(No Model.)

2 Sheets—Sheet 1.

G. B. WILLIAMS.

AUTOMATIC AIR BRAKE.

No. 431,303. Patented July 1, 1890.

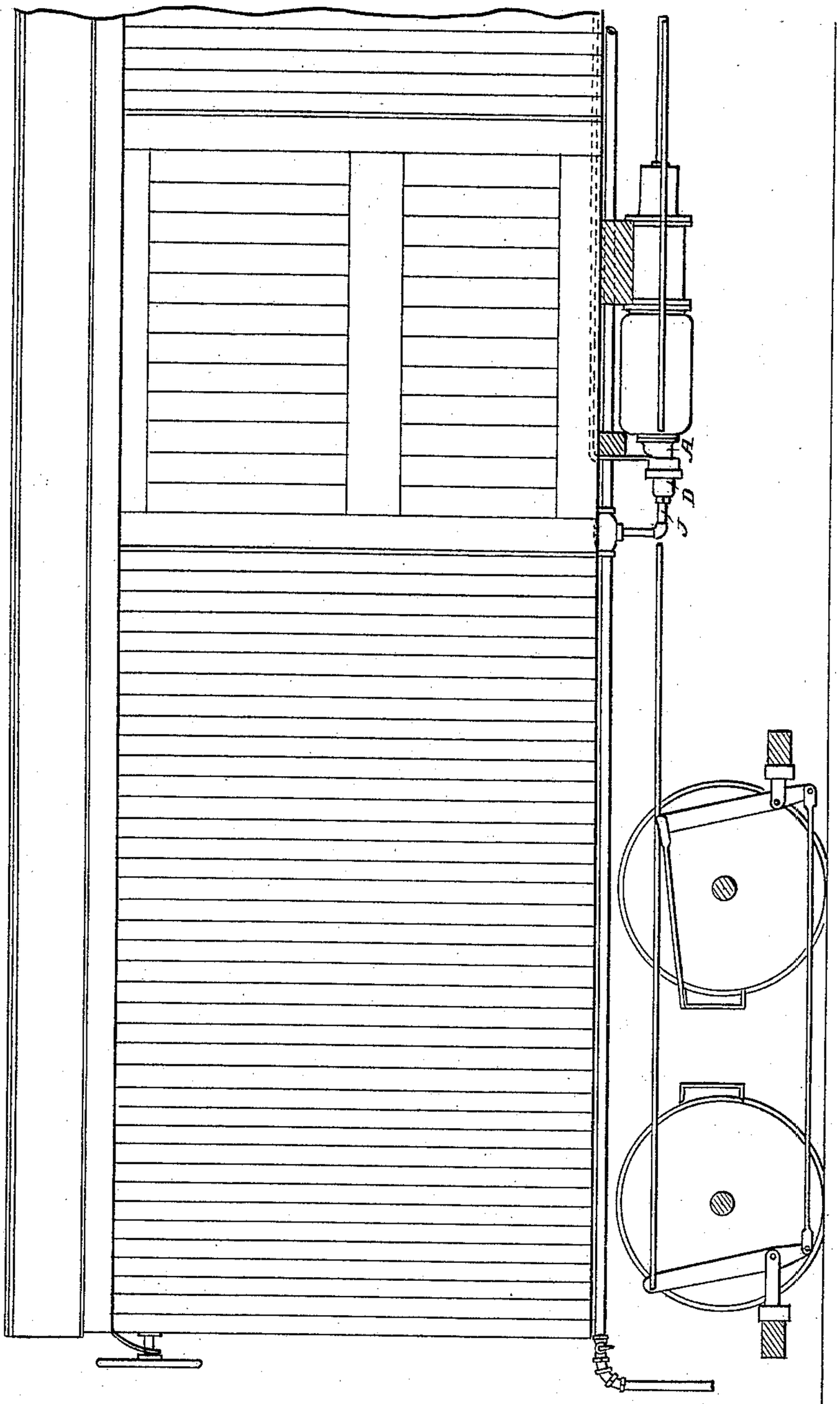

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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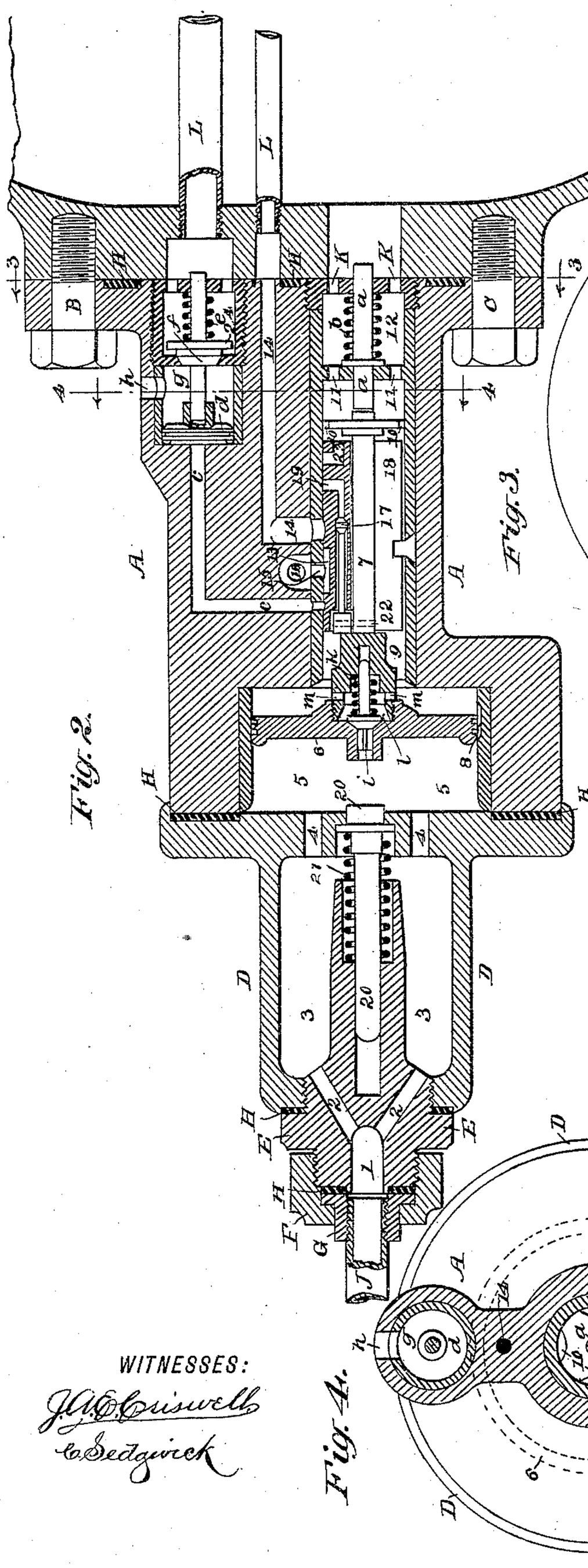

Fig. 2.

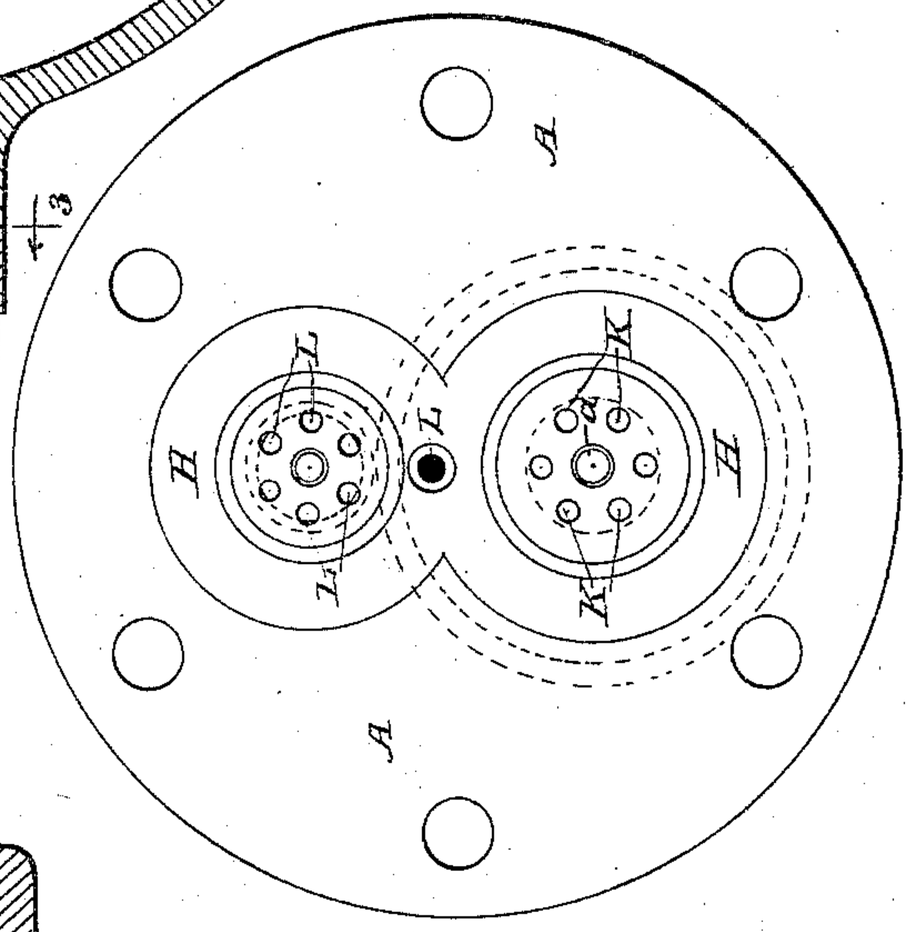

Fig. 3.

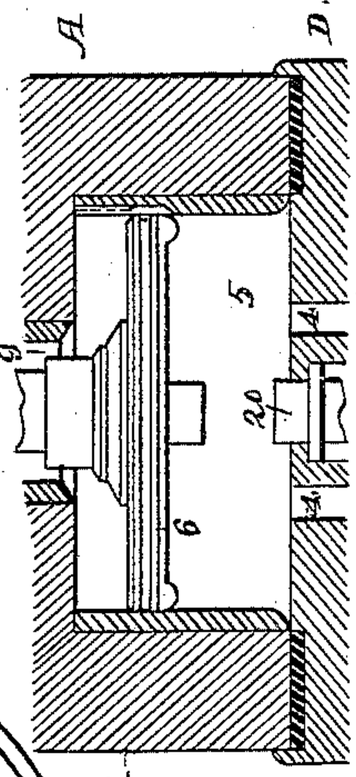

Fig. 5.

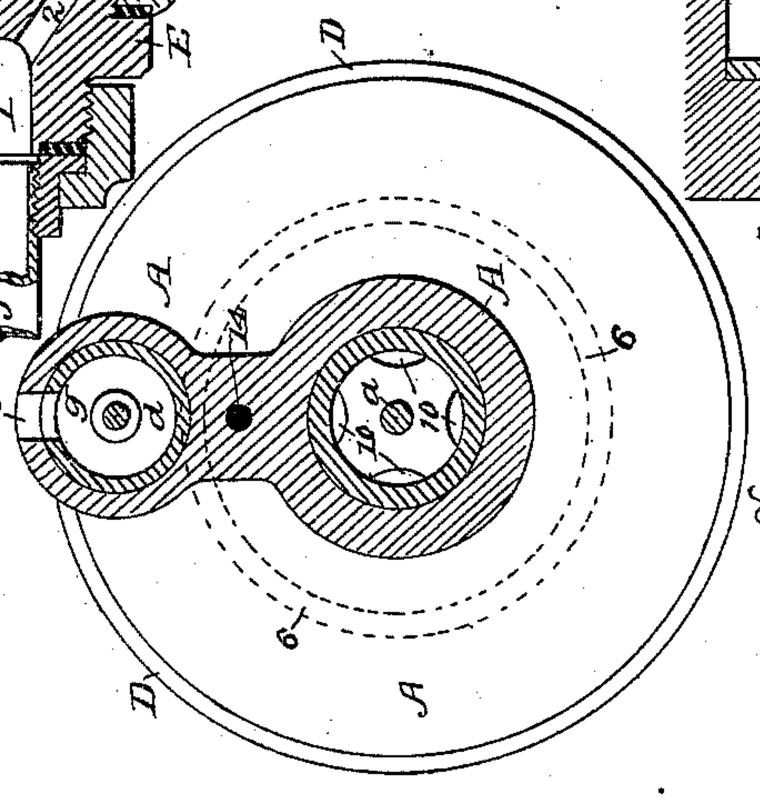

Fig. 4.

WITNESSES:

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UNITED STATES PATENT OFFICE.

GEORGE BAYLEY WILLIAMS, OF PORTLAND, OREGON.

AUTOMATIC AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 431,303, dated July 1, 1890.

Application filed October 10, 1889. Serial No. 326,562. (No model.)

To all whom it may concern:

Be it known that I, GEORGE BAYLEY WILLIAMS, of Portland, in the county of Multnomah and State of Oregon, have invented certain new and useful Improvements in Automatic Air-Brakes, of which the following is a full, clear, and exact description.

For convenience of description, and because the Westinghouse automatic air-brake is so well known as not to need minute description, I prefer to illustrate my improvements as applied to that system, though they are equally applicable in connection with other automatic air-brake systems.

One of the main objects of my invention is to provide certain new and useful improvements in automatic air-brakes whereby the auxiliary reservoir can be easily recharged with a single line of train-pipe either with or without the release of the brakes, as desired, such recharging being either continuous during the entire inward travel of main piston of triple valve from its normal position for the release of the brakes or cut-off during part of the inward motion of main piston of triple valve from its normal position to its inner seat.

Another and independent object of my invention is to provide certain new and useful improvements in automatic air-brakes whereby the pressure in the brake-cylinder can be reduced to any desired extent, and the brakes only partially released coincident with a partial recharging of the auxiliary reservoir.

Another and independent object of my invention is to provide certain new and useful improvements in automatic air-brakes whereby the brakes can be entirely released quickly and with certainty when desired.

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

Reference is to be had to the accompanying drawings, forming a part of this specification, in which capital letters are used for reference to the casings and other external parts of the structure; figures or numerals refer to the operative parts and passages which are substantially the same as in the Westinghouse automatic air-brake, and small letters are used for reference to the additional structural features which comprise my invention.

Figure 1 is a side elevation of the improvement as applied. Fig. 2 is an enlarged sectional side elevation of the improvement. Fig. 3 is a sectional end view of the same on the line 3 3 of Fig. 2. Fig. 4 is a similar view of the same on the line 4 4 of Fig. 2, and Fig. 5 is a sectional side elevation of a modified form of part of the improvement.

A represents the valve-case, which is adapted to be fastened to the auxiliary reservoir by means of bolts passing through the holes B and C, and to have communication with the auxiliary reservoir and brake-cylinder, respectively, as in the case of the Westinghouse "single-structure" freight-brake.

D represents the lower cap of the triple-valve case, in which is screwed the nipple E, and from which connection is made with branch pipe leading to main air-pipe by means of union-nut F and sleeve G, into which latter the branch pipe is screwed.

H represents packing used in making air-tight joints between the various parts.

At J, K, and L connections are made with the main air-pipe, the auxiliary reservoir, and the brake-cylinder, respectively.

18 represents the well-known piston-valve of the Westinghouse automatic air-brake, 6 being its controlling-piston; 7, the piston-stem; 8, the feed-groove; 17, the graduating-piston, fastened to stem 7 by means of pin 22; 19 and 23, the application outlets; 14, the passage leading to brake-cylinder; 20, the graduating-stem; 21, the graduating-spring; 13, the exhaust-groove; 15, the exhaust-port, and 16 the exhaust-outlet. These parts are adapted to perform the same functions in the application and release of the brakes as in the Westinghouse automatic air-brake.

My invention consists in additional structural features to the above and in a modified arrangement of the piston 6 in its chamber 5, by means of which the triple valve is adapted to perform the additional functions comprised in my improvement. In my improvement the inward travel of piston 6 is initially checked by the piston-stem 7 coming in contact with the release-graduating stem *a* and meeting resistance from the expansive force of its spring *b*, at which time the feed-groove 8 is partly uncovered. The feed-groove 8 in my improvement may be of sufficient length to be uncovered during the entire subsequent inward travel of piston 6, as shown in Fig. 5,

the inner end of which feed-groove may be contracted in size, if desired, as shown by the dotted lines, or otherwise modified in shape; or, as shown in Fig. 2, it may be shorter, so as to be closed during part of the subsequent inward travel of piston 6, in order to facilitate the inward movement of said piston. Piston 6 will then preferably have within it or its stem 7 a passage between the train-pipe and auxiliary reservoir, an auxiliary feed-valve *i*, spring *k*, chamber *l*, and passage or passages *m*, by means of which the compressed air from the main air-pipe can pass into the auxiliary reservoir when piston 6 is at the inner limit of its travel.

The governing-valve device 18 is controlled by the piston 6, which is adapted to occupy a normal position intermediate between the extremities of its traverse, being held away from its inner seat by the expansion of spring *b*. It is also adapted to open a port from the auxiliary reservoir to the brake-cylinder by its outward movement; to allow communication between the train-pipe and the auxiliary reservoir when at its normal position, and during so much of its inward movements as may be desired, and to open a port or ports from the brake-cylinder to the atmosphere by its inward movement. All the ports between the auxiliary reservoir and the brake-cylinder and between the brake-cylinder and the atmosphere are closed when piston 6 is in its normal position, as shown, except after the complete release of the brakes, when the release-valve *f* will remain open till the main piston moves outward for the application of the brakes or until the pressure-actuating piston *d* leaks round said piston. When piston 6 compresses spring *b* sufficiently to reach the inner limit of its travel, a further slight increase of pressure on the outer side of piston 6 will unseat valve *i*, pass through same into the auxiliary reservoir, and so increase the reservoir-pressure as to enable it, with the assistance of the expansive force of spring *b*, to force piston 6 back to its normal position, as shown, at which time the air-pressure in the train-pipe will exceed the air-pressure in the auxiliary reservoir to the extent of the expansive force of the springs *b* and *k*. The spring *k* should have only sufficient expansive force to hold valve *i* to its seat until piston 6 reaches its inner seat, or until slide-valve 18 has uncovered passage *c*.

Other additional structural features for entirely releasing the brakes certainly and quickly when desired consist of the passage *c*, piston *d*, spring *e*, piston-valve *f*, and exhaust-outlet *h*, the use of which will be clearly explained in the description of the operation of the brakes. The valve *f* governs an auxiliary communication between the brake-cylinder and the atmosphere.

In the operation of the brake mechanism as above described air from the main reservoir and main air-pipe passes through the passages 1 2, chamber 3, and passage or passages 4 into the piston-chamber 5, forcing the piston 6 inward till it meets with resistance from the spring *b*, at which time the feed-groove 8 will be uncovered for recharging the auxiliary reservoir. If the increase of pressure in the main air-pipe is sufficiently gradual, it will be so reduced by expansion through groove 8 as to lack sufficient force to move piston 6 farther inward, and the auxiliary reservoir will be gradually recharged without any release of the brakes, the exhaust-groove 13 not yet registering with passage 14, leading to brake-cylinder. A somewhat greater increase of pressure in the main air-pipe than can be reduced by expansion through groove 8 more quickly than piston 6 can be moved by such increased pressure will move the piston 6 inward till exhaust-groove 13 does register with channel 14 as well as with exhaust-port 15, when air from the brake-cylinder will pass to the atmosphere through groove 13 and passages 15 and 16. The engineer having stopped any further increase of pressure in the main air-pipe, this increase of pressure will quickly equalize on both sides of piston 6, when the spring *b* will force the piston 6 outward to the position shown and the further release of the brakes will cease. A sudden and continuous increase of pressure in the main air-pipe with the full reserve pressure will move piston 6 to the inner limit of its travel, causing the slide-valve 18 to pass by and uncover the passage *c*, through which the main-reservoir pressure will pass to piston *d*, forcing it inward, compressing spring *e*, and unseating valve *f*, when the brake-cylinder pressure will be entirely exhausted through chamber *g* and exhaust-outlet *h*, as the spring *e* cannot move piston *d* outward and seat valve *f* until the groove 13 registers with the passage *c* and with exhaust-port 15 during descent of piston 6 for the application of the brakes; hence when piston 6 has been at the inner limit of its travel, or has uncovered passage *c*, so as to allow the auxiliary-reservoir pressure to actuate piston *d* and open valve *f*, the complete release of the brakes is assured, although the piston 6 may be at once forced back to its normal position by the expansion of spring *b*. When the piston 6 is at the inner limit of its travel, the auxiliary reservoir will continue to be recharged through elongated feed-grove 8, as shown in Fig. 5; or if the feed-grove 8 at this time has become closed, as would be the case in Fig. 2, then the valve *i* will be forced open and air will pass from the main air-pipe into the auxiliary reservoir through chamber *l* and passages *m*, 10, 11, and 12. Hence it is immaterial whether the exhaust-groove 13 does or does not connect the passages 14 and 15 when the slide-valve 17 uncovers the passage *c*, for then the release of the brakes will be insured by the entire exhaust of compressed air from the brake-cylinder past the valve *f*, opened by the compressed air passing into passage *c'* and moving piston *d* and valve *f* from their

seats. Either form can be used without departing from the spirit of my invention. When piston 6 is forced back to its normal position by the expansion of spring *b*, the air-pressure on the outer side of piston exceeds the air-pressure on the inner side of piston, which prevents the piston from moving farther outward at this time. This temporary retention of an excess pressure in the train-pipe helps to insure the release of the brakes to the rear of the train, though the pressure in the train-pipe and auxiliary reservoir will fully equalize quickly through feed-groove 8.

It being desired to make a preliminary application of the brakes, which, in order to avoid shock, if considerable braking-power is required, should never be with the full desired application of the brakes, the engineer will exhaust from the main air-pipe sufficient pressure to allow the superior pressure on the opposite side of piston 6 to force piston 6 outward. The first effect of such movement will be the closing of feed-groove 8 and the opening of graduating-valve 17, thus allowing the auxiliary-reservoir pressure to enter passage 19. A further outward movement of piston will cause the exhaust-groove 13 to register with passages *c* and 15, when the pressure in passage *c* will be exhausted and the spring *e* will force the piston *d* outward, closing valve *f*. A still further outward movement of piston will cause the passage 19 to register with passage 14, and the compressed air from the auxiliary reservoir will pass through said passage into the brake-cylinder, charging same with a pressure proportionate to the reduction of pressure in the main air-pipe. The piston 6 in its outward movement will have struck graduating-stem 20, moving it outward and compressing its spring 21. When the pressure in the auxiliary reservoir has been reduced by expansion into the brake-cylinder until it equals the pressure in the main air-pipe, or nearly so, the graduating-spring 21 will expand and force piston 6 inward till the graduating-stem 20 reaches its seat. The preliminary inward movement of piston 6 will close graduating-valve 17 and prevent the escape of any further and greater pressure into the brake-cylinder; hence any small exhaust of air at this time will cause piston 6 to move slightly outward and partly open the graduating-valve 17, resulting in an increase of pressure in the brake-cylinder proportionate to the reduction of pressure in the main air-pipe, the graduating-valve 17 again closing as soon as this has been accomplished. It being desired to make an emergency application of the brakes, the engineer will cause such exhaust of air from the main air-pipe as will leave in the main air-pipe a pressure equal to what will remain in the auxiliary reservoir when its pressure has fully equalized with the pressure in the brake-cylinder during the application of the brakes. Any greater exhaust than this will be a waste of air, and will render it more difficult to release the brakes later. The result of such exhaust will be that piston 6 will move outward, with the results previously described, and passing to the outer limit of its travel will carry the port 19 past the passage 14 and cause the port 23 to register with passage 14, leading to the brake-cylinder, when the brakes will be applied with full force.

My improvements are adapted to be used either separately or conjointly, in combination with either the Westinghouse quick-action valve for an automatic exhaust from the main air-pipe into the brake-cylinder or in combination with the Dixon quick-action valve for an automatic exhaust of air from the main air-pipe to the atmosphere during an emergency application of the brakes. If either of these quick actions are used, the exhaust from the main air-pipe for an emergency application of the brakes should be such as, combined with the subsequent automatic exhaust from the main air-pipe, will leave in the main air-pipe a pressure equal to the pressure there will be in the auxiliary reservoir and brake-cylinder when both pressures have equalized.

When it is desired to use the quick release only, the stem *a* and spring *b* need not be used.

Changes of form or modifications of structure, by means of which the functions of my improvements are performed, either separately or conjointly, in substantially the same way, are included in the spirit of my invention.

I am aware that a method of recharging the auxiliary reservoir without releasing the brakes has been patented in which there are two feed-passages in the sides of the valve-chambers, and this construction I hereby expressly disclaim in so far as the above-mentioned improvements are concerned.

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

1. In an air-brake, the combination, with the main piston and slide-valve of triple valve, of a detached and auxiliary spring-pressed piston-valve for effecting the complete exhaust of compressed air from the brake-cylinder and the complete release of the brakes, the valve of which is opened by the admission of air-pressure to its piston coincidently with a sufficient increase of pressure in the train-pipe and only when the main piston of triple valve approaches near or reaches its inner seat, and the valve of which is closed by the expansion of a spring coincidently with the exhaust of compressed air from its piston during the outward movement of main piston of triple valve for the application of the brakes, substantially as shown and described.

2. In a triple valve for air-brakes, a detached and auxiliary piston-valve governing communication between the brake-cylinder and the atmosphere normally seated by the expansion of a spring and opened by the force of compressed air on the opposite side of its piston when it is desired to effect the com-

plete release of the brakes, in combination with the main piston and slide-valve of triple valve, substantially as shown and described.

3. In an air-brake of the class specified, the combination, with a spring-pressed brake-release piston which is detached from and auxiliary to the main piston and slide-valve of triple valve and which is held to slide in an auxiliary chamber which is in communication with the atmosphere and the brake cylinder on one of its sides, and with the slide-valve chamber on the other side, which is opposite its spring, of a valve connected with or actuated by said piston which controls the communication between the brake-cylinder and the atmosphere, substantially as shown and described.

4. In an air-brake of the class specified, the combination, with the main piston, slide-valve, and feed-groove of triple valve, the latter being open when the main piston is at its normal position at a point intermediate between the limits of its traverse, of an auxiliary and retaining feed-valve adapted to establish communication between the opposite sides of said piston only when said piston approaches near or reaches its inner seat, substantially as shown and described.

5. In an air-brake of the class specified, the combination, with the main piston, slide-valve, and feed-groove of triple valve, the latter being open when the main piston is at its normal position at a point intermediate between the limits of its traverse, of an auxiliary feed-valve held in the said piston and normally seated by a spring of sufficient tension to prevent the establishment of communication through said valve between the opposite sides of said piston until the latter approaches near or reaches its inner seat, substantially as shown and described.

6. In an air-brake of the class specified, a spring-pressed auxiliary feed-valve held in the passage of the controlling-piston and adapted to establish communication between the opposite sides of said piston only when the piston leaves its normal position at a point intermediate between the extremities of its traverse and temporarily approaches near or reaches its inner seat, substantially as shown and described.

7. In an air-brake of the class specified, the combination, with the main piston and slide-valve of triple valve, of a spring-pressed brake-release graduating-stem which resists the inward movement of main piston of triple valve from its normal position at a point intermediate between the extremities of its traverse in such manner that the brakes may be partly or entirely released during the inward movement of said main piston of triple valve from its normal position and the compression of the brake-release graduating-spring, substantially as shown and described.

8. In an air-brake of the class specified, the combination, with the main piston and slide-valve of triple valve, the feed-groove, and the spring-pressed brake-application graduating-stem which resists the movement of said main piston to its outer seat, of a spring-pressed brake-release graduating-stem which resists the inward movement of main piston of triple valve from its normal position at a point intermediate between the extremities of its traverse, a spring-pressed brake-release piston held to slide in a chamber connected with the slide valve-chamber, the brake-cylinder, and the atmosphere, and a spring-pressed auxiliary feed-valve held in the controlling-piston and adapted to establish communication between the opposite sides of said piston only when the piston leaves its normal position and temporarily approaches near or reaches its inner seat, substantially as shown and described.

9. In an air-brake, the passage *c*, release-piston *d*, spring *e*, valve *f*, chamber *g*, and exhaust-outlet *h*, in combination with the piston 6, feed-groove 8, slide-valve 18, graduating-valve 17, passage 14, exhaust-groove 13, exhaust-port 15, exhaust-outlet 16, graduating-stem 20, and graduating-spring 21, substantially as shown and described.

10. In an air-brake, the release graduating-stem *a* and its spring *b*, in combination with the piston 6, feed-groove 8, slide-valve 18, graduating-valve 17, passage 14, exhaust-groove 13, exhaust-port 15, exhaust-outlet 16, graduating-stem 20, and graduating-spring 21, substantially as shown and described.

11. In an air-brake, the release graduating-stem *a* and its spring *b*, in combination with the passage *c*, release-piston *d*, spring *e*, valve *f*, chamber *g*, exhaust-outlet *h*, piston 6, feed-groove 8, slide-valve 18, graduating-valve 17, passage 14, exhaust-groove 13, exhaust-port 15, exhaust-outlet 16, graduating-stem 20, and graduating-valve 21, substantially as shown and described.

12. In an air-brake, the elongated feed-groove 8, in combination with the release graduating-stem *a*, spring *b*, piston 6, slide-valve 18, graduating-valve 17, passage 14, exhaust-groove 13, exhaust-port 15, exhaust-outlet 16, graduating-stem 20, and graduating-valve 21, substantially as shown and described.

13. In an air-brake, a short feed-groove 8, in combination with the auxiliary feed-valve *i*, spring *k*, chamber *l*, passages *m*, graduating-stem *a*, spring *b*, piston 6, slide-valve 18, graduating-valve 17, passages 14, exhaust-groove 13, exhaust-port 15, exhaust-outlet 16, graduating-stem 20, and graduating-spring 21, substantially as shown and described.

14. In an air-brake, a short feed-groove 8, in combination with the auxiliary feed-valve *i*, spring *k*, chamber *l*, passages *m*, piston 6, slide-valve 18, passage 14, exhaust-groove 13, exhaust-port 15, exhaust-outlet 16, graduating-valve 20, and graduating-spring 21, substantially as shown and described.

15. In an air-brake, a graduating-stem *a*, spring *b*, passage *c*, release-piston *d*, spring

e, valve f, chamber g, exhaust-outlet h, auxiliary feed-valve i, spring k, chamber l, and passages m, in combination with the piston-6, feed-groove 8, slide-valve 18, graduating-valve 17, passage 14, exhaust-groove 13, exhaust-port 15, exhaust-outlet 16, graduating-stem 20, and graduating-spring 21, substantially as shown and described.

16. In a fluid-pressure-brake mechanism, the combination of a train-pipe, an auxiliary reservoir, a brake-cylinder, and a governing-valve device, the main piston of which is adapted to occupy a normal position intermediate between the extremities of its traverse to open a port from the auxiliary reservoir to the brake-cylinder by its outward movement, and to open a port or ports from the brake-cylinder to the atmosphere by its inward movement from said normal position coincidently with the compression of a graduating-spring in each case, substantially as shown and described.

17. In a fluid-pressure-brake mechanism, the combination of the main piston of triple valve provided with a single slide-valve controlling the partial exhaust of compressed air from the brake-cylinder and the partial release of the brakes, and controlling also the admission of compressed air to an auxiliary piston-valve for causing the complete exhaust of compressed air from the brake-cylinder and the complete release of the brakes, with a spring-stop to resist with predetermined force the inward movement of said main piston of triple valve from its normal position to where it causes a partial release of the brakes, and to resist with a greater force the further inward movement of said main piston of triple valve to where it causes the complete release of the brakes, substantially as shown and described.

18. In a fluid-pressure-brake mechanism, the combination of the main piston of triple valve provided with a single slide-valve controlling the partial as well as the complete exhaust of compressed air from the brake-cylinder, with a spring-stop to resist with predetermined force the inward movement of said main piston of triple valve from its normal position to where it causes a partial release of the brakes, and to resist with greater force the further inward movement of said main piston of triple valve to where it causes the complete release of the brakes, and which spring thereafter returns the said main piston of triple valve to its normal position, substantially as shown and described.

19. In a fluid-pressure-brake mechanism, the combination of the main piston of triple valve with a single slide-valve controlling the admission of compressed air from the auxiliary reservoir to the brake-cylinder, and also the partial as well as complete exhaust of compressed air from the brake-cylinder to the atmosphere, with a spring to resist the outward movement of said main piston of triple valve at a predetermined point in its traverse, and a spring to resist its inward movement with a predetermined force at a predetermined point in its traverse where it causes the partial release of the brakes, and to resist with greater force its movement to its inner seat where it causes the complete release of the brakes, substantially as shown and described.

20. In a fluid-pressure-brake mechanism, the combination of a governing-valve whose inward movement to open the brake-release port is opposed by a spring-stop with a port or passage for refilling the auxiliary reservoir, and another port or passage establishing communication between the train-pipe and the auxiliary reservoir controlled by a retaining-valve seated by an independent spring, and which retaining-valve cannot be opened to serve as a reducing-feed valve until the governing-valve approaches near or reaches its inner seat, substantially as shown and described.

21. In a fluid-pressure-brake mechanism, the combination of the train-pipe, governing-valve device, brake-cylinder, and auxiliary reservoir, with a passage for refilling the auxiliary reservoir from the train-pipe when the governing-valve is at its normal position, and another passage for the same purpose provided with a retaining-valve for holding a sufficient excess pressure in the train-pipe to force the various governing-valves on the train to their respective brake-releasing positions, which retaining-valve can only be forced open when the governing-valve approaches near or reaches its inner seat, and with means for fully but more gradually equalizing the pressures in the train-pipe and the auxiliary reservoir through the normal refilling-passage after the governing-valve has returned to its normal position, substantially as shown and decribed.

22. In a triple-valve device for automatic brake mechanisms, a piston-chamber having the inner surface of its wall provided with a recharging groove or channel for the passage of compressed air past the main piston of triple valve from the train-pipe to the auxiliary reservoir when the said piston is at its normal position at a point intermediate between the limits of its travel with its stem in contact with a release graduating-stem and during the period of the application of the brakes, and which recharging-groove is also open during the inward motion of the main piston from its normal position for the partial release of the brakes, and also during the further inward motion of said main piston to its inner seat for the complete release of the brakes.

GEORGE BAYLEY WILLIAMS.

Witnesses:
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GEO. W. POOLE.