

vices to coast between the actuating-screw, head, box, and pin so as to practically absorb friction between the moving parts, rendering the device more durable and easier of operation and increasing the mechanical efficiency of the hoisting-engine.

COIN-CONTROLLED VENDING DEVICE.—G. W. MEREDITH, Wichita, Kan. In the present patent the invention is a division of a prior application for a patent for a cigar-vending machine, which was formerly filed by Mr. Meredith; and it consists in the novel mechanical features whereby a deposited coin is made the intermediary through which one or more cigars held in the cells of a carrier-belt are discharged into range of possession by the purchaser.

CIGAR-VENDING MACHINE.—G. W. MEREDITH, Wichita, Kan. The invention relates to vending-machines, in which individual articles of merchandise are discharged from a stock held for sale by means of a manually-operated handle. Although applicable to sale of other merchandise in packages of nearly uniform size, it is especially intended for the sale of cigars. The machine is constructed in its entirety as a cigar-case in which cigars are arranged in their original boxes, with quality, brand, and price exposed to view for selection. It is for use in hotels, clubrooms, barber shops, and other places. Mr. Meredith has invented another cigar-vending machine in which articles of merchandise are discharged from a stock held for sale by working and manipulating an operating-handle, and although applicable for the sale of any kind of package articles of somewhat uniform size, it is especially intended for the sale of cigars. His machine provides for an extension of the function of the machine for the sale of one for five cents, two for five cents, three for five cents, one for ten cents, three for ten cents, one for a quarter, or any number for a single coin value up to one dollar.

UNIVERSAL EXCAVATING AND GRADING MACHINE.—W. GILMORE, Meridian, Miss. The principal object in this case is to provide for universal adjustment of the parts to permit working under various conditions, and especially to provide for excavating under a railroad-track without removing the track, so as to cut down grades without discontinuing the trains for any length of time and to do the work at greatly-reduced cost on account of the rapidity of the machine in handling large amounts of earth.

SAWING-MACHINE.—S. J. GRAY and J. HORNING, Oakland, Cal. The object of the improvement is to provide a novel machine of the endless-saw type adapted for cutting in any position—either vertically, horizontally, or at any desired angle. A further object is to provide means for cutting at any height desired, whereby trees may be cut near or far from the ground and large or small logs sawed with equal facility.

APPARATUS FOR SORTING CHIPS.—H. POWERS, Lincoln, N. H. The tank or receptacle is filled with water, into which the screened-out knots and large chips are discharged and in which the knots by their greater specific gravity sink, while the lighter chips float, in combination with a series of perforated pipes arranged close to the water-level, the issue-orifices all being faced in one direction, whereby the floating chips are continuously carried away by a surface current produced by a series of impinging jets of water or air and under the influence of which the floating chips are carried over a spillway and delivered to an elevator to be carried up to the rechipper.

ELEVATOR DRIVING MECHANISM.—V. W. MASON, Providence, R. I. The invention is especially applicable in mechanism of the elevator driving class which is driven by an electric motor. It relates especially to reversing mechanism, and concerns itself also with the connection from the motor to the mechanism. The object is to provide a reversing mechanism which will operate to apply a brake automatically immediately upon the arresting of the forward motion and prior to the reversal of the motion.

MEASURING ATTACHMENT FOR PAPER-BOX MACHINES.—A. BELL, New York, N. Y. The invention refers to improvements in attachments for machines employed in placing the paper covering on the sides and ends of pasteboard boxes and covers, the object being to provide a simple means whereby the desired length of material may be accurately measured, thus resulting in a considerable saving of paper at the overlap.

CLOCK.—A. D. GARY, Lavonia, Ga. The invention comprises the combination with the clock-train having an escapement shaft and wheel, of a plate having a laterally-extending arm, a pallet for engaging the escapement-wheel mounted on the arm, a pendulum mounted to swing upon the plate, and a connection between the pallet and pendulum. The plate is provided with a bearing for engaging the escapement-shaft and a slot leading therefrom to permit removal and attachment of the plate, and a rod secured to the plate and extending therebelow to swing the plate.

BEATING-IN DEVICE FOR LOOMS.—J. K. DALKRANIAN, New York, N. Y. The object of this invention is to provide a device arranged to insure a proper beating in of the weft and the pile-warp-threads loops, to hold the beaten-in parts in position during the formation of the following row of pile-warp-threads loops,

and to keep the pairs of ground-warp threads properly separated for the pile warp-threads needles to pass between adjacent pairs of ground-warp threads. This is a division of the application for Letters Patent of the United States for a pile-fabric loom, formerly filed by Mr. Dalkranian.

JIG OR ORE-CONCENTRATOR.—A. C. CAMPBELL, Asheville, N. C. The device comprises an inclined riffle upon which the ore is deposited and along which it is driven by an intermittent air-blast. The dense stuff settles upon the riffles and is blown through them, while the less dense matter is carried to a dam at the lower end of the river whence it flows off through a pipe.

MOTOR-TOOL HOLDER.—C. B. HASTINGS, New York, N. Y. The invention pertains to motor-tools such as are adapted to be held in the hand when applied to the work. The object is to produce a holder having means for guiding the tool in a vertical plane and having a construction enabling the tool-holder to be readily adjusted, so as to change the elevation at which the tool operates.

AUTOMATIC STOP FOR HOISTS.—F. H. KOHLBRAKER, Nanticoke, Pa. The object here is not only to provide a throttle-valve cut-off mechanism that may be operated by the cage should it rise too high in its shaft by overwinding of the hoisting-engine drum, but to provide means whereby the valve or valves may be closed and the brake set to instantly stop the engine should any of the parts become deranged, such manual operation taking place without disturbing the automatic device, thus saving time and trouble of resetting said device, as is necessary with the construction shown in a former patent granted to Mr. Kohlbraker.

Prime Movers and Their Accessories.

BOILER-FLUE.—A. VAN WALTERS, Gallon, Ohio. The invention refers to flues or tubes as constructed in modern tubular boilers, and is especially useful in connection with steam-boilers of the locomotive or marine type. The object is to provide a boiler-tube which effects a lasting and hermetically-tight joint between the tube and the flue-sheets, which can be easily removed and replaced when worn out, and which tends to decrease the troublesome incrustation encountered in steam-boilers.

PYROMOTOR.—W. W. FRENCH, Fort Branch, Ind. In this patent the improvement refers to motors, the more particular object being to produce a motor controlled directly by heat upon the principle of the expansion and contraction of one or more metallic members. It further relates to means whereby the expansion and contraction of the metallic members or member is caused to produce an appreciable degree of motion.

EXPLOSION-ENGINE.—H. D. DIBBLE, Mystic, S. D. The object of the invention is to provide a gas or explosion engine arranged to utilize the motive agent to the fullest advantage and to use a small portion of the hot residue from a previous explosion to compress the same to the igniting-point with a view to ignite the incoming new charge.

Railways and Their Accessories.

AUTOMATIC AIR-BRAKE AND STEAM COUPLING.—O. E. LAIB and E. B. WITTE, Trenton, N. J. The principal objects of the improvement are to provide means for effecting making an air-tight joint between two air-brake-system cars when the latter are coupled together and for automatically allowing an escape of air from each car when the cars are uncoupled or when one is released from the other; furthermore, to prevent the escape of all the air from the air-brake system in an uncoupled car, only allowing enough to escape to set the brakes, and to apply the device to both freight and passenger cars.

GRAIN-DOOR.—W. S. GILLELAND, Newkirk, Oklahoma. The invention comprises the combination with a car having a door-opening provided with a sill, of doors hinged to the sides of the opening, a plurality of catches on one of the doors and a plurality of rock-levers pivoted to the other. The levers have their outer ends provided with flanges for engaging the catches, the inner end of levers being extended to form a handle. A bar connects the inner end of said levers to constrain them to move in unison, one being provided with an integral lug for directly engaging the sill when the flanges are engaged with the catches. This prevents movement of the doors with respect to the sill.

CAR-UNLOADING APPARATUS.—A. BUCKER and A. CROCHER, Minerva, Ia. The invention relates to apparatus for unloading sugar-cane from cars into the feeder for cane-mills. It is an improvement upon that form of device in which a large rake is attached to and carried by a horizontally-reciprocating frame, which frame is hinged to swing vertically about a horizontal axis at one end, so as to be raised and lowered to permit the rake to operate in any horizontal plane.

CAR-FENDER.—M. WICK, New York, N. Y. The principal objects of the inventor are to provide means for automatically releasing a series of movable elements when a portion of the fender comes in contact with an obstacle so as to lift the obstacle upon a platform and hold it thereon without stopping the car or running any danger of throwing the obstacle under the wheels, provided it is approximately the size of a human body.

CAR-FENDER.—C. HAGER and T. D. FINIZIE, New York, N. Y. In the present patent the invention is an improvement in side fenders for street-railway cars, the same being attached to and dependent from the body of a car and hanging outside of and parallel to the wheels, so as to practically inclose and prevent access to the space between the ends or platforms of the car. Messrs. Hager and Finizie have invented another improvement in the class of car-fenders which are detachably connected with the fronts or platforms of street-cars and adapted to be lowered from normal position in case of emergency.

Pertaining to Recreation.

GAME DEVICE.—R. D. MARTIN, Tampa, Fla. The object of the game is to completely wrap a string around a mast with the intention of making the ball strike the mast at a chosen point. The ball having a flexible connection with the mast, any impulse given to the ball will cause the string constituting such connection to wind around the mast and likewise unwind of its own accord. The purpose is to provide a portable game requiring the exercise of considerable skill.

Pertaining to Vehicles.

COOLER.—D. MC RA LIVINGSTON, New York, N. Y. The invention is more particularly intended for the coolers of motor-vehicles propelled by explosive-engines. It consists in a cooler having lapped joints at the side edges formed by means of return-bent or inwardly projecting portions formed along the opposite edges of one plate or wall and outwardly-projecting plain portions on the two side edges of the companion plate or wall of the conduit through which the fluid to be cooled passes. In order that the hooked edge portions may be formed, slits at the angles are produced. Mr. Livingston has invented another cooler and the improvement is intended principally for embodiment in the coolers of motor-vehicles propelled by explosive-engines, and the present relates especially to that form of cooler in which conduits are so bent as to present a diamond figure, the bends of the conduits being diagonal to the vertical and horizontal.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. In every case it is necessary to give the number of the inquiry.

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 8208.—Wanted, manufacturers of alcoholometers for testing alcohols.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 8209.—Wanted, makers of steam cooking apparatus.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 8210.—Wanted, addresses of manufacturers of pneumatic water supply apparatus, such as used in country residences.

FOR SALE.—Water front in New York harbor with upland and riparian right. Address X. Y. Z., Box 773, New York.

Inquiry No. 8211.—Wanted, makers of machines for washing buttons.

The celebrated "Hornby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

Inquiry No. 8212.—Wanted, makers of portable soda fountains.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery tools, and wood fiber products. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 8213.—Wanted, manufacturers of brick-making machinery.

Automobile experts are in constant demand at high salaries. Our seven weeks' course is the most thorough and practical, fitting men to drive, handle and repair Day and evening classes. Special course for owners New York School of Automobile Engineers, 146 West 56th Street, New York.

Inquiry No. 8214.—Wanted, information as to the manufacture of paper from the pith and other parts of the corn stalk.

WANTED.—Physical Culture Appliances. Because of my great success in the sale of appliances for the improvement of the health and strength, I have found it necessary to open another store at 1 West 42d St., New York City. I would like to hear from owners of special appliances such as vibrators, braces, or anything in that line that would pay to push.

Prof. Anthony Barker, 1164 Broadway, N. Y. City.

Inquiry No. 8215.—Wanted, manufacturers of oil burners.

Inquiry No. 8216.—Wanted, makers of invalid rolling chairs with power attached.

Inquiry No. 8217.—Wanted, the address of the manufacturers of the "Rapid" boiler tube cleaner.

Inquiry No. 8218.—Wanted, flexible cloth, air-tight, capable of holding a pressure of three inches of water; or factory which treats cloth with paraffine or other chemicals.

Inquiry No. 8219.—Wanted, the address of the manufacturer of the machines making flower pots from 5 centimeters and upward, and sewer piping 60 centimeters long and 15 to 25 centimeters in diameter.

Inquiry No. 8220.—For manufacturers of "cotton-flock" for the wall-paper printing trade.

Inquiry No. 8221.—For makers of styptic pencils in quantities.

Inquiry No. 8222.—Wanted, the address of the Crown Cap Co., manufacturers of the metal cap for bottles; also for makers of similar bottle caps.



HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question. Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(10036) H. M. writes: The SCIENTIFIC AMERICAN, of May 19, 1906, contains an answer to some queries from A. X. (9976) that

is, to say the least, different from the information that is generally to be found in the Notes and Queries column. Your paper has the reputation of being a conservative scientific journal, reasonably accurate, and one that never stoops to persiflage. But this time the bounds were overstepped, with the usual result—the ridicule of the editor acted as a boomerang. In attempting to make sport of a letter from a schoolboy, he made some mistakes that are more mirth-provoking than the errors of the student. Among other things he says: "This letter claims to come from a high school, from a scholar, we assume." Now in the El Paso high school we are taught that the term scholar is applied only to a learned man, or one having great knowledge of literature or philology. Of course, etymologically considered the word scholar means "one who learns from a teacher," but good usage does not countenance its use with that meaning. Again he says: "A body weighs more on the top of a mountain than it does at sea level, at any time, since it is farther from the center of the earth on the mountain top." Our physics teacher taught us that the maximum weight of a body is at the surface of the earth (at the sea level). Of course, a body weighs more at the poles than it would at the equator, because in the former position it is nearer to the center of the earth. But, "if a body is removed above the sea level, as on the top of a mountain or in a balloon, the distance d between it and the center of the earth is increased and by reference to formula

$F_g = \frac{GM}{d^2}$ we see that its weight is diminished."

(Hoadley's "Physics," p. 62). Fair play demands, Mr. Editor, that you publish an answer to your explanation in as prominent a place as was the original article. I am going to watch with interest to see if you dare publish this letter. In conclusion, give the next boy a chance, for he will get over his carelessness, and please do not publish any more erroneous answers to questions dealing with elementary physics. A. Thank you, my lad, we are much under obligation to you for setting us right. Over forty years' experience as a professor has taught us to welcome correction, even from a high school scholar, and even on a point where the error was one of the types simply, or at most one of inadvertence. It was so evident that "more" had been printed, where "less" should have been printed, that we had not supposed even the most captious and hypercritical would waste a postage stamp in telling us the mistake, which we saw as soon as the paper came from the press. It was so plain a slip that any one would be stupid not to see it. Oh, yes, we do dare, we are bold and bad enough to dare to print your letter, impertinence to an older person and all, and to say that we do not believe the teachers of the El Paso high school teach their students and scholars—we hope there are scholars there—any such manners as are found in your letter. As to your limitation of the use of the word "scholar," we doubt if El Paso will be able to make this use of the word universal, especially as both Webster and the Century do not give it first place. The Standard says, "When used without qualification, the word is understood in this latter sense"—that is, "one who is thoroughly schooled, an erudite person." We agree with this usage, and wish it might become general. Our use of the word was in connection with the qualifying phrase, "from a high school," and, as we understand English authorities, was correct. Of course, one is quite at liberty to restrict the sense of a word in his own use of it as he pleases, but one has no right whatever to find fault with another as you do for using that word in any sense authorized by any good authority. In this you overstep the bounds of good taste, as among gentlemen. We note with pleasure that you bear witness to the general and "reasonable" accuracy of the SCIENTIFIC AMERICAN, and that it does not stoop to persiflage. Persiflage is a very fine word for a high-school scholar to use. It means literally to whistle. And most high school boys do considerable of that. We shall be glad to hear from you again at any time, but will not publish another letter from you of the sort you have sent us this time.

(10037) C. D. asks: 1. What point below the freezing point do air, hydrogen, nitrogen, oxygen, become liquid? A. These temperature points are very nearly as follows in Fahr. degrees, below zero: Air, 312; hydrogen, 422; nitrogen, 317; oxygen, 297. 2. Please give me the address of a reliable company that sells chemicals and chemical apparatus. A. You would better deal with a firm in the city near your home than to buy at a distance and pay transportation charges. Our advertising columns very often contain the advertisements of these dealers. We do not advertise dealers in the Notes and Queries column. 3. Where can I get some books on argon, helium, neon, krypton and xenon, and give me the prices of them? A. We can send you many valuable papers on the rare gases of the atmosphere which have appeared in the SUPPLEMENT. Among them are argon, Nos. 1000, 1001, 1002, and others, price ten cents each; helium, Nos. 1056, 1057, price ten cents each. 4. What kind of chemical books, as organic chemistry, etc., so I can find liquid formene? What is formene? A. Formene is a tetrachloride of carbon CCl_4 . Its preparation can be found in the Dispensatory. Its properties are those of an anesthetic, similar to those of chloroform, soothing the pain of neuralgia and even causing insensibility. As it has been the cause of death also, it is not used by physicians. It is not a substance for an amateur to meddle with. 5. What are the uses of liquid air? A. At present liquid air is not put to any commercial use.

(10038) C. J. K. asks: I beg to inquire if you can suggest anything that I can use for a reflector in place of plate glass where the size required, 10 feet x 12 feet, makes plate glass impracticable to handle? A. Glass is the best material for a reflector, since it does not tarnish with exposure to moisture and can be easily cleaned. It would not seem to be necessary to have a single piece of glass for a reflector 10 x 12 feet. The difference could not be told if there were a large number of pieces of glass set edge to edge in the frame, making a total area as great as desired. This has been done in the various solar engines which have been built. We do not think any artificial glass would answer your purpose.

(10039) J. E. N. writes: I have been a reader of your paper for many years, and several times I have noticed where you have given receipts for, and published articles on, ice-cream making. In every case you claim that to make a good ice cream it is necessary to use pure cream. Now I am telling you that you are mistaken there. There are trade secrets and trade secrets, but the following is a Simon pure one; it has never been published to my knowledge, and the ice cream is as good from every point of view as that made from pure cream. It is used by several large dealers, the whites of the eggs being used for making icing for cakes and for cake making. Well, to proceed. To every quart of unskimmed milk use one pound of granulated sugar and the yolks of five eggs and any flavor desired. Place the milk in an enameled dish, and heat slowly, stirring continually until it just comes to a boil, then skim and add the sugar and remove from the fire, stir with a wooden stick until the sugar is dissolved, have the yolks of eggs in a dish well beaten up with a few quarts of warm (not hot) milk, and now add these, stirring the milk all the time. Place the milk in a tub with broken ice around it, and stir milk until it is cool, add your flavor, and it is ready to freeze. It costs far less than pure cream, and makes, if anything, a far nicer article.

(10040) J. T. R. writes: I have a primary battery of eighteen cells; two series of nine connected in multiple, i.e., two positive and two negative wires connected. These are used to charge a secondary battery of three cells of chloride accumulator. The voltmeter indicates 6.6 volts at storage battery and 6.5 volts at terminals of primary battery. Is my primary battery large enough, and what should be the potential of the charging plant described above? A. A storage battery should have a charging current with a pressure of $2\frac{1}{2}$ volts per cell. Three cells require $7\frac{1}{2}$ volts. The maximum charging rate should be $\frac{1}{6}$ amperes per square foot of surface of positive plate, reckoning both sides. You probably fall short in both pressure and current.

(10041) C. J. H. asks: What is the most desirable formula for making soap bubbles? I am in doubt in regard to the amount of glycerine and soft soap to use and as to whether there were any other ingredients that could be added to advantage. A. A good soap bubble solution is not to be obtained by simply mixing soft soap and glycerine. It is very difficult to secure a good solution. Only the purest oleate of soda, or the best white soap, white Castile for example, can be used. Only the best glycerine can be used. Price's glycerine is reliable. The manipulation is tedious. If, however, you wish to undertake it, proceed as follows: Take the purest caustic soda 1 part, and dissolve in distilled water 40 to 50 parts. All parts by weight, of course. Take pure oleic acid. Set it for a few days in a refrigerator and decant the clear fluid, if a separation takes place. Of this take 7 parts, and mix with the soda solution. Shake till the reaction is complete. Now add water up to 350 parts with the previous water. To two measures of the oleate of soda add one measure of Price's glycerine. Run no risk

with poor glycerine. Let this stand a few days in a cool place, and siphon off the clear solution, which is to be used for soap bubbles. Some add a little ammonia to this, but it works well as we have given it.

(10042) A. P. B. says: I wish to pump the air out of a glass fruit jar, and then seal it so well that air cannot get back in the jar for at least one year. Please tell me what pump to use and how to seal. A. A glass fruit jar is a poor style of bottle to use for this purpose. Better get a ground-glass stoppered bottle with another opening near the neck, to which a small glass tube is sealed. Coat the stopper with petroleum, and after having introduced the contents put in stopper, and seal with hot sealing wax. The air is to be drawn out through the other opening and glass tube, which is then sealed with a blow-pipe and gas or alcohol flame. Any maker of scientific apparatus can furnish a small pump as well as bottle for this purpose. An ordinary mechanical air pump used in the school laboratory will give a vacuum having not over 2 ounces pressure absolute, or more than 14 pounds pressure less than the air. J. W. Queen & Co., Philadelphia, Pa., can furnish what you want.

(10043) F. H. B. writes: Please explain what metals, minerals or ores draw lightning the most. We have a piece of about 20 acres on which lightning always strikes during a thunder shower. Land slopes to the west with higher land farther east, on which lightning seldom strikes, that is, comparatively seldom. Rock near surface, sometimes cropping out, of a light gray color, looks like basalt slate, but will seldom split. Land covered with young timber, hemlock, pine, white oak, red oak, maple, and hickory. I think full 90 per cent of the hemlocks have been struck by lightning, while a large per cent of the other trees have also been struck. Out of 116 hemlocks which measured 6 inches 20 feet above the ground, 112 showed lightning marks. Near one end of the tract is a depression, at the bottom of which almost every tree has been struck by lightning. Live stock and game shun the tract, but not the land around it. The surface rock overlies a soft slate, which, judging from the dip, must be 300 feet below the surface. Near the upper edge of the slate is a spring, where, when the water is low, an oil collects, which, when collected on a woolen cloth, burns. I have never been able to collect enough to send you for a test, as it flows off with the water, and being transparent, is hard to find. Only when the spring is so low that no water runs away have I collected it on woolen cloth. A. It is a fact that some kinds of trees are struck more frequently by lightning than others. The Weather Bureau has investigated this matter and its brochure on the subject states that 54 per cent (the highest) of all trees struck are oak and one per cent (the lowest) beech. We do not think any ores or metals under the ground would draw the lightning any more readily than water would do it. Nor would the mineral oil seem to account for the phenomena.

(10044) M. E. P. asks: 1. I am operating a single-phase light plant with about 800 lights. My transformer and liner are nearly all overloaded. Could I raise the voltage from 1,000 to 2,000 volts and use 200-volt lamps in place of 100-volt, or would it be better to parallel the secondary coils in the transformer and still run 100-volt lamps and change the generator to 2,000 volts? A. An additional generator to relieve the overload is a more natural solution of your difficulty than to change all your lamps and transformers, since 2,000 volts is a much greater strain on the insulation everywhere than 1,000 volts is. 2. What voltage is required to make a 15-inch spark, such as is given by a static machine? A. We have not exact data at hand for the voltage required to force a spark through 15 inches of dry air under all circumstances. A paper read before the American Institute of Electrical Engineers showed that 150,000 volts were required to force a discharge between points, and that a different pressure was necessary if spheres, disks, etc., were employed. We have from time to time published valuable papers concerning the work of Prof. Trowbridge, of Harvard University, in this direction. These can be had for ten cents each. 3. Is the current or discharge from a static machine giving 15-inch spark, such as is used in X-ray work, dangerous? Will it produce death? A. A discharge through 15 inches of air is a very dangerous current to encounter. Any discharge from a coil capable of giving such a spark should be avoided. The only safe rule is not to touch the secondary while the coil is active; and if necessary to touch any part of the apparatus, to place the hand not in use behind the back. No circuit can then be made through the body from arm to arm. 4. Will the 200-volt lamp last as long as the 100-volt? A. One of the largest lamp makers says of 200-volt lamps: "Owing to the increased strain to which the carbons or filaments are subjected by the high voltage, these lamps are uncommon except in the lower efficiencies. The efficiency of our regular product is 4 watts per candle, and in its average life and maintenance of candle power it corresponds to our standard 100 to 125-volt 3.1 watt lamp." This shows that it will cost more to run a 200-volt lamp than a 100-volt lamp for the same candle power.

(10045) T. D. asks: In a perfect compound dynamo, would the neutral points vary with the load? A. Yes.

(10046) H. E. T. asks: 1. Is there an alloy approximately as soft as lead, and as tenacious, malleable, and ductile as copper? If so, what are the properties of the alloy? A. There is no alloy known to us that is as soft as lead and as tenacious as copper. The alloys of lead and copper have no commercial value as a metal and are not in use. We do not know the properties of such alloys. 2. Is there any need (commercially speaking) now of a telephone repeater, since Dr. Pupin's invention? In other words, could a telephone repeater have any other use than to increase the distance at which speech may be transmitted? A. There is the same need that there has always been. If such an instrument can be invented, it will enable speech to be transmitted not only to greater distances, but at a much less cost than the system to which you refer.

(10047) J. M. S. writes: I have a small electric mouth lamp that when connected up with an alternating 104-volt current, by means of a rheostat, requires from $3\frac{1}{2}$ to 4 volts to light it. Now what I want is to make a rheostat by covering either a piece of wood or iron with asbestos, and then placing same in a lathe and winding it with German silver wire, so as to be able to cut the 104 volts down and not burn out my lamp. Can you inform me what gage wire and how much of it will it take to accomplish the desired results? A. We cannot give exact data for a coil such as you require, since we do not know what the current is which you use. But you can proceed as follows: Take 24 B. & S. German silver wire, which has 3 feet to the ohm. Provide 375 feet, and wind into the coil as you propose. You can arrange a switch so that the current may be adjusted; that is, make a variable rheostat; or you can by testing find what amount will be needed to have the light burn properly. You are probably aware that the more economical way is to have a small transformer for your lamps. Such lamps can be run with a battery also.

(10048) M. McC. writes: A positive remedy for carbon brushes sparking is to soak the brushes for twenty-four hours in ordinary machine oil. Complaints I have read in columns of the SCIENTIFIC AMERICAN prompts the above and should be generally known. I had the same trouble and it occurred to me to try above remedy, and I find it does avoid sparking positively. A. We are not able to indorse this as a sovereign remedy for all diseases of dynamos which show themselves by the symptom called sparking. Machine oil can only act as a lubricator, and sparking may be due to a cause deeper than the surface of the armature.

(10049) F. H. asks: Will you please tell me what kind of metal to use on contact points on a gasoline engine electric igniter, and where to purchase the same? A. Always use platinum at the contact points for breaking a circuit where there will be a strong spark. Any dealer in gasoline engines who advertises in our columns can furnish the article. So also can dealers in electric materials.

(10050) A. S. asks: 1. Would ten cells be sufficient to run a six-candle lamp (10 volts, 1.5 amperes)? If not, how many would be required? A. No. Your lamp requires 1.5 amperes. This battery furnishes 30-1000 of an ampere, or about one-fiftieth as much current as is needed for the lamp. 3. How shall I prepare the pastes used in the upper and lower spirals? A. This battery is useful for testing purposes only, as the description states. The paste is prepared by mixing the solid minium or litharge into a paste with dilute sulphuric acid. This is the method in all storage batteries using such pastes. 3. What is used as the electrolyte, and how is it made? A. Dilute sulphuric acid. You will have to buy the acid. You cannot very well make it. 4. Where could I get the battery charged? A. Charge the battery with a primary battery. A gravity battery is as good as any for the purpose.

(10051) N. D. writes: In your issue of April 13 you mention sulphides of barium and calcium, and state "when properly prepared." Are there any special directions for preparation, and how? A. To prepare a phosphorescent calcium sulphide, calcine clean oyster shells in order to burn out all but the calcium carbonate. Then reduce the shells to a fine powder by pounding or grinding. Place this powder in layers in a crucible with flowers of sulphur. Cover the crucible to shut out the air, and heat to dull redness for half an hour. Let the whole cool while still covered, and transfer the calcium sulphide formed to a glass bottle, which cork tight to prevent the accession of moisture. Barium sulphide should be formed from witherite and sulphur by heating in a crucible in the same manner.

(10052) W. M. R. writes: I made some little time back the eight-light dynamo described in your valuable paper, designed by Hopkins some twelve years ago or so. Having studied electricity at University College, London, I made some alterations in the design of armature which I think have made material improvement in dynamo. The alterations were these: Instead of using washers as sug-

gested, I cut washers out of 20-gage charcoal iron, using varnish for insulation. These I fastened on to the armature by thick-end washers engaging a screw on armature shaft. After getting all firmly screwed up, I put into lathe and slotted out 24 grooves the breadth of 4 wires and 8 wires deep, and in these I wound the wires very carefully. By this arrangement I was enabled to run the armature with iron 1-16 inch distant from cheeks of field magnet. I turned the field magnet upside down, with yokes firmly bolted to base plate, from which rose two pedestals (hollow) forming bearings for the ends of armature. I arranged the bearings with an endless chain dipping six inches into oil chamber, with the result that I can light up 50-volt lamps to full brilliancy at a speed of 1,660, instead of 2,200, the speed mentioned in your article. I have had the machine lighting up my house, driven by a Pelton wheel, for several months, and the bearings have not an atom of shake and have only been filled up with oil once, as it circulates and runs back again. I thought possibly some of your readers would like to hear of my results. I would advise anyone attempting to make the machine to get the segments for commutator cast separate. I tried both ways and found the latter preferable. I made the commutator much larger than the design. A. Of course, the iron-clad armature is an improvement over the old form of a dozen years ago. The results of the alterations are very satisfactory.

(10053) J. M. S. asks: 1. What size German silver wire and how long a piece should I use to wind a rheostat to reduce an alternating current 7,200 amperes, 104 volts, down to 2 volts? Also size and amount of iron wire for above results? A. The use of a choke coil is not the most economical way to reduce from 104 volts to 2. A simple mode of getting the result would be to put a wire in series with an incandescent lamp, and take a shunt from the wire at two points which have a resistance between them equal to about one-fiftieth of the resistance of the lamp. The best way, however, is to obtain a transformer from the company supplying the current, which will give you this rate of transformation. If your current should happen to be transformed from 2,000 volts to 104 a second transformer like the first would carry it down to about 5 volts, which perhaps is near enough to your limit for your use. 2. How shall I proceed to construct an appliance for heating say a glass of water, using same current, amount, size and kind of wire? A. This you can do by means of a small coil of wire in series with a lamp. An arc lamp would give a quicker result. With an arc lamp use 12 or 14 B. & S. German silver wire. With an incandescent lamp use 18 or 20 wire.

(10054) B. P. asks: Will you kindly furnish me with information regarding liquid air, its process of manufacture, cost, properties, etc., and what developments have been made regarding its uses and its dangers? A. We can send you ten good articles upon liquid air at ten cents each, or else the book upon the subject by Sloane, for \$2.50 by mail. Liquid air has no commercial uses at present, and there are no dangers from it, if handled by one having knowledge of the usual properties of gases.

(10055) C. M. L.—The principal source of graphite in the United States is the mines at Ticonderoga, N. Y., which furnish about 200 tons per annum. It is also mined near Raleigh, N. C., and in Virginia, Georgia, New Hampshire, Rhode Island, and California; also in Nova Scotia. The best graphite comes from Colombo, Ceylon, and costs from 2 to 4 cents per pound, according to quality. Prices depend much upon the regularity of the supply.

(10056) W. E. asks: Will you tell me how the voltage and internal resistance of a Bunsen cell can be calculated mathematically, or refer me to a good book on the subject? A. The voltage and internal resistance of a battery are not calculated by mathematics. They are measured by instruments. The processes employed are to be found in Kempe's "Handbook of Electrical Testing," price \$7.50. This work is complete. A special book upon batteries is Carhart's "Primary Batteries," price \$1.50, both prices by mail.

(10057) X. writes: I wish to obtain some information which would be very acceptable to me, and in fact to a great many at this time, when the question of using gasoline engines on automobiles of different kinds is very popular; and that is, the dimensions and drawings, if possible, of a jump spark or induction coil that would be oblong in shape, without vibrator, light as possible, and to work on low voltage giving a one-quarter inch spark. A. The details for making an induction coil to give a spark one-quarter inch in length can be found in Bonney's "Induction Coils," price \$1 by mail. You can omit the vibrator and arrange the break in the combustion chamber or cylinder without special instructions. The shape may also be changed to adapt it to the space allotted to it. The important thing is the insulation and the windings. All else is secondary. Only a low voltage can be used upon so small a coil.

(10058) F. P. asks: 1. Is the efficiency of an electric motor affected if the body frame of the automobile is iron, or if motor is clad with wrought iron or other metal instead of cast iron? A. The efficiency of an

The Index of Patented Inventions, Registered Trade Marks, Designs, Labels and Prints which usually appears on this page is this week omitted, the United States Patent Office being unable to supply it in time because of new arrangements which it is about to make for the printing of the Official Gazette. The index will be published in next week's issue.

electric motor is not affected by the material of the frame of the carriage to which it is attached. Nor does it make any difference to the motor by what metal it is inclosed. The reason for using ironclad motors on street cars is chiefly to prevent the escape of magnetic lines into the space around the motor. No metal but iron can do this, and cast iron is cheaper than wrought iron. 2. Will wrought iron field magnets, instead of cast iron, in SUPPLEMENT 1195, double the efficiency of the motors? If not, what winding will do it? A. Wrought iron will transmit about twice as many lines of force as cast iron; hence a saturated magnet core of wrought iron will give twice the effect of one of cast iron. 3. If pinion wheel is placed on top of gear wheel, is it as efficient as if placed on the side? A. The position of the driving gear does not affect the amount of power it transmits. 4. If not too small, how should motors in SUPPLEMENT 1195 be wound so as to act as dynamos also? A. The winding of a motor does not need to be changed to make it generate as a dynamo. 5. Is there any special danger on an electric automobile, whether still or moving, in a thunder-storm? A. An electric automobile is not exposed to any more danger in a thunder-storm than any other. We do not recall ever hearing of any person being struck by lightning upon a railway train. 6. In the inclosed sketch, if *U* is a one-horse-power motor, with 3-inch pinion meshing into 30-inch gearwheel, connected to 18-inch rod, *JH*, and this joined to 6-foot lever *HF*, working on fulcrum *G*, five feet from power end, what horse-power will be obtained at *A* on the bent axle, *CABE*, which is connected to lever, *HF*, by 18-inch rod, *AF*? A. With the arrangement you describe you will have at the end of the train of wheels and levers one horse-power less whatever has been lost in friction at the several bearings. No one can calculate this. It must be found by experiment, and will depend upon the condition of the machine. A horse-power is 33,000 foot-pounds of work done in a minute. It is not affected by the speed of motion nor by the weight lifted. If the speed is great a less weight will be lifted by a horse-power; and if the weight is great, the less will be the speed. Your arrangement reduces speed and increases pressure, or weight lifted, but the amount of power remains the same. The 30-inch gear moves one-tenth as fast as the gear which drives it, and the end, *F*, of the lever moves one-fifth as fast as the end, *H*. Hence *F* moves one-fiftieth as fast as the small gear on the motor.

(10059) J. F. C. asks: What is the fraction of power lost in the current produced by a generator which runs a motor, the connecting wires being not longer than 10 yards? That is, what is the relative power of motor and generator? Both are the same size. What size of a booster would be required to have both equal? A. A motor only thirty feet from the dynamo which furnishes the current for running it has little or no drop of potential from that of the dynamo, and needs no booster. The only loss is due to the heating of the coils by the current.

(10060) F. S. L. writes: I would like to know how to make a spark or a spark coil, and in what way it differs from an induction coil. I want to make a spark coil to use to ignite an acetylene gas jet. A. Spark coils are made about ten inches long. The center is a core of iron wire as in an induction coil. It may be $\frac{1}{8}$ inch in diameter. Insulate the core by wrapping it with paper which may be soaked in paraffine. Fit heads upon the ends of the core to hold the winding and wind four to six layers of about No. 12 B. & S. double cotton-covered wire upon the core. Insulate the layers with paper. This coil is put in series with a battery, and upon breaking the circuit a spark is produced at the break which lights the gas. There is no secondary coil. In this is the difference between a spark and an induction coil.

NEW BOOKS, ETC.

PRACTICAL PAINTERS' WORK. Edited by Paul N. Hasluck. Philadelphia: David McKay, 1906. 8vo.; pp. 160. Price, \$1.

The reader will find that this book contains a fairly comprehensive digest of information which will be of considerable value to the painter and the workman in allied arts. It is based upon a series of contributions by experienced craftsmen to the various publications and supplies many valuable hints on the general principles and processes of the art of which it treats.

MODERN POLYPHASE MACHINERY. By Andrew Stewart, A.M.I.E.E. London: S. Rentell & Co., Ltd., 1906. 12mo.; pp. 296. Price, \$2.

The use of the alternating current is daily becoming a factor of greater importance in the general subject of electricity. Mr. Stewart's book on polyphase machinery, dealing exclusively with the principles, design and construction of modern mechanism of this character, will doubtless be found of assistance by the electrical engineer. Mathematical methods of investigation and explanation have been largely dispensed with and, although this may appear to be *contra* to general practice in writings of this class, it will be found that the discussion has been considerably simplified by this method without, however, materially limiting the information which the author gives about the chief characteristics of such machinery. The book is hardly intended for the use of students, but was written for the practicing engineer.

GLASS WRITING, EMBOSSEMENT AND FASCIA WORK. Edited by Paul N. Hasluck. Philadelphia: David McKay, 1906. 32mo.; pp. 160. Price, 50 cents.

The information detailed in this handy little volume is edited by a writer who has contributed largely to the literature of practical handicrafts and it is in the convenient form of a comprehensive series of short articles. It will be found of value for the artisan engaged in work of this character, as well as for the practical man in general.

NOTES ON ELECTROCHEMISTRY. By F. G. Wiechmann, Ph.D. New York: McGraw Publishing Company, 1906. 12mo.; pp. 145. Price, \$2.

The latest contribution to the literature of electrical chemistry—to-day a subject which is rapidly coming to occupy a place as one of the most important practical arts—is this book by Dr. Wiechmann. While the compass of the work is limited, it gives an excellent general summary of the present state of the art. The subject is treated in a practical manner without the elaboration of abstruse theories. Unfortunately no descriptions of the actual apparatus used are given, the author contenting himself with elaboration of the principles underlying the process.

ELECTRIC WIRING, DIAGRAMS, AND SWITCHBOARDS. By Newton Harrison, E.E. New York: The Norman W. Henley Publishing Company, 1906. 12mo.; pp. 272. Price, \$1.50.

This excellent little book was written especially for the electrical artisan, the object being to give a practical treatise on electric wiring, the construction of switchboards, and other related subjects. Not only is the subject of building wiring discussed, but brief explanations of the principles of transmission and the types of electrical machinery employed are added to the text. The discussions are usually concise, though, unfortunately, the text contains a number of mistakes which it is hoped a second edition will correct.

PRACTICAL PATTERN MAKING. By F. W. Barrows. New York: Norman W. Henley Publishing Company, 1906. 12mo.; pp. 326. Price, \$2.

The author is thoroughly conversant with his subject. While the literature of pattern making is voluminous, still there always seems to be ample room for an acceptable work. The work describes in lucid language the principles which underlie pattern making, as well as the more practical side. It is very well illustrated.

BOSSISM AND MONOPOLY. By Thomas Carl Spelling. New York: D. Appleton & Co., 1906. 16mo.; pp. 358. Price, \$1.50.

The author states that: "The purpose of this book is not to humiliate Americans by pointing out their lack of public spirit and need for a moral awakening in all that pertains to government, but is rather to state boldly and without an attempt at concealment true conditions as the author sees them. It is better to know the worst and to apply the remedy than to go straight to destruction under a delusion." The author's Preface is dated November, 1905. Since that date there has been much "muckraking," productive of great good. The work is a valuable one dealing with important economic questions.

TRANSMISSION OF HEAT THROUGH COLD STORAGE INSTITUTION. By Charles F. Paulding, M.E. New York: D. Van Nostrand Company, 1905. 18mo.; pp. 41. Price, \$1.

A special book on a special subject. The literature of ice making and refrigeration is quite extensive already, but there always seems to be a field for a book which deals with one corner of a large industry. The refrigerating engineer will find this book invaluable.

PRACTICAL HANDRAILING. Edited by Paul N. Hasluck. Philadelphia: David McKay, 1905. 18mo.; pp. 160. Price, \$1.

The art and craft of handrailing is justly considered the highest branch of carpentry. The present work begins at the very foundation of the subject, and works through the more difficult problems until the most complicated handrails are reached. The practice is English, but it will prove of value to the American artisan.

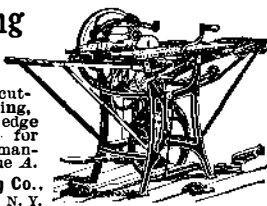
PHYSICAL OPTICS. By Robert W. Wood. New York: The Macmillan Company, 1905. 8vo.; pp. 546. Price, \$3.50.

An advanced text-book for students who wish to obtain a special knowledge of a very important branch of physics. The author is

Wood-working Machinery

For ripping, cross-cutting, mitering, grooving, boring, scroll-sawing, edge moulding, mortising; for working wood in any manner. Send for catalogue A.

The Seneca Falls Mfg. Co., 695 Water St., Seneca Falls, N. Y.



Engine and Foot Lathes

MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. BEST MATERIALS. BEST WORKMANSHIP. CATALOGUE FREE

SEBASTIAN LATHE CO., 120 Culvert St., Cincinnati, O.

Foot and Power and Turret Lathes, Planers, Shapers, and Drill Presses. SHEPARD LATHE CO., 23 W. 41 St. Cincinnati, O.

GIANT STEAM SHOVELS

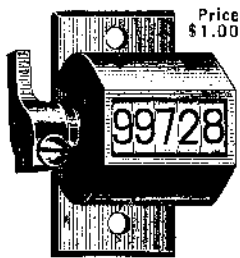
Toledo 125 Ohio, U.S.A. Vulcan Place

The Vulcan Iron Works Co.

Veeder Counters

to register reciprocating movements or revolutions. Cut full size.

Booklet Free
VEEDER MFG. CO., 15 Sargeant St., Hartford, Conn.
Cyclometers, Odometers, Tachometers, Counters and Fine Castings.



ELECTRO MOTOR, SIMPLE, HOW TO MAKE.—By G. M. Hopkins. Description of a small electric motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641. Price 10 cents. To be had at this office and from all newsdealers.



THE CLIPPER CLIP

Its triangular shape prevents entangling and gives three times the capacity of any other clip for attaching papers together.

Best & Cheapest. All Stationers.
CLIPPER MFG. CO., 401 West 124th St., New York, U.S.A.
For free samples and information write to us.

A. M. Faber.

Manufactory Established 1761.

Lead-Colored & Slate Pencils, Rubber Bands, Erasers, Inks, Penholders, Rulers, Water Colors, Improved Calculating Rules.

Send for descriptive Circular S.

44-60 East 23d Street, New York, N. Y.
Grand Prize, Highest Award, St. Louis, 1904.

PATENTS

Our Hand Book on Patents, Trade-Marks, etc., sent free. Patents procured through Munn & Co. receive free notice in the SCIENTIFIC AMERICAN

MUNN & CO., 361 Broadway, N. Y.
BRANCH OFFICE: 625 F St., Washington, D.C.

ORIGINAL BARNES

Positive Feed

Upright Drills

10 to 50-inch Swing

Send for Drill Catalogue.

W. F. & JNO. BARNES CO.
(Established 1872)
1999 Ruby St., Rockford, Ill.

French Motors for Lighting Plants

The "ASTER" is the best French motor on the market for lighting houses, hotels, etc. Small, compact simple and safe to operate. Motive power alcohol oil or gas. 2 and 4 cylinders. Great power for small engines. Easy running. Write for illustrated Price List.

ASTER COMPANY
1591 Broadway NEW YORK CITY

How To Increase Your Business

READ carefully, every week, the Business and Personal Wants column in the Scientific American

This week it will be found on page 34.

Some week you will be likely to find an inquiry for something that you manufacture or deal in. A prompt reply may bring an order.

Watch it Carefully

"Maxwell"

What do the Owners Say?

That is the best question to ask, when selecting an automobile.

Maxwell owners are the Maxwell's best advertisements.

The contentment and satisfaction that stands out all over them is the most "catching" thing in the motor world. Just talk to one of them and get the "sunny side" of the automobile question.

Multiple Disc Clutch. Three-point Suspension of Motor and Transmission (Unit). Metal Bodies. No Noise. No Vibration.

Send for our book "Facts and Testimony" which contains letters from 32 owners who enjoy telling what they know of the "Maxwell." Free to those sending for our catalogue.

Write Department 22.

20 H. P. Touring Car \$1,450 10 H. P. Tourabout \$730

MAXWELL-BRISCOE MOTOR CO.
Members American Motor Car Manufacturers' Association

FACTORIES:

Main Plant: TARRYTOWN, N. Y.

CHICAGO, ILL. PAWBUCKET, R. I.

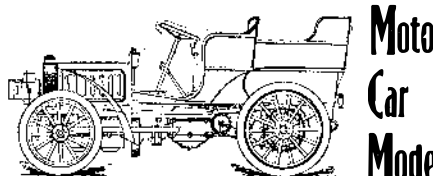
BRANCHES: Maxwell-Briscoe, Inc., New York, N. Y.; Maxwell-Briscoe-Chase Co., Chicago, Ill.; Fisher Automobile Co., Indianapolis, Ind.; Morrison Tyler Motor Co., Boston, Mass.; Maxwell-Briscoe-McLure Co., Detroit, Mich.; Maxwell Garage, Newark, N. Y.; J. W. Wilcox & Son, Los Angeles, Cal.; Richard Irvin & Co., New York City.

A MONEY MAKER

Hollow Concrete Building Blocks Best, Fastest, Simplest, Cheapest Machine. Fully guaranteed.

THE PETTYJOHN CO.
615 N. 6th Street, Terre Haute, Ind.

IF YOU OWN or run an AUTOMOBILE



It consists of Colored Charts bound up with explanatory letterpress in strong cardboard binding, size 9 1/4 by 13 1/4 inches.

Price \$1.50. By Mail, \$1.57

T. Y. WHITTAKER, 2 and 3 Bible House NEW YORK

THOMAS AUTO-BI

Model No. 44. Price \$145

Three Horse Power. Simplest motorcycle on the market. Agents wanted everywhere. Catalog free.

THE THOMAS AUTO-BI CO.
1450 Niagara Street Buffalo, N. Y.

MUD FORGET IT AND USE WEED'S TIRE GRIPS

Positively Stops Slipping or Skidding They Make Bad Roads Good

Send for Booklet "S"

WEED CHAIN TIRE GRIP COMPANY
28 Moore St., New York City

FRONT DRIVE

Best Low-Priced Automobile on market. Will not skid, great hill climber, easy to control.

D. W. Haydock Automobile Mfg. Co., St. Louis, Mo.

WARREN'S WALRUS ROOFING

Put a "Walrus" on your roof and you will have a perfect results for years after other roofings are worn out. One free sample shows the value. Write for it.

WARREN CHEMICAL & MFG. CO.
1 Battery Place, New York

HASBROUCK

SAFE! SIMPLE! SILENT! SAVING!

A combination of excellence unsurpassed in the motor world. Send for illustrated catalogue, sent free.

Hasbrouck Motor Works, Inc., New London, Conn.

RELIABLE MARINE ENGINES

Reliability under all conditions is the characteristic of the "Lamb" Engines. Sizes from 1 1/2 to 100 H. P. in stock. Write for catalogue.

TERRY & CO.
Managers Eastern and Foreign Branch
112 Chambers St., New York

Everything for Boat & Engine

WELL DRILLING Machines

Over 70 sizes and styles, for drilling either deep or shallow wells in any kind of soil or rock. Mounted on wheels or on skids. With engines or horse powers. Strong, simple and durable. Any mechanic can operate them easily. Send for catalog.

WILLIAMS BROS., Ithaca, N. Y.