DENTISTRY IN THE UNITED STATES.

NUMBER 3.

DENTAL FILLINGS.

Of the various materials used to fill cavities in teeth, the principal ones are gold, tin, amalgams, and cements. Of each of these there are different qualities and makes. Of gold foil filling there are three principal manufacturers, whose goods are so nearly alike that there is but little choice. The dentist prefers the softest metal. Many practitioners, not finding the foil sufficiently soft for their taste when purchased, anneal it over the flame of a spirit lamp before using it. When thus manipulated, it is more easily packed, can be condensed better, and the particles adhere to each other as though welded; thus making a filling almost as solid as if the metal had been melted, and poured into the cavity. Another kind of gold used for filling is the "crystal sponge gold," so called from its having the appearance of a crystalized sponge. This is used principally for "building up" teeth which have the crown destroyed. For a successful operation, this gold must be condensed by either automatic plugger or hand mallet process. Any attempt to condense it by hand pressure will fail, as the particles will "bridge," thus leaving the filling sufficiently porous to absorb the acids of the mouth, which would thus find their way to the walls of the cavity and continue their destruction. This metal can be condensed to a great degree of solidity. A patient who had the six central teeth built down with it (he had broken the natural ones) used the gold front teeth for cracking shell barks, in preference to the natural back ones; and they stood this rough usage for four years, and no doubt would have continued to do so longer, had the patient lived. Tin as a filling is used as in foil and in amalgams. As a foil, it requires as much manipulating as the gold, though it is not as durable; and the profit to the dentist not being in proportion to that on the use of gold, it is seldom used. A filling of tin foil will not retain its bright appearance and smooth surface, on account of the corroding action of the heat and acids of the mouth. Tin united with silver makes a good amalgam for temporary fillings. There is quite a number of different formulas for making amalgams, which are, as a general rule, composed of silver and tin. Some are of silver and cadmium, others of cadmium and tin. The metals are melted together, cast into an ingot, and made into fillings, which are sold to the dentist. Having prepared the cavity to be filled as for other fillings, he then mixes a small quantity of the fillings with sufficient quicksilver to make a thick paste, which he puts in a cloth, and by pressure squeezes out all the superfluous mercury. The silvery looking mass that remains in the cloth is plastered into the prepared cavity as quickly as possible, and in a few minutes sets sufficiently hard to receive a burnishing. This filling, when properly prepared and used, makes a good temporary filling; but unless done by an expert, it becomes a useless, crumbling mass. Though this is called a temporary filling, and is used as such by the profession generally, I know of two lower molar teeth still in use, that were filled with this amalgam fourteen years ago. The bone cements are usually nothing but chlorides, sulphates, and oxides of zinc. They are technically termed "*os artificiel*" or artificial bone, and are put into the cavity like mortar, with a spatula-shaped instrument instead of a trowel. In a short time, the material sets, and, as in the case of amalgams, if inserted by a competent person, it is a success. Otherwise it is a failure, as it will in that case shrink from the walls of the cavity, be acted upon by the secretions of the mouth, and sometimes wash out during the process of cleansing the teeth. There is but a trifling difference in the amount or quality of fillings used in the various sections; the gold being predominant, and the amalgams and cements standing side by side. There are about forty gold fillings to one plastic filling. One dental depot sold of gold foil in one year 957 ounces, which, at the usual rate of $36 per ounce, makes $34,452 paid for gold plugs by the dentist. As each ounce of this mass will average twenty-three fillings, and the cost of fillings averages six dollars, we find that the public paid for useful and ornamental repairs to the teeth (made with what was sold in one year, by one business house, of one single article) the sum of $132,066. About $1,000 was also paid for amalgam and cement fillings, according the usual proportion. Some practitioners utterly refuse to use anything but gold; and if the walls of a cavity will not sustain the pressure of inserting a gold filling, they will cut off the crown of the tooth, and set a pivot tooth, or build up with sponge gold. The plastic fillings are used principally by the lower classes, chiefly on account of the price; the proportionate rate of charges being $1 to $100 for gold, and from 25 cents to $5 for plastic fillings per cavity.

Correspondence.

Locomotives and Steam Cars.

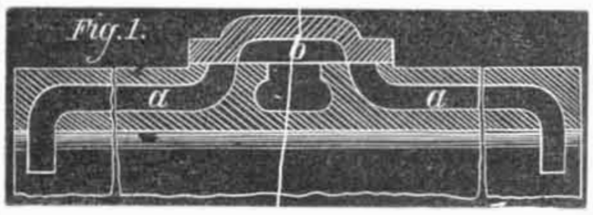
To the Editor of the Scientific American:

In your issue of August 22, it was stated, in an article under the head of "Steam Cars," that the locomotive ought to be more of a guide for builders of steam cars and other steam vehicles, on account of its low center of gravity, its excellent boiler, etc. The great problem, of course, is to so proportion and combine the various parts that the machine shall do the most work with the least possible repairs and fuel. To this end some of the following are essential:

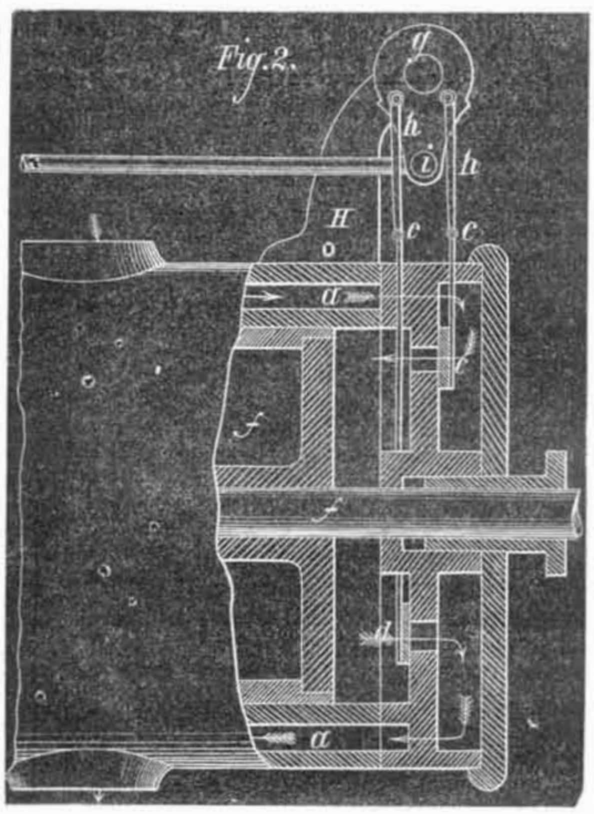
First, and most important, is a low center of gravity, as above stated.

Second: The connecting bar between the piston rod and crank should be as long as the machine will possibly admit—from eight times to ten times the length of crank, if possible—in order to reduce the pressure of the slides upon their guides, and hence their friction and wear, to a minimum.

Third: The length of the piston should equal half its diameter at least; if its length fully equalled its diameter, its durability and economy would be still greater. It should be cast in one piece, and made hollow or in cup form, to insure proper lightness. It should be fixed permanently to the piston rod before the last chip is turned off; then it should

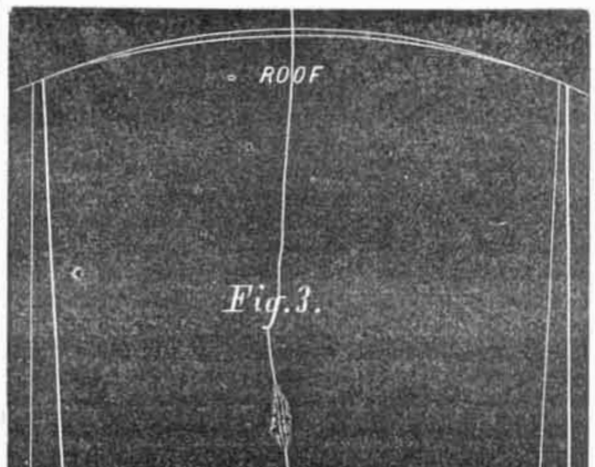


be fitted as snugly as possible to the bore of the cylinder, and yet it must work without chafing. A good practice is to surface such pistons with a shell of hard Babbitt or other composition not liable to chafe, and which may be easily renewed. If packing rings are used, they should be of the simplest possible make: two simple rings of steel or some other hard material, sufficiently elastic to admit, after being cut at one point, of being sprung into a single groove midway of the piston, the rings, of course, being placed so as to break joints. They may be held in position by a single dowel pin set in the piston beneath each ring. The loss occasioned by the escape of steam around a piston of the above description would be far less than the loss resulting from friction in attempting to keep a piston steamtight by set screws and springs (the old way), or by steam pressure.



Fourth: The bearing surface of the slides should be ample. A good rule is to make their combined upper and lower surface equal the piston area. For instance, a piston of seventeen inches diameter has an area of two hundred and twenty-seven square inches; one fourth of this is about fifty-six square inches for each of the four faces of the slides, as usually made.

Fifth: In the slide valves, considerable economy would doubtless result from a slight modification in the valve system. It now takes, to fill the passages, *a* (Fig. 1), between



the valve, *b*, and the ends of the cylinder, about five per cent of the steam used; if the valves were arranged as shown in Fig. 2. this five per cent of steam and fuel would, of course, be saved. (This illustration was drawn from a stationary engine in Worcester, which has this new system of valves.) It will be seen that there are two simple plate valves at each end of the cylinder, the inlet valve, *c*, and the discharge valve, *d*; *f* indicates the piston and its rod, the view being a central section at one end to show the arrangement; the valves, *c* and *d*, are driven by the rockers, *g*, which work in the top of two standards, H, the valve stems being jointed, at *c*, to the links, *h*. The arrangement is simple and perfectly applicable to the link motion of the present locomotive; it would only be necessary to connect tha valve rod to the point, *i*, of one of the rockers, *g*. This arrangement would not only cause a direct saving of five per cent of the fuel now used, but would render the action of the steam upon the piston more direct and efficient; it would also reduce the steam pressure upon the back of the valves to less than half its present amount.

Sixth: Much better provision should be made for freeing the boiler from sediment; the narrow water space around the fire box and the bottom of the cylinder of the boiler under the tubes are liable to become so clogged with foul matter as not only to destroy much of the most valuable generating surface, but to cause irreparable damage to the boiler from excessive heat. One or two blow-off cocks are of very little use. Their influence extends but four or five inches either way from their openings; hence it would require at least 8 or 10 two inch cocks around the base of the fire box, and as many more in the cylinder of the boiler under the tubes to insure anything like a tolerable freedom from sediment; and even then, I think that in many localities sediment would still accumulate between the cocks. But as there are serious objections to numerous blow-off cocks, the only safety seems to be in screw plugs judiciously placed and used. Two plugs should be placed at each corner, even with the bottom of the water space around the fire box, so that a scraper may be passed entirely through from corner to corner, both laterally and fore-and-aft. A screw plug should also be placed exactly beneath the tubes in the cylinder of the boiler near the fire end, and another in the tube sheet under the tubes in the smoke chest. The most important item, in connection with this screw plug system, is to cause these plugs to be removed from three to six times a year, or as often as the nature of the water demands, and, by means of a scraper and a powerful jet of water, to thoroughly cleanse the boilers from sediment; this should be one of the most imperative duties of the men in charge.

Again, as you state, a low center of gravity is of the utmost importance in the make-up of a first class steam car, and this applies with equal force to all rolling stock. The narrower the gage of the track, the more imperative is the necessity of a low center of gravity. The reason is obvious: The lower the center of gravity of a car, the more steady will be its progress upon the track; and the less the lateral strain upon the rails and running gear, the less the liability of its leaving the track, and the less the liability of its overturning when it does leave the track. These facts are sufficiently trite and self-evident to need no comment.

Our present passenger and freight cars are susceptible of much improvement in this direction. The roof and the upper portion of the body might doubtless be reduced in weight one third and yet have ample strength for all that is required of this portion of the car, namely, protection of passengers and freight from the weather, and the safe passage of the brakeman from car to car on the roof. The running gear and the base of the body is none too strong or too heavy now, perhaps; but from the base timbers, the weight of the frame ought to diminish quite rapidly to the roof, not by offsets, but by gradual taper. The diagram (Fig. 3) presents this idea to the eye. Our car builders and intelligent railroad men recognize this idea, of course, but they do not carry it out perfectly in their practice. When this point shall be gained, an important economic result will have been attained.

If the body of a car could be dropped so as to bring the floor within two or three inches of the axles, this economic result would, of course, be still further enhanced; the wheels would not project through the floor sufficiently to interfere much with the seats or the loading of freight. A simple iron cap over each wheel would make all safe inside the car. This change would, of course, require some alteration in the truck frame and the housing of the wheel boxes; nevertheless it seems to be an alteration which is perfectly practical.

Any change in our present system which seems to indicate an important improvement in the stability, safety, and economy of our rolling stock is worthy the candid consideration of railroad men. F. G. WOODWARD.

Tides of Lakes and Lakelets.

To the Editor of the Scientific American:

It is said by most authors on tidal theories that there can be no tides on lakes, for the reason that the moon's attraction is equal over the whole surface of water. I hold that there is a tide raised from every body of water on earth. It is impossible for the moon to raise a body of water from the earth by its attraction, but it counterbalances or neutralizes a portion of the earth's attraction for the water, in consequence of which the water becomes lighter and the lower portion not so much compressed. Hence, on account of the elasticity of the compressed water, the diminution of compression is followed by an expansion which drives the superincumbent water upward. This is a natural principle which belongs to all bodies of water, although the effect is imperceptible if the water be shallow and not connected with very deep water.

By this theory (of my own) I account for the very considerable tide that rises on Eagle Lake in the northern part of this State. The lake is very deep and has never been fathomed. LA FAYETTE LILLARD.

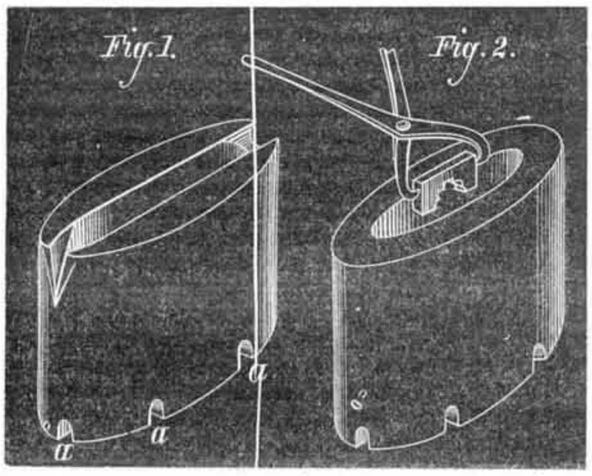
California College, Vacaville, Cal.

Hardening and Tempering of Tools.

To the Editor of the Scientific American:

I have not heretofore objected to any of Mr. Rose's processes, as such, but have stated merely that, in any of the usual methods, the elements of time and access of air are important ones. I do now, however, object to the tube method, the sand bath, and to the heated iron in contact with the piece to be tempered.

A tube heated to redness in an ordinary forge fire, or in fact in any sort of fire, if not long enough to project at both ends beyond where it is possible for the products of combustion to enter, will vitiate a result predicated upon the



color produced by the entrance of these gases. If it be long enough to exclude the gases, and its diameter is in any reasonable proportion to that of the article to be tempered, it will be very inconvenient for observation of the color without withdrawing the piece often. Anyone at all accustomed to tempering well knows that, to bring to a nice shade of color any article by a process which requires its repeated removal from the source of heat, is very difficult; as there can be no nicer gradation arrived at than may happen to have been produced by one of the periods during which the piece was subjected to the heat. If the tube be so large in diameter as to permit of the colors being readily observed, there remains the objection (which applies to all processes which require that the color be observed, almost exclusively, under the light emanating from red hot iron or the yellow rays from a fire or a gas light) that the color does not appear the same as it would if observed under white or daylight. The colors dealt with in tempering, being principally of the yellow and blue order, are much modified in appearance by the yellow and red rays from the above mentioned sources. To be sure, an expert at tempering, one who makes it almost exclusively his business, can by continued practice decide what particular shade in the red hot tube would correspond to a required shade as seen by daylight; but our object is, or should be, a method by which any workman may arrive at a color, correct for a given tool as ordinarily seen.

My objections to the sand bath are precisely those which Mr. Rose now admits to be its weak points: the difficulty of determining its temperature, of maintaining it at a given temperature if such could be determined within reasonable limits, and the difficulty of insuring a uniformity of temperature throughout its mass; and, failing to use it successfully because of the three difficulties, the absolute uselessness of attempting to use the color test with it while excluding the air from the tool by immersing it in the sand.

The use of a red hot piece of iron in contact with the tool to be tempered, as advocated by Mr. Rose in tempering dies is objectionable, not only because the surface of the die or other tool in contact with the hot iron is, during contact, excluded from the air, and the progress of the color formation modified thereby, as advocated in my original communication, but there is also the objection which applies very particularly to dies; that the end convolution of the thread, nearest to the hot iron, is liable, and in fact almost certain to be made hotter than the body of the die, as indicated by the color of the side exposed to view; and as this particular part of the die has to bear the brunt of the work while in use, it is of the last importance that it should not be softer than the workman will be likely to regard it as determined by the color of the body of the die; and this objection applies of course to any article having thin or projecting members.

The process I desire to suggest for drawing the temper of taps, reamers, and similar forms, and which I have used with uniform success, is shown at Fig. 1. It consists of a piece of iron—wrought iron preferably—although cast iron is much cheaper and answers very well—made in the form of a heavy flattened tube 5 or 6 inches in hight, made thin at the curves and cut as shown in the figure. The opening requires to be in width at least twice the diameter of the piece to be tempered, and in the bottom several channels are cut or cast leading to the side, shown at *a*, *a*, *a*. These channels are for the purpose of admitting air to pass in and establish a current upward through its inside. The channels require to be quite small, so that the upward current shall be sufficiently slow to insure the air being heated to a very high temperature, it, the tube in Fig. 1, being heated to a bright red heat. The tap or other piece may be held in a suitable holder made of soft iron wire, coiled so as to take the shank within it and extend long enough to form a ring-shaped handle at the end; the wire holder is allowed to rest in one of the depressions in the ends of the apparatus, thus supporting the tap or reamer in the center of the opening, in which position it can be rotated, moved endwise, or tilted in or out of the opening, as may be found necessary to establish a uniform color throughout its length; or the tap may be held in the tongs by the wrench end, the shank laid in the V-shaped opening, and the threaded part only tempered, leaving the softening of the shank, etc., to be done afterward. Fig. 2 is simply a thick circular tube similarly grooved in the bottom, with which dies and other short pieces may be tempered. They may be also held in a wire holder, or in tongs (with points turned inward, forming a pair of centers upon which the die may be rotated by a piece of wire in the other hand). Other modifications of these may be used to conform to the tool or piece required to be tempered.

Of course, where a number of similar pieces are to be tempered by this method, it is necessary to have two irons in the fire, or, rather, one in the fire while the other is in use.

It will readily be seen that in this method there is perfectly free access of air, while the operation may always be performed in a situation where the colors may be seen by daylight; and it will be found that, owing to the fact that the heating of the piece to be tempered is effected principally by the heated current of air, it will be very uniformly done; in fact it is superior, even in this respect, to the tube process.

An ordinary flat piece of iron may be used, for many forms of tools, to advantage, as for instance in hastening the drawing of a cold chisel which has been dipped too far or for too long a time, if care be taken to keep the two from contact. If Mr. Rose will give the above methods a trial, as he has promised, I am persuaded that he will thereafter give them the preference over the methods he has illustrated.

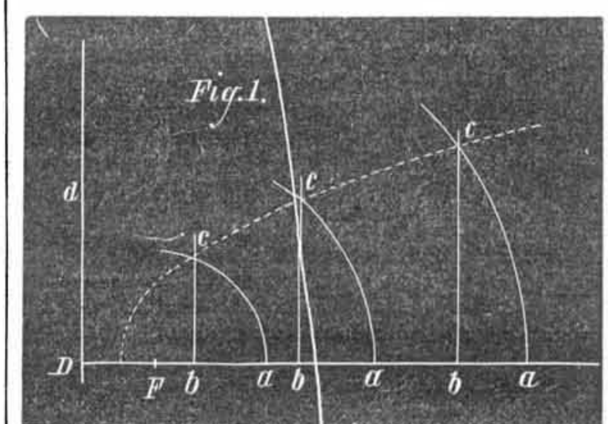
The element of time I have not pretended to be able to control to any considerable extent, as Mr. Rose would seem to infer; but I do insist that, with any process whatever in which the color is taken as a guide, it must be taken into account, and the proper allowance made if the operation be from any cause unduly prolonged or hastened.

62 Cannon street, New York. JOHN T. HAWKINS.

To Draw a Parabola.

To the Editor of the Scientific American:

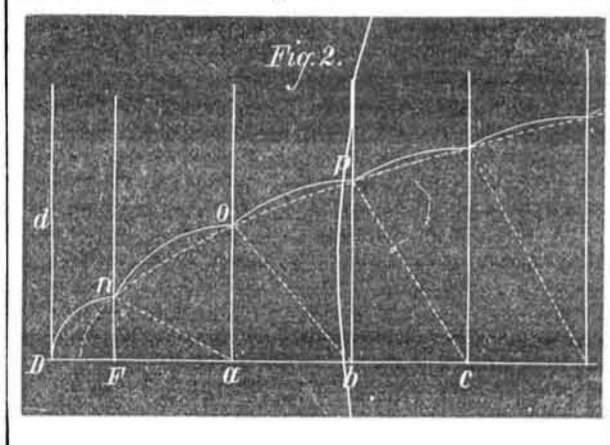
A very convenient way to draw this curve is as follows: On the principal diameter, Fig. 1, lay off the proposed directrix, D *d*, and focus, F. With F as a center describe arcs, *a c*, at convenient distances from each other. From *a*, set off *a b* equal D F, and draw *b c* perpendicular to D F *b*. Then will the intersections, *c*, be points in the required curve.



While geometrically accurate, this method has the advantage of being applicable where the usual methods are not convenient.

Another equally convenient method is as follows:

Lay off D *d*, and F (Fig. 2) as in the first instance, and make the distances, F *a*, *a b*, *b c*, on principal diameter equal to 2 D F. From F *a b c* draw perpendiculars to principal diameter. With F as a center, describe arc D *n*; with *a* as a center, describe arc *n o*; with *b* as a center, describe arc *o p*, and so continue as far as necessary.



 Then will *n o p* be points in the required curve. Having determined D F, and drawn the perpendiculars, F *n*, *a o*, and *b p*, the points *n o p* may be determined without drawing the arcs, by taking the root of every fourth number, beginning with one, from a table of square roots, as shown in the following table, in which D F = X is taken as the unit:

F $n=\sqrt{1}=1$; $a\ o=\sqrt{5}=2{\cdot}236$; $b\ p=\sqrt{9}=3$; $c\ q=\sqrt{13}=3{\cdot}605$; $d\ r=\sqrt{17}=4{\cdot}123$; $e\ s=\sqrt{21}=4{\cdot}582$; $f\ t=\sqrt{25}=5$; $g\ u=\sqrt{29}=5{\cdot}385$.

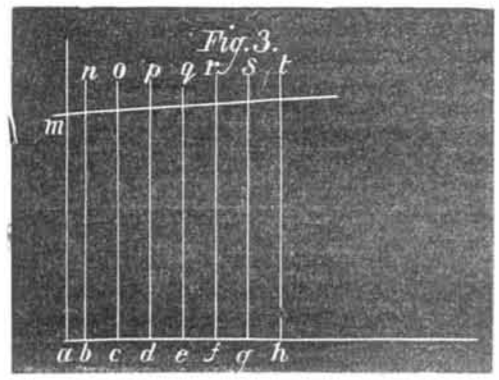
By the aid of this table, sufficiently extended, and the principle illustrated in Fig. 1, we may readily draw any desired section of the curve, on any scale, as shown in the following example: On the principal diameter (Fig. 3), the point, *a*, is 95 inches from focus, F; and at this point the width of the curve, $a\ m=14$ inches. Required the curve beyond (at the right hand) of $a\ m$.

We first determine the radius F *a* (Fig. 1) by taking from a table of squares:

$$F\ a^2=95^2=9025$$
$$a\ m^2=14^2=196$$

$$\sqrt{9221}=95{\cdot}98 \text{ nearly.}$$

Therefore, D F = 95 98 — 95 = 0·98; and, therefore, the perpendiculars must be $0{\cdot}98\times 2=1{\cdot}96$ inches apart. To determine the position of the first one, divide F $a=95$ by 1 96 = 48 + a fraction. We now multiply 1·96 by 48 + 1, and obtain 96·04 inches as the distance of the first line, *b n*, from F, or 96·04 — 95 = 1 04 inches from *a m*. This being drawn,



the other lines may be laid off 1·96 inches from each other as described—

As *b n* is the 49th perpendicular from F, its length will equal $\sqrt{49\times 4+1}=\sqrt{197}=14{\cdot}035$ units (not inches) as in this table

$b\ n=\sqrt{197}=14{\cdot}035$; $c\ o=\sqrt{201}=14{\cdot}177$; $d\ p=\sqrt{205}=14{\cdot}317$; $e\ q=\sqrt{209}=14{\cdot}456$; $f\ r=\sqrt{213}=14{\cdot}594$; $g\ s=\sqrt{217}=14{\cdot}730$; $h\ t=\sqrt{221}=14{\cdot}866$.

Proceed in this manner as far as required, bearing in mind that the unit of this table is D F (Figs. 1 and 2). This last method, though requiring considerable calculation, is the most accurate in practice, and therefore the best for such cases as the example given. F. H. R.

New Britain, Conn.

Vesicatory Potato Bugs.

To the Editor of the Scientific American.

In your article on bugs on page 17 of your current volume, you say, referring to the alleged fact that potato bugs are a good substitute for the Spanish fly: "This is interesting but, unfortunately, not authenticated." Begging pardon for putting in my oar where there is no rowlock, I have to say that your error consists in not discriminating between different bugs. That the Colorado bug is valuable for blistering purposes, I am not aware; but any one who has to deal with the long striped bug, somewhat resembling the lightning bug (*cantharis vitatis*), will find to his grief that they are an exceedingly active vesicant. During the war, when ("down South") we were obliged to utilize our home productions, we found this insect to answer all the purposes of its Spanish cousin. Any one who does not believe this can easily test it by visiting Virginia in July, and mashing one of those bugs on his arm. If it does not blister, I will pay his expenses for the trip.

Alexandria, Va. J. B. HODGKIN.

Bees and Honey.

To the Editor of the Scientific American:

I think that H. W. S. (SCIENTIFIC AMERICAN, page 148, current volume) will have very little trouble in finding a market for strained honey, if he will be very clean in all his operations, and, when it is convenient, invite in some of his probable customers to see him manipulate, explaining the advantages of getting clean honey from the comb, with an occasional cell of bee bread in it.

I have kept bees solely for the pleasure of studying their habits, and should keep them if I never got an ounce of honey from them. I am a mechanic; but I have had no trouble in disposing, out of work hours, of a barrel of strained honey in a very short time, to persons who, I afterwards found, were anxious to buy again.

I think that if apiarians considered the value of comb, they would be more saving of it than they are. Probably each pound of comb represents ten pounds of honey, which should not be wasted (to be replaced each year) when it might be saved. I have thought the bees might be saved the trouble of making comb, wholly or in part, by making it of paper and waxing it. If we could not make the whole comb, the partition in the middle might be made by indenting paper, waxing it, and suspending it in the frames. This would ensure straight combs at least, which are very important; and with these, an emptying machine, and good frame hives, I think that bee-keeping would be in its simplest form. WILLIAM G. BARNES.

Bridgeport, Conn.

THE CORRELATION OF FORCES.—Of the various forms of energy existing in Nature, any one may be transformed into any other, the one form appearing as the other disappears. This is what is meant by "the correlation of forces." Thus the rotary power of a wheel, if applied to turn a magnet, is converted into electricity; and this electricity, if employed to drive a wheel, is changed back into rotary power.