PERPETUAL MOTION.

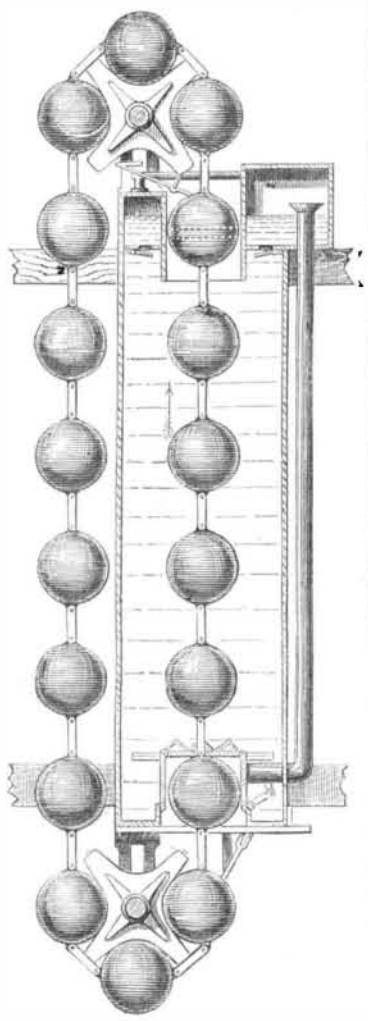
NUMBER VI.

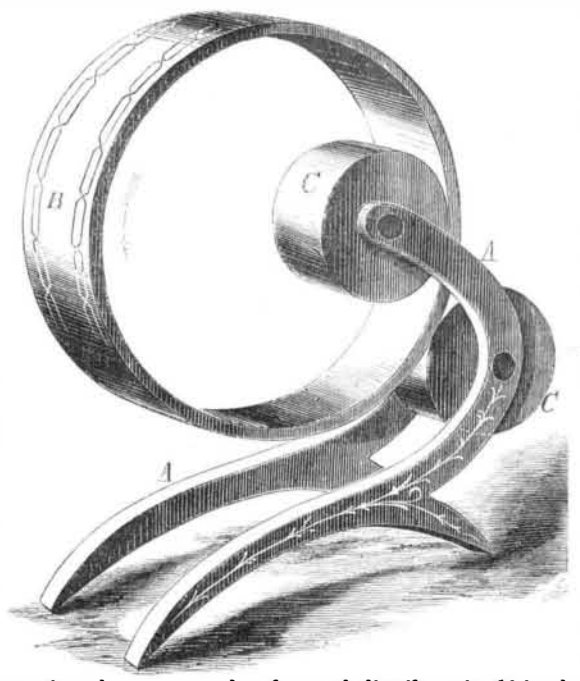
In 1865, Herman Leonhardt, of St. Gall, Switzerland, invented a new motive-power engine, which he thus describes:

"I avail myself of the property of bodies or objects of a certain specific gravity when immersed in a fluid of a greater specific gravity to rise or ascend to the surface of such fluid. This buoyancy represents a greater or lesser force or power according to the greater or lesser difference between the specific gravity of the object and that of the fluid, and the size of or the displacement caused in the fluid by such object. In order to make the said objects, which I will call floats (see Fig. 13), as light as possible, and yet strong enough to resist the pressure of the water, I construct them of thin sheet metal, and in preference, in the form of tubes or hollow cylinders with flat ends. A number or series of these cylinders placed horizontally parallel to each other, are hinged or linked together in a similar manner as the buckets of a chain pump; this chain of floats is passed over two sets of pulleys or disks fixed to two horizontal shafts, the one placed vertically above the other, the said pulleys being formed to suit the diameter of the floats. One half of this chain of floats passes through the center of the tank holding the water or other fluid, and the other half passes outside the tank through the air. The floats, when in motion, enter through the bottom of the tank, in the manner hereafter described, and rise up by their buoyancy through the water; they then pass round the top pulley, descend outside the tank, and passing over the bottom pulley, again enter the tank, and so on. If cylindrical floats are used, as described, they are fixed on the connecting links half a diameter or more apart from each other; therefore supposing the floats to be fifty centimeters in diameter they would be placed twenty-five centimeters apart.

"Now the principal part of my invention consists in relieving the floats, when entering through the bottom of the tank, of the pressure of the water column, which pressure, if not removed or neutralized, would render the rising of the floats in the water impossible, and prevent the machine from acting. The manner in which the floats are relieved from the pressure of the water column when entering the tank is as follows: On the bottom of the tank I form an entrance chamber for the said floats of a depth equal to the diameter of a float; the bottom of the chamber and its top are each provided with double slides which open and close as the floats enter and leave the chamber. Supposing the floats to be in motion, and one of them to have arrived in the center of the chamber, a lever actuated by the moving floats or by the revolving float pulley or disk, will cause the top or egress slides of the chamber to open in the same measure as the float rises; this slide, acting through another lever, will, at the same time, open a slide or valve in the side of the chamber and admit water into it, thereby bringing the water in the tank and in the chamber into equilibrium. When one half of the float has passed through the top or egress slide, the next float will have arrived at the bottom or ingress slide, which latter will now open in proportion to the rise of the float. The egress slide will close in the same measure and at the same time shut off the communication between the tank and the chamber, which was necessary for establishing the equilibrium. At this juncture other valves connecting the chamber with pipes leading to the top of the tank are opened, and the water in the chamber, which would be detrimental to the further rise of the entering float is withdrawn through these pipes, which I will call return pipes, by suction, and allowed to flow back into the tank above the water level; this suction is effected through the following arrangement:—That portion of the top of the tank where the floats leave the water is open, but the other portion of it is covered, and a partition dividing it from the open portion is made to dip into the water to some depth, thereby rendering it a hermetically closed chamber, and the above-mentioned return pipes open at a certain hight above the water-line into it. This chamber I call the vacuum chamber, because previous to starting the machine a vacuum or a partial vacuum must be formed in it, and afterwards maintained as long as the machine is to continue in operation. The air is exhausted from the chamber by means of an air pump driven by the machine, but arranged for driving by hand for the purpose of starting the machine. By forming this vacuum the original water level in the tank will be disturbed, the water level being raised in the vacuum chamber and lowered to a corresponding extent in the open part of the tank. Supposing the tank to be of a hight to hold six floats 1, 2, 3, 4, 5, and 6, 1 being the one above described, as entering the admission chamber, it is clear that as 6 leaves the water, the water level in the open part of the tank will be lowered in proportion to the displacement previously caused by 6, and the water level in the vacuum chamber being thereby likewise lowered, it will cause a suction or drawing up of water in the return pipes, equal in quantity to the amount of water displaced in the entrance chamber by the entering float, 1. The water sucked up through the return pipes will flow

FIG. 13.





over into the vacuum chamber and distribute itself in the water of the tank. The ingress and egress slides of the entrance chamber are furnished with linings or packing of felt previously boiled in oil for insuring a water-tight fit against the floats without much friction, and the flat ends of the floats likewise pass between sheets of felt previously boiled in oil and pressed against the flat ends by fluted rollers. The air pump is maintained in operation in order to remove the trifling quantity of atmospheric air adhering to and introduced into the tank by the entering floats. The motion communicated by the rising floats to the float pulleys or disks and shafts, is further transmitted by means of belts or other gearing, in the manner usual with other motive-power engines.

"The details of arrangement and construction of my new motive-power engine may be altered or varied, but the main features of my invention consist in relieving the floats, when entering the tank, of the pressure of the water column by means of a vacuum chamber and parts connected therewith, as described, or their equivalents."

Only about a year since the *London Mining Journal* described a machine, patented in England, the essential features of which did not differ from those of Leonhardt; and what is more, expressed a favorable opinion of it.

We have received several letters with diagrams of "perpetual-motion machines" from correspondents, one of which we will herewith present, and defer others for future articles.

Fig. 14 is a diagram sent us by F. G. Woodward, whose address was not given in his letter.

The writer says: "It consists of a stand, A, two idler pulleys, C, between which a hollow cylindrical ring, suspended in the manner shown, is expected to revolve in the direction indicated by the arrows." The only difficulty about it is, that it will not work, though it looks plausible enough.

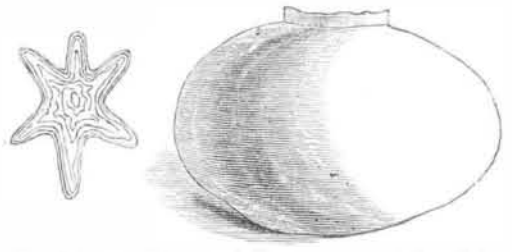
THE HAIL-STORM OF JUNE 20, 1870.

This remarkable storm swept along a path about thirty miles wide, and extending from Troy, N. Y., to Bangor, Me., though it was not everywhere accompanied by hail.

My point of observation was in Northampton, Mass., which was in the central line of the storm.

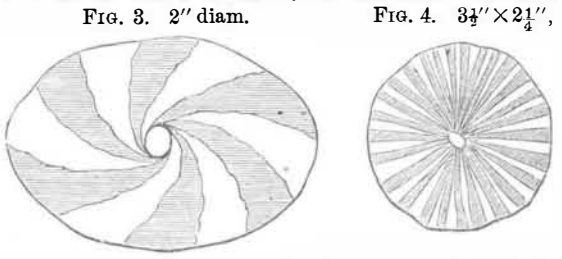
At sunrise the atmosphere was obscured by fog, which was partially dispersed at a later hour. The day was sultry. At noon the thermometer indicated 88° in the shade. At 3 P. M. a vast mass of dark-green cloud rolled up from the N. W., while lateral currents seemed to set in, forcing the clouds at first into confusion, but afterwards into a well-defined vortex, or spout. The electrical detonations were frequent and sharp. No rain preceded the hail, though it fell copiously after a few minutes. The first hail-stones were about one inch in diameter, and seemed to fall from a greater hight, and with more force, than those that fell subsequently. The latter were probably nearer the center of the vortex, and so had their downward motion restrained by that which was lateral. The first that fell were, most of them, on striking the ground, instantly buried out of sight. If they struck on a rocky surface they were dashed in pieces, or else rebounded to a considerable hight in the air. Had their larger successors been driven by a corresponding force, nothing could have survived their assault. The smaller hail-stones were generally flattened spheres, though sometimes in rude stellar forms, Fig. 1. But the largest ones were symmetrical ovoids; each being surmounted, however, by a roughened crown, Fig. 2. The dimensions and weight of three specimens are given, with such accuracy as could be secured by the means at hand. These are but samples of thousands that fell till the earth was covered with ice. The first was, in long diameter, $3\frac{3}{8}$ inches; short diameter, $2\frac{1}{8}$ inches; weight, 7 ounces. The second was $3\frac{1}{2}$ inches by $2\frac{1}{4}$; weight, 8 ounces. The third was 4 inches by $2\frac{3}{8}$; weight, 10 ounces. This monster, a foot

FIG. 1. FIG. 2. $3\frac{1}{2}'' \times 2\frac{1}{4}''$.



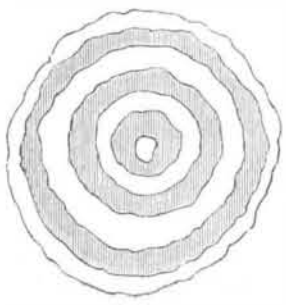
in circumference, did not entirely melt away for six hours after it fell! The ice in all the hail-stones was peculiarly hard and compact. Interesting structural peculiarities were noted. Hail-stones of stellar form were always transparent and homogeneous. The spheroids were covered with an opaque coating, and had likewise an opaque center. On being bisected some of them showed a radiated structure, the alternate rays being white and clear, Fig. 3. The largest hail-stones had an axis of white ice, half an inch in diameter,

FIG. 3. 2″ diam. FIG. 4. $3\frac{1}{2}'' \times 2\frac{1}{4}''$,



around which the alternate layers were arranged in spiral convolutions, Fig. 4. The most common form was in concentric layers, like the coats of an onion, still alternating opaque and transparent; but the edges were finely serrated, like the stripes in some species of agate, Fig. 5. In one hail-stone I counted thirteen of these layers, indicating that it had passed through as many strata of snowy and vaporous cloud.

FIG. 5. 3″ diam.

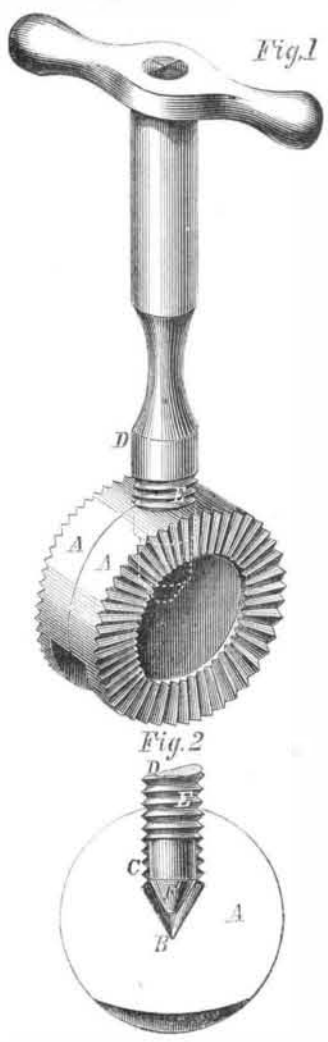


After a lull in the storm, for half an hour, there was a second fall of hail, but much lighter than the first.

The damage done by such a war of the elements cannot easily be ascertained. Vegetation suffered greatly. In some cases men and animals were wounded. The icy missiles not only broke thousands of panes of glass, but also in many instances the window-blinds and sash. In a few cases weather-worn house roofs were pierced.—*Rev. Horace C. Hovey, M. A., in the American Journal of Science.*

IMPLEMENT FOR GRINDING VALVES.

This device was invented to supply an easy method of regrinding the Peet valve. The valve is an extremely efficient one, and has achieved, we are glad to say, great popularity. It is now extensively used both in this country and in Europe. The great durability of the valve renders regrinding seldom necessary, but when this operation is required the instrument under consideration supplies a very simple and ready means for accomplishing the desired object.



It consists of a pair of steel disks, A, made parallel like the valve disks, provided with serrated cutters upon their outer surfaces. Their interior surfaces are provided with wedge-shaped cavities, B, and the thread, C. The stem, D, is made with a screw, E, corresponding to the thread, C, in the disks. The conical wedge, F, is fitted to the cavities, B.

By removing the bonnet from the valve body, and placing the stem in its position in the disks, the grinder may be slipped into the valve body. A slight turn of the stem drives the wedge forward and forces the cutters firmly against the seats. A rocking motion of the stem will then polish down the valve seats to a perfect joint.

The valve disks are readily ground by placing a piece of fine emery cloth on a piece of planed iron and rubbing the disk face on it until it is perfect. The "Peet" valve is not

weakened by regrinding, as is the case with the globe valve, but it may be safely repaired many times.

The office of the Peet Valve Company is at 152 Hampden street, Boston, Mass., where users of the valve may obtain this grinding implement.

Correspondence.

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

Spiritualism and Science.

MESSRS. EDITORS:—The article under this heading, page 360. Vol. XXIII., is certainly well intended, serving to prevent persons of feeble mind from being deluded into mischievous notions of spiritual intercourse with departed beings, the basis of which is fallacious. Unless qualified, however, the said article is apt to confirm an error in another direction—an error which we find only too frequent. In proving the fallacy of the theory of spiritualism (as spirit manifestations, etc.,) phenomena of a quite different nature, having no connection whatever with the delusive theory—and which, by the way, are as stubborn facts as the growth of organism from the germ, or, indeed, nearly all animal function that at present baffles explanation—are classed under the same head, and, by implication, their existence is attempted to be disproved, for the reason that they are beyond explanation in the present state of scientific knowledge. We should, however, remember that we know absolutely nothing of many things, but that they take place, and only under certain conditions. The phenomena referred to are those generally designated as mesmerism, or animal magnetism, the powerful influence of the will of one individual upon the other, the trance produced, a more or less genuine clairvoyance, etc. That these conditions can be and are induced, no candid investigator in our time will deny; and that they are taken advantage of for deception is no reason to deny their genuineness under the proper conditions. Remember, there is nothing so noble that cannot be abused, or be made the guise for unworthy motives or actions. Love and the religious sentiment may be accepted as the most elevated conceptions which the human mind is capable of entertaining, and admitted that they are oftener perverted to base purposes than to good, we cannot denounce them as delusions, or humbug. That by the powerful will of the operator the whole system of another individual, bodily functions as well as those of the mind, may be controlled, was probably known and made use of among the first societies of men. They found that ills could be cured, insensibility to pain produced, and a trance, in which the mind appears to be to a greater or less extent liberated from the fetters of the body, the veil raised from an inner vision or perception, which penetrates through solid extraneous matter as through thin air; in fact, matter, distance, or time, ceases to interfere with a perception by which the mind places itself in communication with everything without and within. Admitted that the cases are rare in which the mind, while in such condition, is not influenced by the minds of surrounding individuals, nor by its own individual constitutional peculiarities, trainings, or aims. Finally, the faculty of giving utterance about objects or facts perceived, may be imperfect. But the rarity of a more complete state of the kind explained should not carry us so far as to deny the phenomenon itself. Prof. Gregory Ersdale and other investigators testify to the facts, though they fail to give an explanation for them.

It seems, however, a part of common human credulity to receive the rambling utterances of individuals in the state of trance, in a mood which favors deception, and, awe-struck, to connect them with communications from another world—instance the oracles of ancient and modern times. There is little disposition in general, or ability to examine if the condition is genuine, or unintentional, or purposely fictitious. And granted genuine, the utterances cannot be implicitly relied upon, because we are unable to detect to what extent the individual is influenced by the minds of others, by surrounding objects, or by its own individual constitution. This whole subject, moreover, is one too generally avoided by profound investigators, for the reason that they fear association with professional cheats and deceivers, or that they fail to recognize a tangible basis to start from, on which to build a system. The consequence is, that the phenomena are viewed with distrust and ignored, if not actually repudiated. In this manner, however, as we have seen in other branches of science, nothing is cleared up; the darkness remains, and under cloak of it cheats and impostors play their nefarious game.

Let us have light on this subject, if attainable, by starting from what we know of the working of the mind, and progressively learn what the mind may be capable of.

New York city. R. H.

[The whole subject of mesmerism was investigated by Dr. James Braid, of Manchester, England, in 1842, and his researches lead to the discovery of *hypnotism*, to which this class of phenomena can now be referred. There is no doubt about the partial sleep of certain faculties, while others are wide awake; and Dr. Hammond, of New York, gives remarkable instances from his own practice. The peculiar condition of nervous sleep, called hypnotic, which is produced in certain people by their fixedly gazing at an object, is entirely a subjective phenomenon, and does not depend upon any external force, electrical, magnetic, or nervous, coming from another person, but, under proper conditions, arises spontaneously, just like ordinary sleep. Some persons, as Dr. Hammond relates, pass into the hypnotic state of their own accord, and with the utmost readiness, and are "natural clairvoyants," or "spiritual mediums."

Unconscious cerebration has been a subject of study for a long time, and most of the phenomena are capable of scientific explanation. There is not the slightest necessity of making a mystery of them. Those who are "natural clairvoyants" are fit subjects for the care of a physician, and when they neglect the warnings of nature they are certain, sooner or later, to demand medical treatment when it is generally too late. Mesmerism served one good purpose, and that was to call the attention of scientific men to the possibility of performing surgical operations while the patient was insensible. Some of our older readers will remember that this was one of the strongest claims of the earliest advocates of mesmeric doctrines. The idea was at once seized upon as important, and in the course of researches on the subject, ether was suggested as an anesthetic agent. Afterwards, chloroform and nitrous oxide were employed, and in July, 1869, a new method of producing the hypnotic state was discovered in the hydrate of chloral, a medicine now largely employed for the purpose, and far more rational and effective than the laying on of hands, so popular twenty-five years ago.

Mesmerism, or hypnotism, is a subject for the physiologist to study; other persons had better let it alone.—EDS.

Deviation of the Plummet.

MESSRS. EDITORS:—The SCIENTIFIC AMERICAN for October 29, 1870, contains an editorial under the caption of "Central Shaft—Hoosac Tunnel." In that article you gave a lucid explanation of some of the difficulties the engineer would have to contend with when he made an attempt to lay down the line on the bottom of the shaft, but you forgot to mention one difficulty of considerable importance—you said nothing about the deviation of the plummets toward that side of the shaft upon which the greatest mass is located. That the plummets will lean toward that side is a foregone conclusion, Dr. Maskelyne's celebrated experiment with the plummet near Mount Schehallien, in Wales, having removed the subject beyond the pale of controversy.

To ascertain the amount of deviation I would suggest the following expedient:

With a No. 9 iron wire carry the surface line across the mouth of the shaft. Erect a thirty-foot pole upon either side of the shaft—their bases upon the surface line. Stretch another wire across the mouth of the shaft from the top of the poles. Suspend plummets from the upper wire, and by means of guys attached to the poles strain the points of the plummets exactly over the lower wire. Make all secure, and go below, taking with you two photographic cameras, so modified as will enable negatives to be taken of the zenith. Place one on either side of the bottom of the shaft, perfectly level, and on the tunnel line as established by the plummets. Of course there must be a line cut upon the back of the glass negative, and that cut line must cover the line of tunnel as established by the plummets. Photograph the wires overhead, and when the negatives are finished hold them between your eyes and a strong light. Unless I am very much mistaken, the photograph of the wires will appear like a thin wedge laid across the cut line at an acute angle, the apex pointing towards the center of the shaft. The right-hand plane of one wedge should, if extended, form the left-hand plane of the opposite wedge. The base of the wedges will show how much the tunnel line is out of truth. Photographs showing a clean single wire directly over the cut line will indicate that the true line for the tunnel has been found. Compare the true line with their other and their difference is the amount of plummet deviation.

Perhaps there will be three objections made to the foregoing method:

1st. The test requires too much nicety and perfection of workmanship.

2d. The shaft is too dark.

3d. The wires are too small.

As to the first, I reply that any method must be extremely nice, and the workmanship of the very best.

As to the second, the shaft may be dark so long as the wires remain in the light.

As to the third, it is untenable. In my possession there is a photograph on card-board showing the stem of an oak leaf which was 820 feet distant from the camera.

New York city. R. B. S.

Poisonous Effects of Bee-stings---A Preventive.

MESSRS. EDITORS:—The poisonous effects of a bee-sting can be prevented, or at least considerably mitigated, by passing over it the pipe of an ordinary trunk key.

The reason is obvious. The pipe acting as an annular compress close to the puncture, forces the poison out. Could not this simple process be extended in its application to the bites of serpents and rabid dogs? The absorption and spread of the virus might thus be prevented, or at least retarded, until a physician could arrive with a more effective remedy.

Albany, N. Y. ANTIDOTE.

Glass Cutting.

MESSRS. EDITORS:—The glazier's diamond is an angle of a crystal, the extreme point of which may be regarded as a single atom, which, when pressed upon the glass, acts like a wedge, entering between two particles of glass and producing a minute fracture. When drawn over the glass it produces an infinite number of minute fractures, extending sometimes quite through the glass. A sharp point of iron or lead will not cut glass because it is too soft. The extreme point or atom yields when pressed upon the glass, allowing two or more atoms to touch the glass, which act no longer as a wedge, but as a weight, and if sufficient force be applied, a large and irregular fracture will result.

A sharp point of hardened steel will cut glass nearly as well as a diamond. Take an old worn-out three-cornered file, grind the end to a three-cornered point, heat it red hot, and immediately plunge it into a mixture of snow and salt. Retouch it on the stone to remove the scale, and it is ready for use. If rightly done it will give very good satisfaction. In using it hold the file nearly perpendicular, slightly inclined forward, and with a gentle pressure draw it rapidly over the glass without changing its inclination to the surface. In cutting thick glass it is safer to cut on both sides before attempting to separate the pieces, but thin glass may be cut with the greatest facility. When the point becomes dull from use it will produce only a ragged surface—scratch—but will not cut. It then needs regrinding. A single turn of the stone is sufficient to put it into working order again.

I find such a glass cutter very serviceable for preparing glass for honey boxes and for various other purposes.

J. H. P.

How to Prove a Millstone Level.

MESSRS. EDITORS:—I think the writer of the article in a recent number of the SCIENTIFIC AMERICAN, headed "How to Prove a Millstone Level," is in error. Suppose the bedstone to be level, and the spindle trammed to it; put on the runner, raise it from the bedstone, and set the runner in motion. Now the runner may be out of balance, if so it will click on the bedstone. Will this prove the bedstone is not level?

Again, the writer says another way to make the stones come evenly together is to move the bottom of the spindle *from* the lowest side of the bed stone. If the runner was fastened on the spindle, so as to have no play on the top of the spindle, this would be correct. But at present the irons in millstones are so arranged as to allow the runner to balance and play on the top of the spindle, so that inclining the top of the spindle by moving the foot of the same in an opposite direction, would not incline the runner. If it would, there would be no real need of leveling the bedstone.

I will now give you my plan to level a millstone. Procure a spirit level that is true. But how shall its truth be tested? Easily enough. Lay it on your proof staff, or red staff, if you have no proof staff. Now bring the staff to an approximate level, and change ends with the level, and if it shows the same each way it is true. If it is not true, plane off the bottom of the level, or paste paper on one end at the bottom of the level, until both ends show alike.

Having the bedstone in good face, proceed to level it. The level being true, the stone leveled by it will be true, and will need no proving. Now tram the spindle to it, put on the runner, and set it in motion. The spindle being tight in the step and bush, if the runner ticks on the bedstone, it will not prove the bedstone is not level, but it *will* prove that the irons are not properly fitted, or the runner is out of balance, or both.

Grand Haven, Mich. THOMAS BRADFIELD.

Sounds Produced by Telegraph Wires.

MESSRS. EDITORS:—Having frequently noticed the humming from telegraph poles alluded to by F. P. Dodge, in a recent issue of the SCIENTIFIC AMERICAN, I have no hesitation in assigning said humming to the action of the wind. The telegraph wire forms an Eolian harp, of which the wind is the motor, the wire string the vibrating body, and the poles suspending the wire regulate the tension upon which its pitch depends.

To account for special intensity of sound from a particular pole, a variety of causes may operate and contribute either singly or together. These may be the near presence of a good conductor, as a board fence, a sewer, or covered ditch, or a firm foundation for the pole itself, the adjoining length of wire being exposed to a particular blast or current.

A wire stretched at a certain tension, between unyielding bearing points, and vibrated by the same force, whether plucked or continuous, will give out the same tone. But when the force is variable, as a wind current, not only of changing velocity, but of different densities and velocities at different parts of the string, and the poles or bearing points yield under the changing stress, the wire gives out a ground tone, which rises and falls in accordance with the variability of motor and materials. Add to this tone the higher ones resulting from the string breaking into smaller divisions of vibrating length, and there results the peculiarly wild and uncultivated whining of the Eolian harp, which represents musically all that is uneasy, weak, and miserable.

Professor Tyndall's work "On Sound" gives with admirable clearness a full review of vibrating bodies, whether cords, rods, plates, or pipes.

Washington, D. C. C. W. CHAPMAN.

The Mississippi Bridge at St. Louis.

MESSRS. EDITORS:—You have recently had several articles in regard to the progress of the great bridge across the Mississippi at this place. Difficulties unseen, or, rather, unexpected, which presented themselves in the sinking of the two channel piers, have been guarded against more effectually in the details and machinery of the abutment caisson, with the happiest results so far. Although this pier is much larger and must go much deeper than the east pier, the arrangements are so complete that the engineer experiences no anxiety about the abutment being safely placed on the bed rock of the Mississippi without accident of any kind. The rate of its descent during the last three weeks has averaged nineteen inches per day, thirty inches being the greatest day's work in that time. The masons have been laying stone night and day, eight traveling hydraulic purchases being used to supply the stone and mortar to them. The rate of descent named involves the laying of about 100 cubic yards of stone per day of 20 hours. The penetration of the pier is now 43 feet 6 inches below the surface of the river, 57 feet still interveuing between it and the bed rock.