IMPROVED GAS TORCH.

Albert R. Weiss, Brooklyn, N. Y.—This consists of a gas-lighting torch worked by a fulminate ribbon, whose pellets are fed and ignited by a suitable mechanism. The latter consists of a sliding sectional piston rod, operated from a trigger of the handle guided in a curved tube, and reset by a spring of the feeding device.

IMPROVED REIN SUPPORT.

Joseph L. Ryder, Islesborough, Me.—This device is made of a single piece of metal bent to form a central guide piece, eyes, and guard tongues. It prevents the reins getting entangled under the whiffletrees, or under the horse's tail.

IMPROVED MIDDLINGS SEPARATOR.

Peter Muller, St. Charles, Mo.—This consists in suspending the frame of a middlings purifier by straps, and providing it with a cam wheel, pawl, shaft, and springs, arranged to reciprocate and jar the frame transversely to the flow of the material.

IMPROVED ELECTRIC LIGHTING APPARATUS FOR LAMPS.

Prof. William H. Zimmerman, Chestertown, Md.—This is a novel construction of self-lighting lamp, based upon the general principle of the employment of a hydrogen gas generator, together with a galvanic battery, in which the battery current heats a platinum wire red hot to ignite the jet of hydrogen, the flame of which latter impinges against and ignites the wick of the lamp. The invention consists, mainly, in locating the gas generator and the battery in twin supporting sockets attached to the brachial slide carrying the lamp, and in rendering the various vessels to be filled capable of independent support in upright position while being filled; in addition to which, the invention further consists in novel means for simultaneously bringing into operation both the gas generating apparatus and the battery, and instantly effecting the generation of gas, the flow of the electric current, and the lighting of the lamp. The self-lighting devices may be applied with slight modifications to all forms of lamps as well as to gas brackets.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED HORSESHOE MACHINE.

John W. Chewning, Jr., Shadwell Depot, Va.—The present invention is an improvement upon that for which letters patent of the United States were granted to the same party August 26, 1876 (No. 181,641). The improvement relates to the construction of the contact surfaces of the swaging die and the combined former and ejector; also to the mechanism for reciprocating the swaging die.

IMPROVED CHAIN PROPELLER FOR VESSELS.

William B. Whiting, Milwaukee, Wis.—This invention is an improvement in that class of chain propellers in which the boat is bisected by a central longitudinal opening in which the chain propeller is arranged. The novelty consists partly in the improved construction of the propeller, designed with a view to strength and smoothness of operation; and also in arranging the endless chain propeller about an inclined compartment connecting the two portions of the boat upon opposite sides of the central channel, which compartment rises toward the stern so as to secure the double result of facilitating the return of the paddles to the forward end of the boat upon the inclined deck railway, as well as the withdrawal of the paddles vertically from the water, which obviates the carrying of "dead water."

IMPROVED QUILTING ATTACHMENT FOR SEWING MACHINES.

John Douglass, Millport, Mo.—The quilting frame is attached to and pendant from a traveling carriage, which is supported upon an extensible horizontal beam or frame, in such manner as adapts it to be used in connection with a sewing machine. The quilting frame is moved back and forth to carry the quilt under the needle and return, and may be hung up out of the way when not required for use. The beam on which the carriage runs may be easily taken down when required.

IMPROVED APPARATUS FOR CONVERTING MOTION.

Peter Gregersen, Wauzeka, Wis.—This is an apparatus for converting reciprocating motion to contiuous rotary motion; and it consists in the combination of movable racks with a sliding frame that is attached to the piston rod of an engine. The device also consists in a mutilated pinion that meshes with the movable racks, and is provided with a double cam, by which the motion of the shaft rotated by the said racks is reversed.

IMPROVED MACHINE FOR SHEARING SHEET METAL.

George Summers, Niles, O.—Threaded rods are provided upon which the feet are formed. These feet are fastened to the fixed jaw of the shears by means of bolts, and project therefrom at right angles. Guide plates are fitted loosely to the rods, and are held in place by means of nuts. Several sets of guide plates may be provided, that increase in height as they are placed farther from the blade of the shears, so that a number of widths may be cut without readjusting the gage.

IMPROVED EARTH AUGER.

James McCullough, Pensacola, Fla.—By turning the center shaft in one direction, the auger is opened for work, taking in the sand, earth, and water, and retaining the same, by turning the shaft in opposite direction and closing the openings of the auger by a valve. The auger is then raised for being emptied, the center shaft being attached to the auger, to prevent displacement of the valve in vertical direction by a collar, keyed to the shaft below the yoke.

IMPROVED EARTH AUGER.

Edward Cox and Henry Cox, East St. Louis, Ill.—This consists of a box auger attached, by a yoke, to a vertical shaft, at the upper end of which another yoke is attached that is made to revolve by bevel gearing. The upper yoke is provided with a horizontal shaft, having at its outer end a pinion that travels upon a series of cogs formed at the edge of the circular openings in which the yoke is suspended. An endless chain, carrying buckets, passes over a pulley on the horizontal shaft and around a pulley in the yoke that supports the auger. The whole is supported by a derrick, which is provided with a windlass for raising and lowering.

IMPROVED COTTON CLEANER.

James A. Bowers and Milton Adar, Princeton, Ark.—This consists of a slotted and ribbed stationary concave and a revolving cylinder with beaters, combined with a feeding and discharging case, in which the cotton feeds from a hopper at the top and escapes at the side, while the dirt and trash which are beaten out of the cotton by the beater cylinder and ribbed concave fall through the spaces and escape.

IMPROVED WATER ELEVATOR.

John F. Long, Bridgewater, Va.—This consists in the arrangement of two pulleys, one placed in a curb over a well, and the other at the bottom of the well, over which runs an endless belt carrying buckets that dip up water and deliver it to the spout in the curb.

IMPROVED WATER ELEVATOR.

Thomas J. Reid, Lexington, Ind., assignor to himself and John Malick, of same place.—This relates to that class of elevators that employ a windlass and bucket for raising water. The windlass has two drums, of different diameter, journaled in the upper portion of the curb. Upon the larger drum a rope is wound, by which the bucket is raised or lowered, and upon the smaller drum a strap is wound in a contrary direction, which is attached to a curved lever, by which the elevator is operated. There is also an arrangement of wire guides for the buckets, that extend from the top to the bottom of the well. A slide runs upon the said wires, to which the bucket is hinged, and a catch receives and retains the slide when the water is emptied from the bucket.

IMPROVED STEAM GAGE.

Frederick H. McIntosh, Atlantic, Iowa.—This invention consists of a steam gage, whose pressure-indicating spring rod is guided in a screw sleeve at the top, which screw adjusts the tension of the spring until indicating the correct pressure. A link is screwed on to the threaded end of the pressure rod to apply the scales to the gage.

IMPROVED WATER WHEEL.

Elisha B. Shattuck and Isaac Stahlman, Mount Pleasant, Mich.—In this device it is claimed that increased power is obtained, the water freely discharged, and a larger percentage of the water power utilized. The invention consists of a double wheel, in which the buckets of the upper wheel connect with an inner tube and spiral buckets around the shaft, while the lower wheel connects with an outer cylinder or tube. The wheel is concaved or dishing, and provided with vent holes at the top to accelerate the discharge of the water.

IMPROVED PILE DRIVER.

John Gregg, Riverton, Iowa, assignor to himself and James Miller, of same place.—When this device is used as a pile driver, guy-ropes are fixed in eyes attached to the ends of the bolt, on which the pulley sheave works, and the derrick is inclined, so that its top is directly over the place when the pile is to be driven. A clamp is then loosened, and guides are allowed to swing into a vertical position, where they are secured by the clamp engaging braces. The weight is raised by turning the windlass by means of a lever, a rope being attached to it, and running over the sheave, and attached to the hammer moving in the guides.

IMPROVED METHOD OF PROPELLING BOATS.

Albert Belz, Appleton, Wis.—The paddle wheel shaft is provided with ordinary paddle wheels. A spur wheel, which is keyed to the shaft and takes its power from a similar wheel, which is fixed upon the shaft. Cranks are placed on opposite ends of the shaft, and are worked by hand levers. The whole apparatus may be easily detached from the boat when desired.

IMPROVED BALANCED VALVE FOR STEAM ENGINE.

William Jackson, Millerstown, Pa.—This consists of a valve the back of which is beveled, and whose central or exhaust space extends to the rear in a beveled cover placed at the back of the valve, between which and the valve seat the valve moves. The whole is inclosed in the steam chest, and all of the exposed sides of the valve are subjected to the same pressure, so that the valve is balanced, and little power is required to move it.

IMPROVED ROTARY ENGINE.

John C. Thomas, Carlinville, Ill.—The wheel or disk within the casing has deep transverse grooves in which radial pistons work, the rods of which pass through stuffing boxes in the wheel. The rods are attached to hollow boxes in which are springs which act upon bars. Said bars pass through slots in the boxes and through slots in the radial bars or spokes of the wheel and connect.

IMPROVED HEMMER FOR SEWING MACHINE.

Charles L. Goethals, Los Angeles, Cal.—This is an improved adjustable hemmer for sewing machines, by which folds of different widths may be hemmed and the fabric fed in regular manner to the needle after being started. The invention consists of a base part, with sliding folding part, that folds and feeds the fabric to the needle, and a pivoted guide piece, that regulates the folding of the fabric.

IMPROVED PUMP.

Swan Petersen, Knoxville, Ill.—The lower and the upper pump stock are coupled together by a tube joint. A rim extends around the tube intermediately between the ends of the pump stocks, which are tightly seated against the rim by packing rims. The strong and rigid connection of the pump stocks is obtained by projecting metallic lugs, secured by bands extending around the ends of the pump stocks. The lower pump stock is secured to the walls of the well by a brace, which is rigidly wedged in place. The convenience of releasing the brace and taking out the lower pump stock for repairs, as well as the reliable and effective working of the pump when properly coupled at the tube joint, furnishes a pump of substantial, durable, and convenient construction.

IMPROVED ROTARY ENGINE.

Hodgen I. Willson, Harrisville, Tex., assignor to himself and L. J. Russell, of same place.—The operation of this rotary engine is as follows: Steam passes through a passage in a rocking valve on the upper side of the cylinder, and through one or two passages in said cylinder into the steam chest; thence through a port in a side valve, and through a passage in a guide, and into the cylinder by way of a passage in the abutment. When the piston has moved through a half revolution, a cam quickly shifts the rocking valve, so that steam is admitted to the other of the two passages. The steam acts upon the piston, shifting the abutment, and admitting steam to the cylinder, forcing the piston through the remainder of the stroke. While this takes place the steam from the first passage is allowed to pass into the exhaust.

IMPROVED WATER WHEEL.

Nelson L. Greene, Edmeston, N. Y.—By new devices in this wheel, a body of water of varying cross section may be thrown without obstruction or diminution of power on the wheel. The escape of water at the top of the casing is also prevented, and a full utilization of the reaction of the water at the lower part of the wheel is claimed to be obtained.

IMPROVED TRUSS BRIDGE.

Lyman W. Densmore, St. Joseph, Mo.—The principal novel features of this bridge are: First, forming the truss chord of metallic rods having their ends extended past each other and through the girders or couplings, and fastening them upon the opposite sides of said girders or couplings by means of nuts; the chord rods being increased in number toward the center, but always arranged about a common center of tension; and secondly, the fastening of one of the tension rods in each panel, whose strut carries a cumulative horizontal thrust to an independent angle block carrying said strut; and thirdly, the particular arrangement of a detachable girder beneath the couplings.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CORN HARVESTER.

James Plenkharp, Columbus, O.—The corn stalks are severed close to the ground and carried back on to a platform by means of a rotating-armed shaft, and a vibrating carrier provided with hooks or curved arms. The platform is made in two parts, of elliptical form, each of which turns horizontally, and tilts to discharge the "shock" upon the ground. The platform is tilted by a suitable device under the control of the driver.

IMPROVED SEED PLANTER.

James H. Sale, Boydsville, Ky.—This invention belongs to that class of seed planters in which a given quantity of seed are lifted from the hopper by means of a pivoted reciprocating seed cup, and are dumped into a pipe or chute leading to the furrow. The improvements consist, mainly, in the particular construction and arrangement of the feed bars, hollowed out at their upper ends to form seed cups, which bars are pivoted below to the cranks of the main driving axle and extend upwardly through openings in the bottom of the seed box, in which openings they loosely slide, and about which point the feed bars also oscillate as a fulcrum from the revolution of the cranks carrying the bars below, so that the upper ends of the bars, provided with the feed cups, have a compound motion which causes them alternately to rise and move forward to dump the seed, and then recede toward the center of the box and descend to be filled again.

IMPROVED RECIPROCATING CHURN.

John Henry Sheffer, Cairo, Ky.—This relates to gearing for converting the rotary motion of a hand crank into the reciprocating motion required for driving the dasher. It consists in a crank disk that is attached to a shaft that is journaled in a standard attached to the churn cover, and driven by spur gearing turned by hand power. There is also a slotted cross head that is driven by the crank, and is connected with a jointed dasher rod.

IMPROVED HARROW.

Charles Keehner, Roseville Junction, Cal.—The new feature here is a harrow section formed of converging rods connected by cross rods, the other rods having their nearer ends hooked, and the inner having their farther ends hooked. The middle rod is provided with a hook at one and an eye at the other end, so that by alternately reversing the sections they may be connected at the sides as well as in alignment.

IMPROVED CORN PLANTER.

August. J. Hintz, Lemont, Ill.—In using this planter, the jaws are thrust into the soil up to a stop attached to a stationary jaw. The upper end of the planter is then carried forward, which swings the stationary jaw backward, allowing the seed to drop into the soil, and, at the same time, loosening the soil, so that it will fall into the hole formed by the jaws as the same are withdrawn. As the jaws are withdrawn from the soil a spring closes the said jaws, ready to be again thrust into the soil, and, at the same time, draws forward an arm, bringing the dropping hole within the body, to be again filled with seed.

IMPROVED CORN PLANTER.

Jesse G. Stokesbary and John H. Stokesbary, Millersburg, Iowa.—This corn planter is so constructed as to drop the seed automatically as the machine is drawn forward. It is easily controlled, and enables the hills to be planted in accurate check row.

IMPROVED HAY GATHERER.

Harlin Butner and James J. Ray, Clarence, Mo.—This is a rake for collecting the hay and drawing it to the stack. It is so constructed that the weight of the load will raise the points of the teeth from the ground, so that they will not catch, and so that it may be readily withdrawn from the load when desired.

IMPROVED SHOVEL PLOW.

Thomas H. C. Dow, Tampico, Ill.—This implement is so constructed that it may be adjusted for use as an ordinary shovel plow, or turned toward either side to form a right or left hand plow, as the particular work to be done may require.

IMPROVED COTTON PLANTER AND FERTILIZER DISTRIBUTER.

Joseph A. Shine, Mount Olive, N. C.—This machine is so constructed as to open a furrow, distribute cotton seed and guano into it, and cover the seed. It includes a new construction of the hopper and attached mechanism.

IMPROVED FARM FENCE.

Charles Cremer, Red Bluff, Cal.—This fence is made without posts or nails, and is so constructed that it may be used as a stock fence, as a protector for young hedges, and as a sheep shed. It is not liable to be pushed or blown over. To the notched outer edges of the supporters the side boards are attached. Said boards are beveled at their ends to overlap each other edgewise in said notches, and are secured to each other and to said supporters by wires.

NEW HOUSEHOLD INVENTIONS.

IMPROVED FOLDING CHAIR.

John A. Ware, Morris, Ill.—It consists of a chair having the rear legs and back made in one piece with a seat hinged to the same at the rear and free to fold upwardly at its front; in connection with which elements are arranged a set of front legs with tenons at their upper ends which enter mortises in the chair seat, the said front legs being connected with the seat and back by means of side braces pivoted to the front legs, the middle part of the seat, and the back of the chair, and provided with an upwardly folding toggle joint whereby the parts of the chair may be folded compactly, and in such manner as to stand alone upon its four legs.

IMPROVED FRUIT JAR.

Adam Dicker, Middletown, O.—This is a fruit jar composed of black opaque glass, which excludes light from its interior. It combines all of the advantages of transparent glass, metal, and earthenware, with none of their disadvantages—*i. e.*, it prevents the fading and deleterious effect of light upon the fruit incident to transparent jars, obviates the corrosive action and metallic taste produced by the acids of the fruit upon metal cans, is free from the clumsiness of earthenware jars, and the objectionable action of the acids upon the glaze on the one hand, or the difficulty of removing the germs of ferment on the other when left porous.

IMPROVED BUTTER DISH.

Westel E. Hawkins, Wallingford, Conn., assignor to Simpson, Hall, Miller & Co., of same place.—In this butter dish the cover of metal is made in two parts, pivoted at their angles to the opposite sides of the body of said dish, so that they may be turned down upon the outside of said body. Segmental gear wheels at the angles of the parts of the cover cause said parts to move together upon their pivots. Suitable devices are provided for fastening the cover in desired position.

IMPROVED BLANKET.

Nathaniel Wickliffe, Waterproof, La.—This consists of a couple of light blankets of wool with a lining between or outside of them of paper, laid on a sheet of gauze adapted to strengthen the paper, to prevent it from tearing by the handling of the blankets. The paper and the cloth layers are suitably fastened together detachably by buttons, to take them apart to remove the paper for washing the cloth. The paper, being of such close texture as to prevent the passage or air, makes the blanket much warmer for a given weight of material.

IMPROVED WASHBOARD.

Westly Todd, Wauseon, O., assignor to himself and H. H. Williams, of same place.—The object here is to improve the construction of the washboard for which letters patent were granted to same inventor July 18, 1876, so as make it stronger and more durable without increasing the cost of manufacture. The improvement consists in short parallel corrugations formed along the side edges of the zinc facing, between or within the main corrugations.

IMPROVED ROCKING CHAIR.

William Shaub, Nashville, Tenn.—This consists of a rocking swing, made of round rockers secured centrally to the posts of the seats, and at the ends to the extended foot and seat rests. The seat rests are braced by interior strengthening pieces. The swing cannot upset, and is readily portable from place to place.

IMPROVED WASHING MACHINE.

John W. Modlin, Albion, Iowa, assignor to himself and Simon C. Gillespie, of same place.—By means of a lever, a corrugated rubber is caused to work over a concave bed of rollers. By suitable construction the rubber accommodates itself to the thickness of clothes beneath it.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Notes & Queries

H. B., Jr., will find a good recipe for aquarium cement on p. 202, vol. 28.—C. R. is informed that the apparent spontaneous cracking of glass tumblers is by no means an uncommon occurrence.—P. B. B. will find directions for brazing band saws on p. 194, vol. 31.—C. H. B. will find directions for removing inkstains from clothing on p. 410, vol. 32. For polishing castings, see p. 57, vol. 34.—F. B. S. does not send data enough as to his engine. He will find a formula for ascertaining the horse power on p. 33, vol. 33. For a rule for calculating the dimensions of a flywheel, see p. 251, vol. 32.—J. P. N. will find a recipe for prepared glue on p. 43, vol. 32. For a recipe for mucilage, see p. 27, vol. 34.—R. P. C. is informed that the only non-conductor of magnetism is a sufficient interval of space.—E. G. will find an explanation of horse power on p. 33, vol. 33.—A. J. will find something on tempering chisels, etc., on p. 220, vol. 31.—H. L. H. should address a pump manufacturer.—H. H. will find directions for making shoe polish on p. 107, vol. 36. To season timber of all kinds, follow the directions on p. 58, vol. 32.—F. C. will find a formula for the lifting power of coal gas on p. 65, vol. 32.—C. H. B. will find directions for removing inkstains on p. 410, vol. 32. Brass castings can be polished by following the directions on p. 57, vol. 34. Steel can be etched by the process described on p. 250, vol. 27.—F. J. S. should send us a sample of the efflorescence on the ash heap.—D. W. will find a description of making gas with a hydrocarbon fluid on p. 65, vol. 32.—R. W. K. will find answers to his queries as to ice boats in No. 63 SCIENTIFIC AMERICAN SUPPLEMENT.—U. D. M. is informed that oxychloride of zinc may be used to cement silica together; but we do not think he will succeed very well with the material of which he sent us a sample.—J. C. B. can solder brass by the process described on p. 251, vol. 28. To mend rubber boots, follow the instructions given on p. 203, vol 30.—A. L. F. will find on p. 119, vol. 28, a recipe for a cement for mending leather shoes.—C. A. D. will find a recipe for red fire on p. 171, vol. 36.—J. D. will find directions for fireproofing clothing on p. 282, vol. 32.—A. D. A. will find directions for mounting chromos on p. 91, vol. 31. This also answers T. S. R.—G. K., who asks as to the U. S. Coast Survey, should sign his letters with his name and address.—E. C. S. will find on p. 319, vol. 35, a recipe for a cement wash for woodwork.—A. B. C. will find formulæ for the passage of water through pipes on p. 48, vol. 29.—W. L. B., A. J. W., W. G. L., E. K., C. F. W., J. G., N. T., W. P. B., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) T. A. D. asks: 1. What kind, diameter, and focus should a lens be for a photographic camera to take photographs 4½ inches by 3½ inches, principally landscape views? A. An achromatic of about ½ inch diameter and 5 or 6 inches focus. 2. At about what distance should the lens be placed from the photographic plate? A. Where the image will be sharpest on a ground glass, placed where the photographic plate is to be. 3. If stops or diaphragms are used, what kind is necessary and where should they be placed? A. If the instrument is a double combination, the diaphragm should be placed midway between the lenses. If a single lens, place it in front. A piece of cardboard with a round hole in the center is all that is wanted. The smaller the diaphragm, the sharper the picture will be, and the longer the necessary exposure.

(2) F. I. E. says: I have several photographic lenses; and wishing to form some kind of instrument on the principle of the "Wonder" camera, so that objects and pictures may be projected on a screen without much trouble or expense, I would like to know how the glasses are arranged, and what kind of light is best? A. Your ¼ portrait lens is just what is wanted for the objective. Then, in addition to this, you need two condensing lenses, and (if gas or oil is used) a reflector behind the light, the same as in a magic lantern with the "Wonder" attachment.

(3) A. B. C. asks: Can stereoscope lenses, or the lenses of a small spyglass, be used in constructing the home-made magic lantern? A. The usual stereoscopic lenses cannot be used, because they are ground thicker on one side than the other. The lens of a small spyglass would do if not of too long focus. It will make the picture small unless the lantern is placed at some distance from the screen. A lens of about 6 inches focus is the best; and in small rooms, even shorter focus is preferable.

(4) E. J. B. asks: Will a photographic camera, with three lenses and four inches focus, do as an objective for a magic lantern? Will the "Wonder" camera as described in *Science Record* for 1875 do? Could the object glass of an opera glass be used for the purpose? A. If the photographic combination was made for a portrait camera to be used without a diaphragm, then it will answer the purpose very well. Also the opera glass objectives may be used, either singly or in combination. If one will make the picture on the screen as large as you wish, it will give you more light than the two together.

(5) J. L. K. says: I would like to make a 1 inch hole in a window pane, and have tried several ways, but broke the glass every time. How can it be done? A. Bore a hole in the center by means of a hard steel drill moistened with turpentine. Cut the circle with a good glazier's diamond guided by a small piece of copper wire centered in the hole just bored, and by means of cuts radiating from the center to the circumference divide the circle into numerous small sectors. Then, with a small piece of metal, tap the glass on the posterior side gently, following each cut throughout its extent. When this has been properly done, fasten a piece of putty over the area of the circle on the cut side of the glass; and, while holding the putty, tap the glass on the other side firmly in the center of the circle. Too much pressure on the diamond will cause it to scratch without cutting the glass.

(6) E. B. asks: 1. How shall I treat hickory to prevent its becoming powder-post, as we term it? A. The trouble is due to a diseased state of the timber, which reduces its substance to a mass of dry dust, by the decomposition of its fibers. It is caused by the growth of a species of fungus in those parts of the timber which have not been properly dried or seasoned. One of the best preventives of this disease is a solution of corrosive sublimate forced into the pores of the wood by means of an air pump. 2. When shall I cut it? A. It is best to cut the timber in the late fall or early winter.

(7) E. T. says: In speaking of leaky roofs, you say that the best job would be to put on a new tin roof in small sheets. Which kind of tin is most durable, the leaded or dark lead-colored tin or the bright light-colored tin? A. Use the best charcoal tin, which is bright-colored, and solder the joints securely.

(8) J. H. W. says: We have had an explosion in our foundry that we are not able to explain. The shop is a frame building 50 feet square. We had not made a heat for 24 days; and when we made one and proceeded to drop the bottom as usual, the instant the doors dropped we had a tremendous explosion, breaking some 250 panes of glass. It tore a door that was standing open off its hinges, and made a report that was heard at a distance, shaking the windows in houses squares away. Our shop is quite open, and two doors were standing open at the time. The prop that the cupola man used in dropping the bottom was some 10 feet long and 4 inches square. It was shivered up just as though it had been struck by lightning. There was some ice under the cupola at the time; but we threw, as we thought, sufficient sand on it to prevent the iron coming in contact with it. Are such explosions of common occurrence in foundries? A. We imagine that explosions of such violence are not usual, although those of similar kind are not uncommon, when heated iron comes in contact with moisture. Possibly some of our readers may have knowledge of explosions quite as violent as the one described above, and will favor us with descriptions.

(9) J. M. L. says: I wish to build an air stack with sufficient draught for two furnaces. Can you give me the proportion existing between area of stack at bottom and top and height, and the areas of the flues from furnaces? A. It will be sufficient to make the cross section of the stack equal to the combined cross sections of the flues. You can decrease the cross section towards the top if desirable, but there will probably be no advantage in doing so. Build the chimney at least 40 or 50 feet in height, and as much higher, up to 100 feet, as is convenient.

(10) J. J. says: 1. I wish to make a pair of sleigh runners. I have been told that the rim of a wagon wheel steamed and straightened out is very good to make them out of. But I do not know how to straighten them. Could not I get two pieces of oak, of the same thickness and width of a rim of a wheel, and bend them? A. When the wood is softened, secure it by clamps to a former. Perhaps it cannot be bent into shape all at once, but must be heated several times. 2. For a small 1 horse cutter, how far apart should the runners be at the bottom, and how far at the top? A. Distance between runners, 30 to 36 inches at top, and from 2 to 4 inches more at bottom.

(11) W. S. says: 1. I am building a ditcher for drain tile. It is to be drawn by a rope passing a sufficient number of times around a capstan to prevent its slipping, the free end being wound on a reel. The capstan is to be 18 inches in diameter, and the levers 12 feet from center of capstan to where the horses are hitched. What kind and size of rope will be best if two horses are used, and also if our horses are used? A. You can use hemp rope 1¼ inches in diameter for 2 horses, and 2 inches in diameter for 4 horses. 2. If wire rope should break, how can I mend it? A. By splicing.

(12) E. L. L. asks: Do the rubber covers upon telegraph instruments increase the sound perceptibly? A. No.

(13) C. F. A. asks: 1. What size of boiler should I use for an engine of ½ inch bore and 4 inches stroke? A. Make one 12 inches in diameter and 20 inches high. 2. Can you recommend to me a book on the construction of the marine engine? A. We do not know any work that covers the construction of the modern marine engine. You will find much that is useful in Bourne's and Burgh's treatises.

(14) G. F. asks: 1. What I wish to know is how much power could I expect from an engine 2 x 5 inches, 60 lbs. pressure, 150 revolutions? A. From ⅓ to ¾ of a horse power. 2. What size of boiler would I require if it were a plain cylinder, set in brickwork? A. Make a cylinder boiler with about 11 square feet of heating surface.

(15) W. H. K. asks: Which will bear the greater weight, applied laterally, a round or a square rod of metal or wood, of the same circumference? A. The round one.

(16) J. N. A. asks: What has been the highest result in foot lbs., by any steam engine, per 1 lb. of best coal? A. A horse power for 1·5 lbs. of coal per hour is among the best results; this corresponds to foot lbs. per pound of coal.

(17) C. P. P. says: What size of boiler would run to best advantage an engine 3 x 1½ inches? Of what should it be made? A. You can use a vertical boiler, made of wrought iron, 10 inches in diameter and 18 inches high.

(18) C. R. W. asks: Please tell me how to calculate the number of yards of excavation in digging a pond or lake 100 feet by 80, in form an ellipse, 9 feet deep with banks sloped 1½ feet to 1 foot of depth? A. Add together the top area, the bottom area, and the area of their mean proportional, and multiply the sum by ⅓ the depth.

(19) W. L. F. says: I am making an electro-magnetic machine for medical purposes. I made a spool of wood about 5 inches long, the core of which is a hollow cylinder ¾ of an inch in diameter, containing a bundle of iron wire. For the first coil, I wound about 50 feet copper wire (insulated No. 16) around this, and separate from it. I wound about 500 feet silk insulated wire, No. 22. I connected the ends of the primary coil with 1 cell of carbon battery, but could not get a secondary current. Please tell me where the difficulty lies? A. Your arrangement will give you a secondary current by breaking and making the primary. If you require more power, increase the length of your secondary wire and use more battery.

(20) A. S. asks: I have a battery with two copper cylinders 8 inches and 3 inches in diameter, and a zinc cylinder 16 inches in diameter. What must I put in it to make it work? A. Blue vitriol and water.

(21) L. G. W. says: In making a Camacho electro-magnetic engine, can I construct the tubular magnets, and what should be the size of and length of wire used in making magnets? A. It is not worth while to make the magnets less than an inch in length. Wind each tube separately and then place one over the other. No. 23 silk covered wire will do. The turns on each tube should be in the same direction.

(22) J. S. W. asks: 1. Which will give the longest spark, an induction coil made with 2,000 feet of No. 32 wire or with 2,000 feet of No. 36? A. One with the 2,000 feet No. 36. 2. Will 4,000 feet No. 32 give a longer spark than 3,000 feet No. 36? A. No, not with same primary. 3. Which is best for the primary coil, No. 16 or No. 18 wire? A. That depends upon the size of the core and battery used. Make the resistance of primary about the same as that of the battery. 4. How long a spark ought 2,000 feet of No. 32 wire to give? A. Up to a certain limit, about 1 inch spark per mile of secondary can be obtained.

(23) A. R. asks: 1. Does the Atlantic telegraph work upon the same principle as do telegraph lines in general? It has been stated that the electricity is drawn from the cables. A. The batteries are not connected directly to the cable, but to one side of a condenser and to earth; the opposite side of condenser is connected to the cable. 2. What is the strength of the current used? A. Ten or twelve cells is about the number used to charge the condenser. 3. What is the strength at the receiving station as compared with that at the sending station? A. About 99·5 per cent after 3 seconds contact with battery.

(24) H. S. C. says: In your answer to F. H., you say that an engine generally works more economically when running at its full capacity. This is undoubtedly true of single valve engines, as a single valve cannot cut off at less than ¾ stroke without choking the exhaust and impairing its efficiency in a greater or less degree, according to the point of cut-off. But with an automatic cut-off, or even with a fixed one, I think it can be demonstrated theoretically, as it has been demonstrated practically, that there is great economy in having considerable surplus power in your engine. A. You have misunderstood our reply to F. H. The idea we intended to convey was, that under given conditions there is a point at which an engine will work most economically. This is the point at which it should be run, a point probably far within its full capacity.

(25) I. H. D. asks: 1. Why is a chamber used in a condenser for the exhaust steam to flow in? A. With a view to economy of space and efficiency of action. 2. Could not the steam be condensed in an exhaust pipe, and this pipe be connected with the air pump? A. Yes. 3. How much pressure must be given to a jet of water in the combining tube of an injector, so that it will gain velocity enough to enter a boiler, without flowing back into the overflow? A. It depends upon the proportions of the parts. As usually made, the injector will readily force water into the boiler from which it draws its supply of steam, and could be arranged so as to force against much higher pressure than that under which it was working.

(26) G. F. asks: 1. How large an engine could I supply steam to from a plain cylinder boiler, 9 feet long and 14 inches in diameter, of ¼ inch iron? A. You can use an engine of from 2 to 3 horse power. 2. Is a plain boiler safer than one with flues? A. Not necessarily.

(27) G. L. K. asks: 1. Can steam from a boiler with 60 lbs. force water into a cold boiler? A. Yes. 2. Is it possible to get a pressure in the cold boiler above the steam pressure in the steam boiler? I have seen an injector that is said to have forced water into a boiler having 80 lbs. pressure, the injector being operated from a boiler with 20 lbs. pressure. A. Yes. The philosophy of the matter is that a great deal of steam is used, and comparatively little water is forced into the boiler. It is something like a steam pump in which the water cylinder is only ½ as large as the steam cylinder, so that the water pressure can be 5 times the steam pressure.

(28) H. C. asks: 1. What pressure will a locomotive boiler of copper plates of $\frac{1}{10}$ of an inch thick, 6 inches in diameter, double riveted, stand? A. 40 lbs. 2. How large an engine will it run with firebox 8 x 8 inches and 8 inches high, and 22 half inch tubes 12 inches long. A. Make one 2 x 3 inches. 3. Which of these two engines, 5 x 6 or 4½ x 8 inches, is best for a boat 25 feet long and of 6 feet beam, drawing 6 inches at bow and 24 inches at stern? A. If you wish to compare them when running at the same power, we think the first is preferable on some accounts.

(29) O. A., Jr., says: 1. I have a steam engine with a plain slide valve. The cylinder is 7 inches bore by 9 inches stroke. Steam ports are ⅛ by 5⅛ inches, exhaust port is 1 inch by 5⅛ inches. Valve travels 1¼ inch; lead of valve is about $\frac{1}{16}$ inch, lap about $\frac{7}{16}$ inch, cutting off at about ¾ stroke. Engine runs about 240 revolutions per minute with 70 lbs. steam. Can I get more power out of the engine by changing those proportions? A. We do not think, from your account, that there is any need of a change. 2. Which kind of a return flue boiler is the most economical in fuel and water: the boiler that will hold 1½ barrel of water or the boiler that will hold 4½ barrels, the heating surface being the same in both boilers, and each being of 10 horse power? A. We imagine the difference, if any, would be unimportant.

(30) G. W. A. says: We use 60 lbs. steam on a 12 x 20 inches engine, running three burrs. If we keep just 60 lbs., it is pretty hard work; and it seems easier to let the engine stand and generate 80 lbs. What is the cause of this? A. Generally, an increase of pressure decreases the steam used per horse power, so that although it takes a little more fuel to make 1 lb. of steam at the higher pressure, there are fewer lbs. used to do the same work, and the high pressure is the most economical.

(31) J. R. B. says: I propose running a boat by a screw. She is to be 16 feet long and of sharp bow; of how large a diameter should the screw be? A. Make one 18 to 22 inches in diameter and of 2½ to 3 feet pitch, with a length of blade of 5 or 6 inches. Run it at 300 or 400 revolutions per minute.

(32) C. W. H. says: A boat is 100 rods from a stationary stump. A man in the boat is pulling 50 lbs. on a rope attached to the stump to pull the boat to the stump; and two men are in two separate boats 100 rods apart. Each man is pulling 50 lbs. on opposite ends of a rope between the boats to pull the boats together. The two boats are of equal weight, and all other conditions are equal. Will the one boat arrive at the stump sooner, later, or at the same time as the two boats come together? If not at the same time, how much sooner or later? A. As you have stated the proposition, the two boats would approach each other twice as fast as the single boat approaches the stump—for the reason that the rope is hauled in twice as fast in the first instance, as there are two men hauling it in, one at each end; and in the second instance only one man is hauling in rope, at one end, at the same rate as is employed by each of the two others.

(33) J. J. T. says: I wish to build a locomotive engine with vertical boiler 2 feet high. The cylinders are to be 2½ inches bore by 5 inches stroke. What diameter will the boiler be, and how many 1 inch tubes should I use to get the most power? How much will such a boiler, with all attachments and full of water, weigh? How much power will it develop, if well