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Self-Propelling Rotary Steam Plow.

In forwarding to us the drawings from which our engraving is made, Col. Saladee accompanies them with the following comments and description of his invention, which will be read with interest by all persons interested in agricultural science on an extensive scale :—

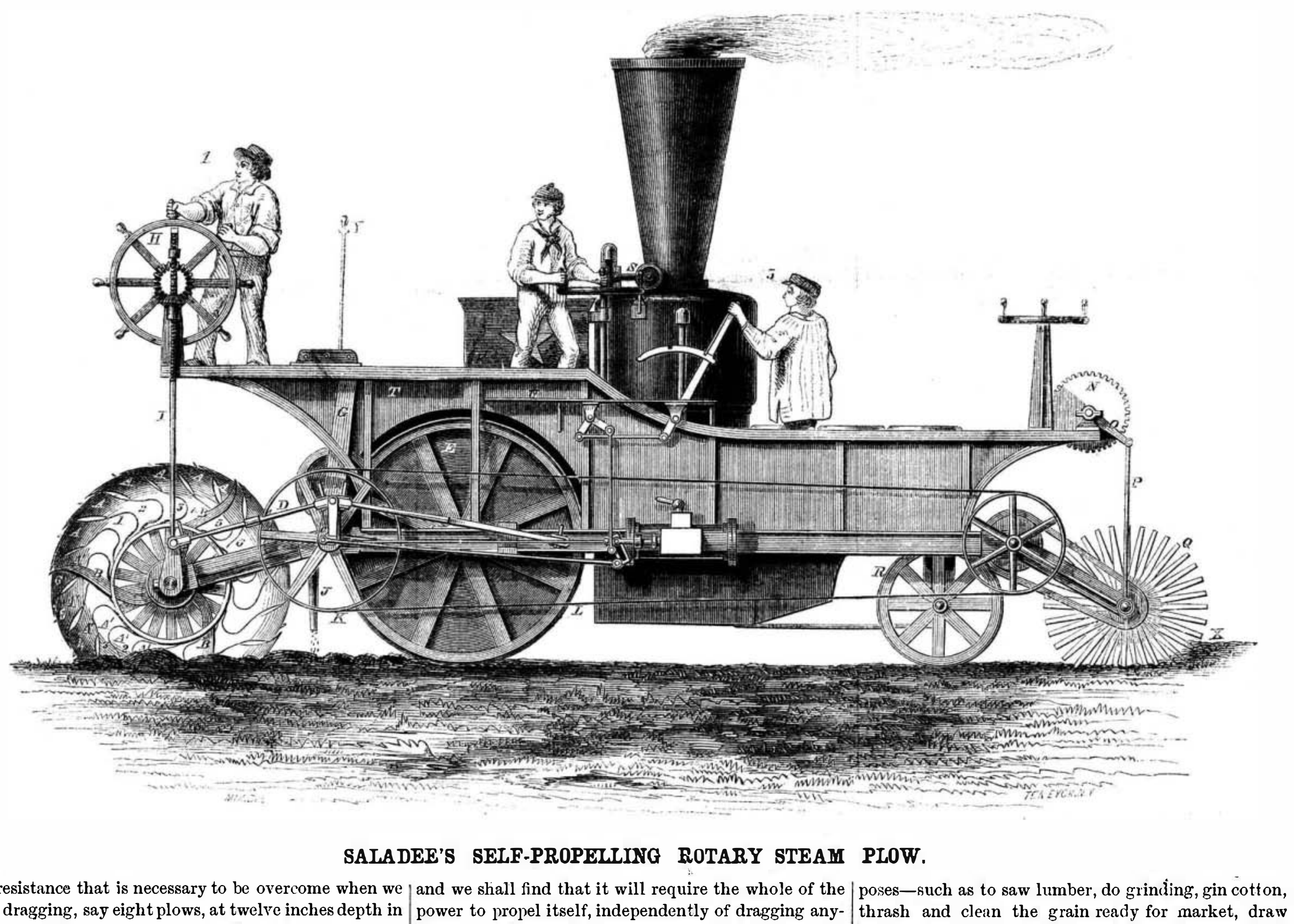
In devising a steam plow there is no idea which seems so naturally to present itself to the mind of the inventor as that of a traction engine, which shall be so constructed as to propel its own ponderous weight, and drag a certain number of plows after it. But past experiments upon this principle have shown a very serious difficulty in the way of its success.

In the first place, we have to consider the amount of resistance that is necessary to be overcome when we are dragging, say eight plows, at twelve inches depth in the ground, before we can decide upon the proportions and weight of a traction engine intended to draw them. And if we shall find that this number of plows, when cutting in a stiff prairie sward at the depth above mentioned, will require a power to draw them equal to that required by any of our heavy freight trains upon the iron rail, we shall perceive the great amount of traction that must be imparted to an engine that will be sufficiently powerful for the execution of its work. It is a principle well understood, that to increase the power of a traction engine to any desired point, a corresponding weight must be imposed upon it ; and that just in proportion as the weight is increased, we magnify the difficulty of propelling it over a soft and yielding surface. And, therefore, when we call into requisition this traction principle upon a yielding soil, we are at once confronted with this palpable objection to it. A twenty-tun engine upon the iron rail can exert a power to draw an immense train ; but if it is placed upon that character of ground over which the steam plow is expected to pass, the weight which in its former condition is the source of its great power, will in the latter condition make it a helpless, worthless machine.

It is true, however, that several of our inventors have partially succeeded in plowing upon this principle ; but their operations seem to have been wholly confined to firm sward plowing, which, in many instances, gives a solid foundation for the massive engine to work upon. But take this 16 or 20-tun machine upon the light ground of an old cultivated field, and we shall find that it will require the whole of the power to propel itself, independently of dragging anything after it.

My invention, which is illustrated by the annexed engraving, exactly *reverses* the principle above considered. In place of using an engine which shall possess the capacity of propelling itself, and to *drag* the plows in the old way, I make the rotary action of my 18 moldboard plows, A A A, upon the ground to *propel* the machine, involving, in fact, the same principle as the action of the wheel upon the water in propelling a boat. I thus most effectually overcome the difficulty which manifests itself upon the *traction* principle ; for upon this plan I am in no sense dependent upon the *weight* of the engine, which is so absolutely necessary in the other case ; but on the contrary, I am permitted to study the *lightness* of the thing, and thus render the machine capable of passing over any species of ground.

Here, then, is a great point attained ; and while this invention embraces that advantage, it, at the same time, embodies into the *one* machine the capacity for doing a greater variety of farm and plantation work than has ever before been attempted in any machinery of a similar character ; indeed, it is capable of performing all the various kinds of farm and plantation work to which the steam engine can possibly be applied. And thus in one simple machine we have the means of plowing, sowing the seed, rolling and harrowing the ground at *one* operation, if that is desired. Or it can be used for plowing alone, or for plowing and harrowing, as the case may be. When in the field it is capable of propelling itself to any point upon the farm or plantation where it may be wanted for other purposes—such as to saw lumber, do grinding, gin cotton, thrash and clean the grain ready for market, draw water, saw the wood consumed by itself ; or it may be used as a locomotive to drag the loaded wagon or "truck" over the prairie, or to operate the mammoth mowing machine built for it by Messrs. Fisher, Shalters & Co., of Alliance, Ohio, cutting a swath nine feet wide.



SALADEE'S SELF-PROPELLING ROTARY STEAM PLOW.

The peculiar construction and operation of this machine will be fully comprehended from the following detailed description of its various parts :—

The main weight of the machine is imposed upon the revolving drum, E, which is 6 feet 2 inches in diameter and 7 feet across, and is separated in the center, so that each part is acted upon independently of the other, for the purpose of facilitating the turning of the machine, as will presently appear. The front extremity of the machine is supported upon two wheels, R, 3 feet 6 inches in diameter, and each having a face tread of 15 inches. These wheels are connected to the steering arrangement which is acted upon by operator 2, while standing upon the platform, U, and taking hold of the steering wheel, S. The main body of the machine is 9 feet wide, and that portion of it where stands operator 3, is divided into three spaces; the center, from the boiler back is 4 feet wide, and the spaces on either side of this are taken up for the wood or fuel boxes. The water is carried in the tank, F, which extends across the full width of the machine, and will hold 900 gallons. The space, T T, is occupied by the seed box, which also extends the full width of the machine. This box is capable of holding 25 bushels of grain, and in the bottom is provided with the arrangements for distributing the seed into the pipes, J, (24 in number) and through which it is cast upon the ground. From this end of the machine extend two radius bores, on the outer ends of which is secured the revolving shaft forming the center of the plows, A. This plow-shaft has cranks, C, at both ends, one set at right angles with the other, and acted upon by double engines through the connecting rods, D. This shaft has secured to it 18 moldboard plows, A, and a corresponding number of coulters, B. They are placed in three spiral rows around the shaft, 6 coulters and 6 plows in each. But, to illustrate this more fully, let us suppose coulter, B, is in the ground and closely pursued by the first plow, A^1, which also is in to its full capacity, and in the act of turning the ground from the moldboard. The next plow, A^2, is on the further side of the first plow, A^1, and set back, so that while the first plow is in to its full capacity, No. 2 is but *half*-way on, No. 3 but one-third the way, while A^{14} is just entering, and the remaining two in this row, 5 and 6, are clear of the ground. The next spiral row of these plows, A^1 A^2 A^3 A^4 A^5 A^6, take the same curve around the shaft as does the first row, so likewise the third row. Now it will be observed that as this shaft holding these 18 plows revolves, there will be one plow an equal distance in advance of the other the whole way round, and thus the first plow, A^1, clears its furrow to receive the dirt from the moldboard of plow A^{12}, and this for A^{13}, and so on around until every plow has cut in its regular order, plowing a swath 7 feet wide, and varying in depth from 6 to 18 inches as may be required. The arms by which the plows and coulters are secured to the revolving shaft, are so connected to the latter that either one may be readily removed by simply taking out the two bolts that hold each to its place. These plows are raised or lowered by means of the long screw rods, I (one at each end of the shaft), which are connected to the hand wheel, H, in such a manner as to permit said rods to assume the various lines of position they must take in turning round either one way or the other. While the plows are at work, operator No. 1 has his hand constantly upon the wheel, H, and thereby regulates the depth at which they are wanted to cut, and by the same means adjusts them to any irregularities there may be upon the surface over which the machine is passing; and when the machine arrives at the end of the "land" on which it is working, to raise them entirely clear of the ground, and so to hold them until the machine is turned and ready to start in again, when they are instantly lowered to their work as before. And this is done without being at the trouble of *stopping* the action of the plows; for when raised out they continue to revolve the same as when in the ground. Indeed it is not necessary to stop the engines at all while the machine is at work.

In the first experiment made by me upon this principle of plowing, I found that when I applied power enough to revolve the plows at 8 inches deep, I had infinitely more power than was necessary to propel the machine; so that in place of plowing the ground clean, but a piece of the soil would be taken out here and there, just sufficient to catch the necessary resistance upon the ground to carry along the machine. Now, then, for the purpose of obviating this difficulty, it was necessary to interpose a gearing between the action of the plows and the main supporting drum, E, that should regulate the forward movement of the latter in proportion to the cut made at each revolution of the plows. This gearing is connected to the power shaft, C^1, which extends across the machine immediately back of the drum, and connected to it by shifting pinions, which mark into trundles connected to the inside ends of said drums; and by the interposition of different-sized shifting pinions, the plows may be regulated to cut any quantity of land at each revolution that may be desired, varying from 18 to 36 inches—so that by this arrangement it is as impossible for the machine to travel faster than the plows are capable of cutting away the ground, as it is for the log upon the saw-mill carriage to advance faster than the saw is capable of cutting away the wood. One acts with the other, so that the machine is made to travel in the exact proportion dictated by the plows or *vice versa*. Between the frame of the machine, on both sides and the crank, C, to the power-shaft, is placed the belt wheels, K, 4 feet in diameter and 5 inch face. The harrow, Q, receives its motion from said belt wheels, K, through the medium of the belts, L. The shaft to the harrow is the same length of the plow-shaft, and marks the same width of land (7 feet). The teeth are likewise placed in a spiral form around the shaft, the same as are the plows and coulters. It is raised and lowered by the handwheel M, worm-wheel N, lever O, and perpendicular rod P. And the harrow being made to revolve with a much greater rapidity than the plows, has a tendency to "bed-up" and lighten the ground as shown at X. The levers, Y, on the stand of operator No. 1, are designed to throw in or out of gear the shifting pinions before mentioned, so that in turning the machine, that drum on the inside of the circle being described by the machine, is thrown out of gear, thus leaving the engine to act entirely upon the outside one, and thereby facilitate the turning, on precisely the same principle of stopping one wheel, and going ahead on the other, in turning a side-wheel boat. The machine, in its present position, is represented as having the plows in front, and the drums and steering wheels passing over the plowed ground. This is necessary only when the machine is worked upon cultivated soil, when it may be wanted to plow and harrow at once, or when performing the whole operation of plowing, sowing, rolling and harrowing. But when worked upon prairie soil, or other ground that is only to be plowed, this order of things is reversed. In this case the plow-shaft is turned end for end; so as to throw the point of the plows the other way, the belts, L, are removed, the harrow hoisted clear up out of the way (or entirely detached from the machine), and the engines reversed, and the machine travels the other way upon the unplowed ground, while the plows work in the rear. This machine requires but two men and a boy to operate it, man No. 1 to regulate the depth of the plows, and throw in and out either one of the drums by levers, Y, when in the act of turning. Man No. 2, standing upon the platform, U, puts on and cuts off the steam as required, and steers the machine by the wheel, S, and boy, No. 3 "fires-up" and raises and lowers the harrow by wheel, M. When used as a stationary engine, for such purposes as before mentioned, the machine is propelled to the place where it is wanted, both pinions connected to the drums, thrown out of gear, and it will remain at rest while the engines act only upon the belt-wheels and the plows, which latter being, in this case, suspended clear of the ground, serve as an immense "fly-wheel;" but if not wanted for this purpose, the connecting rods, D, are removed, and the belt-wheels alone are acted upon by the engines, from which arrangement power may be had for all kinds of work to which any portable engine may be applied. When used as a traction engine, the plows and all their connections are removed, so likewise the harrow and its connections, when we have as perfect a model for a locomotive engine to draw loaded trucks or wagons over our prairies, or upon level roads, as can well be imagined or desired to its weight, which is between 7 and 8 tuns. In this condition the machine is used for operating the large mowing machine before referred to. The mower is attached to the right-hand side of the machine, in such manner as to have the "cutter bar" operate directly opposite the point of bearing of the drum, E, and the required distance from the ground. The cutters are set in motion, with any degree of rapidity that may be desired, from the belt-wheel, K. The machine is also provided with the necessary means by which to raise or lower the cutter-bar instantly, when passing over the ground.

The above engraving is taken from the working drawings, from which this machinery is now being built by Hunsworth, Eaken & Co., of the People's Works, Philadelphia, to the order of the inventor.

The plans by which I propose to arrange and manage a farm or plantation upon which the steam plow is to be permanently introduced, I will furnish you in a week or two for publication. After much investigation I consider this invention, and the system by which it is to be operated, as the most perfect and practical, in all its parts and appliances, that has yet been suggested; and I am confident that steam cultivation upon this principle, can be made a positive success.

Application for patents on this invention is now pending.

Further information in reference to this invention may be had by addressing the inventor, Col. C. W. Saladee, Island City Hotel, Galveston, Texas.

Diphtheria.

The extensive prevalence of this alarming disease in this vicinity, and the general desire which is felt for knowing more about it, induces us to extract from the *Medical and Surgical Reporter* the following pertinent and positive statements of the Standing Committee of the Medical Society of the State of New Jersey, which are embraced in the report made at the meeting on the 22d and 23d of January:—

Diphtheria is regarded, in all the reports, not as a local affection but as a blood disease, and of a specific character, distinct, in the opinion of most of the observers, from scarlatina and cynanche trachealis. Its diagnostic symptom is expressed in its name. The membrane or membranous exudation forms patches, and becoming, more or less, continuous over the velum palatia, fauces and adjacent parts, includes, in the more severe and mostly fatal cases, the larynx and trachea. It prevails epidemically, either by infection or contagion, or under malarious influences, just as scarlet fever and the other exanthemata. It is not attended with an eruption. It is, with few exceptions, a disease of low grade, requiring tonic and not depleting remedial measures. It is epidemic in high, well-drained and non-malarious districts, as well as in insalubrious, low, marshy regions, and lastly, though not less important, on that account, it is, though often fatal, a disease as readily controlled by judicious and careful treatment as any other grave disease. Dr. Bacon, of Cumberland, reports eight deaths in two hundred cases; Dr. Rosenberger, of Hunterdon, reports three deaths in eighty cases; Dr. Southard, of Essex, four deaths in forty cases. This is a mortality of about four per cent. Others report a moderate prevalence of the disease, but in a mild and benignant form.

The views of the reporters in regard to the treatment are remarkably uniform. Indeed, no one can read these reports without being impressed with the fact that there are well-established and well-defined principles of treatment which direct the physician in his management of morbid phenomena. The treatment recommended is constitutional and local. When asthenia characterizes the affection, as was the case in most districts noticed, tonics and stimulants, with beef tea, and other supporting measures, were adopted and recommended as usually successful. The tinct. ferri sesquichloridi, ten to fifteen drops in water, every three or four hours, with chlor. potassæ and quinia, brandy and brandy with milk; chloric, ether, &c., are the articles chiefly recommended. For the local affection, nitrate of silver in solution, twenty to fifty grains to the ounce, sulph. of zinc and tannic acid were used with more or less benefit. The disease, though new here as an epidemic, yet there can be no doubt that it has always occurred sporadically. This is the opinion based upon the experience of the committee.

In regard to the constitutional character of the disease, Professor Pepper, of the University of Pennsylvania, says:—"Diphtheria is not a local affection; it must be owing to some particular condition of the blood. The diphtheritic exudation is not confined to the throat. A blister on the leg of a person will become covered with the deposit, and the patient may become attacked with severe and constitutional affections, and die sometimes, independently of the local disease, when the blood is in this condition."

Gas for the British Navy.—The result of the experiments now being made by order of the Board of Admiralty at the steam factory at Woolwich dockyard, England, for the purpose of testing the availability of Major Fitzmaurice's contrivance for supplying the ships of Her Majesty's fleet with gas, will be to secure the application of gas on shipboard in all cases. The gas could be manufactured in the engine or boiler room at a very small expense. The gasometer could be placed at any convenient position in the ship, and the burners are thence supplied precisely as the various burners in a dwelling house are furnished from the main.

The Illinois Central Railroad forwarded in the month of January seventy thousand tuns of freight. Among the prominent articles were:—147,062 bushels of wheat, 1,131,630 bushels of corn, 133,945 bushels of oats, 28,892 barrels of flour, 2,634 barrels of whiskey, 12,232 barrels of pork, 1,841 barrels of lard, 1234 tuns of hay, 703 barrels of sugar, 3,189 hogsheads of sugar, 2,417 barrels of molasses, 3,787,590 pounds of dressed pork, 2,229 head of cattle, 13,578 live hogs.

THE CHEMICAL HISTORY OF A CANDLE.

By Professor Faraday.

A Course of Six Lectures (adapted to a Juvenile Audience) Delivered before the Royal Institution of Great Britain.

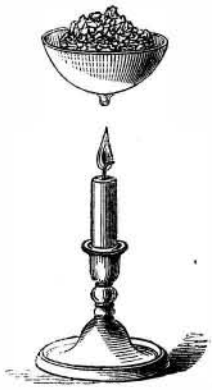
LECTURE III.

Products: Water from the Combustion—Nature of Water—A Compound—Hydrogen.

I dare say you well remember that when we parted we had just mentioned the word "products" from the candle. For when a candle burns we found we were able, by nice adjustment, to get various products from it. There was one substance which was not obtained when the candle was burning properly, which was charcoal or smoke, and there was some other substance that went upward from the flame which did not appear as smoke, but took some other form and made part of that general current which, ascending from the candle upward, becomes invisible and escapes. There were also other products to mention. You remember that in that rising current having its origin at the candle, we found that a part was condensible against a cold spoon, or against a clean plate, or any other cold thing, and part was incondensible.

We will first take the condensible part and examine it, and, strange to say, we find that that part of the product is just water—nothing but water. I last time spoke of it incidentally, merely saying that water was produced among the condensible products of the candle; but, to-day, I wish to draw your attention to water that we may examine it carefully, especially in relation to this subject, and also with respect to its general existence on the surface of the globe.

Now, having previously arranged an experiment for the purpose of condensing water from the products of the candle, my next point will be to show you this water, and perhaps one of the best means that I can adopt for showing its presence to so many at once, is to exhibit a very visible action of water, and then to apply that test to what is collected as a drop at the bottom of that vessel. I have here a chemical substance discovered by Sir Humphry Davy, which has a very energetic action upon water, which I shall use as a test of the presence of water. If I take a little piece of it—it is called potassium, as coming from potash—if I take a little piece of it, and throw it in that basin, you see how it shows the presence of water by lighting up and floating about, burning. I am now going to take away the candle which has been burning underneath the vessel containing ice and salt, and you see a drop of water—a condensed product of the candle—hanging from the under surface of the dish. I will show you that potassium has the same action upon it as upon the water in that basin in the experiment we have just tried. See! it takes fire and burns in just the same manner. I will take another drop upon this glass slab, and when I put the potassium on to it you see at once, from its taking fire that there is water present. Now, that water was produced by the candle.



In the same manner, if I put this spirit lamp under that jar, you will soon see the latter become damp from the dew which is deposited upon it—that dew being the result of combustion; and I have no doubt you will shortly see, by the drops of water which fall upon the paper below, that there is a good deal of water produced from the combustion of the lamp. I will let it remain, and you can afterwards see how much water has been collected. So, if I take a gas lamp and put any cooling arrangement over it, I shall get water—water being likewise produced from the combustion of gas. Here, in this bottle, is a quantity of water—perfectly pure, distilled water, produced from the combustion of a gas lamp—in no point different from the water which you distill from the river, or ocean, or spring, but exactly the same thing. Water is one individual thing, it never changes. We can add to it by careful adjustment, for a little while, or we can take it apart and get other things from it, but water, as water, remains always the same, either in a solid, liquid or fluid state. Here again [holding another bottle] is some water produced by the combustion of an oil lamp. A pint of oil, when burnt fairly and properly, produces rather more than a pint of water. Here, again, is some water produced by a rather long experiment, from a wax candle. And so we can go on with almost all combustible substances, and we find that if they burn with a flame, as a candle, they produce water. You may make these experiments yourselves; the head of a poker is a very good thing to try with, and if it remains cold long enough over the candle, you may get water condensed in drops on it; or a spoon, or ladle, or anything else may be used, provided it be clean, and can carry off the heat, and so condense the water,

And now—to go into the history of this wonderful production of water from combustibles, and by combustion—I must first of all tell you that this water may exist in different conditions, and although you may now be acquainted with all its forms, they still require us to give a little attention to them, for the present, so that we may perceive how the water, whilst it goes through its Protean changes, is entirely and absolutely the same thing, whether it is produced from a candle by combustion, or from the rivers or ocean.

First of all, water when at the coldest is ice. Now, we philosophers—I hope that I may class you and myself together in this case—speak of water as water, whether it be in its solid, or liquid or gaseous state—we speak of it chemically as water. Water is a thing compounded of two substances, one of which we have derived from the candle, and the other we shall find elsewhere. Water may occur as ice; and you have had most excellent opportunities lately of seeing this. Ice changes back into water; and on our last Sabbath we had a strong instance of this change by the sad catastrophe which occurred in our own house, as well as in the houses of many of you. Ice changes back into water when the temperature is raised; water also changes into steam when it is warmed enough. The water which we have here before us as ice, is in its densest state, and although it changes in weight, in condition, in form, and in many other qualities, it is still water; and whether we alter it into ice by cooling, or whether we change it into steam by heat, it increases in volume—in the one case very strangely and powerfully, and in the other case very largely, and strangely and wonderfully. For instance, I will now take this tin cylinder, and pour a little water into it, and seeing how much water I pour in, you may easily estimate for yourselves how high it will rise in the vessel; it will cover the bottom about two inches. I am now about to convert the water into steam, for the purpose of showing to you the different volumes which water occupies in its different states of water and steam.

Let us now take the case of water changing into ice; we can effect that by cooling it in a mixture of salt and pounded ice—and I shall do so to show you the expansion of water into a thing of larger bulk when it is so changed. These bottles [holding one] are made of strong cast iron, very strong and very thick—I suppose they are the third of an inch in thickness; they are very carefully filled with water so as to exclude all air, and then they are screwed down tight. We shall see that when we freeze the water in these iron vessels, they will not be able to hold the ice, and the expansion within them will break them in pieces as these [pointing to some fragments] are broken, which have been bottles of exactly the same kind. I am about to put these two bottles into that mixture of ice and salt for the purpose of showing that when water becomes ice, it changes in volume in this extraordinary way.

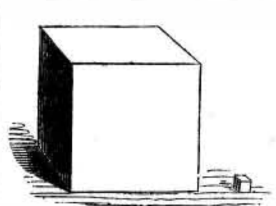
In the meantime, look at the change which has taken place in the water to which we have applied heat; it is losing its fluid state. You may tell this by two or three circumstances. I have covered this glass flask—in which water is boiling—over with a watch glass. Do you see what happens? It rattles away like a valve chattering, because the steam rising from the boiling water sends the valve up and down, and forces itself out, and so makes it clatter. You can very easily perceive that that flask is quite full of steam, or else it would not force its way out. You see also that the flask contains a substance very much larger than the water, for it fills the whole of the flask over and over again, and there it is blowing away into the air; and yet you cannot observe any great change in the bulk of the water, which shows you that its change of bulk is very great when it becomes steam.

I have put our iron bottles containing water into this freezing mixture that you may see what happens. No communication will take place, you observe, between the water in the bottles and the ice in the outer vessel. But there will be a conveyance of heat from one to the other,, and if we are successful—we are making our experiment in very great haste—I expect you will by-and-by, so soon as the cold has taken possession of the bottles and their contents, hear a pop on the occasion of the bursting of the one bottle or the other, and, when we come to examine the bottles, we shall find their contents masses of ice partly inclosed by the covering of iron which is too small for them, because the ice is larger in bulk than the water. You know very well that ice floats upon water; if a boy falls through a hole into the water, he tries to get on the ice again to float him up. Why does the ice float? Think of that, and philosophize. Because the ice is larger than the quantity of water which can produce it, and therefore the ice weighs the lighter, and the water is the heavier.

To return now to the action of heat on water. See what a stream of vapor is issuing from this tin vessel. You observe, we must have made it quite full of steam to have it sent out in that great quantity. And now, as we can convert the water into steam by the application of heat, we convert it back into liquid water by the application of cold. And if we take a glass or any other cold thing, and hold it over this steam, see how soon it gets damp with water; it will condense it until the glass gets warm—it condenses the water now running down the sides of it. I have here another experiment to show the condensation of water from a vaporous state back into a liquid state, in the same way as the vapor, one of the products of the candle, was condensed against the bottom of the

dish and obtained in the form of water; and to show you how truly and thoroughly these changes take place, I shall take this tin flask, which is now full of steam, and I shall close the top. We shall see what takes place when we cause this water or steam to return back to the fluid state by pouring some cold water on the outside. [The lecturer poured the cold water over the vessel, when it immediately collapsed.] You see what has happened. If I had closed the stopper and still kept the heat applied to it, it would have burst the vessel; yet, when then the steam returns to water the vessel collapses, there being a vacuum produced inside by the condensation of the steam. I show you these changes for the purpose of pointing out that in all these occurrences there is nothing that changes the water into another thing; it still remains water, and so the vessel is obliged to give way and is blown inward, as in the other case, by the further application of heat, it would have been blown outward.

And what do you think the bulk of that water is when it assumes the vaporous condition? You see that cube [pointing]; it is a cubic foot. There, by its side, is a cubic inch, it is square, exactly the same shape as the cubic foot, and that bulk of water [the cubic inch] will make that bulk [the cubic foot] of steam, and the application of cold will contract that large quantity of steam into that small quantity of water. [One of the iron bottles burst.



at that moment.] Ah! There is one of our bottles burst, and here you see is a crack down one side, an eighth of an inch in width. [The other now exploded, sending the freezing mixture in all directions.] This other bottle is now broken; and although the iron was nearly half-an-inch thick, the ice has burst it asunder. These changes always take place in water; they do not require to be always produced by artificial means, we only use them here because we want to produce a small winter round that little bottle, instead of a large one. But if you go to Canada or to the North, you will find the temperature there out-doors will do the same thing as has been done here by the freezing mixture.

Machine-made Chains.

Machinery has been perfected in America, says the *London American*, for the manufacture of chains of every description. The smallest chains as well as the largest are constructed with a surprising rapidity and exactness. Those for trimming jewelry, little larger than an ordinary pin to the largest ship cables.

The machines for the manufacture of watch and other small chains have been brought from America, and are now used at Birmingham, each doing the work of fifty hands, and more perfectly than it is possible to accomplish it by manual labor.

The machines for manufacturing cables have not, we believe, been used in this country, though for some time employed to a limited extent in America. Many of the cables, we may say the great majority, with which the American marine is furnished are now manufactured by the old process in the iron districts of England. For this and other purposes a large amount is yearly imported.

If the chain makers of Wolverhampton desire to retain this foreign trade, or even the domestic trade, they must follow the wise example of the Birmingham gold chain makers in introducing these labor-saving machines. We learn a company has been organized in New York, with a capital stock of $1,000,000, for the purpose of manufacturing chains of every description. They are to manufacture with machinery invented by a gentleman who has spent thirteen years in perfecting it, and for which invention they have paid him the sum of three hundred thousand dollars, or more than £60,000.

Iron and Wooden Ships.

In a letter to the *Times*, referring to the absence of all provisions for the construction of iron-coated ships in the new year's programme for the American navy, Mr. J. Scott Russell writes as follows:—"The explanation is the simplest possible. The entire mercantile steam navy of Great Britain, with the exception only of some old vessels, is of iron. The entire mercantile steam navy of America, without any exception known to me, is of wood. The reason is obvious. Timber is one of the staples of America, and we are obliged to import large quantities of it from America into England. Iron is the staple of England, and America is obliged to import large quantities of it from us. Hence, America builds timber vessels far cheaper than we can. We build iron vessels far cheaper than America can. With these facts before us we can readily infer—1. That there are no establishments, manufactories, or skilled artificers in America prepared for the business of iron shipbuilding. 2. That the introduction of iron in substitution for wood gives to England (the country of iron) the means of attaining and maintaining an ascendency over any other country in the matter of iron fleets. 3. We see why in wooden ships America had the advantage over us, and she had the wit to use it. 4. She now sees clearly that we have in future the advantage over her, and she waits to see if we have the wit to work it."

Importance of Good Quality in Iron.—A writer in the London *Quarterly Review* on the iron trade states, that the necessity of employing good iron for rails is now so generally acknowledged, that, in order to insure a superior quality, one of the greatest railway companies in England have established works to manufacture their own iron; and another company, not less important, are just about to follow their example. The writer also thinks that the loss of so many iron ships is to be attributed to the bad quality of metal used in their construction; coinciding in this matter with the opinions repeatedly expressed in the Scientific American.

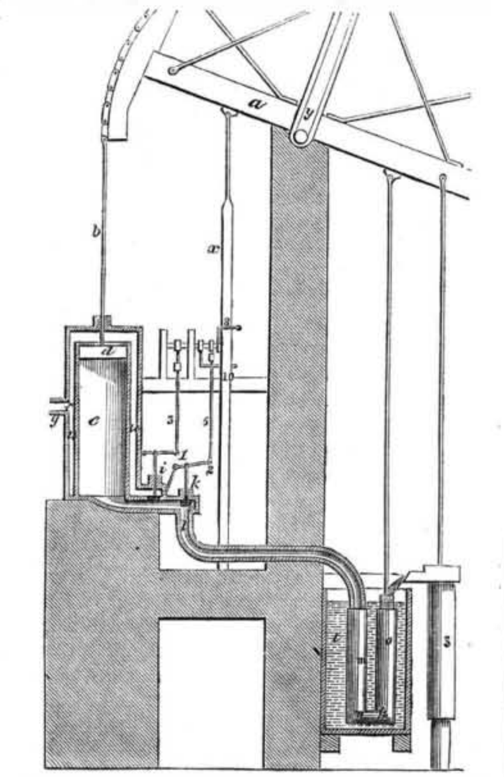
ROMANCE OF THE STEAM ENGINE.

Article XIII.

JAMES WATT.

The grandeur, the value and the importance of every discovery and invention must be judged by the results it has produced. The steam engine was a giant in swaddling bands for eighteen hundred years, but whenever it began to walk alone, under the improvements of Newcomen and Cawley, its wonderful power became manifest, and it was soon adopted for pumping most of the deep mines in England. As represented in its most perfect condition on page 116, present volume, Scientific American, it was still a most clumsy and imperfect engine, but it was the best known, and a great improvement over all that had preceded it. The resources of a greater mind than that of any inventor who had preceded him, were now about to be devoted to the investigation of this mighty subject.

The University of Glasgow, in Scotland, has always been distinguished for teaching the practical arts, such as chemistry and mechanism. In the middle of the last century, its professors gave refuge to a most ingenious young mechanic named James Watt, and furnished him with a shop within its walls, where he practiced his trade of philosophical instrument maker, and kept the instruments belonging to the Macfarlane College Observatory in repair. In 1763, a neat working model of Newcomen's engine having been employed by Dr. Dick, professor of natural philosophy, in his lectures, it received some injury and was taken to Watt for adjustment. He very soon understood this motor as no man ever had done before him; and he saw that there was a great loss of heat entailed by condensing the steam in the inside of its working cylinder. It occurred to him that this waste might be saved, and how to do this was a question which frequently occupied his thoughts. In his own account of the invention, he relates with artless simplicity how he resolved the great problem. One Sunday afternoon, having taken a walk abroad in "Glasgow green," his thoughts turned to the experiments which he had been making for saving heat in the engine, when the idea occurred to him, that as steam was an elastic vapor, it would expand and rush into a previously exhausted space, and that if he were to produce a vacuum



in a separate vessel, and open a communication between the steam in the cylinder and this exhausted vessel, he could obtain a vacuum under the piston, and keep the cylinder always at steam-heat, so that no condensation of *live steam* (that which has done no work) would take place. This brilliant idea Watt resolved into the lever of Archimedes, and with it has elevated a world. He was not long in devising and constructing the model to apply his discovery, and he found it come up to his utmost expectations. We omit giving engravings of the first contrivances which he employed, and come at once to the engine which, under his care and direction, was applied to work on a large scale. The accompanying figure is a vertical section of Watts' single acting and separate condensing engine:—*a* is the beam, connected to the piston rod, *b*, by the chain; *d* is the piston; *e*, the cylinder; *f*, the pipe leading from the boiler, which is also furnished with a box containing a valve, which by its rise or fall opens or shuts a communication between the boiler and cylinder; *k*, a valve, which also by its rise and fall opens or shuts a communication between the under side of the piston and the condenser, *m*, by means of the eduction pipe, *l*. The short pipe, *n*, connecting the condenser with the air and water pump, *o*, has a valve at *p*, opening into the pump barrel; in the piston of this pump are valves opening upwards, and at the top of the barrel is a short pipe, having a valve at its extremity opening outwards; *s* is a common pump, with its rod attached to the balanced lever, to raise water from a well or cistern to replenish the box, *t*, in which the condenser pipes and pumps are placed; the rod which draws the water from the mine, and which is also attached to the working beam is not shown; *y* is the axis of the working beam; 1, 2, 3, 5, are levers moving on joints and attached to the valves, *i k*, by means of rods working steam-tight through the sides of boxes; 8, 10, are tappets or projecting pieces on the plug-rod. The pump-rod works through a stuffing box, so that the atmosphere is completely excluded from the interior of the engine; *u* is a space between the jacket and cylinder into which the steam is admitted by the pipe *f*, and from which it is introduced above the piston in the cylinder.

Previously to the engine being put in motion, the air which occupies its internal parts must be expelled. This is done by opening the valves and allowing steam from the boiler to flow into all the pipes and vessels, and the vapor being lighter than the air, expels it downward through the eduction pipe into the condenser, and from that through the valves which open upward in the air pump. The valve *i* is then shut, and cold water being allowed to flow into the cistern, quickly condenses the steam in the condenser pipes, and the steam under the piston rushing through the eduction pipe to restore the equilibrium, is also converted into water—the condensation in both vessels is so rapid, that in practice it may be considered quite instantaneous. The resistance at the under side of the piston being thus removed, the pressure of the steam issuing from the boiler forces the piston into the vacuous part of the cylinder.

The fall of the piston depresses one end of the working beam, *a*; and as the air-pump rod is attached to the opposite end of the lever, its piston is raised to the top of its barrel, and the air and water which had flowed into the condenser, and was prevented by the valve *p* from returning, is now lying above the air pump piston.

But at the instant when the steam piston had reached to nearly the bottom of its cylinder, or had made its stroke, the tappets on the plug frame, *x*, struck the ends of the levers, or spanners, attached to the valves *i* and *k*, and shut them.

The mine-pump rod is loaded with a weight or counterpoise, and it will be obvious, that to get the piston again into the place from which it has fallen, will require a force to be exerted equal to that which had depressed it, or some means must be resorted to, by which the depressing force may be removed or neutralized, so that the counterpoise (the use of which is to raise the plug frame and the steam piston to the top of the cylinder *e*), may have only their weight and resistance to overcome.

This is the steam jacketted Cornish engine of the present day, with only a different arrangement at the beam-head and devices for operating the valves.

Cork-Cutting Machinery.—From the frequent inquiries in the English papers, and the number of patents taken out in this country, there seems to be an earnest demand for a practical cork-cutting machine which will supersede the expensive hand labor now employed in that manufacture. We invite the attention of all persons interested in the matter to the illustration, on another page, of Millar's cork-cutting machine. It seems to us that he has hit upon the true plan of making a machine for this service, as he produces the peculiar drawing stroke required, by the most simple mechanism; and his machine certainly turns out very perfect work.