Chemical News Translations from *Comptes Rendus, Journal de Pharmacie, Neues Jahrbuch* and *Revue Scientifique.*]

Anti-ferment Substances.

A. Petit records experiments made with the view to ascertain the effect of certain substances on a fermenting liquid made up of 50 grms. of sugar to the liter, and 0·5 grm. of dry yeast to 10 c. c. of fluid. It appears that when silicate of soda and borax are added to such a solution, these salts exert no marked anti-fermentative action. 1 per cent of a solution of sulphate of iron does not affect the fermentation; but it is arrested by a 1 per cent solution of sulphate of copper. Phosphorus, oil of turpentine, mustard powder, creosote, sulphuric and tartaric acids, all in quantities of 1 per cent, fail to affect fermentation; while 1 100th of arsenious acid renders the action more slow, 1 300th of oxalic acid renders it still slower. Acetic acid does not appear to be an anti-ferment, and a liquid containing 25 per cent of alcohol, 5 per cent of glycerin, and one per cent of succinic acid, enters readily into fermentation; on the other hand, corrosive sublimate and red oxide of mercury are strong anti-ferments, even in very small quantities. Sulphites do not impede fermentation, and are converted into sulphates.

Spontaneous Decomposition of an Alloy of Lead.

It appears that, among the collection of coins and medals belonging to the University of Munich, there are preserved some copies of medals and coins made of a soft alloy—bismuth and lead—which was found to consist (when unaltered) of various proportions of the metals alluded to, namely: 1. Lead, 66; bismuth, 34. 2. Lead, 86; bismuth, 14. 3. Lead, 88; bismuth, 12. It is apparent that these alloys were not all made at the same time; in some instances the medals cast in these alloys had not only become somewhat oxidized but had even fallen to powder, which effervesced on being treated with acetic acid, and the solution was found to contain chiefly lead, but bismuth was also present. The author observes that it is rather curious that alloys kept in well closed show cases should have become thus altered and deteriorated; the cause is ascribed to the tendency of bismuth to crystalize, whereby a molecular change is first effected, and thus oxidation is rendered more easy.—*Dr. Vogel.*

Animal Charcoal and Phosphate of Lime.

The author first observed that there is, as far at least as decoloration is concerned, no necessity whatever to wash animal charcoal with dilute hydrochloric acid for the purpose of increasing thereby its decolorizing property; he next observes that the hydrated phosphate of lime, the gelatinous precipitate caused by ammonia in an acid solution of bone ash, has a powerful affinity for coloring matters, organic as well as inorganic, and that that substance by itself exerts a decolorizing effect upon raw sugar. The conclusions drawn from these observations are that, far from being injurious, the phosphate of lime present in bone black is really a useful ingredient, both on account of increasing the efficacy of the charcoal by rendering it more porous, and by acting as a decolorizer itself; bone black should be washed with pure water before being used, and should be stored in cellars so as not to be exposed to direct sunlight.—*M. Collas.*

Metals Contained in Soot from Coals.

The author states that, while testing some soot collected in a stovepipe, he perceived the smell of arsenic: this gave rise to further experiments, the result of which showed that the soot contained iron, manganese, copper, arsenic, potassa, soda, and lime, in considerable quantities. The coal which yielded this soot is that found at Zwickau, Saxony.—*H. Reinsch.*

Chloride of Silver.

When recently precipitated, this substance is soluble in water, 1 liter dissolving 13 milligrammes at the ordinary temperature, and 25 milligrammes at boiling temperature. These solutions are precipitated by hydrochloric acid, as well as by nitrate of silver; 1 molecule of the chloride of silver requires, for complete precipitation, 3 molecules of either the acid or the salt. Bromide of silver is completely insoluble in cold water, and only slightly soluble (2 milligrammes to the liter) in boiling water. When chloride of silver is dissolved in acetate of mercury, it requires for precipitation a quantity of hydrochloric acid or of nitrate of silver in the proportion of 3:1.—*M. Stas.*

Analysis of Phosphates.

The native phosphate is first acted upon by bisulphate of ammonia at a high temperature, and is next treated with cold water; carbonate of ammonia is then added to the decanted solution, whereby lime and alumina are precipitated quite free from phosphoric acid, which is left in the solution and estimated as metaphosphoric acid.—*M. Prat.*

Ozone.

Experiments made by the author prove that, while albumen is not acted upon by ozone—retaining even the property of coagulating by heat—blood albumen, which in consequence of its coloring matter cannot be used in calico printing, becomes quite decolorized by the action of ozone, leaving white and perfectly coagulable albumen. It further appears that ozone is a very powerful disinfectant, since the author found that a room, in which sulphydrate of ammonium was purposely spilt, was readily disinfected by ozone.—*Liés-Bodart.*

Fulminating Compound.

As a substitute for the fulminate of mercury in percussion caps, the author has used a mixture consisting of picrate of lead, chlorate of potassa, and a very small quantity of amorphous phosphorus.—*M. Prat.*

Hydrofluoric Acid.

By causing phosphoric anhydride to act upon anhydrous hydrofluoric acid, the author obtained water and a non-condensable gaseous hydrofluoric acid, thus rendering it probable that the substance hitherto viewed as hydrofluoric acid contains oxygen; the non-condensable hydrofluoric acid just alluded to yields, by saturation with oxide of silver, a fluoride of silver resembling the chloride and quite different from the ordinary fluoride of silver. From these researches it would follow that the bodies known as fluorides, fluor spar for instance, is, instead of fluoride of calcium, an oxyfluoride and that the atomic weight of fluorine is wrong.—*M. Prat.*

A Correction.

In our remarks relating to a communication from "A Disciple of Watt," in our issue of November 16, page 308, an error in punctuation makes us state that we have seen steam rise, with an open safety valve, to a pressure "37 pounds above the inspector's test." The words "above the inspector's test" should have been in parenthesis.

Correspondence.

Fusion of Lightning Rods and the Sound of Thunder.

To the Editor of the Scientific American:

A few years ago during a thunderstorm, I saw a flash of lightning move nearly horizontally into a piece of woods not far from me, and a tremendous peal of thunder, that nearly stunned me, followed. After the storm was over, I went to see what had been struck, and found that a large post oak nearly two feet in diameter had been struck and shivered into rails and splinters, which were scattered in every direction. So complete was the destruction that I could find no piece too large to be conveniently moved, and the stump appeared just above the surface of the ground. There was no appearance of the disruptive force acting in the direction of the flash, but it was as if the tree had been filled with powder and had exploded, scattering the fragments in all directions. The tree was in full leaf and of course full of sap. At another time a dry fence post near me was struck and split into kindling. As the cause of this phenomenon so often observed is under discussion now, I hand in my contribution to its solution; but before doing this, I will present another fact or two that has a bearing upon the question.

I have just had handed to me for examination two lightning rod points that are said to have been struck. They have both been upon the same rod, are hollow cones of brass and were about six inches long originally. Each one bears evidence of having its extreme point, to the distance of about half an inch, fused. The rod was of ⅜ inch iron and the points were driven down upon it. One of the points was melted at the junction of the iron and fell off; the other was burst on one side, the hole being about three quarters of an inch square; and the torn out pieces were nearly symmetrical, opening outward like two doors, the edges having been fused to some extent. I can only account for this by supposing that the conducting ability of the brass point was not equal to that of the iron rod, on account of its thinness, and that, having a large quantity of electricity to conduct to the iron, it became heated by retardation, in the same way as a platinum wire is made to glow by sending a large quantity of electricity through it. If the quantity of electricity be sufficient, the best conductors will be melted. This may be the case in these substances, and will thus account for the fusion. But the exploded one needs further consideration.

As these points were driven down tightly upon the rod, it may be presumed that in a little while, through the oxidation of the iron, an airtight joint was made, the brass cone then containing a volume of confined air. As the confined air was heated, its pressure upon the wall of the cone increased. Now the fusing point of brass is in the neighborhood of 1100°C., and as gas doubles its pressure for every 273° of heat, it is evident that the pressure within the cone will be $\frac{1100}{273} = 4$ atmospheres, or 60 lbs. to the square inch. The metal, being softened by the heat at the same time, would be likely to burst at its weakest place. If my reasoning is correct, it will suggest the propriety of having the conducting ability of the point equal to that of the rod, and also leaving a small hole in it to prevent a greater pressure on its inner surface. There is in the Smithsonian Institute a copper ball, that was once mounted upon the Capitol building and was struck by lightning while there. It has a hole in it that was possibly torn in the same way.

It seems probable that, when an object like a green tree is struck by lightning, the retardation is so great (on account of the poor conductivity of the wood and the water within it) that a great quantity of heat may result, and so the water may be suddenly converted into steam of great tension and explode the tree. If it be a dead and dry tree or pole, the long cells may be filled with air which may be expanded in the same way and produce a like result.

A few words now upon the velocity of the sound of thunder. It is not an uncommon remark during a thunderstorm, if the thunder follows very quick upon the flash: "That struck close by." It may afterward prove to have struck a mile or two away or perhaps not at all. I am aware of the reputed difference in velocity of very heavy sounds, but am quite sure that it does not apply always or often to thunder. I have many times counted the seconds between the appearance of a flash overheard and the accompanying thunder; and if the sound moved much faster than ordinary sounds, the cloud must have been much higher than such clouds are ever found to be. But we do not need to assume it. Lightning is quite as frequently seen moving horizontally as in any other direction, going from one cloud to another; and in most thunderstorms, these clouds are not more than one half a mile above the earth, and very often are not one fourth of a mile above it. In going from one cloud to another, lightning often goes some miles through the air, and lightning that strikes seldom comes down perpendicularly and may start from a distant place. Suppose, for instance, a thunder cloud at the hight of one fourth of a mile above an observer, and a flash of lightning from this cloud should strike a tree two miles distant. The observer would hear the report in a little more than one second after seeing the flash, and if it was particularly heavy, might think it struck close to him. An observer near the tree would hear it at the same time, and all observers on the same line would hear it, practically, at the same time. But it evidently would not be right to conclude that the sound travelled two miles in little more than one second. It is evident that, to settle this, one must know where the lightning starts from as well as where it strikes.

A. E. DOLBEAR.

Bethany, W. Va.

Milk Sickness.

To the Editor of the Scientific American:

In your paper of October 12, an article appears with the caption "Milk Sickness, its Causes and Cure," by Orren S. Mote. Medical men, who have had any experience in treating that fearful disease, will laugh at his theory of the cause. The assertion that the poisoning is from the *rhus toxicodendron* is neither new nor true. Dr. Crooks, of this State, advanced that idea twenty years ago, but actual investigation proved it untenable. Mr. O. S. Mote says that wherever milk sickness exists, the *toxicodendron* may always be found. This is perhaps a fact, but it is equally true that, in the many places where that vegetable is abundant, there is no milk sickness. I have resided in Illinois, where, at certain seasons, the disease was prevalent. And in order to test the Crooks theory, we put a calf in a stable and fed it large quantities of the poison oak, which it ate with perfect impunity. And further: In that State, there are large pastures where milk sickness, or rather its cause, is known to exist on a small piece of ground; and where that is fenced out, cattle range the pasture with perfect freedom; but if one is placed within the ground fenced out, it will be attacked and die. To us who have had some experience in that direction, Mr. O. S. Mote's theory is not only old, but ludicrous.

Lebanon, Ind. A. G. PORTER.

[Mr. Porter's experiment with the calf goes to prove that the leaves of the *rhus toxicodendron* may be eaten with impunity, but the fact of the poisonous exhalation from that plant cannot be denied. The "United States Dispensatory" says: "The juice applied to the skin frequently produces inflammation and vesication; and the same poisonous property is possessed by a volatile principle which escapes from the plant itself, and produces, in certain persons when they come into its vicinity, an exceedingly troublesome erysipelatoid affection, particularly of the face. Itching, redness, a sense of burning, tumefaction, vesication, and ultimate desquamation are some of the attendants of this poisonous action. The swelling of the face is sometimes so great as almost entirely to obliterate the features," etc.—EDS.]

The Sun and the Origin of Storms.

To the Editor of the Scientific American:

In your paper dated November 2, on page 280, Mr. John Hepburn says: "I have seen that all gusts coming up in the morning come from the eastward," and "that the rays of the sun drive the storm," etc. This theory is not sustained by facts, as I am fully prepared to show by numerous examples which are in direct conflict with it. To save time, I will state but one case of the large number I have at hand.

On July 14, 1870, a gust came across this town at right angles to the sun's rays, bringing with it rain and hail, moving with such force as to prostrate many large trees, and bruise others so as to kill many large branches. The hail in some places rolled together more than six inches thick; the crops were destroyed, windows broken and much damage was done. This is enough to show that the theory is not true in all cases; and if necessary, I can confirm the above by like facts both of an earlier and later date. JACOB DAVIS.

Florida, Mass.

REMARKS:—Florida, Mass., the point of observation from which our correspondent writes, is situated, we believe, on a plateau on or near the top of the Hoosic mountains; and we believe that the celebrated Hoosic tunnel through the mountains passes under some portion of the township.

Cider versus Juice.

To the Editor of the Scientific American:

Your correspondent, E. H., of Jacksonville, Pa., thinks it impracticable to make good cider by grinding the apples and expressing the juice at the same operation. My experience tells me that he is mistaken. I have a mill of the kind alluded to that does thorough work. The cider is not colored like that made by ordinary mills, but is nearly as clear as water, and, to my taste, a really superior article. What has given rise to the idea entertained by your correspondent is the fact that apples contain something (I do not know the name of it) that cannot be separated from the pomace by any ordinary pressure, when a considerable amount is in pressure at the same time, unless a chemical change is produced by leaving the bruised apples and cider together for a length of time. But in the mill I use, the smallness of the amount under actual pressure at the same time enables the mill to do thorough work. AN OLD FARMER.

West Union, W. Va.

ABSORPTION OF AMMONIA BY NICKEL.—Boettger finds that nickel absorbs ammonia like palladium. A piece of nickel used as a negative electrode in acidulated water absorbed 165 times its volume of hydrogen. On being detached from the battery and plunged into water, it gave up the whole of its hydrogen in the course of a few days. Palladium absorbs four times as much, and gives it up more rapidly.

Fearful Boiler Explosion.

To the Editor of the Scientific American:

I am requested to call your attention to a fearful steam boiler explosion which happened, at the Mahoning iron works here, about a month ago; and I trust that your circulation of the facts among your numerous readers will effect some good. Probably so violent an explosion as this never occurred before; nine cylindrical boilers, each 36 inches in diameter and 50 feet in length, were literally torn to pieces, some of the fragments being hurled to a distance of two miles from the spot. Three persons were killed, one at the scene of the disaster, and two at a distance of a mile, the latter being struck by a piece of a boiler consisting of the head and about 8 feet of the length. The missile was not only thrown a mile, but penetrated one side of a house, killing two of the inmates. Had the explosion taken place two hours later, when the people were at work, the loss of life would have been far more terrible. A practical investigation of the causes of this calamity will show that it is due to the most culpable negligence of the engineers and their employers.

First. The construction of the boilers was faulty, and the iron of poor quality, breaking short off when bent to a right angle. I send you a piece of the iron that you may judge for yourself. I contend that cylindrical boilers 50 feet long, made of such iron, are unable to carry a pressure of 100 lbs. to the inch; for the longer the tube, the less is its power of resistance. Fig. 1 is a side view of any of the boilers, showing a portion of the surrounding brick work, the grate bars, G, and the mud drum, I. The boilers are suspended by the ends and middles, by hangers, F, F, to beams overhead.

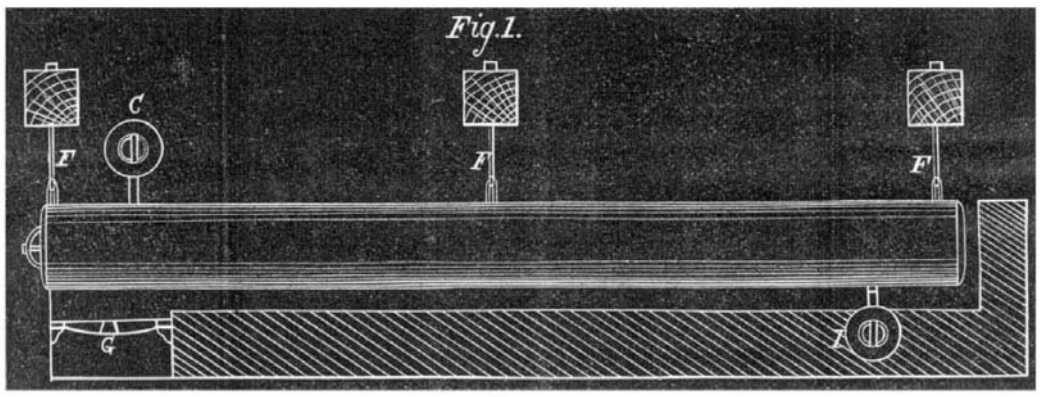


Fig. 1.

Fig. 2 is an end view and vertical section of the boilers, 10 in number, arranged in two batteries of 5 each, A and B. Each battery is surmounted by a steam drum, C. A cast iron pipe, E, joins the two drums. D D are the safety valves, one on each steam drum; each valve, being 8 inches in diameter, required a large lever and a heavy weight to carry the pressure (100 lbs.) at which the boilers were worked; therefore double fulcrum levers were used, as shown in the engraving. This arrangement would, I think, work with more friction than a single lever, and thus impede the free action of the valves. The dotted line in Fig. 1 shows the hight of the fire, the lowest gage cock being 3 inches above the line.

The cause of the explosion was inquired into by a jury consisting of five or six gentlemen, who claim to be acquainted with steam and its powers. The engineers testified as follows: The boilers were in good condition, and never gave them any trouble whatever; the fireman always attended to the water and steam; the pump was a perfect one and capable of keeping the boilers well supplied with water; the fireman must have neglected his duty and let the water get too low, and then the sudden inflow of feed water must have caused the instantaneous generation of steam sufficient to burst the boilers; they gave the fireman strict orders to rake the fires out if the water got low, or anything else happened to the boilers. The engineer, who was on watch at the time of the occurrence, said that he was at the boilers one hour before, and asked the fireman if all was right; the fireman said "yes," and the engineer returned to his engine, which was not running, without trying the gage cocks, or inspecting anything else; and he also said that if the water had been tried every half or three quarters of an hour, no accident would have occurred.

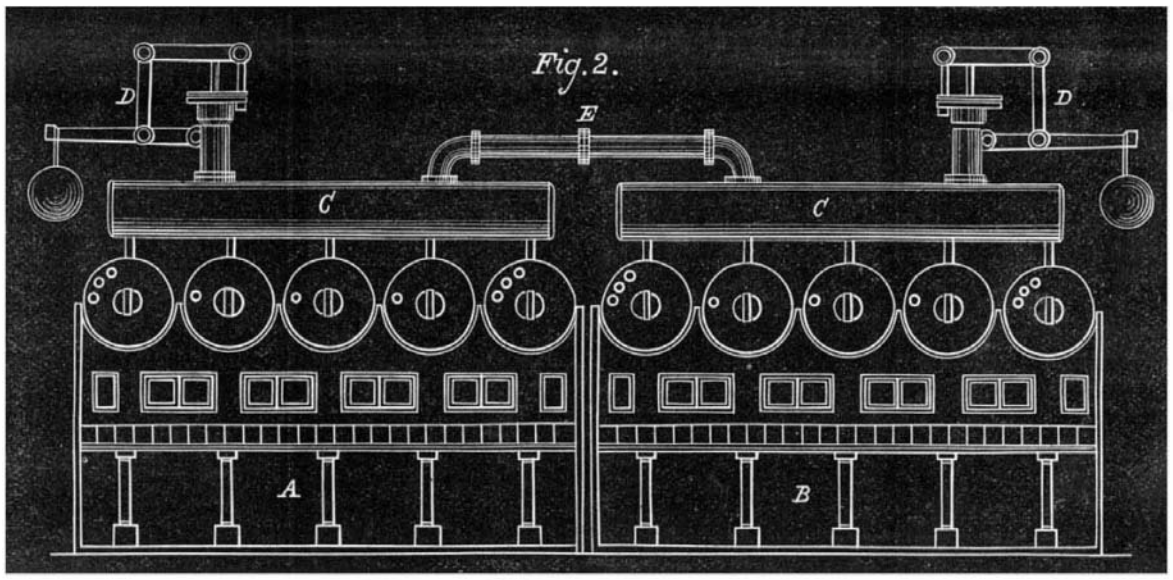


Fig. 2.

The jury decided that the water was too low in battery B, this conclusion being derived from the appearance of the boilers, and the fact that the feed water was turned on. This verdict endorses the view given above, and releases the engineers, putting the blame on the innocent fireman, who was killed. This poor ignorant fellow, instead of the incompetent engineers, has to bear the blame. It is perfectly incredible that, in this enlightened nineteenth century, such engineers can be allowed to go free from the censure of a jury, and all the fault be attributed to the unskilled laborer, whose duty it was to fill up the furnaces, who cannot be supposed to know anything of the instantaneous generation of steam, the repulsion of the atoms of water, or the state of ebullition in a boiler. If the engineer be not responsible for the boilers, who is? When I officiate as engineer, I never feel satisfied unless the gage cocks are tested as often as every ten minutes, and oftener still if the boilers are being worked to their full capacity, as these were. Trying the gage cocks once in half or three quarters of an hour is useless.

Intelligent people will agree with me that, in order to raise the intellectual standard of the men employed in steam engineering, boiler owners must be more liberal in wages, and thus induce a better class of men, both as to habits and education, to enter the honorable and highly responsible profession, in which a full consciousness of the importance of the duties to be performed is most needed. It is the failure to recognize this truth that causes most of the boiler accidents; and so thousands of dollars worth of property and hundreds of lives are sacrificed to "economy," an idea the abuse of which is the most expensive thing in the world. It would be better to pay double, and even treble, wages to a qualified man than to employ one whose education cost nothing, and whose only training as an engineer has been acquired by shoveling coal into a furnace. But the question of saving can hardly be argued in this instance, as the employers are a rich iron company, employing 500 men. There was employment enough for two assistants besides the two engineers employed. There were three engines in use, one of 300 horse power, and two of 80 horse power each, with independent steam pumps, and one or two smaller engines; and there was a third battery of boilers. The works were run day and night, and these two men had to oversee the whole. Can any one wonder that these catastrophes occur, or that machinery and boilers soon become deteriorated, under these very economical arrangements?

The loss caused by this disaster, including the stoppage of business, is estimated at over $100,000. This sum would have paid a first engineer at $1,500 a year, a second engineer at $1,200, and two assistant engineers at $900 a year each, for over twenty-two years.

Some of your readers may think it is hard to lay all the blame on the owners; but as long as money rules the world, who else is to blame? Their low wages deteriorate the engineering profession, and exclude from it capable men.

Let me now give my opinion as to the cause of the explosion. From the appearance of the plates of the boilers in battery B, I should say that the water was somewhat low, as the scale adhered only to the bottom, about two thirds below the water line, and it was firmly fixed all over the boilers of battery A. By this, it will be seen that battery B must have been only one third full of water, which would be 14 inches from the bottom. The lower gage cock, as already stated, was only three inches above the fire line, dotted in Fig. 1. I was informed that the engines, etc., had all been stopped two hours before the disaster; and up to the time of stopping, the fires had been very hot, but had gradually gone down. The watchman stated that the gage showed between 60 and 70 lbs. pressure. I believe that the fireman was asleep, and so did not keep a watch on the hight of the water in the boilers, a duty which is one of the most important, and should be performed by the engineer and not be left to the humble ignorant laborer. The exposure of the boiler to heat would cause the scale to peel off; and then, when the fireman woke and found the water run down, no doubt he turned on his feed cock, and caused an instantaneous generation of steam, and an explosion. The scale was about three sixteenths of an inch thick. I do not think the explosion was caused by the water coming in contact with the iron, as some say it was. If the boilers were one third full of water, the sudden starting of the feed pump would not cause a sudden generation of steam, as the jury and the two engineers believed, for the only heating surface in the cylindrical boiler is the outside shell, and water could not then be converted into steam faster than the safety valves would pass it off, provided the area of the valves was in due proportion to the heating surface, and the levers and weights were so arranged that the valves would act freely.

Similar explosions have no doubt occurred, but they have been seldom as disastrous as this one. I might term them "partial explosions," as they are not caused by over pressure in the boiler, but by over expansion of the metal by cold water coming in contact with the heated plates. This would fracture the plates, or the parts most exposed to the unequal strain.

When explosions tear and rend iron plates and hurl pieces, like projectiles from the mouth of a cannon, two or three miles away, there must be some agent at work more powerful than any yet described, except instantly generated steam or repulsion of the water, which latter is due to the over heating of the water, which occurs when all the steam and water pipes are closed and there is no circulation in the boiler. Water which has been long boiled loses gradually the air it previously contained, and this raises its boiling point little by little. Engineers should be acquainted with an experiment of M. Denny, who found that he could raise water to a temperature of 275° Fah. before it began to evaporate. This was due to the closer adhesion of its particles, the air having been expelled. If a drop of water fall on the surface of a hot stove, it does not touch the plate, but is suspended above it by a thin film of vapor which surrounds the drop. This condition is known as the spheroidal state, and it may be produced in boilers when the fires have burned low; and then all is ready for an explosion. Let any force produce contact between the water and the iron, and an enormous liberation of steam must instantly follow; and this force may be supplied by pumping water into the boiler, or even by the sudden jar of opening the throttle valve to start the engine. I have known explosions to occur at each of these times.

Whatever may cause the contact of the water and iron, the result is an explosive force that nothing can withstand; this could not escape if the safety valve had five times the area usually considered sufficient. Such a force, no doubt, origi nated the awful catastrophe which tore these nine boilers to fragments, one only of the ten being left undestroyed.

ENGINEER.

Youngstown, Ohio.

REMARKS BY THE EDITOR.—Without an opportunity of carefully investigating the case and personally inspecting the exploded boilers, it would be impossible to give an opinion as to the correctness of the views of our correspondent. The piece of iron sent us is not equal in quality to the very best in the market, if we may judge by simple inspection of this small fragment; but it is what would be considered by manufacturers a very fair grade of iron. It must be an excellent iron that will bend over a sharp corner through an angle of 90° without breaking, when of this thickness (quarter inch). If it will bend cold over a corner rounded to a half inch radius, through an angle of 70°, it will come within regulation tests for first quality plate. The tremendous violence of the explosion would be generally considered to indicate great strength in the boiler.

The boilers described, when carrying 100 pounds of steam, subjected the metal to a stress of 7,200 pounds per square inch of section in the whole sheet; deducting for weakening by rivets, this is equivalent to a stress of 12,000 pounds per square inch of metal in the laps, a figure which, although too high for good practice with iron of average quality, is yet not as high as the law permits.

The safety valves are fully as large as is usual with such boilers, but the unfortunate arrangement of levers, described, would seriously interfere with their lifting promptly and sufficiently when steam was rising rapidly.

Our correspondent is fully justified in protesting against the penny wise, pound foolish policy which so frequently leads to the employment of unskillful, unintelligent, and unreliable engineers and firemen, at low rates of pay, instead of men of known good standing at a fair compensation. Good sense and ordinary business prudence unite in dictating the employment of good men at good prices in positions of such importance and responsibility. We have not sufficient evidence before us to justify the expression of an opinion regarding the character of the appointments made in the instance under consideration. We should certainly hesitate to employ any engineer who would allow even cylinder boilers to be worked for a half or three quarters of an hour at a time without trying the gage cocks, or who would visit the fire room and return to his engine without noting the hight of water in his boilers.

AT the Krupp Works, at Essen, a large casting, namely, a steel block weighing 50 tuns, has been made for navy purposes.

On the Manufacture of Phosphoric Acid and of certain Phosphates.

Blanchard describes this process as applied to the fossil phosphate of lime found in the department of Lot, containing from 52 to 80 per cent of tribasic phosphate of lime.

The average composition is: phosphate of lime, 72; carbonate of lime, 7 to 8; phosphate of peroxide of iron, 2; fluoride of calcium, 4 to 5; silicate of lime and alumina, 10. Traces of iodine are also present, especially in the gray varieties. The phosphate is treated with an equal weight of sulphuric acid at 50° to 55° Baumé in large vats, and stirred for a quarter of an hour. It is then allowed to rest for half an hour, when it presents a spongy mass ready for the manure maker or the farmer. At the first, dark brown fumes containing fluorine are given off, and afterwards splendid violet fumes of iodine, neither of which appear to injure the health of the workmen.

The superphosphates produced are of two classes; the lower quality containing 10 to 14, and the higher 17 to 18 per cent of soluble phosphate.

For the preparation of free phosphoric acid, equal weights of acid and phosphate are mixed as above, but after a short time, 1,200 kilogrammes of water are added to 1,000 kilogrammes of phosphate taken, and the agitation is continued. After an hour, the product is submitted to hydraulic pressure in coarse cloths surrounded by casings of wood perforated with holes. The solution of acid phosphate of lime at 18° Baumé, which is thus obtained, can be used either for the preparation of alkaline phosphates or of the free acid. The last equivalent of lime is removed by the addition of a further equivalent of sulphuric acid, when sulphate of lime subsides, and the phosphoric acid is drawn off at 61° Baumé.

The Macropode.

This little fish forms the subject of a paper communicated to the French Academy of Sciences by M. N. Joly. Eight years ago, M. Agassiz said that he had found among the fish tribe metamorphoses as considerable as those which had been remarked in reptiles; and this is a case in point. The egg of the macropode, not bigger than a poppy seed, when hatched is perfectly transparent and lighter than water. It is hatched in about sixty-five hours, just as is the case with the egg of the tench. But on account of this rapid birth, the creature is necessarily in an imperfect state. It makes its appearance in the shape of a tadpole, the head and trunk of which are attached to a large belly, the tail being free and surrounded with a natatory membrane which is exceedingly transparent. Although the animal seems to have no striped muscular fibers, it is very nimble under the microscope and is not more than a millimeter and a half in length. Its head has two large eyes still deprived of their pigment; there is no mouth, and no digestive apparatus either. But the heart is already active, and some circulation is perceptible in the upper part of the tail. There are no gills, so that respiration must be effected through the skin. There are no secretory organs and no fins. The same as in all fish, the nervous system is formed at an early period, and is composed of two parallel chords which branch out into the head. Of the skeleton, nothing appears as yet but the dorsal cord. Numerous pigmentary spots appear all over the body. A short time after, the mouth, intestines, liver and air bladder are formed, together with the gills. New vessels gradually make their appearance, while the earlier ones are obliterated. The caudal natatory membrane is gradually formed into two pectoral fins, and brilliant scales cover the body, and from that moment the creature assumes the shape of a regular fish. Here, therefore, we have changes similar to those which are observed in Planer's lamprey, in insects and in crustacea. This is an important fact, since naturalists had hitherto denied the existence of such changes in fish.

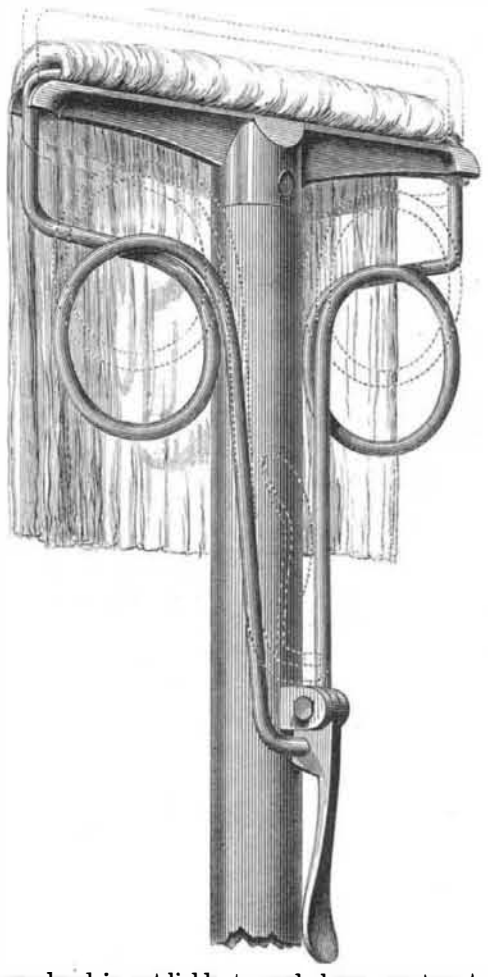
Beware of Green Wall Papers.

A physician in Western Massachusetts recently had a lady patient who, for several weeks, had been suffering from nausea, general prostration, and other symptoms of slow poisoning. Failing to discover the cause of the symptoms, says the Hartford *Courant*, as a last resort the doctor requested her to move from her chamber, the walls of which were covered with paper of a very light shade of green, so light, indeed, that in the evening it could scarcely be distinguished from white. After leaving the room the symptoms immediately disappeared, and the patient rapidly recovered. A sample of the paper was forwarded for analysis to the State chemist at Hartford (Mr. Joseph Hall, of the High School), and was found to contain a large quantity of arsenic. Mr. Hall obtained the poison in the various forms of metallic arsenic, yellow tersulphite, silver arsenite and arsenious acid or common white arsenic. He estimates that every square foot of this innocent-looking paper contained an amount of the poison equivalent to five grains of arsenious acid, or double the fatal dose for an adult person. This, in the moist warm weather of last July and August, was amply sufficient to keep the air of a room constantly impregnated with the poison, and any person occupying such a room would be as certainly poisoned as though the arsenic had been taken into the stomach.

LONDON has a new industry, namely the manufacture of cripples. The police have discovered a firm of human fiends that take children of tender age and twist their limbs so that they may be bandy-legged or otherwise deformed, according to the wish of the parents. The object of this is to make the unfortunate infants objects of charity. A regular tariff of prices is demanded, a thorough and complete maiming costing four pounds. The members of the concern and about a dozen employees have been imprisoned.

IMPROVED MOP HEAD.

The invention herewith illustrated furnishes an improved method of attaching a mop to its handle. To operate the device, the small lever on the staff is turned over, the bail is lifted from the notch on the same, and pushed down as far as necessary to receive the mop. The relative position of the parts will then be as shown by the dotted lines in the engraving. The mop being inserted in place, the bail is pulled up into the notch on the lever and the latter is turned back to its original position.

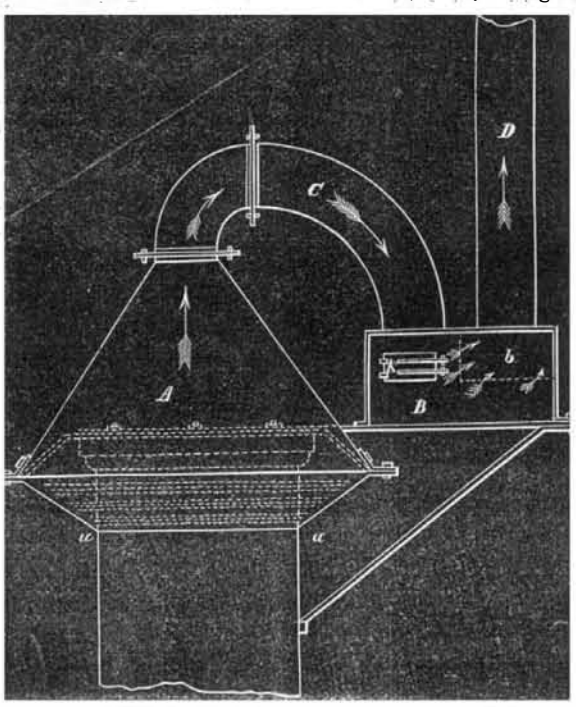


This mop head is not liable to work loose, nor to get out of order from hard usage, while it is easily and quickly adjusted to hold any thickness of mop.

Patented December 13, 1870. For rights and further information, address the inventor, Mr. L. Williams, Arlington, Vt.

APPARATUS FOR EXTINGUISHING SPARKS.

G. J. Syrkin, of Irkutsk, Eastern Siberia, describes, in No. 18 of the *Practische Maschinen Constructeur*, an apparatus which was constructed for the purpose of extinguishing the sparks issuing from the stacks of the gold-refining establishments of that city. The incandescent particles of carbon have sometimes very nearly set the whole town, which is almost entirely constructed of wood, in flames. Being of course applicable to stacks of all kinds, we believe the following illustration and description will be found interesting:



The apparatus consists of four principal parts. A is the head, fastened with iron clamps over the opening of the chimney; B is a water reservoir, with a compartment, *b*, occupying exactly a fourth of the length of the reservoir, and containing numerous perforations on its sides. *k* is a small airtight side door. C is a pipe, extending from the head of the receptacle to B, both of which consist of strong sheet iron. The lower rim of the head does not directly rest on the chimney top, but extends for 14 inches further downwards, being supported by the slanting sides, *u u*. These four sides are perforated, so that a part of the hot gases may escape through them. The size of the head corresponds to the diameter of the chimney, and the bent pipe may vary in size according to the distance of the receptacle, B, from the stack, while the straight pipe may be of any length. The reservoir should be large enough to hold more water than will evaporate during the melting operation, and till the furnaces are cooled down sufficiently; it is filled to one quarter of its hight.

Incandescent particles of carbon will fall in the water, while the gaseous products of combustion pass off through the perforations of the compartment, *b*, and pipe D. As the density of the watery vapors is less than that of the products of combustion, the pressure they exert can in no wise influence the draft. Any gold that may be carried off through the chimney will be deposited in the water and thus saved.

In the establishment where the above described apparatus is in use, the following quantities of gold, from the various districts of Eastern Siberia, have been refined.

	Pouds.
Olekme (Irkutsk)	761¼
Bargusin (Transbaikalien)	69¼
Werchneoudinsk (do.)	15
Nertschinsk (do.)	154¾
Amur	172
Total	1172¼

One poud equals 36·11 lbs. avoirdupois.

One of the Errors of the Age.

One of the growing evils of this country is the overweening desire on the part of young men to engage for life in pursuits that have not "the smell of shop" about them (says the *Journal of the Farm*), or to be more explicit, to engage in those classes of business which do not involve the necessity for practical mechanical skill, or even a theoretical knowledge of them. Thus we find thousands of farmers' sons rushing to the city, and eagerly seeking employment in stores as clerks or salesmen. A portion of them, with better judgment, apply themselves to the study of the professions, and hence it is that large cities abound with hundreds of lawyers, physicians and clergymen, who eke out a miserable subsistence, and who, had Nature's rights been respected, should be following the plow, or doing duty in the workshop. Much of this unwholesome disposition is due to what are known as business colleges, the proprietors of which, by inflated advertisements, induce young men to believe that all that is necessary to success in life is a knowledge of bookkeeping, and that this knowledge can be obtained through their institution in the course of a month or two of ordinary study. Excited by these plausible stories, and believing—as many of them do—that a clerkship is not only a more lucrative, but more respectable, avocation than that of a farmer, young men flock to the city, enter upon a course of two or three months, study in one of these mercantile colleges, graduate(?), and are awarded a diploma, setting forth the fact that they are thoroughly fitted to take charge of the books of any business house. It is only when these graduates are called upon to apply in practice what they found so easy in theory that they awaken to the fact that they have made a serious blunder, and, worse yet, that their visions of big salaries have dwindled down to figures that barely provide them with the commonest necessities of life. Occasionally one succeeds in doing better, but the instances are rare. Failure is the rule; success the exception.

It is not surprising, therefore, to find business men fighting shy of these mercantile college graduates, or to encounter at almost every step young men in fruitless search of clerkships, while our workshops and farms are sadly needing their services.

A Meteor in Arkansas.

About twelve miles south of Huntsville, Madison county, on the 8th instant, occurred the most wonderful and startling phenomenon that has ever been witnessed by the citizens of that neighborhood. Near the farm of Captain Smith, sheriff of the county, some of the citizens were startled by a frightful noise like the rushing of a mighty cannon ball through the air. On looking up, they discovered something that looked like a solid column of fire passing with tremendous velocity through the air, with a whirring, hissing sound, something like that of a shell, but many fold louder. It appeared to be from eight to ten feet in length and from four to five feet in diameter, but it was passing with such swiftness that it may have been many times larger than it appeared. When first discovered, it seemed to be several hundred feet above the earth, and was inclining in its course toward the ground, profusely emitting great sparks of fire. About a minute or two after it passed out of sight, an awful explosion was heard, that shook the earth for miles around, and was heard at a distance of fifteen miles. The truth of this statement is vouched for by several prominent citizens of the neighborhood.—*Fayetteville (Ark.) News.*

CUTTING UP WHALES BY STEAM.—The whaling bark Java, of New Bedford, is provided with an upright five horse power engine, to be used in cutting in whales and discharging cargo, hoisting topsails, if required, etc. This must prove a great saving of time and labor, as it usually requires 15 or 16 men to cut in a whale, while, with the help of the engine, six men can easily attend to it. The engine is stationed in the forecastle, occupying a space ten feet by four feet. It will be the first ever carried to sea in a whaler for these purposes. The idea originated with the first officer of the Java, Mr. E. T. Fish, of Falmouth, Mass.

COOKING UNDER PRESSURE.—Experiments by Professor Junichen prove that the time for cooking various articles of daily consumption is very much shorter when effected under strong pressure, while a great saving in fuel is also obtained.