(No Model.) 3 Sheets—Sheet 1.

R. HARDIE.

CHARGING DEVICE FOR AIR STORAGE MOTOR CARS.

No. 577,024. Patented Feb. 16, 1897.

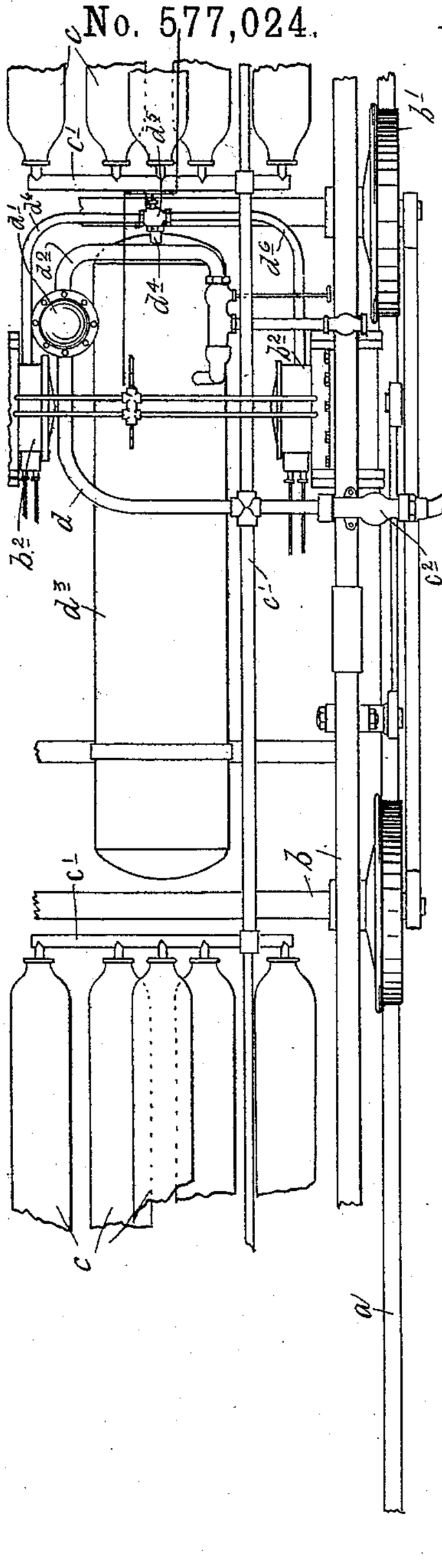

Fig. 1.

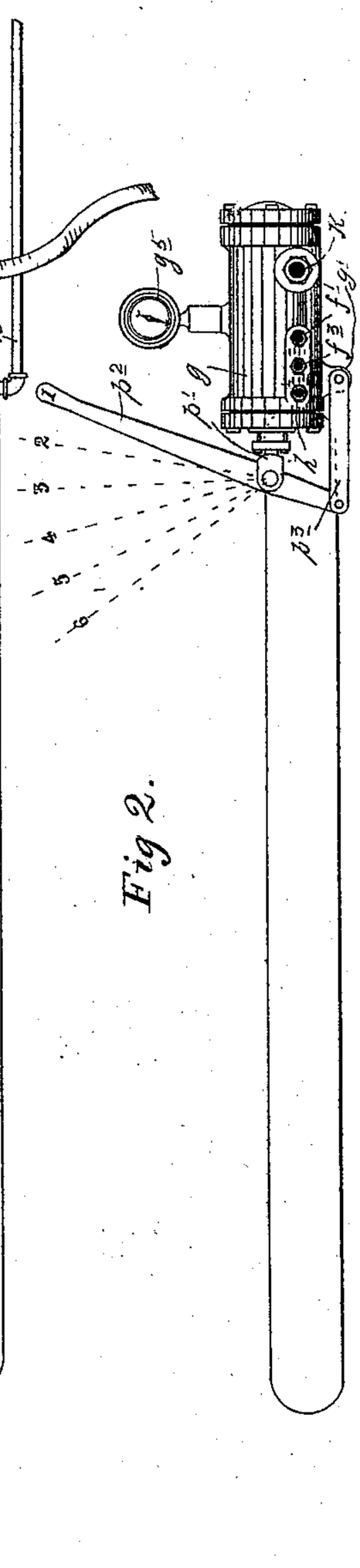

Fig. 2.

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Inventor:
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(No Model.) 3 Sheets—Sheet 2.

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Fig. 4.

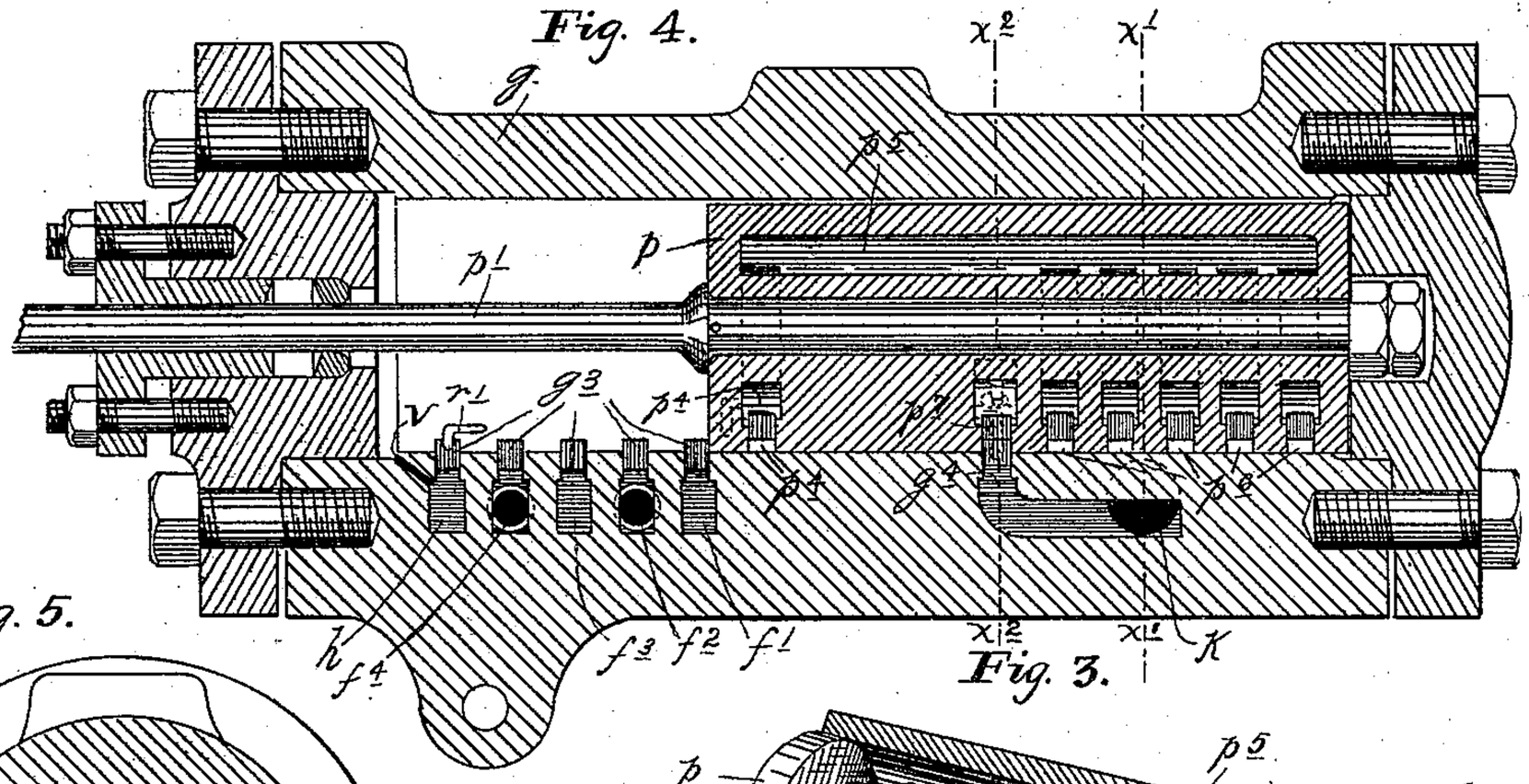


Fig. 3.

Fig. 5.

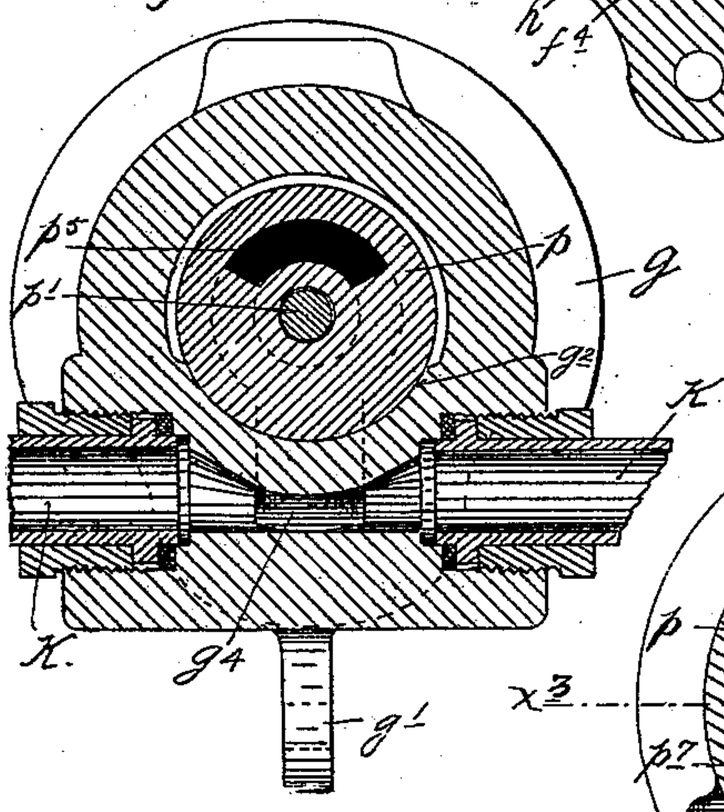
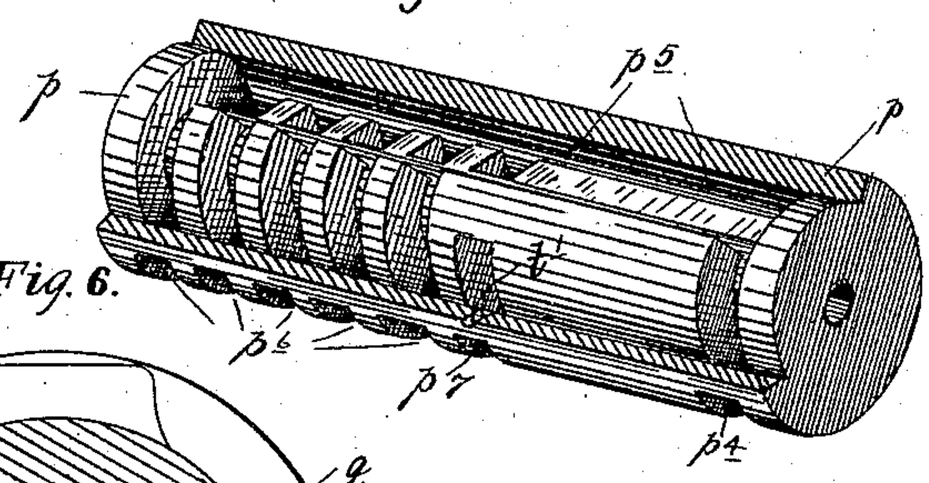


Fig. 6.



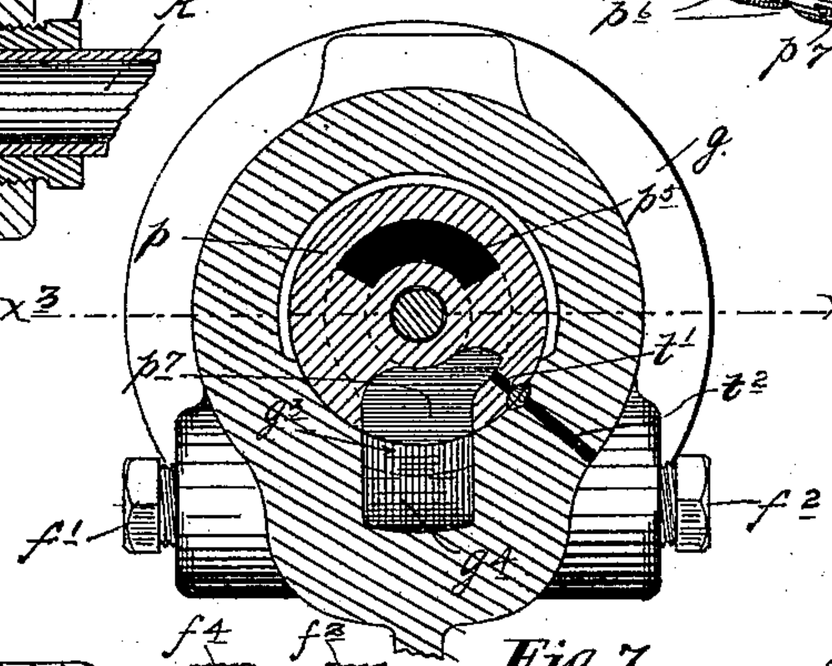
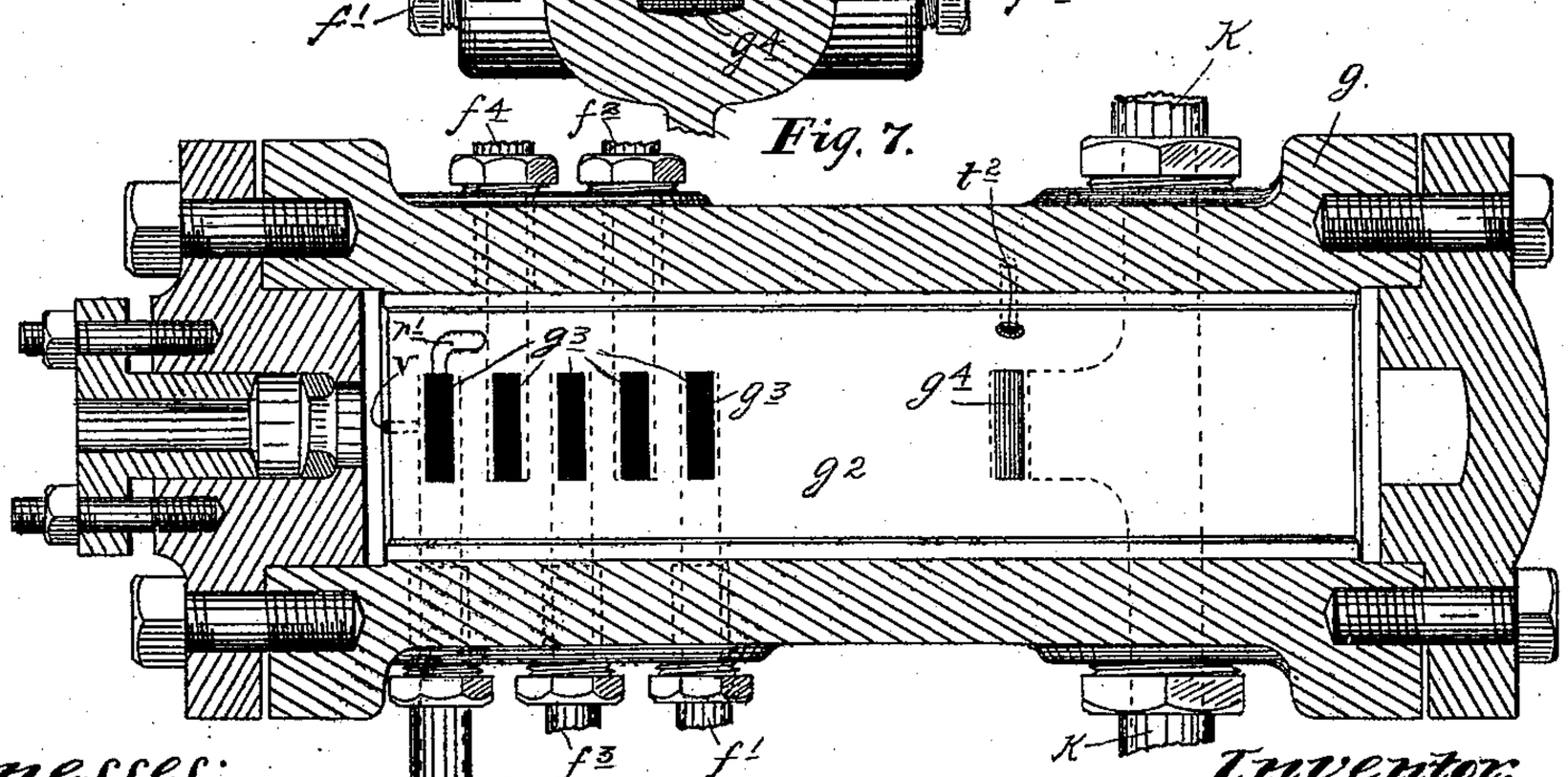


Fig. 7.



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(No Model.) 3 Sheets—Sheet 3.

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Fig. 8.

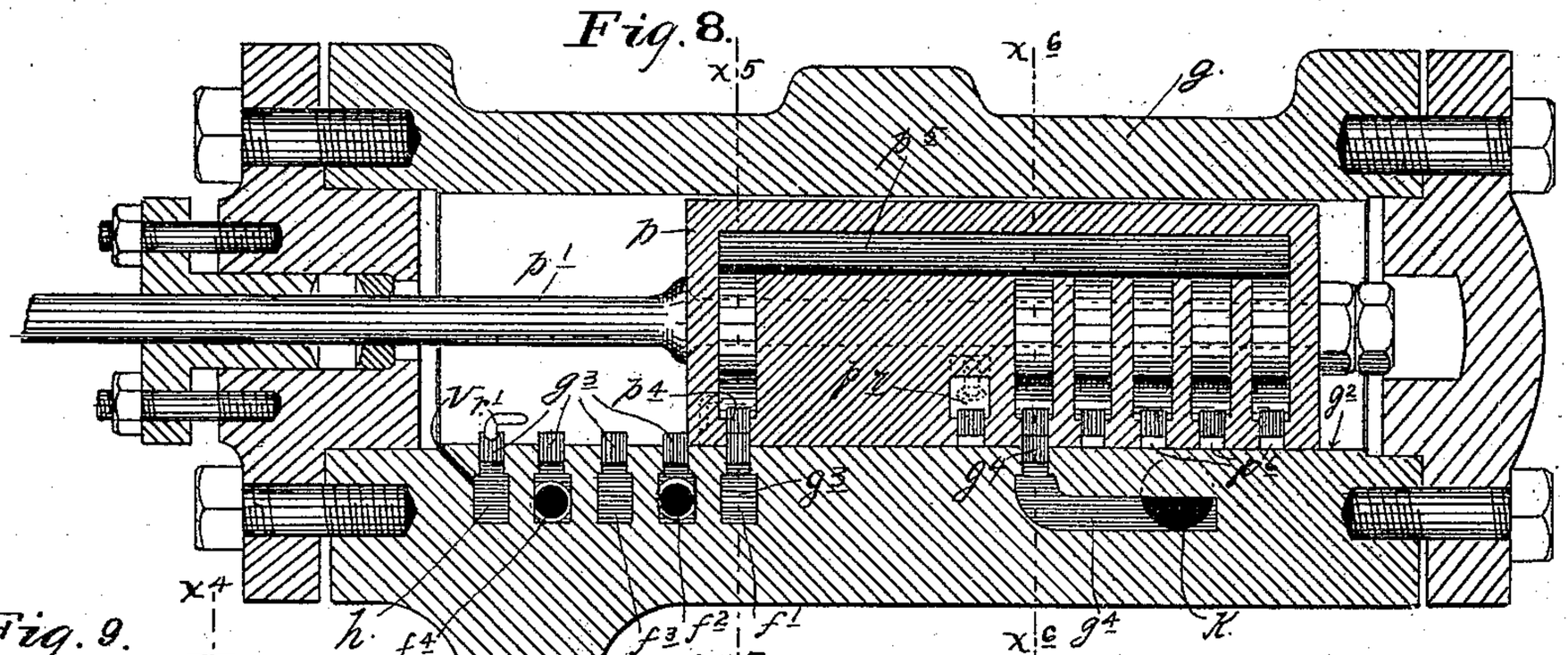


Fig. 9.

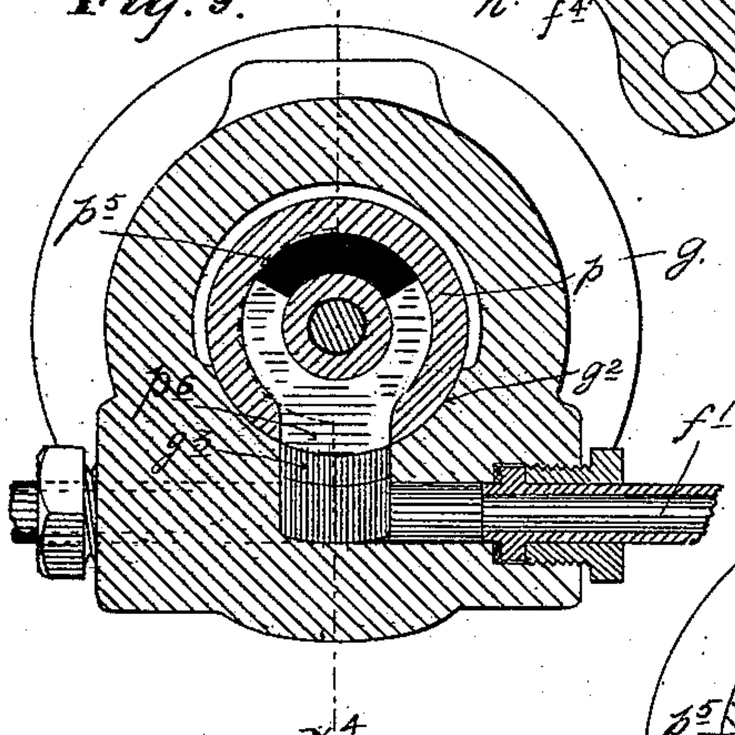


Fig. 10.

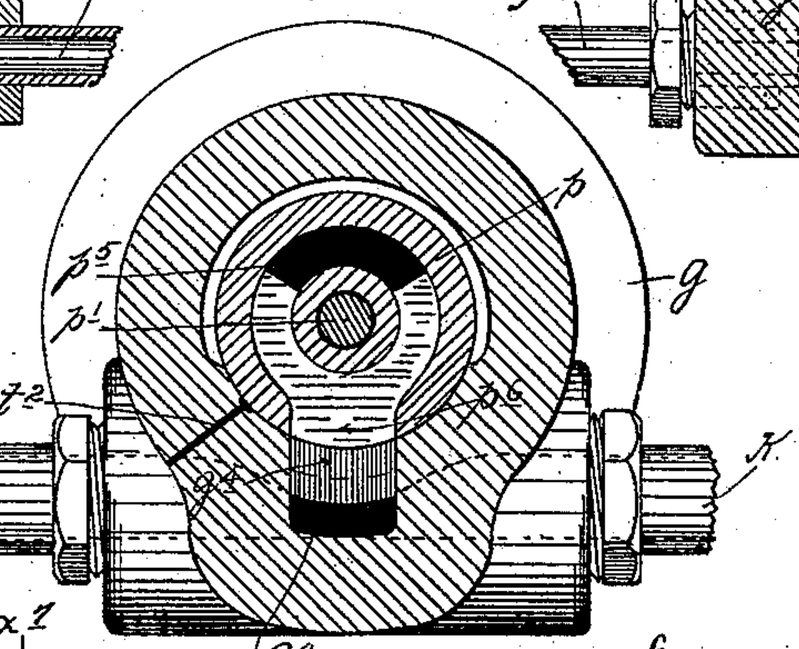


Fig. 12

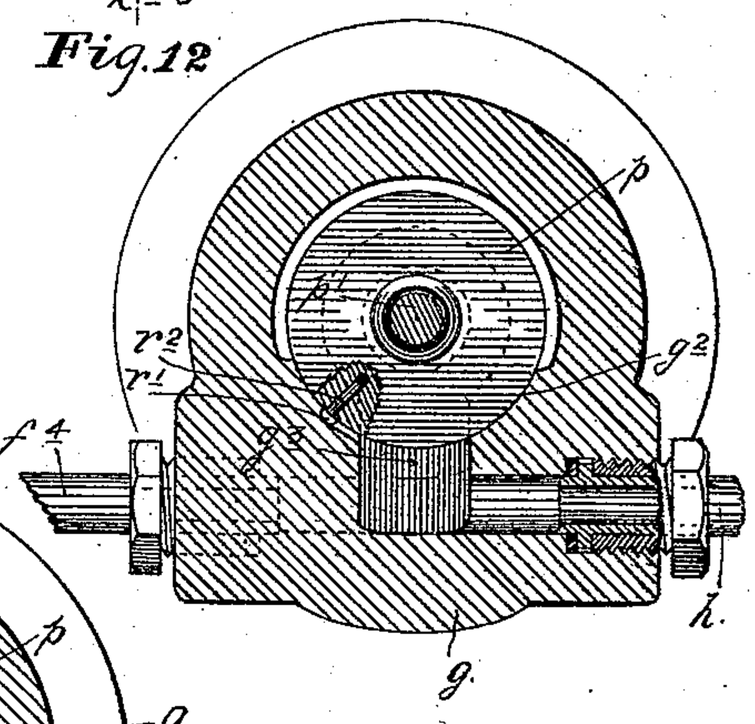
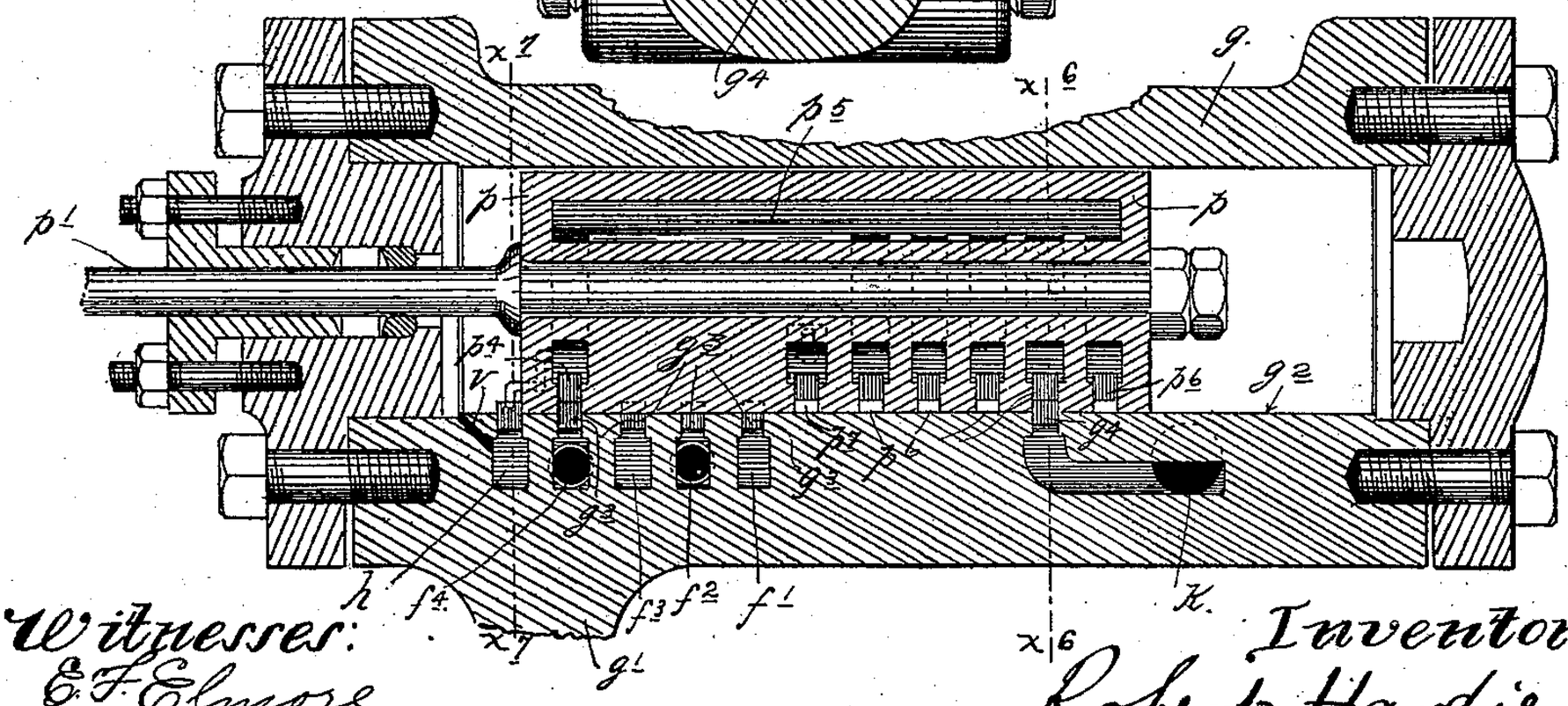


Fig. 11



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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.

CHARGING DEVICE FOR AIR-STORAGE MOTOR-CARS.

SPECIFICATION forming part of Letters Patent No. 577,024, dated February 16, 1897.

Application filed June 25, 1895. Renewed November 11, 1896. Serial No. 611,783. (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 Charging Devices for Air-Storage Motor-Cars; 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.

In that system of pneumatic railways wherein the air employed for propulsion is carried on the car or locomotive in storage reservoirs or receivers it is necessary to recharge the storage-car or locomotive at frequent intervals, as, for example, at the end of each trip made by the car. It is desirable to be able to make this charge in the storage-car as quickly as possible. To this end it has been the custom to provide either a large supply-reservoir or a battery of smaller reservoirs at the local charging-station, into which the air is forced by a compressor to a comparatively high pressure, for the purpose of being available to charge the car from the said local supply reservoir or reservoirs instead of from the compressor direct. It has also been found by experience that the storage-reservoirs on the car may be charged to a higher pressure for any given volume in the battery of reservoirs at the local station by drawing the charge from the several supply-reservoirs in succession instead of from a single large reservoir or from all the members of the battery of reservoirs at the same time.

My invention has for its object to provide a device through which the battery of reservoirs at the local station may be charged from the compressor or other primary source of supply, and by means of which the charge to the car may be quickly made, drawing the same from the several supply-reservoirs of the battery in succession and without shutting off the connection to the compressor or other primary source of supply.

To these ends my invention consists of the novel features of construction hereinafter fully described, and defined in the claims.

The invention is illustrated in the accompanying drawings, wherein, like letters referring to like parts—

Figure 1 is a plan view of a part of the charging-station with the pneumatic motor-car or locomotive in position to be charged, with some parts omitted and others broken away. Fig. 2 is a left side elevation of the charging device and one of the supply-reservoirs shown in Fig. 1 with the facing connections removed. Fig. 3 is a perspective view of the valve with some parts shown in section detached. Fig. 4 is a longitudinal vertical section through the charging device on the line $x\ x$ of Fig. 1, with the valve in its extreme right-hand or primary position with respect to the notations in Fig. 2, directions being taken with reference to Figs. 1 and 2. Fig. 5 is a vertical cross-section on the line $x'\ x'$ of Fig. 4, looking toward the left. Fig. 6 is a cross-section on the line $x^2\ x^2$ of Fig. 4, looking toward the left. Fig. 7 is a horizontal section on the line $x^3\ x^3$ of Fig. 6 with the valve removed. Fig. 8 is a vertical longitudinal section somewhat similar to Fig. 4, but is taken on the irregular line $x^4\ x^4$ of Fig. 9 instead of in the true vertical plane, as shown in Fig. 3, and with the valve moved toward the left one step, or into its second position in respect to the lever-notations on Fig. 2. Fig. 9 is a cross-section on the line $x^5\ x^5$ of Fig. 8, looking toward the right. Fig. 10 is a cross-section on the line $x^6\ x^6$ of Fig. 8 or Fig. 11, looking toward the right. Fig. 11 is a vertical longitudinal section in the same plane as Fig. 4, with the valve thrown toward the left into its fifth position in respect to the lever-notations on Fig. 2; and Fig. 12 is a cross-section on the line $x^7\ x^7$ of Fig. 11, looking toward the right.

a represents part of a street-railway track, and $b\ b'\ b^2$ represent parts of a motor-car or locomotive thereon in position for receiving a charge of air from the local station. The said motor-car is provided with a series of air-storage reservoirs c, which are connected by suitable piping c'. The said piping c' is provided with a receiving-section fitted with an outwardly-closing check-valve at c^2.

When running, the air passes from the reservoir c and the piping c' through a branch d

to reducing-valve d', and thence through pipe d^2 to a hot-water reservoir d^3, and thence out through pipe d^4 to throttle-valve d^5, and thence through pipes d^6 to the cylinders of the engines b^2. For the purposes of this case it is not deemed necessary to further specify the details of the motor-car.

At the charging-station are located a series of supply-reservoirs f' f^2 f^3 f^4, &c., to any desired number, all of which are connected to the valve-chest g of the charging device. The connections from the reservoirs f' f^2 f^3 f^4 are marked with the same letters as the reservoirs themselves, and the openings from the said connections into the valve-chest g are marked in the same way. The said valve-chest g is also tapped by a pipe h, leading to a compressor (not shown) or other primary source of supply located either at the charging-station or some point remote therefrom, and the opening from the said compressor or source pipe h into the valve-chest is marked with the same letter, as shown in Fig. 12. The said valve-chest g is also tapped by a pair of valved pipes k, with flexible sections k', for connection with the receiving-section of the piping c' on the car to effect the charge. The openings for the pipe-sections k in the valve-chest g are marked with the same letters. In the valve-chest g is mounted a valve p, provided with a stem p', which extends outward through the end of the chest and is pivoted to a hand-lever p^2, the lower end of which is connected by a link p^3 with a lug g', projecting from the valve-chest casting g, as shown in Fig. 2.

The valve p is provided with an admission-port p^4, a longitudinal connecting-port p^5, a series of outlet-ports p^6, and a leakage-port p^7. The port p^5 connects the admission-port p^4 with all of the discharge or outlet ports p^6 in the valve p, as best shown in Figs. 3 and 8. The valve p works on a seat g^2. The said seat g^2 is provided with a series of supply-ports g^3, one of which connects with the compressor or source pipe h and the other four of which connect with the openings in the chest g, which lead to the supply-reservoirs f' f^2 f^3 f^4. The said valve-seat g^2 is also provided with a discharge-port g^4, which leads to the charging-pipe openings k. The valve-seat g^2 is also provided with one section, r', of a by-pass duct r' r^2, the other section, r^2, of which is formed in the left end of the valve, as best shown in Fig. 12, for connecting the compressor supply-port with the admission-port of the valve when the valve is in its fifth position, as will later more fully appear. The valve-chest g is also provided at a suitable point in the seat g^2 with one section, t^2, of a leakage-duct t' t^2, the other section, t', of which is formed in the valve and constantly connects with the leakage-port p^7 in the said valve, as best shown in Fig. 6.

The valve p is loosely mounted on the valve stem or rod p', so as to be free for a slight vertical movement thereon, and sufficient clearance is afforded above the valve for the free passage of the air over the top of the same, as may be seen in Figs. 5, 6, 9, 10, and 12, for holding the valve down to its seat. The position of the compressor member of the supply-ports g^3, taken together with a special duct v in the valve-seat g^2, as best shown in Figs. 4, 7, 8, and 11, insures a constant supply of air under pressure to the interior of the valve-chest, for rendering the pressure available over the top of the valve and equalizing the pressure on the opposite ends of the valve.

It should further be noted that the series of supply-ports g^3 in the valve-seat g^2 and the series of outlet or discharge ports p^6 in the valve p are located so as to be in an inverse relation to each other, or, otherwise stated, the series of supply-ports g^3 in the valve-seat are in the left end portion of the seat, and the series of outlet or discharge ports p^6 in the valve are at the right end portion of the same. The said supply-ports g^3 in the seat and the said outlet-ports p^6 in the valve are spaced apart equal distances by intervening walls of the valve-seat and the valve, respectively. The admission-port p^4 of the valve and the discharge-port g^4 of the seat are also located so as to be in an inverse relation to each other. Hence the admission-port p^4 of the valve may be made to register in succession with any one of the supply-ports g^3 in the seat, and when this occurs some one of the outlet or discharge ports p^6 of the valve will be in registration with the discharge-port g^4 of the seat.

With the foregoing statements of fact clearly in mind the operation of this valve mechanism may be readily traced.

If the valve be in its primary position, as shown in Figs. 1, 2, and 4, at the extreme right hand of its travel, it will be obvious from an inspection of Figs. 4, 5, and 6 that the air supplied from the compressor or other primary source through the pipe h will pass directly into the valve-chest, in front of the valve, and will be equally distributed therefrom through the other members of the ports g^3 into the supply-reservoirs f' f^2 f^3 f^4 at the station. It is also obvious, by reference to Figs. 4, 5, and 6, that when the valve is in its said primary position the leakage-port p^7 of the valve will be in registration with the discharge-port g^4 of the seat, and hence, if the charging-pipes k k' be in communication with the cars and contain any air under pressure, then if the valves in the sections k be open the air in said pipes k k' may blow out through the registered ports g^4 and p^7 and the registered sections of the leakage-ducts t' and t^2, as shown in Fig. 6. This leakage is serviceable for emptying the charging-pipes after the storage-reservoirs on the car have been given their charge, in order to facilitate the separation of the said charging-pipes from the car-pipes.

If now the valve be moved toward the left

one step, so as to occupy the second position, all the ports will appear as shown in Figs. 8, 9, and 10; or, otherwise stated, the right-hand member of the supply-ports g^3 will connect with the admission-port p^4 of the valve, and the left-hand member of the outlet-ports p^6 in the valve will connect with the discharge-port g^4 in the seat, and hence the supply-reservoir f' will be connected with the storage-reservoirs on the car, supposing the charging-pipes $k\,k'$ to be in the position shown in Fig. 1 and their valves to be open. On the movement of the valve p toward the left another step, or into its third position, the supply-reservoir f^2 will be brought into communication with the storage-reservoir c on the car. At the third position of the valve the supply-reservoir f^3 will be brought into communication with the storage-reservoirs on the car, and at the fourth position of the valve the supply-reservoir f^4 will be brought into communication with the storage-reservoirs on the car. If a larger number of supply-reservoirs were employed at a local station, the same rule would hold, supposing the supply-ports in the valve-seat and the outlet-ports in the valve to be correspondingly increased in number.

During the movement of the valve from its primary to its fourth position it is obvious that there will always be one or more supply-ports g^3, leading to one or more of the supply-reservoirs at the station, open in advance of the valve, and this, of course, will permit the supply from the compressor or other primary source through the pipe h to pass into the said supply-reservoirs, which remain in open communication with the valve-chest in advance of the valve. It is equally obvious that the said supply-reservoirs will be successively cut off from the compressor or source connection in the same order as they are connected with the storage-reservoirs on the car. Hence if the compressor is to continue to run or the primary source to remain in communication with the valve-chest in advance of the valve some provision must be made for taking care of the supply at the time when the valve reaches its fifth position. This is accomplished by the by-pass $r'\,r^2$, the section of which in the seat and in the valve will then come into registration, as clearly shown in Figs. 11 and 12, and will permit the supply from the compressor or other primary source to blow through into the admission-port p^4 of the valve and pass with the supply from the reservoir f^4 into the car.

By throwing the valve into its sixth or outermost left-hand position the admission-port p^4 of the valve will be brought into direct registration with the compressor or source member of the supply-ports g^3 and permit the direct charging of the car from the compressor or primary source whenever so desired, and during this time the duct v will pass into the valve-chest sufficient air to hold the valve down to its seat.

After the charge of the car has been completed in the manner above described the valve is thrown back to its primary or first position, as shown in Fig. 4, &c., whereby the bleeding-port p^7 of the valve will be brought into registration with the port g^4 in the seat for emptying the charging-pipe $k\,k'$, as hitherto noted. The flexible sections k' of the said charging-pipe may then be readily disconnected from the car-pipe without noise.

The leverage may be arranged so as to permit the valve p to be operated by hand; but in practice it will be desirable to operate the said valve p by a power device, on account of the high pressure to which the valve will be subject from the supply-reservoirs $f'\,f^2$, &c., at the time when the charge of the car is being made.

The valve-chest g is shown as provided with a pressure gage or register g^5 for indicating the pressure in the supply-reservoirs and the valve-chest.

In the drawings the charging device has been shown as provided with a pair of charging-pipe connections $k\,k'$, although only one set thereof would of course be used for charging a single car. It is contemplated, however, that the charging-station will be located between a pair of tracks, and that it will be adapted for the charging of two motor-cars at the same time if necessary.

As already stated, the primary purpose of this charging device was for use in charging the reservoirs of storage-cars or locomotives; but it will be understood, of course, that the same is equally well applicable for charging an air receiver or reservoir, wherever located and however applied, from a battery of supply-reservoirs one after the other in succession, without shutting off the compressor or primary-source connection.

It is equally obvious that this charging device would be serviceable for a similar usage with any other kind of elastic fluid as well as for air.

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

1. A device, for charging supply-reservoirs from a compressor or other primary source and for charging a storage-car or other receiver from said supply-reservoirs, comprising a valve and valve-seat with the ports therein arranged to permit the several supply-reservoirs to be connected with the storage-car, in succession, under a step-by-step movement of the valve, while always keeping open the compressor or source connection and delivering therefrom first to the untapped reservoirs in advance of the valve and then to the storage-car on reaching the last of the reservoirs, substantially as and for the purposes set forth.

2. A charging device involving the combination with a valve-seat, having a series of supply-ports and a discharge-port, of a valve having an admission-port, a series of outlet or discharge ports and a port connecting said

admission-port with all of said outlet-ports, in the valve, with the ports in the seat and in the valve in reverse relation to each other, for permitting the supply-ports of the seat to be connected with the discharge-port thereof, under a step-by-step movement of the valve, substantially as described.

3. A device, for charging an air-storage car or other receiver from one or more supply reservoirs, comprising a valve and valve-seat with coöperating ports for connecting the supply reservoir or reservoirs to the car, and with coöperating ports for bleeding the charging-pipes, after the charge is made, under the control of said valve, substantially as described.

4. The combination with the supply-reservoirs f' f^2, &c., and the compressor or source pipe h, of the valve-chest g, the valve-seat g^2 having the supply-ports g^3, the discharge-port g^4, the by-pass section r', the bleeding-duct section t^2 and the chest-duct v, the valve p having the admission-port p^4, the discharge or outlet ports p^6, the connecting-port p^5, the bleeding-port t', the by-pass section r^2, one or more charging-pipes k k', for connection with the car or other receiver, and means for operating the valve, substantially as and for the purposes set forth.

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

ROBERT HARDIE.

Witnesses:
F. H. COHOON,
JAS. F. WILLIAMSON.