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FLUID PRESSURE BRAKE SYSTEM.

APPLICATION FILED JUNE 25, 1903.

Fig. I.

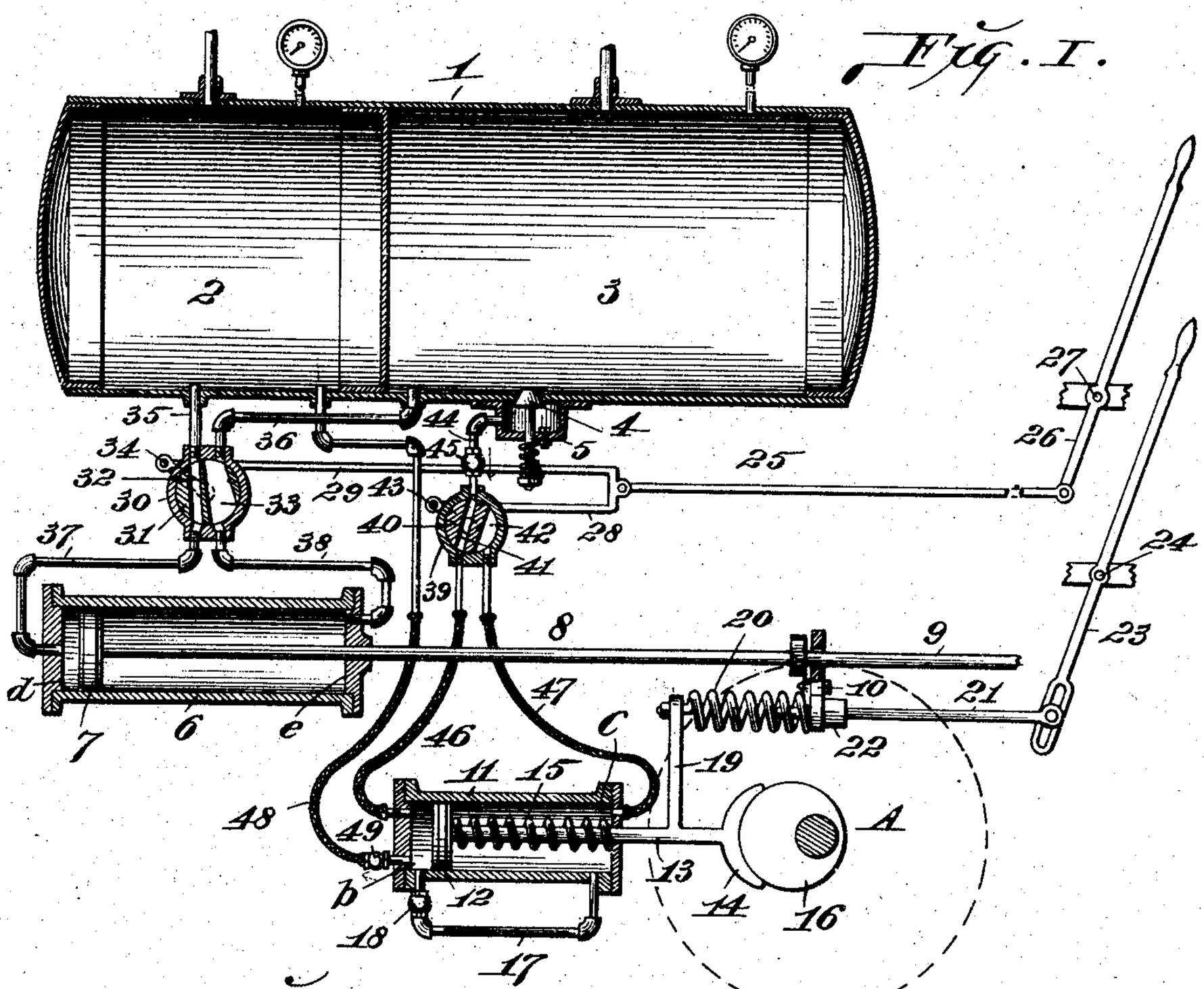


Fig. II.

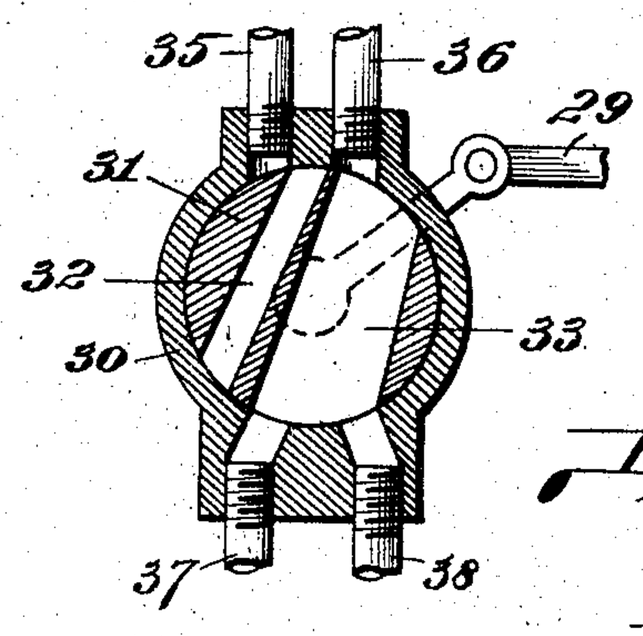


Fig. III.

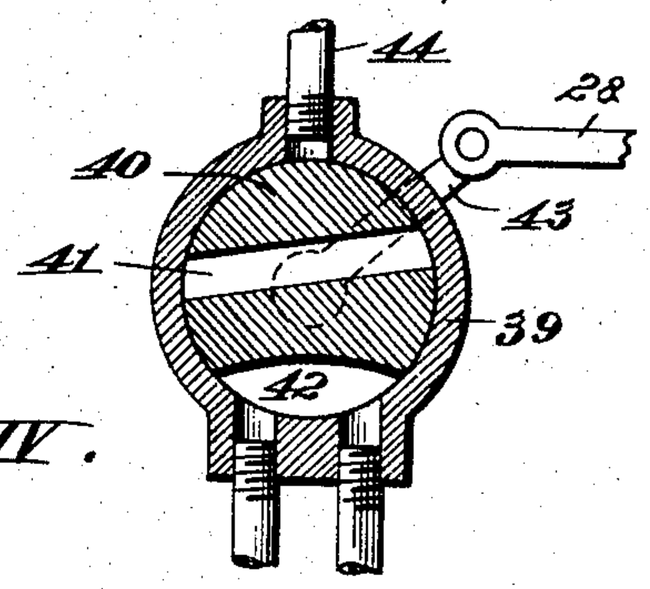
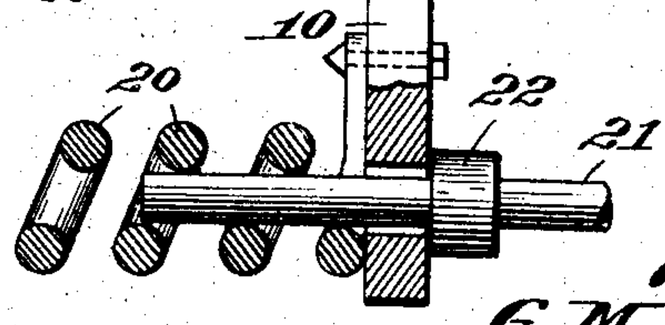


Fig. IV.



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UNITED STATES PATENT OFFICE.

GEORGE M. SPENCER AND CHRISTOPHER J. GRELLNER, OF ST. LOUIS, MISSOURI.

FLUID-PRESSURE BRAKE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 781,029, dated January 31, 1905.

Application filed June 25, 1903. Serial No. 162,997.

To all whom it may concern:

Be it known that we, GEORGE M. SPENCER and CHRISTOPHER J. GRELLNER, citizens of the United States, residing in the city of St. Louis, in the State of Missouri, have invented certain new and useful Improvements in Fluid-Pressure Brake Systems, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

Our invention relates to a fluid-pressure brake system for use upon railway-cars; and, briefly stated, the invention comprises a system in which it is rendered possible to utilize the same fluid in the system over and over with uniform efficiency. The system further contemplates the carrying of a high pressure in one part thereof and a lower pressure in another part and means whereby the low pressure is converted into high pressure for utility in the operation of car-brakes.

Our invention consists in features of novelty hereinafter fully described, and pointed out in the claims.

Figure I is a sectional view of our fluid-pressure-system apparatus, parts of the apparatus being shown in elevation. Fig. II is a section of the controlling-valve located between the high and low pressure chamber of the apparatus and the power-cylinder with the ducts in said valve in the position in which they appear in equalizing the pressure in the power-cylinder with low pressure. Fig. III is a section of the controlling-valve between the low-pressure chamber and the compressor of the apparatus with the ducts in the valve shown in the position in which they appear in equalizing the pressure in the compressor-cylinder. Fig. IV is a section of the spring by which the compressor-cylinder piston is controlled and the adjacent parts by which said spring is governed.

To afford a proper understanding of our invention, we consider it advisable to classify the descriptions of fluid-pressure systems now in use, which we divide into two classes—namely, the independent and storage systems—in both of which the fluid commonly used is air. By the "independent" systems we refer to that class in which a complete generating appliance is utilized to furnish the pressure as it is used. By the "storage" systems we refer to that class in which the generation of pressure is accomplished in a generating-station and delivered into storage-tanks for use on railway-cars, &c. The object in both of the classes mentioned is to furnish a constant and regular supply of pressure medium, and a further object in the storage system over the independent system is to provide for the protection of the generating machinery against dust and to exclude the entrance of dust into the pressure medium.

We will mention a few of the objections to the two methods now in use. In the independent system the generating machinery is constantly exposed and the fluid used is unprepared, so that it frequently freezes in low temperatures, thereby rendering the system impractical. The storage system requires extensive plants to furnish the required volume of fluid and to dry or otherwise prepare the fluid and extensive machinery to generate the pressure. It moreover necessitates the use of very large tanks or other receptacles to carry a reserve supply on a vehicle, and this supply diminishes in volume pressure by use and temperature, thereby becoming irregular, and therefore unreliable.

For the purpose of overcoming the objections noted we make use of some of the features of both the storage and independent systems by combining them and utilize in connection therewith what we term an "intermediate" system. By so doing we need only a small generating plant to prepare and supply the initial volume and pressure of fluid and furnish density. We also guard against the entrance of dust and dirt, and by simple devices we are able to retain the pressure of fluid through dividing the mechanical operation in the combined systems and utilizing some of nature's assistance, such as momentum of the vehicle, so that we effect a saving in large percentage of actual energy expended over what is present in the systems heretofore in use and to which reference has been made.

We are aware that there are various ways in which our system may be carried out, but it is deemed sufficient to herein illustrate and

describe one method only, without by so doing limiting ourselves to any particular arrangement of the parts in the system.

1 designates a tank containing a high-pressure chamber 2 and a low-pressure chamber 3.

4 is a governor-valve controlling an outlet from the low-pressure chamber and having communication with a valve-box 5. The valve 4 is controlled by a spring fixed to the valve-box 5 by means of a bolt.

6 designates a power-cylinder in which operates a piston 7, that carries a power piston-rod 8, from which extends the brake-mechanism-operating rod 9. (See Fig. I.) The power piston-rod also carries a collar 9^a, and to the piston-rod is loosely and slidably fitted an arm 10, to which reference will hereinafter be made.

11 designates a compressor-cylinder that contains a piston 12, which carries a piston-rod 13, equipped with a shoe 14 and surrounded in the interior of the compressor-cylinder by a coil-spring 15, that is positioned between the piston 12 and the end of the cylinder near the shoe 14. The shoe 14 is adapted to receive the engagement of an eccentric 16, fixed to one of the car-axles or wherever connected, as seen at A, Fig. I. Communication between the outer end *b* of the compressor-cylinder and the inner end *c* of said cylinder is provided for by a return-pipe 17, that contains a check-valve 18, that permits flow of pressure medium from the end *c* to the end *b* of the cylinder, but prevents flow of fluid in the opposite direction. The compressor piston-rod 14 carries an arm 19, that extends from said piston-rod in the direction of the power-cylinder piston-rod 8 and receives the bearing of an expansion-spring 20, that occupies a position between said arm 19 and the arm 10, carried by the power-cylinder piston-rod. Said spring 20 is fixed to the arm 10 by a bolt.

21 is a throw-rod that extends through the arm 10 and bears a collar 22, that rests against the arm 10. The outer end of the throw-rod 21 is connected to a lever 23, that is pivoted at 24 to a suitable fulcrum-support.

25 designates a throw-rod pivoted to a lever 26, that is pivoted at 27 to a suitable fulcrum-support. The throw-rod 25 is connected to a pair of arms 28 and 29.

30 designates a valve-housing containing a valve 31, provided with ducts 32 and 33 and having connected thereto a crank-arm 34, to which the throw-rod-operated arm 29 is united. The valve-housing 30 receives the connection of a pipe 35, leading from the high-pressure chamber 2 of the system, and a pipe 36, leading from said housing to the low-pressure chamber 3.

37 is a pipe leading from the valve-housing 30 to the end *d* of the power-cylinder 6, and 38 is a pipe leading from the same housing to the end *e* of the power-cylinder.

39 is a valve-housing containing a valve 40, provided with ducts 41 and 42 and bearing a crank-arm 43, to which the throw-rod-operated arm 28 is connected. Communication to the valve-housing 39 from the low-pressure chamber 3 is furnished through a conducting-pipe 44, that leads from the valve-box 5 to said housing and contains a check-valve 45, through which the fluid may pass from said valve-box to said housing, but by which retrograde flow of the fluid is prevented.

46 is a communication-pipe situated between the valve-housing 39 and the end *b* of the compressor-cylinder 11, and 47 is a communication-pipe situated between the said housing and the end *c* of the compressor-cylinder to equalize as brakes are released.

48 is a conducting-pipe leading from the end *b* of the compressor-cylinder to the high-pressure chamber 2 and through which the air compressed in said cylinder is conveyed to said chamber. This pipe 48 contains a check-valve 49, that opens to permit the flow of fluid from the compressor-cylinder into and through the pipe to the high-pressure chamber 2, but through which retrograde flow is prevented.

The pipes 46, 47, and 48 are all, at least preferably in part, flexible, as illustrated in Fig. I, in order that any movement of the compressor-cylinder 11 in the operation of the system may not affect the remaining parts of the system.

In the practical use of our system the parts are operated as follows: Through the medium of the lever 26, throw-rod 25, and arms 28 and 29 the valves 31 and 40 are moved into the positions seen in Fig. I. It will be understood, as hereinbefore alluded to, that the chamber 2 has been charged with a high pressure and the chamber 3 with a low pressure. Now when the valve 31 is moved into the position mentioned communication is established between the high-pressure chamber 2 and the end *d* of the power-cylinder through the pipe 37, and the fluid entering into said cylinder operates against the piston 7 and acts to move the power piston-rod 8 and operate the brake mechanism through the medium of the operating-rod 9. At the same time any air at the opposite side of said piston 7 in the power-cylinder is forced from the cylinder through the pipes 38 and 36 into the lower-pressure chamber 3 by passing through the valve 31. At the same time that the valve 31 is operated to permit the flow of fluid to the power-cylinder the valve 40 is operated to move it into the position seen in Fig. I, so that fluid from the low-pressure chamber will cause the governor-valve 4 to be unseated, and the fluid will flow to and through the pipe 44 to the valve 40 and from the valve-housing 39 through the communication-pipe 46 to the end *b* of the compressor-cylinder 11. When the foregoing occurs, the power-cylinder piston-rod acts, through the medium of its arm 10, to expand the spring 20 and force the compressor-

cylinder piston-rod 13 forwardly in the direction of the eccentric 16 through the medium of the arm 19, in which action the spring 15, which is weaker than the spring 20, is overcome, and the shoe 14, carried by the compressor-cylinder piston-rod, is moved to the eccentric 16, to be engaged thereby. The result is that fluid is transferred from *c* to *b* through pipe 17 and mixed with the fluid received from low pressure as the car-brakes are applied to stop or check the car, the piston 12 in the compressor-cylinder is reciprocated to compress the air passing to the compressor-cylinder from the low-pressure chamber 3, and when compressed to a high pressure the fluid passes into the conducting-pipe 48 and flows to the high-pressure chamber 2 to maintain the supply of high pressure therein. The return-pipe 17 furnishes communication between the ends of the compressor-cylinder, through which fluid at the end *c* of said cylinder is returned to the end *b*. When the brakes are released, the valves 31 and 40 are moved into the position seen in Figs. II and III, thereby connecting both ends of the power-cylinder to the low-pressure chamber 3 through the pipe 36 and also connects each end of the compressor-cylinder through the pipe 46 and 47 to thereby equalize the pressure in said cylinder and permit the springs 15 and the brake-spring 20 to readjust themselves into their normal positions.

As will appear from the foregoing, fluid is compressed and forced into the high-pressure chamber 2 during the act of setting the brakes. It is desirable at certain times or in certain instances to create a more positive action between the eccentric-shoe 14 and the eccentric 16 to more forcibly compress the air in the compressor-cylinder 11, to be forced therefrom in the course previously referred to to the high-pressure chamber 2. At such times the lever 23 may be manipulated to actuate the throw-rod 21 and cause movement of the piston-rod 13 against the action of the spring 15 in the compressor-cylinder. When this actuation takes place, the eccentric-shoe 14 is drawn to the eccentric 16 in a positive manner, and the eccentric operating against the shoe will act to more forcibly drive the piston-rod 13 forwardly and cause the piston carried thereby to compress the air in the compressor-cylinder. The movement of the throw-rod 21 independently of the brake-operating rod 9 is permitted, due to the sliding connection between said rods furnished by the arm 10, as seen in Fig. 1.

By our arrangement we are enabled to carry a volume to supply the high-pressure chamber 2 in case of leakage. For example, suppose we charge the high-pressure chamber to one hundred and fifty pounds per square inch and the low-pressure chamber to seventy pounds per square inch. We then have seventy-five pounds per square inch that can be applied to brake; but, if due to leakage, the pressure in the storage-tank should become reduced to, say, one hundred and forty pounds per square inch there would be available for use but sixty-five pounds per square inch, that being the difference in pressure in the chambers 2 and 3; but, however, by adjusting the governor-valve 4 so as to retain but sixty pounds per square inch in the low-pressure chamber the difference of pressure between the seventy-five pounds and sixty pounds will be transferred to the high-pressure chamber, and this will be maintained until there is absence of pressure in the low-pressure chamber, at which time the chambers should be recharged. We recommend the recharging, so as to keep a supply volume under pressure to assist in compressing.

In our brake system we provide by the arrangement and combination of parts set forth without limiting ourselves to the specific construction shown for the use and reuse of the same fluid over and over, thereby accomplishing a great saving in the amount of compressed fluid necessary to operate the car-brakes. We further provide for the maintenance of a steady and uniform pressure in the storage-chamber of our system solely by the momentum of the car. We prevent the ingress of dust into the system and avoid freezing of the fluid under low temperatures, owing to the fluid being prepared previous to its use. We also provide a construction in which all of the parts of the system are thrown out of operation when the brakes are released. In addition to the foregoing we would call attention also to the fact that the fluid in our system is retained and transferred from one part of the system to another, due to the velocity and momentum of a car during the period that it is being stopped or checked by the brakes and not at a time when the motive power is shut off and the momentum of the car is relied upon for its travel. If the system were operated under the latter condition, the motive power would be used indirectly, and it would have to be again thrown into use much sooner than under the condition in which we operate our brake—namely, at the time that the car is being stopped or checked by the brakes.

We claim as our invention—

1. A fluid-pressure system having means therein to utilize different degrees of original fluid-pressures for the purpose of reconverting low pressures to high pressures without loss during operation of system, substantially as set forth.

2. A fluid-pressure system having a compressor therein, means for supplying said compressor with fluid volume under pressure, and means for operating said compressor solely through the momentum of the vehicle to re-

turn the compressed fluid from said compressor to the source of supply without loss, substantially as set forth.

3. A fluid-pressure brake system having high and low pressure chambers and containing a power-cylinder, means for delivering fluid to the low-pressure chamber and for connecting both ends of said power-cylinder to said low-pressure chamber to release the brakes, substantially as set forth.

4. In a fluid-pressure brake system, the combination of a power-cylinder through the medium of which the brakes are applied, a compressor, and a piston operating in said compressor, a shoe carried by said piston, an eccentric carried by a revolving part of a car to actuate said shoe, and means for releasing the pressure from said power-cylinder and compressor simultaneously to relieve frictional contact between said shoe and said eccentric when the brakes are released.

5. In a fluid-pressure system, the combination of a pressure-chamber, power mechanism to which the fluid is conducted, and means for returning the fluid to said chamber for reuse continually and without escape from the system throughout the operation thereof, substantially as set forth.

6. In a fluid-pressure system, the combination of a pressure-chamber, power mechanism to which the fluid is conducted from said chamber, and means for compressing said fluid and returning it to said chamber for reuse continually and without escape from the system throughout the operation thereof, substantially as set forth.

7. In a fluid-pressure system, the combination of a pressure-chamber, power mechanism to which the fluid from said chamber is conducted, means through which the fluid is conveyed from said power mechanism, and means for converting said fluid into high pressure again and returning it to said pressure-chamber for reuse continually and without escape from the system throughout the operation thereof, substantially as set forth.

8. In a fluid-pressure system, the combination of a chamber containing constant high pressure, a chamber containing constant low pressure, power mechanism having communication with said high and low pressure chambers, and means having connection with said low-pressure chamber for compressing the fluid and returning it to said high-pressure chamber, substantially as set forth.

9. In a fluid-pressure system, the combination of a chamber containing constant high pressure, a chamber containing constant low pressure, a power-cylinder having communication with said chambers, a compressor-cylinder having communication with said low-pressure chamber and also with said high-pressure chamber, and means whereby fluid entering said compressor-cylinder from said low-pressure chamber is converted into high pressure in said cylinder and returned to said high-pressure chamber, substantially as set forth.

10. In a fluid-pressure system, the combination of a chamber containing constant high pressure, a chamber containing constant low pressure, a power-cylinder having communication with said chambers, a governor-valve controlling an outlet from said low-pressure chamber, a compressor-cylinder, means leading from the location of said governor-valve to said compressor-cylinder through which the fluid is conducted from said low-pressure chamber to said compressor-cylinder, a pipe leading from said compressor-cylinder to said high-pressure chamber, and means for compressing the fluid in cylinder and forcing it through said pipe to said high-pressure chamber, substantially as set forth.

11. In a fluid-pressure system, the combination of high and low pressure chambers, a power-cylinder having communication with said chambers, a compressor-cylinder having communication with said chambers, a piston operating in said compressor-cylinder, a shoe carried by said piston and an eccentric carried by a car-wheel axle or other suitable place to operate said piston, substantially as set forth.

12. In a fluid-pressure system, the combination of high and low pressure chambers, a power-cylinder having communication with said chambers, a piston operating in said power-cylinder, a piston-rod carried by said piston, a compressor-cylinder having communication with said high and low pressure chambers, a piston in said compressor-cylinder, a piston-rod carried by said piston, a spring surrounding said piston-rod, and a spring interposed between said power-cylinder piston-rod and said compressor-cylinder piston-rod, substantially as and for the purpose set forth.

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In presence of—
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