F. B. COREY.

EMERGENCY BRAKE.

APPLICATION FILED JULY 16, 1903.

904,844.

Patented Nov. 24, 1908.

2 SHEETS—SHEET 1.

Fig. 1.

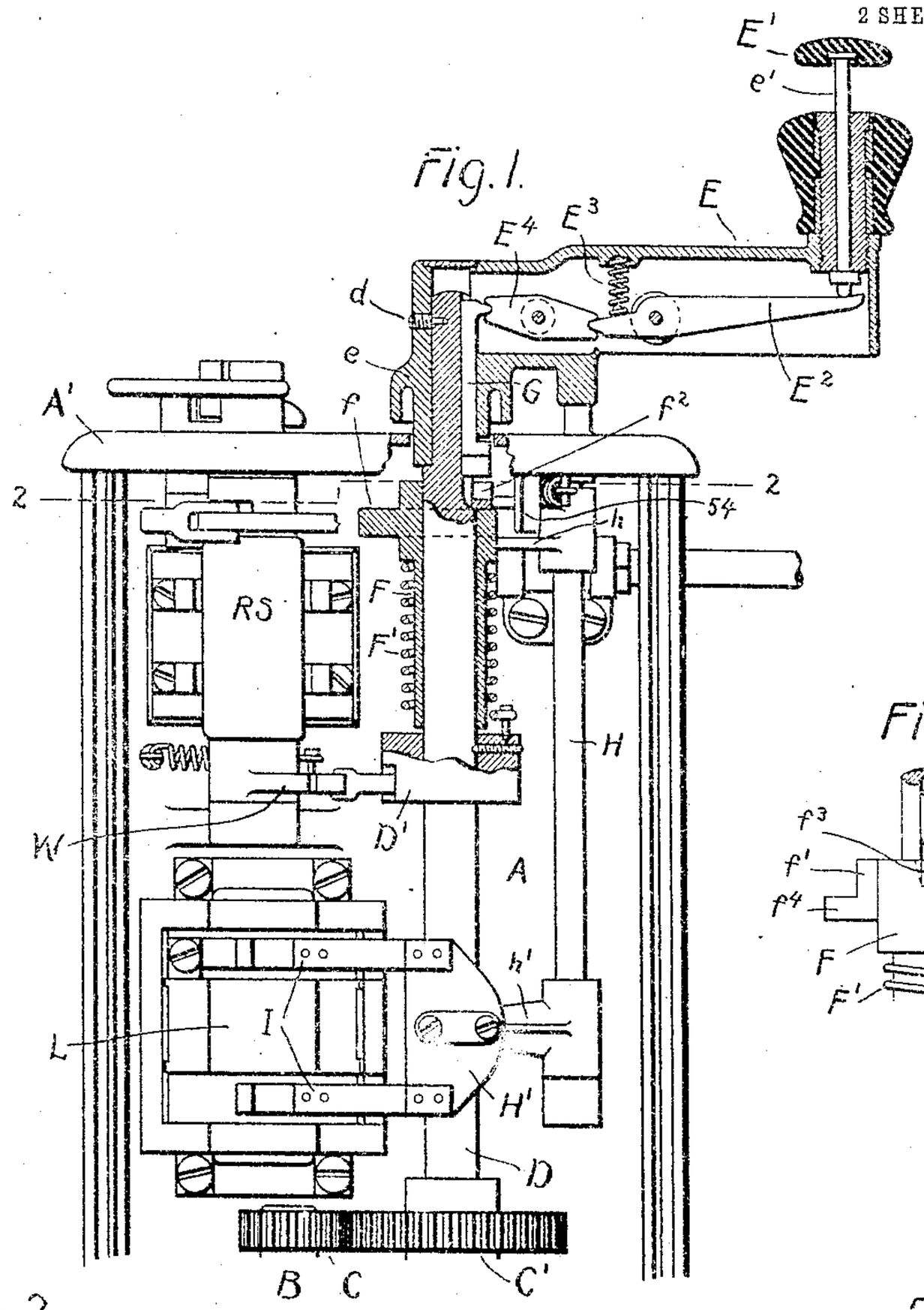


Fig. 4.

Fig. 2

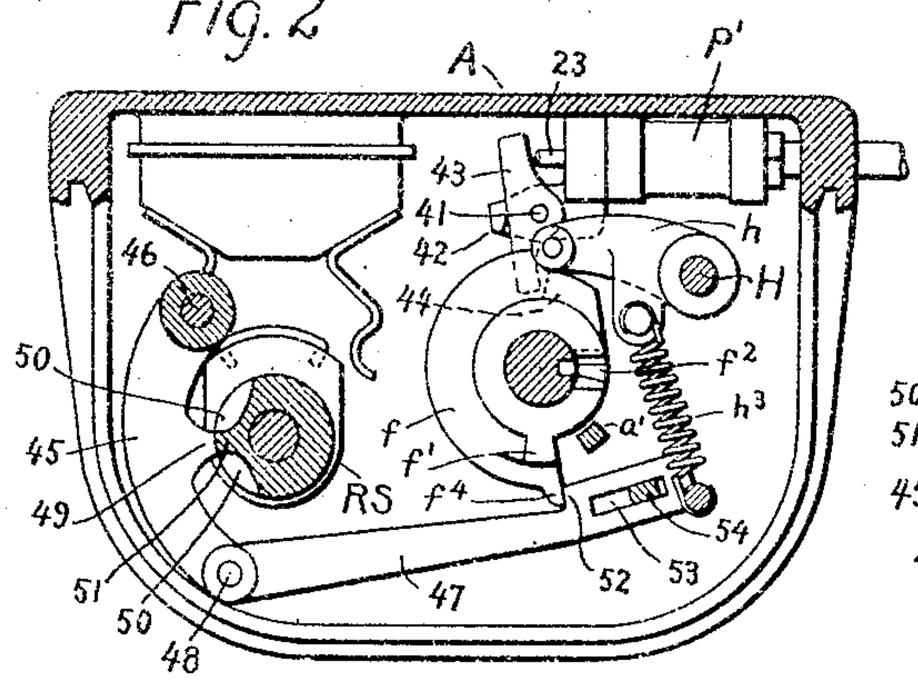
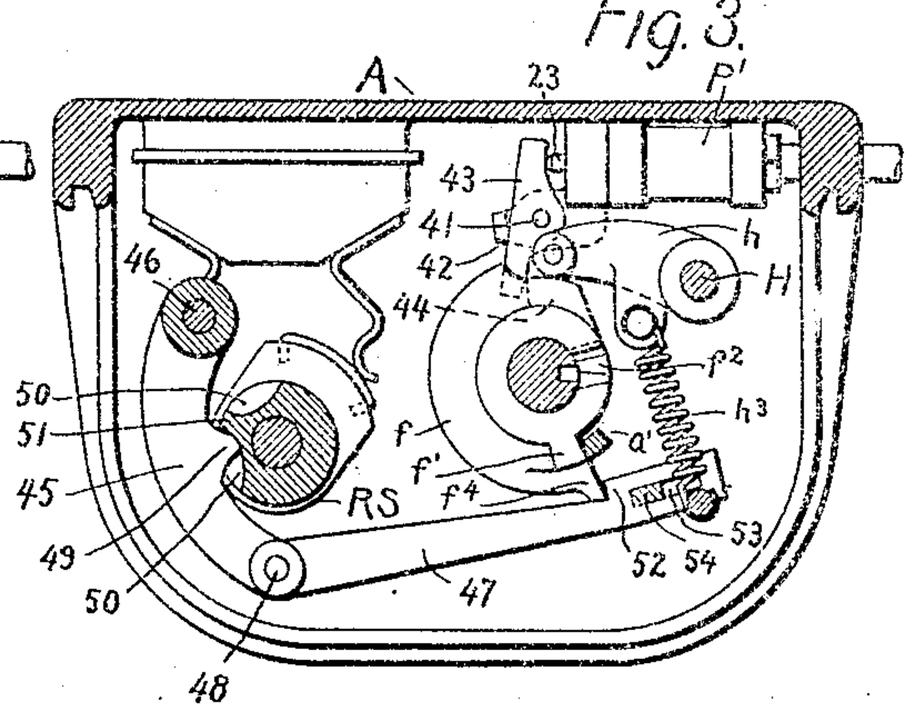


Fig. 3.



WITNESSES

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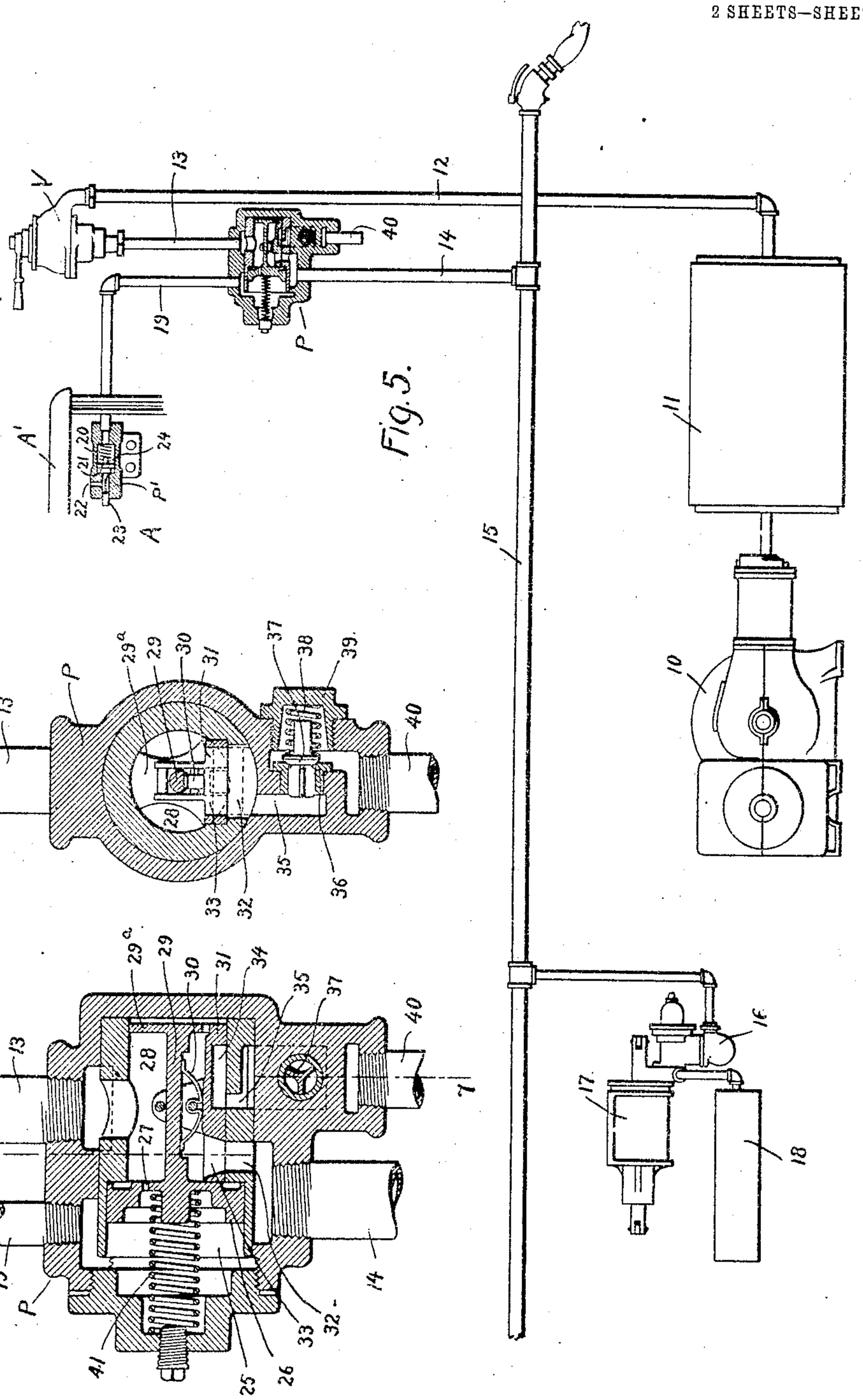

Fig. 5.

Fig. 7

Fig. 6.

WITNESSES

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UNITED STATES PATENT OFFICE.

FRED B. COREY, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

EMERGENCY-BRAKE.

No. 904,844. Specification of Letters Patent. Patented Nov. 24, 1908.

Application filed July 16, 1908. Serial No. 443,717.

To all whom it may concern:

Be it known that I, FRED B. COREY, a citizen of the United States, residing at Schenectady, in the county of Schenectady and State of New York, have invented certain new and useful Improvements in Emergency-Brakes, of which the following is a specification.

My invention relates to improvements in means for automatically controlling power-actuated brakes in case of an emergency and is intended for use especially in connection with electrically-propelled vehicles or trains employing a braking system actuated by fluid pressure.

In air-brake systems as commonly applied to electrically-propelled vehicles, it is desirable to provide an automatically-actuated valve or other equivalent mechanism which will operate to cause the brakes to be applied in case of an emergency. Such an emergency arises whenever the motorman becomes incapacitated through sudden illness, death or any other cause, and it is now common practice to provide an emergency valve which will operate automatically to apply the brakes whenever the controlling handle is released by the operator. Such emergency devices are described in a patent issued in my name, No. 881,552, dated March 10, 1908, emergency brake. My invention therefore constitutes an improvement on the devices set forth in the patent above referred to.

My invention is particularly adapted for use in connection with the so-called "automatic" air-brake system, that is, a system in which the train-pipe is exhausted to atmosphere to apply the brakes in contradistinction to the "straight" air-brake system in which the compressed-fluid is supplied to the train-pipe from a source of supply to apply the brakes. In such a system it is very desirable to provide an emergency valve which will have ports of sufficient size to exhaust the train-pipe rapidly to cause the brakes to be applied quickly in case of an emergency and to so construct said valve that in case it sticks in an inoperative position the pressure within the train-pipe is sufficient to force the valve from its seat and cause the brakes to be applied. To accomplish these results, I employ a large-ported relay slide-valve maintained yieldingly on its seat, and control said slide-valve by means of a pilot or controlling valve located in proximity to the controlling handle.

In the ordinary form of "automatic" air-brake systems now in use the pressure normally maintained in the train-pipe is about 70 pounds per square inch. A reduction of 20 pounds per square inch or thereabouts in the train-pipe pressure is sufficient to cause the operation of the triple-valve to apply the brakes under the full pressure in the auxiliary reservoir. During the emergency application of the brakes the pressure in said train-pipe is reduced to that of atmosphere, thereby causing a waste of air without any useful result after the triple-valve is operated. Furthermore, if the train-pipe pressure is reduced to that of atmosphere at each application of the brakes it requires considerable time to recharge the train-pipe sufficiently to operate the triple-valve and release the brakes. It is therefore desirable to provide means connected with the air-brake system which will prevent the pressure in the train-pipe from falling below a predetermined amount when the emergency valve is operated to apply the brakes.

The object of my invention is therefore to render the operation of the emergency valve more positive and to simplify its construction, and a further object is to economize the air used in the operation of an "automatic" air-brake system and to increase the rapidity with which the brakes may be successively applied and released.

My invention therefore consists in the combination with an emergency valve for use in connection with an "automatic" air-brake system, of a pressure-retaining valve which is adapted to prevent the reduction of the train-pipe pressure below a predetermined amount after the emergency valve has been operated, and further consists of improvements in the construction of the emergency valve which will be hereinafter fully described and more clearly set forth in the appended claims.

In the accompanying drawings which illustrate the preferred embodiment of my invention, Figure 1 is an elevation of a specific form of motor controller supplied with emergency-valve actuating-mechanism, parts of said controller being shown broken away and in section; Fig. 2 is a sectional plan view of the controller and emergency-valve

actuating-mechanism on the line 2 2 of Fig. 1; Fig. 3 is a sectional plan view similar to Fig. 2 showing the emergency-valve actuating-mechanism in the position it assumes after operating the pilot-valve; Fig. 4 is a side elevation showing part of the mechanism operated from the controller handle for resetting the emergency-valve actuating-mechanism; Fig. 5 is a diagrammatic representation of an "automatic" air-brake system embodying my invention; Fig. 6 is a vertical section through the emergency valve; and Fig. 7 is a vertical section through said emergency valve on the line 7 7 of Fig. 6.

Referring now to the drawings, A represents the back of the controller casing and E the operating handle for the controller cylinder B mounted within said casing. The controller cylinder B carries the usual contact segments and is geared by cog-wheels C and C′ to the shaft D which runs up into the hub *e* of the operating handle E, the said hub being rotatable in an opening in the cap-plate A′ and fastened to the shaft D by means of a set-screw *d*. Rotatably mounted on the shaft D is a sleeve F maintained yieldingly in its normal position by means of the helical spring F′ which is connected at one end to the sleeve and at the other end to the shaft, preferably by means of the collar D′ secured to the shaft. The sleeve F carries a cam *f* and lug *f′* (Fig. 2), the latter serving as a stop by abutting against a stationary lug *a′* on the under side of the cap-plate.

Connected with the knob E′ in the controlling handle is a pin *e′* which rests upon the long arm of the lever E^2 fulcrumed on the operating handle E. A spring E^3 bears on the short arm of the lever E^2 and keeps the pin and knob normally raised. A toothed rocker E^4 also is fulcrumed on the operating handle and engages with the short arm of the lever E^2. The other end of the rocker E^4 engages with a lug on the upper end of the bolt G slidable in a keyway in the shaft D and adapted to enter a notch f^2 formed in the upper end of the sleeve F and acts to lock said sleeve to the shaft. The bolt G will enter the notch f^2 whenever the knob E′ is depressed, providing the controller is in the "off" position. The sleeve F is adapted to be rotated with the shaft D so long as pressure is maintained on the knob E′ on which the palm of the motorman's hand is adapted to rest while the controlling handle is being operated.

Adjacent to the shaft D within the controller casing is a rock-shaft H carrying an arm *h* which bears against the cam *f*, as is clearly shown in Figs. 2 and 3, whereby the movement of said cam will rock the shaft H. Also mounted on the rock-shaft H is an arm *h′* carrying a block of insulation H′ on which are mounted two connected spring-contact-fingers which coöperate with stationary contacts forming therewith a double-pole switch I for closing and opening the power-circuit when shaft H is rocked. The insulating casing containing the blow-out coil for the switch I is indicated at L. The reversing-switch RS is of the type used in connection with master-controllers for train-control systems employing motor-controllers of the separately-actuated contact type. The customary interlocking mechanism between the said reversing-switch and the shaft D is indicated at W.

Mounted within the controller casing and operatively connected to the relay emergency valve which will be hereinafter described is a pilot-valve which is adapted to cause said relay emergency valve to operate to apply the brakes in case the controller handle is released by the operator.

Referring now to Fig. 5, which illustrates diagrammatically an "automatic" air-brake system, the main storage reservoir 11 is connected to the train-pipe 15 through the engineer's valve V and the casing P of the relay emergency valve, communication being made through the pipes 12, 13 and 14. The pressure in the main reservoir 11 is maintained practically constant by means of the motor-driven air-compressor 10. Also connected with the train-pipe 15 is the triple-valve 16 which controls the communication between the auxiliary reservoir 18 and the brake cylinder 17 and train-pipe in a manner now well understood by those familiar with "automatic" air-brake systems. The engineer's or motorman's valve V is of the customary type and controls the admission of compressed-fluid from the source of supply to the train-pipe and also the exhaust from the train-pipe to atmosphere through wide and restricted passageways.

The casing P of the relay emergency valve contains a slide-valve 31 which is adapted to control the communication between the train-pipe 15 and the engineer's valve V and also the communication between said train-pipe 15 and the atmosphere through the exhaust pipe 40. This slide valve 31 is normally maintained in the position shown in Figs. 5 and 6 by means of the spring 41 so that the pipe 13 leading to the motorman's valve V will be maintained normally in communication with the pipe 14 leading to the train-pipe 15, the port 33 in said slide valve being normally in register with the port 32 in the valve seat. The said valve is maintained yieldingly on its seat by the action of the spring 30 which rests against the extension 29 of the piston 26 operatively connected with the valve 31 and is guided in its reciprocatory movements by the member 29^a formed on the opposite end of the extension 29. The chamber 25 is supplied with compressed-fluid from the cham-

ber 28 through the contracted passageway 27 formed in the piston 26 thus equalizing the pressure on both sides of said piston 26. The chamber 25 is in communication with the casing P′ of the pilot-valve through the pipe 19, the said pilot-valve being constructed and arranged to exhaust the chamber 25 to atmosphere to allow the pressure within the chamber 28 to overcome the pressure of the spring 41 and move the valve 31 to the left. In this latter position the passageway 34 formed in said slide valve 31 is brought into register with said port 32 and the port 35 leading to the exhaust-pipe 40, thereby allowing the train-pipe to be exhausted to atmosphere. The pressure-retaining valve 37 located in the exhaust passageway between the port 35 and the exhaust-pipe 40 is maintained on its seat 36 by the pressure of the spring 38. The pressure exerted by said spring 38 determines the fluid-pressure in the train-pipe below which it is not desired to go and may be varied by varying the position of the nut 39. Located within the casing P′ is the pilot-valve 24 which is maintained on its seat 21 by means of the spring 20. The pilot-valve 24 controls the passageway leading to the exhaust port 22 in said valve casing and is moved away from its seat against the action of the spring 20 by pressure exerted upon the outer end of the valve spindle 23.

The mechanism for operating the pilot-valve will now be described. Pivotally mounted at 41 on the bracket 42 attached to the controller casing or to the pilot-valve casing is a lever 43 one end of which is adapted to impinge the valve spindle 23 and the other end of which lies in the path of a projection or lug 44 formed on the under side of the cam *f*. The projection 44 is adapted to strike the lever 43 so as to cause the pilot-valve 24 to open whenever the controller handle is released by the operator, provided the reversing-switch RS is in one or the other of its operative positions. The controller is provided with means whereby the lug 44 may be held out of engagement with the lever 43 and locked in such a position when the reversing-switch is in its neutral position. The said means, which renders the emergency valve inoperative at the time the handle is released by the operator, comprises a lever-arm 45 pivoted to the cap-plate A′ at 46 and the link 47 pivoted to the lever-arm 45 at 48. The lever-arm 45 has formed thereon a projection 49 adapted to engage the recesses 50 and the projection 51 which are formed on the reversing-switch cylinder. The recesses 50 correspond to the operative positions of the reversing-switch. The link 47 has formed at its outer end a shoulder 52 and a slot 53. The shoulder 52 is adapted to engage the projection or lug f^4 formed on the cam *f*, and the slot 53 co-acts with the fixed pin 54 integrally formed with or otherwise attached to the cap-plate A′ to form a guide for the reciprocable link 47.

As will be clearly seen by referring to Fig. 4, one side f^3 of the notch f^2 formed in the upper end of the sleeve F is inclined in such a manner that as the bolt G, which is beveled at its lower end, is forced into said notch, the sleeve F is rotated about the shaft D and is moved from the position shown in Fig. 3 to the position shown in Fig. 2. This is accomplished by depressing the knob E′ in the controller handle after the said controller handle has been brought back to its "off" position.

In the operation of the controller and emergency valve, when the motorman places his hand on the operating handle E he depresses the push-pin *e*′ and forces the bolt G down into the notch f^2 in the sleeve F, thereby locking the sleeve to the shaft D. The rotation of the handle operates first to close the cut-out switch I by operating the rock-shaft H through the agency of the sleeve F and the cam *f*, and then to control the motor-circuits by means of the controlling cylinder B.

With the operating handle in its "off" position and the reversing-switch in its neutral position, the emergency-valve actuating-mechanism is in the position shown in Fig. 2, the lever 43 being out of engagement with or lightly resting against the end of the valve spindle 23. When the reversing-switch is thrown into one of its operative positions and the handle E is moved forward after depressing the knob E′ the sleeve F is rotated with the shaft D and the projection 44 is moved away from the lever 43 and the lug or projection f^4 is moved out of engagement with the shoulder 52. If now the motorman removes his hand from the operating handle, the sleeve F is unlocked and the spring F′ instantly turns the said sleeve backward until the lug f^3 strikes the stop e^3 on the cap-plate as shown in Fig. 3. In this position of the sleeve the projection 44 engages with one arm of the lever 43 and forces the other arm of said lever into engagement with the valve spindle 23, thereby opening the pilot-valve 21 which in turn causes the compressed-fluid from the chamber 25 of the emergency valve to be exhausted to atmosphere and allows the valve 31 to open communication between the train-pipe and atmosphere as has been heretofore described. Also in this position of the sleeve the cam *f* allows the cut-out switch I to be thrown open by means of the spring i^3. The air-brakes are therefore applied suddenly and the power-circuit is opened.

While the train-pipe 15 is being exhausted through the exhaust-pipe 40, the valve 31 is in such a position as to cut off the communication between the train-pipe 15 and the

motorman's valve V; that is to say, the ports 32 and 33 are moved out of register with each other. This prevents any compressed-fluid passing into the train-pipe from the source of supply through the motorman's valve to maintain the pressure in the train-pipe thereby preventing the triple-valve 16 from operating to apply the brakes when the train-pipe is connected to atmosphere through the emergency valve. It will of course be understood in connection with the ordinary "automatic" system that at the time the motorman's valve is in its "running" position, the small passageway in said valve or the feed valve which is sometimes used in connection with said motorman's valve allows a small amount of compressed air to flow from the source of supply to the train-pipe to take care of any leakage in the piping system and to maintain the brakes in their released position.

When the train-pipe 15 is brought into communication with the exhaust passageway through the emergency valve, the pressure-retaining valve 37 will be forced away from its seat against the action of the spring 38, provided the fluid-pressure in the train-pipe is above the minimum required to operate said pressure-retaining valve. As soon as the pressure in the train-pipe reaches the predetermined minimum amount the valve 37 is forced to its seat again by the action of the spring 38. For instance, suppose the train-pipe pressure is normally 70 pounds, then if it requires 20 pounds reduction in pressure to cause the triple-valve 16 to operate, the pressure-retaining valve will be set to close at approximately 40 pounds pressure, thus maintaining a sufficient amount of compressed-air in the train-pipe so that when the emergency valve is released it will take but a very short time to raise the train-pipe pressure to normal, operate the triple-valve and recharge the auxiliary reservoir 18. At the same time a great saving in air takes place by the use of such a pressure-retaining valve.

In order to release the brakes without operating the motorman's valve, after they have been applied by the operation of the emergency valve, and also to reset the emergency-valve actuating-mechanism, it is merely necessary to turn the controller handle back to its initial or "off" position and press the knob E′ so as to force the lower end of the bolt G into engagement with the inclined side f^3 of the slot f^2, thereby rotating the sleeve F about the shaft D and moving the projection 44 away from the lever 43. The pilot-valve 24 is thus allowed to close under the action of the spring 20 and as the pressure on both sides of the piston 26 connected with the valve 31 is almost instantly equalized the spring 41 moves said valve 31 to cut off the communication between the train-pipe and the atmosphere. The emergency valve 31 when in this position again connects the source of supply to the train-pipe through the motorman's valve or feed valve and therefore the pressure in the train-pipe 15 is almost instantly raised to a degree sufficient to cause the triple valve to operate to exhaust the brake cylinder 17 and release the brakes. In this normal position of the emergency valve the operation of the brakes through the agency of the motorman's valve V is not interfered with. But should the valve 31 stick in such an inoperative position as to cut off the communication between the motorman's valve and the train-pipe and prevent the train-pipe exhausting to atmosphere in the proper manner, and the motorman's valve is operated to apply the brakes, the fluid-pressure in chamber 28 will be reduced and the fluid-pressure in the train-pipe will force the valve 31 from its seat against the action of the spring 30 and exhaust the train-pipe so as to apply the brakes.

The specific construction of the working parts of the motor-controller herein shown and described is not herein claimed, since it constitutes no part of my present invention but forms the subject-matter of a patent to Frank E. Case, No. 750,947, February 2, 1904. It is merely illustrated and described here to show more clearly how my invention may be applied to the type of master-controller generally employed in train-control systems. It will be readily understood however that the invention is not limited in its application to any specific type of motor-control.

I aim to cover in the claims hereto appended all modifications which do not involve a departure from the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is,

1. In combination, an "automatic" air-brake system including the usual train-pipe and triple-valve connected thereto, an emergency valve for exhausting the train-pipe to actuate the triple-valve for applying the brakes, and a pressure-retaining valve for preventing the pressure in the train-pipe falling below a predetermined amount when the emergency valve is operated.

2. In an "automatic" air-brake system in combination with the usual train-pipe and triple-valves connected thereto, a valve for exhausting the train-pipe to actuate the triple-valves for making an emergency application of the brakes, and a pressure-retaining valve operating to prevent the pressure in the train-pipe falling below a predetermined amount when the emergency valve is operated.

3. In an "automatic" air-brake system

in combination with the usual train-pipe and triple-valves connected thereto, a valve for exhausting the train-pipe to actuate the triple-valves for making an emergency application of the brakes, a pressure-retaining valve operating to prevent the pressure in the train-pipe falling below a predetermined amount when the emergency valve is operated, and means for adjusting said pressure-retaining valve so that it will operate at any desired train-pipe pressure.

4. In combination, an "automatic" air-brake system, a controlling handle, an emergency valve adapted to apply the brakes when the controlling handle is released by the operator, and a pressure-retaining valve adapted to prevent any appreciable further reduction of the train-pipe pressure after the triple-valve or valves of the "automatic" air-brake system has been operated.

5. In combination, an "automatic" air-brake system including the usual train-pipe and triple-valves connected thereto, a valve adapted to connect the train-pipe of said system to atmosphere to actuate the triple-valves in case of an emergency, and an automatically-actuated valve for preventing the reduction of the pressure in the train-pipe to that of the atmosphere when the emergency valve is operated.

6. In an "automatic" air-brake system, a slide-valve adapted to open communication between the train-pipe of said system and the atmosphere, and means for maintaining said slide-valve yieldingly on its seat so that in case the said valve sticks in an inoperative position when it is desired to apply the brakes it will be forced from its seat by the pressure in the train-pipe.

7. In combination, an "automatic" air-brake system, a relay slide-valve adapted to connect the train-pipe to atmosphere in case of an emergency and at the same time close the communication between the train-pipe and the motorman's valve, means for maintaining said slide-valve yieldingly on its seat, a piston operatively connected with said slide-valve, and a pilot-valve connected with the chamber in which said piston operates whereby said slide-valve is operated when the pilot-valve is operated.

8. In combination, an "automatic" air-brake system, a relay slide-valve adapted to connect the train-pipe to atmosphere in case of an emergency and at the same time close the communication between the train-pipe and the motorman's valve, means for maintaining said slide-valve yieldingly on its seat, a piston operatively connected with said slide-valve, a pilot-valve connected with the chamber in which said piston operates whereby said slide-valve is operated when the pilot-valve is operated, a motor-controller, an operating handle therefor, and means operatively connected with said handle for operating said pilot-valve when said handle is released by the operator.

9. In combination, an "automatic" air-brake system, including the usual train-pipe and triple-valves connected thereto, a slide-valve adapted to control the train-pipe pressure to actuate the triple-valves to apply the brakes in case of an emergency, means for maintaining said slide-valve yieldingly on its seat, a piston operatively connected with said slide-valve, and means for controlling the operation of said piston from a distant point.

10. In combination, an "automatic" air-brake system including the usual train-pipe and triple-valves connected thereto, an emergency valve for exhausting the train-pipe to actuate the triple-valves for applying the brakes, means for preventing the pressure in the train pipe falling below a predetermined amount when the emergency valve is operated, and means for controlling said valve from a distant point.

11. In combination, an "automatic" air-brake system including the usual train-pipe and triple-valves connected thereto, an emergency valve for exhausting the train-pipe to actuate the triple-valves for applying the brakes, and means for preventing the pressure in the train pipe falling below a predetermined amount when the emergency valve is operated.

12. In combination, an "automatic" air-brake system including the usual train-pipe and triple-valves connected thereto, an emergency valve for exhausting the train-pipe to actuate the triple-valves for applying the brakes, means for controlling said valve from a distant point, and means associated with said emergency valve for preventing the pressure in said train pipe from falling below a predetermined point when the emergency valve is operated.

13. In combination, an "automatic" air-brake system, a controlling valve, an emergency valve governed by said controlling valve and situated between said controlling valve and the train pipe, and means associated with said emergency valve for preventing the exhausting of said train pipe below a predetermined pressure upon the operation of said emergency valve.

14. In an automatic air-brake system, in combination with the usual train-pipe and triple-valves connected thereto, an emergency valve arranged to exhaust the train-pipe to actuate the triple-valves for applying the brakes, and a pressure-retaining valve in the exhaust connection of said emergency valve.

In witness whereof, I have hereunto set my hand this 14th day of July, 1903.

FRED B. COREY.

Witnesses:

BENJAMIN B. HULL,

HELEN ORFORD.