No. 814,021. PATENTED MAR. 6, 1906.

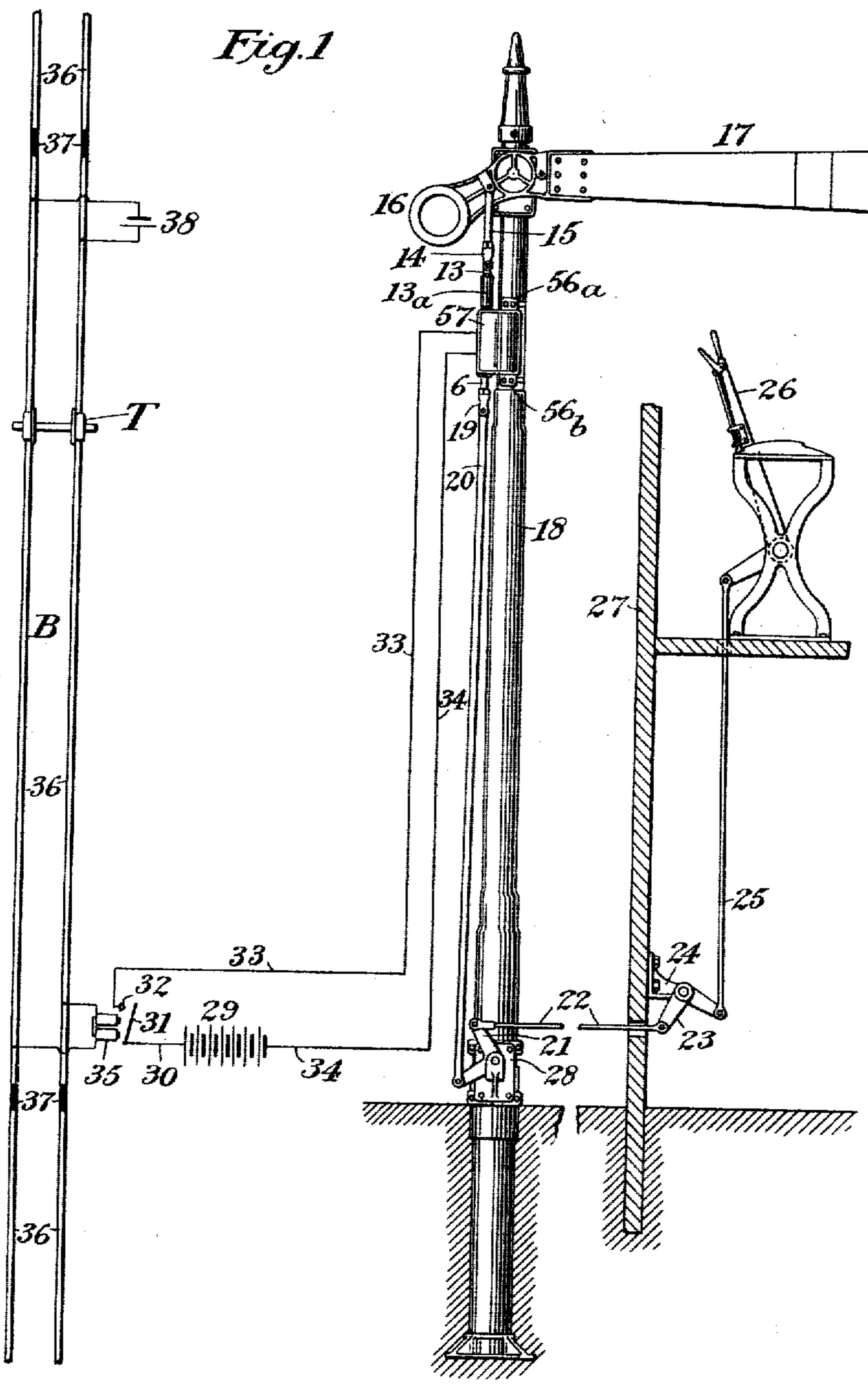
C. W. COLEMAN.

RAILWAY TRAFFIC CONTROLLING APPARATUS.

APPLICATION FILED APR. 13, 1905.

3 SHEETS—SHEET 1.

Fig. 1



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3 SHEETS—SHEET 2.

Fig. 5

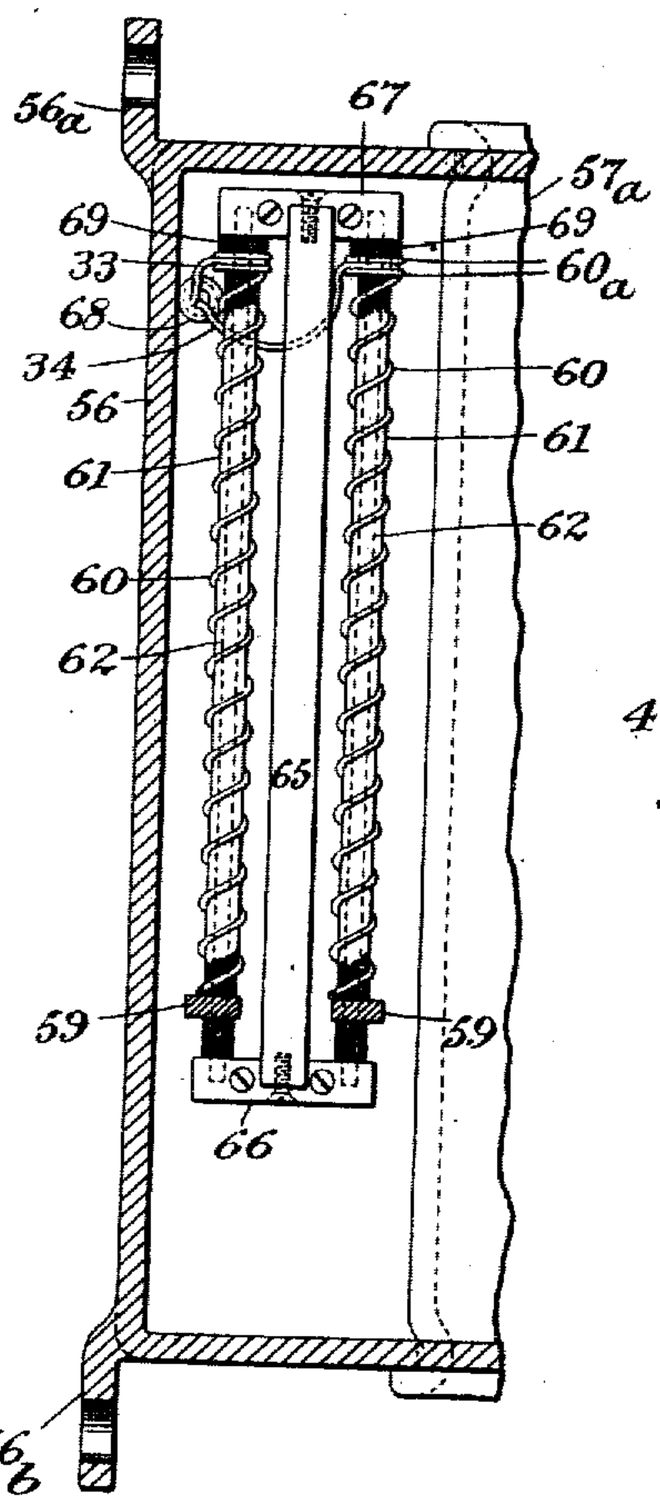
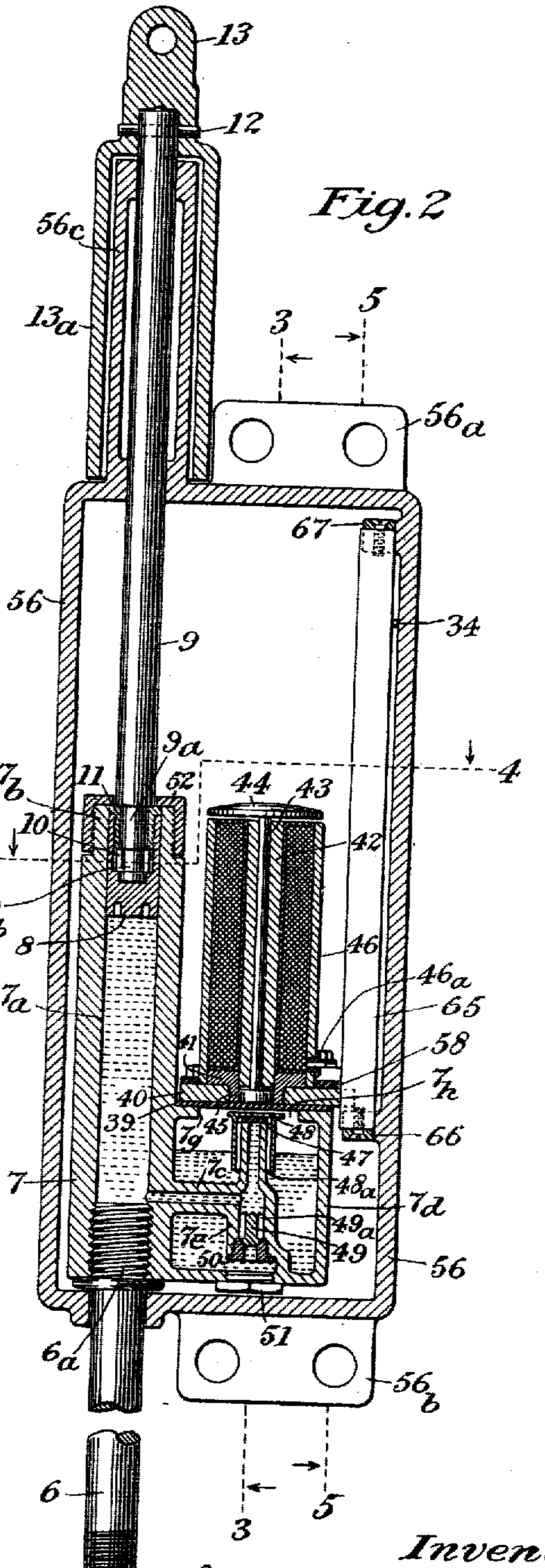


Fig. 2



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3 SHEETS—SHEET 3.

Fig. 3

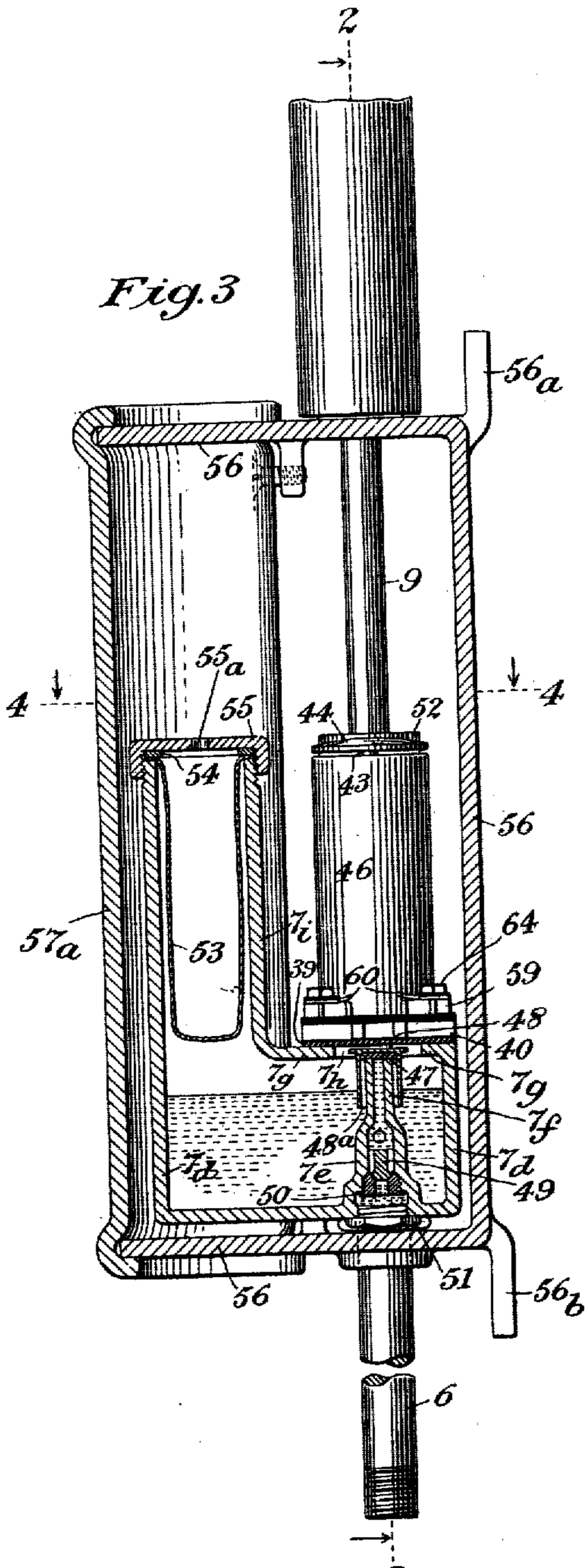
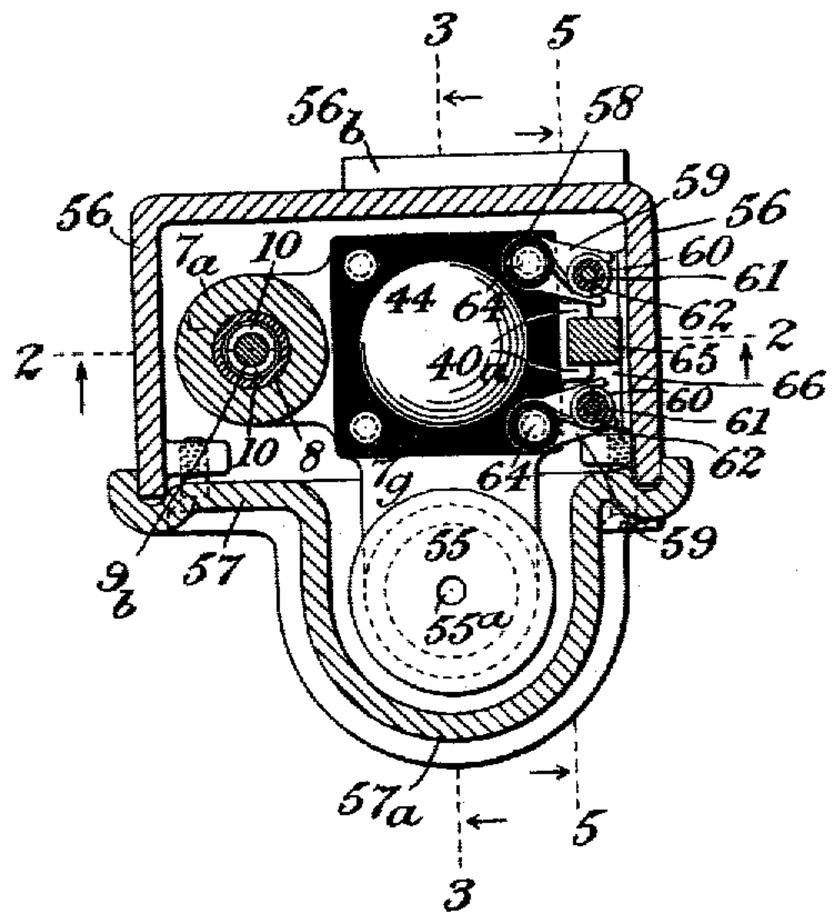


Fig. 4



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UNITED STATES PATENT OFFICE.

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

RAILWAY-TRAFFIC-CONTROLLING APPARATUS.

No. 814,021. Specification of Letters Patent. Patented March 6, 1906.

Application filed April 13, 1905. Serial No. 255,301.

To all whom it may concern:

Be it known that I, CLARENCE W. COLEMAN, a citizen of the United States, residing at Westfield, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Railway-Traffic-Controlling Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings, forming a part thereof.

My invention relates to railway-traffic-controlling apparatus, and that embodiment of my invention which I have particularly illustrated in the accompanying drawings and particularly described in the following specification relates especially to that class of railway-traffic-controlling apparatus which controls railway traffic by the display of visual signals, such as signal-semaphores. Such particularly illustrated and described embodiment of my invention may be more specifically designated as a "signal-slot," since this particular adaptation of my invention is designed to take the place of those mechanisms which in signaling nomenclature are generally designated as "slots" and which are generally employed to automatically control a railway-semaphore or other signal in conjunction with manual signal operating or controlling means.

Broadly stated, the objects of my present invention are reliability of operation, simplicity, compactness, and economy of construction, and economy of maintenance.

A manually-operated railway-signal is often located a considerable distance from the operator's tower or other point of manual control, and the usual purpose of the slot is to automatically prevent the signal from being cleared from the point of manual control when traffic conditions are such that the signal should not be cleared and also to automatically cause such signal to assume its danger position upon the occurrence of any condition of traffic requiring the signal to be placed at "danger" in order to discharge its protective function. Such signals are generally moved manually from a manually-operated lever and through a system of transmission levers and rods which may extend over a very considerable distance, and the slot mechanism or automatic signal-governing or signal-controlling mechanism is generally located at or near the signal proper, so as to control or govern transmission or communication of the manual actuative or signal-operating force from the system of manually-operated transmission levers and rods to the signal proper. For instance, when the thrust of a manually-operated transmission-rod is employed to move a semaphore-signal to its clear position and against the effort of its counterweight the slot mechanism is generally employed to control the transmission or communication of such manual actuative thrust to the signal by maintaining connection or communication between the signal-semaphore and such thrust-rod when traffic conditions permit the signal to be safely cleared and held "clear" and by automatically severing or discontinuing such connection or communication between the thrust-rod and the signal-semaphore when any traffic condition arises which requires the signal to assume its danger position. The slot mechanisms which have heretofore been employed have generally required that those portions of the manual signal-operating means adjacent to the signal proper shall be placed in a definite position relative to such signal proper in order that such slot mechanism may reëstablish effectual connection or communication between such manual operating means and such signal and after such connection or communication has been discontinued by the automatic operation of the slot mechanism. For instance, assuming that the signal has been placed to clear position by the manual operating means and that the slot mechanism has subsequently severed communication between the signal and manual operating means, which would otherwise maintain the signal in clear position, and assuming that the signal has gone to danger position in the ordinary manner, due to such severance of its communication with the manual operating means, the manual signal-operating means must then ordinarily be returned to its extreme danger position or extreme position opposite its signal-clearing position in order to reëstablish that definite relative position of the manual actuating means and the signal proper which relative position is necessary for reëstablishment of communication by the slot mechanism when the traffic conditions will again permit the signal to be cleared. The hand-lever in the signal-operator's tower or such other prime mover as may

be employed in the signal-operating system of transmission rods, levers, &c., can of course be returned to its extreme danger position; but the signal-actuating thrust-rod or equivalent signal-actuating element of the transmission system, which is adjacent to the signal proper and which is ofttimes located a long distance from the hand-lever or prime mover, is subject to variations in position due to varying degrees of thermal expansion in the transmission system and due to variations in adjustment, lost motion, &c., and does not always return to the same position when the hand-lever or prime mover is returned to its extreme danger position, and in consequence it has frequently been found impossible to return the signal-actuating thrust-rod or equivalent portion of the manual transmission system to proper position to be reëngaged or connected with the signal proper and by the slot mechanism.

It is one object of my invention to overcome the foregoing difficulty of reëstablishing connection or communication between the signal and the manual or other motive means for operating such signal from a distance.

Another object of my invention is to perform in one mechanism or apparatus the functions of a signal-controlling slot mechanism and a cushioning or shock-relieving function to ease or reduce the mechanical shock of the movement of the signal to "danger" under impetus of its counterweight.

To the foregoing ends my invention comprehends the combination of a railway-traffic controller proper, such as a railway-signal, motive or actuative means arranged to operate the traffic-controller or signal proper, and two members connected with the actuative means and the traffic-controller or signal and movable relative to each other by relative movement of such actuative means and traffic-controller, so as to effect a change or increase of fluid-pressure in a fluid-containing space varied by such relative movement, such change in fluid-pressure being effective to transmit operating or controlling force from the actuative means to the traffic-controller or signal proper, and fluid-controlling means—for instance, automatically responsive to movement of a railway-vehicle along the railway line—arranged to open and close a vent leading to the fluid-containing space, whereby to relieve or maintain the change in fluid-pressure effected by relative movement of the actuative means and the traffic-controller, and thus discontinue transmission or communication of operating force or energy from the motive means to the traffic-controller or reëstablish such transmission or communication of operating force when the motive means and the traffic-controller are in any relative position or in any one of a plurality of relative positions.

Also, to the foregoing ends my invention further comprises the combination of traffic-controlling means proper—such, for instance, as a railway-signal—actuative means, such as a manually-operated system of transmission rods and levers, arranged to actuate the traffic-controlling means proper or signal, a fluid-containing chamber coöperative with the actuative means and with the traffic-controlling means proper and variable in fluid-containing volume by relative movement of such actuative means and the traffic-controlling means proper but arranged to oppose such volume variation and relative movement by a change or increase in fluid-pressure developed by such relative movement and volume variation, whereby to transmit or communicate actuative force from the actuative means to the traffic-controlling means proper, and means for relieving the change or increase in fluid-pressure to permit relative movement of the actuative means and the traffic-controlling means proper.

My invention comprehends also, in combination with features already mentioned, a means for relieving the aforementioned fluid-pressure resistance to relative movement of the actuative means and traffic-controlling means proper consisting in a vent communicating with the fluid-containing chamber aforementioned and electrical vent-controlling means in control of the vent to govern the flow of fluid through such vent; and my invention comprehends also, in combination with such electrical vent-controlling means, an electric controlling-circuit in control of the vent-controlling means and in turn controllable by movement of a railway-vehicle along the railway-track.

In the foregoing preamble I have set forth the general objects of my invention and have separately and particularly mentioned several of its features. My invention, however, also comprehends various other important objects and features which I will not mention separately and particularly in this preamble, but which clearly appear in the light of the following description of my invention, which is illustrated in the drawings, and such features are further definitely set forth in the claims annexed hereto.

In the accompanying drawings, Figure 1 shows a manually-operated railway-semaphore signal equipped with a controlling-slot mechanism embodying my invention and shows in diagram the controlling electric circuits which automatically control the slot mechanism. Fig. 2 is a sectional front elevation of the slot mechanism proper comprised in the signaling apparatus of Fig. 1, the section of Fig. 2 being taken on a plane indicated by the lines 2 2 of Figs. 3 and 4. Fig. 3 is a sectional right-side elevation of the slot mechanism shown in Figs. 1 and 2, the plane of section being indicated by the lines 3 3 of

Figs. 2 and 4. Fig. 4 is a partially sectional plan view of the slot mechanism shown in Figs. 1 to 3, inclusive, and the planes of section are those indicated by the lines 4 4 of Figs. 2 and 3. Fig. 5 is a sectional left-side elevation of the slot mechanism shown in Figs. 1 to 4, inclusive, the section being taken on a plane indicated by the line 5 5 of Figs. 2 and 4.

In the embodiment and adaptation of my invention which is illustrated in the accompanying drawings the slot mechanism or automatic signal-controlling mechanism proper is contained in a small compact casing 56, mounted upon the signal-post 18 by means of suitable upper and lower lugs 56^a and 56^b, formed integrally with the casing. The casing is provided with a removable front cover 57, which gives access to its interior parts.

The operator's signal-operating hand-lever 26 is in the present instance mounted in a suitable switch-tower 27, which may be located some distance from the signal proper, and the manual signal-operating energy is transmitted from the hand-lever 26 through the depending link 25 to the bell-crank 23, mounted in a suitable bracket 24, secured to the wall of the switch-tower below the operating-floor and near the ground-level, and from such bell-crank 23 the signal-operating energy is transmitted through a single link 22, or through a system of links which may take the place of such single link 22, and to the bell-crank 21, mounted upon the signal-post 18, and from such bell-crank upward through the vertical thrust-rod 20 to the slotted pivot-head 19, pivotally connected with the upper end of such thrust-rod 20 and also secured upon the lower end of the cylinder-rod 6 of the slot mechanism proper. Such cylinder-rod 6 passes through the lower wall of the casing 56 and is screwed into the lower end of the vertical cylinder-bore of the cylinder-casting 7. This cylinder-casting not only comprises the vertical cylinder proper, 7^a, within which the aforesaid cylinder-bore is formed, but also integrally comprises the fluid-reservoir 7^d, arranged on the right of the cylinder proper, 7^a, and also comprises the cylindrical compensating-chamber 7^j integral with the reservoir 7^d and extending upwardly from the front portion thereof. The reservoir 7^d communicates with the cylinder proper through a horizontal duct or vent 7^c, opening into the lower end of the cylinder proper and extending rightward to a point of connection with the lower and upper vertical valve-tubes 7^e and 7^f, respectively, formed integrally with each other, and with the duct 7^c and the other portions of the cylinder-casting. The lower valve-tube 7^e at its lower end communicates with the reservoir 7^d through a simple check-valve or influx-valve 49, which is provided with suitable guide wings or ribs 49^a, working vertically in the bore of the tube as a guide, such valve engaging the annular valve-seat at the upper or inner end of a valve-seat bushing 50, which is screwed into the lower end of the lower valve-tube or check-valve tube 7^e. The tapped hole, normally closed by the screw-plug 51, gives access to the lower end of the valve-tube 7^e for the introduction of the check-valve 49 and its seat 50. The check-valve 49 opens upwardly in the direction of influx to the cylinder proper from the reservoir 7^d and closes against efflux of fluid from the cylinder to such reservoir. The upper valve-tube or efflux-valve tube 7^f at its upper end also communicates with the reservoir 7^d and through an electrically-controllable hollow cylindrical efflux-controlling cup-valve or cap-valve 48, in the form of an inverted cylindrical cup, placed as a cap over the upper end of the efflux valve-tube 7^f and provided with longitudinal interior guide-ribs 48^a, which work upon the outer cylindrical surface of the valve-tube 7^f as a guide and which form channels through which the fluid may pass from the valve-tube 7^f to the reservoir 7^d. A washer 47, of leather, rubber, or other suitable valve-seat material is secured in the upper end of the cap-valve 48 and engages with the upper end of the valve-tube 7^f as a valve-seat.

Immediately above the efflux-controlling valve 48 the upper horizontal wall 7^g of the reservoir 7^d is provided with an aperture 7^h, which is closed by a flexible gasket or diaphragm 39, secured between such upper reservoir-wall 7^g and a square clamping-plate 40, held in place, as indicated, by suitable cap-screws inserted through an insulating-plate 58, mounted upon the square clamping-plate 40 and also through such clamping-plate 40 and through the gasket and into the reservoir-wall 7^g. The diaphragm clamping-plate 40 is provided with a central threaded opening coaxial with the efflux-valve 48, and into this threaded opening is screwed the centrally-depending lug or nipple of a circular or disk shaped magnetic iron yoke 41. The magnetic yoke 41 has a central bore passing through its depending nipple, and into the upper end of this bore is tightly driven a hollow magnetic iron core 42, extending vertically upward from the circular yoke. The iron core is provided with suitable insulation and wound with a coil of insulated electro-conductive wire, which is surrounded by a cylindrical magnetic iron casing 46, fitting tightly over the outer circumference of the lower circular magnetic yoke 41. Thus is formed a cylindrical ironclad electromagnet presenting at its upper end two magnetic poles, one being constituted in the upper end of the hollow cylindrical core 42 and the other being an annular pole constituted in the upper end of the cylindrical magnetic casing 46.

A non-magnetic armature stem or rod 43

passes through the central bore of the hollow magnetic core 42 and slides freely therein and at its upper end carries a concentrically-mounted disk-shaped magnetic armature 44 in close proximity to the poles of the ironclad magnet. A small diaphragm-engaging button 45 is located below the hollow magnetic core 42 and within the lower end of the central bore of the circular yoke 41, and this button is secured to the lower end of the armature-stem 43. The button rests centrally upon the upper surface of the diaphragm or gasket 39, and when the ironclad magnet is energized its disk-shaped armature 44 is attracted toward the poles of the magnet and presses down upon the armature-stem 43, thus pressing the diaphragm-button 45 down upon the center of the diaphragm 39 and overcoming the elasticity of the diaphragm sufficiently to press the latter firmly down upon the smooth flat upper surface of the cap-valve 48, thereby holding the cap-valve firmly closed and preventing efflux of fluid from the cylinder 7^a to the reservoir 7^d.

The square insulating-plate 58 is provided with a circular hole receiving the lower end of the ironclad magnet 46. Such insulating-plate registers with the square clamping-plate 40, and upon the right-hand corners of the insulating-plate are mounted two contact-travelers 59, clamped beneath, but insulated from, the cap-screws 64, inserted through the right-hand corners of the insulating-plate and clamping-plate into the gasket and reservoir-wall. The right-hand or outer ends of these contact-travelers 59 are slotted and straddle spring insulating-sleeves 61, mounted upon vertical spring-rods 62, secured at their upper and lower ends in suitable upper and lower brackets 67 and 66, respectively, which are secured upon small bosses on the inner surface of the right-hand wall of the main casing 56. Spring insulating-washers 69 are mounted upon the upper ends of the spring-rods 62 and interposed between the upper bracket 67 and the upper ends of the spring insulating-sleeves 61. Electroconductive helical compression-springs 60 are coiled upon the spring insulating-sleeves 61 and at their lower ends bear upon the contact-travelers 59, while the upper ends of the springs bear upon copper washers 60^a, two of which are interposed between each spring and its insulating-washer 69 at the upper end of its respective spring insulating-sleeve 61. The lower ends of the springs are secured to the contact-travelers which straddle their respective spring insulating-sleeves 61—for instance, the lower ends of the springs may be clamped upon the contact-travelers underneath suitable insulating-washers interposed between the spring ends and the heads of the cap-screws 64. Through an insulating-bushing 46^a in the magnetic casing 46 the ends of the magnet-coil may be led to the contact-travelers, each terminal of the magnet being connected with one traveler and its respective conductive springs 60 by clamping such magnet-terminal under the cap-screws which clamp the ends of the springs. Suitable insulated wires 33 and 34, leading from the external circuit which energizes the magnet 46, may be introduced through the insulating-bushing 68 and may be conductively connected with the upper ends of the electroconductive springs by interposing the ends of the insulated circuit-wires between the copper washers 60^a at the upper ends of the two springs, respectively.

The upper end of the piston-rod 9 is secured by a pin 12 to the pivot-head 13, which is pivotally connected to the slotted pivot-head 14, fixed to the lower end of the thrust-rod or thrust-link 15, the upper end of which is pivoted directly to the signal proper. Integrally formed upon the pivot-head 13 is a depending cylindrical sleeve 13^a, which incloses a piston-rod guide 56^c, formed integrally upon the upper horizontal wall of the casing 56 and extending vertically upward therefrom. The depending sleeve 13^a shields the piston-rod guide and piston-rod from dust and from the weather, &c. The piston-rod depends from its connection to the pivot-head 13 and passes centrally downward through the cylindrical piston-rod guide 56^c into the casing 56. The lower end of the piston-rod 9 is provided with a cylindrical shank 9^a of lesser diameter than the piston-rod proper, and this shank near its lower end is provided with a groove 9^b. A cylinder-cap 52, interiorly threaded to be screwed upon the upper end of the cylinder proper, 7^a, is provided with a central hole which receives the lower end of the piston-rod 9. A flanged bushing 11 snugly fits over the shank 9^a of the piston-rod and is slipped over such shank so that its flanged end bears against the shoulder of the piston-rod proper, and the bushing 11 extends from such shoulder downward to the upper end of the shank-groove 9^b. The outer surface of the flanged bushing 11 is threaded. A split ring or collar 10 is slipped into the groove 9^b in the lower end of the piston-shank 9^a, and the piston proper, 8, is provided with a threaded bore which receives the piston-shank and split ring and which screws over the threaded bushing 11 and up against the flange thereof. The split ring 10 is held firmly in its place in the groove 9^b of the piston-shank and in the lower end of the piston bore or recess, and such split ring prevents withdrawal of the flanged bushing 11, thereby locking such flanged bushing and the piston proper, 8, firmly in place upon the lower end of the piston-rod. The cylinder-cap 52 is screwed firmly down upon the upper end of the cylinder proper and abuts the upper end of the flanged bushing 11 to limit the upward movement of the piston-rod and

the downward movement of the cylinder proper relative to each other.

In the illustrated application of my invention the signal 17 is located in proximity to a railway-track and near the rear end of a signal-block B of such track, such block being formed by the interposition of suitable insulations 37 in the track-rails 36. A battery 38 is connected with the rails of the block at the advance end thereof, and a rear track-relay 35 is connected to such rails at the rear end of the block B. When no train is present in the block B, the battery 38 will transmit current by way of the track-rails to and through the rear track-relay 35 and will energize such relay and cause the same to close its relay-controlled contacts 31 32; but when a train or railway-vehicle is present in the block B the wheels and axles thereof will short-circuit the rails of the block and will thus short-circuit the current from the battery, so as to deënergize the rear track-relay 35 and cause its contacts 31 32 to be opened.

The relay-controlled contacts 31 32 are interposed in the local circuit of the ironclad magnet 46 of the slot mechanism proper, such local circuit being traceable as follows: from the local battery 29 through conductor 30, movable relay-contact 31, stationary relay-contact 32, conductor 33, one pair of the contact-washers 60^a, one of the conductive springs 60, coil of the magnet 46, the other conductive spring 60, the other pair of contact-washers 60^a, and conductor 34 back to the opposite pole of the battery 29. Obviously this local circuit is closed at its relay-controlled contacts 31 32 when the block B is unoccupied by traffic and is opened at such relay-controlled contacts when such block is occupied by traffic. Therefore the controlling-magnet of the slot mechanism proper will always be energized while the block B is unoccupied and will always be deënergized as soon as a railway-vehicle enters the block B and as long as such vehicle remains in such block.

The diagram Fig. 1 shows a train T in the block B and shows the relay-controlled contacts 31 32 open in consequence, and Figs. 2 and 3 show the magnet-armature 44 and the diaphragm 39 in the positions which they occupy while the magnet is deënergized in consequence of the opening of its circuit at the contacts 31 32. Such position of the armature 44 and diaphragm 39 are the positions which permit free opening of the efflux-controlling valve 48 and efflux of fluid from the cylinder 7^a. Should the operator in the tower 27 endeavor to clear the signal 17 while the slot mechanism is in such condition, owing to occupancy of the block B by the train T, he could draw his hand-lever 26 to its extreme rearward position—*i. e.*, to its extreme right-hand position, as shown in Fig. 1—and could thereby cause the signal-operating thrust-rod 20 at the signal-post 18 to rise and thrust upward upon the cylinder-rod 6, and such cylinder-rod 6 would then move upward and would carry the cylinder 7^a and entire cylinder-casting and magnet upward with it, while the piston proper, 8, would remain stationary, and the fluid in the cylinder would be freely ejected by the relative movement of the cylinder and piston through the vent 7^c and through the efflux-valve tube 7^f and the efflux-controlling valve 48 into the reservoir 7^d, because under these conditions there would be no restraining force to prevent the efflux-controlling valve from rising freely off its seat to permit such free efflux of fluid. During such a movement of the cylinder and attached parts the piston acts as a guide for the cylinder, and the cylinder-casting is also further guided by a slotted guide-foot 40^a, formed integrally upon and projecting horizontally rightward from the right edge of the square clamping-plate 40 and straddling a vertical guide-bar 65 of rectangular cross-section mounted at its upper and lower ends in the upper and lower guide-brackets 67 and 66, respectively. Assuming, however, that the train passes out of the block B before the operator in the tower endeavors to clear the signal 17, it will be noted that the controlling-magnet 46 will then be energized and will pull its armature 44 down against or nearer the poles of the magnet and will thereby press down on the armature-stem 43 and diaphragm-button 45, so as to distend the diaphragm 39 downward and hold it firmly against the top of the efflux-controlling cap-valve 48, thereby holding such valve firmly in closed position to resist efflux of fluid from the cylinder. Now the upward or signal-clearing thrust of the cylinder-rod 6 raises the cylinder and compresses the fluid therein by the resultant downward relative pressure of the piston 8, and since there is no escape for the fluid in the cylinder its pressure will force the piston upward in substantially fixed position relative to the cylinder and will thereby clear the signal 17. Should another train now enter the block B after the signal has been thus cleared, the controlling-magnet 46 would immediately become deëner-gized, its armature 44 and the diaphragm 39 would be returned to normal position by elasticity of the diaphragm, and the efflux-controlling cap-valve 48 would freely open and permit free efflux of fluid from the cylinder 7^a, thus permitting the counterweight of the signal 17 to force the piston 8 downward relative to the cylinder, while bringing the signal to its danger position and ejecting the fluid from the cylinder. It will be noted that when the signal thus goes to danger position the action of the piston in ejecting the fluid from the cylinder is that of a dash-pot which relieves the mechanical shock of the movement. After the signal thus goes

to danger position by the deënergization of the magnet 46 of the slot mechanism the operator of the tower may then replace his hand-lever 26 to its danger position—*i. e.*, its left-hand position in Fig. 1—thereby depressing the cylinder-rod 6 and cylinder 7^a, and thus causing the piston 8 to be drawn upward relative to the cylinder and causing the cylinder and piston to assume or approximate their normal relative positions. This upward stroke of the piston relative to the cylinder of course draws fluid freely into the cylinder through its vent 7^c from the reservoir 7^d and by way of the influx check-valve 49. Should the signal stick or bind in its clear position for any reason—for instance, under the weight of ice and snow clinging to the semaphore-blade, so as to overbalance its counterweight—the signal could then be positively forced to its danger position by forcibly moving the hand-lever 26 to danger position, and thereby pulling down upon the cylinder-rod 6 and the cylinder 7^a so as to engage the cylinder-cap 52 with the flanged bushing 11 on the lower end of the piston-rod 9 and by such engagement forcibly pull the piston-rod down and forcibly restore the signal to its danger position.

The fluid employed in the cylinder will generally be a non-freezing liquid—such, for instance, as alcohol or a mixture of alcohol and water—and the lower liquid-level in the reservoir 7^d will generally be slightly above the lower end of the cylindrical cap-valve 48.

A swell or chamber 57^a in the casing-cover 57 provides room for the compensating chamber 7^i, which extends some distance in front of the cylinder proper, 7^a, and the ironclad controlling-magnet 46. Such vertical cylindrical compensating chamber 7^i contains a collapsible bag or sack 53, of air-proof or gas-proof material, with its upper or open end clamped upon the upper end of the compensating chamber underneath a clamping-washer 54, and by means of a clamping-cap 55, which is screwed over the upper or open end of the compensating chamber and screwed firmly down upon the clamping-washer 54. This clamping-cap 55 is provided with a central vent-hole 55^a, communicating with the interior of the collapsible bag 53. The collapsible bag 53 forms a flexible or collapsible septum or seal between the reservoir 7^d and the outer atmosphere and prevents evaporation of the volatile elements of the liquid, while at the same time it provides for variation in the fluid-containing volume of the reservoir to permit such reservoir to give and take fluid from the cylinder without causing the pressure of the fluid in the reservoir to vary substantially from the normal atmospheric pressure.

It will be noted that the cylinder and its contained fluid are adapted to transmit upward or signal-clearing thrust to the piston 8 and piston-rod 9 in any and every relative position of such cylinder and piston-rod so long as traffic conditions permit the signal to be cleared safely—that is to say, in the present instance, so long as the block B is not occupied by a railway train or vehicle.

It will be apparent that my invention may be embodied in various forms of structure and arrangement of its elements and features and in various modifications of that embodiment which I have particularly illustrated and described, all such embodiments coming, however, within the spirit, principles, and scope of my invention.

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

1. Railway-traffic-controlling apparatus comprising traffic-controlling means proper, movable actuative means therefor, and a chamber arranged to be varied in volume by relative movement of the movable actuative means and the traffic-controlling means proper and arranged to transmit actuative or controlling motion or force from the movable actuative means to the traffic-controlling means proper by fluid-pressure developed by tendency to such relative movement and variation in chamber volume, a fluid-vent connected to the chamber, and means for controlling the vent to relieve the fluid-pressure and permit relative movement of the actuative means and traffic-controlling means proper.

2. Railway-traffic-controlling apparatus comprising traffic-controlling means proper, movable actuative means therefor, a fluid arranged to be compressed by relative movement or tendency toward relative movement of the movable actuative means and the traffic-controlling means proper and arranged to transmit actuative or controlling movement or force from the movable actuative means to the traffic-controlling means proper by fluid-pressure of the compression due to the said relative motion or tendency thereto, and means for relieving the fluid compression to permit said relative movement.

3. Railway-traffic-controlling apparatus comprising traffic-controlling means proper, movable actuative means therefor, a compression-chamber variable in containing volume by relative movement of the movable actuative means and the traffic-controlling means proper, a liquid contained in the compression-chamber and arranged to oppose by compressive resistance relative movement of the actuative means and traffic-controlling means proper and thus to transmit actuative or controlling force from the actuative means to the traffic-controlling means proper, a fluid-vent connected with the compression-chamber, and means for controlling the vent to relieve the fluid-pressure of compression in the compression-chamber and thereby permit relative movement of the actuative means and the traffic-controlling means proper.

4. Railway-traffic-controlling apparatus comprising traffic-controlling means proper located in proximity to a railway-track, movable actuative means for the traffic-controlling means proper, a chamber arranged to be varied in volume by relative movement of the movable actuative means and the traffic-controlling means proper and arranged to transmit actuative or controlling force from the actuative means to the traffic-controlling means proper by change in fluid-pressure developed by tendency toward the variation in chamber volume caused by tendency to the said relative movement of the actuative means and traffic-controlling means proper, a fluid-vent connected with the chamber, and automatic vent-controlling means responsive to movement of a railway-vehicle along the railway-track and arranged to control the fluid-vent to relieve the change in fluid-pressure so as to permit relative movement of the actuative means and traffic-controlling means proper.

5. Railway-traffic-controlling apparatus comprising traffic-controlling means proper located in proximity to a railway-track, movable actuative means arranged to operate the traffic-controlling means proper, a fluid-compression chamber arranged to have its fluid-containing volume reduced by relative movement of the movable actuative means and the traffic-controlling means proper and containing a fluid subject to compression by tendency to such reduction in chamber volume, so as to transmit by such compression actuative or controlling force from the actuative means to the traffic-controlling means proper, a fluid-vent connected with the compression-chamber, and vent-controlling means automatically responsive to movement of a railway-vehicle along the railway-track and arranged to control the fluid-vent and thus oppose or permit relative movement of the actuative means and the traffic-controlling means proper.

6. Railway-traffic-controlling apparatus comprising traffic-controlling means proper located in proximity to a railway-line, movable actuative means in actuative coöperation with the traffic-controlling means proper, a chamber arranged to be varied in volume by relative movement of the traffic-controlling means and the movable actuative means and arranged to oppose such relative movement by a change in fluid-pressure developed in such chamber by tendency to such variation of its volume whereby to transmit actuative or controlling force from the actuative means to the traffic-controlling means proper, a fluid-vent connected with the chamber, electrical vent-controlling means in control of the fluid-vent to relieve the change in fluid-pressure and permit relative movement of the actuative means and the traffic-controlling means proper, and a controlling electric circuit in control of the electrical vent-controlling means and controllable in turn by movement of a railway-vehicle along the railway-track.

7. Railway-traffic-controlling apparatus comprising traffic-controlling means proper located in proximity to a railway-track, movable actuative means in actuative coöperation with the traffic-controlling means proper, a fluid-compression chamber containing a fluid and arranged to be varied in its fluid-containing volume by relative movement of the movable actuative means and the traffic-controlling means proper and arranged to oppose such relative movement by compression of its contained fluid effected by tendency to such relative movement, a relief-vent communicating with the compression-chamber, an electrically-controllable vent-controlling valve in control of the relief-vent so as to relieve the fluid-pressure therein and permit relative movement of the actuative means and the traffic-controlling means proper, and a controlling electric circuit in control of the electrically-controllable vent-controlling valve, such circuit being in turn controllable by movement of a railway-vehicle along the railway-track.

8. Railway-traffic-controlling apparatus comprising traffic-controlling means proper located in proximity to a railway-track, manually-operatable controller-actuating means in actuative coöperation with the traffic-controlling means proper, a fluid-compression chamber arranged to compress its contained fluid by relative movement of the manual actuative means and the traffic-controlling means proper and containing a fluid adapted to oppose the said relative movement by fluid-pressure resistance, a fluid relief-vent communicating with the compression-chamber, a valve in control of the fluid relief-vent to open the same and relieve the fluid-pressure in the compression-chamber and thus permit relative movement of the manual actuative means and the traffic-controlling means proper, an electromagnet in control of the vent-controlling valve, and an electric circuit in control of the electromagnet and controllable in turn by movement of a railway-vehicle along the railway-track.

9. Railway-traffic-controlling apparatus comprising traffic-controlling means proper, movable controller-actuating means arranged in actuative relation to the traffic-controlling means proper, a fluid-compression chamber operatable by relative movement of the movable actuative means and the traffic-controlling means proper and containing a fluid arranged to oppose by compressive resistance such relative movement and thereby to transmit actuative or controlling movement or force from the actuative means to the traffic-controlling means proper, a second fluid-chamber, a fluid-vent connecting the

compression-chamber and the second fluid-chamber, and vent-controlling means arranged to control flow of fluid between the chambers.

10. Railway-traffic-controlling apparatus comprising traffic-controlling means proper, movable actuative means arranged to actuate the traffic-controlling means proper, a fluid-containing chamber reducible in fluid-containing volume by relative movement of the movable actuative means and the traffic-controlling means proper and containing a fluid arranged to oppose by compressive resistance the said relative movement and thus to transmit actuative or controlling movement or force from the actuative means to the traffic-controlling means proper, a second fluid-containing chamber variable in fluid-containing volume to contain a varying quantity of fluid, a fluid-vent connecting the first and second fluid-containing chambers, and vent-controlling means arranged to control flow of fluid between the two fluid-containing chambers so as to retain fluid in the first-mentioned fluid-containing chamber and transmit actuative or controlling movement or force to the traffic-controlling means proper or so as to relieve fluid-pressure in the first fluid-containing chamber and permit relative movement of the movable actuative means and the traffic-controlling means proper.

11. Railway-traffic-controlling apparatus comprising traffic-controlling means proper, movable controller-actuating means arranged to actuate the traffic-controlling means proper, a fluid-containing chamber reducible in fluid-containing volume by relative movement of the controller-actuating means and the traffic-controlling means proper and containing a fluid arranged to oppose such relative movement by compressive resistance and thus transmit actuative or controlling movement or force from the movable controller-actuating means to the traffic-controlling means proper, a second fluid-containing chamber communicating with the first fluid-containing chamber and including a flexible wall arranged to move and vary the fluid-containing volume of the second chamber, and means for controlling communication between the two fluid-containing chambers so as to retain or vent fluid-pressure in the first fluid-containing chamber whereby to transmit actuative or controlling movement or force from the controller-actuating means to the traffic-controlling means proper or to permit relative movement of such controller-actuating means and such traffic-controlling means proper.

12. Railway-traffic-controlling apparatus comprising traffic-controlling means proper, movable controller-actuating means arranged to operate the traffic-controlling means proper, a fluid-containing chamber variable in fluid-containing volume by relative movement of the controller-actuating means and the traffic-controlling means proper and containing a fluid arranged to oppose such relative movement by resistance to compression whereby to transmit controlling force from the controller-actuating means to the traffic-controlling means proper, a check-valve permitting influx of fluid into the fluid-containing chamber but arranged to arrest efflux of fluid therefrom, an efflux-controlling valve arranged to control efflux of fluid from the fluid-containing chamber, and electrical valve-controlling means arranged in control of the efflux-controlling valve.

13. Railway-traffic-controlling apparatus comprising traffic-controlling means proper, movable controller-actuating means arranged to operate the traffic-controlling means proper, a fluid-containing chamber variable in fluid-containing volume by relative movement of the controller-actuating means and the traffic-controlling means proper and containing a fluid arranged to oppose such relative movement by resistance to compression whereby to transmit controlling force from the controller-actuating means and the traffic-controlling means proper, a second fluid-containing chamber communicating with the first-mentioned fluid-containing chamber, a check-valve permitting flow of fluid from the second to the first fluid-containing chamber but arranged to arrest reverse flow of fluid, and electrically-controllable valve mechanism adapted to arrest or permit reverse flow of fluid from the first fluid-containing chamber to the second fluid-containing chamber.

14. Railway-traffic-controlling apparatus comprising traffic-controlling means proper, movable controller-actuating means arranged to operate the traffic-controlling means proper, a fluid-containing chamber variable in fluid-containing volume by relative movement of the controller-actuating means and the traffic-controlling means proper and containing a fluid arranged to oppose such relative movement by resistance to compression whereby to transmit controlling force from the controller-actuating means and the traffic-controlling means proper, a second fluid-containing chamber variable in fluid-containing volume and communicating with the first-mentioned fluid-containing chamber, a check-valve permitting flow of fluid from the second to the first fluid-containing chamber but arranged to arrest reverse flow of fluid, and electrically-controllable valve mechanism adapted to arrest or permit reverse flow of fluid from the first fluid-containing chamber to the second fluid-containing chamber.

15. Railway-traffic-controlling apparatus comprising traffic-controlling means proper, movable actuative means arranged to operate the traffic-controlling means proper, a cylinder and a piston arranged in coöperation with each other and one of such members be-

ing connected with the movable actuative means and the other of such members being connected with the traffic-controlling means proper and such members being movable relative to each other by relative movement of the actuative means and the traffic-controlling means proper and such cylinder containing a fluid subject to compression by such relative movement and arranged to oppose such relative movement by compressive resistance whereby to transmit controlling force from the actuative means to the traffic-controlling means proper, a relief-vent communicating with the cylinder, and means for controlling the relief-vent whereby to retain fluid-pressure in the cylinder for transmitting controlling force to the traffic-controlling means proper and whereby to relieve such fluid-pressure to permit relative movement of the traffic-controlling means proper and the actuative means.

16. Railway-traffic-controlling apparatus comprising traffic-controlling means proper, movable controller-actuative means arranged to operate the traffic-controlling means proper, a cylinder connected with the movable controller-actuative means, a piston cooperative with the cylinder and connected with the traffic-controlling means proper, a fluid contained in the cylinder and arranged to oppose by compressive resistance a relative movement of the cylinder and piston so as to transmit controlling force from the controller-actuative means to the traffic-controlling means proper, a relief-vent communicating with the cylinder, and means for controlling the relief-vent whereby to retain fluid-pressure in the cylinder for transmitting controlling force to the traffic-controlling means proper and whereby to relieve such fluid-pressure to permit relative movement of the traffic-controlling means proper and the actuative means.

17. Railway-traffic-controlling apparatus comprising traffic-controlling means proper, movable actuative means arranged to operate the traffic-controlling means proper, a cylinder and a piston arranged in coöperation with each other and one of such members being connected with the movable actuative means and the other of such members being connected with the traffic-controlling means proper and such members being movable relative to each other by relative movement of the actuative means and the traffic-controlling means proper and such cylinder containing a fluid subject to compression by such relative movement and arranged to oppose such relative movement by compressive resistance whereby to transmit controlling force from the actuative means to the traffic-controlling means proper, a relief-vent communicating with the cylinder, a valve in control of the relief-vent whereby to retain fluid-pressure in the cylinder and transmit controlling force from the movable actuative means to the traffic-controlling means proper and whereby to relieve such fluid-pressure and permit relative movement of such actuative means and traffic-controlling means proper, and an electromagnet movable with the cylinder and arranged to control the vent-controlling valve.

18. Railway-traffic-controlling apparatus comprising traffic-controlling means proper, movable actuative means arranged to operate the traffic-controlling means proper, a cylinder and a piston arranged in coöperation with each other and one of such members being connected with the movable actuative means and the other of such members being connected with the traffic-controlling means proper and such members being movable relative to each other by relative movement of the actuative means and the traffic-controlling means proper and such cylinder containing a fluid subject to compression by such relative movement and arranged to oppose such relative movement by compressive resistance whereby to transmit controlling force from the actuative means to the traffic-controlling means proper, a relief-vent communicating with the cylinder, a valve in control of the relief-vent whereby to retain fluid-pressure in the cylinder and transmit controlling force from the movable actuative means to the traffic-controlling means proper and whereby to relieve such fluid-pressure and permit the relative movement of such actuative means and traffic-controlling means proper, an electromagnet movable with the cylinder and arranged to control the vent-controlling valve, and a flexible conductor connected with the electromagnet to maintain electrical communication therewith while permitting movement of the magnet.

19. Railway-traffic-controlling apparatus comprising traffic-controlling means proper, controller-actuating means arranged to actuate the traffic-controlling means proper, a fluid-containing chamber variable in fluid-containing volume by relative movement of the controller-actuating means and the traffic-controlling means proper and containing a fluid adapted to oppose such relative movement by compressive resistance so as to transmit controlling force from the controller-actuating means to the traffic-controlling means proper, a sealed second fluid-containing chamber communicating with the first-mentioned fluid-containing chamber and comprising a collapsible bag adapted to vary the total fluid-containing volume of such second chamber whereby to give and take fluid from the first-mentioned fluid-containing chamber, and means for controlling communication between the two fluid-containing chambers whereby to retain fluid-pressure in the first-mentioned fluid-containing chamber so as to transmit controlling force to the

traffic-controlling means proper and whereby also to relieve such fluid-pressure in the first-mentioned fluid-containing chamber so as to permit relative movement of the controller-actuating means and the traffic-controlling means proper.

20. Railway-traffic-controlling apparatus comprising traffic-controlling means proper, movable actuative means arranged to actuate the traffic-controlling means proper, two coöperating fluid-compressive members connected one with the controller-actuating means and the other with the traffic-controlling means proper and arranged to contain a fluid and to compress the same by tendency to one direction of relative movement of the controller-actuating means and the traffic-controlling means proper whereby to transmit controlling force in one direction from the controller-actuating means to the traffic-controlling means proper, a fluid-vent communicating with the fluid-containing space formed by the two fluid-compressive members, means for controlling the vent to maintain fluid-pressure in such fluid-containing space and thereby transmit controlling force in one direction to the traffic-controlling means proper and for controlling such vent also to relieve the fluid-pressure in such space and thereby permit relative movement of the controller-actuating means and the traffic-controlling means proper, and positive connecting means arranged to effect positive mechanical connection between the controller-actuating means and the traffic-controlling means proper whereby to positively transmit actuative or controlling movement or force to the traffic-controlling means proper in the direction opposite to the aforementioned force transmitted from the controller-actuating means by fluid-pressure.

21. Railway-traffic-controlling apparatus comprising traffic-controlling means proper, controller-actuating means arranged to actuate the traffic-controlling means proper, a fluid-containing cylinder and a piston coöperative therewith, such cylinder and piston being connected one with the controller-actuating means and the other with the traffic-controlling means proper and such cylinder containing a fluid arranged to transmit controlling force in one direction from the controller-actuating means to the traffic-controlling means proper, a fluid-vent communicating with the cylinder, means for controlling passage of fluid through the fluid-vent, and a device connected with the cylinder and arranged to engage the piston and positively transmit mechanical force thereto in a direction opposite to the direction of the aforementioned force transmitted by the fluid.

22. Railway signaling apparatus comprising signal-indicating means having a normal bent to a given signal indication, signal-actuative means arranged to actuate the signal-indicating means, and signal-governing means coöperative with the signal-indicating means and with the signal-actuative means to govern transmission of actuative or controlling force from the signal-actuative means to the signal-indicating means and such signal-governing means including members movable relative to each other by relative movement of the signal-actuative and signal-indicating means so as to develop fluid-pressure effective to transmit actuative or controlling force to the signal-indicating means in opposition to its normal bent, and such signal-governing means also including fluid-pressure-relief means arranged to relieve the aforementioned fluid-pressure and permit actuation of the signal-indicating means by its normal bent.

23. Railway signaling apparatus comprising signal-indicating means having a normal bent to a given signal indication, signal-actuative means arranged to actuate the signal-indicating means, a positive connection between the signal-actuative means and the signal-indicating means arranged to positively transmit actuative or controlling force to the signal-indicating means in the direction of its normal bent, and signal-governing means cooperative with the signal-indicating means and with the signal-actuative means to govern transmission of actuative or controlling force from the signal-actuative means to the signal-indicating means and such signal-governing means including members movable relative to each other by relative movement of the signal-actuative and signal-indicating means so as to develop fluid-pressure effective to transmit actuative or controlling force to the signal-indicating means in opposition to its normal bent, and such signal-governing means also including fluid-pressure-relief means arranged to relieve the aforementioned fluid-pressure and permit actuation of the signal-indicating means by its normal bent.

24. Railway signaling apparatus comprising a signal proper, two vertical movable thrust-rods disposed in substantial alinement and arranged to transmit actuative or controlling thrust to the signal proper, a cylinder disposed in alinement with the thrust-rods and connected to one of such rods, a piston coöperative with the cylinder and also disposed in alinement with the thrust-rods and connected to the other of such rods, a fluid-containing chamber movable with the cylinder, a fluid-vent affording communication between the cylinder and fluid-containing chamber, a check-valve permitting influx of fluid into the cylinder from the fluid-containing chamber upon the influx-stroke of the piston but arresting efflux of fluid from the cylinder, an efflux-controlling valve arranged to permit and to control efflux of fluid from the cylinder to the fluid-containing chamber, an electromagnet movable with the cylinder and fluid-

containing chamber and arranged in control of the efflux-controlling valve, circuit connections for the electromagnet, and means for limiting the influx-stroke of the piston relative to the cylinder.

25. Railway signaling apparatus comprising a railway-signal proper, movable signal-actuative means arranged to actuate the signal proper, a fluid-containing chamber variable in fluid-containing volume by relative movement of the signal-actuative means and the signal proper and arranged to oppose such relative movement by fluid-pressure resistance whereby to transmit controlling force from the signal-actuative means to the signal proper, a vent communicating with the fluid-containing chamber, means for controlling the vent to relieve the fluid-pressure resistance and permit relative movement of the signal-actuative means and the signal proper, and a casing inclosing the fluid-containing chamber.

26. Railway signaling apparatus comprising a railway-signal proper, movable signal-actuative means, signal-controlling means arranged to transmit actuative force from the signal-actuative means to the signal proper and including a fluid-containing chamber variable in volume by relative movement of the signal-actuative means and the signal proper and arranged to oppose such relative movement by fluid-pressure resistance whereby to transmit actuative force to the signal proper and such signal-controlling means including also a second fluid-containing chamber, a vent affording fluid communication between the two fluid-containing chambers, means for controlling the vent, and a casing inclosing the foregoing portions of the signal-controlling means.

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

CLARENCE W. COLEMAN.

Witnesses:

HENRY D. WILLIAMS,

HUBER H. GIBBS.