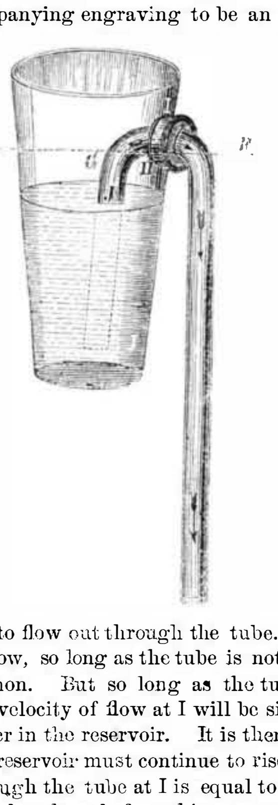
Correspondence.

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

Intermittent Springs---Silliman All Right.

MESSRS. EDITORS:—Your last number (March 27) contains an article, attempting to demonstrate that the generally received explanation of the working of intermittent springs is either insufficient or absurd. I think it can be shown to be adequate. Without stopping to discuss well-known general principles with regard to the syphon, let us at once take an example to illustrate the case. Suppose the vessel in the accompanying engraving to be an open reservoir receiving a constant supply of water. For simplicity, let the amount of water received each minute be the quantity which would flow through a two-inch pipe in that time under a pressure of ten feet head. Now let a syphon communicate with the reservoir as in the figure, and let its diameter be two inches or less, and then let us consider what results will follow.



Suppose first the water to be at the level, J, in the reservoir, and the syphon to be empty. As the water rises in the reservoir it will also rise correspondingly in the short leg of the syphon, and when it has reached the level of the bend it will begin to flow out through the tube.

Now, so long as the tube is not full at I it will not act as a syphon. But so long as the tube does not act as a syphon, the velocity of flow at I will be simply that due to the rising water in the reservoir. It is then evident that the water in the reservoir must continue to rise till the velocity of the flow through the tube at I is equal to that due to a head of ten feet, but long before this the tube will be full, and will begin to act as a syphon. It is also evident that a much larger tube would be readily filled at I by the action of the water in the reservoir, since so long as the tube does not act as a syphon, the velocity at I will be very small, and this velocity cannot be much increased till the tube is full.

Our tube now acting as a syphon, let us note what will happen. And first, we will suppose the syphon to be two inches in diameter, and the lower end of it to be ten feet below the point, I. When it begins to act as a syphon, the velocity of flow through it will be just the velocity due to a head of ten feet, and the water will therefore be drawn from the reservoir, at exactly the same rate as it is received by the reservoir, and hence the flow will be continuous. The same effect would evidently be produced if the same sized syphon were any shorter, since the water would rise in the reservoir above the point, I, till the velocity of discharge became equal to the velocity of influx. If, however, the syphon extends to a lower point, say to twenty feet below the point, I, the water will at first flow through the tube with a velocity due to a head of twenty feet, thus discharging from the reservoir much more rapidly than the water is received there, and reducing the level of the water to J, when the flow will cease, to begin again when the water rises to I, thus giving an intermittent syphon. It is easily seen that a tube smaller than two inches diameter would produce the same effect of extending to a sufficiently low level, or a larger tube of even less length than ten feet, the *capacity* of a syphon for emptying a reservoir depending on the comparative level of the water in the reservoir and the lower opening of the syphon, as well as on its size, a fact entirely overlooked by the previous writer.

There are thus many supposable circumstances under which intermittent springs might be produced by the action of a syphon. That these circumstances are not difficult to realize, is shown by the fact that in a hasty experiment made by myself on reading the article mentioned, the second trial adjusted the flow of water from a faucet into the reservoir so as to produce a complete intermitting syphon.

There is also no difficulty in supposing sufficient air to be admitted to a subterranean chamber, if we consider the extremely small quantity which could escape at each break in the flow. The moment that any air is admitted from the reservoir into the tube, the water in the short leg being relieved from pressure instantly flows back into the reservoir and the opening is closed. If the air in the reservoir is now prevented from escaping readily by other channels, it will simply act like the air in the chamber of a hydraulic ram, contracting and expanding with the rise and fall of the water, and sufficient air coming in with the water, or from any minute openings, when the air in the chamber is rarefied, to supply the waste, since, of course, if no air whatever be admitted to the chamber, the flow will finally become constant.

STUDENT.

New Haven, Conn.

[Before replying to our correspondent, we desire to say a word in regard to the practical value of this discussion. In no department of physics are there more points of subtle nicety than in hydraulics. Failure to take into account these nice points is the cause of frequent failures in hydraulic engineering. Many devices have been attempted having for their basis self-acting syphons, and many have been misled on precisely the point in question by the assumption that a syphon will commence to act as a syphon as soon as the fluid in the reservoir rises to the top of the bend, I. The fact is, that no syphon, so large that the flow is uninfluenced by capillarity, will so operate. We can recall many instances where inventors have been misled by the precise words of the text-book from which we quoted in our former article upon the subject, viz.: "*This cavity is gradually filled, until, at last, the water reaches the level, B, B* (see Fig. 1 in the article referred to), *when the syphon is filled, and the water escapes.*" Now, we assert that the water rising in the way described will not have filled the syphon until the level has risen to a point *above* I, a fact shown very clearly in our correspondents' communication.

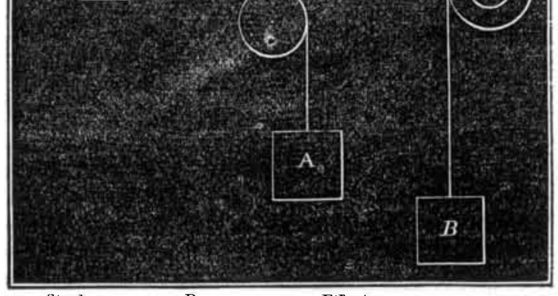
In reply to his statements, we say, first, that we have not claimed that an intermittent fountain cannot be made by the proper adjustment of supply to the capacity of a syphon. A constant supply, operating as he describes, would produce such a fountain, but his description of its action does not coincide with that of the books, as he assumes that the water would rise higher than the level, I, while they say the syphon will be filled when the level is raised to that point, a statement which, as we have shown, is only true of syphons possessing a sufficient amount of capillarity. Had our correspondent, in his experiment—which he states succeeded in the second attempt—observed the position of the level (premising that the syphon used was not a capillary tube), he would have seen that the level previous to its fall by the action of the syphon rose some distance above I, thus confirming his reasoning. This reasoning is not identical with that of the books; but though written to controvert our proposition, exactly confirms it. Instead of overlooking the fact that the capacity of a syphon varies with the relative lengths of the columns in the longer and shorter legs, it was taken fully into account.

Now, if the circumstances of higher level than I, capillarity, and proper adjustment of supply in the reservoir are essential to the theory of intermittent springs, we submit that their omission renders that theory "*insufficient.*" If they are not essential to the theory, and therefore to be disregarded, we reassert that the theory is "*absurd,*" for, in the absence of these conditions, there will be no intermission of flow.

Assuming that they were considered unessential because not alluded to in the books, and because the general proposition that the syphon will be filled, when the level of the fluid in the reservoir reaches I, indicates that they must have been either overlooked or dismissed as unessential, we proceeded to state that the only condition that would make the theory of intermittent springs, as enunciated in the books, tenable, was capillarity. We added some hypotheses which would, in our opinion, account for intermittent springs, only one of which we deemed adequate to account for *all* the facts. It is quite possible we may, upon further reflection, discard that also, but of that more anon. The last part of the communication, pertaining to the inclosed volume of air, is equivalent to the hypothesis of a remittent supply, as the compression and subsequent rarefaction of the air in the chamber, reacting upon the columns of water entering the chamber, would produce a remitting action in their discharge. There are, however, objections to such a view, which those acquainted with the operation of air bulbs upon rams, pumps, etc., will readily discover.—EDS.

The Crank and its Powers.

MESSRS. EDITORS:—I at one time thought, as I see some of your readers still do, that there was a great loss in the crank motion. I tried an experiment as follows: Crank, 6 inches long; connecting rod, 3 feet long; pulley on crank shaft, 7·64 inches in diameter. When the crosshead makes one single stroke 12 inches, the box, B, will be raised 12 inches. The weight in the box, A, represents the pressure on the piston. I divided the stroke into ten equal parts on the guides. The weight in the box, A, was 100, and in the following table you will see what weight it is capable of starting at each tenth. I do not pretend that my experiment is very exact, as my model was rather rough.



Stroke.	Power.	Effects.	
0·1	100	55	
0·2	100	95	
0·3	100	115	
0·4	100	127	
0·5	100	133	(7·64 : 12 : : 100 : 155)
0·6	100	127	
0·7	100	115	
0·8	100	96	
0·9	100	76	
1·0	100	00	
	100	939	

Mean effect, 93·9 per cent

THOMAS PETHERICK, JR.

Easton, Pa.

NORTH CAROLINA makes more money from her peanut crop than from her cotton crop.

Cheap Gas.

MESSRS. EDITORS:—While the people of New York and its vicinity are loudly clamoring against the bad smell, poor quality, and high price of the gas supplied to them by irresponsible monopolies, it is my belief that all these evils will eventually be done away with, through a little sound legislation, and by the application of the co-operative system to the production of this necessity of our present civilization.

It has often been stated, but never proved, that a mode of cheapening gas would be to diminish its cost by saving the whole amount of freight on the coal used in its manufacture, and that this could be done by making it at the mouth of the coal pit and transmitting it, ready prepared, from thence to the centers of consumption.

Having been led accidentally to reflect on this matter, lately, after a conversation with some persons interested in our bituminous coal mines, I, from mere curiosity, have taken the trouble to investigate the practical feasibility or rather non-feasibility of such a project, and herewith forward you a summary of my calculations and deductions, which may, perhaps, interest some of your readers.

The cities of New York, Brooklyn, Jersey, Williamsburgh, Hoboken, and the whole neighborhood, as far as Newark and Elizabeth, consume annually about 500,000 tuns of coal for the production of 5,000,000,000 cubic feet of gas. The freight on this coal amounts to not less than $3,000,000 annually.

If gas could be made at the collieries and conveyed safely from thence to the metropolis in tight, well-laid pipes, the whole of these $3,000,000 would necessarily be economized. Obstacles, however, of a formidable nature stand in the way of such a desirable result, as we shall now attempt to show. Starting from a supposition that the nearest gas-coal colliery is situated at 200 miles, and is 600 feet above our level, and that the gas is admitted into the mains under a pressure of ten inches of water through mains 50 inches in diameter we find, by Hughes' formula, $A = D^2\sqrt{(HD \div LG)}$, in which D = diameter of the main in inches (50 inches); H = the pressure of water in inches (10 inches); L = the length of the main in yards (352,000); G = density of gas (supposed to be 0·42), that $A = 2{,}500\sqrt{0{\cdot}0034} = 145$, which, multiplied by 1350, Pole's coefficient, gives us 195,750 cubic feet delivered per hour. The pressure here would be 0·36 lb. per square inch of area.

The loss of pressure by passing through mains is, by d'Harcourt's formula, $LQ^2 \div D^5 \times 0{\cdot}611$, in which Q is the quantity of gas passing per hour, L the length of the main in yards, and D the diameter of the same. In our case we find it to be equal to 26,470,399 inches of water, or 13,485 inches per square inch of area of a 50-inch main. This multiplied by 0·036 lbs. the weight of an inch of water, indicates a loss of pressure of 485·38 lbs. per square inch, to which must be added the above 0·36 (or ten inches water), making a total of 485·74 lbs. of pressure needed per square inch of area at the initial point.

As the gas-works are supposed to be situated 600 feet above our level, we have another correction of $\frac{1}{100}$ of an inch of water to make for every foot of descent which adds another 6 lbs. per square inch to the above, and gives a grand total of 491·74 lbs. per square inch, equivalent to a pressure of more than 1,360 feet of water, the realization of which, practically, would amount to an impossibility or very nearly so.

Under such a pressure, could it be effected, no doubt can be entertained that, even with our modern improvements in joining pipes, etc., more than 50 per cent of the whole of the gas would be lost by leakage on the way, so that in reality not more than 95,875 cubic feet per hour would reach the consumers at the end of the 200 miles of mains.

To supply New York and vicinity would require sixteen such 50-inch mains as the above. Iron pipes of good quality, one-half inch thick, would support the pressure, and their weight would be, by the formula, $K = (D^2 - d^2)$, in which K = 2·45; D = external diameter of pipe in inches; d = internal diameter in inches; 247·45 lbs. per running foot, or 116,678 tuns for 200 miles. Sixteen such mains would weigh 1,866,848 tuns, and at $45 per tun would cost $84,008,160. Adding to this the cost of transportation, the laying and joining of the mains, the hydraulic appliances, gasometers, etc.; we arrive in round numbers at $100,000,000, which would be needed to carry out a project of lighting New York and vicinity with gas manufactured in the coal regions, at a distance of 200 miles.

We do not believe that the above figures, exhibiting conditions of pressure, leakage, and cost of construction, are of such a nature as will induce capitalists, gas companies, or the public in general, to invest in any wild scheme, which might at any time be brought to their notice, having for its object the removal of the gas works from New York city to the Pennsylvania coal basin. Any such attempt must result in failure even supposing all our calculations to be twice too high.

X. Y. Z.

Laying Out Gear Teeth.

MESSRS. EDITORS.—I inclose for publication, a few words of criticism on an article which appeared in your valuable paper, the SCIENTIFIC AMERICAN, for March 13th.

The article signed "J. C." is upon the subject of gear teeth, and I think it will do harm rather than good unless righted. In the first paragraph he says, "Why are the teeth of wheels made on a curve, is a question which, if propounded to a majority of mechanics, who have almost daily experience on the subject, would not elicit a satisfactory explanation." The strength of this remark, it appears to me, is no better exemplified than in some of the statements of the very article in question. For example, it is stated that "the curve forming the point (face) of the tooth of one wheel will be a curve for the root (flank) of the other." Also "the curves *thus* formed are the epicycloidal, the proper mathematical curve for the teeth of gearing." If the writer of the article were familiar with such good authority as "Appleton's Dictionary of

Mechanics," the "Practical Draughtsman," and especially with "Willis' Principles of Mechanism," he would probably have said, that when the generating circles are the pitch circles themselves, the teeth of one wheel only could be formed with the epicycloidal curves, and that the teeth of the other must be mere round points; or, if the points of the one wheel be enlarged to cylindrical pins, parallel to the axes of the gears, the teeth of the other must be formed with curves, which are drawn at a distance from the epicycloidal curves throughout, equal to the radius of the pins, as shown in "Appleton's Dictionary of Mechanics," Vol. I, p. 828, and also "Appleton's Encylopedia of Drawing," p. 169, and that the epicycloidal curves *thus* formed are *not* the proper curves for the teeth of gearing as ordinarily properly constructed. Also, if he had said that the circle rolling upon A, generating the curve for the face of each tooth of A, should have half the diameter of B, and *vice versa* for the opposite wheels, and then instead of using the same curves for the flanks, he had recommended radial flanks, as far as the teeth of the other wheel have bearing upon them, he would have approached more nearly to the modern practice of correct mechanics. The method of thus constructing teeth is also illustrated in "Appleton's Dictionary of Mechanics," Vol. I, p. 830, and in the "Practical Draughtsman," and numerous other works.

He further says that "the epicycloidal curve is not invariably given to the teeth of wheels *because* it is peculiar to the diameter of the wheels for which it is constructed, and admits of a limited range in case the teeth are wanted to be used for other diameters than that for which they were made." But it is shown in "Appleton's Dictionary of Mechanics," Vol. 1, p. 825, in "Willis' Principles of Mechanism," p. 107, and in Rankine's Applied Mechanics," p. 444, how a *single circle of fixed diameter* may be rolled on the outside and inside of a pitch circle of any diameter, to generate the epicycloidal and hypocycloidal curves which shall form the outlines or faces and flanks of the teeth for those pitch circles respectively, giving a great number of wheels of various diameters, any two of which will work truly together. A number of wheels of different diameters thus constructed is called a set, or the wheels are said to belong to the same set. Mr. "J. C." gives favor to an old millwright's rule for shaping teeth and cogs, a rule which has been condemned, for failing in accuracy, for twenty-five years or more. This rule, however, is better than none at all, but why use that where we have a so much better approximate method as that presented in Prof. Willis' "Odontograph?"

To those who desire to become experts in the construction of correct gear teeth, I would recommend a careful perusal of the subject, as given in Prof. Willis' immensely valuable work, already referred to, or as found in Appleton's dictionary, also already cited above, in which the subject of gearing, for the most part, represents a recast from Prof. Willis' work.

S. W. Robinson.

University of Michigan, Ann Arbor, Mich.

Messrs. Editors:—Will "J. C." please explain a few lines of his article on "Gearing," page 165? The sentence commences with the words, "Proceeding to form the tooth," etc; "the curve found." What curve? How found? "Opposite direction from point of bisection." What is meant by this? "With the proper radius." What radius is this? How found?

In his figure what is the meaning of the unlettered lines found touching the curve, E *i* and *d d'*?

In forming the teeth of two wheels of different diameters, is there any definite rule for determining the construction of the curve that forms the outline of the pinion tooth, or is the proper center for this curve determined solely by experience, as this center is sometimes taken at a point not upon the pitch line?

M. N. R.

A Proposition from a Prominent Engine Manufacturer.

Messrs. Editors:—Learning that the American Institute intends to hold a fair during the coming fall, I would make, through your columns, the following proposition, both to the Institute and manufacturers of engines and boilers:

I will contribute $1,000 toward defraying the expenses of a thorough test of steam boilers and engines, to be made under the direction of a committee of experts, to be appointed by the Institute, the test to be made at the next fair. I will send, at my own expense, for competition, one of my trunk engines of 40-horse power, and one of my safety boilers, my competitors also to erect their own engines and boilers of equal capacity.

The test to cover efficiency, economy of fuel, safety, and all other points that make up the practical value of boilers and engines for general use.

John B. Root.

95 and 97 Liberty street, New York.

On Non-Rotary Propulsion.

Messrs. Editors:—On page 165, current volume Scientific American, your correspondent, F. R. P., under heading, "Economy of the Short Stroke of Engines in Non-Rotary Propulsion," takes for granted that, as 75 lbs. pressure (over and above friction) applied at A, could not overcome resistance 10, at the circle B, it would, of necessity, cause resistance 70 at point C, to move to point D. Otherwise it would be obviously impossible, he says, for the engine to make its stroke. (I refer to diagram on page 165, so as to economize space in your valuable paper).

If there was no other alternative but for resistance at B to be overcome and carried to E, or resistance at C to be moved all the way to D, it would follow most assuredly that the power applied at A would be incapable of producing motion. But the power applied at A, instead of moving "all the way" to D may be supposed to move in the direction of D, which is quite another thing. Otherwise (stroke of engine being one foot, power 75 lbs., and resistance at C, being 70 lbs., distance from C to D, 8 feet, as given by your correspondent) we would have, power applied, $1 \times 75 = .75$, and effect produced, $8 \times 70 = 560$, that is, 75 would produce 560, which would be an actual creation of power.

Now, this would be, not only an extraordinary discovery, which would probably soon lead to the further discovery of that great desideratum, perpetual motion, or something akin to it, but it would be a discovery subverting the fundamental laws of mechanics, as well as the late discoveries concerning the correlation and conservation of forces.

Whether there is really any saving of power in the short stroke of engines, I am not prepared to say, but is not certainly *for the reasons* given by your correspondent.

R. Desbonne.

St. Louis, Mo.

Results from Expanding Steam—The Indicator.

Messrs. Editors:—In your isssue of March 17th there is a communication under the title of "Wonderful Results from Expanding Steam," criticising an indicator diagram, published in a certain pamphlet, which is so obviously the one circulated by the Wood & Mann Steam Engine Company, that a few words from us on the subject, perhaps, may not be inappropriate. That the card published in that circular is a literal and reasonable one, no engineer would doubt; that it is a good one—far above the average—no engineer competent to apply the test of the theoretical diagram can deny; but the increasing interest shown by manufacturers in the use of the indicator, and the importance of having its functions rightly understood, induce us to ask the favor of a little space to continue the discussion.

Let us state, in passing, that the card published in the Scientific American, is not exactly a reduced copy of the one in the circular; the characteristics which are enlarged upon in the article seem to be exaggerated in the engraving. Your correspondent is evidently familiar with the law governing the expansion of gases and the "Joule's equivalent;" that his experience is very limited in the practical working of those laws, as shown by the indicator is also evident, or he would not take upon himself to say "that such a card was never fairly taken from any steam engine." They who adopt the slashing style of criticism ought to thoroughly understand their subject.

The high terminal pressure to which he objects is, in ordinary working engines, the rule and not the exception. Only in first-class cut-off engines, and in those not always, does the line traced by the pencil of the indicator show a curve nearly approaching the theoretical. A Corliss engine, driving the Utica Cotton Mill, has been in constant use for seven years, during which time the valves have never been repaired. We have recently taken a card from this engine, which shows the actual expansion curve to be within three per cent of the theoretical.

If your correspondent will be at the pains to apply an indicator to any engine, except a Corliss, running in his immediate neighborhood, and subject the cards to his analysis, he will doubtless be surprised to find their terminal pressures show a still greater disregard of the law governing the "expansion of gases" than the one in the Wood & Mann circular. It will be proper here to state that the card referred to was taken some time ago from an engine, in which certain patent balanced valves were used, but their lack of tightness and excessive steam clearance was found to more than offset the advantage of balance. The one we now use is the slide valve, with the Corliss valve gear.

Your correspondent's method of judging the comparative performance of different engines by bringing them to a common standard is, doubtless, the correct one; but he errs in supposing the amount of steam used is measured by that admitted to the cylinder up to the point of cut-off—it is not the amount admitted, but the amount exhausted; it is the volume of steam in the cylinder at the opening of the exhaust valve which determines the quantity of heat required to do the work of the half-stroke of that engine. The item of "units of heat," lost in developing power may be disregarded, or rather only regarded generally along with other losses of which the indicator takes no note, such as leakage of piston and exhaust valve, condensation, the re-evaporation toward termination of stroke (which latter, especially in a slow-running condensing engine, goes far to produce the result in the expansion line, so startling to your correspondent), goes further than any cause perhaps, except leakage of steam valve, to which the editor alludes. The clearance in this engine, of which you also speak, is large, being four per cent of stroke. This affects the expansion line, but with proper management of exhaust valve and "compression curve," is not a fault. Your correspondent also alludes to the increasing pressure, which begins at one and one-half inches from termination of stroke, and reaches forty pounds at the end; this he evidently believes is due to lead on steam valve. It is, on the contrary, due to early closing of exhaust valve. The card as drawn in the Scientific American, really shows *a negative steam lead*, the steam valve not opening until the piston has moved some little distance on its forward stroke.

That the indicator shows with absolute accuracy the power and working condition of an engine, no intelligent engineer will claim, but in experienced and judicious hands its value is unquestionable, especially in testing the relative performance of various engines. We have found a simple and effective method of bringing engines to a standard, and testing them by their cards, to be the Regnault tables.

Howard Rogers.

Utica, N. Y.

Peat.

Messrs. Editors:—You are probably well advised of the great number of improvements that have, within about four years past, been patented, for treating peat for heating purposes, yet may not be as well informed as to the number of individuals and associations, who during that period have ventured their money and lost in trial to utilize this immeasurably extensive and highly valued product of nature, which is consequently much abused; while the entire fault lies with the too-confiding promoters for trusting to impractical theories, when a little investigation and a few almost inexpensive tests would have proved the fallacy of the system proposed.

As the season is nearly upon us when peat deposits can be worked, and as many parties will doubtless engage in the work, I am confident that you will gratify your army of readers by giving them a few useful hints and practical advice upon this important question for the manufacturing and home interests, as well as to the owners of peat lands, which information will come most legitimately from the Scientific American.

Wherever soil is exposed to constant water saturation, from springs, or by percolation, or intermittent overflow from a stream, pond, or lake, or from any two or more of such causes, the vegetation of such soil will be converted into peat; and all fibrous vegetable matters, whether grasses, mosses, leaves, twigs, plants, shrubs, roots, and even trees, in fact all woody matter which may become enveloped therein, will, in process of time be converted into that dark brown pulpy substance.

Surface depressions, particularly where underlaid by water leaving clays or rocks—even upon the sides and tops of elevated lands—and most meadow lands holding or overflowed by water without intermittent drying, accumulate peat by the annual decomposition of the vegetation growing on the spot, or which may become immersed within it.

Some deposits of grass and moss peat predominate in fiber throughout, and often for a few feet only from the surface. This description is inferior to the pulped or decomposed vegetation. It is manipulated with difficulty and almost impossible to condense from its extreme sponginess and the elasticity of fiber. Except in very rare cases, and then at very considerable depth, all peats are spongy and retain their porosity after being dried, whatever may be the means used therefor, in which condition it has little commercial value as fuel; hence the necessity to condense it, which in fact is imperative, and to do this some mechanical means must be used to knead and break up the cellular structure.

A bed of peat is often more or less impaired by earth washings, particularly around its borders. This is caused by the water shed from adjoining elevated lands, or by freshet overflows from a bordering or bordered stream. Such adulterations may permeate those carboniferous accumulations of ages, from first to last, and consequently impoverish the peat throughout. Such cases, however, are seldom. Sedimentary washings rarely extend beyond a few feet from the escapement of the ground furnishing them.

This earthy matter is the chief cause of difference in the heating values of peat, and it will always be found admixed with the ashes, causing this residue to vary from two to fifty per cent of the original weight, beyond which it is difficult of combustion. Of course the less ash the better peat.

The color of peat when dry is no indication of its quality, whether it be light or dark brown, or even jet black.

Pine, fir, cedar, juniper, and cypress, furnish peat of more combustible nature than less resinous plants. Its commercial or heating value therefore differs considerably according to the nature of the original vegetation.

Peat consequently being the product of vegetable fiber or woody matter, decomposed and concentrated by chemical disintegration without the loss of an atom of the calorific power, it follows that in a condensed state it should have great heating properties.

The first step to be taken is to determine the quality of your peat. To do this, take a few pounds of peat from any convenient depth, and at proper distances from the border to escape the earth washings, if in such a locality, and where the peat is as free as possible from fiber. Dry the peat thoroughly in the air; then pulverize a portion, from which carefully weigh an ounce, say 480 grains, which place on a hot fire—coals are best—in a shallow vessel, covering the vessel loosely to exclude the air. A drip saucer to a common three-inch earthen flower-pot is a good vessel for the purpose.

As most air-dried unmanipulated peat contains about one-fourth its weight in moisture, this will pass off around the edges of the cover as vapor, and be succeeded by gas, which, ignited with a flame, yields a blueish, reddish, or bright flame, according to the character of the peat, the gas being hydrogen and carbon combined in different proportions. When the gas has ceased flowing remove the vessel with the cover still on and allow it to cool, after which weigh the charcoal with care—at the druggist's or doctor's if you have not the means to do so—being careful to note the weight in grains.

Having noted the time that the gas continued to burn, and as near as you can the color, write that down also, and next replace the charcoal on the fire but without the cover. The charcoal spread evenly over the vessel will soon ignite, and by absorbing oxygen from the air decompose and leave the ashes. This process may be slow but it must be thorough, requiring the mass to be occasionally stirred with some non-combustible article until all the sparks of coal have disappeared. Then remove carefully without losing any of the ashes and when cool weigh again. If the ash does not exceed twenty per cent of the weight you can proceed with further investigations, as the heating properties lie first in the gas, and secondly in the charcoal; the combustion of these two mediums determines the measure of calorific power. The weight of peat consumed being known by deducting the ashes and allowing for the moisture, gives directly that destroyed by combustion as the index of value.

For your next number I propose to furnish another paper upon harvesting and manipulating peat for heating use.

J. B. HYDE.

119 Broadway, New York.

Lamp Flames.

MESSRS. EDITORS:—If a lantern with a flat wick—the one noticed had the ordinary kerosene burner without chimney—is suspended by a cord and then rotated, the flame will assume a twisted shape like an auger, but strange to say the twist will go ahead of the wick instead of behind it; that is, if the lantern, as seen from above, rotates to the right, the twist of the flame will be left handed, instead of right as we would naturally suppose it should be considering the resistance of the air. Can your readers explain the cause?

R. F. H.

New York city.

Estimated Horse-power of Engines.

A correspondent, "Mathematician," of March 27, page 197, deprives the steam engine of its due, by deducting from its usually estimated power, what is required to propel the unprofitable part of its work, viz., the engine and gearing, before arriving at the work desired to be done.

The engine is entitled to credit for all the labor performed, useful or *useless*. "Mathematician" gives, as explaining his views, an engine of 30-horse power, making 75 revolutions when doing the intended work, but, when this work is detached, will make double the number of revolutions, "with the same amount and pressure of steam." Thence coming to the conclusion that twice the power, by the usual estimate, is developed, making the engine a 60-horse power when running empty, and a 30-horse when loaded, "which is absurd."

In the above example, the useful and *useless* work are considered equal, and the engine would, therefore, drive the *useless* alone, through double the space, and, of necessity, for the same amount of steam, under an expanded steam pressure of one-half the pressure on the combined work, which accords with the usual estimate, and *is rational*.

Pittsburg, Pa. T. W. B.

The Kindling-Wood Business---How it is Conducted.

There are at present in this city and Brooklyn about sixty wood-yards, where the business of sawing and splitting wood is carried on, and which furnish the inhabitants of the two cities with their kindling wood.

The largest quantity of the pine wood received here is furnished by the State of Virginia, particularly that portion of the State which is watered by the James and York Rivers. Delaware and Maryland send a large quota, but they are not so prolific in the production of pine as the first-named State.

The State of Georgia grows a great deal of pine wood, but it is not in as great demand, nor does it command the ready sale that the wood does that is raised in the States of Virginia and Maryland, as it contains too much pitch, which, when the wood is used for fuel, causes a very thick black smoke to arise from it, which blackens the housewife's culinary utensils, and clogs up the flues of the stove. Hence, for burning purposes, "Old Virginia" pine has the preference.

In some instances large dealers and speculators buy up large tracts of land covered with pine forests, and, after cutting it down, the wood is placed on board of schooners and brought to this city, where the consignees dispose of it to the smaller dealers. The heaviest shipments are made in the fall of the year, at which time it is no uncommon thing to see a fleet of fifty or sixty schooners laden with pine, anchored off the Jersey Flats, the headquarters for them on their arrival at this port.

A great deal of the wood, on its arrival at the yards, is cut up into kindling size, ranging from two and a half to eight and nine inches in length. The wood which is cut into pieces from two and a half to four inches in length, is tied up into small bundles, which are sold to the retail grocery dealers. The longer pieces are sold by the box, twelve of which boxes, when honestly filled, hold an ordinary load of wood.

There are some dealers who buy the wood already split at the yard, and peddle it about the city in their own wagons. Many of them have become so expert at the packing process that they manage to make half a load of split wood fill up twelve boxes, so as to deceive any one who does not take the trouble to examine the contents and to see how the wood is packed. These unprincipled dealers do not hesitate, when filling their boxes, to so arrange the sticks at the bottom that they form a kind of network, after which they fill up the box; and to those who are not up to the dodge they present the appearance of well-filled boxes, standing any amount of "shaking down." It therefore behooves those who buy their wood by the box from the peddlers, to stand by and see that the packages are honestly made up, otherwise they run the risk of being grossly swindled.

There are three ordinary loads in a cord of wood, and when wood is bought at the yard by the cord, as a great deal of it is, it is cut into as many lengths as desired, at a charge of $1·50 a cord, the number of lengths making no difference, as it is sawed by steam power; whereas the charge when sawed by hand, using a bucksaw, is $1·50 a load.

Boys from ten to fifteen years of age are employed at the yards to tie up the wood into bundles, for which they are paid twenty-five cents per 100 bundles. A smart boy can tie up on an average 600 a day, which enables him to make very fair wages.

A small machine is used which answers the double purpose of gaging the size of, and tightening the bundle. The machine consists of a rod of curved iron about a quarter of an inch in diameter, which extends above the bench, into which the pieces of wood are placed, and when this is filled, the boy places his foot on a lever below the bench, which is attached to the hoops encircling the wood, and by bearing his weight on it, causes the hoop to press the wood closely together.

There are about 800 bundles in a cord, and the present price per bundle, four cents when bought singly, foots up the snug little sum of $32 per cord. When bought at the yard by the cord the price ranges from $14 to $16. Poor people who are forced to buy their wood by the bundle are compelled to pay twice as much for it as the wealthy.

There is very little hard wood used for fuel, lighter wood being preferable, as it burns more readily. The hard wood is used principally for making mallets, wedges, etc.

Spring Diseases.

Reader! have you a mite, one solitary atom, of common sense? If you have, be persuaded to make a healthful use of it and commence on the instant. As soon as spring begins to set in, almost everybody has more or less a feeling of lassitude; there is less buoyancy, less of an appetite, less disposition to exercise; some are so indisposed that they have to keep in the house, and numbers take to their beds. All this is your own fault; it's because you have got no sense, not a particle; or, if you have, you do not make use of it. You can readily understand that now, as the weather is warmer, you do not require as much fire in the house; and may be you are wondering why the servants will persist in making the house hotter now than in the depth of winter; they are only burning as much fuel now as in mid-winter, and they have not the sense to know this, or at least they do not care to think. The human body is a house to be kept warm; and, to be in health, its heat must be maintained at the same temperature the year round—that is, about ninety-six degrees. The stomach is, in a sense, the furnace; the food put into it the fuel; the lungs set it on fire. Why, then, do you eat in warm weather as much as in cold weather? On a spring day, when scarcely any fire is needed in the house, you cram as much fuel into your stomach as in the depth of winter. You see now that you have not as much sense as Biddy; she is only trying to burn up your house, you are trying to burn yourself up with fever. A baby not three months old has too much sense to poke into its little finger into the candle twice, yet you are poking your whole gluttonous hulk, head foremost, every day into the furnace, and yet actually don't know what hurts you. You don't think; or, if you do, they are such diluted, milk-and-water "thinks," that a dime a load would be a bad bargain to the purchaser.

In adult life all the food we eat serves two purposes; it sustains and keeps warm. For the latter object meats, oils, butters, gravies, and sweets are used; hence, in warm weather, a comparatively small amount of these things should be eaten; but in their place take breads, fruits, vegetables, melons, and berries. Nature's instincts call loudly for the acids of berries and fruits, and for the earliest tender vegetables, the "greens" and the salads of our gardens. It is because they have no heating qualities; they are rather "cooling" in their nature. They who spend much of their time indoors, would enjoy an exemption from a great many bodily discomforts if, upon the first day of spring, they would begin to have meat for only one meal in the day, and in lessening quantities as the summer comes on.

[The above from our excellent cotemporary, *Hall's Journal of Health*, we indorse as, in the main, timely advice. But would it not be better, Doctor, to qualify the advice, and recommend a reduction of animal food in accordance with the consumer's occupation. A man at the "anvil" certainly requires more hearty food than the merchant or professional man. And in recommending fruits and berries, we know many persons on whom the acid of these articles acts injuriously. Admitting this, would it not be well to recommend persons to watch the effect of fruits and berries upon their systems, and if flatulency exists after partaking, had they not better substitute oat meal or other light food which the stomach does not repel?—EDS.

Shiftlessness of an Artist---What Came of it.

An artist in *Harper's Monthly*, says: "In the spring of 1841 I was searching for a studio in which to set up my easel. My 'house-hunting' ended at the New York University, where I found what I wanted in one of the turrets of that stately edifice. When I had fixed my choice the janitor, who accompanied me in my examination of the rooms, threw open a door on the opposite side of the hall and invited me to enter. I found myself in what was evidently an artist's studio, but every object in it bore indubitable signs of unthrift and neglect. The statuettes, busts, and models of various kinds were covered with dust and cobwebs; dusty canvases were faced to the wall, and stumps of brushes and scraps of paper littered the floor. The only signs of industry consisted of a few masterly crayon drawings and little luscious studies of color pinned to the wall.

"'You will have an artist for your neighbor,' said the janitor, 'though he is not here much of late; he seems to be getting rather shiftless, he is wasting his time over some silly invention, a machine by which he expects to send messages from one place to another. He is a very good painter, and might do well if he would only stick to his business; but, Lord!' he added, with a sneer of contempt, 'the idea of telling by a little streak of lightning what a body is saying at the other end of it! His friends think he is crazy on the subject, and are trying to dissuade him from it, but he persists in it until he is almost ruined.'

"Judge of my astonishment when he informed me that the 'shiftless' individual, whose foolish waste of time so excited his commiseration, was none other than the President of the National Academy of Design—the most exalted position, in my youthful artistic fancy, it was possible for mortal to attain—S. F. B. Morse, since much better known as the inventor of the electric telegraph. But a little while after this his fame was flashing through the world, and the unbelievers who voted him insane were forced to confess that there was at least, 'method in his madness.'"

The "Wave" Time of the Electric Telegraph.

We have already published a full account of the interesting experiment of transmitting telegraphic signals to San Francisco and back; but the Boston *Traveler* adds the following official figures from the records at Harvard College: "It was proposed to begin with a comparatively short loop, extending from Cambridge to Buffalo and back, and then to extend the loops successively to Chicago, Omaha, Salt Lake, Virginia City, and finally to San Francisco. The plan was put into execution on the nights of February 28 and March 7, and in both instances the results were extremely successful. It was quite fascinating to stand before two instruments, a few inches apart, and to see and hear a signal made upon one repeated on the other in a fraction of a second, after having traversed a distance of over seven thousand miles.

"Below is given a table which shows the time, to hundredths of seconds, occupied by a signal passing from Cambridge to each of the stations and back. The numbers of repeaters in the circuits are also given:

"TIME OF TRANSMISSION FROM CAMBRIDGE.

	Seconds.	
To Buffalo and return	0·10	1 repeater.
To Chicago and return	0·20	3 "
To Omaha and return	0·33	5 "
To Salt Lake and return	0.54	9 "
To Virginia City and return	0·70	11 "
To San Francisco and return	0·74	13 "

"The actual time of transmission, from Cambridge to San Francisco and back, does not probably exceed three-tenths of a second; the 'armature times' of the thirteen repeaters in all probability amounting to four or five-tenths of a second."

Paint for the Protection of Metals from the Action of Sea Water.

A paint for the protection of iron and other metals from the detrimental influence of sea water, and the prevention of "fouling," has been invented, and is made in England as follows:

30 parts of quicksilver.
7 " thick turpentine.
55 " red lead.

These materials are mixed with as much boiled linseed oil as is necessary to make a paint of the proper consistency. The quicksilver must be thoroughly amalgamated with the thick turpentine by grinding or rubbing, and this mixture must be ground with the red lead and more boiled oil. A little oil as is necessary to make the paint "lay" well must be used. In damp weather, some fine ground manganese may be added. To make this paint adhere more firmly, a previous coat of oxide of iron paint may be applied. The use of the quicksilver, turpentine, and red lead are the special features claimed by the inventors.

AMMONIA AS A REMEDY FOR SNAKE BITES.—In the last volume of *Transactions of the Royal Society of Victoria*, published at Melbourne, there was an account of Dr. Halford's interesting researches into the nature of the change produced in the blood by the poison of snake bites. The doctor worked with the microscope, satisfied himself that there was a change, and described it, and has since had an opportunity of testing his theory and his antidote. A man working on a railway was bitten by a snake: ere long, drowsiness came on; medical assistance was obtained, but by the time it arrived, the man was comatose, and his lower extremities were paralyzed. Dr. Halford was then summoned by telegraph: he made an incision in a vein, inserted the point of a syringe, injected ammonia diluted with water; and the effect produced is described as "marvelous and immediate." The man became conscious, steadily recovered, and became quite well. Henceforth, let all people who live in districts infested by poisonous snakes, remember that ammonia injected into a vein is the remedy for a bite.

STRAW HOUSES.—An English inventor has built some houses on a novel principle at New Hampton. The houses are of a cheap order designed for laborers. He compresses straw into slabs, soaks them in a solution of flint, to render them fireproof, coats the two sides with a kind of cement or concrete; and of these slabs the cottages are built. By ingenious contrivances, the quantity of joiners' work is much reduced, and the chimney is so constructed as to secure warmth with the smallest consumption of fuel, and at the same time to heat a drying closet. The cost of a single cottage of this description, combining "all the requirements of health, decency, and comfort," is eighty-five pounds. The commissioners on the employment of children, young persons, and women in agriculture, report favorably of these cottages.

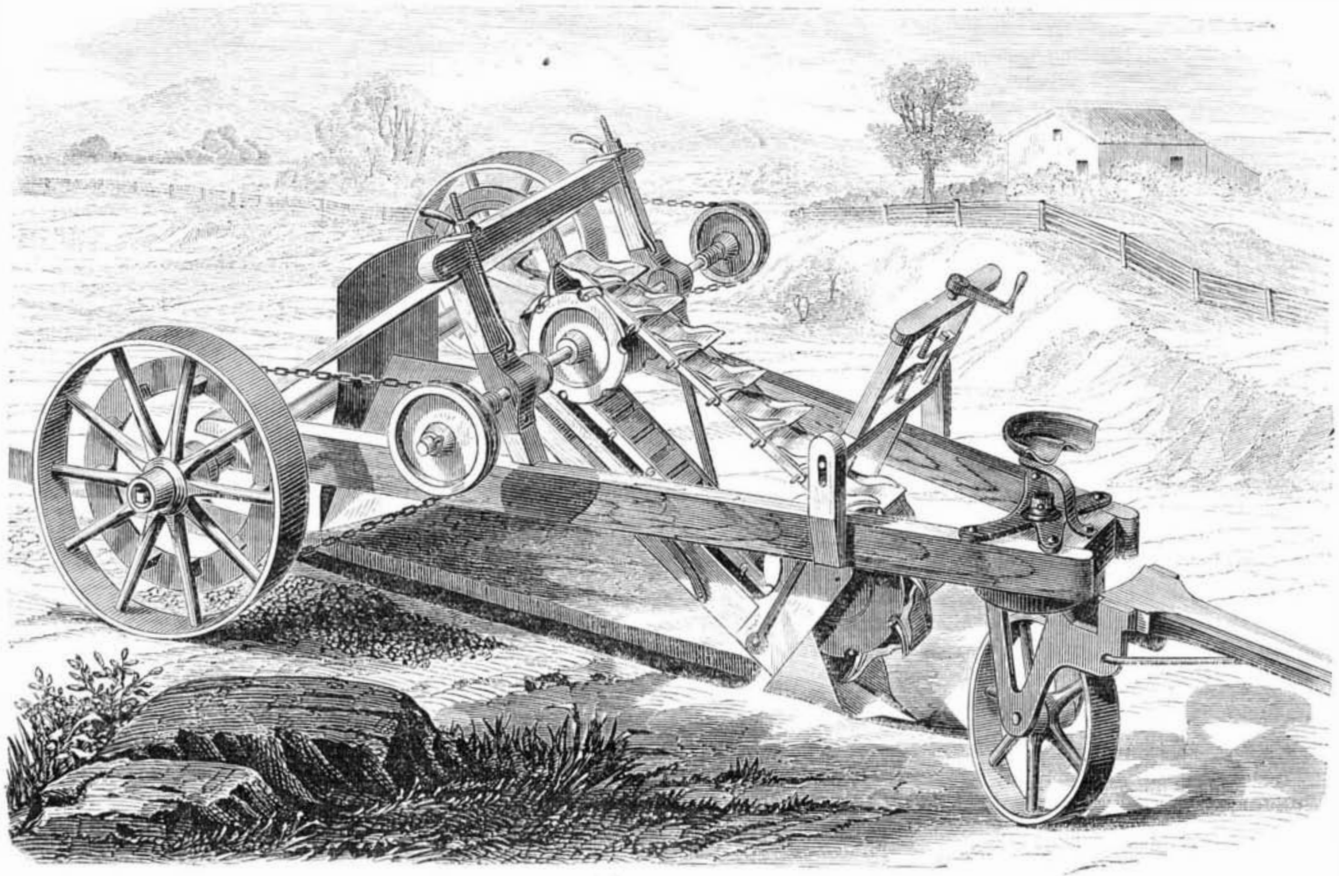
THE directors of the New York and New Haven Railroad have decided, as an experiment, to use wooden wheels on some of the cars upon their road. Quite a number of these wheels have been purchased, and will be substituted for the present iron ones on some of the new cars. They are understood to cost nearly treble the price of iron wheels, but are considered quite as cheap in the end. They are made of elm or teak wood, and bound with steel tires. Besides being less liable to break by the action of frost, they make less noise.

Improved Machinery for Excavating Ditches.

Draining the soil is an important process in agricultural operations and one demanding a large degree of hard labor, labor of the most arduous character; consequently the adaptation of machinery to ditching is very desirable; but most machines heretofore produced have been too costly and too cumbersome to come into general use. The machine shown in the accompanying engravings is intended to supply a want generally felt by farmers. It is comparatively light, easily worked, simple in its parts, and efficient.

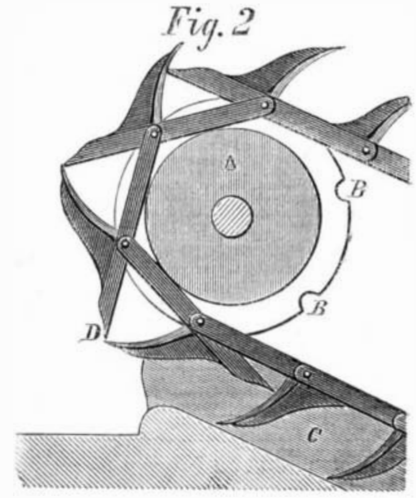
It consists, first, of a horizontal triangular frame, the wide or rear end of which supports the main axle, carrying two broad faced driving wheels. The apex or front end of the frame has a guiding wheel, swiveled by a king bolt to turn in any direction. The main axle has secured on it, just inside the driving wheels, two chain wheels of somewhat smaller diameter, which, by means of chains, give motion to a cross shaft hung on a transverse frame rising from the frame near the rear. This shaft, by means of a suitable wheel at its center, impels an endless apron composed of a series of scrapers which, at the front end, pass over a similar wheel near the ground. Under this endless apron is an inclined trough, adapted in depth and width to the scrapers, and armed at the lower end with a pointed plow. The depth to which this plow is adjusted is governed by a screw seen directly back of the driver's seat. When not working, the plow may be raised entirely above the surface by this means. An examination of the large engraving will explain these parts without the necessity of letters of reference.

Fig. 2 gives the details of the scrapers. A is a section of the upper wheel over which the scrapers pass. These are pivoted together about midway of their length; the pivots projecting to engage with the semi-circular recesses, B, on the flanges of the wheels. These pivots operate, also, as fulcra on which the scrapers turn. As the scrapers travel up the inclined trough, C, bringing the earth with them, they successively turn on the wheel, as seen, their projecting back ends sweeping the face of the scraper next in the rear until they assume the position represented at D, when the earth is thrown out and falls on a V-shaped incline that deposits it on either side of the excavation. This incline and guard are represented in the large figure.



CONARROE'S BUCKEYE DITCHING MACHINE.

Fig. 2



Patented, Nov. 19, 1867, by Robert Conarroe. A patent for recent improvements is now pending. For machines or other information, address Conarroe, Young, and Smyers, Hamilton, Ohio.

WRITE LEGIBLY AND INTELLIGENTLY.

The grand object of putting language on paper—of writing that others may read—is to give to the reader the ideas in the mind of the writer. This cannot be done if the writing is illegible. A large part of the annoyance of editors—those who attempt to give to the public the ideas of their correspondents through the organs (papers) they conduct—is occasioned by the neglect of their correspondents to write legibly. Not infrequently we receive articles containing *facts* that *should* see the light, and theories which should be brought to the notice of our thinkers; but they are frequently presented in such a garb that it is more than they are worth to pick out the grains of wheat from the ocean of chaff. Many of these communications have been laid quietly aside in our oblivion box, which if presented in any reasonable shape would have appeared in our columns. We do not allude only to valuable communications from those who have never had the advantage of a grammar school and do not understand the rules of orthography, but to those who have an idea on mechanical or scientific subjects but are themselves befogged and do not know how to present it, simply because they do not understand it.

If one has an idea, he should thoroughly understand it himself before he attempts to impart it to others. If he cannot put it into grammatical or journalistic form, that is his misfortune, and on this paper, as least, will not prevent him from a hearing from the great public reached by the Scientific American; but if he does not, himself, understand what he attempts to write about, it is too much to require that the editors of the the paper should do the work which his incompetency prevents him from accomplishing. If correspondents of newspapers and magazines would consider, never so slightly, the labor they impose upon editors in sending illegible and incongruous articles intended for publication they would take some pains to prepare their articles for their insertion.

GROSS' PATENT COMBINED LETTER OPENER.

The ordinary methods of opening letter envelopes by means of an ivory paper cutter, a knife, or the handle of an eraser, is slouchy and in many cases destructive to the envelope, the preservation of which is sometimes very important in settling disputes, either in or out of the courts. Very methodical men carefully cut the end of the envelope with scissors; but when the inclosed letter fills the envelope, as it frequently does, there is danger of mutilating the letter and its contents, which is not comfortable in the case of a dunning letter or one containing greenbacks. The engraving, however, shows two adaptations of a simple device intended for opening letter envelopes, and useful, also, for ripping seams in garments and similar purposes.

Fig. 1

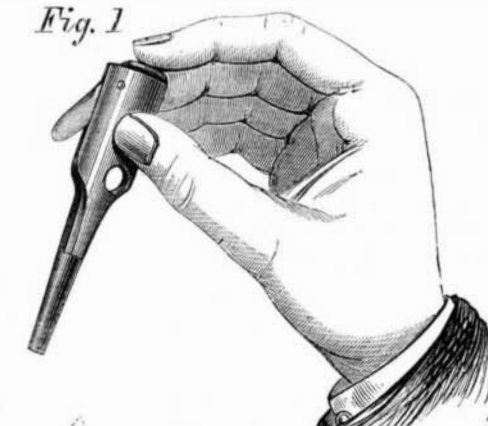


Fig. 2

Fig. 1 is the device in the form of a watch key, and Fig. 2 the same, forming the head of an ordinary lead pencil. The device is very simple: it is merely a blade, like a diminutive pen-knife blade, held in a sheath or handle of metal, and so formed and pivoted that a light spiral spring, inside the sheath, keeps the blade inclosed until pressure is applied by the finger to the projecting head of the blade. This construction is plainly seen in Fig. 2. In Fig. 1 the manner of using it is exhibited. It forms an ornament to the watch guard or a neat head to the pencil, to which it is attached by a screw thread in the socket.

Patented by Henry Gross, Sept. 8, 1868. All orders should be addressed to Gross, Lysle, & Co., Tiffin, Ohio.

Two large steamers, each 246 feet long, have just been despatched from New York to China. They are to sail on the Yangtse river.

SMALL-POX AND VACCINATION.

The scourge of small-pox has, it is well known, visited the city of San Francisco during the past season with frightful severity. Fears have been expressed that it would, in spite of the precautions taken to prevent its spread, visit the large towns in the Atlantic States. In view of these facts we copy from the *Pacific Medical and Surgical Journal*, facts upon which the public should be posted at all times, and which are of special value upon a threatened invasion of this horible disease.

"Small-pox does not tend to spread extensively in a city or district, unless quickened by an epidemic influence. It may exist in a city constantly, from year to year, a few cases at a time, without displaying an active contagion.

"During an epidemic aggravation *recent vaccination is the only safeguard*. Persons who have had small-pox, or who have been exposed to it in former years with impunity, as nurses and the like, are not secure from attack.

"The duration of an epidemic is from six months to a year. The disease seldom progresses steadily, but fluctuates without relation to the sensible changes of climate. Winter is the season most favorable to its prevalence.

"During an epidemic of small-pox, other diseases are more frequent and more fatal.

"Foul emanations from sewers and so forth have little to do with it. They affect the general health, but do not promote in a marked degree the spread or duration of the epidemic.

"When the disease is not epidemic, the morbific germs emanating from a patient soon lose their vitality. But when an epidemic influence prevails, these germs resist decay and infect the entire atmosphere. They do not cause sickness unless the condition of the individual be favorable to their development. In an infected city, many persons—perhaps most of the inhabitants—receive them in the blood without injury.

"Disinfectants, such as chlorine, carbolic acid, the fumes of sulphur, etc., will not destroy the germs of small-pox, unless they are strong enough to destroy human life. Sunlight, air, and heat are the best disinfectants. Clothing is perfectly disinfected by baking in an oven, or exposure for a short time to a heat at or above that of boiling water.

"The period of most active contagion is after the appearance of the eruption and during the process of scabbing. It is questioned by some good authorities whether the disease is contagious at all prior to the formation of pustules.

"Vaccination will not take perfectly a second time in more than one or two out of every one hundred persons.

"It will take partially, with some resemblance to the genuine cow-pox, in twenty-five per cent of the cases. Here the presumption is that re-vaccination was useful.

"A large scar is no evidence of genuine vaccination, nor is a large and painful sore. A spurious pustule is apt to be worse than the genuine vaccina.

"When re-vaccination is not followed by itching, or any other effect, it should be repeated. The virus may not have been active.

"No other matter should be employed than the lymph or crust from the first vaccination of a healthy child; or that taken from the cow. There is less uncertainty in the former than the latter.

"The crust should never be kept long after mixing it with water. It develops a virulent poison.

"Evacuation of the pustules is advised not only to prevent pitting, but as possibly serviceable in lessening danger from secondary fever, and as a case in point it is stated thus: An entirely unexpected recovery of a very bad case, was effected by the patient opening of the pustules and wiping away of the matter by the wife of the patient, rapid improvement taking place at the time when the dreaded secondary fever should have set in."

India Rubber Liquid Blacking.—Take of ivory black, sixty pounds; molasses, forty-five pounds; gum-arabic dissolved in a sufficient quantity of hot water, one pound; vinegar, twenty gallons; sulphuric acid, twenty-four pounds; India rubber, dissolved by the aid of heat in nine pounds of rape seed oil, eighteen ounces; mix them well together. This blacking may be applied by means of a small sponge, attached to a piece of twisted wire, like the well-known Japan blacking.