of the sun from its center, 430,000 miles. In bulk, the sun is a million and a quarter times larger than the earth; that is, it would take that number of earths rolled into one to make up the bulk of the sun. It would not take that number to make up the weight of the sun, for the sun is lighter, bushel for bushel, than the earth. It weighs about 325,000 times as much as the earth. With that enormous mass, the force of gravity must be 28 times as great as on the surface of the earth; so that the weight of an ordinarily heavy man on its surface would be about two tuns.

THE HEAT OF THE SUN

is estimated by French physicists to not greatly exceed that of the electric arc, being, perhaps, once and a half or twice as great. Secchi, on the other hand, estimates it at 2,000,000° Fahr., and Ericsson at from 6,000,000° to 7,000,000°. Sir John Herschel illustrates the quantity of heat given out by the sun, as determined by his experiments, as follows: Suppose ice should be formed into a rod forty-five miles in diameter, and that rod of ice should be darted at the sun with the velocity of light: if all the heat of the sun could be concentrated upon the point of that advancing javelin of ice, it would never approach the sun, for the point would melt off as fast as it came. Or we may put it in another way: Suppose we should build a railroad from here to the sun, and should take to it two and one quarter miles square of solid ice, carrying it clear by the moon, Mercury, and Venus, and if we should concentrate upon that the heat of the sun, it would take just one second to melt it, and in seven seconds it would be volatilized, changed into steam, and invisible.

THE ORIGIN OF SOLAR HEAT

has been attributed by some to chemical combinations, but if the sun were of solid coal, it would have been completely burned out in 5,000 years, giving out heat at the present rate. The proper view is that its heat is maintained by the influx of matter. As meteors fall upon the earth, several millions in a day, so they fall into the sun, millions of millions per day, and contribute to the solar heat. But that does not account for it all. Another cause, I doubt not, is the contraction of its volume. If the sun were to contract one hundred and twenty feet in radius, or two hundred and forty feet in diameter, in a year, that would account for all the heat it gives off. Bodies may give off heat without growing colder. If we freeze a pail of water, it gives off heat while it is freezing, but the thermometer will indicate no fall of temperature until it is all frozen. So it is quite likely that the gases in the outer surface of the sun will enter into combinations with each other, dissociating and uniting in other forms, and emitting heat in the combination.

THE PHYSICAL APPEARANCE OF THE SUN

in the telescope is like a mass of clouds, or rather curdled milk or cotton wool. It is much darker on the edges, which is a very important point in explaining its constitution, and there are also numerous bright streaks, called faculæ, besides the solar spots. Mr. Nasmyth thinks that these irregular forms resemble willow leaves. I have not seen that, but I have seen in the sun what seemed irregular masses, dark spaces, and here and there apparently little holes.

The bright spots, called faculæ, are elevations on the solar surface. But the most remarkable objects on the surface of the sun are the spots; they are far more striking than the faculæ, and this before you (pointing to the diagram) may be taken as a good example or type of such spot, fairly formed and well established. In the center of it is a dark spot looking like a hole. The holes are not usually uniformly dark; there are usually little bays formed in the surrounding region; the edges of these are sharply defined, with no shading. Around this center, called the umbra, there is a wide border called the penumbra, almost invariably darker toward its outside edge, and striped radially. This hole—the umbra, if it be a hole—is so large that the earth might be dropped through into it without touching its edge. It is over 12,000 miles in diameter. The faculæ are always very numerous near the spot. Where the faculæ comes to the edge, there is a little projection. As to the nature of the

SUN SPOTS,

it is absolutely certain that the dark centers are depressed below the solar surface, but whether they are holes through to the body of the sun is another question, but they are cavities when the spot is first formed. You do not see the umbra, but the penumbra. To talk of temperate zones in a body as hot as the sun seems strange, but the spots are found in the temperate zones. They are not common in the sun's equator, or more than 30° from the equator. Rare examples have been found at 40° or 45° from it.

VARIATIONS OF SUN SPOTS.

The most curious thing about them is that they are not equally frequent in different years, and are regular in their irregularity or periodicity. After appearing in great force, they become infrequent for three years; then they gradually increase in number until, in about ten years from the first period or maximum frequency, they are again abundant. Sometimes as many as 400 or 500 separate groups of spots have been remarked upon the sun in a single year, and again there is a year when spots are few, and there may not be more than 80 or 100 in a year; so that in the year of maximum spot-frequency, the number is four times as great as on the year of minimum frequency. The cause of this is not yet known, but it is surmised that it is connected with the motions of Mercury, Venus and Jupiter, though it is probably due to a periodical boiling over of the vast caldron. When we examine the sun with the spectroscope, we find outward motion. Under the cloudy surface there is an ocean of liquid, and slags are formed in this ocean, and there is a blowing out of matter which gives rise to the penumbral phenomenon. There is undoubtedly an underfeed from the outside toward the center, but whether by a rush downward from the center of the spot, I cannot say. The English astronomers believe it is from the outside atmosphere to the center of the spot.

Professor Young then proceeded to explain and illustrate by diagrams on the screen, the solar prominences and their spectra. Fig. 3 is a representation of the sun with chromosphere and prominences, showing the relative magnitudes of the latter as compared with the sun, and also their number. The inner circular line is the boundary of the sun proper as distinguished from the chromosphere. The remainder of the lecture was devoted to the description of eclipses and the lecturer's observation of phenomena, the details of which have already appeared in our columns.

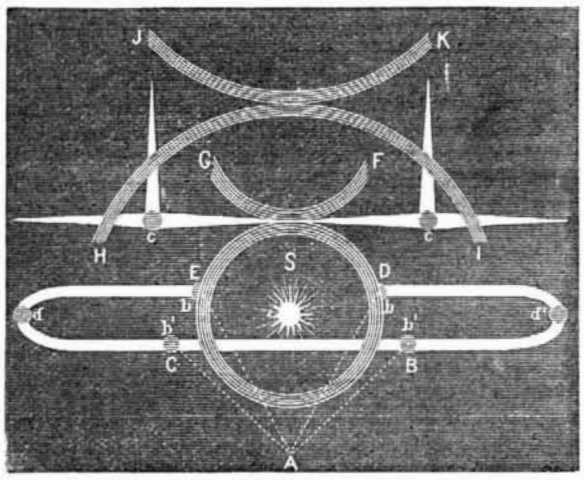
Correspondence.

Extraordinary Parhelia observed at Independence, Mo.

To the Editor of the Scientific American:

The inclosed diagram represents phenomena that occurred here on Saturday, January 25, at 9 o'clock A. M. In order that it may be better understood and more highly appreciated, it will be necessary to give some few points of description.

A is the place of observation; S the sun, E D a circle around the sun, or rainbow; F G is what we term the first reverse circle or rainbow; H I is a second circle or rainbow, whose brilliancy is cut short by the bright silvery belt, D B C E, which extends the whole heavens around, from east to west, in a plane, the hight of the sun, and parallel to the plane of the horizon, having its origin in the two dazzlingly brilliant sun dogs, or false suns, *b b*; J K is the second reverse rainbow, which was the most brilliant of all. The observations A B and A C, are west, and point to two very bright sun dogs, *b' b'*, which seem to correspond to D E in the east. *d* and *d'* are in the north and south, and quite bright also. But what is more singular, two more are at *c c*, but they are much the same as the others, except *b b*, in color, being bright and silvery; and emanating from each, at right angles, are the silvery bright streaks shown in the figure, which neither absorb nor are absorbed by the semicircle, H I, but cross and produce the remarkably beautiful figure as seen in the misty clouds that morning. J K is a remarkably brilliant rainbow. E G is not so brilliant in the rainbow as J K, but is made dazzlingly bright at the point of contact with E D, by the two streaks from *c c*. Part of the circle, E D, is very brilliant, and H I is nearly as distinct, if not more so. The two sun dogs, *b b*, were fiery red around the edges, and some colors of the bow attend, which made them dazzlingly brilliant. One very singular thing about it was the appearance of the entire upper part of the figure in a plane, horizontal to D B C E, instead of in a vertical one, as is usually seen in rainbows. The background for the streaks proceeding from *c c* was a dark hazy blue, somewhat deeper than a sky blue.



The segment of the arc, J K, was apparently 90°; that of H I, 125°. Radius of H I seemed about 1,000 feet; J K, 750 feet; F G, 375 feet, and E D, 500 feet. The citizens here desire you to give or explain the philosophy of every part of the whole thing, either through your columns or by private letters. As we think it would be a very interesting matter to many of your readers, we hope you will insert the diagram and an explanation in your valuable paper.

The sky was, generally, slightly cloudy, hazy, and misty, and the earth was, and had been for some time, deeply covered with snow.

Will you please explain, particularly, the reversion of these rainbows? Some parts we understand, but what we want is an explanation of the whole thing as it was seen. The extreme upper part of the figure was east of a vertical line, and the whole was northwest of the sun's position.

D. M. WOODSON.

Independence, Mo.

REMARKS BY THE EDITOR.—When the sun is seen in a clear sky, the luminous disk is visible to us without any attendant phenomena; but if the air is loaded with moisture, or there are other favorable conditions, a great variety of phenomena present themselves and become the subject of investigation and study. The name halo is given indiscriminately to the circles which appear around the sun and the moon. and, for the purposes of precision, it has been proposed to call the rings about the sun "parhelia," and those about the moon, "paraselenæ." The parhelia witnessed at Independence were of rare occurrence, and we can only give the explanation of the phenomena that has been propounded by Newton and accepted by other philosophers. In cold weather, when particles of ice are floating in the higher regions, the sun is sometimes surrounded with the most complicated rings, circles, and mock suns, formed at the points where these circles intersect each other. Sir Isaac Newton considered the rings as produced by the light passing through very small drops of water, in the same manner as colors are produced by thin plates. Descartes supposed that the halos were due to refraction, through crystals of ice and snow floating in the air. The same view was taken by Mariotte, Young, Cavendish, and Brewster. In order to explain the larger halo. Dr. Young supposes that the rays which have been once refracted by the ice prisms fall on other prisms, and the effect is doubled by a second refraction, so as to produce a deviation of 90°. This explanation is not accepted by Brewster, who thinks that the external halo may be produced by the refraction of the rectangular terminations of crystals. All parties agree that such phenomena as were observed at Independence, Mo., are due to solid particles of ice floating in the higher regions of the air, and that refraction through ice prisms is the primitive cause. The air has been unusually charged with frozen water this winter, and an extraordinary number of halos, around the moon as well as around the sun, have been observed. On Lake Superior, the sun has been known to sink below the horizon and then to come up again to view, owing to a sudden change in the refracting medium through which the light passed. At Independence there was an unusual number of mock suns; but the other features of the parhelia were the same as have been pictured and described in works on natural philosophy. In fact, our correspondent will find in Brewster's "Treatise on Optics," two diagrams, one of parhelia and the other of paraselenæ, witnessed in 1630, which coincide very closely with the drawing shown by our engraving. The explanation of the whole set of phenomena is, therefore, resolvable into this, that the light was doubly refracted by ice prisms floating in the air, the sun being at a convenient hight above the horizon to produce the best effect. Experiments to prove the accuracy of this theory have been prepared and shown in the lecture rooms of professors of physics; and until a better explanation is offered, we prefer to abide by the above decision.

A Brilliant Meteor in Massachusetts.

To the Editor of the Scientific American:

I notice in your journal mention of meteors seen in Mason City, Ill., and in England, and the perusal calls to my mind a very sharp flash seen on the evening of January 11, 1873. It was caused by a large ball of fire, about the size of a bushel basket; it fell in Tyngsboro', Mass., some 6 or 7 miles from Lowell, on the Boston, Lowell, and Nashua Railroad. The flash was seen some twenty-five miles all around, and a dull rumbling sound was heard. It fell near or upon the railroad track, just in advance of an approaching passenger train, and caused quite a panic among the passengers, for a short time, until the conductor could satisfy them that there was no danger in proceeding. W. H. R.

Lowell, Mass.

Tree Transplantation.

To the Editor of the Scientific American:

On page 37 of your current volume some one says: "Most persons make a fatal mistake in trimming trees when transplanted. Never cut off a limb or a twig till they (the trees) have a secure foothold."

This advice, in the SCIENTIFIC AMERICAN, at once becomes a powerful influence. Whatever affects the tree-planting interest is of national importance; and I think I can show by reasons sufficient, as I could by the experience of all successful tree planters, that the advice referred to is radically wrong, and should read: "Always cut down the top of a tree transplanted, so that the relative proportion be preserved between roots and branches."

A tree to secure a foothold in its new bed must make a new growth of wood both at the top and root; otherwise death results in all cases after transplantation. Most trees lose, in transplanting, the larger portion of their roots; how does this operate when the top is left of full size and untrimmed? The leaves come out full with the advent of spring; and it takes all the nourishment supplied by the remaining roots to support the leaves, and no new wood is made.

If the top of the tree is cut down and the leaf buds destroyed, then, of necessity, in order to put forth leaves, there must be a new woody growth; when this occurs, there is always a corresponding root growth, and thus a foothold is secured. Many trees, like the sugar maple, only make wood during a brief period in spring; consequently, if transplanted with ever so much care after this season, they invariably die.

A tree which continues making wood during the entire season, like the willow and locust, can with care be transplanted at any time; but it may be set down as a rule, with but few exceptions, that deciduous trees should only be transplanted when bare of leaves, and then the top left must be proportioned to the root.

To further illustrate the fallacy of the no trimming theory, suppose that in putting out cuttings, as of the cotton wood or willow, a top was left. Does any one suppose that a new root would be formed? It is the growth of the new top that is accompanied by new root growth; in fact they are inseparable. The everywhere popular white elm and sugar maple, although exceedingly difficult to transplant successfully with large tops, will generally live and grow if every branch is cut off and the short bare poles only set. E.H.R.

A Spider Balloon.

To the Editor of the Scientific American:

If a description of a spider balloon will be of any interest to your readers, I will endeavor to give you particulars of one that I saw on the 10th of last October. It was a very calm and pleasant day, and not a breeze disturbed the still waters of Lake Seneca. In company with others I was crossing the lake, and when near the center one of the party noticed and called our attention to a small wake, caused by the moving of some insects; and with some difficulty we succeeded in gaining a point where we could see that they were spiders, three in number, gliding at a rapid rate over the smooth surface of the water; and we were much surprised to see a single thread, the size of a knitting needle, extending in the air to the hight of thirty feet, at an angle of sixty degrees, terminating with an enormous balloon-shaped web. I should think that it was eight feet long and five feet wide, with stays fastened to the main thread, something similar to those of a balloon; and it was managed, apparently, by an innumerable number of these insects stationed at proper intervals. Wishing to obtain a closer view, we undertook to approach it; but when we were within a few feet, it began to rise, though the last spider, which proved to be about the size of a house fly, was brought back by the strokeof an oar. The balloon went onward and upward until it was lost to sight. Whether this is a mode of travel peculiar to spiders, and how the balloon is kept in its proper shape, I am at a loss to know; and I should be glad to have an opinion.

Rock Stream, N. Y. C. F. HATHAWAY.

Heating of Journals.

To the Editor of the Scientific American:

I take great interest in reading the various articles in your paper, especially under the head of "Answers to Correspondents." I have watched the discussion lately in regard to running and standing balance, and last week I was called to look at an engine which was heating in the journals of the main shaft to such an extent that water had to be used to cool them off. I found the fly wheel about ¾ of an inch out of truth edgeways, the key being imperfectly fitted. The shaft was about 7 feet long and 5 inches in diameter, and the wheel, 10 feet in diameter. After properly fitting the key and trueing the wheel, I found the tendency of the shaft to "wobble" had disappeared; and after a few days of careful usage, the engine ran quietly and the bearings were cool.

C. C. C.

Spinning Cotton in the South.

To the Editor of the Scientific American:

In your issue of January 25, a correspondent from Aiken, S. C., mentions the necessity for a machine to spin cotton, that can be operated by the same power which gins the cotton in the Southern States.

This reminds me that, about thirty-five years since, some one introduced in this section a machine worked by hand, which ginned the cotton and spun it into yarns. These machines were usually placed in the hands of slaves and soon became worthless. Now is it not possible that some scientific mechanic might so enlarge and improve this machine as to make it available for the purpose suggested?

Warthen's Store, Ga. JOHN H. WALKER.

Powder versus Dynamite.

The explosive power of dynamite as compared to that of blasting powder is 2⅔ to 1, that is to say, the same quantity of dynamite will do 2⅔ times the work of powder. At the calamine mines of Chrzanow, the working effect of each hewer, driving in hard dolomite rock, is in an eight hours shift 6·5 cubic feet with dynamite against 3·5 to 4 cubic feet with powder, and when using the former each man can bore and fire three holes of 16 inches against two with powder. The explosion of dynamite is very sudden, and the rock is far more shattered by it, without being projected, as is the case with powder. At the tin mines of Graupen, in Bohemia, dynamite only shows a decided advantage when deep bore holes can be used, but it is unquestionable that in water-bearing rocks, when a charge of dynamite has never failed when judiciously treated, it is considered as much safer than powder. When sinking a round shaft of 12 feet diameter at the Britannia colliery, near Mariaschein, in Bohemia, through a bed of very hard and tough clay, another explosive, "haloxyline," was employed. Three holes of 30to 40 inches were bored in the bottom of the shaft, and inclined to the sides of the shaft with an angle of 60°. They were charged each with 3·5 ounces of haloxyline, and fired simultaneously by electricity, when the whole mass of the rock, about 226 cubic feet, covering the area of the shaft, and to the depth of the holes, was so completely shattered that it could be easily removed.

A New Paper.

Iron, the Journal of Science, Metals and Manufactures, is the name of a new first class weekly paper, of large size, which made its appearance in London, on the 1st of January. It is devoted chiefly to iron-producing interests and iron manufactures, including also other metals. The numbers before us give evidence of marked ability in the editorship of every department, and the paper promises to be a most valuable addition to the ranks of scientific and special journals.

AN old colored minister, in a sermon on hell, pictured it as a region of ice and snow, where the damned froze throughout eternity. When privately asked his purpose in representing Gehenna in this way, he said: "I don't dare to tell dem people nuffin else. Why, if I were to say dat hell was warm, some o' dem old rhumatic niggas would be wantin' to start down dar de bery fust frost!"

How to Search for Metals.

SEARCHING FOR GOLD.

The paying localities of gold deposits are the slopes of the Rocky and Alleghany Mountains. Gold need not be looked for in the anthracite and bituminous coal fields, nor in limestone rock. It is seldom found in the beds of rivers. The thing itself is the surest indication of its existence. If soil or sand is washed, and the particles of gold are not heavy enough to remain at the bottom, but float away, the bed will not pay.

Along streams rather high up among the mountains, and in the gravelly drift covering the slopes of the valley below, are the best prospects. Where the stream meets an obstacle in its path, or makes a bend, or has deep holes, there we may look for "pockets" of gold. Black or red sands are usually richest. Gold-bearing rock is a slate or granite abounding in rusty-looking quartz veins, the latter containing iron pyrites or cavities. Almost all iron pyrites and silver ores may be worked for gold. When the quartz veins are thin and numerous rather than massive, and lie near the surface, they are considered most profitable. Few veins can be worked with profit very far down. As traces of gold may be found almost everywhere, no one should indulge in speculation before calculating the percentage and the cost of extraction. Gold hunting, after all, is a lottery with more blanks than prizes.

The substances most frequently mistaken for gold are iron pyrites, copper pyrites, and mica. The precious metal is easily distinguished from these by its malleability (flattening under the hammer) and its great weight, sinking rapidly in water.

SEARCHING FOR SILVER.

This metal is usually found with lead ore and native copper. Slates and sandstones intersected by igneous rocks, as trap and porphyry, are good localities. Pure silver is often found in or near iron ores and the dark brown zinc blende. The Colorado silver lodes are porous at the surface and colored more or less red or green. Any rock suspected of containing silver should be powdered and dissolved in nitric acid. Pour off the liquid and add to it a solution of salt. If a white powder falls to the bottom, which, upon exposure, turns black, there is silver in it. Silver mines increase in value as in depth, whereas gold diminishes as we descend.

SEARCHING FOR COPPER.

The copper ores, after exposure, or after being dipped in vinegar, are almost invariably green on the surface. They are most abundant near trap dykes. The pyrites are generally found in lead mines, and in granite and clay slate. Copper very rarely occurs in the new formations, as along the Atlantic and Gulf borders, and in the Mississippi valley south of Cairo.

SEARCHING FOR LEAD.

Lead is seldom discovered in the surface soil. It is also in vain to look for it in the coal region and along the coast. It must be sought in steep hills, in limestone and slate rocks. A surface cut by frequent ravines, or covered by vegetation in lines, indicates mineral crevices. The galena from the slate is said to contain more silver than that from the limestone. The purest specimens of galena are poorest in silver; the small veins are richest in the more precious metal. A lead vein is thickest in limestone, thinner in sandstone, and thinnest in slate.

SEARCHING FOR IRON.

Any heavy mineral of a black, brown, red, or yellow color may be suspected to be iron. To prove it, dissolve some in oil of vitriol and pour in an infusion of nut gall or oak bark; if it turns black, iron is present. If a tun of rich magnetic ore costs more than $4 at the furnace, good hematite more than $3, and poor ores more than $1.50 or $2, they are too expensive to pay, unless iron is unusually high. Deep mining for iron is not profitable. Generally speaking, a bed of good iron ore, a foot thick, will repay the cost of stripping it of soil, etc., twelve feet thick. Red and yellow earths, called ochers, contain iron. Magnetic ore is easily found by a compass.—*Underground Treasures, by Professor James Orton.*

[Dental Cosmos.]

Treatment of Exposed Dental Pulps.

BY DR. C. E. FRANCIS.

If, by any unlucky turn of the excavator, a healthy pulp gets suddenly uncovered and wounded, there is no necessity for destroying its vitality. Proper care and gentle treatment will almost invariably save it. Indeed, we have but to prevent inflammation by keeping away irritating agents, and the pulp will soon heal by first intention and deposit a sufficient amount of calciferous matter to fill the breach, and thus protect itself. Now let us see how this may be accomplished. If the tooth is aching, apply just sufficient carbolic acid to allay the pain; then cover with a small cap of note paper, and carefully fill with a tolerably thick paste of oxychloride of zinc. This has been my method for several years, as has been repeatedly stated and published. I have found, however, that though protected in this manner, pulps would sometimes become irritated by the application of the zinc, thus endangering their vitality. Recently I have overcome this trouble, and now have little fear of such danger. After applying the carbolic acid, and carefully mopping out the excess with a bit of soft spunk, I cover one side of the paper cap with a solution of balsam of fir with chloroform, and place it gently over the wound. The chloroform quickly evaporates and leaves a smooth, glossy coating of soothing balsam, which perfectly protects the pulp and holds the paper snugly in its position. The coating cannot be permeated by the muriate of zinc, and consequently bids it defiance.

Having given reasons for using the balsam, let us consider the benefit derived from the use of the paper "cap." Cut from note paper, it is smooth and of just the thickness to be manageable, and is the best substance of the same bulk for protecting the pulp from thermal shocks that can be used.

As for the zinc, its office is purely mechanical. It simply makes a good, firm cover to the pulp, and a floor or foundation for a gold filling. Some individuals seem to imagine that oxychloride of zinc possesses some medicinal virtue that acts with magic influence upon an exposed pulp. No such thing! Despite its "antiseptic properties," it tends to irritate wherever applied, and endangers the vitality of any pulp that it touches.

Aerial Navigation.

M. Hannel, Ingénieur des Arts et Manufactures, lately presented to the French Aëronautical Society some observations upon the flight of birds, which are worth noticing. He assumes that, during normal flight, the speed of the center of movement of the wings is constant, and equals 1·15 meters or 3½ feet per second. This center of movement is situated on the line which divides the triangle representing the wing in two equivalent parts. The weight which a bird can support without fatigue, may increase, according to circumstances, up to one half of its own weight; the mean value is equal to one fourth of its weight. The total load, that is to say, the weight of the bird, increased by the weight that it can carry, is thus, on an average, equal to five-fourths its proper weight. The relation between the total load and the breadth of wing is x—y log. 500, or, x—$y^{2.69897}$.

In this formula x represents the total load expressed in kilogrammes, and y the breadth of the wing in meters. A kilogramme is 2·2 lbs., and a meter is 1·1 yards nearly. This formula can be applied to insects as well as to birds.

Supposing this formula to hold good for all bodies passing through the air, and carrying with them their motive power, the application of it can be made to a man or a machine. For a machine weighing 3·5 tuns, the spread of wing should be 26 feet, and 6 yards for a man weighing, with the necessary appliances, 220 lbs.

The conclusions of M. Hannel have been discussed by a large number of the Society, who in the majority do not agree with them. They have been compared with those of M. Harting, according to whom the weight increases according to the cube of the lengths of the wings, modified by a coefficient which varies with different kinds of birds. M. Hannel and M. Harting do not consider the weight and spread of wings in the same manner, and they do not adopt the same speed. Besides, M. Hannel assumes a constant speed in the center of motion, an assumption which has not been proved mathematically.

Improvement in the Manufactura of Sulphuric Acid.

The platinum vessels employed for the concentration of sulphuric acid are extremely costly. A small portion of the platinum is moreover constantly dissolved, and represents a money loss of considerable importance. Manufacturers have, for these reasons, long sought for a less costly material to replace the platinum. In 1844 M. Kulhmann, of Lille, remarked that the temperature of boiling sulphuric acid at 66° Baume, when, instead of being subjected to atmospheric pressure, it was kept almost in vacuo, was reduced from 325° to 190 or 195°. Now lead is not attacked by the acid at a temperature below 200 or 205°.

M. de Heuiptume, a manufacturing chemist of Molenbeek-Saint-Jean-les-Bruxelles, has succeeded in establishing, on a commercial footing, a process of concentration in lead vessels and in vacuo.

The vacuum is made to the degree desired by the condensation of steam injected into a cast iron boiler in communication with the concentrating vessel.

According to the calculation of M. Heuiptume, the concentration of one bottle of sulphuric acid, weighing 220 lbs., costs 17·4 cents, if effected by the platinum process, and 9·46 cents if his vacuum method be adopted. The gain therefore, resulting from this latter system would be 7·94 cents per bottle, or 44 per cent.

The Purification of Rivers.

Mr. J. J. Lundy, of Edinburgh, Scotland, recently published a pamphlet on the above topic, in which he proposes a plan which will take, from foul water, impurities of every kind, whether of sewage or of manufacturers' and dyers' waste waters.

The substance used is a peculiar kind of animal charcoal made from any substance which is not bone. It is stated to be not only a powerful decolorizer but has peculiar powers of absorbing not only organic but also inorganic substances, while it is from twenty to fifty times cheaper than ordinary bone charcoal.

In carrying out the method proposed by the author, of using this material, the sewage is caused to fall into a bed of sand which lies on a thinner bed of gravel, under which lies a bed of the charcoal. After passing through another layer of gravel, the liquid goes upward through more charcoal and flows over into a bed of sand. It is thus thoroughly filtered and purified.

The charcoal after use may be laid aside in the open air without causing any smell, and in a little time will recover its original power, or it may be reburnt or distilled with great profit, as the whole of the nitrogen taken from the sewage would pass over in the distillation as ammonia, accompanied by other valuable products.

THE production of musical sounds from magnets, by Dr. Page, was effected in 1837.