No. 788,208. PATENTED APR. 25, 1905.

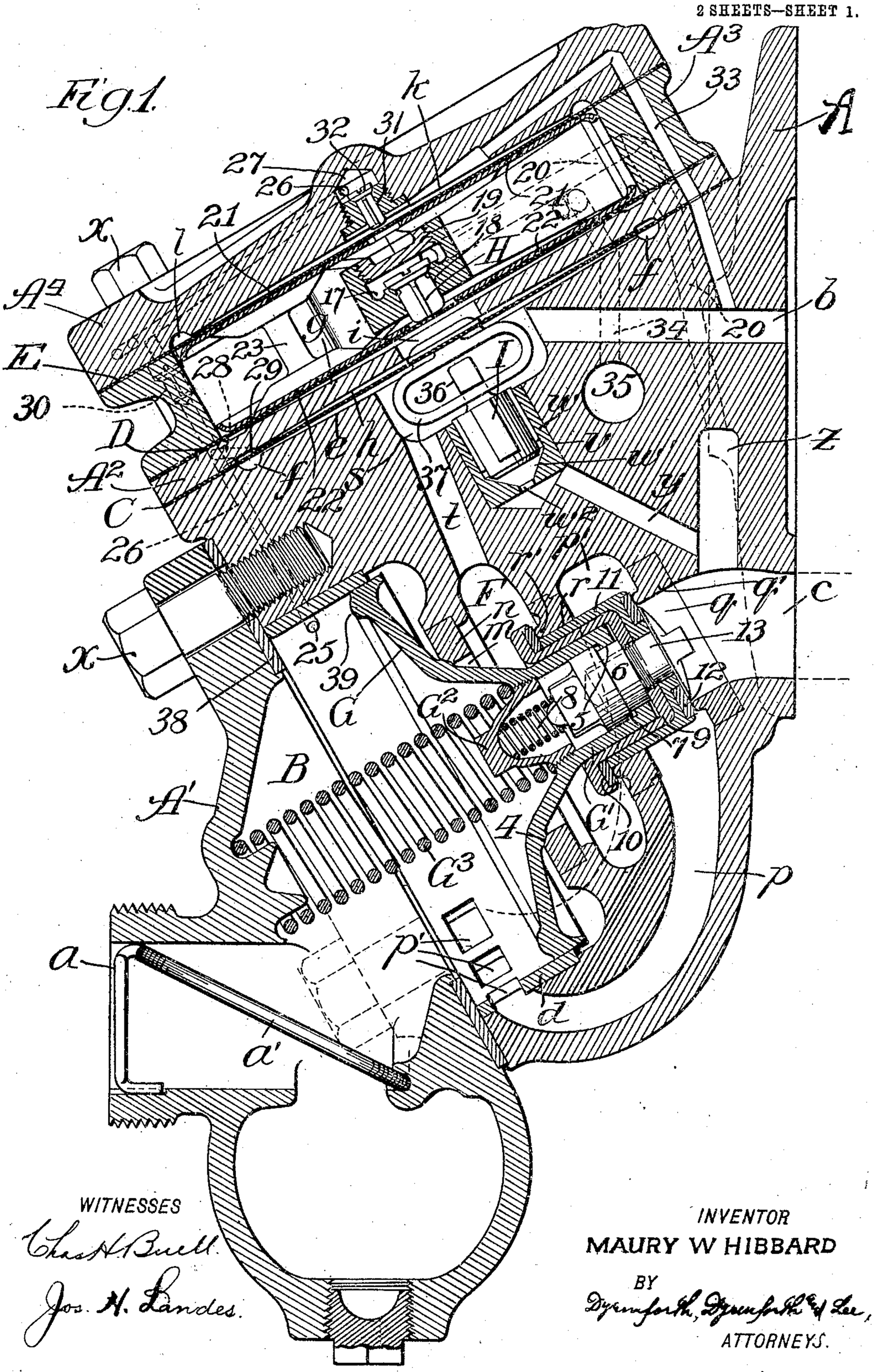
M. W. HIBBARD.

FLUID PRESSURE BRAKE.

APPLICATION FILED DEC. 27, 1904.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

Chas. A. Buell.

Jos. H. Landes.

INVENTOR

MAURY W HIBBARD

BY

Dyrenforth, Dyrenforth & Lee,

ATTORNEYS.

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2 SHEETS—SHEET 2.

Fig. 2.

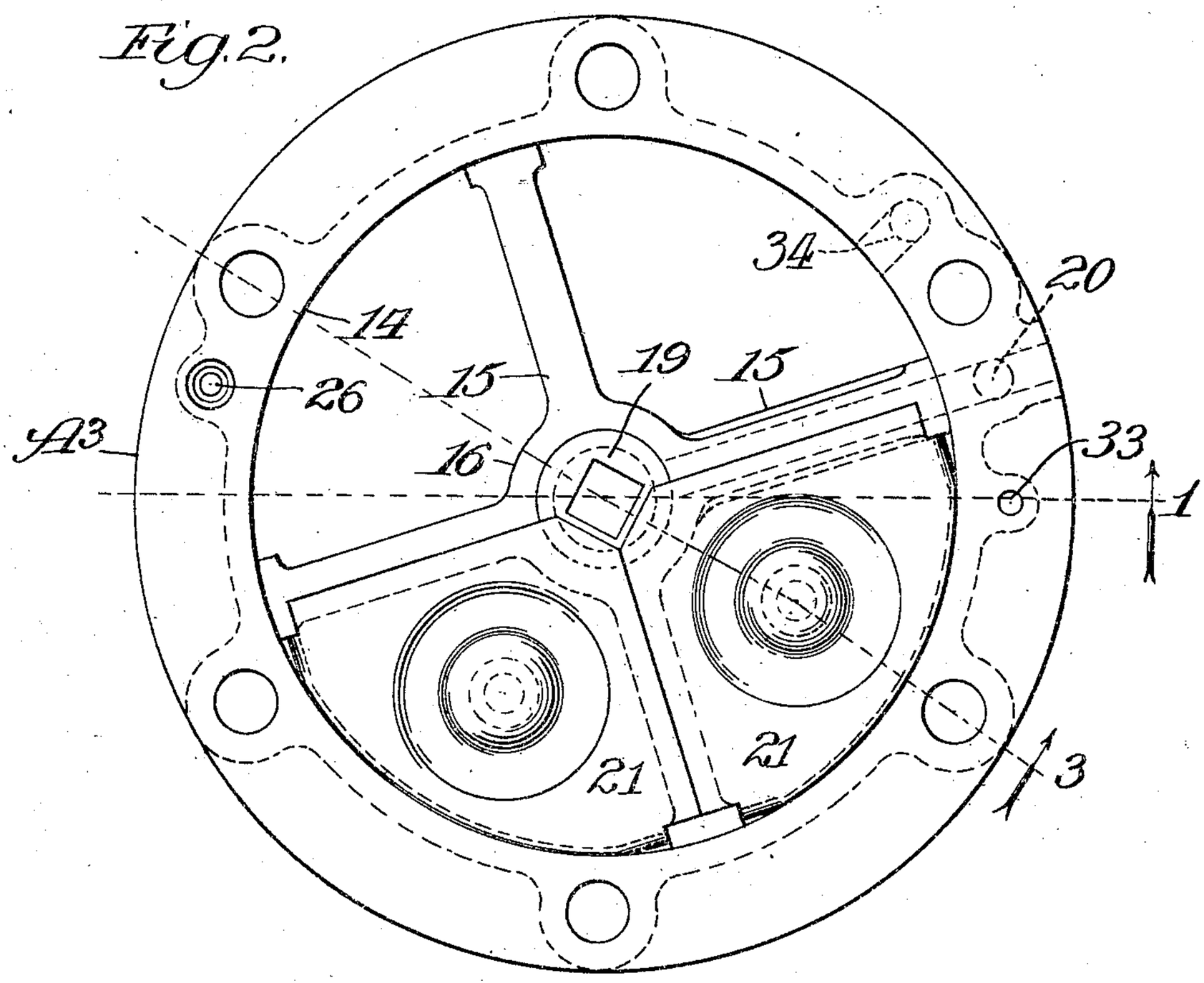
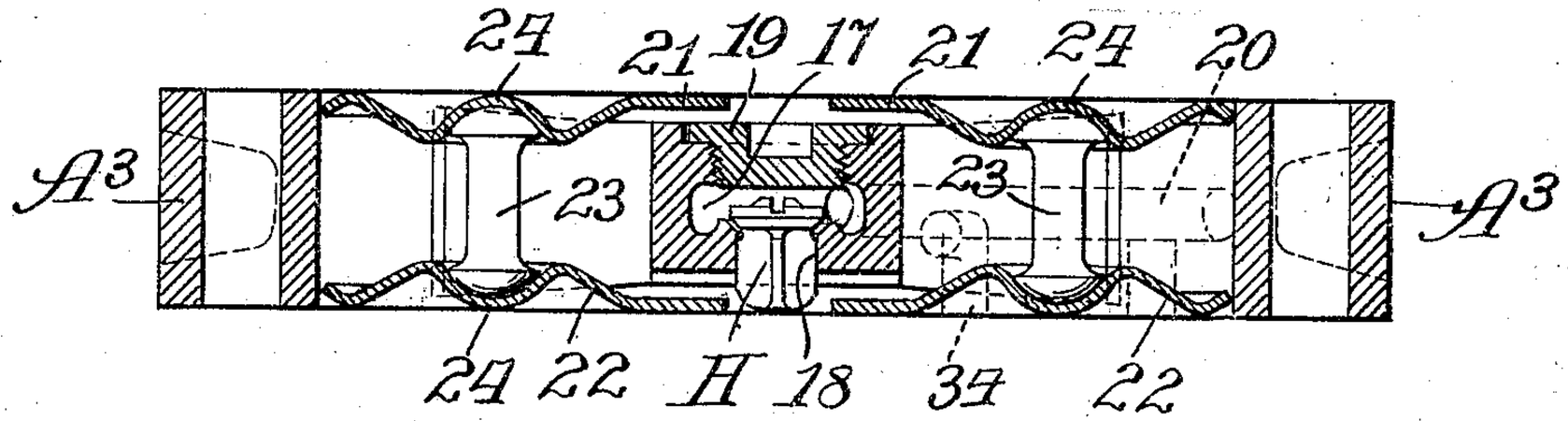


Fig. 3.



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UNITED STATES PATENT OFFICE.

MAURY W. HIBBARD, OF CHICAGO, ILLINOIS.

FLUID-PRESSURE BRAKE.

SPECIFICATION forming part of Letters Patent No. 788,208, dated April 25, 1905.

Application filed December 27, 1904. Serial No. 238,463.

To all whom it may concern:

Be it known that I, MAURY W. HIBBARD, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Fluid-Pressure Brakes, of which the following is a specification.

My invention relates to improvements in triple valves for fluid-pressure automatic-brake apparatus.

My objects are to provide a triple-valve device of generally improved construction in which the release of air from the brake-cylinder and the feed of air to the auxiliary reservoir are produced by valves actuated by movement of a highly-flexible, durable, and suitably-sensitive diaphragm device of novel construction in which a service-valve of improved construction is also preferably actuated by movement of a flexible diaphragm and in which a piston-actuated emergency-valve when employed will operate in a manner to effect a quick "serial release" of brakes to decrease danger of stuck brakes after emergency action.

It is further my object to provide a triple valve of a particularly simple, durable, and economical construction conforming in all essential particulars to the requirements laid down by the Master Car-Builders' Association.

In the drawings, Figure 1 is a central section of my valve device, taken on line 1 in Fig. 2; Fig. 2, a plan view of a double-diaphragm device forming one of the features of the valve with certain parts removed, and Fig. 3 a section taken on line 3 in Fig. 2.

The casing of the valve device has, as shown, a body portion A, adapted to fit in the usual way against an auxiliary reservoir, (not shown,) and a cap A′, having a train-pipe connection *a*. In the body portion are an auxiliary-reservoir port *b* and a brake-cylinder port *c*. The device is constructed with its body portion at an angle to the perpendicular face, as represented, for the purpose of saving metal and that of having the measurements between the ports *a*, *c*, and *b* conform to the Master Car-Builders' rules. In the body portion is a chamber B, containing a bushing *d*. The top face of the body portion proper is rendered slightly concave to produce the diaphragm-seat *e*, surrounded by a dust-catching groove *f*. A flexible diaphragm C is clamped between the body portion A and a ring A^2, also formed with slightly-concaved upper and lower diaphragm-seating faces *g h* and provided with a central opening *i*. On the upper side of the ring A^2 is a flexible diaphragm D, clamped in place by a spider device A^3. Extending over the top of the spider device is still another flexible diaphragm, E, clamped in placed by a cap A^4. The parts A^2 A^3 A^4, with the body portion A and cap A′, constitute the shell of the triple valve and fit together at air-tight joints, being held in place by suitably-disposed screws *x*. The under face of the cap A^4 is slightly concave to produce the diaphragm-seating face *k*, surrounded by a dust-catching groove *l*.

In the body portion A is a chamber F, and between the chambers B F is an opening *m*, surrounded by a bushing forming the valve-seat *n*. The body portion also has an emergency-passage *p* terminating in a chamber *p*′, provided at one side with a port *q*, communicating with the brake-cylinder port *c*, and at its opposite side with an opening *r*, extending to the chamber F. The port *q* is surrounded by a bushing *q*′ and the port *r* by a bushing *r*′, said bushings forming valve-seats, as hereinafter described. In the top of the body portion is a recess or chamber *s*, communicating with the chamber F through a passage *t*. Below the chamber *s* is a chamber or socket *v*, provided with a bushing *w*, forming a valve-seat *w*′, and having a small outlet-port w^2, communicating with a passage *y*, leading to a chamber or passage *z*, communicating with the brake-cylinder port *c*. The auxiliary-reservoir port or passage *b* communicates, as shown, with the chamber *s*.

G is an emergency-valve piston sliding in the bushing *d* and provided on its rear side with an annular valve-face 4, adapted to close against the seat *n*. The piston G has a hollow stem G′, fitted at its forward end with a screw-cap G^2 and provided at its rear end with a flanged opening 5. Slidably fitting through the opening 5 is a loose plug 6, having an annular shoulder 7, at which it is normally pressed

toward the end of the stem G′ by a spring 8. Loosely surrounding the stem G′ is a cup 9, carrying a valve-ring 10, to bear normally against the valve-seat r'. Loosely surrounding the cup 9 is a cup 11, fitting through the opening r and carrying a valve-ring 12, closing normally against the seat q'. The valve-rings 10 and 12 are formed, preferably, of hard rubber or vulcanized fiber. The end of the plug 6 is tapped to receive a screw 13, provided with a flange extending over the end of the cup 11. The screw holds the cups 9 and 11 and the plug 6 firmly together; but they have independent movement to a slight extent with reference to the piston-stem G′.

The opening i gives open communication between the upper face of the diaphragm C and under face of the diaphragm D.

The spider or double-diaphragm device A^3 has the outer ring portion 14, spokes 15, and hub 16. The upper and lower faces of the spokes are slightly inclined in the direction of the hub 16, as shown. In the hub 16 is a valve-chamber 17 and a port 18, extending to the under side of the hub. The top of the chamber 17 is closed by a screw-plug 19.

H is a release-valve extending through the port 18 and seating around the top of the said port. The stem portion of this valve projects normally some distance below the hub 16 to contact with the diaphragm D.

20 indicates a brake-cylinder passage cored through one of the spokes 15 and through the rings A^3 A^2 and body portion A and communicating with the recess or chamber z.

The diaphragm E at its under face and diaphragm D at its upper face rest against a series of independently-movable spacers or distance-pieces, four of which are employed in the present construction. Each distance-piece or spacer comprises an upper segmental plate 21 and lower segmental plate 22, held apart by a distance-pin 23, having convex upper and lower ends fitting concave sockets 24 in the adjacent surfaces of the plates 21 22. All the plates 21 nearly abut at their edges with the adjacent edges of the other plates 21 over spokes 15, and the lower plates are arranged in the same manner. The distance-pins 23 will roll slightly in the sockets 24.

In the bushing d of the chamber B is a port 25, communicating with a cored passage 26, leading, as indicated, to a chamber 27 in the center of the cap A^4. A branch 28 of the passage 26 opens into an annular groove 29 in the under side of the ring A^2 above the diaphragm C. In the passage 26, preferably in the position shown, is a non-return valve 30. Extending from the chamber 27 to the under side of the cap A^4 is a port 31, forming a valve-seat for a feed-valve 32, closing in the downward direction. The stem of the feed-valve 32 projects normally a short distance below the surface k of the cap to be engaged by the diaphragm E in the rise of the latter. It will be noticed that the stem of the feed-valve 32 does not normally extend as close to the diaphragm E as the stem of the release-valve H does to the diaphragm D.

33 is a cored passage extending from the under face of the cap A^4 above the diaphragm E to the auxiliary-reservoir port b. Extending from the space between the diaphragms D E is a cored passage 34, communicating with the exhaust port or chamber 35 of the valve device.

I is the service-valve, closing at its lower end normally against the seat w'. The valve I is formed at its top with a hook 36, entering a loop or yoke 37, fastened at its upper end to the diaphragm C. It will be noticed that the connection between the service-valve and the diaphragm C permits slight independent play and adjustment of the valve to its seat.

In operation air from the train-pipe enters the port at a and passes through the screen a' to the chamber B. The piston G is held normally to its seat at n by means of an emergency-spring G^3. This seating of the piston G closes communication between the chambers B F and seats the valves 10 and 12 to seal the chamber F from the emergency-passage p and close the emergency-port q, leading to the brake-cylinder. Air from the chamber B passes through the port 25, passage 26, and branch passage 28 to the upper side of the diaphragm C and through the opening i to the under side of the diaphragm D. As a consequence the service-valve I is pressed to its seat and the release-valve is opened by rise of the diaphragm D. By reason of the double-diaphragm construction described in the part A^3 of the valve device upward movement of the diaphragm D produces the same movement of the diaphragm E, and downward movement of the latter causes downward movement of the former. In other words, the diaphragms D E act in unison. The upward movement of the diaphragm device, consequent upon the air-pressure directed against the diaphragm D, causes the latter to open the release-valve H, as described, and thereafter the diaphragm E engages and raises the feed-valve 32 from its seat. Following this action the air from the train-pipe lifts and opens the non-return valve 30 and, passing to the chamber 27 and through the open valve 32, enters the space above the diaphragm E and flows through the passage 33 to the auxiliary reservoir through the port b. When the auxiliary reservoir has been filled with air-pressure equal or approximately equal to the train-pipe pressure, the auxiliary-reservoir pressure exerted through the passage 34 against the under side of the diaphragm C holds the same in balance. Immaterial fluctuations between the train-pipe and auxiliary-reservoir pressures may produce slight movement of the diaphragm C without disturbing the service-valve I, owing

to the loose connection between the service-valve and its diaphragm C and the seating force of the valve. To render the diaphragms sufficiently sensitive to move under slight variations of pressure, it is necessary that they shall be of very thin metal. When the valve device is in running position, for example, pressure of seventy or more pounds to the square inch may be exerted by the train-pipe and reservoir airs against the diaphragms D E, while the pressure between the said diaphragms is simply atmospheric, or *nil*. To permit the diaphragms to withstand the strain, the distance or spacer mechanism described is provided, and this spacer mechanism being formed of independently-movable sections permits the diaphragms to "undulate," so to speak, and move readily. At the same time they support the diaphragms in such a manner that the difference of pressure against opposite sides of the pair is only that between auxiliary and train-pipe pressure. The slight sliding movement of the diaphragms upon the plates 21 22 incident to their rise and descent is neutralized by the rocking of the spacer-pins 23, which cause the plates to move slightly under frictional engagement of the diaphragms therewith. Thus I make it possible to provide very thin and highly-sensitive diaphragms, so reinforced at their reverse sides that there is no danger of their bursting under the force of the pressure to which they may be subjected in practice. The surfaces *e h* at opposite sides of the diaphragm C and the surfaces *g k* at opposite sides of the double-diaphragm device form extensive seating-faces for the diaphragms, which prevent undue strain against the diaphragms when pressed in either direction. When a limited amount of air is withdrawn from the train-pipe for service application of brakes, the lowering of train-pipe pressure at the upper side of the diaphragm C and beneath the diaphragm D causes the reservoir-pressure exerted against the top of the diaphragm E to lower the double-diaphragm device, causing, first, the feed-valve 32 to close and then the release-valve H to close. It also causes the auxiliary-reservoir pressure to raise the diaphragm C toward the face *h* and lift the service-valve from its seat. Auxiliary-reservoir pressure then flows to the brake-cylinder through the passage *y* and port *c* until the reservoir-pressure descends, approximately, to the train-pipe pressure. Then the train-pipe pressure upon the diaphragm C, supplemented by the auxiliary-reservoir pressure upon the service-valve, will cause the latter to close without the double-diaphragm device being disturbed. This causes the brakes to remain applied. When the train-pipe pressure is raised again to release brakes, the double-diaphragm device is raised by the train-pipe pressure against the then inferior reservoir-pressure to first open the release-valve H and then the feed-valve 32, after which train-pipe air passes to the auxiliary reservoir to replenish the same. In practice the diaphragm C would be more sensitive than the double-diaphragm device described, whereby the latter will remain immovable, while the diaphragm C moves under slight reductions of train-pipe pressures for graduation.

It will be noticed that the emergency-passage *p* opens through a series of ports *p'* into the chamber B through the bushing *d*, the said ports being in the positions indicated. Under abnormal reduction of train-pipe pressure, intended to bring about an emergency application, the fall of pressure in the chamber B when sufficiently low to permit reservoir-pressure exerted against the piston G within the opening *m* to overcome the spring G^3 will move the piston away from its seat *n*. In this initial movement the piston-stem slides a short distance before its flanged end portion 5 contacts with the shoulder 7 of the plug 6. Thus reservoir-pressure is exerted against the entire surface of the piston G to withdraw the emergency-valve from the seat at *q'*. The first action due to the abnormal lowering of train-pipe pressure will be to cause the reservoir-pressure to raise the diaphragm C, open the service-valve, and start a flow of pressure to the brake-cylinder from the reservoir. At approximately the same time the piston G will move toward a seat 38 in the chamber B between the train-pipe port and the ports 25 *p'*. While the piston G is moving toward the ports *p'* a rush of air takes place from the train-pipe to the brake-cylinder, thus producing what is termed "quick serial action." When the piston crosses the ports *p'*, the latter are closed to the train-pipe and the engagement of the annular seating-valve portion 39 against the seat 38 will prevent any retrogression of pressure from the brake-cylinder and auxiliary reservoir to the train-pipe. After the emergency action described rise of pressure in the train-pipe moves the piston G toward its normal position shown. The action of the rising train-pipe pressure is supplemented by that of the spring G^3 in returning the piston to normal position. Thus this may take place while the train-pipe pressure is materially lower than that in the auxiliary reservoir and brake-cylinder. As the piston opens the ports *p'* therefor a rush of air may take place from the auxiliary reservoir and brake-cylinder to the train-pipe before the emergency-valve is closed. This causes reservoir and brake-cylinder pressures to aid in raising the train-pipe pressure, producing what I term "serial release action," which has a tendency to prevent stuck brakes, as will be readily apparent to those skilled in the art.

It is often necessary in practice for the purpose of facilitating switching, more especially in freight-train service, to vent nearly all the pressure from the train-pipe and reservoirs

along the train to below that necessary for causing application of brakes. Hitherto it has been necessary to accomplish this end by locally bleeding the reservoirs along the train, which is an operation necessarily consuming much time. In a train equipped throughout with my improved triple valves this venting of the train-pipe and all the auxiliary reservoirs and brake-cylinders may be accomplished when desired from the engine.

The piston G of my improved valve is not provided with the usual piston-rings, and therefore fits the bushing somewhat loosely. This in itself is a material saving in the cost of constructing the valve and prevents wear of the bushing. The spring G^3 holds the piston to its seat *n* with pressure sufficient to easily withstand such reductions in the train-pipe as are necessary under the rules for service application. The emergency-valve 12 is held to its seat to close the port *q* by the reservoir-pressure against it supplemented by the pressure of the comparatively light spring 8. By making a slow and prolonged reduction at the engineer's valve the pistons G may be caused to move slightly away from the seats *n*, permitting leakage past the pistons G after equalization of train-pipe and reservoir pressures from the auxiliary reservoirs to the train-pipe and later from the reservoirs and brake-cylinders through the emergency-valves and emergency-passages *p* to the train-pipe under the force of the brake-cylinder springs. Thus all the brake-cylinders will be bled and the pressure left in the reservoirs will be insufficient to apply the brakes.

While I prefer to construct my improvements throughout as shown and described, they may be variously modified in the matter of details of construction without departing from the spirit of my invention as defined by the claims.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a fluid-pressure automatic brake system, the combination with a train-pipe, triple valve, auxiliary reservoir and brake cylinder, of means for producing temporary retrogression of pressure from the brake-cylinder to the train-pipe, before any venting thereof to the atmosphere, during the rise of train-pipe pressure following emergency action, for the purpose set forth.

2. In a triple-valve device, the combination with means for temporarily venting train-pipe pressure to the brake-cylinder direct in emergency action, of means for causing temporary retrogression of pressure to the train-pipe from the brake-cylinder, before any venting thereof to the atmosphere, during the rise of train-pipe pressure following emergency action, for the purpose set forth.

3. In a triple-valve device for air-brakes, the combination of a chamber communicating with the train-pipe, an emergency-valve-operating piston in said chamber, emergency-ports in said chamber opened and then closed by the piston in its emergency-valve-opening movement to temporarily vent pressure from the train-pipe to the brake-cylinder direct, and opened and closed in the emergency-valve-seating movement of the piston to temporarily vent pressure from the brake-cylinder to the train-pipe, for the purpose set forth.

4. In a triple-valve device for air-brakes, the combination of a pair of coöperating flexible diaphragms, exposed at their outer sides, respectively, to train-pipe and reservoir pressures and at their inner sides to the atmosphere, and governing the movements of the feed and release valves, and distance mechanism between the diaphragms formed of independently-movable sections.

5. In a triple-valve device for air-brakes, the combination of a pair of coöperating flexible diaphragms exposed at their outer sides, respectively, to train-pipe and reservoir pressures and at their inner sides to the atmosphere, and governing the movements of the feed and release valves, and distance mechanism between the diaphragms formed of independently-movable sections, each said section consisting of a pair of diaphragm-engaging plates and a distance-pin separating the plates.

6. In a triple-valve device for air-brakes, the combination of a pair of coöperating flexible diaphragms exposed at their outer sides, respectively, to train-pipe and reservoir pressures and at their inner sides to the atmosphere, and governing the movements of the feed and release valves, and distance mechanism between the diaphragms formed of independently-movable sections, each said section consisting of a pair of diaphragm-engaging plates and distance-pins bearing pivotally at opposite ends against said plates.

7. In a triple-valve device for air-brakes, the combination of a pair of coöperating flexible diaphragms exposed at their outer sides, respectively, to train-pipe and reservoir pressures and at their inner sides to the atmosphere, and governing the movements of the feed and release valves, and distance mechanism between the diaphragms formed of independently-movable sections, each said section consisting of a pair of diaphragm-engaging plates provided with concave sockets on their adjacent sides, and a distance-pin having convex ends fitting said sockets.

8. In a triple-valve device for air-brakes, the combination with feed and release valves, a diaphragm device for actuating said valves, an emergency-valve and an emergency-valve-actuating piston, of a service-valve and a flexible service-valve-actuating diaphragm mounted independently of said piston and diaphragm device.

9. In a triple-valve device for air-brakes, the combination with feed and release valves, a diaphragm device for actuating said valves,

an emergency-valve and an emergency-valve-actuating piston, of a service-valve, a flexible service-valve-actuating diaphragm mounted independently of said piston and diaphragm device, and of greater flexibility than said diaphragm device.

10. In a triple-valve device for air-brakes, the combination with feed and release valves and operating means therefor, of a service-valve, a flexible service-valve-actuating diaphragm and means upon the diaphragm for loosely engaging the service-valve to permit limited independent movement between them.

11. In a fluid-pressure automatic brake system, the combination with a train-pipe, triple valve, auxiliary reservoir and brake-cylinder, of means for causing venting of the auxiliary-reservoir and brake-cylinder pressures to the train-pipe under slow and prolonged reduction of train-pipe pressure, for the purpose set forth.

12. In a fluid-pressure automatic brake system, the combination with a train-pipe, triple valve, auxiliary reservoir and brake-cylinder, of means for causing venting of the auxiliary-reservoir and brake-cylinder pressures after equalization to the train-pipe under slow and prolonged reduction of train-pipe pressure, comprising a piston movable in a bushing and loosely fitting the same, and subject on opposite sides to reservoir and train-pipe pressures and seating under preponderance of pressure from the train-pipe to shut off communication between the train-pipe and brake-cylinder, but movable from its seat under comparatively great preponderance of auxiliary-reservoir pressure to permit the latter and brake-cylinder pressures to pass by the piston to the train-pipe, substantially as and for the purpose set forth.

MAURY W. HIBBARD.

In presence of—
J. H. LANDES,
M. S. MACKENZIE.