

fectly in the hardest seasoned timber, turning the work smooth and producing perfectly square corners without tearing, and it is extremely simple to operate.

The tight and loose pulleys are 10 inches diameter, 5 inches face, and should run 430 rotations per minute; the floor space occupied by this machine is $4\frac{1}{2}$ feet by 8 feet.

A CUSHION PAVEMENT.

The improved street pavement herewith illustrated has been designed and patented by Mr. Daniel W. Campbell, of North Creek, Warren County, New York. The blocks are all made in one shape and size, being formed with plane faces on the top, bottom, and sides, but having offsets or ledges formed at each end, the front ledge being at the top and the rear ledge at the bottom of the block, as shown in the illustration.

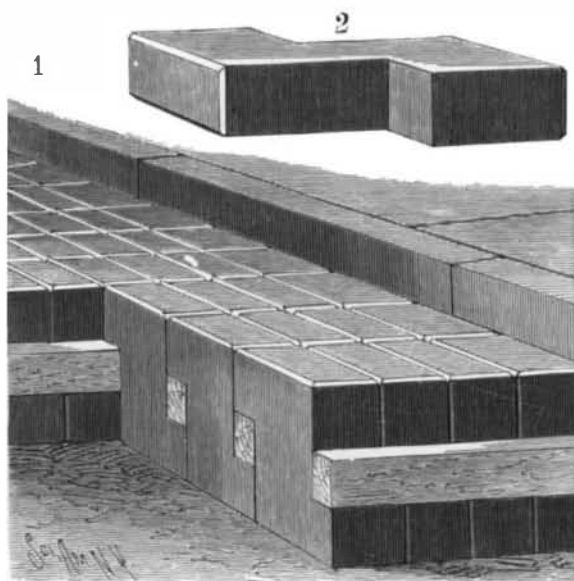
The depth of the said ledges is such that when the blocks are laid together there will be a square void between them whose depth will be approximately one third the height of the blocks. In paving a street the brick or stone blocks are laid in rows transversely to the street, with their flush sides in contact, and the offsets forming a continuous ledge or step across the street as shown in the engraving. Upon this ledge is laid a strip of wood or other flexible material, and another row of blocks is then laid in place, its upper ledges overlapping and resting upon the upper face of the strip as shown. Such a form of construction presents a flexible pavement, which will be comparatively silent under a passing vehicle; and the longitudinal strips will assist in preventing the formation of ruts and hollows in the surface of the street. It will be seen that by completely overlapping the wooden strips the blocks exercise upon them merely a compressive strain, and do not tend to shear them off, as is the case when such strips are engaged by grooves formed in the adjoining faces of the blocks.

COPPERSMITHING.

The present illustrations represent the manufacture of the copper vacuum pans used principally by sugar manufacturers, distillers, etc. In the manufacture of sugar the sirup is run into these pans, where it is evaporated by means of steam to the point of crystallization. The pans range in size from about 3 feet to 15 feet in diameter and from 8 to 25 feet in height. The pans when completed consist of a dome, belt and bottom. The dome and bottom being beaten to the proper form by hand and the belt plates rolled into shape and brazed, the different sections then being placed in position and bolted together. Connected to the sides on the interior of the bottom sec-

tions are coils of copper pipe which are heated with steam for boiling the sirup.

The number of feet of pipe for each apparatus depends on the size of the pan and the amount of evaporation required. In the largest of these pans as many as 3,000 square feet is used. The pipes range, according to the size of the pan, from 2 to 6 inches in diameter. The copper comes from the mills to the coppersmith in sheet form cut into the proper shape.



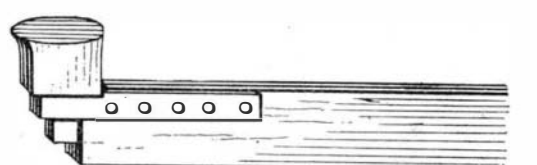
CAMPBELL'S CUSHION PAVEMENT.

The belt plates range from about 28 inches to 24 feet in length, from 14 inches to 12 feet in width, and from $\frac{1}{8}$ to $\frac{5}{8}$ of an inch in thickness. The belts are made in from two to eight pieces, according to the height and diameter of the pan. The copper plates for the dome and bottom come circular in shape and flat. They are first suspended over a forge containing a hot coke fire until they become red hot and then beaten into shape with wooden mauls. The furnace or forge is about 10 feet in length, about 4 feet in width and about $2\frac{1}{2}$ feet in height. The copper sheet is suspended to within 4 inches of the fire until it becomes red hot, which takes about twenty minutes. Two operators then beat the heated metal with the mauls, beginning about half way from the center, the heavy blow causing the material to bend and form itself into the proper shape. During the beating process the metal is turned and held in position by an attendant with a pair of tongs. The mauls are about 12

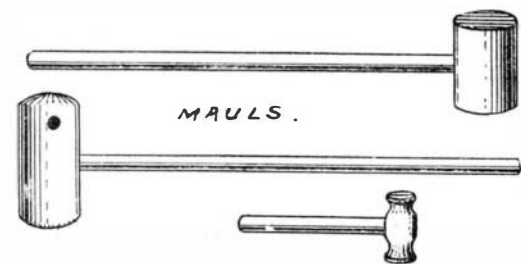
inches in length, about 5 inches in diameter, and weigh 15 lb. each. It requires about two days to beat out a dome 8 feet in diameter and 30 inches in depth. The object of beating the metal while hot is to keep it a uniform thickness. After the beating process the dome or bottom is suspended on what is called a head. This head is about 8 inches square and made of steel, the top of which is slightly curved and smooth. The head rests in an iron brace which is fastened securely to the end of a heavy wooden beam about 5 feet from the floor. The under side of the dome or bottom rests on top of the head, the two operators who stand on a raised platform then hammering the metal smooth, hard and bright. The planishing hammers used weigh about 6 lb. each, and are very highly polished and made of steel. An attendant also turns the material during the hammering process, which takes about one and one-half days. The ends of the belt are then scarfed and rolled and the parts brazed. The ends of the belt to be brazed are placed over the forge fire, which is blown up to a temperature of about 1,800° Fah. A brazing spelter composed of about 60 per cent of copper and 40 per cent of zinc is then placed along the joint, which melts and unites the two parts solidly together. Bolt holes are then bored in the 5 inch flanges on the belt, bottom and dome and the sections then put together.

The copper pipe is placed in the bottom section in rows one above the other, between braces made of gun metal, the coils of pipe being placed about 10 inches apart. As the sections are put together a coating of putty, consisting of red and white lead and oakum, is put between the flanges, making it airtight when bolted. After the putty has been applied, two iron rings, one being placed on top of the flanges and the other on the bottom, are bolted securely together with $\frac{3}{4}$ inch iron bolts, about $3\frac{1}{2}$ inches apart. The large copper vacuum pans, that measure 15 feet in diameter and containing about 3,000 feet of pipe, will weigh about 80,000 lb. To build one of these large pans it will require about four months with the labor of from twelve to fifteen men. The cost of these pans ranges from \$500 up to about \$15,000, according to the size and quantity of material used. The copper costs from 16 to 22 cents per pound, according to the size of sheet, the length and the width and thickness. The sketches were made at the North River Copper Works, New York.

It is said that the habit of turning around three or four times before lying down has survived in the domestic dog from his savage ancestry. It then served to break down the grass and make a bed.



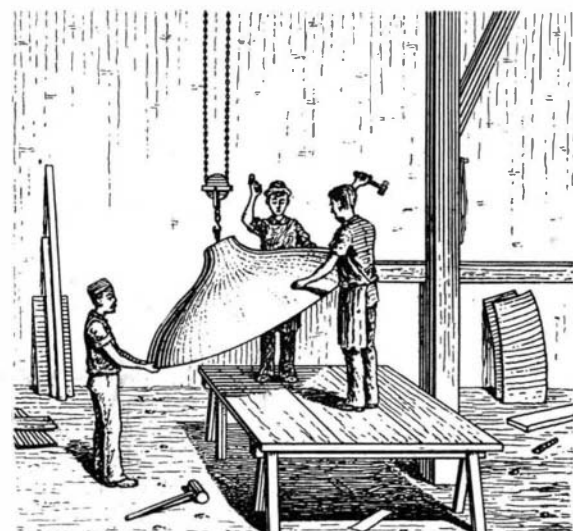
STEEL HEAD FOR SMOOTHING DOME.



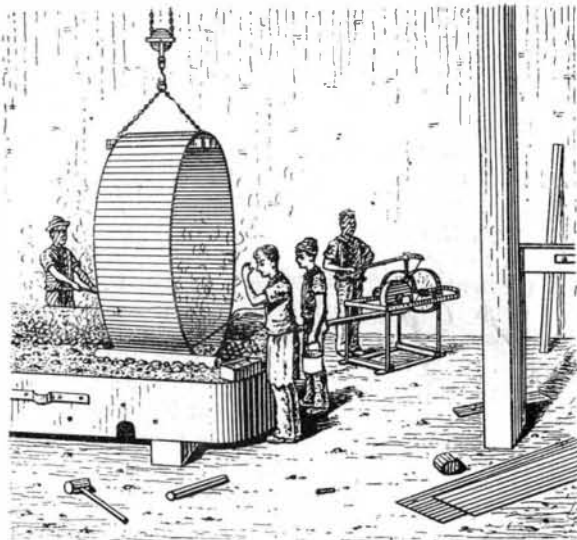
MAULS.
PLANISHING HAMMER



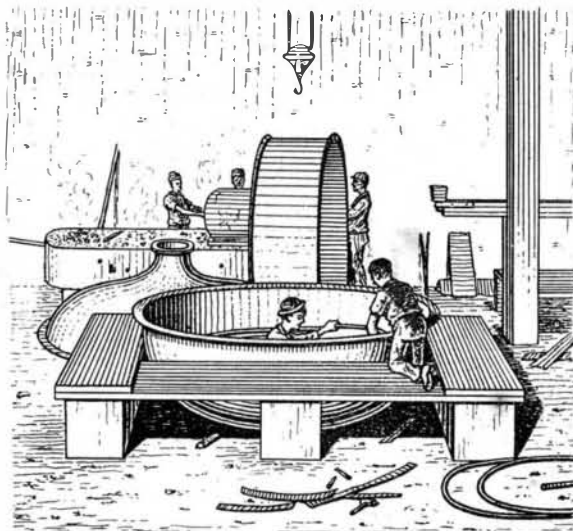
BEATING HEATED COPPER INTO SHAPE.



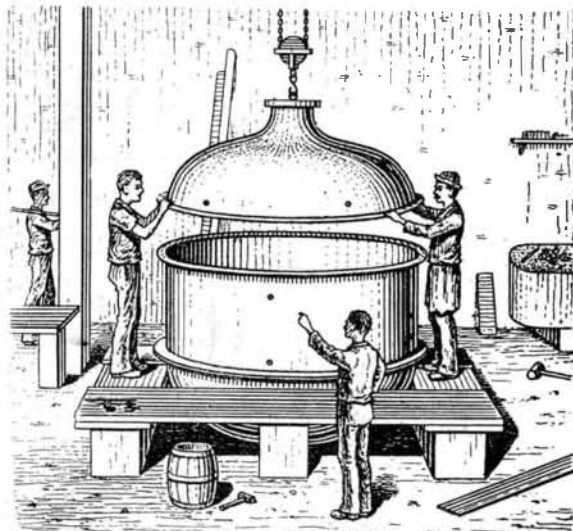
SMOOTHING.



BRAZING.



PUTTING PIPE IN PAN BOTTOM



SETTING UP.

THE MANUFACTURE OF COPPER VACUUM PANS.

Science Notes.

It is stated that Huxley's library is now offered for sale.

Dr. Adalbert Kruger, Director of Kiel Observatory, died recently. He was an astronomer of world-wide reputation and was editor of the *Astronomische Nachrichten*.

Rev. W. C. Ley, a meteorologist of considerable reputation, died on April 22. His researches were principally on the clouds and the movements of the upper air currents.

The University of Pesth has conferred honorary degrees upon Lord Kelvin, professor in the Glasgow University; Herbert Spencer, the English philosopher; Max Muller, the orientalist; Prof. James Bryce, M. P., the eminent English geologist and scientific author, and Dr. John Shaw Billings, of Philadelphia.

It is said that dew is a great respecter of colors. To prove this take pieces of glass or board and paint them red, yellow, green, and black. Expose them at night, and you will find that the yellow will be covered with moisture, and the green will be damp, but that the red and the black will be left perfectly dry.

Negroes are black owing "to the stimulating action of solar heat, combined with moisture and an excess of vegetable food, yielding more carbon than can be assimilated, the character being then fixed by heredity." This extraordinary theory appears in a recent geographical school book bearing the name of Cambridge University.

The Paruchowitz bore hole, near Rybnick, in Silesia, which attained a depth of 2004 3/4 m. (nearly 1,096 fathoms) when the rod broke, has passed through eighty-three carboniferous strata, the total expense having amounted to \$18,700, says the *Practical Engineer*. The 384 thermometrical observations that were made showed a very irregular increase of temperature with depth, the average being 1° C. (1.8° F.) for every 35.14 m. (18 1/2 fathoms).

The question as to the fusibility of platinum in a carbon heated furnace seems at last to have been definitely settled by Victor Meyer, says *Science*. A sheet of platinum completely inclosed in a mass of fire clay was fused to a globule in a blast furnace heated with gas carbon. In this case action of carbon or of furnace gases on the platinum was absolutely excluded. Under similar conditions an alloy of platinum with 25 per cent iridium was unchanged.

Filehne has studied the action of copper when combined with albuminous substances, and finds that a cupratin compound, analogous to Schmeideberg's feratin, can be administered to dogs and cats in doses of 26 grammes within twenty days without injurious effects. He infers that compounds of copper with albumen would not be injurious in human food, and that from 0.01 to 0.02 gramme of copper daily in this form would not cause any sensible disturbance. The case is very different with copper stearate, which causes serious degeneration of the liver and kidneys when administered for some long time, though it was not possible in this way to produce acute poisoning.—*Deutsch. Med. Wochensh.*, 1896.

In the *Contemporary Review* for May, Dr. Alfred R. Wallace describes M. Elisee Reclus' proposed gigantic model of the earth, and argues that the construction of such a globe would be feasible and desirable. But he thinks that the scale proposed by M. Reclus, 1/1000000, should be reduced by one-half. This would give an internal diameter of 167 feet and a scale of almost exactly a quarter of an inch to a mile. The chief point made by Dr. Wallace is, however, that the model should be placed on the inner surface of the sphere.

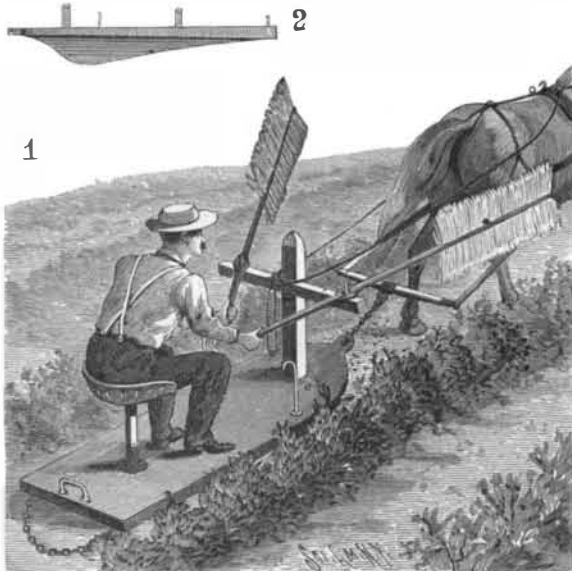
There has been a volcanic eruption on the island of Socorro, off the Mexican coast. Two months ago, which is the latest date of news received, lava was running down the mountain sides, overflowing the lowlands, and moving toward the sea. The news came in a letter to the Hydrographic Office from the schooner Zampa, bound for Tacoma, whose captain spoke the Danish bark Schwalde, of Guaymas, which passed Socorro on March 20. The sky and sea were filled with ashes miles away from the island, and the blazing mountain was first made out at night. It was a magnificent sight, the Danish captain said, but he did not dare venture too near, on account of the troubled condition of the ocean.

An extremely interesting series of experiments on the action of a powerful magnetic field on the cathodic rays in Crookes' or Hittorf's tubes is described by Herr Kr. Birkeland in the *Elektroteknisk Tidsskrift* (Christiania). These experiments prove, says *Nature*, that in such a field the cathode rays are strongly deflected in the direction of the lines of force, and can even be concentrated on to the surface of the tube until the glass melts. Moreover, the evidence suggests that the rays which emanate from one and the same cathode fall into groups, of which the physical constants are connected by some definite law, just as are the frequencies of the different tones emitted by a vibrating rod. The investigation has an important bearing on the theory of the aurora borealis. The Danish meteorologist, Herr A. Paulsen, is of opinion that the aurora owes its origin to phosphorescence of

the air produced by cathodic rays in the upper strata of the atmosphere, and Herr Birkeland suggests that the earth's magnetism may be the cause of this phosphorescence becoming intensified in the neighborhood of the terrestrial poles.

INSECT REMOVER AND DESTROYER.

A new and improved machine for the removal of potato bugs and like insects from vines has been patented by Mr. Washington Reeder, of Lake City, Michigan. The invention consists of a machine with



REEDER'S INSECT REMOVER AND DESTROYER.

a body shaped substantially like the hull of a boat, having a pointed front and a rounded keel as shown in the illustration. An upright mast is provided in front of the driver, upon which is fitted a cross bar, at the ends of which are pivoted two oar-like arms, which project on each side of the machine and terminate in brooms or brushes. The inner ends of these oars have suitable handles which can be grasped by the driver, and he is thereby enabled to beat and brush the bug-infested rows of potatoes on each side as he drives the machine through between them. At the front central portion of the body of the machine a clevis is provided, to which the machine may be attached. As the device is driven through a potato field the bugs are brushed into the space between the rows and crushed by the passage of the body of the machine over them.

IMPROVED BOILER FURNACE.

The improved furnace shown in the accompanying illustration has been patented by Mr. Henry Theodore Dieck, corner of Alvar and Dauphine Streets, New Orleans, La. The furnace may be constructed with only one shell, as shown in the illustration, or with two or more shells if desired. At the front end of the shell is a firebox with grate and ash pit of the usual construction. The bridge wall slants upwardly and



DIECK'S IMPROVED BOILER FURNACE.

rearwardly, and terminates in a flame bed, which is segmental in cross section, and has its upper surface eccentric to the exterior surface of the shell, the greater distance between the flame bed and shell being at the upper portion of the former. The flame bed falls slightly toward the rear, where it curves up and over, finishing against the end of the shell just above the shell flues, into which it guides the furnace gases. The flame bed extends upwardly on both sides to or above the shell flues and provides a large heating surface; and as the area of the cross section of the flame bed increases in a rearward direction, ample provision is made for the proper combustion and flow of the smoke and gases, and a superior draught is secured.

The Proposed Extensions of the Manhattan Elevated Railroads.

A committee of the Manhattan Elevated Railroad directors has submitted to the Rapid Transit Commission a comprehensive plan for the extension of their system. Briefly stated the proposed extensions and additions are as follows:

1. A new two track structure to commence at the Battery Place station on the west side and run along West Street to Little West Twelfth Street; then by Tenth Avenue to Twenty-third Street, where a spur would be run from the Pennsylvania and Erie ferry houses to Ninth Avenue. Another spur would run from Christopher Street ferry to the Eighth Street station of the Sixth Avenue line.

2. A cross town line from the City Hall station at the entrance to the Brooklyn Bridge, running up Centre Street to Canal Street, and westward along the same to a junction with the proposed West Street line.

3. To provide increased accommodation and speed on the up and down lines, it is proposed to provide four tracks on the Third Avenue line from Chatham Square to Sixth Street, and three tracks from Sixth Street to the Harlem.

On Second Avenue it is proposed to lay a third track from Grand Street to the Harlem River.

The Ninth Avenue line is to have a third track from the Battery to the curve at One Hundred and Eighth Street, whence a new line is proposed which shall run via Tenth Avenue or the Western Boulevard to Fort George.

Mr. Gould stated that the company stood ready to build these proposed lines at once; and he submitted two other routes which the company were prepared to cover as soon as the growth of the neighborhood called for it. The first of these was a line from the Fort George extension at One Hundred and Sixty-second Street and Tenth Avenue, to run out along the Kingsbridge Road to the city line. The other future extension was to take place from the One Hundred and Seventy-seventh Street terminus of the present line toward the city line to the north. To provide for a pressing need Mr. Gould said that his company was prepared to build at once a branch line from the One Hundred and Forty-ninth Street station on the east side line, running along the Westchester Road to the Bronx River. It is reported that the representatives of the Manhattan roads stated that they were prepared to build the extensions with their own capital and that they made no stipulations as to the payment of damages.

It must be admitted that this proposal is framed on comprehensive lines, and that it appears to meet the pressing necessities of the hour most admirably. The directors of the elevated roads have a rare opportunity just now to establish themselves in the confidence of the public, by pursuing the liberal and far-sighted policy which is outlined in their present proposals.

Explorer Peary's Plans.

Civil Engineer R. E. Peary's plans for his Arctic expedition this summer are now substantially complete. Instead of St. John's, N. E., as in former years, Sydney (Cape Breton) will be the point of departure, from which port the expedition will leave about July 15 in a steam whaler from the Newfoundland fleet. From Cape Breton the course northward will be laid along the Labrador coast, as the conditions of ice will permit; then, crossing Davis Straits to the Greenland coast, stops will be made, if practicable, at Godthaab and Godhavn, and possibly at Upernavik. Lieut. Peary will push forward with all practicable speed to accomplish the main object, the obtaining of the great meteorite, the largest in the world, which he discovered and located not far from Cape York last year. With the meteorite secured, the southern course will be laid across Melville Bay to Godhavn, where a call will be made on the return for the purpose of embarking any of the party who may have awaited the ship at that point. Coming south, an attempt will be made to penetrate Hudson Straits and, if possible, examine some valuable mining prospects which have been reported in an uninhabited and inaccessible place on the north coast of its waters. Calls may also be made at the Labrador ports, if circumstances favor, and it is possible that while the ship is absent Peary may go, if conditions are favorable, north of Cape York, to his former headquarters at Inglefield Gulf. The scientific party from Cornell University, headed by Prof. Ralph S. Tarr, of the department of geology, will embark on the steamer, leaving her at some point agreed upon in Greenland, for scientific field work, during the time of her absence to the north. Prof. Burton, of the Boston Institute of Technology, is also contemplating a similar scientific field excursion, and one or two other passengers may be added to the party. North of Godhavn, however, Mr. Peary will be without associates, excepting the captain and crew of the steamer, whose aid will be ample for the work which he will have in hand. If the expedition accomplishes its designed work and obtains the meteorite, it will return directly to New York.