Upsetting of Leaden Bullets.

MESSRS. EDITORS.—Your correspondent of San Francisco, in your issue of August 3d, gives a very ingenious explanation of the cause of upsetting and fracture of bullets. Its only fault appears to be in its want of truth. The true cause, as I understand it, lies in the inertia of the metal forming the front portion of the bullet resisting the pressure of the rear portion. Of the truth of this I think your correspondent will be convinced if he will try the following experiment: Take a piece of heavy rifle barrel, say 4½ inches long, close one end securely, leaving four inches of bore, charge with two inches of best electric powder, then drive a tightly fitting steel plug half an inch long down to the powder, insert a loosely fitting soft leaden bullet long enough to fill the remainder of the bore, with the pointed portion outside, so that no confined air will oppose the bullet; fasten it to some heavy body to prevent recoil, and fire with a percussion cap, and the bullet will be found shortened and enlarged in diameter. The plug acts as a wad preventing leakage, and by its friction resisting pressure until the powder is burned.

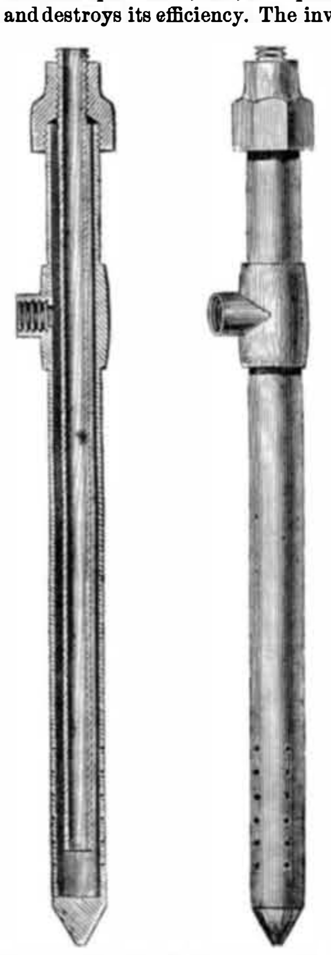
The experiment of the bullet on the anvil proves just nothing at all, as the pressure given by the bat is simply inadequate to produce sufficient velocity to upset the lead; the surface of wood in contact with the bullet yields to the pressure and thus the time is extended enough to move the bullet without change of form. If your correspondent will try again using a steel hammer of the same weight of the bullet and give the same power as before he will find the form of the bullet sensibly changed, simply because the motion was imparted in a shorter space of time.

Again in the second experiment. The principles involved when the bullet is placed on its point and struck, are entirely different from two opposing elastic gases. In this case one solid is placed between two other solids and pressure applied, a simple case of forging Where the principle applied is pressure exerted on a part of the surface at a time, it would be impossible to upset the bullet by the pressure of elastic gas alone, even if it should be condensed to equal the lead in density, as the pressure must be equal over the whole surface and in effect the same as placing it in a swage exactly fitting it and applying pressure, it would be condensed if porous, but not changed in form. S. H. ROPER.

Roxbury, Mass.

DUTTON AND MAGUIRE'S PUMP TUBE.

The labor of digging a well is one requiring time and not unattended with danger, especially when the soil is of a yielding nature. And sometimes after the well has been dug and walled up, the inflowing of quicksand keeps the water in an impure state, and, if a pump is used, cuts the valves and destroys its efficiency. The invention herewith illustrated



wholly obviates the necessity of digging a well, by merely driving a proper tube into the earth.

By the device shown in the engraving—the pipe in one case being a whole, and the other a section—it is shown that a stream of pure water can be lifted to the ordinary hight without the nuisance and trouble of the common pump-pipe. The outer or main pipe is armed at the bottom with a cone which penetrates the soil to the requisite depth, while the tube contains another pipe that only admits the water, pure and separated from gravel, sand, and other foreign matters.

The inner tube is whole and perfect, the only entrance to its interior being its bottom, while the outer tube is perforated at its lower end with holes which allow the passage of water, while their diameters do not permit the ingress of of gravel or sand.

The result of this device is that while the inner tube allows the ingress of water, free from the sediment of sand or fine gravel, the outer one will yield the fluid, but in perhaps a less pure state. In fact, by the use of the side tap, shown in the engraving, water can be drawn from the outer pipe for outside purposes, while, for domestic uses, it can be drawn from the inner pipe in a state of purity not allowed by ordinary well or pumps.

The improvement seeks to prevent the rising of sand or gravel in the pump, and to prevent, by the combination of two tubes, the accumulation of sand in the pump tube or pipe by encasing the pump tube, proper, in a perforated pipe, which, while it gives ample ingress to the water, prevents the ingress of any body which may prevent the free action of the pump.

To those who have been annoyed by the use of pumps, which brought up as much soil or sand as water, this device will appear as an improvement. It was patented Oct. 10th, 1865, by Thomas Dutton and Thomas Maguire, of Port Jervis, N. Y., who may be addressed as above.

MANUFACTURE OF MAGNESIUM AND SODIUM.

Altogether, in the manufacture of sodium and magnesium an average number of twenty men and boys are employed in the works at Manchester, Eng. To make magnesium, one part of sodium is mixed with five parts of chloride of magnesium, the crucible is covered and heated to redness, and afterwards allowed to cool. The block thus produced is then broken up, and reveals lumps of crude magnesium metal in the form of eggs, nuts, granules, and minute buttons. The crude metal is then put in a crucible through which a tube rises to within an inch of the lid; the crucible is at first filled with the metal nearly up to the top of the tube. The pipe

passes from the crucible, A, down through the furnace bars into the closed iron box, B. When the crucible is heated the magnesium distils over pure-like zinc, and descends into the box below, where, at the conclusion of the process, it is found in the form of a heap of drippings. It is subsequently melted, and may be cast into ingots or any required shape, although it is much easier rolled than cast into thin plates, being a somewhat awkward metal to work.

SODIUM.

Sodium is not only in common use in all laboratories, but the recent discovery of the method of manufacturing magnesium on a large scale, by the aid of sodium, has caused an excessively heavy commercial demand for the latter metal. Sodium is also used in the reduction of aluminum and other of the rarer metals. In consequence of the present large demand, it is now manufactured in England on a large scale, and almost exclusively by the Magnesium Metal Company, at Manchester; so that this remarkable metal, which threw Sir Humphrey Davy into ecstacies when he for the first time saw a few globules of it early in this century, has within the last few months been selling in London at a wholesale price of five shillings per pound avoirdupois.

Before describing the recent improvements by the Magnesium Metal Company in the manufacture of sodium, it may be as well to summarise some of its properties and applications. Its great affinity for oxygen and power of decomposing water without the aid of an acid are well known. Unlike potassium, it does not cause the gas evolved to take fire spontaneously, for this only occurs when there is so little water that the fragment cannot swim, or when the water is thickened with gum to prevent it from moving about. It is a light metal of the specific gravity of 0·972. Sodium is much valued by men of science, because the rapidity and length of the vibrations of its particles, when burning, are such that it throws out rays of pure monochromatic yellow light. This property is especially valuable to those philosophers who have occasionally to explain to large audiences the properties of light and the phenomena of spectrum analysis.

This month, chemically pure hydrate of soda, obtained by the direct action of water upon metal itself, has for the first time been introduced into the market. Chemists require this article in a very pure state for analytical investigations; hence they will value the new hydrate of soda, which is necessarily free from silica, calcium, and other salts, which are commonly found in the hydrate of soda now used in analysis. The pure hydrate of soda is prepared by placing a single drop of distilled water in a deep semicircular silver vessel capable of holding about four gallons. Blocks of pure sodium are then cut into lumps, each about one and a half inch square, and one of these pieces is allowed to fall on the drop of water. The vessel, which rests upon a stream of cold water, is then agitated by hand to present a larger cold surface to the fusing sodium, and thus prevent explosion. Great heat is evolved during the combination, hence the necessity for the stream of cold water. The piece of sodium, now transformed into a a milky liquid, has other lumps of sodium and other drops of water successively added, with continual agitation, till several pounds of sodium have been used up. A thick residue, with only a few drops of milky liquid on the top, then remains in the silver vessel, which is next placed over a gas stove, the contents heated to redness to drive off the superfluous moisture, and the remaining hydrate of soda cast into any form required.

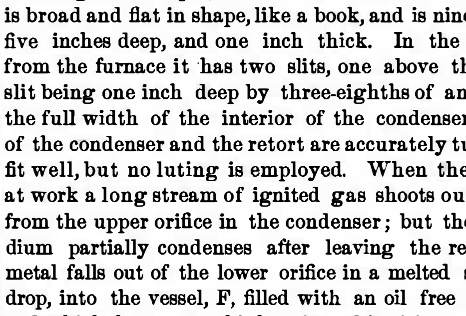
Mr. Crookes, F.R.S., has recently shown that an alloy of sodium and mercury, which he calls "sodium amalgam," can most advantageously be used in the extraction of the precious metals from their ores. Till recently, the miners used unalloyed mercury for the purpose, which answers well up to a certain point, but, after being ground up with the ore for a prolonged period, becomes what the miners call "sicklied," or incapable of acting further upon the ore. The addition of a small percentage of sodium renders the mercury much more active, but why it is so, is not clearly understood. In practice, however, the use of amalgam has been found more economical than the old process, and it has been suggested that the auriferous ores of Wales, which are too poor to be worked profitably at present, may be made to yield a good return by the use of sodium amalgam.

The explosive power of sodium, when brought under the necessary conditions into contact with water, renders it a somewhat dangerous substance to place in the hands of men unacquainted with its properties; but, when kept away from damp and wet, it is a very harmless metal. In the course of last winter the river Irwell rose nearly twenty feet above its ordinary level, and flooded the works of the Magnesium Metal Company, on the Salford side, to a depth of about seven feet in every part. There were then from three to four hundred weight of sodium in stock, and, soon after the commencement of the flood, the room in which the sodium was stored was two feet deep in water; but, as it rained in torrents, it was then considered best not to run the risk of attempting to move it off the premises. The sodium was stored in long narrow jars, with loosely-fitting covers, made air-tight by allowing the bottoms of the lids to rest in a circular groove filled with oil. As the flood did not abate, and the position began to grow more dangerous, one of the men volunteered to go on to the roof of the sodium shed and watch the water rise, and for hours he lay upon the roof in a soaking shower of rain, watching the sodium jars. Inch by inch the water rose, and at last, when it was only half a foot from the top of the jars, he drew his head out of the hole in the roof where it had been sticking so long and summoned the rest of the men. They unslated the roof of the storeroom, let themselves down into the water, now reaching nearly to their armpits, and removed the sodium, lump by lump, into other vessels placed among the rafters of the roof. By accident one little ingot of sodium fell into the water, causing the courage of the men to falter; but the lump, fortunately, only fumed and fizzed, and dissolved away without exploding.

In the manufacture of sodium the Magnesium Metal Company has devoted much attention to the construction of good furnaces, and to the adoption of effective measures for protecting the wrought-iron reducing retorts from the destructive effects of an exposure of seven or eight hours' duration to a white heat. The iron retorts are surrounded by plumbago jackets, which remain permanently in the furnace till they are used up. The openings of the plumbago tubes are in the sides of the furnace, so that the retorts can be easily placed in them and taken out. The retorts are of wrought-iron, since cast iron would yield to the excessive heat necessary for the reduction of sodium. The retorts are, in fact, iron tubes three feet six inches long and five inches in diameter. Both ends are plugged with wrought-iron stoppers, luted in with fireclay; but one of the stoppers carries the tube to which the condenser is attached.

Each retort holds about thirty pounds of the "sodium mixture," which consists of coal, coke, chalk, and soda. The soda is first thoroughly dried at a high temperature, then all the four substances are separately ground to the finest dust, and afterwards they are mixed and ground together, as much of the success of the operation depends upon the thorough incorporation of the ingredients. These substances, when heated together, necessarily give off volumes of carbonic oxide and carbureted hydrogen, these gases, rushing out of the retort, do good service in acting as carriers to the sodium vapor.

In the cut, A A A A is the plumbago jacket inserted in the



heart of the fire, and B B the wrought-iron tube plugged at each end in the manner already described. D is the exit tube for the gas and vapor, and E the condenser. The condenser is broad and flat in shape, like a book, and is nine inches long, five inches deep, and one inch thick. In the end furthest from the furnace it has two slits, one above the other, each slit being one inch deep by three-eighths of an inch wide—the full width of the interior of the condenser. The necks of the condenser and the retort are accurately turned so as to fit well, but no luting is employed. When the apparatus is at work a long stream of ignited gas shoots out several feet from the upper orifice in the condenser; but the vapor of sodium partially condenses after leaving the retort, and the metal falls out of the lower orifice in a melted state, drop by drop, into the vessel, F, filled with an oil free from oxygen, and which has a very high point of ignition, to do away as much as possible with its tendency to catch fire during the distilling operations. The sodium is then run together beneath oil, over a slow fire, and then cast into rectangular blocks, or any other shape, for the market.

The entire operation lasts from six to eight hours, during the whole of which time the tubes are subjected to an intense white heat. Most of the furnaces contain four tubes, but one of them is a reverberatory furnace and holds eight. One man and three boys manage a furnace of four tubes. The boys are much occupied in the task of keeping the condensers from being choked by clearing them out as much as possible with hot iron rods inserted through the slits. Nevertheless the condensers have to be constantly changed, for some of them will not last longer than twenty minutes without getting choked. When choked, the condenser is taken off, thrown into water, its sides are then unscrewed, taken off, and cleaned, then fitted together again, ready for future operations. Altogether, the appliances on the premises are capable of turning out four or five hundred weight per week—a large amount considering the expense of the metal, and the fact that it is lighter than water, and consequently is bulky.—*British Journal of Photography.*

TEST OBJECTS FOR THE MICROSCOPE.—To such wonderful perfection has this process been carried that M. Nobert, of Griefswald, in Prussia, has engraved lines upon glass so close together that upwards of eighty thousand would go in the space of an English inch. Several series of these lines were engraved upon one slip of glass. By these, the defining power of any object glass could be ascertained. As test objects they are equal to, and even rival, many natural objects which have hitherto been employed for this purpose. The delicate lines on some of the diatomaceæ are separated from each other by the 1-50,000 of an inch, while the finest lines engraved by M. Nobert a not more than the 1-100,000 of an inch apart.