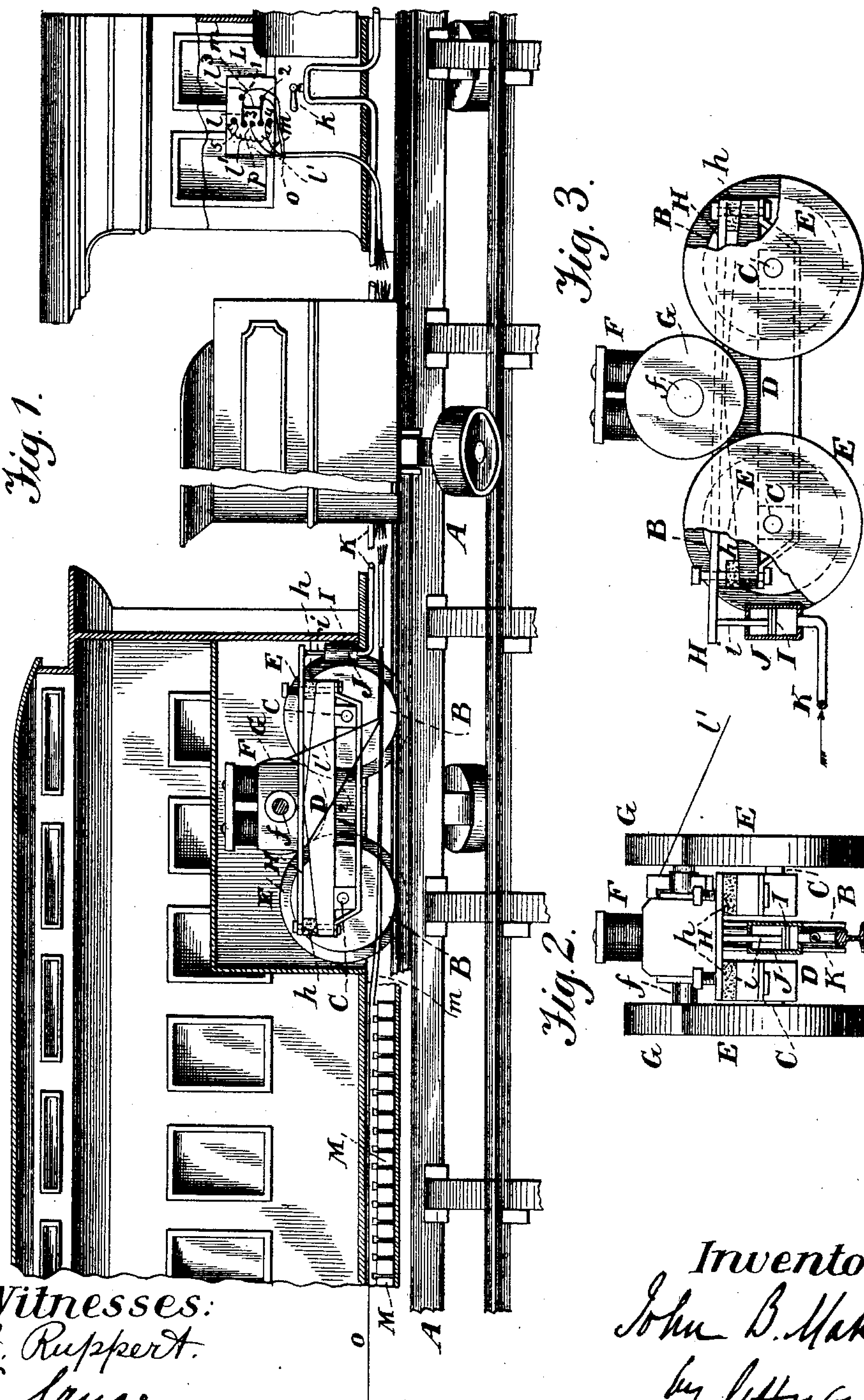
(No Model.) 2 Sheets—Sheet 1.

J. B. MAHANA.

METHOD OF AND APPARATUS FOR THE PROPULSION OF TRAINS.

No. 464,342. Patented Dec. 1, 1891.



Witnesses:
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E. Cruse.

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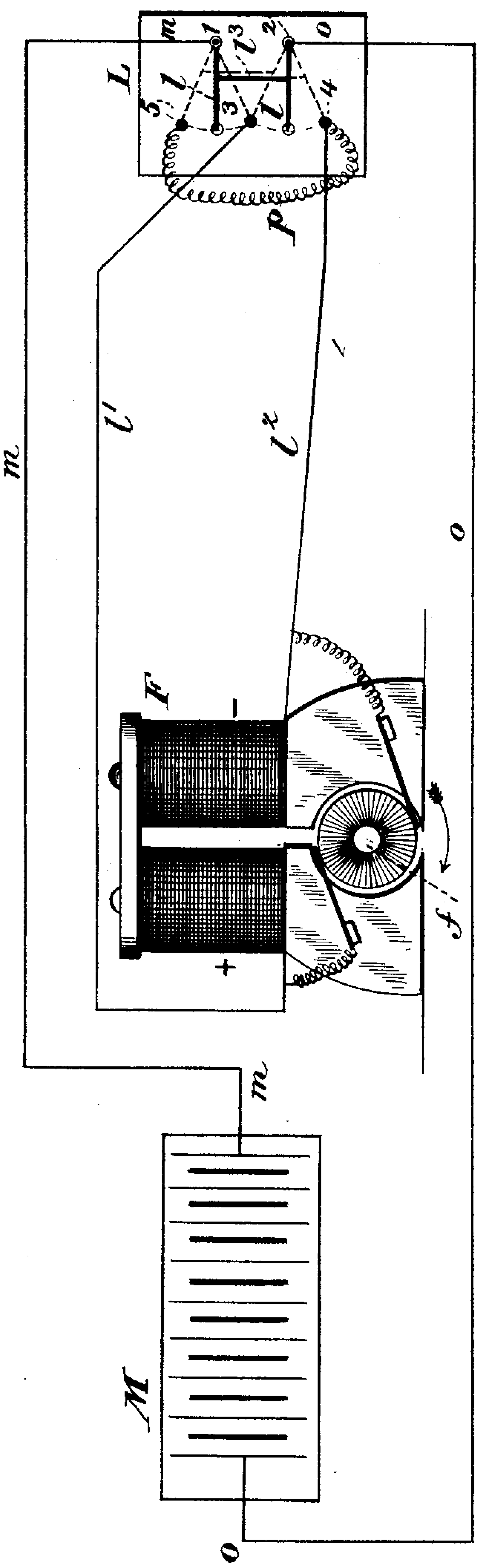
Fig. 4.



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JOHN B. MAHANA, OF FREEWATER, OREGON.

METHOD OF AND APPARATUS FOR THE PROPULSION OF TRAINS.

SPECIFICATION forming part of Letters Patent No. 464,342, dated December 1, 1891.

Application filed January 24, 1891. Serial No. 378,966. (No model.)

To all whom it may concern:

Be it known that I, JOHN B. MAHANA, of Freewater, in the county of Umatilla and State of Oregon, have invented certain new and useful Improvements in Methods of and Apparatus for the Propulsion of Trains, of which the following is a specification, reference being had to the accompanying drawings, and to the letters and numerals of reference marked thereon.

At present in hauling trains the weight to be moved has to be gaged by the capacity of the locomotive to haul it up the steepest grade, and as it is often impossible or inconvenient to obtain assistance in moving a train up a steep grade a locomotive of a certain capacity has to haul on a comparatively level grade much less than its maximum load on account of its inability to haul the same amount up a steep grade. In other words, the load having to be gaged by the weight the locomotive is capable of pulling up the steepest grade, it necessarily follows that the locomotive is not worked to its highest capacity at all times.

The object of my invention is to overcome this difficulty, and to accomplish this end I propose to use the full energy of the locomotive, when not needed to move the train, to create and store up surplus power for use in cases of emergency. I also propose to utilize the momentum of the train when running downgrade for the same purpose.

In the accompanying drawings I have illustrated an apparatus applied to a single-rail railway-train adapted to carry out my improved method; but it must be understood that I do not limit myself to the special apparatus illustrated and described, nor to its application to a single-rail railway-train, for my method is equally applicable to the ordinary two-rail railway-trains, other apparatus being designed to carry it into effect. In running downgrade it is customary to shut off steam and also to apply brakes when the grade is sufficiently steep to call for braking. Now, for all practical economy the locomotive might almost as well be running under a full head of steam as with steam shut off. Nor is there any appreciable economy in fuel unless, as in running down a very long grade, the fire is banked. In any case the saving is almost inappreciable. I propose to run the locomotive at its full capacity at all times; but in order to obviate the dangerous increase in speed that would thus ensue in running downgrade I use friction-rollers, which serve as brakes for the car-wheels, and utilize the friction created thereby to generate electricity, which is stored in ordinary storage-batteries, to be used to aid the locomotive in pulling the train upgrade.

Referring to the drawings, Figure 1 represents portions of a locomotive, tender, and car, partly in section, adapted for use on a single-rail railway. Fig. 2 is an end view; Fig. 3, a side view of the running-gear of a car with my apparatus for generating electricity attached thereto; and Fig. 4 is a diagram illustrating one arrangement of circuits and switch-board to be used in carrying out my method.

Similar letters and numerals of reference indicate similar parts in the respective figures.

A represents the rail of a single-rail railway, and B B are the vertical wheels of a car-truck, adapted to run thereon.

C C are the axles of the wheels B B, having suitable bearings in the truck D. These axles are extended at both ends beyond the truck-frame and carry on their ends the pulleys E E, each axle carrying two pulleys.

F represents a shunt-wound dynamo, and *f* the shaft of the armature. The shaft projects beyond the dynamo on both sides and carries at each end a friction-pulley G, of smaller diameter than the pulleys E. The dynamo is supported on a suitable frame H, which rests on rubber cushions *h h* on the truck, and is so arranged that when the frame rests at both ends on the cushions the friction-pulleys G will be between and in contact with the pulleys E E. When, however, it is desired to lift the friction-pulleys G out of contact with the pulleys E, one end of the frame H is lifted by means of the piston I in the cylinder J, the piston-rod *i* being connected to the end of the frame in any suitable manner. The piston may be actuated either by steam or compressed air to be admitted under it through the pipe K, its admission being controlled by means of the valve *k* in the cab.

L represents a switch-board in the cab, to which lead as many series of wires as there are dynamos on the train. M is a storage-battery supported in any convenient manner under or in the car. On the switch-board L a double switch-lever is pivoted. This lever consists of two arms l l, connected together by an insulated cross-bar l^3, the connection being such that the two arms are adapted to have simultaneous and parallel movement. The arms l are pivoted at one end to the switch-board at 1 and 2, and these pivots 1 and 2 form the terminals of the wires m and o, respectively, leading from the opposite ends of the battery M. A wire l' leads from the positive pole of the dynamo to the terminal 3 on the switch-board, and another l^2 from the negative pole of the dynamo to the terminal 4 on the switch-board. A short wire p leads from the terminal 4 to a contact 5, also on the switch-board. When the dynamo is not in operation, the switch-lever will occupy the position shown in full lines in Fig. 4. Supposing the armature to be mechanically revolved in the direction of the arrow on Fig. 4 and the switch-lever moved to engage the terminals 3 and 4, as indicated in dotted lines, Fig. 4, the current of electricity will pass through wire l' to terminal 3, through the arm of the lever to terminal 1, and through wire m to the storage-battery, the circuit being completed by wire o to terminal 2, through the other arm of the lever to terminal 4, and through wire l^2 to the dynamo. When the dynamo is to be used as a motor, the switch will be moved to come in contact with the terminal 3 and contact 5. The electricity will then pass from the battery through wire m to terminal 1, through lever-arm to contact 5, through wire p to terminal 4, and through wire l^2 to the dynamo, the armature of which will then be electrically revolved, the circuit being completed by wire l' to terminal 3, lever-arm to terminal 2, and wire o to battery. If, therefore, the friction-pulleys G are brought into contact with the pulleys E, the armature will aid in turning the wheels B, and therefore assist the locomotive in moving the train. Now it is evident that when the armature of the dynamo is mechanically operated by the friction-pulleys E and G a certain amount of resistance will be offered to the revolution of the car-wheels, and upon a moderate downgrade and with steam shut off the train would under such circumstances be brought to a standstill, and in order to overcome this tendency I propose to use, as stated, the full power of the locomotive when running downgrade. The full power thus exerted, added to that acquired by the momentum of the train, will then be divided, one moiety being used to maintain the ordinary speed of the train, and the other to generate electricity to be stored up for future use.

While I have illustrated only one car provided with the necessary apparatus to carry out my method, it is obvious that more than one car may be so fitted up, the connections to the switch board on the locomotive and to the air or steam reservoir being duplicated for each apparatus. The advantage attached to this arrangement is that if the train is running down a slight grade very little braking power need be applied, the resistance offered by one dynamo being sufficient, and therefore the steeper and longer the grade the greater is the number of dynamos which may be mechanically operated to store electricity. The connecting-wires and the air or steam pipe to operate the pistons will be connected between the cars by any approved coupling, and the connecting-wires may optionally pass either under the cars, as shown in the drawings, or overhead.

Any well-known devices to operate only one or any number or all of the series of pistons for raising or lowering the dynamos may be used; but as they form no part of my present invention I do not particularly describe them.

In operation the electricity will be stored when the train is running downgrade, as before described. When running on a level, the dynamos will be out of gear with the friction-wheels E and the switch-lever l out of contact with both wires leading from the dynamos. As soon as an upgrade is reached the switch-lever is moved to connect the dynamo and battery, as before described, to cause the armature of the dynamo to be electrically revolved, when on bringing the friction-wheels G and E in contact in with each other the car-wheels will receive positive rotation, and the locomotive be thus aided in its work. As many of the dynamos as may be needed to sufficiently aid the locomotive will be put in operation, they all being under the control of the engineer.

Having described my invention, I claim—

1. The method herein described of creating and storing an auxiliary propulsive power for use in an emergency without impeding the forward movement of the train, which consists in generating electricity by the rotation of the car-wheels on a downgrade, storing such electricity, and overcoming the resistance to the forward movement of the train caused by such generation by using the power of the prime motor in addition to the force of momentum of the train on the downgrade, substantially as described.

2. The improved method herein described for propelling a train, which consists in generating electricity by the rotation of the car-wheels, storing the electricity so generated, overcoming the resistance to the forward movement of the train caused by such generation by using the full power of the prime motor in addition to the force of the momentum of the train on a downgrade, and then using the electricity so stored to convert the generator into an auxiliary motor to aid the prime motor when the train is going upgrade, substantially as described.

3. A truck, cushions on said truck, a frame

resting on the cushions, a dynamo attached to said frame, and pulleys on the truck and on the dynamo adapted to have frictional contact, combined with a piston and cylinder on the truck, the piston being connected to one end of said frame, and means, substantially as described, to operate the piston, as and for the purpose specified.

4. A truck, a dynamo supported on said truck, pulleys on the armature of the dynamo, adapted to frictionally engage pulleys on the truck, having uniform rotation with its wheels, combined with a storage-battery, a switch-board, a switch-lever, suitable wire connections between the dynamo, storage-battery, switch-board, and switch-lever whereby the dynamo can be used as a generator or as a motor, and suitable means to bring the pulleys on the dynamo into or out of engagement with the pulleys on the truck, all substantially as and for the purpose specified.

In testimony whereof I hereto set my hand and seal.

JOHN B. MAHANA. [L. S.]

Witnesses:
EDWIN CRUSE,
E. L. WHITE.