Improvement in Bridle Bits.

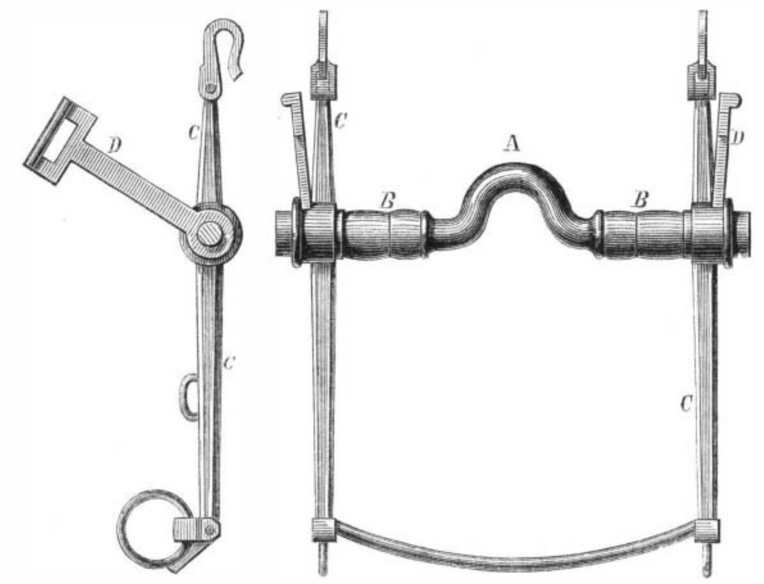
This invention consists in making the cheek pieces by which the bit is hung to the cheek straps, independent of the bit, to a certain extent, so that the latter may be rotated in the horse's mouth to bring the curb chain to bear upon the jaw without moving the cheek pieces. Also in placing small metal rollers on the bit, to prevent the horse from seizing the bit in his teeth.

A in the engraving represents the bit, and B the small metal rollers. The side pieces, C, have square holes in them by which they are fastened upon the ends of the bit. The extremities of the bit outside the square shoulders, are cylindrical, and upon these cylindrical portions are loosely placed the lower ends of the cheek pieces, D, where they are retained by nuts, spaces wider than the cheek pieces being left between the nuts and side pieces by means of which the bit and side pieces are allowed to freely rotate.

The spaces are partially closed by flanges projecting from the side pieces and inclosing the lower ends of the cheek pieces, with the exception of a recess in which the side pieces rotate. This arrangement enables the rider to tighten the curb, without interfering with the cheek pieces

The bit is more particularly designed for cavalry use, and is the invention of Col. Thomas B. Hunt, Quartermasters' Department, Austin, Texas.

Patented in France through the Office of the Scientific American.



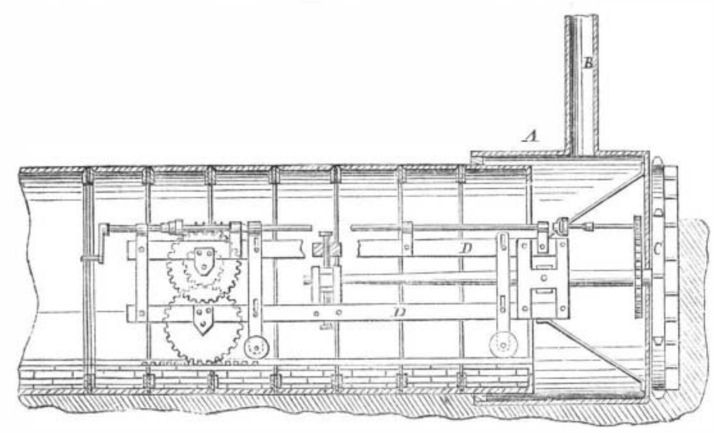
HUNT'S BRIDLE BIT.

Important Patent Decision.

In the United States Circuit Court, Judge Blatchford has granted an injunction in the important suit of Isaac P. Frank against Charles F. Jacobson and Charles E. Mabie (known as the United States Refractor Company), in which great interests are involved, restraining the defendants from infringing on the plaintiff's patent for glass-lined reflectors, such as are used for lighting stores, churches, theaters, and public buildings generally.

TUNNEL EXCAVATOR.

Our engraving illustrates an appliance for excavating tunnels, patented by Theodore A. Fisher and Anson F. Fisher, of Beardstown, Ill. It consists of a sliding coffer, A, provided with an excavating disk, C, supported by a car, D, arranged on a suitable way in a cast-iron tube. By means of suitable gear the excavating disk is kept advanced to its work. Those familiar with the excavation of the tunnels by the use of coffers, will need no further description to understand the general principle of the device, which is designed to lay submarine tunnels, the cast-iron tubing to be laid in sections as the work proceeds. Air is supplied to the coffer through the tube, B.



Manufacture of Champagne.

As the greater part of the champagne country has been overrun by the German army and the exportation of genuine wine can hardly take place for sometime to come, the artificial production of this beverage is likely to receive a new impulse. For those who prefer to manufacture their own champagne we append a number of approved recipes:

8 Parts of the best West India sugar are to be dissolved in 4 quarts of distilled water, and boiled, and while still hot, 2 quarts of rectified spirits added. This affords what is called champagne liquor to serve as stock in the manufacture.

To prepare the Roedern brand with green seal and bronze cap, take one portion of the above liquor, 1 anker white wine, 1 bottle cognac, and 4 drops of the oil of wine beer dissolved in cognac.

For Heidsick, 1 portion liquor, 1 anker white wine, and $\frac{1}{2}$ quart cognac.

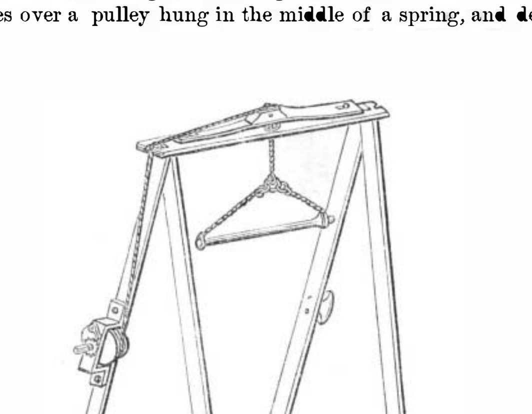
Other varieties are prepared in a similar way, the chief difficulty being to provide the proper bottle, sealing-wax, and labels. In default of white wine, cider is found to answer every purpose, and glycerin can be substituted for sugar.

Plaster Casts of Natural History Objects.

At a recent meeting of the Manchester Philosophical Society, Mr. Boyd Dawkins, F. R. S., exhibited a number of casts in plaster of Paris, of various objects of natural history, and explained the process by which any one can make them for himself. The material of the mold is artists' modeling wax, which is a composition akin to that which is used by dentists. And as it becomes soft and plastic by the application of heat, though in a cold state it is perfectly rigid, it may be applied to the most delicate object without injury. As it takes the most minute markings and striations of the original to which it is applied, the microscopic structure of the surface of the original is faithfully reproduced in the cast. The method is briefly this: 1. Cover the object to be cast with a thin powder of steatite, or French chalk, which prevents the adhesion of the wax. 2. After the wax has become soft, either from immersion in warm water or from exposure to the direct heat of the fire, apply it to the original, being careful to press it into the little cavities. Then carefully cut off the edges of the wax all round, if the under cutting of the object necessitates the mold being in two or more pieces, and let the wax cool with the object in it, until it be sufficiently hard to bear the repetition of the operation on the uncovered portion of the object. The steatite prevents the one piece of the mold sticking to the other. The original ought to be taken out of the mold before the latter becomes perfectly cold and rigid, as in that case it is very difficult to extract. 3. Then pour in plaster of Paris, after having wetted the molds to prevent bubbles of air lurking in the small interstices, and if the molds be in two pieces it is generally convenient to fill them with plaster separately before putting them together. 4. Then dry the plaster casts, either wholly or partially. 5. Paint the casts in water colors, which must be fainter than those of the original, because the next process adds to their intensity. The delicate shades of color in the original will be marked in the cast by the different quantity of the same color which is taken up by the different textures of the cast. 6. After drying the cast, steep it in hard paraffine. The ordinary paraffine candles, which can be obtained from any grocer, will serve the purpose. 7. Cool and polish the cast by hand, with steatite. The result of this process is far better than that obtained by any other. The whole operation is very simple, and promises to afford a means of comparison of natural historys pecimens in different countries, which has long been felt to be a scientific need. Casts of type specimens may be multiplied to any extent, at a small cost of time and money, and are as good as the original for purposes of comparison, and almost as hard as any fossil. Mr. Dawkins has employed it for copying flint implements, fossils, and bones and teeth, which can scarcely be distinguished from the originals.

EXERCISING APPARATUS.

A portable apparatus for gymnasiums and private use, and which combines the horizontal bar with the swing, is shown in the accompanying engraving. It is the invention of Geo. W. S. Hall, of Baltimore, Md. On the upright of the frame is a device for taking up or letting out the rope, which latter passes over a pulley hung in the middle of a spring, and descends to support the bar, as shown in the engraving. The whole can be taken in pieces for transportation, and easily set up for use when wanted. The utility of apparatus of this kind to those leading sedentary lives, has not been hitherto properly appreciated by the American public, but we are glad to say that the disorders which our general lack of proper muscular exercise has entailed upon a large class of our population are gradually teaching us its value.



SIEMENS' PYROMETER.

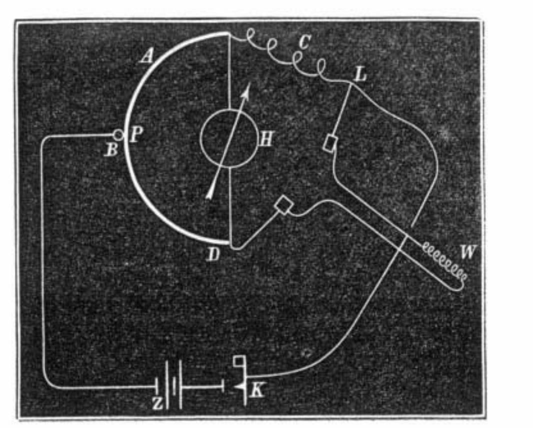
[Condensed from The Mechanics' Magazine.]

This instrument can be used to indicate high temperatures, such as those met with in blast furnaces; it can also be used to measure moderate temperatures, but its chief feature is that the indicating part of the apparatus may be several yards, or miles even, away from the place of which the temperature has to be ascertained. Hence it was used by Dr. Carpenter to learn the temperature of the deeper portions of the Atlantic, and it enables ironmasters and colliery proprietors to see in the office of the works the temperature of their pits or furnaces which are at a distance from the place of observation.

The principle of the instrument is simple. When a plati-num or iron wire rises in temperature it offers more resistance than before to the passage of a current of electricity. Hence the variations in the conductivity of the wire serve to indicate the variations in temperature, which variations may be read off by means of suitable galvanometric appliances.

The apparatus for indicating high temperatures, such as those of furnaces, consists in a coil of fine platinum wire wound round a cylindrical clay pipe, which pipe is about 3in. long by $\frac{1}{2}$in. in diameter. The wire lies in a spiral groove made upon the surface of the clay cylinder; this grooving prevents the convolutions of the platinum wire from touching each other, in consequence of which the electrical current must pass along the whole length of the wire, or about three yards. The exact length through which it must pass is regulated by a small platinum adjusting clamp, the position of which may be shifted. In this way all the instruments made by Mr. Siemens are adjusted to give the same indications. The ends of the fine wire which measures the temperature are connected with two thick platinum wires, each about 18in. long; as the further ends of these thick wires are at a tolerable distance from the source of heat when the instrument is in use, they in their turn are connected with thick copper conducting wires. All these wires are protected by clay pipes. The whole of this arrangement is placed in a protecting tube of iron about 4ft. long. The platinum spiral pyrometer is then in the closed end of the tube; the other end of the tube has a wooden cap on which two brass terminal screws are fixed, and these screws are connected with the conducting wires to and from the spiral.

When temperatures above the melting point of iron have



to be measured, the end of the tube which is subjected to the heat must be made of platinum. In some instances, where moderate furnace temperatures have to be measured, the end of the tube may be made of copper. The metal is very thick at a point some few inches nearer the cold end of the pipe than the platinum spiral, in order that the cooler part of the outer pipe may not draw off the heat by conduction too rapidly, and thus affect the reliability of the indications. The short clay cylinder carrying the platinum spiral has a projection at each end, which prevents any part of the spiral touching the sides of the iron pipe, and thus interfering with the accuracy of the indications by increasing the electrical conductivity of the whole arrangement.

When the end of the great metallic pipe is pushed into a furnace, the temperature of the platinum spiral rises and its electrical conductivity consequently decreases; the decrease in conductivity is measured by electrical appliances, and thus the temperature of the furnace is read off.

Conducting wires are connected with the terminal screws at the cold end of the iron pipe, and thus the hot spiral becomes a part of the electrical circuit. The change in the electrical resistance is then measured by apparatus, the principle of which may be explained by the aid of the accompanying diagram.

The current goes from the zinc pole of the battery, Z, to the movable contact wheel, B, which wheel may be moved to any part of the arc, A D, which is a very fine platinum wire fixed round the edge of a disk of ebonite. When the little wheel is in the position shown in the diagram, the current enters the platinum wire at P, and splits into two parts, one portion of the current going to A, and the other to D. Midway between A and D, the galvanometer, H, is fixed. From the two ends of the platinum wire, A D, the current passes on one side into the constant resistance, C, and at the same time into the galvanometer; on the other side it passes to the other terminal of the same galvanometer, and at the same time to one of the leading wires of the platinum spiral pyrometer, W. The current passes through the platinum spiral as well as through the constant resistance, C, and the two branches meet at the point, L, in order to return to the other pole of the battery. K is a "key" for making contact with the battery. As long as the electrical force at A and D is equal, the galvanometer needle will be at rest, but when it is unequal the needle is deflected. The balance may be restored and the needle brought back to zero by shifting the wheel, B; hence, when the electrical balance of forces is disturbed by the heating of the spiral, W, it may be restored by shifting the wheel, B, consequently the temperature is read off by noting the position of the wheel, B, upon the graduated arc, A D.

The plan of action is to expose the platinum spiral to the temperature to be be examined, and to connect the leading wires with the terminals; then the astatic needle of the galvanometer has to be adjusted, so that it points to the zero of ts small scale. When the contact key, K, is pressed down, the needle is deflected, and the movable contact wheel, B, is shifted until equilibrium is obtained. After this, a reading of the large scale on the arc, A D, is taken, and a calculated table attached to the instrument gives the real degrees in Centigrades of the heat of the platinum spiral in the furnace. Many of the instruments are made to register temperatures up to 1,000° Centigrade, and some have been made to register 2,000°, but in these instances, the end of the large tube was made of platinum.

For ordinary temperatures, or temperatures much below a red heat, a fine insulated iron wire, several miles in length is used, and it is inclosed in a hermetically closed tube, that it may be removed from the influences of moisture and rusting. Such thermometers are found to be very sensitive, and to give very accurate readings.

Some of these pyrometers are now in use in the Imperial Ironworks in Russia; they are also used for blast furnaces, and in gas works, for the temperature at which coal is distilled much influences the quality of the gas. Some of the instruments for testing low temperatures have gone to Turin for experimental purposes.

DR. DOREMUS ON THE TRIUMPHS OF SCIENCE.

THE LENS AND THE PRISM.

The first of a course of four lectures at the Hall of the Young Men's Christian Association, on "The Triumphs of Science," was delivered on the evening of December 1st by Professor Doremus.

The lecturer in opening his address alluded in strong terms to the feeble interest manifested by the wealthy citizens of New York in regard to scientific education and the want of pecuniary aid felt by colleges and scientific institutions in general, and made an earnest appeal to all public scientific lecturers to urge the claims of these institutions with greater confidence and energy as opportunity shall offer.

He then announced the subject of the lecture for the evening as the Lens and the Prism, as through these simple yet powerful instruments a very large proportion of "the triumphs of science" have been achieved.

He first briefly sketched the history of the development of knowledge with regard to celestial objects. Strange to say, although we had such perfect records of the workings of the human mind in other fields, we did not know the authors of some of the grandest achievements in connection with astronomy. Naturally, we should conclude, the first object of attention would be the sun, and the second the moon. These were evidently the means of indicating to us the hours of the day. "To every nation, tongue, and clime, each in its meridian, the eternal sun strikes twelve at noon, and the glorious stars, far up in the everlasting belfry of the sky, chime twelve at midnight." As a time measurer the sun was the first object of attention. It was then probably observed that the shadow of the sun lengthened and shortened, and thus we had two periods of the year—the period of the longest and the shortest day. Next came the observation of the moon, and then of the stars—their movements, magnitude, and grouping, especially those constellations through which the sun and moon passed.

The Professor then detailed the various discoveries made by Pythagoras, Copernicus, Galileo, and Kepler, saying in regard to the latter that astronomers of all lands had agreed in awarding him the proud and well-earned title of law-giver of the heavens. His discovery of the elliptical movement of the planets was one of the greatest achievements of science. In regard to Galileo the lecturer said: "Let us not forget the painful termination of his splendid career, and the extraordinary and infernal vice of the human brain to humiliate this great champion of truth, who, though assured of the reality of the revolution of the earth, was obliged, upon his knees, and with his hand upon the sacred Scriptures, to swear the earth did not move. I have never seen a more infernal vice in history."

The lecturer then advanced to the discoveries of Arago, and Leverrier, and gave several instances of the marvelous accuracy with which mathematics had been applied to astronomy. In 1846 Leverrier predicted the locality where the new planet that had been previously observed, and had then disappeared, ought to shine, and his friend in Berlin examined the firmament on the night announced, and lo! there the new world was found. Dr. Doremus concluded this portion of his lecture by showing how vividly the discovery that our whole solar system revolved round a sun (which some had supposed to be Hercules), which again in its turn, with its attendant systems, rotated round yet another central sun, mpressed us with a sense of the boundlessness of the universe

His remarks on the prism consisted chiefly of a clear and interesting explanation of spectrum analysis. He said that probably the prism would prove even more fertile as a means of discovery than the lens. Several new metals had already been discovered by its aid, and we had now something like proof as to the real nature of the sun, which probably consisted of metals in a highly incandescent state.

The lecture was illustrated by many brilliant and interesting experiments. He gave among others the well-known experiment of a body of oil suspended in a globe of alcohol and water, which, upon being moved upon an axis, gradually threw off bodies of eccentric forms. The motions of the universe and the results of spectrum analysis were displayed by the aid of a series of dissolving views, which were of a highly entertaining and instructive character.

Correspondence.

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

Automatic Telegraphy.

MESSRS. EDITORS:—In your issue of November 5th, is an article upon the subject of "Automatic Telegraphy," by George B. Prescott, Esq., in which occurs this passage:

"In order to attain the exceptionally high rate of speed which has been experimentally obtained upon the Automatic line recently constructed between New York and Washington, the Company put up a steel and copper wire for which they paid more than three times the cost of a good iron wire, suitable for the use of the systems in general use. It is evident, therefore, that even the claim for greater economy in the construction of their lines, which has been so frequently made by the advocates of that system, is not well founded."

Let us see if this be so. The National Company, referred to by Mr. Prescott, have used the American compound telegraph wire, in the construction of their line to Washington. This wire is composed of 80 pounds of steel and 80 pounds of copper to the mile, its total weight per mile is therefore 160 pounds, but its conducting power is equal to that of an iron wire weighing 630 pounds per mile, and its cost per mile was $82. It is erected on an average of about 15 poles per mile, and is insulated by the Brooks insulator.

We will suppose that the posts cost, all set, on an average, $3 each, also that it cost $3 per mile for stringing the wire, and that the insulators cost 38 cents each.

These are among the principal items which go to make up the cost of a line of telegraph. Let us see how they sum up:

1.	Cost per mile of 15 posts set............	$45·00
2.	" " " " 15 insulators..........	5·70
3.	" " " " wire..................	82·00
4.	" " " " stringing..............	3·00
	Total.....	$135·70

or less than one-half of Mr. Prescott's estimated cost of an ordinary line, call it $150·00 per mile, which will cover the cost of such materials and equipments over most of the length of such a line. Of course the expense of poles suitable for use in large cities, and the cost of setting them in cities would be considerably above these figures, still the average cost will be less than Mr. Prescott's estimate for an "ordinary line suitable for the systems in ordinary use."

Don't they get the worth of their money?

The line is 280 miles in length instead of 228, simply because they were obliged to go upon highways and byways, and it was under great difficulties that they secured a location at all.

Mr. Prescott admits (which is true) that they have attained a speed of 250 words per minute over the 280 miles of compound wire line, and he remarks (which is also true) "that the speed of automatic transmitting varies inversely as the square of the length of the line."

Suppose then that this line could be shortened to 250 miles by going alongside of the railroad for most of the distance, its speed then would be increased in the proportion of the square of 280 = 78,400 to the square of 250 = 62,500, or $\frac{78400}{62500} =$ 1·25, an increase of twenty-five per cent, thus making 1·25 × 250 = 312 words per minute.

Mr. Prescott also admits that 100 words per minute were all he could obtain over 250 miles of No. 8 iron wire, in a series of carefully conducted experiments.

If now, with this superior compound wire, the National Company can transmit automatically three times as fast as upon a No. 8 iron wire for the same distance, are they not fully justified in paying three times as much for it? but is $82 three times as much as the cost of a No. 8 iron wire?

We must take into account also that this new compound wire can be put upon 15 poles per mile, and withstand the storms quite as well and better than the Western Union Company's wires do with 38 poles per mile.

Now when we realize that insulation improves inversely as the square root of the number of insulators, we see that the gain in insulation, by using 15 instead of 38 insulators per mile is $\sqrt{\frac{38}{15}} = 1·59$, nearly 60 per cent, let alone the saving in cost of construction and maintenance, and by doubling the conductivity only one half of the battery is necessary. The conductivity of this compound wire per pound per mile, is three times that of an iron wire.

Again, since it is admitted that the Phelps printer can transmit only about 50 or 60 words per minute, while it will be seen from the above that an automatic system can transmit five or six times as many, now why not employ some kind of an automatic system to transmit the messages, and employ the Phelps, House, or some other printer, to simply copy them, as I suggested to Mr. Craig and Mr. Little last summer, and to several other friends nearly two years since.

Boston, Mass. MOSES G. FARMER.

The Man who Built the Telegraph.

MESSRS. EDITORS:—On page 326, Nov. 19 issue of your paper, is an editorial notice of a late meeting of the Western Union Telegraph Company, which is headed "Honors to the Inventor of Telegraphy," containing an abstract from the very appropriate remarks of its President, Mr. William Orton, in which abstract, by an error of one letter (e), the meaning of the President in one sentence is entirely changed. It occurs in the eighth line of the second paragraph, in the word "men," which should have been "man," or as follows: "In the same presence sit to-day, in the annual services of the largest telegraphic organization in the world, the man who made its existence possible, and the man (men) who made it."

Now to whom did Mr. Orton refer as "the man who made it?"

Aside from Professor Morse and one other gentleman, there were none present who contributed either in making the telegraph, or by money for its development, or as an investment in its stocks, for years after its introduction into general use and its necessity as a business agent became apparent and generally acknowledged. By reading the above sentence as corrected and as pronounced by President Orton, it will be seen that it refers to Professor Morse as the man who invented the telegraph, and to Hon. Ezra Cornell, of Ithaca, as "the man who made it." It was Mr. Cornell who took the entire management of building the first line in this country, from Washington to Baltimore, to its completion, and put it into successful operation, after the Professors Morse and Gale, Doctor Fisher, and Messrs. Vail and Smith, had expended twenty-three thousand dollars of the Congressional appropriation of thirty thousand dollars, and broken down at the Relay House ten miles from Baltimore in the winter of 1843 and 4, in their fruitless attempts to insulate the wires so as to make them work, inclosed in leaden tubes beneath the surface of the earth. As this allusion of President Orton is the first public recognition, small though it may be, of the important services of Mr. Cornell in rescuing the telegraph from the wreck of the failure which had been made by its inventors in their efforts to build their first line, which has ever come under the notice of the writer, he deems it but just and proper that this correction should be made, and asks its insertion in your columns. HORACE L. EMERY.

Albany, Dec. 5, 1870.

Spiritualism and Science.

MESSRS. EDITORS:—In your last issue appeared an article entitled "Spiritualism aad Science," which is a sort of review of a work by Dr. Hammond. I have not seen Dr. Hammond's work, but from the extracts which you give and the remarks you make—with all due respect to the learned doctor—I must say that he has not only been a partial but a prejudiced observer. My own experience teaches me this. He has endeavored, as many other scientific men have already done, to reconcile the observed facts with scientific laws, has failed, and therefore denounces them as hallucinations.

I do not intend to speak of spiritual visions, communications, and so forth, since these may readily be pronounced impositions, and attributed to diseased conditions of the brain; but it is to table movings and such manifestations, which Dr. Hammond states to be "due to hallucination, legerdemain, or actual fraud," that I intend to call your attention.

He also states that equally wonderful tricks can be performed by any professor of natural magic. Without denying the latter assertion, allow me to add that all such tricks can be detected by a thorough investigation, but I defy any man to detect the least deception in the phenomenon of table tipping. I have seen the experiments performed in private parlors, and under circumstances when I knew there could have been no deception; in fact, have myself been violently thrown to the floor, as a number of ladies and gentlemen who were present can testify, while attempting to prevent a table which was under this influence from moving.

The evidence which can be brought forward to support the existence of this occult science is too weighty to be overthrown by ridicule.

In conclusion let me state that I am not a spiritualist, nor am I in any way connected with any spiritual circle. I have studied the subject with an unprejudiced mind, and am convinced that there is a mystery about it which ought to be solved, and which lies within the scope of science to investigate.

I am aware that these things are in opposition to gravity; I am also awere that by writing this I expose myself to the ridicule of the greater part of the scientific world; but as I have devoted my life to the study of science and truth, I have seen these things and know them to be facts. I hope in this way to call the attention of scientific men to these things, which seem fatal to all the laws of nature. I hope to see them fairly investigated; discarded if they are deceptions, and if not attributed to some mysterious power beyond our ken. R. H.

Ithaca, N.Y.

Sanity vs. Insanity.

MESSRS. EDITORS:—Over twenty-one years a regular reader of the SCIENTIFIC AMERICAN, I hope the Editors will allow me to be of age, and in sound mind, when I add, that I have every copy well bound, and not a number missing, and prize them next to the Year Book of "Scientific" (Annual) Discovery.

Having dabbled a little with the microscopic, magnetical, and electrical experiments, collected all sorts of weeds, and "livin'" things, and curious about spontaneous generation, surrounding ether, the egg-development, and all that sort of thing—and occasionally written articles for horticultural journals, folks here in this benighted quarter give me credit for