(No Model.) 2 Sheets—Sheet 1.

S. R. KNEELAND.

AIR BRAKE.

No. 351,383. Patented Oct. 26, 1886.

Fig. 1.

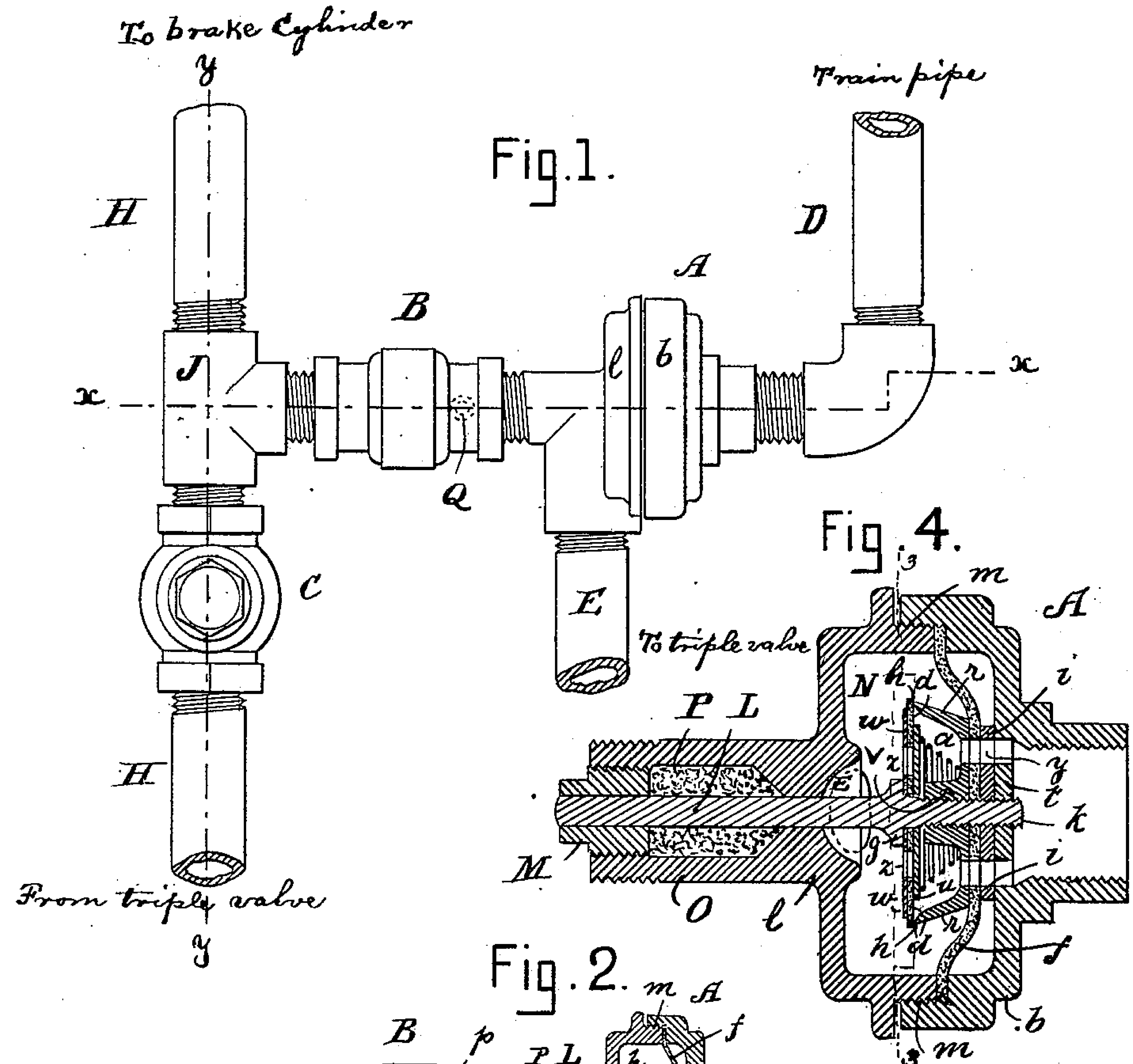


Fig. 4.

Fig. 2.

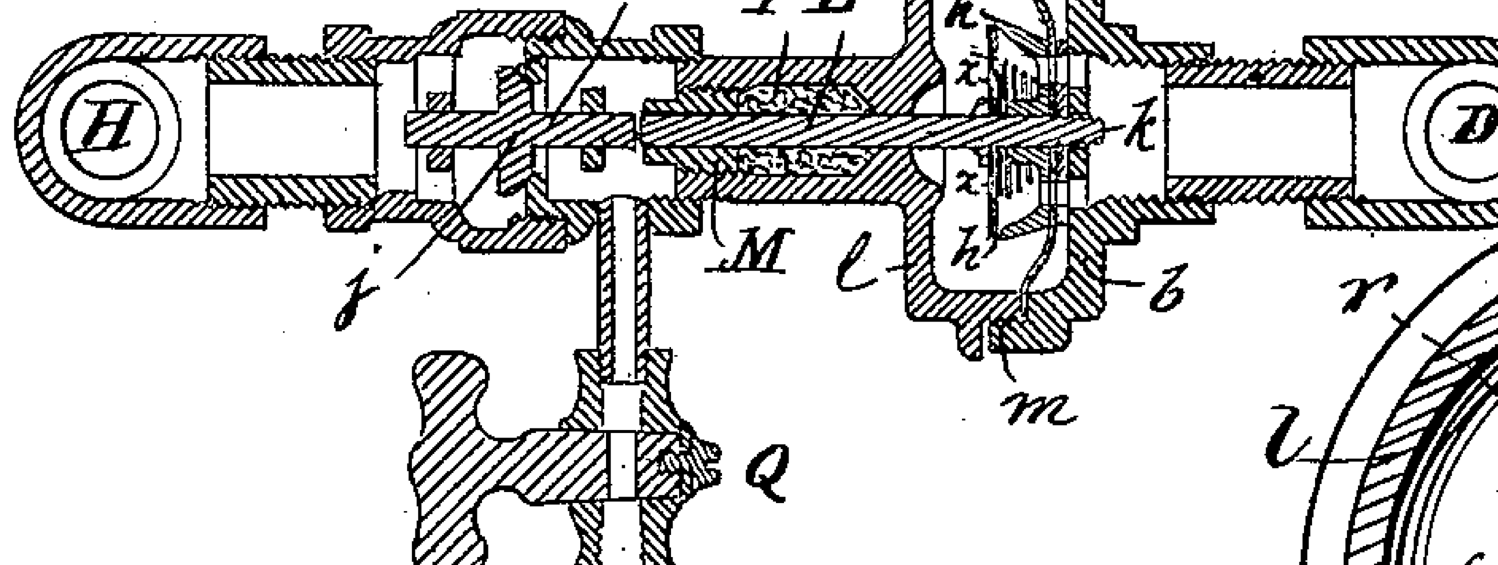


Fig. 7.

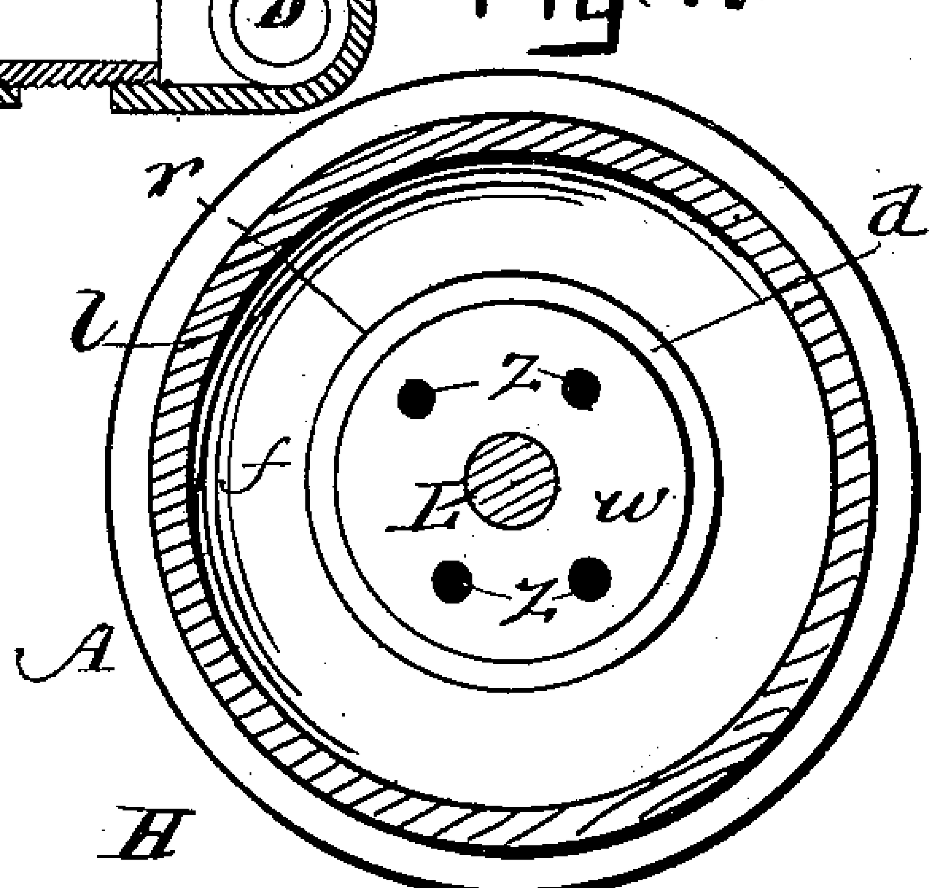
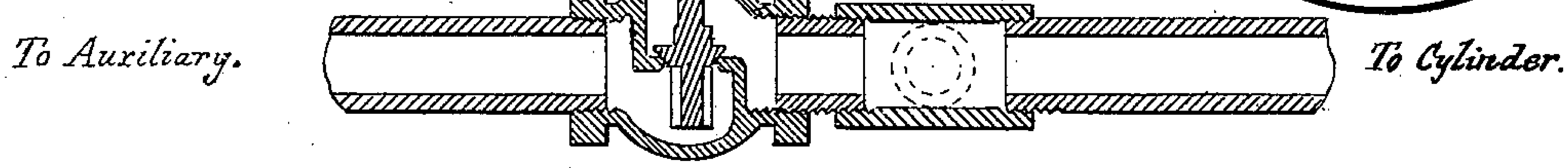


Fig. 3.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 5.

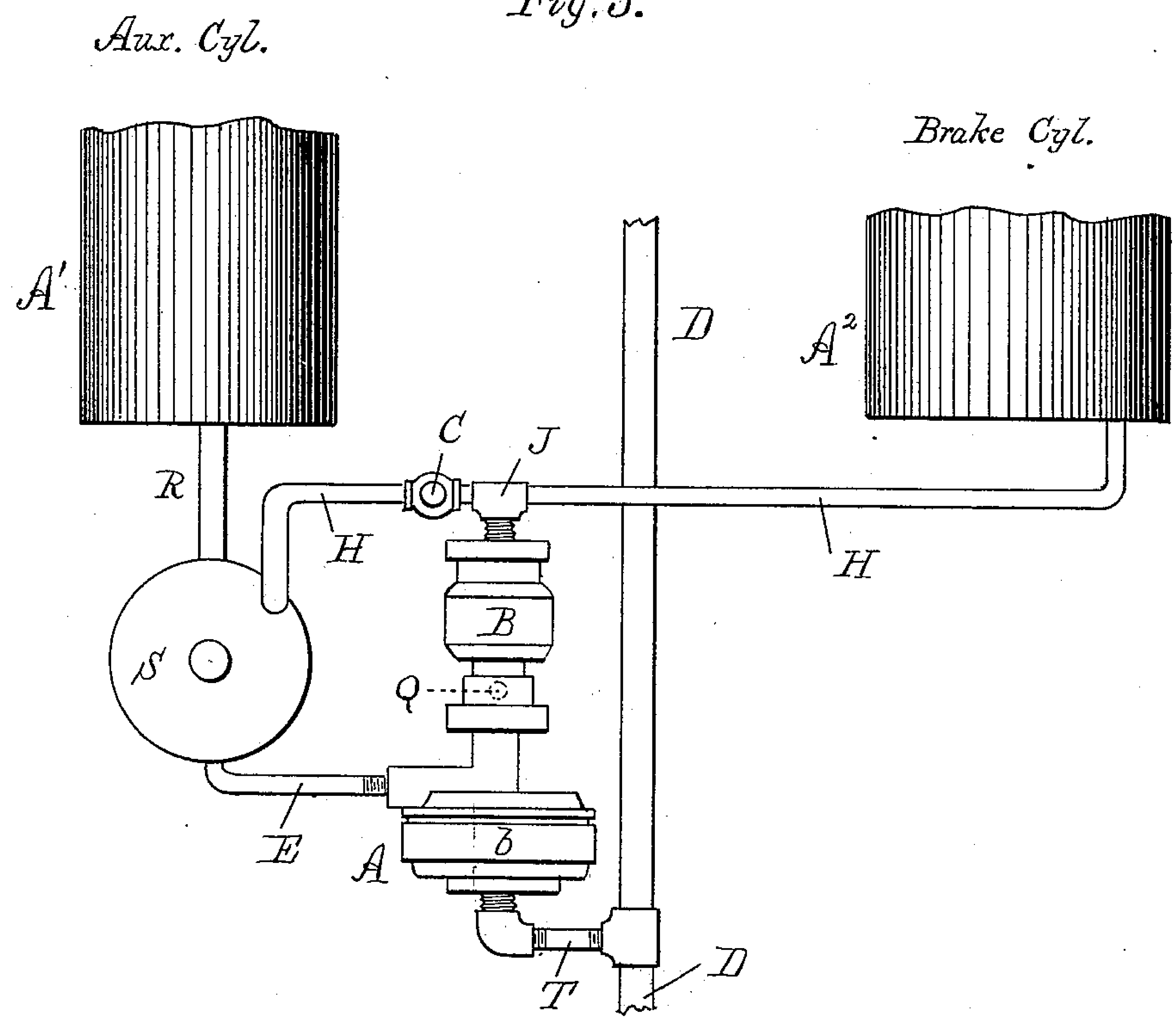
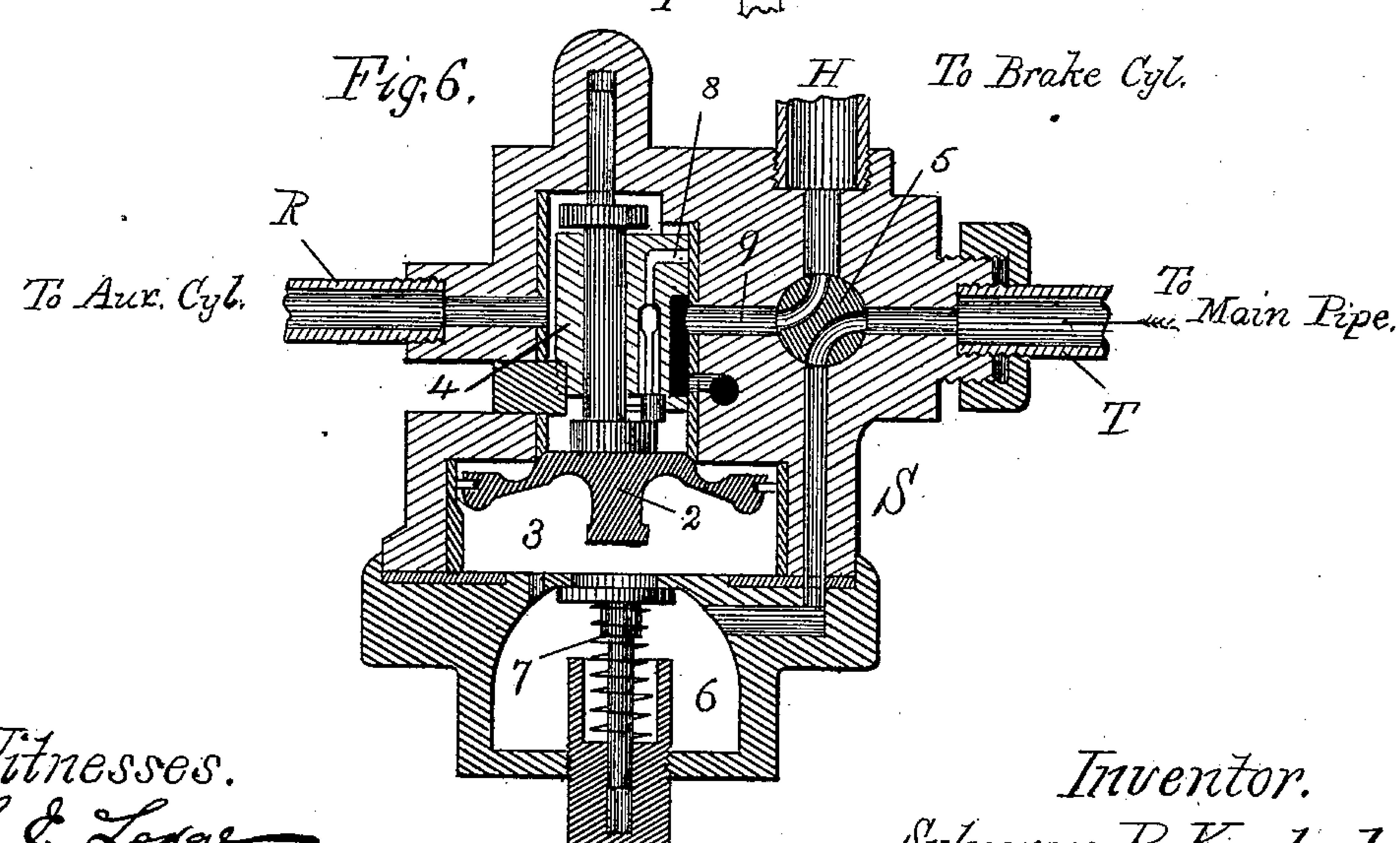


Fig. 6.



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UNITED STATES PATENT OFFICE.

SYLVANUS R. KNEELAND, OF BOSTON, MASSACHUSETTS.

AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 351,383, dated October 26, 1886.

Application filed December 2, 1885. Serial No. 184,441. (No model.)

To all whom it may concern:

Be it known that I, SYLVANUS R. KNEELAND, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Air-Brakes for Railway-Cars; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to that class of air-brakes which are known as "automatic;" and it consists in a novel construction and arrangement of the parts, as hereinafter more fully set forth and described, by which a more effective apparatus and system of the class above premised is produced than is now ordinarily employed, and by means of which the brakes are prevented from "creeping." This latter is occasioned by the pressure in the main air-supply pipe leading from the pump becoming less than the pressure in the auxiliary or storing reservoir, due to various existing causes and circumstances. Furthermore, my device is so arranged that unless the brakes are to be intentionally set or operated no movement of said device containing my improvements will occur, and any air passing from the auxiliary to the brake cylinder will be diverted and escape to the atmosphere; hence while the position of the various parts so remain it is impossible to set the brakes, as the brake-cylinder is rendered inoperative by the escape of the compressed air—the actuating agent.

The nature and operation of the improvement from the description following will be readily understood by all conversant with such matters.

Figure 1 is a plan view showing the relative arrangement of the valves; Fig. 2, a vertical section taken on line *x x* in Fig. 1. Fig. 3 is a vertical section on line *y y* in Fig. 1, and Fig. 4 is an enlarged section of the main valve. Fig. 5 is a general plan of an air-brake system embodying my invention, while Fig. 6 is a vertical section of a "triple valve," so called, which is shown for convenience of reference in the description of the invention; and Fig. 7 is a plan view, partly in section, on the line 3 3 of Fig. 4.

In the drawings, A represents what I term the "main valve;" B, a valve-chamber within which operates the auxiliary valve *j*, while C is a check-valve. The main valve is located between the main air-supply pipe D and the triple valve S, and, as shown, is connected to said pipe D by the induction branch pipe T and with the triple valve by the eduction-pipe E. Communication from the triple valve to the auxiliary cylinder or storage-reservoir A′ is had through the pipe R.

The brake-cylinder is represented at A^2, and the latter united and connected with the other operating parts of the system by the pipe H, which enters the triple valve. Within said pipe is inserted a check-valve, C, so disposed as to prevent air returning to the triple valve from the brake-cylinder A^2, but will permit free passage of air to the latter from the auxiliary cylinder A′ to actively operate the brakes. The valve-chamber B is interposed between the pipe H and main valve A, being properly coupled therewith by the T (shown at J) and other suitable connections, it being understood that all of the parts mentioned are so united as to communicate with each other.

The case of the main valve is made in two sections, *b l*, which are screwed together as shown at *m*, while a flexible annular diaphragm, *f*, is secured between them. An annular valve-seat, *r*, is centrally mounted on the diaphragm *f* by means of the washer *i*, nut *t*, and screw *k*, said washer resting on the bottom or inner face of section *b* when the valve is closed, as shown in Fig. 4.

A hub, *v*, projects from the center of the part forming the valve-seat, said hub being centrally bored and screw-threaded to receive the screw *k*. Disposed around the hub *v* there is a coiled spring, *a*, and resting against the outer end of this spring is a metallic disk, *u*. A leather disk, *d*, is placed outside the metallic disk *u*, which rests on the valve-seat *r*, and outside of the leather disk there is a similar metal one, *w*, which is slightly smaller than the disk *d*, the disks *d w* being provided with a series of holes or air-ducts, *z*, opening against the outer side of the metallic disk *u*. A shoulder, g, is formed on the screw k, and when said screw is turned fully into the hub v the disks d w will be clamped between said shoulder and the metallic disk u, which latter rests against the outer end of the spring a, and is adapted to move back and forth slightly on the body of said screw between the top of the hub v and disk d as the spring is compressed and expands. A series of air holes or ducts, y, are formed in the washer i, diaphragm f, and seat r, so that when the air is forced from the main supply-pipe D into the valve through the induction-pipe T it will pass through said ducts and out under the edges h of the disk d, said disk yielding to permit the air to pass into the chamber N of the valve only after movement of said valve and diaphragm, and thence through the pipe E into the triple valve S.

The screw k is elongated to form the stem L, which is fitted to slide in the elongated nipple O, on section l of the valve A, and in a screw-plug, M, inserted in the outer end of said nipple, a packing, P, being inserted beneath said plug to cause the stem to work air tight in said nipple.

The valve proper, j, located in the valve-chamber B, opens in the direction of the pipe H, and is fitted with a stem, p, adapted to engage the stem L in the valve A. A stop-cock, Q, is attached to the valve-chamber B, said stop-cock ordinarily being left open during the working of the brake.

The check-valve C is of ordinary construction, as shown in Fig. 3, and opens in the direction of the brake-cylinder A^2, while the same valve prevents return of air to the auxiliary air-tank A', (shown as adjoining and connected with the triple-valve in the usual manner.)

It is well known that in automatic air-brakes the brakes are very liable to gradually "creep on" or become "set" accidentally by the independent action of the triple valve; and to obviate this objection or difficulty is the design of my present invention. This "creeping or setting" of the "brakes," so-called, can readily be understood by reference to Fig. 6, which shows the triple valve S. This triple valve contains a piston, 2, working in the chamber 3, and operates a slide-valve, 4. Air enters from the pipes D T through the four-way cock 5 into receiver 6, and thence passes to the chamber 3, forcing the piston up and uncovering a small feed-duct in the upper part of the chamber, which permits air to flow past the piston into the auxiliary reservoir A', while at the same time there is an open communication from the brake-cylinder A^2 to the atmosphere by means of the valve j and discharge-cock Q. Air will continue to flow into the auxiliary reservoir until it contains the same pressure of air as the main brake-pipe D, when the piston 2 is maintained in an upraised or normal position.

To apply the brakes with their full force, the air-pressure in the auxiliary chamber A' must be equal to or greater than that in the supply-pipe D. Suppose the main valve A to be thrust toward and against the auxiliary valve j, opening the same, while the piston 2 in triple valve S is in its extreme upper position. Now, when the compressed air in the main pipe D is allowed to escape, the greater pressure in the auxiliary reservoir A' forces the piston 2 down below the feed-duct, thus preventing the return of air from said reservoir to the main brake-pipe D. As the piston descends it moves with it the slide-valve 4, so as to permit air to flow directly from the auxiliary reservoir A' into the brake-cylinder A^2, which forces the pistons within the latter to advance and set the brakes. The result is a consequence of the sudden diminution of the pressure in the main pipe, whereby the valve A is operated to close the valve j. Thus the latter prevents escape of any air through the cock Q, and the brake cylinder A^2 is actively operated. The brakes are released by again increasing the pressure of the air in the main pipe D by aid of the pump, (not shown,) which pressure becoming greater than that in the auxiliary reservoir A' forces the piston 2 back or upward, recharging the auxiliary reservoir A', and at the same time permits air in the brake-cylinder to escape by closing communication between the brake-cylinder A^2 and the cylinder A' and simultaneously opening the valve j at the time of opening the valve A.

To apply the brakes gently, a slight reduction is made in the pressure in the main pipe, which moves the piston down slowly until it is stopped by the coiled spring 7. At this point the opening 8 in the slide-valve is opposite the port 9, and allows air from the auxiliary reservoir A' to feed through a hole in the side of the slide-valve, and thence by the opening 8 into the brake-cylinder A^2 by way of the pipe H. When the pressure in the auxiliary cylinder A' has been reduced, by expanding into the brake-cylinder A^2 until it is the same as the pressure in the main brake-pipe D the graduating-spring 7 pushes the piston up until the small valve closes the opening 8. This causes whatever pressure is in the brake-cylinder A^2 to be retained, thus applying the brakes with a force proportional to the reduction of pressure in the main brake-pipe. When the train is in motion, in case the pressure in the main pipe D for any cause—as by leakage or otherwise—becomes less than that within the auxiliary cylinder A', the piston 2 gradually drops, and with it the slide-valve 4, which opens communication between the cylinder A' and brake-cylinder A^2, by means of the pipes R, duct 9, and pipe H, to gradually set the brakes. To obviate this difficulty, I make use of the auxiliary valve j, interposed between the main valve A and pipe H, introduce the check-valve C in the pipe H, elongate the stem L, and so connect and arrange the valve A and valve-chamber B that the valve *j* may be opened by the stem of the valve A, and provide the stop-cock Q as a leakage-opening to the valve *j*, and through it for the brake-cylinder A^2.

In the use of my improvement, when the pressure is put on by the pump, the air enters the main valve A, raises the diaphragm *f*, forces the stem L forward into contact with the stem *p* of the valve *j*, and opens the latter, the diaphragm, being composed of leather, rubber, or other analogous material, yielding to permit the stem to advance, as described. After the stem L has advanced to its fullest extent and the valve *j* is opened, the air passing through the ducts *y* will raise the disk *d* from the seat *r* in the valve A, pass out under said disk at *h* into the chamber N, and thence through the pipe E to the triple valve and auxiliary air-tank A' in the usual manner; but the stop-cock Q being open the air in the brake-cylinder A^2 will rush back through the pipe H, close the check-valve C, and escape through the stop-cock, thereby speedily and effectually relieving the brakes. It is evident the valve *j* will always remain open while the pressure is greater in the main air-pipe D than that in the auxiliary cylinder A'. Furthermore, it is obvious that if the triple valve or piston 2 is accidentally operated to open the outlet from the auxiliary air-tank A' to the brake-cylinder, thereby permitting air to pass to the latter through the valve C, the brakes will not be operated thereby, as the main valve A will not move, except upon sudden escape of the air in setting the brakes, and the valve *j* remains open to permit escape of air through the stop-cock Q. The valve *j* being open and the brakes off, as described, if now the air in the main pipe is released and the pressure suddenly reduced, the piston 2 in the triple valve S will drop, and communication is established between the triple valve and the brake-cylinder A^2, thereby permitting the air to pass from the auxiliary air-tank A' to the brake-cylinder A^2 and put on the brakes, the valve *j* being closed when the pressure is removed from the valve A. By closing the stop-cock Q and removing the check-valve C the brake may be used as a direct air-brake in the usual manner. When the pressure is removed in the valve A, the air from the pipe E will pass through the ducts *z* and force the disk *u* down upon the spring *a*, thereby compressing said spring and escaping between the disks *u d*, by way of the ducts *y*, into the pipe T, and thence into the main pipe D.

In making up trains, and also in coupling cars into trains on the road, when the cars are provided with the ordinary automatic air-brakes, the air-pressure is sometimes found to vary greatly in the brakes of different cars, thus rendering it difficult to operate the brakes satisfactorily. My invention overcomes this difficulty, the auxiliary valve *j* and leakage-opening equalizing the pressure throughout the train.

As I have before premised, in the making up of trains it frequently occurs that two or more cars are coupled in which the auxiliary cylinders or air-reservoirs A' vary greatly in pressure; and to illustrate the advantages of my invention I will assume that a car, No. 20, carries the tank A', (shown in Fig. 5,) which is under a pressure of eighty pounds, and this car is now coupled with a second car—say No. 25—provided with a similar tank or auxiliary cylinder under a pressure of fifty pounds. It is evident that the piston 2 in the triple valve S on car No. 20 cannot be raised or actuated to release the brakes, except by an equal or greater pressure throughout the main pipe D, connecting the brake system on the cars; hence it must be assumed that the brakes are set on car No. 20. Ordinarily the pressure must be brought to eighty pounds or more to release the brakes, or else they must be released by hand.

Now, in my apparatus a lower pressure will release a higher pressure, as I will proceed to explain. The pump now started will be supposed to attain a pressure equal to or slightly greater than the lowest pressure in any tank A', on the train—in this case assume car No. 25 with fifty pounds—hence the triple-valve piston is actuated and simultaneously the diaphragm-valves A on every car, and with them the auxiliary valves *j*, are moved. Thus the high pressure in any auxiliary cylinder A' is overcome by means of the large area of the diaphragm-valves A, compared with the auxiliary valves *j*, actuated thereby. Thus at the moment of opening the valves *j* by the impulse of the diaphragm-valves A in the act of recharging one or more auxiliary cylinders under low pressure the corresponding cylinders A' under high pressure are at once reduced to a pressure equal to the lowest pressure in any one storage-cylinder A'. When this reduction in pressure is accomplished, and not until then, does the piston 2 in a triple valve, connected with any such cylinder A', under high pressure rise. When it is so actuated, the supply to the brake-cylinder A^2 is stopped and the brakes entirely released. Thus it is not necessary to raise the pressure throughout the train of all the low-pressure cylinders A' in order to release one under a high pressure; but the latter can be reduced and the brakes released. Then, if desired, the pressure in the cylinders A' throughout the train can be restored and maintained at any high pressure deemed most efficient.

I claim—

1. In an automatic air-brake system, the combination of the vibrating diaphragm and the main valve operated thereby with a supplemental valve the stem of which is in contact with the stem of the main valve, but not connected thereto, substantially as shown.

2. In an air-brake for railway-cars of the character described, the combination of the following instrumentalities, to wit: a main valve, an auxiliary valve, a check-valve, and

a stop-cock, the main valve being provided with an induction-pipe connecting it with the main pipe, with an eduction-pipe connecting it with the triple valve, and with a stem adapted to open the auxiliary valve, the check-valve being disposed between the triple valve and brake-cylinder and suitably connected therewith, the auxiliary valve disposed between the main valve and pipe connecting the triple valve and brake-cylinder and adapted to be opened by the stem of the main valve, and the stop-cock disposed between the main and auxiliary valves, substantially as described.

3. In an air-brake of the character described, the valves A *j* C, pipes D E H, and stop-cock Q, or a leakage-opening, combined and arranged to operate substantially as set forth.

4. In an air-brake of the character described, the valve-chamber B, provided with the valve *j*, and having a leak-opening or stop-cock, in combination with the valve-stem L and operative mechanism therefor, substantially as described.

5. In an air-brake of the character described, the valve A, provided with the pipes D E, valve-chamber B, provided with a leakage-opening or stop-cock, and pipe H, combined and arranged to operate substantially as set forth.

6. In an air-brake of the character described, a main valve and an auxiliary valve, the auxiliary valve being provided with a leakage-opening or stop-cock, and adapted to be opened by the main valve, in combination with pipes for properly connecting said valves with the main pipe, triple valve, and cylinder of the brake, substantially as described.

7. In a valve for air-brakes, the flexible diaphragm *f*, seat *r*, provided with the ducts *y*, screw *k*, nut *t*, stem L, spring *a*, disk *u*, and disks *d w*, provided with the ducts *z*, combined and arranged to operate substantially as set forth.

8. In a valve for air-brakes, the section *b*, provided with an induction-opening, the section *l*, provided with an eduction-opening, flexible diaphragm *f*, seat *r*, spring *a*, disk *u*, disks *w d*, provided with the ducts *z*, screw *k*, nut *t*, stem L, ways for said stem, and means for properly packing the same, combined and arranged to operate substantially as described.

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

SYLVANUS R. KNEELAND.

Witnesses:
H. E. LODGE,
E. K. BOYNTON.