(No Model.) 3 Sheets—Sheet 1.

G. B. WILLIAMS.

AIR BRAKE.

No. 393,950. Patented Dec. 4, 1888.

Fig. 1.

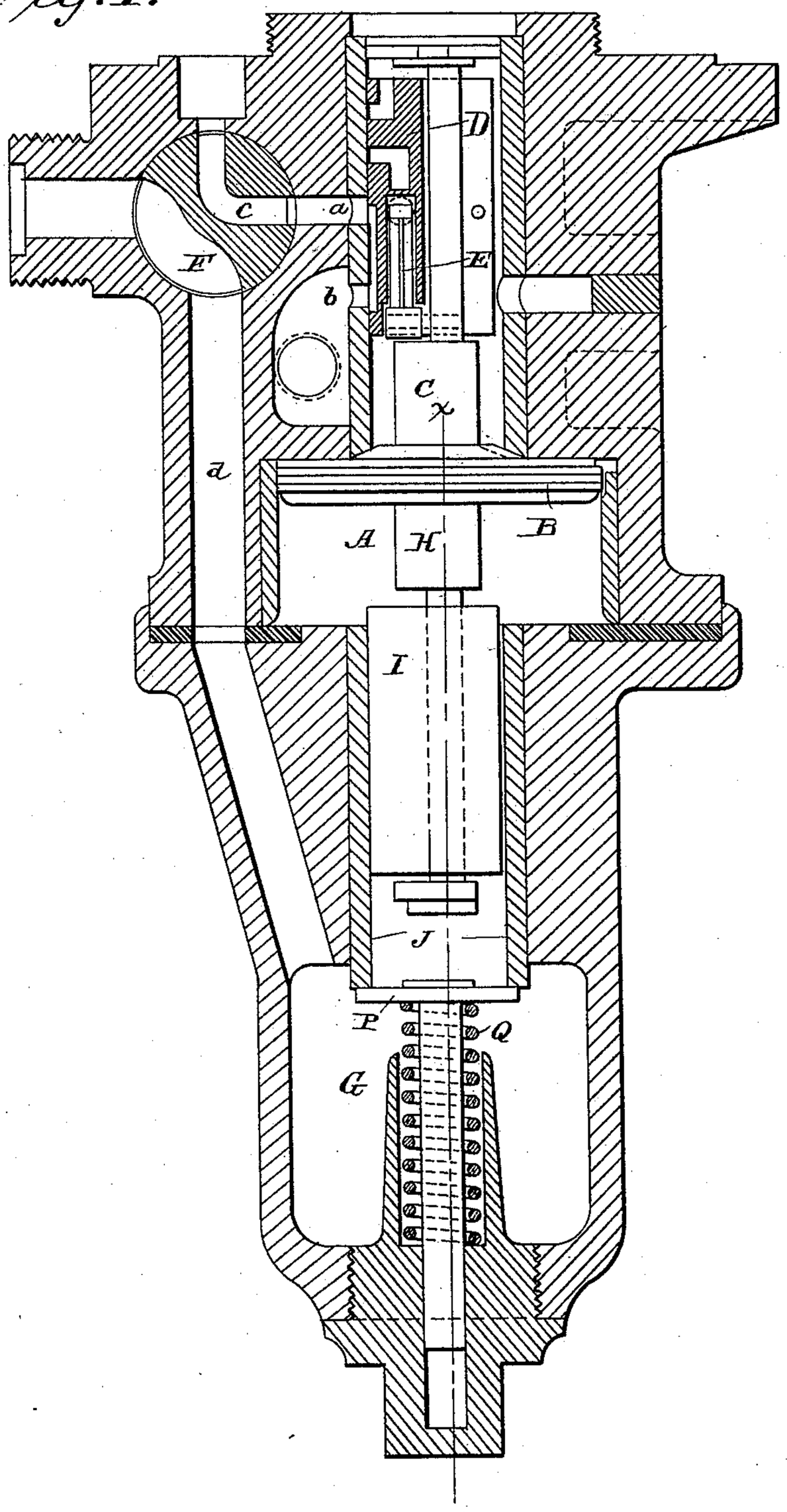

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Fig. 2.

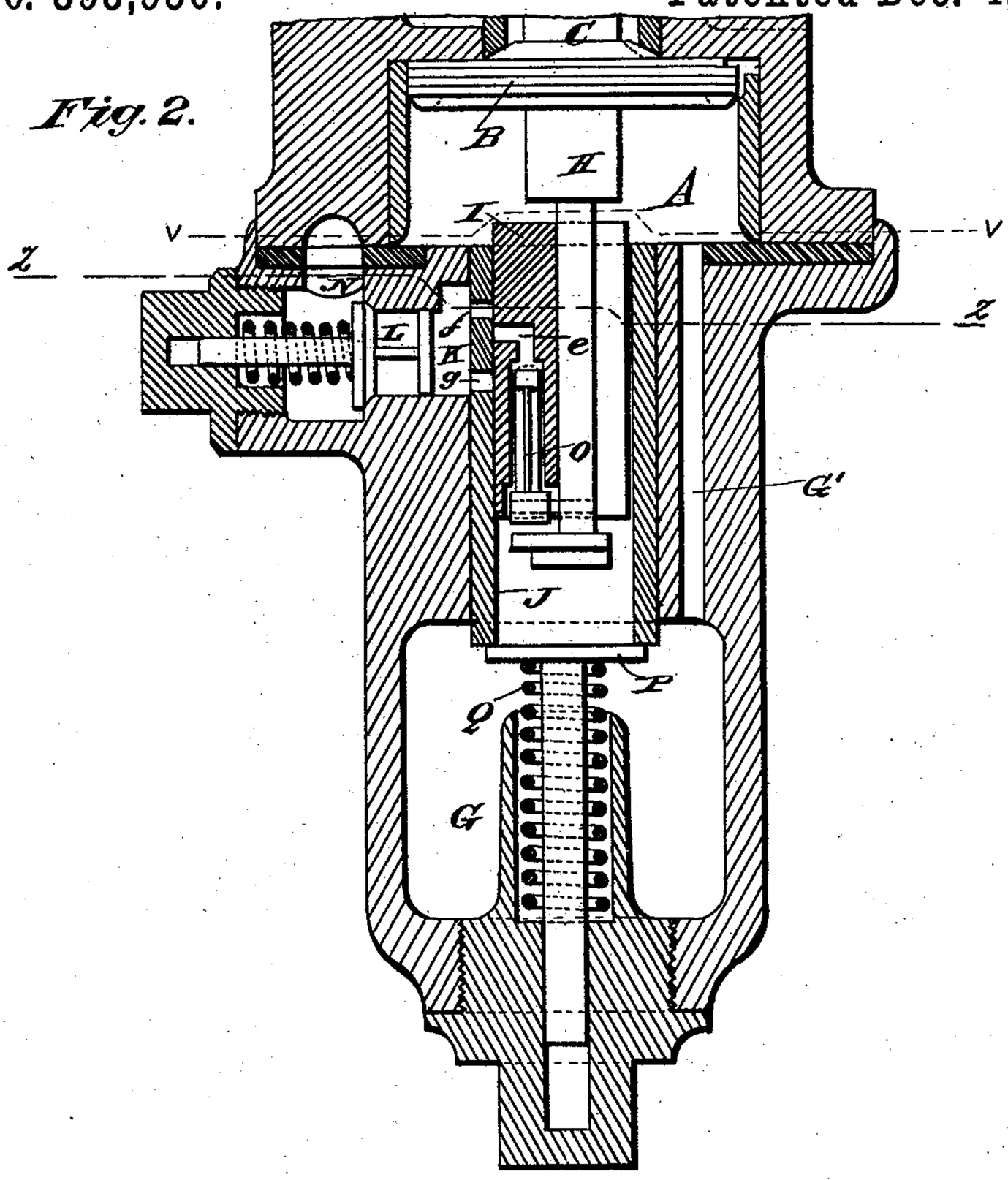
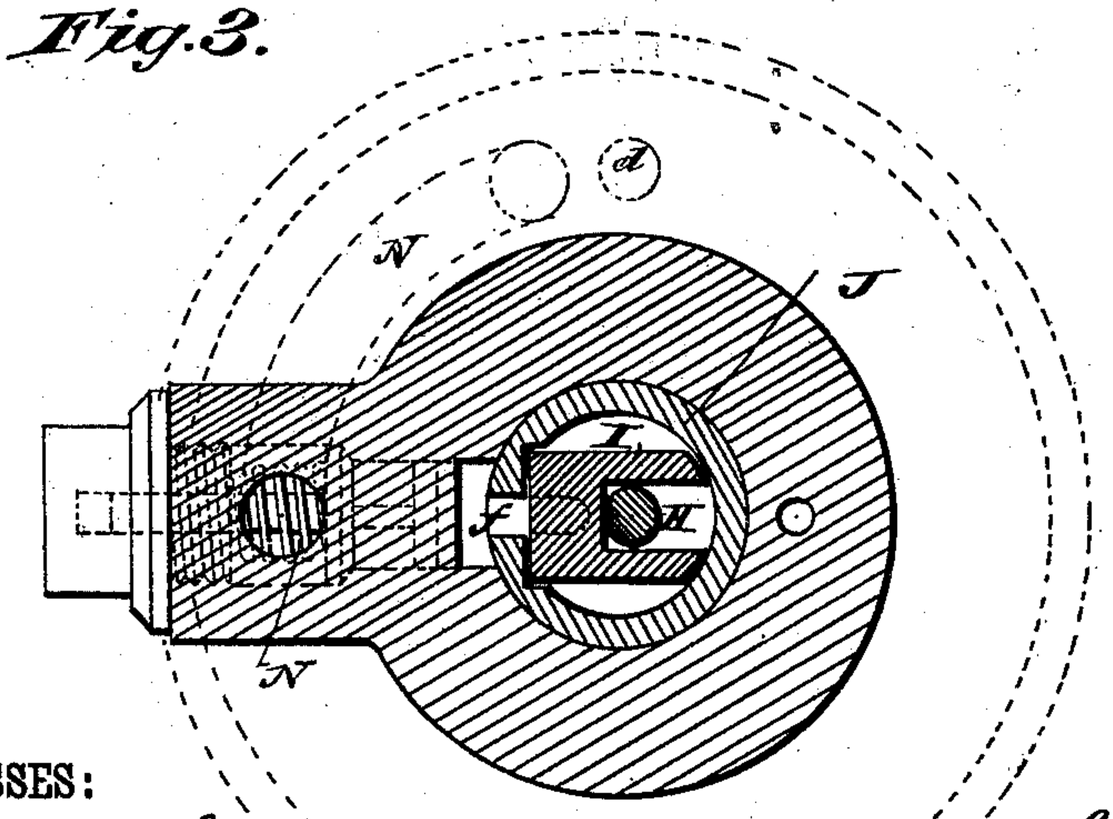


Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

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Fig. 5.

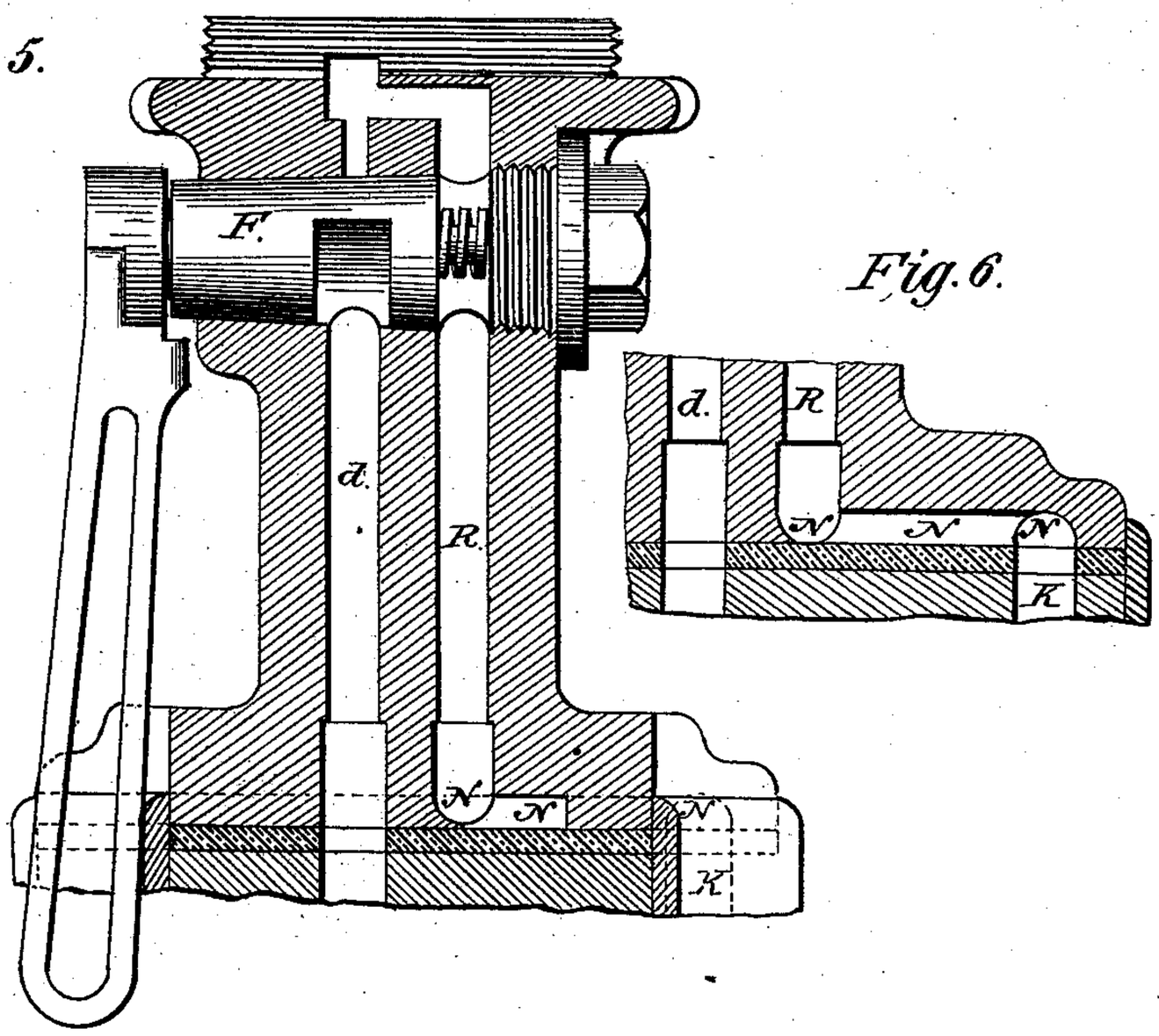
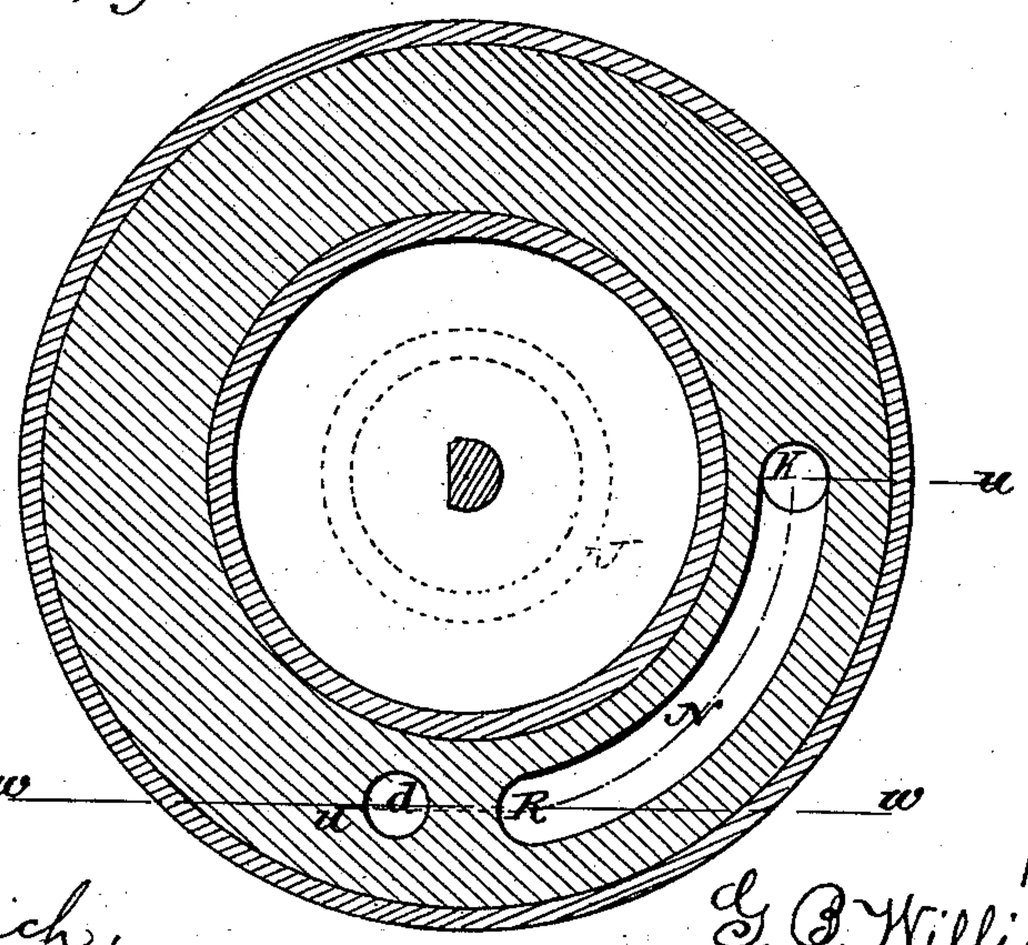


Fig. 6.

Fig. 4.



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AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 393,950, dated December 4, 1888.

Application filed September 8, 1887. Serial No. 249,170. (No model.)

To all whom it may concern:

Be it known that I, GEORGE BAYLEY WILLIAMS, of La Crosse, in the county of La Crosse and State of Wisconsin, have invented a new and Improved Air-Brake, of which the following is a full, clear, and exact description.

My invention relates to improvements in air-brakes such as are represented in Letters Patent No. 360,070, issued March 29, 1887, to George Westinghouse, Jr.

The object of my invention is to provide a new and improved air-brake in which the waste air from the train-pipe is reduced to a minimum when air from an auxiliary reservoir is used for applying the brakes.

The invention consists in the construction and arrangement of certain parts and details and combinations of the same, as will be fully described hereinafter, and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a central sectional elevation of my improvement. Fig. 2 is a similar view of the same on the line *x x* of Fig. 1. Fig. 3 is a sectional plan view of my improvement on the line *z z* of Fig. 2. Fig. 4 is a transverse section on the line *v v*, Fig. 2. Fig. 5 is a partial vertical section on the line *w w* of Fig. 4; and Fig. 6 is a partial vertical section on the curved line *u u*, Fig. 4.

In the cylinder A operates the piston B, provided on one side with the piston-rod C, carrying the slide-valve D, operating over the ports *a* and *b* and carrying the graduating-valve E. The port *a* connects by a channel, *c*, of the four-way cock F with the brake-cylinder, and the port *b* connects with the exhaust. The four-way cock F also connects the train-pipe with the channel *d*, leading to the drain-cup G, connected by the aperture G′ with the cylinder A, so that the air can pass from the train-pipe to the said cylinder.

The construction and the functions of the slide-valve D and the graduating-valve E, in connection with the piston B and the four-way cock F, are the same as in Patent No. 360,070, above referred to, and hence a detailed description is not necessary. On the other side of the piston B is secured a piston-rod, H, carrying a slide-valve, I, held in the cylinder J, and having a port, *e*, which operates over small port *g* in cylinder J. The port *f* is uncovered only when top of slide-valve I passes below same, or an additional outlet is provided in slide-valve I to connect with same, as in slide-valve D. The ports *f* and *g* lead to chamber K, in which is seated the check-valve L, controlling communication between the said chamber K and the grooved chamber N in lower surface of upper cap, which connects with a passage, R, parallel with the channel *d*, and a channel leading to the brake-cylinder, just as in Patent No. 360,070, before referred to. This channel may lead into channel *c* of four-way cock F, and thence to brake-cylinder, if desired.

The slide-valve I serves to control the admission of air from the train-pipe into the brake-cylinder for the purpose of applying the brakes in a manner similar to that in which the slide-valve D controls the admission of air from the auxiliary reservoir into the brake-cylinder for the same purpose.

In the slide-valve I is held the graduating-valve O, similar in construction to the valve E, above referred to in relation to the slide-valve D. The slide-valve I has a limited free motion on its piston-rod H, so as to limit the motion of the graduating-valve O while the slide-valve I remains stationary.

The attachment of the slide-valves D and I to the piston-rods C and H of the piston B constitutes a duplex-acting triple valve which causes the automatic air-brakes to be applied by using air from both the train-pipe and from the auxiliary reservoir, instead of wasting the former, thereby saving compressed air whenever the brakes are applied. Against the lower end of the cylinder J the graduating stem P is held by the action of the spring Q.

The operation is as follows: When the auxiliary reservoir is charged in the ordinary manner, the piston B is in its uppermost position, as shown in Figs. 1 and 2. When the engineer desires to apply the brakes, he opens his valve to allow the air to escape from the train-pipe. As soon as a small amount of air has escaped the valve is again closed, as only

a very slight reduction of pressure in the train-pipe causes the piston B to fall, carrying with it the valves D and I, and thereby opening the respective graduating-valves E and O. As soon as the exhaust-port from the brake-cylinder is closed the train-pipe air will pass through the port *g*, the check-valve L, and the channel N into the brake-cylinder, thereby applying the brakes. This admission of air from the train-pipe into the brake-cylinder will have the same effect as if the air had been wasted in the ordinary way by leaving the engineer's valve open and allowing the air to escape from the train-pipe into the open air. The reduction of pressure thus obtained in the train-pipe will cause the piston to further descend, thus depressing the stem P and compressing the spring Q, so that the passing of air from the train-pipe through the slide-valve I and check-valve L into the brake-cylinder will be instantly followed by the passing of air from the auxiliary reservoir through the slide-valve D into the brake-cylinder. This will result in the passing of the outlet *e* in the slide-valve I below the port *g*, so as to prevent the passing of so much air from train-pipe into the brake-cylinder as would prevent any graduation of the application of the brakes, and would cause the brakes to be applied with considerable severity in every case. This is obviated by making the outlet *e* and the port *g* sufficiently small in size to prevent any considerable exhaust from the main air-pipe into the brake-cylinder when it is desired to make only a light application of the brakes, and by having the outlet *e* pass below the port *g* when outlet in slide-valve D is fully opposite port *a*. When the pressure of air in the auxiliary reservoir has been reduced by expansion into the brake-cylinder, so that the air-pressure is the same in the auxiliary reservoir and in the train-pipe—that is, the same on both sides of the piston B—then the graduating-spring Q causes the piston B to rise, thus closing the graduating-valves E and O in both slide-valves D and I and preventing the further escape of air from auxiliary reservoir and train-pipe through slide-valves D and I, respectively, into the brake-cylinder until the graduating-valves E and O are again caused to open by the descent of the piston B, resulting from the engineer allowing air to again escape from the train-pipe. So long as piston B continues to rise the graduating-valves E and O will remain closed. If air is now admitted into the train-pipe from the main reservoir, it cannot do otherwise than lift the piston B to its extreme uppermost position, and then charge the reservoir through the port in the top of the cylinder A, beyond which said piston passes, until there is the same pressure in the auxilary reservoir as in the train-pipe. The engineer can easily vary the pressure with which the auxiliary reservoir is charged according to the grades on which he is running and the manner in which he desires to apply the brakes. When the auxiliary reservoir is charged with the maximum desirable pressure for emergency stops, the engineer can repeat the process of letting air escape from the train-pipe through his valve several times successively till he gets the desired brake-pressure, or as additional pressure becomes necessary. Economy in the use of train-pipe air is, however, best attained by obtaining the desired brake-pressure by opening the engineer's valve only once. When it is desired to apply the brakes suddenly and with full force, the engineer opens his valve wide, which allows considerable air to escape from the train-pipe through the engineer's valve, and also into the brake-cylinder through the slide-valve I, followed by the passage of air from the auxiliary reservoir into the brake-cylinder through the outlet-port in the slide-valve D. These operations follow each other in rapid succession, and are themselves instantaneously followed by the passing of the slide-valve I below the port *f*, thereby allowing the air to rush from the train-pipe into the brake-cylinder through said port, and by the outlet in the upper part of the slide-valve D coming opposite the port *a*, thus allowing air from the auxiliary reservoir also to rush to brake-cylinder until there is the same pressure in the auxiliary reservoir and in brake-cylinder. This results in the most rapid and effective application of the brakes that is possibe, combined with the least waste of compressed air in accomplishing the same. When the air-pressure is the same on both sides of the check-valve L, then the valve-spring causes the valve to close, so that air which has passed through said valve L toward the brake-cylinder cannot return through it to the train-pipe. When the brakes have been suddenly applied to their full extent, the pressure in the brake-cylinder and on the back of the check-valve L, also in the auxiliary reservoir and on the upper side of the piston B, is very considerable, while on the lower side of the piston B and in the train-pipe the pressure is very small—almost nothing. This superior pressure on the upper side of the piston B presses it downward on the graduating-stem P and to its lowest position.

Air will have to be admitted into the train-pipe from the main reservoir when it is desired to recharge the auxiliary reservoir and release the brakes; but air thus admitted can exert a pressure on the check-valve L by passing over the top of slide-valve I and through the port *f*, exerting at the same time an equal pressure on the lower side of piston B. The pressure behind the check-valve L and above the piston B is nearly the same, while the check-valve L is re-enforced by a spring. The greatly superior area of the pressure on the lower side of piston B over the small area of pressure on face of check-valve L causes said piston to rise while the valve L remains closed. The rising of the piston B closes graduating-

valves E and O in slide-valves D and I, respectively. This is quickly followed by the slide-valve I covering port *f* and by the upper outlet in slide-valve D passing beyond port *a* before exhaust from the brake-cylinder will allow air to pass through the port *f* and the check-valve L into the brake-cylinder. Consequently the only effect of admitting the air from the main reservoir into the train-pipe is to lift the piston B, recharge the auxiliary reservoir, and release the brakes.

The necessity for the graduating-valve O in the slide-valve I, in connection with the small outlet *e* and with the small port *g*, is to secure control over the escape of air from the train-pipe into the brake-cylinder, which is limited by the sizes of outlet *e* and of port *g*, and ceases when lower outlet in slide-valve D is fully opposite port *a*. Unless the escape of air from train-pipe into brake-cylinder is properly controlled and limited, it will be impossible while making a duplex use of automatic and straight air to control and limit the admission of air from the auxiliary reservoir into the brake-cylinder. So long as the pressure in the train-pipe decreases by air passing out through the engineer's valve or by passing into the brake-cylinder, so long must air continue to pass from the auxiliary reservoir to the brake-cylinder till there is the same pressure in both.

The use of the port *f*, which is much larger than the small port *g*, is to enable the brakes to be more suddenly applied to their fullest extent than could result from having an upper outlet in the slide-valve I discharge air into the brake-cylinder through the limited and small port *g*. The valve I works on the same principle and is the same invention, whether it admits air into one or more ports, but having outlets into two ports, as shown, is the best application of the same.

The duplex-acting triple valve will be properly adjusted to work when the outlet-port *e* in the slide-valve I is below the port *g* at the same time that the lower outlet in slide-valve D is at full exhaust into port *a*. The adjustment may possibly be made somewhat closer to utilize more air from the train-pipe in applying the brakes or to make the effect come on more rapidly.

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

1. The combination, in a triple-valve device, of a casing or chest, a piston working in a chamber therein, a valve moving with the piston-stem at one side of the piston, and governing ports and passages in the case leading to connections with an auxiliary reservoir and to the brake-cylinder, and to the atmosphere, respectively, with an auxiliary valve at the outer side of the piston actuated thereby and normally closing two ports of different size communicating with the auxiliary passage leading to the said brake-cylinder connection and with the main air or train pipe connection, respectively, the preliminary outward movement of said auxiliary slide-valve allowing a small amount of compressed air from the main air-pipe to pass into the brake-cylinder through the smaller port and auxiliary passage in all applications of the brakes, and the full outward traverse of said auxiliary slide-valve allowing the maximum amount of compressed air to pass from the main air-pipe through the larger port and auxiliary passage into the brake-cylinder when it is desired to apply the full force of the brakes or make an emergency stop, substantially as set forth.

2. In an air-brake mechanism, the combination, with the main air-pipe and auxiliary reservoir and brake-cylinder, of a triple valve carrying a slide-valve on its inner side and another slide-valve on its outside, the former governing the admission of compressed air from the auxiliary reservoir into the brake-cylinder and from the brake-cylinder to the atmosphere, while the latter governs the admission of compressed air from the main air-pipe into the brake-cylinder in such manner that the preliminary outward traverse of said piston and slide valves first admits a limited amount of compressed air from the main air-pipe into the brake-cylinder, thus giving the initial pressure to the brake-cylinder piston for the application of the brakes, which is quickly followed by the admission into the brake-cylinder of compressed air from the auxiliary reservoir for the same purpose, while the full outward traverse of said piston and slide valves admits the full force of air from both the auxiliary reservoir and the main air-pipe into the brake-cylinder when it is desired to apply the full force of the brakes, the air from the main air-pipe preferably acting initially on the brake-cylinder piston every time the brakes are applied, substantially as set forth.

3. In an air-brake, the combination, with the main air-pipe and auxiliary reservoir and brake-cylinder, of a triple valve having a piston carrying a slide-valve on its inner side governing the admission of compressed air from the auxiliary reservoir into the brake-cylinder and from the brake-cylinder to the atmosphere, said piston also carrying a slide-valve on its outer side governing the admission of compressed air from the main air-pipe into the brake-cylinder, the preliminary outward traverse of piston and slide valves attached causing the admission of compressed air from both the main air-pipe and the auxiliary reservoir into the brake-cylinder for ordinary applications of the brakes, while the full outward traverse of said piston and slide valves attached causes the admission into the brake-cylinder of the maximum amount of compressed air from both the main air-pipe and the auxiliary reservoir for emergency and other full stops, the air from the main air-pipe preferably passing into the brake-cylin-

der sooner than the air from the auxiliary reservoir in all applications of the brakes, substantially as set forth.

4. In an air-brake, the combination, with the main air-pipe, auxiliary reservoir, and a brake-cylinder, of a triple valve having a cylinder, A, a piston, B, having piston-rods C H, the brake-cylinder port *a* to receive air from auxiliary reservoir, and exhaust-port *b* at the inner side of the piston, the smaller port, *f*, and larger port, *g*, at the outer side of the piston and chamber K, into which said ports lead, the valve L, a channel leading therefrom to the brake-cylinder for passage of air from main air-pipe, slide-valve D on rod C at the inner side of the piston, and slide-valve I on rod H at the outer side thereof normally closing both ports *f g* and having a port, *e*, a graduating-valve, O, and the yielding stem, P, the preliminary outward movement of the auxiliary valve I, causing the port *e* to register with the smaller port, *f*, to allow a small amount of air from the main air-pipe to pass to the brake-cylinder in all applications of the brakes, and the full traverse of the said valve uncovering or opening both ports *f g* to admit the full force of the air from main air-pipe to brake-cylinder, substantially as set forth.

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