Correspondence.

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

Psychic Force.

To the Editor of the Scientific American:

Further information on this subject, published in your journal of last week, induces me to ask you for space to say a few words in reply to Dr. Vander Weyde's last letter.

His charges of "misstatements" are easily disposed of. He says "I did not plead ignorance of these experiments." His own words were: "How can B. D. expect that I would be able to unearth tricks which not only I had no opportunities to investigate, but which I have not even seen?" Now, as the learned Doctor gave the weight of his undoubtedly high authority to the statement that the effects in question were produced by jugglery, I cannot but think that his admission that he had not investigated or seen them is a confession of ignorance of them. I am more convinced that this view is a just one, for, in his next paragraph, the Doctor courageously makes the statement that these experiments are Home's, and that Dr. Crookes was merely a spectator. Now we have Dr. Crookes' authority for the fact that he devised the apparatus expressly to test the powers of Home, and, if possible, to "unearth" his "jugglery." He takes the entire responsibility of all the experiments, and has produced similar results with other persons than Home, some of whom were members of private families, and neither spiritualists, jugglers, learned Doctors, nor B. Ds. I think, therefore, we must hold the opinion that these experiments were Dr. Crookes'. Dr. Vander Weyde will, perhaps, continue to believe in the jugglery explanation.

The "tricks" which Dr. Vander Weyde calls "childish" were the exhibition of force upon a spring balance without contact except through water, and without contact at all. A similar result upon a parchment disk was produced by the presence of a lady who had no previous knowledge of the experiments or the apparatus.

In explanation, I informed Dr. Vander Weyde who Professor Crookes was. I now much regret to find that he was well aware of Dr. Crookes' labors and record, and that it was in the full possession of this knowledge that he accused him of going to work to find a result to fit a preconceived opinion. This last is the most serious charge that can be brought against a scientific investigator; but Dr. Vander Weyde has made it, and adheres to it. Perhaps this reckless accusation against Dr. Crookes would not have been made had Dr. Vander Weyde read the account of the further experiments; and this brings us back to our starting point, my original proposition that Dr. Vander Weyde's jugglery theory is incompatible with all we know of Dr. Crookes, will not bear the slightest comparison with the facts of the case, and was merely an assumption, unsatisfactory and unconvincing to any one in search of definite truth on the matter, and of which, perhaps, I was wrong to take any notice at all.

Dr. Vander Weyde speaks of the numerous spiritualists in the United States, a fact which has no relevancy to the subject. Certainly I have no desire to believe in what I like best, and am indifferent to the cause of Dr. Crookes' results; but these results were certainly achieved in direct contradiction to many popular opinions as to the nature of force, and are thus worthy of investigation. Dr. Vander Weyde promises in a future article to address himself to the subject, and calls my stating the question "an argument in favor of the deceiver Home." This is good, but better remains behind. He says that the psychic force theory arises from "the ancient misconception that force is separate from matter." We know that all force exists, *primarily*, in connection with matter. The psychic force theory is, as far as I understand it, that matter (the human body influenced by the human will, for instance) may move objects at a distance and without any material connection with such objects. If this theory be at variance with the positive physical sciences, the force of magnetism, which will operate through a vacuum, is also in contradiction to them; and must, I suppose, be explained on the jugglery hypothesis. Another "misconception" is that force can have its origin purely in the will or the mind. Dr. Vander Weyde cannot raise his hand to his head without endorsing this "misconception."

I certainly am not "prejudiced by a foregone conclusion." I do not as yet believe in the existence of a psychic force; I only say that it is a proper subject for philosophical enquiry, and that such is the only spirit in which to treat it. I do not know, nor, with due submission, does any one else, that there is no force yet undiscovered, and no unexplored field of investigation; but I do know that Dr. Crookes is an honest and acute observer, and that the jugglery theory will not bear inspection. Your readers will, I believe, think that Dr. Crookes' strictly scientific investigation of the phenomena in question does him infinite credit; and that is by experiment and proof only that he will stand or fall. With the expression of these views I began, and so will I end, with many thanks for the use of your valued columns.

Jersey City. B. D.

Comparative Efficiency of different kinds of Boiler Plates for Steam Generation.

To the Editor of the Scientific American:

None of the various causes which engineers have assigned for the wide differences in the evaporative powers of boilers have seemed to be sufficient and conclusive; and some other important element of variation has long been suspected by those who have given thought to the matter.

In order to discover this hitherto unknown cause, a series of experiments was made, based on the supposition that the conditions which affect the conducting power of a metal for electricity—alloys and impurities—would, perhaps in equal degrees, affect its power for transmission of heat.

It was evident that all previous estimates of comparative values of fuels, modes of firing, and styles of boilers (the universally recognized causes of variation), would be subject to careful revision if it could be demonstrated that the most important source of error had hitherto been overlooked. The accepted standard results would become valueless.

Nine pieces of boiler plates of different brands were selected for the purpose of the experiment; they were of uniform thickness ($\frac{5}{16}$ of an inch.) Some of them were samples of locomotive fire box plate, and the others of boiler plate.

They were tested for their heat transmitting and steam generating efficiency, with the following results: Allowing the plate of lowest transmitting power to have a value of 100, we have

1	Power of transmission	100
2	" " "	104.4
3	" " "	117.7
4	" " "	118.8
5	" " "	121
6	" " "	123
7	" " "	123.3
8	" " "	141.9
9	" " "	144

It must be distinctly understood that these transmitting powers were measured by the generation of steam under equal and similar conditions. Each plate was subjected to a number of trials; the temperature of the flame to which it was exposed varying, during each series of trials, but a very few degrees from 550° Fahr., and the time of evaporation of the water but a few seconds.

The ratios of values have been calculated according to the tables for such purposes prepared by Dulong. The experiments have been conducted by Mr. Charles E. Avery, of Boston, a gentleman thoroughly competent by scientific and practical knowledge for the undertaking of such delicate work.

In order to discover and avoid all sources of error, the apparatus and method finally adopted for these determinations were first subjected to the test of weeks of most careful experiment.

To generate an equal amount of steam in equal times and with similar conditions of fuel and draft, boilers made of Nos. 8 and 9 plates would consume *constantly* 40 per cent. less fuel than boilers made of plates Nos. 1 and 2.

Insomuch, therefore, as their efficiency in the production of steam is vastly greater than that of the inferior plates, the commercial values of these plates will be still greater in proportion. The possibility of a daily economy of 40 per cent of fuel should induce boiler users to purchase the best plate and boiler plate manufacturers to exercise more care in its manufacture.

Some of the most considerable variations in evaporative efficiency were found between plates from the same manufactory.

No analyses of the iron of the plates have been made, it having been assumed that the comparative presence or absence of slag or glass—a poor conductor of heat—was the chief cause of the determined variations; though, doubtless, carbon and other elements will be found to exercise decided influences. These we propose to determine; and other points of novelty and interest in regard to boiler plates have been decided, which we hope at some future day to give to the public.

With our method of firing (our application of pulverized fuel to the generation of steam), which almost entirely eliminates other causes of variation, we had found one boiler to have an evaporative efficiency of nearly 60 per cent. more than another. Hence the search for the unknown causes of variation. JACOB J. STORER.

BOSTON, Nov. 1, 1871. JAMES D. WHELPLEY.

Perpetual Motion--Experience of a Man who took an Interest in one.

To the Editor of the Scientific American:

There has always been a perpetual movement in the direction of perpetual motion, but the problem still awaits an answer. The nearest approach to the desired result was attained by the "Wandering Jew," who started his movements several centuries ago, and was still on the move at last accounts.

I had a *dear* friend (I say dear because he cost me considerable), who experimented to some extent in perpetual motion on borrowed capital. I took some interest (16 per cent) in his investigations, and was present at most of his failures. He performed in a small room, six stories from the ground, where he might have been seen at almost any time, surrounded by wheels, springs, levers, pulleys, and screws, in fact by almost everything into which brass and iron might be made. I never knew a man more confident of success; he would ask for money without regard to my *interest*, being sure he could pay five dollars for one. He went around pricing the finest residences in the city, examining thousand dollar horses, talked about making a gold model of his machine, buying a steamboat, and making other modest purchases.

In a conversation with him, while at his work, I asked: "Why do you have so much machinery and complication in your experiments? You only confuse your mind with the combinations, and can't tell what the result will be when the machine is finished." He answered me: "Who was making that machine?" I didn't reply, but couldn't help thinking whose money was in it.

At another time (when in a better humor) he asked what course I would advise in experimenting, if I didn't like his. In reply I said: "Get a stick four feet long, balance it on a fulcrum, place weight enough on one end to raise the other; you have by this means accomplished one motion; then place weight enough on the other end to raise the first, and so on till you break the stick. In this way you can accomplish about all any one ever has." He seemed to think I didn't mean what I said, and so made no reply.

At another time he said: "Luke, you have taken considerable interest in this machine, and paid some attention to its construction. I want to ask what conclusion you have come to." I said, "I have come to the conclusion that all in this world is a perfect balance, except your mind." He got huffy at this, and didn't speak for twenty minutes.

At last the final day arrived; he got me to hold the machine while he put in the last screw, which was to complete the model, and start it on its never ending journey.

The screw was in—he was seated in a chair—I still had hold of the machine. He said: "Let go carefully, or it will tear things to pieces." I let go—the machine moved not. He assumed the consistency of a dish cloth, and hung over the back of the chair. He now resides in the insane asylum; his mind is gone, and so is my money. From that day to this I have had but little confidence in perpetual motion.

LUKE COPPERTON.

Ice Fleas.

To the Editor of the Scientific American:

On page 272, current volume of the SCIENTIFIC AMERICAN, you give an interesting article by E. Franklin, in *Nature*, and in it the question is asked: "Is the ice flea like its irritating cousin?"

Having a knowledge of the insect referred to, not, however by having found it on the Morteratsch Glacier, yet under identical circumstances, I will state that the insect in question belongs to an order of animals termed *Ametabolia* (without change), a sub-class of insects which do not undergo any metamorphosis. Among these are included the order *Thysanaura* (Leach), and genera of *Lepisma, Forbicina, Petrobius, Podura*. Of this latter there are a great number of species, as well as in the genus *Smynthurus*, which two were united by Fabricius as identical. In Rees' "Cyclopedia" I find thirty species described, from Gmelin. I expected Dr. Harris would have met with this minute creature, which is often highly injurious in the vegetable garden, by the immense number that are met with. I will quote *verbatim* from Maunder's "Treasury of Natural History" (before I give my own experience), which reads thus: "*Podura*.—The *Poduræ* are small insects, which, in general, are found in damp places, under stones, on the bark of trees, etc. When disturbed, they suddenly spring to a small distance by the help of a long forked process or tail, which is bent forward beneath the abdomen; and it is by the sudden extension of it that the leap is produced. Hence these insects are commonly known under the name of "spring tails." One of the most common of this genus is the *Podura aquatica* of Linnæus, a minute black insect, occasionally seen in vast numbers, particularly near the brinks of ponds, and sometimes even on the surface of the water itself."

This species is further described as measuring scarcely the one twelfth of an inch in length, and entirely of a black color. It is a gregarious species, collecting in numbers so great as to have the appearance of scattered grains of gunpowder; and if closely examined (when on the ground) will be found in almost perpetual skipping motion.

I have met with them during the winter, when there was snow on the ground, hibernating under stones, availing themselves of the "conduction, partly by radiation, from its under surface." They understand, instinctively, the action of the "luminous thermal rays." But then their leap differs from "the performance of a common flea," and is not so nearly related as that of "cousin." The common flea (*Pulex irritans*—Lin.) belongs to a different class, and is included among the *Aphanipterous* orders—name, Greek, "unseen" and "wing." The apterous haustelate insects have rudimental wings in the perfect state. These undergo a metamorphosis in a marked degree.

I might have passed the article without notice, were it not that we have species of *Podura* that do a vast amount of mischief occasionally, and are almost unknown to modern entomologists. JACOB STAUFFER.

Lancaster, Pa.

Safety Valve--A Leaf from a Practical Engineer's Experience.

To the Editor of the Scientific American:

In your issue of October 14th, John Mailer says: "While I was running a portable engine, the steam rose from 80 to 140 lbs. in about four seconds. I raised the safety valve lever as high as the construction of the connection would allow, till mud and foam rose high in the air, and the pressure came down to the running point."

Now a boiler that will throw mud and foam out, through the safety valve, is in a very dirty condition, and not fit for service until it has been thoroughly washed out and cleaned. After publishing such carelessness to the world, he asks for the construction of a safety valve that will enable him, and others, to practice such carelessness with impunity.

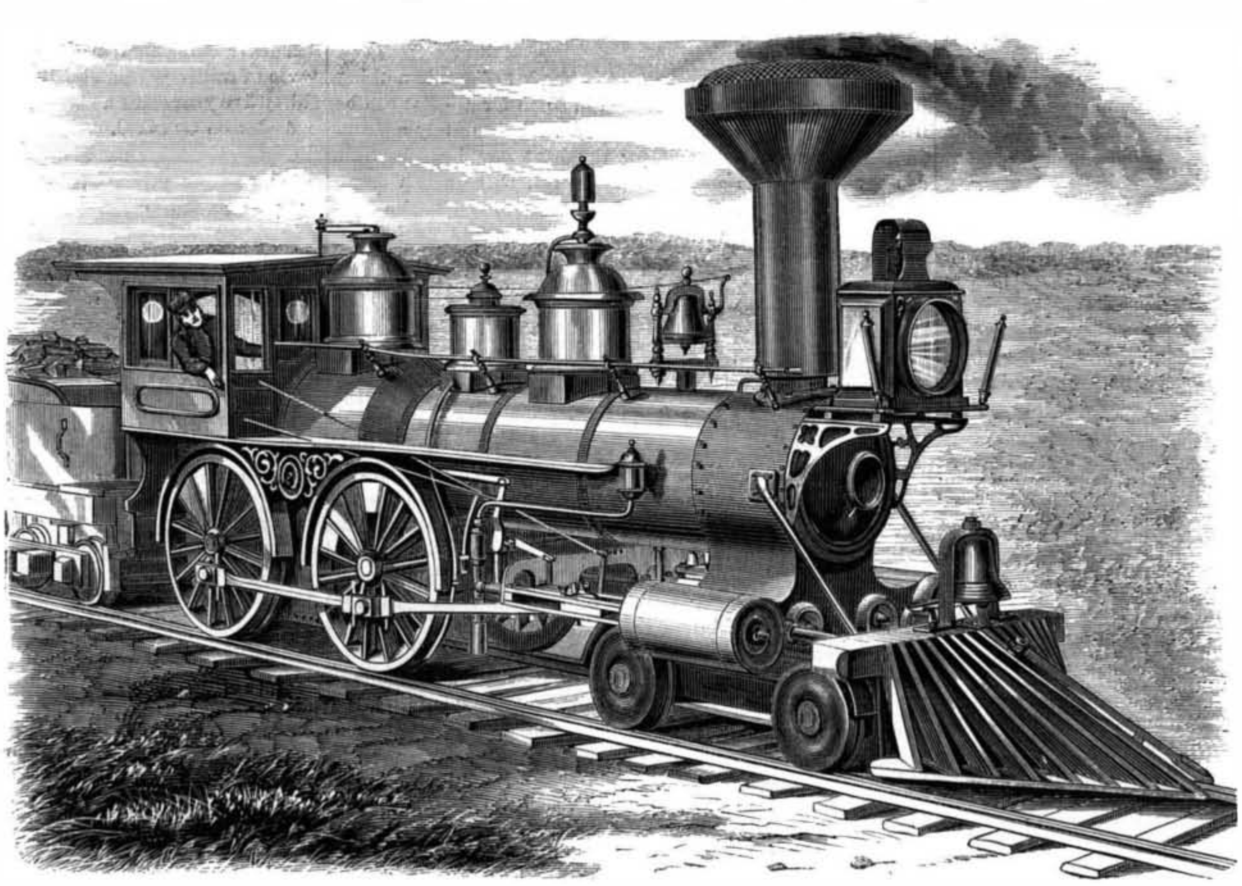
He says: "We need a valve that will rise two or three inches out of its seat in one moment, so as to give full relief before the pressure has time to get to bursting point. It would almost entirely do away with the idea that, if part of the fire surface gets red hot, and the water rises over it in that condition, that there must be an explosion." Now as none of us care to arrive at the bursting point, I would ask, where is the necessity, or reason, for allowing steam to rise above its working pressure? Even if it did, the raising of the safety valve, several inches out of its seat, would not cause steam, or mud either, to flow more readily than when

Locomotive Alarm Bell.

The accompanying engraving represents a continuous ringing or sounding alarm bell, placed on the front beam of a locomotive engine, for the purpose of warning persons about to cross the railroad, or who may be in its vicinity. The bell, it will be seen by the engraving, is so attached that when the engine goes, the bell rings, being struck by the hammer once at each revolution of the driving wheels. Being placed directly in front of the boiler, the ringing or sound of the bell is seldom heard by the engineer or fireman on the engine, and cannot be heard on the train; consequently it is no annoyance to passengers, while, it is claimed, its position causes the sound to be thrown forward, and conducted, by the earth and the railroad track or rails, so that it can be heard a considerable distance in advance of the train, thus giving timely warning.

The inventor, Mr. B. Briscoe, Mechanical Superintendent of the Detroit and Milwaukee Railroad and Steamship line, writes us that these bells have been placed on the engines of that road, 34 in all, and he has no doubt but that it has prevented many accidents, and perhaps saved many lives. He says that during the two years the alarm has been used, "we have not struck a team or vehicle of any kind at or near a crossing, while such accidents (though not frequent) did occur, and, in some cases, loss of life and valuable property resulted before the alarm was brought into use."

The General Superintendent of the road also speaks in high terms of the value of the invention, and states that they are now on trial by some other roads. He thinks the recent terrible accident on the Eastern road would have been certainly prevented by its use.

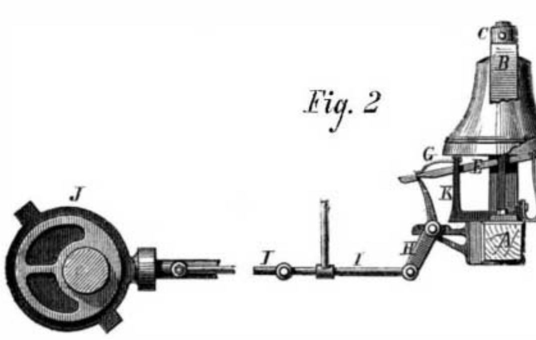


BRISCOE'S LOCOMOTIVE ALARM BELL.

Upon examination of the invention, we concur in these opinions, and have no doubt that both railway companies and the public would be benefitted by its general introduction, in the diminution of the number of accidents, and in the simplification of litigations arising therefrom. It is often the case in suits arising from railway accidents that there is a disagreement on the part of witnesses as to whether the bell was ringing at the time or not. The application of this improvement would settle all doubts arising from such conflict of testimony, and thus benefit companies, while the certainty of the alarm would prevent accidents arising from neglect.

Fig. 1 is a perspective view of a locomotive with the alarm attached. Fig. 2 is a diagram showing the details of construction.

Fig. 2



A represents the front beam of the locomotive, upon which is properly secured the yoke, B, to which the bell is suspended in the following manner: The shank of the bell is turned off smoothly, and inserted through a hole through the top of the frame, which hole is bored to fit the shank of the bell closely, and, at the same time, not so tightly as to prevent the bell from being rotated.

The top of the shank is provided with a proper nut, C, by means of which it is held in the yoke, and which rests upon a metal washer, which, in turn, rests upon a rubber washer, placed on the top of the frame and surrounding the shank. By this means the bell is secured in a vertical position, allowing it no motion but a rotary one about its vertical axis. A hammer, D, is attached to the lever, E. This lever is sustained by the two vertical guides, K, and is actuated by a spiral spring, F. The lever is also held in position by the spring, G, which prevents it from being thrown out of place by the lever, H, which is pivoted to a bracket, and has its lower end pivoted to the connecting rod, I, which receives reciprocating motion from the revolution of the eccentric, J.

The hammer may be so placed as to impinge against the outer or inner side of the bell, as desired. In either case it is secured, in a position out of the line of the center of the bell, in such a manner that each stroke of the hammer will rotate the bell a little distance.

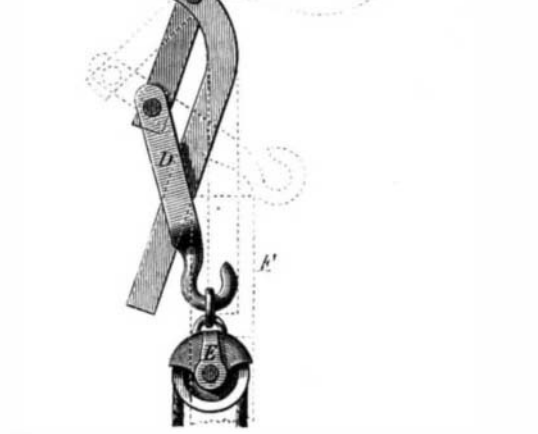
The locomotive being in operation, the revolutions of the eccentric communicate a rocking motion to the lever, H, by means of the connecting rod. The upper end of this lever engages with a notch on the lower side of the lever, E, thereby withdrawing the hammer head from the side of the bell, and compressing the spring, F. The lever, E, being thus withdrawn, is slightly elevated, in the shorter guide, by the lever, H, and the latter is disengaged from the notch in the lever, E, which is instantly forced down by the spring, G, when the recoil of the spring, F, throws the hammer violently forward against the bell.

A constant and positive action is thus secured; the apparatus, interfering in no way with other working parts of the locomotive, is so placed as to be out of the way, while its position is favorable to throw the sound in advance of the train.

Patented March 2, 1869. For further information address Benjamin Briscoe, care Detroit and Milwaukee Railroad Company, Detroit, Mich.

BEBOUT'S RAFTER HOOK.

This invention is intended to supply a simple, easily attached, and readily detachable rafter hook, for the support of the tackle of horse hay forks, steelyards, and, in general, for any purpose to which such a device can be conveniently



applied. Farmers and owners of warehouses will at once see the convenience of the improvement, upon perusal of the accompanying description.

Referring to the engraving, A represents a jointed hook bar, and B a similar bar, not jointed; C is the section of a rafter, joist or beam, to which the apparatus is attached, and D is a short bar, pivoted or jointed to the hook, which, together with the hook bar, constitutes the jointed hook bar lettered A. E is a sheave over which the rope is passed for the suspension or elevation of the object to be supported or raised. F is a pole shown in dotted outline. Into a socket in the end of this pole, the shank or lower end of the hook bar, B, enters, when it is desired to put up or take down the apparatus.

Pushing up on this pole disengages both the hook bars from the timber, and they then assume the position shown in the dotted outline. Reversing the operation attaches the apparatus, when the pole may be taken away until it is required to move the hook to some other part of the building.

This invention was patented through the Scientific American Patent Agency, August 8th, 1871, by John Newton Bebout of Oberlin, Ohio, who may be addressed for further information.

Students do not Sleep Enough.

It has become common for the students in our principal colleges to publish weekly, monthly, or quarterly journals, the matter being supplied principally by the students themselves, and relating to college affairs. Some of these are very creditable in character. Among the most respectable is *The Williams Vidette*, from which we copy the following caution:

"Students, as a class, do not sleep enough. There is no law so fundamental and imperative on the student, as the law which requires him to sleep, and no other law does he so systematically and recklessly ignore.

"It is a popularly accepted fallacy that students and literary men do not require as much sleep as mechanics and laborers. Physiology shows us that, during the operation of the intellect, rapid changes of tissue take place, and that a few hours of close application to thought and study exhaust the system more than two or three times the same period devoted to manual labor. It is evident, then, in order to compensate for this greater waste of tissue, that the brain worker will require more sleep than the muscle worker.

"In the violation of this first great hygienic commandment is found the secret of most of the special diseases to which the student is liable. To this cause can be traced the eye affections that are so common. By neglecting to obtain sufficient rest, the system becames relaxed and its tone lowered, thereby inviting disease, of which these organs, being especially overtaxed and weakened, are the first to become sensible.

"Anything, therefore, which is intended to increase our facilities for sleeping, is of the highest importance and interest."

What Railway Dust is Composed of.

Mr. Joseph Sidebotham has made a microscopical examination of dust blown into a railway carriage near Birmingham. He says: "I spread a paper on the seat of the carriage, near the open window, and collected the dust that fell upon it. A rough examination of this, with a two thirds power, showed a large portion of fragments of iron, and, on applying a soft iron needle, I found that many of them were highly magnetic. They were mostly long, thin, and straight, the largest being about 1-150th of an inch, and, under the power used, had the appearance of a quantity of old nails. I then, with a magnet, separated the iron from the other particles.

"The weight, altogether, of the dust collected was 5·7 grains, and the proportion of those particles composed wholly, or in part, of iron was 2·9 grains, or more than one half. The iron thus separated consisted chiefly of fused particles of dross or burned iron, like 'clinkers;' many were more or less spherical, like those, brought to our notice by Mr. Dancer, from the flue of a furnace, but none so smooth; they were all more or less covered with spikes and excrescences, some having long tails, like the old 'Prince Rupert's drops;' there were also many small, angular particles like cast iron, having crystalline structure.

"The other portion of the dust consisted largely of cinders, some very bright angular fragments of glass or quartz, a few bits of yellow metal, opaque, white, and spherical bodies, grains of sand, a few bits of coal, etc.

"After the examination of this dust, I could easily understand why it had produced such irritation; the number of angular, pointed, and spiked pieces of iron, and the *scoriæ*, or clinkers, being quite sufficient to account for the unpleasant effect.

"I think it probable that the magnetic strips of iron are laminæ from the rails and tires of the wheels, and the other iron particles, portions of fused metal, either from the coal or from the furnace bars. The large proportion of iron found in the dust is probably owing to the metal being heavier than the ordinary dust, and accumulating in cuttings such as those between the two stations named.

"If I had to travel much by railway through that district, I should like to wear magnetic railway spectacles, and a magnetic respirator in dry weather."

TEMPTATIONS are enemies, outside the castle, seeking entrance.

raised a certain hight, which hight is determined by dividing the area of the opening by its circumference.

Again, it is not absolutely certain that an explosion will result from water being thrown on red hot fire surfaces; yet no engineer, who has any regard for his reputation, or for the property under his control, whatever might be the size and number of safety valves, would risk it, under any circumstances, well knowing that damage is as sure to result to the boiler as it is done. Red hot metal is weak, and an explosion or collapse does not necessarily result from the sudden accumulation of steam when water is thrown on it; but the metal, in this state, is not able to bear the ordinary working pressure. When boilers are properly constructed and properly managed, explosions will cease, but not before.

L. E.

Macon, Miss.

Fireproof Safes.

To the Editor of the Scientific American :

In your issue of October 28 is an article entitled "Fireproof Safes—Improvements urgently called for," and I would earnestly ask the privilege of making some reply to the same.

A word, first, in reference to the Chicago fire, in which the safes referred to failed to preserve their contents. Here was a vast city, with thousands of wooden buildings, shingled roofs, wooden stables filled with hay and straw, planing mills crowded with dry lumber, shavings, and kindling wood—cabinet shops, lumber yards, gas works, etc. etc. After a long drouth, with every thing as dry as tinder, a fire occurs in a hay stable, at a time when the wind is blowing a hurricane. In a very short time the fire is beyond all human control. Before its terrible march, iron walls melt as before the blast of a furnace, and soon a very large portion of the great city is in ruins. In view of the circumstances, the wonder is not that the city was burned at last; but that it has stood so long unconsumed.

Now comes the reproach to the builders of the so called fireproof buildings, and also, of course, to the makers of fireproof safes. Perhaps the reproach in both cases is well deserved; but I think not. The builder of a fireproof store never contemplated placing his work before the terrific power of a blast furnace; yet, from the testimony of eyewitnesses, the hurricane was the same in effect as the "blast" of a smelting furnace, and the iron, of course, was melted. What, then, is the use of a fireproof building? We answer: Had the city been properly built, with no wooden structures, and no shingled roofs, but with substantial stone, brick, iron, and slate, the fire could not have spread—even under the power of a hurricane—beyond the control of a well organized fire department, and the intense heat, which melted the iron of the fireproof buildings, could not have existed. The builders of fireproof structures cannot justly be held account able for results arising from such circumstances.

Now, as to the fireproof safes which failed: What is the construction of a fireproof safe? Simply this: An iron box is made, an iron lining is placed inside, leaving a few inches space between it and the outside wall of the iron box. This space is filled with some material which contains moisture; and, when the safe is exposed to a fire, the moisture is evaporated into the interior of the safe; and while the moisture lasts, the heat cannot consume the books, papers, etc., placed in the center of the safe. Various materials are and have been used. Substances which contain a large per centage of what is called the water of crystallization, as plaster and alum, and various kinds of concrete, are also employed with more or less success. And safes thus supplied, when exposed for the same length of time to an equal degree of heat, will preserve their contents just as long in proportion as the relative degree of moisture exists in their filling, and no longer. One kind of safe has the space between the walls filled entirely with water; and this kind, it would seem, when equally exposed, would preserve its contents much longer than safes, a portion only of whose filling is water. One of these water filled safes, on the published testimony of the proprietor of a hotel which was burned a few weeks since at Ithaca, N. Y., was exposed to the hottest of the fire for a period of sixty hours, and yet kept its contents uninjured. Now, the Chicago fire lasted from ten to twenty days. I mean by this, that the vast mass of *débris* which fell was, at the time of falling, not one half, and probably not one quarter part, consumed to ashes; and after the fire, driven by the tornado, had passed on, this vast mass of timbers and other inflammable materials continued to burn for many days unquenched; and the moisture contained in safes of any kind must, of course, have been exhausted long before the flames and live coals, which surrounded and embedded the safes, were either burned out or quenched. Of course the contents of safes thus exposed were consumed.

Who ever constructed a safe of any kind with the expectation of such an ordeal? It were just as reasonable to reproach the insurance companies with their failure. Who ever expected insurance companies to meet liabilities amounting to two or three hundred millions of dollars? No one. The wonder is that the insurance companies have stood the disaster as well as they have.

The merchants, and people generally who buy safes, usually try to get them as cheaply as possible. But there is no such thing as a cheap safe. If you want protection from fire and thieves, be willing to pay for it.

In most counting rooms and offices, there is plenty of room for the black walnut desks, tables, and other elegant furniture. But the safe, though gilded and landscaped, is begrudged the little room it occupies, and so the manufacturer must make it of the smallest possible dimensions; consequently he cannot put in filling enough of any kind—even clear water—to outlast a very long conflagration. The fact is, that safety is obtained by *quantity*. The water safe at Ithaca went through a test of sixty hours. Can any sane man doubt that, had it contained four times as much water as it did, it would outlast a fire of more than four times sixty hours? A safe will preserve its contents till all its moisture is used up, and no longer. But when any kind of safe of the usual size—let its filling be what it may—is kept in a furnace for ten, twelve, fifteen, or twenty days, is it a matter of surprise or reproach that its moisture is exhausted, and its contents consumed? If you mean to have such fires as that of Chicago, then give the safe makers leave to build their safes large in proportion.

How can any real improvement be made? There is nothing but moisture,—that is, water held in some form—that can be used. If the safe was made of a material absolutely nonconsumable, it would not avail, for the heat would consume its contents. Carbonic acid gas, it is said, will quench flame quicker than water. But there is no flame to be quenched inside a safe during a conflagration. When the books and papers are hot enough to burst into a flame, they may as well burn, for they are already destroyed.

The only improvement of consequence, of which we can conceive, is in the increase of the amount of the filling which gives out the moisture, and the building of towns and cities of material that cannot kindle, even under the force of a hurricane, so rapidly that a well organized fire department cannot control it.

JUSTICE.

Protection against Fire.

To the Editor of the Scientific American:

It seems to me that the SCIENTIFIC AMERICAN is the proper vehicle to convey useful knowledge from one portion of the people to another.

The recent fires are sufficient to awaken the spirit of reform in building. But we must bear in mind that we have, in our midst, very many enterprising young men who, if they build at all, and have any thing left to commence business with, must study economy. But, if we would combine economy with utility and safety, we must make great reform in the mode and construction of building.

Now, if we will dispense with wooden walls and roofs altogether, we shall save nearly enough to erect our buildings with mineral substances, provided we use economy in the use of the latter.

For example, take the roof. Slate, in St. Albans, can be put on for $8 per square, a trifle dearer than shingles; while, in Rutland, slate is $1 per square cheaper than shingles.

Next, for the outside walls. If we were to lay up two courses of brick—laying them two inches apart (of course, binding them with "headers")—we should get a "dead" space between the two courses, which would render the building dry and warm; and, at the same time, enable us to plaster upon the bricks without any laths, thus saving the frame, boarding, clapboarding, lathing and back plastering. And not only this, but we could use poor bricks for the inside course. We could also introduce a new article of ornamental bricks for the formation of cornices and brackets. In this way, we can, if we will, make a reform in building materials, increasing the expense of building but very little.

Inside walls may also be formed of one course of poor bricks. If made of wood at all, they should be formed of planks, and set as tightly together as possible. The spaces between floor joists, or at least that portion next to partitions and walls, should be packed with mortar, broken bricks, cobble stones, etc. The worst feature in our present mode of constructing wooden buildings is the open space between the floor joists and the studding. In case of fire, these spaces form so many flues to lead the devouring element in every direction at once, so that a single spark of fire in some remote corner is sufficient, with the aid of these flues, to wrap the entire structure in one sheet of flame in a very few minutes.

Remember, I am not now advocating fireproof buildings, but simply cheap buildings, and the very cheapest that should ever be allowed to go up in a densely populated place.

Under the present state of affairs, there is seldom any hope of saving the building in which a fire originates; and, if a conflagration can be stopped by pulling down two or three buildings, we think ourselves lucky; whereas, if we had commenced twenty years ago to build with proper materials, and, at the same time, built so compactly as to leave no spaces in the walls and flooring for fire to run in, but few buildings, comparatively, would be burned; for the fire would make so much less rapid progress that it would, in nine cases out of ten, be put out where it originated. So that, in the end, we should save, in insurance and in the fire department alone, more than the extra expense accruing from a more substantial mode of building, to say nothing of the enormous losses and suffering by fire.

CHARLES THOMPSON.

St. Albans, Vt.

A Blacksmith's Pianoforte.

To the Editor of the Scientific American:

Having seen several notices, in your columns, of the early manufacture of pianos in the United States, I propose to place on record the performances of a South Carolina mechanic.

About the year 1823, the first piano was introduced into this portion of what was then Pendleton district. Being quite a curiosity, it was "interviewed" by many of the neighbors, among others by William Turner, a young blacksmith, who examined its construction. In a short time, he exhibited a piano of his own manufacture, the wire forged under the hammer and drawn by hand, and the keys made of bone and wood. This instrument was for many years in the possession of Daniel E. Riley, late of Pickens county, and, for aught I know, may be still in existence. I have frequently amused myself, when a boy, trying to play on it.

Encouraged by the success of this experiment, Turner made a trip to Augusta, bought wire and ivory, and made—for the time—a pretty respectable instrument, which he sold to a gentleman, whose name I have forgotten, whose family used it for many years.

I had in my possession, for several years, a penknife of exquisite temper and polish, one inch and a quarter long when open, which Turner made about the same time and presented to my mother.

Turner emigrated to Illinois in my boyhood, took up the trade of millwright, and, I believe, was killed by a fall about thirty five years since.

Anderson Co., S. C. E.

Incident in Engineering.

To the Editor of the Scientific American :

Permit me, as a practical engineer, to mention a circumstance that occurred to me while in charge of a stationary steam engine. My engine was stopped with but little fire under the boilers. I tried the water, and found two solid gages, and noticed by my steam gage that I had forty pounds of steam. I went up stairs and returned in about a half hour, tried my water again, and found the gages remained in, neither water or steam coming out. I looked in the furnace, and saw that the sheet directly over the fire was red hot. It was a mystery to me what had become of the water and steam which was there but a few minutes before.

After the boiler had cooled, I let in water, and found it ran out at the bottom of the boiler, as fast as I let it in. I found, on inspection, that the bottom sheet, about five sheets from the front end, had opened for a space of twelve inches, in direction of its length, and quietly allowed the water and steam to blow out without doing any damage. Now why did it not produce as disastrous an explosion as the *Westfield* boiler, which had only twenty-seven pounds, as it is said? Because the plates of the boiler were not overheated, and there was no sudden formation of steam of immense pressure, as there might have been, had I had a hot fire with the engine standing still. I give this for what it is worth. I would like to see it commented on in your paper. Being a young engineer, I am desirous of learning.

St. Louis, Mo. F. WEST.

Plumb Line Variation.

To the Editor of the Scientific American :

The deviation of the plumb line from the vertical, at the shaft of the Hoosac Tunnel, has called forth the mathematical acumen of the writers in the SCIENTIFIC AMERICAN, of January 14th and October 14th, 1871.

Their learned expositions, which are accusively conflicting with each other, "both in principle and result," may be simplified by the following version. The rotary velocity of the earth at the surface decreases as the depth, and the plumb line, when descending, will incline eastward from the vertical, but when arrested in its descent, will, as a pendulum, vibrate past a true vertical line of direction, until brought to rest, when the plumb line itself will be vertical.

The above relative action and positions would take place at any depth, or with any difference of rotary velocities, and consequently, no practical difficulty can be experienced, which important item the said writers have omitted to state.

The central direction of gravity constantly tends to draw the plumb from its deviation, and, if lowered very slowly, no appreciable divergent angle would be formed, being nearly equivalent to a stationary condition of the plumb.

Pittsburgh, Pa. THOS. W. BAKEWELL.

Cundurango.

The Secretary of State, Hon. Hamilton Fish, has transmitted to the Department of Agriculture a package containing specimens of the fruit and seed bearing capsules of the "cundurango" plant or vine, received from Charles Weile, United States Consul at Guayaquil, together with the following extract from the official letter of the consul:

"I have just returned from a visit to the cundurango region, in the province of Loja, where I spent a month in collecting the different species of the plant. Dr. Destruge, of this city, an excellent botanist, has classified the vine as belonging to the order *asclepiadiæ*. The word 'cundurango' is a compound of '*cundur*,' eagle, and '*ango*,' a vine. The aborigines probably applied this name owing to the winding growth of the vine, and because it seeks the highest trees for its support. Its growth is most vigorous in moist places, on the banks of rivers and creeks, where the body often attains a diameter of two or three inches, diminishing gradually to tendrils at the top. The family is a numerous one. Leaves, vines, fruit and flowers of the species differ materially, but all contain—some in a greater degree than others—a liquid that resembles milk, and which, exposed to heat or coming in contact with other bodies, coagulates and forms an aromatic resinous substance."

Inclosed was a list of the specimens and a piece of the balsam which the milk produces. The list names the following varieties, all found at Zaruma: No. 1. *Cundurango Pepino;* No. 2. *C. Tumbo Grande;* No. 3. *C. Tumbo Chico;* No. 4. Variety of *C. Tumbo Grande;* No. 5. *C. Paloma Grande;* No. 6. *C. Batea Grande.*

The seeds received by the Agricultural Department will be propagated, with the design of testing the practicability of the cultivation of the plant in some section of this country, should its production be found to be desirable.