light is operated in a lighthouse. They will be rung simultaneously at the beginning of each minute, and at the end of 20 seconds bell No. 1 will sound one stroke, and 20 seconds later bell No. 2 will sound two strokes, each bell thus declaring its identity.

Prof. Gray invented an electrical receiver to determine the direction of the origin of the sound. It therefore becomes a simple task to draw two lines on the chart at the ascertained angles, one from each charted signal bell, and where these two lines intersect there will be the position of the ship.

Prof. Gray invented an improvement by means of which his electrical receiver operates automatically a gong in the pilot house whenever the ship comes within a given distance of one of the submerged bells. Thus a submerged bell placed near a dangerous reef would set up an automatic alarm on board any ship thus equipped the moment she came within the radius of danger. This device would have saved countless lives and thousands of vessels which have been lost by getting out of their course and going to destruction when their commanders were off their guard, because they thought themselves perfectly safe.

It is, of course, obvious that vessels equipped with both sound-producing and sound-receiving apparatus may avoid collision, and send and receive intelligible messages to and from each other when they meet at sea. Also that lightships may be put in communication with shore stations, and that vessels passing along the coast may likewise send and receive messages to and from the shore.

Gray and Mundy patented a bell which is rung electrically, but without being struck percussively. Nothing touches it as it hangs motionless in either the air or water, but by depressing a common Morse key an electric circuit is made, which sends an alternating current to electro-magnets contained in the cavity of the bell, as shown in the detail view, and the magnetic lines of force thus created vibrate the bell continuously as long as the current is maintained, causing it to sound forth like a great organ pipe, but with tremendous power.

The successful ringing of a bell by this method depends upon sending precisely the proper number of impulses to the electro-magnets, and this in turn depends upon maintaining an absolutely uniform rate of speed in the motor driving the generator. The slightest change of speed will silence the bell. Prof. Gray could find no governor sufficiently sensitive to hold the speed uniformly to the rate called for by the fundamental tone of the bell; he therefore invented a device for this purpose. It is efficient and simple.

VIII. MERCURIAL BAROMETER.

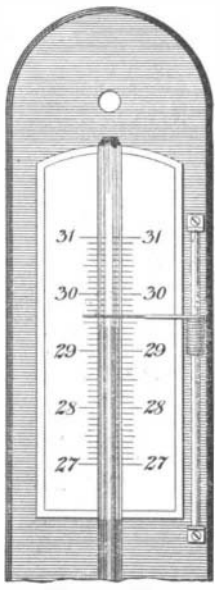
BY GEORGE M. HOPKINS.

The variations of atmospheric pressure are shown by the barometer. The pressure of the air in round numbers is 15 pounds per square inch; that is, a column of air 1 inch square, the height of the atmosphere (which is not positively known), weighs 15 pounds, and will balance a column of water 1 inch square and 34 feet high, or a column of mercury 1 square inch in area and 30 inches high.

A mercurial barometer is here shown on account of facility of construction and the accuracy of its operation. To make the simplest form of mercurial barometer, a strong glass tube a little more than 33 inches long and about 3-16 inch internal diameter is required. It must be sealed at one end, and left open and contracted to ⅛ inch at the other. This work is readily done by a glass blower. The open end is fused to remove the sharp edges. A small glass bottle is provided, the body of which is about 1 inch internal diameter and 1½ inches high. The neck is short and a little larger internally than the outside of the tube A board ⅞ inch thick, 3 inches wide and 39 inches long has a shallow half-round groove to receive the glass tube, and two brass straps extend over the tube and are clamped to the board by means of screws. Near the bottom of the board a hole is cut for the glass bottle or cistern, as it is called; a small shelf is secured by screws to the back board, even with the lower side of the hole in the board. A small hole is made in the back board near the top to receive the nail or screw upon which the instrument hangs.

Of course all the parts will be tried in place before attempting to fill the tube with mercury.

The tube must be perfectly clean, and only re-distilled mercury should be used. In the bottom of the glass bottle is placed a layer of pure beeswax 1-16 inch thick. The wax is made smooth and level by melting it by gently heating the glass bottle over an alcohol or Bunsen gas flame. When the wax is cold the filling of the tube with mercury may be proceeded with. The tube and the mercury are first warmed by passing them over an alcohol or gas flame; then mercury is poured into the tube through a small paper funnel. The tube should be filled to within ½ inch of the end with mercury. Then the clean, dry forefinger is held over the open end of the tube and the tube is placed in a horizontal position and tilted one way and then the other, to allow the bubble of air to gather up as much as possible of the air contained in the tube. The tube is then placed open end up and entirely filled with mercury. It is then inverted while it is kept closed by the finger. The end of the tube is placed below a body of mercury in a suitable vessel and a little of the mercury is let out so as to produce a partial vacuum at the top. Then the tube is closed and again turned into a horizontal position and tilted in one way and then the other, and at the same time turned or rolled over so as to cause the bubble to gather up any air

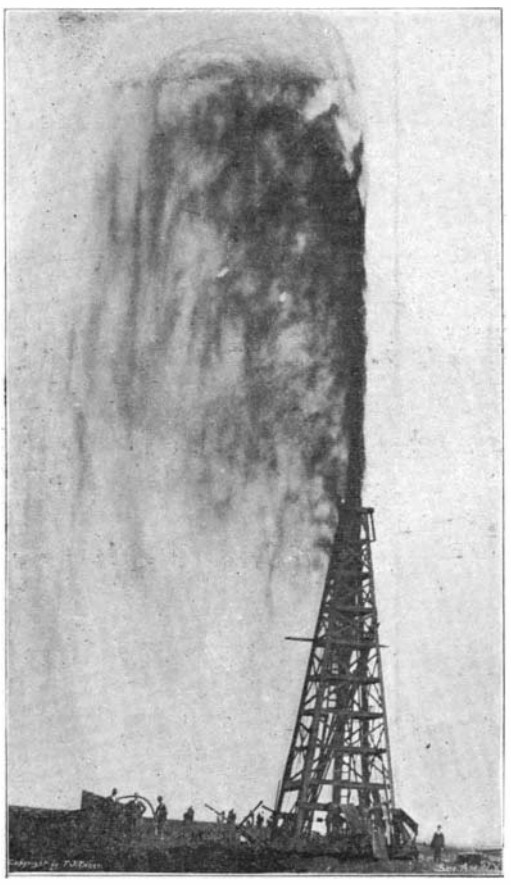


SCALE AND INDICATOR.

MERCURIAL BAROMETER.

that may remain. The tube is again inverted and filled, until it is entirely full of mercury. The finger is again applied, and a vacuum is produced by allowing a small amount of mercury to escape, when the tube is vertical as before. It is closed and tilted, allowing the bubble to again gather air. This operation is repeated two or three times. The tube is finally inverted and filled with mercury, so as to present a convex surface above the open end of the tube. The glass bottle containing the wax is placed over the open end of the tube and pressed down, causing the wax to make a good contact with the end of the tube.

The bottle is held firmly in place by the finger, and



THE BEAUMONT OIL WELL.

the bottle and the tube may now be inverted together, and after putting a little mercury in the bottle, the latter may be placed on the shelf prepared for it, and the tube may be raised a little, so as to clear its open end from the wax, and the tube is fastened in place by clamping it with the brass strips and screws. More mercury is added to that in the bottle so as to make the depth about ¾ inch above the lower end of the tube. A quantity of clean cotton wool is placed in the mouth of the bottle around the tube, to exclude dust, at the same time to admit air freely. The barometer is now finished with the exception of the scale.

A scale of inches ¾ inch wide and 4 inches long is laid out in the center of a card 2½ inches wide and 6½ inches long. Each inch is divided into tenths, and the divisional lines for the inches and half inches are extended beyond the ¾ inch limit. The beginning of the scale is numbered 27. The upper end of the first inch is numbered 28, the second inch is numbered 29, the third inch 30, and the fourth inch 31. The scale is placed behind the tube and the division line corresponding with the line at the top of the mercury in a standard barometer is placed in the same position relative to the mercury, and fastened by small tacks.

To enable the observer to mark the neight of the column of mercury, so that he may compare the present observation with the previous one, an indicator is provided, which consists of a rod supported by posts attached to the board, and a short section of spiral spring placed on the rod, with the upper extremity straightened and extending over the barometer tube. This end of the wire is flattened by hammering to make a more delicate index.

In a general way the changes of the barometer are given, but they must be taken with some allowance. High winds and storms usually follow the sudden drop of the mercury. The rising of the mercury generally indicates fair weather; the drop of the mercury indicates bad weather. The fall of the mercury in sultry weather is followed by thunder; the rise of the mercury in winter indicates frost. In frosty weather the fall of the mercury precedes a thaw, and the rise is followed by snow. Sudden changes in the barometer indicate similar changes in the weather. Continued foul weather may be expected if the mercury falls slowly; on the contrary if it rises slowly continued fair weather may be looked for. Changeable weather is indicated by an unsettled barometer.

It is perhaps unnecessary to caution the maker of the barometer to conduct the various operations of filling and adjusting above a large platter or piece of smooth paper, with the edges turned up to avoid unnecessary waste of mercury.

THE BEAUMONT OIL WELL.

The well at Beaumont, Texas, has the reputation of being the largest "gusher" yet located in the United States. It is estimated that fully 150,000 barrels of oil escaped from it before the flow could be controlled. Already a large territory in its vicinity has been sold to oil companies, and it is probable that the country between Beaumont and Corsicana will be thoroughly exploited within the next year by prospectors.

The well was struck on January 10, 1901, by Capt. A. F. Lucas, a geologist, of Washington, D. C., who has been prospecting for oil in this section of Texas for about two years.

While the men were at work on the derrick they noticed a commotion in the well, and hastily retiring had no sooner reached a safe distance when the well burst with a terrific noise, and 600 feet of four inch iron pipe was shot from the well and sent 600 feet into the air. The pipe was followed by hissing gas and oil which spouted 150 feet into the air. Almost immediately the stream settled down to pouring out pure oil, and from that time until the evening of January 16 the solid stream of oil continued to pour without a particle of diminution into the air. On January 18 the flow of oil was well under control. It fell to ground in a mist and ran off in a small river into a ravine or valley below, where it formed a lake which was ultimately overflowed and the oil continued down the regular watercourses to the Gulf of Mexico. The stream of oil is six inches where it issues and spouts fully 150 feet high in a solid body, then sprays. Experts have estimated that it flowed 20,000 barrels of oil every twenty-four hours. The oil has a specific gravity of about 24 degrees and is a good lubricating grade.

The mayor of Toledo said in relation of this well to the oil industry, after an examination of it:

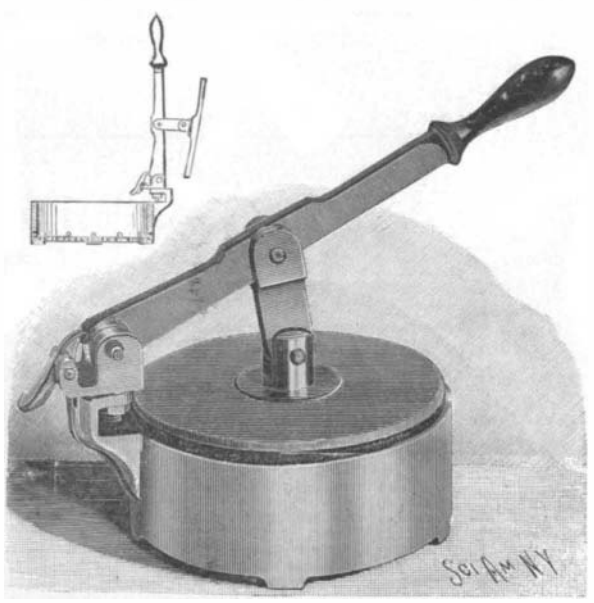
"I think it the greatest oil well ever discovered in the United States. It is fortunate, for the oil trade, that it is not illuminating oil. If it were it would paralyze the entire industry. Its advent, however, means that liquid fuel is to be the fuel of the twentieth century. Smoke, cinders, ashes and soot will disappear along with war and other evidences of barbarism. The new oil well means a cleaner as well as a better civilization.

"Practically the only market for it is for fuel and road making. Texas should use millions of barrels for the latter purpose. Both these markets, however, must be created, and this means that before a market can be established two things must be demonstrated beyond question: first, that there is a great area of oil-producing territory and that the supply is inexhaustible, and this can only be done by drilling many wells; second, after the fact of the existence of the territory is demonstrated, it will be necessary to secure the confidence

of the consumers of fuel oil, and this can only be done by the accumulating of a stock of from 10,000,000 to 40,000,000 barrels on top of ground in iron tanks. This means an investment of millions of dollars and systematic organized effort for several months, possibly a year or two, before this oil market is firmly and satisfactorily established."

PRESS FOR PREPARING FOMENTATIONS.

The inconvenience and difficulty of preparing bandages for fomentations by hand are overcome by a simple press which has been invented by Mrs. Mary Jordan Smith, of New York city, and which performs its work far more effectively than would otherwise be possible. The making of the press has been undertaken

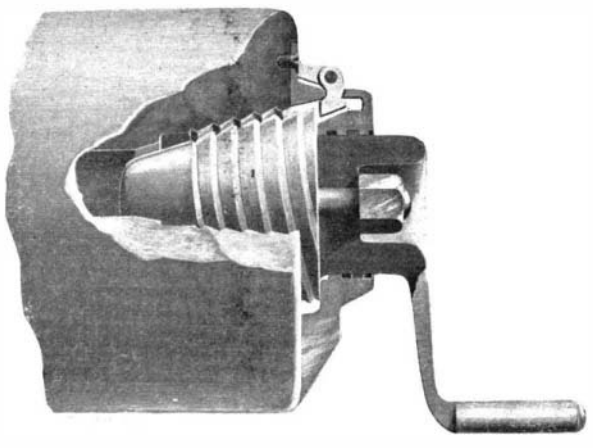


PRESS FOR PREPARING FOMENTATIONS.

by George Tiemann & Co., 107 Park Row, New York city.

As shown in our engraving, the press is composed essentially of three parts—a receptacle, a lever and a pivoted plunger carried by the lever. The bottom of the receptacle is perforated to permit the escape of water. The lever is mounted on a bracket to swing both in a circle horizontally, and up and down, so that the plunger may be either depressed in the receptacle or raised and carried to one side.

In service, the bandages having been placed in the receptacle, hot water or any medicated solution is poured over them. The lever is then swung around to bring the plunger over the bandages. By pressing downwardly on the lever, the plunger is made to force water out of the bandages, through the perforated bottom of the receptacle. In order to prevent an upward movement of the plunger when the lever is released, a spring-pressed detent is employed which is pivoted on the bracket and which coacts with teeth on the pivoted end of the lever. After the surplus water has been expressed, the detent is released and the lever swung up and aside in order that the apparatus can be carried to the bedside and that the bandages can be readily removed.



A DOUBLE-THREADED BREECH-PLUG.

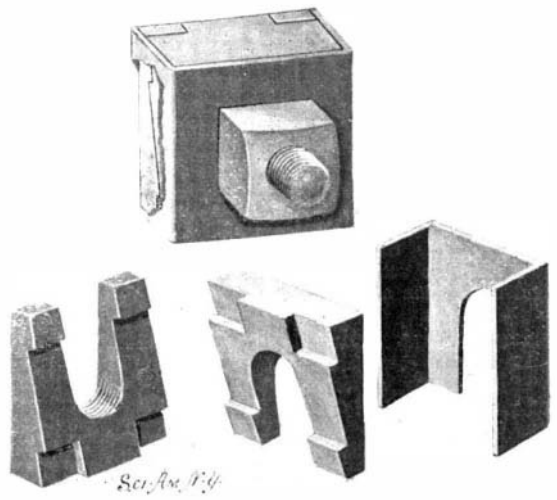
The advantages of the invention are obvious. The hands need never come in contact with the bandages during the operation of the device. The bandages, retained as they are in the receptacle and thus carried to the patient, retain their heat for twenty minutes, a result which testifies to the efficiency of the instrument. In preparing fomentations, it is the custom to bring to the bedside the several utensils which are required. Not only is the fomentation prepared with difficulty, but the moral effect of the utensils on the patient is often harmful. The press described simplifies the preparation of fomentations by dispensing with these utensils and enables a bandage to be prepared without the knowle the patient.

NOVEL INVENTIONS RECENTLY PATENTED.

Sometimes it happens that a bolt cannot be removed or that a much-worn thread prevents a removal of the nut. For such emergencies Alfred S. Seaman, of Frackville, Pa., has invented a simple relief-nut, which also serves as a washer and as a time-saving device for fitting a new washer or nut without stopping the machinery. The relief nut is substantially composed of two wedge-shaped nut-sections, slotted from their ends to form arms. The free ends of the arms of these sections have hooks, which interlock with seats on the opposite ends of the abutting section, so that the sections embrace the bolt. When they are applied and fitted tightly, the relief-nut sections can be removed only by releasing or turning the bolt-nut outwardly. A flanged cap is fitted over the relief-nut and forms a bearing for the bolt-nut and a retainer for the relief-nut sections. The device can be applied to the head-ends of partially-worn foundation-bolts and other bolts under great strains. The improvement can also be used when the bolt is battered or riveted, or when the thread is stripped or does not extend to the surface against which the nut is to be turned.

A very simple and ingenious improvement in breech-blocks has been devised by John F Meigs and Sigard A. S. Hammar, of South Bethlehem, Pa., which improvement not only strengthens the connection between breech and plug, but also increases the rapidity of fire. The plug is formed with a continuous, tapering multiple thread, instead of with the usual "interrupted screw," whereby very important results are obtained. With a double thread, for example, less longitudinal and consequently less angular movement is required than with a single thread of the same pitch. The height or projection of the double thread is half that of the single thread; and hence it is necessary to move the plug longitudinally only half as far to free its thread from the breech. The swinging-plate by which the plug is carried is provided with radial pins for engagement with a thread in the carrier-opening. The pitch of the thread is the same as that of the plug until a point is reached in the rearward travel of the plug, when the plug-thread is disengaged from the breech. The pitch of the thread in the carrier-opening then increases. The purpose of this arrangement is to accelerate the movement of the plug after it has been cleared of the breech.

In the ordinary construction of preserve-jars, when the cover is screwed on the neck, the air remaining within the jar is compressed, thereby leaving a space between the preserves and the cover. In this space mildew usually collects. Moreover, it is necessary to heat the preserves to a high temperature in order to expel the oxygen. These evils of the ordinary preserve-jar are remedied in an invention which has been

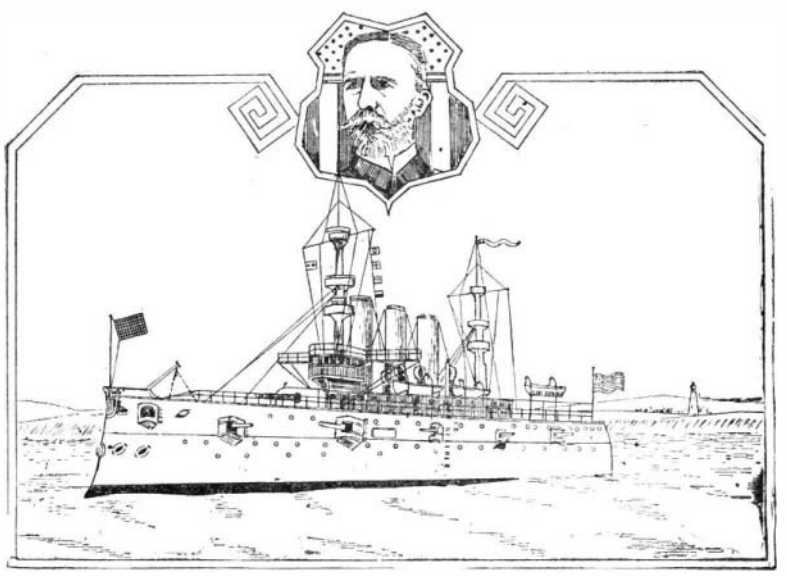


A SIMPLE RELIEF-NUT.

patented by Henry W. Woolbert, Box 690, Pittsburg, Pa. The accompanying illustrations represent two forms of the new jar. The body of the jar is flanged to receive a rubber ring upon which the flanges of the cover bear. The concave center of the cover is provided with a small cup in which a plunger is contained, operated by a cam-lever. A valve in the plunger permits the escape of air from the jar, but prevents the entrance of air into the jar. By operating the cam-lever the air in the jar is partially exhausted, so that the heat required to expel the oxygen is considerably less than would otherwise be necessary. In Fig. 2 a bell-crank lever is shown instead of the arrangement described. It will be seen that the invention consists essentially in applying a miniature vacuum-pump to a preserve-jar.

PICTURE MAKING ON THE TYPEWRITER.

The accompanying engraving of Admiral Sampson and his flagship the "New York" was reproduced from an original picture measuring 8 inches in height by 11 inches in width, which was made entirely on a typewriter. At first sight one would be tempted to deny that such a result could be obtained, except by the use of some special type, which had been arranged to make impressions through the manipulation of the key-board; but as a matter of fact, the original drawing was made by A. Roeder, Jr., of Baltimore, entirely by the aid of the standard characters which are to be found on the Densmore typewriter. If the picture be closely examined, it will be found that the straight lines and curves with which the ship is built up are formed by ingenious combinations of the various letters and characters shown on the key-board. The horizontal and vertical lines were obtained by the use of the shift, underscore, etc., the curves were obtained by using the parenthesis, the apostrophe, etc. Thus, the two hawse holes for the anchor chains were formed by using the signs of the parenthesis and the acute accent. The portholes were made by using the sign for a degree. In the signal flags we see the use of the asterisk, the degree sign, the hyphen, etc., while the flag at the stern of the vessel is made by the use of the parenthesis and the period. It will be understood, of course, that the paper on which a picture of this kind is made has to be constantly twisted to different angles in order to get the desired lines.

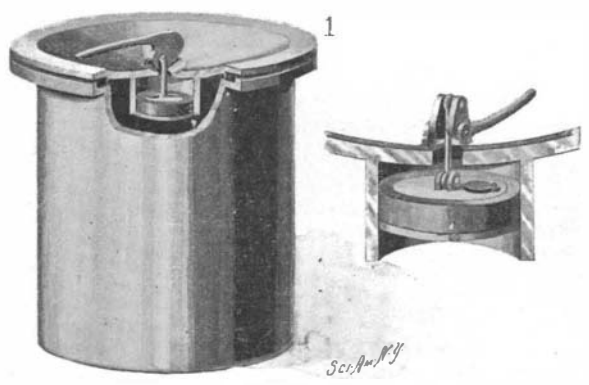


ADMIRAL SAMPSON AND THE "NEW YORK."

This picture was made on the typewriter by the use of the regular characters and signs.

The Current Supplement.

The current SUPPLEMENT begins with a portrait and biographical notice of the late Queen Victoria. "Archæology" (in the last century) is by Prof. W. M. Flinders Petrie, D.C.L., LL.D., and deals with archæology in Syria, Greece, Italy, India, and America. It is an article of the greatest possible importance. "Meteorological Instruments," by Prof. Hans Hartl, is accompanied by twelve engravings. "Recent Science," by Prince Kropotkin, is concluded. "A New Page-Printing Telegraph" is by William N. Vansize, and describes the epoch-making invention of Donald Murray. A fully illustrated article on "The Colwell Rotary Engine, Reciprocating Engine and Condenser" is also included in this issue.



A VACUUM-PUMP FOR PRESERVE-JARS.

Contents.

(Illustrated articles are marked with an asterisk.)