two stout arbors each carrying a heavy bevel gear. These gears take into similar ones secured to the large pulleys, and transmit the motion of the shaft to them. If the rope on one wheel pulls tighter than that on the other, the intermediate gear on the driving coupling will turn slightly and relieve somewhat the tension on the one wheel, while the other will be revolved in the opposite direction until it comes under the same tension as the first. The ropes that run on these pulleys are a little over an inch in diameter. At the speed above mentioned for the pulleys, it will be seen that the speed of the ropes will be about 4,400 feet per minute, or say 50 miles per hour. The difficulty of providing practically for such a speed will be apparent to every one who has had any experience in similar undertakings, and as a matter of fact, this has been the great difficulty to be met in carrying out this plan of distribution, and it is only after a long series of trials that this has been successfully accomplished.

As already mentioned, the driving and driven pulleys at Schaffhausen are of iron, faced with wood; in other cases, to be mentioned presently, another combination is used which has given the most satisfactory results. To continue, however, our description of the present apparatus. On the opposite bank of the river, or rather a few feet from it, are built some solid stone piers on which is placed a second shaft and pair of wheels, similarly arranged to those in the wheel house, and high enough to keep the ropes in their transit clear of the water The shaft is about twelve inches in diameter in the body and seven inches at the journals, and is supported in iron housings firmly bolted to the piers. By a pair of bevel gears the motion of this shaft is transmitted to another at right angles to it, carrying another exactly similar pair of wheels running in a plane in the direction of the course of the river instead of across it. Coupled to the end of this shaft is a small one which takes off a portion of the power to some factories situated just at this point on the bank. From the large pulleys a second pair of wire ropes carry the power to a third pair of wheels about 400 feet up the stream, and from here again it is transmitted a similar distance to another pair, and again to another, the pulleys being made with double grooves in their faces to accommodate the two ropes that pass around each of the intermediate wheels. At any of these points a portion of the power may be taken off, and this is done in a variety of ways as may be most convenient under the particular circumstances; sometimes by gearing and shafting, or again by small pulleys carrying a smaller size wire rope, say half an inch in diameter. On the last span, but one rope is at present in operation, the coupling between the two wheels being locked to prevent it turning, but new piers and housings are being erected for the purpose of transmitting the power to a still greater distance, and then the second rope will be required. As a rule, the speed of all the successive wheels and branch lines of shafting is kept the same, namely, one hundred revolutions.

This system of transmitting power to a distance has been a subject of great study during the past ten years and is now being applied to much greater distances than those here mentioned. Where longer intervals than, say, 450 feet between the large pulleys occur, it becomes necessary to provide pulley supports to sustain the weight of the rope. These are made six or seven feet in diameter, and it is these in particular that have given so much trouble. With the high speed of cable used it was soon found that the wheels were very rapidly destroyed, or if made of any substance hard enough to resist the action of the cable, they in turn as rapidly destroyed the latter. This has at last been obviated by filling the dovetailed groove in the face of the wheels with gutta percha, driven in hard, and it is stated that wheels so constructed have been in use seven years without injury. The inventor and the constructing engineers, Messrs. Stein & Co., of Alsace, who have introduced the system, estimate that it is possible to transmit 120-horse power twelve miles with a loss of but 21-horse power. The cost is stated at £320 per mile for everything, including cost of erection, and £1 per horse-power for the terminal apparatus, which of course is small in comparison with that of any system of transmission of the water itself for similar distances, and the only question remaining is the relative cost of repairs. If the statement published may be relied on, these are not excessive with the new system. The comparison with the method of transmitting the water bodily, illustrates beautifully the theoretical principle which is involved in this means of working, viz., the reduction of mass and the increase of velocity, the quick running rope carrying in itself all the power of the ponderous mass of water slowly flowing through an ordinary canal. The importance of some system for the transportation of power can hardly be overestimated, and it is a matter of surprise that more serious attention has not been given to it by engineers. It is certain that, looking forward at least to the time when our fuel beds shall be exhausted as they one day will, such immense supplies of power as exist at Niagara will not be permitted to run to waste, and the first steps toward the practical accomplishment of such a utilization of it, are accordingly of peculiar interest. SLADE.

A Valuable Invention.

The attempt to secure an English patent for a plan of "preventing financial crises" was not successful. But a better fortune has smiled upon the application of a certain Mr. Liegher, who has been granted a patent for the manufacture of the vital fluid, as he calls it. This imponderable fluid, is developed when a nitrogenized substance comes in contact with a carbonized one. It is not electricity, as it passes through bodies which do not conduct electricity. Nitrogenized bodies, like silk, are its best conductors. To make it, he takes a bladder full of liquid ammonia, and places this in a vessel containing molasses. At the neck of the bladder is a silk cord attached, and another such cord hangs in the molasses. When the ends of these silk cords are joined, the current of the vital fluid is established, as may be seen by placing animals in the circuit, when they become very lively. The effects are hightened by combining several of those elements as we combine the elements of a galvanic battery.

Correspondence.

The Editors are not responsible for the opinions expressed by their correspondents.

River Embankments---Mississippi Levees.

MESSRS. EDITORS:—The article of W. J. B., in your paper of July 5th, though courteous and unexceptionable in its tenor, seems to require of me a reply. He considers that my proposed plan of timber piling, sheet piling, and inclined planking in front of all new large levees, though in its general features good, is yet on the whole, too expensive, and liable to decay. He proposes instead of it a battened plank fence in the middle of the levee, and a front protection of "willows, or any shrub of southern growth, which roots well," or that "the outer slope should be protected with stone." Experience has demonstrated that embankments of Mississippi sand or loam—the only material obtainable—are unreliable. The losses, only to be estimated by millions, resulting year after year, from inundations caused by the breaking or cutting of the levees, have driven the inhabitants of the valley nearly to desperation; they are abandoning lands which, in fertility, can hardly be equalled on the globe, and the present value of these lands is but a fraction of what it was. I maintain, as the result of twenty-one years' study and observation of the lower Mississippi, that every acre in the valley, above the channels required for interior drainage, can be reclaimed permanently without increasing the high-water line of the river, and that levees can be relied upon if properly constructed and maintained. As before remarked, levees of Mississippi earth alone, are unreliable. Stone, for the protection of the river slope of levees, would answer a good purpose, if we could get it. It would have to be transported at enormous cost for hundreds of miles. Neither stone, gravel or even coarse sand is to be found on the alluvial banks of the lower Mississippi. The fine sand mixed with clay found everywhere on the banks of the river becomes mud or silt when saturated with water and disturbed. The placing of "the more open and porous material in the slopes" would be very well, but, like stone, where are we to obtain it? Levees have to be built of the earth obtainable where they are built, and that is, a fine sandy loam more or less mixed with clay. "A front protection of willows" would answer a good purpose, but, willows only grow in water or wet ground, while the levees become as dry as it is possible for earth to be, during low water and the dry season. The first rise, after the new levee is built, is what endangers it most, and willows, even if they could be made to grow on the slopes of levees, would require several years before they would be of much benefit. I have myself proposed a method which I think would answer a better purpose, and this is the thatching or shingling of the outer slope with successive layers of green willows, or bundles of willows—fascines—secured in place by means of transverse poles and stakes of green willows. This, if done just before the rise of the river, or in the winter—the river generally begins to rise in March, and is highest in April and May, though we always expect a partial rise in January—might result in the rooting of the willow stakes, and prevent their giving way. The willows forming the thatching or fascines, where they touch the ground—which would be kept moist for a time even after the decline of the river, by such a covering—might also root well, for the first year. I apprehend, however, that they would die during the low water and dry season in the fall months. However, as the protection of the new or green levee during the first rise of the river after its construction is a matter of the highest importance, for it acquires solidity or cohesion, and grass grows upon its rear slope forming a sod before the next rise, I think that my plan of thatching or fascining in the manner described would be useful. Any quantity of young willows can be obtained, and, so used, they would protect the levee front from the action of the river waves. A fence in the middle of the levee has been proposed years ago by myself and others, and in combination with my system of thatching or fascining it would do very well for small or moderate-sized levees. But for large levees, ten, fifteen or twenty feet in hight—and these, when a crevasse occurs in them, are what occasion our desolating inundations —a simple fence would not be reliable, except as a bar to the crawfish. Crevasses occurring in small or moderate-sized levees can readily be closed, but when they occur in larger ones, owing to the unstable nature of the bottom and sides of the opening, they are seldom, if ever, closed until the river falls. Like an arch, when added to a bridge truss, the woodwork added to a large levee must have strength sufficient to sustain the load or pressure of itself. I recommend wood, because we have an abundance of durable cypress and no stone; brick masonry would be very expensive. Wood can also be rendered durable by creosotizing it, or by adopting the Robbin's process; but only the exposed portions would need it.

As to the question of cost, I think that is a matter of secondary consideration, but of course that plan which will insure safety, at the least expense, is the best. The amount expended for a wall of brick or stone masonry, would be incomparibly less than the losses sustained by the failure of a large levee.

Non-residents, or persons unacquainted practically with the difficulties to be surmounted in the construction and maintenance of the Mississippi levees are apt to underrate them. A body of water of the width and depth of that river, flowing with a velocity of nearly five miles per hour, is a different thing from the still-water pond or canal, even if the material or earth we have to use for embankments were as good. The difficulties to be overcome are the following:

1. The washing away of the front—of new levees particularly—by the action of river waves during storms, and the sinking, sliding or sloughing of the rear slope, when saturated with water during the first rise after it is built.

2. The perforation or honeycombing of an old levee by crawfish and perhaps—in some cases—by muskrats. Crawfish most abound where the ground is low and the levee high, where the damage they do is greatest.

3. The general neglect of levees after they are built and received from the contractor, and the notoriously imperfect manner in which contract work is done. The earth should be rolled, or rammed, or compacted by building with carts; it is generally only wheeled up in barrows, and, is therefore, as loose as it possibly can be.

4. The cutting of the levee by malicious persons, but principally by "swampees" or "timber getters," who require an overflow to enable them to float out the timber they have "deadened" during the low water season, generally on land which is public, or the property of others than themselves.

The levees built in Louisiana in 1866-7 by the Board of Levee Commissioners—nearly all of which failed—were of much larger dimensions than W. J. B. proposes. These had a river slope of four feet base to one foot rise, a rear slope of two feet base to one foot rise, and a width at the top equal to the hight.

The plan of timber piling, sheet piling or inclined planking proposed by me, is approved by some of the most experienced levee men here. It will meet all the difficulties stated above, and though expensive, perhaps, would prevent all failures of levees, and render practically impossible the occurrence of crevasses. Absolute security must be felt or capital will not again seek investment in the Mississippi Valley.

G. W. R. B.

A Plan for Ventilation.

MESSRS. EDITORS.—I have just read in your issue for July 27th, the article on ventilation taken from the London *Herald*, and will give you the idea which I have of the question: Let there be a trench dug and a pipe or flue built therein along the lines of a street or other public thoroughfare, one end—its mouth or receiving end—being at as low a point as attainable, where it may receive through its funnel-shaped mouth fresh air from off water or from the valley, and then pursue its course along to all the panting inhabitants and dust-covered goods upon its line. Let it be tapped as gas or water pipes are now, or somewhat similar thereto, and let it be under the care of trusty officers to see that it is not wasted in unoccupied buildings or parts of buildings that may once have used it.

There may be many or few of these pipes, as surface of water, or low ground presents itself or necessity requires. If demand is greater than space, the steam force-pump or fan may be employed to meet it.

The air, in passing through these pipes, would be cooled in summer and warmed in winter. Two highly prized conditions, and the latter one, of economy. Cities built upon hills, if of great elevation, would need but little or no assistance from the steam engine. Your city and surrounding cities might be abundantly supplied from your water surfaces. A mouth at the Battery might receive a large amount of pure, cool, fresh, and invigorating air, fresh from the sea. The mouth might be closed against the smoke of passing steamers by an ever-present watchman.

I must modify the terms "pure" and "fresh," so long as we continue in the lazy, filthy, disease-breeding and abominable practice of emptying our privies and sewers into running water, rather than to collect their contents and deodorize and use it in agriculture. They do this, and that too with large profits in England. But as long as this abomination remains the mouth or mouths of large enough flues might be placed, as is the head of the Croton Aqueduct, miles away, and in a section free of stench, smoke and dust. Would not this answer for the purpose of keeping our dwellings and fine goods and wares in a good degree free from dust, as inquired for by a correspondent of your paper a short time ago?

The air tube should be a tube within a tube, an open space being left entirely around it except enough of bearings for its support. T. E. G.

Erie, Pa.

Rotation of Forest Crops---Are Acorns Seeds?

MESSRS. EDITORS:—Are acorns the seed of oak trees? Will acorns sprout and grow into oaks? Wherever a pine forest is cut off, a growth of oak immediately follows, and as regularly as though the seed had been sown, although there was not a oak tree in the forest to produce seed before it was cleared. The question is often asked, do the oaks grow from seeds produced in the acorn, if so, how does this seed get in the clearing so regularly? Some say it is carried there by birds, but the kind of birds are not named that would be likely to distribute acorns; others think the acorn is not a seed but a fruit for the food of the wild animal, that oaks are spontaneous or grow from a certain inherent combination of matter of the earth that will produce, and one of the productions is the oak, the same with the chestnut and the walnut; neither reproduce from the nut. Please give the correct information upon the subject. FANNY.

Philadelphia, Pa.

[The succession of growth of forest trees in the circumstances named is well established, and does not affect the acorn question. There is no doubt that the acorn is a seed and contains the germ of the oak. "Tall oaks from little acorns grow."—EDS.

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.

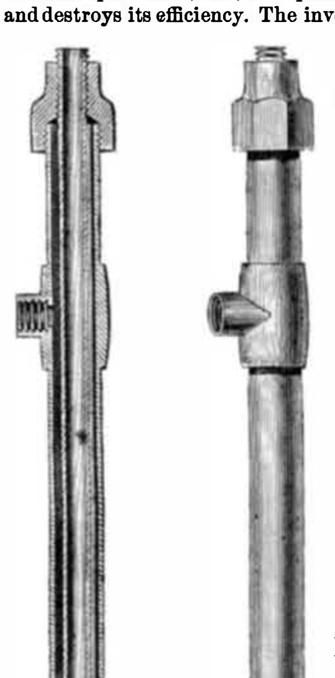
The experiment of the bullet on the anvil proves just nothing at all, as the pressure given by the bat is simply inadequate to produce sufficient velocity to upset the lead; the surface of wood in contact with the bullet yields to the pressure and thus the time is extended enough to move the bullet without 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.

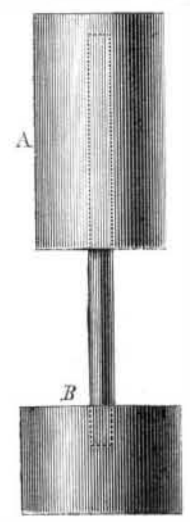
The result of this device is that while the inner tube allows the ingress of water, free from the sediment of sand or fine gravel, the outer one will yield the fluid, but in perhaps a less pure state. In fact, by the use of the side tap, shown in the engraving, water can be drawn from the outer pipe 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.

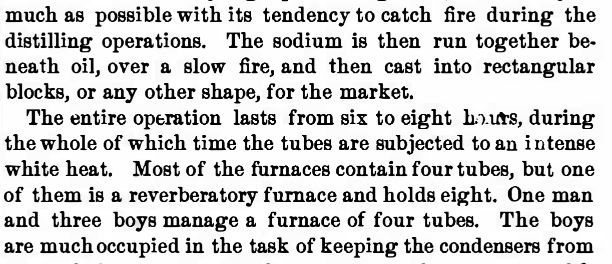
Mr. Crookes, F.R.S., has recently shown that an alloy of sodium and mercury, which he calls "sodium amalgam," can most advantageously be used in the extraction of the precious metals from their ores. Till recently, the miners used unalloyed mercury for the purpose, which answers well up to a certain 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.