each other, as the boards else may be too elastic and not strong enough to support the weight of the workmen during the roofing, while the roof will not be perfectly substantial.

The roofing may be done either from gable to gable, or from the eaves to the foot ridge, the first roll being laid with a bend of one inch beyond the roof and fastened with the flat-headed iron wire nails supplied for that purpose. The second roll is laid one inch or one inch and a half over the first, and so on till the roof is covered. The joints and heads of the nails are then coated with the asphalt-mastic, and the seams thus coated are strewed with dry sand. The whole roof is then coated with the mastic and strewed with sand. This coating, which is only to be effected in dry weather, renders the roof perfectly water-tight, and it can then, if it be desired, be painted or whitewashed.

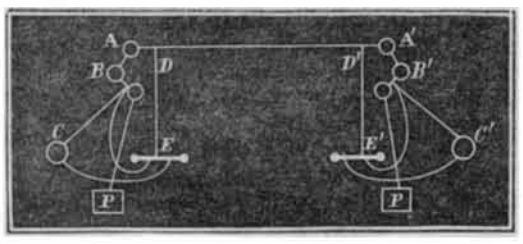
THE SIMULTANEOUS TRANSMISSION OF MESSAGES OVER A SINGLE WIRE IN OPPOSITE DIRECTIONS.

Many of our readers will be interested in understanding how it is possible to transmit messages over the same wire in opposite directions at the same time. The following from the London *Telegraphic Journal* will explain one of the ways in which it can be done:

The transmission of messages over a single wire in opposite directions at the same instant, had occupied the attention of the scientific, both in Europe and America; and the problem has been solved, in as many different ways, by no less than five individuals. The following drawing illustrates the method devised by Dr. Gintl, of Germany, which seems to be very simple, and proves, upon trial, to work with entire success.

The apparatus used is that of Professor Morse. The arrangement of the circuit is that technically known as the open circuit.

Let me premise that in transmitting a dispatch by this system, the electro-magnet of the transmitting station does not work—only that of the receiving station is operated by the current. When the key, or transmitter, is at rest, a spring closes the connecting point at the back end, and when it is pressed down by the operator in transmitting a message, the back connection is broken, and the front one established.



I have represented a section of line between London and Liverpool, A A', are two rheostats in the offices of London and Liverpool, which represent, each of them, the exact resistance of the line wire between these two points. B B' are electro-magnets of peculiar construction, being so arranged that a current may traverse either half or the whole of the coils, or may traverse one coil in one direction, and the other coil in the opposite direction. C C' are the batteries; E E', the keys; and P P' the ground plates.

Let us now suppose that London wishes to send to Liverpool. The operator at London presses down his key, and the current from the battery, C, passes through the key to the main wire, and thence down the branch wire, D', through the key, E', to magnet, B', thence through the ground plates, P' and P, to the magnet, B', and thus back to its starting point in the battery at C. When the current passes through the coil, B', at Liverpool, it operates the apparatus there in the usual manner. But I have not described the entire course of the current. When it reached the junction, D, one half of it passed through the rheostat, A, through the upper half of the magnet, B, and thence to its starting point at the battery. It will thus be seen that one half of the current having passed in one direction through one of the coils, B, and the other half in the opposite direction through the other coil, B, C', that its effect is neutralized and that no action takes place in the magnet at the transmitting station.

Now let us suppose that London and Liverpool both press their keys down at the same moment, each sending to the other. The current from the batteries, C and C', would meet at the junction D and D', and neutralize each other, and consequently, no current would pass over the wire. It would, in fact, be the same as if the wire were actually broken between these points during the time that both keys were pressed down. Under these circumstances the current from the battery, C, returns through the rheostat, A, through one half of the coil, B, and thence back to the battery, C. What takes place at London, of course occurs at Liverpool under the same conditions.

Thus the writing upon the London and Liverpool instruments is actually performed by their own respective batteries, but as this record depends upon the closing of the key at the distant station, it amounts to the same as if done by the battery of the other.

Having now shown how the record is made while the receiving station has his key in its ordinary position of rest, as well as where it is pressed down in the act of transmitting, let us now consider what will be the course of the current when it is in neither of these positions—that is to say, when the back connection has been broken by pressing the lever to make a letter, but before the front contact has been established. We will consider that Liverpool's key is in this position, and that London is writing. In this case the current, on arriving at D', does not pass down the branch wire, as there is no outlet for it, but passes on through the rheostat, A', thence through both coils, B', to the ground plate, P'. The current in this case passes not only along the line between London and Liverpool, but also encounters a resistance at A' of equal extent; but this is equalized by passing through both coils of the electro-magnet, B, so that the adjustment of the instrument remains the same throughout.

If this apparatus has not been generally used, it does not arise from its inutility. With a line well constructed and properly insulated, there would be no difficulty in working it. It could not be relied upon where there is heavy escape, and to have entire success the resistance coils should exactly equal the resistance of the line wire, and the magnets be well constructed.

Correspondence.

The Editors are no responsible for the Opinions expressed by their Correspondents.

Cotton Picker Wanted.

MESSRS. EDITORS:—In your issue of the 3d inst., I noticed a plan for directing the attention of inventors to the perfection of machines generally needed. The idea is good, and if the different sections of the country will make known their several necessities I have no doubt but that we will see valuable acquisitions to the already voluminous catalogues of machinery. The necessities of the South in the way of machinery are many. The statistics of cotton show that we have lost about one half of our labor. The experience of every honest planter shows that there is an increasing yearly diminution of labor which so far as the negro is concerned, must go on so long as he controls the Government and makes his money by going into politics, and holding all the offices.

The additional experience of our farmers is, that not more than three bales of cotton can be gathered per hand, there are exceptions to this of course. But I lay down the proposition that three bales per hand are more than the average gathered even with the additional labor of the women usually hired during the picking season, and I will sustain the fact by the testimony of every planter in South Carolina. Here then is an urgent necessity for a machine to gather cotton; and to the fortunate inventor, whoever he may be, there are laurels and money brighter and more bountiful than have been reached by mowing machines, or sewing machines, or any other invention since the days of the saw gin. The South, the North, the world needs, and must have a machine to "pick out" cotton, and until we have it, it is folly to talk of raising a "bale to the acre," etc. I have for three years past raised upon our old plan, more cotton than I gathered with all the additional labor that I could hire. Give us a machine to gather, and we may meet the deficiency of labor in raising, by the use of seed planters and other machinery now used in the cultivation of the plant. But don't let it partake of any of the utter worthlessness of that miserable little tin tube with a crank and endless chain, with which we have been humbugged since the war. T. W. WOODWARD.

Winnsboro, S. C.

The Coming Boiler.

MESSRS. EDITORS:—After reading the article on Improvements in the Steam Engine (page 361, last volume), I concluded to give you my opinion as to wherein the present system of applying heat to steam boilers is really defective, and in what manner the "coming" steam generator must differ from that now in use.

First, let us look at the act of making steam in its simplest light: We apply heat to a vessel of water, and when the temperature rises to 212° Fah. it is gradually converted into vapor, for, at that degree of heat, the expansive force of the unconfined particles of water just overcome the pressure of the atmosphere. It is gradually converted into steam, because each atom, as it expands, absorbs a great amount of heat from the surrounding mass of water—the latent heat which is necessary to its existence as steam—and this must be replaced by a continued application of heat from the combustion of the fuel so long as the operation is prolonged. A greater intensity of heat will raise the temperature no higher, but, by more abundantly supplying this "latent heat," will hasten the evaporation. If the latent heat of steam was the same as that of water, other conditions remaining the same, as soon as a mass of water reached the boiling point, it would undoubtedly explode with great violence. Now, as steam at 212°, while under the pressure of the atmosphere, is not capable of performing work, to make it a power, we must still further heat it; and not only that, but confine it, in order that we may apply its increased expansive force to useful purposes. To use steam economically would seem to be to apply heat in such a manner that no more water be heated than necessary to keep up a constant supply of steam; and no more heat be used than is required to maintain the evaporation, and to expand the vapor of water to the desired pressure. In the ordinary boiler (it is more properly called "boiler" than steam generator), a large volume of water is kept constantly far above the boiling point, and, as its radiating surface is necessarily very large, it requires a great amount of heat to maintain it at such a high temperature; remembering this, we can imagine the result if a portion of the boiler gives way, when a great proportion of this water would instantly expand into steam.

So much may be said, supposing the water to be absolutely pure, but practically this cannot be. The various saline impurities so common in feed water, increasing its density, the more as its depth increases, are, by continued boiling, deposited as a non-conducting incrustation on the bottom and sides of, and within the boiler. To remedy this, I would never apply heat to the bottom of a steam generator. As it is not necessary to heat the entire mass of water—the object not being merely to make it "boil," as in cooking—for the sake of safety and of economizing heat, I would, also, not place the fire underneath the steam boiler. Safety and economy cover the whole ground as to the value of a steam generator. Now, as it is impracticable to apply heat directly to the surface of the water, which would be, it seems to me, the nearest way of getting at the theoretical result of the amount of heat used in the evaporation of a certain quantity of water, the nearer we approach this point, in the adaptation of the form of the boiler, and in the mode of applying the heat to meet the requirements of the case, not overlooking other important requisites, so much nearer shall we be to the attainment of that greatly-to-be-desired *ne plus ultra* of steam generators.

After a great deal of study on this subject, I have designed a form of boiler, differing entirely in principle from any that I have seen; and though I by no means say that it is of the same form as that which the steam boiler will ultimately assume, yet, for various reasons, as I shall show, it seems to me to be more nearly perfect in theory than any other description of boiler with which I am acquainted. Fig. 1 shows it in vertical section. The boiler proper, B B, is bell-shaped, spherical in its horizontal section, Fig. 2, O being the outer, and I the inner shell. D is the steam dome in which the flues (only one of which is shown, at F), should expose a large heating surface. The grate, I, is placed considerably above the bottom of the boiler, a space being left entirely around between it and the boiler, except at the furnace door, to admit air for the perfect combustion of the fuel. Fig. 2 is a horizontal sectional view at the level of the grate. The water level, L, is at the point of greatest heat; and in practice, the temperature would vary from above 212°, at this point, down to perhaps 40° at the bottom of the boiler. As the saline matter became more concentrated, it could be drawn off as often as desired, with very little loss of heat. Near the bottom, also, the feed-water should be introduced. The form of the boiler shows great strength, which would safely admit of the use of a high pressure; and owing to its shape, also, and the position of the furnace, there could be no unequal expansion. With a safety valve, I believe, that even if the feed-pump gave out—the fire being undiminished—there would be no great danger of an explosion, for, as the water level depressed, the influence of the fire would grow less and less until the heat would only be expended in gradually expanding the steam, the result of which would not be hazardous. A considerable depth of water constantly remaining in the boiler, would prove a great means of safety. Other advantages might be named, such as no foaming; rapidity of making steam after "firing up," owing to the small quantity of water heated at once; ease of noting the hight of water from the temperatures of different hights. Of course, the form might be somewhat modified from that which I give; as, for a very large boiler, or, to suit its location, it could be made oval or oblong, from front to rear, remaining about the same in cross section.

Fig. 1

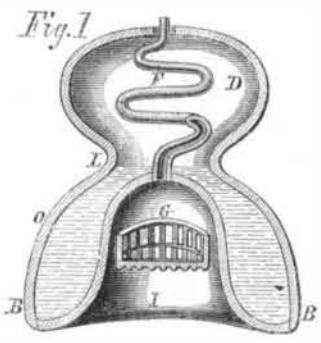
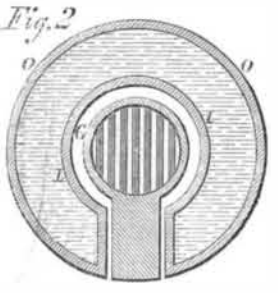


Fig. 2



As the foregoing is as yet merely an opinion, deduced from the laws of steam, as I understand them, not based on a trial of the principle proposed, I may be somewhat in error. If such is the case, please inform me wherein it consists.

CALORIC.

Montour, N. Y.

Ought Patent Rights to be Perpetual?

MESSRS. EDITORS:—In No. 2, current volume, of the SCIENTIFIC AMERICAN, there is an article from Horace Greeley on the rights of property, and after advocating the protection by law of *all* property, including copyrights and patents, Mr. G. says, "'Then why not make patents and copyrights absolute and perpetual?' is often asked. I answer: There are *no* absolute rights of property. The land you bought of Government yesterday may be taken from you for the bed of some highway or railroad to-morrow, and you have no redress. *All* rights of property are held subordinate to the dictates of national well-being, and the Government will batter down or burn to ashes your house if it shall have become (through no fault on your part) a harbor or defense of public enemies, and make you no compensation therefor."

Mr. Greeley has dismissed the great question, "Why not make patents and copyrights absolute and perpetual?" in a very summary manner, for one who usually reasons as closely as he does. Yes, why not make patents and copyrights absolute and perpetual? And as sacred to the author as any other property? What is an invention? What is an original book, or picture, or statue? Are they not the work of the human brains and hands? Most certainly. And fully recognizing this fact, Mr. Greeley says, "Whenever the laws of my country shall refuse to protect the inventor, they should, in simple consistency, bid the land owner, the bond holder, the merchant, 'take care of yourself and of all that you call your own.'"

Now if the inventor has a right of property in his invention at all, it must, in the nature of things, be a perpetual right, just as much so as the right of the land owner, the