good idea of the true condition of the cells. Often a cell, when standing idle, will indicate a voltage of perhaps 2.0 volts, but as soon as any current is taken from it, the reading will immediately drop to a much lower value.

The engine room should be heated in the winter to keep the battery solution from freezing. A low temperature of the electrolyte decreases the capacity of the battery to a marked extent.

The principal things to watch about the dynamo are the bearings, the commutator, and the brushes. The bearings should always be kept supplied with a good quantity of oil, and watched to see that the oiling rings rotate freely when the machine is running. If there is any sparking at the brushes they should be examined to see if they fit the commutator perfectly at every point. If not, they should be sandpapered carefully. To do this a

strip of extra fine sandpaper, a trifle narrower than the commutator is long, should be used. Lift the brush and slip the paper under it with the smooth side next the commutator, then, after letting the brush down and holding the paper snugly against the commutator, carefully draw the paper under the brush in the direction which the com-



Dynamo, Switchboard and Gas Engine

mutator turns when the dynamo is in operation. Lift the brush, remove the paper, and repeat the process until the brush fits perfectly.

When the commutator is in good condition it will not have a bright metallic copper color, but a fine dark luster. If the commutator is bright after operating for a while, the brushes probably bear too hard or else there has been sparking. Occasionally the commutator should be cleaned by holding a soft rag, slightly oily, upon it while the dynamo is running.

The principal cost of running such a plant is the cost of operating a gasoline engine. A 2-hp. engine will run upon about 5 cents' worth of gasoline per hour when carrying a full load. When the engine is driving the dynamo alone it is giving about .7 hp. and the cost of gasoline is about 1.8 cents per hour. In giving these figures it is assumed that gasoline costs about 18 cents per gallon.

The dynamo costs but very little to operate, almost the only item being oil for the bearings. The storage battery requires no supplies except the occasional addition of sulphuric acid to the electrolyte of those cells whose specific gravity has fallen low. The acid costs

5 or 6 cents a pound, and only a small quantity is needed.

Depreciation is the most costly item in storage battery operation, and this depends altogether upon the treatment of the battery. It matters not how good or how poor a cell may be, careless treatment will reduce its life of useful service to a few months. The cost of maintenance or making good this depreciation is practically that of renewing the plates. With careful use the positive plates of the battery probably will not need renewal in less than 4 or 5 years, and the negative plates in 8 or 10 years. This should make the average annual cost of maintaining the battery no more than \$8 or \$10.

ENGLAND'S TRIBUTE TO U. S. NAVY

An English naval journal of the highest standing has the following to say of the English and American navy:

"The 'Dreadnought' and all of its successors in the British navy—the 'Bellerophon,' 'Temeraire,' 'Superb,' 'St. Vincent,' 'Collingwood,' 'Vanguard,' and 'Neptune'—are the most weakly armed of all modern battleships now under construction in the world.

"The United States has pursued a consistent course in the development of its 'Dreadnought' policy. It laid down the first all-big-gun ships in 1906. They are the 'South Carolina' and 'Michigan,' each 16,000 tons, and although they carry only eight 12-in. guns, they can fire the whole of them on either broadside, and may thus be reckoned as almost equal to the 'Dreadnought,' which, with 10 guns, can obtain no more effective broadside fire.

"In the following years, while Great Britain stuck to the 'Dreadnought' design, the United States went one better than its 1906 ships and produced designs for two new vessels—the 'Delaware,' and 'North Dakota'—of 20,000 tons each, armed with ten 12-in. guns. The whole of the five turrets are placed on the center line of the ships, so that here again the full armament of 12-in. guns can be brought to bear on either

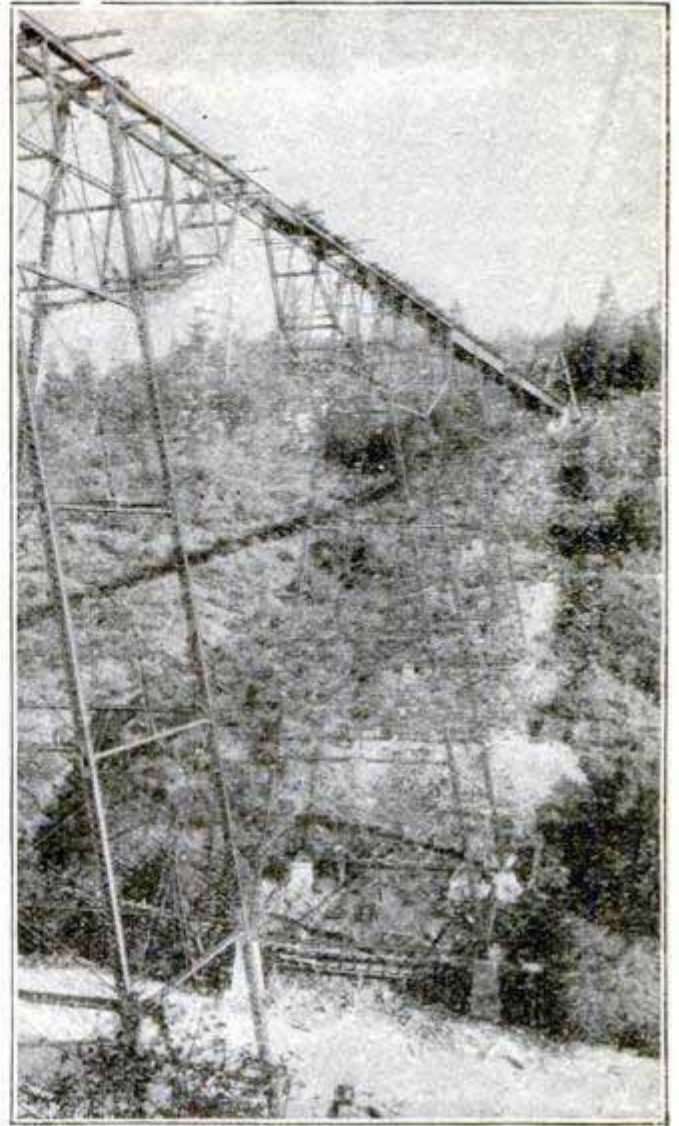
broadside. This is two more than the British 'Dreadnought.'

"In 1908 the 'Utah' and 'Florida,' which are similar to the 'Delaware,' were laid down, but this year a further step has been taken. Two ships are to be laid down, their names being 'Wyoming' and 'Oklahoma.' They are not only to be the largest in the world—their displacement being no less than 26,000 tons—but will carry an armament at least 50 per cent more effective than that of the 'Dreadnought.'

"Their 12 guns will be arranged in six turrets, all disposed on the center line, and the full capacity will be available on either broadside. The weight of the 'Wyoming's' broadside will be 10,200 lb. with these guns alone, to the 6,800 lb. of the British 'Dreadnought' and its successors down to date."

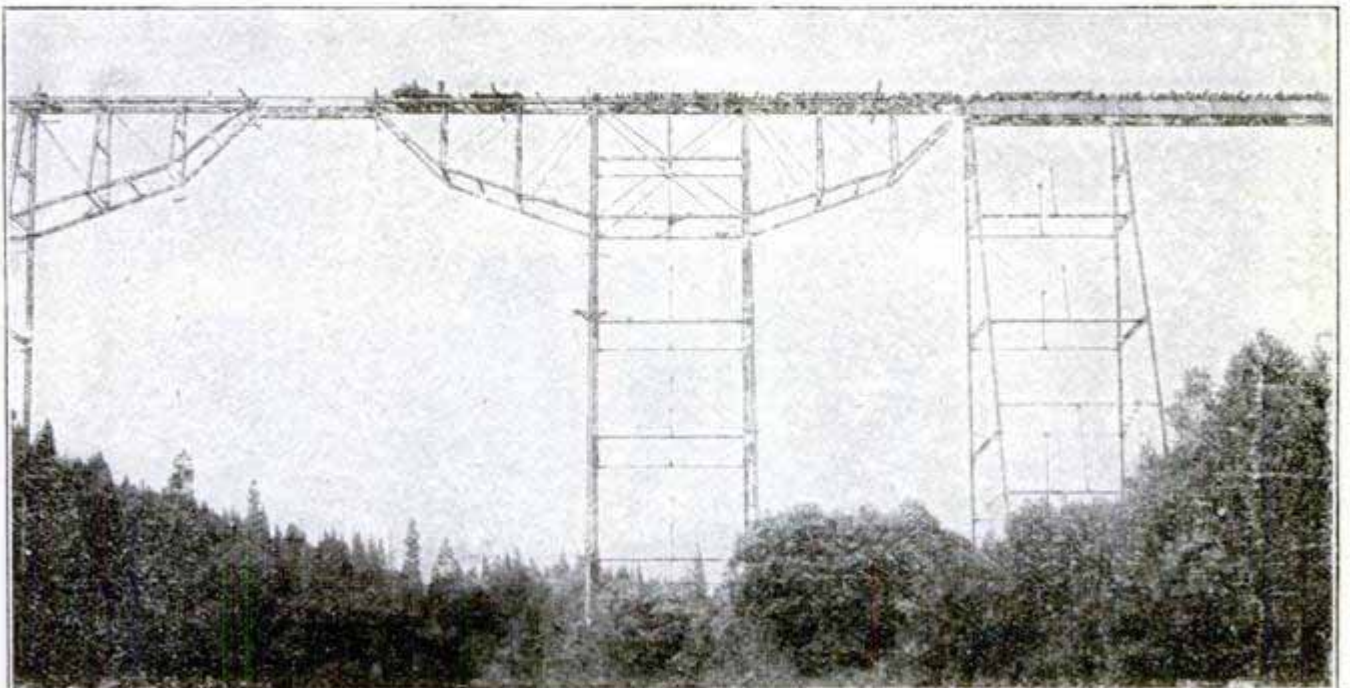
HIGHEST BRIDGE IN CALIFORNIA

The new steel cantilever bridge across the Bear river near Grass valley, Cal., is said to be the highest in that state. One feature of the construction is the fact that the bridge has no approaches, the banks on each side being very high and abrupt. The distance from abutment to abutment is 800 ft. and the height above the rushing



"The Banks Are High and Abrupt"

waters of the river is 200 ft. It replaces an old railway structure that was 100

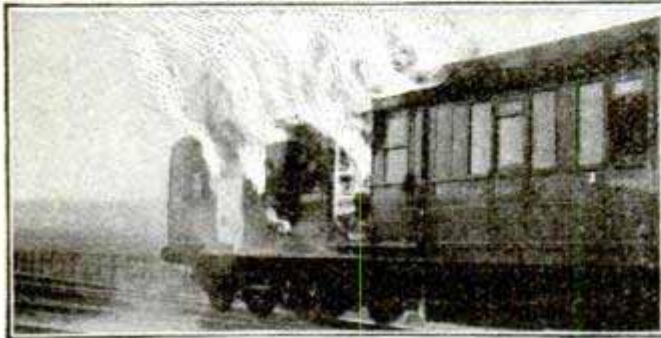


A Bridge Without Approaches—200 Feet High

ft. lower. The additional height of 100 ft. above the river was necessary to secure a better grade, and in so doing, shortens the length of the line about three miles. All of the steel material, as well as the concrete, was swung out to position on a $2\frac{1}{4}$ -in. cable.

TRAIN FIRE IN ENGLAND

While the Scotch express of the Great Northern Railway of England was recently speeding from London to



Train Catches Fire at High Speed

Edinburgh, the overheating of an axle caused one of the mail coaches to catch fire. No water being available, the car was uncoupled from the rest of the train, pulled down the tracks a short distance, and allowed to burn itself out.

USING A RING LIFE PRESERVER

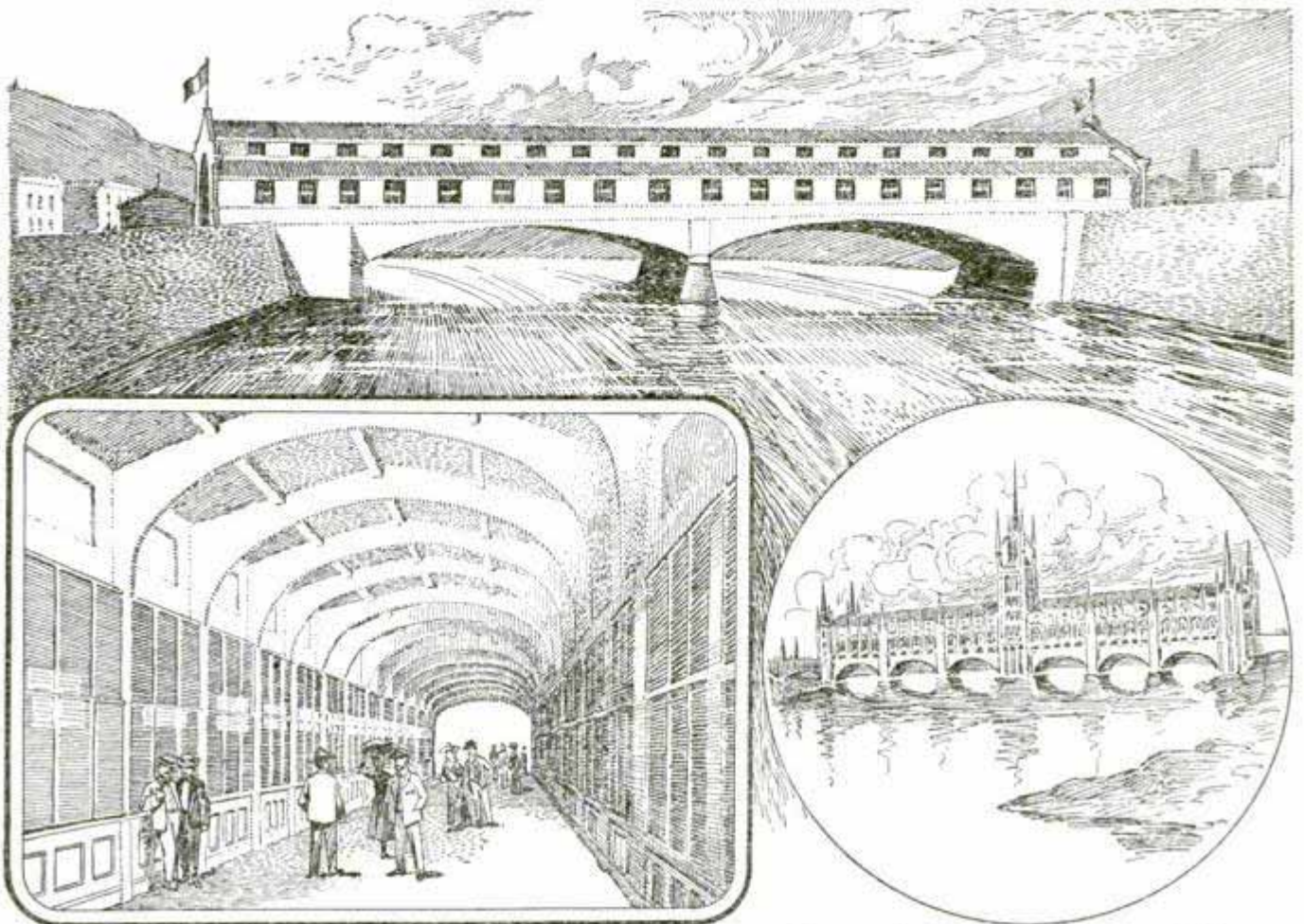
On all steamships and many docks are life preservers of the ring type, to be thrown to persons struggling in the water. The proper way to approach or grasp such a life preserver in the water is to take hold of the side nearest and press down with all your weight. This causes the further side to fly up in the air and down over the head. The average person struggling about in the water would try to lift up the big life ring and put it over his head, this causing him to sink deeper.

PHILIPPINE SUGAR MILL

The method of sugar manufacture in the Philippines, as shown in the accompanying photograph, is crude and primitive. Although the islands produce great quantities of sugar, supplying the local markets and those of China, but one or two refineries having a semblance of latter day methods are to be found in the archipelago. The sugar mill shown herewith is one of the countless used by small planters. The motive power is furnished by the slow-going carabao while the mill is fed by hand.—Contributed by Monroe Woolley.



Sugar Mill Used by Small Planter in Philippines



Utilizing Bridge Space for the Sale of Wares
Arcade Bridge in Mexico

Suggested Hall over a London Bridge

STORE ARCADE BUILT OVER CONCRETE BRIDGE

The idea of making use of a bridge as a foundation for an arcade of stores and booths, and the passageway between these stores as the means of crossing, is aptly demonstrated by this unique reinforced concrete arcade bridge in the city of Monterey, Mexico.

The arcade is 200 ft. long by 52 ft. wide, and has an outside wall height of 10 ft. 6 in. A clear roadway of 19 ft. 6 in. occupies the center, and the floor space on each side is divided into 20 stalls or stores, each being 10 ft. wide by 16 ft. long. The building is entirely of reinforced concrete, with the exception of the wooden counters, the expanded metal screens in front of the stalls and the windows. The walls are 3 in. thick.

The illustrations show the exterior of the concrete bridge and arcade, the interior of the arcade, and a suggested hall to be built over a bridge on the

Thames for the London County Council. The latter is used because of the contrast.

THE VALUE OF CITY-OWNED WATER-FRONTS

Toronto, the leading city of Canada, sets an example in the control of waterfront property that should be a lesson to every city in the United States bordering on waterways. Four years ago Toronto owned only one-half mile of water frontage, now it owns nearly four miles, and a great sea wall is to be constructed along its entire length.

As an example, showing the other extreme of municipal foresight, Buffalo, N. Y., is struggling to regain some of its water frontage lost by blunders and neglect in the past. The handicap is a difficult one to overcome, and many other cities in the United States are fighting the same conditions.

THE DINING ROOM OF A CIRCUS

The tented dining room of a certain big circus is one of its most important adjuncts, and also one of the most interesting to the people who throng the



Requires 5,000 Pancakes for Breakfast

show grounds before the afternoon performance. The circus train travels in five sections, the first section containing the kitchen and hotel outfit. It has the right-of-way over all the other sections, and is known in one of the big shows as "The Flying Squadron."

The discipline of an army reigns supreme in circus life, and it is always interesting to watch how the thousand or more people of such an organization are fed three meals a day without a hitch, and as silently as in a big hotel. The grass serves as a carpet, and the 40 or more waiters move quietly in and out. The kitchen tent is completely equipped with pastry ovens, warming tables, steam vats for stewing, steam urns for coffee and tea, boiling ovens, and numberless other cooking utensils. The force of cooks numbers 16, including the three which tend the camp fire, at which nothing but soup is prepared. The ranges fold up and are carried in wagons, and the tents are lighted with electricity at night. It is not unusual

to serve as many as 5,000 pancakes for breakfast, and 600 loaves of bread are used each day, in addition to crackers and biscuit. The meat consumed each day is somewhere near 1,000 lb. Such provisions as celery, young onions, strawberries, radishes, melons, etc., are bought in each town, often cleaning out the entire market. An advance agent of the commissary department keeps well in advance of the show, contracting for its supplies, for man and beast. When, through some accident such as washed out bridges, the circus is obliged to change a date on a few hours' notice and give the day's performance in another city, there has to be some lively work to provide the food.

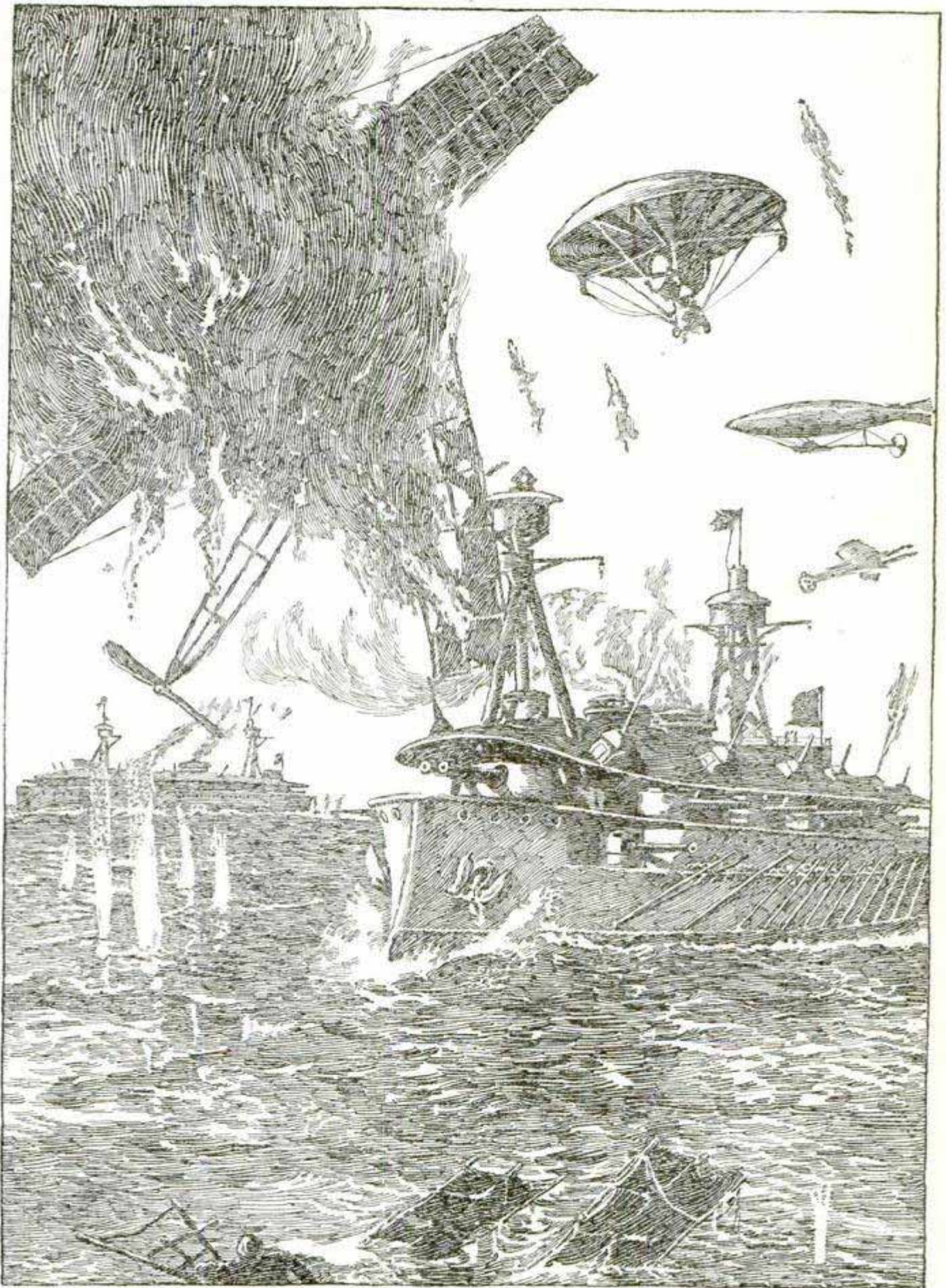
FUTURE AERIAL AND SEA WARFARE

The knowledge that the airship will play an important part in the next great war has made the necessity of devising ways and means of fighting them a vital one. Already, Germany, as has been shown in recent pages of this magazine, has devised guns of many types and kinds with which to do battle with aerial craft, but this imaginary battleship, specially designed for fighting enemies in the air, is the idea of the English.

Airship-destroying battleships driven by internal combustion engines probably will be provided with some kind of armored overhead protection along the turtle-back design shown in the illustration. Small, but powerful, rapid-fire guns, protruding through the turtle-back armor, may drop the flying-machines like wounded birds, while the explosives projected from them will be deflected.

Such an idea is as yet only a dream, but so were airships only a few short years ago.

A hotel on wheels, nearly 4 miles long and made up of 300 Pullman sleepers, stood on the beach tracks near Ocean Park, Cal., for the use of the Elks during their annual convention last month.



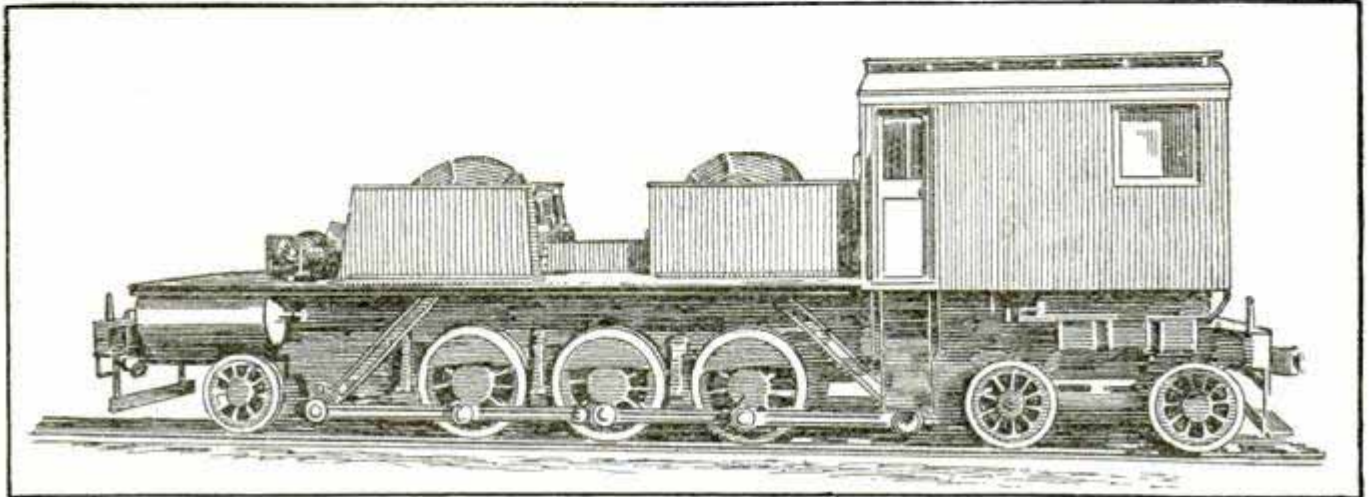
Courtesy London Sphere

Battleship Specially Designed for Fighting Airships

STEAM TYPE OF LOCOMOTIVE DRIVEN BY ELECTRICITY

This novel electric locomotive retains many of the principal features of a steam locomotive, embodying, in fact, a return to steam locomotive practice, the one vital difference being the substitution of electricity for steam. The

lb., slightly less than the maximum weight of a high-speed steam locomotive, but much higher than the usual type of electric locomotive. A tractive force of 30,000 lb. is developed at a speed of 18 miles per hour.



Motors Connected to Driving-Rods as in Steam Engines

motors, which are 800 hp. and two in number, are mounted on top of the frames of the locomotive and are connected to the driving wheels by rods and cranks, instead of having the armatures geared or mounted directly on the driving wheels.

These motors are capable of driving the locomotive at a maximum speed of 50 miles per hour, and will operate equally well when running in either direction. The frame and running gear are similar to those of steam locomotives. There are three pairs of coupled driving wheels, 49 in. in diameter, a radial 2-wheeled pony truck with wheels 36 in. in diameter at one end, and a 4-wheeled bogie truck with 36-in. diameter wheels at the other end. The total wheel base is 36 ft. 3 in., but the rigid wheel base is only 10 ft., which will permit rounding the sharpest curves. The wheel arrangement corresponds to what is known as the "Pacific" type in the steam locomotive.

The total weight of the locomotive is 250,000 lb., of which 162,000 lb. is carried by the three driving axles. This gives a weight for each axle of 54,000

The fact that the motors are mounted on top of the frames permits the use of armature bearings of exceptionally large size. With such bearings there is no danger of the armature dropping on the pole pieces, therefore the air gap can be reduced to a minimum. The entire weight of the motor field and the armature, being carried on the frame, is spring supported, and no severe shocks are produced by dead weight carried on the axles. For each revolution of the motor armatures, the driving wheels make one complete revolution and the two motors revolve in exact unison.

Tests have demonstrated that the design is entirely satisfactory, both mechanically and electrically. The fact that the motors are located in the cab, where they may be easily inspected and adjusted, and also where they are out of the way of dust and other foreign material, means, it is believed, that the cost of maintenance of electric locomotives will be greatly reduced. The design also permits the use of driving wheels of small diameter and motors of comparatively large size.

PROPOSED INTERNATIONAL WIRELESS WEATHER REPORTS

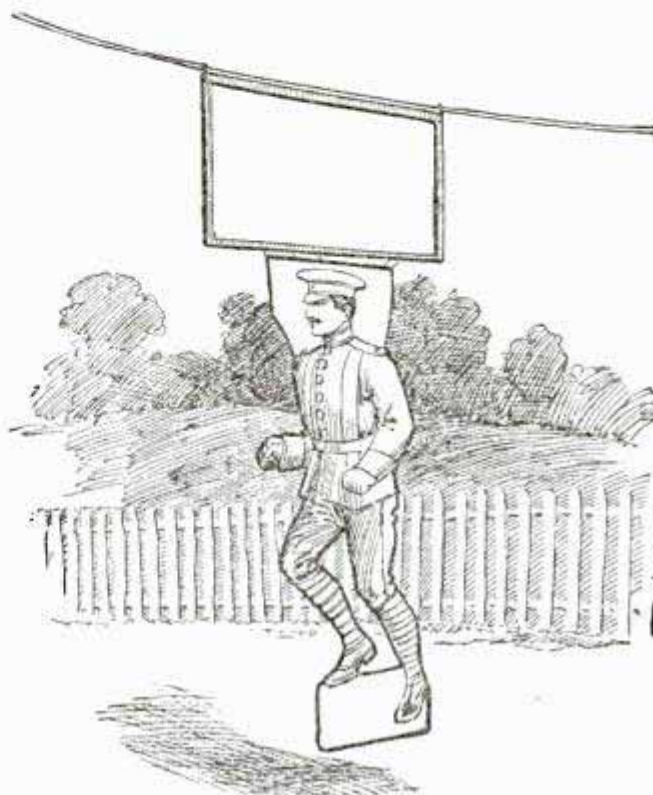
Weather reports by wireless will be discussed by the International Conference of Meteorologists at London next month. The scheme would be only an extension of the service now given to each other by steamships. Conditions of sea and sky and wind for from 300 to 1,000 miles ahead are now regularly in the possession of ship captains. It is argued that the systemization of such news, and the flashing of it between nations in a code mutually agreed upon, would be of great benefit to mankind. Willis Moore, chief of the United States Weather Bureau at Washington, is heartily in favor of the plan. As merely local predictions would not be sent across the sea, his own most famous prophecy of fair weather for Taft's inauguration would not go by wireless to astound Tokyo and petrify Budapest.

A BRICK CONVEYER FOR PAVERS

This is an illustration of a set of conveying rolls devised to facilitate the work of pavers. By the use of three of these conveyers, four loaders and three pavers have laid 1,500 sq. yd. of paving per day. The conveyers are usually 16 ft. long, but can be made any length. Two boards carry between them a train of spools spaced so as to have a clearance of $\frac{1}{8}$ in. A brick set edgewise on the spools will slide slowly down the conveyer to the hands of the paver. The loader takes care to put the best side of the brick up and to keep the supply just ahead of the laying.

MOTORISTS PRACTISE ON MOVING DUMMIES

One of the features of motor life at Brooklands, England, is the monthly bogey competitions. Obstacles are



Moving Figure to be Dodged

suspended along the race course and kept moving across the track by means of a pulley. It is the object of the motorists to dodge the figure.

WHITEWASH AS A FIRE-PROOF- ING MATERIAL

The efficiency of whitewash as a fire retardant is almost universally recognized, insurance companies being among the interests that suggests its liberal application on the wooden portions of large buildings, barns and rafters. It is difficult, it is claimed, for fire

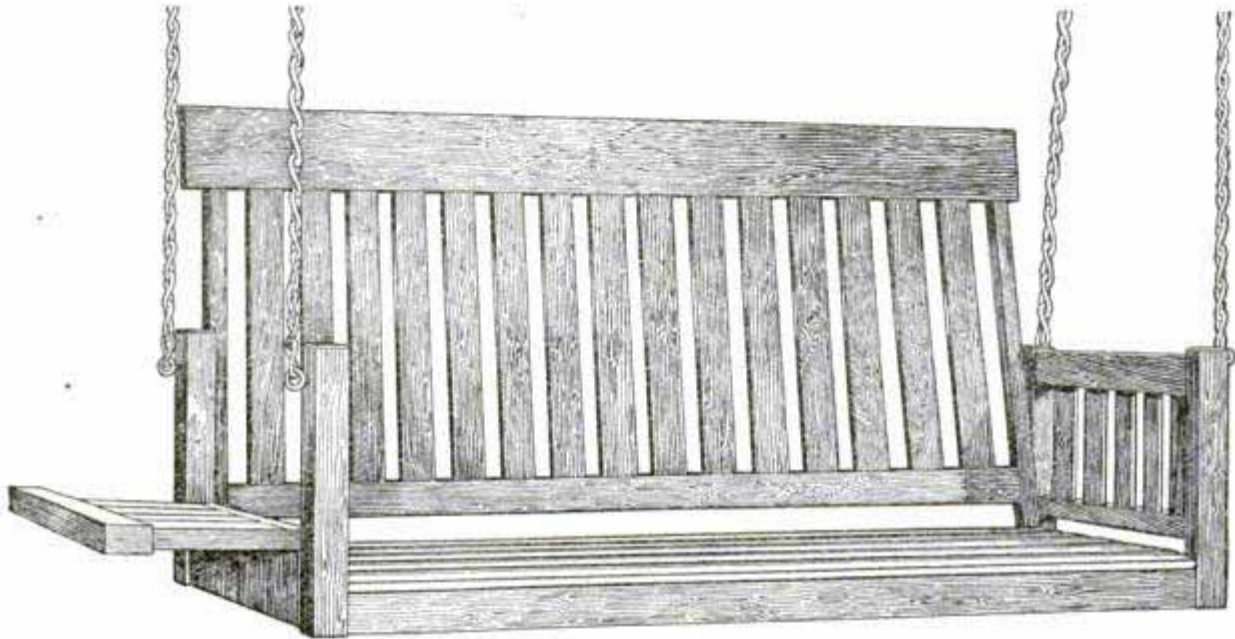


Chutes Facilitate Handling Brick

to spread among whitewashed structures. The United States government has long recognized the practical value of whitewash as a protection against such danger and the lighthouse board orders its use wherever possible.

RECLINING PORCH SWING

This illustration shows a new idea in porch swings, the feature being in the fact that it is equipped with drop ends



Porch Swing with Drop Ends

for pillow rests. The swing is made of solid oak in all the different finishes. The ordinary porch swing, or swinging seat, as it is called, has solid ends.

REPRIMANDING ON THE SLY

A most sensible remark was made by Mr. W. J. Harahan in his paper on "Discipline on Railways," when he said: "When possible to avoid it, men should not be reprimanded within the hearing of other men, as it seems to inflame and wound them, and such reprimand loses a large part of its efficiency." This reminds us, says Railway and Locomotive Engineering, of the ways of a Western general manager who was one of the most popular men in his day and generation. He was familiar with every detail of railroad work and never hesitated to express

himself with vigorous fluency when he found anything going in the way he considered wrong. When an individual was at fault, however, or was guilty of any serious blunder, this general manager would pour the vials of his wrath into the delinquent's ear, but always did the reprimanding on what the men called the sly. He would go behind a box car or call the man into a private room or car and roast him to his heart's content, but never a word of reprimand

was uttered where others could hear what was said. The consequence was that the worst abused man would depart from the tongue lashing, feeling that he deserved much more than he had received and ready to swear that the general manager was the finest gentleman in Illinois.

Not only does the man not lose self-respect, but the fact that no one else has heard the rebuke, entirely eliminates any exhibition of bravado or resistance to authority. In fact, on one occasion, a boy with a sense of humor, who had been rather severely dealt with quietly and alone by his superior, went out into the roundhouse after he had been "called down" and gave it out that he had been brought in for consultation and his advice on certain matters had been asked for by the boss. His altered behavior in the thing complained of was noticed.

SHIPS WITH CONJUGATED HULLS TRIED LONG AGO

The illustration is one of the type of vessels with double hulls which were built and tried out as far back as 1878. The two ships were connected with a heavy framework carrying the saloon and were used for the purpose of smoothing the passage between France and England on the well known choppy English channel. Their resistance to the rolling waves was very great, but the ships were finally disjointed by the agitation, although one of the vessels was used through one summer. The instances of associated hull construction were brought out by a French writer following an American article which was quoted in these columns recently, on the practicability of triple and double hulls for swift ocean vessels.

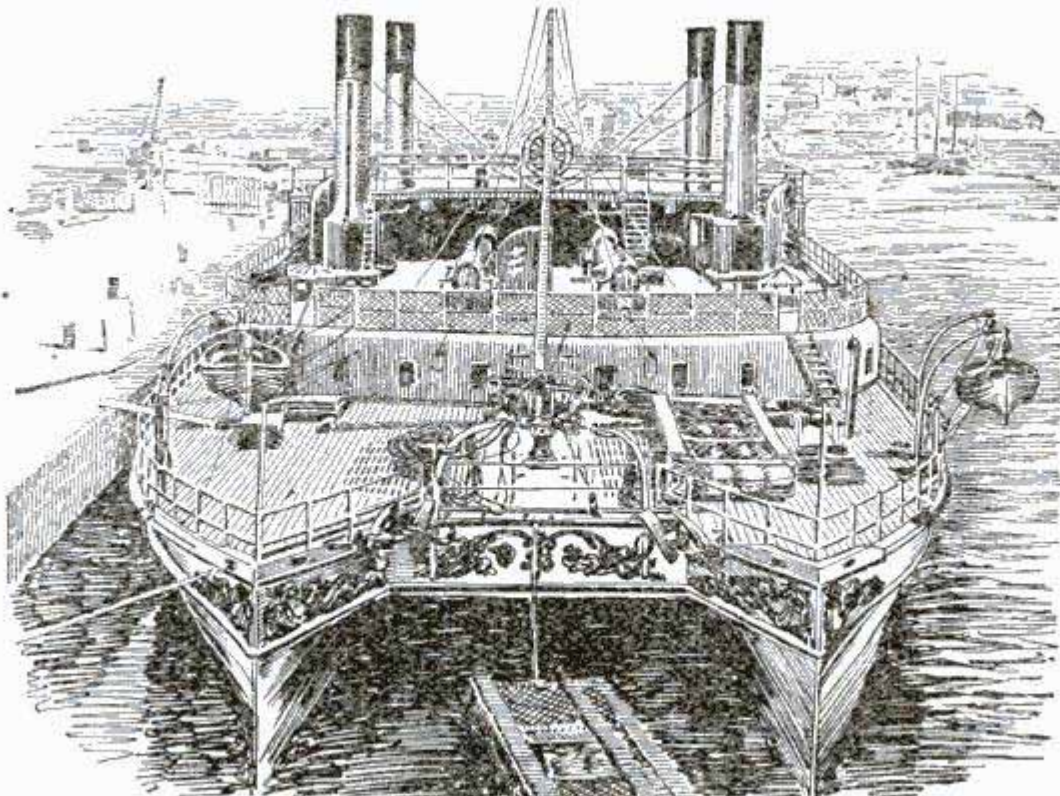
The German nation has recently placed in service the steamer "Vulcan" with conjugated hulls which is destined to succor and to raise submarines and torpedoes. This French writer believes that the ship will serve its purpose in this way but not as a swift passenger boat.

TEXT BOOK FOR BURGLARY APPRENTICES

The police of New York found upon a burglar, arrested by them, a treatise on safe-cracking that is said to be the most remarkable document that has ever fallen into their hands. The contents are so well compiled that the police unhesitatingly declare the author a past grand master in his profession, and are somewhat anxious to find out just how many copies are in circulation throughout the country.

For the most part, the manuscript is in the yegg code, a lingo freely used by thieves the country over. It describes the two kinds of safes recognized by the profession, namely, the fireproof and the burglar-proof, asserting, however, that there is no genuine burglar-proof safe, and that the kind that are drill-proof are only called so by courtesy. Minute directions for cracking a safe are given, together with diagrams to illustrate the treatise.

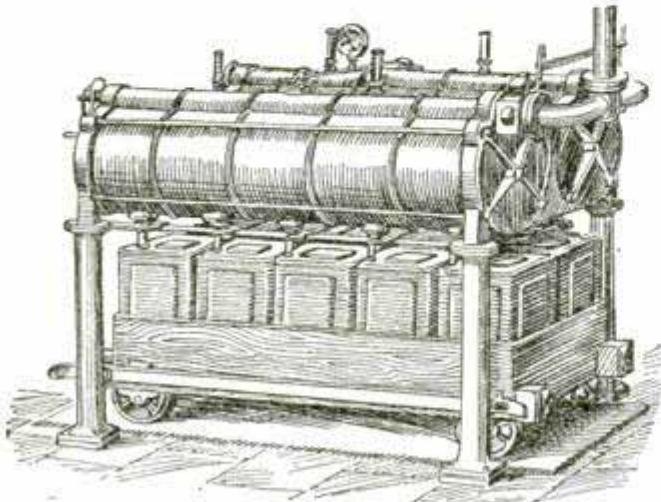
Graves, a motorcycle racer, made a mile in 46 $\frac{4}{5}$ seconds on the new coliseum track in Los Angeles.



This Type of Vessel Was Proven Impracticable 30 Years Ago

MEASURING OIL AND FILLING CANS BY MACHINERY

This oil-measuring and filling machine has several ingenious features, including a compensating arrangement for varying the capacity of the measures to meet the increase and decrease



Courtesy Petroleum World

Accurate Oil-Measuring Machine

in bulk due to rise and fall of temperature, or for dealing with oils of different specific gravities, so that the same weight can be placed in each can, although the gravity may vary considerably throughout the day.

The degree of accuracy attained is claimed to be very high. In a machine of ten 4-gal. measures, the variation in any one measure is not more than .076 per cent, and in the range of 10 measures, only .005 per cent. This accuracy is obtained by the use of closed measures, filled under pressure, the air being driven off through air valves fixed at the highest point of each measure. These valves close automatically the moment the measures are filled, an indicator showing whether the measures are full or empty.

The measures are in the form of hollow cylinders or rings accurately bored out and faced at the ends. The feed pipe passes through the center of all the measures, projecting through the end cover farthest from the inlet valves. The tube has ports for the flow of oil to each measure and is free to revolve through half its circumference, thus making it possible to deliver a vary-

ing quantity of oil, the quantity being determined by the radial position of the ports. The tube is revolved by a disc with lever handle fixed to its projecting end. A pointer, fixed to the end cover, indicates the required position of the lever, the periphery of the disc being marked to correspond with the various gravities of oil used and the degrees of the thermometer. The cans to be filled are run under the machine on a truck.

EFFICIENT SYSTEM OF STREET SIGNS

The system of street signs in the business districts of the larger cities of the United States is not the best in the world by any means, as many people who have tried to find a street and a certain number in the midst of a congestion strange to them can attest. Some pointers could be gained by municipal authorities in studying the system adopted in Hamburg, Germany. The poles are so arranged that the signboards point in the direction of the intersecting streets, and a pole is placed on each corner, carrying in all, 8 signs. Under the name of the street on each sign is placed the commencing and ending numbers of the buildings on that side of the block, so that people looking for a certain building can easily locate it.

Say the thoroughfare were Washington street in an American city, the number of the first building in the block, on the side the sign is located, 41, and the last building in the block, 69.

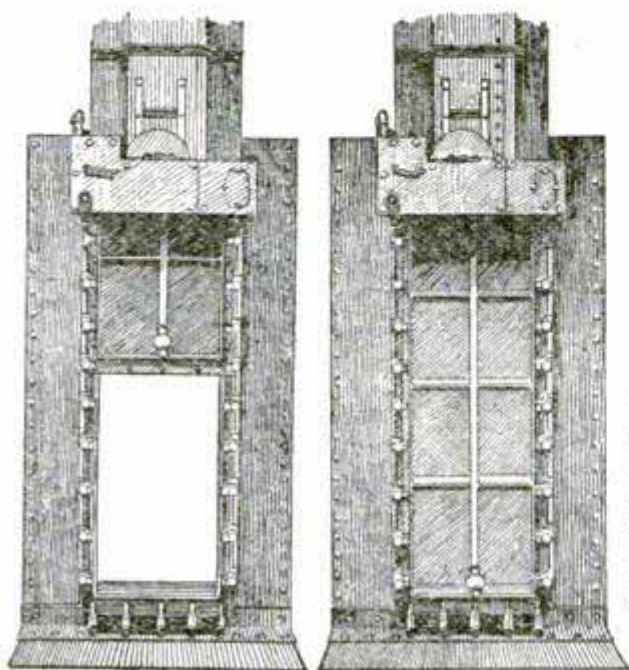
WASHINGTON ST.
41  69

Then such a sign would read "Washington St.," and under it would be "41-69," a hand between the sets of figures, pointing the direction.

About 2,000,000,000 bbl. of oil, or enough to fill the Panama Canal twice, was produced in the United States during the last 50 years.

WIRED CURTAINS AS BURGLAR AND FIRE ALARMS

An ingenious scheme of burglar protection, embodying specially designed curtains and portières, has been invented by a Dresden engineer. The



Door Partially Closed and Entirely So

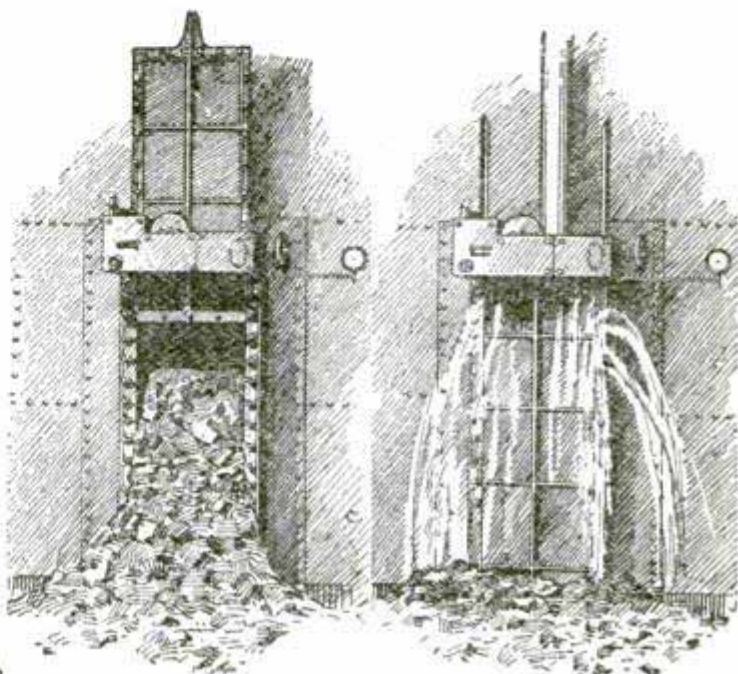
curtains and portières are made of any of the materials used for such purposes, and wired with fine conductors. At certain places on the curtains are affixed small metal knobs, connected with the wire conductors. When drawn across a window or door, or around a safe or vault, the slightest disturbance of their position immediately breaks the circuit, as the metal knobs are thus thrown out of contact with each other. Should the intruder notice the wires and cut one or more of them, his action would break the circuit and start the alarm.

The alarm itself may consist of a series of bells, lights, or other electrical appliances. The curtains, unless made of fireproof material, will also act as a fire alarm, as any part of them being burned will cause the alarm to act.

The cruiser battleship "Invincible" of the British navy maintained a speed of $32\frac{1}{4}$ miles an hour for 8 hours in a recent test.

ELECTRICALLY OPERATED WATERTIGHT DOORS FOR SHIPS

Naval construction has developed the watertight bulkhead to such an extent in the past few years that it has



Completely Closed after Water Washed Coal Away

become one of the most important factors in the safety of a ship and its passengers. Many a ship has been saved from sinking, or at least been enabled to keep afloat for a sufficient time to rescue passengers and crew, by these bulkheads, as was aptly demonstrated by the collision of the "Republic" and "Florida," the former being kept afloat for more than a day and the latter limping safely into port.

But in order that a ship may be conveniently worked, watertight doors in the bulkheads are a practical necessity, and herein lies the possibility of a danger that, through years of study and experiment, has been minimized by what is known as the long-arm system of closing and controlling such doors by electrical power.

Bulkhead doors, operated by the long-arm system, may be either of the type that is pulled shut horizontally or that drop vertically in a grooved door-frame. The latter, however, seems the most efficient under conditions in which obstructions may impede its

complete closure, as would be the case when coal bunkers are full and the doorways between the bunkers and fire room are open and choked with coal. Therefore, this article will be confined to the operation and efficiency of this type of door.

These doors are effective in operation and watertightness, each being provided with a specially designed electric motor and safety controller whereby the door may be closed from an emergency mechanism on the bridge, or operated locally from either side of the door frame.

The emergency mechanism, or station as it is called, is always under the eye of the captain or officer of the watch. Indicator lamps on the box show at all times whether the doors are open or closed, and in case of local obstruction, point out the door to be cleared. The turning of the wheel on the box, which is shown in one of the illustrations, will close all the doors, but, by what is known as "the liberty action" at each door, a person caught on the danger side can open it at any time during an emergency period for escape, the door immediately closing automatically after any such action without further manipulation either locally or from the emergency station. This is an essential feature.

Still another important feature of the system is the automatic cut-out at each door, whereby the power is continually weighted during operation, shutting off the current when an obstruction stops the doors and throwing it on again the moment the obstruction is removed. Thus the danger of the apparatus being rendered inoperative by a burnt-out fuse is avoided,



and the door is practically assured of being completely closed.

Just how the doors work is clearly shown by these illustrations and description of the tests made by the United States Navy. The doorway of a full bunker was allowed to fill with coal, as would be the case under natural conditions, large lumps being mixed with the layer of all sizes. Before closing the door upon this mass of coal, fine coal dust was shoveled up all over the tighteners and frame, in order that the test might be as severe as possible. To make the coal dust stick in sufficient quantity the bulkhead frame was covered with thin oil.

The door was then closed from the bridge emergency station and the doorplate cut through nearly all the coal, the clear opening being almost completely closed when the automatic cut-out opened the circuit and stopped the motor. After the door had closed into the coal and been stopped by the automatic cut-out, water was let into the bunker, as would be the condition if the hull of the ship were so punctured as to admit water to the bunkers, making the closure of the door necessary. This water gradually washed the obstructing coal from under the door, thus relieving the resistance to the thrust of the door and causing the automatic cut-out to throw on the current again, forcing the door to complete its closure.

This automatic cut-out gives the door an almost human intelligence in its action. When striking lumps of coal so large that it cannot cut through them, the motor stops. When these lumps are removed by the inrush of water it starts again. The whole secret of the manipulation of the door is its weight. This weight, unsupported, closes the circuit to the motor, and when supported by the obstruction under it, thus taking part of the weight from itself, opens it.

All the operating gear of the doors, including the motor and local controller, are contained in a cast-steel box above each door. These boxes have watertight covers to protect the mech-

anism from water and dirt and consequent impairment of the apparatus from these causes.

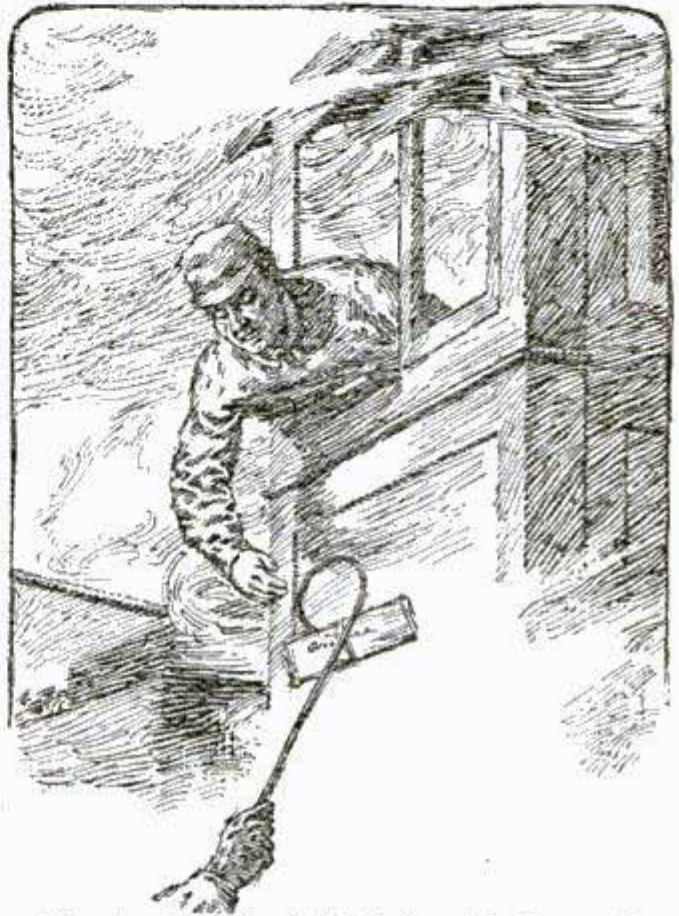
The illustrations show the emergency control on the bridge from which all the doors can be closed, the appearance of the doors partly open and closed, and two views of the door as tested by the United States Navy. The first of the latter shows the coal-choked condition of the doorway before the door was closed, and the second shows its appearance just after the coal had been washed away by the water, causing the automatic cut-out to throw on the current again and complete the closure. The actual leakage just before the door was finally closed was too small to be dangerous, even if several were allowing as much water to work through.

AERIAL VIEW OF LARGE CAR BARN

This illustration does not show hundreds of small forcing boxes on a truck farm, or beehives, or chicken coops, but the skylights of a large electric railway car barn in Chicago as they appear from an adjacent elevation. The barn in question is 303 ft. wide by 344 ft. long, and it has a housing capacity of 137 large double-truck cars, in addition to a repair section with track room for 5 cars on a side, and a row of utility rooms. The sketch is drawn from a photograph.

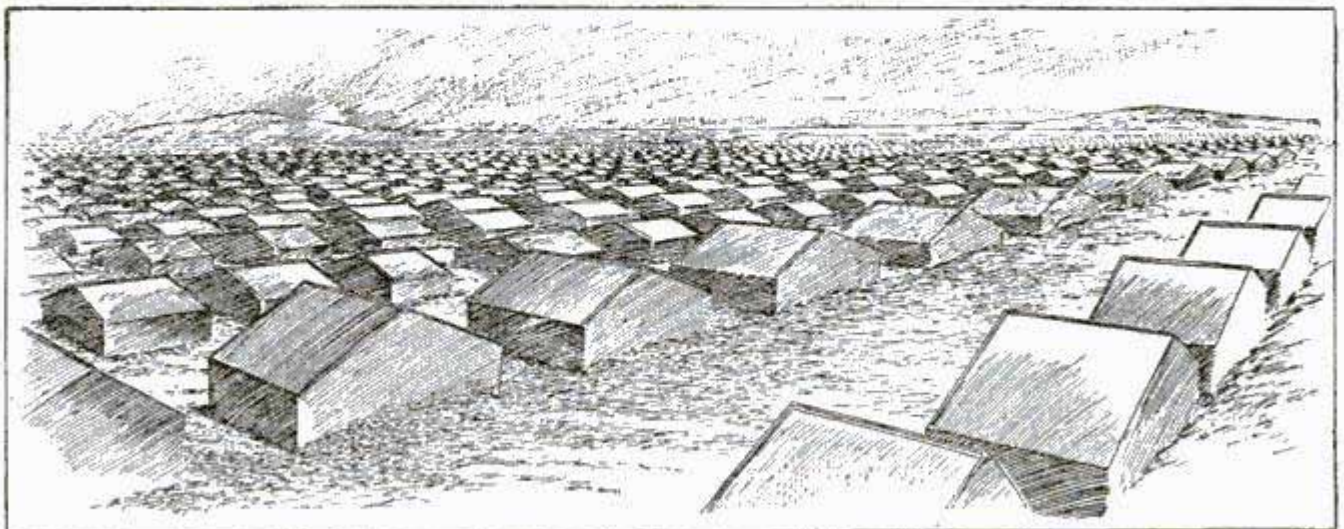
STAFF SYSTEM OF TRANSMITTING TRAIN ORDERS

The staff system of passing orders to and from the crews of trains while the latter are in motion has been



"Leaning from the Cab Window, He Grasps the Message"

used on many of the railroads of the United States for some time, yet it is probable that little is known of this procedure outside of railroad circles. The staffs used are usually of wicker



Chicago Car Barns Viewed from Aloft

or other material that bends easily without breaking, shaped as shown in the illustration. The message to be delivered to the train crew is slipped into the staff at the point where the bent end engages with the straight part. The station agent or operator stands at the edge of the platform as the train approaches, and the engineer or fireman, leaning out of the cab window, grasps the message as the train passes. If a message is to be left at the station for transmission to headquarters, the conductor of the train stands at the rear end of the train with a like staff and the station agent in his turn snatches the message.

This system is used chiefly with freight trains in this country, but in England is employed generally.

AN INGENIOUS WATER "THRILLER"

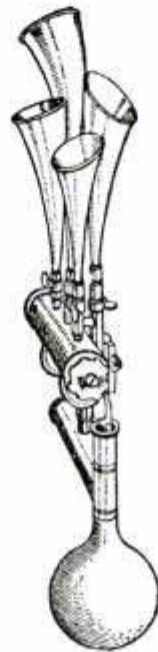
The demand of the people to be entertained by acts that startle, known in the profession as "thrillers," and not only that, but by acts that mystify as well, has caused this ingenious water performance to be added to the hundreds of like amusement features. W. H. Dilger, the perpetrator of the act, was handcuffed, shackled, sewed up in a canvas sack, and headed up in an oak barrel, previously drilled full of holes and weighted with pig-iron. Then the police who superintended the performance dropped the barrel off a raft into 10 ft. of water at Cincinnati, Ohio. In less than a minute Dilger's head

bobbed out of the water and he crawled safely onto the raft.

Such acts are certainly mystifying, giving the spectators a problem to think over for some time, but close inspection would prove the performer's chief aid to be mechanical ingenuity.

A MULTI-TONE AUTO HORN

The multi-tone automobile horn shown in this illustration is unlike any other of the multi-tone variety in that it is sounded by means of a rubber bulb. It is comparatively light in weight, not bulky, and can be fixed anywhere that is suitable for the ordinary type of single-note horn.



In producing the notes, pressure on the bulb simultaneously forces air in two directions. The first is along a passage containing a revolving air distributor that branches in four directions to the four horns. The second passage contains a small piston carrying a ratchet tooth which is shot forward and engages with a ratchet wheel, revolving it one tooth only. The ratchet wheel is attached to the air distributor, which, revolving, opens in turn the orifices to the four horns. By moving a cap, air can be shut off from all the reeds, so that the horn cannot be sounded by boys while the automobile is standing



Sewn up in a Canvas Sack



Headed up in an Oak Barrel



Dropped into Ten Feet of Water

beside the curbing of a street, or so that only one note is sounded continuously.

THE NEGLECT OF FREIGHT CARS

Somewhere in the vicinity of \$1,000,000,000 is invested in freight-car rolling-stock in the United States, yet it is impossible to ignore the fact that this great investment is neglected as far as proper care is concerned. Many of the steel cars are rusting so rapidly that their life will be much shorter than was anticipated when purchased, and wooden cars are in a bad state of decay. By proper painting, their life would be doubled, probably quadrupled, over what it will be if the present neglect continues.

The real cause for the neglect in painting freight cars is due to the fact that it has long been the custom to give them this treatment only when sent to the shops for general repairs. Freight cars that have been standing idle on side tracks for the past year or 18 months—and there are many of them—have not suffered the usual wear to running gear and probably will not be shopped for at least another year, they have been exposed to the weather, however, and are badly in need of painting.

"Better paint and more of it ought to be used on freight cars," says Engineering News. "Not necessarily more expensive, but better paint. How many railroads really purchase their paints with any thorough scientific care to see that they are getting the best and most economical? A few do, but the majority do not."

TREADLE SKATES FOR SOLDIERS

The European treadle skate, or "techypod" as it is called, has been tested out in Stockholm as a means by which soldiers can get over the ground quickly. It is claimed that the skates will enable the wearer to cover the ground, and especially rough ground, at a speed equal to that attained

by an ordinary bicycle rider. The motive power is gained by the wearer treading in the same manner as in

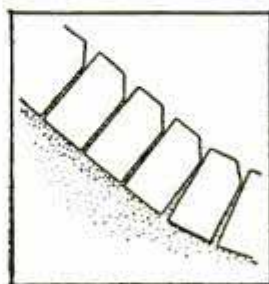


Soldier Equipped with Treadle Skates

running a sewing machine. The wheels are miniature bicycle wheels.

BEVELED BRICK FOR HILLSIDE PAVEMENTS

While in many cities the same style of brick used for level paving is also used for hillside pavements, it is generally considered advisable to use what are known as "hillside pavers." These are made with one edge beveled and are laid as shown

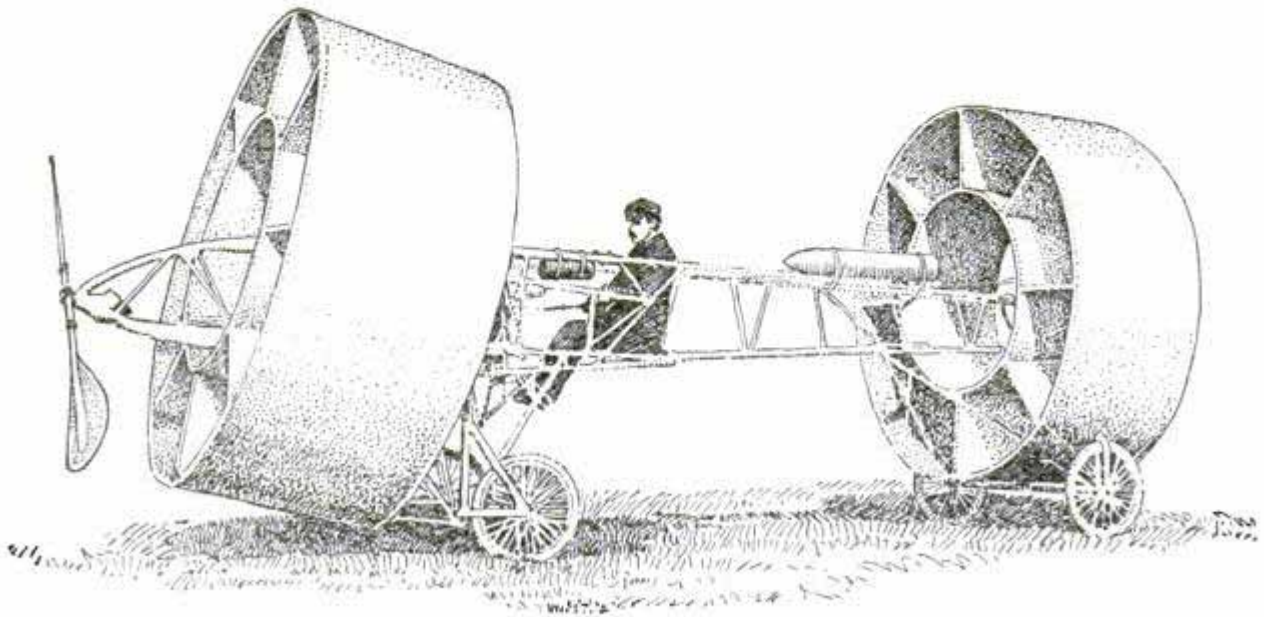


in the illustration. The bevel makes a foothold for horses in ascending and descending. According to "Brick" magazine, brick is considered the only paving for hills both high and steep.

FLYING-MACHINE WITH VENTILATOR-LIKE PLANES

Although the flying-machine of the Wright type, and the kindred French machines, have thus far proved them-

Most of the frogs sold in Paris are caught wild, but the demand is so constant that during recent years some



Curious French Aeroplane

selves to be the only ones that have successfully flown, many aerial enthusiasts are attempting to work out other ideas of construction. This aeroplane was designed by M. Givaudan, a Frenchman. Its lifters are the two circular constructions which are not unlike ventilators placed on edge. The propeller is in front of the first of these, which is tilted forward or backward to make the machine lift or drop.

THE FROG INDUSTRY OF FRANCE

It is in France that the frog was first generally used for food and it is in that country that the industry of frog farming has been most largely developed. The green frog exists abundantly throughout France wherever there are marshes, ponds, or sedgy margins of rivers or bays that contain fresh or slightly brackish water. The supply of frogs for the markets of Paris comes mainly from the marshes and stagnant waters in the neighborhood of Montmorency, Vincennes, and Boulogne.

effort has been made to propagate and fatten them by more or less artificial means.

The best outfit for frog raising is one or more shallow ponds or reservoirs, filled with grasses and other water plants. It should be so situated that the water can be partially drawn off, so as to facilitate the labor of catching. If, as is often the case, the pond already abounds in frogs, they are simply protected and left for a year or two to propagate. If food does not prove abundant the owner throws in live earth worms, as the frog is a carnivorous animal and prefers the food, whether worms, larvae or insects, fresh and in a normal, living condition.

If no frogs exist in the water they are planted either living, or in the form of eggs, which hatch when the water becomes warm in April. The frog spawns during early spring, the female depositing from 600 to 1,000 eggs, surrounded with a gelatinous substance which holds them together. The eggs hatch at the end of a week or 10 days, according to the temperature of the water, producing tadpoles. As the tadpole grows, the hinder, then the for-

ward, legs appear, the tail shrinks and disappears, and the creature develops into a frog. The hatching and transformation take place within a period of about 4 months, and the frog hatched in April or May, although not fully grown until the following year, is ready for market by the end of October.

The frogs are taken from the pond with a seine or other form of dragnet, or, if possible, the water is drawn off until the pond is a shallow pool, the owner wading in and scooping up the frogs with a net or basket. Dealers usually collect the frogs in the late summer and autumn, when they are at their best, and keep them in tanks, so that the market can be supplied throughout the year.

The following recommendations concerning the catching, packing and transporting of frogs to market are made by French frog farm experts: Firstly, they should not be taken from the water during the prevalence of a south wind or in very hot weather. When taken with nets or by any other method that leaves them alive and uninjured they should be put at once into a tank or box without water, where they should be kept dry for at least two hours, during which they exude a frothy liquid. Water is then poured in, washing away this secretion and leaving the frog clean and ready for market. For shipment they should be put into bags, boxes or other packages with an allowance of sufficient space for them to move around. If piled into masses or crushed against each other they exude the frothy secretion above mentioned, and this renders them stale and flaccid. In very warm weather they can best be shipped in wooden crates, the bottoms of which are covered with sand or sawdust.

Frogs are usually retailed alive in the markets of Paris, thus assuring the buyers of their freshness.

Fire losses in this country for 5 years approximate \$1,245,002,059, excluding forest fires.

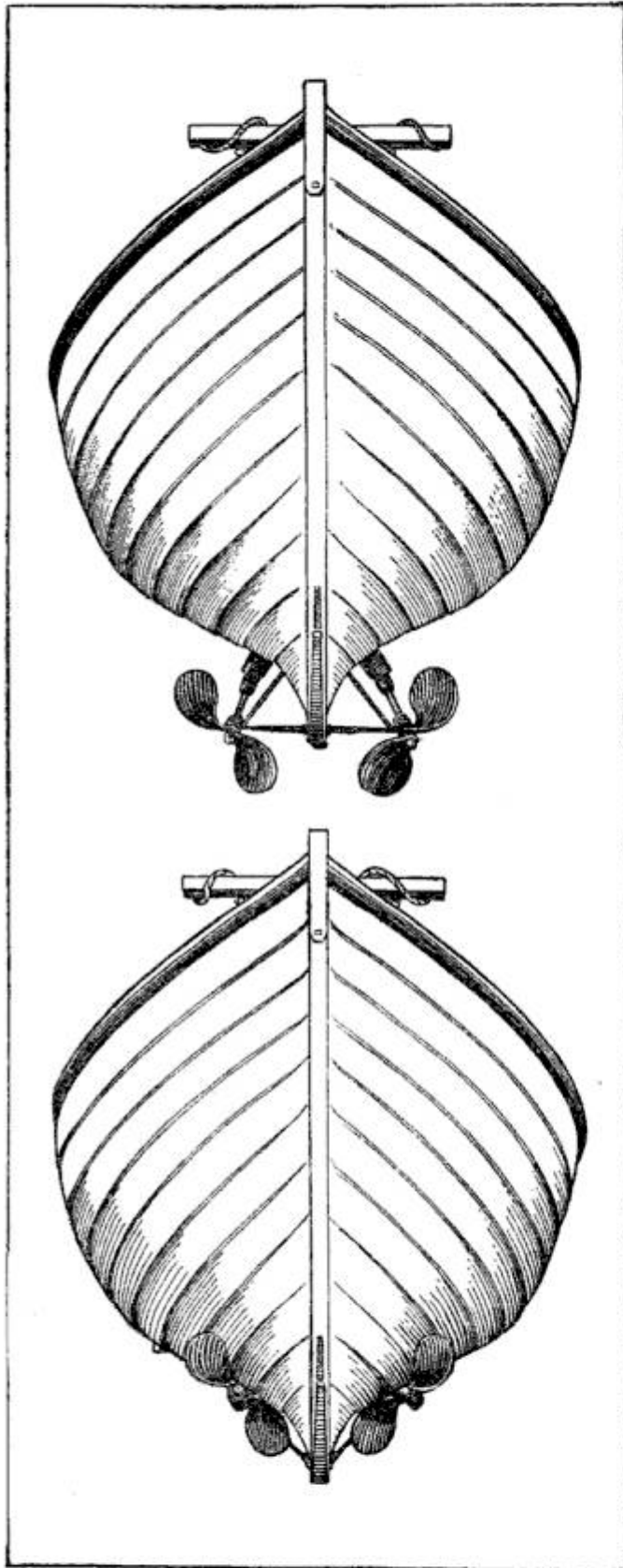
INTERESTING MAGIC-LAMP TRICK

One of the latest magic-lamp tricks for magicians is this new German invention. It is a disappearing and reap-



pearing lamp, used as is shown in the illustration. Magic fools the public, but it is very seldom that anyone fools the magician in his own line, therefore it is safe to take the claims made for this trick by the concern which controls it, at their face value. The lamp is positively not exchanged for another in the trick, only one lamp being used. It is not covered in any way, nor is a background necessary.

The magician shoots a pistol at the lamp and it immediately disappears in a flash of smoke to appear a moment later on another table some distance away, also with a flash, and burning brightly.



UNCLE SAM'S NEW LIFEBOAT

The latest addition to the United States life-saving service is rightly called the "Storm King," but she could be more properly called the "Storm Fox." She can sail, swim, turn over in the water, right herself, throwing off the water like a fish, and go ahead at a 10-mile clip. The new boat has

a length of 36 ft. 8 in. The 1,500-lb. bronze hull aids it in self-righting. In a recent test this boat after being capsized with all machinery aboard righted itself, threw off the water and had the gasoline engine running in less than 3 minutes. Besides her equipment of a power plant, two masts and sails and a set of oars, the boat can carry 75 passengers.

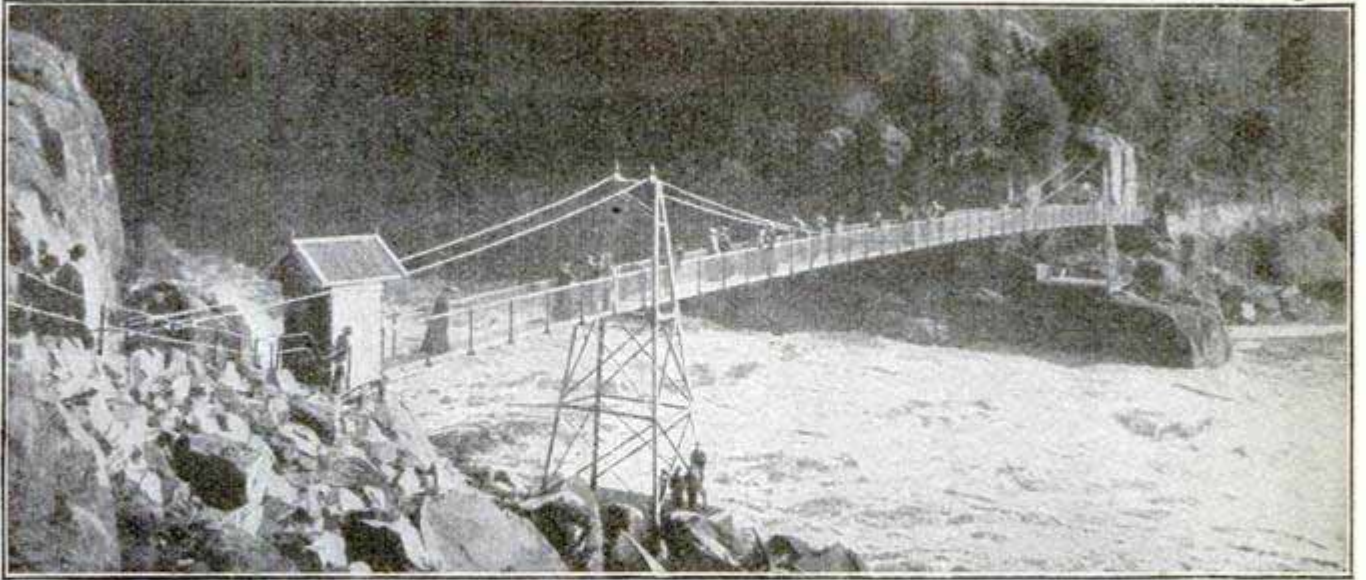
The latest device for lifeboats is on this boat. Her two screws can be folded up under the stern of the vessel, as shown in the illustration, to be out of the way when the boat is beached.

MAY USE ELECTRIC POWER ON CANADIAN RAILWAY

With the idea of protecting from fire the forest area in New Brunswick through which a portion of the Grand Trunk Pacific railway runs, resolutions for its electrification between the St. Lawrence river and Moncton were unanimously carried in the Brunswick legislature. The distance between the two points named is 460 miles, and much of the line passes through dense forests of spruce and fir in lower Quebec and northern New Brunswick. If carried out it will be one of the most ambitious electrification projects that has yet been proposed, as far as mileage is concerned. Water power sufficient to develop the current for the whole line is available at Grand Falls on the St. John river.

NEW SCOTLAND CANAL PROJECT

A great canal across Scotland, to cost about \$90,000,000, and to be large enough to accommodate the largest battleships of the British navy, is being advocated by a national canal association of Great Britain. The route being most discussed is from Grangemouth on the Forth river to Loch Lomond, up that lake and across a narrow neck of land to Loch Long, and through the latter to the Firth of Clyde. The argument for this route is military, its strategic importance being considered the greatest.



The Famous Cataract Gorge on the South Esk near Launceston, Tasmania

SAFETY SHOES FOR CONVICTS

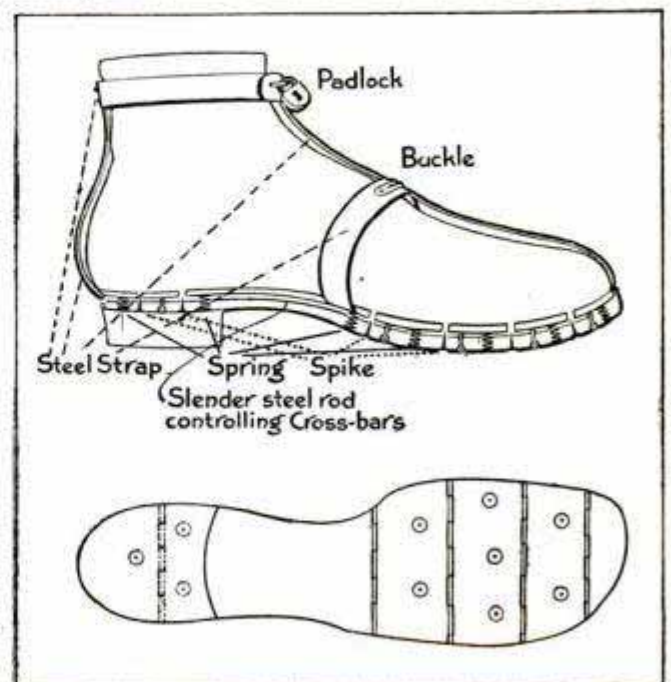
A shoe which will make impossible the escape of convicts while being transported from one point to another has been invented by a Californian. The idea came to him after suffering on several occasions through the protrusion of hob-nails through the heel of a boot in need of repair.

The device consists of a heavy leather shoe, with a perforated sole to which is attached a second sole of steel plate, jointed so that the whole will bend with the usual motion of the toes and foot. Riveted upright to this steel sole are sharp spikes, placed in such a position that they will enter the perforations of the leather sole, but kept from ordinarily doing so by crossbars with a series of steel springs on either side.

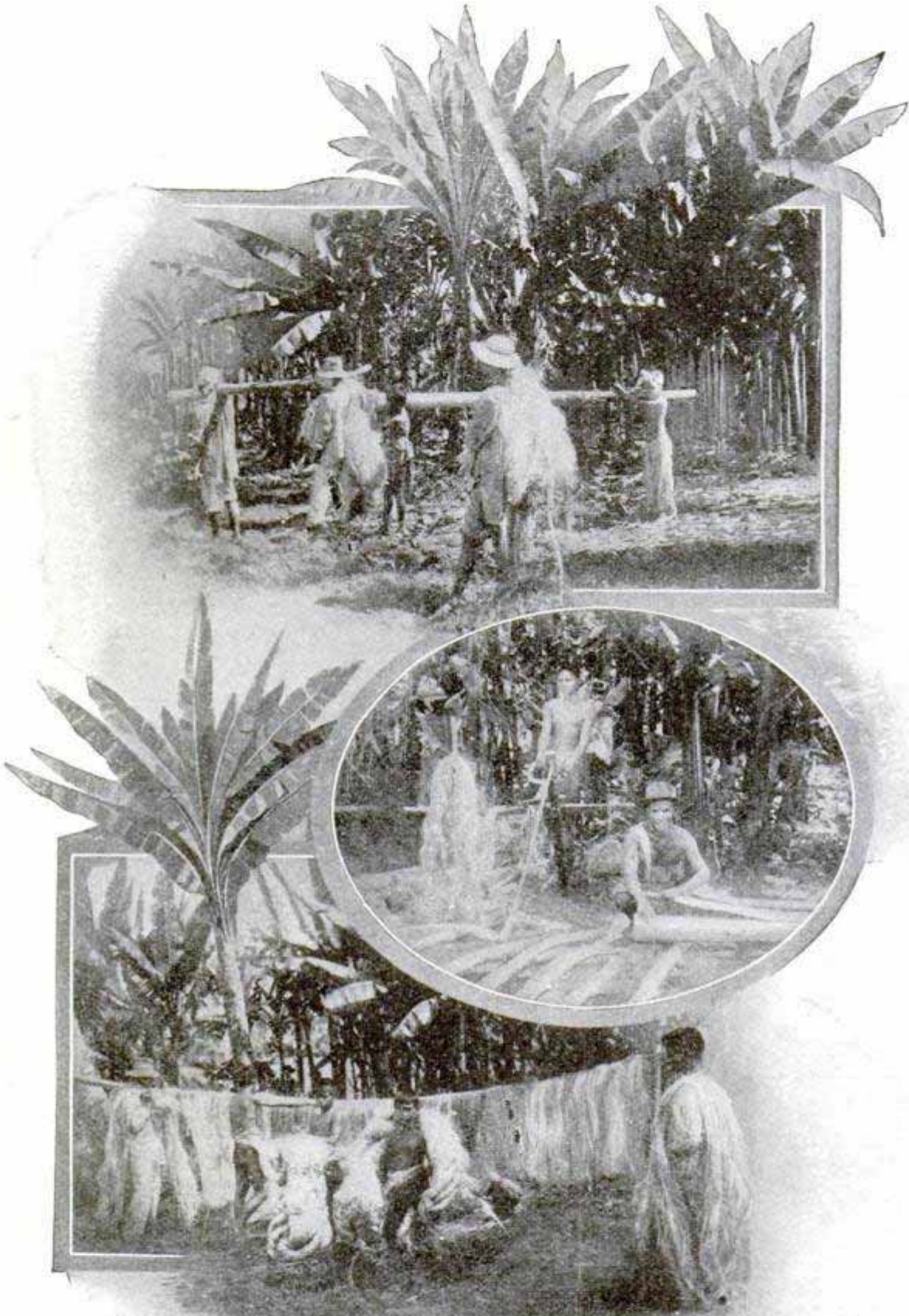
The whole contrivance is fastened to the prisoner's foot by means of metal straps, held secure by a padlock. With the crossbars in position, the prisoner can walk in the shoes as in ordinary ones, but once he is placed on a train or other conveyance, the officer releases the crossbars and locks them in such position that they cannot be replaced between the spikes and perforations without a key. The only thing that now keeps the spikes from entering the perforations and gouging into the criminal's foot is the springs. These are of sufficient strength to protect him from harm as long as he is seated, but if he

stands up and attempts to walk, the weight of his body compresses them enough to make it impossible for him to stand the anguish of more than a step or two.

Many deputies are required in a sheriff's office solely to convey prisoners from the jail to the state's prison, and grave danger of escape is constantly present when an attempt is made by one deputy to transport more than one prisoner at a time. If shod in such shoes, several prisoners could be left in charge of but one deputy after being placed upon a train, without fear of even a serious attempt to escape.



A Shoe That Is as Confining as a Prison Cell



Wild Banana Fiber from Which Manila Rope Is Made

THE SOURCE OF ROPE AND ITS MANUFACTURE

[Condensed and reprinted by permission from "The Story of Rope," copyrighted by Plymouth Cordage Co.]

Rope is an article of use so common that very few people ever give a thought to how it is made, where it comes from, how long it has been in use, or what it is made of. Rope is older than history itself, antedating all authentic records. In his very earliest days, man must have had something to serve for cords or lines. Strips of hide or of bark, pliant reeds and rushes, withes of tough woods, fibrous roots, and hair of animals first sufficed, then as the need rose for longer, larger, and stronger lines, the demand was met by twisting a number of some one of these materials together and forming a rope or cord.

This same process, repeated over and over again, has been the history of rope from the beginning to the present day, the form and materials used changing but little. Ancient Egyptian rope, as is shown in the illustration on page 197, differed in appearance but slightly and in some instances not at all from rope of the present day.

The most satisfactory raw material of the rope maker is Manila hemp, the

second is sisal. Manila hemp, strictly speaking, is not a hemp at all, but a



Cleaning Manila Fiber

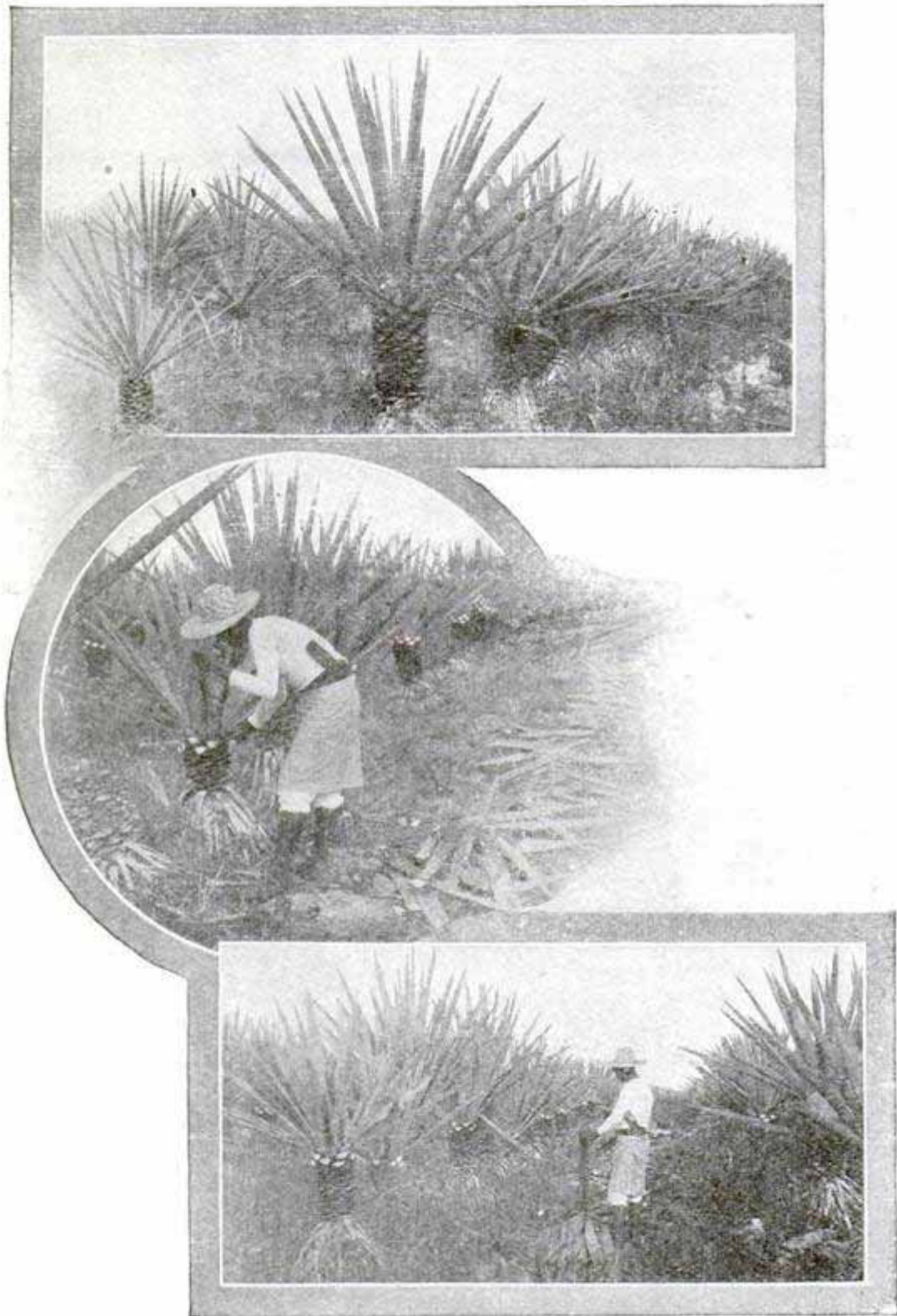
fiber obtained from the wild banana plant of the Philippine islands. It is cultivated by setting out shoots of the



Marketing Manila Hemp

plant after a suitable tract of land has been cleared. After proper cultivation for a period of two or three years, some of the plants are ready to cut. They

leaf stems growing compactly together in overlapping layers. The fiber from which rope is made is contained in the outer bark of these leaf stems, their



Sisal Plant from Which Inferior Grade of Rope Is Made—Mexican

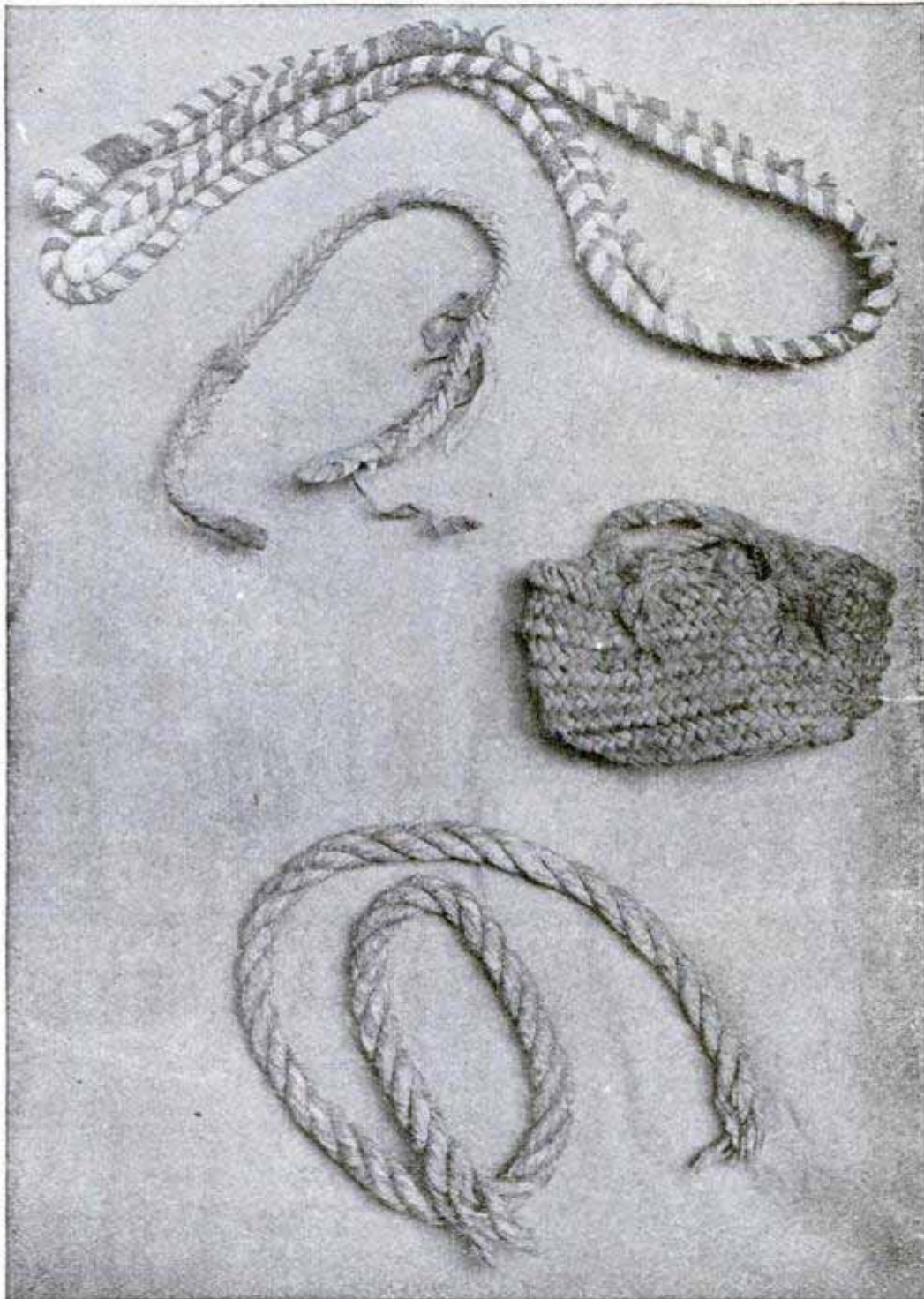
will then be in tree-like shape, and from 15 to 20 ft. in height. The stalk, some 15 ft. long, and a foot or more in diameter, is composed of the separate

inner portions being of a soft, pulpy nature.

After the stalks are cut the natives peel off strips of this fibrous bark.

layer by layer. The fiber from the inner layers of the stems is finer and whiter than that from the outside. The fibrous strips are then cleaned by drawing them under a knife hinged

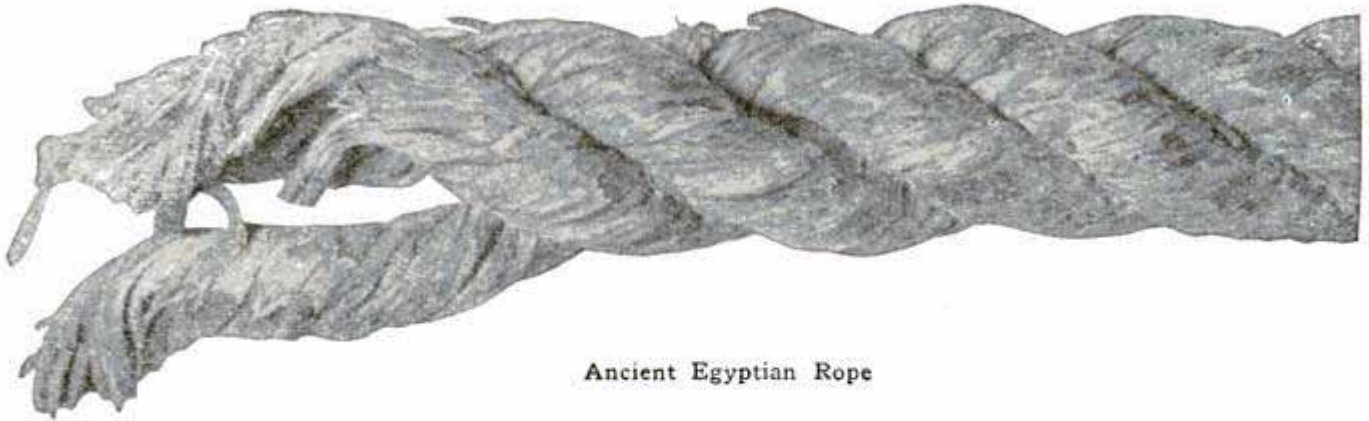
Sisal is a fibrous plant extensively grown in Mexico. Its fiber, which is taken from the sword-like leaves of the plant, is used as a substitute or competitor of Manila. The length of its



Ancient Egyptian Relics
Bridle of Hemp Rope Covered with Woven Cotton—Halter of Braided Leather
Basket with Rope Handles—Palm Fiber Rope

over a block of wood. After scraping, the fiber is hung over bamboo poles to dry, then tied up in hanks and carried to market. In the warehouse of the exporter it is sorted and graded, packed in bales of 275 lb., and shipped to the rope factories in all parts of the world.

fiber, however, is only from 2 to 4 ft., while the Manila fiber is usually from 6 to 8 ft. Its strength is not more than three-fourths that of Manila, it is not as flexible, and the fiber splinters, consequently rope made of it is considered of inferior quality.

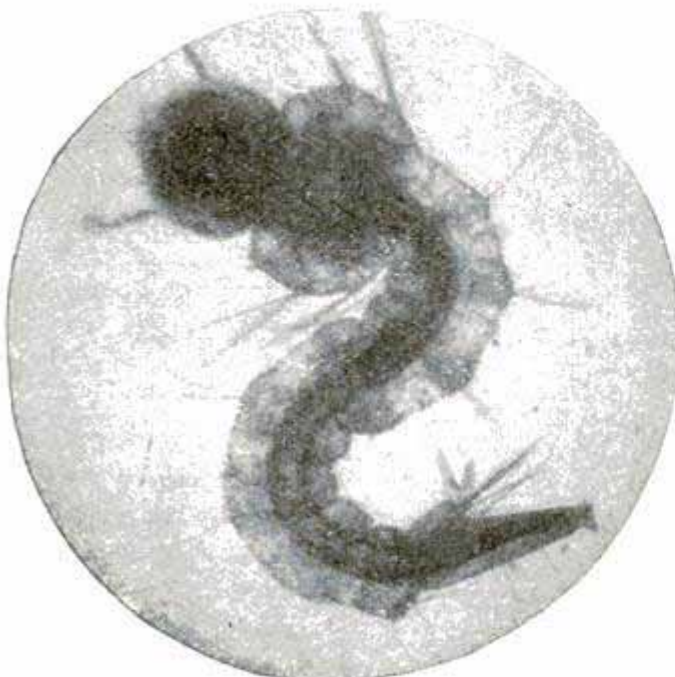


Ancient Egyptian Rope

The actual manufacture of rope consists simply of a series of twisting processes, ingeniously devised machinery now being used to accomplish it. In the early days all the yarn for rope-making was spun by hand. The hemp was first hacked on a board having long, sharp steel teeth set into it. This combed out the tow or short, matted fiber, leaving the clean, straight hemp. This the spinner wrapped about his waist, bringing the ends around his neck, thus keeping the material without knot or twist and allowing the fibers to play out freely as feed to the spindles.

THE BEGINNING OF A MOSQUITO

This terrible looking object is not an animal of pre-historic times, but the photograph of a mosquito larva, or



Highly Magnified Mosquito Larva

"wiggler" as often called, highly magnified. The bite, however, of the insect the wiggler might have become is far out of proportion to its size, as most anyone will bear witness.—Photo by N. Tranfler, Toledo.

CORRESPONDENTS' DIRECTORY

In compliance with requests from readers who are desirous of corresponding on special subjects, a correspondents' directory has been added to the classification in our want advertising section and appears on page 22 this month.

This will enable anyone who is making a study or research on any topic to know of others in various parts of the country who are also interested in the same subject, and who are willing to exchange views, information and experiences to mutual advantage.

The directory will be arranged as illustrated in the following fictitious examples:

WILL CORRESPOND	SUBJECT
John Doe, Redbank, Ohio	Flour
Richard Roe, Blue Point, Ill.	Radium
James Smith, Hooptown, Ariz.	Wireless Telegraphy

STEEL WHARFBOAT FOR MEMPHIS

An all-steel wharfboat has been built in Pittsburg for boat interests at Memphis, Tenn., and will be used in that city as a landing boat for steamboats. The hull is a steel-plated structure, 240 ft. in length and 50 ft. wide, provided with water-tight compartments. The deck has a steel base, covered with several inches of concrete.

THE ROPEWALK

In that building, long and low,
 With its windows all a-row,
 Like the port-holes of a hulk,
 Human spiders spin and spin,
 Backward down their threads so thin
 Dropping, each a hempen bulk.

At the end, an open door;
 Squares of sunshine on the floor
 Light the long and dusky lane;
 And the whirring of a wheel,
 Dull and drowsy, makes me feel
 All its spokes are in my brain.

As the spinners to the end
 Downward go and reascend,
 Gleam the long threads in the sun;
 While within this brain of mine
 Cobwebs brighter and more fine
 By the busy wheel are spun.

Two fair maidens in a swing,
 Like white doves upon the wing,
 First before my vision pass;
 Laughing, as their gentle hands
 Closely clasp the twisted strands,
 At their shadow on the grass.

Then a booth of mountebanks,
 With its smell of tan and planks,
 And a girl poised high in air
 On a cord, in spangled dress,
 With a faded loveliness,
 And a weary look of care.

Then a homestead among farms,
 And a woman with bare arms
 Drawing water from a well;
 As the bucket mounts apace,
 With it mounts her own fair face,
 As at some magician's spell.

Then an old man in a tower,
 Ringing loud the noontide hour,
 While the rope coils round and round
 Like a serpent at his feet,
 And again, in swift retreat,
 Nearly lifts him from the ground.

Then within a prison-yard,
 Faces fixed, and stern, and hard,
 Laughter and indecent mirth;
 Ah! it is the gallows-tree!
 Breath of Christian charity,
 Blow, and sweep it from the earth!

Then a schoolboy, with his kite
 Gleaming in a sky of light,
 And an eager, upward look;
 Steeds pursued through lane and field;
 Fowlers with their snares concealed;
 And an angler by a brook.

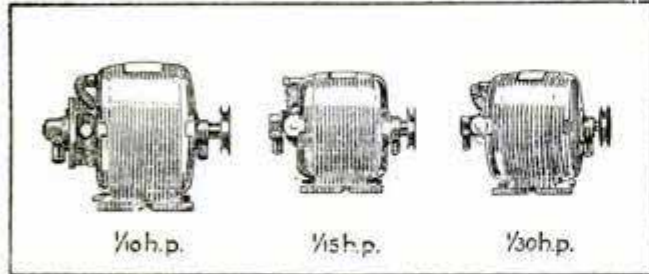
Ships rejoicing in the breeze
 Wrecks that float o'er unknown seas,
 Anchors dragged through faithless sand;
 Sea-fog drifting overhead,
 And, with lessening line and lead,
 Sailors feeling for the land.

All these scenes do I behold,
 These, and many left untold,
 In that building long and low;
 While the wheel goes round and round,
 With a drowsy, dreamy sound,
 And the spinners backward go.

—LONGFELLOW.

SMALL MOTORS IN GRADUATED SIZES

Complete lines of small motors for either direct or alternating current, ranging in power from $1/30$ hp. to $1/6$ hp., are supplied to meet all commer-



cial circuit conditions of voltage and current. It often happens that the user desires direct- and alternating-current motors of the same dimensions, so that they may be used interchangeably on certain kinds of apparatus. This requirement can readily be met by interchanging an alternating-current motor with a direct-current motor of next larger capacity, thus making these lines of great value in their application to the many modern household tasks for which electricity is harnessed.

The illustration shows three sizes of direct-current motors, ranging in power from $1/30$ to $1/10$ hp. The motor in the center is of $1/15$ hp. The line is completed by three more motors, one of which gives $1/8$ hp. while the other two each give $1/6$ hp., one developing it at 1,700 revolutions per minute and the other at 2,400.

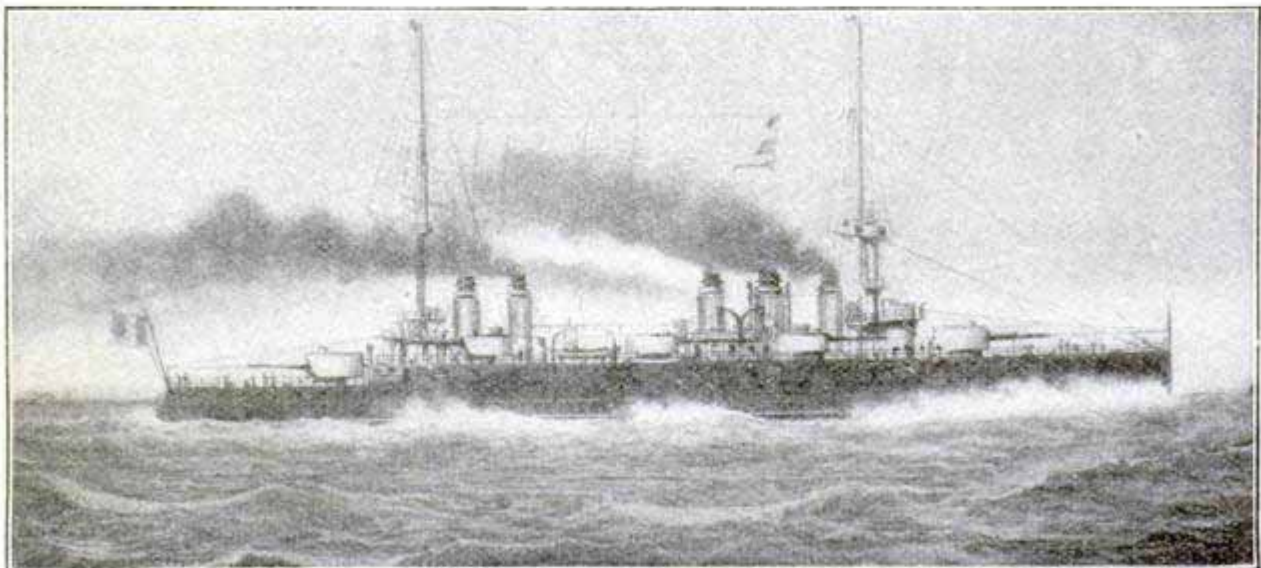
TO SEARCH FOR EXPLORER COOK

Arrangements have been made by the Arctic Club of America for an expedition to go in search of Dr. A. Cook, the explorer, who has been in the Arctic regions more than two years. Dr. Cook had planned to return in September, 1908. At that time he was 40 miles north of Cape Thomas Hubbard on the polar sea. The Arctic Club sent to the American consul at Dundee an offer of \$1,000 reward to any whaler that brought news of Dr. Cook, but all the whalers had departed for the north before the offer was received.

THE FIRST FRENCH "DREAD-NOUGHT"

The first of the six great French "Dreadnoughts" was launched recently at Toulon and will be completed early in 1911. It is 500 ft. long, has a beam of 80 ft., and will be driven at a speed of 21 or 22 miles an hour by turbine engines, the first to be installed on large warships in France.

Unlike the English and American "Dreadnoughts" only four 12-in. guns will be carried, but in addition to these, the armament will consist of twelve 10-in. guns, sixteen 3-in. guns, and two torpedo tubes. She will carry 31 officers and 650 men, and will cost close to \$11,000,000.



A Future Bulldog of the French Navy

EDITORIAL

More or less extensive peat bogs exist in nearly all the states east of the Missouri river. For fifty years past efforts have been made to utilize this peat for the production of heat, as is done in Ireland and on the continent. More recently the advent of the gas producer has awakened new possibilities in the minds of some who hope to find in peat a cheap source of power for the gas engine.

Peat has been possible as fuel in Ireland on account of the low cost of labor and the superior quality of the peat. On this side large sums of money have been spent in an attempt to perfect machinery for digging, washing, pressing and drying the peat, which is turned out in briquettes.

Millions of dollars have been contributed by expectant stockholders, only to find their bog schemes as truly a "Will-o'-the-wisp" as any told in verse or myth.

In Canada one or two companies are operating, but to date the cash returns from sales of all the peat marketed in North America is only a fraction of the money spent in exploiting what has been in most cases complete financial failure.

Attention is again directed to the subject by the announcement that Colonel John Jacob Astor has invented a peat gas producer. The value of our peat deposits is estimated at from fifty to one hundred million dollars—relatively not a large amount. Colonel Astor is credited with the expectation that his machine, when perfected, will enable the farmer to produce at the cost of digging, power to operate stationary machinery used upon a farm.

It seems unlikely, however, that peat as a source of power, or even heat, will be a practical proposition at least for many years to come, as the cost of extracting the water (which constitutes 80 per cent or more of its weight when dug), either by natural or mechanical methods, leaves the net result too small. The price of coal in this country, together with the possibilities of water powers and windmills, puts peat as power in the class of those things which are possible, but not profitable; and this condition will doubtless continue for many years. Our coal deposits are too large and accessible to permit peat to come into competition, and it must always labor under the same disadvantage as the lignite of the Dakotas—that of large bulk for any given weight.

Much more likely is it, that before peat can hope to become a commercial commodity of any consequence, our electricians will have perfected long-distance transmission of electricity which will enable them to gather the intense heat of Death Valley and other southwestern deserts for delivery in every city from the Atlantic to the Pacific.

* * *

Shall it be a good road or good roads?

The State of Pennsylvania appropriated \$3,000,000, to be spent during the next two years in the construction of a good road from Philadelphia to Pittsburg and on to the Ohio state line. The distance to be about 360 miles, which makes the average cost per mile \$8,300. Inasmuch as the route will doubtless follow to a large extent highways now in use, much of which is already fairly "good roads," the expenditure of such a sum, if honestly applied, cannot fail of superior results.

The plan, however, is to be regretted. In the first place it is not needed. There is not now, nor is there likely to be, any considerable amount of trans-state freight traffic for such a road. All classes of freight are being moved by the railroads at rates which make hauling on highways prohibitive.

The cities and villages on the immediate route would, of course, be benefited, but at the expense of other portions of the state.

As an example of high-grade road building to the rest of the state it is of doubtful value, because of its very excellence. Few counties and fewer townships could or would feel able or inclined to duplicate it locally. On the contrary, on account of its cost, it places an argument in the mouths of those opposing the good roads movement calculated to create adverse opinion.

Vastly better would be a distribution of this money on a basis, say, of \$2,000 a mile, to such counties as would spend an equal amount of their own money. This would provide for 1,500 miles of excellent roads; as \$4,000 a mile spent on present highways would make a really good road where road material is as abundant as it is in Pennsylvania. This is the plan which has been adopted elsewhere, and is found not only to stimulate the desire for good roads, but enables any and all parts of the state to be equally benefited.

* * *

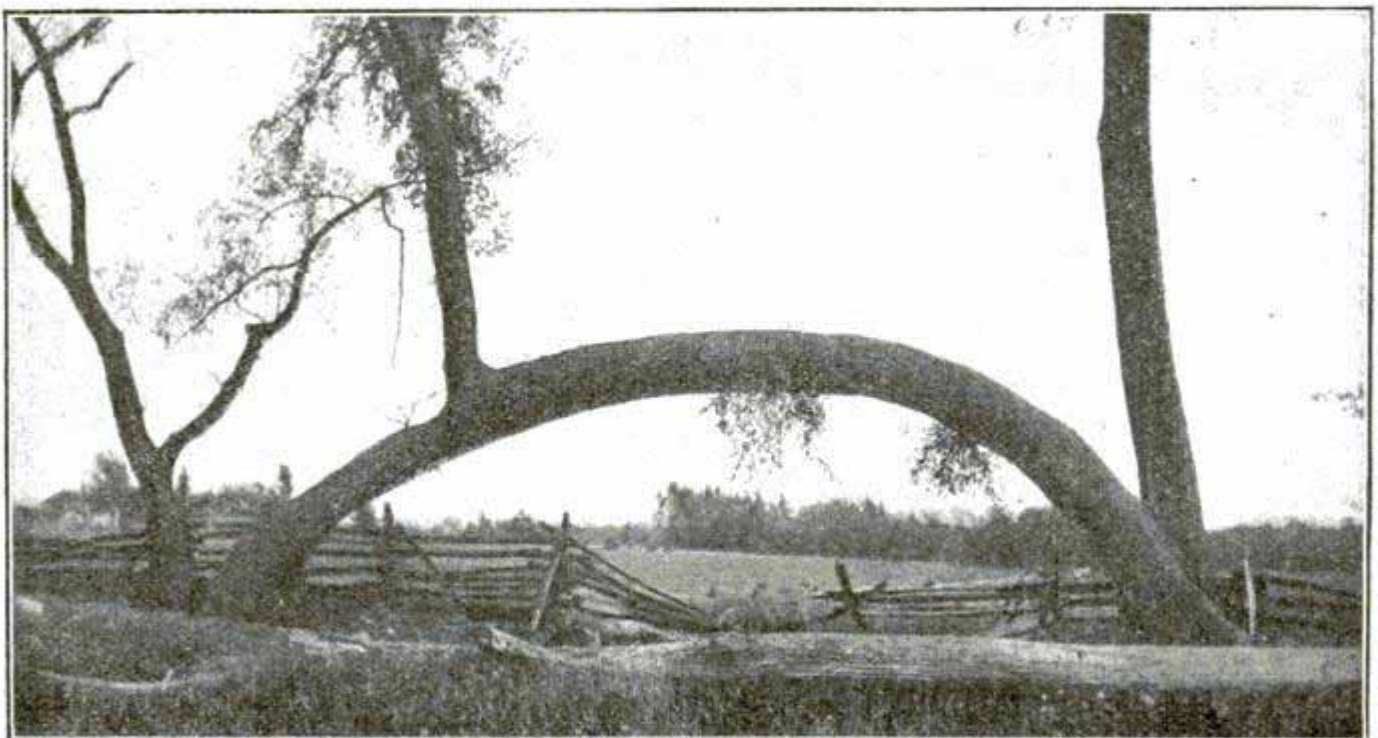
The smallest motor vehicles generally make the most noise, in which respect they are very like men of a similar calibre. The midget motorboat can be heard a long distance, while the great ocean liner moves majestically along in comparative silence. In proportion as a man raises his voice when in argument with another, in just that ratio does he lose dignity and force.

The young man with ambitions for advancement is recommended to try the effect on himself of self-control in speech, and note results. Most disputants have a good deal more in common than either is aware of and if they would first only try to see to what extent they are agreed, they are likely to find the point at issue decrease considerably in magnitude. Anyway, right or wrong, the one who has his voice in control stands a better chance to win.

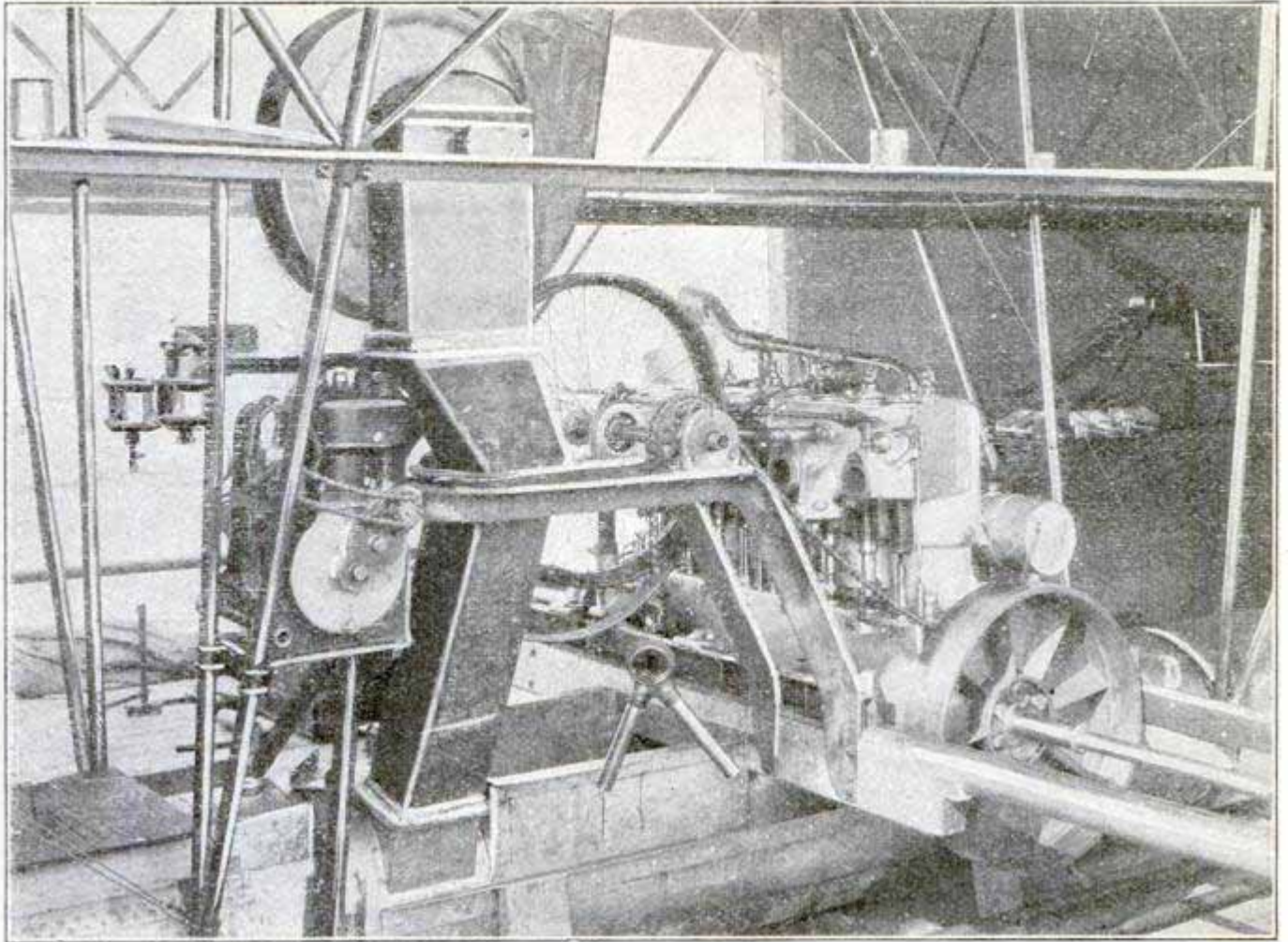
H. H. WINDSOR.

ARCH-SHAPED TREE GROWTH

One of the most curious tree growths in New York is in Livingston county. As shown in the illustration, it is a natural arch, the highest part being about 15 ft. from the ground. Its circumference at the largest part is $8\frac{1}{4}$ ft.



A Natural Wood Arch



Power Plant of the Arctic Airship

WELLMAN MAY ATTEMPT FLIGHT TO POLE IN AUGUST

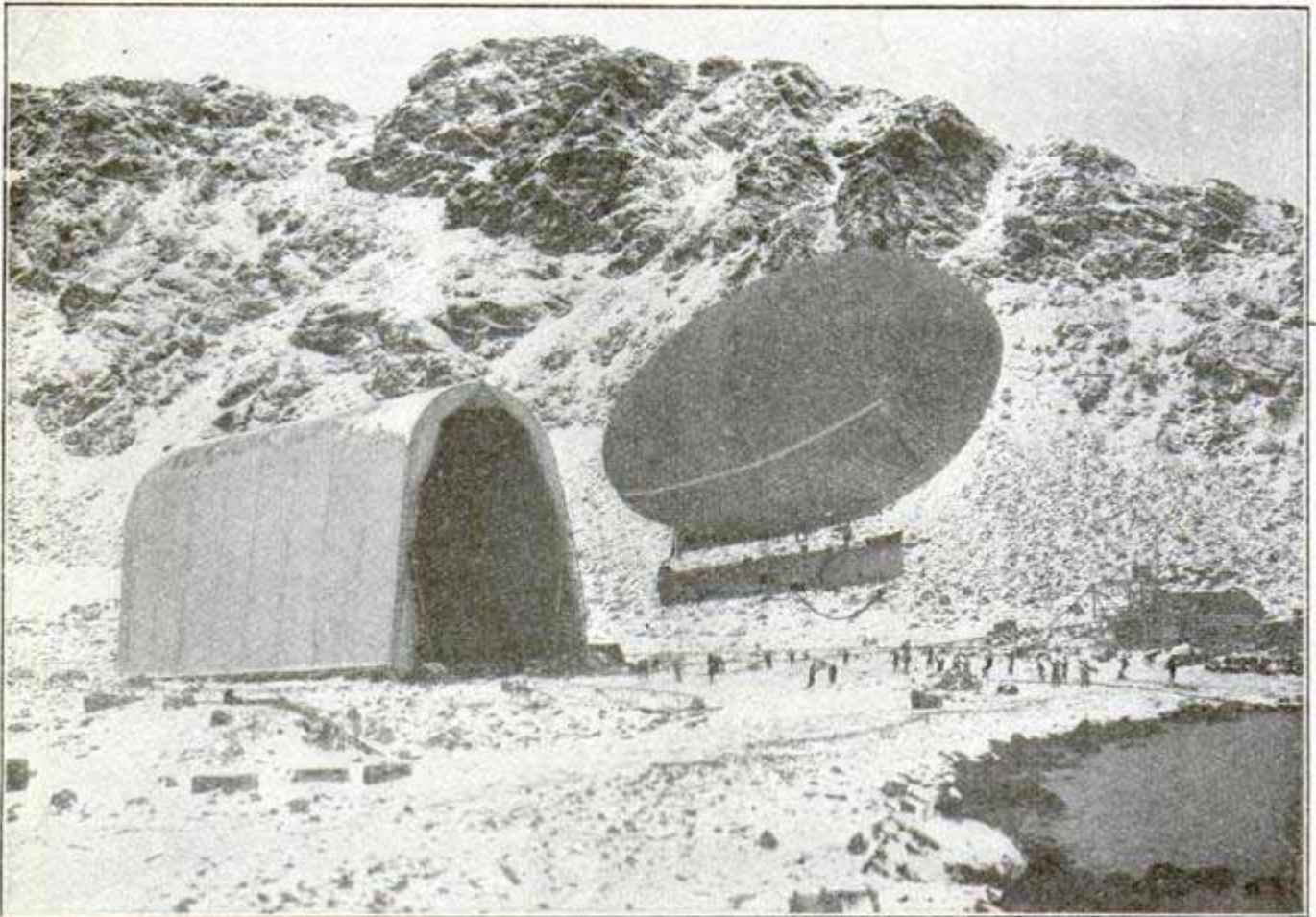
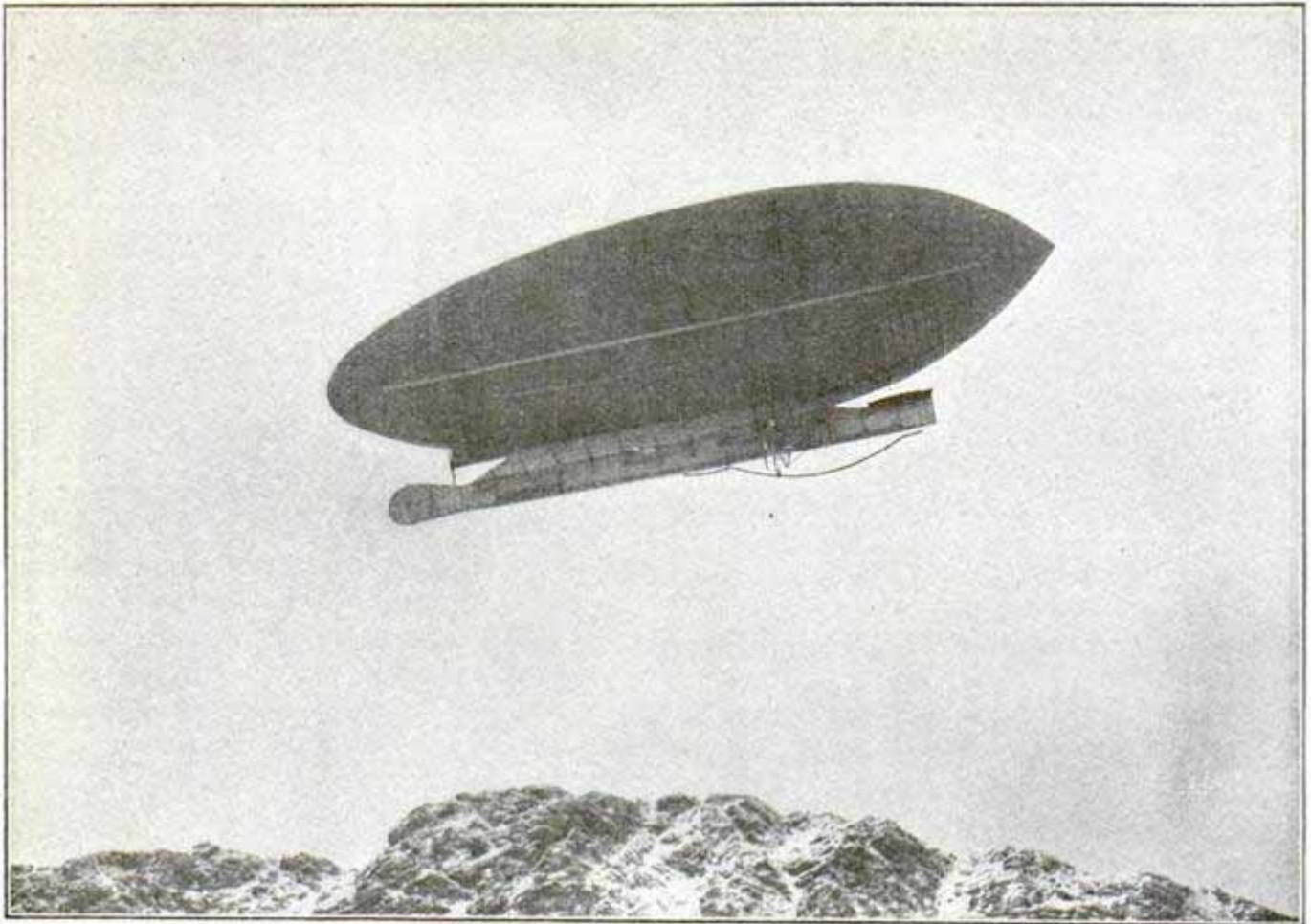
Walter Wellman, the journalist and explorer who made an unsuccessful attempt to start for the North Pole by airship in September, 1907, may make another attempt in August of this year, part of the expedition now being on the Spitzbergen group of islands far north of the continent of Europe in the Arctic ocean, and about 600 miles from the coveted goal.

The attempt this year, however, and future attempts, will not be connected in any way with the Chicago Record Herald or any other newspaper. The Record Herald has turned the equipment used in the first attempt over to Wellman as a gift, and the capital for the new venture has been supplied by friends of the journalist in the east. The airship "America," which is about three-fifths the size of the "Zeppelin," has received many minor improvements and is in excellent condition.

When she starts upon her voyage she will carry, as before, a crew of three men, 3 tons of gasoline, food for a year, sledges, sledge dogs, and all the requisites for turning the expedition into a sledging party, should accident require it.

Just what may be expected of the expedition this year or in future years is best told in Walter Wellman's own words.

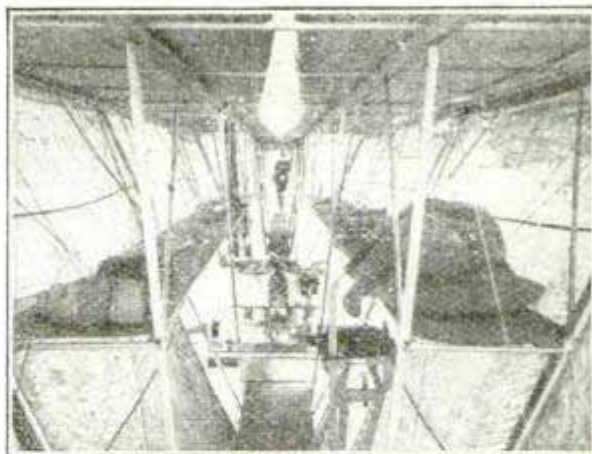
"If no serious accidents occur, and weather conditions are reasonably favorable, we shall start for the Pole in August. Otherwise, the start may be deferred until a more propitious moment. We have never had, and do not now have, the slightest intention of permitting ourselves to be driven by public clamor or the fear of criticism into an action not warranted by circumstances and our own judgment. We have set out upon a difficult task.



Views of Wellman's Airship at Spitzbergen

What the difficulties are, what the conditions under which success may or may not be attained, we know better than outsiders could possibly know. Hence our determination to play the game in our own way—to start when we are ready and the right moment has come, and not before. We hope that moment may come next August, and shall do our best to make it come."

When Wellman first announced his decision to try and reach the North Pole by airship, this magazine was somewhat critical. In 1906 the development of the airship, either of the heavier or lighter-than-air type, had not advanced far enough to prove even a flight of a hundred or so miles possible under perfect climatic conditions. To make the statement that a flight to the North Pole should not be attempted until such flights had been successfully accomplished was therefore perfectly justified. Now, however, such flights have been made. Zeppelin's great German airship has flown 850 miles, which is 250 miles further than the Pole is from the Spitzbergen station, and only

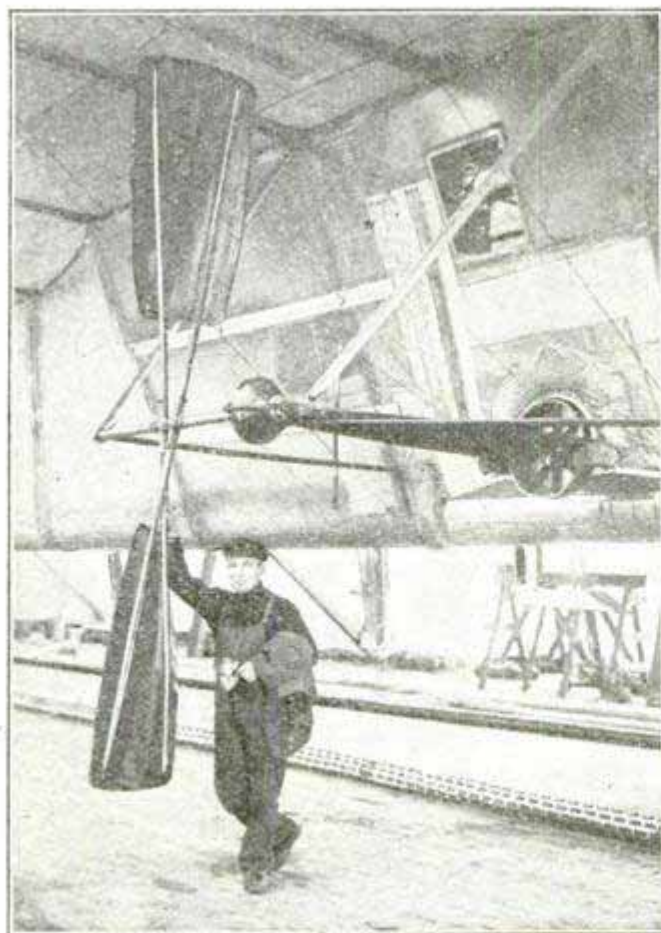


The Car Enclosed in Canvas

350 miles shorter than the round trip would be. Since Wellman made his attempt to start in September, 1907, the world has seen the airship develop from a possibility to an assured and recognized means of traveling through the air. If there was any chance at all of an aerial expedition reaching the Pole in 1907, there are a hundred more chances in its favor now.

BURIED ALIVE

Prince Urussov, in his "Memoirs of a Russian Governor," writes of an acquaintance, one Von Rohren, a very kindly man, who liked to tell sometimes of his presence of mind and his police ability as demonstrated on one occasion at his former post. He was once called upon to be present at the execution of a Jewish criminal. The condemned man hung the required number of minutes, and was taken down from the gallows, when the physician was supposed to confirm his death. But it appeared that they had forgotten to cut off the Jew's long, thick beard, thanks to which, although the noose had deprived the man of consciousness, it had not killed him. "Imagine yourself in my position," said Rohren; "the doctor told me the Jew would come back to life in five minutes. What was I to do? To hang him a second time I held to be impossible, and yet I had to execute the death sentence." "But what did you do, then," I asked, and received the memorable answer: "I had him buried quickly before he regained consciousness!"



One of the Propellers

HOW TO MAKE A MISSION COUCH

This beautiful piece of mission furniture can be made at a very moderate cost, if the material used for the cushions is of good imitation leather. These substitutes for leather last fully as long and the difference can only be detected by an expert. White oak will give the best results except for the frames or slats on which the cushions rest and these may be made of poplar or pine. If a mill or woodworking shop of any kind is handy, the hardest part of the work can be saved by securing the following list of material, cut, planed, sanded and squared up to the exact sizes given:

- 2 posts, 3 in. square by 17 in.
- 2 posts, 3 in. square by 26 in.
- 2 rails, $\frac{3}{8}$ by 8 by 82 in.
- 1 rail, $\frac{3}{8}$ by 8 by 25 in.
- 1 end, $\frac{3}{8}$ by 18 by 25 in.
- 1 piece, $\frac{3}{8}$ by 9 by 24 $\frac{1}{2}$ in.

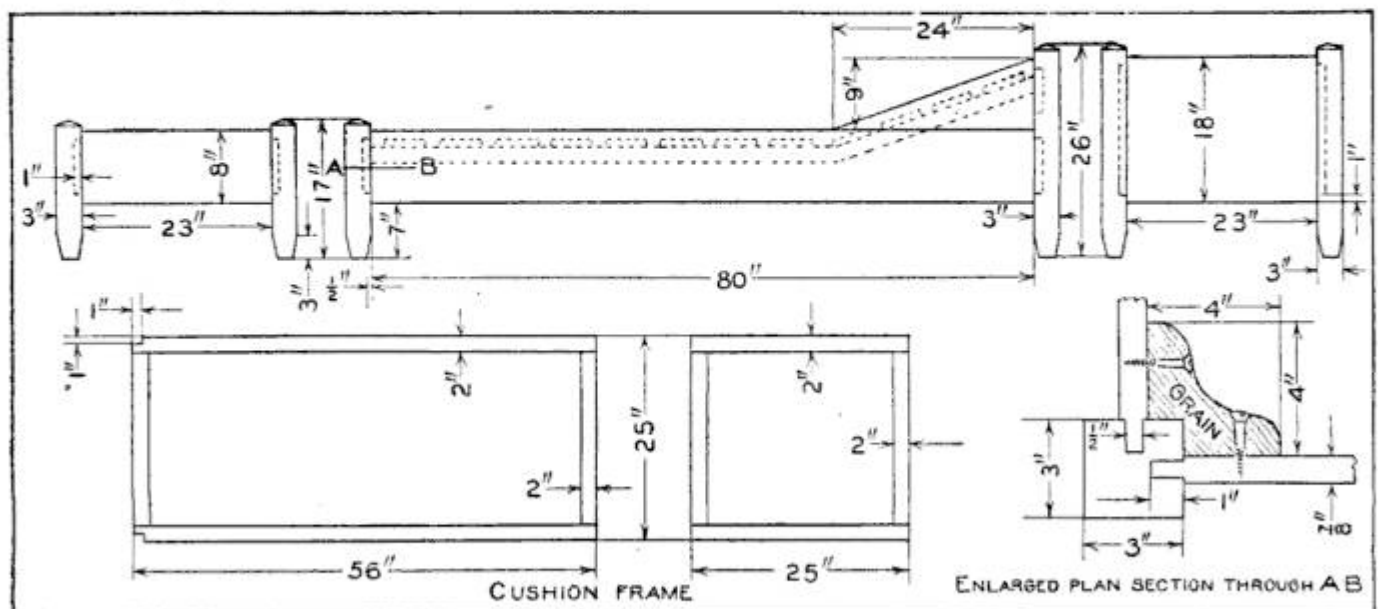
The last piece on the list when sawed diagonal makes the two slanting pieces at the head of the couch. The corner braces are made from two pieces of straight grained oak, 2 by 4 $\frac{1}{2}$ by 4 $\frac{1}{2}$ in., sawed on the diagonal, and cut as shown in the enlarged plan section to make the four pieces.

First be sure the legs are perfectly square, the two short ones and the two long ones of equal length respectively. Either chamfer or round the upper ends as desired, chisel and plane the taper on the lower ends. Lay out and

cut all the tenons on the rails—1 in. is the amount allowed at each end in the stock dimensions given. Arrange the posts and rails in the positions they are to occupy in the finished couch. Number each tenon and the place its corresponding mortise is to be cut in the post. Mark each mortise directly from the tenon which is to fit into it, taking care that all the rails will be an equal distance from the floor. Bore and chisel out all mortises and see that all the rails fit perfectly, before proceeding with the work.

The next step will be to fit in the slanting side pieces at the head of the couch. These must be let into the long posts $\frac{1}{2}$ in. and held also by a dowel in the side rail. In order to get these pieces into place, the mortise in the long post must be made $\frac{1}{2}$ in. longer than the tenon on the sloping side piece so the tenon may be first pushed into the mortise and then the side clamped down on the rail over the dowel. The whole couch should fit together perfectly before gluing any of the parts.

Glue the end parts together first. Hot glue will hold best if the room and lumber are warm; if these cannot be had, use cold glue. After the ends have set for at least 24 hours, glue in place the side rails and slanting head



Details of Mission Couch Construction



Mission Style Couch Complete

pieces. Screw in place the corner braces. Be sure when making these braces to have the grain running diagonally across the corner, or the brace will be weak, also, be sure the sides are square with the ends; this may be determined by measuring the diagonals to find if they are equal.

If it is decided to use frames for the cushions, then the following material will be necessary:

- 2 pieces, $\frac{7}{8}$ by 2 by 56 in.
- 2 pieces, $\frac{7}{8}$ by 2 by 25 in.
- 4 pieces, $\frac{7}{8}$ by 2 by 21 in.

This material may be of pine or poplar. These pieces are made into two frames as shown in the drawing and held together with long screws or nails. Fasten with glue and screw short blocks on the inside of the couch rails for holding the two frames in place. Tack pieces of cheap burlap across the frame and cover with ordinary black cambric. This will give a strong, springy rest for the cushions.

Should slats be used instead of frames for holding the cushions, then the following list of material should be substituted for the frame material list:

- 2 cleats, $\frac{7}{8}$ by 2 by 56 in.
- 2 cleats, $\frac{7}{8}$ by 2 by 25 in.
- 12 slats, $\frac{3}{4}$ by 5 by 25 in.

This list of materials may be of soft wood the same as for the frame. The cleats are fastened to the inside of the rails of the couch with screws, so the top edge will be 2 in. lower than the top edge of the rails. The slats are spaced evenly on these cleats.

After the glue is all set, remove the clamps and scrape off any glue that may be on the wood. If this glue is not removed it will keep the stain from

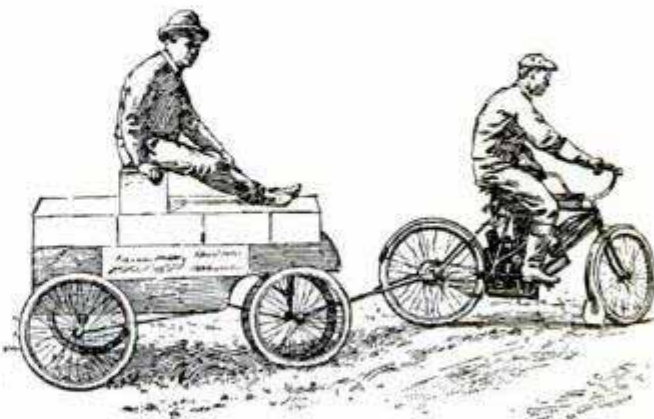
entering the wood, which will show up when finished in white spots.

This couch may be stained in any of the shades of brown or dark to harmonize with its lines of construction. A water stain will penetrate the wood best and after this is applied and thoroughly dried the surface should be well sanded to remove the roughness of the raised grain. Apply one coat of thin shellac and when this is dry, put on two coats of wax.

In making up the cushions, use either hair or elastic felt for the filling.

MOTORCYCLE TRAIN DELIVERS DYNAMITE

A dynamite agent in Salem, Oregon, uses the method here illustrated in delivering the explosive to his customers. He finds the motorcycle and its attendant truck an easy and safe means of getting rapidly over the ground. It is



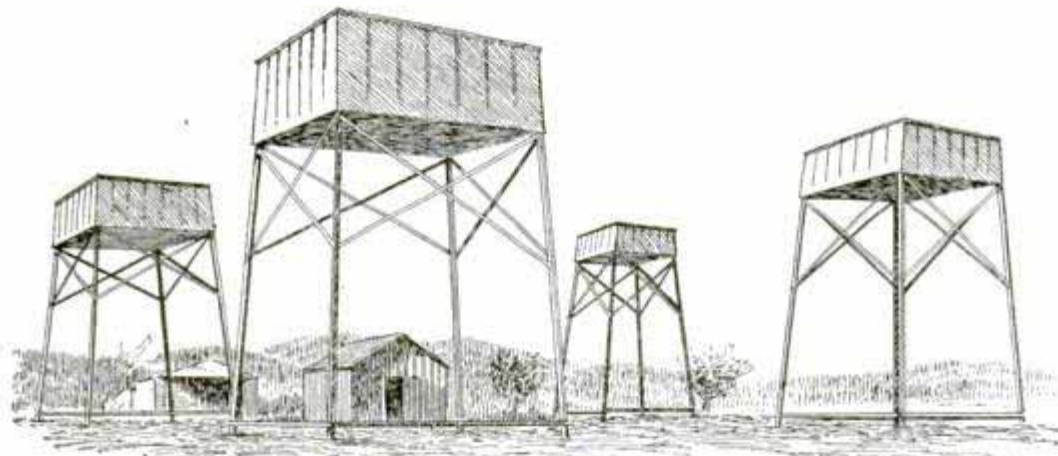
Hauling Dynamite

hardly necessary to state, however, that he does not attempt to break speed records.

MODERN RAIN-MAKING APPARATUS

That the making or precipitation of rain, a profession which had many exponents a few years ago in the West, has been modernized and brought down to date is shown in this illustration of just such a plant in the semi-arid portion of Oregon.

Electrical influences and powerful chemical combinations, so says the inventor, are the potent factors of the system. In any place or locality in which rain is to be made, the highest altitude near water in the neighborhood is selected, and towers are built at various heights. The station must be near water because of the quantity of it used, and the altitude is necessary



Plant for Precipitating Rain

so that it will be possible to treat all moisture-laden clouds directly.

In the box-like enclosure at the top of the towers are arranged tiers of trays, 216 for each tower. Into these trays is placed water and the secret chemical formula used. The water in the trays, aided by the chemical formula, rapidly evaporates, and this evaporation is kept up constantly, day and night, for long periods of time.

The system is not depended upon to precipitate rain from a clear sky, but to make the moisture condense and fall as rain when clouds are present. According to the inventor, there are many places and localities in the western states that have a deficiency of rainfall, not because there are no clouds or conditions to produce it, but

because the moisture fails to condense. "In fact," says he, "the elements at times are as favorable for heavy precipitation where it refuses to fall, as where it does fall."

TROUBLES OF THE FRENCH NAVY

No navy in the world has suffered more from minor accidents than has the French navy in the past few years. Incident after incident has occurred to throw discredit upon the organization of the service, the last being the failure to successfully launch the "Danton," one of the French "Dreadnoughts," on the date set.

The great vessel stopped on the ways and refused to budge, several reasons

being given in the official explanation. Among them is the fact that a new lubricant was employed for the ways and did not prove satisfactory. Part of it was absorbed by the wood and the remainder was washed away by the water. The incline of the ship was also stated to have been insufficient, and the attempt to launch was delayed until the tide was high, the after body of the battleship offering resistance to the water before it was fairly under way. Moreover, the total weight of the vessel was much above that estimated, due to the many hundreds of tons of armor plate in position and a lack of foresight somewhere. It was estimated just after the failure that it would cost France an additional \$100,000 to launch the ship.



Courtesy London Illus. News

Electric Watchdogs of Gibraltar

GIBRALTAR'S SEARCHLIGHT BATTERY

For ships to pass around Gibraltar, England's and the world's greatest fortress, without being observed even at night is a practical impossibility, owing to the great battery of searchlights arranged along the bottom of the rock. A ship running either in or out runs into one of the fixed beams of light and is revealed. A moving beam of light then follows her until the lookout officers are satisfied as to her intentions. The ship caught in this illustration is making private signals with Roman candles.

MYSTERIOUS WIRELESS BUZZ CAUSED BY INDUCTION OF TELEPHONES

For some time past, buzzings, believed to be mysterious signals, have been picked up by different wireless stations on the Pacific coast. These have puzzled many operators to such an extent that knowledge of the mystery spread all over the world, attracting the attention of scientists in every country and giving rise, among other suppositions, to the belief that perhaps Mars or some other planet was trying to signal this world.

Through experiments carried on by W. O. Boyd, chief operator of the Southern Pacific telegraph school, Mr. Falch, Leon Benner and Everett Osborne, on the top of Mt. Wilson, which

is one mile high, the conclusion has now been reached that the mysterious signals are nothing more nor less than the buzz caused by the induction of telephone lines. Some operators have asserted that they succeeded in tuning down the buzz to a point where they could make out what seemed to be signals in a code unknown to telegraphers in this world.

Another achievement of this lofty experiment station was to pick up clear signals from the Hawaiian islands, 2,000 miles distant. Messages sent by the wireless operator at the navy yard at Bremerton, Wash., wireless exchanges between warships out in the Pacific and of vessels of the Pacific Steamship Co., as well as from 75 stations along the coast were clearly read. This is double the number that were brought into the local field a year ago. The majority of the land stations picked are operated by amateurs, there being nearly 200 such stations along



Wireless Operators Experimenting on Mount Wilson

the coast, most of which are in and around Los Angeles.

The experiment party tried 10 different locations on Mt. Wilson before finding the one considered best. Conditions at the point selected were found to be admirable, one of its greatest features being a wonderful "ground." This was a well or spring with an iron pipe protruding, and water bubbling forth. To this was attached the ground wire, which plays such an important part in all electrical operations.

In carrying out the tests, the operators suffered greatly from the cold, as the station was out in the open and the most important work was done at night. With a railroad lantern to furnish light, the men remained at their posts through the nights, with receiving instruments strapped to their heads, listening for anything that might be picked out of the air.

MINERS' HOME IN IDAHO

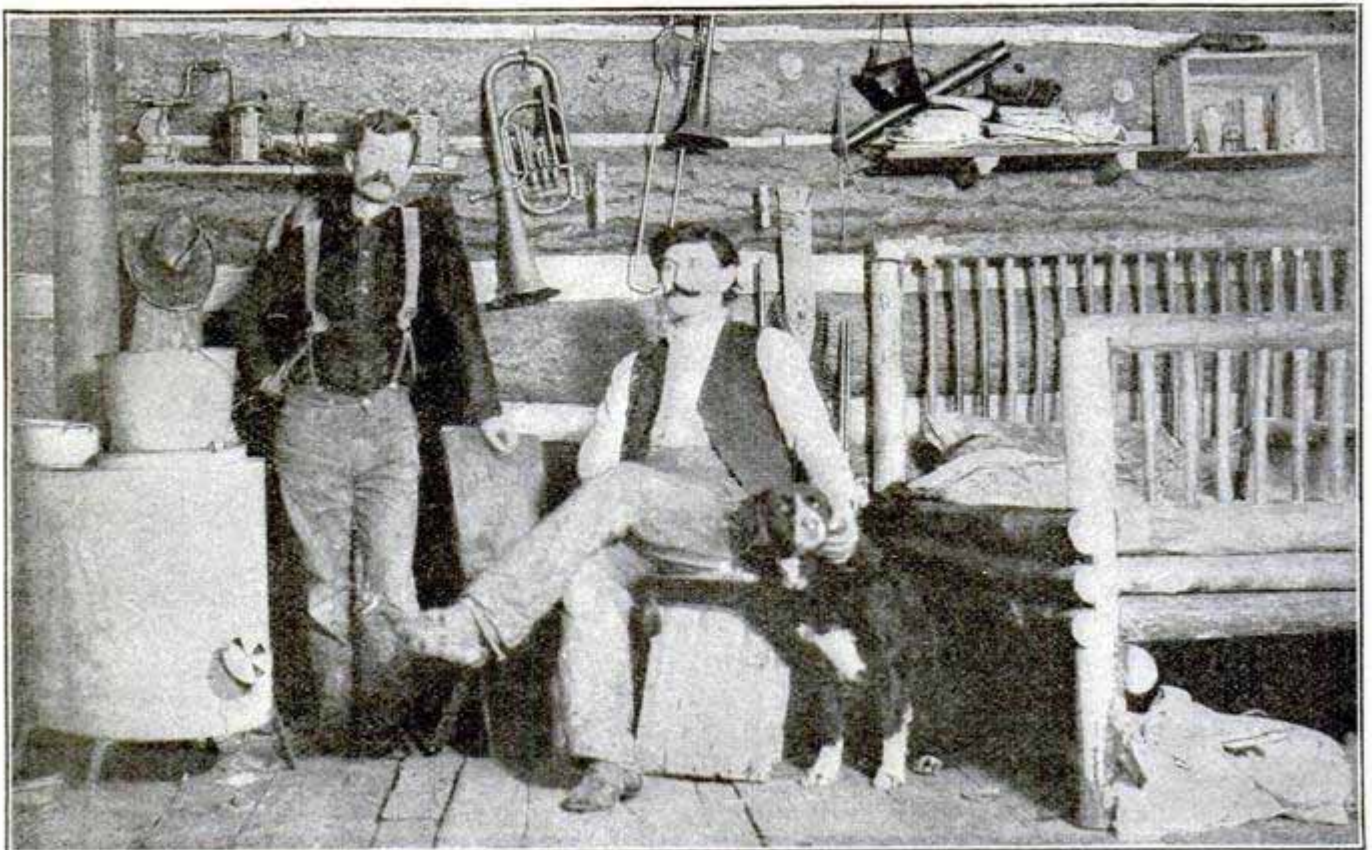
This illustration shows a miner's idea of comfort in the West. It is the log-cabin home of two miners near Idaho City, who, with the dog, are its

sole occupants. The bed is of the solid home-made kind that graced the homes of many of the early woodmen settlers of the country. The two horns hanging on the wall attest to the miners' love of music during leisure hours.

WHAT GRADE ELEVATION HAS MEANT FOR CHICAGO

The abolishment of grade crossings in Chicago up to the present time has cost \$53,622,000, and has prevented about 1,380 fatalities and 2,510 non-fatal accidents. On this basis each grade crossing prevented to date has been effected at an expense of \$13,800. The total expenditure on track elevation when all the work is completed probably will reach \$150,000,000, and with even this great figure it is estimated that within two generations the \$13,800 cost of prevention for each accident will be reduced to less than \$3,000.

The decrease in grade crossing accidents since 1899 has been steady. In that year Chicago had a population of 1,626,333, and 113 fatal and 169 non-fatal grade crossing accidents were re-



Solid Comfort in a Mining Camp



Probably one of the most curious street-cleaning brigades of any city in the world is that composed of tame buzzards in Vera Cruz, Mexico. They act as scavengers throughout the whole city, and a few years ago, before the streets were paved, were of the greatest necessity. One of the amusements of tourists in Vera Cruz is to throw food to these birds while dining at the tables on the porches of the hotels. The illustration shows these scavengers busily engaged in lightening the load of a garbage cart. Hundreds of the buzzards roost in the cathedral towers at night.

corded. In 1908 Chicago had a population of 2,166,055 and only 20 fatal and 27 nonfatal grade crossing accidents occurred. Prior to 1899 only 35 miles of roadbed had been elevated. At the present time about 120 miles has been elevated.

Aside from the safeguarding of human life, which is the most important, the material results of track elevation must also be considered. During the year 1908 the fares recorded by Chicago's street car lines numbered 643,386,000. Most of the railroads intersect street car tracks every half mile where surface traffic is the heaviest, and it is fair to assume that at least 150,000,000 of these fares encountered railroad tracks or subways.

If tracks had not been elevated passengers would have suffered many delays from blocked crossings. Assuming that each passenger trip of the 150,000,000 would have been delayed an average of one minute, and that 90,000,000 pedestrians would have been held up a like time, 4,000,000 hours' time would have been lost.

The avoidance of delay to the fire

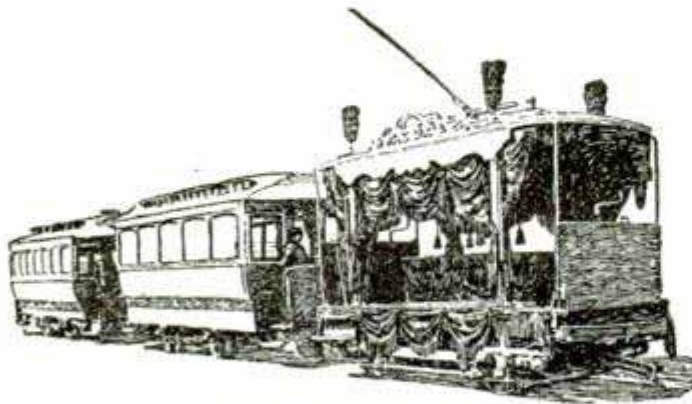
department is also of vital importance. This delay is of enormous consequence when the passage of streets is blocked by long freight trains.

AIRSHIP WAR STATIONS ALONG ATLANTIC COAST

The signal corps of the U. S. Army has been issued instructions by the secretary of war to prepare a plan for the protection of the Atlantic coast by dirigible balloons. The scheme involves the establishment of balloon houses all along the coast from Maine to Florida. The stations, if built, will be 250 miles apart, this being considered a safe distance of flight for the airship of the present day. The intention is for these aerial craft to go scouting at sea, turning and flying back to shore to give the alarm when the fleet of an enemy is sighted, but if Congress should provide for such a fleet, it would undoubtedly be ready before long to drop explosives on the ships of an enemy as well as simply scout.

FUNERAL TRAINS AND CARS IN MEXICO CITY

The returns from the funeral service of the electric street railway company of Mexico City is between 3 per cent and 4 per cent of its total traffic. The

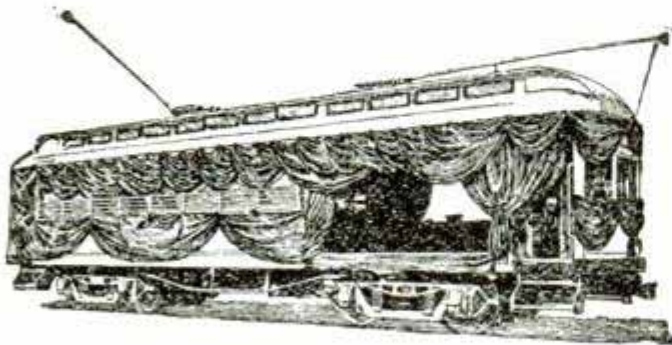


Mexican Funeral Train

company conducts all the city funerals, even to furnishing the hearse and trailer cars for mourners. In accordance with a clause in its concession the corpse of a pauper must be carried free.

The cemeteries of the city are several miles away from the central portion, the country roads are difficult for vehicles to traverse, and the general scarcity of vehicles not engaged in public carriage service around the city is so pronounced that the advantages of the more showy method of carrying the corpse in the "caroso," funeral car, and the mourners in trailers, outweigh all other considerations.

On receipt of a call the company sends the cars to an appointed place on the line nearest the home of the deceased and the funeral cortège proceeds



Combination Funeral Car

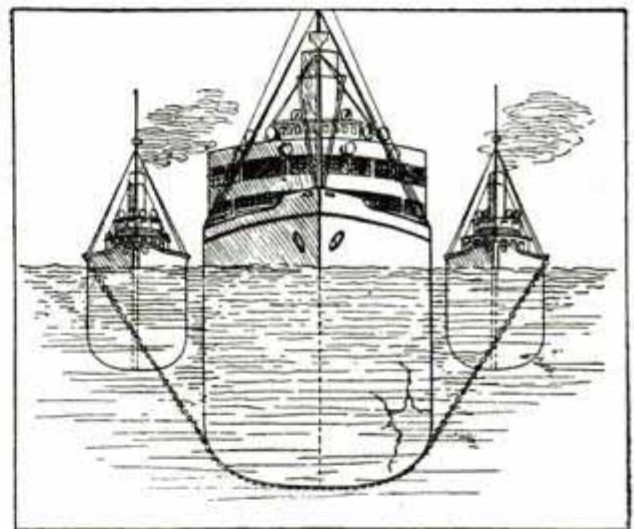
on foot from the house to the train. The illustrations show a first-class combination funeral car, having one

compartment for the coffin and another for the mourners, and a funeral train, consisting of a motor hearse and two trailers. The different funeral cars and trains of the company, which are many, comprising even mule-drawn cars to run on old lines, vary in price from \$3.75 to \$150 for a funeral.

PONTOON-TUG BOATS TO RAISE SHIPS

A new application of the old principle of pontoons for raising sunken ships is shown in this illustration. The idea is a combined pontoon and tug, forming a wrecking plant designed to raise submerged craft of any tonnage, no matter what the position of the wreck is and regardless of the heaviest seas.

The plant consists of four pontoon-



New Application of an Old Principle

tugs, each 150 ft. long, 40 ft. wide, and 40 ft. deep. Each tug is equipped with engine and screw for propulsion purposes, and engines to pump water into and out of the compartments. In the case of a wreck lying, say, in 30 ft. of water, where the services of an ordinary diver could be utilized, two pontoon-tugs would be arranged on one side of the submerged vessel and two on the other. The compartments would then be filled with water, sinking the tugs alongside the sunken vessel. The diver, armed with a hydraulic hose, would cut a channel through the sand or mud under the keel, both fore and aft, and by the same method drive cables



through these openings. These cables would drag the lifting chains under the hull. The ship would then be resting in a sort of chain-cradle, with the ends of the chains made fast to the pontoons. Pumping the water out of the compartments of the pontoons would cause enough buoyancy power to be exerted on the chains to lift the vessel to the surface.

Where a vessel lies too deep for an ordinary diver to reach, a telescopic chute, down which a man is lowered to the sides of the hull, is to be used, and the hydraulic hose employed as in shallower water to drive the grip chains into position.

It is claimed that each pontoon-tug will possess a lifting power of 5,000 tons, giving the complete plant of four tugs a lifting capacity of 20,000 tons. The most powerful of the ordinary wrecking tugs, equipped with chains and tackle to give them lifting power, will not lift more than 2,000 tons dead weight.

In case of a severe storm while at sea the compartments of the tugs will be filled with water, sinking all but a small part of them beneath the surface.

More than \$1,000,000 a year is lost by shipwrecks in the Hell Gate channels in the East river, although millions have been spent on improving the tortuous channels.

BARN BLOWN OVER HOUSE

This illustration depicts the playful freak of an Iowa blizzard. The barn was lifted bodily off its foundation and made to turn a somersault over a tool house without harming a shingle of it. Several other buildings were blown down at Alata while the storm was at its worst.

Many buildings have been picked up bodily and whirled over and over by cyclones in western states, but the wind which caused this damage was of the straight variety, not a "twister."

AEROPLANES TO FIGHT DIRIGIBLES

European aeronautic experts are of the opinion that the best means of fighting dirigible balloons of the Zeppelin type is the aeroplane. They believe that the aeroplane is not limited by the density of air to the same extent as the dirigible airship in the height it may attain. Above the two cars of such an airship as the Zeppelin is a great expanse of gas bag, keeping the operators from seeing what is going on over their heads and making it impossible to devise a means of defense against an enemy in the heights above. "What would prevent," they ask, "an aeroplane from rising above and destroying it with impunity and ease?"

GREAT AUSTRALIAN RAILWAY STATION

By the completion of the huge structure shown in this illustration, Melbourne, Australia, has one of the most up-to-date railroad stations in the world. Its cost, including the supplementary work, entailed an expenditure of more than \$2,000,000.

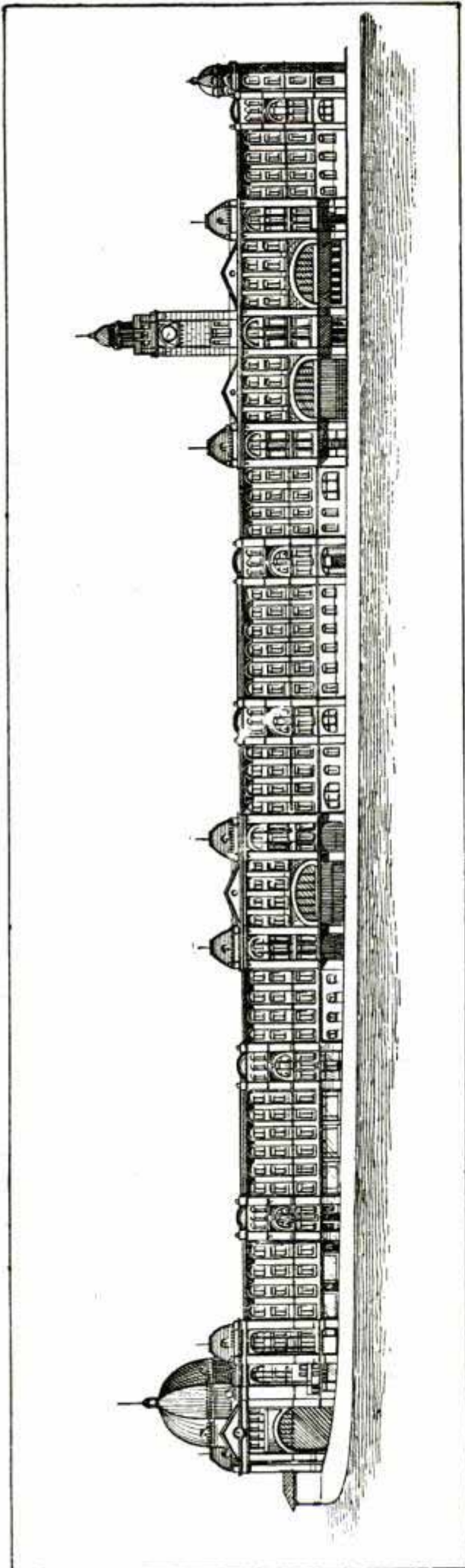
Australians, in manner of speech, and many other respects, are more like Americans than like the English. The country's area, 2,972,573 square miles, is only 120,000 square miles less than that of the United States, not including Alaska. Its colonization is now advancing somewhat along the lines of that of America in the last century, and the rush and hustle usually accredited to Americans is part of its spirit.

THE FIRST FRICTION WAGON BRAKE

McConnellsburg, Pennsylvania, situated on what was the ancient Indian path from the Delaware to the Ohio river and later a famous wagon road, claims the distinction of having been the home of the man who invented the friction wagon brake. Great difficulty and many accidents in descending the mountains with the heavily loaded wagons, caused by the lack of a convenient and effective device to hold the wheels under control, gave George Divens the incentive to invent and place on his wagons a friction brake. It is the same brake being used today, without a single essential change in mechanical structure or application.

At certain seasons of the year the travel and transportation over the old wagon road was extensive, as many as one hundred 6-horse teams stopping in the town over night on occasions.

Light housekeeping in the cab of a locomotive was the experience of an engineer who took charge of two new "dead" locomotives that were drawn across the continent. A stove was rigged up in one corner of the cab and a small bed along one side.



EUCALYPTUS PILING PROOF AGAINST TEREDO

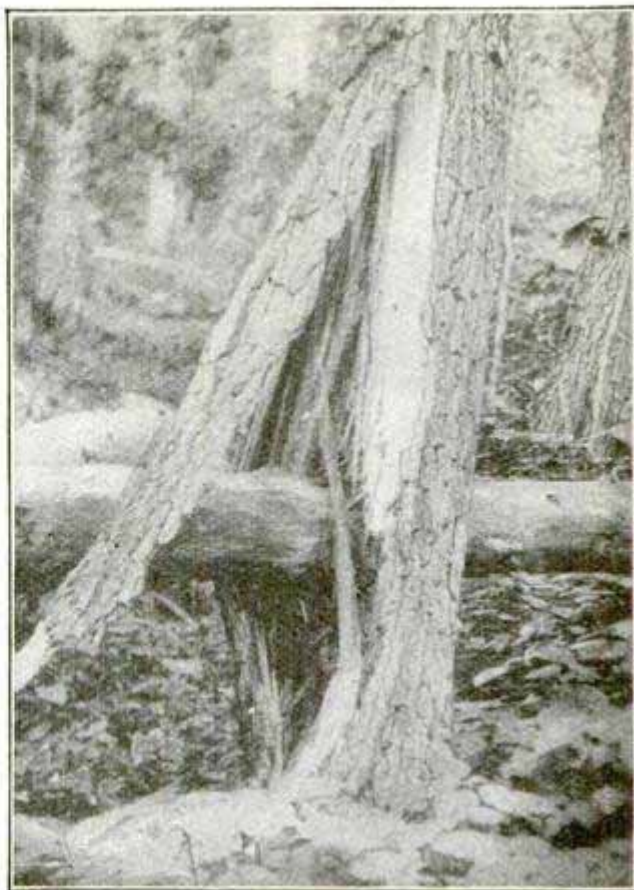
Within the last few years a considerable number of eucalyptus piles have been sunk in the harbor at San Francisco. In every instance these piles, which have now been down long enough to make a thorough test, have successfully resisted the inroads of the teredo and other destructive marine life. Something like 250 eucalyptus piles are now being used in repairing one of the city's wharves.

SMOKELESS POWDER BURSTS RIFLE

Following a target practice at Fort De Soto, Florida, the private shown in this illustration jammed a cleaning rag in the barrel. An attempt to drive it out with a rod and hammer only made it become wedged still harder. Five blank cartridges also failed to budge it, but a ball cartridge discharged into the barrel ended with the result shown. The barrel was split nearly its entire length.



Clogged Rifle Split by Discharge



SLIDING LOG TEARS THROUGH TREE TRUNK

A log, sliding down a runway in the lumber district in Lycoming County, Pa., known as the "Black Forest," swerved from its path with the result shown in the illustration. It struck the tree trunk squarely with enough force to drive its end completely through.

FIFTY YEARS OF PROGRESS

In the annual report of the New York Chamber of Commerce, dealing with the growth of the United States, it is shown that the increase in population since 1858 has been 193 per cent; the wealth of the country, 563 per cent; the public debt, 2,375 per cent; war expenditures, 329 per cent; navy expenditures, 745 per cent; the per capita debt from \$1.51 to \$10.76; bank deposits, 3,460 per cent; receipts of the government, 1,186 per cent; imports per capita, from \$8.35 to \$13.70; exports per capita, from \$9.14 to \$21.04, and the consumption of wines and liquors, 266 per cent, or from 6.42 gal. per capita to 23.25 gal.

COMBINATION CHAIR FOR INFANTS AND ADULTS

This combination dining chair for infants and adults is a high chair possessing all the practical features of the



ordinary dining chair. It looks like, and is, an ordinary dining chair when folded, but simply lifting back the seat converts it into a high chair of the standard height, tray and all. When in the latter position, the infant's seat is supported by steel bars of the Jack-in-the-box type, and that is what the chair really is.

RAISING BRITISH "GLADIATOR" A FAILURE

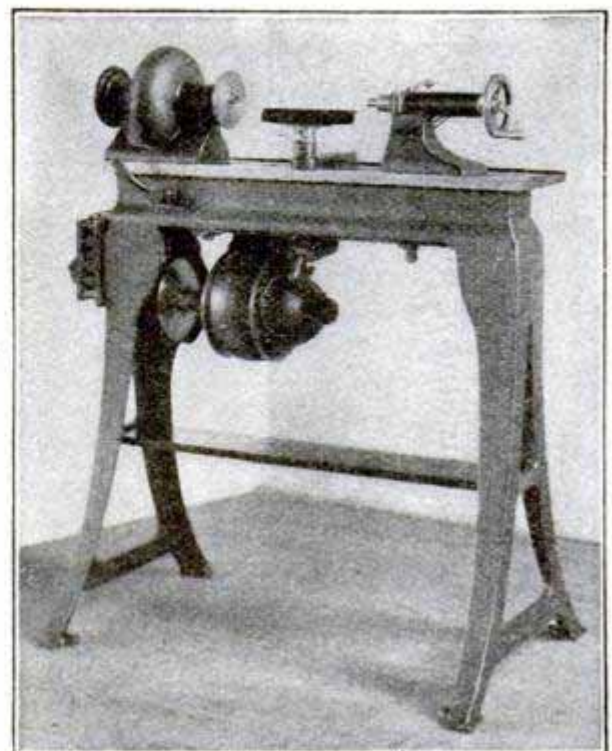
Bad judgment on the part of the British Admiralty in raising the cruiser "Gladiator," sunk a little more than a year ago in a collision with the trans-Atlantic liner "St. Paul" off Yarmouth, has cost England a dead loss of \$280,000. No less than \$325,000 was expended in the difficult task of salvaging, yet she has just been sold to a Dutch firm of shipbuilders for \$45,000. It is claimed that she could have been sold where she lay for that amount.

THE NATIONAL BALLOON RACE

Six big balloons left Indianapolis on June 5 in the first national championship balloon race held in this country. The distances flown were not great, the balloon "University City," of St. Louis winning the distance contest by a flight of only 375 miles. The "Indiana"—Carl G. Fisher, pilot—won the time trophy by staying in the air 48 hours. He finally landed near Tennessee City, Tenn. The air currents were not steady, the balloons circling around and gradually moving south.

MOTOR-DRIVEN SPEED LATHE

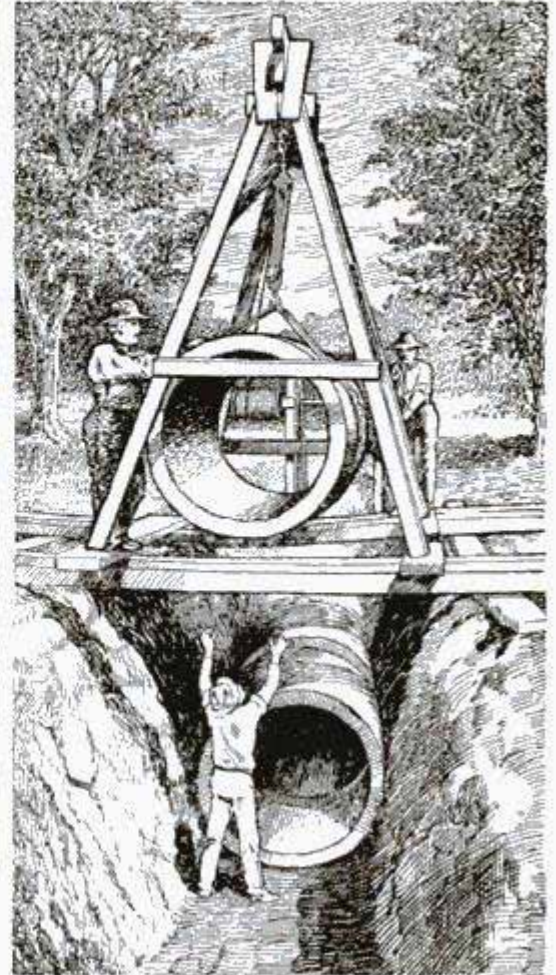
The illustration shows a motor-driven type of speed lathe constructed by the Washburn Shops of the Worcester Polytechnic Institute. The success attained by the friction-driven drill presses, also a product of this same institution, led to the adaptation of the same principle on both wood and metal lathes. The motor is so hung under the bed of the lathe as to be out of the way of the operator. The power from the motor is transmitted to the headstock spindle by means of rolls and disk friction. The pressure neces-



Motor Hung Under Lathe Bed



A Stock of Concrete Pipe
Moulds in Which Pipe Is Made



Method of Laying Pipe under Ground

sary between the rolls and disks is controlled automatically with a cam clutch. This cam clutch acts as a positive drive or tightener and increases or decreases the pull of the disk on the roll directly as the work requires, the pressure between the disks and rolls being very slight, except when turning.

The lever near the headstock controls the variation spindle speeds. The lever is attached to a gear that meshes in a rack that is 2 in. long. This will make the changes of speeds of over 4 to 1. The spindle is stopped without stopping the motor by throwing the speed lever to its extreme position. When in this position, the driver disk is out of contact with the rolls, the disk being recessed for this purpose.

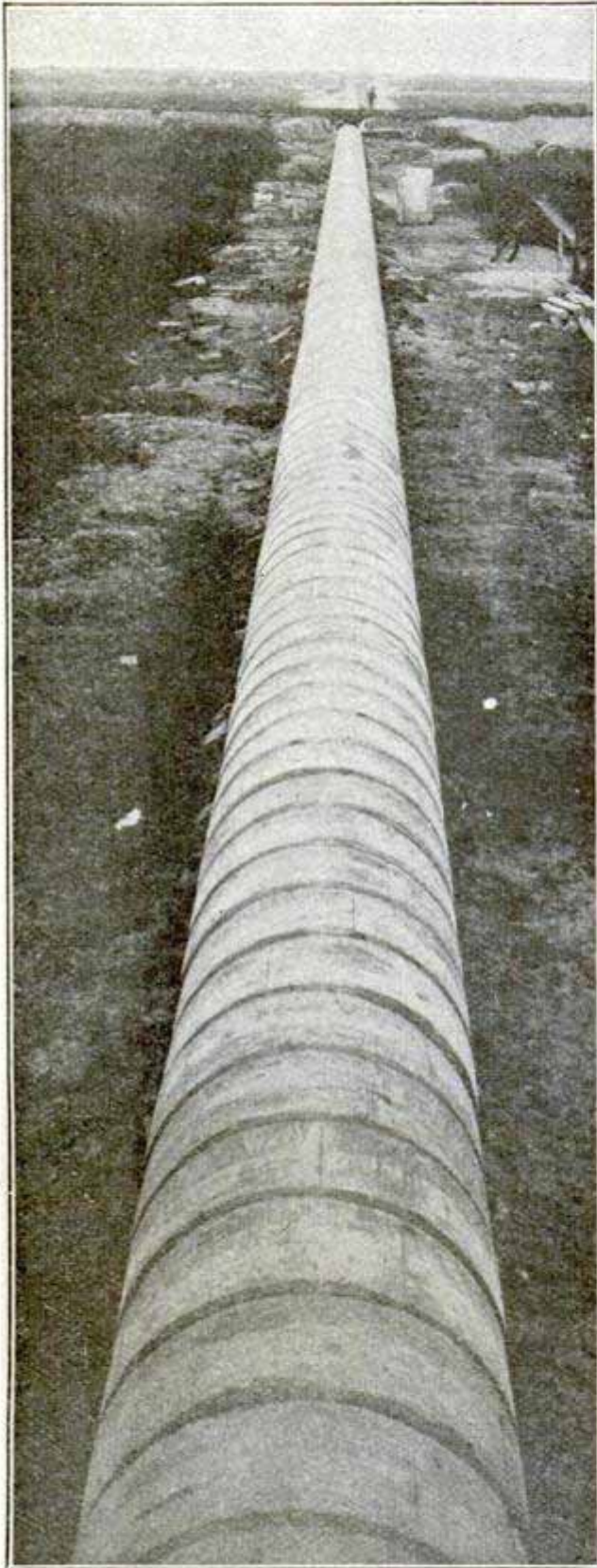
The contract for constructing the concrete drydock at Pearl Harbor, Hawaii, was awarded on a \$1,700,000 bid. It will be one of the most extensive concrete constructions of its kind ever attempted.

REINFORCED CONCRETE WATER AND SEWER PIPE

While iron and steel men insist that this is an age of steel, and electrical engineers hold it is the electrical age, concrete builders maintain that it is also the concrete age, and everyone will agree that while concrete has been utilized for centuries past, it has never been so universally employed as at present. Buildings of all kinds, large and small, vessels, railroad ties, pavements, mine shafts, walls, breakwaters, piers, piles, water and sewer pipe, tanks and wells, as well as many other kinds of construction are now being made of concrete.

The illustrations show the moulds for making sewer and water pipe, the method of laying them, and a line of 5,000 ft. of such pipe in Waukegan, Ill. The Waukegan line, however, is above ground. The diameter of the pipe is 48 in. More than 1,000 ft. of pipe 66 in. in diameter has been laid at Atlantic City, and in still another

city a line of pipe 72 in. in diameter has been completed for a distance of 4,000 ft. Hydro-electric power plants are also using reinforced concrete pipe.



Surface Line at Waukegan

WIRELESS TELEPHONE ON BATTLE FLEET A TOTAL FAILURE

Conditions at Sea Less Favorable Than on Land
—Experiments Will Continue However

While "C. Q. D." proved successful with the Atlantic fleet on its trip around the world, wireless telephony tests resulted just the opposite. In no instance during the entire voyage did the "hello 'Connecticut'" or the greeting to any of the other battleships of the fleet get any response.

This is the text of a report of the wireless telephone as made by Admiral Sperry to the Navy Department upon his return from the famous trip. During the voyage the telephone was tried daily by the commandants of each ship, and each filed a report as to the nature and result of the tests. In not one single instance was there a favorable report made, and the Navy Department, upon the strength of the reports, abolished the telephone on ships of the Navy.

The Navy Department, however, will, during the summer and fall, make further experiments and tests with the wireless talking apparatus, with the view of perfecting it. One test station will be at the Alaska-Yukon-Pacific Exposition at Seattle.

"The chief trouble with the wireless telephone," said a prominent naval officer, "is the receiver. It is easy enough to make a call, but it is almost impossible to receive any message. We tried the apparatus at all distances, from a half mile to five miles. It was easy enough to distinguish 'hello,' but as for making out anything else it was quite impossible.

"The service was installed by a New York concern, and a member of that firm personally supervised many of the trials at sending and receiving messages.

"It will be years, if ever, before the wireless telephone will be of any service to naval vessels," continued the officer. "It may, eventually, prove successful on land, and become commer-

It is estimated that 200 aeroplanes can be built at the cost of one "Zep-pelin."

cially one of the wonders of the twentieth century."

The Army's greatest interest lies in the wireless telephone. General Allen has at his disposal about \$30,000 to be used for purchasing suitable apparatus for the Army's use.

Wireless Telegraphy Improving

The United States Navy is not lagging in the development of wireless telegraphy. The wireless experts of the Navy are continuously working to improve its use on the big sea fighters. A series of extensive experiments have begun at Brand Rock, Mass. These experiments will be carried on to demonstrate the capability of meeting all requirements set forth in the specifications of the Navy Department, about which some doubt has been expressed by the experts.

These experiments will probably extend throughout the summer, and the battleship "Connecticut," flagship of the Atlantic fleet, will take part. There is being installed on the "Connecticut" a new set of wireless instruments capable of sending messages a distance of 2,000 miles and receiving them at a distance of 3,000 miles. The battleship "Mississippi" also is to be equipped with a similar apparatus later on.

Extensive use will be made of wireless telegraphy during the maneuvers of the Atlantic battleship fleet on the Atlantic coast this summer. The torpedo boats of the Atlantic torpedo flotilla are being equipped with wireless. These will be the first vessels of the torpedo craft of the Navy to be so equipped. These little vessels will have a sending radius of about 200 miles.

At present the Navy has a school for instructing men in wireless telegraphy. It is located at the New York Navy Yard and there are in attendance about 60 students. These men when fully efficient are sent to the Navy wireless stations on the coast or aboard one of the battleships, where a force of five men is required to work the ship's instruments.

The Army Signal Corps officers have purchased for experimental purposes a

German portable wireless set, mounted on wheels. The army has been using a portable set which is carried on the backs of animals and which is capable of exchanging messages at a distance of 25 miles. With the larger wireless set from abroad, communication is possible for a distance of from 100 to 125 miles.

The apparatus is mounted on a vehicle drawn by four horses and equipped with an extension steel mast which may be elevated to a height of 60 ft. It is proposed to try out this type of portable wireless apparatus, with a view to ascertaining whether it may be advantageous to add it to the equipment of the Army Signal Corps in the field.

BIRD HANGS SELF IN ALMOST HUMAN FASHION

When this blue jay was found "hung by the neck until dead" in a tree at De Kalb, Ill., it was first hailed as an



Unpremeditated Death by Hanging

extraordinary example of animal suicide, but after close study the bird was proved not guilty of cold-blooded, pre-meditated self-destruction. The investigation shows that the bird had been flying through a box elder while carrying a string about 3 ft. long. The string

was looped very evenly, and in some manner the loose ends became entangled around a twig, this probably stopping the bird in its flight. In the mix-up the looped end caught around its neck, becoming tighter and tighter as it struggled to free itself.

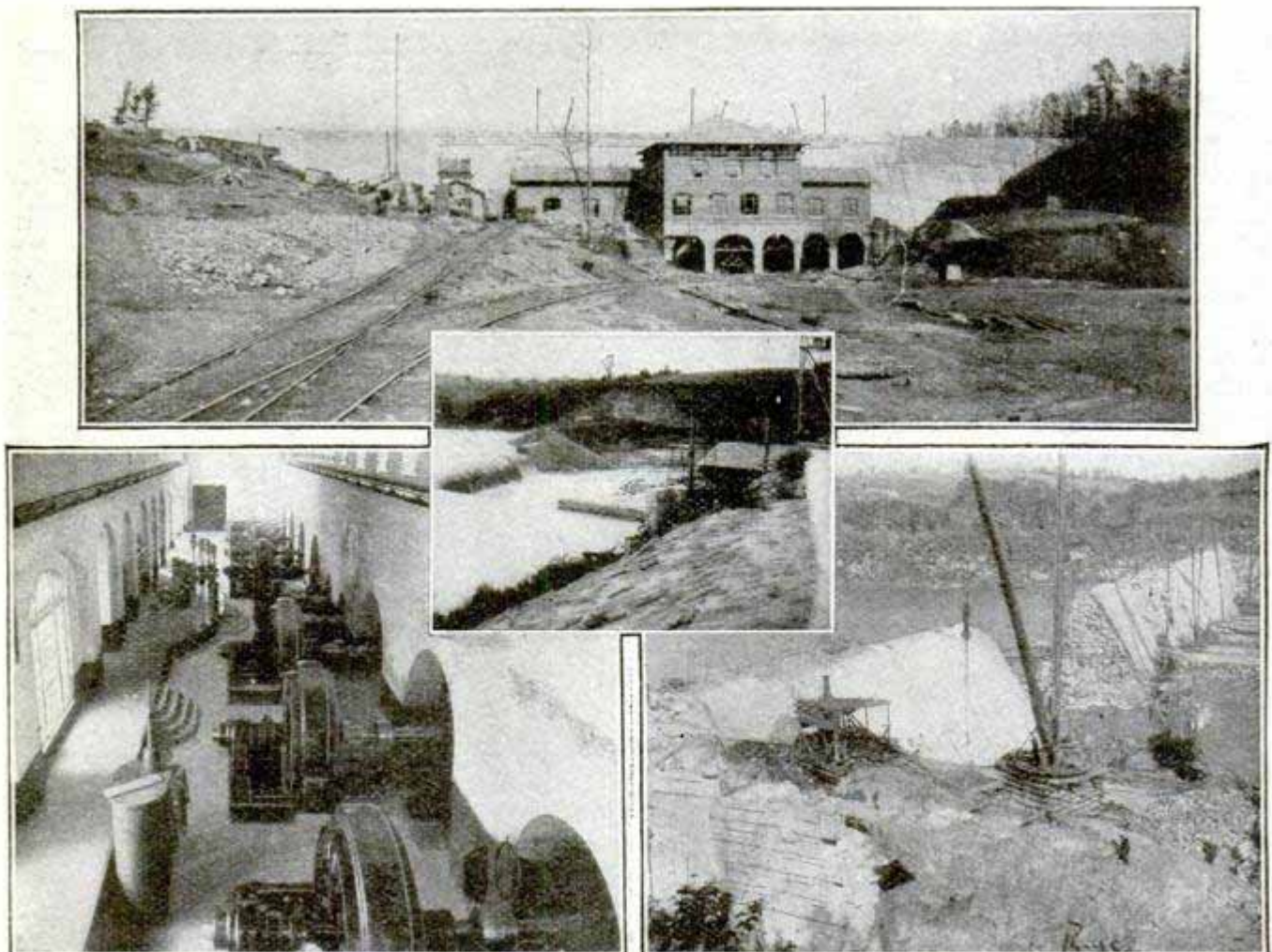
GREAT HYDRO-ELECTRIC COMPANY OPERATES 110 COTTON MILLS

By S. Mays Ball

There is a great hydro-electric power company in the South, with headquarters at Charlotte, North Carolina, which has contracts to furnish power to 110 cotton mills in the Piedmont-Carolinas, and at present is supplying most of them. Four great power stations are now in operation or building at the different sources of water power. When all are completed, the company will have 640 miles of transmission

lines and will furnish 110,000 hp. per day to the 110 or more mills.

There are in the cotton mills of the South at the present time 13,000,000 spindles, using approximately 400,000 hp. Less than one-third of this is furnished by water power, while something like 2,000,000 of such horsepower is still undeveloped in the very heart of the cotton fields. For some time the company has had over 400 miles of



Massive Bulkhead of Great Falls Station
 Interior of Great Falls Station
 Developing Electricity from Water Power
 Rocky Creek Station Dam

50,000-volt line, carrying from 50,000 to 60,000 hp., in commission. The additional transmission lines will extend over 240 miles and carry 100,000 voltage.

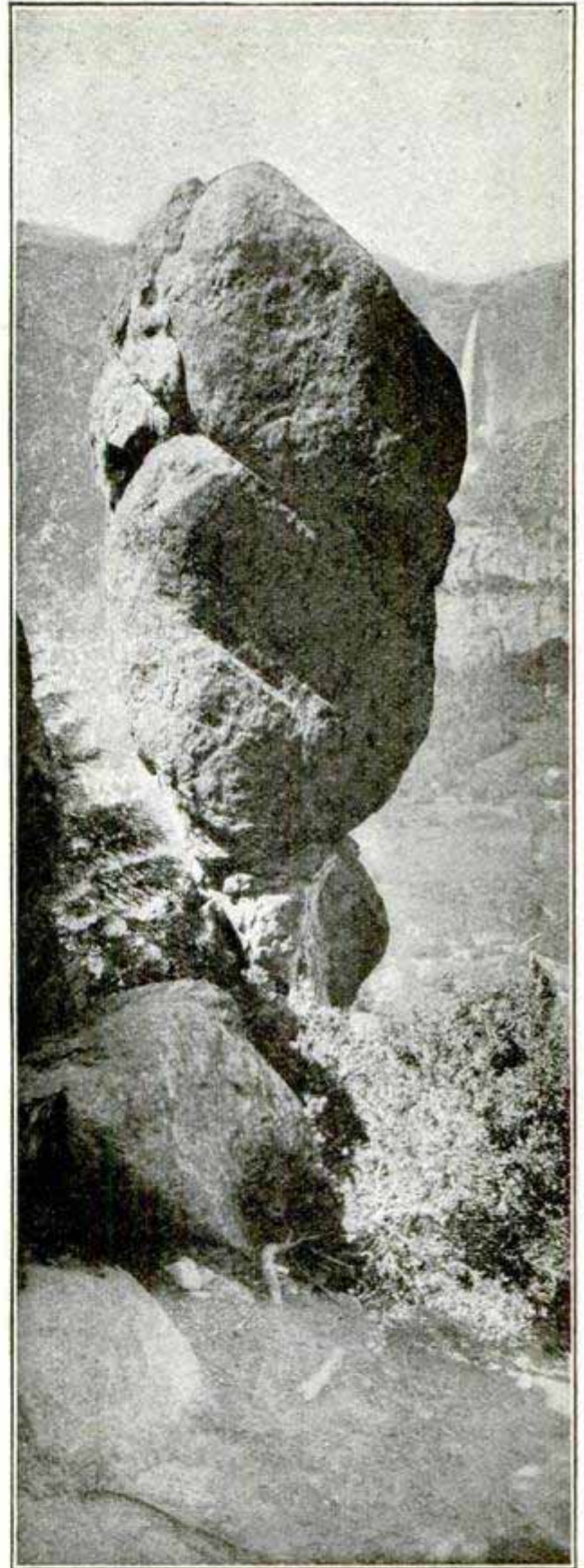
The Rocky Creek development of the company, now practically completed, will furnish 40,000 hp., of which amount only 35,000 will be sold, the remainder being retained for reserve. The Great Falls station, now completed, will also furnish 40,000 hp., while the Ninety-Nine-Islands station will develop 18,000 hp. more. The Catawba station has a capacity of more than 10,000 hp.

The Great Falls and Rocky Creek stations each have eight 3,000-kilowatt, 3-phase generators, direct-connected to six horizontal-shaft turbines and two vertical turbines of 5,200 hp. each. The two 400-kilowatt 250-volt exciters at the Great Falls station are driven by individual water-wheels, while at the Rocky Creek station the two exciters and a 600-hp. induction motor are set in line with the shaft of a single wheel.

The first two illustrations are views of the Great Falls station. The first shows the station and the great bulk-head wall which holds a head of 72 ft. More than 75,000 yd. of masonry was used in its construction, the time required for its building being 360 days. The second illustration shows the interior of the Great Falls station, and the third illustration, the Rocky Creek dam under construction—120,000 yd. of masonry was required for this dam. The fourth illustration shows the Catawba station in operation.

THE YOSEMITE VALLEY BALANCED ROCK

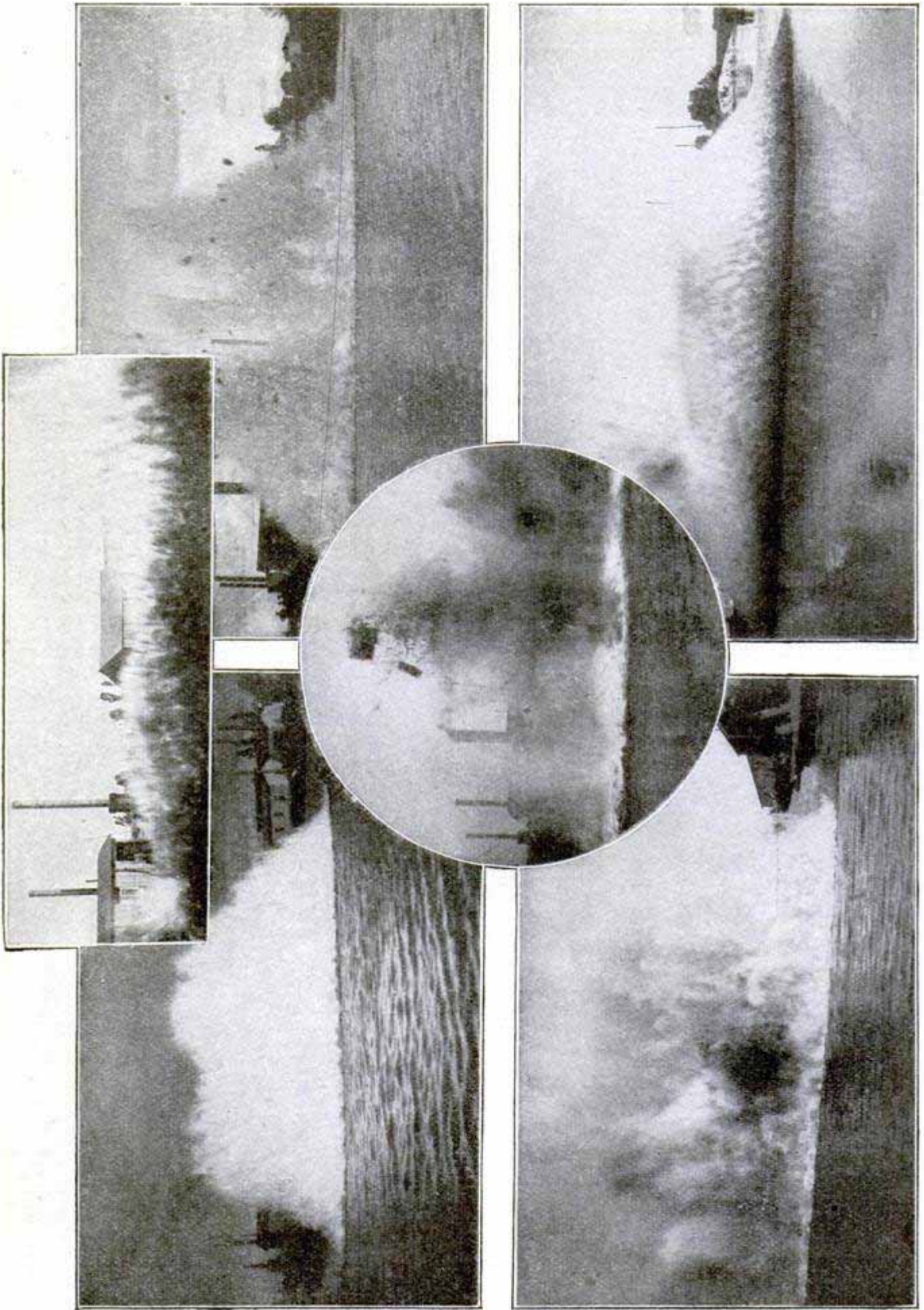
One of the formations of the greatest interest in Yosemite Valley, California, is this balanced rock. It is a peculiar shaped shaft of granite 85 ft. in height, balanced to a nicety on a small projecting ledge 2,000 ft. above the valley proper. Its base is so small and frail looking that it would seem that the slightest wind storm would



Balanced to a Nicety

send it crashing to the depths below, but it has probably held its seemingly precarious position for centuries.

The German aeronautic society now numbers more than 10,000 members.



These views of submarine blasting taken at Algoma, Wis., where the United States government is working on harbor improvements, show the many curious results of explosions. There is no accounting for the remarkable effects. No two ever are alike. no matter how many views are taken.

HOW TO MAKE A DRESSER FOR CHILD'S PLAYROOM

This dresser can be made of two kinds of wood as marked on the drawing or it can be made all of one kind. The original dresser was made of oak and walnut and was finished natural, the contrast between the light and dark woods adding much to the value of the piece in the eyes of the little ones. Have all surfaces that will show well sandpapered at the mill. The following is a list of the material wanted:

- 4 oak posts $1\frac{1}{2}$ in. square by $19\frac{1}{2}$ in. S-4-S.
- 3 walnut drawer fronts $\frac{3}{4}$ by 5 by 17 in. S-2-S.
- 6 yellow poplar drawer sides $\frac{3}{8}$ by 5 by 12 in. S-2-S.
- 3 yellow poplar backs $\frac{3}{8}$ by $4\frac{1}{2}$ by $16\frac{1}{2}$ in. S-2-S.
- 3 yellow poplar bottoms $\frac{3}{8}$ by 12 by $16\frac{1}{2}$ in. S-2-S.
- 4 oak front stretchers $\frac{7}{8}$ by $1\frac{3}{4}$ by $17\frac{1}{2}$ in. S-4-S.
- 4 oak side rails $\frac{7}{8}$ by 2 by 12 in. S-4-S.
- 2 walnut side panels $\frac{1}{4}$ by 11 by $14\frac{1}{2}$ in. S-2-S.
- 8 oak drawer slides $\frac{7}{8}$ by 2 by $10\frac{1}{2}$ in. S-2-S.
- 6 oak drawer guides $\frac{1}{2}$ by $\frac{3}{4}$ by $10\frac{1}{2}$ in. S-2-S.
- 4 oak back stretchers $\frac{3}{8}$ by 2 by $17\frac{1}{2}$ in. S-2-S.
- 1 oak top $\frac{3}{8}$ by 14 by $20\frac{1}{2}$ in. S-2-S.
- 3 sq. ft. of $\frac{3}{8}$ in. matched yellow pine ceiling for back.

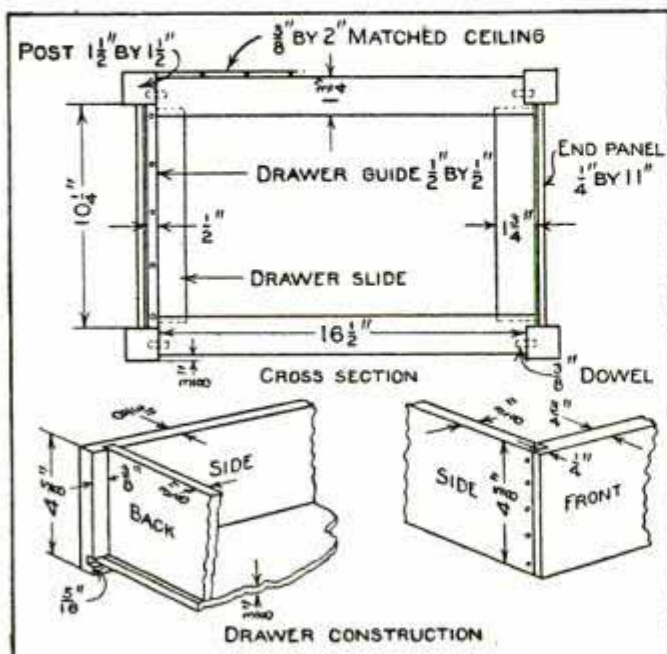
Material For Mirror Support

- 1 walnut piece $\frac{7}{8}$ by $1\frac{3}{4}$ by $20\frac{1}{2}$ in. S-2-S.
- 1 walnut piece $\frac{7}{8}$ by $1\frac{1}{2}$ by 18 in. S-2-S.
- 1 oak piece $\frac{3}{4}$ by $1\frac{1}{4}$ by $10\frac{1}{2}$ in. S-2-S.
- 2 oak pieces $\frac{7}{8}$ by $1\frac{1}{2}$ by 11 in. S-2-S.
- 1 walnut bracket piece $\frac{7}{8}$ by $1\frac{1}{4}$ by 5 in. S-2-S.

Mirror Frame Parts

- 2 walnut pieces $\frac{7}{8}$ by $1\frac{1}{2}$ by $12\frac{1}{2}$ in. S-2-S.
- 2 walnut pieces $\frac{7}{8}$ by $1\frac{1}{2}$ by $10\frac{1}{2}$ in. S-2-S.
- 2 oak pieces $\frac{1}{4}$ by $\frac{3}{8}$ by 10 in. S-4-S.
- 2 oak pieces $\frac{1}{4}$ by $\frac{3}{8}$ by 8 in. S-4-S.
- 1 back $\frac{3}{16}$ by 8 by 10 in. soft wood.
- 2 cleats $\frac{3}{8}$ by $1\frac{1}{4}$ by 8 in.
- 1 plain mirror glass $7\frac{1}{2}$ by $9\frac{1}{2}$ in.

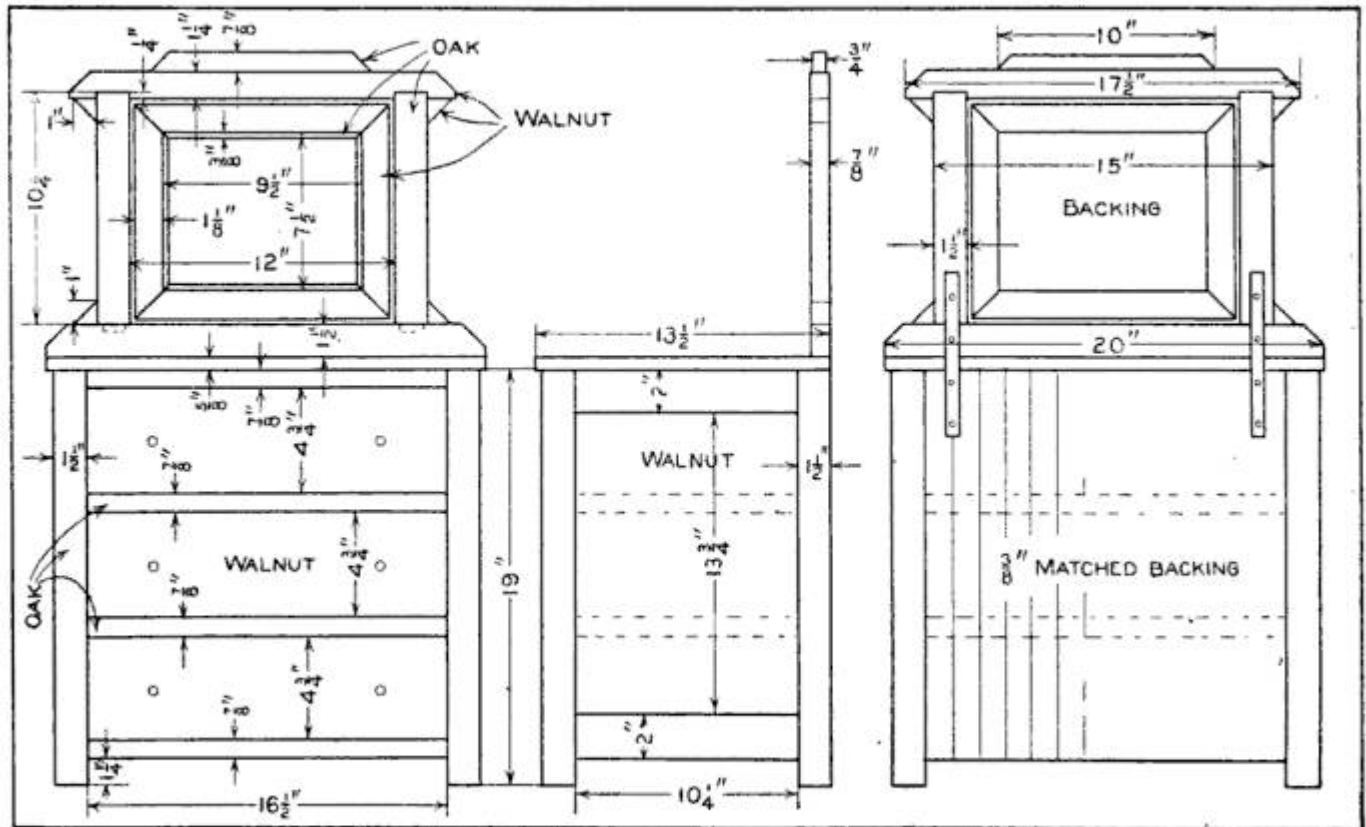
Begin by planing the four posts to length. The lower ends should be slightly beveled to prevent their sliver-



Dresser Complete

ing. Cut the mortises for the tenons that are on the ends of the side rails. These rails are to be $\frac{7}{8}$ by 2 in. and the tenons should be $\frac{3}{8}$ by $1\frac{1}{4}$ in. wide by $\frac{3}{4}$ in. long. The posts should be rabbeted down to their middles to a depth of $\frac{3}{8}$ in. so as to receive the $\frac{1}{4}$ -in. end panels. The end rails should be cut to length and their tenons worked after one edge of each has been rabbeted as were the posts.

Having squared the panels to size, put the two ends of the dresser together with glue. Next make the four frames which are to carry the drawers. They should measure from outside to outside, in length $17\frac{1}{2}$ in.; in width, $12\frac{1}{2}$ in. It is intended that the short pieces shall be tenoned into the long ones. When these frames are ready, cut out of each corner as indicated in the cross section drawing. Reduce to size the drawer guides and fasten them in place. Dowel the frames to the ends of the dresser in the places indicated on the drawing. Put on the back, nailing into the frames just placed. Turn



Details of Dresser Construction

the dresser upside down and fasten the top in place, putting screws into it from the under side.

The mirror frame and support should next be made. The drawing shows quite clearly the parts and their relation to each other. All the slopes are of 45 deg. Instead of rabbeting the mirror frame, a $\frac{1}{4}$ by $\frac{3}{8}$ -in. fillet of oak is nailed around to form the recess, the walnut frame and oak fillet making a pretty contrast. All nail holes are to be filled with putty colored to match the finish. Wooden pins or roundhead screws are to be used to fasten the mirror frame to its support and should be placed above center an inch or so.

The drawers are to be constructed in the usual manner. It is a good plan to make the grooves $\frac{1}{16}$ in. narrower than the stock is thick to insure a fit, chamfering the under or back sides of the bottom and back if necessary. Make the sides of the drawers of such a length that when the drawer has been pushed in as far as it will go, the front will be recessed about $\frac{1}{4}$ in. behind the front cross pieces. Groove the inside of the drawer front $\frac{3}{16}$ in. to receive the bottom. The mirror should not be placed until the wood has been finished.

Finish the wood natural, apply three coats of varnish. Rub the first two with haircloth or curled hair and the last with pulverized pumice stone and crude oil or raw linseed oil. This gives an egg-shell gloss. For a dull finish, rub the varnish after it has become bone dry with pulverized pumice stone and water using a piece of rubbing felt. Rub until the surface is smooth and even, and clean with a wet sponge or chamois skin. If a polished finish is desired, rub first with pulverized pumice stone and water then with rotten stone and water. Finish with a mixture of oil and a little pulverized rotten stone.

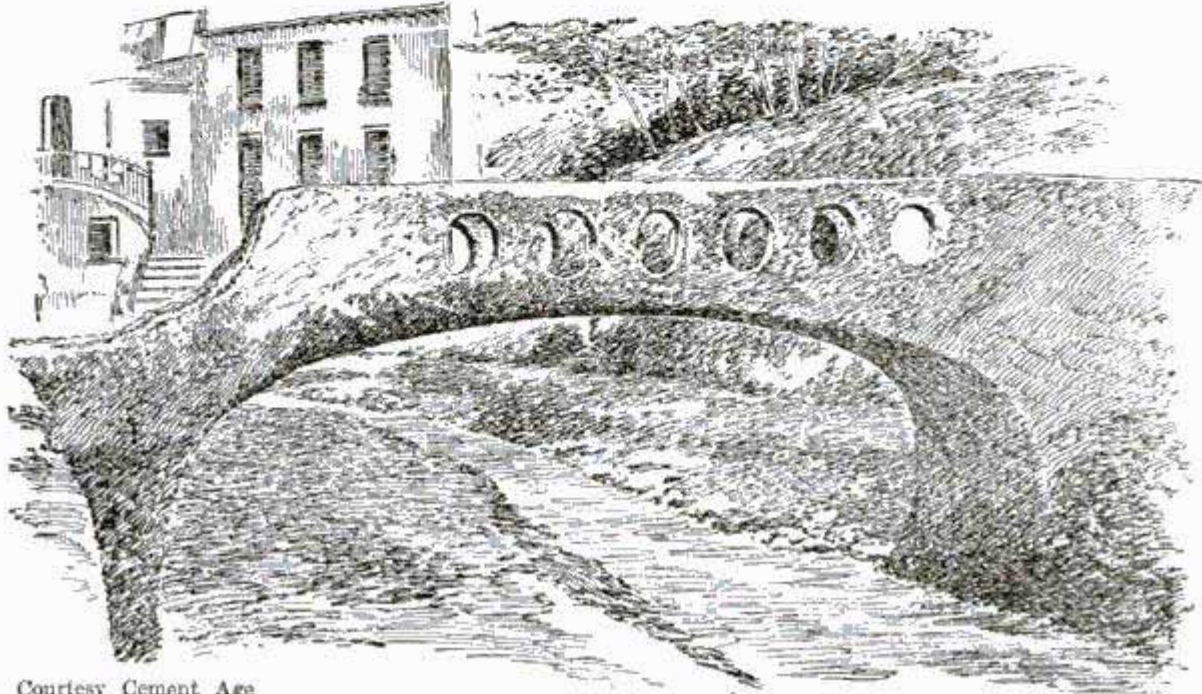
NEW METAL COMBINATION

A metal, heretofore claimed to be unknown to geologists and metallurgists, has been discovered near Bangor, Maine. It is in reality natural tin in alloy with bismuth, and it is found in sheet and ingot formation. So far as its discoverer and Prof. Ora W. Knight, a noted mineralogist of Bangor, have been able to ascertain, no such combination has ever been found before. Pure tin has been found, and tin in alloy with lead is well known, but never in connection with bismuth.

CONCRETE CONSTRUCTION NOTHING NEW

Concrete, which has been considered a twentieth century wonder on account of the many uses to which it has been put, is found to be the composition of

curved brass dies attached to the cylinders to print the impressions as the wood passes through, constitute the printing equipment. The capacity of



Courtesy Cement Age

Concrete Foot Bridge of Sixth Century

an old Italian bridge, near Amalfi on the Gulf of Salerno, said to be over 1,500 years old. Examination by interested travelers shows it to be made of natural cement and good sized pieces of crushed stone. The bridge is of classic construction and the worn ornamentations and designs unmistakably point back to Turkish origin and was probably built under the direction of one of the Eastern emperors.

PRINTING IN COLORS ON WOOD

Wood printing is so common in the box factories of today that a factory is not only considered incomplete without a press, but must have one that will print two or more colors at one operation, even going so far as to imitate burnt work or pyrography.

A cylinder press, containing from one to three cylinders, dependent on the number of colors to be printed at one operation, a hopper-feeding device to supply the boards to the press, and

such a press on box boards varies considerably, ranging anywhere from 1,000 to 7,000 impressions an hour, the latter figure really being a double capacity by arranging two short plates tandem on the cylinder or two long ones side by side.

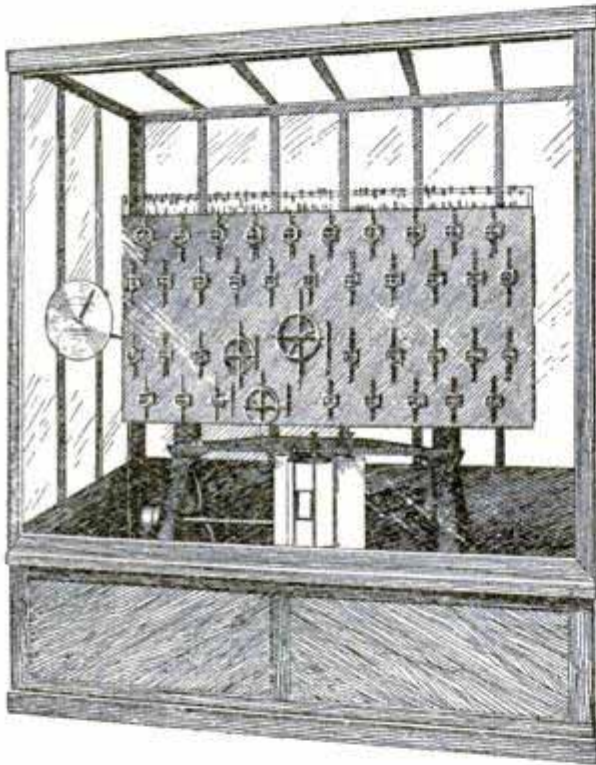
In addition to multi-color printing, in which various artistic features are brought out in the printing of packing boxes, the presses are made to do a rather good imitation of burnt-wood work. Plates clean cut and deeply routed around the figures and letters, brown ink, and sufficient pressure on the cylinder to indent the type into the wood accomplish this. Following along this same idea, more elaborate designs, imitations of pyrography in fact, are made with the wood-printer just as reproductions of paintings are made with modern printing presses on calendered paper.

According to Wood Craft, great strides have been made in covering the ground from the lampblack and brush

and stencil of years ago to the modern wood-printing press of today, and the time may come when such presses will do the expensive and artistic wood-finishing that is now done by hand. The wood-printer is already being made use of for graining lumber used for cheap cigar boxes, thus making them imitate the more expensive ones.

REMARKABLE TIDE-PREDICTING MACHINE

With this wonderful mechanism, in reality a mechanical fortune-teller of



Courtesy Graphic, London
Tide-Predicting Machine Does Six Months' Work in Two Hours

the seas, the complex calculations necessary for predicting the tides, which would employ an expert computer 6 months, can be made in a couple of hours. It is the invention of an Englishman, and was first used for predicting the complex tides in the Indian ports, where, in consequence of the large diurnal tides, the ordinary plan of tide-tables, showing the time and height of high water in the days of full and change, or on every day of the year, did not afford enough information for practical purposes.

By its means, elaborate tide-tables, or time guides to water movements, are constructed, foretelling not merely

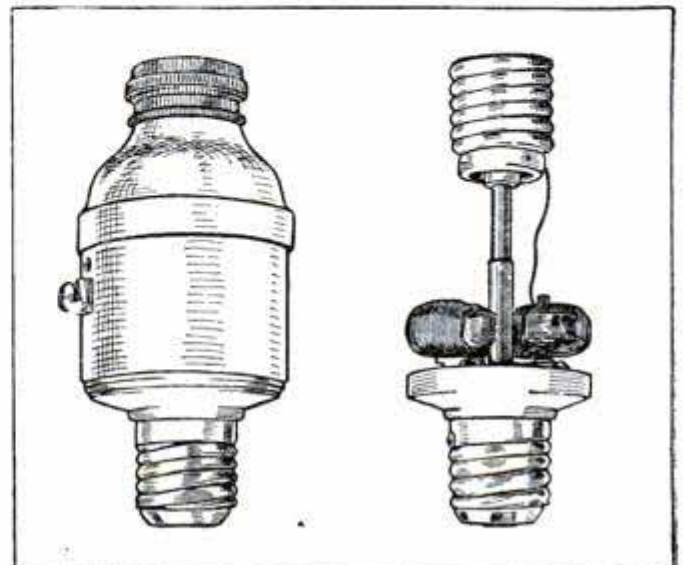
the times and heights of high water, but the depth of water at any and every instant, showing it in advance for a year or for any number of years. The machine, as one great scientist describes it, is a substitution of brass for brain.

PITTSBURG BUILDS SMALL AMAZON STEAMERS

A number of small stern-wheel steamers, 40 ft. long by 10 ft. wide, are being built in Pittsburg for use on the Amazon river and its tributaries. The boats have flat bottoms and are each propelled by a stern-wheel, driven by two horizontal engines supplied with power from a safety steam boiler. They will be shipped by rail from Pittsburg to New York, and thence to the mouth of the Amazon by an Atlantic transportation company. The little vessels will be used in a quest for timber lands.

ELECTRIC BUZZER TO CUT LIGHT BILLS

This buzzer is a new light attachment for reducing light bills. If a light is left burning in a closet or hall unnecessarily, as happens every day, the little buzzer announces that an unnecessary light is burning. It was designed for residence use and is so simple that anyone can attach it to the lamp. An alternating current passing through the windings of the coil seen in the second illustration causes the steel tongue on



Anyone Can Attach It to Lamp

the side of the case to vibrate rapidly with a whirring sound. This buzzing is regulated by a screw in the side of the case, as seen in the first picture.

SAFETY DEVICE FOR SHORT-CIRCUITING THIRD RAIL

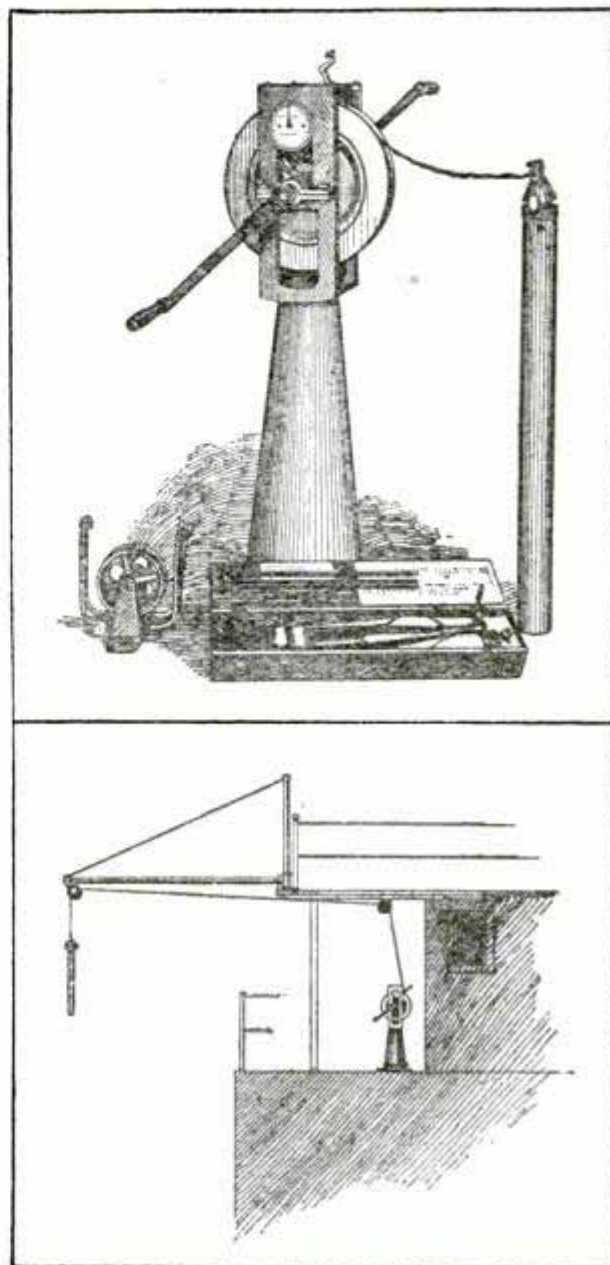
When an accident occurs on an electrically-operated elevated or subway railroad it is of the utmost importance that there should be no delay in cutting off the current at the generating station so that the third rail will lose its deadly danger. This safeguard to passengers is usually secured by telephoning the station, or by short-circuiting the third rail so that the automatic switch in the generating station will open and remain open. The first takes time and the second may cause delay when every moment is of vital importance, unless there is suitable means for producing an effectual short circuit.

Such means is provided on the elevated and underground railways of Berlin by a switch mounted on one of the axle-boxes of the trucks. In case of necessity the motorman throws this switch, the third rail is connected through a collector shoe with the earth, and the short circuit so formed is maintained until the switch is thrown back again. The switch is mounted on the axle-box without intermediate insulation.

SOUNDING MACHINE WITH PATENT DEPTH GAUGE AND OUTRIGGER

This patent sounding machine and depth gauge, with its attendant outrigger, is being placed on many of the Great Lakes steamships. It consists of a standard and outrigger, together with a reel containing 1,500 ft. of fine piano wire, to which is attached a 25-lb. lead having a hollow space large enough to take the depth gauge.

The working of the instrument is based on the pressure of water, the depth gauge having a very small hole, through which the water is forced against the air pressure as the lead is lowered. On being brought to the



Ingenious Sounding Machine and Outrigger

surface, the depth gauge is opened and the water is measured by a small ebony gauge. As the working of the instrument depends entirely upon the pressure of the water, soundings up to 600 ft. can easily be taken while the vessel is going full speed. The approximate depth can always be determined by the length of wire out, as shown by the dial on the machine.

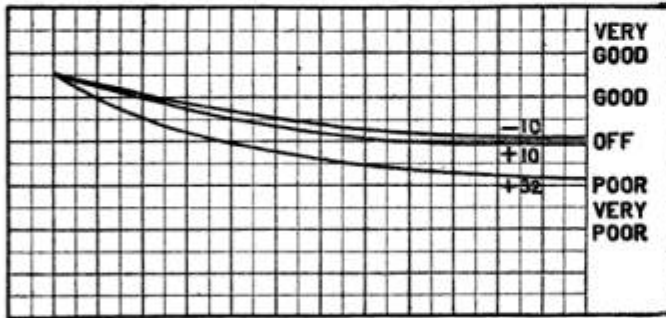
The outrigger is a feature which adds materially to the handiness of the apparatus. It is swung out over the water when the lead is to be used, and at other times swings back against the side of the cabin out of the way.

The Chicago & Alton railroad has installed 36 automatic stokers on its largest engines.

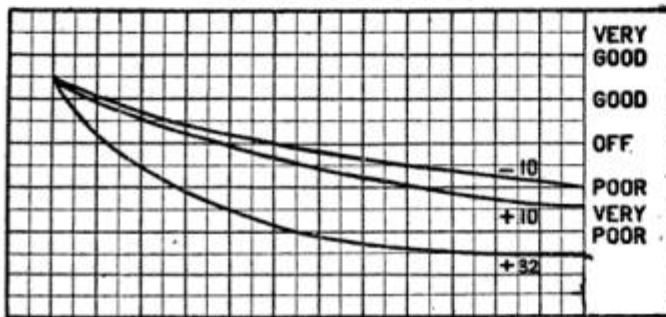
QUALITY OF BUTTER IN STORAGE

Storage of butter is the method of protecting it from absorption of foreign flavors and holding it at temperatures sufficiently low to check spontaneous

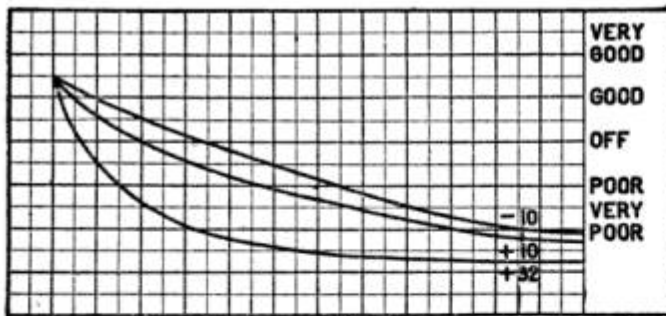
I. BEST KEEPING BUTTER.



2. AVERAGE BUTTER.



3. POOR BUTTER.



Courtesy Ice and Refrigeration

chemical changes and deteriorations due to previous bacterial growths. Changes in butter are never the same, it being impossible to make two lots exactly alike. When finished it may be considered as predestined, by the conditions under which it is made, to pass through a certain series of changes. The nature of these changes is probably little affected by temperature, but the rate at which the change takes place is modified by the temperature at which it is held.

Experiments with butter held at temperatures of 10° below zero, 10° above zero, and 32° above zero have consist-

ently shown that the conditions in which it is found after remaining for a while in storage are much more dependent on methods of manufacture than on the storage temperature. These changes are shown by the charts.

The first shows the usual progressive changes at the three temperatures above mentioned in butter made from sweet cream, pasteurized, and churned without development of acidity. Change is slow, and the difference in the condition of the butter held at the three temperatures is slight.

The second chart shows the changes in ordinary butter made from good cream, ripened to the usual degree of acidity. Change is more rapid. The difference between the butters held at 10° below and 10° above zero are slight, but there is a decided difference between 10° below and 32° above zero.

The third chart shows the relative change in butter made from poor hand separator cream. The curve descends rapidly into poor and very poor grades.

CURIOUS WIRELESS MISTAKE

A curious wireless misinterpretation, arising from the exchange of wireless messages for practice among the vessels of the British Asiatic squadron, caused great anxiety for a couple of days in Japan and other countries. The British fleet was about 175 miles from Choshi, Japan, when the "King Alfred," flagship of the fleet, sent a secret cipher message to the other ships. This was accidentally felt at the Choshi station, the letters caught reading V. A. W. B. D. U., which could be interpreted in the universal code as "Boiler Explosion. Send Help!"

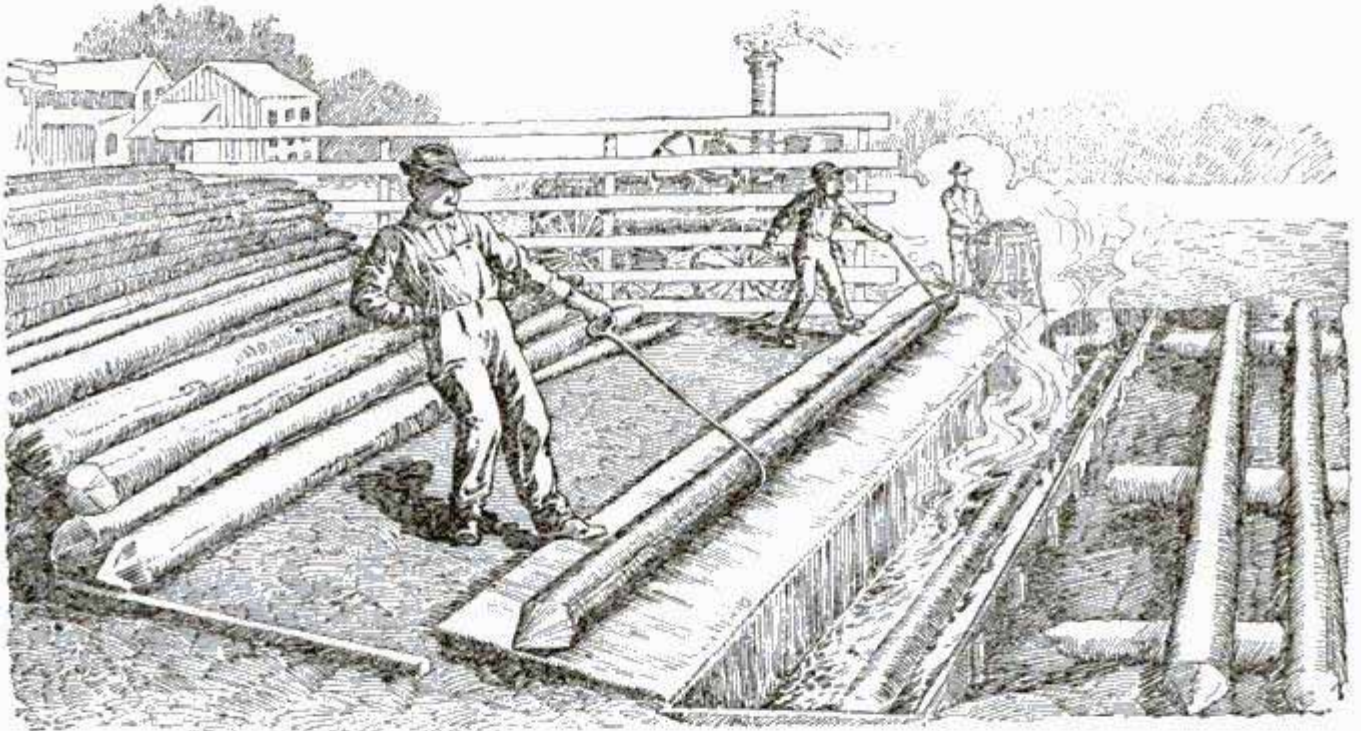
This message was at once transmitted to the Tokio headquarters of the Marine Disaster Relief Association. Attempts were then made by return signals to find out the name of the ship in trouble and her position, but no response was made, therefore giving rise to the fear that the ship sending out the call had foundered.

SHOP NOTES

Preserving Telephone Poles

The various preservative products on the market require many different ways of application to the telephone poles, and the operating man of a small line must select the best suitable that can be applied with an arrangement inexpensive. A small telephone plant in a western state found by experience

are 20 ft. long, the box should be 22 ft. in length; if 25-ft. poles are to be dipped, the tank should have a length of 27 ft. It is advisable to build the box in the place where it will be used, as a box of this length is not convenient to move around. The box should be placed in a long trench of sufficient depth to sink the tank to a level with the surface of the ground. Supports



Putting the Poles into a Hot Creosote Bath

that the dipping of the whole pole in an open tank filled with ordinary commercial creosote was very satisfactory.

A serviceable tank can be constructed by lining a long wooden box with galvanized sheet iron, and soldering the joints, says a correspondent of Telephony. The box or trough may be made of rough, 1-in. planks; ordinary sheeting lumber will do for the sides, ends and bottom. The outside frames should be made of 2 by 4-in. pieces, placed not more than 4 ft. apart, in order to give the necessary support and stiffness to the box. The length of the tank will be determined by the length of the poles to be treated; if the poles

must be placed at intervals along the sides of the tank to hold them from crushing in from the pressure of the dirt. The box is then lined with the galvanized sheet metal. A hinged cover should be constructed to keep out the rain or snow when the tank is not in use. Galvanized sheet metal is placed on the inside of this cover so when turned over on the side where the poles are removed it furnishes a place to catch the drippings and return them to the tank.

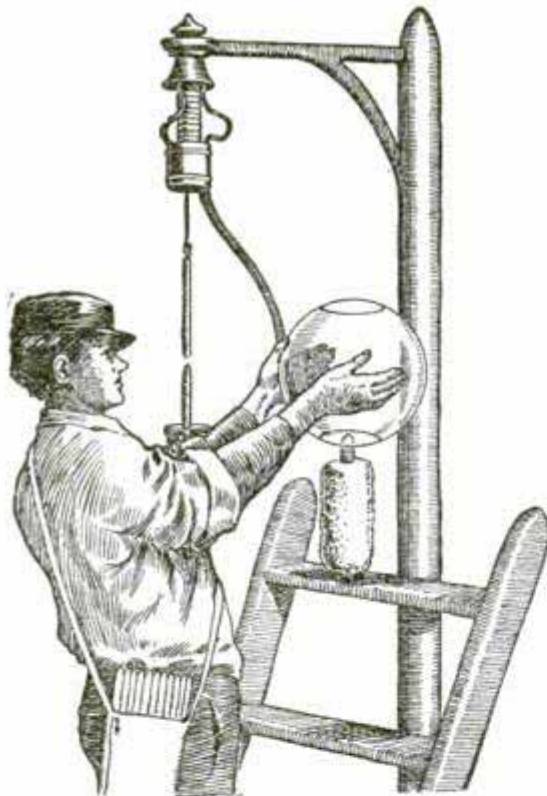
The most practical method of heating such a tank is to use steam, which may be applied through steam pipes laid in the bottom of the tank. In a

tank for treating poles 20 ft. long, six 1-in. pipes, connected in series, will give sufficient radiating surface. Steam may be supplied by a traction engine or some other boiler that will produce 80 to 110 lb. pressure of steam and placed near the tank. Pipes and valves are connected to the tank so the steam may be controlled to obtain an even temperature. Saturated steam under 50 lb. pressure has a temperature of 295 deg. F., at a 100-lb. pressure, its temperature is 340 deg.

A pole 20 ft. long, 5 in. in diameter

A Kink for the Electric Arc Light Trimmer

Some time ago I saw a simple device which was as good as it was



The Globe Sets on a Padded Pin

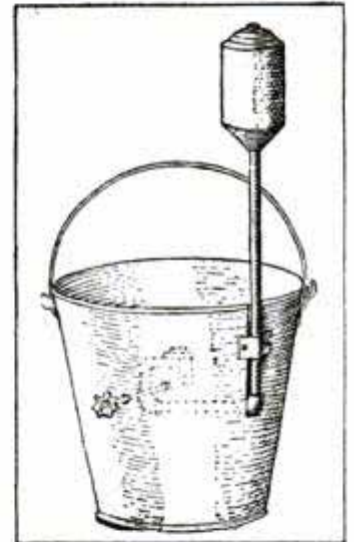
simple. A lamp trimmer had set a post, about $\frac{5}{8}$ or $\frac{3}{4}$ in. in diameter, into the top step of his step ladder and padded it with a big bunch of cotton waste. When he would take off a globe he would just slip it on this post and not be hampered in trimming the lamp.—Contributed by J. J. Voelicker, Decatur, Ill.

at the top, given a ten-minute boil in oil at a temperature of 250 deg. F. will absorb almost 1 gal. of the oil. If the poles are roofed, gamed and bored before treatment, the oil will enter the pores of the wood in these places and save the trouble of painting with oil and lead. Some care must be taken when fresh oil is to be heated. When a temperature of 212 deg. is reached the oil begins to foam, due to the presence of moisture, and, unless the heat is applied carefully, there is danger of the oil boiling over.

Gasoline Stove for Camping

A good stove for the camp while hunting and fishing can be made from

an ordinary 14-qt. iron pail and a common gasoline burner. A slot is cut in the side of the pail wide enough for the pipe on the burner to pass through easily and the edges of the slot are joined together with one or two metal clips bent over the pipe and bolted to the



thin metal of the pail. A hole is cut through one side of the pail for the valve stem of the burner. The bottom of the pail can be used for carrying small packages.—Contributed by E. Danz, Streator, Ill.

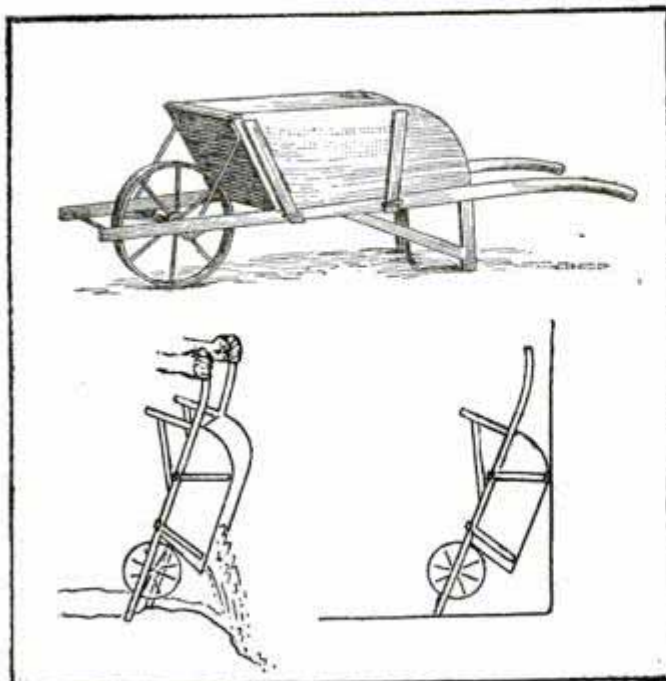
Etched Labels on Bottles

Any substitute for labels possessing permanency is preferable to the paper kind which are so easily destroyed. Etching a bottle with a solution, as herein described, cannot help but be permanent. Two methods may be used for writing the labels, says the Photographic Times. The simplest is to use a quill pen, or the place to be engraved may be covered with wax or paraffin and the design cut in with a pointed

tool. The etching fluid is then applied with a brush. Two mixtures should be made, one consisting of equal parts of sodium fluoride, potassium sulphate and water. The sodium fluoride is only slightly soluble in water, but this does not matter. The other mixture contains equal parts of zinc chloride, hydrochloric acid and water. When ready to use, mix equal parts. As this mixture attacks glass, porcelain, or any glazed ware and most metals, the vessel should be protected by a lining of wax or paraffin.

Extension Handles on a Wheelbarrow

The general make-up of this wheelbarrow is no different from the ordinary kind with the one exception: that of the pieces forming the handles extending beyond the wheel circumference being about 6 in. This will prove to be a great advantage in various ways. The bar in front can be used in lifting the wheel over a curb, or attaching a rope for a second person in helping to pull a heavy load. When dumping out the contents, there will be no danger of the wheel kicking back, as the wheelbarrow will rest upon the projecting ends. The wheelbarrow can be turned on end against a wall when not in use, thus taking up less room than when on the ground, and being safer than when held by a brick.



Wheelbarrow with Extension Ends

Pipe-Cutting Outfit for a Traveling Machine Man

A traveling machine expert finds it necessary to do small jobs of pipe fitting, yet to take with him the regular



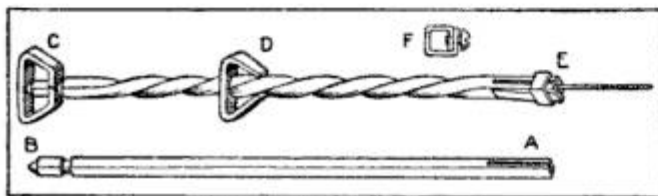
Cutting Threads on a Nipple

equipment for this work would be out of the question. I have done pipe fitting up to $\frac{3}{4}$ in. in size with an outfit weighing less than 5 lb. This outfit consists of 5 dies, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{3}{4}$ in., of the square kind; two pipe jaws that will fit into a monkey wrench; one hacksaw. The die holders, pipe cutter, pipe vise and pipe wrenches are not necessary. The hacksaw is used to cut the pipe to the desired length. A die is fastened between wood blocks nailed to the floor, and the pipe turned into the die with one or two wrenches to make the threads. If the pipe has threads on one end you can hold it by screwing the threaded end into a tee or ell on the pipe line. Should you need a nipple, cut off the threaded end of a pipe and screw it into a tee and put a bar through the tee for a lever, or turn two pieces of pipe into the other openings of the tee and then turn the unthreaded end of the nipple into the die as shown in the illustration. If the pipe to be threaded is fastened to a pipe line, turn the die on the pipe with a monkey wrench. The jaws contained

in the outfit will convert a monkey wrench into a pipe wrench. Monkey wrenches can be had around almost any machinery.—Contributed by R. B. White, Denver, Col.

A Drill Driver for Small Drills

A small emergency drill driver was made by a correspondent of Scientific American and is illustrated herewith. A piece of 3/16-in. square brass wire about 10 in. long was slit at one end with a hacksaw, as shown at A, and the opposite end filed to a blunt point, B. About 1/2 in. from this end a round section was filed. The pieces C and D were formed from sheet brass. The swivel C was made with a socket to receive the round end B. The slide D



Details of the Drill Driver

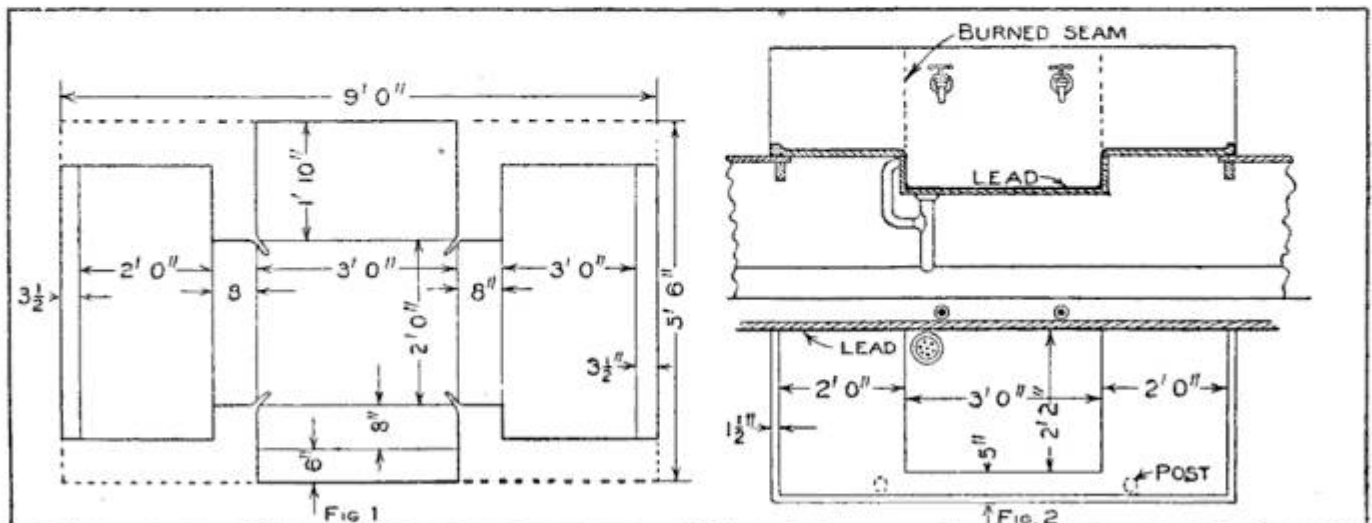
has a square hole to fit loosely on the wire. One end of the wire was gripped in a vise and the other turned with a wrench to make the twist as shown. A ring and a wedge, E, formed a grip for the drill. A more practical grip could be made as shown at F. The two ends of this ring should be soldered. A slot can be filed in opposite sides of the twisted wire to receive the ring and prevent it from dropping off.

Lining a Photographer's Sink with Sheet Lead

Miniature Pattern Used in Construction

An acid-proof sink, 8 in. deep, 24 in. wide, and 36 in. long, was recently put in the New York Public Library for the use of the photographer. A table with the shape of the sink made in the center was constructed of wood and this had to be lined and covered, as well as the wall back of it, with sheet lead. The table was 2 ft. 5 in. wide and 7 ft. 3 in. long. Several methods were suggested for doing the work, but the one adopted was to lay out a miniature pattern showing how the whole sink lining and table covering could be cut from one piece of lead, says the Metal Worker. The sheet of lead needed for the work, measured with careful allowance for beating in the coves in the bottom and turning up the sides and ends, was 5 1/2 ft. wide and 9 ft. long and the pattern lay upon it as shown in Fig. 1.

Commencing at the left-hand end of the plan, as shown in Fig. 2 facing the sink, 3 1/2 in. was allowed to cover the ridge and return under the top of the sink table for nailing fast, then 24 in. for the left end of the table, 8 in. for the left side of the sink, 36 in. to go across the bottom, 8 in. up the right side, 24 in. across the right end of the table, and 3 1/2 in. to fit over the ridge and turn down under the woodwork and be nailed fast at the right end of the table. The length of the sheet ordered left



Pattern for Lead and the Sink to be Lined

only 1 in. for trimming, but there was more leeway in the width of the sheet. The width of the sheet allowed 3 in. for turning over and fastening at the top, $10\frac{1}{2}$ in. for the back, then 8 in. down into the sink, 24 in. across the bottom, 8 in. up the front and 6 in. across the front of the table, including 3 in. for covering the ridge and returning under the woodwork to be nailed fast. The dimensions and shape of the pattern were checked up and found to be accurate before the sheet was cut. The sheet had to be cut at four places because the center portion, forming the lining of the sink, dropped away from its neighboring sheets, with an 8-in. side wall on all four sides. The lead had to be cut again at four places to bring the sides and end pieces covering the table so they could be formed up and fitted into the sink. There also had to be cut from each corner an elongated leaf or spear-shaped piece, so that the sheet lead could be worked into the corner over the cove in the bottom. When all the cutting had been done, the sheet was carefully folded and dropped into place, forming the sink, as shown in Fig. 1. The lead was then worked into the corners with a plug of soft pine wood and a sheet lead dresser, so that it would fit around and over the ridges and down into the depressions, as shown in Fig. 2.

When the lead was all carefully fitted into place it was fastened to the woodwork with tinned nails, and the sink then appeared as in Fig. 3. When the lead was securely fastened, the next step was to make the abutted seams which run from the cove in the corners of the sink from the bottom to the top. These were made by the lead-burning process. The corners of the sink lining were grooved out, thoroughly cleaned and burned together, with the

addition of a piece of clean sheet lead to give additional strength and thickness at the points marked by dotted lines in Fig. 3. Care was taken to burn all parts thoroughly and to have a con-

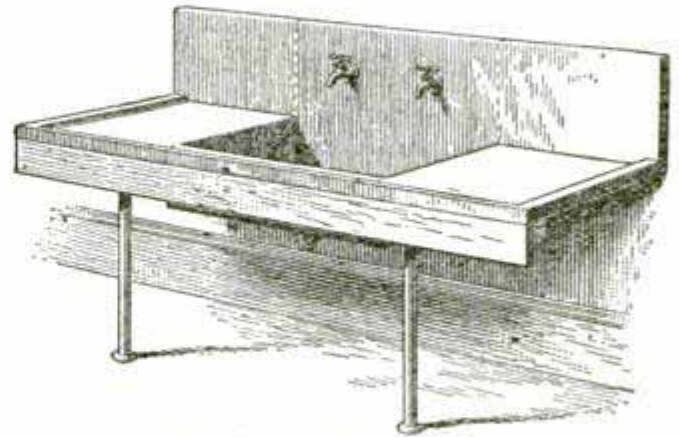


Fig. 3. The Finished Sink

siderable thickness of lead at the seams. This made it possible for the lead-burned seams to be shaved down and smoothed so that they were as invisible as if the lining were made entirely of one sheet of lead, or had been cast or beaten up from one piece complete. A 2-in. cast lead trap received the waste from the sink and connected with a $2\frac{1}{2}$ -in. lead-lined iron pipe, all of the joints being made by the lead burner. The iron pipe was, therefore, on the outside to protect it from hard usage. This waste line was carried down to the basement along the ceiling and connected with the brick sewer in the street separately, without the use of an intercepting trap at the front wall. The upper part of this waste line was carried directly from a point above the sink through the roof and to a height of 10 ft. In the basement where the turn from the vertical was made to the horizontal line, a long sweep bend was used. At the base of the vertical line there was a clean-out opening, so that in case of stoppage of any kind, an opening for clearing the pipe would be

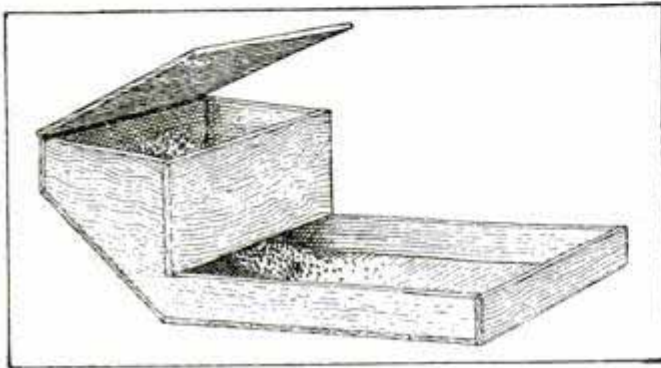


One Way to Haul a Long Ladder on a Wheelbarrow

available. The use of a long sweep bend and a straight line through the roof permits the use of a flexible rod to be inserted for clearing the pipe, if necessary.

Feed Box for Horses

Some horses have a habit of eating their feed too fast if it is placed loosely in a box. This can be easily remedied by making a self-feeder on the feed

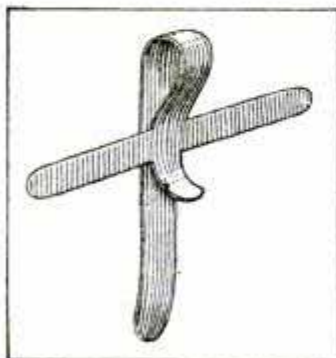


Feed Box for a Fast Eating Horse

box. The accompanying sketch shows how a feeder can be made similar to a poultry feed hopper. The box can be made of 1-in. boards large enough to hold one feed. The horse can get the grain only in small quantities, so he cannot eat more rapidly than he should. The bottom must be made with enough slant to insure all of the feed coming out in the trough.

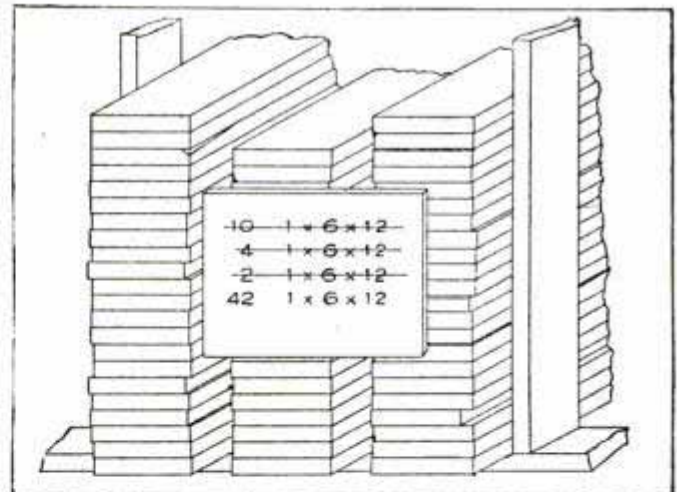
Spring to Hold a Music Book Open

The accompanying sketch shows the construction of a spring to be inserted in the back of a book for holding the leaves flat and the book open. The device is made from thin spring steel cut and bent as shown. The long part slips down on the outside of the book and the two extending side pieces press against the leaves at the opening.—Contributed by Chas. Katz, Philadelphia, Pa.



How to Keep Lumber Inventories

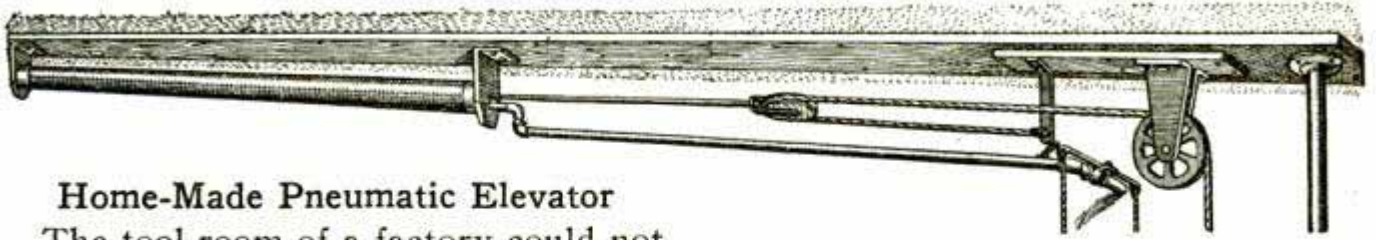
This is a continuous stock-taking arrangement which permits the mill man to tell at a glance exactly what material, what kind and how much there is in any pile or section of storage shed, says Wood Craft. All that is necessary to render this a permanent and continuous stock-taking arrangement is a moment's attention on the part of the man who puts in or takes out the material of the section covered by the arrangement in question. The device is nothing more than a board nailed to a scantling which has been purposely placed so it projects beyond the rest of the lumber just to receive the tally-board, if we may call it that. This is a piece of planed board, so the numbers of pieces contained in that section can be penciled on the surface. In the accompanying illustration the figures denote that originally 10 pieces of 1 by 6 in. and 12 ft. long material was in the section, with the other material that may be on the board, and that somebody took out 6 pieces, then 2 pieces, then the yard man put in 40 pieces



Keeps Lumber Stock List

more of the same material. All the entries are crossed out except the last, which is the one denoting the amount of that kind of material now in the section.

Gun barrels may be browned by rubbing them with a flannel cloth while warm and then using a little beeswax and turpentine.



Home-Made Pneumatic Elevator

The tool room of a factory could not be increased in size for the growing business and it was decided to open up another room overhead to relieve the overtaxed condition. This made it necessary for some one to run up and down stairs very often with much loss of time, says the American Machinist. A mechanic of the shop devised a pneumatic elevator that abolished the stairs, thus giving more room on the ground floor and a saving in time of climbing the stairs. The accompanying sketches show that the whole mechanism is most compact and represents an ideal of simplicity. An odd corner in the room was utilized and less space taken up than would have been necessary with anything more bulky than a plain ladder.

The upright guides are two galvanized pipes $1\frac{1}{2}$ in. in diameter. The platform is 2 ft. square made from 1-in. hardwood, well cleated underneath. The upright bars are of cold rolled steel $\frac{7}{8}$ in. in diameter, and to them is bolted the cross bar that takes the shackle of the rope. The rope is $\frac{7}{16}$ in. steel wire cable and runs at the top over a cast-iron sheave set in two angle plates which in turn are bolted to the ceiling of the upper room. A square hole with about $\frac{3}{8}$ -in. all-round clearance was sawed in the corner of the latter to allow the elevator to pass through.

After passing over the sheave just referred to, the rope passes horizontally parallel with the ceiling and the wall to another sheave which is attached to the end of the piston rod, as shown; it then returns and is attached to a bracket. The piston rod is a piece of cold-rolled steel 1 in. in diameter. The piston, as shown in the sectional drawing, is a cast-iron block turned $\frac{1}{64}$ in. smaller than the interior of the cylinder. The latter is a piece of drawn-brass tube, $3\frac{1}{2}$ in. in diameter by 4 in. outside, so smooth and true

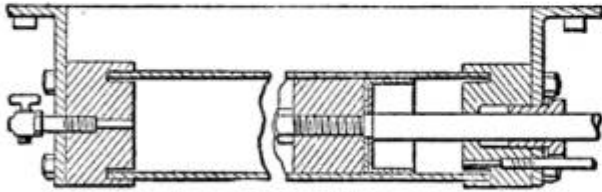
that it was not deemed necessary to bore it. The cup leather shown at the forward end of the piston works admirably. The cylinder ends are blocks of cast iron attached to small sections of wrought-iron angles $\frac{3}{8}$ by 3 by 6 in., which in turn are bolted to the ceiling. In action the pet cock, shown at the rear of cylinder in the sectional drawing, is regulated so that, as the elevator is rising, enough air shall be retained in the cylinder to cushion the piston and prevent sudden shock.

To operate the device, after taking your stand on the little platform you pull one side of the continuous cord as shown, and this action opens a three-way valve admitting air from the main to the cylinder. When descending you operate the cord the reverse way and this action allows the air which is pent up in the cylinder to return along the feed pipe and find an exit through one passage of the three-way valve into the open air; at the same time, of course, cutting off the communication between the main and cylinder. The hole in the plug of the valve by which the exhaust takes place is about $\frac{5}{32}$ in. in diameter so that the descent is not too sudden.

The sensation of a ride on this simple, yet useful, little elevator is worthy of note. After taking one's stand



in the cage the cord is pulled and you expect sudden death, but you become alarmed when you find nothing has happened and you stand in fear of, you know not what, for a space of about two seconds. You have just begun to think of giving the trigger a second tug when up you go with an airy bound and your face is on a level with the floor above, a distance of some 14 ft.; just about this point the cushion



Details of the Air Cylinder

at the back of the cylinder is coming into action and you arrive at your destination with scarcely a jar. The delay at the start is to be accounted for, no doubt, by the time required to fill the pipe and part of the cylinder.

Repairing the Pearl on a Knife Handle

The pearl on a knife handle will sometimes break in an irregular form, leaving the large part of the pearl loosely fastened by one rivet. Apply solder with a soldering iron to the



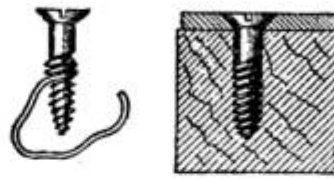
Knife Handle Repaired with Solder

metal part of the handle as shown in the sketch. The solder is then dressed down, by using a file and sandpaper, even with the pearl. The joint may be made so smooth that it cannot be detected by the touch.—Contributed by Edd Heflinger, Pasadena, Calif.

A composition for protecting stone, wood and cement is made by mixing quicklime, chalk, mineral colors and turpentine into a paste with boiled oil, and grinding this paste fine. Galipot and rosin are dissolved in benzine and thoroughly mixed with the finely ground paste.

How to Remedy a Loose Wood Screw

A hinge, door lock, or some other piece of metal having a loose wood



screw caused by the wood shrinking away, the wood fibers rotting or pulling out, is usu-

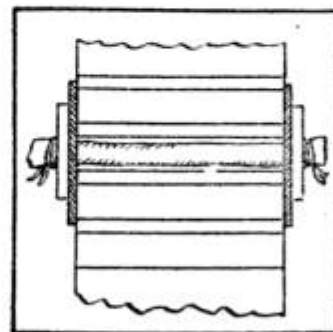
ally fixed by plugging the hole, or putting in a larger screw. A convenient method of making such a screw hold is shown in the accompanying sketch. A soft copper wire is wound around the threads of the screw as shown, thus increasing the diameter of the threaded part, says a correspondent of Scientific American. The same screw is used which will hold better than using a plug driven in the hole.

How to Remove Heavy Wall Paper

Wet the surface of heavy bronze papers with warm or hot water and keep it wet until the paper feels the effects of it, showing some saturation, says the Master Painter. Heat the surface with a torch and follow with a scraper. The heat and water will soften up the paper and make it easy to remove by scraping.

Temporary Repairs on a Leaky Automobile Radiator

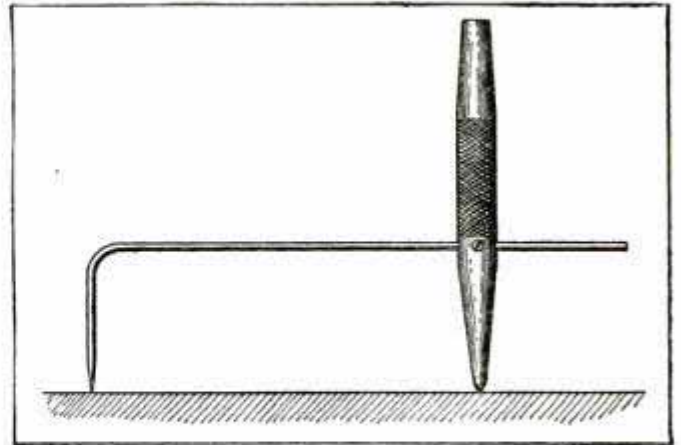
Honeycomb radiators are given to "weeping" or leaking at the ends of the cells, and if a radiator plug is not



at hand a substitute can be found in passing a long, small bolt through the defective cell, fitting the bolt at both ends with leather or rubber washers or tire patches, backed with strips of metal, and screwing the nut down until the leak is stopped, says the Automobile. If no such bolt

is obtainable, a stick can be whittled to take its place and the washers retained by means of copper wire, as shown in the sketch. When a leak occurs inside one of the cells, a square peg cut from soft wood and covered with a piece of handkerchief smeared with white lead can be used as a stopper. In all of these operations only a moderate amount of force should be used, as the tubes are easily buckled. Leaks in gilled tube radiators can be stopped by applying a rubber patch held in place by tire tape and wire.

the proper place, then set the steel point in the center punch hole and



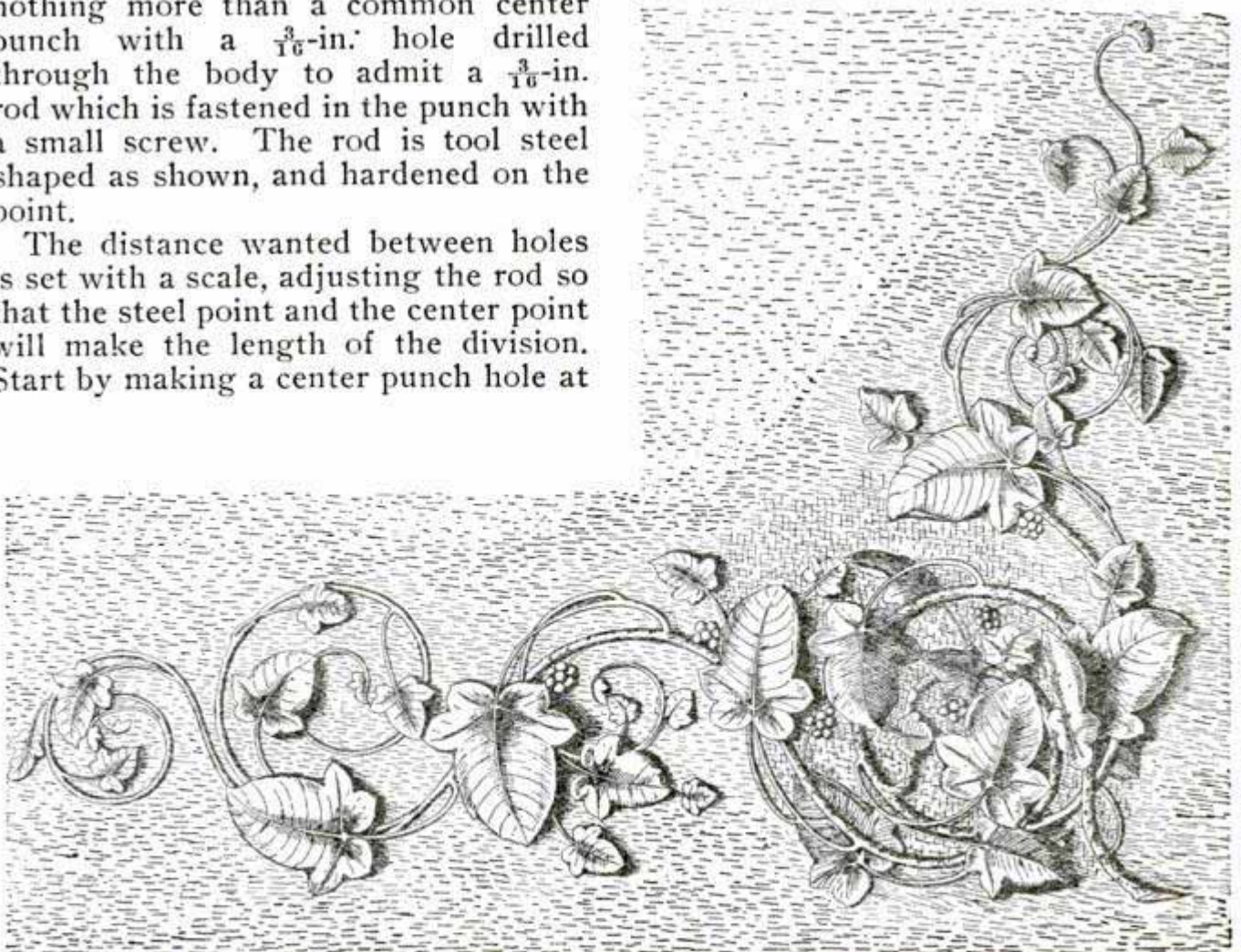
Spacing the Marks

A Spacing Center Punch

The old method of laying off centers for holes with dividers and then following up with a center punch is not very reliable. When stepping off the divisions the mechanic is liable to draw the marks both ways and in the end be out $\frac{1}{4}$ in. if there are very many holes to lay out. The tool as illustrated is nothing more than a common center punch with a $\frac{3}{16}$ -in. hole drilled through the body to admit a $\frac{3}{16}$ -in. rod which is fastened in the punch with a small screw. The rod is tool steel shaped as shown, and hardened on the point.

The distance wanted between holes is set with a scale, adjusting the rod so that the steel point and the center point will make the length of the division. Start by making a center punch hole at

the right distance will be spaced for the next point which can be made with a blow from a hammer on the center punch. Change the tool over for each succeeding mark.—Contributed by Joseph Weaner, Plainfield, N. J.

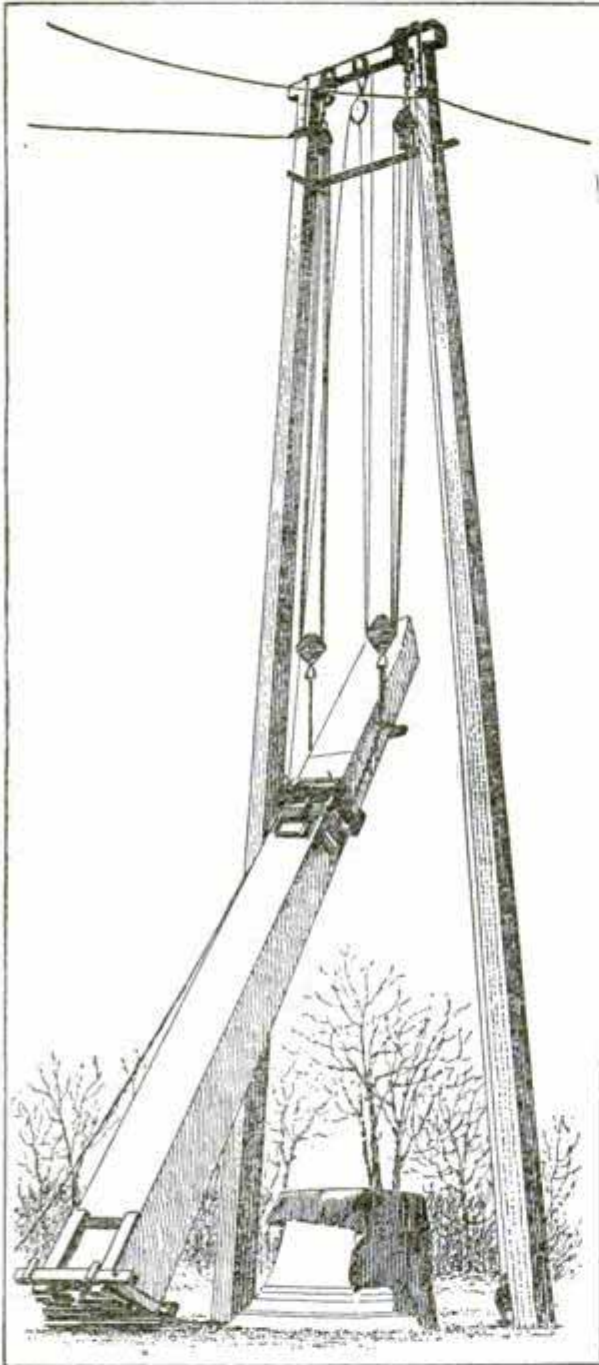


Courtesy Monumental News

Design for Carved Corner—to be Executed in Stone

Setting a Big Spire

The tall spire monument is becoming the favorite in some of the eastern



Raising the Spire into Place

states. The tallest private spire erected in the United States is 67 ft. high, says *Monumental News*. Recently a shaft of Barre granite, $10\frac{1}{2}$ ft. square at the base and 50 ft. high, was erected and as the stone was carefully proportioned, handsomely executed, and stands on a wooded knoll, it makes a very imposing showing in the cemetery. The transportation of such a spire was no small job. Fourteen horses were required to haul it over level

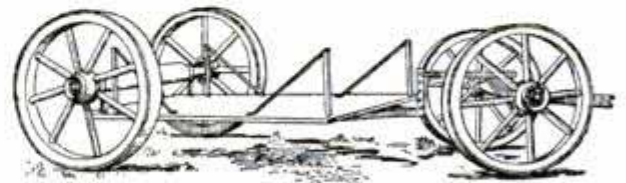
ground. The horses were taken off and capstans used on turns and on hills. The sketch illustrates the method of hooking onto and raising the shaft. The derrick is 70 ft. long, made of 14-in. timbers in solid piece with all-steel rigging throughout.

Aid in Cutting Keyways

Occasion may require the making of a keyway in a shaft by the aid of drilling holes in a line and clipping out the bridges between the holes. This will help along considerably when a hasty repair must be made on some job of work where a key-seating machine cannot be used. While the drilled holes help to some extent, they do not make a very good bottom to the keyway unless the conical holes are removed by clipping. This can quickly be remedied by first drilling the holes to a uniform depth then grinding all the taper off from the drill end and making the end perfectly square, leaving a slight bevel or clearance from the cutting edge. Redrill the holes with this square end drill and the bottoms of the holes will all be level when the bridges between them are removed.—Contributed by W. O. Hay, Camden, S. C.

Platform Wagons for Hauling Silage Corn

The accompanying sketch shows a platform construction using common wagon wheels for hauling silage corn. The platform is 7 ft. wide and 8 ft. long and is so arranged that it is hung

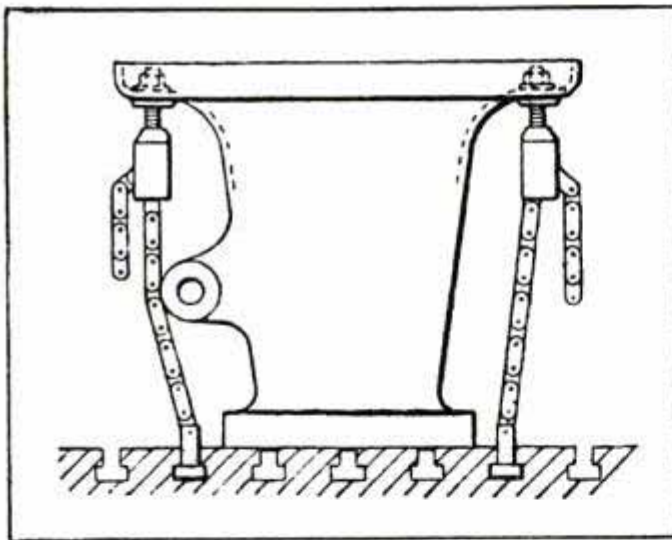


Low Platform for Silage Corn

under the axles with its top about 15 in. above the ground, says the *Jersey Bulletin*. Wagons of this construction will haul about one ton each load.

Adjustable Chain Clamping Bolt

Planing, large milling and shaping machines must be provided with a large assortment of bolts for holding work, and apart from the initial cost, there is much time wasted in sorting out the necessary bolts for a job of work. The sketch illustrates a new flexible device which may be lengthened or shortened to suit the work at hand. The device consists of a chain having a T-head at one end to fit the slots in the machine tool bed and the other end is attached to a head by bending the chain sharply through a slot. The length of the chain is varied by passing more or less of its length through the slot which may be readily adjusted from a few inches to several feet in length. Each of these chains will take the place of a whole set of ordinary bolts. The chain, being



Flexible Holding-on Bolts

flexible, can be bent as required, or passed around objects such as cylinders or pipes.

A Metal Polishing Paste

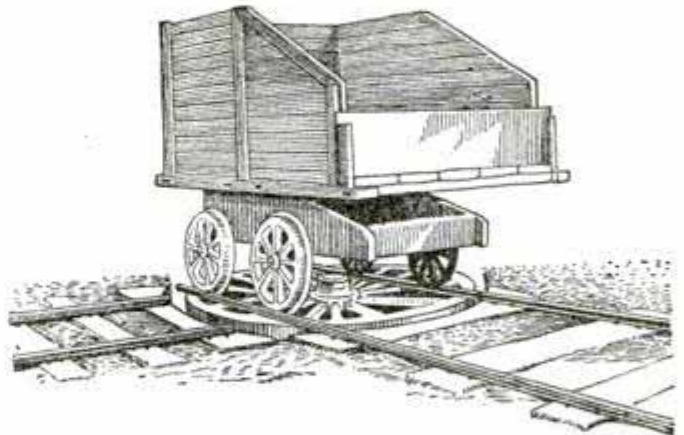
A paste that will clean and polish the various metals may be made as follows:

- Pumice stone50 parts
- Paraffin30 "
- Kerosene oil15 "
- Banana oil5 "

This paste will not scratch and is used by one of the largest navies for cleaning and polishing.—Contributed by J. H. Crawford, Schenectady, N. Y.

Turntable Made From a Wagon Wheel

The track for the cinder car at a large factory runs at right angles to



The Car Turns on the Wagon Wheel

the short spur that extends from the boiler room. The turn was too sharp for a curved track, so a turntable had to be used. The turntable was made by setting a post solid in the ground and placing a common wagon wheel on a spindle attached to the post. A short track was attached to the rim of the wheel and, also, a bumper so the car could not run off on the outside. The cinder car can be run on the wheel which is easily turned to the right-angle track.—Contributed by Amos Poe, Evansville, Ind.

Dirigible and Glider Framing Wood Tests

The tests, tabulated herewith, were made with spruce from Washington

	Size of Pieces	Breaking Strain	Weight of Pieces
Elm ...	1 1/8 x 1 1/8 x 12 ins.	900 lbs.	5 1/4 oz.
Spruce .	1 1/8 x 1 1/8 x 12 ins.	900 lbs.	4 1/4 oz.
Elm ...	1 1/16 x 1 1/16 x 12 ins.	880 lbs.	4 3/4 oz.
Spruce .	1 1/16 x 1 1/16 x 12 ins.	760 lbs.	3 7/8 oz.
Elm ...	1 x 1 x 12 ins.	450 lbs.	4 oz.
Spruce .	1 x 1 x 12 ins.	600 lbs.	3 1/2 oz.
Elm ...	1 3/16 x 1 1/8 x 12 ins.	390 lbs.	3 1/2 oz.
Spruce .	1 3/16 x 1 1/8 x 12 ins.	475 lbs.	3 oz.
Elm ...	3/4 x 3/4 x 12 ins.	275 lbs.	2 1/2 oz.
Spruce .	3/4 x 3/4 x 12 ins.	280 lbs.	2 1/4 oz.
Elm ...	9/16 x 1 3/16 x 12 ins.	175 lbs.	2 1/8 oz.
Spruce .	9/16 x 1 3/16 x 12 ins.	175 lbs.	2 oz.

and Oregon, and with elm from Michigan and Indiana. In making these tests, says a correspondent of Aero-

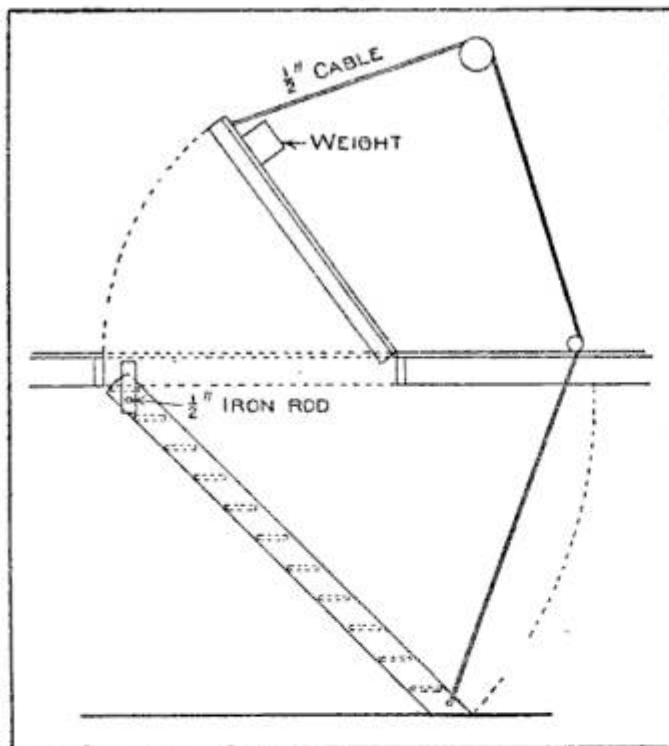
nautics, testing scales were used, the pieces supported at the ends with the load in the center.

Elm has a rather interwoven grain and does not split easily, but warps out of shape when under a strain or when it is not stiffly braced. It is good for ribs, etc., as tacks do not split it.

Spruce is very strong and stiff and does not easily warp. It will bend as much as elm without breaking, and springs back to shape again. It splits easily and will stand but little nailing. Holes for nails and bolts should be bored full size.

Stairway for a Limited Space in a Barn

The accompanying sketch shows how to construct a stairway in a barn of limited space. The stair stringers are hinged on an iron rod, while the cover is hinged with ordinary strap hinges. The cover closes the opening in the floor when the stairway is raised.



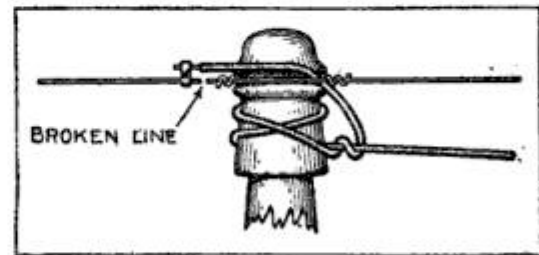
Balanced Cover and Stairway

There are two cables connecting the lower end of the stair and the upper end of the cover and are attached one to each stringer. The upper pulleys are of iron 9 in. in diameter. As it was found that the stairway was heavier

than the cover a weight was attached to the cover for a balance. The weight consisted of a box filled with a suitable amount of gravel.—Contributed by H Halvorsen, St. Ansgar, Ia.

Telephone Line Broken Behind the Test Connector

In testing out a telephone circuit the line was found to be open beyond the



The Broken Line Could Not Fall

first subscriber, and as two other circuits were repaired the same day, the breaks being caused by the sudden change to low temperature, the break was expected to be located by finding the wire down at some point between the first and second subscriber, says a correspondent of Telephony. The distance of about one mile beyond the second subscriber was covered and the line apparently was in good condition. As none of the parties beyond the first subscriber could call the office, the line was more closely examined on the backward trip. This revealed the break to be in between a test clamp and a tie wire, as shown in the sketch. The second subscriber's drop, which was of insulated No. 12 wire, was wrapped around the insulator a few times, and held the line up one way, and the tie held it up the other, as shown. No slack was noticeable at all in the line, and the line was up in good shape.

An Automatic Siphon

This siphon is well adapted for the continual refilling of vessels, as it can never run empty and starts to work automatically as soon as the solution in the reservoir rises above the level of the mouth of the siphon. The essential part of this siphon is shown from

A to B in the sketch. The upward projecting parts can be shortened as required. The opening at C causes the siphon to continue its action automatically, and also prevents the parts from running empty. A suitable length of pipe is shown at D. This siphon is especially adapted for decanting solutions from precipitates, mother liquors, slimy precipitates, etc., where the settling only takes place gradually. In such cases, the automatic siphon must be lowered gradually, as the settling of the suspended matter takes place. This device is of special advantage for such operations, because it enables the suction of the solution to take place from above, thus preventing disturbance of the precipitate. The siphon can also be used as an overflow. If the

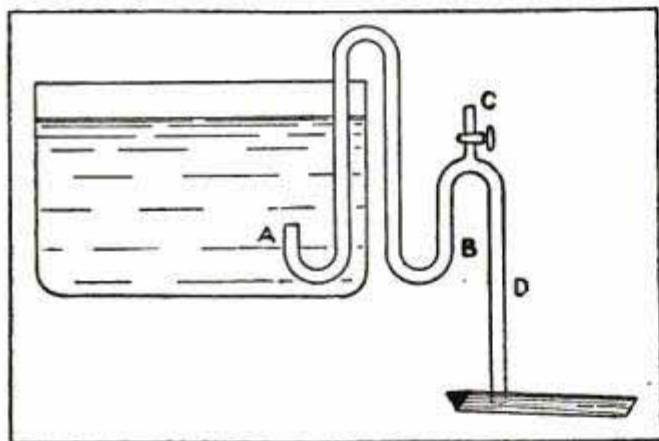


Diagram of the Automatic Siphon

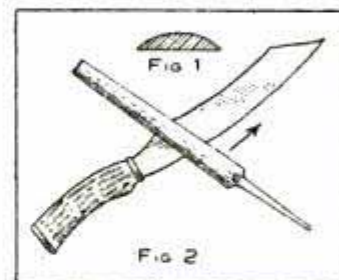
diameter of the automatic siphon corresponds with that of the supply pipe, an overflowing of the collecting vessel is made impossible, as the siphon does not then require any further attention.

When in action the siphon sucks air in at C. It is also possible to make an accurate mixture of solutions if the opening C is conveniently connected. If it is desired to hasten the flow of the solution, the opening C can be closed, and after the vessel has become nearly empty, it can be reopened so as to prevent the siphon from running entirely empty. This can be regulated automatically by connecting the cock with a float in the tank.

When filing turned work in a lathe cover the piece over with chalk and the part where the file touches can be seen.

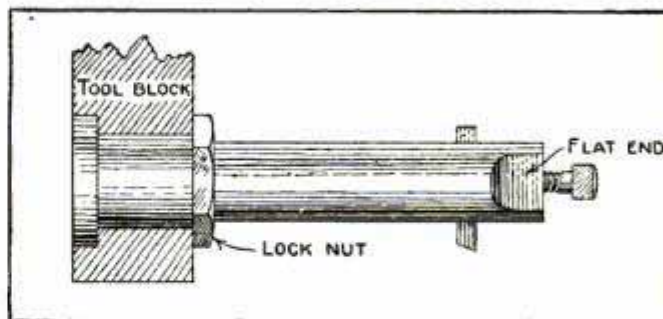
Home-Made Knife Sharpener

Recently, I made a sharpener which is found to be excellent for carving or kitchen knives. The sharpener was made by grinding a half-round file smooth and to a sharp edge on both sides, similar to a babbitt scraper for scraping babbitted shaft bearings. The section of the file is shown in Fig. 1, the edges being used to scrape the blade of the knife as shown in the sketch, Fig. 2. This will give a sharp, but somewhat rough edge which is excellent for its purpose. The sharpener will cut good-sized chips from the knife blade.—Contributed by W. E. Morey, Chicago, Ill.



Extension Tool for Cutting Keyways

This tool is especially adapted to cutting keyways in pulley castings and internal work of a similar kind. The tool may be used in a shaper in place of a regular tool-post. The round bar carrying the cutting tool can be set at any desired angle of offset for cutting the keyway, and when the lock nut is tightened, the tool holder will

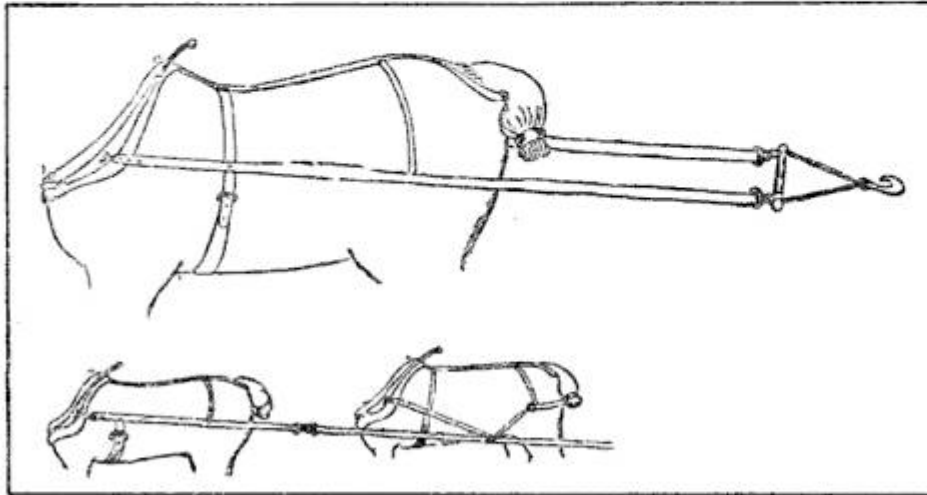


Rigid Keyway Cutting Tool

be rigid for cutting the metal. The end of the round bar is filed flat so a wrench can be used when turning up the lock nut. As the cutting thrust is directly endways on the round bar, the spring of the metal is entirely avoided.—Contributed by Donald A. Hampson, Middletown, N. Y.

How to Make a Blacksmith's Rule

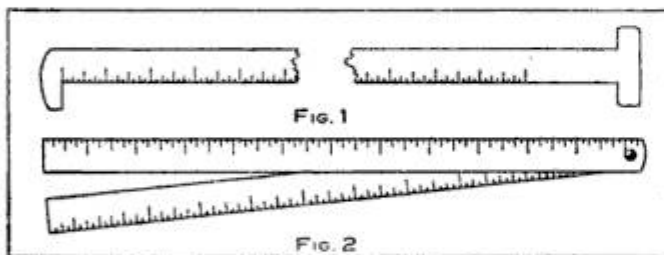
The majority of blacksmiths use a wooden 2-ft. rule as a measure. A handy rule for hot iron, as well as for other purposes, can be made from a piece of bar iron, $\frac{1}{8}$ in. thick, $\frac{1}{2}$ in.



Harnessing for Single and Tandem Mine Horses

wide and about 3 ft. long. The bar is forged in the shape shown in Fig. 1. Clean and polish the metal and cover with a thin coat of paraffin on one side. Mark or scratch through the wax coating with a sharp-pointed awl or steel on $\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{4}$ and $\frac{1}{2}$ -in. marks. Fill up the scratched places with a mixture of nitric acid and water and allow this to stand for several hours. Wash off the acid with water and melt the wax and you will have a fine etched measure.

A jointed rule can be etched in a similar way, as shown in Fig. 2. The pieces are put together with a loose



Steel Rule for Blacksmiths

rivet. Three or more pieces can be put together in this manner forming a rod measure if desired. A rule of this kind should be made from iron or steel, $\frac{1}{16}$ in. thick and $\frac{3}{4}$ in. wide.—Contributed by James E. Noble, Toronto, Canada.

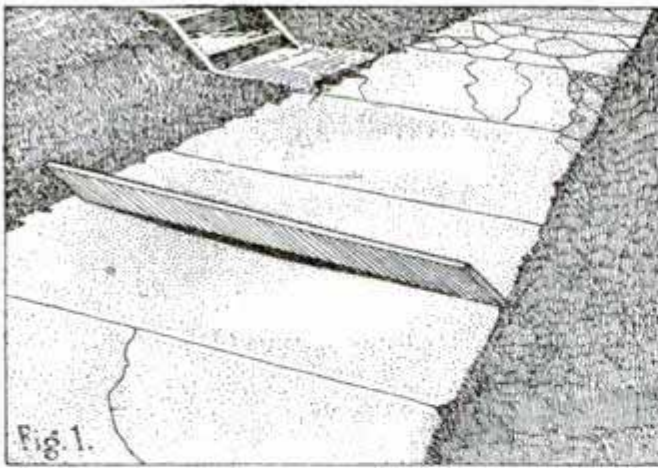
How to Harness Mine Horses

The method of harnessing mine horses for the hard coal mines in Pennsylvania is shown in the accompanying illustration. This is handier than shafts, for if shafts are used, the driver must go to the bother of un-hitching his horse or mule every time he has to pull, says the American Blacksmith. The harness is of the very heaviest that can be had. The traces are made of $\frac{3}{8}$ -in. chain, about $7\frac{1}{2}$ ft. long, with a spreader of $3\frac{1}{2}$ ft. The harness is like the common work harness. You take the trace in the middle or a few inches ahead of the middle

and fasten it to the crupper; the front or short end is hooked to the harness and there is a tee on the other end of the trace that goes through the ring of the spreader. The accompanying engraving shows a set of mine harness for one horse and for two or more horses in one team.

There are no brakes on the cars and if they are lowered down an incline and the grade is too steep, they are braked by what is known as a "spragg." It is a piece of hard wood about 18 in. long which the driver places in the wheel; if one is not enough, two are placed in, or as many as are needed. Wheels are slid in this manner so as to insure safety. The "spragg" is made out of hard wood and the ends are pointed so the runner can place it in the wheel while the car is in motion.

A concise way of stating the value of exhaust steam, says Power, is that every 6 lb. of it is worth as much as 1 lb. of coal, plus fireman's wages, plus interest and depreciation on boiler plant, plus 6 lb. of pure boiler feed water; that is, provided you want the steam for heating, drying or similar purposes.



Flags Become Saucer Shaped



Longitudinal Crack through Center

The Causes of Failures in Making Concrete Sidewalks

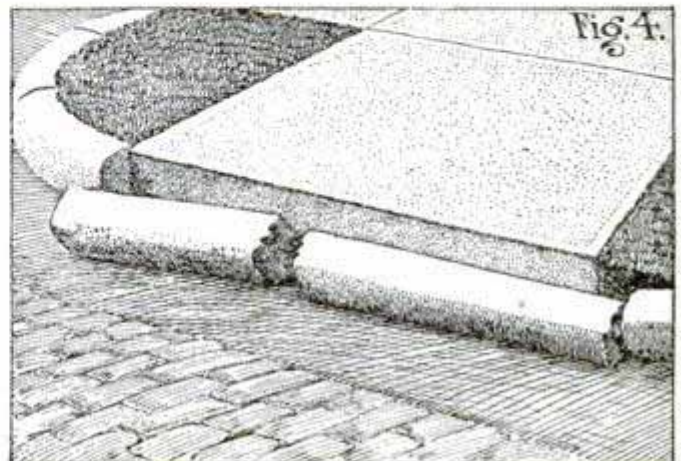
Investigation has recently been made to determine the causes of failures in making concrete walks and, if possible, to determine whether or not the fault was with the materials used, the design of the walk, or with the workmanship. The tests show that these failures are seldom caused by the chemical action in the cement used, but are the result of poor work during construction and due in many cases to wrong designs for foundations and drainage. A great many walks are seen where the flags have warped (Fig. 1), causing a sink in the middle that acts as a basin for holding water after each rain. These flags will have no cracks, but the surface is similar to a saucer. In a report presented to the Pennsylvania Company, the Engineer says that these warped flags occur both in walks of large area made up of a number of rows and in single-flag suburban walks, flanked by

lawns. In the latter case, the warping of the flags transversely to the length of the street is generally greater than that along the street, and in addition, there is usually a longitudinal crack along the center of the walk, as shown in Fig. 2. Suburban walks flanked on one side by a terrace are generally the worst. A great many walks are cracked at curved corner curbs, and at the ends of walks next to the curb. At cross streets, often flags in the middle of long walks buckle up, as shown in Fig. 3. In many cases the expansion in the cement walk has either pushed the curb out of line, or broken it off entirely, as shown in Fig. 4.

The usual method of laying concrete walks is to excavate the earth to 10 or 12 in. below the finished surface and pack a bed of cinders 6 or 8 in. deep in the bottom of the trench. A 3-in. concrete walk is laid on top of the cinders



Bulging from Expansion



Curb Broken by Expansion

and a 1-in. covering of cement is put on the surface. No additional drainage is provided. This results in the surface water entering the foundation of the walk through the lawns on either side, and at all the points between the flags. Very little of this moisture reaches the center of the flag and that part of the concrete at the sides and near the joints is filled with water. Freezing will cause a greater upheaval near the edges of the flag than in the center, the flag bearing only on the edges acts as a beam. The load, while not great, is applied continuously and simultaneously, with changes in temperature, and finally causes a flow of the material, resulting in depression and permanent set. The 1-in. cement covering will readily bend without cracking.

Another cause for warping is the difference in the density of the concrete base and the top coat or wearing surface. This will cause a different ratio of expansion and contraction in the two parts. The concrete base also is quite porous and if water gets into the foundation, there is no doubt but that this porous concrete will absorb considerable moisture which, when freezing, will cause compressive stresses on the under side, thus wearing the flag.

The most important thing to be considered is the sub-foundation and the drainage. In Fig. 5 is shown a cross section illustrating how to properly drain a sidewalk foundation. The curb is provided with broken stone foundation which acts as a drain and this is connected to the sidewalk foundation every 25 ft. with broken stone drain. If there is no provision made at the curb for drainage, it would be well to

carry the same to sink holes made to get the water below the freezing line. The sub-foundation should have an even plane exactly parallel to the proposed top surface. There should be no low places where water might collect and could not be drained. Low places should be filled up with foundation material to an even surface. The sub-foundation should be rammed evenly in such a way as to get the same compactness at all points. Cinders are preferable for a foundation and are most frequently used. A cinder thickness of 6 in. is ample for a foundation, while this specification will vary from 4 to 12 in. in different cities. The foundation should have a thorough wetting just before the concrete is laid, as dry cinders will absorb some of the water from the mixture, and cause an inferior concrete.

The proportions used in mixing concrete are 1 of cement, $2\frac{1}{2}$ sand and 5 of gravel or crushed stone. A slight change is all that will be necessary to the foregoing proportions, to meet the condition in local sands and gravels. The mixture should contain more water than generally used and thoroughly mixed, as well-mixed concrete is more dense than poorly mixed, and requires less tamping. If the cinder bed is not thoroughly compacted, the blows from tamping the concrete will force it up in another place. This is why the cinder bed should be well tamped, and the concrete mixed to have such a constituency as to reduce the amount of tamping. The concrete base should be 3 or more inches thick varying with the amount of traffic.

The top or wearing coat should be

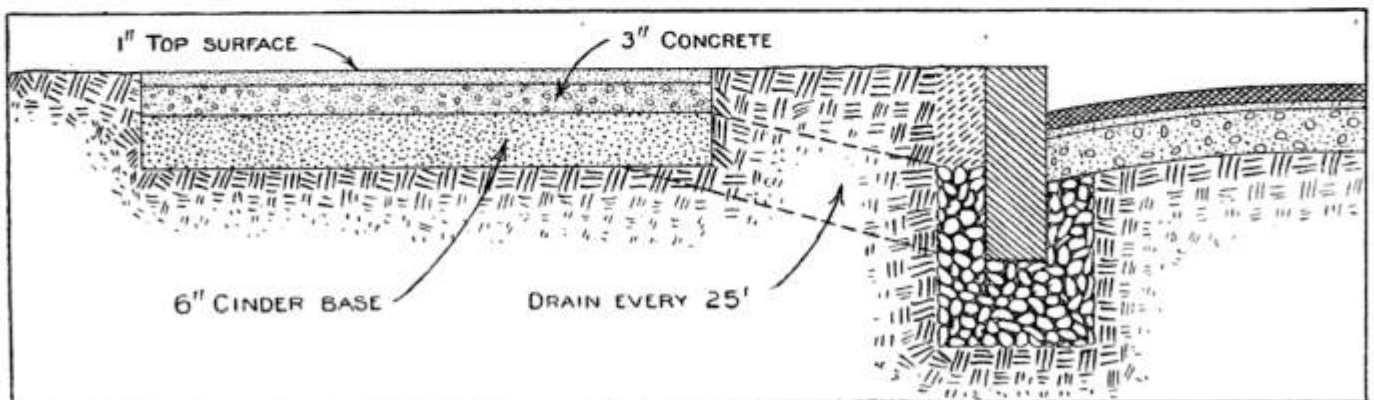


Fig. 5. Drainage Construction for Concrete Sidewalks

almost the same mixture as the base, that is, if the base is mixed 1, $2\frac{1}{2}$ and 5, then the wearing surface should be 1 of cement, and $2\frac{1}{2}$ sand. The proportion of one to one is too rich. The expansion of the neat cement is about three times as much for 1 to 3 mixture, and, therefore, it seems reasonable to assume that a 1 to 1 mixture used for the wearing surface will have a greater expansion and contraction than the base which is 1 to 3, and to attribute some of the warping to this cause.

When making the first walks of concrete, the mixture was placed in forms, outlining the alternate blocks, and when these had set the remaining spaces were filled in. This made positive joints and prevented the breaking of the flags in settlement. The drawback in laying alternate blocks was that the blocks could not be made in a true plane, also the increased cost and time required.

Various methods are adopted to make the joints, but the best way is to have a tool so shaped as to make the top edges of the groove firm, smooth, and slightly round, and should have such a length to cut entirely through the top coat and the concrete base. This will allow a continuous course of walk to be laid and cut up in blocks when complete. The size of the blocks should be limited to about 6 by 6 ft.

To take care of the expansion in long walks, it is well to provide extra joints in addition to the block joints, from 1 to $1\frac{1}{2}$ in. wide, about every 100 ft. This width joint should be made next to the curb at cross streets, and along the curb where the sidewalks are very wide and have curved corners. These joints can be filled with sand, but pitch and asphalt is better, as this will prevent moisture from reaching the cinder bed.

The amount of gasoline to run an automobile a certain distance may be determined as follows: One gallon of gasoline will run a one-cylinder 30 miles; two-cylinder, 20 miles; four-cylinder, 15 miles and a six-cylinder car, 10 miles.

Fusing and Welding by Gas and Air

The welding and melting of metals by the use of the blowpipe flame has



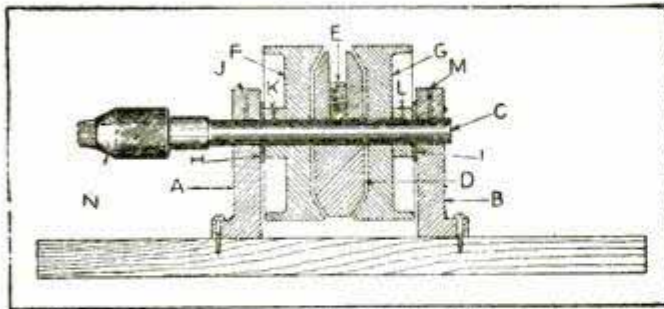
Melting Metal under Water

opened up a new field for the manufacturer. Another inventor has constructed a torch with which illuminating gas and air is used to practically duplicate the results obtained by the oxy-hydrogen or oxy-acetylene flames. The blowpipe is made in numerous sizes for the various kinds of work. The flame from the blowpipe made for jewelers does not produce a flame any larger than the size of a match, while any size may be used for larger work. One of the most remarkable features of this blowpipe is that it will melt metals while they are under water. The flame parts the water and will melt at that point only, the other surfaces being covered with water.

Small Tapping Machine

The tapping of small holes in several thousand pieces of brass made it necessary to have a special tapping machine constructed for quick operation.

The holes were drilled with about $\frac{1}{8}$ -in. drill, $\frac{1}{4}$ in. deep. A machine was so constructed as to drive the tap by friction caused by pressure on the main



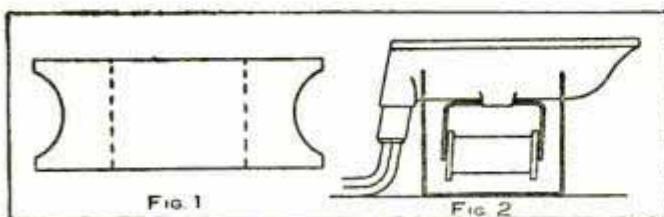
Details of Tapping Machine

shaft. The device consisted of pillow post bearings, A and B, with a shaft, C, which carries the chuck, N. Two pulleys, F and G, were so constructed as to have their inside surfaces conical to match a cone-shaped disk, D. The pulleys run loose on the shaft while the disk is fastened with a screw, E. Washers, H and I, are placed on the shaft to make a seat for the pulley flanges. The action of this device is apparent when the pulleys are belted to run in opposite directions.

A slight push on the end of the top will cause the cone disk to be propelled by the pulley G, thus turning the tap into the hole and cutting the threads; and a pull on the piece being tapped causes the reverse action, the cone disk clutching the pulley F, which runs the opposite direction, turning the tap out as the shaft revolves backward.—Contributed by C. G. Smith, Brooklyn, N. Y.

Heating Water with an Electric Iron

A young couple while moving found that when meal time came they had no way to heat water. There was no



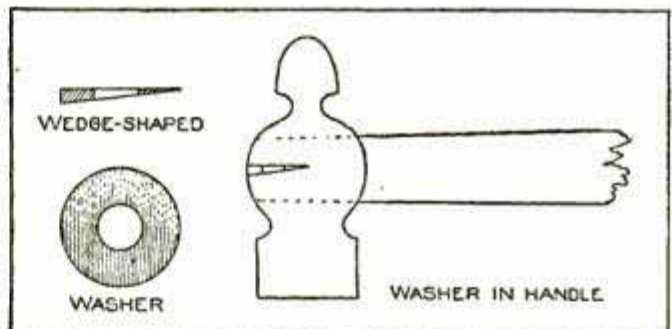
Boiling Water with the Iron

stove in place or gas that could be used, so after some thinking the head of the

house dug up a sheet of tin and with a pair of shears he cut the tin in the shape shown in Fig. 1 and bent the sides up on the dotted lines. Their electric iron was taken from a box of kitchen utensils and set inverted on this improvised stand. The plug was turned into a nearby electric socket, the switch turned on and a quart measure full of water set on the bottom of the iron. In ten minutes they had enough boiling water to make a cup of tea.—Contributed by J. H. Crawford, Schenectady, N. Y.

How to Wedge a Hammer Handle

One of the most annoying things for the mechanic is to have a hammer head loose on the handle. A wood or iron wedge driven into the end of the handle will soon become loose and drop out leaving the hammer in a worse



Hold-Tight Wedge for a Hammer Handle

condition than before. Take an ordinary washer that will pass freely through the eye of the hammer and grind a wedge-shaped piece, as shown in the illustration. This is driven into the wood as an ordinary wedge would be driven. The tightness of the fit will swell out the wood into the hole of the washer, which makes it impossible for the washer to come out. A hammer and handle supplied with such a washer wedge has been in constant use for 8 years without any signs of coming loose.—Contributed by Joseph Weaner, Plainfield, N. J.

Tarnished zinc nameplates may be cleaned with 1 part sulphuric acid to 12 parts water. Rub well with a rag and wash with clean water.

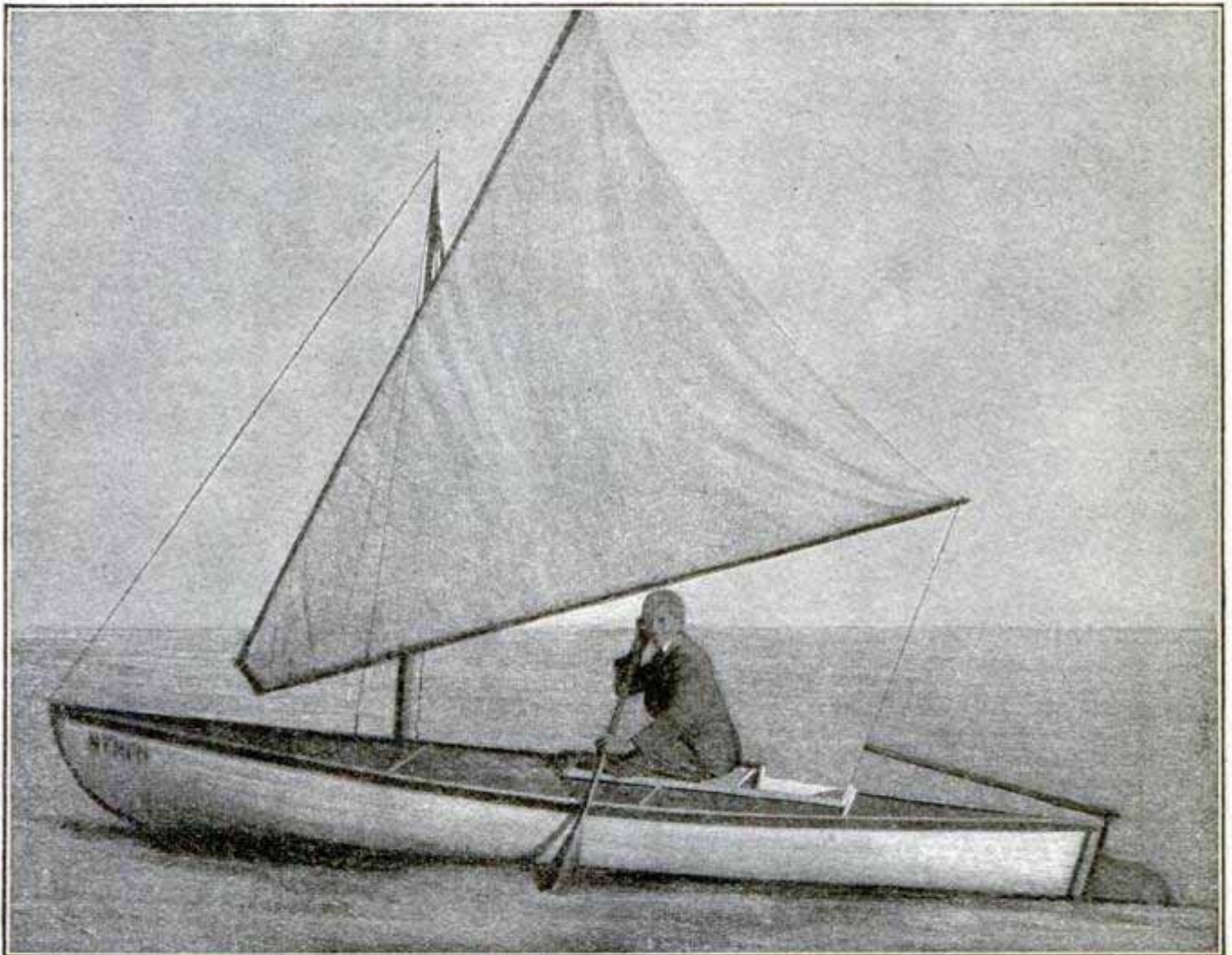
AMATEUR MECHANICS

How to Make a Sailing Canoe

Editor's Note.—While a good many would like to build a canvas boat, and in some waters such a boat will answer the purpose well, yet we would not advise its use, as the cloth is liable to be torn on snags.

The materials necessary for the construction of a sailing canoe as illustrated in the engraving are as follows:

from a point 4 ft. from each end to 1 in. at the ends. Both ends are mortised, one 6 in. for the stern piece, and the



Completed Sailing Canoe

1 keelson, 1 in. by 8 in. by 15 ft., selected pine.
 14 rib-bands, 1 in. square by 16 ft. clear pine.
 2 gunwales, 1 in. by 2 in. by 16 ft.
 1 piece for forms and bow pieces, 1 in. by 12 in. by 10 ft.
 4 outwales, $\frac{1}{4}$ in. by 2 in. by 16 ft.
 1 piece 3 in. wide and 12 ft. long for cockpit frame.
 1 piece, 2 in. wide and 12 ft. long, for center deck braces.
 11 yd. of $1\frac{1}{2}$ -yd. wide 12-oz. ducking.
 8 yd. of 1-yd. wide unbleached muslin.
 50 ft. of rope.
 1 mast, 9 ft. long.
 Paint, screws and cleats.

The keelson, Fig. 1, is 14 ft. long, 8 in. wide in the center and tapered down

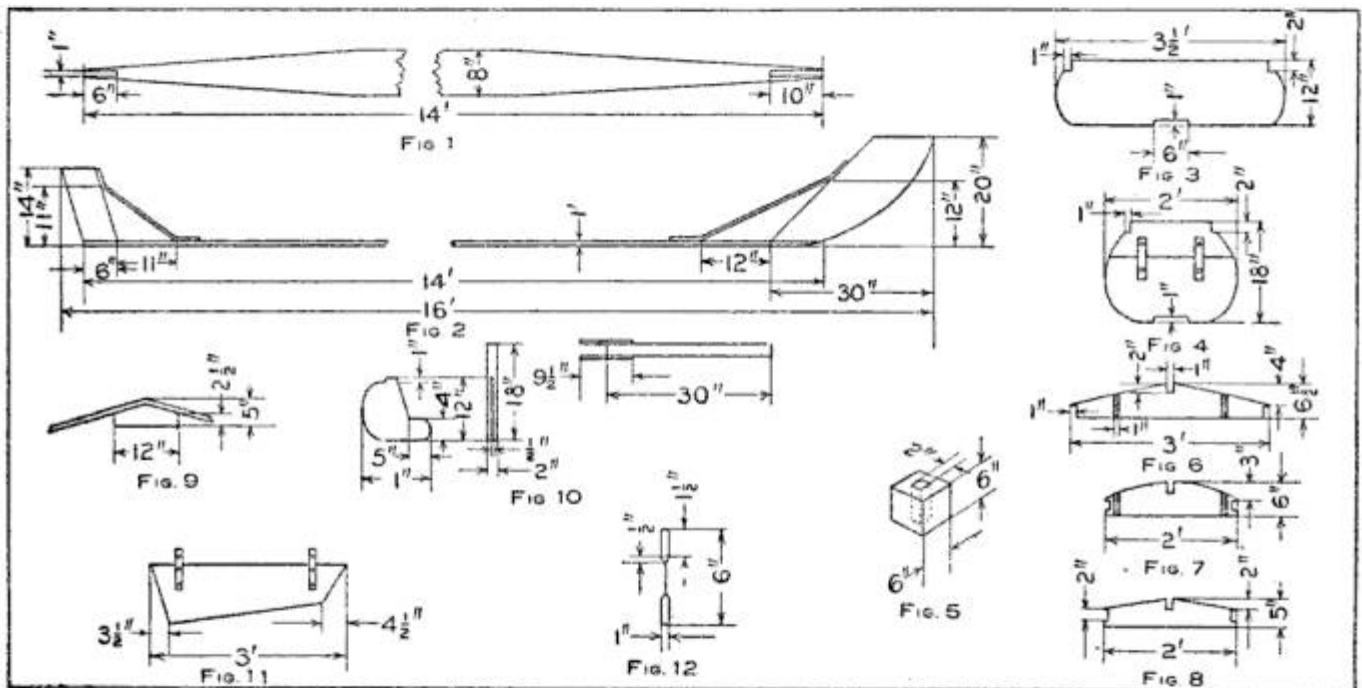
other, 12 in. for the bow. Be sure to get the bow and stern pieces directly in the middle of the keelson and at right angles with the top edge. The stern and bow pieces are cut as shown in Fig. 2 and braced with an iron band $\frac{1}{8}$ in. thick and $\frac{3}{4}$ in. wide drilled and fastened with screws.

Two forms are made as shown in Figs. 3 and 4, the smaller is placed 3 ft. from the bow and the large one, 7

ft. 3 in. from the stern. The larger mould is used temporarily while making the boat, and is removed after the ribs are in place. The gunwales are now placed over the forms and in the notches shown, and fastened with screws, and, after cutting the ends to fit the bow and stern pieces, they are fastened with bolts put through the three pieces. The sharp edges on one side of each rib-band are removed and seven of them fastened with screws to each side of the moulds, spacing them on the large mould 4 in. apart. The ribs are made of 28 good barrel hoops

son, $3\frac{1}{2}$ ft. from the bow, with bolts through countersunk holes from the under side.

There are three deck braces made as shown in Figs. 6, 7 and 8. Braces, Figs. 6 and 7, form the ends of the cockpit which is 20 in. wide. A 6-in. board is fitted into the mortises shown in these pieces; a center piece is fitted in the other mortises. The other deck braces slope down from the center piece and are placed 6 in. apart. They are 1 in. square and are mortised into the center piece and fastened to the gunwales with screws. The main deck



Details of a Home-Made Sailing Canoe

which should be well soaked in water for several hours before bending them in shape. These are put in 6 in. apart and are fastened to the rib-bands with $\frac{7}{8}$ -in. wood screws. The ribs should be put in straight and true to keep them from pulling the rib-bands out of shape. After the ribs are in place and fastened to the rib-bands, gunwales and keelson, put on the outwale strips and fasten them to the gunwales between every rib with $1\frac{1}{2}$ -in. screws.

Before making the deck, a block for the mast to rest in must be made and fastened to the keelson. This block, Fig. 5, is a cube having sides 6 in. square and is kept from splitting by an iron band tightly fitted around the outside. The block is fastened to the keel-

braces are fastened to the gunwales with 4-in. corner braces and to the center piece with 2-in. corner braces. The mast hole on the deck is made as follows: Secure a piece of twine 1 in. thick, 6 in. wide and 3 ft. long. Cut this in halves and mortise for the center piece in the two halves and fasten to the gunwales. A block of pine, 4 in. thick and 12 in. long, is cut to fit under the top boards, Fig. 9, and fastened to them with bolts. With an expansive bit bore a hole 3 in. in diameter through the block. Be sure to get the block and hole directly over the block that is fastened to the keelson. Put on a coat of boiled linseed oil all over the frame before proceeding farther.

Putting on the canvas may be a diffi-

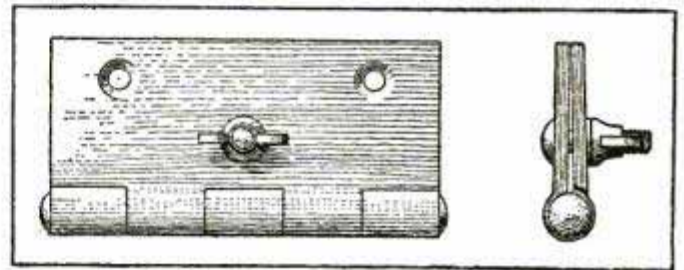
cult piece of work to do, yet if the following simple directions are followed out no trouble will be encountered. The 11-yd. length of canvas is cut in the center, doubled, and a seam made joining the two pieces together. Fill the seam with thick paint and tack it down with copper tacks along the center of the keelson. When this is well tacked commence stretching and pulling the canvas in the middle of the gunwales so as to make it as even and tight as possible and work toward each end, tacking the canvas as it is stretched to the outside of the gunwale. Seam the canvas along the stern and bow pieces as was done on the keelson. The deck is not so hard to do, but be careful to get the canvas tight and even. A seam should be made along the center piece. The trimming is wood, $\frac{1}{4}$ in. thick and $\frac{1}{2}$ in. wide. A strip of this is nailed along the center piece over the canvas. The outwales are nailed on over the canvas. A piece of oak, 1 in. thick $1\frac{1}{2}$ in. wide and 14 in. long, is fastened with screws over the canvas on the stern piece; also, a piece $\frac{1}{4}$ in. thick, 1 in. wide and 24 in. long is well soaked in water, bent to the right shape and fastened over the canvas on the bow.

The rudder is made as shown in Fig. 10 with a movable handle. A strip 1 in. thick by 2 in. wide, is bolted to the keelson over the canvas for the outer keel. The keel, Fig. 11, is 6 in. wide at one end and 12 in. at the other, which is fastened to the outer keel with bolts having thumb nuts. The mast can be made of a young spruce tree having a diameter of 3 in. at the base with sufficient height to make it 9 ft. long. The canoe is driven by a lanteen sail and two curtain poles, each 1 in. in diameter and 10 ft. long, are used for the boom and gaff, which are held together with two pieces of iron bent as shown in Fig. 12. The sail is a triangle, $9\frac{3}{4}$ by $9\frac{3}{4}$ by $8\frac{1}{2}$ ft. which is held to the boom and gaff by cord lacings run through eyelets inserted in the muslin. The eyelets are of brass placed 4 in. apart in the muslin. The mast has two side and one front stay, each fitted with

a turnbuckle for tightening. A pulley is placed at the top and bottom of the mast for the lift rope. The sail is held to the mast by an iron ring and the lift rope at the top of the mast. The boom rope is held in the hand and several cleats should be placed in the cockpit for convenience. A chock is placed at the bow for tying up to piers. Several coats of good paint complete the boat.—Contributed by O. E. Tronnes, Wilmette, Ill.

A Home-Made Hand Vise

A very useful little hand vise can easily be made from a hinge and a bolt carrying a wing nut. Get a fast



Hand Vise Made from a Hinge

joint hinge about 2 in. or more long and a bolt about $\frac{1}{2}$ in. long that will fit the holes in the hinge. Put the bolt through the middle hole of the hinge and replace the nut as shown in the drawing. With this device any small object may be firmly held by simply placing it between the sides of the hinge and tightening the nut.

Proper Design for a Bird House

This bird house was designed and built to make a home for the American martin. The house will accommodate 20 families. All the holes are arranged



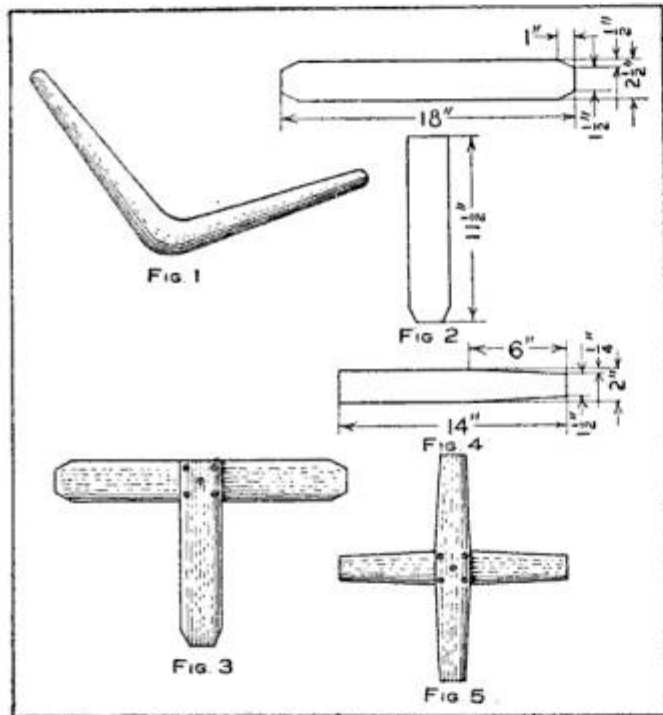
so they will not be open to the cold winds from the north which often kill the birds which come in the early spring. Around each opening is an extra ring of wood to make a longer passage which assists the martin inside in fighting off the Eng-

lish sparrow who tries to drive him out. The holes are made oval to allow all the little ones to get their heads out for fresh air. The long overhanging eaves protect the little birds from the hot summer sun.

The rooms are made up with partitions on the inside so each opening will have a room. The inside of the rooms should be stained black.

Boomerangs and How to Make Them

A boomerang is a weapon invented and used by the native Australians, who seemed to have the least intelligence of any race of mankind. The



Details of Three Boomerangs

boomerang is a curved stick of hardwood, Fig. 1, about $5/16$ in. thick, $2\frac{1}{2}$ in. wide and 2 ft. long, flat on one side, with the ends and the other side rounding. One end of the stick is grasped in one hand with the convex edge forward and the flat side up and thrown upward. After going some distance and ascending slowly to a great height in the air with a quick rotary motion, it suddenly returns in an elliptical orbit to a spot near the starting point. If thrown down on the ground the boomerang rebounds in a straight line, pursuing a ricochet motion until the object is struck at which it was thrown.

Two other types of boomerangs are

illustrated herewith and they can be made as described. The materials necessary for the T-shaped boomerang are: One piece of hard maple $5/16$ in. thick, $2\frac{1}{2}$ in. wide, and 3 ft. long; five $1/2$ -in. flat-headed screws. Cut the piece of hard maple into two pieces, one $11\frac{1}{2}$ in. and the other 18 in. long. The corners are cut from these pieces as shown in Fig. 2, taking care to cut exactly the same amount from each corner. Bevel both sides of the pieces, making the edges very thin so they will cut the air better. Find the exact center of the long piece and make a line $1\frac{1}{4}$ in. on each side of the center and fasten the short length between the lines with the screws as shown in Fig. 3. The short piece should be fastened perfectly square and at right angles to the long one.

The materials necessary for the cross-shaped boomerang are one piece hard maple $5/16$ in. thick, 2 in. wide and 30 in. long and five $1/2$ -in. flat-headed screws. Cut the maple into two 14-in. pieces and plane the edges of these pieces so the ends will be $1\frac{1}{2}$ in. wide, as shown in Fig. 4. Bevel these pieces the same as the ones for the T-shaped boomerang. The two pieces are fastened together as shown in Fig. 5. All of the boomerangs when completed should be given several coats of linseed oil and thoroughly dried. This will keep the wood from absorbing water and becoming heavy. The last two boomerangs are thrown in a similar way to the first one, except that one of the pieces is grasped in the hand and the throw given with a quick underhand motion. A little practice is all that is necessary for one to become skillful in throwing them.—Contributed by O. E. Tronnes, Wilmette, Ill.

How to Make Water Wings

Purchase a piece of unbleached muslin, 1 yd. square. Take this and fold it over once, forming a double piece $1\frac{1}{2}$ ft. wide and 3 ft. long. Make a double stitch all around the edge, leaving a small opening at one corner. Insert

a piece of tape at this corner to be used for tying around the opening when the bag is blown up. The bag is then turned inside out, soaked with water and blown up. An occasional wetting

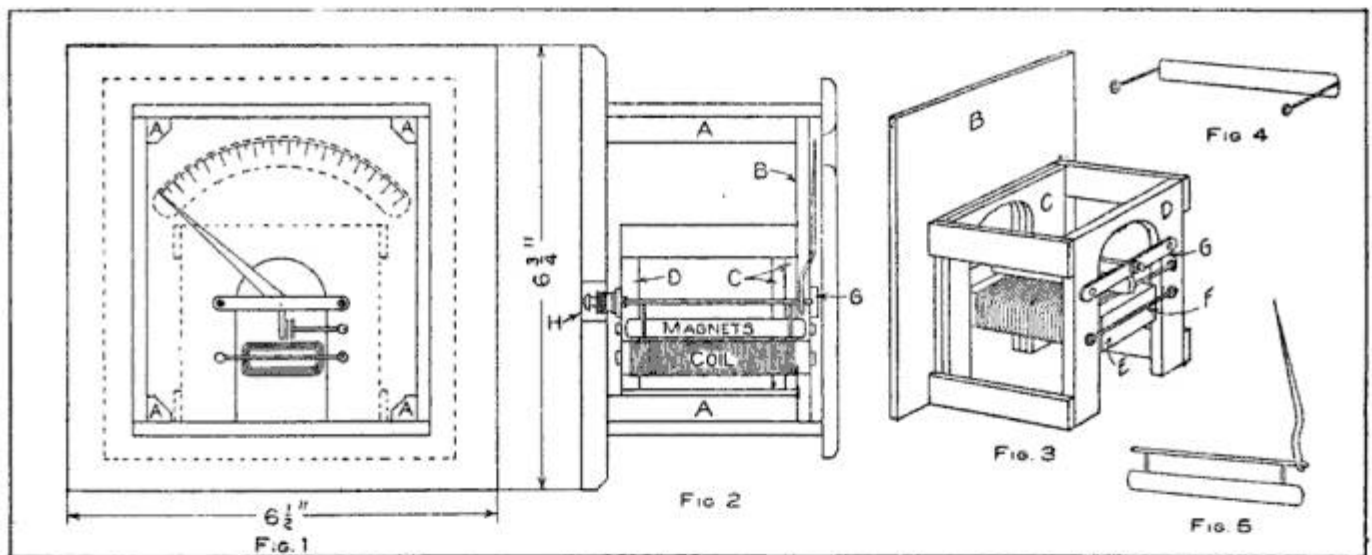
all over will prevent it from leaking. As these wings are very large they will prevent the swimmer from sinking.—Contributed by W. C. Bliss, St. Louis, Mo.

How to Make an Ammeter

The outside case of this instrument is made of wood taken from old cigar boxes with the exception of the back. If carefully and neatly made, the finished instrument will be very satisfactory. The measurements here given need not be strictly followed out, but can be governed by circumstances. The case should first be made and varnished and while this is drying, the mechanical parts can be put together.

turned into each three-cornered piece.

The front, which is a piece $5\frac{1}{4}$ in. wide and $6\frac{1}{2}$ in. long, has a circular opening cut near the top through which the graduated scale may be seen. This front is centered and fastened the same as the back, and the four outside edges, as well as the edges around the opening, are rounded. The whole case can now be cleaned and stained with a light mahogany stain,



Details of an Ammeter

The back is a board $\frac{3}{8}$ in. thick, $6\frac{1}{2}$ in. wide and $6\frac{3}{4}$ in. long. The outer edges of this board are chamfered. The other parts of the case are made from the cigar box wood which should be well sandpapered to remove the labels. The sides are $3\frac{1}{4}$ in. wide and 5 in. long; the top and bottom, $3\frac{1}{4}$ in. wide and $4\frac{1}{2}$ in. long. Glue a three-cornered piece, A, Fig. 1, at each end on the surface that is to be the inside of the top and bottom pieces. After the glue is set, fasten the sides to the pieces with glue, and take care that the pieces are all square. When the glue is set, this square box is well sandpapered, then centered, and fastened to the back with small screws

and varnished. Cut another piece of board, B, Figs. 2 and 3, to just fit inside the case and rest on the ends of the three-cornered pieces, A, and glue to this board two smaller pieces, C, 3 in. square, with the grain of the wood in alternate directions to prevent warping. All of these pieces are made of the cigar box wood. Another piece, D, $\frac{3}{8}$ in. thick and 3 in. square, is placed on the other pieces and a U-shaped opening $1\frac{3}{4}$ in. wide and $2\frac{1}{2}$ in. high sawed out from all of the pieces as shown. The piece D is attached to the pieces C with four $\frac{1}{2}$ -in. pieces $2\frac{5}{8}$ in. long.

A magnet is made from a soft piece of iron, E, about $\frac{3}{8}$ in. thick, $1\frac{1}{4}$ in.

wide and $2\frac{3}{4}$ in. long. Solder across each end of the iron a piece of brass wire, F, and make a turn in each end of the wires, forming an eye for a screw. These wires are about $2\frac{1}{2}$ in. long. Wind three layers of about No. 14 double cotton-covered copper wire on the soft iron and leave about 5 or 6 in. of each end unwound for connections.

The pointer is made as shown in Fig. 5 from $1/16$ -in. brass wire filed to make a point at both ends for a spindle. About $1/2$ in. from each end of this wire are soldered two smaller brass wires which in turn are soldered to a strip of light tin $1/4$ in. wide and $2\frac{5}{8}$ in. long. The lower edge of this tin should be about $1/2$ in. from the spindle. The pointer is soldered to the spindle $1/4$ in. from one end. All of these parts should be brass with the exception of the strip of tin. Another strip of tin, the same size as the first, is soldered to two brass wires as shown in Fig. 4. These wires should be about 1 in. long.

The spindle of the pointer swings freely between two bars of brass, G, $1/16$ in. thick, $1/4$ in. wide and $2\frac{1}{2}$ in. long. A small hole is countersunk in one of the bars to receive one end of the spindle and a hole $1/8$ in. in diameter is drilled in the other and a thumb nut taken from the binding-post of an old battery soldered over the hole so the screw will pass through when turned into the nut. The end of the screw is countersunk to receive the other end of the spindle. A lock nut is necessary to fasten the screw when proper adjustment is secured. A hole is drilled in both ends of the bars for screws to fasten them in place. The bar with the adjusting screw is fastened on the back so it can be readily adjusted through the hole H, bored in the back. The pointer is bent so it will pass through the U-shaped cut-out and up back of the board B. A brass pin is driven in the board B to hold the pointer from dropping down too far to the left. Place the tin, Fig. 4, so it will just clear the tin, Fig. 5, and fasten in place. The magnet is next placed with the ends of the coil to the back

and the top just clearing the tin strips. Two binding screws are fitted to the bottom of the back and connected to the extending wires from the coil.

The instrument is now ready for calibrating. This is done by connecting it in series with another standard ammeter which has the scale marked in known quantities. In this series is also connected a variable resistance and a battery or some other source of current supply. The resistance is now adjusted to show .5 ampere on the standard ammeter and the position of the pointer marked on the scale. Change your resistance to all points and make the numbers until the entire scale is complete.

When the current flows through the coil, the two tinned strips of metal are magnetized, and being magnetized by the same lines of force they are both of the same polarity. Like poles repel each other, and as the part Fig. 4 is not movable, the part carrying the pointer moves away. The stronger the current, the greater the magnetism of the metal strips, and the farther apart they will be forced, showing a greater deflection of the pointer.—Contributed by George Heimroth, Richmond Hill, L. I.

How to Make an Equatorial

Condensed from article contributed by J. R. Chapman, F. R. A. S. Austwick Hall, W. Yorkshire, England

This star finder can easily be made by anyone who can use a few tools as the parts are all wood and the only lathe work necessary is the turned shoulder on the polar axis and this could be dressed and sandpapered true enough for the purpose. The base is a board 5 in. wide and 9 in. long which is fitted with an ordinary wood screw in each corner for leveling. Two side pieces cut with an angle equal to the colatitude of the place are nailed to the base and on top of them is fastened another board on which is marked the hour circle as shown. The end of the polar axis B, that has the end turned with a shoulder, is fitted in a hole bored in the center of the hour circle. The polar axis B is secured to the board

with a wooden collar and a pin underneath. The upper end of the polar axis is fitted with a 1/4-in. board, C, 5 1/2 in. in diameter. A thin compass card divided into degrees is fitted on the edge of this disk for the declination circle.

The hour circle A is half of a similar card with the hour marks divided into 20 minutes. An index pointer is fastened to the base of the polar axis. A pointer 12 in. long is fastened with a small bolt to the center of the declination circle. A small opening is made in the pointer into which an ordinary needle is inserted. This needle is adjusted to the degree to set the pointer in declination and when set, the pointer is clamped with the bolt at the center. A brass tube having a 1/4-in. hole is fastened to the pointer.

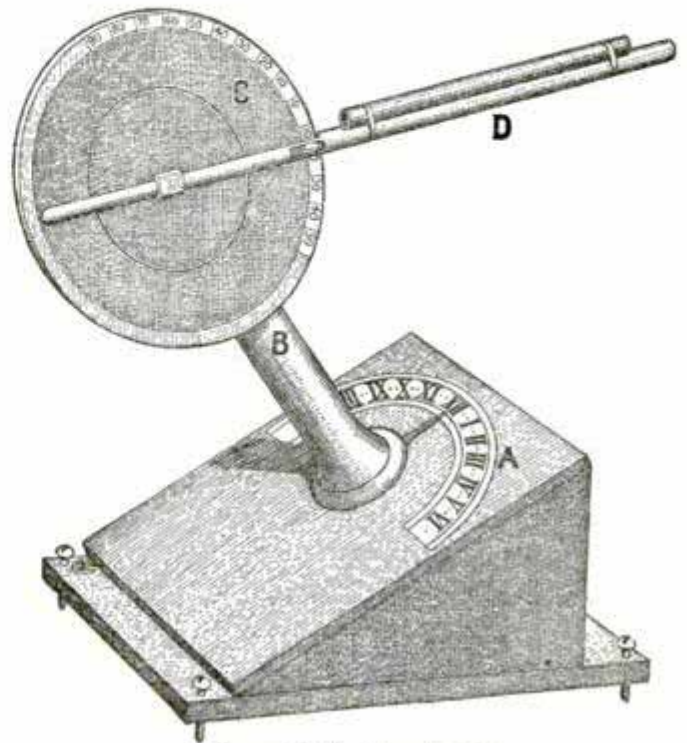
The first thing to do is to get a true N and S meridian mark. This can be approximately obtained by a good compass, and allowance made for the magnetic declination at your own place. Secure a slab of stone or some other solid flat surface, level this and have it firmly fixed facing due south with a line drawn through the center and put the equatorial on the surface with XII on the south end of the line. Then set the pointer D to the declination of the object, say Venus at the date of observation. You now want to know if this planet is east or west of your meridian at the time of observation. The following formula will show how this may be found. To find a celestial object by equatorial: Find the planet Venus May 21, 1881, at 9 hr. 10 min. A. M. Subtract right ascension of planet from the time shown by the clock, thus:

	hr.	min.	sec.
9 hr. 10 min. shows mean sidereal...	9	10	0
Add 12 hrs.....	12	0	0
	13	0	0
Right ascension of Venus.....	2	10	0
Set hour circle to before meridian..	10	50	0
Again			
	hr.	min.	sec.
At 1 hr. 30 min. mean clock			
shows	5	20	0
Right ascension of Venus..	2	10	0
Set hour circle to.....	3	10	0
			afternoon

Books may be found in libraries that will give the right ascension and dec-

lination of most of the heavenly bodies.

The foregoing tables assume that you have a clock rated to sidereal time,

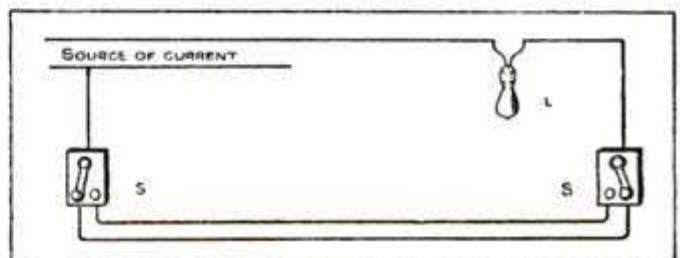


Home-Made Equatorial

but this is not absolutely necessary. If you can obtain the planet's declination on the day of observation and ascertain when it is due south, all you have to do is to set the pointer D by the needle point and note whether Venus has passed your meridian or not and set your hour index. There will be no difficulty in picking up Venus even in bright sunlight when the planet is visible to the naked eye.

Electric Light Turned On and Off from Different Places

How nice it would be to have an electric light at the turn in a stairway, or at the top that could be turned on before starting up the stair and on reaching the top turned out, and vice

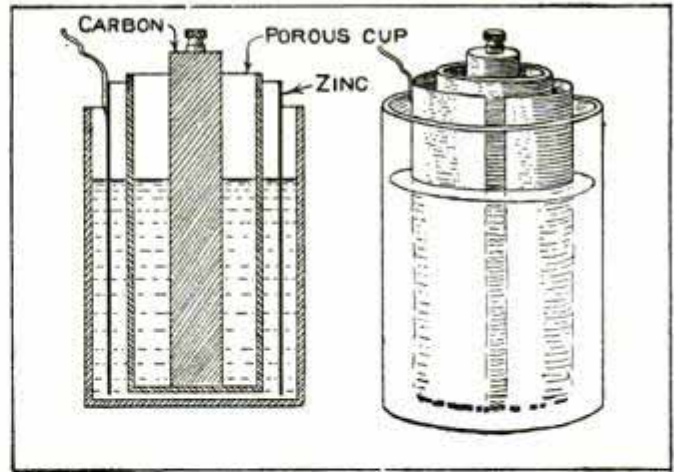


The Wiring Diagram

versa when coming down. The wiring diagram as shown in the illustration will make this a pleasant reality. This wiring may be applied in numerous like instances. The electric globe may be located at any desired place and the two point switches are connected in series with the source of current as shown in the sketch. The light may be turned on or off at either one of the switches.—Contributed by Robert W. Hall, New Haven, Conn.

How to Make a Bunsen Cell

This kind of a cell produces a high e. m. f. owing to the low internal resistance. Procure a glass jar such as used for a gravity battery, or, if one of these cannot be had, get a glazed vessel of similar construction. Take a piece of sheet zinc large enough so that when it is rolled up in the shape of a cylinder it will clear the edge of the jar by about $\frac{1}{2}$ in. Solder a wire or binding-post to the edge of the cylinder for a connection. Secure a small unglazed vessel



Cross Section and Completed Cell

to fit inside of the zinc, or such a receptacle as used in a sal ammoniac cell, and fill it with a strong solution of nitric acid. Fill the outer jar with a solution of 16 parts water and 5 parts sulphuric acid. The connections are made from the zinc and carbon.

One Way to Cook Fish

One of the best and easiest ways of cooking fish while out camping is told by a correspondent of *Forest and Stream*. A fire is built the size for the amount of food to be cooked and the wood allowed to burn down to a glowing mass of coals and ashes. Wash and season your fish well and then wrap them up in clean, fresh grass, leaves or bark. Then, after scraping away the greater part of the coals, put the fish among the ashes, cover up with the same, and heap the glowing coals on top. The fish cooks quickly—15 or 20 minutes—according to their size.

If you eat fish or game cooked after this fashion you will agree that it cannot be beaten by any method known to camp culinary savants. Clay also answers the purpose of protecting the fish or game from the fire if no other material is at hand, and for anything that requires more time for cooking it makes the best covering. Wet paper will answer, especially for cooking fish.



Optical Illusion.—Can you tell which of these three figures is the tallest? Make a guess, and then verify its correctness by measurement.

A successful method of hardening copper is to add 1 lb. of alum and 4 oz. arsenic to every 20 lb. of melted copper and stir for 10 minutes.

RECENT PATENTS

ROCKER CHURN.—Figure 1 shows an interesting butter churn that is rotated or whirled by gently rocking its support. The churn receptacle rests upon straps which are fastened to the ends of the rockers. The rockers are made in collapsible sections hinged together. The weight of the box on the straps furnishes a continual tension which causes the box to whirl as the frame rocks. The person churning can sit beside the churn, or work in different parts of the room while the butter is being made, it only being necessary to rock it when its motion begins to cease.

UMBRELLA SUPPORTER.—Mail carriers and other workers who require the use of both hands in their task while compelled to be out in all kinds of weather will find the umbrella holder in Fig. 2 of interest. It is composed of a handle grip attached to a breastplate, the latter being held in position by straps which pass over the shoulders and across the back. The umbrella handle is slipped through the grip and made fast, after which the carrier need pay no attention to it.

FAN DRIVEN BY ROCKING-CHAIR MOVEMENT.—One of the most ingenious fan arrangements recently patented is shown in Fig. 3. It is attached to a rocking chair as illustrated and provides a current of cool air without any more exertion than is required in ordinary rocking in a chair.

DEVICE TURNS DOWN ELECTRIC LIGHTS.—To make possible the turning down of electric lights somewhat in the same manner that lamp and gas flames are turned lower, special electric lamps were invented and met with success, but Fig. 4 is not a special lamp but a special socket which produces the same result. It consists of a lamp socket which has a miniature rheostat, and it will screw into any ordinary electric light socket in the same manner as a lamp, the lamp being in turn screwed into it. It has four changes, "full," "dim," "very low," and "out."

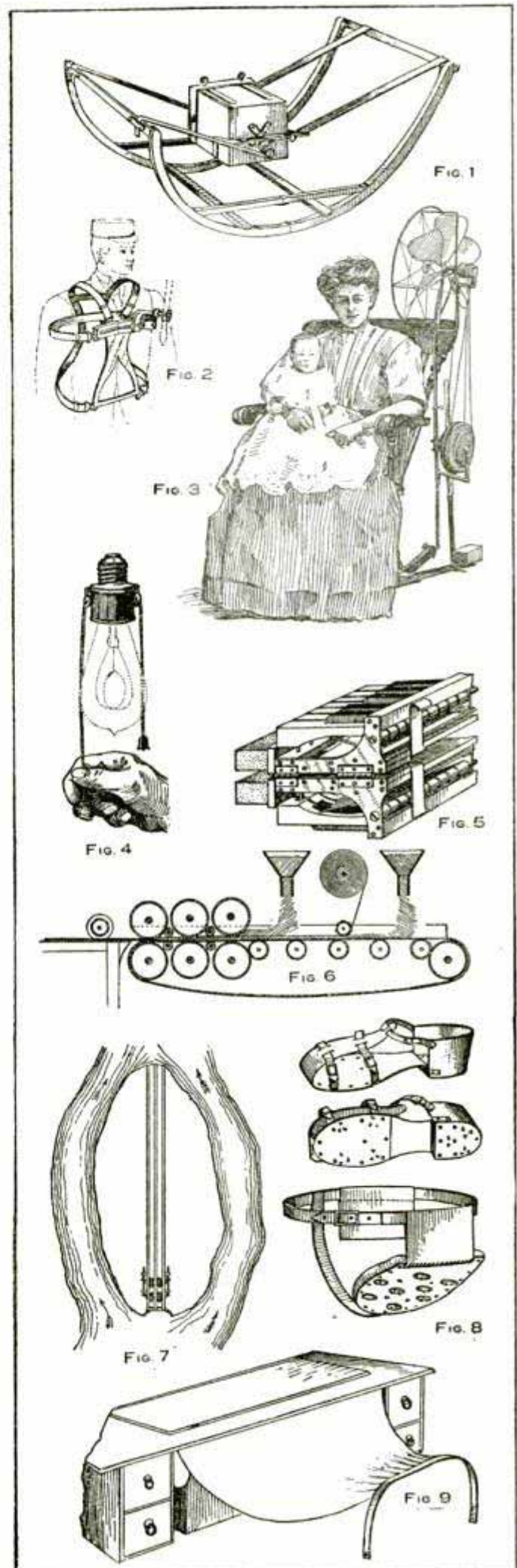
PRACTICE PIANO KEYBOARD.—The invention illustrated in Fig. 5 will interest almost anyone, but especially those who are cliff dwellers in modern apartment houses. It is a practice keyboard on which beginners may go through the exercises required to make the fingers supple without at the same time making nerve-racking unmusical sounds.

TO PRODUCE REINFORCED PULP BOARD.—The machine shown in Fig. 6 is designed to manufacture reinforced pulp board. The reinforcing fabric is run through the rollers on an endless belt. This reinforcing material unrolls from the holder shown between the two funnels in the drawing. The pulp is fed onto the reinforcing fabric by one pipe, and from the other onto the belt that carries both fabric and pulp through the rollers, thus providing the reinforcement with a coating of pulp on both sides by the one operation.

UTILIZING WATER POWER ON AN ISLAND.—Figure 7 shows means of utilizing the power of a river by means of waterways run through the central part of an island. The power house and water wheels are at the head of the island and the water, passing through the wheels is carried to the end of the island in pipes, where it flows into the river again.

COMFORTABLE SAFEGUARDS FOR ROOFERS.—The sandals and saddles shown in Fig. 8 are designed for the safeguarding and comfort of roofworkers. The sandals are strapped to the ankles and have 42 case-hardened points in each sole, making the securing of a substantial footing on a slanting roof quite simple. The saddle is held in position on either hip by a belt, and also has steel points to engage with the roof and hold the worker in position.

SEWING-MACHINE APRON.—The sewing-machine apron illustrated in Fig. 9 is a useful attachment for the purposes desired. One end is fastened



RECENT PATENTS

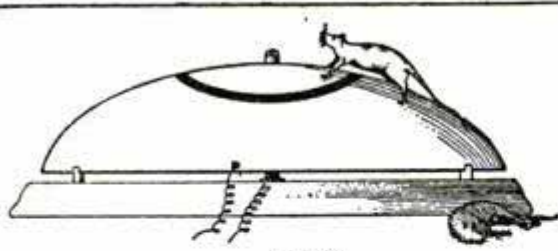


FIG. 10

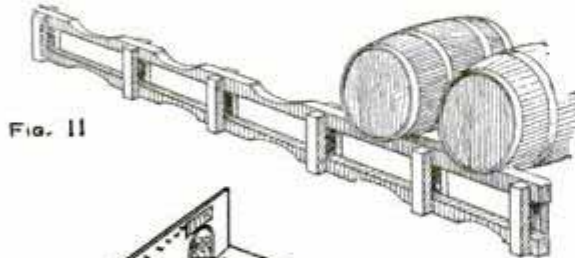


FIG. 11

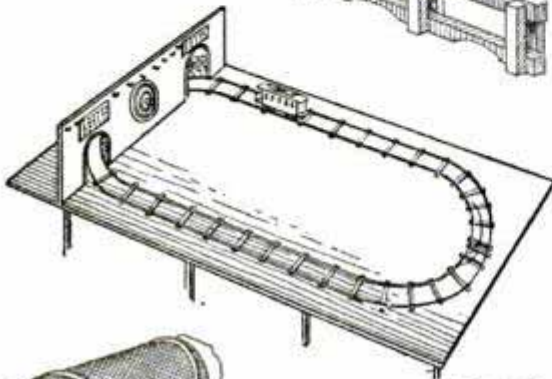


FIG. 12



FIG. 13



FIG. 14



FIG. 15



FIG. 16

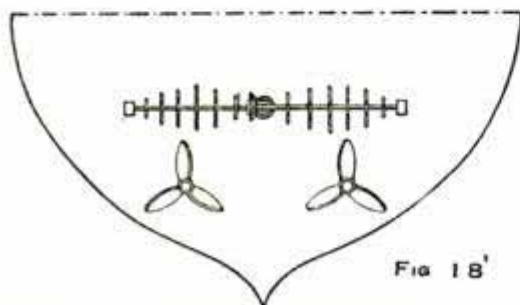
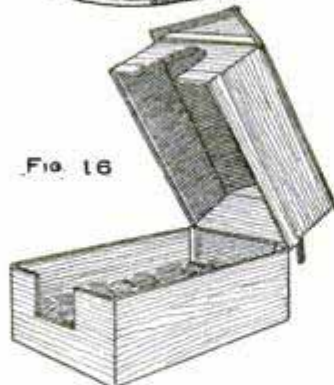


FIG. 18

to the top of the machine stand and the other has a band to fasten around the waist. Scissors and other sewing implements as well as the material being worked upon are placed upon it. They could not be held in the lap because of the continuous movement of the limbs in running the machine.

ELECTRIC MOUSE TRAP.—Figure 10, which shows what appears to be an ordinary electric gong, is in reality an electric rodent trap. On top of it is a receptacle in which cheese or other rodent dainties are placed. The bell is electrically charged and the animal is electrocuted the moment it steps upon it.

SUPPORT ON WHICH TO PILE BARRELS.—A removable support to be placed between the outer ends of ends of barrels of alternate tiers in a pile is illustrated in Fig. 11. Piled in this way, every other tier overlapping and being held up by a support, the bilge of the barrels does not interfere with the evenness and steadiness of the pile.

HITTING BULLSEYE STARTS THE CAR.—A new and interesting target device for shooting galleries is shown in Fig. 12. An endless track is arranged upon a platform and back of it is a target. The track is electrically connected and when the bullseye is hit, the circuit is closed, causing the car to run once around it.

HANDHOLD FOR BATHTUB RIMS.—Many accidents caused by slipping on the smooth bottom of a bathtub while bathing have inspired an inventor to design the handhold for bathtub rims shown in Fig. 13. It is made of rubber and can be clamped to the rim of any tub.

GOLF PRACTICE NET.—Figure 14 is a device for practice in the game of golf. It comprises a pivoted frame from which a net is hung. The balls are knocked into the net, falling into one of the three pockets or past them into the bottom.

NAPKIN HOLDER FOR CHILDREN.—The hoop attachment shown in Fig. 15 is a napkin holder. It slips around the neck of the child, and one edge of the napkin is held between the rim and the strip which engages with it.

SANITARY DOG KENNEL.—Dog kennels of the ordinary kind are somewhat difficult to keep clean, therefore the one illustrated in Fig. 16 has been designed. It is divided into two sections which are hinged at the rear end and close very tightly. All that is necessary to clean the kennel is to lift the upper section back, remove the bedding, brush out the sides, and refill with clean straw.

STRETCHER-SACK FOR SHIPBOARD OR LAND.—The stretcher-sack shown in Fig. 17, although not unlike several others used on shipboard, is interesting. It is comprised of a gas-pipe frame to which a canvas bag is bound in the manner shown. The injured person is placed on the stretcher and laced up in the canvas, after which he can be lowered or raised at any angle without additional injury or discomfort. Binding bands and splints are provided by which both the arms and legs can be separately bound to the canvas bottom. A combined pillow and pocket form one end of the canvas body of the stretcher.

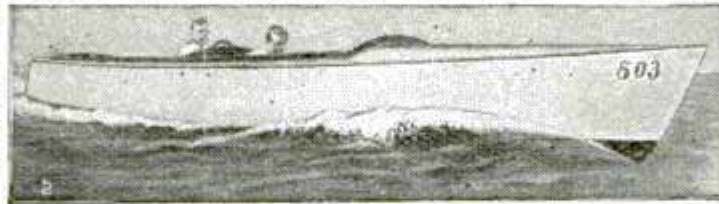
APPARATUS FOR STEERING VESSELS.—Figure 18 shows a new idea in rudders for the steering of boats. It consists of a number of blades spirally arranged upon a horizontal rotary shaft and having a pitch sufficient to exert enough force against the water to swing the vessel either way, according to the direction in which the shaft is rotated. It is driven by an electric motor, and the idea is to eliminate the resistance to speed that is caused by an ordinary rudder, which, of course, must have a retarding tendency to be efficient.

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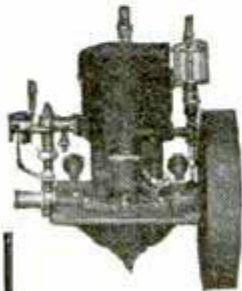
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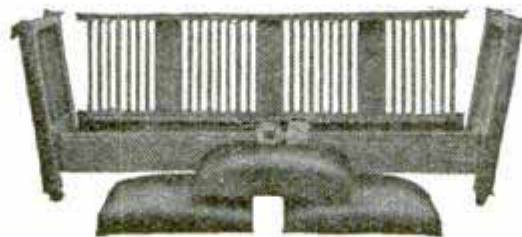


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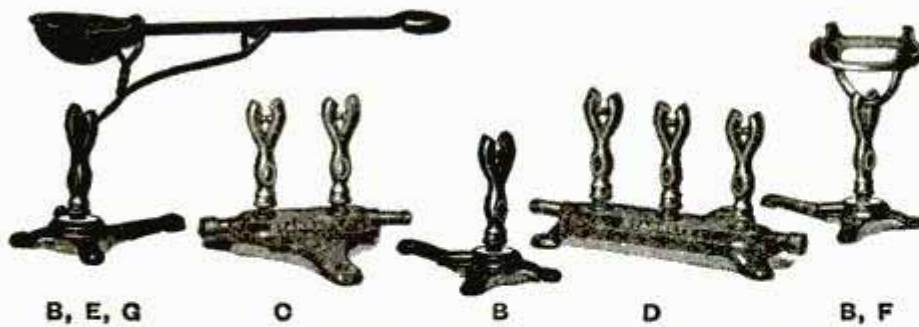
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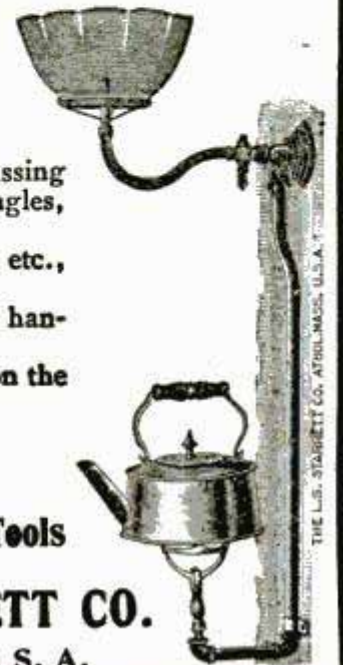
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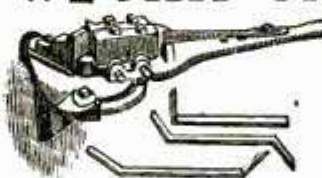
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"What height did I go? Six thousand feet by the aneroid. It was one of my best voyages. After I had righted myself the going was easy. But at 4,000 ft. I struck a strong current, which carried me in a southwesterly direction. The balloon was still rising. I had crossed Middle Harbor, and noticed that I was being carried right over the harbor, so decided to cut myself adrift. Down I shot for about 150 ft. straight as a plummet. Then the parachute spread its white wings, and the rest was easy. I came down onto the top of a tall gum tree, but, hanging by my hands to the bar, I threw clear, and touched the ground without a scratch.

"What is the sensation like? Have you ever stood on a spring-board in the baths with no intention of going into the water, when somebody has come along and upset you, and you feel yourself falling, falling, until you touch the water, and then you feel safe? That is just the sensation. I don't know what is going

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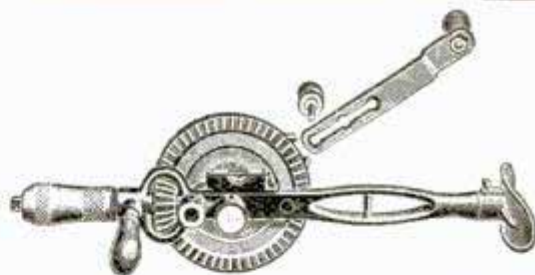
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to happen until the parachute opens, and then I feel like a bird, and just fly down to the earth.

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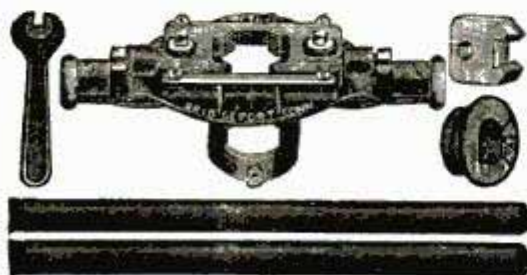
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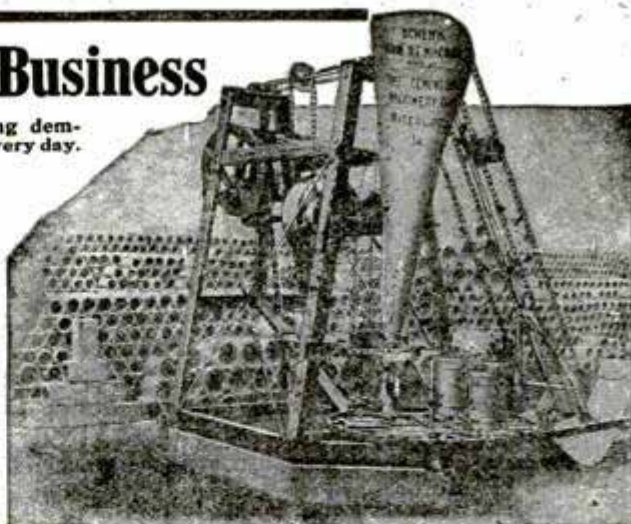
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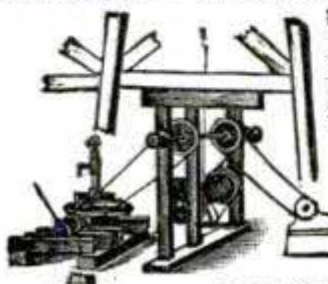
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"I well remember," says Mr. Wells, "of seeing at the Chicago World's Fair, a post similar to the one you show. In this case it was made doubly interesting by a placard explaining that the acorns which were stored in almost every hole, were not stored that they themselves might be eaten for food, but that the worms which infested them might be eaten after they had properly fattened upon the acorn."

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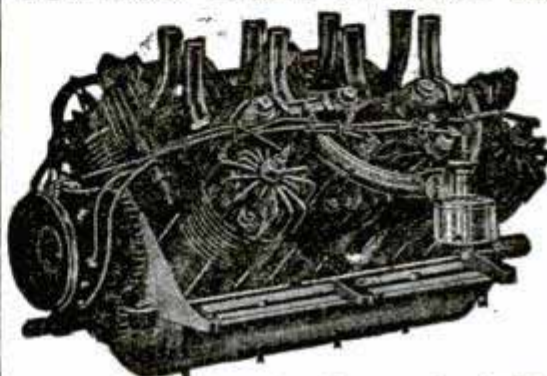
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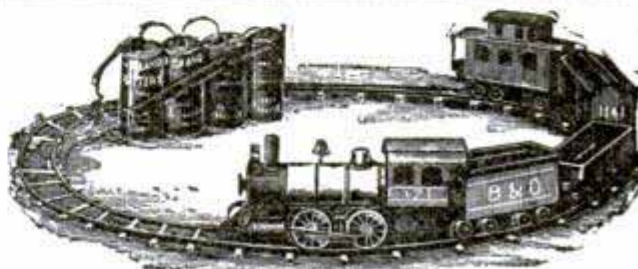
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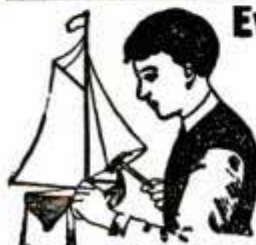
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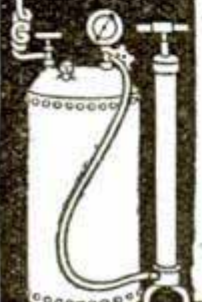
Natural death can only occur at an extremely old age. When a man is very old, say one hundred years, and still preserves the last flickers of an expiring intelligence, he feels he is losing strength from day to day, his limbs refuse to obey his will, the wrinkled skin becomes insensitive, dry and cold; the extremities lose their warmth; the face is thin; the eyes hollow and sight weak or entirely gone. Serum drops almost continually from the eyes, nose and partially open mouth; speech dies out on his lips; breathing grows labored; life quits the old man from the surface to the center, and at last the heart stops beating. The old man's life departs quietly and he seems to fall asleep for the last time. Such is natural death which follows a physiological life. Quite different is the death from disease, which follows a pathological life. Natural death is not due to exhaustion or from failure of nutrition, but most probably is due to auto-intoxication (poisoning) of the organisms. The very close analogy between natural death and sleep supports this view, as it is very probable that sleep is due to the effect of substances which are products of our life processes. That the human body secretes poisons which will destroy life if not elim-

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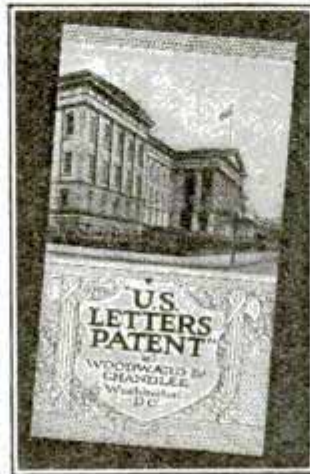
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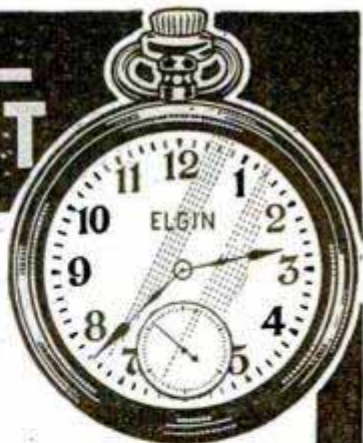
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A SPADE STORY.—A pleasant story is being told of a Sparkbrook ironmonger who had, during a recent week of snow, stolen from his shop over a score of spades and shovels. On the Saturday evening a poor fellow marched into his shop and put down a spade. Said he: "Here, gov'nor, is your spade; I pinched it on Thursday. Now you can have me pinched. I've just took home some grub, and the missis and kids will have a good square meal to-morrow; it's the first this winter. I've earned nearly a sovereign with your spade, and now, if you'll let me, I'll buy it, or you can have me locked up." The man was not locked up, and he had the further use of the spade until the snow had gone.—Ironmongers' Chronicle, England.

ENGLAND HAS AEROPLANE THAT FLIES.—England, aided by an American aviator, now has an aeroplane that will fly, and great expectations are now arising in the breasts of the people who have looked askance at Germany's success. Captain Samuel F. Cody, the American in charge of the British army's aerial work, made a circular flight of two miles at Aldershot on June 18. The speed of the new machine was 30 miles an hour.

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The Thor Electric is a real washing machine which washes everything from the most delicate laces to heavy blankets, beautifully clean. It is built on the revolving cylinder principle and has no rubbing or scraping action so destructive to goods. It is equipped with a 3-roll self-working electric wringer which wrings from either side of machine. A patent gas burner heats the water in the machine and keeps it hot.

The Thor Electric is Simple and Easy to Operate

It is as simple in construction as an ordinary ice cream freezer and just as safe to operate. There is no installing to be done with the Thor Electric. You simply attach the plug to an electric light socket and you are ready for the day's washing, and anyone with ability to insert an electric bulb in its socket can operate the Thor Electric.

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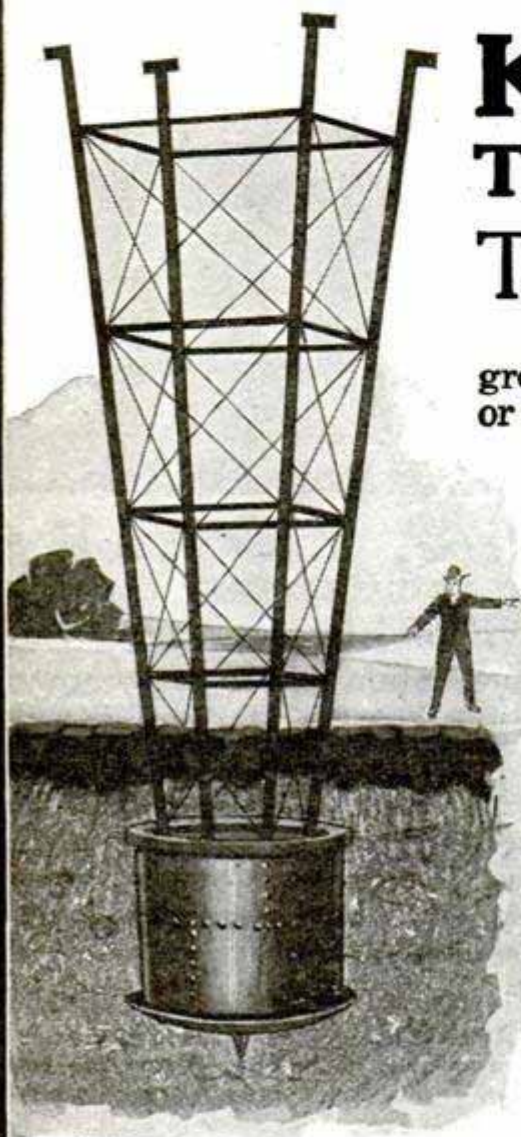
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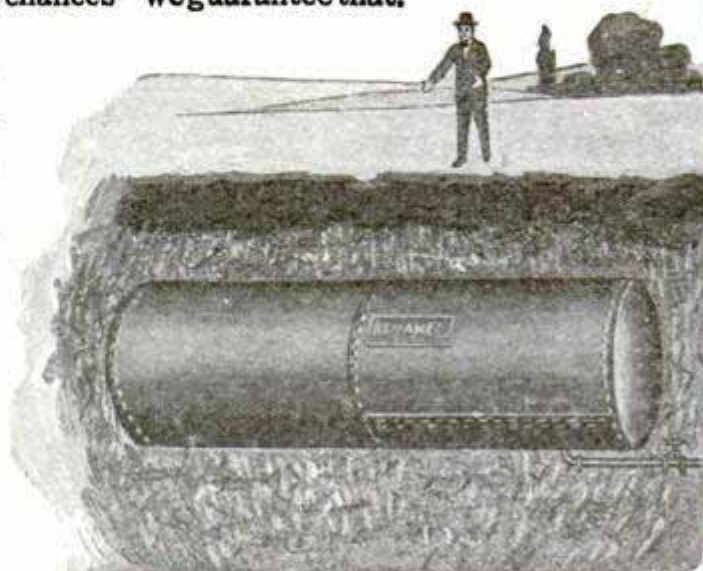
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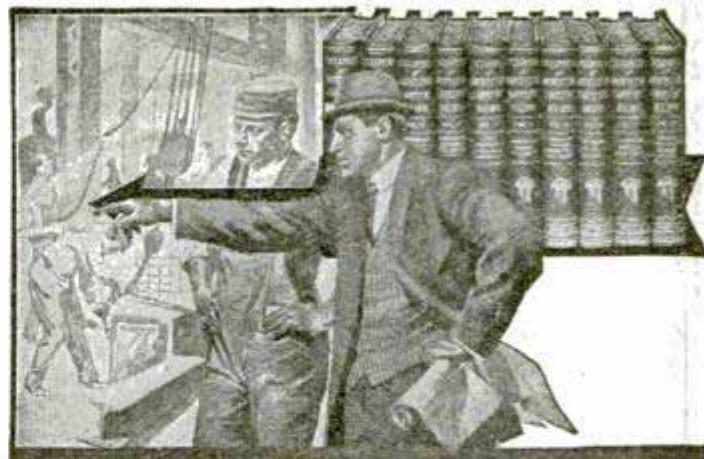


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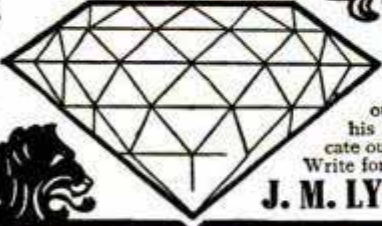
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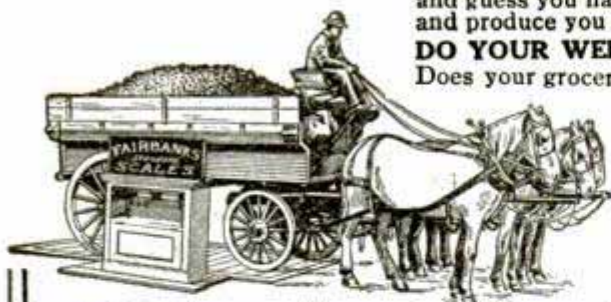
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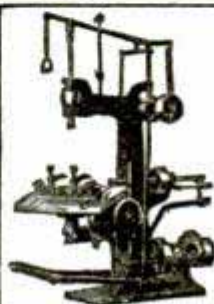
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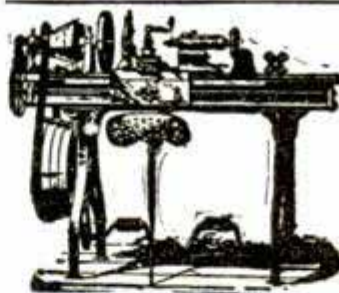
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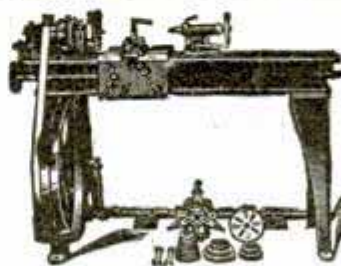
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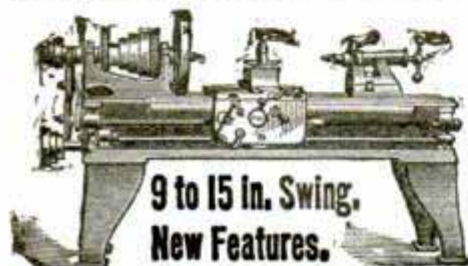
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That makes you feel
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Puts the somber clouds to rout
The man who's fair
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WONDER OF THE AGE



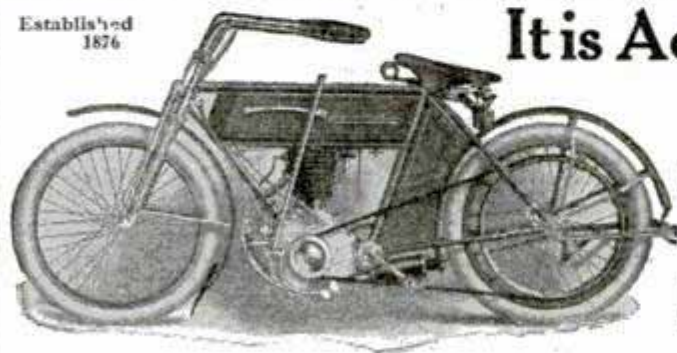
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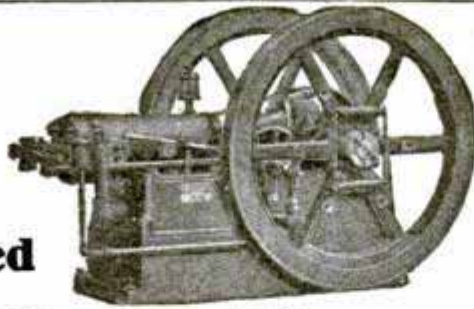
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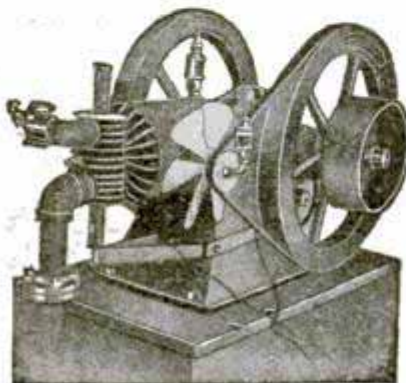
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"On Dec. 6, while we were running before the worst gale I ever encountered in all my life at sea, the first officer came to me, his face as white as a ghost's.

"The ship is afire!" he cried. "Come out and see for yourself." "I went with him and, sure enough, some cans of calcium carbide that we were carrying on our after deck had broken loose and were afire. It was a magnificent sight. The more water that came aboard the higher the carbides burned, it being the nature of the stuff, as you know, to burn fiercely when wetted.

"I smiled, knowing that the carbides would burn themselves out without injuring the vessel, which has steel decks. At that moment the lookout raised a blood curdling cry.

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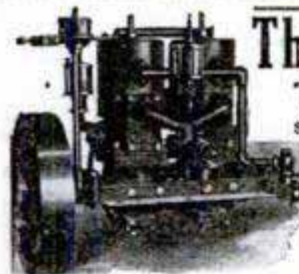
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head sea. It was night, of course, and the weather was very thick, of course, otherwise, of course, we would have seen the berg in time."

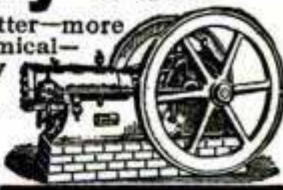
"How about that heavy head sea, captain?"

"Why, the wind had shifted, you lubber. But listen, now comes the bear part. We crashed, as I have said, into the iceberg, and at least 20 tons of ice came tumbling down upon our bows. I gave the order to full steam astern; and when we got clear of the berg I ordered all hands forward to shovel away the loose ice that had fallen on us.

"It was then that I got my surprise. Two men who had tackled an especially big block of ice suddenly leaped back, screaming. The ice it seems was not ice at all, but a polar bear that had been on

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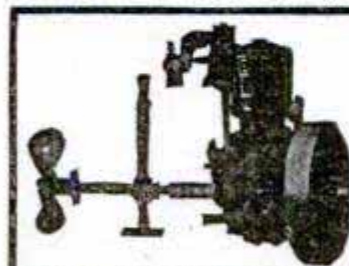


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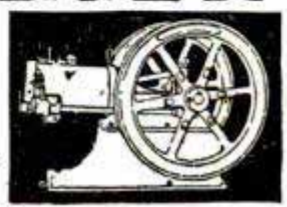
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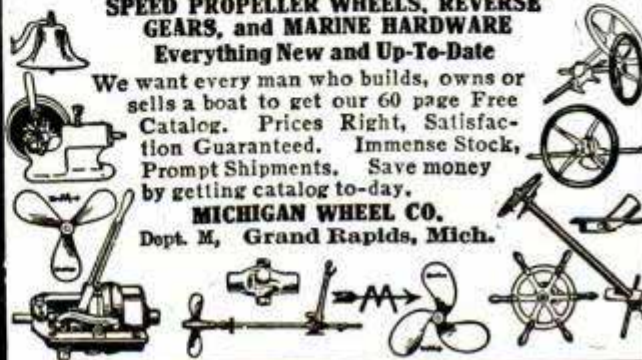
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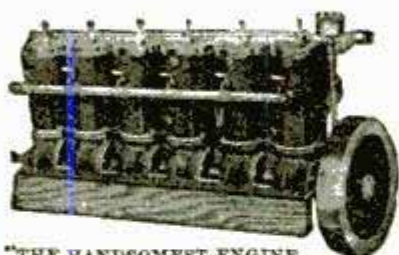
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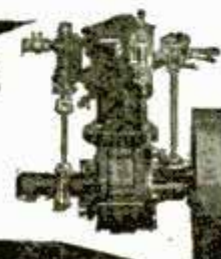
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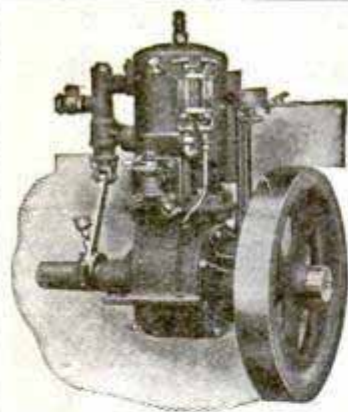
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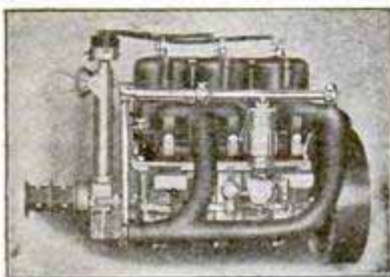
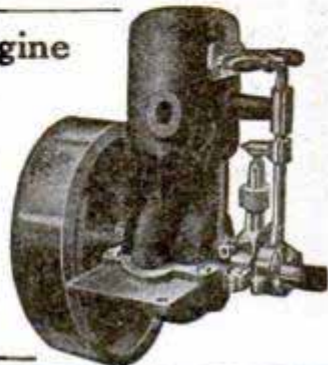
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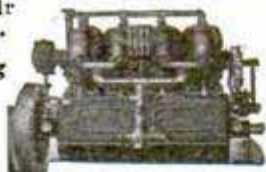
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"The Motor of Quality"

THE H. C. DOMAN CO.

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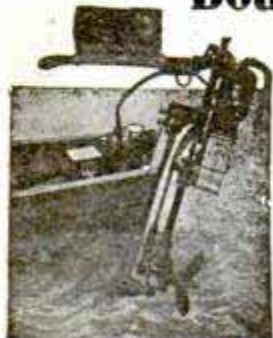
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2,500 Miles Without a Hitch

One more remarkable demonstration of the unequalled reliability and endurance of Scripps Motors. The 32-foot cabin cruiser "Grace B" makes the trip from Marysville, Kentucky, to Knoxville, Tennessee, and return, on a course of 2,500 miles, driven by a two-cylinder 12-15 H.P. Scripps Motor.

You motor boat owners who have equipped your boat with an engine of the "I-guess-it's-good-enough-for-me" description, know how much doctoring and coaxing your engine needs for little trips around home.

You realize that an engine that needs to be petted, and coaxed to get through a single day's outing without a hold-up, wouldn't do to take on a six months' trip over uncertain waters.

Think then for a moment, what it means when Mr. W. L. Pelham, of Marysville, Kentucky, planned to take his 32-foot cabin cruiser "Grace B" from Marysville to Knoxville, Tenn. So thor-

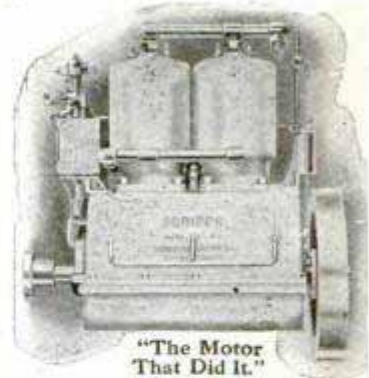
oughly consistent and reliable had been his experience with his two-cylinder 12-15 H. P. Scripps Motor, that he felt entirely confident of making his long journey successfully, and did not even take the precaution of carrying any duplicate repair parts.

He started from Marysville, in December, 1908, down the Ohio river into the Mississippi, then up the Chattanooga to Knoxville, and then turned around and retraced his course, arriving back in Marysville in May, 1909.

During these six months, the engine was in use nearly every day, although Mr. Pelham ran leisurely, tying up from time to time and making a leisurely, easy-going trip of it. During all this time, however, not once did his reliable Scripps Motor give him any trouble. Not a single hitch no repairs were necessary, beyond placing a pair of contact points which wore out on his ignition coil. How many engines made today do you suppose would equal that record?

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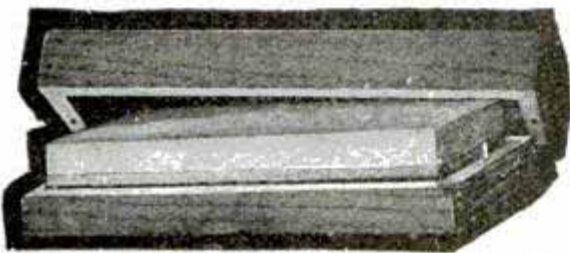
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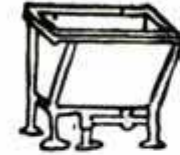
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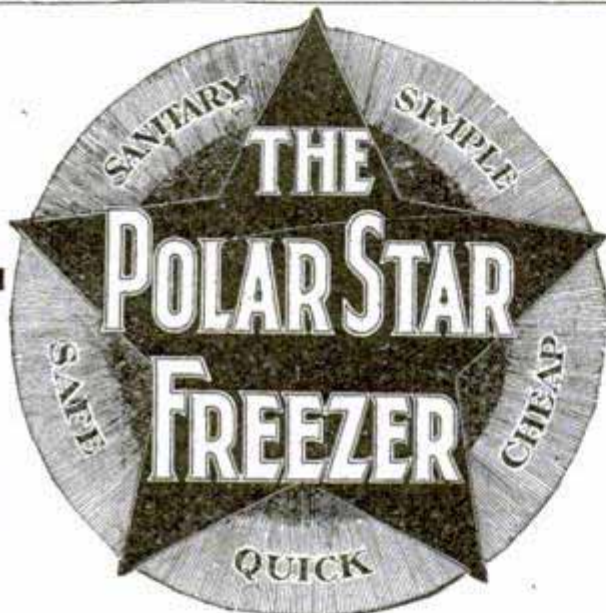


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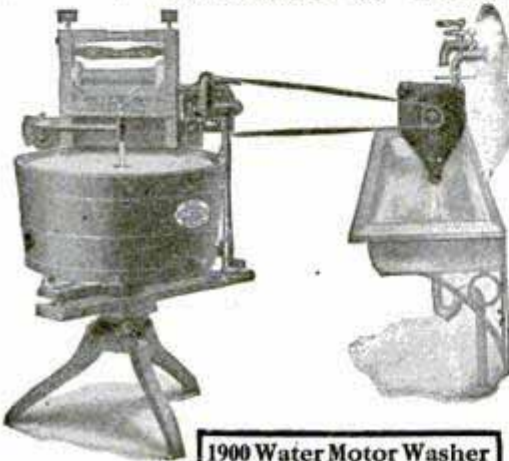
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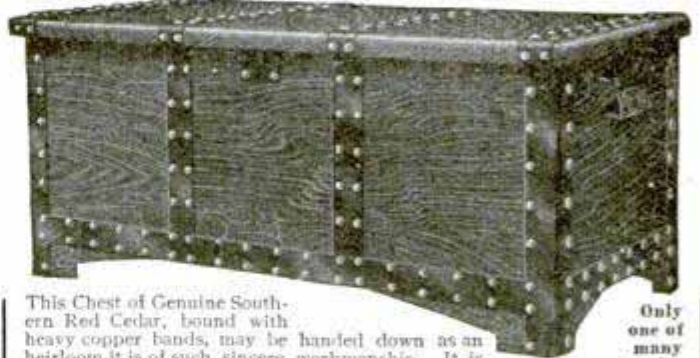
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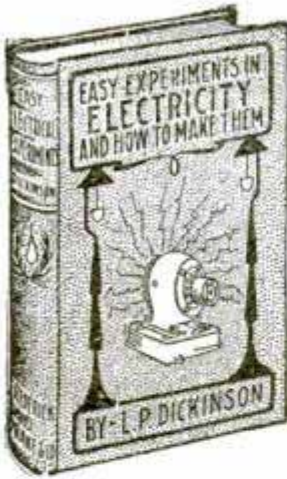
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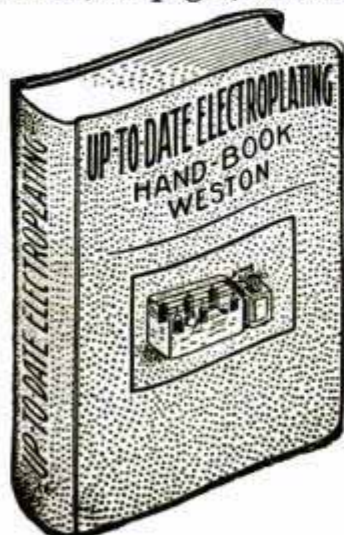
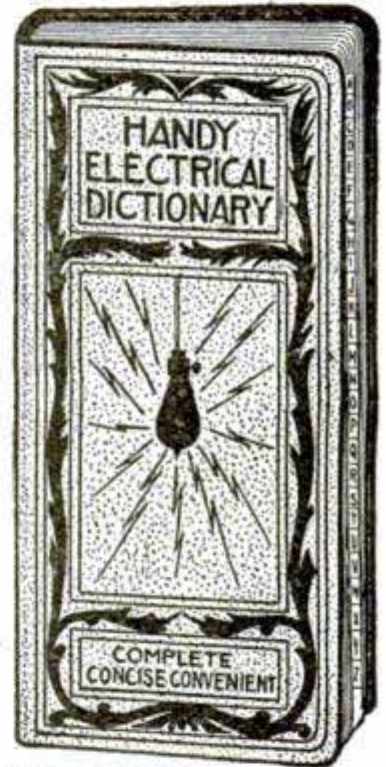
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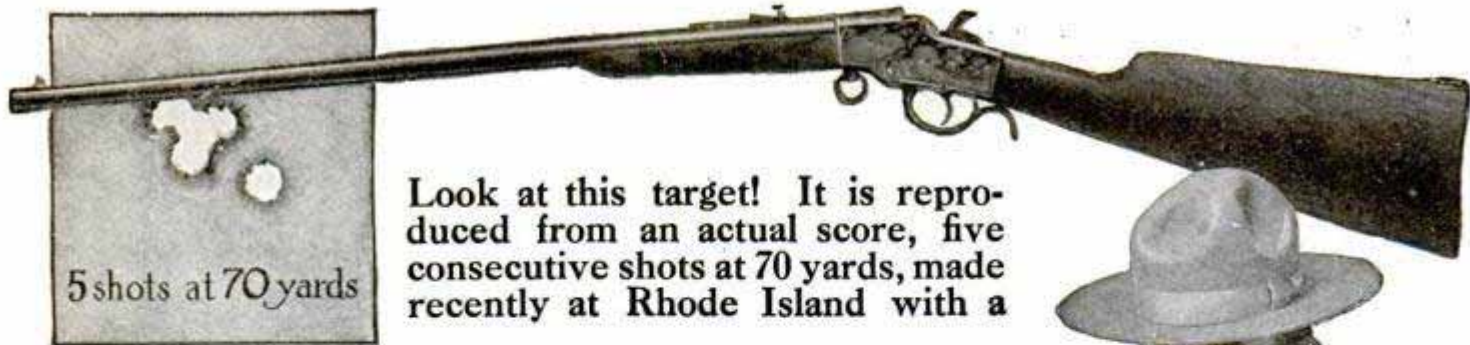
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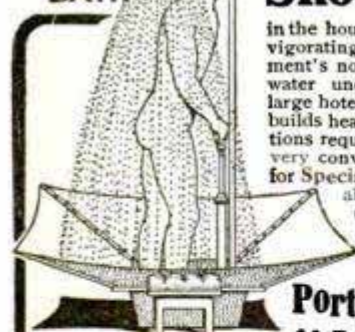
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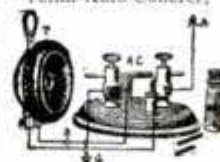
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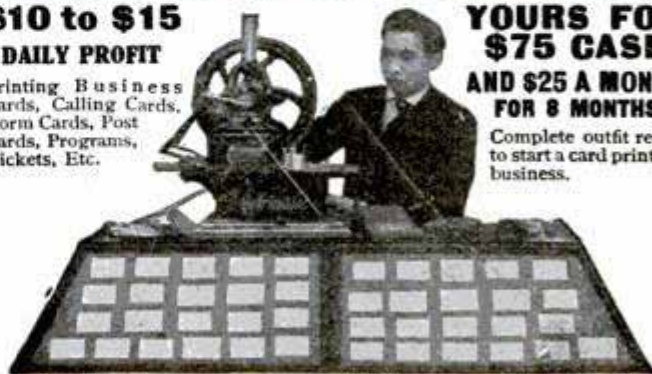
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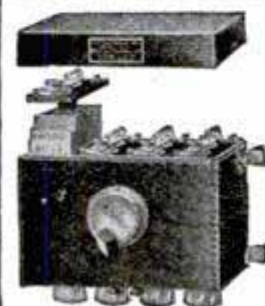
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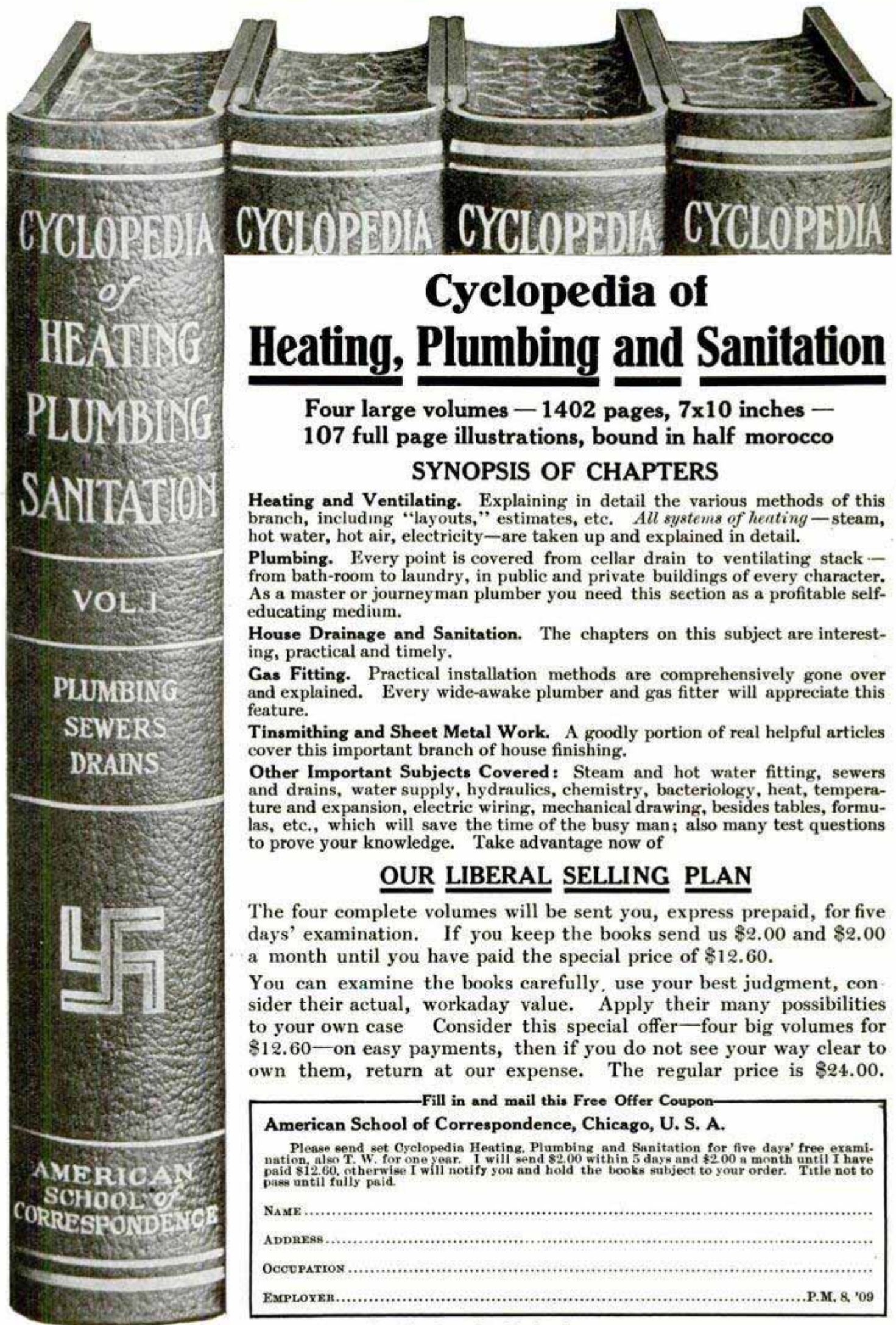
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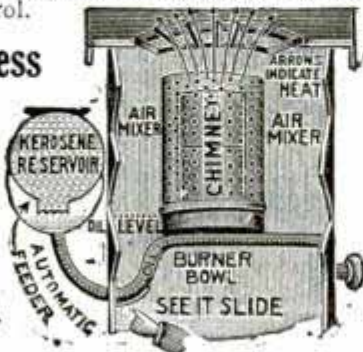
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—Courtesy Columbus Dispatch.

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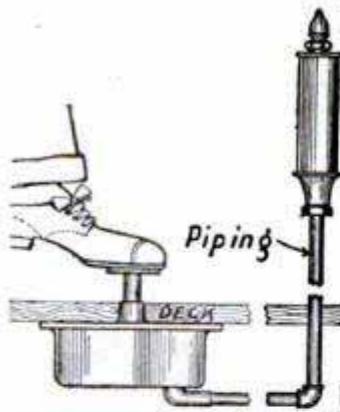
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At present—

1. Great Britain, 1,669,005 tons.
2. United States, 685,426.
3. France, 628,882.
4. Germany, 524,573.
5. Japan, 371,891.
6. Russia, 249,943.
7. Italy, 220,458.
8. Austria, 114,450.

When vessels building now, completed—

1. Great Britain, 1,871,176.
2. France, 801,188.
3. United States, 770,468.
4. Germany, 693,599.
5. Japan, 444,903.
6. Russia, 320,040.
7. Italy, 284,778.
8. Austria, 148,350.

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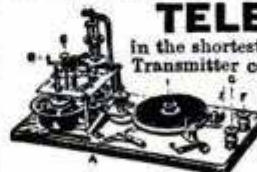


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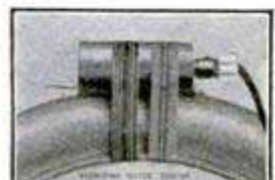
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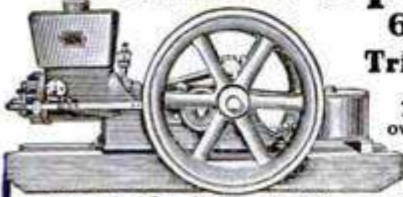


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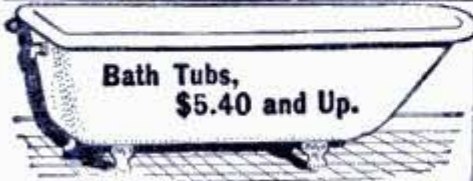
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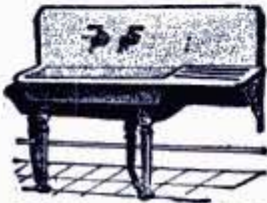
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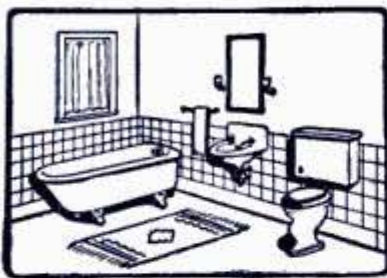
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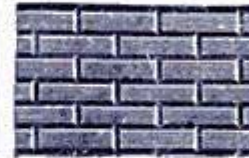
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