

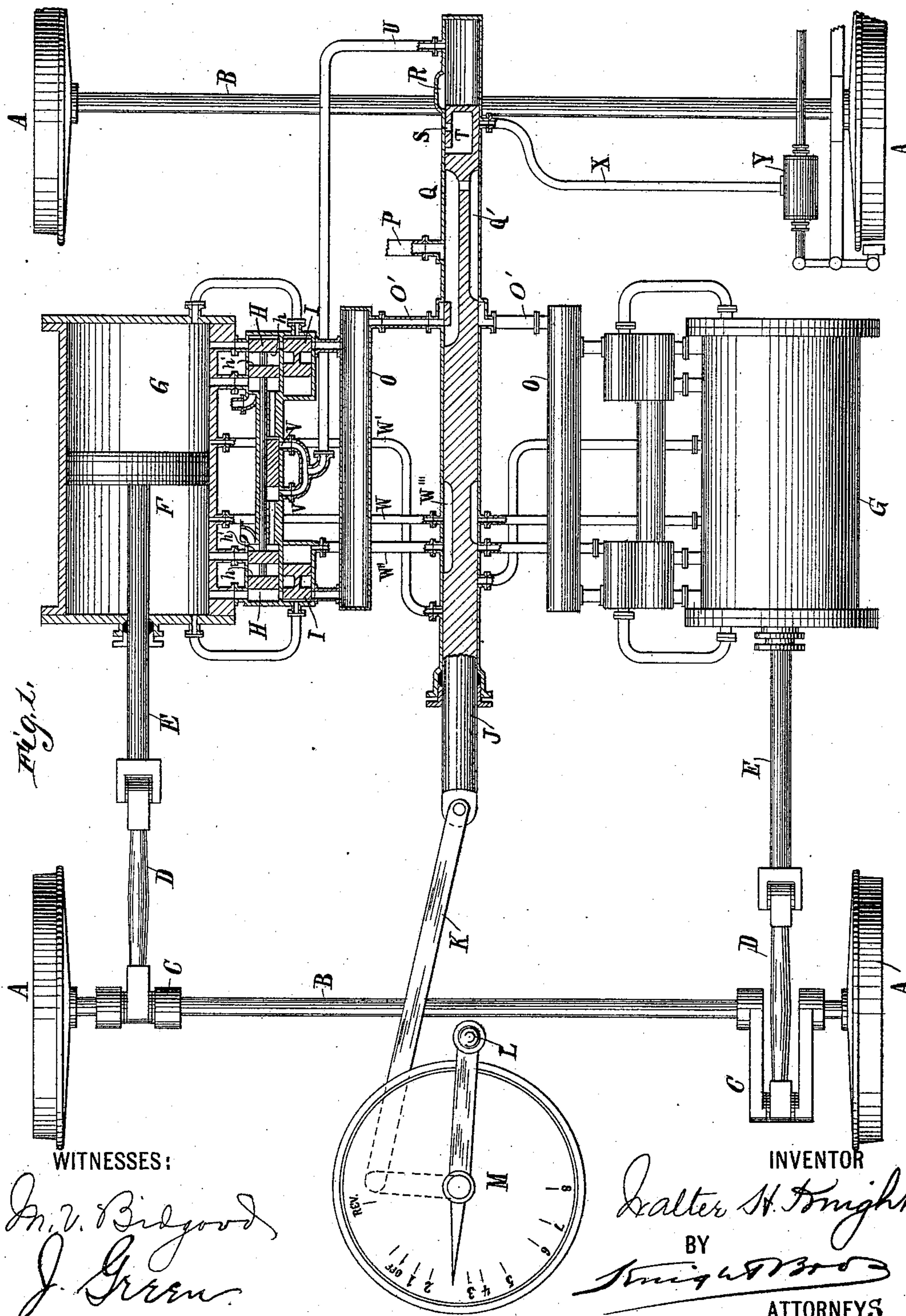
(No Model.)

2 Sheets—Sheet 1.

W. H. KNIGHT.
CONTROLLER FOR AIR MOTORS.

No. 575,652.

Patented Jan. 19, 1897.



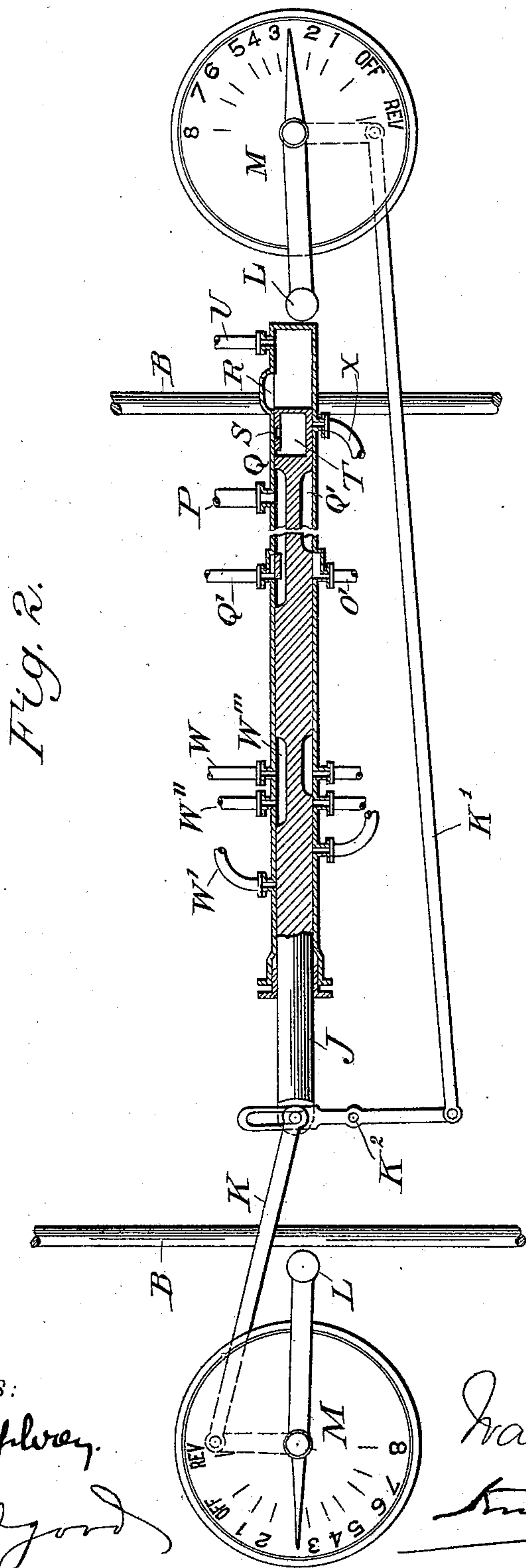
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WITNESSES:

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UNITED STATES PATENT OFFICE.

WALTER H. KNIGHT, OF NEW BRIGHTON, NEW YORK.

CONTROLLER FOR AIR-MOTORS.

SPECIFICATION forming part of Letters Patent No. 575,652, dated January 19, 1897.

Application filed January 15, 1896. Serial No. 575,546. (No model.)

To all whom it may concern:

Be it known that I, WALTER H. KNIGHT, a citizen of the United States, residing at New Brighton, Richmond county, New York, have invented a new and useful Improvement in Controllers for Air-Motors, of which the following is a specification.

My invention relates to an apparatus for controlling an air-motor, and has special reference to the use of such a motor in operating a moving vehicle, such as a street-car.

My invention consists, chiefly, in a controlling-valve adapted to perform the various functions of stopping and starting the motor and varying the admission of air-pressure to the motor, as a throttle-valve does, to control the cut-offs of such a motor according to the work to be done and at the will of the operator, and to control the reversing of the motor. All these steps are to be performed by one valve or a valve mechanism operated by a single handle moving over a dial-plate or its equivalent, various positions marked on the dial-plate corresponding with the various steps brought into operation by the various positions of the valve.

In the accompanying drawings, Figure 1 is a detail sectional plan view of my improved motor. Fig. 2 is a detail sectional plan representing the arrangement of the controlling devices at both ends of a vehicle.

The initial or inoperative position of the handle will be marked on the dial-plate as "Off." A forward movement from this position will bring the handle to the second notch or mark, which may be designated as "1," which will correspond to the initial opening of the throttle, permitting air-pressure to flow into one side of the motor and wiredrawing it. A still further forward movement of the handle will bring it to the position marked "2" on the dial, which will correspond to the position of the valve that will admit practically full pressure to one side of the motor. A still further forward movement of the handle will bring it to the position on the dial marked "3," at which position the valve will be admitting pressure to both sides of the motor and wiredrawing the same. Position "4" will be the same, but with the throttle still further open to reduce or entirely remove the wiredrawing. Position "5" will change

the cut-off from minimum to maximum. Position "6" will remove all cut-offs, so as to allow air to enter cylinders of the motor for full stroke at full pressure. Position "7" may partially close the throttle, with other conditions remaining as in "6," so as to give a wiredrawn effect with full-stroke admission, and position "8" may again entirely close the throttle. Positions "6," "7," and "8" are not considered essential, but may be useful at times.

In bringing handle back to the first position the various steps will be repeated in inverse order until "off" position is reached, when power will be completely shut off from the motor. A still further backward movement from the "off" position will bring the handle to the position marked "Reverse," at which point the valve will be in position to cause a reversal of the motor, as hereinafter explained. This valve will be connected with the handle by connecting-rods and cranks or any other suitable connecting mechanism.

In case of the application of the motor to a street-car it is essential that the handles on each end of the car shall be so connected with the valve that the handle or mechanism on that end not being used shall not interfere with the movements of the handle that is in use, and also that the motions of the handle on one end of the car shall be identical with the motions of the handle on the other end of the car, so that a given movement of the handle on either end of the car will produce the same result with respect to that end. This means, of course, that the dial-plates will be identical for both ends.

The accompanying drawings represent, partly in horizontal section, an air-motor embodying my invention applied to a street-car. I show only the wheels and axles of the car.

A are the wheels; B, the axles; C, the cranks; D, connecting-rods; E, piston-rods; F, pistons; G, cylinders; H, main valves; I, cut-off valves; J, controller-valve; K, controller-valve-operating mechanism; L, operating-handle, and M dial-plates.

In Fig. 2 the arrangement of a dial-plate and controlling-handle is shown at both ends of the car. To produce same effects by same movements of the handles L, one of the handles is connected with the controller-valve J

through a pivoted lever K^2 and connecting-rod K' , as shown.

My invention more particularly relates to an air-motor having its valves operated by air-pressure, either the initial pressure, which furnishes power to the motor being used for this purpose, or pressure caused by compression occurring at the end of the stroke after the piston passes the exhaust-port.

In the motor shown the cut-off valves I are operated by this compression-pressure, they in turn admitting initial pressure from air-chests O to the main valve H, which, operating upon differential faces h h' , will reverse the said main valve and cause the proper consecutive reversal of pressure in the cylinder G to give a continuous motion to the engine. Fluid-pressure from pipe P is controlled in its admission to air-pressure chests O by throttle-passages Q Q' in the controller-valve. These passages are so arranged as to first gradually admit pressure to one of the chests O, going through all different degrees of wire-drawing, and then to admit pressure to both chests O, at which point it again wiredraws the air and finally opens up both passages to the chests O, so as to reduce the wiredrawing to *nil*, if desired. To accomplish this, that port Q of the valve J which first admitted pressure to one of the chests O through one passage O' closes just before and again opens simultaneously with the opening of that port Q' of the valve which admits pressure to the other chest O, so that the wiredrawing process commences over again.

It is intended that the controller-valve J be perfectly balanced both longitudinally and latitudinally. This is easily accomplished by cutting it out in various parts, so as to allow the pressure to operate against the walls of its casing, instead of against it, until the desired balancing is effected. While the controller-valve is in the "off" position a bypass R leads through port S to chamber T in the controller-valve. A backward movement of the operating-handle L closes off port S from passage R, and a further backward movement brings said port S, or it may be another port, from T into communication with passage U, allowing the contents of chamber T to discharge through passage U and ports V in the main valve to the pockets at the end of the main-valve chamber, so as to cause a reversal of the main valve irrespective of the positions of the pistons, and thus compel the reversing of the engine. The size of the chamber T is made just such as will supply air-pressure for one reversal and no more, so that when the main valve is thrown over and the passage V at the other end of the valve is brought in communication with passage U and chamber T there is not air-pressure enough left in T to again reverse the valve.

W is a minimum cut-off passage, and W' maximum cut-off passage, leading from the cylinder at a predetermined point and adapt-

ed to be brought successively into communication with passage W'' by means of port W''' in the controller-valve, so as to throw the cut-off valve I closed at a proper point of the stroke of the main piston and prevent the further admission of air to the cylinder. To save confusion, only one set of these cut-off passages (for one end of the cylinder) are shown. There is, however, such a set for each cut-off valve, there being one cut-off valve for each end of each cylinder.

It will be seen that all the various functions of the motor can be brought into use at will and controlled at will by the operation of a single handle and from either end of the car. I may further make the same handle and valve control the air-brakes by a passage X, which allows air-pressure to flow to the brake-cylinders Y at a point intermediate between the "off" position and the "reverse" position of the handle.

For the sake of clearness I have not attempted herein to show more than a diagrammatic representation of the main and cut-off valve mechanisms, which may in practice be constructed as more fully shown in detail in some of my other pending applications, for example, in my application, Serial No. 573,825, filed December 30, 1895.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. In a motor provided with fluid-actuated main and cut-off valves, and a fluid chest or holder, a controller-valve comprising a throttle-valve and cut-off controller-valve, substantially as set forth.

2. In a motor provided with fluid-actuated main and cut-off valves and a fluid chest or holder, a controller-valve comprising a throttle-valve, a reversing controller-valve and a cut-off controller-valve, substantially as set forth.

3. In a motor provided with a fluid-actuated valve, and a fluid chest or holder, a controller-valve comprising a throttle-valve and a reversing controller-valve.

4. In a motor provided with a fluid-actuated valve, and a fluid chest or holder, a controller-valve comprising a throttle and reversing valve and adapted to close the throttle when in its "off" position and operate the reversing mechanism in a backward movement therefrom, substantially as set forth.

5. In a motor provided with a fluid-actuated valve, and a fluid chest or holder, a controller-valve comprising a throttle and reversing valve which is adapted to close the throttle in its initial position, operate the reversing mechanism in a backward movement therefrom, and open the throttle in a forward movement therefrom, substantially as set forth.

6. In a motor provided with a fluid-actuated valve, and a fluid chest or holder, a controller-valve comprising a throttle and reversing valve which is adapted to close the throttle in its initial position, operate the reversing

mechanism in a backward movement therefrom, and in a forward movement from the initial position, first open the pressure to one part of the engine and second to more than one part, substantially as set forth.

7. In a motor provided with fluid-actuated main and cut-off valves, and a fluid chest or holder, a controller-valve comprising a throttle, a reversing-valve and a cut-off controller-valve, said controller-valve being adapted to close the throttle in its initial position, operate the reversing mechanism in a backward movement therefrom, and in its forward movement from the initial position, first open the throttle and second change the cut-off from a lesser to a greater portion of the stroke, substantially as set forth.

8. In a motor provided with a fluid-actuated valve, and a fluid chest or holder, a controller-valve comprising a throttle and reversing valve, and a single handle for operating it, said controller-valve being adapted to open the throttle by a movement of the handle in one direction, and operate the reversing mechanism by a movement of the handle in the opposite direction.

9. In a motor provided with a fluid-actuated valve, and a fluid chest or holder, a controller-valve comprising a throttle and reversing valve, in combination with an operating-handle at each end of the vehicle, each of the handles being adapted to produce similar results by similar movements, substantially as set forth.

10. In a motor provided with fluid-actuated main and cut-off valves and a fluid chest or holder, a controller-valve provided with a throttle adapted to first admit pressure gradually to one part of the motor so as to give a degree of wiredrawing, and then to two or more parts of the motor with a like gradual degree of wiredrawing, substantially as set forth.

11. In a motor provided with a fluid-actuated valve, and a fluid chest or holder, a controller-valve provided with a reversing-port and a closed chamber or casing, for holding a definite quantity of compressed air, the controlling-valve being adapted to charge said chamber in one position, and discharge the same to operate the reversing mechanism in another position, substantially as set forth.

12. In a motor provided with a fluid-actu-

ated valve, and a fluid chest or holder, a controller-valve provided with a closed chamber or casing for holding a definite quantity of compressed air, and a reversing-port, said controller-valve being adapted to admit compressed air to the said closed chamber or casing in one position of the valve, and in another position to discharge the contents of said chamber through the reversing-port leading to the main valve, so as to reverse the main valve and cause a reversal of the motor, substantially as set forth.

13. A fluid-pressure motor having a fluid-actuated valve, a reversing-port communicating with said valve, and a closed chamber or casing holding a definite quantity of compressed air, in combination with a controller-valve adapted to bring said chamber into communication with a source of fluid-pressure in one position, and cut off said communication and place said chamber in communication with the reversing-passage in another position, so as to reverse the main valve, substantially as set forth.

14. A fluid-pressure motor having a fluid-actuated valve, a reversing-port communicating with said valve, an air-brake, and a controller-valve which is adapted in one position to close the throttle and in another position to reverse the engine, and in an intermediate position to admit air to the air-brakes, substantially as set forth.

15. The combination of a fluid-pressure motor having a fluid-actuated valve, and a reversing-port communicating with said valve, an air-brake, and a controlling-valve which is adapted in one position to open the throttle to said motor, and in another position to close said throttle, and in another position to admit air to the air-brakes, and in still another position to reverse the motor, substantially as set forth.

16. The combination of a fluid-pressure motor having a fluid-actuated valve, an air-brake, and a controlling-valve which is adapted in one position to open the throttle to the motor, and in another position to close the throttle, and in another position to admit air to the air-brake, substantially as set forth.

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Witnesses:

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