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.

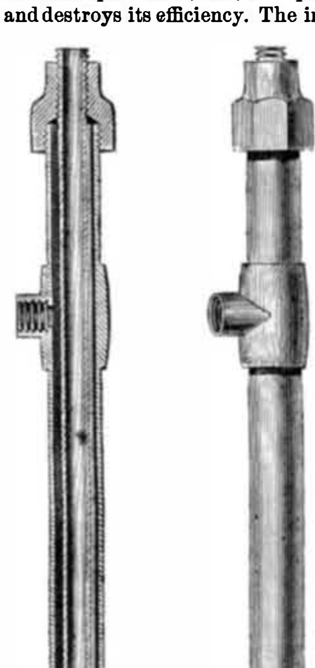
The experiment of the bullet on the anvil proves just nothing at all, as the pressure given by the bat is simply inadequate to produce sufficient velocity to upset the lead; the surface of wood in contact with the bullet yields to the pressure and thus the time is extended enough to move the bullet without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

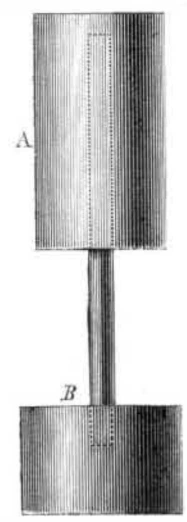
The result of this device is that while the inner tube allows the ingress of water, free from the sediment of sand or fine gravel, the outer one will yield the fluid, but in perhaps a less pure state. In fact, by the use of the side tap, shown in the engraving, water can be drawn from the outer pipe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

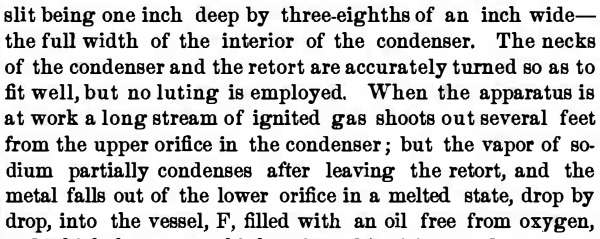
Mr. Crookes, F.R.S., has recently shown that an alloy of sodium and mercury, which he calls "sodium amalgam," can most advantageously be used in the extraction of the precious metals from their ores. Till recently, the miners used unalloyed mercury for the purpose, which answers well up to a certain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

Improved Extension Trestle.

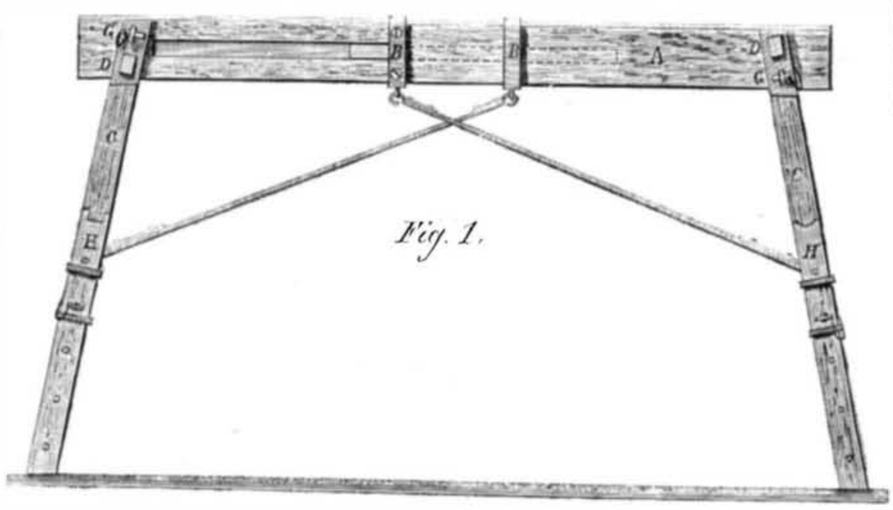
The object of the device shown in the engravings, in elevation and perspective, is to furnish a convenient trestle or horse for the use of masons, plasterers, and others, which can be extended in length and hight, or folded compactly together for transportation or stowage.

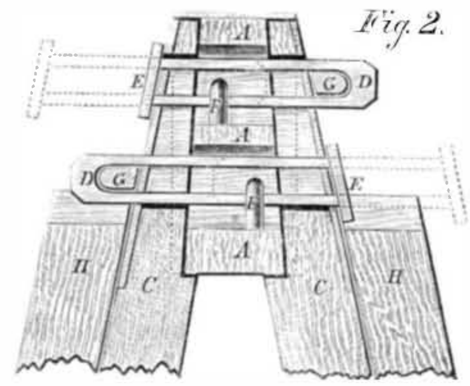
The main horizontal beam, A, is in two parallel parts, connected and held together by straps, B, one of which is fastened by screws to the inner end of each beam and surrounds the other, so that the two portions of the beam may be slipped, one past the other, for extending the length of the trestle. Between these two parallel parts is a bar or feather sliding in a groove, cut half in each portion of the beam and stayed by pins at its ends to prevent it from slipping entirely out. The object of the feather is to stiffen the beam when extended and to keep it perfectly in line.

At each end of the beam, A, are two legs, C, which are secured by means of slotted pins, D, Fig. 2, which are flat and have heads, E, inclined to the slant of the legs, C. The slot in these pins is to prevent them from being entirely withdrawn which is assured by the staples, F, fastened in the mortises through the beam, A, in which the pins, D, fit. The pins can be drawn back, as shown by the dotted lines, by removing the keys, G, when the legs or supports may be folded against the bar, A.

To these supports or legs are attached supplementary legs, H, in both figures, which are secured to the outside of the true legs by bands seen in Fig. 1. A series of holes through the extension leg and into the main leg secures the two, by pins, in any required position. Braces running diagonally from the rings, B, to cross braces between the legs, keep the structure in a rigid condition when in use.

The device was patented through the Scientific American Patent Agency, June 11, 1867, by Richard Hammill, of Mineral Point, Wis., who will answer all inquiries addressed to him relative to his improvement.





HAMMILL'S EXTENSION TRESTLE OR HORSE FOR SUPPORTING PLATFORM.

Improvement, and Usefulness of the Milling Machine.

It is doubtful if any tool now used by machinists is more valuable and capable of being applied to a greater variety of purposes than the milling machine, yet it has been a growth of comparatively a few years. Twenty years ago the milling machine, or rather the "slabbing machine," its progenitor, was seldom seen, and when found was constructed and used only for a special purpose. A pair of ways, on which traversed a platform or table, and from which rose two supports for a head that received an arbor with its rotary cutter, comprised the "slabber," and the work was fed to the milling tool by means of a weight and strap running over a friction wheel. It was a rude machine, coarsely made, and unreliable in its work; yet it was the germ of the present milling machine, one of the most expensive, best finished, and valuable of the machinist's tools.

For many uses it is better than the planer and superior to the shaping machine, and not seldom does the work of the gear cutter. The manufacture of fire arms, rifles and pistols, and of sewing machines could not be carried on so perfectly and rapidly without the milling machine. The cutting of ratchets, the squaring of studs, the finishing of nuts, scoring of taps and reamers, facing of surfaces, and a thousand and one other processes can be done with this machine quicker and better than with any other appliance used by the mechanic. When the machine works as it should, the article submitted to it comes out almost completely finished, without "chatter" marks, and smoother and more accurate on on the surface than is possible with the file, while its rapidity of execution puts to shame the most expert filer. We have seen the lock plates of fire arms so finely finished by this machine that it would seem to be a waste of endeavor and and time to do more than to polish them.

Some of those machines are of such perfection of workmanship, plan, and action that it would seem impossible to improve them. Their saving of files, and time, and labor, would hardly be believed by machinists who have never used them; and their easy adaptation to different jobs makes them one of the most economical machines ever constructed. And yet we are not aware that any man holds a patent on any essential portion of the machine; it has been the gradual growth of experience, one mechanic adding a part or improving a movement, and another improving again on that, until it would be assumption in any one to claim the machine perfected as his own.

Its value is such that a shop of any pretensions should as soon go without a decent screw-cutting engine lathe as without a good milling machine. There is no department of finished metal work where it cannot be advantageously used, and no matter how small the shop, or how contracted its influence, every manufacturer of machinery should possess a milling machine.

Aerial Navigation.

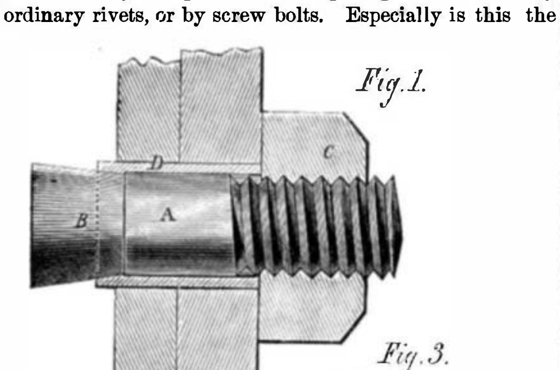
A stock company of San Francisco are building a flying machine which is described by papers of that section as resembling in appearance a hybrid between a fish and a short-necked bird with wings expanded. Hydrogen gas furfurnishes the ascensive power, the wings aid in sustaining it in mid air, and two propellers which may revolve at any angle, give motion to the machine. The rudder is like the tail of a fish, and to rise to any hight it is given a twist, the movable wings are depressed ten or twenty degrees and her propellers are placed at angles of forty-five degrees. Her weight including propellers, frame, engine of three horse power, boiler, furnace and fuel, is only 1,171 pounds, and in lightness and the application of steam power, rest the hopes of her projectors in success.

In M. de Louvrié's system of æronautics, which the Academy of Sciences have seen fit to disapprove, the recoil caused by a sudden expansion of gases as in the sky rocket, seems to have been made use of as a motor. This inventor provides a hollow cylinder which contains an explosive compound generated by the mixture of air with a highly inflammable gas formed from some volatile hydro-carbon, such as benzine or petroleum. The combined gases are lighted as they escape from a small orifice at the lower end of the cylinder and the resistance at the closed end from this explosion, causes the ascent. Of these explosions there are from thirty to forty per minute.

Justbefore the close of the war our government was induced to undertake the building of a flying machine constructed on what seemed the correct principle, namely, that of the flying top. Accordingly a huge ellipsoid of copper was constructed having three propellers, revolving in a horizontal plane above, and an equal number below. Although it, according to theory, ought to have ascended, the weight of the apparatus with its engine which was necessary to turn the propellers, was so great that the machine proved a failure, and it is now being broken up and sold as old metal at a heavy loss to the constructors.

CLARK'S COMBINED BOILER BOLT AND FERRULE.

Much difficulty is experienced in reparing boilers either by the ordinary rivets, or by screw bolts. Especially is this the



case where the leak is near an angle or any abrupt connection of sheets with flues, etc. The use of red-hot bolts is attended often with considerable annoyance, and screw bolts are well known to be unreliable. The engraving represents a new style of bolt which posesses great advantages over the devices usually employed for the purpose. The bolt, A, has an "upset" or conical head, B, which prevents it from being drawn through the holes in the plates by the tension of the nut, C. On the outside of the shank of the bolt, is slipped a ferrule, D, of steel which is expanded by the strain of the nut and the incline of the head so as to entirely fill the hole. Fig. 1 shows section of the two plates of a boiler with the bolt and ferrule passed into the hole, and Fig, 2 shows the bolt set up and the ferrule spread. Fig. 3 is the steel ferrule, which is split. The larger end or head of the bolt is smaller than the hole through the plates, and the ferrule is of external diameter suited to the hole, so that the bolt can be passed, head first, through the hole, the ferrule passed over the shank and into the hole, and the nut screwed on from the outside. The result will be as seen in Fig. 2. The cone shape of the head forces the ferrule out against the sides of the hole making a perfect joint. It will be noticed that with this bolt there is no necessity for cutting hand-holes to get at the point for repair, and no bother of "stringing" bolts. Beside, the nuisance of "soft patching" is wholly avoided. The friction of the bolt in the hole is such that even by turning up the nut with the fingers, the bolt will never turn in setting up. If deemed advisable, an outer ferrule of brass or copper can be used over the steel ferrule, which fills more easily the hole in the plates. If the hole is somewhat out of round, this may be found to be an advantage. Seams can be chipped and calked where made with this bolt as readily as though made with the ordinary rivet.

Letters patent were secured for this improvement April 24, 1866, and it has been thoroughly tested on a large number of boilers always with satisfactory results. Further information may be obtained by addressing the patentee, E, Clark, a practical boiler maker, at 80 New Chambers street. New York city.

ANOTHER PETROLEUM DISASTER. DANGER OF TRANSPORTING CRUDE PETROLEUM.

On the 20th of June the ship *Meteor* with 2,007 barrels of petroleum, stowed away in the hold left New York for London. On the morning of June 14th when she was about 300 miles from New York, the captain who was looking over the ship's side felt something strike him on his back with great force, instantly followed by a great noise. For an instant he supposed that some of the crew had shot him, but turning round he saw the whole of the deck blown away, immense volumes of flames shooting into the air, and the top-gallant sail on fire. Between him and the fore part of the vessel the deck was blown to atoms, the boats were reduced to match wood, while beneath his feet was exposed the whole of the hold, one mass of fire, raging like a volcano. Several of the crew were instantly prostrated and although they state they heard no sound, the explosion was heard on a ship twenty miles away. This is the begining of the fearful disaster of which we have the further details in the newspapers.

This case of the *Meteor* is by no means the first of the kind nor is it mysterious nor extraordinary. We have read a dozen cases quite as remarkable. Every one understands the nature of petroleum, and can give the reasonable explanation of what are called "accidents." The hold of a ship in which crude petroleum is stored in ordinary wooden barrels, has an atmosphere which is as ignitable and explosive as gunpowder. The barrels perspire the oil at every pore, and the vapor which steams away from their surfaces mingles with the air—the other element of the danger. Moreover this explosive compound being heavier than the air, remains in the hold of a ship as if corked in a bottle, and is ready at any moment of the voyage to blow the ship to atoms. A ship laden with petroleum is the most fearful of torpedoes. Gunpowder will stay in its barrel, and will be found where it has been stowed, but petroleum escapes from its confinement and seeks the fire.

We earnestly submit that the time has come when the destruction of life and property by crude petroleum should be ended. These disasters are preventable and we believe that no reasonable and legitimate commercial interest is promoted by their contiuuance. The simple and practicable prevention of the danger of petroleum is the entire prohibition of the transportation of crude oil. The volatile and dangerous part of petroleum is useful and needed at the wells where produced, and at no other place. Why send it to New York and Europe where no one wants it? If the oil business were rightly managed, refined oil could be sold at lower prices to consumers while the proprietors of wells and refineries might have a better profit for their investments. The whole force of legislation, national, state, and town, ought to be brought to bear against the transportation of crude petroleum.

THE DENTAL ART AND PRACTITIONERS.—Forty years ago surgeons and doctors generally officiated as teeth-pullers whenever occasion demanded. In 1820 there were but thirty practicing dentists in the United States. In 1850 the number had increased to 2,923, and at present there are about 5,000 regular dentists. A college for the education of those desiring to enter this profession, has been established over a year in this city, and the faculty of Harvard College, at their last Commencement, provided for a department of dentistry in connection with that university.