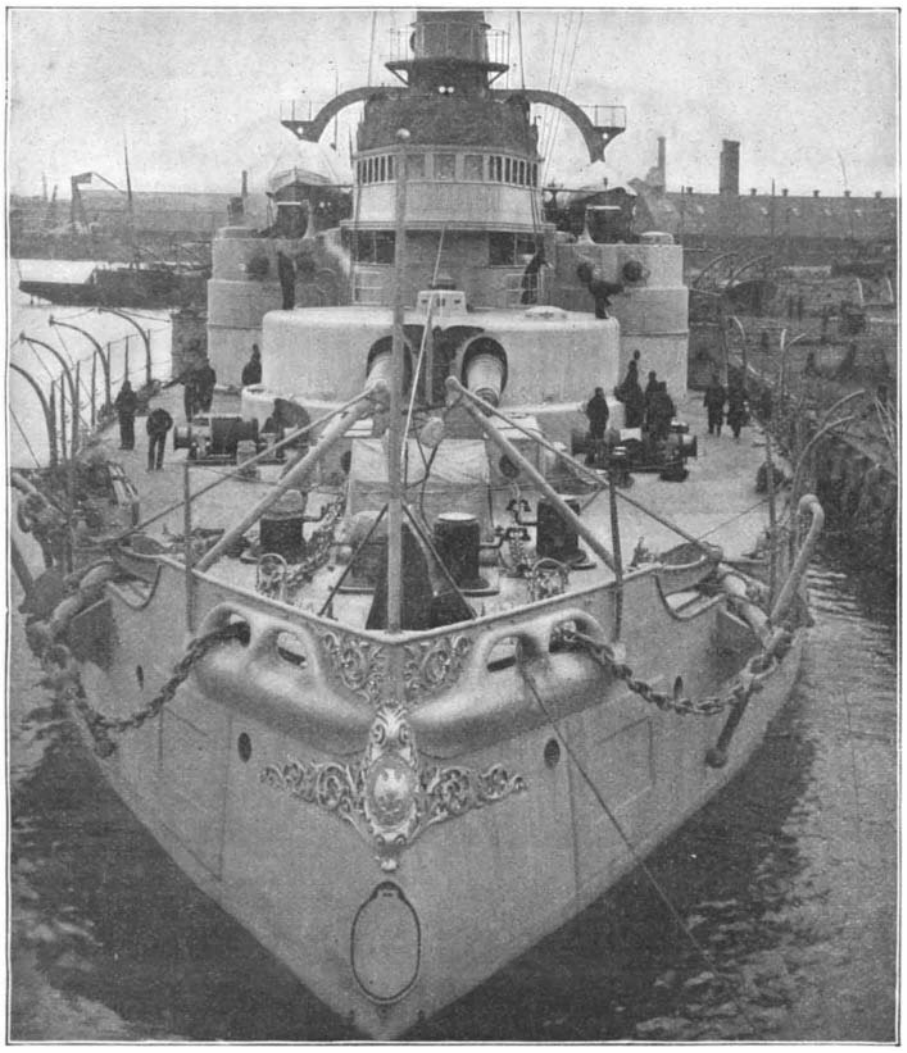
## REPAIRING THE KEEL OF A BATTLESHIP.

The illustrations which we present in this issue of the difficult repairs of the keel of the "Massachusetts" which are being carried on in the large, new dry dock at the Brooklyn navy yard are of special interest. We are all perfectly familiar with the terms "double bottom," "cellular construction," etc., as applied to warship construction, but it is a novel experience to be able to look, as we do in these photographs, right into this complicated portion of the anatomy of the modern battleship. That the readers of the SCIENTIFIC AMERICAN are able to do so in the present instance, is due to the fact that the injuries to the keel of the "Massachusetts," when she recently grounded on a reef in New York Harbor, were so serious as to necessitate removing the plates of her outer bottom for a length of over 100 feet measured fore and aft, and for a considerable distance on either side of the keel.

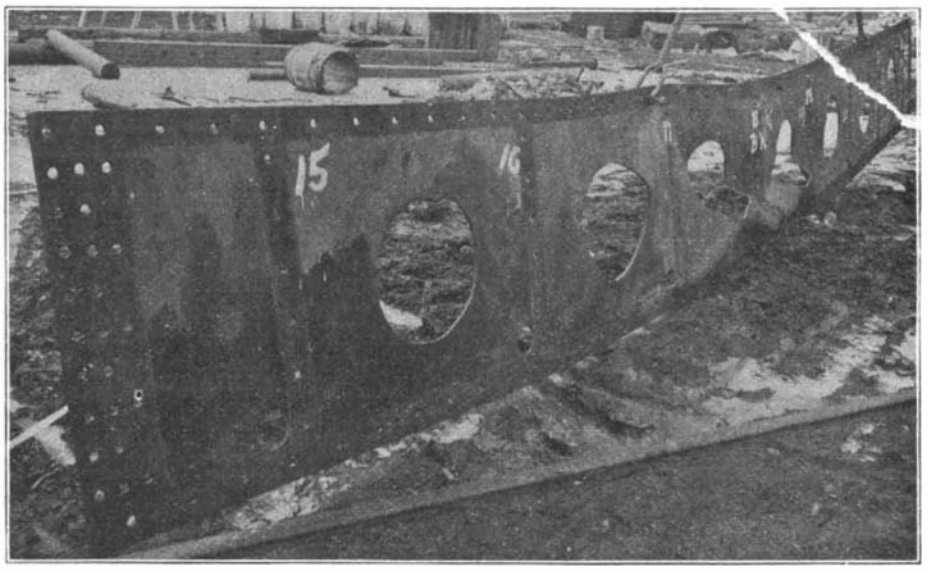
It will be remembered that this splendid vessel met with her mishap a few minutes after she had left the Brooklyn navy yard, with a full complement of coal, ammunition, general stores, etc., on board. She was drawing at the time 26 feet 4 inches of water, and it was supposed that she would be able to clear the shoals in the channel on her way down the bay with a safe margin to spare. As she was passing what is known as the Diamond Shoal, however (the dangerous reef which extends across the channel off Governor's Island), she touched bottom and forced her way bodily through the reef of sand. At the time of the grounding there was only 24 feet 5 inches of water above the shoal, so that the battleship had to cut a channel for herself, which was about 2 feet in depth. The reef consists chiefly of firm sand, and as the impetus of the vessel carried her through it the enormous pressure against her bottom buckled the outer plating between the frames, and in some cases buckled and pushed upward the framing itself. It speaks volumes for the excellent quality of the mild steel of which the ship is built, that only in a few cases was there any actual fracture of either frames or plating. A large number of the plates that were taken off the bottom were heated, straightened, and found to be perfectly serviceable for riveting into the ship again. The injuries extended from frame No. 16 for over 100 feet aft, and the correctness of the theories upon which the outer and inner bottom of a ship and the framing between them is constructed is shown by the fact that although the outer bottom is so badly crumpled, and the framing buckled and generally distorted, the inner bottom was found to be absolutely intact, and therefore thoroughly watertight. What flooding there was was confined entirely to the double bottom.

The repairs which are now being carried out on the ship are among the most difficult and expensive ever made in our navy. It is probable that they will cost between $40,000 and $50,000 before the ship again leaves the dry dock. Fortunately, the new dock, No. 3, which, it will be remembered, was handed over to Naval Constructor Bowles for repairs at the time of its collapse, has been placed in thoroughly serviceable condition and has proved to be absolutely watertight. When the "Massachusetts" returned to the yard, she was floated into this dock and the very difficult and delicate work of settling the big battleship, which weighs in all about 12,000 tons, upon the blocks, was carried out with a success which reflects the very highest credit upon Mr. Bowles and his assistants.

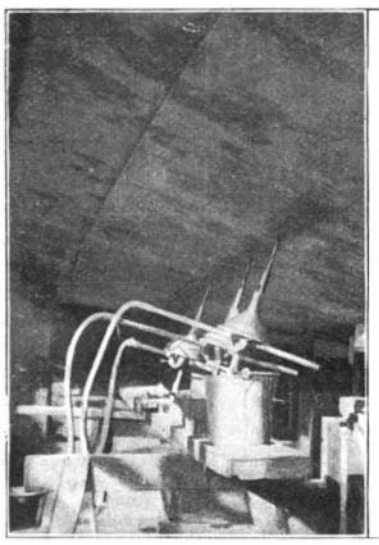
As we have often explained in these columns, when a ship is in dry dock her weight is carried by a line of keel blocks which are placed immediately beneath the keel, and by two lines of bilge blocks, one on each side of the vessel. In the present case it was impossible to support the forward injured portion of the vessel upon the keel blocks, and the weight had to be carried by means of



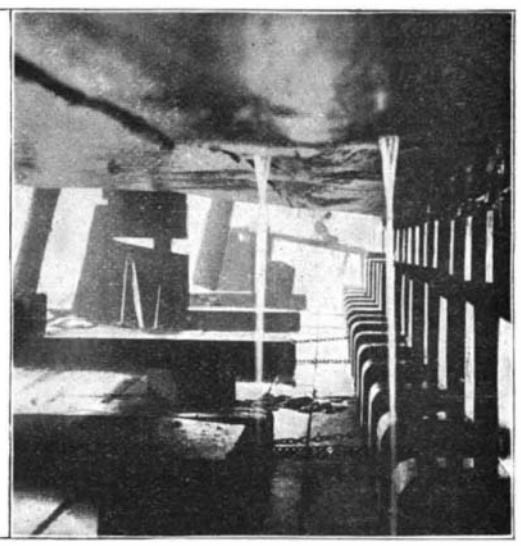
1.—Bow View of First-class Battleship "Massachusetts," Now Undergoing Repairs to Keel.



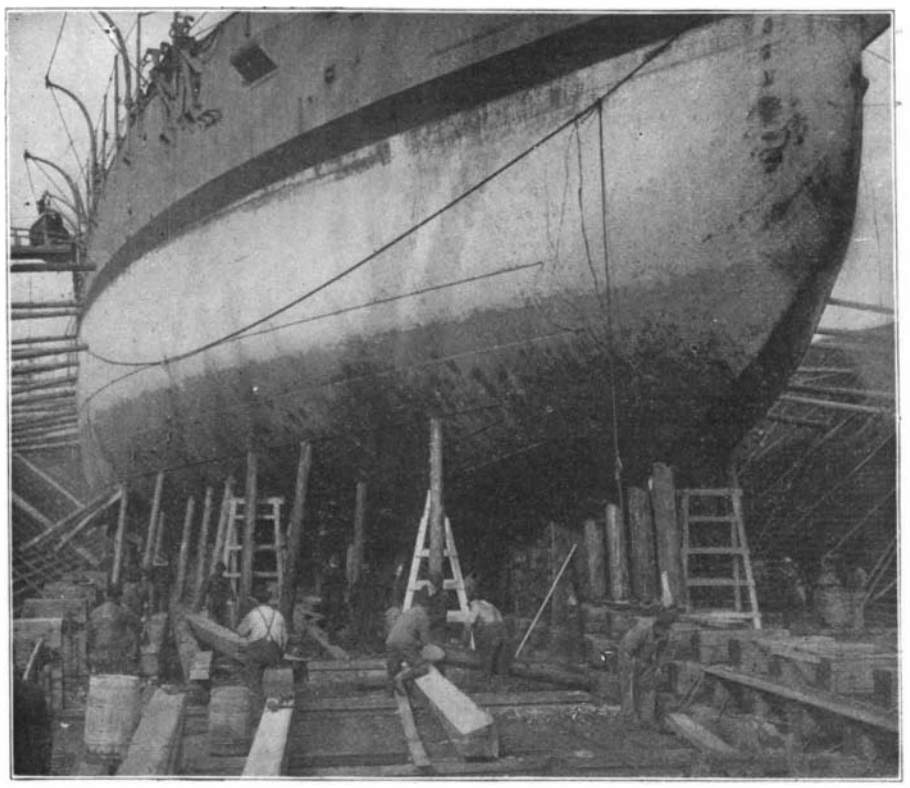

2.—Damaged Vertical Keel-plate Taken from Between Frames 14½ and 22½.



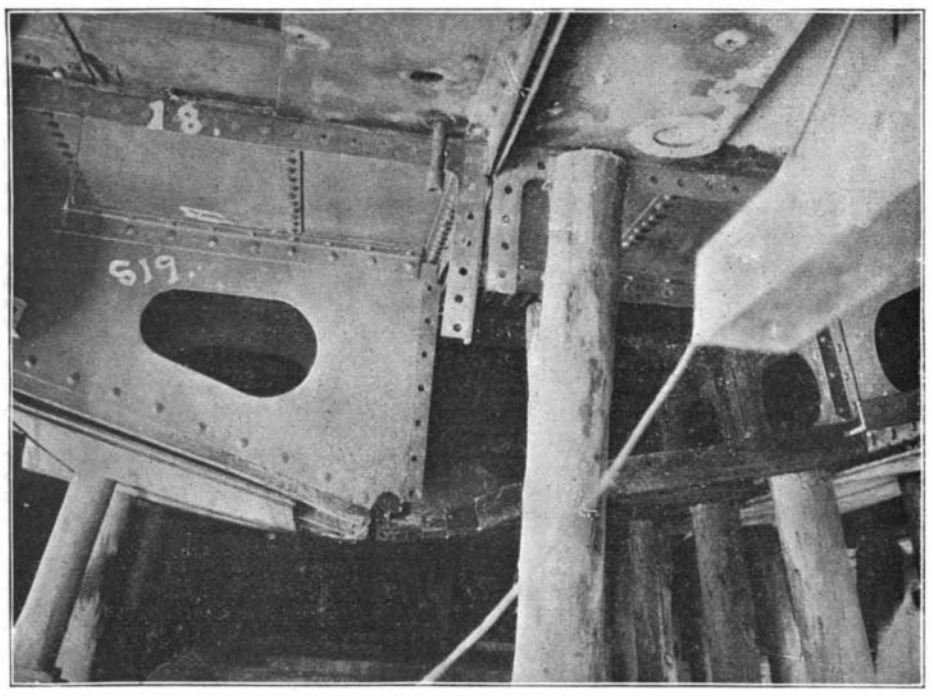
3.—Pneumatic Drills Drilling Out Rivets from Damaged Plating.



4.—Damaged Garboard Strake, Port Side, Looking Forward—Keel Block Seen at Right of Cut.



5.—Bow View of Ship when Water was First Pumped Out of Dock, Showing Method of Shoring.




6.—Showing Double-bottom Construction—Outside Plating and Section of Vertical Keel Removed.

lines of shores which were placed beneath the two longitudinal girders which are within the double bottom, one on each side of the keel, and about 7 feet distant from it. These shores are shown clearly in Fig. 6.

The work of taking out the damaged plates, straightening them, and riveting them again in place, or, if they were too much damaged, replacing them by new plates, was done in sections; for it would not have been advisable to weaken the ship by disconnecting too much of the structure at one time. Our illustration, No. 3, shows the method of cutting out the rivets.

This was done by means of pneumatic drills, which drilled do in through the shank of the rivets sufficiently to allow them to be driven inward. clear of the plate, by means of a punch and sledge hammer. Half a dozen blows of the sledge were sufficient, usually, to drive out the rivet. When all the rivets had been removed, the plate would come away easily from the framing. Illustration, No. 4, shows the line of keel blocks on the right; some of the shoring pieces on the left; and above is the damaged garboard strake on the port side of the ship (the view being taken looking toward the bow of the vessel). The water is pouring from the double bottom through a couple of fractures in the plating, and the indented or corrugated appearance of the bottom is very clearly shown in this photograph. Perhaps the most interesting view is that shown in No. 6, which was taken looking aft along the center line of the keel after about 30 feet of the keel plate had been removed. This keel plate is shown in Fig. 2, and it will be noticed that the most serious distortion took place at frame No. 18. The view, Fig. 6, looking into the inner bottom, is quite unique, for it is very rarely that the camera has a chance to be set up in such a position as that from which the photograph was taken. The heavy shoring beneath the two longitudinals, which are 7 feet on either side of the keel plate, is seen clearly in this view.

These difficult repairs are proceeding very satisfactorily, and it is likely that before many weeks the "Massachusetts" will be afloat and in as sound condition as when she was launched.

The grounding of the "Massachusetts" will have served a good purpose if it leads to an immediate appropriation for removing the dangerous Diamond Shoal from the channel. As it now stands, this obstruction is a menace to every large warship that enters or leaves the Brooklyn navy yard.

### A Double-Barrel Cannon.

In Athens, Ga., is a curious cannon which is now owned by the city and is placed on the City Hall lawn. It is probably the only double-barrel cannon of the kind in the world. It belonged to the "Mitchell Thunderbolts," a company of old men which was organized in Athens in 1863 for home defense. One of the company, John Gilleland, invented this cannon and had it cast at the Athens foundry. The idea was one of considerable ingenuity, but was entirely impractical. The ends of a 50 foot chain were attached to two cannon balls which formed the charge, and the idea of the inventor was that when the cannon balls came out of the muzzles of the cannon they would have a tendency to diverge, drawing the chain taut, and as they proceeded on their course would mow down a company. The cannon was taken out into the country, near Athens, one day to test it. It was properly charged and was fired with ceremony. Unfortunately, one of the cannon balls got out a little ahead of the other and the result was disastrous. Projectiles and chain had a kind of circular motion and plowed up about one-quarter of an acre of ground. The members of the Thunderbolt Company scattered in all directions to avoid being hit by the flying chain. The cannon was never used after that except at an occasional jubilee, when charges of powder was fired. A few years ago it disappeared, and finally it turned up in a junkshop, and was promptly purchased by the city. The owner of the cannon had been offered $50, but when he learned that the city wished the cannon, he promptly refused the offer and traded it with the State for an old bell.

### Photography as an Aid to Exploration.

In a lecture delivered by Flinders Petrie, entitled "Photography the Handmaid of Exploration," he showed to what an enormous extent exploration has been aided by photography, and when we examine such books as Davis' "Carthage," we see to what extent explorations were handicapped in the days when photography was just coming into use. Especially in Egypt the success of photography is very great, owing to the splendid atmospheric conditions and fine sunlight which prevail in that country. Mr. Petrie finds that the great difficulty was in obtaining plates which were slow enough. With the aid of the camera not only can the actual finds be photographed, but the exact condition of the objects in situ can be recorded, furnishing valuable data. With the aid of the new surveying cameras the results will prove even more valuable. Some very valuable finds are of such a nature that they cannot be well removed, and in this case photography is also invaluable. Nowadays all explorers go equipped with the best photographic apparatus which money can purchase and an adequate supply of photographic materials.

### The "Chicago" in Commission.

The "Chicago" left the Brooklyn navy yard on February 6, and will proceed to New Orleans to represent the Navy Department at the Mardi Gras festival on February 13. This is the first time the "Chicago" has had any sea service in four years. During the last two years she has been under reconstruction, and we have already illustrated the novel features of the remodeling. During the trip her guns and speed will be tested, and on returning from New Orleans she will join the North Atlantic squadron at Hampton Roads.

### The Current Supplement.

The current SUPPLEMENT, No. 1207, has a number of articles of more than usual interest on account of the variety of the subjects treated. The largest and most complete yacht built last year in Great Britain, for Baron de Rothschild, is illustrated and described. "The Mutoscope" is illustrated by detail engravings showing how this very interesting American invention is worked. "Bridges over the Tiber in Ancient Rome" is an interesting illustrated article. "Women Inventors" will be warmly welcomed by many of our readers who have been inquiring for information on this subject. "Kieselguhr and Other Infusorial Earths" is an important paper. "In German New Guinea" is an illustrated article. "Low Temperatures," "Is the World Nearing Starvation?" and "Tuberculosis in Animals" are all interesting articles. "The Honey Bee" is a valuable article dealing in a popular way with the wonderful structure and performance of the bee.

### Contents.

(Illustrated articles are marked with an asterisk.)



## RECENTLY PATENTED INVENTIONS.

### Bicycle Appliances.

PNEUMATIC TIRE.—ARRAH J. WHISLER, 180 Warren Avenue, Chicago, Ill. This tire has two layers of rubber with a layer of fabric between. The inner layer of rubber laps over for a considerable distance when the tire is put together and is fastened by cement and head-and-socket clasps. If a puncture occurs, the tire may be easily ripped open, and, after the puncture has been repaired from the inside, it can be fastened together again.

BICYCLE COUPLING.—FRANK BARTO, 150 Fifth Avenue, New York city. The object of this coupling is to allow of two bicycles being easily and quickly separated. Each cross connection is made by two metal inverted triangular yokes fastened together at their points by a flexible coupling. The upper base of the yokes pass through sockets that are clamped to the bicycle frame and have an up-and-down motion in them, thus allowing for inequalities in the road. Diagonal brace wires connect opposite sides of one of the cross connections with opposite sides of the other, and are tautened by a turnbuckle at their crossing place. Another cross connection with clamps on both forks of each wheel completes the coupling. To separate the bicycles, it is necessary only to unfasten the flexible couplings of the triangles and fold the latter back beside the frame of the wheels, and, at the same time, the brace wires may be loosened and unfastened.

BACK-PEDALING BRAKE.—CHRISTIAN H. SCHLAF, Springfield, Mass. This invention consists of a free running sprocket wheel driven by a smaller driving disk by means of dogs and lugs on the latter, which engage ratchet teeth in a ring on the surface of the sprocket. The driving disk has ratchet teeth on its periphery arranged so that when back pressure is applied a dog catches in one of these teeth and presses a band brake against a flange on the inner edge of the sprocket. When the forward pressure on the pedals is stopped, the driving dogs slip past the teeth in which they normally engage, thus allowing the machine to coast till a backward pressure is exerted. By means of the band brake on the sprocket, the wear and tear of a tire brake is avoided.

### Household Inventions.

FOLDING TUB OR SIMILAR VESSEL.—J. A. SHEARER, Langley, Canada. The tub, pail, or similar article is made of canvas or rubber and has two stiff wire rings fastened in the material at top and bottom. The bottom ring projects somewhat beyond the bottom diameter of the vessel in order to allow wire brace rods, which are hooked around the top ring, to be sprung in place. These rods hold the vessel in shape while it is in use, after which it is easily folded for packing away.

CLOTHES RACK.—LOUIS A. WIECHEL and DAVID HIMMELHEBER, Evansville, Ind. This rack consists of a semicircular hanger projecting outward horizontally from a wooden support adapted to be hung on the wall. The hanger is made up of wedge-shaped radial center supports with spaces between to receive the ends of the arms. These are pivoted upon a semicircular pintle-rod, which passes through rectangular slots in the arms. The slots allow the arms to be advanced horizontally a little, thus withdrawing their ends from under a ledge and allowing them to assume a vertical position when not in use.

### Miscellaneous.

WINDOW AWNING.—JOSEPH W. BUCK, Washington, D. C. The improvement in this awning consists in its being hung by cords passing through pulleys at the top of the window-frame. This arrangement allows of the awning, when dropped flat against the frame to act as a blind, being lowered from the top for ventilation. The cords which raise the lower end of the awning are rove through eyelets in it, so as to make even folds when the awning is raised.

CHANDELIER FOR PIANOS.—PETER ANDERSON, 456 College Avenue, New York city. The object of this invention is to attach a candlestick to the front panel of a piano or organ so that it will always be in a vertical position when the panel is inclined. The bracket holding the candlestick is pivoted horizontally to a flat bracket fastened to the panel and its end passes through this bracket and the panel. A rod extends downward from the end of the bracket and has a slight vertical motion in a suitable bearing. Another rod reaches upward from the fulcrum of the bracket and is similarly fastened in the piano top. When the panel is inclined, the rods allow the bracket to move upward slightly, at the same time retaining it in its original vertical position.

COMBINED WHIP-SOCKET AND REIN-HOLDER.—GEORGE W. HYDE, St. Paul, Neb. The feature of this device is its simplicity of construction. It consists of a pair of jaws for holding the reins, the inner one of which forms one side of a saddle-frame which fits over a support. The other side of the saddle-frame forms the inner side of the whip-socket, and the rest of the socket is formed from the same piece. Both holder and socket are formed from a single piece of spring sheet-metal. A simple clamp consisting of two beveled uprights bolted to the support on each side of the jaws and having a U-shaped cross-piece that fits around the outer jaw and presses against it, regulates the grip of the jaws by the cross-piece being fastened at different places on the beveled side-pieces.

COMBINATION AX AND CUTTER.—WILLIAM GARLICK, DAVID MURRAY, and ALFRED O. HOWSE, Wingham, New South Wales. This tool is designed for farmers who have to shoe their horses. It is an ordinary ax head, having two semicircular apertures in the case-hardened back edge, which act as cutters for cutting off horseshoe heads. In the center of the flat surface of the head is an aperture shaped so as to receive one end of a horseshoe. After the ax has been driven in a log, the horseshoe can be bent to the desired shape by placing the end in this aperture and hammering the shoe; or a portion may be cut from the heel of the shoe by hammering it on the cutters on top.

INCANDESCENT GAS LAMP.—ADALBERT KEYSSER, Hanover, Germany. The object of this invention is to protect the incandescent mantle from direct draught and also obtain a higher illuminating effect. This is accomplished by having an air chamber in the porcelain globe-holder. The air enters the chamber through small holes in the top, after passing downward between the chimney and surrounding globe. It becomes highly heated in this chamber, is drawn into the burner tube through the inlet apertures of the Bunsen burner, and is carried upward to the burner by the rising current of gas. A steady, intense light is thus obtained, while the tearing or bursting of the incandescent mantle, which results from direct impact of the air, is obviated.

ELECTRIC LAMP.—JOHN SLOANE MEAD, Mount Vernon, N. Y. This electric lamp consists of a containing tube in which several cells of a storage battery are placed end to end, the connection between cells being made by the contact of the bottom of one cell with the top of the next one. In one end of the tube is a small incandescent lamp set in a parabolic reflector behind a lens. A contact button of special design is suitably connected in the circuit so that by pressing it the lamp may be lighted at will. The containing case is uniform in shape and may be easily carried in the pocket.

PURSE OR BAG-FRAME.—JOHN KLEINSTUBER, 430 Broome St., New York city. This invention consists of a frame having pointed binding extensions by means of which the fabric is bound to the frame in a simple manner, thus avoiding the necessity of riveting the fabric to the covering channel-shaped frame bars. The fabric is first fastened to this frame, after which the frame is clamped in place in the covering frame bars of channel shape.

SEWING-AWL.—CHARLES A. NELSON, Gladstone, Mich. The stem of this awl consists of two parts, one fixed and the other movable upon it. An eye in the movable part of the stem is uncovered by working a catch on the handle of the awl. This enables the manipulator to slip in a thread easily after the point has been passed through leather, and, after closing the eye again, to draw the thread through the hole as the awl is withdrawn.

ICE CREEPER.—CHARLES G. BLANDFORD, Sing Sing, N. Y. This simple device consists of a wire in the shape of a double bow, two ends of which hook over the sole of the shoe at the instep, the other ends uniting in a loop which slips over the toe. At the points farthest apart on the two bows, and at the forward point where they cross, are spikes having cruciform bases through which the wires pass. A sinuous wire connects the two opposite points, and its ends hook over the sole.

ROTARY TOOTH-BRUSH.—ADRIAN MARIE WILLEM TER LAAG, Philipsburg, St. Martin, West Indies (via St. Kitts). This rotary-brush is fastened to the end of a shaft which revolves in a casing and is turned by a handle moving on a thread at its further end. Half of the brush is covered by a shield so as to protect the mouth when brushing the back of the teeth. The brush is easily removed from the shaft and replaced with a new one. There are several designs of rotary-brushes to choose from. The advantages of this form of brush are that it brushes in the direction of the bars of enamel and between the teeth in an efficient manner.

PERCOLATOR-PACKAGE.—HENRY M. HUMPHREY, Plainfield, N. J. In the present invention a package is provided for coffee and tea-pots, which is designed to contain the tea or coffee to be infused or boiled. The package is made of a porous fabric, such as muslin or cheese-cloth, and is provided with a weight whereby it is held in position. The weight assists the package in its downward course and serves constantly to change the position of the package so that the hot water will have free contact with all the surface. The weight is, moreover, so constructed that it may be employed to direct the coffee-containing package from a coin-operated machine. It is evident that the package can be made of such size as to contain coffee or tea enough for one cup or for two or more cups. After the coffee or tea has been thoroughly exhausted, the bag can be removed and the pot left entirely free from all grounds.

### Designs.

CUT GLASS VESSEL.—T. B. CLARK, Honesville, Pa. The design is a bowl-shaped vessel with scalloped edges, the surface of the bowl being divided into four triangular-shaped pentagons circumscribed around a quadrilateral space in which is a diamond-shaped rosette. The main feature of the design consists in a lapidary figure faceted in imitation of a diamond, which is inscribed within a circle in each of the five pentagons. The pentagons are separated by radial fields made up of rosettes bounded by ornamental radiating bands.

BUTTON-HOLDER.—ADOLPH SAMETZ, 212 Wooster St., New York city. A rectangular card having T-shaped openings with eyelets at each end of the horizontal slit. The corners at the juncture of the two slits are curved outward.

BACK-BAND HOOK.—HUGH P. QUIN, Washington, Ga. The upper half of this hook is broad, and contains a shield-shaped opening with a small hole near each point of the shield. The lower half tapers inward and contains a U-shaped opening, from the bottom of which a hook rises and curves inward, terminating in the center of the opening.

POCKET FOR GREASE-CANS.—ALDEN CROCHERON, Salt Lake City, Utah. This pocket is designed to be fastened to the exterior of a grease-can for the purpose of holding a swab. Attached to one side of the interior is a curved, flat, steel spring, which clamps the brush when inserted. The bottom of the pocket is inclined inward and downward toward the surface of the can. It makes a very complete and convenient device for the purpose mentioned.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for 10 cents each. Please send the name of the patentee, title of the invention, and date of this paper.