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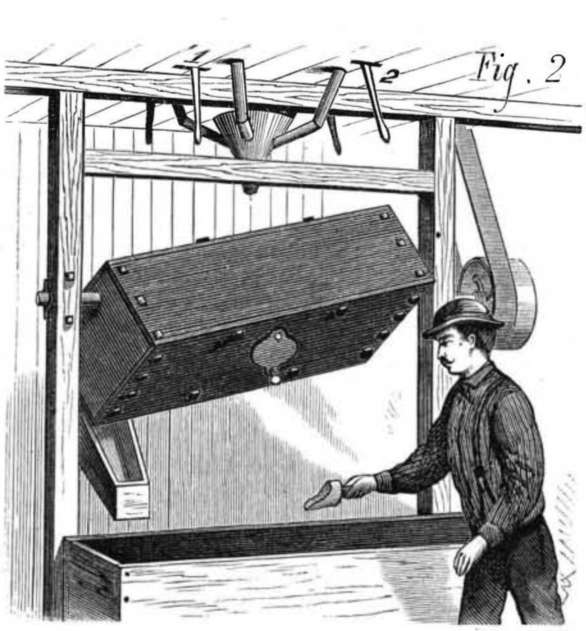
## THE MANUFACTURE OF SHOT.

Lead shot, though sometimes made of lead alone, are almost always formed of an alloy of arsenic and lead, the arsenic being introduced in the form of arsenious acid or the sulphuret (orpiment). The object of the addition of the arsenic is to render the hard brittle qualities of the lead, which is contaminated by iron and antimony, softer and more ductile and of the proper consistence, when melted, for taking the globular form. Owing to the rapid decomposition of the arsenic it is treated by itself in the bottom of the melting kettle shown in Fig. 5. A cover is placed over the substance, and its stem, which rises up through the kettle, is fastened down. The lead is then added above the cover, and when melted the cover is lifted out of the liquid mass, which instantly becomes permeated by the arsenic beneath. The alloy thus produced contains 45 lbs. of arsenic to the ton of lead, and is known as "temper." This again is added in the proportion of 1 per cent to the pure lead, and thus the shot alloy, containing a very small percentage of arsenic, is produced. The making of quantities of the temper at a time is a great convenience, as the proportion of arsenic in the shot is thus kept uniform while the melting can be done in the ordinary kettle in the summit of the shot tower. The temper pots hold about a ton of metal each, and the cooled product has a brownish gloss distinguishing it in marked manner from the dull hue of the pure lead.

The ascent of a shot tower cannot be commended as either agreeable or interesting. To go round and round a spiral staircase, just wide enough for the body and no more, is to get into a bewilderingly dizzy state. Besides, after developing about one fourteenth of a horse power with one's leg muscles, a sensation of fatigue follows, which is not easily got rid of. After the visitor has reached the uppermost story and regained both his equanimity and his wind, he is treated to a new sensation, which becomes the more marked in accordance with the force of the prevailing breeze. The tower rocks like a ship at sea—sometimes so much as to dash some of the molten lead out of the kettle. Of course there is no danger, because the edifice is usually constructed with an iron frame, which is not only strong but elastic, while the brick filling gives additional stability. But, as at the famous tower at Pisa, to the summit of which no one probably ever ascended without, on looking over, involuntarily recoiling with the expectation that the edifice surely was about to fall; so, in the shot tower, one's powers of perception and reasoning faculties are at direct variance: and nervous people are liable to receive a disagreeable shock in consequence.

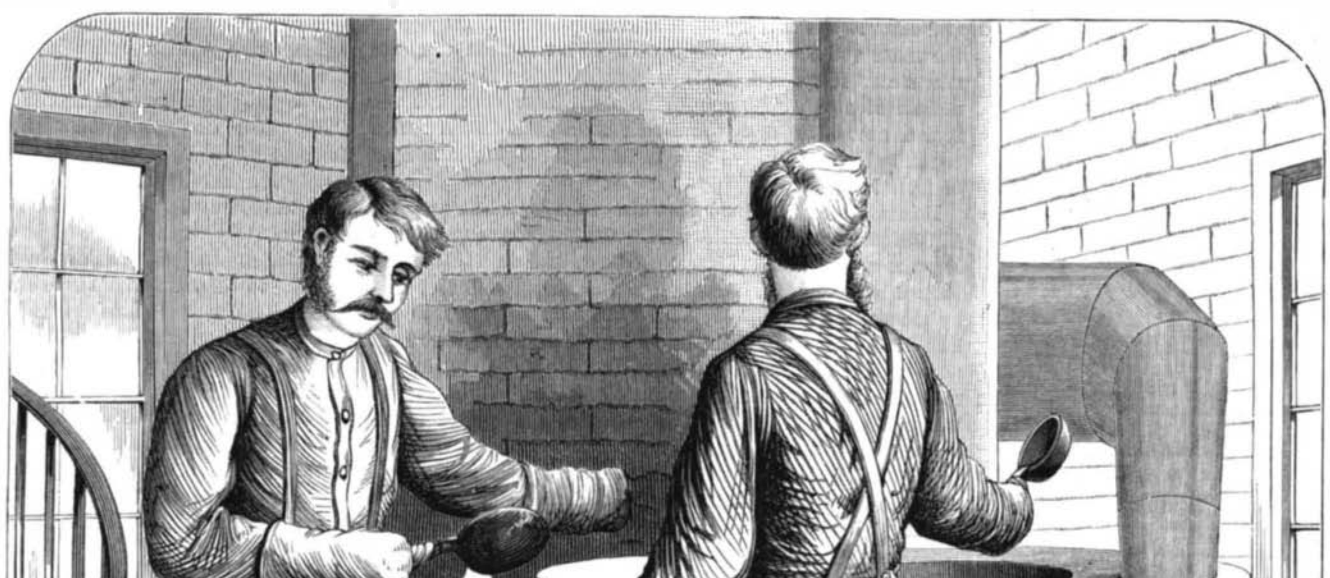
Up in that lofty apartment (Fig. 1, represented in our large engraving) the visitor finds two men, their hands incased in thick bags, and grasping heavy iron ladles with which they dip out the molten metal from the kettle, and pour it into the collenders. Here is the source of that dazzling stream, which, passing down through the center of the structure, salutes the climber of the narrow stairs at every turn. Blistering as the molten metal is, the men dash their ladles into it as if it were water. This is hard labor, and rapid besides, for the lead runs through the collender almost like quicksilver: while if it is allowed to become a little chilled in the




bottom of the vessel, then the holes are stopped, and the careless workmen have no easy job in cleaning them. Five tons of lead are often thrown down in half an hour in the establishment we visited. The collender is simply a copper pan, the bottom of which is perforated and which rests in an iron ring. A long handle from the latter allows of the collender being fastened over the well. In the bottom of the collender is placed a layer of the dross which rises to the surface of the lead during melting. This in a measure checks the too rapid escape of the melted metal, and is thought to have the effect of increasing the rotundity of the shot, possibly by expediting its cooling as it passes through. The holes in the collenders vary from $\frac{1}{60}$ to $\frac{1}{360}$ of an inch, but the shot are of larger diameter than the orifices. In falling to the base of the tower the particles of semi-fluid lead, acted upon alike over their whole surface by a current of air, are made to assume the globular form, and by the time they reach the bottom they are sufficiently hardened by cooling to bear the shock of striking the surface of the water in the well below.

The size of the shot is only approximately fixed by the sizes of the holes in the collenders. The mass is always larger than the hole from which it exudes, and as the period of dropping is not exactly uniform, perhaps half a dozen sizes are produced from the same sieve. Again, large sized shot require to be dropped from a greater height than small sized, and while in some cases 100 feet is sufficient, in others an elevation of 150 feet is hardly enough. Buck shot, as will be explained further on, are not made by the dropping process at all, owing to their size. Various devices have been proposed for shot-making, having for their object the abolition of the tower. One process consists in pouring lead upon a revolving table on which is placed a cylinder of perforated sheet brass. The table is revolved with a velocity of 1,000 feet per minute on the periphery, and the lead is thrown through the perforations on the side, forming round shot, which strike against a linen screen placed to intercept them. A method has also been patented in this country for dropping shot through short distances but subjecting them meanwhile to a powerful air current which cools them.

After the shot have reached the bottom of the well, they are at once lifted out by an elevator and thrown upon an inclined drying table over which they slide, falling ultimately into a wire gauze rotating cylinder. Here they are rolled and ground together, and in this way the minute burrs upon them are removed. From the cylinder another elevator lifts the shot upon a screening table, Fig. 3. This consists of a series of planes arranged at gradually decreasing heights. Between each there is an interval. The shot being started at the end of the highest plane will, if perfect, roll from one plane to another, jumping over the intermediate spaces; if imperfect, however, the latter become pitfalls, into which, sooner or later, it tumbles and is carried off into a receptacle, the contents of which go back to the melting kettle. The good shot, after passing this ordeal, reach the separators. It should be explained that there are usually several tables, each being devoted to a different size of shot and its approximating sizes. This [Continued on page 50]



THE MANUFACTURE OF SHOT. POURING THE MELTED LEAD.

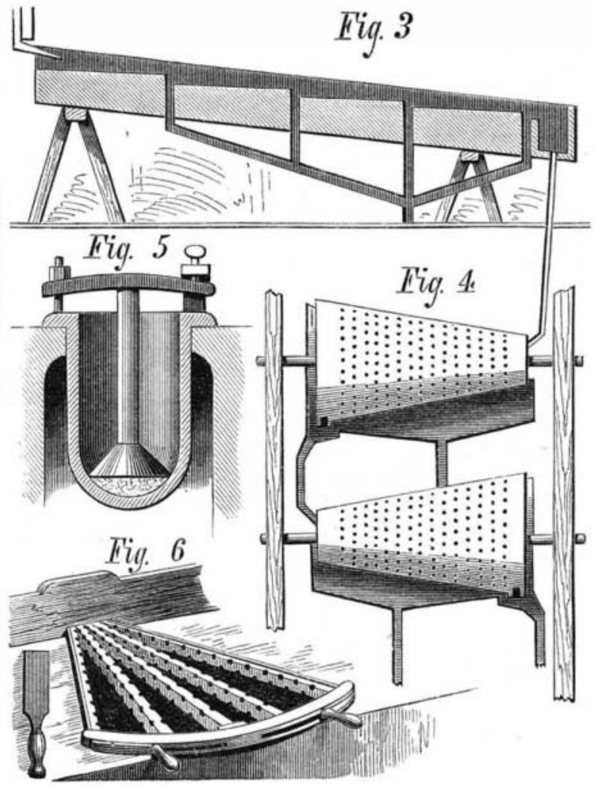
[*Continued from first page.*]

is for convenience in future separating. The shot are next elevated to the top cylinder of a series, arranged on an incline. Two of these cylinders are represented in Fig. 4. They are conical in form and inclined, and are covered with perforated sheet brass. Each cylinder serves as a sieve for a particular size of shot, retaining that and allowing all smaller sizes to escape. The shot, as the cylinder revolves, traverse its entire length, and then the small ones run out into the next cylinder below, and thus the sifting goes on until each cylinder has picked out the particular class of shot to which it is adapted.

The sizes of shot are standard. The smallest is known as "dust," and then comes No. 12, which is 0·05 inch in diameter, 2,326 shot going to the ounce. The sizes then increase by one-hundredths of an inch to up to twenty-three hundredths, of which there are 24 shot to the ounce.

The shot being now assorted, polishing alone remains to be done. This is accomplished by placing the shot together with plumbago in the box, Fig. 2, which is rapidly rotated. This imparts the glossy black smoothness demanded by sportsmen. The shot are then weighed, bagged, and are ready for commerce.

Buck shot, which range in size from twenty-two to thirty-eight hundredths of an inch, are moulded. The moulds represented in Fig. 6 consist of a series of pivoted bars, the outer pair of which have handles. The upper edges of these bars are hollowed to form the moulds, so that when they are closed together, the opposite halves of each cavity unite, and it is only necessary to pour the lead into the apertures. The shot are thus at once moulded to the proper size, so that rumbling and polishing only are subsequently required.

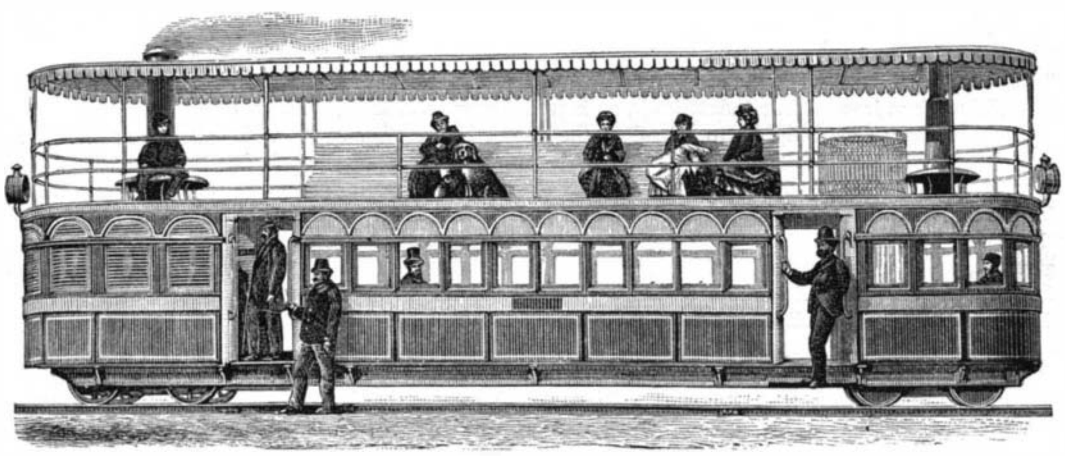



THE MANUFACTURE OF SHOT.

### A SWISS STEAM TRAMWAY CAR.

In the annexed engraving, from *La Nature*, is represented a steam car used on the route between Lausanne and Echellens, Switzerland. The length of the line is nearly nine miles. There are numerous curves; some having a radius as small as 62 feet. The speed at which the car travels is about 15 miles per hour, and the time of passage, including eight stoppages, 50 minutes. The steam engine and boiler is located in one end of the vehicle, similar to the Philadelphia street steam cars, and directly over the trucks. The heating surface of the boiler, according to the builder, M. Brunner, is 143 square feet, corresponding to a motive power of 25 horse. The consumption of fuel is 220 lbs. per trip. Coke is used in the towns, and soft coal during the journey. The tractile power is 1,650 lbs., and the car can be stopped by its brake within a distance of 20 feet.

The vehicle has two stories, with 24 seats in the lower one, and places for 32 people on the deck. Eight more passengers can be carried in the lower end compartment. No turn-tables are used, the car running in either direction. The total length is 41·2 feet, breadth 7·6 feet, height 13·7 feet. The weight, empty, is 11·5 tons; or, with a load of 64 persons, about 16 tons. There are many branch roads in this country where a car similar to the above might be used, and a great saving be effected in cost over the locomotive and ordinary cars now employed.

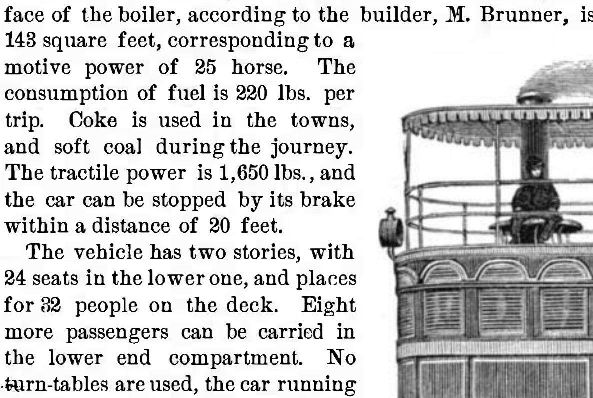


SWISS STEAM STREET CAR.

### IMPROVED FAUCET.

This invention is designed to furnish a faucet so constructed as to prevent leakage, and enable the valve-packing to be readily renewed should it become worn.

In the engraving A represents the receiving tube, B the key seat, and C the discharge pipe. The passage, E, through the receiving tube near the outer end of the faucet, is inclined upward at an angle of 45°, so as to meet the lower end of the key, D. The passage, F, of the discharge pipe, C, passes down vertically entering the cavity of the key seat, B, at an angle of 45°, and just above the vent of



the passage, E. The key, D, screws into its seat, and has a rubber button or packing, G, secured detachably to its forward end by a small screw. The rubber button, G, is unaffected by the liquor, consequently it lasts almost as long as the metal parts of the faucet: but, should it become worn or frayed by use, it can readily be detached by removing the small screw, and replaced by a new one.

Patented through the Scientific American Patent Agency April 2, 1877, by Ralph Hathaway, of Memphis, Tenn.

### Esquimaux Implements.

In looking up objects of interest in my museum at South Kensington for the Westminster Aquarium, I have re-arranged a very nice collection of Esquimaux implements. These were obtained from the Esquimaux at Kotzebue Sound, Behring's Straights (latitude 70°), Arctic Ocean, and presented to me by Commander Hill, R.N., June, 1865. These articles are as follows: A set of instruments used for producing fire. These consist of a bow made of walrus tusk, a round piece of stick like a large cedar pencil, and a piece of wood with cavities in it, corresponding with the end of the stick. The stick being worked very quickly by means of the bow like a drill, smoke and then fire ultimately ensue. Neither Mr. Searle nor myself can produce the fire, but can make the top of the drill very hot. To the Esquimaux, who have no lucifer matches, this fire-stick must be of the greatest importance.

Tusks of the walrus are of the greatest value to the Esquimaux. We observe in the collection several articles made of this—namely, a netting-needle, the same as our own—three other needles—I cannot conjecture their use. They are about eight inches long, pointed at one end, blunt at the other, and a small hole bored through them about half way down. There is also another walrus ivory implement, used for plaiting or twisting lines. There are four hooks very unlike the hooks used by civilized nations. They are in the shape of a letter U, with a barb running down from the top of one side nearly across to the center. The hook is made of some very hard bent wood, but the barb is made of bone or ivory, and very sharp pointed. There are two kinds of baits, namely, a rough imitation of a fish, also in bone, which is evidently a spinning bait. Holes are drilled down the side, what the exact use of these is I am unable to determine. A very interesting specimen of a harpoon demands our attention. It consists of a heart-shaped termination. The edges of this weapon are very sharp, and are made of a portion of some shell. The material into which this shell is set is, I have ascertained by burning, to be some resinous gum, a native-made rope with two barbs of bone standing backwards is let into the hollow of this harpoon, and cemented fast by the gum. The strength evidently is trusted to the barb, the line and the shell are used for the lancing and penetrating purpose. The use of the flying lasso (or bolas as called in South America) is not unknown to the Esquimaux. It consists of strings made of the intestine of some animal; to the end of each string is attached a heart or pyramidal shaped bit of walrus tusk, about the size of a walnut; one has eight ends to it, the other nine. The bolas is thrown by hand. It is first of all twirled two or three times round the head; and then is sent flying through the air like a large cobweb; it will lap round any object it meets with the greatest quickness; it is used by the Esquimaux for catching birds. I think the idea may be applied to catching such birds as partridges. It would require some skill and practice to use it properly, but therein it would cause some sport. At the ends of each bolas are attached a few birds' feathers. In order to avoid the terrible glare of the Arctic snow, we find the Esquimaux have invented snow spectacles. These consist of a piece of wood cut out in the shape of a spectacle; where the glass should be in ordinary spectacles we find two very fine slits. This apparatus I should think would be admirably adapted to drivers of railway engines, who have to encounter snow, wet, and hail, as the engine rushes through storms at express pace. The eye itself is entirely protected, while the eye gets a fair lookout through the slit in the wood. The ingenuity displayed by these hardy Esquimaux is very interesting and instructive.—*Frank Buckland, in "Land and Water."*

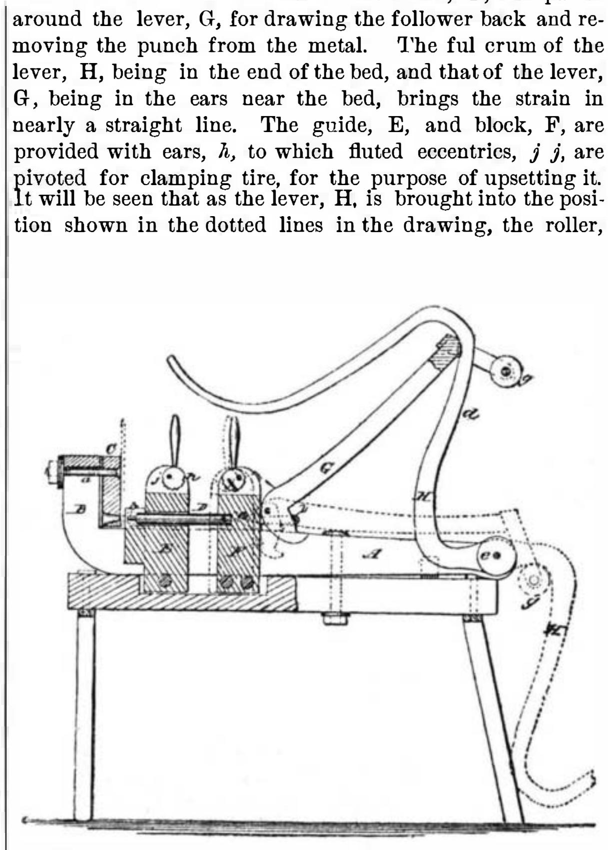
### Proposed Utilization of a New York Reservoir as a Science Museum.

Messrs Vaux and Radford, architects of this city, have recently suggested the utilization of the ground on which the 42d street reservoir (which structure is no longer required for water distribution) stands as a site for a permanent museum of science. This is an old idea, which was quite fully elaborated by Professor C. F. Chandler and Mr. E. D. Lindsay some five years ago. It was then proposed to leave the reservoir as it is, removing only the inner dividing wall, the material in which could be used for building porches, etc. With the reservoir walls serving as those of the building, a glass and iron superstructure alone would be needed. Mr. Lindsay has prepared drawings of quite an imposing structure, which according to this plan would roof over nearly four acres of ground.

### IMPROVED METAL PUNCHING MACHINE.

Mr. Adam Robertson, of Blanchardsville, Wis., has patented through the Scientific American Patent Agency, May 22, 1877, the novel metal punching machine herewith illustrated.

B is a right-angled support for the dies, that is formed on the end of the bed, A. C is a die that is provided with several holes for punches, and is adjustably attached to the support, B, by a bolt, *a*. D is a follower that moves in a guide, E, attached to the bed, and F is a movable block that is attached to the end of the follower and slides in the slot in the bed. The follower, D, carries a punch, *b*. G is a cam lever that is journaled in ears, *c c*, attached to the bed of the machine, and bears against the block, F. The lever, H, is curved in the form of an irregular volute from *d* to its fulcrum, *e*, and its outer end is bent into convenient form for a handle. A fork, *f*, is formed on the end of the lever, G, for supporting a friction roller, *g*, between which and the lever, G, the lever, H, passes. A loop, *i*, is attached to the block, F, and passes around the lever, G, for drawing the follower back and removing the punch from the metal. The ful crum of the lever, H, being in the end of the bed, and that of the lever, G, being in the ears near the bed, brings the strain in nearly a straight line. The guide, E, and block, F, are provided with ears, *h*, to which fluted eccentrics, *j j*, are pivoted for clamping tire, for the purpose of upsetting it. It will be seen that as the lever, H, is brought into the position shown in the dotted lines in the drawing, the roller,



*g*, draws constantly nearer the fulcrum of the said lever, thereby increasing its advantage over the lever, G, which, by the form of its cam, works against the block, F, with a slightly-decreasing efficiency; but this loss is more than compensated by the advantage gained in the lever, H.