No. 767,272. PATENTED AUG. 9, 1904.

W. A. & B. S. H. HARRIS.

AUTOMATIC CAR DISCHARGE VALVE.

APPLICATION FILED APR. 30, 1902. RENEWED DEC. 24, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

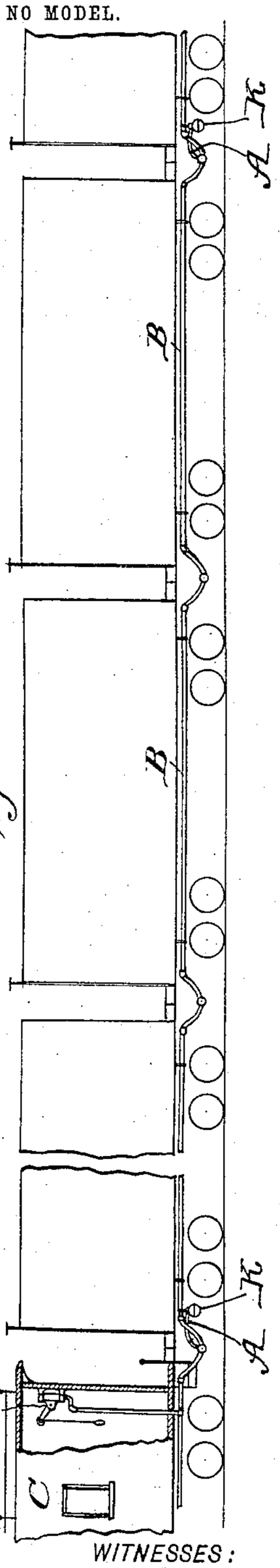

Fig. 4.

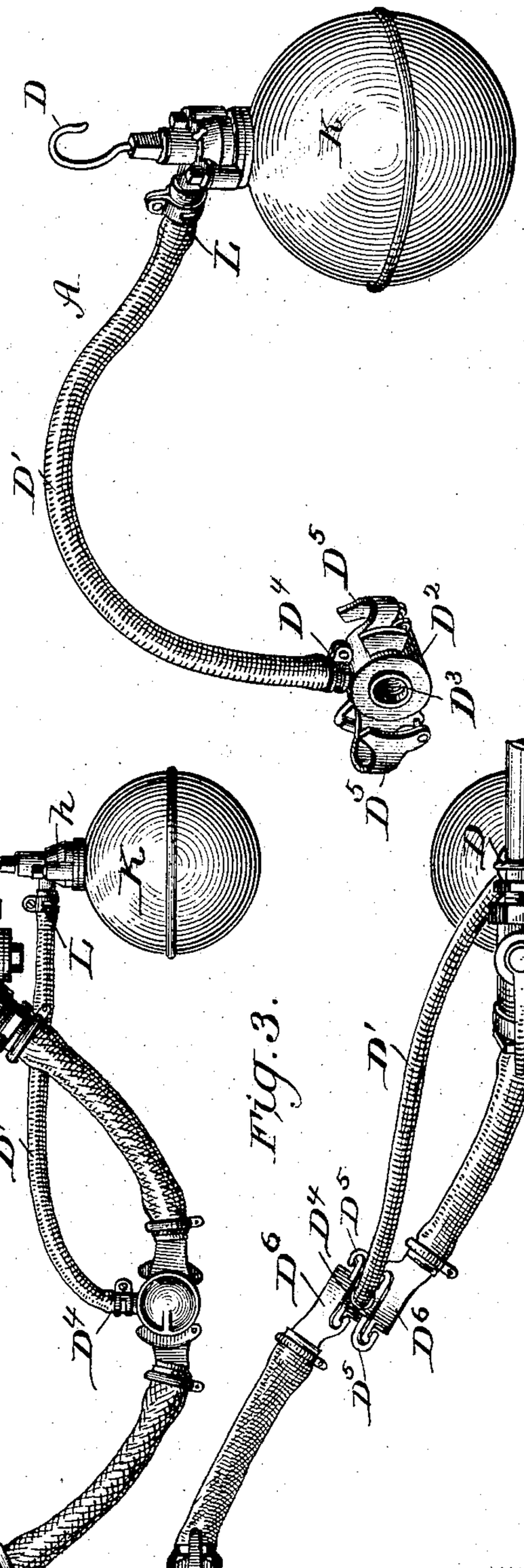

Fig. 2.

Fig. 3.

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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 5.

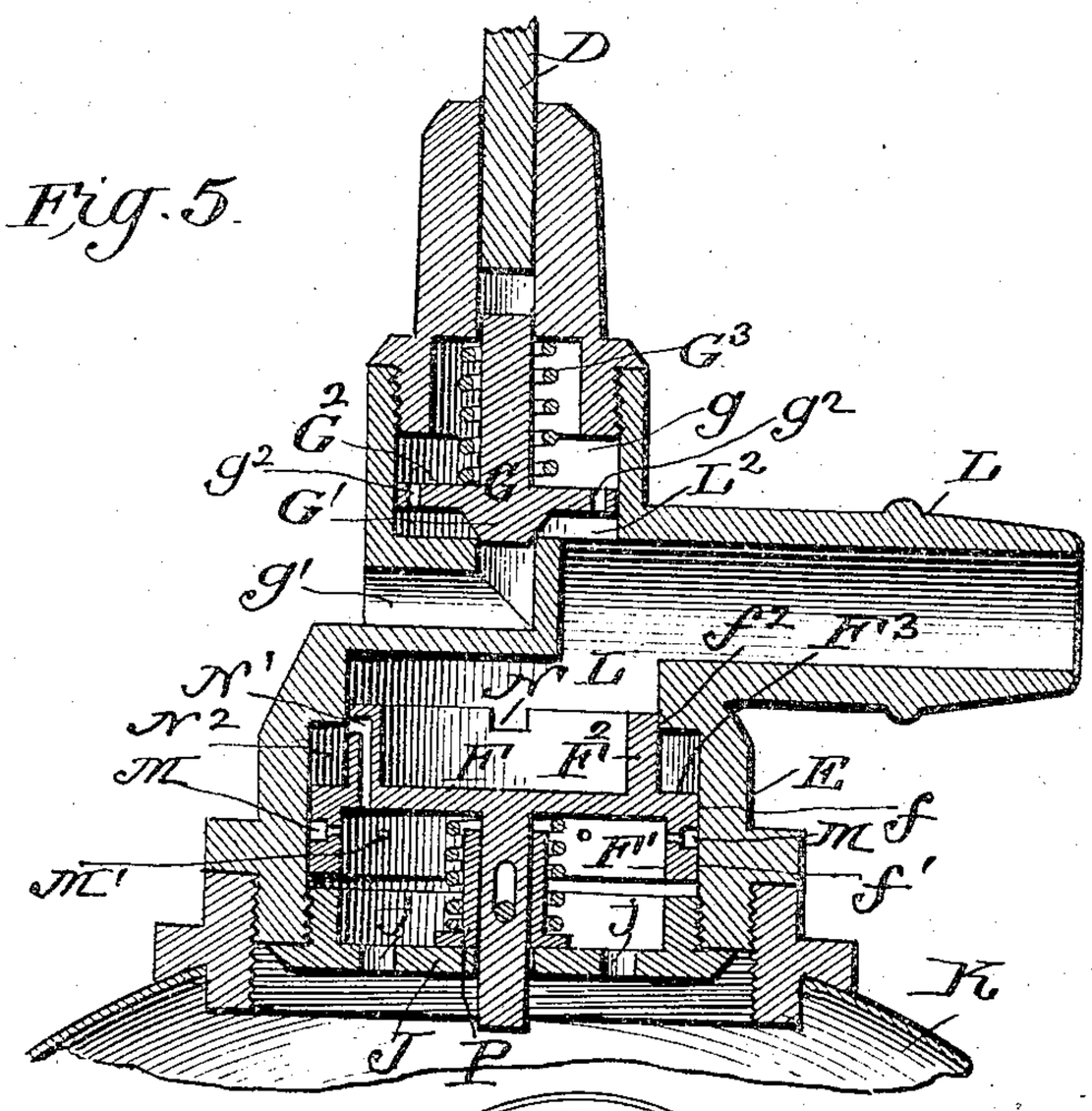
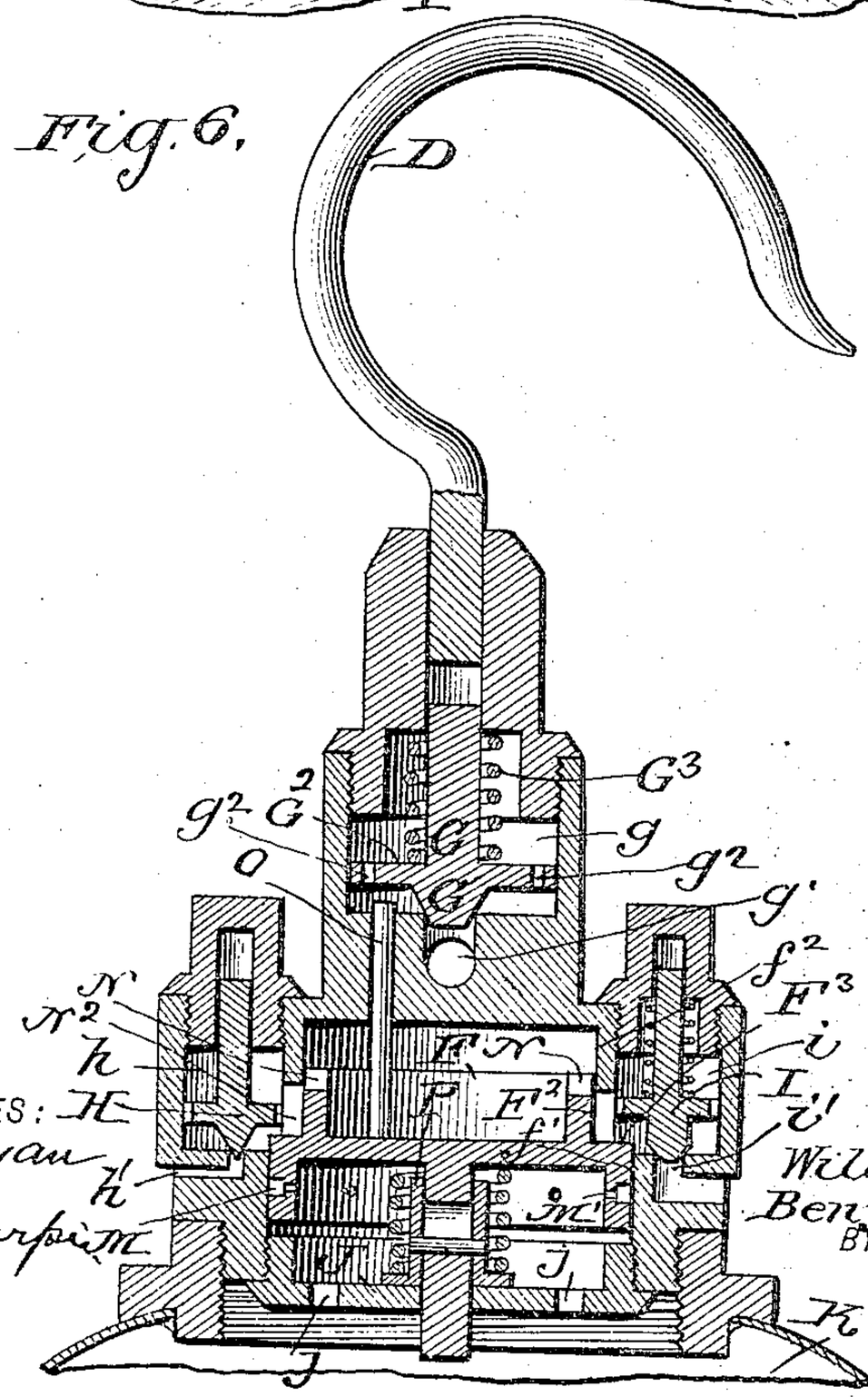


Fig. 6.



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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 7

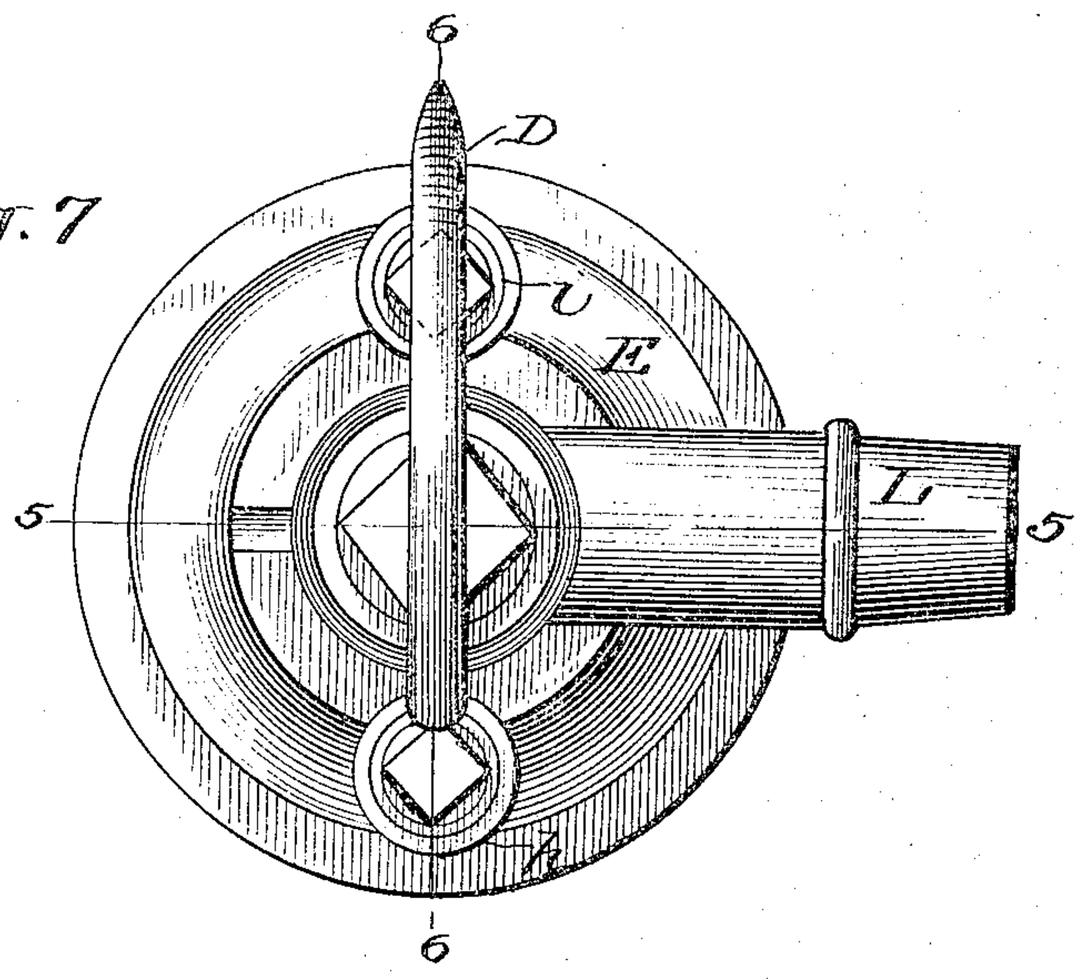


Fig. 9.

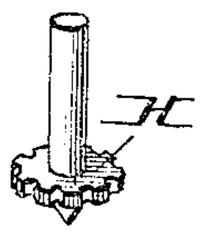


Fig. 8.

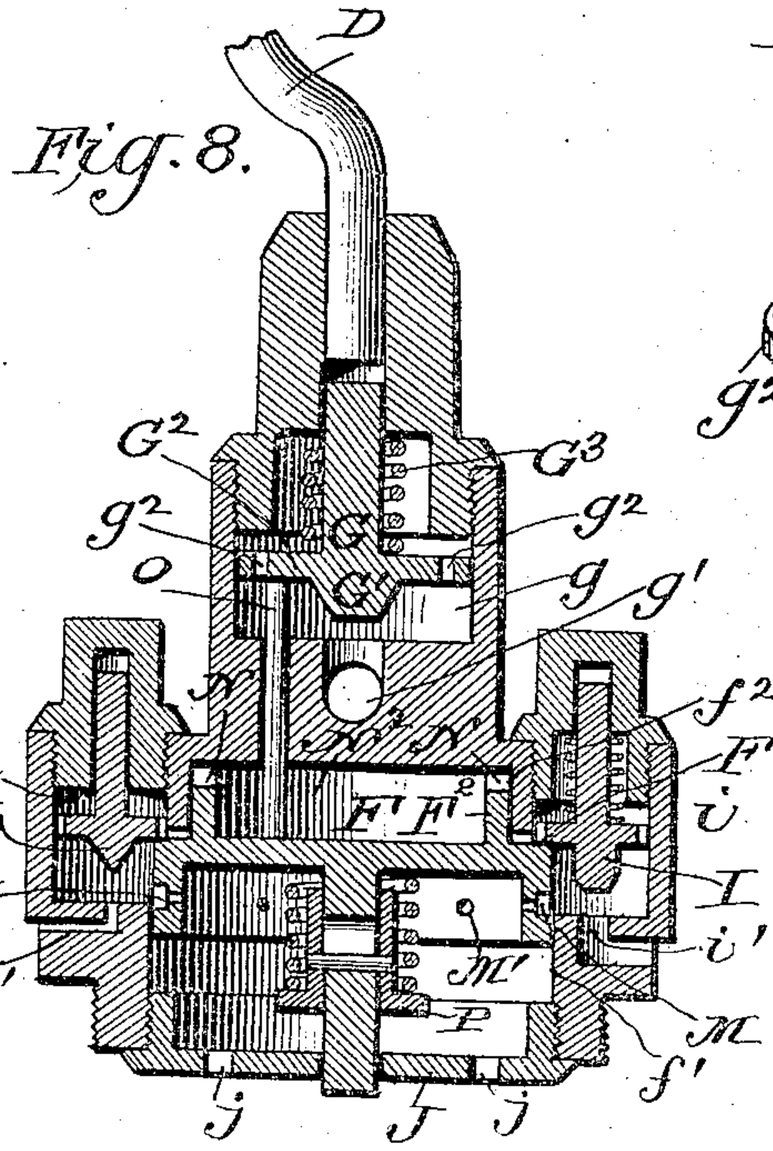


Fig. 11.

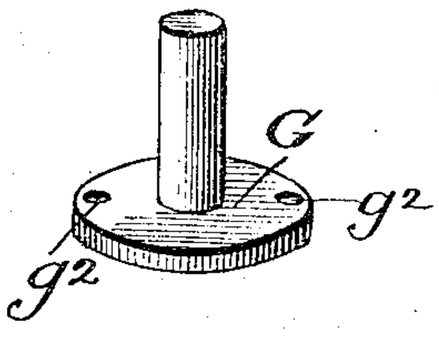


Fig. 10.

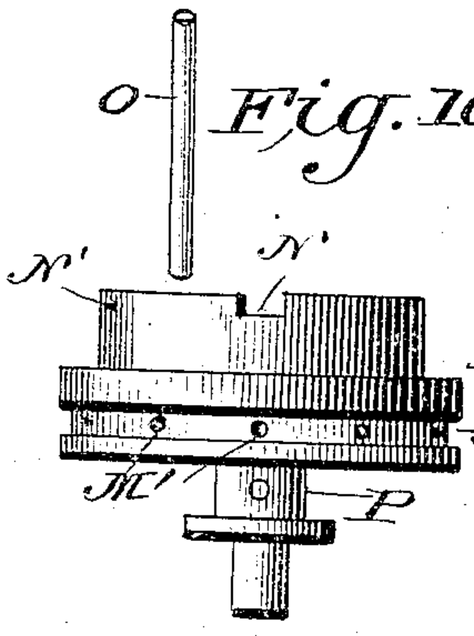
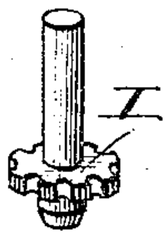


Fig. 12.



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No. 767,272. Patented August 9, 1904.

UNITED STATES PATENT OFFICE.

WILLIAM A. HARRIS AND BENJAMIN S. H. HARRIS, OF GREENVILLE, SOUTH CAROLINA, ASSIGNORS TO HARRIS MANUFACTURING COMPANY, A CORPORATION OF SOUTH CAROLINA, AND GEORGE W. TAYLOR, OF GREENVILLE, SOUTH CAROLINA.

AUTOMATIC CAR DISCHARGE-VALVE.

SPECIFICATION forming part of Letters Patent No. 767,272, dated August 9, 1904.

Application filed April 30, 1902. Renewed December 24, 1903. Serial No. 186,508. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM A. HARRIS and BENJAMIN S. H. HARRIS, citizens of the United States, and residents of Greenville, in the county of Greenville and State of South Carolina, have made certain new and useful Improvements in Automatic Car Discharge-Valves, of which the following is a specification.

This invention is an improvement in automatic car discharge-valves intended and adapted especially for use in train-signaling apparatus, and particularly in signaling apparatus wherein the signal is caused to sound by a slight reduction of pressure in the train-line; and the invention consists in the novel constructions and combinations of parts, as will be hereinafter described and claimed.

In the drawings, Figure 1 is a side view in diagrammatic form and partly broken away, illustrating the invention applied to a train. Fig. 2 is a detail side view showing the automatic discharge devices coupled in the train-line. Fig. 3 is a top plan view of the construction shown in Fig. 2. Fig. 4 is a detail perspective view of the automatic discharge devices detached. Fig. 5 is a vertical cross-section on about line 5 5, Fig. 7; and Fig. 6 is a vertical cross-section on about line 6 6 of Fig. 7, the operating-piston and the vent-valve and reservoir discharge-valve and main discharge-valve being shown in normal position in Figs. 5 and 6. Fig. 7 is a top plan view of the automatic discharge-valve. Fig. 8 is a vertical section similar to Fig. 6, except that in Fig. 8 the several valves are moved upward to their uppermost position as in the operation of producing the succeeding or relay reduction. Fig. 9 is a detail perspective view of the venting-valve. Fig. 10 is a detail side view of the operating-piston. Fig. 11 is a detail perspective view of the main discharge-valve, and Fig. 12 is a detail perspective view of the reservoir discharge-valve.

In the operation of signals in the locomotive-cab from the train-line it is usual in some classes of signals to effect the operation of the signal to the engineer by means of a slight reduction in the train-line, which reduction is effected by means of any suitable form of discharge-valve by which the slight reduction may be effected, it being understood that this slight reduction to operate the signal is not sufficient to operate the brakes. This slight reduction results in the production within the train-line of what is sometimes termed a "reduction-wave," and it has been found in practice that this reduction-wave will not ordinarily extend beyond about twenty cars from the point where the initial reduction is effected, but will die out and become ineffective beyond a certain limit, which limit may be twenty cars or may be more or less, twenty cars being about the limit according to our experience in the application and use of this class of signals. Therefore if a train includes more than twenty cars and it is desired to signal from the rear end of the train to the engineer the signals operated by the slight reduction of pressure in the train-line will be inoperative or unreliable at the best. It has therefore appeared to us important to provide means whereby the operation of the signal by the reduction of pressure in the train-line may be unlimited by the number of cars in the train, so that the signal can be operated from the rear of any train without regard to its length. It has also appeared to us important to secure this operation of the signal by means receiving their operating impulse either directly or indirectly from the initial reduction of pressure in the train-line.

We have found it desirable to secure the operation of the signal by reducing the pressure initially under the control of the operator, which may be effected in the usual manner, and subsequently automatically reducing the pressure in the train-line at a point remote from that of the initial reduction and also to secure this subsequent automatic reduction through the aid of the previous reduction and by means of the reduction-wave pro-

duced by the preceding reduction. In doing this we provide what for convenience of reference we term an "automatic discharge-valve," which is coupled in the train-line in such manner as to be operated by the slight reduction of pressure in said line and to operate as a relay, being operated by the previous reduction of pressure to produce a succeeding reduction of pressure by which to continue the previous reduction-wave, and we couple these automatic discharge-valves in the train-line at intervals spaced apart less than the number of cars constituting the limit of operation of the reduction-wave, so the initial reduction of pressure will operate upon the first discharge-valve, such discharge-valve will produce a relay reduction of pressure whose wave will pass on to the succeeding discharge-valve and operate the same, the latter producing the succeeding reduction of pressure, which will pass on to the next, and so on without regard to the length of the train, it being understood that any number, one or more, of the automatic discharge-valves may be provided, according to the length of the train.

With this explanation of the general purpose and operation of our invention we will proceed to a description of the automatic discharge devices, as shown in Fig. 4, and to the connection of same with the train-line, as shown in Figs. 1, 2, and 3. In this connection it will be understood that while our automatic discharge devices are shown coupled in the brake-pipe we do not wish to be limited to the application of the invention to such pipe, as the train-line referred to herein may be a special pipe provided for the purpose or any other extending throughout the train and carrying pressure. Therefore in referring to the train-line in the description and appended claims we desire to be understood as including therein any pipe carrying pressure and extending throughout the train.

In carrying out the invention the automatic discharge devices A, as shown in detail in Fig. 4, may be coupled in the train-line B, as shown in Fig. 1, which figure illustrates in diagrammatic form the application of the invention to a train of cars, the caboose or rear car being provided at C′ with a suitable discharge-valve, which may be operated to reduce pressure in the train-line B for the operation of the signal or for any other operation desired. It will also be understood that the train-line B is connected with a suitable signaling apparatus in the cab of the locomotive. (Not shown.) This signaling apparatus may be of any suitable form adapted for operation by a slight reduction of pressure in the train-line B. It will be understood from Fig. 1 that the automatic discharge devices A may be spaced apart a distance equal to the distance of twenty cars or such limit as may be found to exist with respect to the extent of the reduction-wave produced by the initial or preceding reduction of pressure in the train-line.

As will be understood from Figs. 3 and 4, the discharge device is portable and can be applied to the couplings between any two cars, being to such end provided with a hook D, by which it can be suspended from the train-line, as shown in Figs. 2 and 3, with a hose D′ for the passage of train-line pressure, and with a coupling-head D^2, provided with a passage D^3 for train-line pressure, and with a nipple at D^4, to which the hose D′ is connected, whereby the said hose receives train-pipe pressure, as will be understood from Figs. 3 and 4 of the drawings.

The head D^2 is provided at its opposite ends with standard coupling-sections D^5 for connection with the standard couplings D^6 on the hose of the train-line, the head D^2 being a double coupling of standard form, with the coupling-sections on opposite sides of the intermediate connection for the hose D′ for conveying train-pipe pressure to the automatic discharge-valve.

From the foregoing it will be seen that the automatic discharge device is entirely portable and can be carried in the cab and applied by the flagman or other trainman between any two cars whenever desired and can be applied to position and removed just as such trainhand hangs a lantern or flag or other portable appliance carried on the train. Further, by making the coupling-head with the opposite standard coupling-sections and between the same with a connection for the pipe for conveying pressure to the automatic valve the improved automatic valve can be readily applied to any train supplied with standard hose-couplings. By the described construction it will be noticed the automatic valve, as shown in Figs. 2 and 3, is in communication with the train-line and subject to the train-line pressure at all times. We thus provide an automatic discharge-valve provided with means whereby it may be connected with the train-line, and we embody in such automatic discharge-valve means for operation by a reduction of pressure in the train-line and whereby to secure a subsequent reduction of pressure in the said line.

In the specific construction of automatic discharge-valve shown we provide a casing E, which is provided with a chamber *f* for the main operating-piston F, a chamber *g* for the main discharge-valve G, a chamber *h* for the venting-valve H, and a chamber *i* for the reservoir discharge-valve I. The chamber *f* communicates at its lower end through openings *j* in a guide or stop plate J with the reservoir K, which is secured to the lower end of the casing E and which carries train-line pressure in the operation of the device, as will be presently described. The train-line pressure is

supplied through the hose D′, which connects with a nipple L and supplies train-line pressure through a port L′ to the top of the operating-piston F and through a port L^2 to the chamber *g* for the main discharge-valve, whence the train-line pressure is discharged through a port *g′* to the atmosphere, the port *g′* being controlled by the head G′ of the main discharge-valve, as shown in Figs. 5 and 6.

The discharge-valve G has the head G′ to control the port *g′* and is preferably provided with the guide-plate G^2, perforated at g^2, so the pressure may pass above it, and such valve G is preferably actuated by the spring G^3, which holds it normally to its seat, it being understood that this discharge-valve is always held onto its seat, as shown in Figs. 5 and 6, except when it is lifted from its seat or opened by the operation of the main operating-piston presently described. When the discharge-valve is raised to the position shown in Fig. 8, the train-line pressure reduces to the atmosphere through the port *g′*.

The chamber *f* for the operating-piston F is formed with a lower cylinder *f′* and an upper cylinder f^2, and the valve F has the lower piston portion F′ operating in the cylinder *f′* and the upper or smaller piston F^2 operating in the upper cylinder f^2, an upwardly-facing shoulder F^3 being provided on the outer side of the piston F at the juncture of the portions F′ and F^2, as shown in Figs. 5, 6, and 8. This shoulder F^3 operates the venting-valve H and the reservoir discharge-valve I to open position on the initial movement of the operating-piston F, as presently described. The larger portion F′ of the operating-piston F is provided in its outer side with a circumferential groove M, and a number of perforations M′ are formed through the portion F′, leading to the groove M, for the passage of pressure in the open position of the operating-piston, as shown in Fig. 8. The upper portion F^2 of the piston F is provided in its upper edge with notches N and is also provided with a laterally-opening port N′, extending from its outer side near its upper end and thence downwardly and opening below the diaphragm of piston F into the space within the lower portion F′ of the piston, as shown in Fig. 5. The difference in diameter between the portions F′ and F^2 of the piston F and the formation of the casing with the cylinders *f′* and f^2 provides at N^2 a chamber which in the position of parts shown in Fig. 6 is open to the train-line pressure, but when the piston is thrown to the position shown in Fig. 8 is cut off in such manner as to reduce the area of the upper side of the piston exposed to train-line pressure, so the pressure in the reservoir K can force the piston F to the position shown in said Fig. 8. This chamber N^2 is vented by the valve H through the port *h′* to the atmosphere on the initial movement of the piston F. In such movement of the piston F the shoulder F^3 engages the valve H, raises the same, opening the port *h′* and permitting the pressure in chamber N^2 to escape to the atmosphere. Then instantly the pressure in the reservoir K will force the piston F upward to the position shown in Fig. 8, which movement of the piston F is transmitted to the sliding rod O, which extends up into the chamber *g*, operates beneath the discharge-valve G, and opens said valve to permit the discharge of train-line pressure through the port *g′*. In its upward movement the piston F by the engagement of its shoulder F^3 with the reservoir discharge-valve I opens said valve I shortly after the vent-valve H is opened and raises the valve I, opening the port *i″* to the atmosphere. When the valve I is opened, the piston F travels upward to the position shown in Fig. 8, in which position its groove M will register with the chambers H and I, and the pressure in the reservoir K will reduce by passing outwardly and discharging from the groove M. Thus in the operation of the device the initial reduction of pressure in the train-line will operate to permit the upward movement of the main piston by the pressure in the reservoir K, which upward movement tends to cut off the chamber N^2 and to vent said chamber to the atmosphere, thus reducing the relative area of the piston exposed to train-line pressure compared to that exposed to reservoir-pressure, and the main piston will move up quickly to its uppermost position, opening the main discharge-valve, by which the pressure is reduced in the train-line. When the parts thus move to position shown in Fig. 8, the pressure in the reservoir will be reduced by the opening of the discharge-valve I and the parts will readjust toward normal position, the main discharge-valve closing and the train-line pressure operating upon the upper side of the operating-piston will force said piston downward below normal position until it bears upon its stop P. At this time the train-line pressure will pass through the notches N into the chamber N^2 and will thence pass through the passage N′ to the space within the lower portion F′ of the piston F and thence through the openings *j* in the guide-plate J to recharge the reservoir K, and when the pressure in the reservoir K equalizes with the train-line pressure the parts will reassume their normal position, (shown in Fig. 6,) the vent-valve H, main discharge-valve G, and reservoir discharge-valve I being closed and the operating-piston being adjusted to the position shown in Fig. 6, in which its notches N establish communication between the train-line and the chamber N^2 and thence through the passage N′ with the reservoir K.

By the described construction it will be seen that the reduction-wave produced in the train-

line at any point near enough to the automatic valve to influence the same will cause the operating-piston of said valve to so move by the action of the reservoir-pressure as to open the main discharge-valve, and thus produce a succeeding reduction in the train-line, which succeeding reduction will travel on to the next automatic valve or to the signal, as the case may be, and influence the same. It will be understood from the foregoing description that the pressure in the reservoir K will be very considerably reduced in the production of the succeeding reduction in the train-line, and as the reduction in the train-line will of course travel in both directions it will be asked why, in case two or more automatic valves are employed, the second or third automatic valve from the initial reduction will not operate upon the preceding automatic valve, and so produce a seesawing between two adjacent automatic valves, which would produce a confusion of the signals. To avoid this result, we arrange for the equalization of pressure in the reservoir K comparatively slowly and through the small port N′, so that when the succeeding reduction is effected by one automatic valve and the reduction-wave travels on to the next automatic valve the reservoir K of the first one of said valves will not have become charged with pressure when the wave produced by the second valve reaches it and there will not be sufficient pressure in the said reservoir to force its operating-piston upward to again discharge the pressure from the train-line.

While our invention is especially designed for use in operating signals, it will be understood that it will also operate advantageously as an aid in the emergency or service application of the brakes on long trains, as at such times when the automatic valve is connected with the brake-pipe the reduction in the latter will operate to effect a discharge of air from the brake-pipe and so improve the operation of the brakes on long trains. This operation of the automatic valve in the emergency or service application of the brakes will not necessarily operate the signal, as some signaling apparatus are so constructed as to prevent the sounding of the signal in the service or emergency application of the brakes; but as such construction of signal forms no part of the present invention it need not be described in detail herein.

It will be understood from the foregoing that we provide an apparatus for use in connection with a train-line which will automatically discharge pressure from the train-line by means operated by a preceding reduction of pressure in said line. This seems to involve an important advance in the methods of operating signals by reduction of pressure in the train-line, such method consisting in initially reducing the pressure in the train-line under the control of the operator and subsequently reducing pressure in the train-line at a point remote from that of the initial reduction, and, furthermore, in securing such subsequent automatic reduction of pressure through the aid of the reduction-wave produced by the initial or preceding reduction.

By this invention we are able to operate signals without being limited by the length of the train-line, the first or initial reduction operating the first automatic discharge-valve, the reduction effected by such discharge-valve passing on to operate the signal or, in case a second discharge-valve is employed, to operate such discharge-valve, and so on throughout the series of discharge-valves when the length of the train is such as to necessitate the use of more than one automatic discharge-valve.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. An automatic discharge-valve comprising the casing having the train-line connection and the main discharge-port, the main discharge-valve operating between said port and the train-line connection, the reservoir connected with the casing, the operating-piston between the reservoir and the train-line connection, means for cutting off a portion of the operating-piston from exposure to the train-line pressure subsequent to the initial movement of said piston, and means whereby the operating-piston may open the main discharge-valve when pressure in the train-line is reduced relatively to that in the reservoir.

2. The combination in an automatic discharge-valve of the main discharge-valve, the main operating-piston, the reservoir, the casing having a train-line connection, the operating-piston being arranged for initial opening movement by reduction of the pressure in the train-line, and the reservoir discharge-valve arranged for operation by the initial movement of the operating-valve whereby the pressure in the reservoir may be quickly reduced, and means whereby the main operating-piston may operate the main discharge-valve, substantially as set forth.

3. In an apparatus substantially as described the combination with the casing and the operating-valve therein of the reservoir discharge-valve arranged to be opened by the operating-valve, the latter having ports for the passage of pressure to the chamber of the discharge-valve substantially as set forth.

4. In an apparatus substantially as described the combination of the casing, the vent-valve, the operating-piston arranged to open the vent-valve, the main discharge-valve, and means whereby the operating-piston may open the discharge-valve substantially as set forth.

5. An automatic discharge device comprising the reservoir, the valve-casing connected

therewith, the main operating-piston arranged for operation by the pressure in the reservoir, the hose connection for conveying train-line pressure to the valve-casing, and the main discharge-valve controlling the discharge of the train-line pressure and arranged for operation by the main operating-piston substantially as set forth.

6. An automatic discharge device comprising a reservoir, a valve-casing connected with the reservoir, means for connecting the casing with the train-line, a main discharge-valve, and an operating-piston between the reservoir-pressure and the train-line pressure, means for cutting off a portion of the operating-piston from exposure to the train-line pressure subsequent to the initial movement of said piston, and means whereby the operating-piston may open the main discharge-valve when the pressure in the train-line is reduced substantially as set forth.

7. A portable automatic discharge device provided with a hose, whereby it may be coupled in the train-line between the cars and having a reservoir and an operating-valve between the said reservoir and the train-line and means whereby said valve may on a reduction of pressure in the train-line effect a further reduction of said pressure, and means independent of the hose for supporting the discharge devices substantially as set forth.

8. An automatic discharge device, comprising the connected valve-casing and reservoir provided with means whereby they may be suspended from a train-line, operating devices in the valve-casing, a connection between the valve-casing and the main line, and coupling devices for coupling such connection in with the main line, substantially as set forth.

9. A portable automatic discharge device comprising the casing provided with a hook whereby it may be suspended from the train-line, the reservoir connected with said casing, the hose connected at one end with the casing and provided at its other end with a coupling whereby it may be coupled in the train-line, and means in the casing operating on a reduction of pressure in the train-line to secure a further reduction of said pressure substantially as set forth.

10. As a means for aiding in operations effected by the reduction of pressure in a train-line, an automatic discharge-valve comprising a casing, valve devices operating therein, a hose connected at one end with the casing and means at the other end of the hose whereby it may be coupled in with the train-line between cars.

11. The combination of the casing, the reservoir connected therewith, the operating-piston having upper and lower piston portions of different diameters operating in corresponding cylinders in the casing, the lower portion being provided with the outer annular groove and with openings leading thence below the piston and the upper portion being provided with notches in its upper edge and with a passage for pressure such passage opening at its upper end through the outer side of the upper piston portion and at its lower end below the operating-piston, a chamber being provided within the casing and surrounding the upper portion of the operating-piston, the vent-valve for venting said chamber and arranged for operation by the operating-piston, the reservoir discharge-valve arranged for operation by the operating-piston, the main discharge-valve for discharging train-line pressure to the atmosphere and means for operating said main discharge-valve by the operating-piston substantially as set forth.

12. The combination in an automatic discharge-valve of the casing having a connection for the train-line pressure and a main discharge-valve controlling the train-line pressure, the reservoir connected with the casing, the vent-valve and reservoir discharge-valve operating in the casing, the operating-piston arranged to open the vent-valve and the reservoir discharge-valve, and means whereby the operating-piston may open the main discharge-valve substantially as set forth.

13. The combination of the casing the main discharge-valve, the reservoir discharge-valve, and the operating-piston arranged to open the main discharge-valve and also to open the reservoir discharge-valve and provided with a port or passage through which pressure may discharge from the reservoir subsequent to the opening of the reservoir discharge-valve substantially as set forth.

14. The combination, in an automatic discharge-valve, of the casing, the main operating-piston therein, and a yielding support whereby the main operating-piston may be depressed below its normal position in order to facilitate the recharging of the reservoir substantially as set forth.

15. In an automatic discharge-valve an operating-piston having upper and lower portions of different diameters and provided in the lower portion with an annular groove vented below the piston, and in the upper portion with a passage N′ opening below the piston substantially as set forth.

16. The combination in an apparatus substantially as described of the casing, valve devices operating therein, a hose connected at one end with the casing, and a double coupling at the opposite end of the hose whereby it may be coupled with the train-line between cars.

17. A portable apparatus substantially as described for application to a train-line, comprising a casing, valve devices therein and arranged for operation by a reduction of pressure in the train-line, means whereby the cas-

ing may be supported, a hose connected at one end with the casing for delivering train-pipe pressure thereto, and means whereby the hose may be coupled in with the train-line between cars.

18. A portable apparatus for application to a train-line comprising a casing having valve devices arranged for operation by reduction of pressure in the train-line and standard-hose-coupling sections in connection with said casing for coupling with corresponding sections on the train-line substantially as set forth.

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