the angles, formed by the joined sections, to be increased or decreased, so that a section of a side, and a corresponding roof section, may be added to or taken from, the building without impairing its efficiency or affecting the strength of the fastenings.

Curved weather strips are applied to the outer portion of the angles, their shape permitting their adjustment to the angles in altering the size of the building, while they completely exclude the wind and rain, and also operate in connection with peculiar shaped bolts, which fasten them to the building, as binders, to strengthen and support the structure. The roof sections may be carried to a point, or a cone of sheet metal may be fitted at the summit, as shown.

The cone may be used as a ventilator or flue, in which case it should be made with a circular shaft, in order to more readily fit the roof sections to it, their points being cut properly for this purpose.

The building may be set upon any kind of ordinary foundation. To secure it at the bottom, if thought necessary, a sill or rail can be used.

The roof can be covered, if desired, by canvas or other material, but the inventor prefers to strip the joints with tarred or painted canvas.

The advantages of this kind of building are cheapness, portability (the pieces being light and few), the ease and facility with which such houses can be put together or taken down, and the capability of enlargement or diminution, nothing being needed but duplicate sections to enlarge as much as desired.

Patented August 8, 1871, by Francis M. Bain, of Delaware, Ohio, who may be addressed for further information.

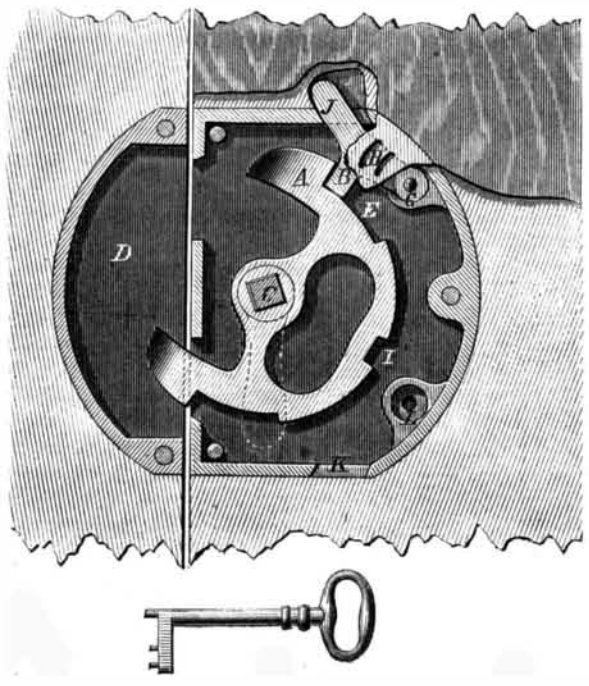
WARNER AND PAYNE'S DOOR LOCK.

This is a very simple lock, the bolt of which may be used either as a latch bolt, or as a lock bolt to securely fasten the door to which it is applied.

Besides the case, it consists of only two working parts, namely, the bolt, A, and the pawl, B, and the pivots on which they turn, all of which are cheaply made.

The bolt, A, which is in form something more than a semicircle, turning freely on its spindle, C, drops by its own gravity into the position shown in the engraving, and enters the keeper, D. In this position it may be turned by the knobs or handles on the spindle to a distance limited by the length of the notch, E, in which the pawl, B—also acting by gravity—enters, and with the shoulders of which notch the pawl engages.

This motion, however, is sufficient to release the bolt from the keeper, so that the knobs only are required to move the former when used in the manner described.



The pawl, b, turns upon a hollow pivot or cylinder, G, the opening in which coincides with a hole in the case of the lock. From the center of this opening, two segmental apertures, H, are cut through the case. The pod of the key enters the hollow pivot of the pawl, and the two wards enter holes in the pawl reached through the segmental openings, H. By turning the key thus applied, the pawl is raised, so that the bolt may be turned further round by the knobs on the spindle, and the pawl may enter the notch, I, the latter being made to fit, quite closely, the downward projection on the pawl. In this position, the bolt cannot be turned from the outside without the use of the key. The pawl, however, has a handle, J, from which projects a knob on the inside of the door, by the use of which the pawl may be raised and the bolt turned without the key. By making the bolt similar at both extremities and providing a second opening, K, for the handle of the pawl, and a proper pivot hole, L, for the pivot of the pawl, the lock is made reversible for right and left hand doors.

Patented through the Scientific American Patent Agency, Oct. 3, 1871, by Martin P. Warner and Edwin W. Payne, of Morrison, Ill.

Novel Uses of Electricity.

The efforts which have been made from time to time, with but poor encouragement, to engrave on metals by means of electricity, seem at last, says the *Iron Age*, to have resulted in the attainment of practical results. An ingenious French mechanic has produced an invention by which a metal plate, upon which a design is drawn with a chemical ink of some kind is slowly rotated with its face vertical, and several other similar plates, graded in size, are also slowly rotated by appropriate mechanism. The object of the invention is to engrave on the smaller plates the design traced upon the largest, on different scales of magnitude, which is accomplished by applying a cutting point to the face of each plate, and which is pressed against it by means of an electric current whenever a blunt point, applied to the large plate, encounters the ink in which the design is traced—the cutting points being at other times withdrawn. The point presented to the first plate is merely a "feeler," which determines by electrical agency whether the ink is beneath it or not. If it is, the points are pressed into the surface of the other plates; if not, they are withdrawn and prevented from cutting. The feeler and the bruns must, of course, all follow a spiral track. This is crude, and can be made applicable to the reproduction of certain kinds of designs only, but it is considered a long step in the direction of practical success.

Correspondence.

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

The Psychic Force.

To the Editor of the Scientific American:

An anonymous writer from Jersey City, signing himself B. D., remarks in your last number, that the unearthing of the jugglery which I maintain to underly the manifestations exhibited by Home, requires "far deeper plowing than Dr. Vander Weyde has done in his letter of August 12."

I say so myself; but how can B. D. expect that I would be able thoroughly to unearth tricks which not only I had no opportunities to investigate, but which I have even not seen, and of which I know nothing except by description, in which, no doubt, many most important details were left out, and only such particulars were mentioned as served to apologize for the apparent credulity of the reporter, Mr. Crookes? His whole report is evidently one sided. He overlooked little particulars, which would, to a more competent expert than he proves himself to be, have given the key to the mystery of the whole performance.

When, some years ago, the Emperor Napoleon III. had seen Home's exhibition, he was full of astonishment at the wonderful feats he had witnessed, and invited, the next day, the eminent savant Arago to the Tuileries; and, after giving him a detailed statement of the performances, asked an explanation on scientific principles. "Sire," said Arago, "it is utterly impossible for me to give a satisfactory explanation of phenomena which I have not seen myself." I think this is an excellent rule, and I have since followed this example, and do not pretend to give a satisfactory explanation. All that I did, and intended to do, was to suggest some ideas explaining how such tricks might be done, and to call attention to the infinite resources offered to the initiated in the field of physical sciences.

B. D. makes one strong point out of the fact that Mr. Crookes saw Mr. Home change his dress, and therefore knows that there was no machinery secreted about him. Well, this only proves that the tricks were performed by means of contrivances not concealed on Mr. Home's body; or, after all, perhaps there may have been some machinery concealed in the clothes he put on—a trick of which I myself have been guilty. Mr. Crookes, it appears, was not enough of an expert to examine carefully every article of dress put on by Home, otherwise he would surely have mentioned this also.

Another strong point made by B. D. is the statement that the apparatus was arranged without Home's supervision. I ask, therefore: Who arranged it? Evidently, Mr. Crookes did not do it alone; his assistant, who looked under the table during the performance, says he saw certain motions of the accordion, and Mr. Crookes inserts in his testimony the existence of these motions, which he did not see at all himself. This has no value, it is not even legal testimony, as before a court you may not swear as to facts you know only by hearsay. I have my strong suspicions that there was collusion between Home and Mr. Crookes' assistant; this is another trick of which I myself confess again to have been guilty often: but Mr. Crookes is too confiding and too innocent to cherish any such suspicions.

B. D. thinks I am "attributing to Mr. Crookes, and the two other gentlemen, an amount of obtuseness that is not characteristic of either of them." B. D. must profess little knowledge of human character not to know, or never to have observed, that many men, very intelligent and of sound judgment in almost all respects, are obtuse, and even stupid, in certain peculiar matters—for instance, in their religious tenets, or in their political convictions. It has even been asserted that most men are insane on some particular subject, and it is surely true of a great many I know; they rather believe in a mysterious supernatural agency, acting in an absurd, nonsensical manner, than in the well known natural laws and forces, acting always consistently and wisely, and of which those who are more acute than their fellow men take advantage to deceive them.

Certain men will profit by the general love for the mysterious, by the universal predilection for believing in what is liked best, without investigating what is strictly true, and by the general disgust of people in being told that they err in judgment. This last fact is the strong point which maintains the belief in supernatural agencies. Men, in general, are not ashamed to complain of their bodily defective constitution, and even their mental deficiences in regard to memory, etc., but never in regard to their judgment; this is infallible, in their own sight. Therefore, when you tell them that they erred in judging about the so called spiritual manifestations, and that they were totally mistaken in ascribing them to the mysterious agencies, the belief in which they so dearly cherish, you will find that there are very few who will ever forgive you.

I will only add, as a proof for the necessity of witnessing such performances in order to explain them, that I was at a total loss to explain the feats performed by the Davenport brothers, as long as I only had heard of them by report; but as soon as I saw their performance, at the Cooper Institute in 1864, it was not only all clear to me, but I performed myself all their feats, before many witnesses, when no public performances were taking place. As at that time I lived in the Cooper Institute building, I had access to the hall in which their box or closet remained, and in which they performed every evening. I had, therefore, for some two weeks, a good chance to practice, and soon became as expert in all their feats as the genuine original performers themselves, and must declare that I since have remained utterly astonished at the obtuseness of the audiences which nightly paid their money, and believed in supernatural agencies to account for so clumsy and stupid deceptions. The only way by which I can account at all for this fact, is the consideration that the very great majority of those who came there, are prejudiced in favor of the reality of supernatural agencies; they expect and they wish to see them, and therefore get what they wish. Luther gave proof of his deep knowledge of human nature when he said: "Just as you want your mental belief, so you will get it."

P. H. VANDER WEYDE.

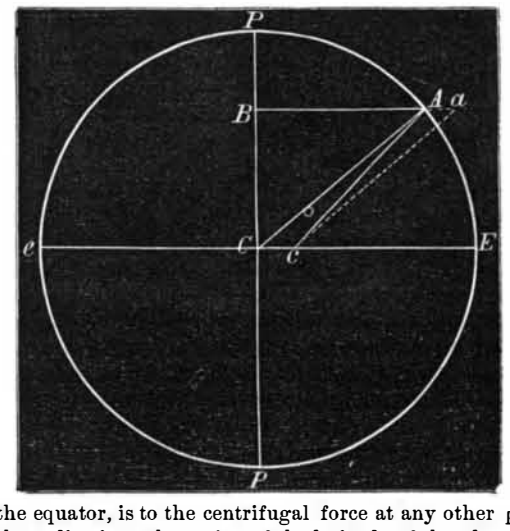
New York, Sept. 27, 1871.

Variation of a Plumb Line from the Perpendicular.

To the Editor of the Scientific American:

In looking over a file of the SCIENTIFIC AMERICAN, I find in your issue of January 14, 1871, a discussion relative to the tendency of a plumb line to vary from the true perpendicular, as is found to exist at the central shaft of the Hoosac tunnel. A mathematical demonstration by J. E. Hendricks, of Des Moines, Iowa, is there given, which I think can be shown to be incorrect both in principle and in the result.

Let P, E, P, e, be the earth; P, P, the axis; E, e, the equator. As the earth revolves upon its axis, every place on its surface, except at the two poles, describes a circle; thus a body, placed at A, will, in one revolution of the earth, describe a circle, the semidiameter of which will be A, B, perpendicular to the axis, P, P. In like manner; C, E, is the semidiameter of the circle described by the revolution of a place at the equator. But C, E, is the semidiameter of the earth, and A, B, the cosine of the latitude of the place, A. By the "Laws of Central Forces," when the periodic times of a revolution are equal, the centrifugal forces are as the radii. Whence a body at E has its centrifugal force as much greater than at A as the radius C, E, is greater than the radius A, B. Consequently we have this universal rule: The centrifugal force



at the equator, is to the centrifugal force at any other place, as the radius is to the cosine of the latitude of the place.

With the foregoing explanation, we come direct to the question at issue. Required the point toward which a falling body will tend, at the mouth of the central shaft of the Hoosac tunnel in 42° N. Lat., the centrifugal force at the equator being to the force of gravity as 1 is to 289. 1. As radius: to the cosine of 42° :: is 1, (the centrifugal force at the equator): the centrifugal force at 42° N. Lat. = 0·74314.

Hence the force of gravity at that point is to the centrifugal force in the ratio of 289 to 0·74314. To construct the problem geometrically, draw the dotted line, A, a, (representing the centrifugal force and its direction), so that it shall have a proportionate length to line A, C, (representing the force of gravity and its direction), as 0·74314 is to 289; draw the line, a, c, parallel to A, C, and c will be the point to which the falling body will tend, along the diagonal, A, c. c will be a point on a semidiameter at the equator, drawn parallel to a tangent at the equator, where it is intersected by a meridian of the place of experiment. 2. To find the angle of variation from a true perpendicular: The line, A, a, equals C, c, the angle A, C, c, equals the latitude of the place of experiment, 42°, therefore, as the logarithm of 289 is to the logarithm of 0·74314, so is the sine of 42° to the angle required, which = 5′,55·095″

To find the amount of deflection at the bottom of the shaft it being 1,030 feet deep. As radius is to the sine of 5′,55·095″, so is the logarithm of 1,030 to the distance, which = 1·7722 feet in the direction of the centrifugal force.

The foregoing demonstration is based on the supposition that the earth is a sphere, and the place of experiment at the

level of the sea, but the earth being spheroidical in form, and the place in question some thousand feet above that level, will change the result here given. Knowing the difference between the polar and equatorial semidiameters, the ordinate A, B, corresponding to any required degree of latitude, can be readily found, to the length of the ordinate thus found, all the hight above the sea level; then instead of using the formula as radius is to the cosine of the latitude, say as the logarithm of the equatorial diameter, in feet, is to the logarithm of the ordinate A, B, plus the hight above the sea level in feet, so is 1 to the centrifugal force at A, which will slightly alter the fraction from what is before given, representing the centrifugal force at that point; thereafter, in the solution, follow with the proportions as before given.

Corning, Mo. HORACE MARTIN.

Facts and Figures Regarding Steam Boiler Explosions.

To the Editor of the Scientific American:

In your issue of September 23, John Lynch, M.D., Professor in South Carolina University, is very severe on the profession of which I am a humble member. He says that "the world looks to the practical engineer for an explanation of the causes of the frequent steam boiler explosions. But the recent examination of the so called experts shows that the world (and, no doubt, the experts also) has been deceived," etc. I must differ with the learned professor. The practical engineers who testified, among whom is Mr. McMurray, have shown that the boiler of the *Westfield* exploded simply because it was not strong enough to resist the internal pressure of the steam. It is true that the said experts used the opportunity to ventilate their mysterious theories, and let off the gases with which their boilers are charged; and even the learned professor seems anxious to add to the number of "probabilities" which are so injurious to all calm and candid investigations. In this age of scientific inquiry, it is certainly strange that even educated men should cling to the superstition of the middle ages, as they evidently do, from the love of the mysterious, which enables thousands to accumulate wealth as astrologers, mediums, and quacks. So great is this love of the mysterious that I would not be astonished to find at some future investigation of boiler explosions, the newly discovered psychic force act an important part. We are told that this is a latent force, possessed by many (unknown to themselves), a force able to suspend a man in mid air, and move the heaviest furniture; and no doubt it is the cause of earthquakes and boiler explosions.

The only reliable manner of investigation is to carefully examine the results produced under various circumstances, and thence to find the common cause. To do this, I will take for investigation two explosions with which I am familiar in every detail. The first was the most disastrous explosion that has ever come under my personal notice. A kier, about four feet in diameter by ten in hight, situated some fifty feet from the boiler, and connected with the same by an 1½ inch pipe, had a safety valve, 2 inches in diameter, and was filled about eight feet with woolen yarn and water. The steam pipe entered near the bottom of the kier, and ended near the center of a cast iron pipe called the "vomit" pipe. After the whole of the water was heated, this vomit pipe ejected water and steam on top of the yarn, in the same manner as the patent wash boilers vomit the water from the bottom over the clothes. This kier exploded with terrific force, carrying destruction to every building within 100 feet, and projecting the upper part of the kier like a rocket into the air, the bottom separating from the cylindrical shell. I have never seen a more complete ruin. Buildings were shattered, walls thrown down, roofs and rafters torn off, and houses and trees in the vicinity covered with yarn of all colors. Now here, certainly, could be no hydrogen gas, still less free oxygen; and certainly not even red hot plates to ignite the compound. There could be no low water, no overheated plates. No camel's back expansion; no water overcharged with heat while in a quiet state; no sudden evolution of steam, no electricity, although there might have have some psychic force. What caused this kier to explode? Overpressure! What caused the immense destruction? Instantaneous relief of an immense power! I am sorry I cannot gratify the love of the mysterious; but facts are stubborn things. The safety valve was choked with woolen yarn; and every bleacher is familiar with the trouble, in all kiers, of swelling by the steam getting under the cloth or yarn, and raising the same bodily. Now this kier was built to stand thirty pounds pressure, and when the vomit pipe discharged freely, any overpressure should have been relieved by the valve; but the kier swelled, the safety valve was choked, the pressure rose, and the weakest part gave way, opening the whole bottom, containing an area of 1809½ square inches, which, at 30 pounds pressure, would give a force of 54,285 pounds on the bottom, and a reactive force to lift the kier of 27,142½ pounds. The whole power stored up in the kier, if expended in one second of time, was equal to 345,600 horse power, certainly sufficient to cause all the destruction accomplished.

The second case happened within one mile of the first. It was the explosion of a 125 horse power Miller's safety boiler, and consisted of fifteen sections, each of twelve three inch tubes, which were connected with the water and steam main by two one inch pipes each. This boiler supplied steam for a 200 horse power Corliss engine, carrying a load, as near as could be ascertained, of 180 horse power; it had a grate surface of 11 ft. 6 in. by 5 ft., or 57½ square feet, with an extraordinary good draft. The engineer, an honest, intelligent man, stood near one of the fire doors when one of the tubes burst, the weld opening for about twelve inches. The result was a discharge of steam which partially extinguished the fire, with a hissing noise, but not the slightest damage either to life or property. On taking out the sections, it was found that seven had been injured by fire, and it was perfectly evident that they were exposed to a severe fire with little or no water. These are the facts. The pressure at the time of the explosion was 80 pounds. We ask why no serious damage was done, and find an answer in this: Each section was connected with the rest by two one inch pipes, giving an area of one and a half square inches, or a force of 120 pounds, with a reacting force of 60 pounds, not sufficient to displace any part of the structure. Here we have low water, red hot plates or tubes, sudden expansion of metal, favorable provision for the formation of hydrogen gas, and all the mysterious conditions for a first class explosion; why not the disastrous results? Simply because the relief of the power stored in the boiler took too much time, and time is an important consideration in estimating power.

If it is your good fortune, Mr. Editor, to open a bottle of champagne, with a friend or two, and let the stopper pop, you have a *bonâ fide* explosion; "the act of driving out any thing with noise and violence." If you drink one alone, and wish no one to hear the noise of the explosion, insert a tubular corkscrew provided with a pet cock and relieve the gas gradually; if no such corkscrew is handy, keep your hand on the stopper, and so let out the gas and prevent an explosion. If the bottle be weak, and you have the stopper secured by the wire, a sudden shaking, particularly when a little warm, will cause a "burst; to break suddenly." If you drink too much, you are "on a burst," because some people in that interesting condition break things suddenly, although I suppose editors never do.

Steam boilers, as other things, become weak by wear. They grow weak sooner when forced, when bad water is used, when they are irregularly fed, or when they are carelessly managed. In fact, the occasional reports of the Hartford Steam Boiler Inspection and Insurance Company tell the whole story. For July, 1871, they report "Furnaces out of shape, 33—6 dangerous; fractures in all, 40—19 dangerous; burnt plates, 50—16 dangerous," etc. Boilers may be, and often are, so faulty in construction that some of their parts have to resist a greater strain than they are able to sustain, as may be seen in boiler works where some difficult parts are often forced into position, and at times are split and rejected, but more often made to answer. There is no mystery as to the cause of boiler explosions, and there is a simple remedy. All modern ships are built in compartments, so that injury to one does not impair the efficiency of the rest; and we must do the same with steam boilers. There are many such in the market, and there are some that combine an economy never before reached with absolute safety. They are appreciated by manufacturers, and some of the largest of them, such as the A. & W. Sprague Manufacturing Company, who are using over 100 steam boilers, are now putting in safety boilers, as much on account of their great economy in fuel as their safety from disastrous explosions. One firm in Rhode Island manufactures now over 300 horse power of safety boilers per week, and has orders on hand to last till January. Ferry boats and steam ships must soon follow. And the world will be forced to admit that engineers, even if not perfectly familiar with modern chemistry, have conquered steam and made it safe and cheap.

JOSEPH A. MILLER, C. E.

Boston, Mass.

Testing the Purity of White Lead.

To the Editor of the Scientific American:

On the 18th of March last, you were kind enough to publish a test of the purity of white lead by use of the blowpipe, sent you by me over my own signature. A short time after its publication, a criticism of it appeared in your columns, signed by "X," of Pittsburgh, Pa.

I did not at the time deem it incumbent upon me to notice the criticism—if it can be so called—first, because the writer did not see fit to sign his own name, as in all fairness he should have done; and secondly, because I did not consider that to a reader of ordinary care, it really called in question the correctness and certainty of the blowpipe test, but only stated that the writer had once made an experiment in another and entirely different manner from that directed by me, which experiment had proved a failure.

My attention has, however, been recently called to the fact that the communication of "X" has been made use of (I trust without his knowledge) in trade circles, in such a manner as to make it appear as a partial refutation of the test, so I am induced to ask again the use of your columns to reply, which I will do as briefly as possible.

In my description of the test, I did not state that carbonate of lead would or would not reduce to its metallic base when heated in a crucible, so I cannot see that the gentleman's experiment has any bearing upon the test whatever. What I did state, and what I now beg to reiterate, is simply this: That a sample of pure carbonate of lead (white lead) when exposed, upon a piece of charcoal, to the action of the "blue" or hottest part of the flame of the blowpipe (in chemistry the word "reducing" is used, it being, in the use of the blowpipe, synonymous with "blue" or "hottest") will quickly part with its carbonic acid and oxygen.

I will also say that it makes no difference whether the sample be dry or in oil (except that in the latter case it will reduce a little quicker, as the oil helps it) whether a long or short time has been consumed in its corrosion or manufacture, whether it has "age" after manufacture or not, or by whom or by what process it has been converted into a carbonate.

But if a sample be adulterated with oxide of zinc, sulphate of baryta, whiting or other carbonate of lime (the usual adulterations), it cannot be reduced, because the adulterations cannot, by any heat obtainable with the blowpipe, be reduced to their own metallic bases, and cannot, of course, be converted into metallic lead.

The test is simply the adaptation of long and well known chemical facts to a beneficial commercial use, and I have not heretofore claimed and do not now claim more for it. As I fully realized its importance, and anticipated the probable effect of its publication upon the trade in imitation and adulterated white lead, before writing it I had applied it to many and various samples of white lead, both of American and foreign manufacture, of various "ages," and its results were in every instance confirmed by my tests or analyses in the "wet" way.

It will be found equally useful in detecting adulterations in litharge, red lead, or orange mineral, the latter being simply a superior article of red lead.

If "X" instead of setting up a test (?) of his own, and then proceeding to knock it down, will consult any analytical chemist as to the truth of the test, or will make the test as directed in my description, he will certainly be at once convinced of its correctness and reliability; and this course I would recommend to any one interested in the matter.

I will not again trespass upon your valuable space to reply to an anonymous communication on this subject, and I thank you for your indulgence in this instance.

St. Louis, Mo. FELIX MCARDLE.

Exit Mr. Paine.—He Declines the Challenge for a Test of His Electromotor.

To the Editor of the Scientific American:

Barnum, in his "Forty Years Recollections," relates his purchase of Peal's Museum, and the running of it in opposition to his other museum, the abuse of each other, growing out of their simulated rivalry, resulting as a profitable advertisement.

Now, I desire to assure you that there is no collusion of this kind between Mr. Smith and myself. I do not remember to have ever met the gentleman, and, as far as I am concerned, he is a Mr. Smith seeking knowledge under difficulties.

Mr. Smith, feeling uncomfortable in his "ridiculous position," attempts to make a diversion by citing certain alleged violations of contract on my part. I am at a loss to conceive what relation my private business matters may have with the subject matter under consideration, but Mr. Smith undoubtedly has an object in view, and in courtesy to him I proceed to state, that he has not seen, neither has any one seen, such a contract as he specifies in his seventh paragraph, for the very good reason that no such contract, *expressed* or *implied*, ever did exist, and furthermore, my name cannot be found as a party to any contract where it is not expressly stated that the enterprise is experimental, and to be solely under my supervision. Therefore, the remarks attributed to me in Mr. Smith's eighth paragraph are the coinage of his own brain, as they are predicated of a condition of things that had no existence.

Mr. Smith's closing proposition amounts to just this: "Mr. Paine, I bet you five hundred dollars that I can flog you; now if you don't step out and let me try, you must consider yourself flogged." Mr. Paine respectfully declines to accept this sportsman's bluff, and does not fear to let the matter be an open question.

To Mr. Smith and others, who have attempted to cast odium on my experiments, I have already given too much notice. Hereafter I propose to allow these gentlemen to continue their defamation of me as may please them. At the proper time my work will show for itself.

H. M. PAINE.

Selenitic Mortar.

To the Editor of the Scientific American:

We live and learn, and the present teachings open wide our eyes in astonishment. Under the head of "Selenitic Mortars," in your issue of the 26th ult., I discover that there is something new under the sun, and learn, for the first time, that sulphate of lime added to mortar renders it hydraulic. I again repeat, we live and learn, as I am told to believe that such is the case. However, my experience tells me, that plaster of Paris, in its natural state, will not render any lime hydraulic. This is easily proved. However, if any one doubts my assertion, I call upon him to make an artificial hydraulic cement out of a pure lime. I should first get rid of the sulphate in any ingredients I might have to use (pumice grit, for instance, for the cementing material therein is pure sulphate of lime) by "roasting," and I should add an ingredient containing alumina and the oxide of iron. Soapstone would answer; but, better still, any clay containing those two ingredients, and which is very abundant all over the world. This has, however, to undergo a certain preparation, which I thought was known only to the writer; and then I should proceed in my manufacture as Colonel Scott, R. E., has done. I may remark, that in 1840 to '45, I built many bridges and culverts in Matwa, India, of cement thus formed; and in 1846–'47, I laid the artificial foundations of the Aden defensive works with coral lime (the purest of lime), rendered hydraulic by the admixture of pumice grit deprived of its sulphate; I found in Aden that if this sulphate was not got rid of by "roasting," there was no hydraulic property whatever. We all know for internal work (decorations) plaster of Paris is used, and that it alone is very quick setting. I admit, any lime may be made selenitic by Colonel Scott's process; but that that alone will render any lime hydraulic, I cannot admit. The secret is the burnt clay. If nodular lime stone be procurable, calcine it, *without* washing, and you have an hydraulic cement, unless the clay

in the nodules be over abundant; and this was the origin of my cement in 1840. As the result of my observation, I wrote an article on this subject in the *Country Gentleman* of March last.

J. KILNER,
Major-General Retired List, Royal, late Bombay, Engineers.
Fredericton, New Brunswick, D. C., Sept. 19, 1871.

A Leaf from a Practical Engineer's Experience.

To the Editor of the Scientific American:

I sent you an account of a circumstance which happened while I was running a portable engine, which you printed in an early number of last volume of the SCIENTIFIC AMERICAN.

I mentioned that in about four seconds the steam rose from eighty to one hundred and forty pounds. The safety valve would never, of its own natural action, have saved that boiler. I was looking at the steam gage at the moment that it began to indicate more pressure, and I raised the valve lever as high as the construction of the connections would allow, till mud and foam rose high in the air, and the pressure came down to the running point.

After reading of the *Westfield* explosion, and the opinions of your correspondents, I came to the conclusion that it is high time that something was done for the safety valve. It is in the same condition now that it was in seventy years ago. We need a valve that will rise two or three inches out of its seat in one moment, so as to give full relief before the pressure has time to get to a bursting point. That valve might be set so that it would not act unless there was positive danger. It might be constructed with what I will call the first load direct on the valve stem, without a lever. I would continue the stem upward, and connect it with a loaded lever or a spring that might be held down with a catch that would be let go with the first motion upward of the valve stem. It would almost entirely do away with the idea that if part of the fire surface gets red hot, and the water rises over it while in that condition, that there must be an explosion. If there are any weak points in my plan, I hope your correspondents will let me know them, so that the public may find out whether there is any means of reducing the number of boiler explosions.

San Francisco, Cal. JOHN MAILER.

Controlling Balloons.

To the Editor of the Scientific American:

While experimenting with a magnetic needle and observing the well known fact, that when the needle is thrust through any solid body and delicately poised, the attraction of the needle is strong enough to turn the body toward the north, it occurred to me that this principle of the needle might be applied to aid in guiding balloons.

Aeronauts have vainly sought for some contrivance for guiding, or preventing the rotation of the balloon. Now, suppose we construct a powerful magnetic needle, or bar, long enough to pass through and project from each side of the balloon; as the slightest influence will rotate a balloon or any other body when suspended in still air, or in a steady current of air, the magnetic bar would keep one side of the balloon toward the north, and other appliances could be used to drive it in other directions.

Hartford, N. Y. JOHN H. MARTIN.

Baltic Sea Soundings---Results of a Recent Exploration of the Baltic.

The greatest depth of the Baltic between Gothland and Windau as reported by the discovery ship *Pomerania* was found to be 720 feet, not 1,000, as was formerly supposed. At the depth of from 600 to 720 feet the water was, at the end of July, very cold, the thermometer giving from ½ to 2° R. No plants were found at this depth, and only a few specimens of one or two species of worms were brought up with the clay and mud. The cold probably prevents fresh water animals from living at such a depth, while the small quantity of salt which the water contains renders it unfit to support sea animals. Animal life abounds from the surface to about 300 feet below it, while plants were seldom found at a depth of more than sixty feet. The Baltic is supplied with salt water by the Cattegat, through which a deep water current flows into the Baltic, while the brackish water which is lighter, streams into the North Sea by a surface current. In the part of the Baltic which lies to the west of Rugen, the difference between the brackish water of the surface and the salt water of the depths is far more strongly marked than in the eastern basin, and consequently a number of animals and plants are to be found in the former which are entirely absent in the latter part, where the water contains a comparatively small percentage of salt. Both animal and vegetable life were found to be most abundant on the coasts of Mecklenburg, Slesvig and Holstein, anc in the bay of Lubeck.

Terrible Conflagration in Wisconsin and Minnesota.

As we go to press, we have telegraphic reports that a terrible conflagration is devastating some of the finest wooded regions of Wisconsin and Minnesota. Fifty townships have been burned out, including dwelling houses, barns, fences, telegraph lines, and every inflammable substance on the surface of the ground. Hundreds of families have been rendered homeless. Animals, wild and domestic, are running in every direction. The burned territory now presents an area of *three thousand square miles!* This is almost equal to the total area of the State of New Jersey.

TRUTH is immortal; the sword cannot pierce it, fire cannot consume it, prisons cannot incarcerate it, famine cannot starve it.

RECENT IMPORTANT PATENT DECISIONS BEFORE THE UNITED STATES CIRCUIT COURT FOR THE EASTERN DISTRICT OF PENNSYLVANIA.---MC'KENNAN, JUDGE.

SAPONIFIER PATENT.

Pennsylvania Salt Manufacturing Company *vs.* E. A. Thomas; Pennsylvania Salt Manufacturing Company *vs.* Christian Barry. The complainant is the assignee of George Thompson, to whom reissued letters patent Nos. 2,570 and 2,571 were granted, for the unexpired term of fourteen years, from October 21, 1856. The first is for the process of putting up caustic alkali (soda or potassa) in metallic casing or integument, by pouring the molten caustic alkali into the casing, and then doing up the top: and the other is for caustic alkali inclosed in a light metallic integument or metallic casing. One is for the process of putting up caustic alkali, and the other for the product of such process.

The validity of these reissues is assailed upon the ground that they are not for the same invention described in the original patent. They are divisions of the original patent, and are, therefore, to be treated as but one patent, with two distinct claims. Although this division of the patent may have been unnecessary to effectuate the invention, it in no view impairs the validity of the reissues. Nor will discrepancy in the titles, and variations in the description and claims of the original reissued patent, avoid the latter. Their effect results only from diversity of subject matter. Battin *vs.* Taggart, 17 Howard, 84.

The material inquiry then is, is the subject matter of both patents the same invention? In other words, are the process and the product claimed in the reissue substantially described in the original?

In the original patent, the nature of the invention is stated to consist in "a new and useful mode of wrapping cakes of potash or caustic soda in air tight wrappings, so as to preserve it from the action of the atmosphere, being designed to enable the manufacturer, of the caustic alkali, to put them up in original packages of uniform size and weight, of such convenient size that when a package is opened the whole may be used at once." Two modes of carrying the invention into effect are described. One is to provide canisters of thin sheet iron, cemented at the joints with inflexible cement, into which the caustic alkali is poured in a molten state, and while hot, the lid is closely fastened down, so as to exclude the atmosphere. Now, while this patent describes and claims the process of putting up caustic alkali in air tight integuments, it describes also the object and result of the process. Packages of caustic alkali are produced of uniform weight, and such convenient size that when a package is opened the whole may be used at once. The very object of the description is to indicate a product possessing original merit as the result of an improved process.

In reissue No. 2,570, which is for "an improved process of putting up caustic alkali," the description of the process is manifestly in substantial accordance with the description in the original specification.

Reissue No. 2,571 is for an "an improvement in the manufacture of caustic alkali," and claims "caustic alkali, incased or enveloped in a tight metallic integument or casing, substantially as above described." The mode of incasing it, and its peculiar properties when incased, are distinctly described and stated, and with no material variation of phraseology from that employed in the original specification.

It is apparent that the subject of both specifications is caustic alkali, so put up and prepared as to secure special commercial properties, protection against deliquescence, capability of safe transportation, and adaptation to general use. The reissued patent, then, is for the same alleged invention described in the original specification, and the apparent object of the amendment was to make an explicit claim for it as a new article of manufacture and commerce, which was distinctly indicated as the patentee's invention, but was not technically claimed in the original specification.

It has been repeatedly adjudged that this may be done. "This," says Mr. Justice McLean, in Battin *vs.* Taggart, 17 How., 84, "the patentee had a right to do. He had a right to restrict or enlarge his claim, so as to give it validity and effectuate his invention." And so Mr. Justice Grier held in passing upon this patent, in this court, in Pennsylvania Salt Manufacturing Company *vs.* Guggenheim, 3 Fisher, 423.

The respondent further objects to the patent, that the invention claimed is not novel. I do not propose to notice in detail the evidence adduced on this point. It is sufficient to say of it generally, that it does not prove that the product, with distinguishing properties claimed by the patentee to belong to his, was in use before his invention. The hydrate of soda was a well known chemical substance, rapidly deliquescent when exposed to the air, and, by reason of its causticity, difficult to handle and dangerous to transport. An obvious security against these risks was to inclose it in anticorrosive, air tight vessels, and so it was treated, but in the modes adopted for its preservation it was only employed in the laboratory, in surgical operations, and in the arts, which would admit of the use of large quantities of it at one time.

It was not until George Thompson, after repeated experiments, perfected his method of putting it up, that caustic soda was brought into very general household use in the manufacture of soap. This was undoubtedly due to the plan devised by him for its preparation, whereby portability, safety and convenience in handling and transportation, and special adaptation to domestic use, were, for the first time, secured. The proofs, therefore, fall short of overcoming the presumption of novelty arising from the patent.

A grave objection is that which brings in question the patentability of the alleged invention. A patentable subject must be not only new and useful, but it must involve some exercise of the inventive faculty, and it must not be merely the application of an old thing to a new use. It is undoubtedly true, that small metal cans and infusible cement were in use before Thompson's invention, and that caustic alkalis were preserved from deliquescence by inclosure in air tight packages of glass, iron and wood; but still the fact remained that caustic soda was unavailable for general use, and especially for the domestic manufacture of soap. By Thompson's method it was invested with commercial properties and practical adaptabilities which did not pertain to it before.

Its deliquescent tendency and corrosiveness confined its consumption within narrow limits. By Thompson's efforts these difficulties were practically overcome, and it was fitted for general use and the supply of a universal want. In the language of Mr. Justice Livingston, in Langden *vs.* De Groot, 1 Paine, 206, "it was rendered more portable and convenient for use." The effect was to immensely increase its consumption in the domestic production of soap, which was before manufactured by other methods, or in large establishments only. Indeed, it may be considered as originating a new branch of domestic manufacture. This is certainly indicative of original merit, and is demonstrative of its great public utility.

The patentability of an alleged invention is, in many cases, most satisfactorily shown by its utility. In Webster on "Subject Matter," 30, it is said, "the utility, then, of the change, as ascertained by its consequences, is the real practical test of the sufficiency of an invention; and since the one cannot exist without the other, the existence of the one may be presumed in proof of the existence of the other. Wherever the utility is proved to exist in any great degree, a sufficiency of invention to support the patent must be presumed." Judged by the standard of utility, then, a sufficiency of invention to support this patent is to be presumed.

In a commercial sense it has just claims to be regarded as a new product. It was so treated by Commissioner Mason in the original application for a patent. In his opinion he very forcibly says: "Had he discovered an ingredient which, mixed with alkali, would, without injury to its properties in other respects, have prevented it from a tendency to deliquescence, he would have made a patentable discovery. Is not this equally so? In fact, the packages of alkali, done up as proposed, may, in substance, be deemed a new commodity, a new article of merchandise, for although its constituent ingredients are the same as were before known and used, a new property has, in reality, been communicated to it. In point of fact, the article now offered for sale is the alkali without any tendency to deliquescence; this, though chemically not new, is so commercially, and is so proved by the affidavits filed." Equally satisfactory proof of this has been exhibited in this case, and to this is to be added the wide extension of its use, as a significant recognition of its novelty as a commercial product.

The whole question was before this court in the Pennsylvania Salt Manufacturing Company *vs.* Guggenheim, and the patent was held to be valid. Such a judgment, pronounced by a judge whose knowledge, experience and ability invest his opinion with the weight of high authority, must and ought to overbear all doubts upon the subject in this controversy.

That there are differences in the method employed by the complainant and respondents, to incase the soda and seal the packages, is doubtless true; but the product of both is substantially the same, namely, caustic soda encased or enveloped in a tight metallic integument, which may be preserved and transported, and thus introduced into general use.

The respondent, therefore, is an infringer.

Decrees were entered by the Court, referring the case to John Cadwalader, Jr., Esq., as Master to report damages Harding, for plaintiff; Cuyler and Burton, for defendant.

THE WETHERILL ZINC CASE.

In the United States Circuit Court for the District of New Jersey, Judge McKennan ordered a decree to be entered for the plaintiff, deciding Samuel Wetherill's patent to be valid, and that the New Jersey Zinc Company had infringed it, and referred it to S. D. Oliphant, Esq., of Princeton, as Master to estimate and report the savings and gains made by the defendants, and also awarded a perpetual injunction. Judge McKennan said he would file an opinion in full hereafter, but would now state the points of his decision, as follows:

In the Circuit Court of the United States, for the Third District of New Jersey:—Samuel Wetherill and George W. Gilbert, administrators of Charles J. Gilbert, deceased, and Martha M. Jones, administratrix of Samuel T. Jones, deceased. Also, S muel Wetherill and George W. Gilbert, administrators of Charles J. Gilbert, deceased. In equity.

1. The patent of Samuel Wetherill for a process of reducing ores of zinc, by the direct application of fuel to the ore in a crushed state.

2. The conspicuous merits of his process are: Great economy in the consumption of fuel; a more thorough liberation of the oxide from the ore than could be accomplished by any known treatment of it; the production of white oxide of zinc, of a better quality and at a less cost than it had been produced before; and the utilization of the slag resulting from the use of some of the ores of zinc. These results demonstrate its utility and value. Of its novelty there is no question.

3. Its essential features are in the employment of a thin bed fire of chestnut coal, and of a superincumbent layer of pulverized ore and pea coal, approximately of the thickness of three inches; the enforced passage of atmospheric air in numerous small jets through the mass, by which its combustion is maintained; the vaporization of the zinc and its oxidation in the furnace above the charge are effected, and the withdrawal of the charge when the zinc in the ore is expelled, and the repetition of the process.

4. It is fully, clearly, exactly, and particularly described in his specification.

5. It is satisfactorily shown, by the oral proofs and by the analysis of the slag, that the thinness of the bed coal and of the charge of crushed ore and coal, within the limit of eight or nine inches, and alternation of the process, are essential to its practical efficiency and success.

6. Burrows' patent is for a furnace, not for a process.

7. The directions given in his specification for the use of his invention, in the statement of its object, do not describe Wetherill's process in its essential features, or so that one skilled in the art could practice it.

8. He was not the first to conceive the practicability of reducing zinc ores by the direct application of fuel to them in a crushed state, and to demonstrate it by successful experiment.

9. Wetherill was the first to comprehend and perfect the process claimed by him, to describe it intelligently and fully, and to reduce it to practice.

10. The respondents are shown to have used his process substantially, and are infringers.

Decree for injunction and an account.

The case was argued by George Harding for plaintiff, and S. D. Cozzens, of New York, for defendants.

THE IRON SHIP A MAGNET.—The following are a few important facts, as deduced by Mr. Stebbing from his experience of iron ships: 1. A compass may be very true on one or several points, and greatly disturbed on others. 2. The errors of one ship are no guide to the errors of another. 3. The errors are least toward the middle of the vessel. 4. Every iron ship is a magnet in itself; some have the north pole aft, and some the south. The magnetic axis is frequently determined diagonally through the ship. 5. There are in all iron ships two points, either opposite, or nearly so, at which there is no error; there are two other points where the error is the greatest. An error will sometimes not alter three degrees in a range of five points, but may then change thirty degrees in the next five points.

TRUE liberty consists in the privilege of enjoying our own rights—not in the destruction of the rights of others.