No. 827,142. PATENTED JULY 31, 1906.

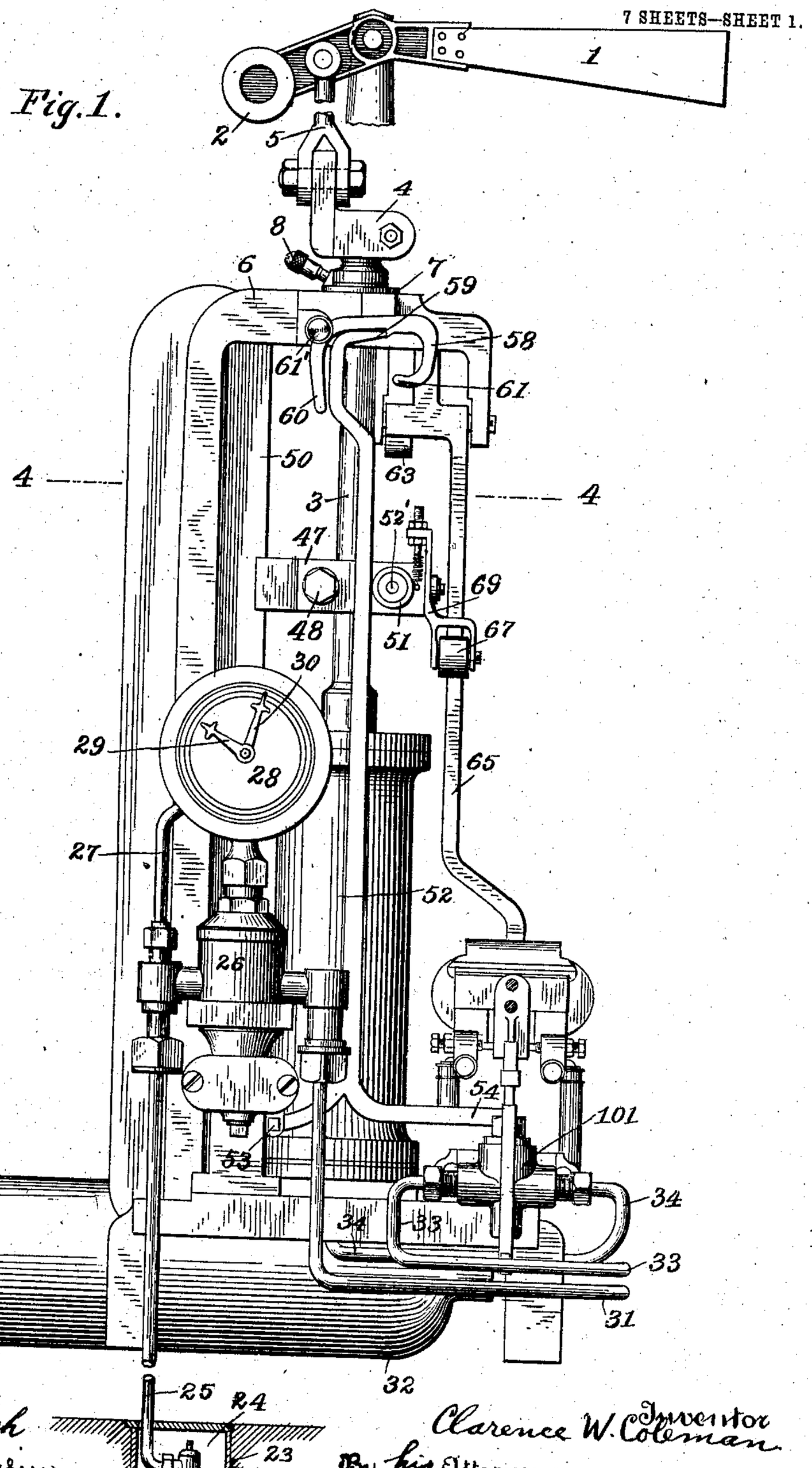
C. W. COLEMAN.

SWITCH AND SIGNAL APPARATUS.

APPLICATION FILED NOV. 2, 1903.

7 SHEETS—SHEET 1.

Fig. 1.



Witnesses
F. N. Roehrich
E. L. Lonsdale

Inventor
Clarence W. Coleman
By his Attorneys
Kenyon and Kenyon.

No. 827,142. PATENTED JULY 31, 1906.

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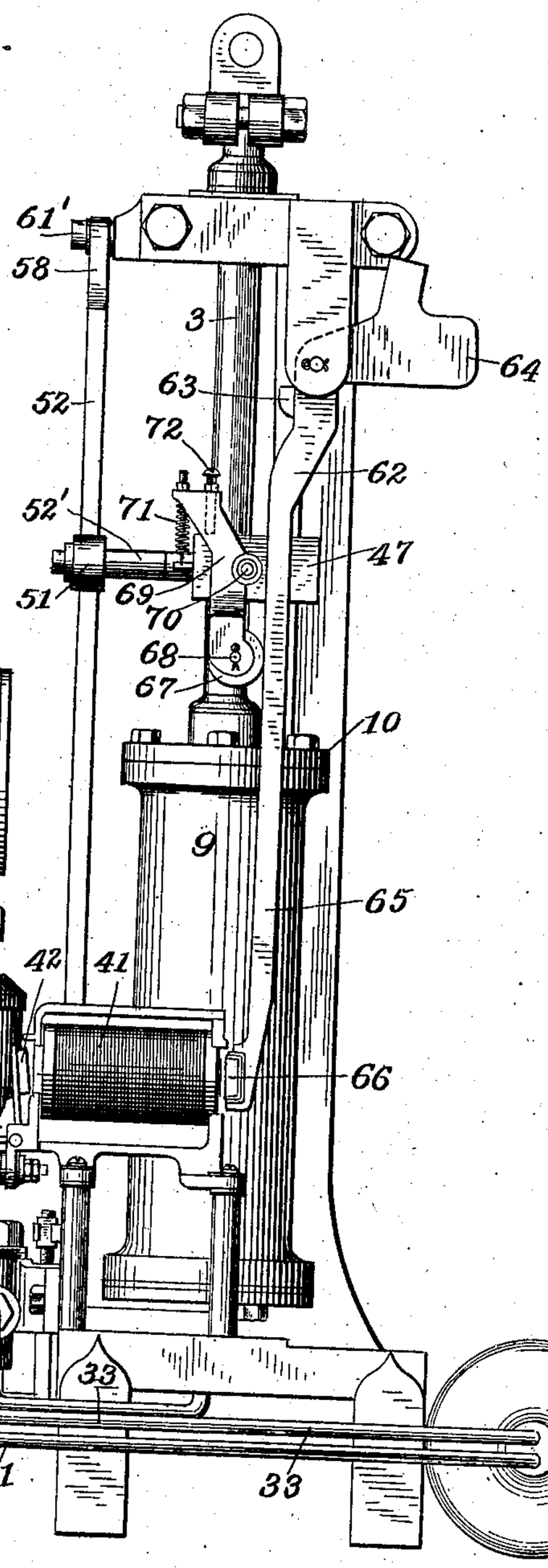
7 SHEETS—SHEET 2.

Fig. 2.



Witnesses
F. N. Rochrich
E. L. Ironmeline

Clarence W. Coleman Inventor
By his Attorneys
Kenyon & Kenyon

No. 827,142. PATENTED JULY 31, 1906.

C. W. COLEMAN.

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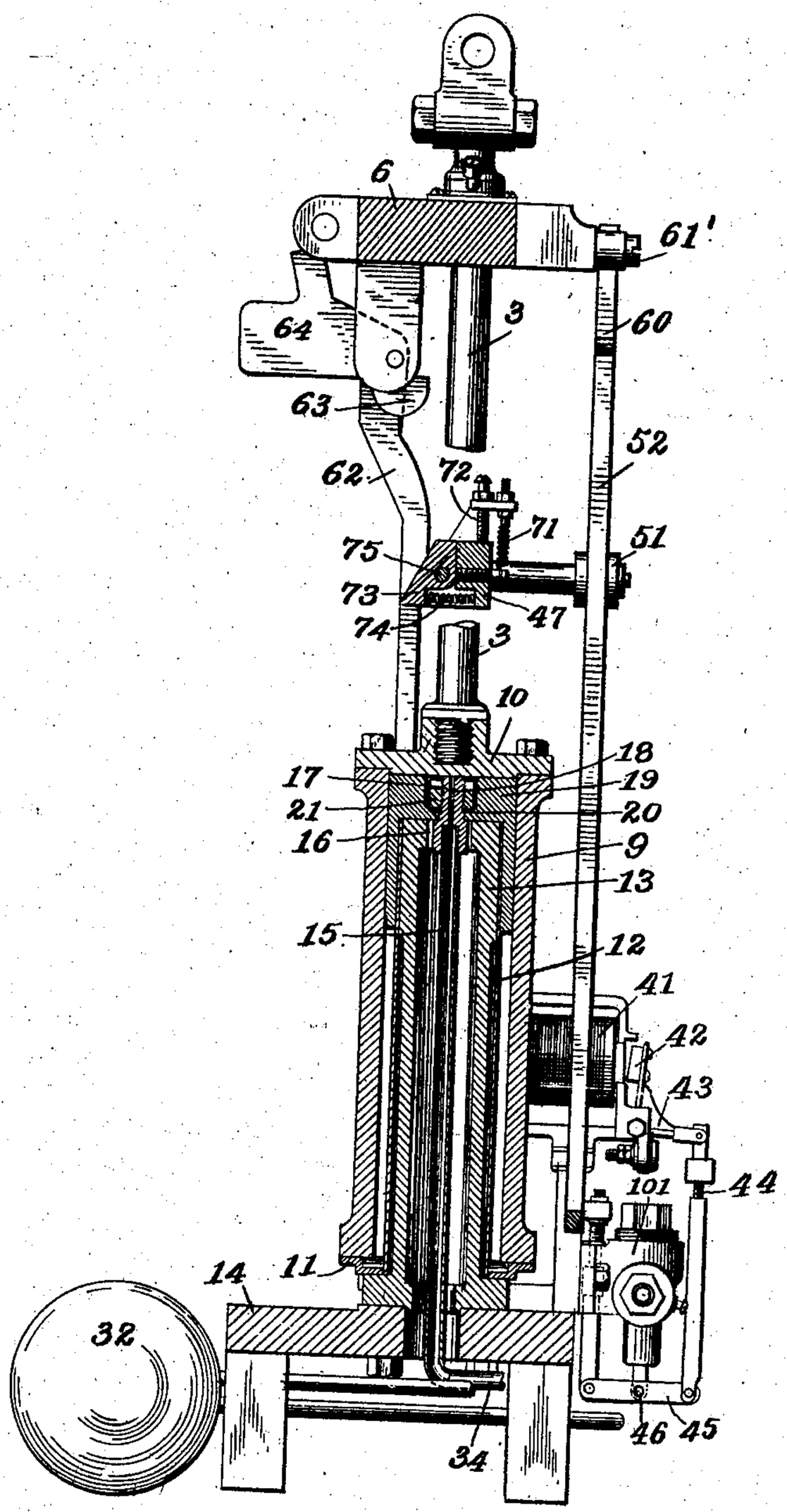
7 SHEETS—SHEET 3.

Fig. 3.



Witnesses
F. N. Roehrich
E. L. Bonnell

Inventor
Clarence W. Coleman
By his Attorneys
Kenyon & Kenyon

No. 827,142. PATENTED JULY 31, 1906.

C. W. COLEMAN.

SWITCH AND SIGNAL APPARATUS.

APPLICATION FILED NOV. 2, 1903.

7 SHEETS—SHEET 4.

Fig. 4.

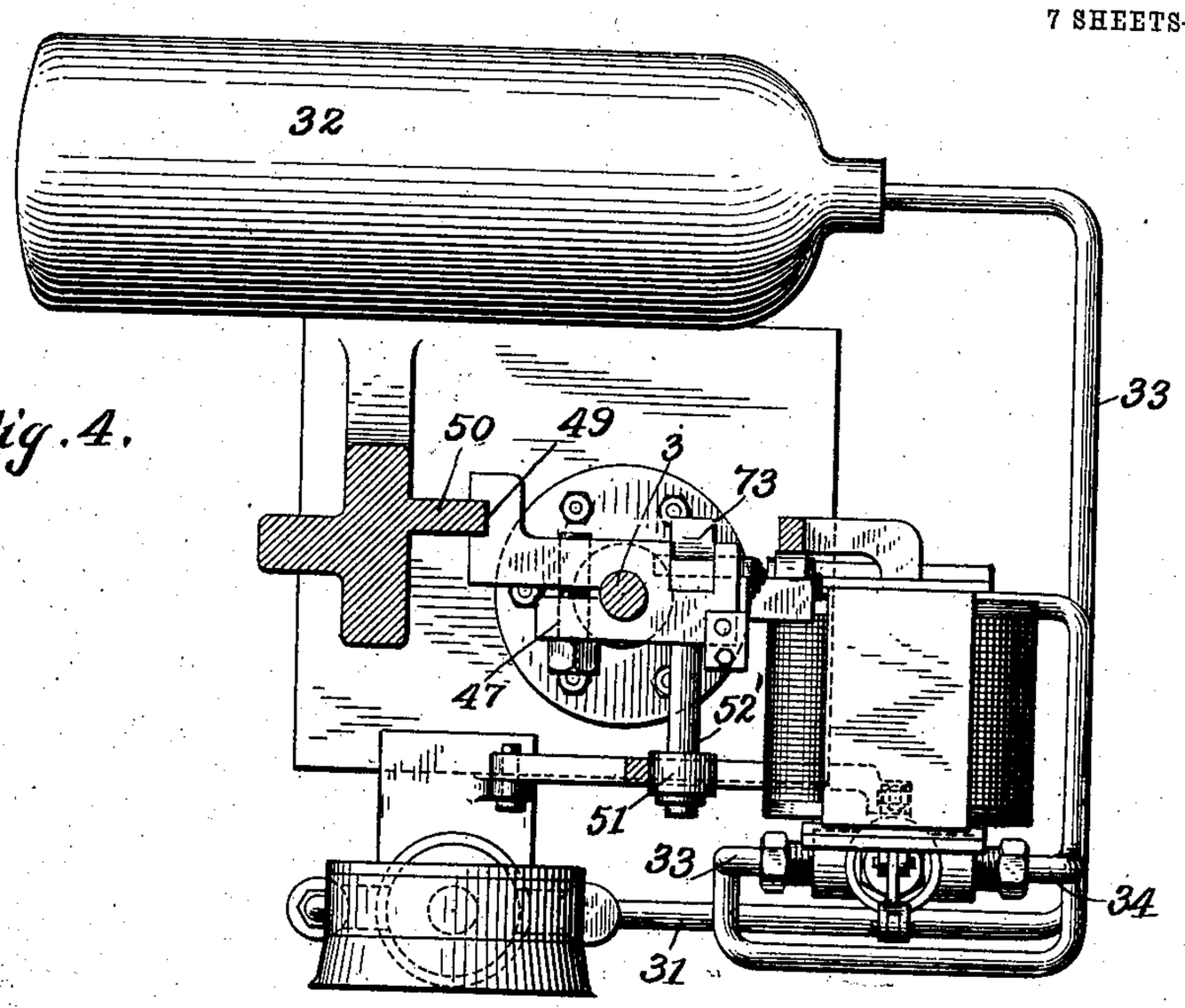


Fig. 5.

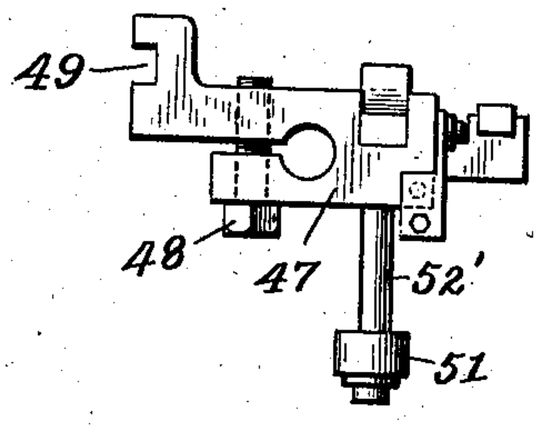


Fig. 6.

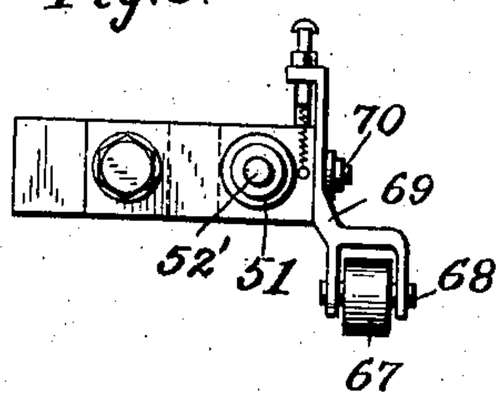
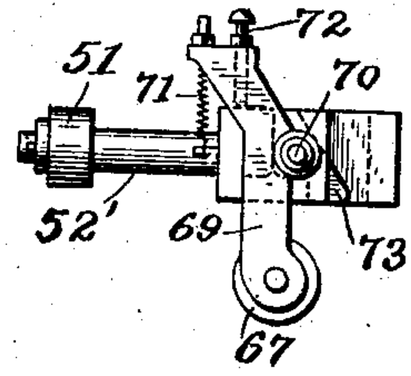


Fig. 7.



Witnesses
F. N. Roehrich
E. L. Semelius

Clarence W. Coleman Inventor
By his Attorneys
Kenyon & Kenyon.

No. 827,142. PATENTED JULY 31, 1906.

C. W. COLEMAN.

SWITCH AND SIGNAL APPARATUS.

APPLICATION FILED NOV. 2, 1903.

7 SHEETS—SHEET 5.

Fig. 8.

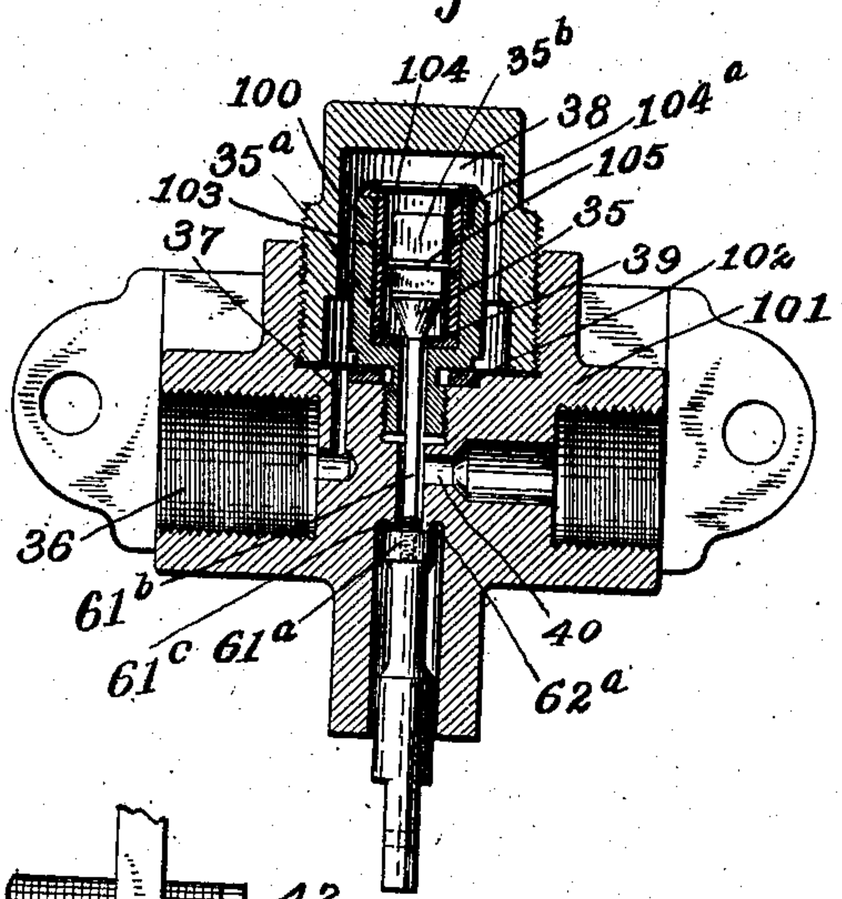


Fig. 9.

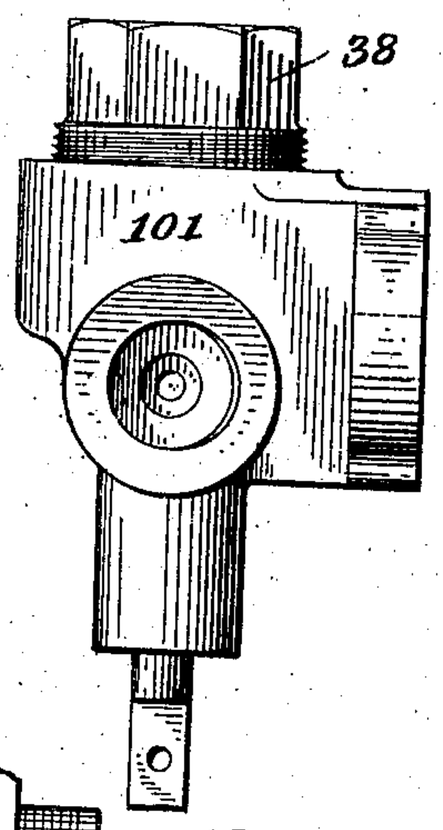
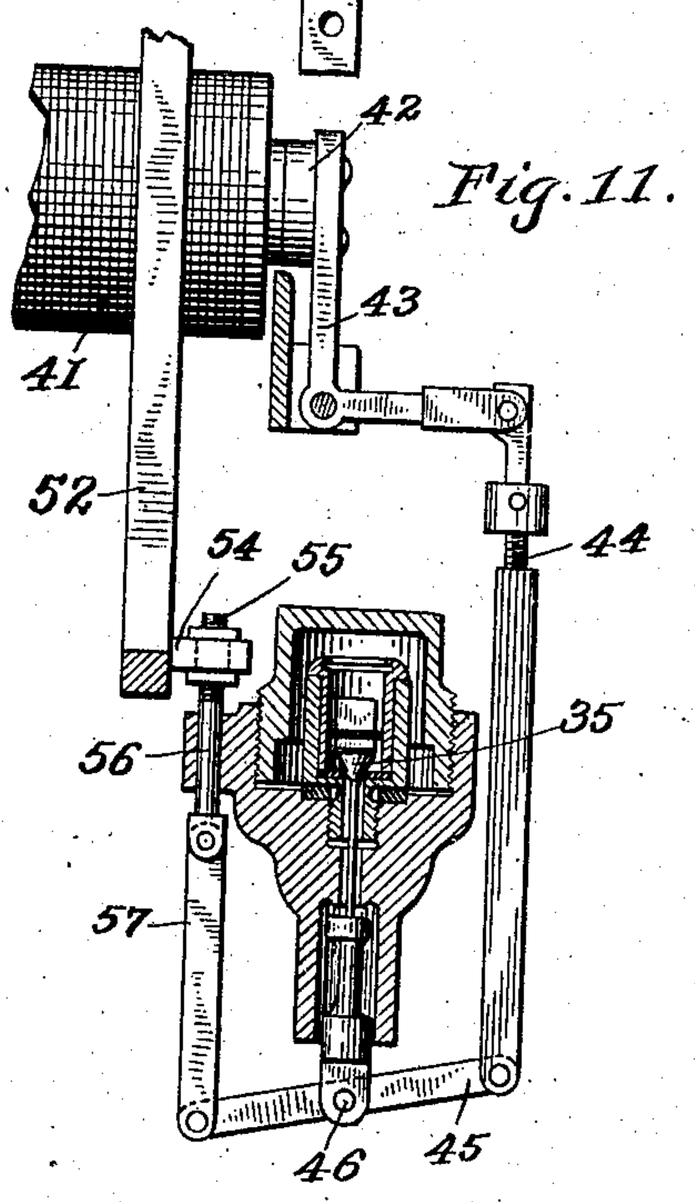


Fig. 10.

Fig. 11.



Witnesses
F. N. Roehrich
E. L. Townsend

Inventor
Clarence W. Coleman
By his Attorneys
Kenyon & Kenyon

No. 827,142.

PATENTED JULY 31, 1906.

C. W. COLEMAN.

SWITCH AND SIGNAL APPARATUS.

APPLICATION FILED NOV. 2, 1903.

7 SHEETS—SHEET 6.

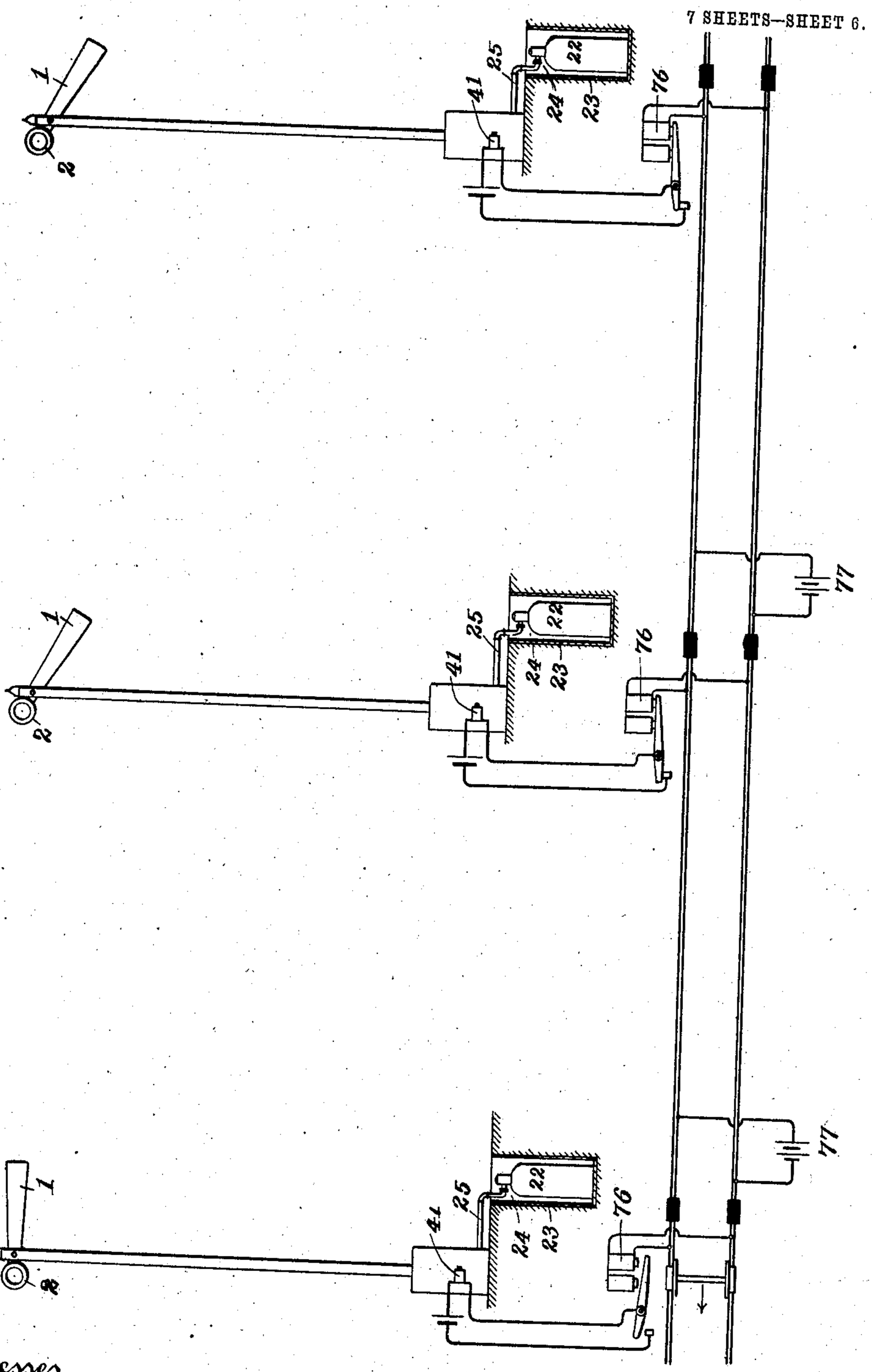


Fig. 12.

Witnesses
F. N. Rochrick
E. L. Townsend

Clarence W. Coleman Inventor
By his Attorneys
Kenyon and Kenyon

No. 827,142. PATENTED JULY 31, 1906.

C. W. COLEMAN.

SWITCH AND SIGNAL APPARATUS.

APPLICATION FILED NOV. 2, 1903.

7 SHEETS—SHEET 7.

Fig. 13.

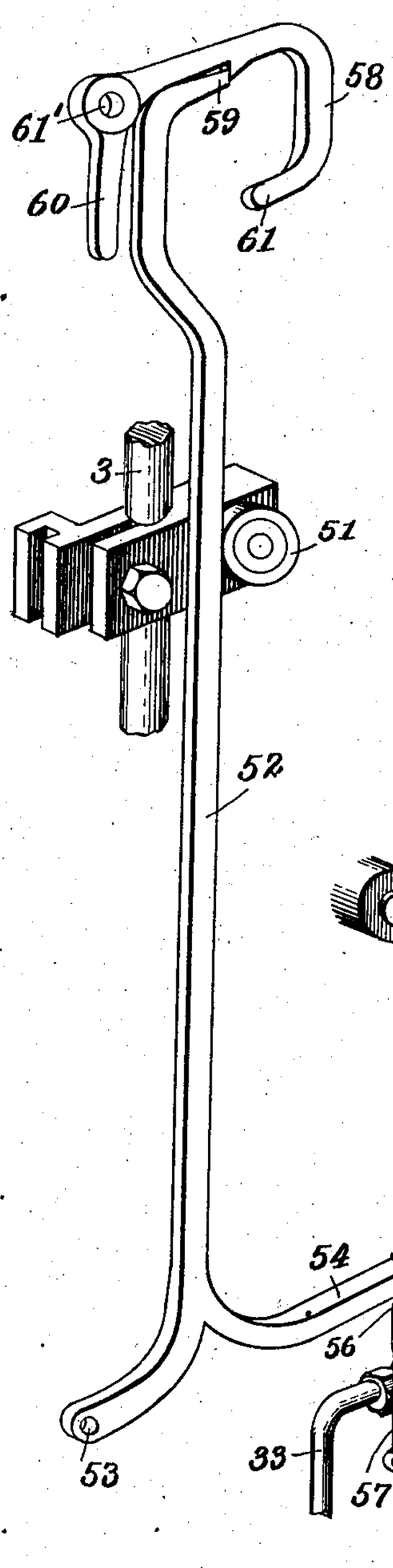
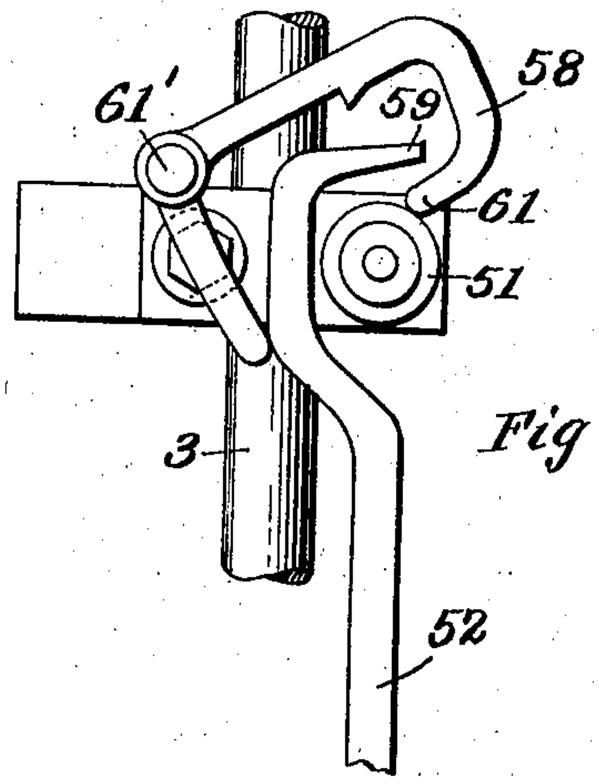


Fig 14



Witnesses
William F. Bissing
E. L. Greenleaf

Inventor
Clarence W. Coleman
by Kenyon & Kenyon
his Attorneys

UNITED STATES PATENT OFFICE.

CLARENCE W. COLEMAN, OF WESTFIELD, NEW JERSEY, ASSIGNOR TO THE HALL SIGNAL COMPANY, A CORPORATION OF MAINE.

SWITCH AND SIGNAL APPARATUS.

No. 827,142. Specification of Letters Patent. Patented July 31, 1906.

Application filed November 2, 1903. Serial No. 179,537.

To all whom it may concern:

Be it known that I, CLARENCE W. COLEMAN, a citizen of the United States, residing at No. 32 Charles street, Westfield, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Switch and Signal Apparatus, of which the following is a specification.

My invention relates to signals, switches, and the like, and particularly to that class of railway appliances and systems for controlling traffic on railways that are adapted to be actuated by fluid-pressure.

In such systems the railway-traffic-controlling apparatus is disposed at local points along a railway-line to permit and control the passage of traffic at these points on the line.

In particular my invention relates to a signal apparatus in which the preferred form of motive power is liquefied carbonic-acid gas.

The object of my invention is to provide an efficient means for the utilization of fluid-pressure without leakage and to reduce to a minimum the number of valves that are necessary to control the supply of fluid to the operating mechanism and to operate the valves so as to secure certain action at all times.

A further object of my invention is to so locate the flasks containing the storage-supply of compressed gas that they will be free from excessive variations of temperature and so that also the size of the signal-casing may be reduced.

A further object of my invention is to improve the retaining device for the signal.

With these and other objects in view my invention consists in the parts, improvements, and combinations more fully set forth hereinafter.

In the accompanying drawings, annexed to this specification and forming a part thereof, Figure 1 is a front view of one form of my invention, the particular embodiment thereof being a railway-signal. Fig. 2 is a side elevation of the right-hand side of Fig. 1. Fig. 3 is a vertical section. Fig. 4 is a horizontal section on the line 4 4 of Fig. 1. Figs. 5, 6, and 7 show details. Fig. 8 is a section through the valve mechanism. Fig. 9 is an elevation of the housing for the valve mechanism. Figs. 10 and 11 illustrate the means for operating the valves, two positions of the valves being shown. Fig. 12 illustrates the circuits that are used to operate the signal. Fig. 13 is a perspective view of the valve-operating means. Fig. 14 is a detail.

Referring now to the drawings in detail, 1 represents an ordinary form of signal, the particular embodiment illustrated being in the form of a signal-blade.

2 indicates the weighted spectacle, the weight of which is sufficient to overbalance the signal-blade and normally bias the signal to the danger position. In the form of the invention illustrated upon the drawings this weight serves also to return the signal and its mechanism.

Any suitable means for connecting the signal with the operating mechanism may be used. In the form shown upon the drawings the rod 3 is connected to the moving member of the operating mechanism at one end. At the other end the rod 3 is provided with a connecting device consisting of the clamp 4, to which the signal-rod 5 is connected. The rod 3 passes through a bearing in frame 6. A dust-guard 7 and an oil-cup 8 are attached to the frame, serving, respectively, to prevent the dust from getting into the bearing for the rod 3 and to lubricate said bearing.

Any form of operating mechanism actuated by fluid-pressure may be used for moving the signal in one direction to alter its position of indication. In the form of my invention illustrated upon the drawings I have shown a piston and piston-chamber for accomplishing this result. In the particular embodiment of the invention illustrated I utilize the movement of the cylinder to actuate the signal. The construction of the piston and piston-chamber is such as to prevent any appreciable leakage of gas during the operation and to permit the smooth action of the parts and also to protect the working parts from dirt and corrosion. The cylinder 9 has securely bolted thereto at one end the end plate 10, into which the connecting-rod 3 is screwed. The other end of the cylinder is closed by any suitable means, so as to prevent the access of moisture to the working parts within the cylinder. This means may be widely varied. In the form of my invention shown in the drawings I make use of a cap-plate 11, secured to the cylinder 9. I also preferably provide a sleeve 12, made of

some non-corrodible material, such as brass, for protecting the pedestal 13. In the form of the invention shown in the drawings the pedestal is made hollow and is mounted upon the base-plate 14. The pedestal is made hollow, so as to give sufficient space to permit the introduction of the supply-pipe 15 through said pedestal and to permit its ready removal therefrom in setting up and repairing the apparatus. It will be noted that the cap-plate 11 fits the protecting-sleeve 12 snugly, which insures a smooth guiding action for the cylinder and avoids the circulation of moisture around the working parts.

At the top of the pedestal 13 there is provided a square opening 16, through which the screw-threaded nipple 17 is inserted, the nipple being provided with a bore 18. In assembling the parts the nipple is first inserted through the square opening, the piston 19 is then dropped upon the pedestal, a packing-ring 20 is then placed around the outside of the nipple, and the nut 21 is screwed down upon the packing-ring. This firmly secures the parts together and prevents the leakage of gas through the hollow pedestal to the atmosphere.

Any suitable means for supplying and controlling the admission of fluid-pressure to the operating mechanism may be used.

In the preferred form of my invention a storage-supply of liquefied gas, such as carbonic-acid gas, is stored in the flask 22. This flask I preferably locate within a receptacle 23, located in the pit 24. By this means the flask of gas is preserved from excessive variations of temperature and from the extreme variations of pressure which would result from large fluctuations in the temperature of the flask if the latter were exposed to the direct rays of the sun. The temperature of the ground being more uniform than that of the atmosphere insures a more uniform temperature and pressure for the gas in the flask. This is particularly desirable when a liquefied gas, such as liquefied carbonic-acid gas, is used. The gas as it issues from the flask under high pressure passes through the pipe 25 into the reducing-valve 26. A branch pipe 27 communicates with a pressure-gage 28, the pointer 29 of which gives the pressure in the flask. The reducing-valve is of the ordinary construction and is fully disclosed in the patent to Nageldinger, No. 519,089, May 1, 1894, and needs no further description here. After the pressure of the gas has been reduced by the reducing-valve, the reduced pressure being indicated by the pointer 30, the gas passes through the pipe 31 into the expansion-chamber 32. This expansion-chamber removes any difficulties which may arise by the formation of carbonic-acid snow. From the expansion-chamber 32 the gas passes, by means of the pipe 33, into the means for controlling the admission of the gas to the operating mechanism. After passing through the controlling mechanism the gas passes through the pipe 34 into the piston-chamber of the operating mechanism.

Any suitable means for controlling the admission of the gas to the piston-chamber may be used. The motive fluid being preferably stored in local storage-tanks, it is desirable to minimize the leaks, and thus prevent the waste of gas, and thus avoid a reduction in the number of operations for each tank full of fluid. The greater the number of valves between the supply-tank and the piston-chamber, other things being equal, the greater the tendency to leak, since each valve-seat and packing affords a source of leakage. I reduce the number of valves and simplify their construction and operation. I prefer to use a single valve between the gas-supply and the piston-chamber. It is also desirable to suitably control the valve mechanism under all conditions that arise in practice. To effect this result, I control the movement of the valve in one direction by an electromagnet and return the valve by the weight of the parts or by means of a suitably-arranged spring. I also prefer to close the valve independently, and I prefer to use means controlled by the movement of a part of the operating mechanism, which part in the embodiment of the form of the invention illustrated is the piston-chamber.

In the preferred embodiment of my invention I make use of an admission-valve 35. The gas entering at a low pressure at the inlet 36 passes through the opening 37 into the chamber 38 and thence through the valve-port 39 to the supply-pipe for the piston-chamber by way of the passage 40.

I make use of an electromagnet 41, the energization of which controls the movement of the admission-valve in one direction. In the best embodiment of my invention the energization of the electromagnet 41 is controlled by a railway-train. In the form of the invention shown upon the drawings the energization of the magnet operates to open the admission-valve. Any suitable means may be used to transmit the action of the magnet to the valve. In the drawings the magnet 41 is provided with an armature 42, and the movement of the armature is utilized to control the movement of the valve. Any suitable form of controlling mechanism may be used. In the form illustrated I have shown suitable connections between the armature of the magnet and the valve. These connections may be widely varied; but in the form illustrated they consist of a bell-crank 43, an adjustable connection 44, the adjustment of which acts to regulate the position of the armature. Any suitable means for transmitting the movement to the valve may be used. In the form of my invention illustrated upon the drawings I make use of a link

45, which may be connected to the valve mechanism in any desired manner, but is preferably pivoted to the valve-rod at 46.

The energization of the magnet 41 moves the valve in one direction. Any suitable means may be used to return it. In the form of the invention illustrated the weight of the valve and of the connections is such that gravity acts to return the parts, the force of gravity being assisted by the pressure of the gas. In the particular embodiment of the invention illustrated the gas-pressure is always effective to urge the admission-valve toward its seat, whether the valve is open or closed. A spring may also be used to move the valve in the direction opposite to the movement given to it by the electromagnet. A means is thus always provided for returning the admission-valve, no matter whether the operating mechanism for the signal or switch has made a complete stroke or not. I also provide a means for closing the admission-valve, which means is preferably controlled by the movement of one of the parts of the signal or switch operating mechanism. In the form of the invention illustrated upon the drawings this means is thrown into action when the piston-chamber reaches the end of its stroke. The means for closing the admission-valve controlled by the movement of the piston-chamber is as follows:

Any suitable movable part of the apparatus may be used to control the closing of the admission-valve. In Fig. 1 the rod 3 is provided with a bracket 47, which is clamped to the rod by means of a bolt 48. I provide a suitable guiding means for insuring the correct position of the parts carried by this bracket, and in the present instance I have shown a groove 49, sliding along the guiding-rib 50 to perform this function. The bracket is provided with an operating-roller 51, freely mounted upon a stud 52′, projecting from the bracket. The connections between the moving element of the mechanism and the parts operated thereby may be widely varied. In the form of the invention illustrated the roller 51 is caused to act upon suitable connections to the valve mechanism, which are as follows: A lever 52 is pivoted at 53 to the frame of the machine. An arm 54 of the lever is connected to the valve mechanism in any desired manner. I have shown this connection as adjustable at 55, the threaded rod 56 being adjustably connected to the arm 54. Any suitable connections may be provided for transmitting the movement to the valve mechanism. In the form of the invention illustrated I interpose between the link 45 and the rod 56 suitable connections, such as the link 57.

It will be observed that the lever 52 is so arranged with relation to its pivot 53 that the weight of the lever acts to close the admission-valve. The lever 52 is prevented from moving until desired by suitable means. In the form of the invention illustrated I make use of a lever 58, the shoulder 59 of which engages with the top of the lever 52. The tail 60 of the lever is arranged so as to be able to engage the back of the lever 52 at the top. When the roller 51 rises, it first engages the latch 58, and the lever 52 drops by gravity toward the roller. I prefer, however, to insure this movement of the lever 52, if necessary, by forcibly acting upon it, and this I accomplish by so arranging the roller 51 with relation to the part 58 that the roller engages the toe 61 of the lever 58 and swings the lever about its pivot 61′. The tail 60 of the lever will then force the lever 52 toward the right in Fig. 1. (See Fig. 14.) This movement is transmitted to the valve and the valve is closed, so that no more gas can enter the cylinder.

I will now describe the means for permitting the gas to exhaust from the operating mechanism. An exhaust-valve 61ª, which engages its seat 62ª, is arranged to move in unison with the admission-valve 35. When the exhaust-valve is closed, the admission-valve is opened, and vice versa. I prefer to mount the admission and exhaust valves on a single stem 61ᵇ and to make the connections between the admission and exhaust valves adjustable, as shown at 61ᶜ, so as to regulate the stroke of the valves. I prefer to transmit the movement to both valves from the same link 45. The exhaust-valve permits the gas to leave the piston-chamber, and thus allows the signal to rest upon the retaining device, as will be more fully described hereinafter. The pressure of gas within the piston-chamber sinks to that of the atmosphere as soon as the exhaust is opened, which occurs, preferably, at the end of the stroke when the piston-chamber has reached the top, so that the gas expelled from the piston-chamber when the signal subsequently goes to "danger" is always under the same condition—*i. e.*, always at atmospheric pressure. The cushioning action is always uniform.

A valve-guard 100 is screwed into the casing 101 and compresses a washer 102, so as to form a gas-tight seal. Inside the guard 100, at the bottom thereof, is a soft-rubber valve-seat 35ª. Inside the guard a sleeve 103 is provided, on which is mounted a screen 104. Two pins 105 embrace the flat part 35ᵇ of the valve 35 to prevent it from turning. The sleeve 103 is prevented from turning by the pin 104ª.

I prefer to employ a suitable retaining device for holding the signal at one position of indication. In the form illustrated the signal is held at "safety" by the retaining device after the parts have been given a full-stroke movement. The form of this retaining device may be widely varied without departing

from the principle of my invention. I prefer to construct it as follows:

A detent 62, provided with a tooth 63, is suitably weighted at 64, so as to normally throw the arm 65 of the detent toward the magnet 41. By this means the armature 66 is always urged toward the field of the magnet 41. Suitable means are provided for limiting the movement of the armature 66 toward the magnet 41, so as to prevent actual contact between the armature and the magnet while the signal is at "danger," and thus avoid any danger of the armature sticking to its magnet by reason of the freezing of moisture between the armature and the magnet or for any other cause. This is particularly advantageous in a normal danger system. I preferably provide a stop to limit the movement of the armature, and I prefer to have this stop movable and to form a movable engagement with the part whose movement it limits, so that all tendency to freeze is avoided. The particular form of the movable stop may be widely varied. I prefer to use a roller 67, pivoted at 68 in an arm 69, the latter being pivoted at 70 to the bracket 47. A spring 71 pulls the arm 69 in one direction, so as to limit the movement of the armature 66 toward the magnet under normal conditions. Nevertheless when the magnet is energized its armature 66 may be brought into contact with the magnet, the stop 67 moving back slightly and the spring 71 being thus put under tension. An adjustable stop 72 limits the movement of the roller-stop 67 in one direction. It will be observed that the roller-stop rolls along the lever 65, so that it is impossible for the lever to freeze to the roller.

Any suitable means for retaining the piston at the end of its stroke may be used. I prefer to provide a spring-pressed detent 73, pressed by a spring 74 and pivoted at 75 in the bracket 47. As the bracket rises the detent 73 snaps past the tooth 63 of the retaining device, the weight 64 of the retaining device assisting in this action. The magnet 41 being energized at this time, the detaining device is firmly held with the tooth 63 supporting the signal and the attached parts in one position of indication against the action of the weighted spectacle 2.

It will be understood that although I have shown a system of circuits for operating my signal, which system is designed to be operated on the normal safety plan—that is to say, with the signal-blades standing normally at "safety" when there is no train on the section—my invention is equally applicable to normal danger systems in which the signal-blades stand normally at "danger" under the conditions referred to. By suitably arranging the circuits my signal may be operated either on the normal danger plan or the normal safety plan.

The operation of my invention is as follows: Referring now to Fig. 12, the signal-blades 1 are shown at "safety" in the unoccupied sections of the track. When a train enters a section, the track-magnets 76 are deënergized, the current from the battery 77 being shunted, and the circuit for controlling the signal is opened. This deënergizes the signal-magnet 41, the retaining device for the signal is released, and the signal goes to "danger" behind the train under the influence of the weight 2. When the train passes out of the section, the track-magnet 76 is reënergized. The signal-circuit through the magnet 41 is closed. The magnet attracts its armature 42, thus opening the inlet-valve and closing the exhaust-valve and admitting gas in the piston-chamber 9, so as to move the signal against the influence of the weight 2 to "safety." At the top of the stroke of the piston-chamber the means for cutting off the supply of gas to the piston-chamber by acting upon the admission-valve is thrown into operation. The lever 52 closes the admission-valve and opens the exhaust-valve, and the detent 63 is held in place by the energization of the magnet 41, so as to retain the signal in the safety position by coöperation with the part 73. If for any reason likely to occur in practice when the signal is at the danger position, such as the sudden opening and closing of a switch by a switchman and the consequent movement of the signal, the electromagnet is energized for an instant and then deënergized before the operating mechanism has completed its stroke, the piston-chamber will only complete part of its movement, and the lever 52 will not be actuated to close the admission-valve. By reason, however, of the weight of the parts attached to the valve mechanism and the pressure of the gas acting to close the admission-valve and open the exhaust-valve, the magnet being deënergized, the admission-valve will drop to its seat and cut off the supply. The exhaust-valve will also be open, and the signal will return to the danger position. It will thus be observed that the valve mechanism is always operated in two directions—one for opening and the other for closing—whether the piston makes a full-stroke movement or not.

By referring to Figs. 10 to 14 the operation of the signal will be readily understood. In Fig. 13 the parts are shown in the position they occupy when the signal is at "danger." With the normal safety system a train is on the section protected by the signal. The admission-valve is closed and the exhaust-valve is open. The piston-chamber now rests upon the piston at the bottom of its stroke. When the magnet 41 becomes energized, the parts assume the intermediate position shown in Fig. 10. The exhaust-valve is closed, and

the admission-valve is open. This is the position assumed while the signal is clearing. The piston-chamber has started, but has not yet reached the top of the stroke.

In Figs. 11 and 14 the parts have made a complete movement. The signal is at "safety," held by its retaining device, and the lever 52 has been actuated to close the admission-valve and open the exhaust-valve.

It is to be understood that many changes may be made in the form of apparatus illustrated without departing from the principle of my invention. It may be adapted to normal safety and normal danger systems, to signals, switches, and the like, by any one skilled in the art.

What I claim, and desire to secure by Letters Patent, is—

1. In a railway-traffic-controlling apparatus, the combination of mechanism operated by fluid-pressure of an admission-valve, means for closing said admission-valve and independent means controlled by the movement of a part of said mechanism for closing said admission-valve, substantially as described.

2. In a railway-traffic-controlling apparatus, the combination of mechanism operated by fluid-pressure, and admission-valve therefor, means for closing said admission-valve and independent means actuated by said mechanism for closing said admission-valve, substantially as described.

3. In a railway-traffic-controlling apparatus, the combination of mechanism operated by gas-pressure, a storage-supply of liquefied gas, a single admission-valve between said storage-supply and said mechanism, means for closing said admission-valve, and independent means for closing said admission-valve, substantially as described.

4. In a railway-traffic-controlling apparatus, the combination of a piston and piston-chamber, a storage-supply of liquefied gas, a single admission-valve between said storage-supply and said piston-chamber, means for closing said admission-valve and independent means for closing said admission-valve, substantially as described.

5. In a railway traffic-controlling apparatus, the combination of an admission-valve, a gas-supply, an operating mechanism, means for actuating said admission-valve to cut off the gas-supply, and independent means for controlling said admission-valve to shut off the gas-supply, substantially as described.

6. In a railway traffic-controlling apparatus, the combination of mechanism operated by fluid-pressure, a single admission-valve therefor, means for closing said admission-valve and means controlled by said mechanism for closing said admission-valve, substantially as described.

7. In a railway traffic-controlling apparatus, the combination of a piston and piston-chamber, a storage supply of liquefied gas, a single admission-valve between said storage-supply and said piston-chamber, means for closing said admission-valve and means controlled by the relative movement between said piston and piston-chamber for closing said admission-valve, substantially as described.

8. In a railway traffic-controlling apparatus, the combination of a piston and piston-chamber, a storage supply of liquefied gas, a single admission-valve between said storage supply and said piston-chamber, means for closing said admission-valve and means controlled by said piston-chamber for closing said admission-valve, substantially as described.

9. In a railway traffic-controlling apparatus, the combination of a piston and piston-chamber, a storage supply of liquefied gas, a single admission-valve between said storage-supply and said piston-chamber, means for closing said admission-valve and means controlled by the relative movement between said piston and piston-chamber, said means being actuated when the parts have made a full-stroke movement, for closing said admission-valve, substantially as described.

10. In a railway traffic-controlling apparatus, the combination of a piston and piston-chamber, a storage supply of liquefied gas, a single admission-valve between said storage supply and said piston-chamber, means for closing said admission-valve and means controlled by said piston-chamber, when said chamber has completed its stroke, for closing said admission-valve, substantially as described.

11. In a railway traffic-controlling apparatus, the combination of an admission-valve, an electromagnet, means whereby the energization of said magnet moves the valve in one direction, means for moving said valve in the opposite direction, and independent means for closing said valve, substantially as described.

12. In a railway traffic-controlling apparatus, the combination of an admission-valve, an electromagnet, means whereby the energization of said magnet acts to open the valve, means for closing the valve, and independent means for closing said valve, substantially as described.

13. In a railway traffic-controlling apparatus, the combination of a piston and piston-chamber, an admission-valve, an electromagnet, means whereby the energization of said magnet acts to open the valve, means for closing the valve, and means controlled by the relative movement between the piston and piston-chamber for closing said valve, substantially as described.

14. In a railway traffic-controlling apparatus, the combination of a piston and piston-chamber, an admission-valve, an electromagnet, means whereby the energization of said magnet acts to open the valve, means for closing the valve and means controlled by the movement of the piston-chamber for closing said valve, substantially as described.

15. In a railway traffic-controlling apparatus, the combination of a piston and piston-chamber, an admission-valve, an electromagnet, means whereby the energization of said magnet acts to open the valve, means for closing the valve, mechanical connections between the piston-chamber and the valve whereby the movement of the piston-chamber acts to close said valve, substantially as described.

16. In a railway traffic-controlling apparatus, the combination of a piston and piston-chamber, an admission-valve, an electromagnet, an armature for said magnet, connections between the armature of said magnet and said valve whereby the energization of said magnet moves the valve in one direction, means for returning said valve, mechanical connections between the piston-chamber and the valve whereby the movement of the piston-chamber acts to close said valve, substantially as described.

17. In a railway traffic-controlling apparatus, the combination of an admission-valve, a link connected to said valve, an electromagnet, an armature for said magnet, connections between the armature of said magnet and said link, a piston and piston-chamber, connections between the piston-chamber and said link whereby the movement of said piston-chamber closes said valve, substantially as described.

18. In a railway traffic-controlling apparatus, the combination of an admission-valve, an exhaust-valve, an electromagnet, means whereby the energization of said magnet moves said valves in one direction, means for moving said valves in the opposite direction and independent means for actuating said valves, substantially as described.

19. In a railway traffic-controlling apparatus, the combination of a piston and piston-chamber, an admission-valve, an exhaust-valve, an electromagnet, means whereby the energization of said magnet moves said valves in one direction, means for moving said valves in the opposite direction and means controlled by the relative movement of said piston and piston-chamber for actuating said valves, substantially as described.

20. In a railway traffic-controlling apparatus, the combination of a piston and piston-chamber, an admission-valve, an exhaust-valve, an electromagnet, means whereby the energization of said magnet moves said valves in one direction, means for moving said valves in the opposite direction and means controlled by the movement of the piston-chamber at the end of its stroke for actuating said valves, substantially as described.

21. The combination of a railway-signal, means for supplying gas to actuate said signal, an admission-valve for controlling said gas-supply, means for closing said admission-valve and independent means for closing said admission-valve, substantially as described.

22. The combination of a railway-signal, mechanism operated by gas-pressure for actuating said signal, a storage supply of liquefied gas, a single admission valve between said storage supply and said mechanism, means for closing said admission-valve, and independent means for closing said admission-valve, substantially as described.

23. The combination of a railway-signal, a piston and piston-chamber, for actuating said signal, a storage supply of liquefied gas, a single admission-valve between said storage supply and said piston-chamber, means for closing said admission-valve and independent means for closing said admission-valve, substantially as described.

24. The combination of a railway-signal, an admission-valve, a gas-supply, an operating mechanism for said signal, means for actuating said admission-valve to cut off the gas-supply, and independent means for controlling said admission-valve to shut off the gas-supply, substantially as described.

25. The combination of a railway-signal, mechanism operated by fluid-pressure for actuating said signal, a single admission-valve therefor, means for closing said admission-valve and means controlled by said mechanism for closing said admission-valve, substantially as described.

26. The combination of a railway-signal, a piston and piston-chamber, for actuating said signal, a storage supply of liquefied gas, a single admission-valve between said storage supply and said piston-chamber, means for closing said admission-valve and means controlled by the relative movement between said piston and piston-chamber for closing said admission-valve, substantially as described.

27. The combination of a railway-signal, a piston and piston-chamber, for actuating said signal, a storage supply of liquefied gas, a single admission-valve between said storage supply and said piston-chamber, means for closing said admission-valve and means controlled by said piston-chamber for closing said admission-valve, substantially as described.

28. The combination of a railway-signal, a piston and piston-chamber, for actuating said signal, a storage supply of liquefied gas, a single admission-valve between said storage supply and said piston-chamber, means for closing said admission-valve and means controlled by the relative movement be-

tween said piston and piston-chamber, said means being actuated when the parts have made a full-stroke movement, for closing said admission-valve, substantially as described.

29. The combination of a railway-signal, a piston and piston-chamber for actuating said signal, a storage supply of liquefied gas, a single admission-valve between said storage supply and said piston-chamber, means for closing said admission-valve and means controlled by said piston-chamber, when said chamber has completed its stroke, for closing said admission-valve, substantially as described.

30. The combination of a railway-signal, an admission-valve for controlling the supply of gas to actuate said signal, an electromagnet, means whereby the energization of said magnet moves the valve in one direction, means for moving said valve in the opposite direction, and means for closing said valve, substantially as described.

31. The combination of a railway-signal, an admission-valve for controlling the supply of gas to actuate said signal, an electromagnet, means whereby the energization of said magnet acts to open the valve, means for closing the valve, and independent means for closing said valve, substantially as described.

32. The combination of a railway-signal, a piston and piston-chamber, for actuating said signal, an admission-valve, an electromagnet, means whereby the energization of said magnet acts to open the valve, means for closing the valve and means controlled by the relative movement between the piston and piston-chamber for closing said valve, substantially as described.

33. The combination of a railway-signal, a piston and piston-chamber, for actuating said signal, an admission-valve, an electromagnet, means whereby the energization of said magnet acts to open the valve, means for closing the valve and means controlled by the movement of the piston-chamber for closing said valve, substantially as described.

34. The combination of a railway-signal, a piston and piston-chamber, for actuating said signal, an admission-valve, an electromagnet, means whereby the energization of said magnet acts to open the valve, means for closing the valve, mechanical connections between the piston-chamber and the valve whereby the movement of the piston-chamber acts to close said valve, substantially as described.

35. The combination of a railway-signal, a piston and piston-chamber, for actuating said signal, an admission-valve, an electromagnet, an armature for said magnet, connections between the armature of said magnet and said valve whereby the energization of said magnet moves the valve in one direction, means for returning said valve, mechanical connections between the piston-chamber and the valve whereby the movement of the piston-chamber acts to close said valve, substantially as described.

36. The combination of a railway-signal, an admission-valve for controlling the supply of gas for actuating said signal, a link connected to said valve, an electromagnet, an armature for said magnet, connections between the armature of said magnet and said link, a piston and piston-chamber, connections between the piston-chamber and said link whereby the movement of said piston-chamber closes said valve, substantially as described.

37. The combination of a railway-signal, an admission-valve for controlling the supply of gas for actuating said signal, an exhaust-valve, an electromagnet, means whereby the energization of said magnet moves said valves in one direction, means for moving said valves in the opposite direction and means for actuating said valves, substantially as described.

38. The combination of a railway-signal, a piston and piston-chamber, for actuating said signal, an admission-valve, an exhaust-valve, an electromagnet, means whereby the energization of said magnet moves said valves in one direction, means for moving said valves in the opposite direction and means controlled by the relative movement of said piston and piston-chamber for actuating said valves, substantially as described.

39. The combination of a railway-signal, a piston and piston-chamber, for actuating said signal, an admission-valve, an exhaust-valve, an electromagnet, means whereby the energization of said magnet moves said valves in one direction, means for moving said valves in the opposite direction and means controlled by the movement of the piston-chamber at the end of its stroke for actuating said valves, substantially as described.

40. The combination of a railway-signal, a retaining device for said signal, means for supplying gas to actuate said signal, an admission-valve for controlling said gas-supply, means for closing said admission-valve, independent means for closing said admission-valve, and means for operating said retaining device, substantially as described.

41. The combination of a railway-signal, a retaining device for said signal, mechanism operated by gas-pressure for actuating said signal, a storage supply of liquefied gas, a single admission-valve between said storage supply and said mechanism, means for closing said admission-valve, independent means for closing said admission-valve, and means for operating said retaining device, substantially as described.

42. The combination of a railway-signal, a retaining device for said signal, an admission-valve, a gas-supply, an operating mechanism

for said signal, means for actuating said admission-valve to cut off the gas-supply, independent means for controlling said admission-valve to shut off the gas-supply, and means for actuating said retaining device, substantially as described.

43. The combination of a railway-signal, a retaining device for said signal, a piston and piston-chamber, for actuating said signal, a storage supply of liquefied gas, a single admission-valve between said storage supply and said piston-chamber, means for closing said admission-valve, means controlled by said piston-chamber for closing said admission-valve, and means for actuating said retaining device, substantially as described.

44. The combination of a railway-signal, a retaining device for said signal, a piston and piston-chamber, for actuating said signal, a storage supply of liquefied gas, a single admission-valve between said storage supply and said piston-chamber, means for closing said admission-valve, means controlled by the relative movement between said piston and piston-chamber, said means being actuated when the parts have made a full-stroke movement, for closing said admission-valve, and means for actuating said retaining device, substantially as described.

45. The combination of a railway-signal, a retaining device for said signal, an admission-valve for controlling the supply of gas to actuate said signal, an electromagnet, means whereby the energization of said magnet moves the valve in one direction, means for moving said valve in the opposite direction, means for closing said valve, and means for actuating said retaining device, substantially as described.

46. The combination of a railway-signal, a retaining device for said signal, a piston and piston-chamber, for actuating said signal, an admission-valve, an electromagnet, means whereby the energization of said magnet acts to open the valve, means for closing the valve, mechanical connections between the piston-chamber and the valve whereby the movement of the piston-chamber acts to close said valve, and means for actuating said retaining device, substantially as described.

47. The combination of a railway-signal, a retaining device for said signal, an admission-valve for controlling the supply of gas for actuating said signal, an exhaust-valve, an electromagnet, means whereby the energization of said magnet moves said valves in one direction, means for moving said valves in the opposite direction, means for actuating said valves, and means for actuating said retaining device, substantially as described.

48. The combination of a railway-signal, a retaining device for said signal, a piston and piston-chamber, for actuating said signal, an admission-valve, an exhaust-valve, an electromagnet, means whereby the energization of said magnet moves said valves in one direction, means for moving said valves in the opposite direction, means controlled by the relative movement of said piston and piston-chamber for actuating said valves, and means for actuating said retaining device, substantially as described.

49. The combination of a railway-signal, a retaining device for said signal, a storage supply of liquefied gas, a piston and piston-chamber, for actuating said signal, an admission-valve, an exhaust-valve, an electromagnet, means whereby the energization of said magnet moves said valves in one direction, means for moving said valves in the opposite direction, means controlled by the relative movement of said piston and piston-chamber for actuating said valves, and means for actuating said retaining device, substantially as described.

50. In a railway traffic-controlling apparatus, the combination of a signal, mechanism operated by fluid-pressure for actuating said signal in one direction, an admission-valve adapted to be opened and closed, means controlled by said mechanism for closing said valve and means controlled by a train for closing said valve, substantially as described.

51. In a railway traffic-controlling apparatus, the combination of a pivoted semaphore-blade normally biased to danger, a piston and piston-chamber for moving said blade against its normal bias, an admission-valve adapted to be opened and closed, means controlled by the relative movement of said piston and piston-chamber for closing said valve and means controlled by a train for closing said valve, substantially as described.

52. In a railway traffic-controlling apparatus, the combination of a pivoted semaphore-blade normally biased to danger, a piston and piston-chamber for moving said blade against its normal bias, a retaining device for holding said blade at one position of indication, an admission-valve adapted to be opened and closed, means controlled by the relative movement of said piston and piston-chamber for closing said valve and means controlled by a train for closing said valve, substantially as described.

53. In a railway traffic-controlling apparatus, the combination of a signal, mechanism operated by fluid-pressure for actuating said signal in one direction, a local storage supply of liquefied gas, an admission-valve adapted to be opened and closed to control the supply of gas to said mechansim, means controlled by said mechanism for closing said valve and means controlled by a train for closing said valve, substantially as described.

54. In a railway traffic-controlling apparatus, the combination of a pivoted semaphore-blade normally biased to danger, mechanism operated by fluid-pressure for actuating said semaphore-blade against its normal bias, a

local storage supply of liquefied gas, an admission-valve adapted to be opened and closed to control the supply of gas to said mechanism, means controlled by said mechanism for closing said valve and means controlled by a train for closing said valve, substantially as described.

55. In a railway traffic-controlling apparatus, the combination of a retaining device, an armature therefor, a magnet for moving said device in one direction, and a yielding stop acting to normally separate said armature from said magnet, substantially as described.

56. The combination of a railway-signal, a retaining device therefor, an armature, connections between the retaining device and the armature, a magnet, a movable stop acting to separate said armature from said magnet and to limit its movement in one direction and means for moving said stop in a transverse direction, substantially as described.

57. The combination of a railway-signal, a retaining device therefor, a magnet, an armature for said magnet whereby the retaining device is thrown into operation, a roller for limiting the movement of said retaining device and means for moving said roller, substantially as described.

58. The combination of a railway-signal, a piston and piston-chamber for actuating said signal, a retaining device for said signal, a magnet, an armature for said magnet whereby the retaining device is thrown into operation, a roller for limiting the movement of said retaining device, and means whereby the relative movement between the piston and piston-chamber acts to bodily move said roller, substantially as described.

59. The combination of a hollow pedestal, a supply-pipe for the operating fluid passing through the interior of said pedestal, a piston secured to said pedestal, a cylinder surrounding said piston, a railway-signal and means connecting said cylinder with said signal, substantially as described.

60. The combination of a hollow pedestal, a protecting-sleeve surrounding said pedestal, a piston and piston-chamber, a railway-signal and means connecting said piston-chamber with said signal, substantially as described.

61. The combination with a hollow pedestal, a piston and piston-chamber, means for closing the ends of said piston-chamber, a railway-signal and means for transmitting the movement of the parts to said signal, substantially as described.

62. The combination with a hollow pedestal, a protecting-sleeve surrounding said pedestal, a piston and piston-chamber, means for closing the ends of said piston-chamber, a railway-signal and means for transmitting the movement of the parts to said signal, substantially as described.

63. The combination of a hollow pedestal, a protecting-sleeve surrounding said pedestal, a piston and piston-chamber, means for closing the ends of said piston-chamber, said piston-chamber fitting said sleeve at one end, a railway-signal and means for communicating the movement of the piston-chamber to said signal, substantially as described.

64. The combination of a railway-signal, a tank containing a storage supply of liquefied gas, for operating said signal, said tank being located in the earth, to avoid excessive variations in pressure, substantially as described.

65. The combination of a railway-signal, a tank for containing a storage supply of liquefied gas for operating said signal, and means for preserving said tank from excessive variation of temperature, substantially as described.

66. The combination of a railway-signal, a local, portable, storage-tank, containing a supply of liquefied gas for operating said signal, said tank being located in the earth to avoid excessive variations in pressure, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

CLARENCE W. COLEMAN.

Witnesses:

ERNEST PULSFORD,

WILLIAM F. BISSING.