C. THERYC.

RAILWAY TRAIN.

APPLICATION FILED APR. 14, 1915.

1,152,451.

Patented Sept. 7, 1915.

2 SHEETS—SHEET 1.

Fig. 1.

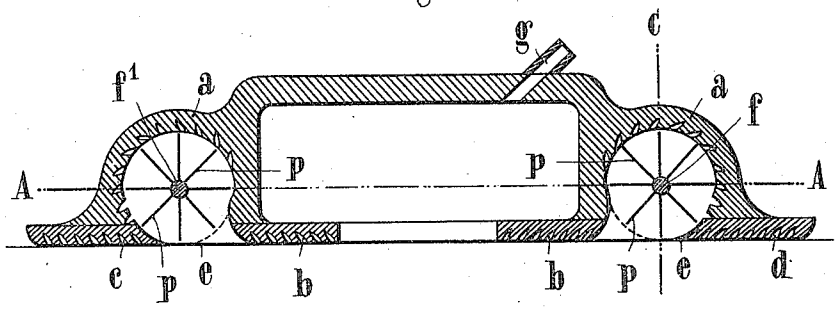


Fig. 2.

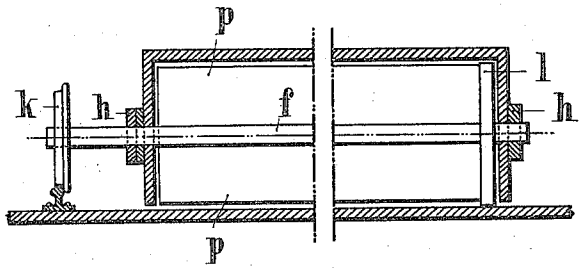
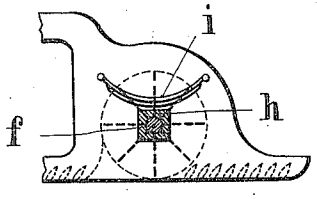


Fig. 3.



INVENTOR
Charles Theryc
BY
Emile Bonnaffé
ATTORNEY

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

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2 SHEETS—SHEET 2.

Fig. 4.

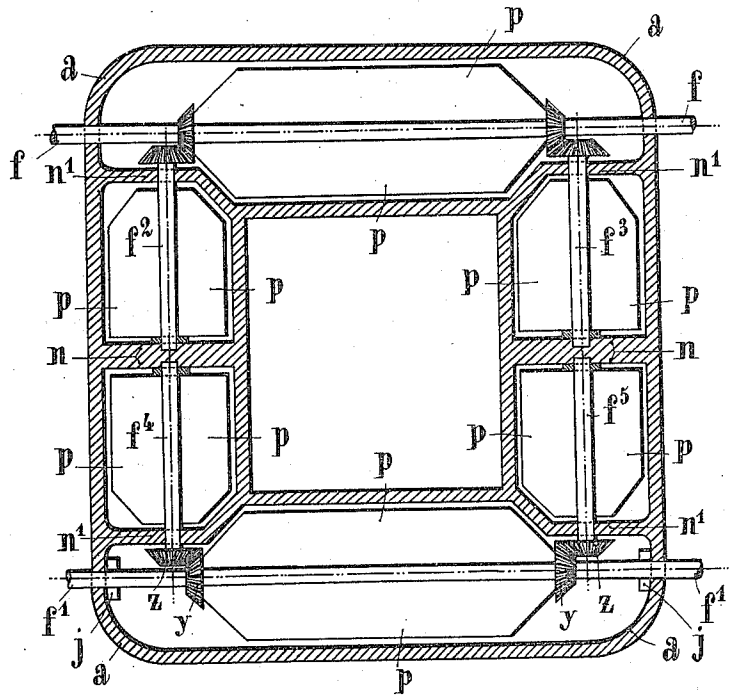
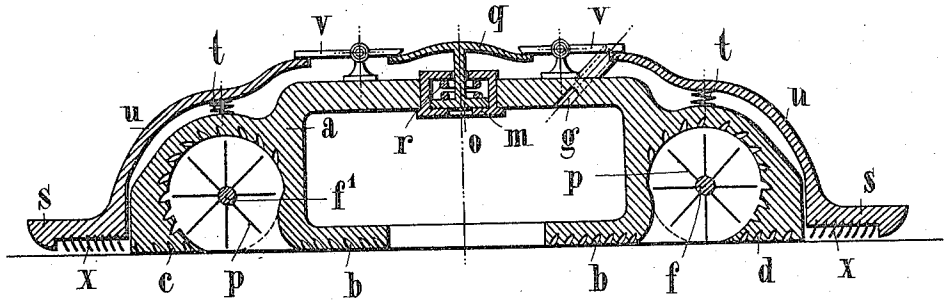


Fig. 5.



INVENTOR
Charles Theryc
BY Emil Baumgarten
ATTORNEY

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CHARLES THERYC, OF MARSEILLE, FRANCE.

RAILWAY-TRAIN.

1,152,451. Specification of Letters Patent. Patented Sept. 7, 1915.

Application filed April 14, 1915. Serial No. 21,378.

To all whom it may concern:

Be it known that I, CHARLES THERYC, a citizen of the Republic of France, and resident of Rue de la Republique 16, Marseille, France, have invented a new and useful Railway-Train, which railway-train is fully set forth in the following specification.

This invention relates to a sliding railway train, the cars of which are provided with runners under which acts a cushion of compressed air which, by balancing the weight of the said cars, enables them to be kept suspended and towed by the exercise of a very small traction effort, that is to say under very advantageous conditions. This traction effort could be obtained by means of a motor of any desired kind.

At the Paris exhibition of 1889, there was working a sliding train on a track 150 meters long, in which the runners of the cars were held in suspension on a layer of water under a pressure of 1.8 kg. As on rising, the runner formed with its circumference a discharge cross-section of 0.0008 sq. m., the loss of water would ordinarily have been 15.117 liters with free escape, in accordance with the formula

$$0.0008 \times \sqrt{2g.h.}$$

But it was reduced to an average of 0.963 liter by a series of four grooves formed in the bottom face of the runner, producing an eddy retarding the flow and reducing it to a coefficient of 0.0637. It was thus found that the loss of fluid became 15.66 times less than with the free flow, owing to the said series of four grooves, and that the pressure corresponding to the said final loss of air was only 0.0072 kg. or 250 times less than that of 1.8 kg. which was maintained constant in the interior of the runner. It will be therefore necessary to reduce this loss of fluid still further, by increasing the number of grooves.

By replacing water by compressed air, the loss of air, under the same pressure and through the same cross-section provided with grooves, will benefit by the same reductions in the proportions determined by the law of respective flow of these two fluids, that is to say

$$\sqrt{2g.h}$$

for water, and

$$\sqrt{2g.h}.800$$

for air.

But the runner of 1889 had a very serious drawback. The counter-pressure of the outside air forced back, which was negligible at such an insignificant speed of the demonstration train, would become very large at high speeds, and the said air, rushing under the runners, would sweep the fluid contained in the grooves at such small pressures, destroying or seriously affecting the working of the system.

The device forming the subject of the present invention is, on the contrary, characterized by the fact that instead of suffering from the said drawbacks, they are utilized, and the said counter-pressure due to the outside air, can even be increased in order to surround, balance and maintain at a constant pressure the air contained under the grooves, instead of expelling it from the same, and to reduce by so much the work to be performed by the compressor.

Other details of the invention will appear from the following description.

In order to make the following explanation as clear as possible, the accompanying drawings show, by way of example:

Figure 1 a longitudinal section of the runner, Fig. 2 a cross-section on line C—C of Fig. 1, Fig. 3 a partial side elevation of the runner, Fig. 4 a horizontal section on line A—A of Fig. 1, Fig. 5 a longitudinal section of an improved construction of the runner.

In the bottom face of the runner *a* are provided grooves *b b*, *c*, *d*, and between the series of inner grooves *b*, *b* and of the outer grooves *c d*, is inserted a set of counter-pressure devices intended to force back the outside air at a certain pressure, and to send it under the runners, as soon as the train is started. This starting is effected by deliver-

ing into the interior of the runner compressed air which, by passing through the branch g connected to a compressor, causes the rising of the runner to an extent sufficient to bring it out of contact with its sliding platform, thus reducing the work of the tractor to a very small effort.

The counter-pressure devices comprise spindles provided with blades p, situated one in front, another at the back and one at each of the sides of the runner. The front counter-pressure device (see Figs. 1 and 2) is movable about a spindle f and rotates in a cylindrical space or chamber e. The spindle f passes through the walls of the runner and rotates in a bearing h (Figs. 2 and 3) arranged at each side outside the walls in question. The said bearing is adjustable in a vertical guide which allows it a play of a few millimeters, so that the counter-pressure bearing can remain in place when the runner is raised or, on the contrary, descends on its sliding track. The semi-cylindrical upper portion of the chamber e has moreover for the same purpose a slightly larger radius than the lower portion. Finally, a powerful spring i (Fig. 3) presses on each of the bearings, in order to insure the counter-pressure device being held against the sliding track, as soon as the vehicle starts. The driving of the said counter-pressure device is insured by the wheel k which is mounted at the end of the spindle f and runs on a rail intended for the tractor (Fig. 2, left hand portion). As shown on the right hand side in the same figure, the driving could also be insured from the interior of the runner, by means of wheels l bearing on the sliding platform. The front counter-pressure device is thus operated in the direction of travel of the vehicle, and if the rear counter-pressure device were arranged in an identical manner, it is clear that it would rotate in the same direction and consequently have the tendency to discharge the air backward and outward. For that reason, the said rear counter-pressure device, rotatable about the spindle f', rotates in the opposite direction. To that end, its blades can be for instance mounted on a sleeve concentric with the spindle f', the said sleeve being driven from the spindle f' by a simple set of toothed wheels which has not been shown so as not to complicate the drawings; the latter shows merely, on the inner face of the runner, the points j j where the movement of the sleeve will be reversed by the toothed wheels.

Fig. 4 shows that the runner is provided with two other counter-pressure devices arranged at a right angle to the preceding ones, one on the right, and the other on the left of the runner. These counter-pressure devices consist, like the preceding ones, of spindles with blades, and are driven by means of bevel pinions, so as to force the air inward. In order to facilitate their driving, each of the said side devices is divided into two sections: the spindle f drives the spindle sections f^2 f^3, while the spindle f' drives the spindle sections f^4 f^5, through the agency of inter-meshing bevel pinions y and z. These spindles preferably run on balls in openings formed in the walls n n' of cylindrical chambers, in which latter the blades on said spindles are disposed, said walls being made integral with the runner and serving, therefore, to strengthen the same. Assuming for instance, that the air sent at the start into the runner, has to be regulated and maintained at the pressure of 1.8 kg., the driver, after the train has started, will stop the supply of air to the runner through the pipe g (such air coming from the compressor installed on the tractor), and it will be the counter-pressure devices hereinbefore described, which will thereafter force beneath the grooves of the runner, the volume of air required in order to inclose and maintain within the interior of the runner, the cushion of compressed air at 1.8 kg.

As will be seen from the foregoing, the said interior pressure is maintained at 1.8 kg., while it is reduced to 0.0072 kg. at the outlet of the grooves, so that the effort to be exercised by the counter-pressure devices, for balancing and completely avoiding the escape of air will be very small. It will be even necessary, by the following means, to avoid a forcing back of air increasing the pressure under the runner. Each runner is connected by its pipe g to a collector terminating at the compressor installed on the tractor. In the same way, the counter-pressure devices of each runner are connected to a collector terminating at the tractor. Each of the two collectors is provided with an indicating pressure gage, so that the driver can adjust and maintain the necessary equilibrium between the two compression systems. He will thus be able to vary, according to the requirements, the pressure of the air supplied by the compressor, or by the counter-pressure devices, by opening, throttling or closing an air discharge opening suitably arranged on each of the two collectors. The said regulation could be even effected by any suitable automatic mechanism.

In order to stop the train, the driver merely has to discharge the air from the runners, by opening fully the pressure regulation opening provided on the compressed air collector connected to the conduits g of the runners, and the train will drag on its sliding track; this gives the simplest and the most perfect kind of braking, bringing

about the stoppage within a length three or four times smaller than that required with the brakes at present employed which moreover are expensive and easily get out of order. It is true that these runners may wear out, but experience has shown that this wear is slight, since the runners of the sliding railway of the Paris exhibition of 1889 merely wear out only after more than four thousand stops. Moreover, the replacing of detachable grooved bases of the runners, would mean a very small expense.

The height to which the runner sliding on water in 1889, was raised, was merely one millimeter at the outside. It would be advisable to increase the height to which the runner is raised, when traveling at higher pressures, but in such case a free exhaust space would be produced below the zone controlled by the grooves of the runners, and in that way a considerable loss of air would follow.

The device shown in Fig. 5 has for its object to remedy the drawback in question by adopting a supplementary series of grooves performing an intermittent service. This device is as follows: In the roof of the sliding runner is provided a cylinder *m* in which travels a piston *o*, the rod of which is connected to a disk *q*. Between the upper face of the piston and the top wall of the cylinder, are arranged springs *r* of any kind, adjusted so as to yield at a given pressure, according to the height to which it is desired that the runner should be raised. On the other hand, a movable frame *s*, provided with grooves and normally held raised by suitably arranged springs *t*, is operated by the disk *q* and by means of its arms *u* and of the levers *v*, in such a manner that at a given compression for which the runner is raised, the movable frame *s* is lowered proportionately and replaces the action of the grooves *b b* and *c d* raised together with the runner. The bottom portion of the said frame is also provided either with grooves, or preferably, with a large number of blades *x*. Fig. 5 shows only two of the faces of the said frame (front and back), but it will be easy to imagine the arrangement of the two lateral faces identical with the preceding ones, operated in the same manner by other arms on the disk *q* identical with the arms shown in the figure. It goes without saying that this device is given merely by way of example, as one of the possible means for controlling or operating the movable frame *s*. The blades and other parts of the counter-pressure devices are adjusted so as to have the least possible clearance and these slight intervals are provided with grooves or recesses in order to reduce to a minimum secondary losses of air.

The inventor expressly reserves to himself the right to use his system for transport of considerable and indivisible weights such as, for instance, that of ships, and to use to that end several series of parallel sliding platforms. He also reserves to himself the right to use under the runner any other fluid in place of air.

The inventor reserves to himself to control the runners exclusively by the compressor installed on the tractor, by supplying to them, through the conduit *g* compressed air, the escape of which is reduced by the two series of grooves *b*, *b*, and *c*, *d*, and by limiting the use of the counter-pressure devices for the purpose of strengthening the action of the grooves by a forcing back of the air at a small pressure.

The chief importance of the invention consists in carrying out in a practical manner the traction of a train on a cushion of captive compressed air, the resistance to sliding becoming thus infinitely small compared to that already so small of sliding on water, already proved. It follows that the effort of and the expense for, traction are thus reduced in very considerable proportions, compared to the present traction.

The secondary advantages of the system are also of great importance: Besides the above mentioned ideal braking, the sliding railway construction described in the foregoing, makes it possible to use for the propulsion owing to the small traction effort required, engines of comparatively small power, namely engines working air propellers. It insures very high speeds, without noise, without vibrations, etc. It is particularly applicable to the working of lines with many inclines and with curves of very small radius, the suppression of wheels and the lowering of the center of gravity reducing the action of centrifugal force, and in any case it gives the best conditions for an economic working, both from the point of view of the first cost and of the upkeep of permanent way and rolling stock.

Claims:

1. In a sliding railway train, a car provided with a runner having an inner chamber receiving compressed air for the purpose of raising the car and permitting it to be slidingly propelled, and also having supporting surfaces provided with grooves; an air counter-pressure device connected to said runner exterior to said chamber and acting for the purpose of surrounding, balancing and maintaining at a constant pressure the compressed air contained in said chamber; and means for driving the counter-pressure device by the movement of the car.

2. In a sliding railway train, a car provided with a runner having an interior chamber receiving compressed air for the purpose of raising the car and permitting it

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to be slidingly propelled, and also having supporting surfaces provided with grooves; a set of spindles connected to said runner and arranged one in front, another at the rear and one each at the sides of the runner, and rotating in cylindrical chambers in the runner, each spindle being provided with blades; and means for driving the said spindles by the movement of the car.

3. In a sliding railway train, a car provided with a runner having an inner chamber receiving compressed air for the purpose of raising the car and permitting it to be slidingly propelled, and also having supporting surfaces provided with grooves; an air counter-pressure device connected to said runner exterior to said chamber and acting for the purpose of surrounding, balancing and maintaining at a constant pressure the compressed air contained in said chamber; a device for driving the counter-pressure device by the movement of the vehicle; an intermittently-acting movable frame mounted to extend around the said runner and provided with grooves; and mechanical connections between the said frame and the said runner, acting to operate the said frame when the said runner is raised.

4. In a sliding railway train, a car provided with a runner having an inner chamber receiving compressed air for the purpose of raising the car and permitting it to be slidingly propelled, and also having supporting surfaces provided with grooves; a set of bladed spindles mounted one in front, another at the back and one at each side of the runner and rotating in cylindrical chambers in the runner, each spindle being provided with blades; means for driving the said spindles by the movement of the car; an intermittently-acting movable frame mounted to extend around the said runner and provided with grooves; and mechancial connections between the said movable frame and the said runner, acting so as to operate the said frame when the said runner is raised.

5. In a sliding railway train, a car provided with a runner having an inner chamber receiving compressed air for the purpose of raising the car and permitting it to be slidingly propelled, and also having supporting surfaces provided with grooves; a set of spindles mounted one in front, one at the back and one at each side of the runner, each spindle being provided with blades; means for driving the said spindles by the movement of the car; an intermittently movable frame mounted to extend around said runner and provided with grooves; arms on said frame; a cylinder mounted upon the top of said runner; a piston movable in said cylinder; a disk secured to the rod of the said piston; and hinged levers in contact at one end with the said disk and operatively engaged at the other end with said arms.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CHARLES THERYC.

Witnesses:
ALLAN MACFARLANE,
PAUL H. CRAM.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."