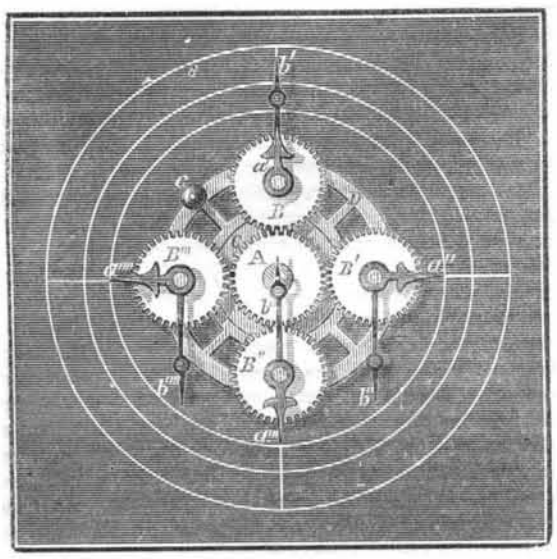
gas be generated alone, which may be employed for chemical distillation, for the desulphurization of ores, and other suitable purposes.

THE WHEEL QUESTION.

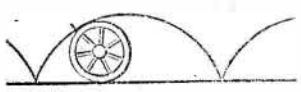
W. E. H was one of the earliest to send us a model illustrative of the views of the two revolution philosophers; but when the engraving of the model was ready we found that we had mislaid his letter. We have therefore been obliged to delay the publication of the engraving until we could communicate with him.



Above is the view of his model. A is the fixed wheel, set on a fixed disk, C; B the movable wheel, carried on a movable disk, D, which is turned by button, *c*. A long pointer, *b'* is attached to the center of the movable wheel, B. The axial line of the movable wheel we have for the convenience of the eye, enlarged into the form of the short pointer, *a'*: instead of a pointer, a dot or other figure might be used. This short pointer our correspondent wishes us to say, is not on the model. B' B" B"' are the several positions of the movable wheel in passing around the fixed wheel. The following is the letter of W. E. H:

MESSRS. EDITORS:—A wheel may properly be said to revolve on its axis, when each point in the circumference of the wheel is successively in every direction from that axis; *i.e.*, if the wheel is vertical each point of the circumference in succession is above, on one side, below the axis, on the other side, and again above: if the wheel is horizontal each point is successively east, south, west, north of the axis or in reverse order. In the case before us, the spokes of the wheel or an index placed upon it would point in order to all the figures on a large clock dial surrounding it. That this is the true and only idea of a revolution, seems to me evident from a simple illustration.

A wagon wheel is said by every one to revolve on its axis (or axle if you choose) when the wagon is drawn forward. This was your illustration on page 67 of the last volume. Why "revolve?" Because each point of the tire in succession is above the axis on one side of it, below it, etc. The actual path described by such point is a cycloid never returning into itself. I give a diagram which will make this clear to unscientific readers.



I refer, also, to Watt's sun-and-planet wheels, designed by him to take the place of a crank and in the use of which he mentions as an advantage, the fact "that one stroke of the engine produces two strokes of the wheel, while with a crank, one stroke of the engine gives but one revolution to the wheel." I regard this device of Watt's as the converse, so to speak, of the question under consideration.

Referring to the engraving I take this ground: 1st. That the long index shows clearly that the movable wheel makes two revolutions while rolling round the fixed wheel. 2d. That the short index, if it shows anything, shows that the bearing (not axis) of the movable wheel makes one revolution 3d. That the two revolutions of the movable wheel are made on the bearing, the central line of which is the axis. I add also the suggestion prompted by the addition of the second index that the question is not how many more revolutions the wheel makes than its axis, but how many it makes on the axis.

W. E. H.

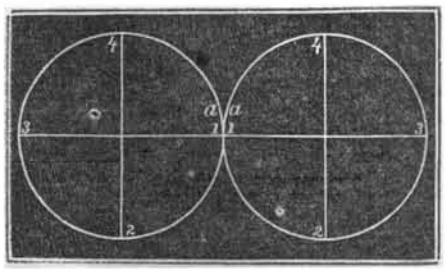
We have understood W. E. H. to be among those who maintain that a movable wheel makes two revolutions on its own axis in rolling once around a fixed wheel of the same diameter. But he does not positively state so in the above explanation. He says, 1st. that the movable wheel makes two revolutions. Does he mean on its own axis, or around the axis of the fixed wheel, or what? 2d. He says that the *bearing* (not axis) of the movable wheel makes one revolution. 3d. He says that two revolutions of the movable wheel are made on the *bearing*, (not axis.) Our correspondent has not clearly answered the question which he correctly propounds in the concluding sentence of his letter.

Whether the axis of B rotates or not, its position is changed by the passage of B around A. One position of the axis is indicated at *a'*, another at *a"*, another at *a"'*, and another at *a""*. By observing these positions, and the movement of the wheel, B, in respect to them, as indicated by the long pointer, it will be seen that the wheel, B in passing once around A, makes one revolution on its own axis. The other movements made by B—*i. e.*, those not made on its own axis—need not be here noticed.

MESSRS. EDITORS:—I submit another style of proof from any yet advanced in support of the "dual theory." It has been effective among the "*one*ists" of my acquaintance, and I hope it will answer as well with you.

A wheel, say three feet in circumference, rolled three feet on a plain surface, will make exactly one revolution; but if (as in the problem) it is ALSO required *to make the circuit of another wheel*, it must necessarily make another revolution to do it, otherwise there is no difference between a plane and a circle.

Again, I have two movable wheels of the same size hung side by side, thus—



I find, in turning them toward each other at equal speed, that it takes just *one* revolution of *each wheel* to bring the points, 1, 1, again together; *consequently* if one was stationary, it would take just *two* revolutions of the other around it to bring about the same result. Be kind enough to show the fallacy of these two propositions, or surrender at once to the victorious "dualists." F. L. B.

Boston, Mass.

We think there may be a difference between a plane and a curve, whether the wheel makes a second revolution or not. Because two wheels of the same size each revolve once in returning to a given point, it does not consequently follow that if one wheel were fixed, the other wheel would have to revolve twice around the fixed wheel in order to reach the starting point.

We have received a model which shows two revolutions of a shaft produced by one revolution of the movable wheel. Also a model which shows one revolution of a shaft by one revolution of the movable wheel. Also a model which the senders think shows two revolutions of the movable wheel when a rod is set in a particular way, and one revolution when set in another way. We have also received a variety of novel diagrams upon the subject, one of which shows how four revolutions of a shaft attached to the axis of a movable wheel may be produced by one revolution of the wheel upon its axis. We shall shortly present diagrams of some of these devices.

Compostion Fuel.

The mixture of tar, coal dust, sawdust, tan bark, peat, and other inflammable refuse stuff, and the pressing of the same into blocks, for the purposes of fuel, is very common, and several patents have been issued for variations of such mixtures. Washington Stickney, and Nathan B. Chase, of Lockport, N. Y, have lately obtained one of these patents, and they say:

"The coal consists of screenings and other fine portions, which accumulate in great abundance in coal yards, and hitherto have been considered comparatively valueless. The tan bark used (commonly called spent tan bark) is also comparatively useless and very abundant. These, with other ingredients, hitherto considered of little or no value, are so combined as to form a cheap and convenient fuel, and may be compressed, by mechanical power into blocks convenient for use. The coal tar cements the whole, making a solid mass, which may be readily ignited, and is well adapted for common fuel, especially for summer use.

"The above ingredients are combined in the following proportions, to wit: Coal, 3 parts; tan bark, 2 parts; sawdust, 2 parts; peat, or other fine woody or vegetable matter, 1 part, coal tar or pitch, 1 part, or sufficient to cement the whole; or they may be combined in a greater or less proportion of either, securing substantially the same result. The whole mass may be easily ignited with shavings or paper, or more readily by the application of a small quantity of benzine and a match."

Richardson's Process for Making Steel.

Many of the puddling furnaces of Great Britain have lately been improved by the addition of an apparatus for blowing air into them, resembling that used by Bessemer in making steel directly from the ore. The application of the improvement requires no alteration in the form of the common puddling furnace, for it does not essentially change the old method of puddling; but by introducing air through the iron rake or rabble used to stir the metal it reduces in quality or duration one particular stage of the process. Instead of numerous small holes in the blast pipe or tubular rabble, to subdivide the current of air, there is one broad slit or rectangular opening about half an inch wide, and three or four inches long, which is more easily kept free from slag. Two or three tubular rabbles are fitted to each furnace, to be used alternately, in order to prevent over-heating. Each one is connected to the air receiver by long flexible tubes of india-rubber. The air is turned on before the rabble is introduced, and remains on until it is withdrawn, in order to prevent the narrow aperture from being choked by cinders. By means of the blast rabble the time occupied in bringing the molten iron to a "boil" has been reduced from 30 or 40 minutes to 10. At the beginning of the operation the sparks thrown off indicate that silica is being separated from the mass, and as soon as the flame is clear the tubular rabble is withdrawn and the common rabble is substituted. A number of experiments have demonstrated that the whole process from the time an ordinary furnace is first charged until the mass is finished does not consume more than one hour and a quarter. The quality of the material produced is said to be superior, and in no case thus far has there been any failure to produce the desired results.

MANUFACTURING, MINING, AND RAILROAD ITEMS.

From a recent report of the Commissioner of the General Land Office, it appears that the construction of railroads in this country, since their first introduction, has been at the rate of a thousand miles a year; that there are now completed no less than 37,000 miles, and in course of construction 17,860 miles additional, or more than one third the length of all the railroads in the world. To assist this wonderful development, Government has contributed over $184,000,000, and 869,000 acres of land.

South Pass City, the headquarters of the last mining sensation, the Sweetwater gold field, was first laid out in October, 1867. It has now eighty houses and eight places of business. Its population at present is but 700, but it is confidently expected that next summer will witness the advent of from twenty to thirty thousand eager searchers for wealth, and that South Pass City will experience a much more rapid and substantial growth than even Cheyenne City.

There is now in course of manufacture at a leather belting factory in this city, what is said to be the largest leather belt ever made. The width is 47 inches; length, 100 feet; weight, 18,000 pounds; and cost, $2,000. It is composed of triplicate layers of leather, making a thickness of three quarters of an inch, and cemented and pressed so firmly together that it has the appearance of one solid piece.

A bed of hematite iron ore has been discovered at Sinking Spring, some four miles from Reading, Pa. Parties have already sunk a shaft which passes through a solid bed of ore twenty-six feet in diameter.

From this city, via Philadelphia and Pittsburg, to Cheyenne City, at the base of the Rocky Mountains, a distance of 1,917 miles, but three changes of cars are made, and five companies control the whole distance. Between New York and New Orleans, 1,500 miles, there are ten different roads, while between New York and Charleston, only 788 miles, there are also ten.

A railroad project to unite the capital of Mexico with the United States, by a line along the Gulf coast, has been referred to a committee of the Mexican Congress.

About four miles from the newly opened Japanese port of Hiogo, is quite an extensive deposit of coal. The methods of working the mines are of the most primitive description. Wherever the coal or shale has been seen cropping out from the hillside, a horizontal passage, never more than twenty-five feet long, has been run in. The miners, crouched to the ground in these burrows, with pointed hammers pick away at the sides, and very carefully assort with their hands each little piece of coal obtained, according to its quality. The Japanese Government is not insensible to the advantages of an improved mode of working the coal of Hiogo, and it is not impossible that before long some more systematic plan will be introduced.

Scarcely inferior in interest to Krupp's mammoth establishment, are the great iron and steel works of Hoerde, employing 4,500 people. Here the iron is produced from the ore, and converted into castings of various kinds, into iron and steel rails, and into puddled steel sheets suited for a variety of purposes, ship-building among others. Most of the vessels built by one of the largest firms in Liverpool are constructed entirely from steel plates made at Horde.

The *Memphis Bulletin* says that the gold discoveries in the counties of Polk and Sevier, Arkansas, are still proceeding, while the indications have proved so encouraging, and so exciting has been the degree of success already achieved, that the winter's snow and cold has not been able to suspend operations now in progress.

There are now about 12,000 miles of railway open to travel in France. Every line is remunerative, some paying original stockholders from 20 to 25 per cent, and it is claimed that passengers are conveyed by them with more regularity, safety, and comfort than elsewhere in Europe. Within eighty years, at the farthest, all these lines will have reverted to the Government and become practically public property.

M. Goudin, some years ago, made exceedingly hard iron by combining it with a small quantity of boron. It is now said that he has produced an equally hard material by combining fused cast iron with phosphate of iron and peroxyde of manganese. The mixture cannot be forged, but is easily cast.

The Boston and Providence railroad are constructing a bridge from India Point, over the Seekonk river, on a plan which embraces some new features. The whole length of the bridge is 876 feet, and the supports in the river are iron cylinders filled with wooden piles and concrete. Six of these cylinders are six feet in diameter, and contain twelve piles, which were driven into the mud forty feet, the cylinders being sunk ten feet. Iron cylinders filled with concrete have been used before, but driving piles within them, and the combining of wood and concrete is a new experiment.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

COTTON AND HAY PRESS.—William Russell, Atlanta, Ga.—This invention relates to that class of presses in which the power is applied to the follow block by revolving the press box. The improvement consists in working the follow block upon two screw rods, in a device for causing the follow block to adjust itself, and in a device which enables the apparatus to be used as a stationary or portable press, and to be worked either by rotating the press box, upon a fixed wheel, or rotating the wheel while the box is stationary.

EXTENSION COAL SHUTE.—Jacob Heatherington, Bellaire, Ohio.—This invention relates to coal shutes which are used on the banks of rivers and at wharves, for discharging coal from cars into steamboats and other vessels, and consists in making them extensible in order that they may be adjusted to vessels in different positions, and at different distances from the shore.

COMBINED STEAM ENGINE AND CANE MILL.—John Moore, Madison, Ind.—This invention relates to a cane mill, the frame of which is so constructed as to be susceptible of receiving such parts of a steam engine, as would be necessary to drive the rollers of the mill; and also in so constructing the said frame that the rollers of the mill can be readily removed therefrom, and placed therein, to enable the steam engine, which is arranged in connection with such cane mill, to be used for threshing wheat, driving a circular or a drag saw, a shingle or a lath machine, a straw or hay cutter, a grinding-mill for corn, and for many other purposes.

COMBINED SCREW WRENCH AND CLAW HAMMER.—Ellis R. Meeker, Elizabeth, N. J.—This invention consists in combining a screw wrench with a claw hammer in such a manner that the device may be used either in the capacity of a claw hammer or a wrench with as great facility as if it were made for either purpose alone.

BEEHIVE.—W. Y. Singleton, Springfield, Ill.—This invention relates to an improvement in the construction of beehives, and has for its object the wintering of the bees in a perfect manner, keeping them warm and dry, to which end a thorough ventilation of the hive is obtained, and due provision made for the absorption of all moisture.

PUMP.—Jas. Vaughn, and John Magee, Galena, Ill.—This invention consists in a novel construction and arrangement of the various parts composing the pump, whereby great effectiveness and many advantages are secured.