Heating Cars---A System of Telegraphic Signals.

MESSRS. EDITORS:—In your issue of Jan. 25th, a correspondent, referring to the *Angola* disaster, asks, "Would the flood of scalding water from the broken pipes have been any more merciful?" etc. He evidently has but crude notions of what is requisite in the application of water for warming cars. No huge tanks of boiling water, as may have been in his fancy, are required for this purpose.

To most comfortably warm every passenger in an ordinary railroad car requires but about a dozen gallons of *warm* (not *scalding*) water, circulating through a single pipe, of one and a half inches diameter, running along the sides of the car, and under each seat, so as to be in easy contact with the feet of every passenger.

This pipe being of very strong wrought iron, and firmly fastened, might be bent; but could hardly be broken by any railroad accident. Even were it to break, and the water "scalding," so small a quantity distributed over the entire floor space of the car could not possibly do any very serious injury.

A dull coal fire, strongly inclosed within a well-secured stove in one corner of the car, or under it, warms the water. In case of a "smash up," the probabilities are that the water, if let out, would protect the passengers by extinguishing the fire, rather than otherwise.

The above brief description is that of my arrangement now in use in cars running between New York and New Haven, and to Boston. I would add, that one of the indispensable requisites in this system is to have the circulating water prepared with salt, so that it cannot freeze when the fire goes out. No safer or "better plan" can be devised.

New York city. W. C. BAKER.

[Another correspondent recommends a stove made of boiler iron, with the openings guarded by dampers and doors to prevent the escape of fire in whatever position the stove may be placed by the overturning of the car. He sends a diagram of a safety stove, which appears to be well designed for the purpose.

For safety from collisions, a correspondent advises that every train, upon arriving at a depot, should be signalled to the next station that it will pass, and not be allowed to leave until an answer is returned, stating that the track is clear; and when again started, the signal of "started" should be again sent forward, so that the train may be expected, and the track kept clear; and in no case should a train be allowed to pass a station, and follow upon the track of a preceding one, until the other shall have reached the next station, and the proper signal have been returned. The same plan should also be adopted with the through express and freight trains passing depots without stopping, so that the ordinary signals now in use may be regulated by these telegraphic messages, which could be modified by using the simple signals of "In" and "Out." When the train has arrived, the message "In" should be used, and when the train has started, "Out" should be employed; and in the event of allowing a train to go past a station at which there may be a train standing, or switched, the signal of "Caution" might be added to the list, and the train would then proceed slowly; also, in the case of an accident between the stations, the very non-arrival of the train in due time, after being signalled as having left the preceding station, would cause an immediate inquiry, and would prevent the following train from running indiscriminately upon it, which is only too often the case.

Tar and Resin Compounds.

Compositions having tar and resin for the basis are almost endless, and so are the patents for them. Almost any simple mixture of these substances, which any one may make, will possess excellent qualities. A recent patent, by Louis Harmyer, of Cincinnati, O., contains the following:—

"This composition is composed of tar, resin, sulphuric acid, copperas, salt, alum, lime, and carbon iron. These articles I compound in the following manner: Take one barrel of tar and boil it for half an hour; then take 10 lbs. pulverized resin, mix with the tar, and boil until the resin is dissolved: then mix carefully with the tar and resin 2½ lbs. of sulphuric acid; then add and mix 10 lbs. of pulverized copperas, 6 lbs salt, 6 lbs. pulverized alum, 60 lbs. lime, and 2 lbs. carbon iron, and the composition is complete.

"This composition is of value for the preservation of wood, metal, canvas, leather, paper, etc., and mixed with another composition, hereinafter described, may be used as a pavement for streets and walks.

"Blocks or pieces of wood, or wooden structures, are benefitted by the use of this composition. The blocks should be saturated with hot composition. Where that cannot well be done, the composition may be put upon blocks, and upon structures, warm, with a brush. On metal, it should be put on in a warm day, or better, in a warm room, with a brush. Canvas may be soaked in it for a few minutes, then rolled and dried. Leather may be painted with it warm. Better to soak it, say for fifteen minutes in warm composition, then rolled and dried in a warm room, and rubbed with rags. Paper and pasteboards for roofing, or for many other purposes, should be saturated with hot composition, and then rolled through rollers. Brick and stone may be soaked in hot composition, or the hot composition may be put on with a brush, etc.

"This composition makes wood water proof and air tight. On metal roofing it is proof against the corroding effects of rain and atmospheric changes. It renders canvas water proof. So also of leather, paper, and pasteboard, and for roofing with paper, is superior to any composition in use.

"For a pavement the composition should be made hot. Then to one barrel of composition add one and a half barrel of pulverized resin, one and a half barrel of lime, and dry fine gravel enough to make it nearly a dry substance. Then put it down hot, and put marble dust upon it.

"To make sealing wax, take one compound of composition, make it hot, and add two pounds of pulverized resin and half a pound of pulverized chalk."

Science Familiarly Illustrated.

HEAT AND COLD.

BY JOHN TYNDALL, ESQ., LL. D., FRS.

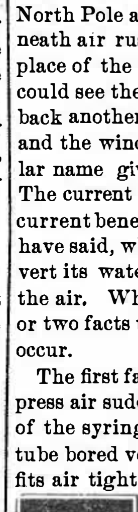
Lecture III.

In the last lecture I showed you the change which takes place in water when it is gradually cooled; and I showed you in a very striking manner that water when it freezes and becomes ice, expands, and that the force of the expansion is so great as to burst the bombshell which was placed before you in the last lecture. Now follow me for a moment, please. Conceive water at the ordinary temperature; conceive it growing gradually colder and colder. Like almost all other bodies it becomes smaller and smaller; it shrinks as it becomes colder; but at a certain point, and some time before it turns into ice, it leaves off contracting. Suppose the water to go down from a temperature of 60°; it continues contracting until it reaches the temperature of 39° Fahr., or 4° Centigrade; and then the water instantly ceases to contract, and 7° F. before it becomes solid it begins to expand as it becomes colder. What is the consequence of this expansion? The water from 39° Fahr. downwards becomes lighter, and it swims like oil over the surface of the water underneath, and there it is frozen; and when it freezes, when it passes from the liquid state to the solid state, a sudden and very great expansion occurs, so that eight volumes of water weigh about as much as nine volumes of ice, the ice being the lighter of the two, and therefore swimming upon the water.

I must ask you now to accompany me for a moment to some of the things that occur in nature in connection with this subject of heat. You know that at certain parts of the earth's surface the heat is very much more powerful than it is here in England; and you know that the reason for this is that at certain parts of the earth's surface the sun is overhead, and its rays come vertically downwards, and thus heat very much the surface of the earth directly underneath the sun. In the region of what is called the Equator we know that the sun is directly above the heads of the people living there, and at certain distances each side of it. Now, imagine this sun pouring down its heat through the atmosphere upon the sea. The surface of the sea is thereby warmed, a quantity of vapor is produced, and that vapor ascends with the air into the higher regions. When the surface of the earth at the Equator is heated, the air also at that point becomes heated, and rises, as the air of this room rose from the surface of that heated spatula, in the last lecture. When the air at the Equator is heated by the sun, part of it goes toward the North Pole and part of it toward the South Pole, while underneath air rushes in from the other directions to supply the place of the air which goes to the north and south. If you could see the air you would see it going one way and coming back another. A continuous circulation is thus going on, and the winds that are produced in this way have a particular name given them. They are called the "trade winds." The current above is called the "upper trade wind," and the current beneath is called the "lower trade wind." Now, as I have said, when the sun's rays act upon the ocean they convert its water into vapor, and this vapor is carried up into the air. What is the consequence? I want to show you one or two facts that will enable you to understand what must occur.

The first fact that I wish to show you is, that if we compress air suddenly we develope heat; and I do this by means of the syringe that I have here. This is a small (Fig. 1) glass tube bored very carefully, and furnished with a piston that fits air tight into that glass tube; so that if I squeeze this piston down I compress the air underneath it. Now, here I have a piece of German tinder, which I place in a little cavity made at the bottom of the piston; and I think I shall be able to ignite that German tinder by forcing down the piston and thus compressing the air. [The tinder was ignited as described.] Now, what we have done here is, indeed, nothing more than simply throwing the atoms (as we have agreed to call them) of the air into this intense state of vibration which we call heat. On the other hand, if we take a body having a certain amount of heat, and, instead of compressing the air, allow it to expand, then the expansion of the air produces cold. I will show you one effect of this expansion of air. I have here condensed in this vessel, forced in by a kind of syringe, a great deal more air than the vessel would contain naturally; and if I were simply to turn this cock, and allow the air to issue from the vessel against an air thermometer, I should produce an effect which would, perhaps, be visible to my young friends immediately before me. If cold is produced in this way the column will rise a little. I will now turn this air out against the thermometer. The column has risen a little, which proves that the air which has come out of this vessel, and become expanded, has become chilled.

Fig. 1.

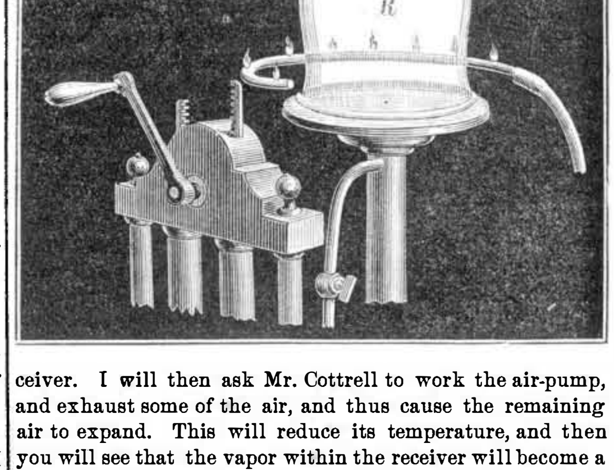


A great man who used to lecture in this room many years ago, Sir Humphrey Davy, described a machine which he saw at Schemnitz in Hungary, formed so as to allow a very strong current of compressed air to issue from it, and the amount of cold produced by the expansion of the air was such as to cause the vapor of the atmosphere to condense and congeal, and form icicles. Now I want you to remember that when air is condensed in the way I have described heat is developed, and that when an expansion of the air takes place an opposite effect is produced. Mr. Cottrell has here arranged a little experiment, but as I do not know whether it will be visible or not to you all, I will tell you what it is. This glass receiver contains air, and within it is a small elastic balloon, which also contains air. The air which the balloon has within it has a certain amount of heat, and in virtue of that heat it has a certain power of squeezing out the sides of the balloon. If we now pump the air out of the outer vessel, and so remove the air from the outside of the balloon, we take away the force which counteracts the force inside this balloon. It will then expand and almost fill the entire vessel. [The air was then exhausted by means of an air pump.] You see the balloon becomes larger and larger. You see it growing visibly before you, and the air within this balloon at the present time is being chilled because of its expansion. The assistant will go on pumping out the air from the glass receiver, and after a time the balloon will almost fill the receiver. It thus goes on swelling and swelling, the air within it expanding, and this air, by the act of expansion, becomes chilled. We will now allow the air to enter by turning this cock, and then the balloon will shrink to its first dimensions. See how small it becomes, because we get a pressure on the outside of the balloon, squeezing it inwards, until now it is finally reduced to the same size that it had at the commencement. Mr. Cottrell will now remove that balloon altogether, as I want to show you what takes place within that receiver when the air is thus taken out of it. I want to show you the effect of the chilling produced by the rarefaction or expansion of the air in nature. But first I will tell you the effect produced on a body of air rising, we will say, from the surface of the sea to a certain hight above it. We will take a definite hight, such as we often find in the Alps—11,000 feet, the hight of one of the higher Alpine passes. Conceive, then, a body of air rushing up the mountain, and going to the top of that pass. In climbing up this 11,000 feet the air gets into a place where it is not so much pressed upon as it was below. A portion of the atmosphere has been removed from above it, and the consequence is that the rising air expands, and the expansion is followed by a lowering of its temperature. The air becomes colder, and if it had in it as much moisture as it could hold, it would, in rising 11,000 feet, fall very nearly 50° Fahrenheit in temperature.

Now, you must remember that in order to preserve the vapor of this room in an invisible state, a certain temperature is necessary. If you could at this moment introduce into this room the temperature of the polar regions, what would you obtain? First, the air of the room would thicken so as to form a fog, and then that air would be chilled and fall as snow. Even in London ball-rooms this may sometimes be observed. When the windows have been opened in the intervals of the dances, the air has immediately become cooled, and a condensation of the vapor has taken place sufficient to make the atmosphere dim. Now imagine air charged with this invisible vapor being carried up one of these high Alpine passes. If in this way it gets its temperature reduced to 32°, the air can no longer hold its vapor, that vapor then falls as snow, and that snow is deposited on the tops of the mountains.

I want now to show you how clouds are formed by the condensation of vapor. Here we have the receiver of our air-pump, enclosing a quantity of air which is charged with invisible aqueous vapor. Mr. Chapman will now place a lamp behind this glass receiver. I will send a beam of light through the receiver, and let it fall on the screen. At first you will not see any appearance of anything inside the receiver. I will then ask Mr. Cottrell to work the air-pump, and exhaust some of the air, and thus cause the remaining air to expand. This will reduce its temperature, and then you will see that the vapor within the receiver will become a fog. You now see no sign of anything within the receiver; but we will now exhaust the air. [The air-pump was then put in action, and a condensation of the vapor became immediately manifest.]

Fig. 2.



You see a cloud has now formed in the receiver, and when the air is allowed to reënter it causes the cloud to go entirely away, although the vapor itself is still there. We will work the pump again, and you will see that the cloud is again formed, and will be again illuminated by the light from the lamp. There it is. That is a true cloud which is formed in this way from the air of the room, and it is in this way that clouds are formed in the atmosphere by the expansion and consequent cooling of the air which rises from the surface of the sea.

These clouds may fall as rain, but as I have said, they may also fall as snow. I suppose that snow is such a familiar thing to every boy and girl here present, that it may seem to be hardly worth thinking about; but still this substance is one of the most wonderful and beautiful things in the whole world; and when snow is formed in a very still atmosphere, as I have often had the pleasure of seeing it formed in the Alps, it takes the form of those beautiful figures which are represented in the diagram yonder. (Fig. 3.)

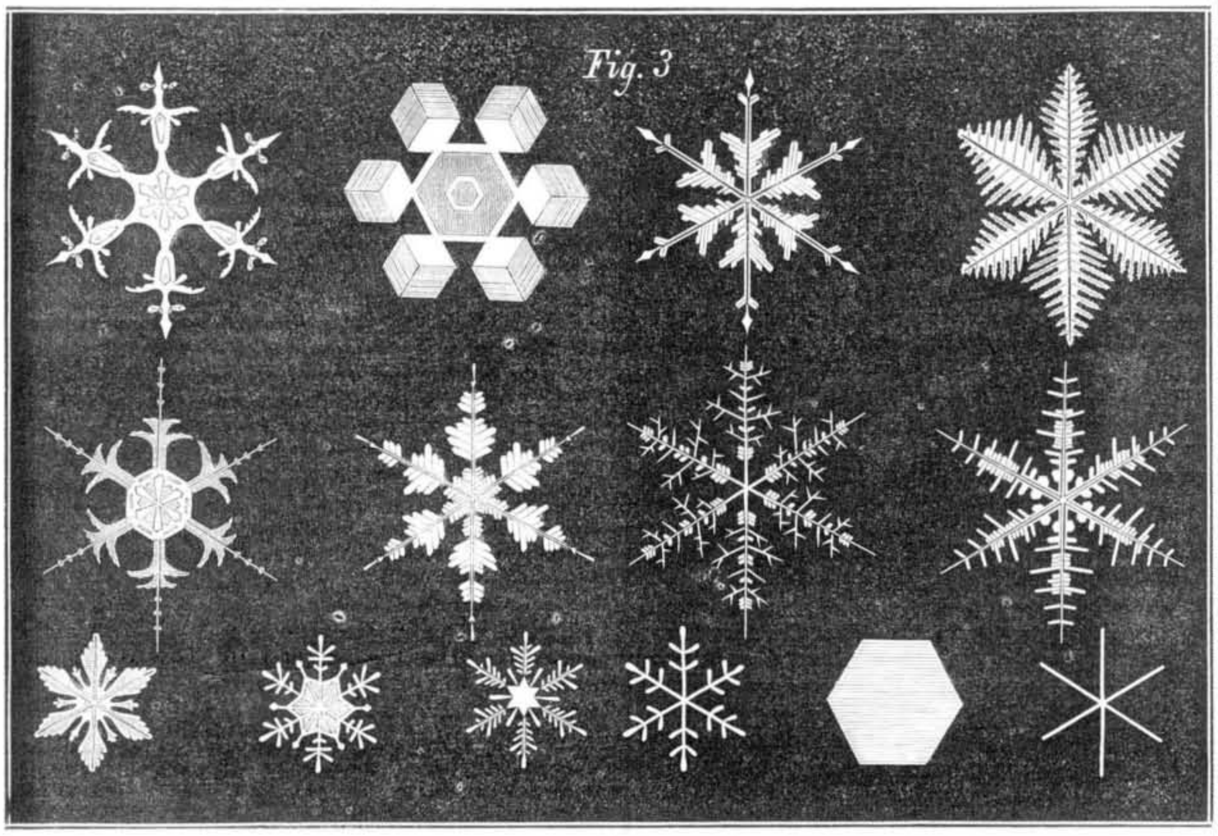


Fig. 3

It forms as small, six-rayed stars. This is the form of the snow which goes on loading the Alpine mountains year after year; and when we look at these mountains, and at the valleys connected with them, we find that the most wonderful series of appearances presents itself. On very closely observing the snow upon the Alpine slopes, we find that it is in a state of motion. We find that the snow has been incessantly moving down the Alpine slopes into the valleys; and hence we have the valleys filled with rivers of ice. On standing for the first time beside one of these rivers of ice, you would imagine that it was perfectly motionless, and that a body so rigid as ice could not move at all; but when you make proper observations, you find that the ice is perpetually moving down, and thus we have these glaciers of the Alps. I have no doubt that every boy here will one day visit those glaciers for himself. I have here a sketch of one of the most famous of those glaciers. It is called the "Mer de Glace," and is situated near Chamounix. This Mer de Glace has its great feeders from the snows that fall upon Mont Blanc and the series of mountains which are rudely sketched in this diagram. Here is a great cascade where the snow, after being half consolidated—squeezed together so as to form ice—actually moves down, forming a cascade of ice which comes along this valley. Here is another basin where the snows collect, and where its particles are squeezed into ice, and you have this ice also always in a state of motion.

Now let us look at the lines which I have drawn on the diagram. The mountains beside the glaciers are always sending down stones and dirt, and consequently you always have lines of dirt carried down; and you see that where two glaciers have their sides turning and uniting as here shown, they form a line along the middle of the trunk of the glacier. Now these lines which I have mentioned are called *moraines*. Those at the side are called *lateral moraines*, and those in the middle are called *medial moraines*. We have in the Mer de Glace these three moraines. If we examine this glacier we find that notwithstanding the rigidity of ice it moves down like a river. Eminent men have worked at this subject; Saussure worked at it a little, not much, and was followed by Bordier, who observed that ice behaved almost like a viscous body. He was the first to propound the fact that ice was of this character. He was fellowed by Rendu, who also took up the idea that ice behaved like a viscous body, such as honey, treacle, or tar, or paste. Then he was followed by Mr. Agassiz, and another, and they determined the velocity with which this ice falls. Then came Principal Forbes, an eminent Scotchman, and his measurements pushed the question far beyond its former stage. And then came Mr. Huxley and myself; and we pushed the matter a little forward; and afterwards I did a little on my own account in reference to this question. It is in this way that scientific knowledge is accumulated. It goes rolling on and becoming bigger like a snow-ball, and thus it is that science grows and has grown to what it is at the present day.

A Transcript from Old Records.

From "Morse's Gazetteer," published in 1797, we take the following relating to New York city:

"The city was incorporated in 1696. It is two miles in length and one mile in breadth. Its population in 1756 was 11,000; in 1771, 22,000; in 1786, 24,000; in 1796, 70,000.

"From the gallery in front of Federal Hall, at the head of Broad street, George Washington took the oath of office as President of the United States, April 30, 1789.

"The supply of water is insufficient, and many of the inhabitants are provided from a well at the head of Queen street, from which the quantity of 110 hogsheads, or 14,400 gallons is daily drawn, and on some hot days the amount of 216 hogsheads. The well is but 20 feet in depth, and holds but three feet of water, which is sold at three pence per hogshead."

From the same work, under the head of "Mingo Town," Pa.: "In this vicinity are some springs which yield 'Petrel,' a bituminous fluid." [The "coal oil" which so universally dispels the darkness of 1868.—ED. SC. AM.]

And from the same work, under the head of "Territory"—relating to the Northwest Territory of the United States—is taken the following prediction, made eleven years previously to the passage of Robert Fulton up the Hudson river in a steamboat: "It is probable that steamboats will be found to do infinite service in all our extensive river navigation."

WHIPPLE'S COMBINED TAPER HOLDER AND MATCH SAFE.

The object of this invention is to furnish a ready means of providing a light on occasions when an ordinary lamp might not be accessible or convenient to carry about. For this purpose the little device shown in the engravings is admirably adapted, being neat, handy, and so small as to be readily carried in the vest pocket. Larger sizes for ordinary candles

Fig. 1.

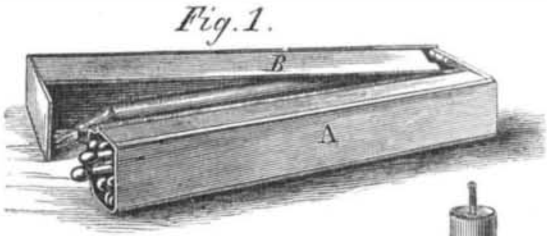
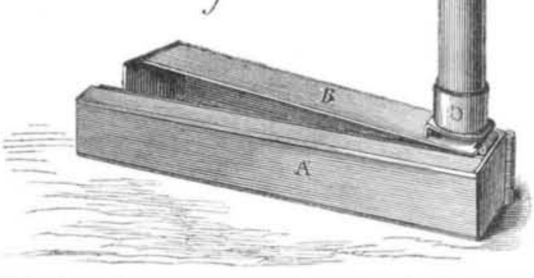


Fig. 2.



are also made. It will prove of great advantage to parties camping out, to mechanics at work in dark places, hunters, frontier's men, and convenient for Christmas tapers. It was patented in the United States, May 28, 1867, by John A. Whipple, 297 Washington street, Boston, Mass. It is also the subject of several foreign patents.

The case proper is in two parts, hinged, and formed of sheet metal. One compartment, A, is the match receptacle; and the other, B, a case or box for its reception. Hinged to the end of the match safe is a socket, C, for holding an ordinary candle or a miniature candle, or taper, D. When closed the contrivance is simply a rectangular box, being, for the small size, about three quarters of an inch square by three-and-a-half inches long. When opened the taper and its socket stands on one end of the case, and the case is a handle and standard for the light.

The foregoing is sufficient to give the reader a correct idea of this eminently handy and useful device. All orders and other communications should be addressed to the patentee, as above.

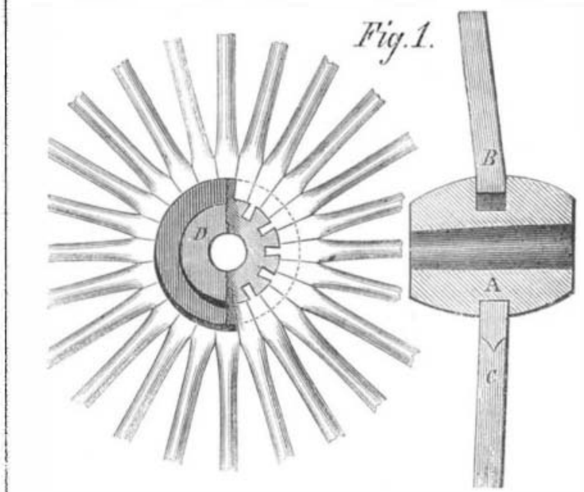
ANY subscriber who fails to get his paper regularly or has not received all the numbers of this volume is desired to inform the publishers by mail; missing numbers will be supplied.

SAWYER'S PATENT CARRIAGE WHEEL.

One great difficulty experienced by carriage makers in constructing a strong and elegant wheel is the necessity of cutting away in mortises so large a proportion of the hub as to greatly weaken this important and central part. The design of the improvement shown in the engraving is to retain the largest number of spokes in a wheel, while the hub shall not be weakened by cutting away the most of its interior in mortising.

In this invention only every alternate spoke is mortised, the others, or supplementary spokes, acting as keys or wedges, yet being firmly held in place by their contact with the other spokes, and with the shoulders or rims on the hub. The hub has a circumferential groove—Fig. 2—turned in it of sufficient width and depth to receive the ends of the supplemen-

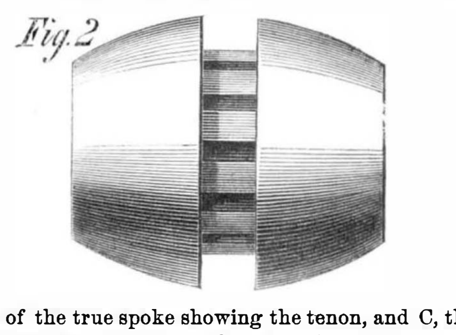
Fig. 1.



tal spokes. At the bottom of this groove the mortises for the true spokes are cut, which are seated in the usual manner, they, with the auxiliary spokes, making a solid continuation of the wheel hub, the whole being thus securely locked and fastened.

A, in the engraving, Fig. 1, is a section of the hub. B, a

Fig. 2



section of the true spoke showing the tenon, and C, the supplementary spoke, seated in the circumferential recess. The figure marked D, shows the wheel as constructed, the dotted lines on one side denoting the periphery of the hub.

Instead of cutting a score or recess in the hub, it may be made quite small, and two strong bands or flanges of iron or other metal may be shrunk on, or otherwise secured to the hub, their inner surfaces forming the recess or groove which will secure the spokes firmly in place. By means of these bands, wheels already in use may be strengthened by the introduction of supplementary spokes, without diminishing the strength of the hub by increasing the number of mortises. This device applies to wheels, the hubs, spokes, and fellies of which may be made of metal, as well as those which are composed of wood.

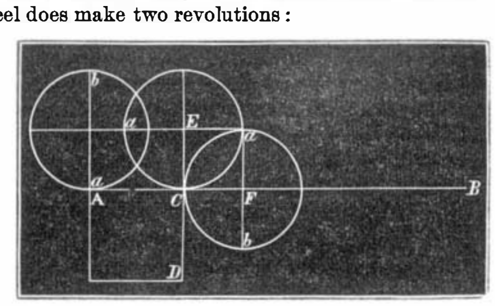
Practical wheelwrights, and others, will readily see the advantages of this mode of constructing wheels. It was patented through the Scientific American Patent Agency, Oct. 22, 1867, by W. T. Sawyer, Whistler, Mobile Co., Ala., whom address for further information.

THE MOVABLE WHEEL QUESTION.

"How many revolutions on its own axis will a movable wheel make in rolling once around a fixed wheel of the same diameter?" [Original question.]

We are in continued receipt of many communications upon the subject, but are obliged this week to curtail our selections. We shall return to the subject next week.

MESSRS EDITORS:—You say that a wheel in revolving around a fixed wheel of the same size makes but one revolution on its axis. You say that L. M., by the diagram given, proves himself wrong. I beg leave to disagree with you, and think the following sketch will make it appear that the wheel does make two revolutions:



If the line, A B, is equal to the circumference of the wheel in revolving from A to B, the wheel will make one revolution, but if A B be bent into a square then the wheel will make two revolutions in passing round it.

Suppose the wheel starts at A, in going from A to C, one-fourth of the distance, A B, the wheel would make one-fourth of a revolution; now before the wheel can advance on the line