No. 816,859. PATENTED APR. 3, 1906.

M. W. HIBBARD.

FLUID PRESSURE BRAKE.

APPLICATION FILED JULY 6, 1903.

2 SHEETS—SHEET 1.

Fig 1

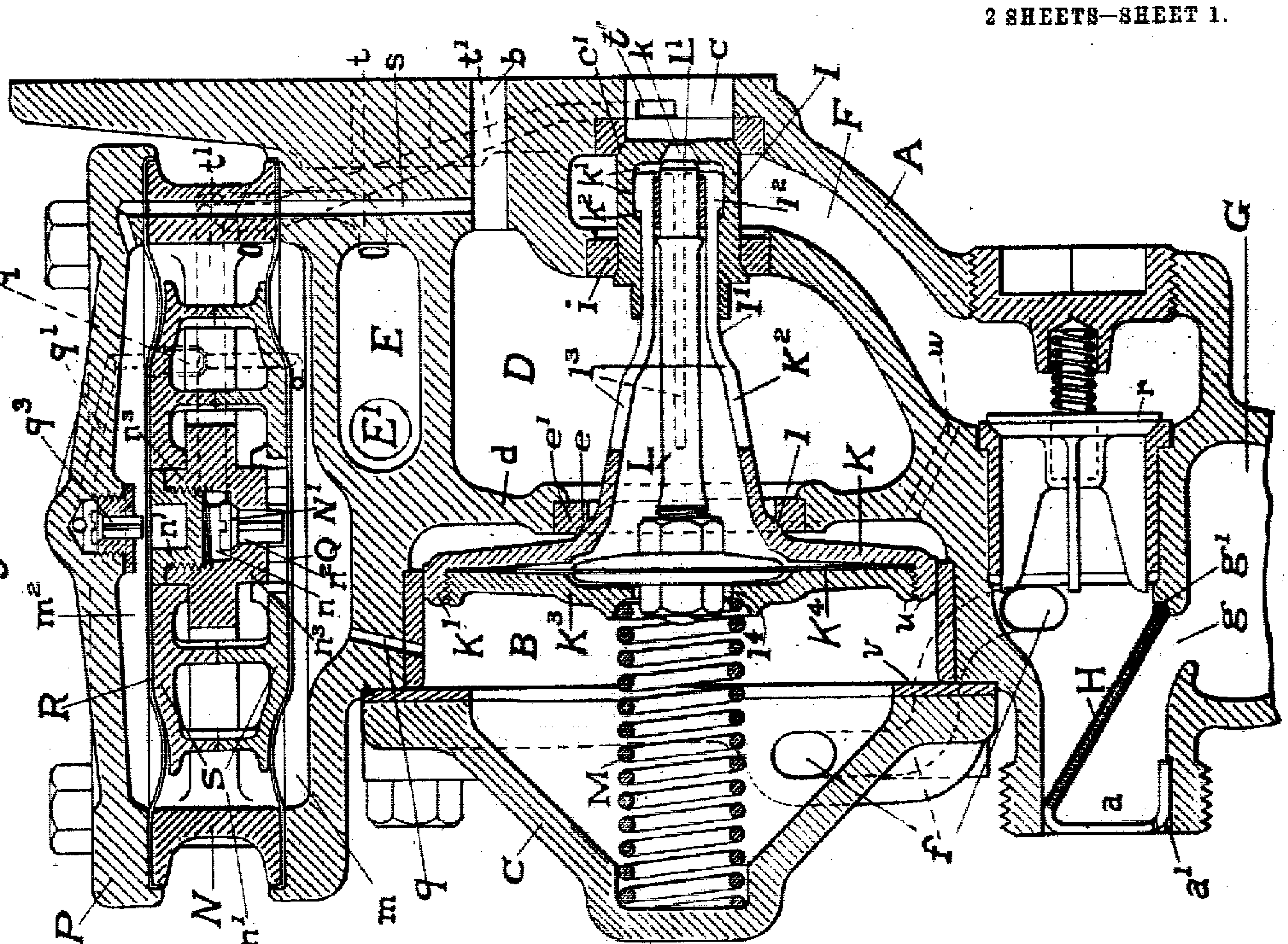
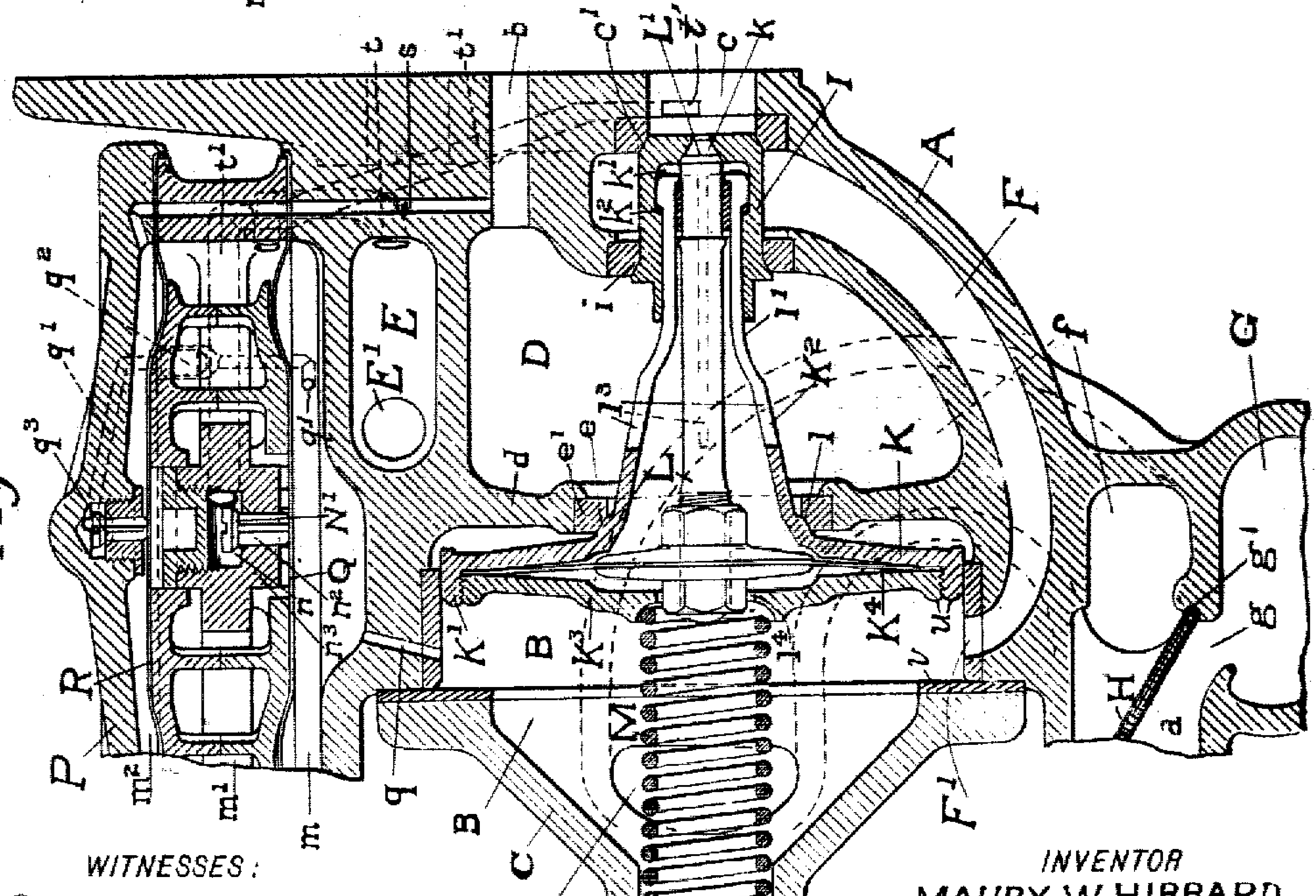


Fig 2



WITNESSES:

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MAURY W. HIBBARD.

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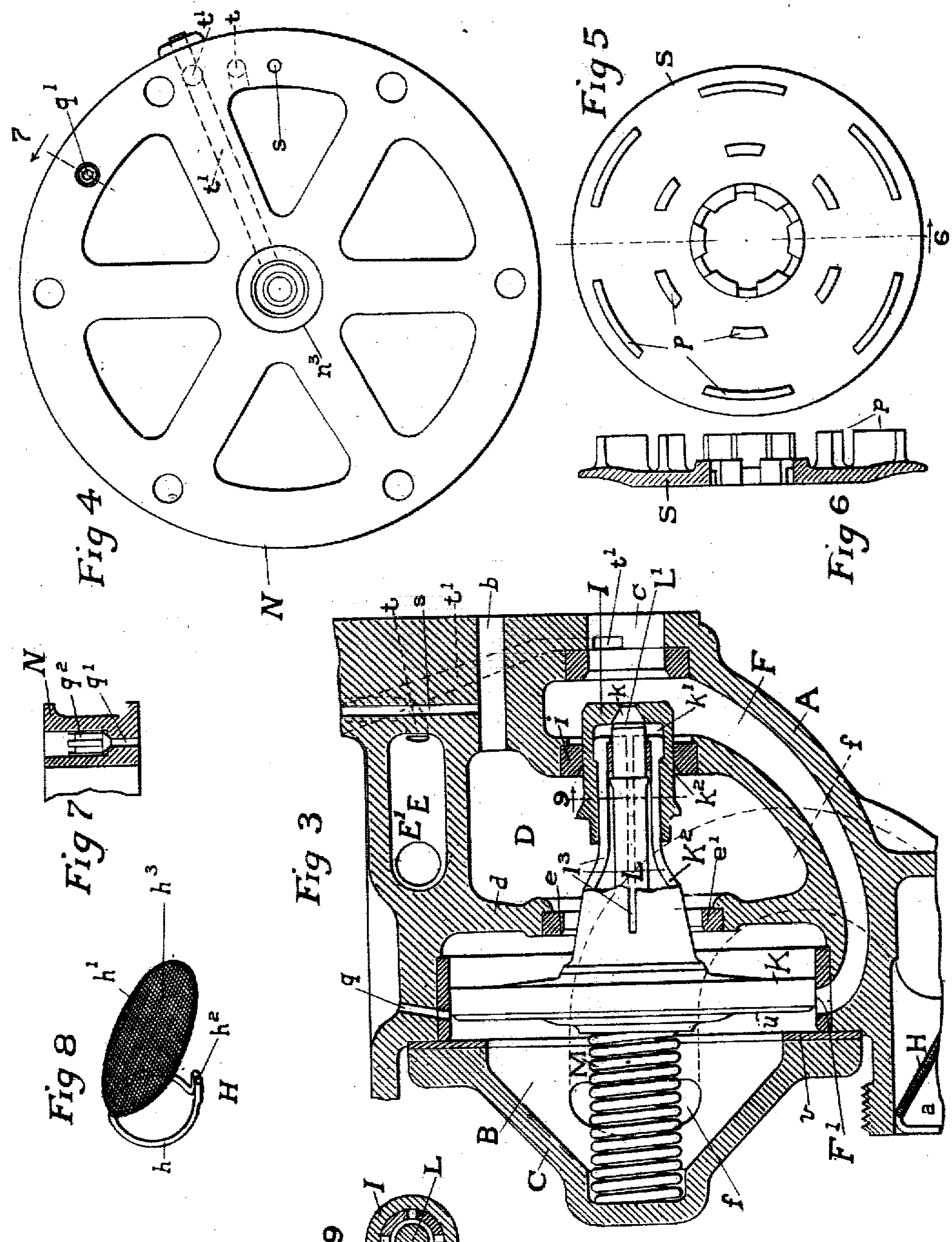

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UNITED STATES PATENT OFFICE.

MAURY W. HIBBARD, OF CHICAGO, ILLINOIS.

FLUID-PRESSURE BRAKE.

No. 816,859. Specification of Letters Patent. Patented April 3, 1906.

Application filed July 6, 1903. Serial No. 164,324.

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, and more especially quick-action triple valves employed in fluid-pressure air-brake systems.

My object is to provide a triple-valve device of generally-improved construction, which while conforming strictly, as required, to the rules laid down by the Master Car-Builders' Association will be particularly responsive to manipulations of the engineer's valve in trains of any length, will be of comparatively simple and economical construction, and require comparatively little attention to maintain it in perfect working order.

In the drawings, Figure 1 is a broken view showing the valve device in vertical section with a check-valve in the emergency-passage and the other passages arranged to conform to this construction, the mechanism being in "service" position; Fig. 2, a similar view of the valve in "running" position, which shows an arrangement of passages where the emergency-passage check-valve is dispensed with; Fig. 3, a similar view of the construction shown in Fig. 2, the mechanism being in a position between "running" and full "emergency;" Fig. 4, a plan view of a stationary spider-frame forming part of the upper construction of the device; Fig. 5, a plan view of one of two similar companion members of a suspended frame or spacer movable within the said spider-frame; Fig. 6, a section on line 6 in Fig. 5; Fig. 7, a broken section on line 7 in Fig. 4, showing a check-valve in one part of the auxiliary-reservoir feed-passage; Fig. 8, a perspective view of an improved strainer which I prefer to employ, and Fig. 9 a section on line 9 in Fig. 3 through the emergency-valve and graduating valve-stem.

The triple-valve body A has a train-pipe port or passage *a*, an auxiliary-reservoir port or passage *b*, and a brake-cylinder port *c*, all arranged to register with standard equipments. In the body A is a bushed piston-chamber B, closed at one side by a cylinder-cap C, and an auxiliary-reservoir chamber D, separated from the chamber B by a partition *d*, having a large central opening *e*, provided with a bushed valve-seat *e'* at the chamber B, an exhaust-chamber E, having an exhaust-port E', a large emergency-passage F, and a passage *f*, extending from the train-pipe passage *a* and through the cap C to the piston-chamber B. In the lower side of the train-pipe passage *a*, between its mouth and the mouth of the passage *f*, is a port *g*, entering the top of the drain-cup G.

H is a strainer having a frame portion formed, preferably, of one length of wire bent to present a circular expansible part *h* and elliptical part *h'* at an acute angle to each other, the part *h* being formed at the free ends of the wire with a divided guide-foot h^2, as shown. The part *h'* forms the frame of a wire-gauze disk h^3. The strainer fits at its foot portion h^2 in a groove *a'* in the passage *a* and the end of the part *h'* fits into a socket *g'* at the rear edge of the port *g*, causing the part *h'*, which fits closely the bore of the passage *a*, to extend in a downward-inclined direction across the passage *a* and over the port *g*. Thus all air entering from the train-pipe must pass through the strainer and any particles of dust carried thereby will be deflected downward by the gauze and fall through the port *g* into the drain-cup.

In the emergency-passage F at the brake-cylinder port *c* is a comparatively large valve-seat *c'*, and extending between the passage F and chamber D in line with the port *c* is an opening fitted with a bushing *i*, presenting a valve-seat to the chamber D. Sliding in the bushing *i* is an emergency-valve I, formed with annular seating-faces to fit snugly the valve-seats *c'* *i*. The valve I is chambered and provided at its end with an opening and tapering valve-seat *k*, forming the service-port. In the part adjacent to the port *k* the valve is formed with an inner annular enlargement *k'*, presenting a shoulder k^2. K is a piston comprising an annular head K', fitting more or less closely and sliding in the bushing of the piston-chamber B and shaped on its rear side with an annular seating-face *l*, fitting the valve-seat *e*, from which extends the hollow stem-portion K^2, formed with a reduced cylindrical extension *l'*, fitting through the open-end portion of the valve I and terminating in an enlargement l^2 in the part *k'* of said valve, but somewhat shorter than said part, as shown. The stem K^2 is slit from its free end to a point near the valve portion *l* to present the openings l^3, of which there may be four, as shown in Fig. 9.

Screwed into the piston-head K′, near the outer circumference thereof, is an annular face-plate K^3, provided with a central opening l^4. Clamped around its circumferential edge by the head K′ and plate K^3 is a preferably flexible metal diaphragm K^4, forming a movable abutment. The head and plate flare slightly with relation to each other toward the center to permit the proper play of the said movable abutment, while protecting it against undue strain. Fastened to the central part of the flexible disk K^4 is the stem L of a graduating-valve L′, sliding in a guide in the end of the stem K^2 and tapered at its end to fit the valve-seat formed by the tapering service-port *k*. Confined between the cap C and the piston K is a graduating-spring M.

Fitting upon the body A is a spider-frame N, and fitting over the upper side of the spider-frame is a cap P. Secured around its edge between the body A and spider-frame is a flexible, preferably thin metal, diaphragm Q, and secured around its edge between the spider-frame and cap P is a thin flexible, preferably metal diaphragm R. The diaphragms Q R separate the space between the top of the body A and cap P into three chambers m m' m^2, respectively. The spider-frame is formed at its hub with a valve-chamber *n*, closed by a screw-plug n' at the upper side and having a port n^2 through to the under side of the hub. The upper end of the port n^2 is formed with a valve-seat, and in the chamber *n* is a valve N′, having a winged stem extending through and beyond the lower end of the port. The hub of the spider-frame presents annular projecting guides n^3 on the upper and under sides of the frame. S S are the similarly-constructed upper and lower members of a spacing-frame, the members being formed on their adjacent sides with similar lugs *p*, fitting against each other. At the centers of the disk portions of the spacers are ribbed openings fitting around and sliding vertically upon the guide projections n^3, the disks bearing, respectively, against the upper and lower flexible diaphragms R Q, as shown. In the position shown is a passage *q* from the piston-chamber B to the chamber or compartment *m*. Extending from the compartment *m* to the compartment m^2 is a passage q', cored through the body A, spider N, and cap P. In the passage q' in the spider-frame is a downwardly-seating check-valve q^2, closing in the direction of the compartment *m*, and in the end of the passage q' at the compartment m^2 is a check-valve q^3, closing in the direction of the compartment m^2. The winged stem of the valve q^3 extends downward into the path of the flexible diaphragm R. Extending between the compartment m^2 and auxiliary-reservoir passage *b* is a cored passage *s*. Extending from the compartment m' to the exhaust-chamber E is a cored passage *t*. (indicated by dotted lines in the figures,) and extending from the spider-chamber *n* through an arm of the spider-frame and thence downward through the body A is a passage t' (indicated by dotted lines) and affording open communication between the said chamber *n* and brake-cylinder passage *c*.

In the construction shown in Fig. 1 the emergency-passage F extends from the train-pipe passage *a*, a check-valve *r* being interposed between them.

When the mechanism is in running position, as indicated in Fig. 2, air entering from the train-pipe passes upward through the passage *f* to the chamber B and supplements the action of the spring M in impressing the piston against the air-tight seat *e*. The pressure is also exerted through the opening l^4 in the piston against the flexible diaphragm or abutment K^4, whereby the graduating-valve L′ is pressed against the seat *k* and the emergency-valve I is pressed firmly against its seat *i* c', thereby closing the brake-cylinder port. Pressure passes from the chamber B through the port *q* to the compartment *m*, exerting pressure against the flexible diaphragm Q and lifting it and the spacer S, whereby the valve N′ is opened by the diaphragm Q and the valve q^3 is opened by the diaphragm R. Thus pressure passes from the compartment *m* through the passage q', lifting and opening the check-valve q^2 therein to the compartment m^2. From the compartment m^2 the pressure passes through the passages *s* *b* to the chamber D and auxiliary reservoir. Thus in running position the pressures in the train-pipe, piston-chamber B, compartments m m^2, chamber D, and auxiliary reservoir will be equalized and the brake-cylinder maintained open to the outside air through the passages *c* t', chamber *n*, port n^2, compartment m', passage *t*, chamber E, and port E′. By reason of the fact that the compartment m' is thus always open to the outside air the diaphragms Q R are held firmly on the upper and lower surfaces of the spacer N. While the pressure in the compartments m m^2 are equal, the spacer and diaphragms R Q would assume the lowered position shown in Fig. 1, permitting the valves q^3 N′ to close; but whenever the auxiliary-reservoir pressure falls below that of the train-pipe the preponderance of pressure in the compartment *m* over that in the compartment m^2 would lift the said diaphragms and permit pressure to pass through the passage q' and feed the auxiliary reservoir.

Under a slight reduction of pressure in the train-pipe for service application the consequent lowering of pressure in the chamber B will cause the preponderating pressure in the chamber D to move the flexible diaphragm K^4 to the position shown in Fig. 1, thereby opening the graduating-valve L′ and permitting air to pass from the auxiliary reservoir to the brake-cylinder through the openings l^3 and small service-port k. At the same time the lowering of pressure in the compartment m would cause the flexible diaphragms Q R to move to or remain in the lowered positions shown in Fig. 1, permitting the brake-cylinder exhaust-valve N′ to seat or remain seated. When pressure from the train-pipe is again raised to release brakes, the flexible diaphragm K^4 will be pressed to the position shown in Fig. 2 to close the service-port k and the diaphragms Q R will be raised to open the valves N′ q^3, whereby the brake-cylinder will exhaust and the auxiliary reservoir will be fed.

The graduating-spring M prevents movement of the piston K in service reductions. When an emergency reduction is brought about in the train-pipe, the mechanism shown in Fig. 1 will operate as follows: The sudden great reduction of pressure in the chamber B in front of the piston will cause the pressure in said chamber behind the piston, and also the pressure in the chamber D exerted against the diaphragm K^4 to move the piston against the resistance of the graduating-spring M until the enlarged end portion l^2 slides in the valve I and after the first slight preliminary movement engages the shoulder k^2 in said valve. The piston is moved until it seats at its annular projecting part u against the annular leather or rubber gasket v, which thus forms a valve-seat, preventing air from escaping around the piston from the chamber D to the train-pipe. The sudden opening of the valve I from the seat e' causes a rush of pressure from the train-pipe, which opens the check-valve r and passes in comparatively large volume to the brake-cylinder. Pressure also passes from the auxiliary reservoir through the port k. Extending from the chamber B behind the piston to the emergency-passage F is a passage w, so that when the piston leaves the seat e pressure will also pass from the auxiliary reservoir to the brake-cylinder. When the train-pipe pressure is suddenly reduced for an emergency stop, owing to the comparatively large size of the passage F and port e, there will be a rush of pressure from the train-pipe to the brake-cylinder in advance of any material rush of pressure from the auxiliary reservoir to the brake-cylinder. Thus the "quick-action" feature of the valve is, in effect, in advance of any material lowering of the auxiliary-reservoir pressure. When the brake-cylinder pressure approximates that of the train-pipe, the check-valve r will be entirely closed by its spring permitting the reservoir pressure to act with full force on top of the pressure which has entered the brake-cylinder from the train-pipe.

It will be noticed that the small end of the graduating-valve port k is of less area than the end of the graduating-valve L′, which insures firm seating of the said valve by pressure when closed. The length of the part l^2 of the piston-stem being less than the enlarged chamber portion k' of the emergency-valve I permits the piston to get under way and open the port e before it engages the shoulder k^2 and starts the opening movement of the emergency-valve. Thus a preliminary blow is given to the emergency-valve to start it away from its seat before the steady direct force of the piston is applied.

In the construction shown in Figs. 2 and 3 the check-valve r (shown in Fig. 1) is not employed, and the emergency-passage F extends from a port F′ in the bushing of the piston-chamber B in the position shown instead of directly from the train-pipe passage. The passage f from the train-pipe to the piston-chamber is also somewhat larger in this construction. The operation of all the mechanism is the same as in the other construction described, except in the case of emergency action. When the piston K is unseated by an emergency reduction in the train-pipe and travels in the direction of the seat v, the opening of the emergency-valve I causes a sudden quick rush of a large volume of pressure from the train-pipe through the chamber B, port F′, and passage F to the brake-cylinder, which is thus filled with pressure from the train-pipe by the time the piston reaches the seat v and closes communication between the train-pipe and brake-cylinder. In the movement of the piston to the seat v the port F′ is opened to the auxiliary reservoir through the chamber D, opening e, and chamber B behind the piston, causing a sudden rush of pressure from the auxiliary reservoir to the brake-cylinder on top of the train-pipe pressure. This construction is more simple and less expensive to maintain than the construction shown in Fig. 1 on account of the leaving out of the check-valve r and its attendant parts. (Shown in Fig. 1.) Furthermore, the action is, if anything, quicker and more positive.

The area of the emergency-valve exposed to pressure from the chamber D is comparatively large, insuring firm seating of said valve against the double seat i e', while the mechanism is in running or service position, and as the service and graduating movements of the stem L are controlled altogether by the movable abutment or flexible diaphragm K^4 there is no strain upon the emergency-valve except after initial movement of the piston K.

The construction insures quick and positive seating and releasing of brakes under minimum desired variations of pressure in the train-pipe, thus rendering the valve device particularly responsive to operations of the engineer's valve. The construction furthermore avoids the necessity of a close-fitting ringed piston, with the attendant danger of "sticking," and the mechanism requires no oiling. This is a material advantage, because oil tends to accumulate dirt. The strainer H, constructed to operate as described, reduces to the minimum any danger of dust entering to interfere with the operation of the mechanism. The ports and passages are of a size to permit the filling of the auxiliary reservoir and service application and release of brakes according to standard requirements. Besides the structural advantages of my improved valve device over those hitherto provided it possesses particular advantages in effecting quick and positive service, release, and emergency actions. As before stated, when the emergency-valve is opened the initial rush of pressure to the brake-cylinder is from the train-pipe before (especially in the construction shown in Figs. 2 and 3) pressure commences to rush thereto to any material extent from the auxiliary reservoir. This insures particularly-quick serial emergency action in long trains.

The spaced flexible diaphragms R Q are particularly sensitive to movement under variation of pressure on their opposite sides, rendering them quick to open and close the valves q^3 N', for the purpose described, and as the auxiliary-reservoir feed-passage is closed except when feeding there can be no retrogression of pressure from the auxiliary reservoir to the train-pipe and all actions brought about by desired variations in train-pipe pressure are practically instantaneous.

The check-valve q^2 presents a small area to the feeding pressure when closed, but a larger area when opened. This has the effect of causing said valve to operate as a pressure-retarding valve by remaining seated after the valves q^3 N' have opened for a sufficient time to permit the train-pipe pressure to accumulate slightly before passing to the auxiliary reservoir. The effect of this action is to cause the pressure to rise practically all along the train-pipe before feeding and tends to insure quicker release of brakes simultaneously throughout the train. This is a practical safeguard against the pulling apart of cars or "breaking the train in two" when releasing on long trains. When brakes are first applied, the pressure in the brake-cylinder is exerted against the upper side of the exhaust-valve N' to hold it firmly to its seat. Thus no matter how gently the brakes are applied the exhaust-valve N' will be held seated under any slight waves of increasing pressure in the train-pipe.

The area of the graduating-valve L' exposed to atmospheric pressure through the port k when brakes are released will insure holding of that valve seated until sufficient reduction in initial service application is made in the train-pipe to lower the double diaphragm device and close the valves q^3 N' and always effect sufficient preponderance of reservoir over train-pipe pressure before the graduating-valve is opened to insure movement of the brake-cylinder piston past the leakage-groove in the brake-cylinder. After the first application in setting the brakes the consequent auxiliary-reservoir reduction, combined with back pressure against the graduating-valve exerted from the brake-cylinder, will allow the said valve to respond readily to train-pipe reductions for graduating. It will be understood that all service actions are effected without any piston travel, but altogether by the movement of flexible diaphragms and seating-valves, which is a decided advantage in preventing leakage and maintaining perfect control of braking action. There can be no sticking of pistons, with attendant irregular action and undesired emergency. The piston seats at the port e independently of the seating of the emergency-valve, which is a structural advantage. The double seating of the emergency-valve at the seats i c' is a very simple construction, rendered easily exact, and the valve I, having slight independent movement relative to the piston, insures perfect seating to effect air-tight closing of the ports at i c'. There should preferably be sufficient spring at the movable diaphragm K^4 to maintain the graduating and emergency valves normally seated. The construction of the double diaphragm involving the spider-frame and spacer is such as to render the moving parts particularly sensitive and easy to get at when desired. The diaphragms employed in the device may be of any suitable construction or material which will give the best results, and the ports should in all cases be of such relative proportions as will best fulfil standard requirements.

If desired, the diaphragm device may be so arranged as to hold the valve q^3 normally open and permit the same to close only when the auxiliary-reservoir pressure exceeds that of the train-pipe.

While I prefer to construct my improvements throughout substantially 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 an automatic fluid-pressure brake apparatus, having a movable abutment, governing the passage of pressure to the brake-cylinder, and a passage for feeding pressure from the train-pipe to the auxiliary reservoir, the combination of a separate movable flexible diaphragm device exposed on opposite sides to pressure from the train-pipe and auxiliary reservoir respectively, and a valve in said feed-passage actuated by movement of said diaphragm device to open said passage

when the train-pipe pressure exceeds that in the auxiliary reservoir.

2. In an automatic fluid-pressure brake apparatus, having a movable abutment, governing the passage of pressure to the brake-cylinder, and a passage for feeding pressure from the train-pipe to the auxiliary reservoir, the combination of a separate movable flexible diaphragm device exposed on opposite sides to pressure from the train-pipe and auxiliary reservoir respectively, and a valve in said feed-passage actuated to open by movement of said diaphragm device under preponderance of train-pipe pressure, and operating to close said passage when the auxiliary-reservoir pressure exceeds that in the train-pipe.

3. In an automatic fluid-pressure brake apparatus having a movable abutment governing the passage of pressure to the brake-cylinder, a passage for feeding pressure from the train-pipe to the auxiliary reservoir, and a brake-cylinder exhaust-passage, the combination of a separate movable flexible diaphragm device exposed on opposite sides to pressure from the train-pipe and auxiliary reservoir respectively, and valves in both said passages actuated by movement of said diaphragm device to open said passages when the train-pipe pressure exceeds that in the auxiliary reservoir.

4. In an automatic fluid-pressure brake apparatus, having a movable abutment governing the passage of pressure to the brake-cylinder, a passage for feeding pressure from the train-pipe to the auxiliary reservoir and a brake-cylinder exhaust-passage, the combination of a separate movable flexible diaphragm device exposed on opposite sides to pressure from the train-pipe and auxiliary reservoir respectively, a check-valve in said exhaust-passage seating under pressure from the brake-cylinder and actuated by movement of said diaphragm device to open against any brake-cylinder pressure when the train-pipe pressure exceeds that in the auxiliary reservoir.

5. In an automatic fluid-pressure brake apparatus, having a movable abutment, governing the passage of pressure to the brake-cylinder, and a passage for feeding pressure from the train-pipe to the auxiliary reservoir, the combination of a separate movable diaphragm device exposed on opposite sides to pressure from the train-pipe and auxiliary reservoir respectively, a valve in said feed-passage actuated by movement of said diaphragm device to open said passage when the train-pipe pressure exceeds that in the auxiliary reservoir, and a pressure-retarding valve in said passage seating in the direction of the train-pipe.

6. In an automatic fluid-pressure brake apparatus, having a movable abutment, governing the passage of pressure to the brake-cylinder, and a passage for feeding pressure from the train-pipe to the auxiliary reservoir, the combination of a movable abutment formed with two coöperating diaphragms exposed at their outer sides, respectively, to pressure from the train-pipe and auxiliary reservoir, a brake-cylinder exhaust-passage between said diaphragms, and valves in said feed and exhaust passages actuated by movement of said coöperating diaphragms to open both said passages when the train-pipe pressure exceeds that in the auxiliary reservoir.

7. In an automatic fluid-pressure brake apparatus having a movable abutment governing the passage of pressure to the brake-cylinder, a passage for feeding pressure from the train-pipe to the auxiliary reservoir and a brake-cylinder exhaust passage, the combination of a movable abutment formed with two coöperating diaphragms exposed at their outer sides respectively to pressure from the train-pipe and auxiliary reservoir and at their inner sides to atmosphere, and valves in said feed and exhaust passages actuated by movement of said coöperating diaphragms to open said passages when the train-pipe pressure exceeds that in the auxiliary reservoir.

8. In an automatic fluid-pressure brake apparatus having a movable abutment, governing the passage of pressure to the brake-cylinder, and a passage for feeding pressure from the train-pipe to the auxiliary reservoir, the combination of a stationary spider-frame having a chamber interposed in the brake-cylinder exhaust-passage, flexible diaphragms on opposite sides of said spider-frame exposed at their outer sides respectively to pressure from the train-pipe and auxiliary reservoir, a spacer movable upon said spider-frame and bearing at opposite sides respectively against said diaphragms and valves in said feed and exhaust passages actuated by movement of said spaced diaphragms.

9. In an automatic fluid-pressure brake apparatus having ports and passages communicating respectively with the train-pipe, auxiliary reservoir and brake-cylinder, the combination of an emergency-valve, a piston device governing said valve, a graduating-valve, and a flexible diaphragm on said piston device and having movement independent thereof operatively connected with said graduating-valve, said piston and diaphragm being exposed on opposite sides to pressure from the train-pipe and auxiliary reservoir respectively.

10. In an automatic fluid-pressure brake apparatus, having ports and passages communicating respectively with the train-pipe, auxiliary reservoir and brake-cylinder, the combination of a chambered emergency-valve provided with a service-port, a piston device having a chambered perforate stem

operatively engaging said emergency-valve, a diaphragm on said piston device and having movement independent thereof, and a graduating-valve in the chambered emergency-valve governing said service-port operatively connected with said diaphragm, the said piston and diaphragm being exposed on opposite sides to pressure from the train-pipe and auxiliary reservoir respectively.

11. In a triple valve device for fluid-pressure brake apparatus having a piston-chamber communicating with the train-pipe, an auxiliary-reservoir chamber communicating with the auxiliary-reservoir, an emergency-passage, and auxiliary reservoir feed and brake cylinder exhaust-passages, a brake-cylinder emergency-port extending from the emergency-passage and presenting a valve-seat, a guide-opening in line with said port extending between the emergency-passage and auxiliary-reservoir chamber and presenting a valve-seat to the auxiliary-reservoir chamber, a chambered emergency-valve movable in said guide-opening and having valve-faces arranged to close air-tight against said seats respectively, a service-port and graduating-valve in the chambered emergency-valve and operating means for said valves exposed to, and movable under variations in, pressure from the train-pipe and auxiliary reservoir.

12. In a triple valve device for automatic fluid-pressure brake apparatus, a piston-chamber communicating with the train-pipe, an auxiliary-reservoir chamber communicating with the auxiliary reservoir, an opening between said chambers surrounded by a valve-seat in the piston-chamber, a brake-cylinder emergency-passage communicating with the piston-chamber, auxiliary-reservoir feed and brake cylinder exhaust-passages, a piston device in said piston-chamber having a seating-face closing air-tight against said valve-seat and a stem portion passing through said opening, and emergency and graduating valves operatively connected with said piston device.

13. In a triple valve device for automatic fluid-pressure brake apparatus, a piston-chamber, a port at said chamber communicating with the train-pipe and presenting a valve-seat in said chamber, an auxiliary-reservoir chamber in open communication with the auxiliary reservoir, an opening between said chambers presenting a valve-seat in the piston-chamber, a brake-cylinder emergency-passage communicating with the piston-chamber, a piston device in the piston-chamber presenting valve-faces on its opposite sides to engage respectively and close air-tight against said piston-chamber valve-seats, and emergency and graduating valves operatively connected with said piston device, whereby in emergency action the piston after opening the emergency-valve, to admit train-pipe pressure to the brake-cylinder, opens the emergency-passage to the auxiliary reservoir and closes communication between the piston-chamber and train-pipe.

14. In a triple valve device for automatic fluid-pressure brake apparatus, a piston-chamber, a port in said chamber communicating with the train-pipe and presenting a valve-seat in said chamber, an auxiliary-reservoir chamber in open communication with the auxiliary reservoir, an opening between the said chambers presenting a valve-seat in the piston-chamber, a brake-cylinder emergency-passage extending from the piston-chamber near the train-pipe port therein, and a piston in the piston-chamber presenting valve-faces on its opposite sides to engage respectively and close air-tight against said piston-chamber valve-seats, and in its movement from one said seat to the other crossing the port of the emergency-passage, whereby in emergency action the piston after opening the emergency-valve, to admit train-pipe pressure to the brake-cylinder, crosses the emergency-port and opens the emergency-passage to the auxiliary reservoir and closes communication between the piston-chamber and train-pipe.

15. In a triple valve device for automatic fluid-pressure brake apparatus, the combination with the piston-chamber having an annular inner guide-wall, auxiliary-reservoir chamber, emergency-passage and auxiliary-reservoir feed and brake cylinder exhaust-passages, of an opening between the piston-chamber and auxiliary-reservoir chamber, presenting a valve-seat in the piston-chamber, a piston device formed with a valve-face at one side, a graduating spring operating normally to press the piston device at its said valve-face air-tight against said seat, the piston fitting around its circumference loosely the annular wall of the piston chamber and sliding readily therein, and emergency and graduating valves operativly connected with said piston device, substantially as and for the purpose set forth.

16. In an automatic fluid-pressure brake apparatus, having a train-pipe passage, drain-cup and port in said passage opening into the drain-cup, a disk-shaped strainer fitting the bore of said passage and extending in an inclined direction over said port to deflect particles of dust into said port, substantially as described.

17. In an automatic fluid-pressure brake apparatus, having a train-pipe passage, drain-cup and port in said passage communicating with the drain-cup, a strainer having a frame presenting two parts at an angle to each other, fitting the bore of said passage and extending at one part in an inclined direction over said port and at its other part engaging the wall of the passage to hold the strainer firmly in position, and a wire-gauze

diaphragm on said inclined part, substantially as described.

18. In a valve device for actuating fluid-pressure brakes, the combination of valve mechanism for controlling the admission and release of fluid-pressure to and from the brake-cylinder, and a valve normally tending to close communication between the train-pipe and auxiliary reservoir and cutting off the feed but actuated by said valve mechanism and held to open position when the brake-cylinder is at released position.

19. In a railway-brake-actuating device of the type in which a movable-abutment-actuated release-valve and a movable-abutment-actuated service-valve are independent of each other, the combination, with said valves, of means controlled by the abutment of the release-valve for governing the feed to the auxiliary reservoir.

20. In a device for actuating brakes, the combination of release-valve mechanism and a valve controlled by such release-valve mechanism and governing the flow or feed of air to the auxiliary reservoir.

21. In a device for actuating brakes, the combination of release-valve mechanism, a feed-valve controlled by said release-valve mechanism and governing the flow or feed of air to the auxiliary reservoir, and means for causing the release-valve to open before the feed-valve opens.

22. In a device for actuating brakes, the combination of a single feed-passage extending from the train-pipe to the auxiliary reservoir, a valve in said passage closing in the direction of the auxiliary reservoir, a diaphragm operating by preponderance of train-pipe pressure to open said valve, and a check-valve in said passage closing in the direction of the train-pipe.

23. In a device for actuating brakes, the combination of release-valve mechanism and a separate valve arranged in a feed-passage between the train-pipe and auxiliary reservoir and governed by said release-valve mechanism to close said feed-passage approximately when the release-valve is closed, and to open the same approximately when the release-valve is opened.

24. In a device for actuating brakes, the combination of release-valve mechanism, a separate valve for controlling the feed of air to the auxiliary reservoir, and a movable abutment for operating both of said valves.

MAURY W. HIBBARD.

In presence of—

WALTER N. WINBERG,
WM. B. DAVIES.