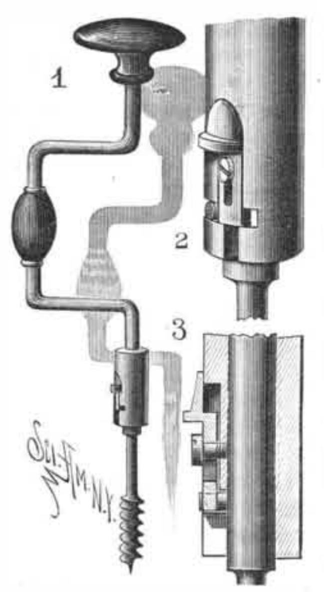
AN IMPROVED BIT BRACE.

A simple construction of bit stock and bit shank, in which the parts are not liable to displacement or breakage, is shown in the accompanying illustration, and has been patented by Messrs. George Gavin and Lawrence W. Cromer, of Eureka, Nevada. The socket of the bit stock has a cylindrical bore adapted to receive a similar cylindrically shaped bit shank, provided above its shoulder with a pin, which, when the bit shank is in position within the socket of the bit stock, engages either end, as desired, of the horizontal arm of a T-slot. A vertical groove is cut in the face of the bit stock above the T-slot, in which slides a bolt that is held in position by a set screw, this bolt securely holding the pin of the bit shank in either division of the T-slot, as plainly shown in Figs. 2 and 3. It is only necessary to employ the sliding bolt when the bit stock is attached to a ratchet brace, the bit stock being complete without the bolt for use with ordinary braces. This invention may also be applied with augers and auger handles, and for other purposes.



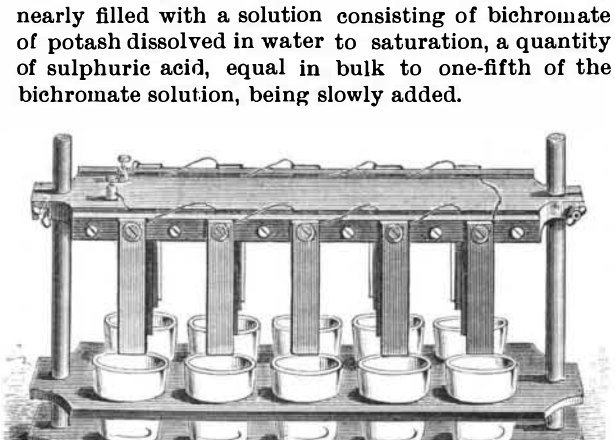
GAVIN & CROMER'S BIT BRACE.

SIMPLE PLUNGE BATTERY.

The engraving represents an inexpensive and easily made plunge battery, which is very convenient for temporary use.

Twelve tumblers, arranged in two rows of six, are held in place by an apertured board supported a short distance above the base board by the round standards. To the standards is fitted a board which is split from the standards outward, and provided with two bolts with wing nuts, by which the board may be clamped at any desired height on the standards. To opposite edges of this movable board are clamped six plates of carbon, 1¼ inches wide, ¼ inch thick, and 6 or 8 inches long. The upper ends of the carbon plates are heated and saturated with wax or paraffine, and a copper wire is interposed between the carbon plate and the edge of the board. The strips of wood by which the carbons are clamped are ⅜ inch thick. To these wooden strips are secured zinc plates of the same dimensions as the carbon plates, by means of ordinary wood screws passing through holes in the zinc into the wood. The wires connected with the carbon plates are bent over and inserted between the zinc plates and the wood, as shown in the engraving. That is, the carbon of one pair is connected with the zinc of the next pair in order, and so on throughout the series, and the terminal plates are connected with the binding posts.

The zincs are amalgamated, and the tumblers are nearly filled with a solution consisting of bichromate of potash dissolved in water to saturation, a quantity of sulphuric acid, equal in bulk to one-fifth of the bichromate solution, being slowly added.


SIMPLE PLUNGE BATTERY.

To maintain the amalgamation of the zincs, a small quantity of bisulphate of mercury is added to the bichromate solution, say ¼ ounce to every quart of solution.

The tumblers should be as large as can be conveniently obtained. Those holding one pint are not too large.

The zincs and carbons may be connected up in different ways for different effects. For example, all of the carbons may be connected together and all of the zincs may be connected in the same way, thus securing a quantity current having the electromotive force of only a single cell; or all of the zincs on each side may be connected together, and all of the carbons may be connected in the same way, and the series of zincs on one side may be connected with the series of carbons on the other side, thus giving a current having the electromotive force of two cells and the quantity of six. G. M. H.

The World's Largest Cities.

The following information is often inquired for, and, as it may be useful in many cases for reference, we have compiled a table of the largest cities of the world, with their populations as stated by the latest authorities. In the absence of any official census, the Chinese cites have simply to be estimated, and, of course, must be accepted as an approximation only. We have not given any city whose population is below 500,000, though there are many we could enumerate which closely approach that figure. It will be seen that in the thirty-five cities tabulated below there are 32,510,-319 souls, or nearly the population of the British Isles, a fact which cannot be grasped in a moment by any ordinary intellect.

Aitichi, Japan	1,332,050
Bangkok, Siam	500,000
Brooklyn, N. Y	771,000
Berlin, Prussia	1,122,330
Calcutta, India	766,298
Canton, China	1,500,000
Changchoofoo, China	1,000,000
Chicago, Ill.	715,000
Constantinople, Turkey	700,000
Foo-choo, China	630,000
Glasgow, Scotland	514,048
Hang-Chow-foo, China	600,000
Hang-Tcheon, China	800,000
Han-Kow, China	600,000
King-te-Chiang, China	500,000
Liverpool, England	573,000
London, England	3,955,819
Madrid, Spain	500,900
Moscow, Russia	611,974
New York, N. Y	1,400,000
Paris, France	2,269,023
Pekalonga, Java	505,204
Pekin, China	800,000
Philadelphia, Pa	850,000
St. Petersburg, Russia	766,964
Sartama, Japan	962,917
Sian, China	1,000,000
St. Louis, Mo	500,000
Tat-Seen-Loo, China	500,000
Tien-Tsin, China	950,000
Tokio, Japan	987,887
Tschautchau-fu, China	1,000,000
Tsin-Tchoo, China	800,000
Vienna, Austria	726,105
Woo-chang, China	800,000

—*Pall Mall Gazette.*

Tariff Revision.

The revision that is sure to come is sure, also, to be made in one of these two ways: Either in the interests of protection and labor here on our own soil, or in that of foreign production and foreign labor. There can be no middle ground, any more than there can be service of two masters. There is a grand struggle going on for the possession of our markets between our own producers and our own labor on the one side and the foreign producer and laborer on the other—and he that is not for us is against us. When the citadel is assaulted, even indifference helps the enemy. The industries of this country and its labor in every calling and pursuit have no option left them, but are called upon, in an inevitable revision of the laws that have created and fostered them, to defend their markets here against foreign invasion.

There are those who talk much of the necessity to us of foreign markets, and are ready to surrender our own to secure them. Do not listen to such preaching. The nation which cannot command its own markets cannot command foreign markets, for those conditions of production which will enable a foreign producer to undersell us here will enable him to undersell us in distant markets, where cost of transportation must be added to cost of production here. Every mile of distance to market is a dead charge upon production, and every mile cut off is a direct addition to profit. Seek first and all the time the nearest market, and make it and all possible augmentation of it your own, and then, if ever, will be added the facilities and opportunities of trade and commerce the world over which are sure to come to that people whose highest attainment in production is the result of the greatest variety and development of their own industries. This is the sure and only way to the markets of the world consistent with health and prosperity at home.—*H. L. Dawes' address at the recent meeting of Amer. Paper Mfrs.' Assn., Saratoga.*

Fireproofing Solution.

For rendering fabrics, wood, and other inflammable objects fireproof, a writer in *La Nature* recommends borotungstate of soda, a salt which he states has never hitherto been employed for the purpose. It is made by dissolving boric acid in a hot solution of tungstate of soda. Objects impregnated with this solution are rendered incombustible. The solution gives off no deleterious gas, while ammoniacal salts, phosphate of ammonia, and salts of phosphorus render the air irrespirable.

Borotungstate of soda in solution is also said to possess valuable antiseptic properties, and has been used with the greatest success in diphtheria, for dressing wounds, and as a wash in cases where an antiseptic is needed. The solution has no odor, but its taste is bitter.

IMPROVEMENT IN MANUFACTURING PLATED WARE.

The invention herewith illustrated provides a method of manufacturing plated ware in which the parts most exposed to wear are filled with precious metal or alloy, as, for instance, the bottom of the bowl of a spoon or the back of the handle of a fork, these being the usual points of rest from which the plating on such articles generally wears off the quickest. In such goods, and all flat plated ware of a similar kind, a recess is made at these points of rest, or places of greatest wear, and this recess is filled, in the process of manufacture, with fine or coin silver, or other metal corresponding with that used in plating, so that, after the whole is plated, abrasions of these parts will not, as in the ordinary plated ware, expose the baser metal or alloy of which the article is mainly composed. The illustration shows


WARNER'S PART SILVER-FILLED SPOONS.

the method of inserting this silver filling in a standard style of silver-plated teaspoons.

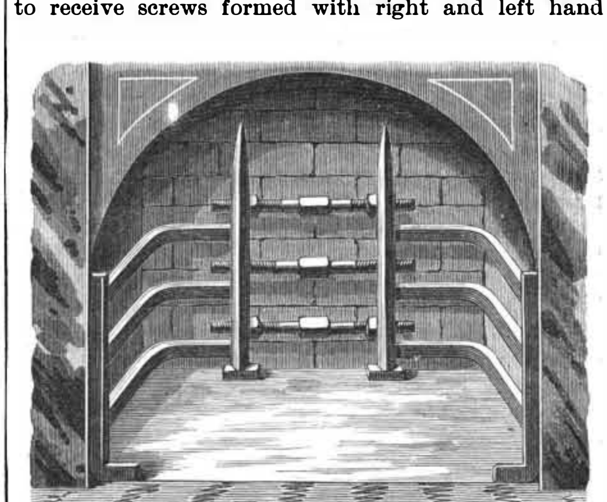
This invention has been patented by Mr. William A. Warner, of Syracuse, N. Y., and articles made after this method are now being manufactured by Messrs. Warner Brothers, of that place.

Removing Rust from Iron.

It frequently causes much trouble, indeed, in some cases defies all efforts, to free iron from ingrained rust, but according to a German paper the thorough cleansing of it may easily be effected by immersing the article in a nearly saturated solution of chloride of tin, even if much eaten into. The duration of the immersion will depend upon the thicker or thinner film of rust; in most cases, however, twelve to twenty-four hours will suffice. The solution of chloride of tin must not contain too great an excess of acid, otherwise it will attack the iron itself. After the articles have been removed from the bath they should first be washed in water and then with ammonia, and be dried as quickly as possible. Articles treated in this manner assume the appearance of dead silver.

AN IMPROVED FIRE-PLACE PROTECTOR.

A device designed to protect the brickwork of fire-places, preventing the fire from resting against the brick, and so constructed that the protector may be adjusted for use in fire-places of different size, is shown in the accompanying illustration, and has been patented by Mr. George W. Meharg, of Kennett, Dunklin County, Mo. To the two outer standards are connected rearwardly extending bars, bent at inner corners, and supported at their other ends by two other standards, in which are threaded apertures arranged to receive screws formed with right and left hand


MEHARG'S FIRE-PLACE PROTECTOR.

threads, and with central heads. In order that the exposed surface of the central standards may be as small as possible, they are made substantially triangular in cross section, the forward edge of the standards being the apex of the triangle, and jamb nuts are arranged on the screws to bind the parts in place when they are once properly adjusted.

Volcanic Silver.

Professor Mallet has analyzed a specimen of volcanic ash collected on the Pacific cost in Ecuador, 120 miles west of Cotopaxi. The ash fell on July 23, 1885, and formed a deposit to the depth of several inches. The interesting feature in the composition of the material was the presence of a small amount of silver, probably as silver chloride; several experiments showed that silver was present to the extent of 1 part in 83,600 of ash. This is the first time that silver has been identified in material ejected from a volcano.—*Proc. Roy. Soc.*

Water in Thermometer Tubes.

It has long been known that thermometers, when made from recently blown tubes, changed their register with lapse of time. The glass seems to undergo a very slow alteration in volume, which alteration extends over several years before a final volume is reached. The cure for this trouble is obvious. The tubes may be blown, filled with mercury, and sealed, and then may be graduated after standing a year or more. This method is obviously only practicable for the finer class of instruments; but it does provide effectually for such.

In thermometers constructed for very high or very low temperatures, abnormal readings have been noticed which often have been considered inexplicable. But in some cases a cause for startlingly large errors has been found in the presence of water in the tube. A thermometer made with every precaution, by one of the makers of highest standing in this city, was recently shown by him. It was made for the higher temperatures, the scale extending from 90° to 440° Fah. After it had been used for a few months, it was, with a number of others, returned as useless, on account of inaccuracy. On inspection, a considerable amount of water, enough to fill three-quarters of an inch of the bore, is seen to be contained within it. This accounts for its erroneous register. More or less of the water is of course mixed with the mercury, and at the high temperatures is converted into steam, rendering the readings valueless. The steam cushion formed above the mercury also would, to some extent, affect its readings.

Of the other thermometers, one showed the presence of a minute amount of some gas, quite possibly of water vapor. A small break existed in the column of mercury near the bulb. If the tube was inclined, this break expanded from a small fraction of an inch to an inch or more. This occurred just before the tube reached the horizontal position. The pressure of a column of mercury a few inches high was enough to compress the vapor to its original and very small volume.

These instances of errors are supplemented in the experience of the same maker by similar trouble found in a low degree instrument. This was made for use in a freezing machine, and when exposed to low temperatures, registered many degrees below the true standard. The maker examined it, comparing it with other thermometers, and tested its accuracy rigorously. He could find no cause for the trouble. From his examinations alone, it appeared that the thermometer was accurate. Exposed to the exceedingly low temperature, it again was found wrong.

The cause of the trouble with the high temperature instruments is evident. Somewhere a crack must exist, through which water or air has been drawn. This undoubtedly happened at the higher temperatures. At ordinary heat the crack is probably hermetically closed. Those who have manipulated glass know that a crack may exist and be quite invisible. The surfaces of the crack may be in such intimate contact that no evidences of the fracture can be seen. Such a crack, or several of them, may have been developed in the glass of the erroneous instruments by the sudden changes of temperature to which they were subjected. On being immersed in a hot solution, the crack may admit some water. A vacuum exists in a thermometer tube, rendering available the atmospheric pressure for forcing water in.

The sudden changes of temperature are inevitable in technical use. A confectioner must plunge his thermometer directly into his sirups; he cannot stop to bring it gradually to the maximum temperature to which it is to be exposed. A thermometer that would stand this treatment is, in a commercial sense, a desideratum. Many such undoubtedly exist, but enough has been said to show that the maker cannot feel confident of any of his instruments, if to be thus treated. A good subject for investigation and invention is here afforded.

The low degree errors are a still more difficult subject. The occurrence cited is probably more of an anomaly than is the other. But it indicates that the perfect low degree as well as high degree thermometer is still to be devised.

Manufacture of White Bread.

Within a recent period experiments have been carried on in Germany, which have met with full success, relating to making bread of the best possible appearance, though from such flour as usually is only made into bread with difficulty. The new improvement suggested consists in the addition of those materials which normally exist in flour from certain regions, and which are wanting in that from elsewhere. For example, the attempt was made to add a part of those components which give its value to the flour of Hungary and of Russia, or what amounts to the same, to add such substances as would bring about the production of products of equally good quality. It is known that carbonic acid gas, which is produced in the fermentation of bread dough, and which makes the loaf porous, comes from the decomposition of maltose. Apparently maltose either does not originally exist in equal proportions in all cereals, or its formation from starch does not occur with equal facility in all flour. When this last is the case, saccharification will be accompanied by peptonization of the gluten, which will seriously deteriorate the quality of the bread.

This makes it clear how the addition of maltose to the flour, in proper proportions, in all cases should facilitate the alcoholic fermentation, and, assisting the development of this, should retard the operation of the false ferments, which tend to darken or sour the dough. The treatment is easily carried out: Maltose sirup in the proportion of about 2 per cent of the weight of the flour is dissolved in the water used in mixing the dough. The quantity of leaven remains the same, and the fermentation occurs with rapidity and vigor. When the baking is executed at the proper time (as determined by experience), a product of most beautiful appearance is produced, yet has no sweet taste, because the maltose has entirely disappeared, being converted into alcohol and carbonic acid gas.—*L'Industria.*

Industrial Education in the Minneapolis High School.

A manual training school, under the instruction of Prof. F. W. Decker, has lately been established by the school board of the city, in connection with the high school, and results have already been obtained that promise well for the success of this new enterprise.

The object of the course is not to make finished mechanics in any definite trade, but rather to give a general training that shall serve to render boys familiar with common tools and materials of construction, and lay a good foundation for any one of the several mechanical trades

The course serves also to correct some of the popular notions among boys that manual occupations are degrading, or at any rate not so respectable as occupations requiring only book knowledge. This latter result is attained by placing the manual training course on an equal footing with other high school courses, and requiring the same attention to system and order as in any branch of knowledge taught.

The course for the present term is woodworking.

A large lower room of the high school building has been fitted up with benches and drawers and a variety of woodworking tools.

Each bench is provided with a full set of bench tools, and each boy has, besides, a number of edge tools and a drawer in which to keep them locked when not in use. Each boy is required to keep his individual tools in order, and all the bench tools have their proper places on a rack in front, where they must be placed at the end of each exercise. The benches and bench tools are lettered to correspond, so that it is easy to see at a glance that everything is in its proper place.

The use of the tools is taught in the following manner, it being assumed there is only one right way. The boys are each given a plane, for instance, and, after being shown the nature and construction of the tool, they are shown how to use it properly. All this is taught to them as a class. They are then given each a piece of board and are required to produce a plane surface, each being drilled until he is tolerably proficient in the use of the tool before being allowed to go on. Sawing is taught in a similar manner. The saw is first discussed, and the reason for the teeth being shaped differently for cross-cut and rip saws is pointed out. A board is then marked with a scratch awl, and the class is shown how to saw to line accurately. They are then each required to saw to given lines until the lesson is thoroughly taught. By keeping the attention of the pupils on one operation at a time and holding it until taught, rapid and sure progress is made. After the uses of a few of the most common tools is thus taught, the boys are allowed to construct something that will bring into use only operations they have previously learned. This serves to make the work interesting, though the work is designed to be for the purposes of instruction rather than construction.

Whenever an article is constructed, it is done from an accurate working drawing made by the pupil himself, and thus the value of drawings, in connection with all construction work, is taught better than it could otherwise be done.

Each pupil is required to spend forty minutes per day in the drawing room and eighty minutes in the shop. Drawing is taught in much the same manner as the use of the tools just described, and it is found that the two branches of work go very nicely together. It was first planned to provide for a class of eighteen only, the class being in three divisions of six, each division spending, as before stated, eighty minutes in the shop and forty minutes in drawing.

The work at once became so popular, however, that the limit was increased to thirty, with several more anxious to join the class, but barred out for want of tools and shop room. Provision will probably be made for double the present number at the beginning of the new school year, and a new building is already talked of, to be provided in the near future.

The school board has also established an evening school of drawing, which has been attended during the winter by over fifty pupils, mostly young mechanics, who are busy during the day.

Instruction is given in this school in both mechanical and architectural draughting after the first principles are mastered; and the interest manifested in the work shows plainly that it is valued as an aid to mechanics in their daily occupations. This school was first established a little over a year ago, but the attendance latterly has been nearly double that of the first season; many of those now attending were present last year.

The most advanced pupils are at present engaged in such work as laying out and projecting bevel gearing, using the correct curves for the teeth, and showing finally the wheels in working position with two sets of teeth in contact. Others are making perspective drawings of objects of given dimensions, with the eye assumed in a given position.

A greater number are employed in making accurate projections of parts of buildings and machinery, working in all cases from dimensions given, rather than being allowed to simply copy.

The outlook promises much for the future of industrial education in our public schools.—*T. T. Journal.*

The Phosphorescence of Sulphate of Lime.

M. Verneuil has recently investigated the cause of the phosphorescence of sulphate of lime, the ingredient of luminous paint. In order to prepare it so as to give a violet phosphorescence, it is sufficient to calcine a mixture of 100 parts of cockle shell lime (*Hypopus vulgaris*), 30 parts of sulphur, and 0·02 part of subnitrate of bismuth. Pure lime does not give the phosphorescence when mixed with these materials. Hence M. Verneuil has analyzed the cockle lime and found it to contain: Lime, 54·95 per cent; carbonic acid, 43·26; carbonate of soda, 0·99; chloride of sodium, 0·06; silica, 0·02; magnesia, 0·01; insoluble matter, 0·04; organic matter and waste, 0·67 per cent; and traces of phosphoric acid. M. Verneuil then ascertained that a fine phosphorescence could be obtained by adding to pure carbonate of lime the foreign substances which analysis reveals in the cockle lime. It follows from his experiments that the violet sulphide of calcium prepared with cockle lime owes its vivid phosphorescence at once to the bismuth salt, the carbonate of soda, the sea salt, and sulphate of lime formed during the reaction, and the cockle lime seems to contain sufficient carbonate of soda and sea salt to give the maximum brightness. M. Verneuil is also of opinion that any matter capable of vitrifying the surface of the sulphite of calcium without coloring it is able to render the latter phosphorescent. It becomes phosphorescent, in fact, when it is heated to red heat on a platinum plate with a little borax, or carbonate of potash, chloride of sodium, carbonate of soda, silicate of soda, fluoride of calcium, cryolithe, fluoride of barium, chloride of strontium, chloride of barium, hydro-fluosilicate of barium, and so on. All these substances probably act in changing the molecular state of the sulphide of calcium conformably to the views of M. Becquerel.

Heating by Electricity.

Though it is claimed as one of the advantages of electricity that it does not raise the temperature of the atmosphere when used for lighting, it is nevertheless, says *La Nature*, capable, under certain conditions, of evolving heat. This property is about to be turned to profitable account by the Societe des Usines Electriques of Berlin, who have announced that, in future, in addition to light, they will be prepared to furnish a supply of electricity for heating purposes. The appliances which the society offer to their customers have been constructed in view of the use to which they are to be put. For instance, for boiling water they have contrived a vessel having two cases, between which is placed a resistance coil. It is stated that with this appliance about 1½ pints of water can be raised to boiling point with 4 amperes 100 volts. In certain theaters electric stoves are employed for heating the curling tongs, the use of gas jets and spirit lamps being rigorously forbidden.

New Russian Gunboat.

A new gunboat, built for the Russian government at Copenhagen, has arrived at Cronstadt. The vessel, which has been named the Manchuria, has been constructed of steel, at a cost of 55,000*l*. The following are the principal dimensions: Length, 210 ft.; beam, 35 ft.; displacement, 1,200 tons; draught, fore, without artillery and war material, 10 ft. 2 in.; aft, 10 ft. 7 in. The boat has two engines, with an indicated power of 1,000 horse power each. They can without any particular strain develop a speed of more than 13 knots. The armament of the Manchuria will consist of two 8 in. long-range guns in the stern, six Hotchkiss, one Baranovsky, and four nine-pounder guns The bottom of the boat is divided into forty-two water-tight compartments, and the hold is amply protected by fourteen air-tight partitions. An apparatus for ejecting Whitehead torpedoes will be placed in the vessel's bow. The average speed attained during the run from Copenhagen to Cronstadt was 11½ knots.