No. 814,012. PATENTED MAR. 6, 1906.

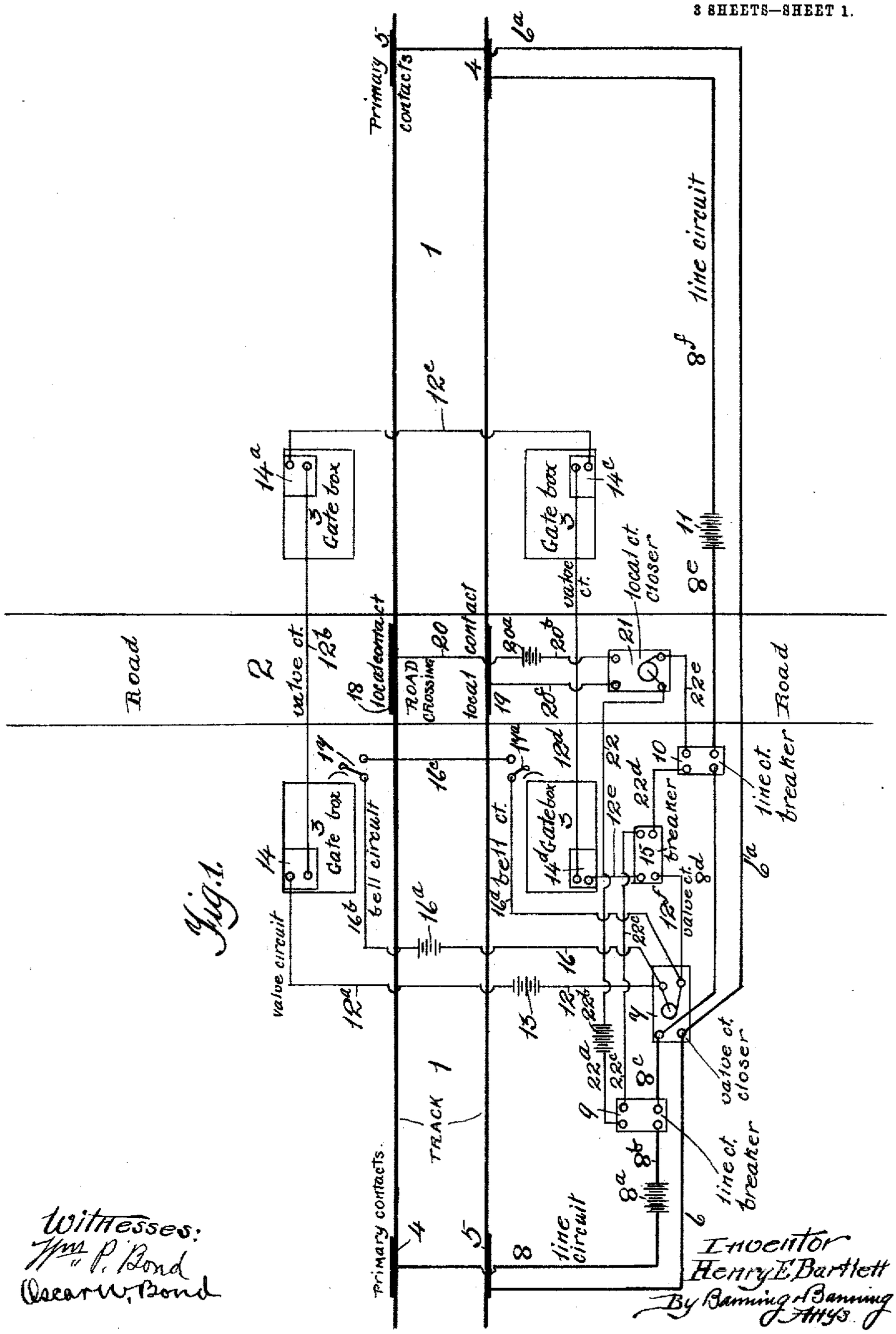
H. E. BARTLETT.

AUTOMATIC RAILWAY SAFETY GATE.

APPLICATION FILED APR. 4, 1905.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2.

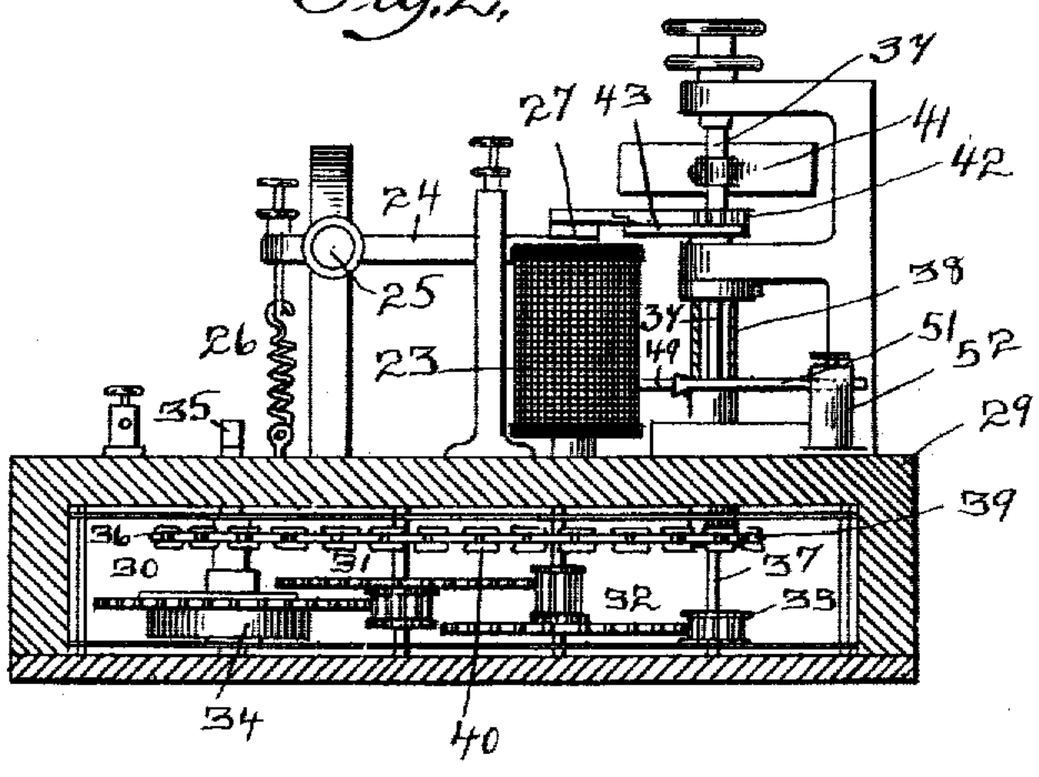

Fig. 7.

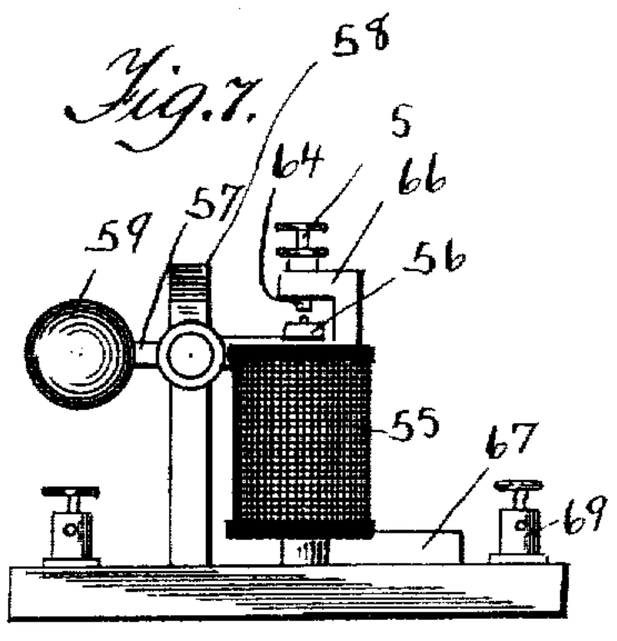

Fig. 3.

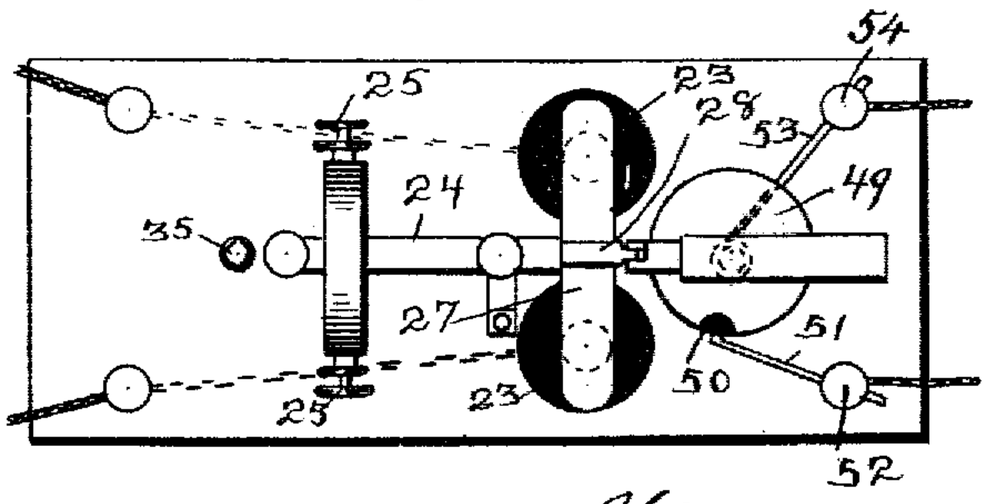

Fig. 8.

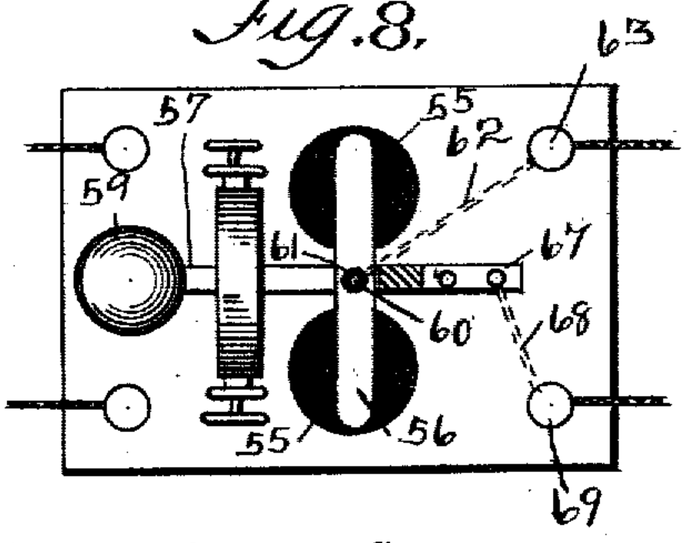

Fig. 5.

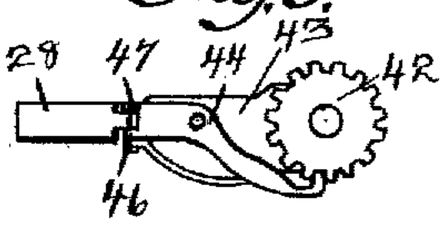

Fig. 4.

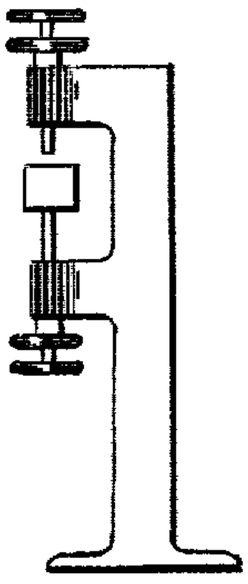

Fig. 9.

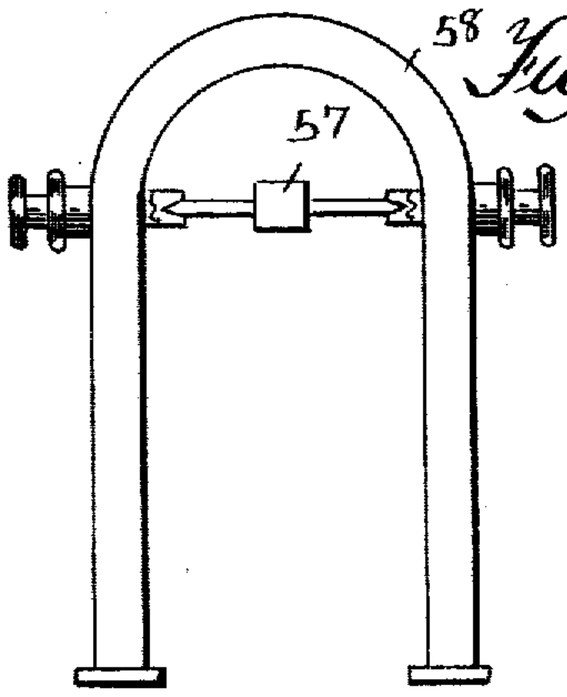

Fig. 6.

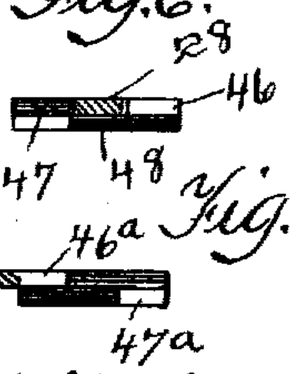

Fig. 6a

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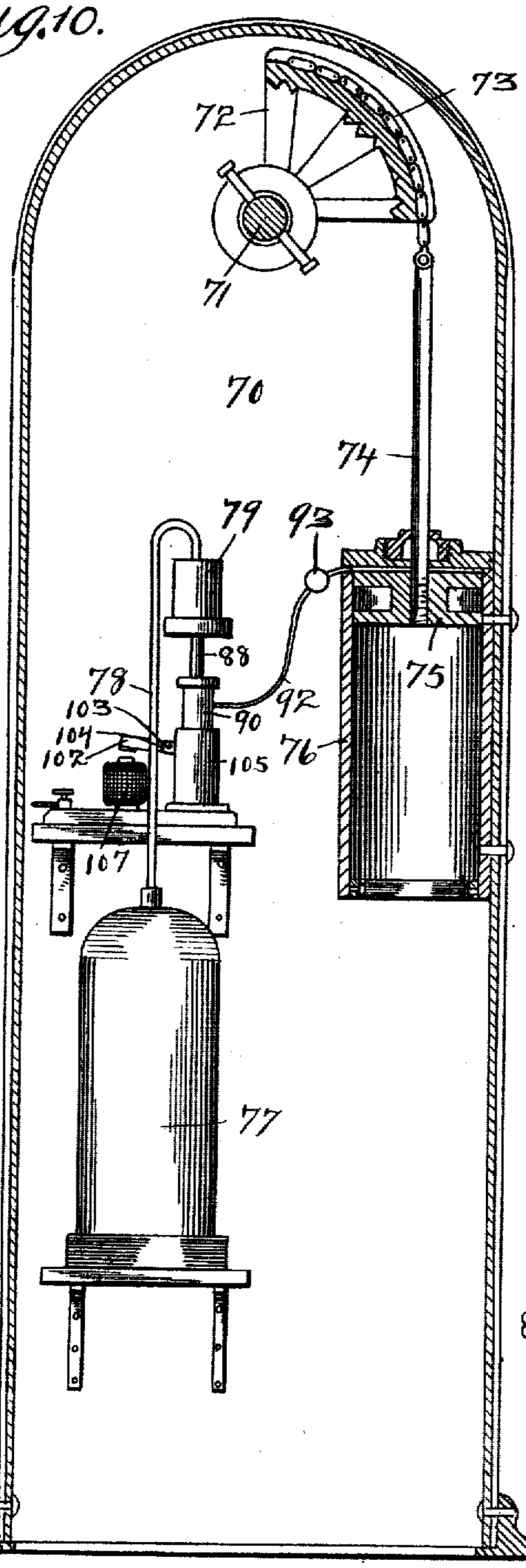
3 SHEETS—SHEET 3.

Fig. 10.



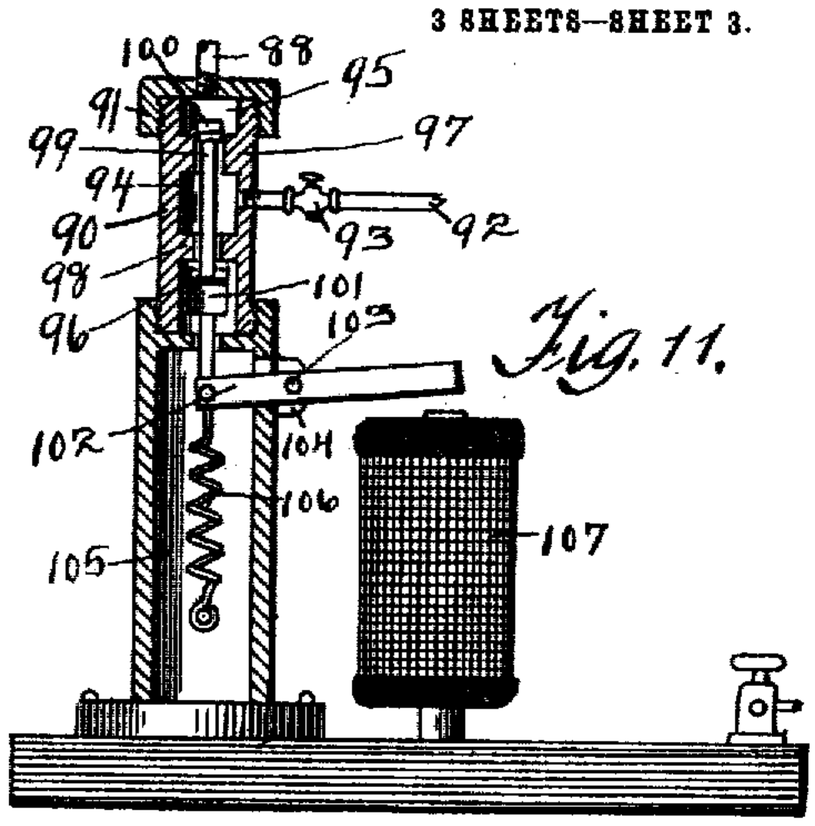


Fig. 11.

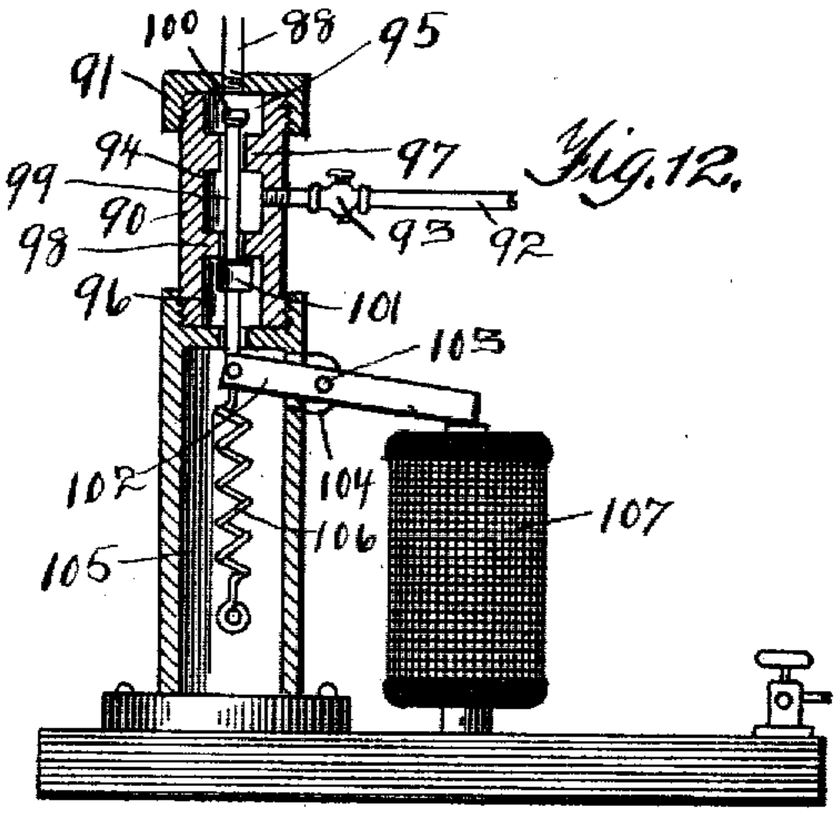
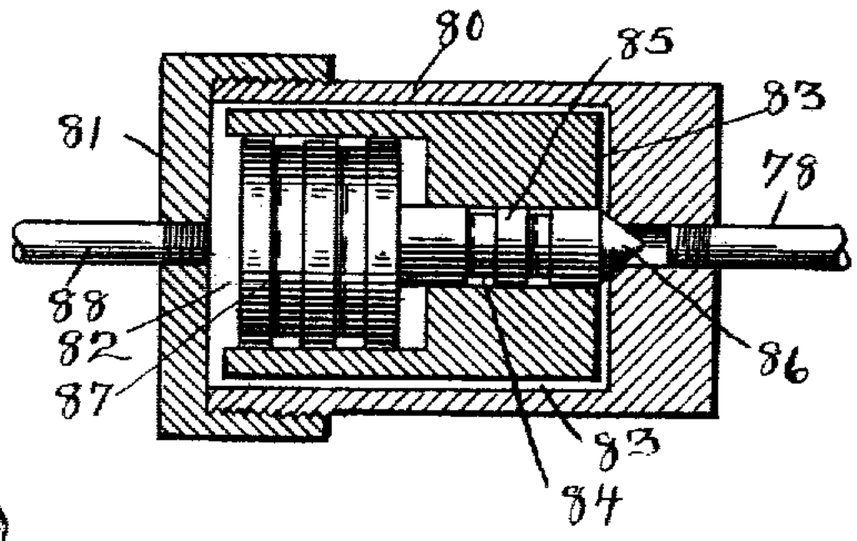


Fig. 12.

Fig. 13.



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UNITED STATES PATENT OFFICE.

HENRY E. BARTLETT, OF CHICAGO, ILLINOIS.

AUTOMATIC RAILWAY SAFETY-GATE.

No. 814,012. Specification of Letters Patent. Patented March 6, 1906.

Application filed April 4, 1905. Serial No. 253,770.

To all whom it may concern:

Be it known that I, HENRY E. BARTLETT, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Automatic Railway Safety-Gates, of which the following is a specification.

The object of this invention is to construct an automatic railway safety-gate adapted to be operated by means of liquid carbonic-acid gas or similar fluid under pressure; and the invention more particularly relates to the devices employed for utilizing the fluid-pressure and to the system of electric circuits employed for actuating the gate-controlling mechanism simultaneously with the passage of a train onto the line-contacts.

The invention also relates to the mechanism employed for timing the closing of the gates and to the provision of circuit-closers and circuit-breakers for holding the gates closed for a predetermined period of time and allowing them to rise after the passage of a train over the crossing.

The invention further relates to the means employed for preventing the operation of the gates by a departing train and the means employed for actuating the gates by the approach of a train from either direction.

The invention finally consists in the features of construction and combination of parts hereinafter described and claimed.

In the drawings illustrating the invention, Figure 1 is a diagrammatical plan view of a section of track and road-crossing, showing the arrangement of circuits for actuating the gates; Fig. 2, a view, partly in section, of one of the circuit-closers; Fig. 3, a top or plan view of the same; Fig. 4, a detail of the device for regulating the movement of the armature; Figs. 5 and 6 and 6^a, details of the dog and finger for controlling the same; Fig. 7, a side elevation of one of the circuit-breakers; Fig. 8, a top or plan view of the same; Fig. 9, an enlarged detail of the support for pivoting the lever carrying the armature; Fig. 10, a view showing the interior of the gate-box and mechanism therein contained; Figs. 11 and 12, sectional elevations of the valve-regulating mechanism for controlling the flow of fluid-pressure, and Fig. 13 an enlarged sectional view of the pressure-reducer.

In Fig. 1 of the drawings, 1 indicates a section of track, and 2 a road crossing the track, and at a suitable proximity to the road-crossing are located the gate-boxes 3, which contain the gate-operating mechanism hereinafter described. At a suitable distance on either side of the road-crossing, preferably a distance adapted to be passed over in about two minutes by trains running at ordinary speed, are located insulated primary contacts 4 and 5 in the companion rails and immediately opposite one another. These contacts may be either separate plates of metal adapted to be connected by the tread of the wheels on a single truck of the train or they may be insulated sections of track, although it is sometimes impossible to employ sections of track where block-signal or other similar mechanism has been installed. The companion contacts are adapted to be electrically connected by the wheels of a train, which bridge the space between the rails and momentarily connect the contacts together.

Leading from the primary contact 5 on one side of the road-crossing is a line-circuit wire 6, which leads to a circuit-closer 7, adapted to close the valve-circuit for a predetermined period of time, which closer will be hereinafter described in detail, and the line-circuit is continued through a line-wire 6^a, which leads from the circuit-closer to the companion primary contact 5 at the opposite side of the road-crossing. The line-circuit is completed through a line-wire 8, which leads from one of the primary contacts 4 to a battery 8^a, which is connected, by means of a wire 8^b, with a circuit-breaker 9, which is connected with the circuit-closer 7 by means of a section of wire 8^c, and the circuit-closer 7 is connected, by means of a wire 8^d, with a circuit-breaker 10, from which leads a wire 8^f, connecting with the primary contact 4 at the opposite side of the road-crossing and having therein a battery 11. The circuit-closer 7, which may be termed the "valve-circuit closer," is adapted to close for a predetermined period of time a circuit for actuating the valve mechanism in the four gate-boxes, which circuit may be termed the "valve-circuit," and is formed through the medium of wires 12 and 12^a and a battery 13, which lead to the first valve-actuating mechanism 14, and the valve-circuit is continued through a wire 12^b, leading to the second valve-actuating mechanism 14^a, which mechanism is connected with a third valve-actuating mechanism 14^c by the wire 12^c, and the third valve-actuating mechanism is connected with a fourth valve-actuating mechanism 14^d by

means of a wire 12^d. The valve-circuit is completed through a pair of wires 12^e and 12^f, the former of which connects the fourth valve-actuating mechanism with a circuit-breaker 15 and the latter of which connects the circuit-breaker 15 with the circuit-closer 7, completing the valve-circuit through the four valve-actuating mechanisms and the circuit-breaker. The valve-closer 7 is also adapted to close for a predetermined period a bell-circuit, which consists of a wire 16, battery 16^a, and wire 16^b, leading to the first bell 17, which bell is connected with the second bell 17^a by means of a wire 16^c, and the bell-circuit is completed by means of a wire 16^d, which leads back to the circuit-closer 7.

In addition to the circuits heretofore described is a local circuit which is adapted to be closed by the passage of the train-wheels over a pair of secondary contacts 18 and 19, which are located at or very near the road-crossing. From the contact 18 leads a wire 20 to a battery 20^a, from which leads a wire 20^b to a circuit-closer 21, and the local circuit is completed through a wire 20^c, which returns to and connects with the secondary contact 19 for actuating the local-circuit closer by the passage of a train over the road-crossing. The local-circuit closer is adapted to actuate the three circuit-breakers heretofore mentioned as circuit-breakers 9, 10, and 15, and all these circuit-breakers are positioned in a breaker-circuit which consists of wires 22 and 22^a, between which is located a battery 22^b, and the wire 22^a connects with the circuit-breaker 9. The circuit-breaker 9 is connected with a circuit-breaker 15 by means of a wire 22^c, and the circuit-breaker 15 is connected to the circuit-breaker 10 by means of a wire 22^d, and the breaker-circuit is completed by means of a wire 22^e, which leads back to the local-circuit closer 21, so that the closing of the local circuit operates the local-circuit closer and breaks the circuits in which the respective circuit-breakers are located. For convenience the circuit-breaker 9 may be called the "primary" line-circuit breaker, the circuit-breaker 10 the "secondary" line-circuit breaker, and the circuit-breaker 15 the "valve-circuit" breaker.

Before describing the construction of the circuit-closers, circuit-breakers, and valve apparatus it will be well to describe briefly the function and operation of the several circuits herein described. When a train approaches the road-crossing from either direction—as, for instance, from the left—the contact of the wheels bridges the space between the primary contacts 4 and 5, thereby temporarily closing the line-circuit and operating the valve-circuit closer 7, which, as will be hereinafter explained, is constructed to operate for a predetermined period of time. The operation of the circuit-closer closes the valve and bell circuits through the four gate-boxes, and unless otherwise interrupted, as will hereinafter appear, these circuits will remain closed for a predetermined period of time so long as the valve-circuit closer is in operation. The valve-circuit closer is timed to operate sufficiently long to allow a train running an ordinary speed to pass the road-crossing. If, on the other hand, the train passes over the space intervening between the primary contact and the road-crossing in a less period of time than the average, it is desirable to allow the gates to rise immediately after the passage of the train instead of waiting until the line-circuit closer has operated to its full extent. To accomplish this raising of gates, a local circuit is provided which is closed by the wheels of the train when passing the road-crossing and serves to operate the local-circuit closer 21, which operates for a predetermined period of time after the train has passed the crossing, and the operation of the local-circuit closer actuates the line-circuit breaker 10, which breaks the line-circuit for a sufficient period of time to allow the departing train to pass beyond the primary contacts 4 and 5 on the farther side of the road-crossing, so that the gates will not be operated by a departing train. The local-circuit closer 21 also operates the valve-circuit breaker 15, which stops the operation of the valves immediately after the passage of the train over the road-crossing, thereby immediately allowing the gates to rise. The local-circuit closer also actuates the circuit-breaker 9, which is likewise in the line-circuit; but it is necessary to provide two circuit-breakers, since there are, in effect, two line-circuits running to the valve-circuit closer 7 from opposite directions.

A detailed description of the circuit-closers 7 and 21 is as follows: Each of the circuit-closers consists of a pair of magnet-coils 23 and an arm 24, pivoted between needle-bearings 25 and having at its outer end a spring connection 26 for normally holding the arm raised. The arm carries at its opposite end a transversely-extending armature 27, adapted to be drawn down by the magnet-coils, and forwardly projecting from the armature is a finger 28.

The mechanism heretofore described is mounted upon a box 29, having therein a train of gears 30, 31, 32, and 33. The gear 30 is actuated by means of a coil-spring 34 in the usual manner and is mounted on a shaft 35, carrying a sprocket-wheel 36. The shaft 35 may be termed the "driving-shaft," and a shaft 37, upon which is mounted the gear-pinion 33, may be termed the "fan-shaft." Rotatably mounted around the fan-shaft is a sleeve 38, having at its lower end a sprocket-wheel 39, and between the sprocket-wheel 36 and the sprocket-wheel 39 is a sprocket-chain 40 for rotating the sleeve 38 at a speed substantially twice the speed of rotation of the

driving-shaft. The fan-shaft has mounted on its upper end a fan 41, which is adapted to revolve at a high rate of speed as compared with the rotation of the surrounding sleeve, and at the same time the power exerted by the fan-shaft as compared with the sleeve will be in inverse ratio to their speeds of revolution. The fan serves as a governor for regulating the speed of the fan-shaft and gearing. The fan-shaft has rigidly secured thereto a toothed wheel 42, and the sleeve has rigidly secured thereto an arm 43. (Best shown in Fig. 5.) The arm has pivoted thereto a dog 44, the tooth 45 of which is adapted to engage with the toothed wheel. The rear end of the dog outwardly projects beyond the arm 43 and terminates in a pair of fingers 46 and 47 in the valve-circuit closer and 46^a and 47^a in the local-circuit closer, the former of which in each case has a greater vertical elevation than the latter, as shown in Figs. 6 and 6^a, and between the fingers is a space 48, into which normally projects the finger 28 on the armature. When the armature is raised, the finger 28 will contact with the finger 46, thereby preventing the movement of the arm 43 and forcing the tooth of the contact into an engagement with the toothed wheel, which locks the fan-shaft and prevents further rotation. The sleeve has mounted thereon a disk 49, of conductive material, such as brass, in the periphery of which is a block of rubber or other non-conductive material 50, which coöperates with a metallic brush 51, secured to a binding-post 52. The brush 51 coöperates with a brush 53 in contact with the sleeve 38 or other portion of the metallic structure, and said brush is secured to a binding-post 54, to which binding-posts are secured the wires forming the circuits, which are intended to be closed by the operation of the circuit-closer. In the case of the valve-circuit closer 7 the wires composing the valve and bell circuits are secured to said binding-posts, and in the case of the local-circuit closer the wires leading to the circuit-breakers are secured to the binding-posts. When the armature is raised, the brush 51 will rest in contact with the insulating-block 50, thereby holding the circuit open; but when the armature is depressed by the closing of the line-circuit from either end the finger on the armature will be thrown down out of contact with the dog 44, releasing the dog from engagement with the wheel on the fan-shaft and allowing the revolution of the sleeve and disk 49, which is secured thereto, and the disk will move during a predetermined period of time a single revolution, during which time the brush 51 will be in contact with the conductive metal of the disk and the circuit will be closed. If for any reason a train should stop for a considerable length of time on the primary contacts, thereby keeping the line-circuit closed, the movement of the disk will be stopped after one revolution by the abutment of the lower tooth 47 against the finger 28, which when the armature is depressed will lie in the path of travel of the lower finger. When the circuit is subsequently broken by the passage of the train off of the primary contacts, the finger 28 will again rise, allowing the disk to revolve slightly until the upper finger 46 is brought into engagement therewith, thereby finally stopping the movement of the disk. In either position, however, the brush 51 will rest upon the non-conductive block 50, so that the circuit through the metallic disk will be broken. In the circuit-closer 21 the fingers 46^a and 47^a are similar to fingers 46 and 47; but their position is reversed.

The circuit-breakers 9, 10, and 15 each consists of an electromagnet 55, which is adapted to be energized to draw down an armature 56, mounted on an arm 57, pivoted within a yoke 58, and the armature end of said arm is normally raised by a weight 59. In the center of the arm is a metallic contact-point 60, insulated by a surrounding block 61, of insulating material, and to the contact-point leads a wire 62, connecting with a binding-post 63, to which is secured one of the circuit-wires composing the circuit within which is located the circuit-breaker. Immediately above the movable contact-point 60 is a fixed contact-point 64, the position of which may be adjusted by means of an adjusting-screw 65, mounted within an overhanging upright 66, to the base 67 of which is secured a wire 68, leading to the binding-post 69, which is a companion to the binding-post 63, and serves as an attachment for the companion circuit-wire. When the arm 57 is held normally raised, the circuit will be closed through the movable and fixed contact-points and will remain closed until the electromagnets are energized, drawing down the armature and breaking the circuit.

Each of the four gates is mounted on a gate-box 70, of suitable size and shape, through which passes a gate-shaft 71, having mounted thereon a segmental sprocket-wheel 72, over which passes a sprocket-chain 73, connected with a piston-rod 74, having on its end a piston 75, mounted within a cylinder 76, secured to the gate-box. The piston is actuated by means of liquid carbonic-acid gas or similar fluid-pressure stored up in the pressure-tank 77, from which leads a pressure-supply pipe 78 to a pressure-reducer 79, which consists of a casing 80, into the end of which is entered the pressure-pipe 78 and which is closed at its opposite end by means of a cap 81, leaving on the interior a chamber 82, to which lead small passages 83, communicating with the pressure-supply pipe 78. The chamber 82 has leading therefrom a bore 84 in line with the pressure-pipe 78, within which bore is entered a valve-stem 85, tapered at its end 86, and said

valve-stem connects with an enlarged piston 87, adapted to move within the chamber 82. The cap 81 has entered thereinto a reduced-pressure pipe 88, leading to an actuating-valve, which valve consists of a shell or casing 90, closed at its upper end by means of a cap 91, and said casing has entered thereinto at one side a pressure-discharge pipe 92, having suitably located therein a valve 93 for regulating the flow of pressure, which pipe leads to the upper end of the operating-cylinder 76, so that when pressure is admitted above the piston 75 the piston will be forced down to actuate the segmental wheel and gate-shaft, causing the gates to descend. The valve-casing 90 has on its interior a central chamber 94, an upper chamber 95, and a lower chamber 96, the upper and lower chambers being separated from the central chamber by annular flanges 97 and 98, respectively. Within the casing is a valve-stem 99, having at its upper end an enlarged head 100, adapted when depressed, as shown in Fig. 11, to set against the annular flange 97, and below the annular flange 98 on the valve-stem is a collar 101, adapted when the valve-stem is raised, as shown in Fig. 12, to set against the lower annular flange 98. The movement of the valve-stem is regulated by means of a lever 102, pivoted at a point 103 between ears 104 on the wall of a cylindrical base or support 105, and the outer or free end of the lever is adapted to be normally held raised by the tension of a spring 106 and the pressure on the head 100. The outer or free end is located immediately above the core of an electromagnet 107, which when energized is adapted to draw down the end of the lever out of the position shown in Fig. 11 into the position shown in Fig. 12.

In operation, when the valve-circuit has been closed, as heretofore described, the electromagnet 107 in each of the four gate-boxes will be energized, drawing down in each case the lever 102, which raises the valve-stem 99, unseating the head 100 and allowing the pressure to flow from the pipe 88, through the upper chamber 95, to the middle chamber 94, and thence through the pipe 97 to the cylinder 76 to actuate the piston therein and raise the gate. When the valve-circuit is broken either by the complete revolution of the disk on the circuit-closer 7 or by the action of the valve-circuit breaker 15, the electromagnets 107 in each of the gate-boxes will be deënergized, allowing the lever 102 to be thrown up into the position shown in Fig. 11, which seats the valve-head 100, thereby shutting off the supply of fluid-pressure and at the same time unseating the collar 101, which allows the pressure in the cylinder 76 to escape through the lower chamber 96 and out into the atmosphere. In view of the fact that liquid carbonic-acid gas is held under a very high pressure it is necessary to employ the pressure-reducer 79, heretofore described, which allows a high pressure to enter through the pipe 78 and strike against the tapered end 86 of the valve-stem, which serves to force back the piston 87, unseating the valve-stem and allowing the fluid to flow through the passages 80 and act upon the enlarged end of the piston 87. This allows it to expand, reducing its pressure, and the fluid will flow continuously until the pressure at both ends of the movable member in the reducer is equalized. This equalization will take place when the products obtained by multiplying the degree of pressure by the area acted upon are equal at both ends of the movable member.

As has been already stated, the fingers 46ª and 47ª on the local circuit-closer are reversely positioned with respect to the fingers 46 and 47 on the valve-circuit closer. The reason for this is that it is desirable to have the valve-circuit closer begin its operation as soon as the train has passed onto the primary contacts at either side of the gate and immediately close the valve-circuit for a predetermined period of time while the train is approaching the gate. It is desirable, however, that the circuit through the local-circuit closer be not established until the last wheels of the train have actually passed the road-crossing and the local contacts at that point. For this reason the finger 28 of the local-circuit closer will normally occupy the position shown in Fig. 6ª. As soon as the front wheels of the train bridge the local contacts and establish a circuit through the local-circuit closer the armature will be drawn down out of engagement with the finger 46ª into the path of travel of the finger 47ª, and the conductive disk 49 will be moved but a fraction of a revolution, and the movement will not be sufficient to bring the conductive portion of the disk 49 into contact with the brush 51. When the last wheels of the departing train have left the local contacts, the armature and finger 28 will of course rise out of abutment with the lower finger 47ª, after which the conductive disk will be free to make a complete revolution, bringing the brush 51 into contact with the conductive portion of the disk and closing the circuit for a predetermined period of time until the departing train has passed the farther primary contact-points. Except for this slight change in the relative position of the fingers the two closers are of similar construction, and this change in adjustment holds the gates closed until the entire train has passed the road-crossing. In order, however, that the local-circuit closer be not successively actuated by each pair of wheels on the train, it is necessary that the length of the local contacts be sufficient to bridge the longitudinal distance between any two pairs of wheels on a train, so that the local circuit will remain

closed continuously during the entire passage of the train over the road-crossing.

It will be seen from the foregoing description that the device of the present invention is adapted to operate in a manner which will be satisfactory under all conditions. The gates under no circumstances will remain closed for a longer period of time than that occupied during one revolution of the closer, and provision is made for raising the gates at all times after a train has actually passed the crossing. The valve-actuating mechanism is one which can be readily installed and suitably protected by the gate-box, which will also serve as a receptacle or shelter for the electric apparatus heretofore described, although said apparatus may be suitably located at any point along the line. By using liquid carbonic-acid gas sufficient liquid may be stored up in a small steel bottle or tank to operate the gates for a long period of time, and in view of the small amount of space occupied and the light weight of the tanks or bottles no difficulty will be experienced in renewing the supply of pressure by providing a new bottle of the liquid gas when necessary.

What I regard as new, and desire to secure by Letters Patent, is—

1. In an automatic railway safety-gate, an actuating mechanism for the gate adapted to be operated by fluid-pressure, a valve controlling the flow of fluid-pressure to the actuating device, an electromagnet adapted to actuate the valve, a line-circuit adapted to be closed by the passage of a train over the track, a circuit-closer adapted to be actuated by the closing of the line-circuit, a valve-circuit leading from the circuit-closer to the valve-actuating electromagnet, and means for maintaining a closed circuit through the closer for a predetermined period of time, substantially as described.

2. In an automatic railway safety-gate, the combination of an actuating mechanism for the gate, adapted to be operated by fluid-pressure, a valve controlling the flow of fluid-pressure to the actuating device, and an electromagnet adapted to actuate the valve, a line-circuit adapted to be closed by the passage of a train over the track, a circuit-closer adapted to be actuated by the closing of the line-circuit, a valve-circuit leading from the circuit-closer to the valve-operating eletromagnet and means for maintaining a closed circuit through the circuit-closer for a predetermined period of time after the primary closer has been broken, substantially as described.

3. In an automatic railway safety-gate, the combination of an actuating mechanism for the gate, adapted to be operated by fluid-pressure, a valve controlling the flow of fluid-pressure to the actuating device, and an electromagnet adapted to actuate the valve, a line-circuit adapted to be closed by the passage of a train over the track, a circuit-closer adapted to be actuated by the closing of the line-circuit, a valve-circuit leading from the circuit-closer to the valve-operating electromagnet and means for maintaining a closed circuit through the closer for a predetermined period of time after the primary closer has been broken, and a circuit-breaker in the valve-circuit adapted to be actuated by the passage of a train past the gate for breaking the valve-circuit and allowing the gate to immediately rise, substantially as described.

4. In an automatic railway safety-gate, the combination of an actuating mechanism for the gate, adapted to be operated by fluid-pressure, a valve controlling the flow of fluid-pressure to the actuating device, and an electromagnet adapted to actuate the valve, a line-circuit adapted to be closed by the passage of a train over the track, a circuit-closer adapted to be actuated by the closing of the line-circuit, a valve-circuit leading from the circuit-closer to the valve-operating electromagnet and means for maintaining a closed circuit through a circuit-closer for a predetermined period of time after the primary circuit has been broken, a local circuit adapted to be closed by the passage of a train past the gate, a local-circuit closer adapted to be actuated for a predetermined period of time by the closing of the local circuit, and a circuit-breaker in the valve-circuit adapted to be actuated by the circuit-closer for breaking the valve-circuit for a predetermined period of time, substantially as described.

5. In an automatic railway safety-gate, the combination of a gate-closing mechanism adapted to be operated by fluid-pressure, a valve controlling the admission of fluid-pressure, an electromagnet adapted to actuate the valve, a line-circuit extending in opposite directions from the gate and adapted to be closed by the passage of a train toward the gate from either direction, a line-circuit closer adapted to be actuated by the closing of the line-circuit from either direction, circuit-breakers in the line-circuit on opposite sides of the line-circuit closer, a valve-circuit for actuating the valve-operating electromagnet and adapted to be closed by the line-circuit closer, a circuit-breaker in the valve-circuit and a local circuit adapted to be closed by the passage of a train past the gate for simultaneously breaking the line-circuit and the valve-circuit, substantially as described.

6. In an automatic railway safety-gate, the combination of a gate-closing mechanism adapted to be operated by fluid-pressure, a valve controlling the admission of fluid-pressure, an electromagnet adapted to actuate the valve, a line-circuit extending in opposite directions from the gate and adapted to be closed by the passage of a train toward the

gate from either direction, a line-circuit closer adapted to be actuated by the closing of the line-circuit from either direction, circuit-breakers in the line-circuit on opposite sides of the line-circuit closer, a valve-circuit for actuating the valve-operating electromagnet and adapted to be closed by the line-circuit closer, a circuit-breaker in the valve-circuit, a local circuit adapted to be closed by the passage of a train past the gate, a local-circuit-closer adapted to be actuated for a predetermined period of time by the closing of the local circuit, and a breaker-circuit leading to the three circuit-breakers and adapted to be closed for a predetermined period of time by the local-circuit closer, substantially as described.

7. In an automatic railway safety-gate, the combination of a gate-shaft, a piston for rotating the gate-shaft, a cylinder within which the piston is located, a pressure-supply tank, a pipe leading therefrom to the cylinder, a valve located in said pipe and consisting of a valve-casing having therein a movable valve-stem, a lever pivoted to the valve-stem for operating the same, a spring for normally holding the valve-stem seated, and an electromagnet adapted to draw down the free end of the lever against the tension of the spring to open the valve, substantially as described.

HENRY E. BARTLETT.

Witnesses:
OSCAR W. BOND,
WALKER BANNING.