No. 778,396. PATENTED DEC. 27, 1904.

W. L. BARKER.

RAILWAY CAR BRAKE.

APPLICATION FILED FEB. 17, 1904.

4 SHEETS—SHEET 1.

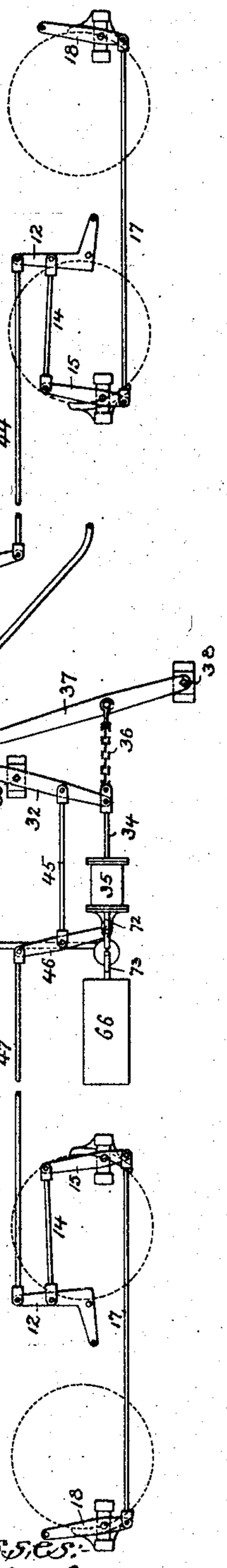

Fig. 4.

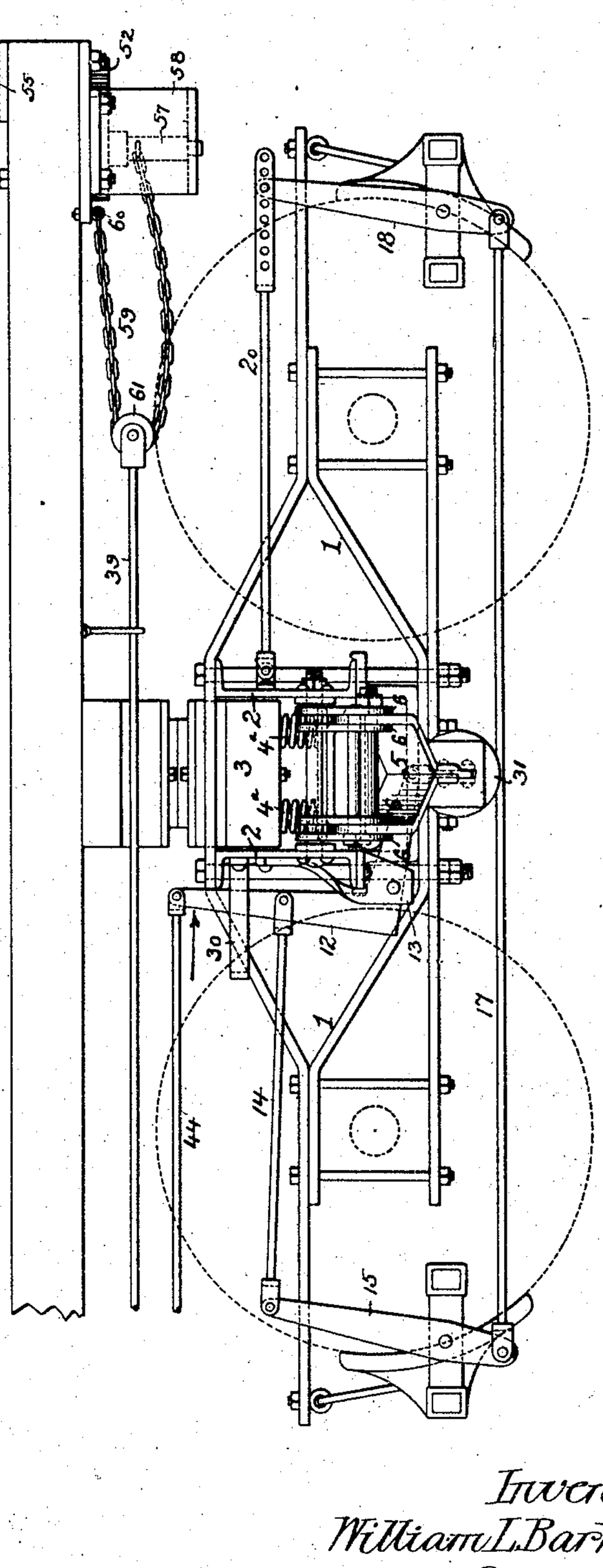

Fig. 1.

Witnesses:-
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4 SHEETS—SHEET 2.

Fig. 3.

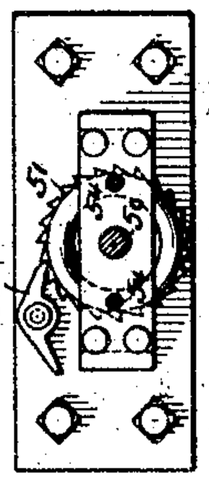

Fig. 2.

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4 SHEETS—SHEET 3.

Fig. 7.

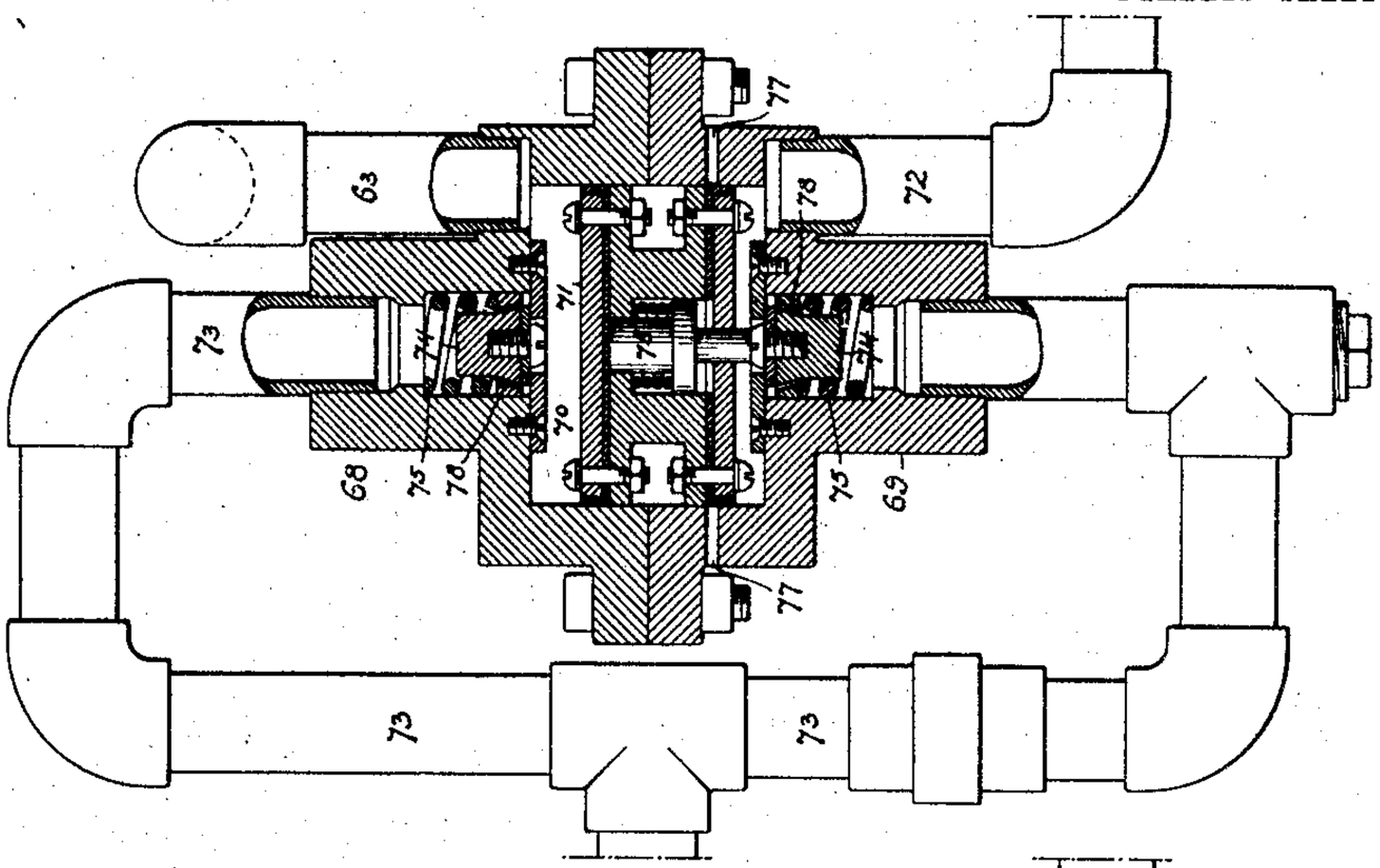


Fig. 6.

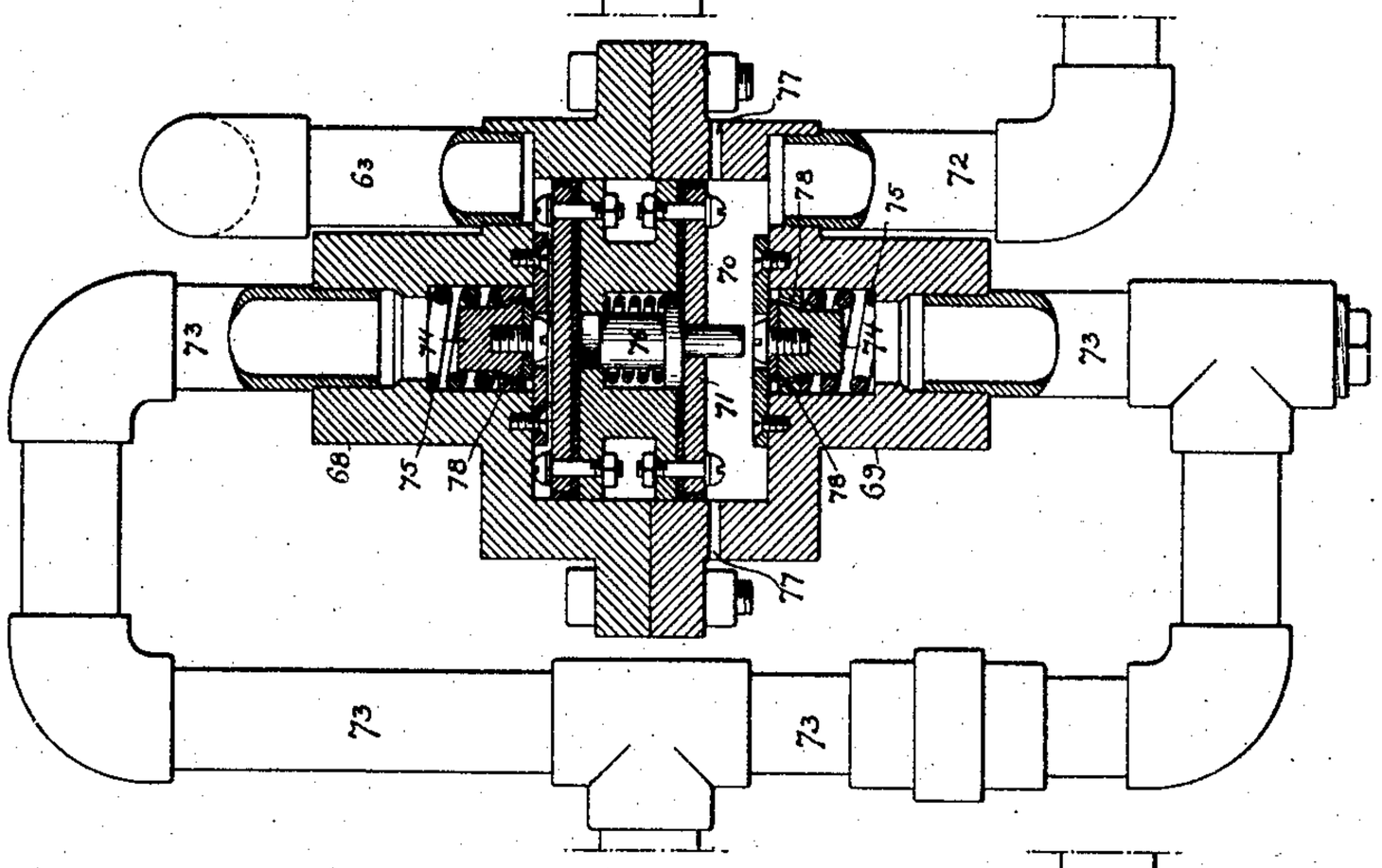
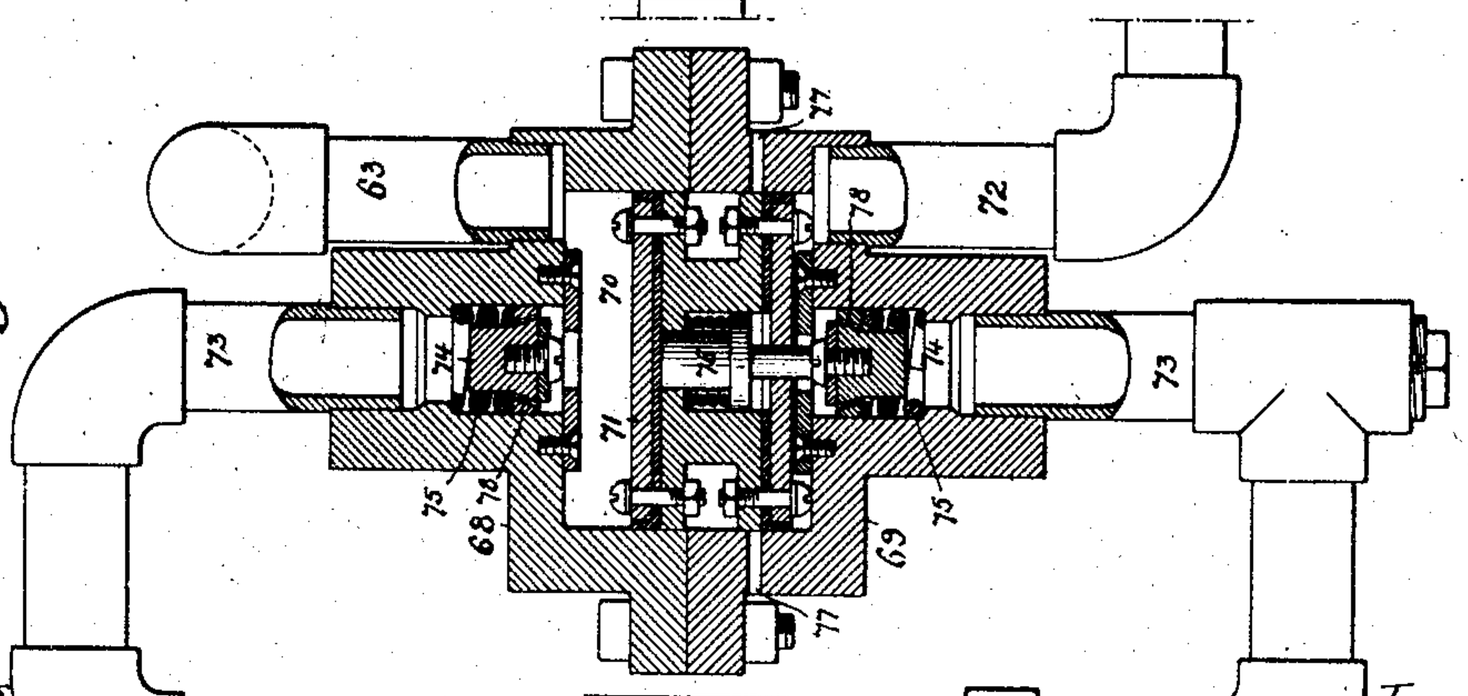


Fig. 5.



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No. 778,396. PATENTED DEC. 27, 1904.

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RAILWAY CAR BRAKE.

APPLICATION FILED FEB. 17, 1904.

4 SHEETS—SHEET 4.

Fig. 10.

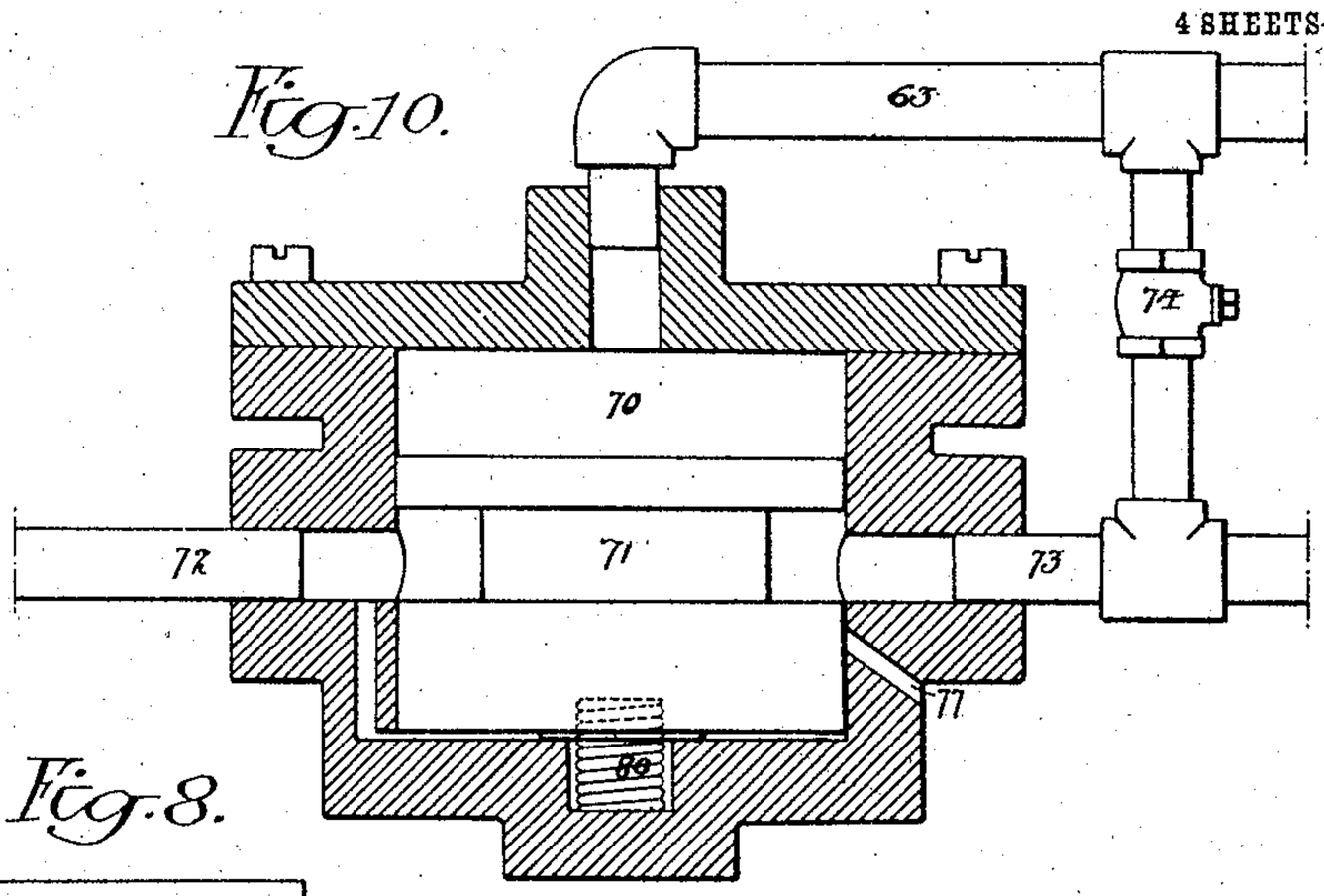


Fig. 8.

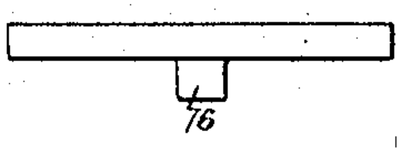


Fig. 11.

Fig. 9.

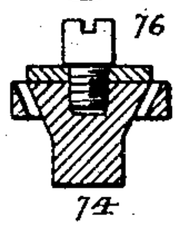
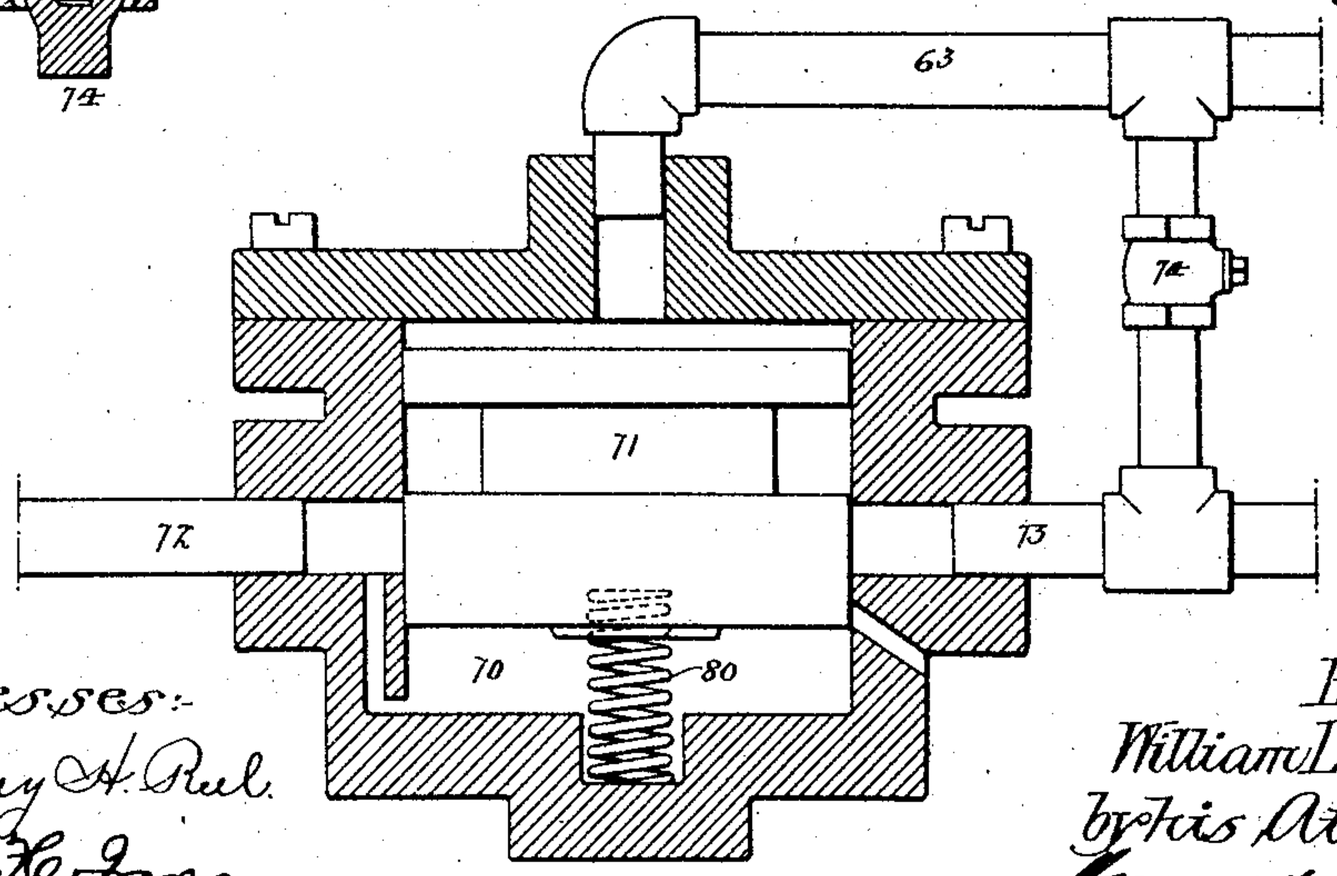


Fig. 12.



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No. 778,396. Patented December 27, 1904.

UNITED STATES PATENT OFFICE.

WILLIAM L. BARKER, OF ASHBOURNE, PENNSYLVANIA.

RAILWAY-CAR BRAKE.

SPECIFICATION forming part of Letters Patent No. 778,396, dated December 27, 1904.

Application filed February 17, 1904. Serial No. 194,004.

To all whom it may concern:

Be it known that I, WILLIAM L. BARKER, a citizen of the United States, residing in Ashbourne, Pennsylvania, have invented certain Improvements in Railway-Car Brakes, of which the following is a specification.

My invention consists of certain improvements in the railway-car brake forming the subject of my prior application, Serial No. 166,102, filed July 18, 1903, one object of my present invention being to render the braking action more directly proportionate to the work to be performed than was possible with the construction previously devised, a further object being to insure the proper application of the brakes to the wheels of both trucks of an unevenly-weighted car without the use of the stops forming an element of the prior structure, and still further objects being to provide for the release and either full or partial application of the brakes, either by hand or fluid-pressure mechanism, and to operate such fluid-pressure mechanism in conjunction with an auxiliary reservoir and by the use of an automatic valve of very simple construction. These objects I attain in the manner hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of one of the trucks of a railway-car provided with braking mechanism in accordance with my invention, this view showing also in side elevation the devices whereby the release and full or partial application of the brakes can be effected by hand. Fig. 2 is a view, partly in transverse section and partly in elevation, of said braking device. Fig. 3 is a plan view of part of the mechanism for releasing or applying brakes by hand. Fig. 4 is a plan view showing the lever mechanism whereby the power devices, either hand or fluid-pressure actuated, are caused to act upon the lever mechanism of the trucks. Figs. 5, 6, and 7 are sectional views of the valve whereby the application or release of the brakes is automatically effected when fluid-pressure is employed, the moving parts of the valve being shown in different positions in the different views; and Figs. 8 to 12 are views illustrating certain modifications of the invention.

Referring in the first instance to Figs. 1 and 2 of the drawings, 1 1 represent the side frames of the truck, and 2 the transverse bars or transoms, these bars 1 and 2 being rigidly secured together and constituting the rigid frame of the truck.

The truck-bolster 3, upon which the body of the car is supported, is mounted upon springs 4^a, which rests upon a transverse spring-plank 4. This spring-plank is mounted upon a pair of levers, each forked at its outer end, as shown in Fig. 1, and each leg of said fork is suspended by depending links 6 from the outer ends of the transoms 2, suitable depending brackets 7 on the spring-plank serving to pivotally connect the latter to the forked end of each lever 5. These depending brackets are in the present instance rigidly secured to the spring-plank at points adjacent to the springs, the swinging links 6, whereby the outer ends of the levers are hung to the transom, providing for the necessary lateral movement of said ends as the levers swing, thus permitting the brackets to travel in direct vertical lines, so as to impart no lateral strain either to the spring-plank or levers.

By forking the levers at their outer ends a broad bearing is obtained and the stability of each lever as regards its capacity for resisting twisting strains is insured.

The inner ends of the levers 5 are connected, by means of links 8, to a triple coupler 9, which consists of a web with eyes for the reception of pins at the upper ends of the links 8, this web having at the top a pair of jaws for the reception of the inner end of the lower arm of a bell-crank lever 12, which is hung to a depending looped strap 13, secured to one of the transoms 2, this lever 12 constituting what I term the "primary" lever of the truck system.

The upwardly-extending arm of the lever 12 plays in a slotted plate or yoke 30, secured to one of the transom-bars 2, and said lever is connected by a bar 14 to the upper end of the live-lever 15 of the braking mechanism of the truck, said lever being hung to jaws on one of the brake-beams of the truck and the lower end of the lever being connected by a rod 17 to the lower end of a dead-lever 18,

which is hung to jaws on the other brake-beam of the truck and is fulcrumed upon the outer end of a rod 20, the latter being hung to a suitable bearing on one of the transom-bars 2.

The weight of the car upon the bolster 3 is transmitted to the spring-plank 4 and thence through the medium of the levers 5 to the lever 12 and tends to move the same in the direction of the arrow, Fig. 1, so as to apply the brake-shoes to the wheels of the truck, movement of said lever 12 in the opposite direction being effected by connection of the same with the power device with which the car is equipped, the action of said power device tending to raise the spring-plank and bolster with their load, and thus loosen the brakes.

So far as described the braking mechanism is similar to that of my former application; but the former construction overlooked the element of momentum due to the weight of the fixed structure of the truck, which has to be taken into account in any proper system of braking mechanism where the weight of the car and its burden is measured by levers operating upon the principle of a weight-beam and is utilized as a braking force. In such mechanism the weight-beam levers must fulcrum somewhere upon the rigid structure of the truck. Hence the weight-beam levers do not measure the weight of such rigid structure and the momentum due to such weight is not represented in the braking action, the latter being proportionate only to the weight of the car and its load, which have vertical movement in respect to the fixed structure of the truck. As the weight of the said fixed structure of the truck, however, is a constant quantity, compensation for the same can be made by appropriately weighting the inner arms of the weight-beam levers 5 so as to produce the same effect upon the braking mechanism as if the total weight of said rigid structure of the truck were actually borne and measured by said weight-beam levers. Such compensating weights are represented at 31 in Fig. 2, the weights being preferably slotted for the reception of the levers, so that they can be adjusted nearer to or farther from the fulcrum of said levers, and being provided with clamp-screws or other means for securing them in position after adjustment. The same result might be attained by a permanent addition to the inner arms of the levers, as by thickening the same or otherwise adding to their weight; but the use of the adjustable weights is preferred as providing a ready means of accurately compensating for different weights of truck.

As in a braking device of the character described the normal condition of the brakes is the applied position, I provide both hand and fluid-pressure actuated mechanism whereby the weight of the load upon each truck can be raised and the force of gravity thus prevented from being operative to apply the brakes to the wheels, said power devices being capable of instantaneous release, partial or complete, as circumstances may require, and resulting in like partial or full application of the brake-shoes to the wheels. In the operation of such hand or fluid-pressure devices the upper end of the primary lever 12 of each truck has to be pulled toward the center of the car; but owing to the disparity of weight almost certain to exist at the respective trucks the system of equalizing-levers ordinarily employed in air-brake mechanisms would be impracticable, for in such systems the pull in one direction operates against the pull in the other direction, and hence would fail to meet the requirements of the present case, since all of the yielding would be at the point of least resistance, which would always be at the truck having the lighter load. Hence the lever 12 of this truck would receive the whole pull, while the brakes upon the heavier-loaded truck would never be fully released. In my former construction of braking mechanism this objection was overcome by causing the slotted guide-bars 30 to act as stops for the respective levers 12, whereby when either lever had been moved to such position as to release the brakes from the wheels of its truck its further movement was arrested and the further pull of the power mechanism was necessarily exerted upon the lever 12 of the other truck. In the braking mechanism which I have now devised the use of this guide 30 as a stop for the lever 12 is rendered unnecessary by the use of a lever 32, fulcrumed at 33 upon some portion of the fixed structure of the car, this lever being connected to the piston-rod 34 of the power-cylinder 35 and also by means of a flexible connection 36 to a lever 37, fulcrumed at one end, as at 38, to the fixed structure of the car and connected at its free end by a rod 39 to the windlass of the hand-actuated braking device at the end of the car.

One arm of the lever 32 is connected by a rod 41 to a lever 42, having a fixed fulcrum 43, the free end of said lever being connected by a rod 44 to the lever 12 of one of the trucks. The other arm of the lever 32 is connected by a rod 45 to a lever 46, fulcrumed upon the cylinder structure 35, the free end of said lever 46, being connected by a rod 47 to the lever 12 of the truck at the opposite end of the car. This system of levers, because of the fixed fulcrum of the lever 32, necessarily imparts equal motion to the lever 12 of each truck, so as to provide for the simultaneous release or application of the brakes of both trucks when said lever 32 is moved in one direction or the other either by the hand or fluid-pressure mechanism.

The hand-actuated mechanism for effecting a release of the brakes has been designed to so

multiply the power applied to the hand-wheel as to enable a single brakeman to release the brakes upon the heaviest car, and in this operation the piston of the fluid-pressure cylinder is drawn out in order that the air may enter the cylinder behind it and form a buffer or cushion to partially guard against the shock which would otherwise be caused if a reapplication of the brakes were effected by releasing the hand-wheel and allowing it to back off unrestrictedly. In the present construction the backing off of the windlass is accompanied by a forcing of the piston rearwardly in the power-cylinder and a consequent compression of the air between the piston and the head of the cylinder which insures a gradual descent of the load and a gradual application of the brakes upon the wheels of each truck. A further retarding effect is accomplished by means of a frictional device acting upon a rotating member of the hand-braking mechanism, as will be understood on reference to Figs. 1, 2, and 3, in which 50 represents the hand-wheel shaft of the brake, which is mounted in suitable bearings on the fixed structure at one end of the car and is provided with a ratchet-wheel 51 and a spur-pinion 52. The ratchet-wheel is engaged by a pawl 53, and upon the upper face of said ratchet-wheel bear the inner ends of screws 54, which engage with threaded openings in a yoke 55, spanning the ratchet-wheel, as shown in Fig. 2, said ratchet-wheel by preference having a raised rib thereon for receiving the pressure of the screws.

The pinion 52 meshes with a spur-wheel 56 on a shaft 57, which is adapted to bearings in a depending hanger 58 and receives one end of a chain 59, the opposite end of which chain is secured to a fixed connection 60 on the car-frame.

The chain 59 passes around a sheave 61 at one end of the rod 39, which is connected to the lever 37. Hence by turning the hand-wheel shaft 50 in the proper direction power multiplied in the first place by the gearing 52 and 56, again by the contracted diameter of the windlass-shaft 57, and again by the doubling of the chain or other flexible connection 59 is transmitted to the lever 37 and thence through the lever 32 and its connections to the levers 12 of the oppoosite trucks, so as to lift the load upon each truck and release the brakes from the wheels, the engagement of the pawl 53 with the ratchet-wheel 51 preventing any backing off of the hand-wheel shaft 50 until it is desired to apply the brakes.

After releasing the brakes by the mechanism described the brakeman applies, by means of the screws 54, any desired degree of pressure to ratchet-wheel 51, so that in applying the brakes this friction must be overcome, as well as the air-cushion acting upon the piston of the power-cylinder, as before described.

Brake-equipments of the character described must naturally vary in proportion to the weights and capacities of cars or other vehicles. Hence I have provided means to effect the requisite multiplication of the power applied by the brakeman to the hand-wheel of the shaft 50 necessary to meet the requirements of the heaviest cars, and of course where lighter net weights are involved, and consequently such numerous multiplications of power are unnecessary, either one or more of the multiplying devices can be dispensed with.

In order to secure the release of the brakes by fluid-pressure, an equipment is provided which renders the system interchangeable with the present air-brake equipment where standard pressure is maintained in the train-pipe when the train is in running order. It is apparent that this pressure could be made to operate direct upon the piston of a cylinder operating through the mechanism which I have shown and described to lift the load upon each truck, and thereby hold the brake-shoes away from the wheels, reductions in the train-line pressure resulting in a partial application of the brakes or full exhaust giving an emergency application; but considerable time would be consumed both in the application and release of the brakes if in the case of brake application the air from all of the cylinders in a train had to be conducted to the engine and exhausted at the engineer's valve or if in the case of brake-release a sufficiency of air had to be carried in the main reservoir to fill every cylinder in the train and to be conducted throughout the train-pipe in so doing. Obviously, therefore, advantages are to be obtained by equipping each car with its own auxiliary reservoir, wherein is stored sufficient pressure to effect a release of the brakes when required, and by providing for the automatic opening of an exhaust-port under each car to effect rapidity of action in applying the brakes. For these purposes an automatic valve is provided having train-line pressure upon one side and cylinder-pressure upon the other, and by variation in these pressures produced at will by manipulation of the engineer's valve to effect addition to or reduction in train-line pressure the valve can be automatically shifted in either direction. In addition to the two positions which the valve can be forced to assume by manipulation of the engineer's valve it has under certain circumstances a third position which it assumes of its own accord, and it is in making these three movements that the valve performs the various functions for which it is designed.

Referring now to Fig. 4, 62 represents the train-pipe, and 63 a crossover-pipe which is intended to be supplied with a suitable drip-cup, strainer, and cut-out cock, such as are usually employed, but which I have not considered it necessary to illustrate or describe. The pipe 63 leads to the casing of the auto-

matic valve, which is also in communication under the circumstances hereinafter described with the power-cylinder 35 and with the auxiliary reservoir 66.

On reference to Figs. 5, 6, and 7 it will be observed that the valve-casing consists of two similar halves 68 and 69, inclosing a chamber 70, in which can reciprocate a suitably-packed piston-valve 71. Communication with the chamber 70 on one side of the valve 71 is made through the crossover-pipe 63 with train-pipe 62 and upon the other side of the valve with a pipe 72, leading to the power-cylinder 35. The chamber 70 is also in communication on each side of the valve 71 through pipes 73 with the auxiliary reservoir 66, that pipe upon the train-line side of the valve being the inlet-pipe through which the auxiliary reservoir is charged with compressed air when standard train-line pressure is maintained and that pipe upon the power-cylinder side of the valve being the outlet-pipe through which the compressed air stored in the auxiliary reservoir is caused to flow or expand into the power-cylinder under conditions hereinafter described. Each of the pipes communicating with the auxiliary reservoir, both inlet and outlet, has a check-valve 74, which opens toward the reservoir and is normally held in a closed position by a coiled spring 75. The inlet-valve is caused to be opened when train-line pressure sufficiently exceeds auxiliary reservoir-pressure to overcome the action of the spring 75 upon said valve. The outlet-valve is caused to be opened by a spring-actuated plunger 76, carried by the valve 71, when said valve 71 is in one of its extreme positions, the spring which acts upon the plunger 76 being lighter than the spring which acts upon the check-valve.

The section 69 of the valve-casing has exhaust-ports 77, which are closed by the valve 71 when the latter is in one of its extreme positions or in an intermediate position, but are open when the valve is in the opposite extreme position, and each of the check-valves 74 has ports 78, through which the air can flow into or from the corresponding pipe 73 when said check-valve has been raised from its seat.

Of the three positions of the valve shown in the drawings that represented in Fig. 5 is a "release" position, that shown in Fig. 6 the position of "emergency" application, and that shown in Fig. 7 the position of "service" application.

As a description of the operation of the device, we will assume that a car equipped therewith and dry of air, but with angle-cocks closed, is picked up from a siding and properly coupled to the end of a train. As soon as its angle-cock next to the car to which it has been coupled has been opened air rushes through its train-pipe 62 and crossover-pipe 63 to the upper or train-line side of the valve 71, immediately forcing the latter downward to the full extent, thereby closing communication between the cylinder-pipe 72 and the exhaust-ports 77 and opening communication between the auxiliary reservoir and the cylinder-pipe 72 through the ports of the lower check-valve 74. At the same time the train-line pressure opens the upper check-valve 74, permitting a flow of air into the auxiliary reservoir and thence into the cylinder 35 of the car, which by reason of its connections with the primary lever 12 of each truck lifts the weight at each truck and by thus restraining it from acting upon the brake-beams effects release of the brakes. This relation of the parts (shown in Fig. 5) is preserved as long as the train is in running order.

In order to provide for an emergency application of the brakes, the engineer's valve is operated so as to exhaust pressure from the train-pipe. This relieves the upper side of the valve 71 from pressure, and the cylinder-pressure exerted beneath said valve therefore immediately forces it to its upward extreme, as shown in Fig. 6, thus closing communication between the auxiliary reservoir and the cylinder, but opening the latter to the exhaust-ports 77 and permitting an escape of pressure from the cylinder, thereby causing an application of the brakes to the wheels with the full force of the load upon each truck.

To perform an ordinary service application, the engineer's valve is operated so as to effect but a partial reduction in train-line pressure. The first effect of this operation is to move the valve 71 from the position shown in Fig. 5 to that shown in Fig. 6; but as soon as the exhaust of pressure from the cylinder through the ports 77 has so reduced the cylinder-pressure that it is slightly overbalanced by the pressure remaining in the train-pipe the valve will be forced downwardly by such preponderating pressure until it closes the exhaust-ports 77, as shown in Fig. 7, thereby retaining in the cylinder 35 sufficient pressure to partly counterbalance the weight of the load upon the trucks, and thus insure an application of the brakes with a force equivalent only to the difference between such pressure and the exerted weight. As soon as the exhaust-ports 77 have been closed the lower end of the plunger 76 comes into contact with the lower check-valve 74, which cannot be unseated by said plunger because of the slight preponderance of pressure on top of the valve 71 over the pressure on the under side of said valve. Hence further downward movement of the valve 71 is resisted first by compression of the spring of the plunger 76 and finally by the more substantial resistance due to contact of the upper end of the plunger with the upper packing-leather of the valve, the latter being thereby brought to a stop without unseating the lower

check-valve 74, for the resistance of the spring of this check-valve, combined with the excess of air-pressure exerted upon said check-valve by the auxiliary reservoir, holds the valve seated with sufficient force to withstand the final impact of the plunger upon it when the downward movement of the valve 71 is stopped. When the valve is in the position shown in Fig. 7, further reductions of pressure can be made in train-pipe and cylinder without disturbing the communications with the auxiliary reservoir or at any time total exhaust of train-pipe and cylinder will give a full emergency application of the brakes.

It will be observed that with the valve in position for either emergency application or service application of the brakes all communication between the auxiliary reservoir and the valve-chest is cut off, so that pressure in the auxiliary reservoir is reserved for effecting release of the brakes. To render this stored energy available, the engineer's valve is manipulated so as to admit full pressure to the train-pipe, which instantaneously forces the valve 71 to the position of "brakes released," thereby closing the exhaust-ports and opening communication between the auxiliary reservoir and the cylinder and permitting a flow of fluid under pressure from the auxiliary reservoir into the cylinder until there is an equalization of pressure in both. If, therefore, relative areas of the auxiliary reservoirs and cylinders are arranged to equalize at, say, sixty pounds to the square inch from a standard train-line pressure of, say, seventy pounds, the areas of the cylinders must be sufficient to produce at sixty pounds pressure to the square inch sufficient power to lift the heaviest weights likely to be imposed thereon.

While I prefer for convenience to mount in the section 68 of the valve-chest the check-valve 74, which controls the inlet of air to the auxiliary reservoir, it will be evident that such construction is not necessary, as the valve might be located in a direct connection between the reservoir and the train-pipe or crossover-pipe—as shown, for instance, in Fig. 10—so as to perform the same function as it performs in the structure shown, and the plunger 76 might in some cases constitute a rigid projection on the bottom plate or other portion of the valve 71—as shown, for instance, in Fig. 8—or the lower check-valve 74 might have a corresponding projection, as shown in Fig. 9, for contacting with the flat under face of the valve.

The valve structure might even be designed so as to dispense with the lower or outlet check-valve 74 for the auxiliary reservoir, the main valve 71 directly controlling the flow from the auxiliary reservoir to the cylinder. Such a construction is illustrated in Figs. 10, 11, and 12, which show, respectively, the "release," "emergency-application," and "service-application" positions of the valve. In this embodiment of my invention the auxiliary-reservoir passage 73 communicates with the cylinder-passage 72 through the central chamber of the valve 71 when the full train-pipe pressure is exerted upon the top of the valve 71, so as to force the latter downward to the full extent, as shown in Fig. 10.

When pressure is exhausted from the train-pipe, the valve 71 rises because of the cylinder-pressure beneath the same, the first effect of this movement being to close the auxiliary-reservoir passage 73 and then to open the exhaust-passages 77, as shown in Fig. 11.

If the train-line pressure is only partially reduced, the valve will under the influence of the cylinder-pressure first rise to the position shown in Fig. 11, so as to open the exhaust-passages 77; but as soon as the cylinder-pressure has by reason of the exhaust been reduced so that it exercises less effect on the valve than the train-line pressure the valve will descend sufficiently to close the exhaust-passages, but not enough to open the auxiliary-reservoir passage 73, the descent being checked, if desired, by a spring 80, which is strong enough to resist the slight preponderance of pressure exerted on the top of the valve during a service application of the brakes, but will yield when full train-pipe pressure is exerted on the top of the valve in order to release the brakes.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. The combination, in car-brake mechanism operated by the weight of the load to apply the brakes and by power mechanism to release the brakes, of weigh-beam levers mounted upon the fixed structure of the car-truck, and serving to transmit to the brakes weight exerted upon the truck, said levers being weighted to compensate for the momentum due to the weight of the fixed structure of the truck, substantially as described.

2. The combination, in car-brake mechanism operated by the weight of the load to apply the brakes and by power mechanism to release the brakes, of weigh-beam levers mounted upon the fixed structure of the car-truck, and serving to transmit to the brakes weight exerted upon the truck, said levers having adjustable weights to compensate for the momentum due to the weight of the fixed structure of the truck, substantially as specified.

3. The combination, in car-brake mechanism operated by the weight of the load to apply the brakes and by power mechanism to release the brakes, of the weight-carrying lever of each truck of the car, and a lever hung to a fixed fulcrum and connected to the power mechanism for releasing the brakes, said lever being also connected to the weight-carrying lever of each truck, substantially as specified.

4. The combination, in car-brake mechanism operated by the weight of the load to ap-

ply the brakes and by power mechanism to release the brakes, of the brake-lever system of each truck, and a hand-power actuating device therefor, comprising a hand-wheel shaft, a windlass operated thereby and connected to said brake-lever system of each truck, and a frictional retarding device acting upon a rotating member of said hand braking mechanism, substantially as specified.

5. The combination, in car-brake mechanism operated by the weight of the load to apply the brakes and by power mechanism to release the brakes, of the brake-lever system of each truck, and a hand-power actuating device therefore, comprising a hand-wheel shaft, a windlass operated thereby and connected to said brake-lever system of each truck, and a frictional retarding device acting upon a member on the hand-wheel shaft of said hand braking mechanism, substantially as specified.

6. The combination, in car-brake mechanism operated by the weight of the load to apply the brakes and by power mechanism to release the brakes, of a fluid-pressure cylinder, an auxiliary reservoir, a train-pipe, and a valve structure combined therewith, as described, whereby the admission of full train-pipe pressure thereto will effect release of the brakes, substantially as specified.

7. The combination, in car-brake mechanism operated by the weight of the load to apply the brakes and by power mechanism to release the brakes, of a fluid-pressure cylinder, an auxiliary reservoir, a train-pipe, and a valve structure combined therewith, as described, whereby exhaust of pressure from the train-pipe will effect full or emergency application of the brakes, substantially as specified.

8. The combination, in car-brake mechanism operated by the weight of the load to apply the brakes and by power mechanism to release the brakes, of a fluid-pressure cylinder, an auxiliary reservoir, a train-pipe, and a valve structure, combined therewith, as described, whereby partial reduction of train-line pressure will effect partial reduction of pressure in the power-cylinder and a partial application of the brakes, substantially as specified.

9. The combination, in car-brake mechanism operated by the weight of the load to apply the brakes and by power mechanism to release the brakes, of a fluid-pressure cylinder, an auxiliary reservoir, a train-pipe, a valve-chest communicating with said cylinder, reservoir and train-pipe and also with an exhaust, and a movable valve in said chest, which, when subject to full train-pipe pressure, opens communication between the auxiliary reservoir and the cylinder, closes the exhaust and effects release of the brakes, substantially as specified.

10. The combination, in car-brake mechanism operated by the weight of the load to apply the brakes and by power mechanism to release the brakes, of a fluid-pressure cylinder, an auxiliary reservoir, a train-pipe, a valve-chest communicating with said cylinder, reservoir and train-pipe and also with an exhaust, and a movable valve in said chest, which, when pressure is exhausted from the train-pipe, closes communication between the auxiliary reservoir and the cylinder, and opens communication between said cylinder and the exhaust, to effect full or emergency application of the brakes, substantially as specified.

11. The combination, in car-brake mechanism operated by the weight of the load to apply the brakes and by power mechanism to release the brakes, of a fluid-pressure cylinder, an auxiliary reservoir, a train-pipe, a valve-chest communicating with said cylinder, reservoir and train-pipe and also with an exhaust, and a valve movable in said chest, which, upon a reduction of pressure in the train-pipe, first opens communication between the cylinder and exhaust, and upon reduction of pressure in the cylinder, closes said exhaust, and thereby effects a service application of the brakes, substantially as specified.

12. The combination, in car-brake mechanism operated by the weight of the load to apply brakes and by power mechanism to release the brakes, of a fluid-pressure cylinder, an auxiliary reservoir, a train-pipe, a valve-chest communicating with said cylinder, reservoir and train-pipe and also with an exhaust, a valve movable in said chest, which, upon a reduction of pressure in the train-pipe, first opens communication between the cylinder and exhaust, and upon reduction of pressure in the cylinder, closes said exhaust, and thereby effects a service application of the brakes, and means to restrict the movement of the valve after it has closed the exhaust and before it completes a full movement, substantially as specified.

13. The combination, in car-brake mechanism operated by the weight of the load to apply the brakes and by power mechanism to release the brakes, of a fluid-pressure cylinder, an auxiliary reservoir, a train-pipe, a valve-chest communicating with said cylinder, reservoir and train-pipe and also with an exhaust, and a valve, movable in said chest and controlling the release or application of the brakes, said valve being operated by variation between the train-line and cylinder pressures, substantially as specified.

14. The combination, in car-brake mechanism operated by the weight of the load to apply the brakes and by power mechanism to release the brakes, of a fluid-pressure cylinder, an auxiliary reservoir, a train-pipe, a valve-chest, and a valve movable therein and controlling communication between the auxiliary reservoir and the cylinder, and between the cyl-

inder and the exhaust, the train-pipe communicating with the valve-chest on one side of said valve, the cylinder communicating with said valve-chest on the opposite side of the valve, and the auxiliary reservoir being in communication with the valve-chest on both sides of the valve through passages each having a check-valve opening toward the reservoir, substantially as specified.

15. The combination, in car-brake mechanism operated by the weight of the load to apply the brakes and by power mechanism to release the brakes, of a fluid-pressure cylinder, an auxiliary reservoir, a train-pipe, a valve-chest, and a valve movable therein and controlling communication between the auxiliary reservoir and the cylinder and between the cylinder and the exhaust, the train-pipe communicating with the valve-chest on one side of said valve, the cylinder communicating with said valve-chest on the opposite side of the valve, and the auxiliary reservoir being in communication with the valve-chest on both sides of the valve through passages, each having a check-valve opening toward the reservoir, and means whereby full movement of the valve in its chest opens that check-valve which controls communication between the auxiliary reservoir and that end of the valve-chest which communicates with the cylinder, substantially as specified.

16. The combination, in car-brake mechanism operated by the weight of the load to apply the brakes and by power mechanism to release the brakes, of a fluid-pressure cylinder, an auxiliary reservoir, a train-pipe, a valve-chest in communication with said train-pipe, cylinder and reservoir, a valve movable in said chest and controlling communication between the cylinder and reservoir, and also between the cylinder and an exhaust, and a check-valve for cutting off communication between the reservoir and the cylinder when the pressure in the latter is less than the pressure in the reservoir, said check-valve serving as a stop for the main valve when the preponderance of train-pipe pressure is light, but being opened by the main valve when there is a sufficient preponderance of train-pipe pressure, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM L. BARKER.

Witnesses:
WILLIAM F. BEATON,
JAMES MCMORRIS.