Railroads of the United States.

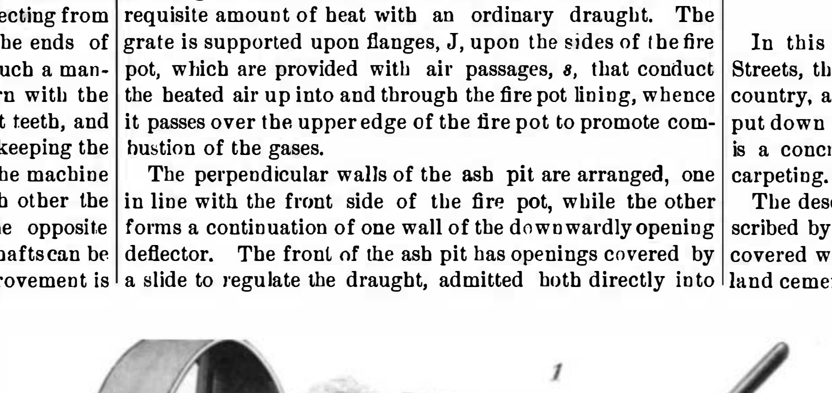
The seventeenth annual issue of "Poor's Railroad Manual," which has just appeared, fully maintains the high reputation heretofore attained by this publication. It is a complete compendium of information touching the railroads of the United States, giving their length, equipment, share capital, funded and floating debts, cost of roads and equipment, traffic operations, earnings and payments, etc. All who have investments in such property, or who think of thus employing their means, cannot fail to do so with a better understanding after looking over the facts presented in this volume.

There were 6,753 miles of railroad built in the United States in 1883, making a total length of 121,592 miles of road built up to the 1st of January last. We have nearly half the railroad mileage of the world, Germany, Great Britain, France, Russia, and Austria following next in order, but the length of our railroads considerably exceeds that of all the European lines combined. The total amount of liabilities of our railroads, on account of stock and debts, is now $7,495,471,311, an enormous amount, certainly; but it appears that their net earnings for 1883 were 4·49 per cent, which is an extremely good average showing, when it is remembered how largely their stocks and bonds have been watered. The "Manual" estimates the actual cost of these railroads at only about one-half of the amount of their funded and floating debts, and that they are thus really paying an annual interest equal to 9 per cent of their cost.

The railroad freight transported in 1883 amounted to 400,453,439 tons, the value of which, at only $25 to the ton, would have exceeded $10,000,000,000. The total length of all tracks was 149,183 miles, of which 78,491 miles were laid with steel rails. The number of locomotive engines employed was 23,823; of freight cars, 748,661; of passenger cars, 17,899; of baggage, mail, and express cars, 5,948.

MEANS FOR TRANSMITTING MOTION.

The object of an invention recently patented by Mr. W. A. Rollins, of Wyattville, County of Surrey, England, is to provide a device for transmitting motion from one part of machinery to another, in one direction, in such a manner that the parts can be revolved independently in the reverse direction. The independent shafts, A, are each formed with an enlargement, B, on the end surface of which are ratchet teeth. These enlargements project into the tubular ends of squared hollow bosses, *c*, projecting from the opposite sides of a wheel, D, held betweens the ends of the shafts. In each boss is held a block, E, in such a manner that it can slide longitudinally, but must turn with the boss. On the outer end of each block are ratchet teeth, and between the blocks and wheel are springs for keeping the blocks engaged with the enlargements. When the machine is moved so that the teeth will engage with each other the wheel, D, will revolve, but when moved in the opposite direction the teeth will slide past each other. Shafts can be coupled in a similar manner, and when this improvement is applied to tricycles the running wheels are operated from the middle wheel, the other parts remaining unchanged. Fig. 3 is a cross section through *x x*, and Fig. 4 a section through *y y*. In addition to simplicity and cheapness of construction, this arrangement admits of perfectly plain drive wheels being used in mowing machines, thus avoiding the expense of making a geared driving wheel and the necessity of replacing this expensive wheel entire if a cog in it gets broken. The clogging by grass, dirt, etc., in the gearing of the drive wheel is entirely obviated in this device. It is not contemplated to alter, further than this, the systems now in use, but to apply this arrangement to existing machines. Further particulars may be obtained from Messrs. Seely & Howell, of 14 Stone Street, New York City.



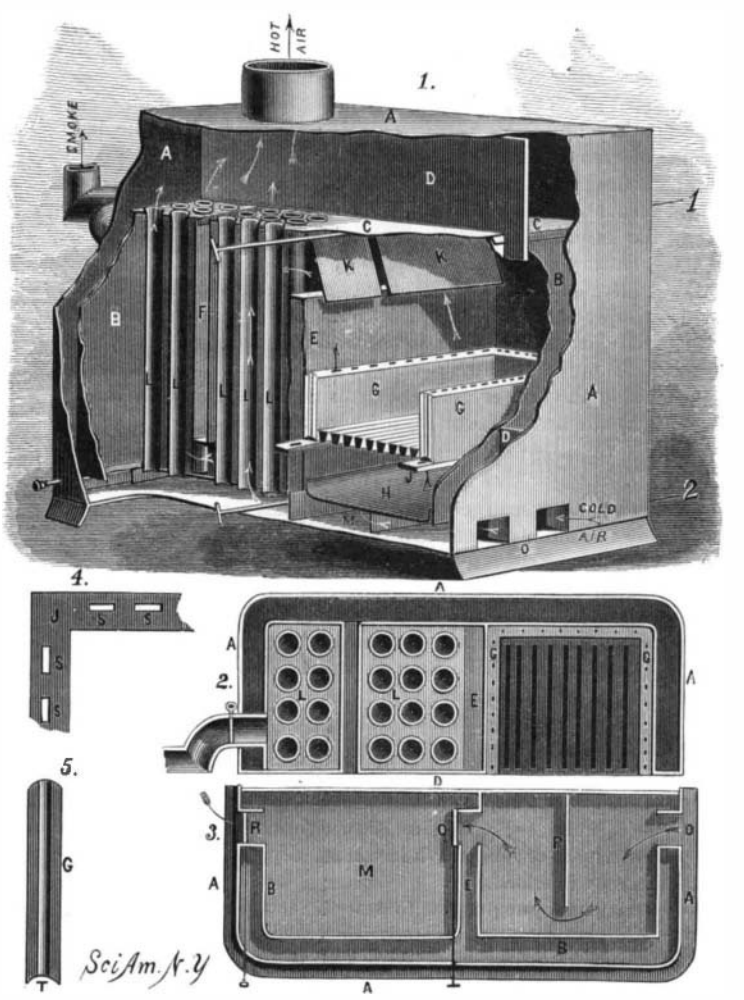
ROLLINS' DEVICE FOR TRANSMITTING MOTION.

Dry Batteries.

MM. Becquerel and Onimus have been experimenting on dry batteries. Many have endeavored to obtain a dry cell by mixing sand with chlorhydrate of ammonia. The two above mentioned obtained a modification of this process by mixing plaster with the exciting liquid, and then allowing it to solidify. As this plan can only be adopted with those cells which work only when the circuit is closed, the chlorhydrate of ammonia and chloride of zinc cells are the only ones that can be used to any advantage. Instead of using plaster only, MM. Becquerel and Onimus sometimes mix peroxide of manganese or sesquioxide of iron with it. In these cases the E.M F is slightly greater. When the battery has run down, all that is required is to moisten with more exciting liquid. The quantity of exciting liquid being a minimum, the total electrical energy is also a minimum.—*The Electrician.*

HOT AIR FURNACE.

The main object of the invention herewith illustrated is to provide an economic and effective heating furnace. Fig. 1 is a perspective view with parts broken away to show the interior; Figs. 2 and 3 are horizontal half sections, the first being above the grate, and the second showing the air passage under the ash pit; Figs. 4 and 5 are details. The fire chamber has an extended area of grate surface to permit the building of a thin fire, and at the same time secure the requisite amount of heat with an ordinary draught. The grate is supported upon flanges, J, upon the sides of the fire pot, which are provided with air passages, *s*, that conduct the heated air up into and through the fire pot lining, whence it passes over the upper edge of the fire pot to promote combustion of the gases.



TRAVIS' HOT AIR FURNACE.

The perpendicular walls of the ash pit are arranged, one in line with the front side of the fire pot, while the other forms a continuation of one wall of the downwardly opening deflector. The front of the ash pit has openings covered by a slide to regulate the draught, admitted both directly into or above the fire pot as occasion may require; by this means the exact amount of air necessary for the consumption of the gases from the fuel in combustion can be obtained. The bottom of the ash pit is made of a thin metal plate, H, that forms the upper wall of an air passage, the bottom of which is formed by the bottom plate of the furnace. Air entering through the two openings, *o*, is affected by the heat of the thin bottom plate of the ash pit. The air passage is divided about centrally by a partition, D, and has two openings at its front and two at its rear, the latter admitting the air to the compartments of the heater. Placed at right angles to the partition, D, are deflectors, P, which cause the air to travel over the greatest possible space. A valve is arranged behind each of the openings, Q, and a valve is hung in each of the two openings, R, in the rear part of the heater, one on each side of the partition. The former admit or cut off hot air from the rear part of the passage, while the latter admit or cut off cold air from the rear part of the passage.

The fire brick lining, G, composed of sections fitting in the sides and ends of the fire chamber, is formed with vertical channels passing through from top to bottom. The channels terminate in a recess made in the lower end of the lining. This recess permits the air to pass up through the channels in the lining to the chamber above the fire pot.

The air is isolated from contact with the walls of the furnace, and, being heated, the combustion of the gases is more surely effected. The crown sheet, C, made in separately removable sections of cast iron, is fitted upon the fire chamber and extended to the rear. The air chamber and deflector, E, forms the fire back of the pot, and between its upper end and the crown sheet is an opening for the passage of the products of combustion. The lower end of this chamber opens into an air inlet under the ash pit, and its sides into a surrounding air chamber.

The upper end and sides of a second air chamber, F, placed midway between that just described and the end of the furnace, open into the surrounding air chamber, while its lower end is a little distance from the furnace bottom. Passing through the crown plate and the lower plate is a series of air tubes, L, whose upper ends are flanged, in order that they may be supported without the use of rivets or similar fastenings.

A hot air chamber surrounds the fire chamber and the case inclosing the tubes and deflectors. The entire heater, save the fire chamber, is divided longitudinally by a vertical partition into two equal compartments of about equal size. Two dampers, K, are hung so as to be operated independently from the outside. Similar dampers are arranged in the smoke pipe. Either compartment is readily accessible to permit separate cleaning, the purpose being to permit the cleaning of the heater without extinguishing the fire. Heat is conducted from the heater through a pipe at the top.

Further information regarding this invention may be obtained by addressing either Mr. J. Travis or Mr. J. W. Travis, 104 Franklin Street, Chicago, Ill.

The Kerr Wood Pavement.

In this city, on Fifth Avenue, between 32d and 33d Streets, there is being laid a pavement which is new to this country, although some 500,000 square yards of it have been put down in Paris, and 800,000 in London. In principle it is a concrete pavement covered with a wooden cushon or carpeting.

The description of the process by which it is laid is described by *Engineering News* as follows: The roadbed is first covered with a 6 inch coating of concrete composed of Portland cement and broken stone, finishing off with a top dressing of Portland cement and fine gravel or sand. Upon this are laid blocks of common red pine of the size commonly used in Nicholson pavement. Between these blocks are left spaces of about one-third of an inch wide into which is poured bitumen or asphalt for an inch in depth. This fastens them to the foundation of concrete and to one another. After this has set, the crevices are filled completely with Portland cement, and the whole is covered with fine sharp gravel, which is ground into the pores of the wood and forms a protective coating. The wooden blocks are previously treated with creosote to protect them from decay and to prevent them from swelling when wet. A space of 3 inches is also left between the wooden blocks and the curbing on each side as a species of expansion joint.

The actual first cost of this pavement is somewhat more than that of Belgian blocks, but the plan upon which it has been put down in Paris is that known as the annuity system, in which the company contracts to lay the pavement and keep it in repair for eighteen years for an annuity of about one dollar per square meter. This annuity was computed on a basis which should render the expense to the city one-half the cost of maintaining a pavement for the eighteen years previous to the contract.

In this connection we give the statistics compiled by Col. Haywood, the London engineer in charge of street construction, in regard to the security of footing afforded by different kinds of pavement. As a result of observations extending over sixty days he found that a horse would travel 117 miles on asphalt, 134 on stone, and 446 on wood pavement before falling, and that falls occurring on wood pavement were by far the least serious.