(No Model.) 4 Sheets—Sheet 1.

C. W. JUUL.

AUTOMATIC AIR BRAKE RETAINER.

No. 570,483. Patented Nov. 3, 1896.

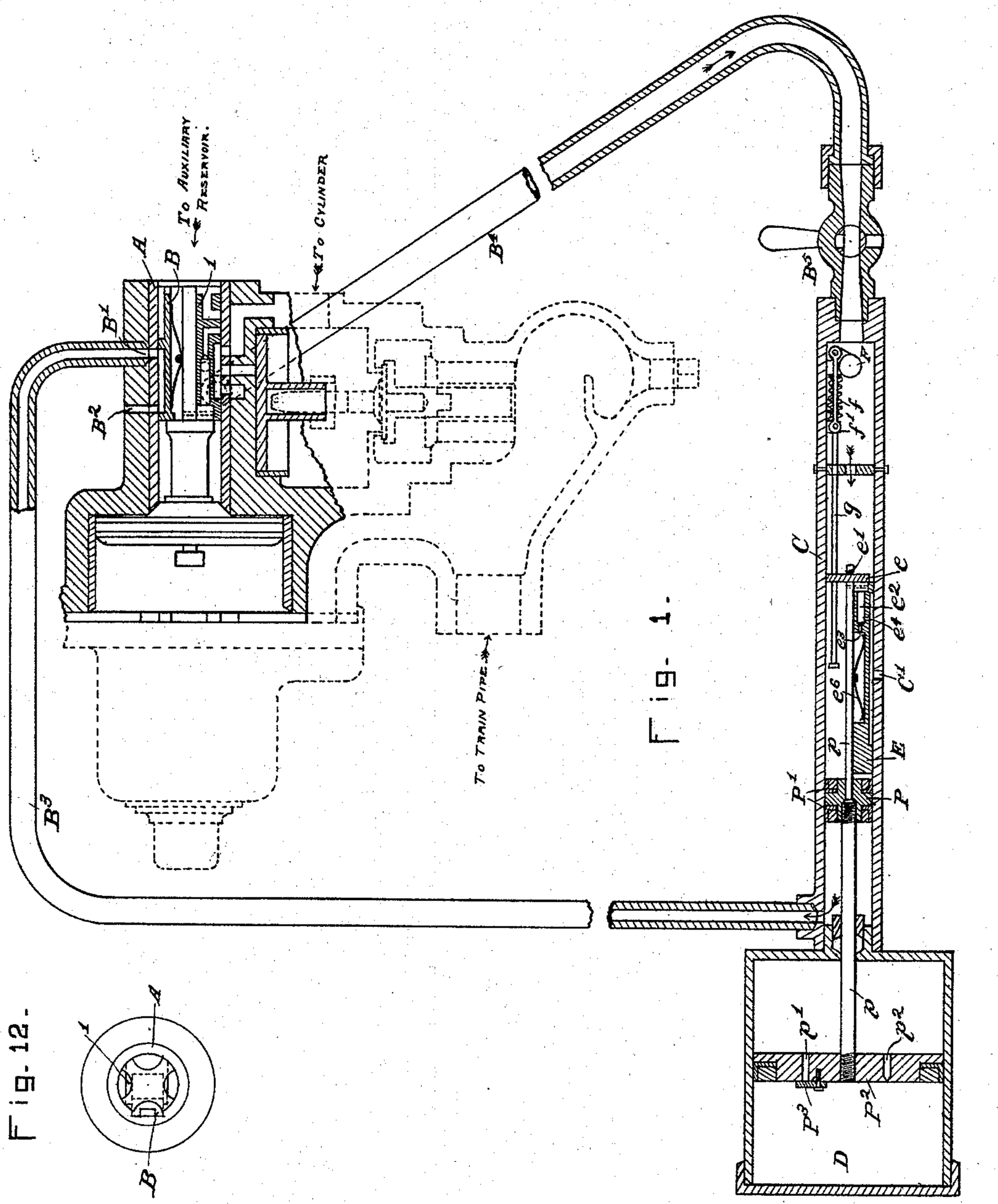

Fig. 1.

Fig. 12.

Witnesses.
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(No Model.) 4 Sheets—Sheet 2.

C. W. JUUL.

AUTOMATIC AIR BRAKE RETAINER.

No. 570,483. Patented Nov. 3, 1896.

Fig. 11.

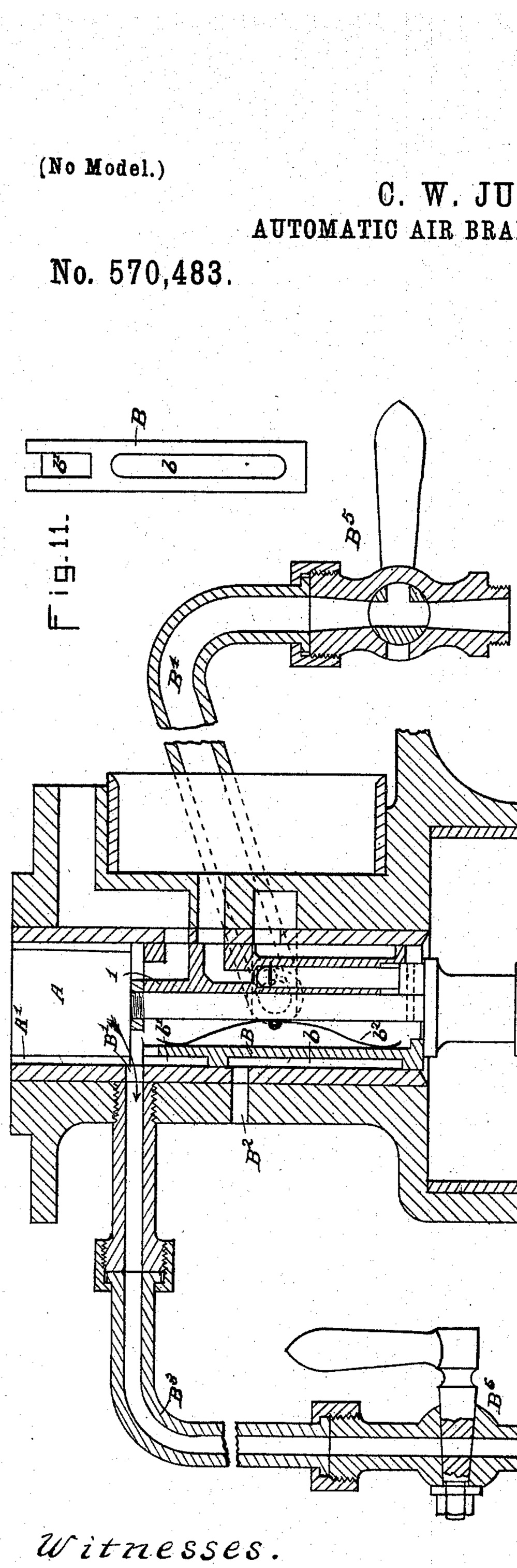
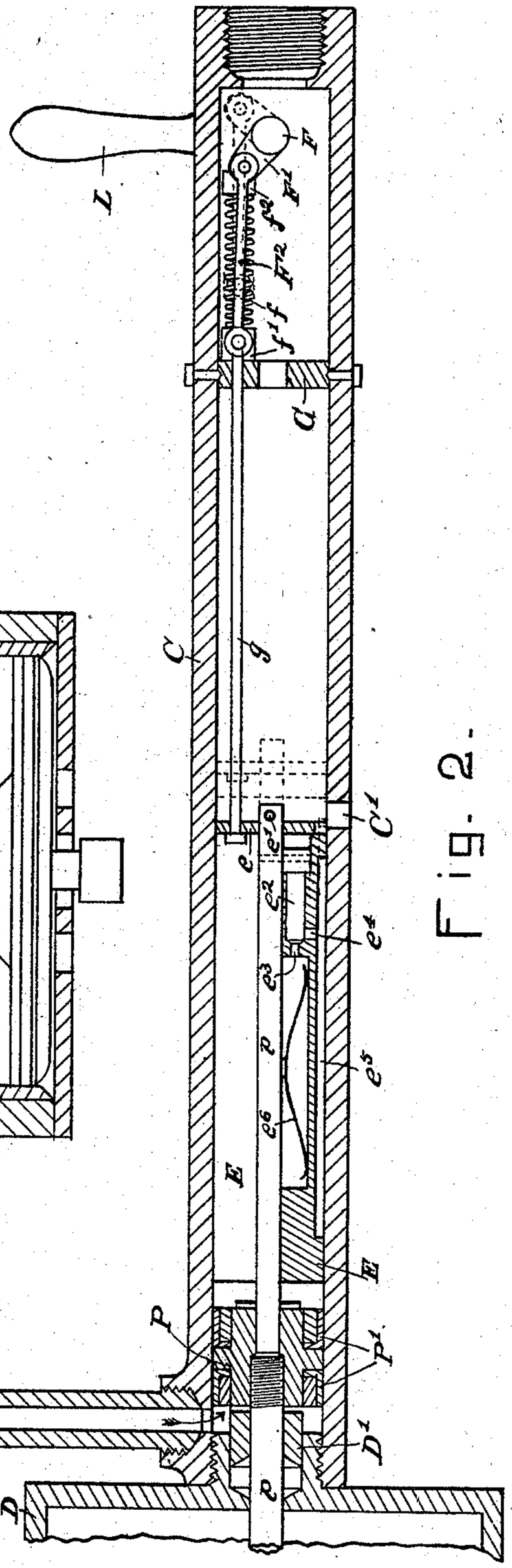


Fig. 2.



Witnesses.
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(No Model.) 4 Sheets—Sheet 3.

C. W. JUUL.

AUTOMATIC AIR BRAKE RETAINER.

No. 570,483. Patented Nov. 3, 1896.

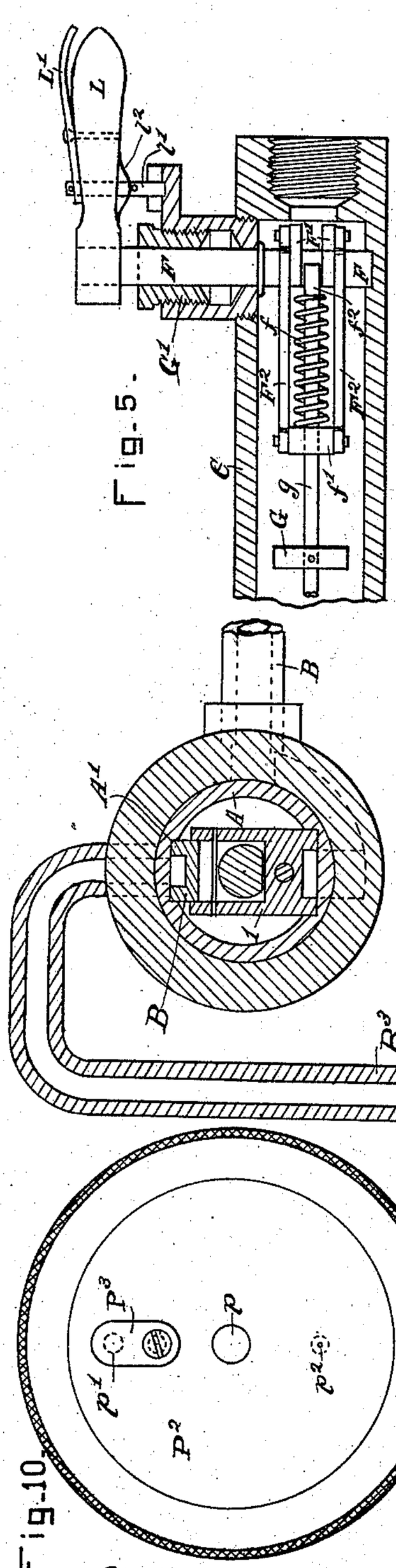

Fig. 5.

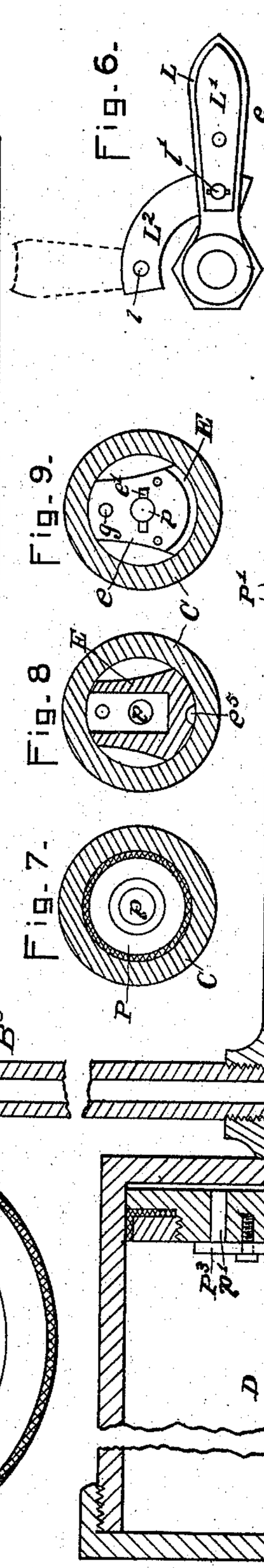

Fig. 6.

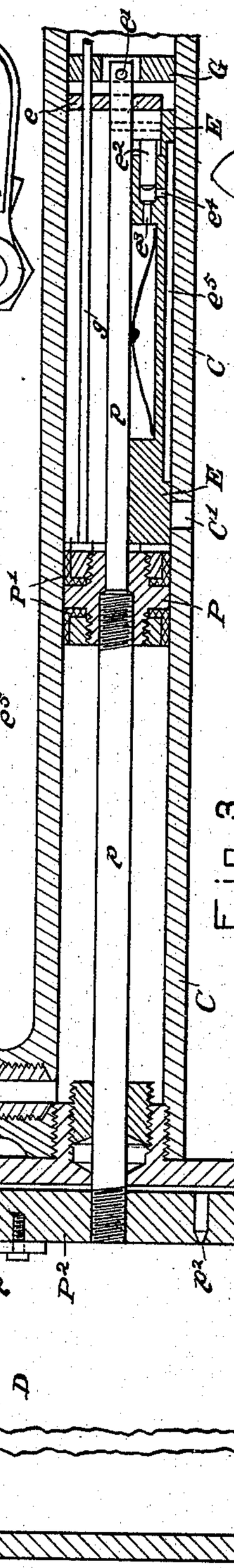

Fig. 3.

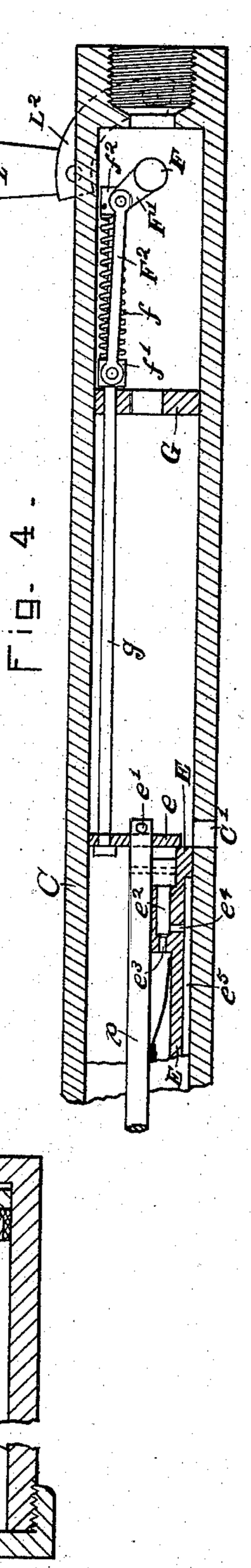

Fig. 4.

Fig. 9.

Fig. 8.

Fig. 7.

Fig. 2.

Fig. 10.

Witnesses.

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(No Model.) 4 Sheets—Sheet 4.

C. W. JUUL.

AUTOMATIC AIR BRAKE RETAINER.

No. 570,483. Patented Nov. 3, 1896.

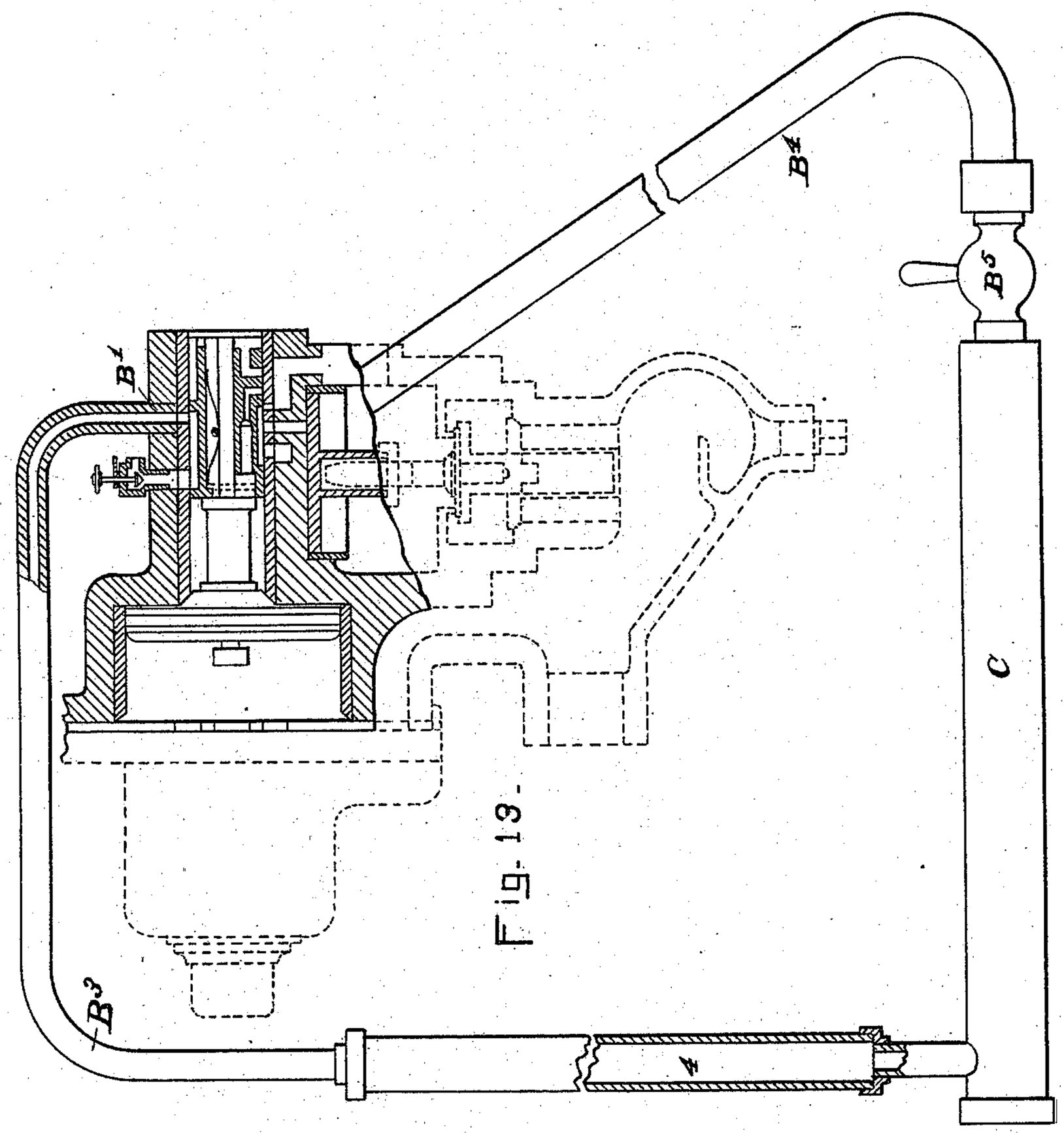

Fig. 13.

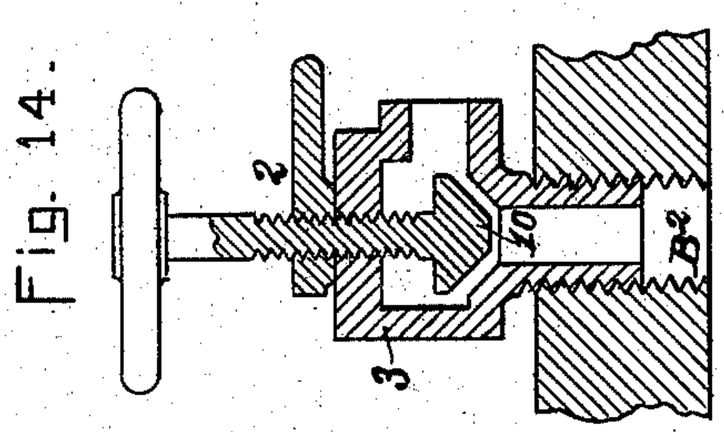

Fig. 14.

Witnesses.
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W. H. O'Neill

Inventor.
Christian W. Juul

UNITED STATES PATENT OFFICE.

CHRISTIAN W. JUUL, OF ELLENSBURG, WASHINGTON.

AUTOMATIC AIR-BRAKE RETAINER.

SPECIFICATION forming part of Letters Patent No. 570,483, dated November 3, 1896.

Application filed May 7, 1894. Serial No. 510,556. (No model.)

To all whom it may concern:

Be it known that I, CHRISTIAN W. JUUL, an alien of the United States, residing at Ellensburg, in the county of Kittitas and State of Washington, have invented a new and useful Improvement in Air-Brake Retainers, of which the following is a specification.

My invention relates to air-brake pressure-retainers; and it has for its object the enabling of the engineer to recharge the auxiliary reservoirs on the cars without releasing any of the air in the brake-cylinders, and so without reducing the braking effect. At the same time the action of the brakes is thoroughly automatic and under the control of the engineer, so that they can be entirely released by him any time. I accomplish this by delaying for a short time the escape of the exhaust after the triple valve has been placed in the release or recharging position by causing the exhaust from the triple valve to act before it can escape to the atmosphere upon a dash-pot, (either atmospheric or liquid,) which has a small by-pass when moving in the release direction and a large by-pass while moving in the opposite direction. This dash-pot is returned by the pressure from the auxiliary reservoir and train-pipe as soon as the brakes are applied again. This slight delay in the release gives time for the engineer to restore the pressure in the auxiliary reservoirs from the main reservoir on the engine, the pressure in which may be kept up by pumping air at any time.

The mechanism and particular operation of my device will be seen by referring to the specification following, and the drawings forming a part thereof, in which—

Figure 1 is a general view of my device in section, showing a triple valve and its connections thereto, a portion of the triple valve being shown in section and other portions being dotted only. Fig. 2 is a somewhat similar view on a larger scale, only a portion of the triple valve being shown. Fig. 3 shows the mechanism in a different position. Figs. 4, 5, and 6 show a device which may be used to permanently retain a certain percentage of the pressure if desired. Figs. 7, 8, and 9 are sections through the retainer-cylinder, showing the contained valve and piston. Fig. 10 is an end view of the dash-pot piston. Fig. 11 is a separate view of the supplemental valve which goes inside of the triple valve and is actuated thereby and returns the retainer and dash-pot to its operating position. Fig. 12 is an end view of a portion of the triple valve, showing end views of the triple valve proper and the supplemental valve. Fig. 13 is a modified form of my device in which the dash-pot cylinder is dispensed with and a throttled opening to the air substituted therefor. Fig. 14 is a detail showing the valve for adjusting the size of this opening.

In operating railway-trains by the automatic air-brake upon long mountain grades it frequently happens, by reason of the varying grades and the necessity for slowing down at curves and other dangerous places, that an engineer finds it necessary to make frequent alternate applications and partial releases without its being safe to entirely release the brakes. These frequent alternate applications and partial releases soon use up the pressure in the auxiliary reservoirs, and as they can only be recharged when the brakes are released, the train is apt while he is recharging them to get under dangerous headway, or if it becomes necessary to apply the brakes harder, he has no reserve air to accomplish this. For this reason the handling of a train on long mountain grades requires an expert and careful man, and even then runaways and accidents are liable to happen. These frequent applications and releases consume a very large amount of air and so make a great deal of additional and very rapid work for the air-pump, which causes it to run hot and wear so that it will soon leak and will not pump air at all. This method of operating the brakes also makes the pump more liable to break down. It also causes unnecessary wear on the brake-shoes. The object of my invention is to cure these faults. I will now describe the mechanism by which I accomplish this. The triple valve shown is the ordinary Westinghouse triple valve. The only changes made in it are as follows:

The lining sleeve or cylinder A has a seat A′, formed opposite the seat for the ordinary slide-valve A. Seated in this is the supplemental slide-valve B, which lies between the side flange of the slide-valve *l*. The two are held to their seats by the spring b^2, which is

the same or similar spring to that ordinarily used for this purpose. This spring lies between the two valves. The forming of a special seat for the supplemental slide-valve is not really necessary, as the side flanges of the main slide-valve would hold it in place and its contact-surface might as well be the curve of the inside of the sleeve A. This supplemental valve is held lengthwise and moved in the same way as is the main valve. It may be either a snug fit between the two lugs on the moving piston, or be a loose fit, as is the main slide-valve as it acts as a plain slide-valve, having no graduating-valve.

The openings B′ and B² are made through the side of the triple-valve cylinder and into the center of the seat of the supplemental valve B. The opening B′ communicates through the pipe B³ with one end of the retainer-cylinder and the other, B², with the outside air. The ordinary exhaust-opening from the triple valve is connected by a pipe B⁴ with the other end of the retainer-cylinder. Aside from these changes, the construction and operation of the triple valve is the same as that in common use. A particular description of it will therefore not be given here.

The retainer-cylinder C is a tube several diameters in length, and contains a piston P, having the ordinary leather packing P′, so that it may be operated by air from either side. The piston-rod *p* passes through a stuffing-box D′ at one end of the retainer-cylinder into a cylinder D, which is of much greater diameter, and is there connected to a piston P², which is packed so as to be air-tight when moving in one direction only, to the left, as shown in the drawings. This cylinder is entirely closed and the air is at atmospheric pressure only. This piston has two by-passes, consisting of the holes *p*′ and *p*², the first, *p*′, being a hole of considerable size covered by the flexible valve *d*³, so that when it is moved to the right the air may pass through it quickly, but is closed by the valve *p*³ when moved to the left, so that the air cannot pass through it. The other by-pass *p*² is a quite small hole, which is always open and permits a gradual and slow movement of the piston to the left. This cylinder and piston form a sort of dash-pot. The piston-rod *p* also extends in the opposite direction from the piston P, and operates the retainer slide-valve E. This valve is of the cross-section shown in Fig. 8, the seating side being round to fit the interior of the cylinder and having two ribs extending upon each side of the piston-rod *p*, and bearing on the upper side of the piston. A plate *e* is fixed to the end of the valve farthest from the piston. The piston-rod passes through this and has a pin *e*′ outside the plate *e*, which engages with the plate and thereby moves the valve in one direction. The valve is moved in the other direction by engagement with the piston P.

The valve is shorter than the space between the piston P and the pin *e*′, the result being the same and for the same purpose as in the slide of the ordinary triple valve—namely, to provide for the opening or closing of the valve *e*² before the slide moves. This valve *e*² is similar in construction to the graduating-valve of the triple valve. It is a round pin connected to and moving with the piston-rod *p*, and having its seat on one end. When in the position shown in Figs. 1, 2, and 4, the ports *e*³ and *e*⁴ are closed, but they are opened when in the position shown in Fig. 3.

The exhaust-opening from the retainer-cylinder is at C′. The valve E has a groove *e*⁵ in its side, which comes directly over the exhaust-port C′.

The operation of the device as so far described is as follows: Before the brakes are applied the retainer-cylinder and piston are in the position shown in Fig. 2. The triple valve is then in the position of release and the supplemental slide-valve B is in the position shown in Fig. 1, the ports B′ and B² being covered thereby. When the brakes are applied, the motion of the main slide-valve *l* moves the supplemental valve B until the port B′ is uncovered. The position of the triple valve as shown in Fig. 2 is that of an emergency application. The uncovering of port B′ permits the air to act upon the piston P to move it to the right. As the by-pass *p*′ in the piston P′ is large, the air in the cylinder D offers but little resistance to this motion, and the piston P is quickly moved to the right, carrying with it the slide-valve E. The first movement of the piston has opened the valve *e*², and the air in the retainer-cylinder back of the piston escapes through the ports *e*³, *e*⁴, *e*⁵, and C′. Now, when the triple valve is moved to the release position as shown in Fig. 1, the exhaust from the brake-cylinder is into the pipe B⁴. It cannot escape to the atmosphere yet, however, because the exhaust-port C′ is covered by the retainer slide-valve E. The pressure of this air is, however, brought to bear upon the piston P to move it to the left, while at the same time the moving of the slide *l* of the triple valve has carried with it the supplemental slide-valve B until connection has been made between the ports B′ and B², through the port *b*, to exhaust the air from the pipe B³, thus taking this pressure off of the piston P. The pressure from the brake-cylinder, acting upon the opposite side of the piston P, forces it to the left. The by-pass *p*² in the piston P² being, however, very small, the air cannot pass through it quickly, and so the motion is slow and the final exhaust of the brake-cylinder air through the port C′ is delayed. This delay may be made anything desired by properly proportioning the size of cylinder D and by-pass *p*². This delay is sufficient to enable the auxiliary reservoirs to be partially recharged from the main reservoir and the triple valve be again set at the application

position before the piston P and valve E have been moved far enough to uncover the exhaust-port C′. When this is done, the air in the pipe B^4 is trapped in by the moving of the triple valve and air from the auxiliary reservoir admitted to the pipe B^3, which, being of greater pressure than that formerly in the brake-cylinder, starts the piston to the right. This first opens the relief-valve e^2, permitting the entrapped air of the pipe B^4 to escape, thus removing the resistance to the forward motion of the piston P. The only air which has escaped from the brake-cylinder by this process is that entrapped in the pipe B^4 and the retainer-cylinder. In this way the auxiliary reservoir may be kept fully charged all the time and the engineer need never be out of air to operate the brakes. The three-way cock B^5 and cock B^6 may be used to cut out the retainer whenever desired. In this case the exhaust is direct to the air by the three-way cock B^5. I have also shown a device by which this may be used as a permanent retainer of a certain portion of the pressure. It will then act similar to what is commonly known as the fifteen-pound retainer—that is, to keep a pressure of a fixed amount, as fifteen pounds, on the brake-cylinders all the time. I accomplish this as follows: The right end of the retainer-cylinder is continued a short distance, and a rod or small shaft F is inserted across the same through a stuffing-box G′. Within the cylinder are the cranks F′. On this rod and attached thereto the links F^2, which are connected to the yoke f'. Through this yoke f' passes the rod g, which has the spiral spring f^2 surrounding it and held thereon by a lug f^2, pin, or other device, which prevents it being removed at the end. The opposite end of the rod g passes through the partition G and the plate e upon the end of the retainer slide-valve, and has a head on the end which prevents its being pulled through the plate e. This rod is made of such a length that when the cranks F′ are in the position shown in full lines in Figs. 2 and 4, it will not have any effect upon the position of the valve, the valve at the exhaust position being in contact with the head on the rod g, but not bringing any strain on the spring f. When, however, it is desired to throw this device into operation, the cranks F′ are thrown to the position shown in Fig. 5 and in dotted lines in Fig. 2. This causes the head on the rod g to engage the plate e before the valve has uncovered the exhaust-port C′, as shown in dotted lines in Fig. 2. The valve then can move farther to uncover the exhaust-port by compressing the spring f. As the pressure is reduced to balance the force of the spring, the valve is returned until it finally closes the exhaust-port and the remaining pressure is permanently retained. The amount of this pressure will depend upon the strength of the spring and its adjustment. The shaft F and cranks F′ are moved and held in the two positions by the handle L, fixed segment L^2, having holes l in each end, into which fit the locking-pin l', which is operated by handle L′ and spring l^2. This device may be operated in connection with the other parts or the full-pressure retainer, or by closing the valve B^6 it may be worked as a fixed or partial retainer. The partition G, plate e, and the valve E do not occupy all the space of the retainer-cylinder, but are cut away at the sides as shown in Figs. 5, 8, and 9, so that the air will have free passage by them at all times.

The essential principle of my device is the delayed exhaust, which gives time for the auxiliary reservoirs to be partially recharged from the main reservoir before the brakes are released. This delay need not be but a few seconds, probably five to seven, but is sufficient for a partial recharging. The auxiliary reservoirs are not necessarily completely recharged by a single application of this process, but without releasing the brakes a little increase of the pressure in the auxiliary reservoirs is acquired at each repetition of this process, until finally the auxiliary pressure and the brake-cylinder pressure also may be brought up to practically main-reservoir pressure, if desired, and this without using the emergency feature of the triple valve. Were it necessary to release the brakes for even this short length of time, the train might get under dangerous headway. This delay in the exhaust might be accomplished with my device in a slightly different way. This is by omitting entirely the cylinder D and its piston, and instead thereof reducing the area of the exhaust-opening B^2 sufficiently to cause the desired delay in the exhaust. This is shown in Fig. 13. The cylinder D is omitted and a valve 3 inserted in the extra exhaust-port B^2, in the triple-valve case. This valve-head 10 may be screwed down upon its seat so as to throttle the escape of the air through it as much as desired, or it can be opened so as to give a free escape. With this valve nearly closed it will take some time for the air in the pipe B^3 and in the retainer-cylinder to escape, and thus delay the escape of the air from the port C′ of the retainer-cylinder. The object attained is thus the same as if the cylinder D and its piston were used. If the volume of air in the pipe is insufficient to cause the required delay, this may be increased by enlarging the pipe or inserting an air-chamber between the retainer-cylinder and the triple valve, as shown at 4, Fig. 13.

A delay of a few seconds in the release of the brakes can never have any serious results. It means simply a loss of that much time, and in most cases it need not cause any loss of time, as an engineer can almost always release the brakes some time before starting, and after becoming accustomed to it he would operate his valve that much in advance of the time he wanted the brakes free, so as to allow for this delay. It is also an easy matter, if it is desired to use the retainer only at certain times, to cut out the retainer when-

ever it is not needed and operate the brakes as at present.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. An air-brake retainer operated by the exhaust from the triple valve to secure a delayed final discharge of the same, substantially as shown and described.

2. An air-brake retainer operated by the exhaust from the triple valve to secure a delayed release of the said exhaust and by the application of the brakes to reset the same in operative position, substantially as shown and described.

3. The combination with the ordinary mechanism of an automatic air-brake, of a valve covering the exhaust-port, means for moving it to uncover said port by the exhaust-pressure, and means for graduating the rapidity of said movement so as to slightly delay the final exhaust release, substantially as shown and described.

4. The combination with the ordinary mechanism of an automatic air-brake, of a valve covering the exhaust-port, means for moving said valve to uncover the port by the exhaust-pressure, and a dash-pot connected to the valve so as to slightly delay the final exhaust release, substantially as shown and described.

5. The combination with the ordinary mechanism of an automatic air-brake, of a slide-valve covering the exhaust-port, means for moving it to uncover said port by means of the exhaust-pressure, and a device connected to the valve for securing a gradual movement thereto so as to slightly delay the final exhaust release and mechanism actuated by the application of the brakes to return this valve to its place covering the exhaust-port, substantially as shown and described.

6. The combination with the ordinary mechanism of an automatic air-brake, of a slide-valve covering the exhaust-port, means for moving it to uncover said port by means of the exhaust-pressure, and a device connected to the valve for securing a gradual movement thereto so as to slightly delay the final exhaust release and mechanism actuated by the air-pressure from the auxiliary reservoir to return this valve to its place covering the exhaust-port, substantially as shown and described.

7. The combination with the ordinary mechanism of an automatic air-brake, of a slide-valve covering the exhaust-port, means for moving it to uncover said port by means of the exhaust-pressure and a device connected to the valve for securing a gradual movement thereto so as to slightly delay the final exhaust release and mechanism consisting of a cylinder and piston and connections therefrom to the auxiliary reservoir to operate this valve by air and return it to its position covering the exhaust-port whenever the brakes are applied, substantially as shown and described.

8. The combination with the ordinary mechanism of an automatic air-brake, of a chamber through which the exhaust from the brake-cylinder passes and having an exhaust-port therein, a valve within said chamber moved by the exhaust from the triple valve to uncover said port and a device connected to said valve to cause a gradual movement thereof so as to cause a delayed but free final exhaust, substantially as shown and described.

9. The combination with the ordinary mechanism of an automatic air-brake, of a chamber having an exhaust-port therein which is closed during applications, through which chamber and port the exhaust from the triple valve must pass, and means actuated by the ordinary releasing mechanism to cause a slightly delayed but free final opening of the said exhaust-port, substantially as shown and described.

10. The combination with the ordinary mechanism of an automatic air-brake of means, other than the triple valve, whereby the exhaust-port is closed during applications and means actuated by the movement of the ordinary releasing mechanism for causing a slightly delayed but free final opening of said exhaust-port, substantially as shown and described.

11. The combination with the ordinary mechanism of an automatic air-brake, of a chamber connected at one end to the exhaust from the brake-cylinder and having an exhaust-port therein, a valve within said chamber moved by the exhaust from the brake-cylinder to uncover the said exhaust-port, means connected with the valve for securing a gradual movement thereto, and means operated by applying the brakes to return the said valve to a position covering the exhaust-port, substantially as shown and described.

12. The combination with the ordinary mechanism of an automatic air-brake, of a cylinder connected at one end to the exhaust from the brake-cylinder and having an exhaust-port therein, a valve closing said port, a piston in said cylinder actuated by the exhaust from the brake-cylinder and by its movement opening said valve, and a device connected to said piston to secure a gradual movement thereto and a delayed opening of the valve, substantially as shown and described.

13. The combination with the ordinary mechanism of an automatic air-brake, of a cylinder connected at one end to the exhaust from the brake-cylinder and having an exhaust-port therein, a valve closing said port, a piston in said cylinder actuated by the exhaust from the brake-cylinder and by its movement opening said valve, and a dash-pot connected to said piston to secure a gradual movement thereto, substantially as shown and described.

14. The combination with the ordinary mechanism of an automatic air-brake, of a cylinder connected at one end to the exhaust

from the brake-cylinder and having an exhaust-port therein, a valve closing said port, a piston in said cylinder actuated by the exhaust from the brake-cylinder and by its movement opening said valve, a dash-pot connected to said piston to secure a gradual movement thereto, connections from the opposite end of the cylinder to the operating or triple valve whereby the working pressure of air is admitted behind the piston to return it and its connected valve to a position to cover the exhaust-port when the brakes are applied, substantially as shown and described.

15. The combination with the ordinary mechanism of an automatic air-brake, of a chamber through which the brake-cylinder exhaust must pass, and having an exhaust-port therein, a valve therein which permits a free passage through the exhaust-port when the brake is not in use, means actuated by the application of the brakes for moving the valve to cover the exhaust-port, and means actuated by setting the triple valve in a release position for uncovering the exhaust-port and means connected to this valve whereby its speed of motion is regulated so that the final release is slightly delayed, substantially as shown and described.

16. The combination with the ordinary mechanism of an automatic air-brake, of a retainer-cylinder having an exhaust-port therein and connections from one end of the retainer-cylinder to the triple-valve exhaust-port, two supplementary ports in the triple-valve cylinder, one connected with the outside air and the other with the other end of the retainer-cylinder, a supplementary valve operated by the triple valve to control these ports, a slide-valve in the retainer-cylinder, a piston therein connected to the slide-valve to operate it and means connected to this piston to cause a slow movement of the piston and connected valve by the air-brake exhaust, thus delaying the final exhaust, substantially as shown and described.

17. The combination with the ordinary mechanism of an automatic air-brake, of a retainer-cylinder having an exhaust-port therein, connections from one end of the retainer-cylinder to the triple-valve exhaust-port, mechanism operated by the triple valve whereby connection is made from the brake-cylinder supply to the opposite end of the retainer-cylinder when the brakes are applied, and from the same end of the retainer-cylinder to the outside air when the triple valve is set at release, a valve closing the exhaust-port in the retainer-cylinder, a piston in this cylinder for operating said valve, and a dash-pot connected to this piston to cause a slow movement of the piston against the exhaust-air, substantially as shown and described.

18. The combination with the ordinary mechanism of an automatic air-brake of a retainer-cylinder having an exhaust-port therein, connections from one end of the retainer-cylinder to the triple-valve exhaust-port, mechanism operated by the triple valve whereby connection is made from the brake-cylinder supply to the opposite end of the retainer-cylinder when the brakes are applied and from the same end of the retainer-cylinder to the outside air when the triple valve is set at release, a valve closing the exhaust-port in the retainer-cylinder, a piston in this cylinder for operating said valve, a retarding-cylinder or dash-pot and a piston therein connected to the retainer-piston, said dash-pot piston having a small by-pass when moved by the exhaust-air but a large by-pass when moved in the opposite direction, substantially as shown and described.

19. The combination with the ordinary mechanism of an automatic air-brake, of a retainer-cylinder having an exhaust-port therein, connections from one end of this cylinder to the exhaust-port of the triple valve, two supplementary ports in the triple-valve cylinder, connections from one of these to the other end of the retainer-cylinder and from the other port to the outer air, a supplemental valve operated by the triple valve to uncover the first supplemental port when the brakes are applied and to connect the two ports when the triple valve is set at release, a valve in the retainer-cylinder controlling its exhaust-port, a piston therein operating the valve and operated in opposite directions by the exhaust-pressure and the application-pressure, and means for making the motion under exhaust-pressure much slower than in the opposite direction, substantially as shown and described.

20. The combination with the ordinary mechanism of an automatic air-brake, of a retainer-cylinder having an exhaust-port therein, connections from one end of this cylinder to the exhaust-port of the triple valve, two supplementary ports in the triple-valve cylinder, connections from one of these to the other end of the retainer-cylinder and from the other port to the outer air, a supplemental valve operated by the triple valve to uncover the first supplemental port when the brakes are applied and to connect the two ports when the triple valve is set at release, a valve in the retainer-cylinder controlling its exhaust-port, a piston therein operating the valve and operated in opposite directions by the exhaust-pressure and the application-pressure, a retarding-cylinder or dash-pot and a piston therein connected to the retainer-piston, said dash-pot having a small by-pass when moved by the exhaust-pressure but a large by-pass when moved in the opposite direction, substantially as shown and described.

21. In an air-brake retainer the combination of a cylinder having an exhaust-port therein through which the brake-cylinder exhaust must pass, a valve in said cylinder controlling the port and means for operating this valve to cover or uncover said port, of a relief port and valve in the said retainer-

valve and operated by the same mechanism to connect the exhaust-port and exhaust end of the retainer-cylinder during the travel of the piston toward that end and to close this connection as soon as motion is commenced in the opposite direction, substantially as shown and described.

22. The combination with the ordinary mechanism of an automatic air-brake, two additional ports in the triple-valve cylinder and a valve within the same and operated by the triple valve to control these extra ports, of a retainer device for delaying the brake-cylinder exhaust after the action of the triple valve and connections therefrom to the exhaust-port and to one of the extra ports whereby it is alternately and oppositely operated by the exhaust-air and the brake-cylinder air, substantially as shown and described.

23. The combination with the ordinary mechanism of an automatic air-brake, two supplemental ports in the triple-valve cylinder, a slide-valve in the said cylinder and operated by the triple valve to uncover one port when in the application position and to connect the two ports when in the release position, of an exhaust-delaying device connected with the triple-valve exhaust and the first or supply port of the supplemental ports so as to be alternately and oppositely operated thereby, substantially as shown and described.

24. The combination with the ordinary mechanism of an automatic air-brake, of an exhaust-delaying device alternately and oppositely operated by the exhaust-air and the brake-cylinder air, connections therefrom to the exhaust-port of the triple valve, and to a supplemental supply-port in the triple-valve cylinder, said supplemental supply-port and a coöperating exhaust-port in the triple-valve cylinder, a valve within said cylinder and operated by the triple valve to uncover the supplemental supply-port when the triple valve is set at the application position and to connect the two ports when the triple valve is set at the release position, substantially as shown and described.

25. In an air-brake retainer the combination of a cylinder having an exhaust-port therein through which the exhaust must pass, a slide-valve for controlling said port and having an exhaust-port in its face, a piston connected to and operating said valve and a relief port and valve in the said slide-valve connecting said exhaust-valve port and exhaust end of the retainer-cylinder and operated by the piston to open the relief-port when moving toward the exhaust end of the retainer-cylinder, and to close it when moving in the opposite direction, substantially as shown and described.

26. In an air-brake pressure-retainer the combination with a cylinder having an exhaust-port therein through which exhaust must pass, a slide-valve therein for controlling this port and a piston operated by air-pressure and operating the said slide-valve, of a relief port and valve adapted to be opened by and during the movement of the piston while closing the exhaust-port and to be closed thereby while moving in the opposite direction, substantially as shown and described.

27. In an air-brake pressure-retainer the combination with a cylinder having an exhaust-port therein through which the exhaust must pass, a piston therein operated alternately and in opposite directions by air-pressure mechanism operated by the triple valve to change the air-pressure to opposite sides of this piston, of a slide-valve within the retainer-cylinder connected to and moved by the piston to control the exhaust-port and a relief valve and port in the said slide-valve controlled by the piston and held open thereby during motion of the valve to cover the exhaust-port, substantially as shown and described.

28. The combination with the ordinary mechanism of an automatic air-brake of a retainer-cylinder having an exhaust-port therein through which the exhaust must pass, connections from one end thereof to the triple-valve exhaust-port, a slide-valve in said cylinder for regulating the opening of the exhaust-port, a piston connected thereto and operated to move the valve to uncover the port by the exhaust from the triple valve, a dash-pot connected to the piston to secure a gradual motion thereof, and a spring resisting the motion of the piston just before uncovering said port, substantially as shown and described.

29. The combination with the ordinary mechanism of an automatic air-brake, of a retainer-cylinder having an exhaust-port therein through which the exhaust must pass, connections from one end thereof to the triple-valve exhaust-port, a slide-valve in said cylinder for regulating the opening of the exhaust-port, a piston connected thereto and operated to move the valve to uncover the port by the exhaust from the triple valve, a dash-pot connected to the piston to secure a gradual motion thereof, and a spring resisting the motion of the piston just before uncovering said port, and means whereby it may be thrown out of action when desired, substantially as shown and described.

C. W. JUUL.

Witnesses:
CHAS. VAN BUSKIRK,
W. H. HOSKINS.