

(No Model.)

2 Sheets—Sheet 1.

R. HARDIE.
POWER CHARGING DEVICE.

No. 580,827.

Patented Apr. 13, 1897.

Fig. 2.

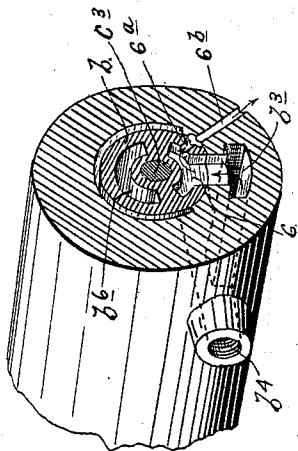
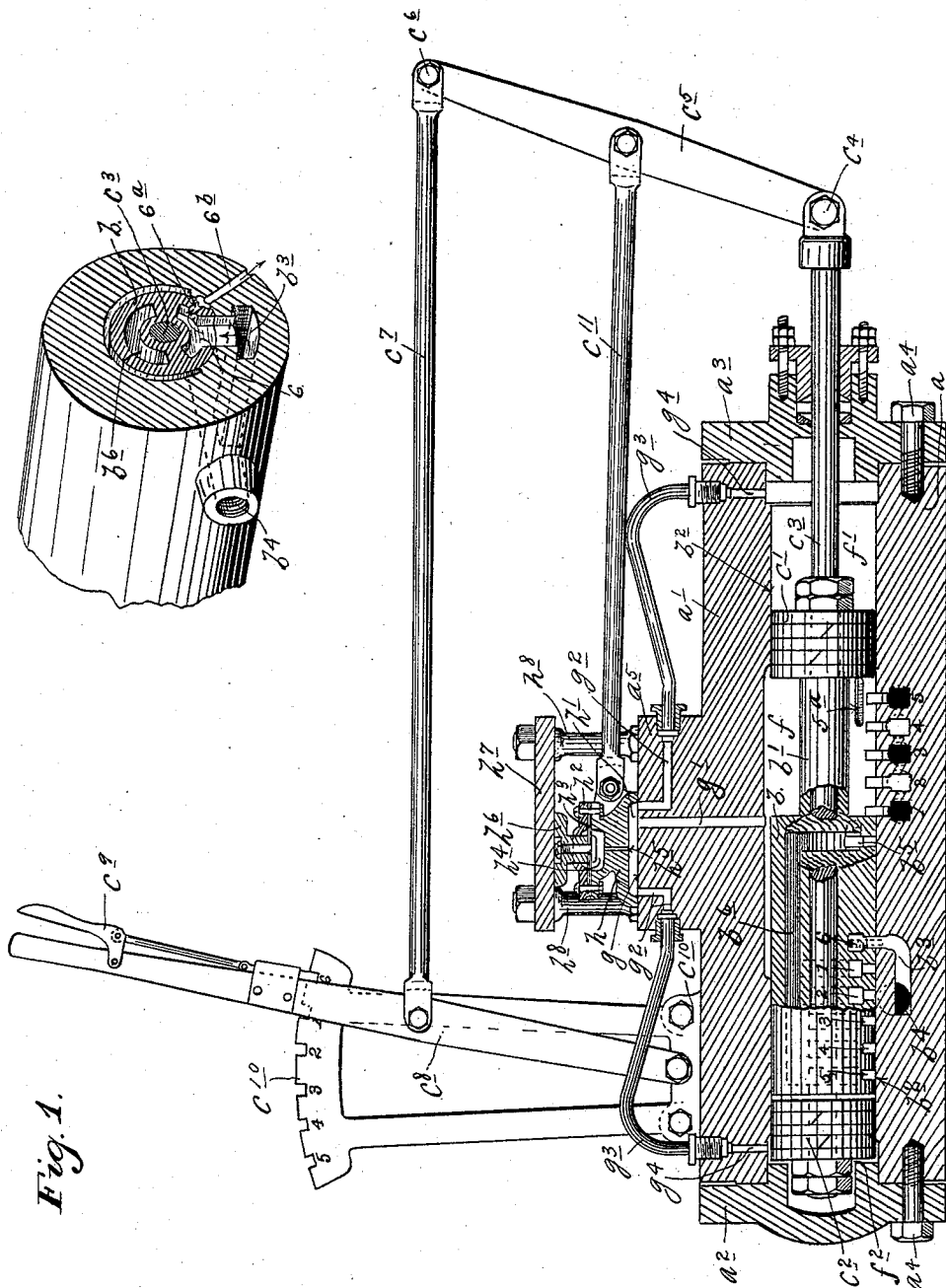


Fig. 1.



Witnesses

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By his Attorney

Jas. F. Williamson

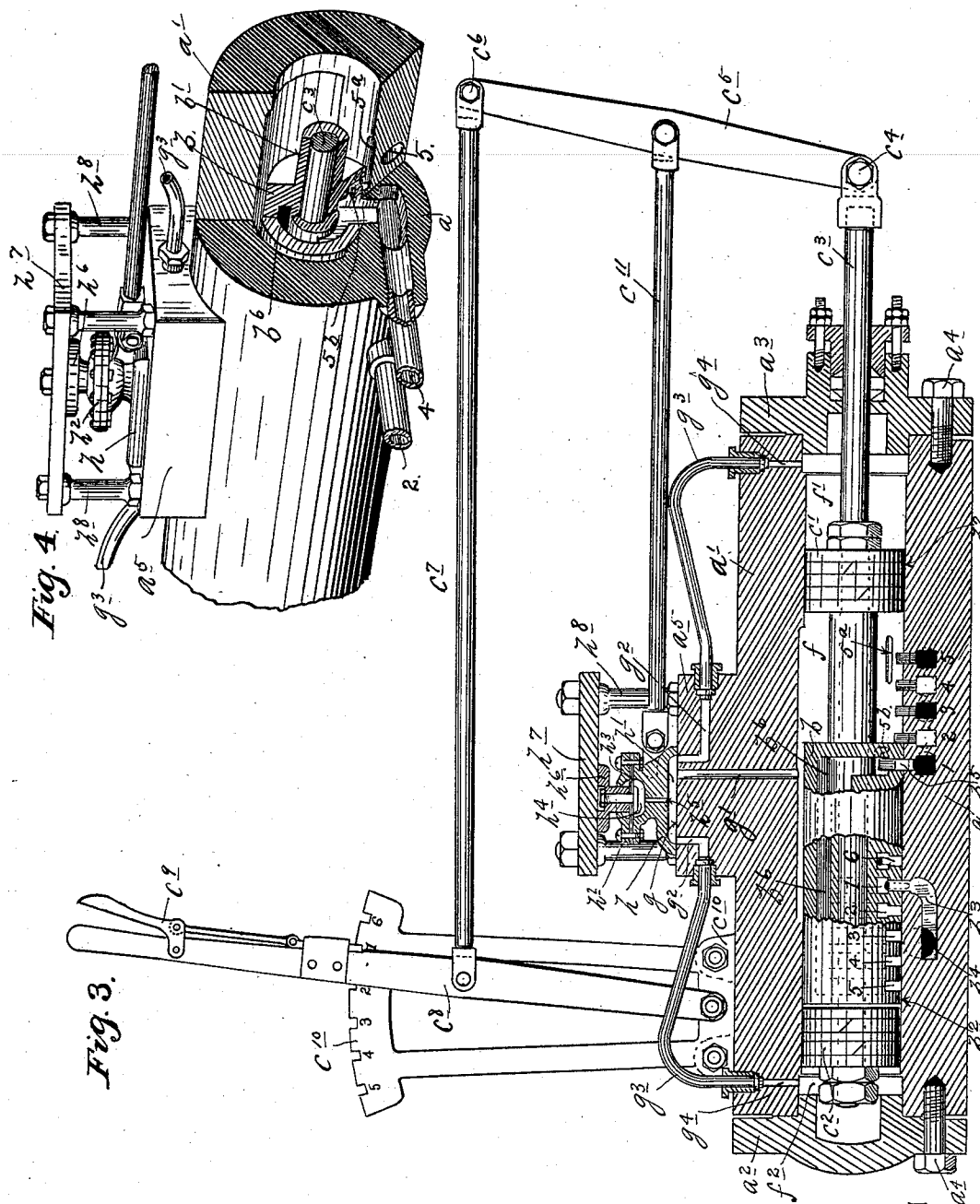
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UNITED STATES PATENT OFFICE.

ROBERT HARDIE, OF ROME, NEW YORK, ASSIGNOR TO THE GENERAL
COMPRESSED AIR COMPANY, OF NEW YORK, N. Y.

POWER-CHARGING DEVICE.

SPECIFICATION forming part of Letters Patent No. 580,827, dated April 13, 1897.

Application filed September 2, 1896. Serial No. 604,622. (No model.)

To all whom it may concern:

Be it known that I, ROBERT HARDIE, a citizen of the United States, residing at Rome, in the county of Oneida and State of New York, have invented certain new and useful Improvements in Power-Charging Devices; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to charging devices for air-storage motor-cars and is in the nature of an improvement on the charging valve or device disclosed in my United States Patent No. 577,024, issued to me of date February 16, 1897, entitled "Charging device for air-storage motor-cars."

In so far as the charging function is concerned the principle of construction and the details of the mechanism are in my present application substantially identical with my said former patent, but additional means are provided whereby power is rendered available for moving the valve. These devices are designed to be used for charging storage-reservoirs up to a pressure of two thousand pounds or more per square inch, and hence with the construction shown in my former case it was difficult to handle the valve. By my present invention I overcome the said difficulty and afford a valve which is easy to operate and is quick in its action.

To the ends above noted, my invention consists of the novel devices and combinations of devices hereinafter described, and defined in the claims.

The invention is illustrated in the accompanying drawings, wherein, like notations referring to like parts throughout the several views—

Figure 1 is a vertical longitudinal section through the charging device or valve mechanism with some parts broken away and some parts shown in elevation, the valve proper being shown in what may be regarded either as its initial position or its final position or the positions taken before the charging has been begun and after the same has been completed. Fig. 2 is a detail in sectional perspective with the valve in the position shown in Fig. 1 for showing the relation of the valve

to the bleeding-duct in the chest or casing. Fig. 3 is a view similar to Fig. 1, but with the valve proper shown in charging position for drawing off the air from reservoir No. 1 of the local battery at the charging-station and delivering the same to the storage system on the car. Fig. 4 is a view, chiefly in perspective, but partly in vertical and longitudinal section, with some portions broken away for showing the relations of the ports in the valve and the valve-chest when the valve proper is at the fourth step of its movement toward the right or in position to draw the air from the last-tapped member of the battery of reservoirs at the local charging-station.

For the purposes of this case it has not been deemed necessary to show either the car or the local battery of reservoirs at the charging-station. It will be understood, of course, that the said battery of reservoirs, at the local charging-station, are themselves charged from a suitable compressor located either at the said station or elsewhere and in communication therewith. The charging device disclosed in this and my former patent is of such construction as to permit the members of the local battery of reservoirs to be tapped in succession, while permitting the compressor to continue to run. During the time that the charge is being drawn from the members of said battery up to, but not including, the last tapped of the series the compressor can continue to deliver to all the members of said battery in advance of the member thereof being tapped by the charging device, and when the last member of the battery is being tapped by the charging device the compressor can deliver, through a by-pass, directly to the storage on the car. After the charge has been completed the valve may be thrown back into its initial or final position, and the proper connections will be established to bleed the coupling-pipes to the car for permitting the separation to be readily made without noise.

With so much of the action premised the construction may be more briefly described and more readily understood.

In respect to the valve-chest it will be convenient to distinguish the base portion *a*, the top portion *a'*, and the heads or end pieces

$a^2 a^3$, respectively. The parts $a a'$ are formed as a cylindrical casting suitably bored out and the end pieces or caps $a^2 a^3$ applied thereto in any suitable way, as by screw-bolts a^4 . The upper or top part a' of the valve-chest casting is provided with a raised portion a^5 , for a purpose which will presently appear.

In the interior of the valve-chest is mounted a valve b and a pair of pistons $c' c^2$, all carried on a common rod c^3 . The piston c' is spaced apart from the valve b by a sleeve-like projection b' , projecting from the body of said valve. The piston c^2 is directly adjacent to the left end of the valve b . The said valve b and the said pistons c' and c^2 divide the interior of the main-valve chest into three chambers, to wit, a central chamber f and end chambers f' and f^2 , respectively, outward of the respective pistons c' and c^2 . The valve b works on a suitable seat b^2 , which at its right-end portion is provided with a series of ports numbered from 1 to 5, inclusive, and near its central portion is provided with a port b^3 , which leads to the outlet or pipe connection b^4 for the motor-car coupling. Of the ports 1, 2, 3, 4, and 5 at the right-end portion of the seat the member 5 is intended for connection with the compressor and the other members 1, 2, 3, and 4 connect with corresponding members of the local battery of reservoirs. (Not shown.)

The valve b is provided with a series of annular ports numbered 1 to 6, inclusive, of which the members 1 to 5, inclusive, correspond to and are intended for coöperation with the ports numbered 1 to 5 in the valve-seat b^2 . The port 6 in the valve b coöperates with the port b^3 in the seat and with bleeding-duct sections 6^a and 6^b , respectively, formed one section in the valve and the other in the casing, as shown in Figs. 1 and 2, for bleeding the car-pipe connections when the valve is in its initial or final position, as shown in Fig. 1. The said valve b is provided with an inlet-port b^5 near its right end, which communicates with a longitudinal chamber b^6 in the valve. The said chamber or passage b^6 intersects all of the annular ports numbered 1 to 5, inclusive, in the said valve. The numbered ports 1 to 5 in the valve-seat and the numbered ports 1 to 5 in the valve are in inverse relation to each other and are so spaced apart that whenever the inlet-port b^5 of the valve is in registration with any given numbered port of the seat the valve-port of corresponding number will be in registration with the outlet-port b^3 of the seat leading to the car-charging connections. Hence it is obvious, supposing the initial position of the valve to be as shown in Fig. 1, that by moving the valve toward the right, one step after another in succession, the ports 1, 2, 3, 4, and 5 of the seat may be successively put into communication with the outlet-port b^3 and the connections therefrom to the storage-reservoirs on the car. In this way, therefore, the battery of local reservoirs

at the charging-station may be successively tapped. When the valve b reaches the fourth step of its right-hand movement, so as to bring the inlet b^5 of the valve into registration with the port 4 of the seat, by-pass sections 5^a and 5^b , formed one section in the seat and the other in the valve, will permit the supply from the compressor, through port 5, to pass into the inlet b^5 of the valve and go thence, with the charge from battery-reservoir No. 4, to the storage-reservoirs on the car. After the valve is thrown back to its initial or starting position, as shown in Fig. 1, the port numbered 6 in the valve and the bleeding-duct sections $6^a 6^b$ will permit the air in the car connections to escape, as hitherto noted.

The actions so far traced are common to this and the valve mechanism shown in my prior patent above identified. For the purpose of rendering power available to operate this valve I have added the pistons $c' c^2$ and the other parts, which will now be noted. The spacing-collar b' on the valve b is of a length to span all the numbered ports 1 to 5, inclusive, of the valve-seat when the valve is in its initial or final position, as shown in Fig. 1, and the by-pass section 5^a extends to the right beyond the compressor inlet-port 5 of the seat. Hence in all positions of the valve the central chamber f of the chest is in communication, directly or indirectly, with the compressor through port 5, or, otherwise stated, contains air under pressure.

The top of the raised part a^5 of the valve-chest casting serves as a seat g for a small controlling-valve h . The seat g is provided with a central duct or port g' , leading to the central chamber f of the main-valve chest, and is also provided with a pair of ports g^2 , one on each side of the central port g' , which ports g^2 lead, respectively, one to the chamber f' and the other to the chamber f^2 of the main-valve chest. The said ports g^2 are shown as connecting with said chambers f' and f^2 by means of pipes g^3 and passages g^4 in the top portion a' of the main-valve-chest casting. The controlling-valve h is of a size to span the three ports g' and g^2 of the seat and is provided with a cavity h' of the proper length to connect all three of said ports when the said valve is central, as shown in Figs. 1 and 3. The top portion of the controlling-valve h is of the proper form for coöperation with a cover h^2 to hold a diaphragm h^3 . The cavity h^4 under the diaphragm h^3 communicates constantly, through a small duct h^5 , with the cavity h' of the valve. The diaphragm h^3 is provided with a plunger h^6 , which works out through the cover h^2 and against a resistance-plate h^7 , carried by corner-posts h^8 , rising from the seat-casting a^3 . Inasmuch as the cavity h' constantly communicates with the central chamber f of the main-valve chest by means of the central port or duct g' in the seat g , it follows that the diaphragm h^3 is constantly subject on its under surface to valve-chest

pressure, and thereby the said diaphragm h^3 and the plunger h^5 , in coöperation with the resistance-plate h^7 , constitute a counterbalance for holding the controlling-valve h down to its seat g . The cavity h' in the controlling-valve h is, in cross-section, only equal to the small ports g^2 or g' in the seat for said valve. Hence the area of the counterbalancing device which is subject to fluid-pressure is greater than the area subject to pressure on the face of the valve, and therefore the counterbalancing device will hold the valve down to its seat.

The rod c^3 of the main valve connects, by a pin c^4 , with the lower end of a lever c^5 . The upper end of said lever c^5 connects, by pin c^6 , with rod c^7 . The rod c^7 connects with a hand-lever c^8 , provided with spring-pawl lock-lever c^9 . The lever c^8 is pivoted at its lower end to the base-plate of a lock-segment c^{10} , provided with notches adapted to be engaged by the spring-pawl c^9 of the hand-lever c^8 . The lock-segment casting c^{10} is bolted or otherwise secured to the main-valve-chest casting, as clearly shown in Figs. 1 and 3. The notches in the lock-segment c^{10} are numbered from 1 to 6 in the same order or relation and corresponding to the numbered ports of the main or charging valve b . The lever c^5 connects with the controlling-valve h by central rod c^{11} .

The action of the power device is as follows: Suppose the main valve b is in its initial or final position, as shown in Fig. 1. Then the hand-lever c^8 will be locked to the notch numbered 6 of the segment c^{10} . This holds the main valve b , as hitherto noted, in its initial or final position, as required for coupling the charging-valve mechanism to the car, or bleeding the coupling-pipes, just before disconnecting the same from the car. When the parts are in the position shown in Fig. 1, the controlling-valve h will be central, and the pressures in the chambers f' and f^2 of the main-valve chest will be equal, inasmuch as all three chambers $f f' f^2$ are in communication through the ports g' and g^2 of the valve-seat g and the cavity h' of the controlling-valve h . If now the hand-lever c^8 be moved toward the left one notch, so as to engage with the notch numbered 1 in the segment c^{10} , the first action will be to throw the controlling-valve h toward the left to the extreme of its travel. This will uncover the right-hand member of the ports g^2 , thereby opening the chamber f' in the main-valve chest to the atmosphere, while at the same time the chamber f^2 in the main-valve chest will be in communication with the chamber f through the left-hand member of the ports g^2 , the cavity h' in the controlling-valve, and the port g' in the seat g . Hence the pressure from the chamber f^2 will become effective on the piston c^2 to move the main or charging valve b toward the right one step or into the position shown in Fig. 2. This step is limited by the movement of the controlling-valve h toward the right by motion imparted from the charging-

valve b through the lever c^5 and the rod c^{11} . Otherwise stated, the initial movement of the controlling-valve h toward the left was imparted by the hand-lever c^8 and the connections $c^5 c^7 c^{11}$, turning on the pin c^4 as a fulcrum, while the main valve b was held stationary. As quick as the hand-lever c^8 became locked to the segment c^{10} the pin c^6 became a fulcrum for the lever c^5 , thereby causing the movement of the main valve toward the right to carry with it the controlling-valve h , through rod c^{11} , back to its normal or central position. As quick as the controlling-valve h is thus restored to its central position the cavity h' thereof will again connect all the ports g' and g^2 of the seat g , thereby equalizing the pressures in the chambers f' and f^2 of the main-valve chest and instantly stopping the charging-valve b . The parts are so proportioned as to make this step of movement of the charging-valve b exactly of the right length to correspond to the spacing between the numbered ports of the main-valve seat and the numbered ports in the main valve. Otherwise stated, at the first step of the main valve's movement toward the right its inlet-port b^5 will be brought into registration with port No. 1 of the main-valve seat, and port No. 1 in the main valve will be brought into registration with the discharge or outlet port b^3 , leading to the car connection. In this way power is rendered available at will for moving the main or charging valve b toward the right under a step-by-step movement in succession until the compressor-port 5 has been tapped. By then throwing the hand-lever c^8 toward the right, so as to engage the same with notch No. 6 of the segment c^{10} , the controlling-valve h will also be thrown to the extreme right-hand limit of its travel. This will open the port g^2 at the left and the chamber f^2 in the chest to the atmosphere and render the pressure in the chamber f' effective on the piston c^2 to move the main valve backward or toward the left into its initial or final position, as shown in Fig. 1. On this return or long stroke of the main valve the controlling-valve h is brought back, of course, to its central position, and this occurs before the extreme limit of the main valve's travel toward the left, so as to reestablish the pressure in the chamber f^2 for stopping the main valve without jar and maintaining open connections to the chamber f^2 . After the main valve has been thus returned to its initial or final position the port 6 in the valve will register with the passage b^3 in the seat, thereby rendering it possible to bleed the car-coupling connections through the bleeding-ducts $6^a 6^b$, as hitherto noted.

From the foregoing description it must be obvious that in virtue of the improvement or invention herein disclosed the charging device disclosed in my prior patent hereinbefore identified is rendered operative by power or air-pressure by a controlling device which

is of simple construction, which is reliable, and which is extremely easy and light to handle.

By actual usage I have demonstrated the efficiency of the mechanism herein disclosed for the purposes had in view. With the use of the same I find that the storage-reservoirs on the car may be quickly charged from the battery of reservoirs and the compressor at the local charging-station up to the pressure desired. The coupling and uncoupling connections are also thereby rendered easy to make without noise.

It will be understood, of course, that the details of the construction might be changed without departing from the spirit of my invention.

I have illustrated and described my preferred form of power device; but it must be understood that I do not, in the broad point of view, limit myself to the particular form herein shown. The fluid-pressure might be rendered available for operating the charging-valve by other forms of air-motors, and motors employing other agents might be employed. In all cases, however, manual action should render the power device operative to move the charging-valve, and the movement of the charging-valve should automatically render the power device operative to stop and hold the charging-valve at the end of the valve's predetermined step of required movement.

In this specification and claims I use the expression "power device," as in its popular usage, to denote any device for utilizing motive forces or agents other than human—such, for example, as fluids or electricity—and by the term "controller" I mean to denote a valve, switch, or other equivalent device for controlling the action of the power device employed.

What I claim, and desire to secure by Letters Patent of the United States, is as follows:

1. The combination with a charging-valve and valve-seat having their ports arranged for tapping a series of supply-reservoirs or other sources, in succession, under a step-by-step movement of the valve, of a power device, for operating said charging-valve, and a controlling-valve for the power device, both the controlling-valve and power device being connected to a common lever, and ports and passages arranged substantially as described, whereby movement of the controlling-valve will cause the power device to move said charging-valve and the movement of the charging-valve will automatically restore the controlling-valve to its normal position and

cause the power device to stop the charging-valve, at the end of its predetermined step of movement, substantially as described.

2. The combination with a charging-valve and valve-chest, of pistons on the charging-valve rod within said chest, a controlling-valve and valve-seat with ports arranged for the application of fluid-pressure to either or to both of said pistons, and manipulating connections, for said controlling-valve, so arranged that said controlling-valve may be set, by hand, for applying pressure to move the charging-valve, and will be set automatically, by the charging-valve, for applying pressure to stop the charging-valve, at the end of its predetermined step of movement, substantially as described.

3. The combination with a charging-valve and valve-seat, with their ports arranged for drawing the charge from a series of supply-reservoirs or other sources, in succession, under a step-by-step movement of the charging-valve, of a fluid-pressure power device, for operating said charging-valve, including a controlling-valve normally rendering the pressure operative to hold the charging-valve wherever set, and a hand-lever with connections to both of said valves, so arranged that the controlling-valve may be set by hand, for rendering the pressure operative to move the charging-valve, and that the movement of the charging-valve will, automatically, restore the controlling-valve to its normal position, for rendering the pressure operative to stop and hold the charging-valve, at the end of its predetermined step of movement, substantially as described.

4. The combination with the charging-valve and valve-chest, of the pistons c^1 , c^2 on the valve-rod within the chest, the central chest-chamber f always open to valve-chest fluid-pressure, the chambers f^1 and f^2 outward of said pistons, the controlling-seat g with the central port g^1 leading from said central chamber f and with the air-ports g^2 leading, one to each of the chambers f^1 and f^2 , the controlling-valve h on said seat g , and provided with the cavity h' spanning all of said ports when the valve is central, and the manipulating connections c^5 , c^7 , c^8 , c^{11} and lock-segment c^{10} , all arranged and cooperating, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

ROBT. HARDIE. [L. s.]

Witnesses:

HUGH ROSE,

E. G. OSTERMANN.