D. H. SCHWEYER.

AUTOMATIC TRAIN CONTROL SYSTEM.

APPLICATION FILED SEPT. 6, 1916.

1,389,602.

Patented Sept. 6, 1921.

6 SHEETS—SHEET 1.

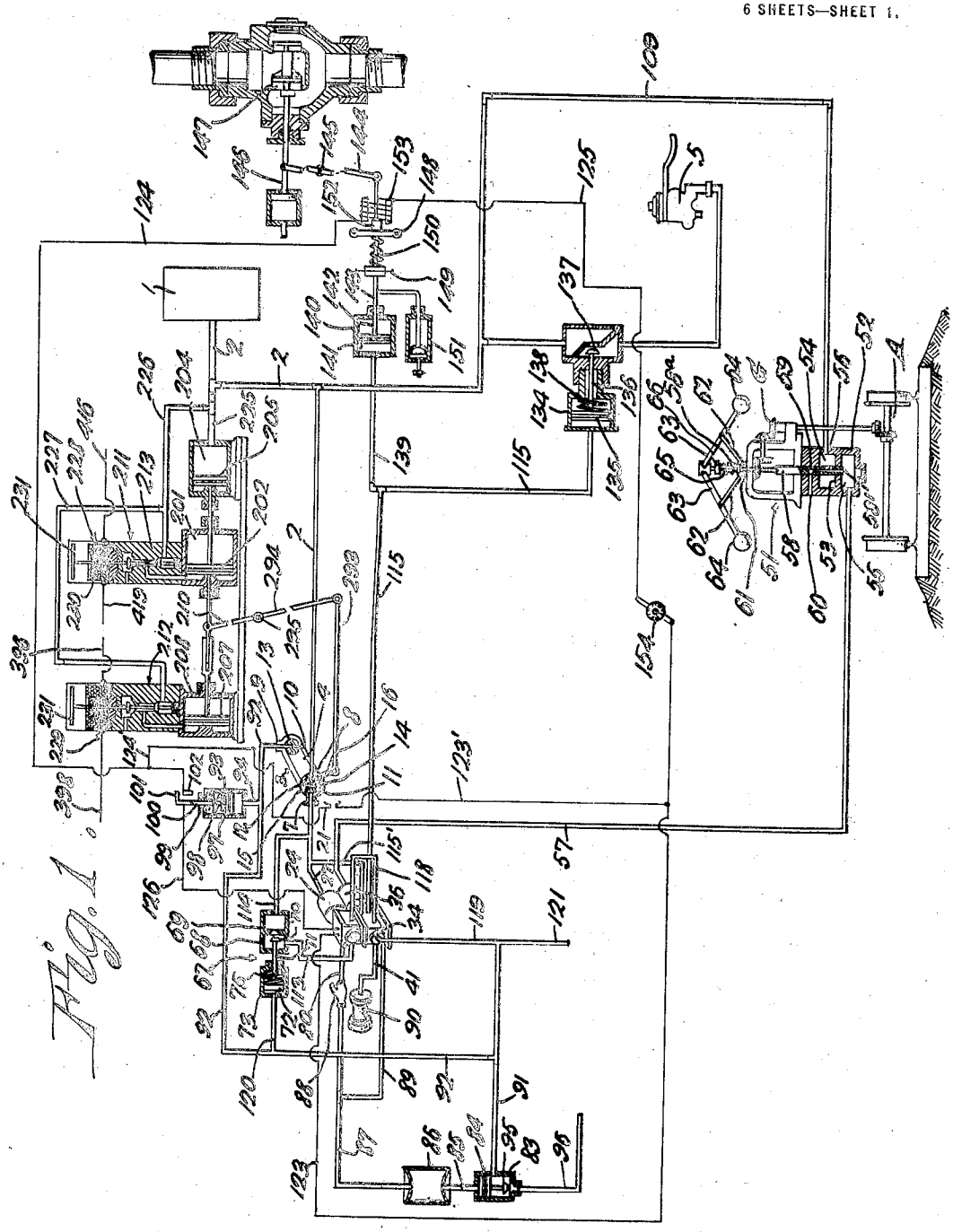


Fig. 1.

Witnesses

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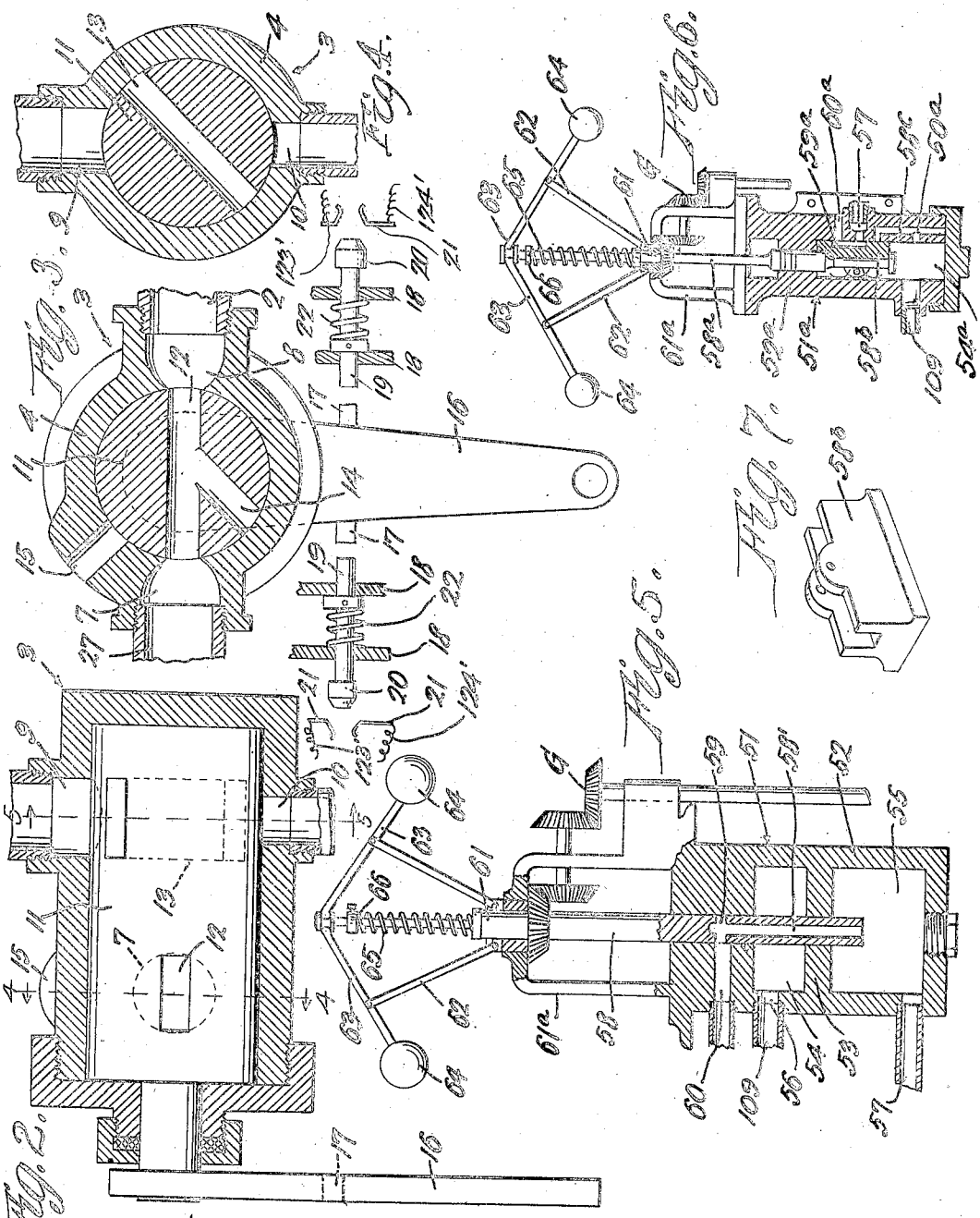
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6 SHEETS—SHEET 2.



Witnesses

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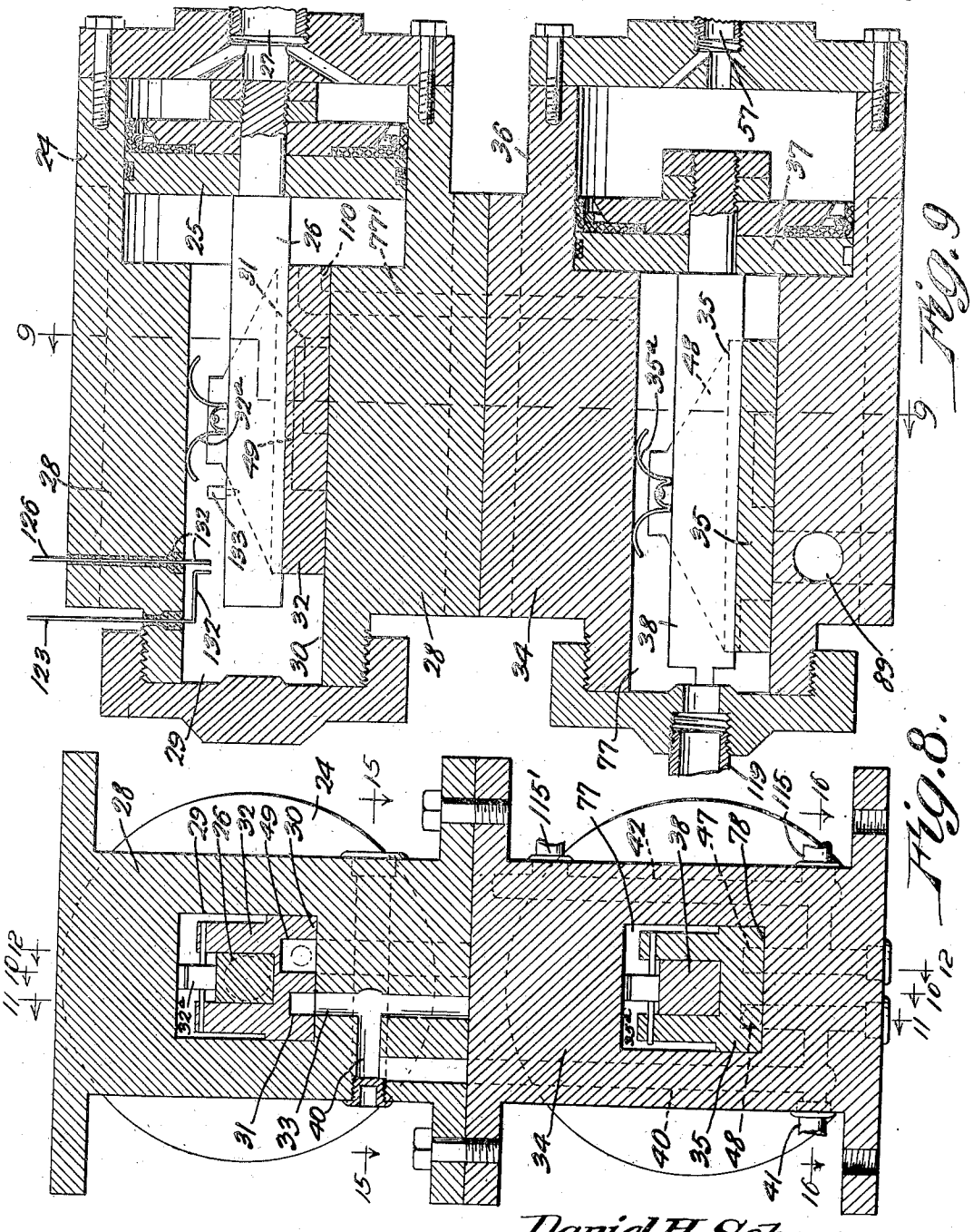


Fig. 8.

Fig. 9.

Witnesses

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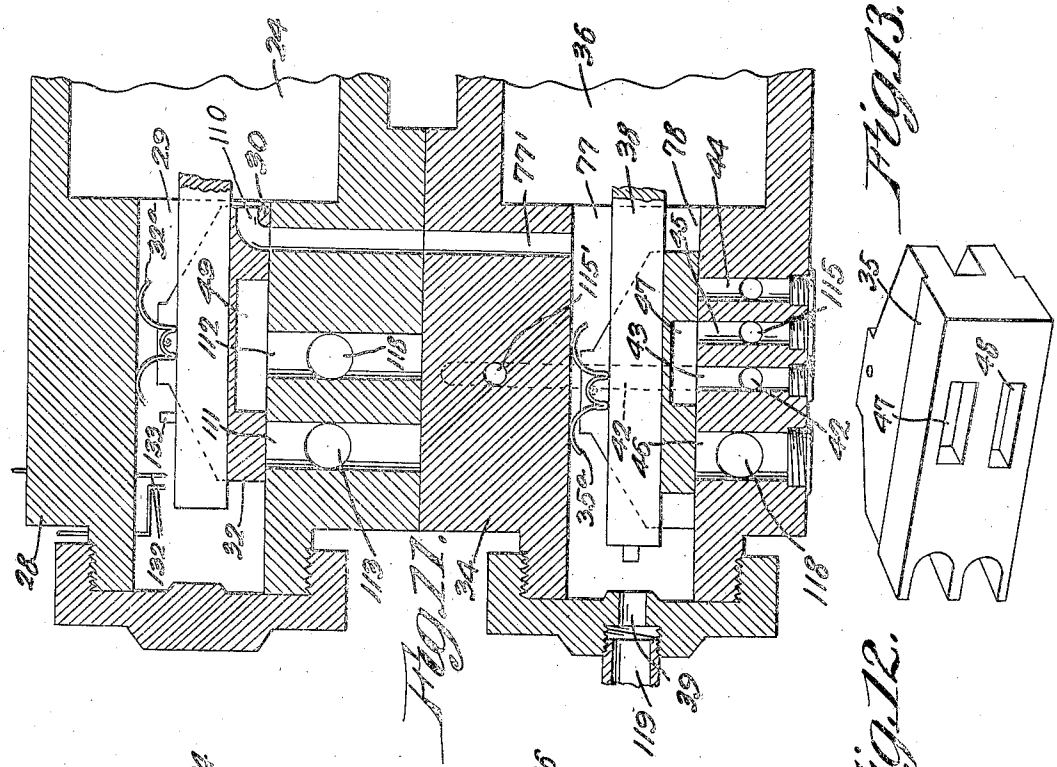


Fig. 11.

Fig. 13.

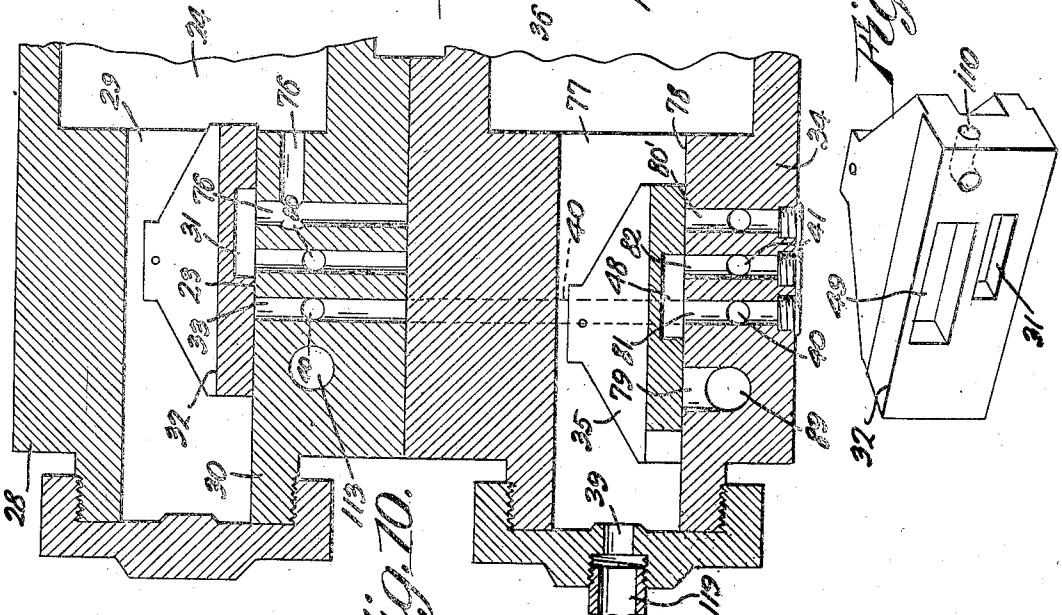


Fig. 10.

Fig. 12.

Witnesses

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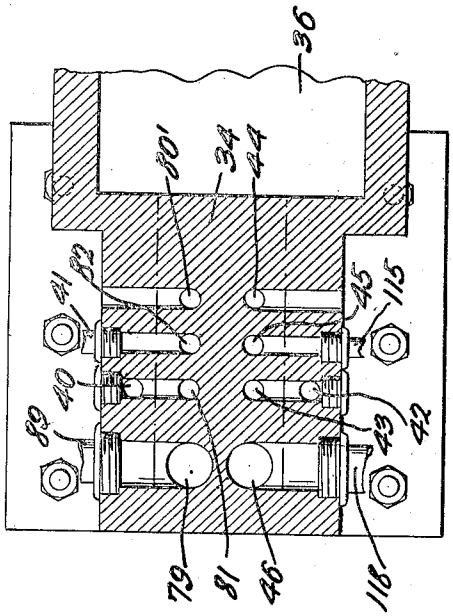


Fig. 15.

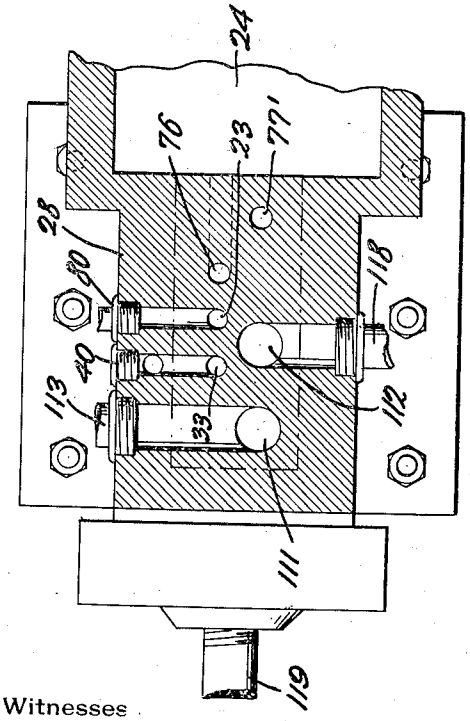


Fig. 14.

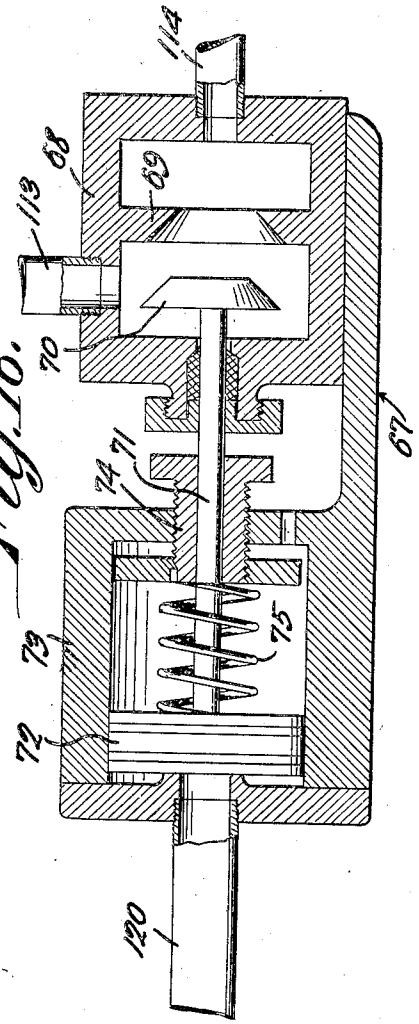


Fig. 16.

Witnesses

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6 SHEETS—SHEET 6.

Fig. 18.

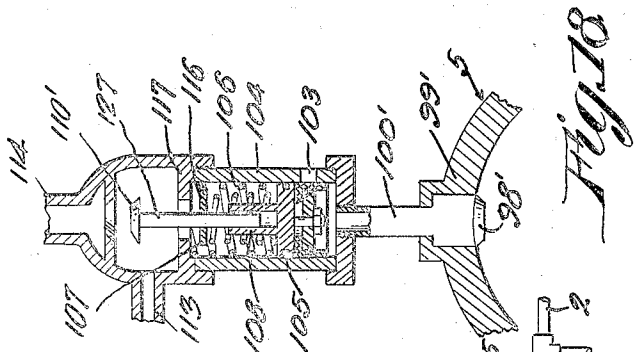
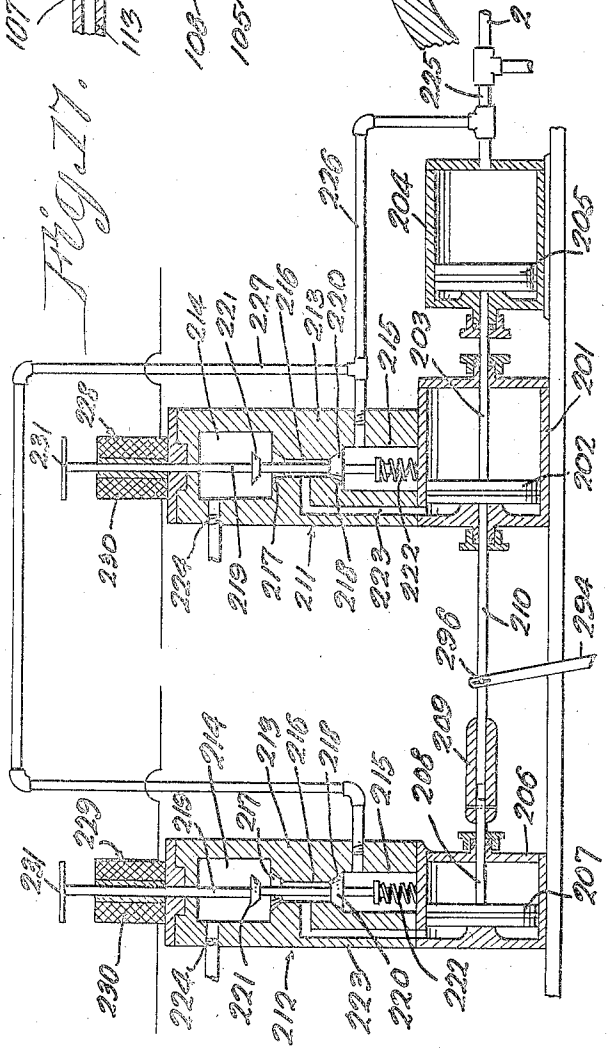


Fig. 17.



Witnesses

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UNITED STATES PATENT OFFICE.

DANIEL HERBERT SCHWEYER, OF EASTON, PENNSYLVANIA.

AUTOMATIC TRAIN-CONTROL SYSTEM.

1,389,602. Specification of Letters Patent. Patented Sept. 6, 1921.

Application filed September 6, 1916. Serial No. 118,731.

To all whom it may concern:

Be it known that I, DANIEL HERBERT SCHWEYER, a citizen of the United States, residing at Easton, in the county of Northampton and State of Pennsylvania, have invented a new and useful Automatic Train-Control System, of which the following is a specification.

The present invention appertains to train control systems, and is particularly an improvement over the train stopping apparatus disclosed in my co-pending application Serial No. 7,074, filed February 9, 1915.

It is the object of the invention to provide a train control system embodying an electrical equipment including novel coöperating track and train apparatus, whereby when the track is clear, the train can proceed, when certain track conditions exist, the train can proceed under caution conditions below a predetermined rate of speed, and when danger condition exists, the train will be automatically stopped.

Another object of the invention is the provision of coöperating track and train devices whereby the train controlling equipment carried thereby is controlled by the track devices without physical contact therebetween, induction devices being used for this purpose in a novel manner.

With the foregoing and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed can be made within the scope of what is claimed without departing from the spirit of the invention.

The invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a diagrammatical view of the pneumatic equipment.

Fig. 2 is an enlarged sectional view of the duplex valve, portions being shown in elevation.

Figs. 3 and 4 are sectional views taken on the respective lines 4—4 and 5—5 of Fig. 2.

Fig. 5 is a sectional view of the speed or governor controlled valve, portions being shown in elevation.

Fig. 6 is a view similar to Fig. 5 of a modified form of speed controlled valve.

Fig. 7 is a perspective view of the slide valve member of the device shown in Fig. 6.

Fig. 8 is a sectional view on the line 9—9 of Fig. 9 illustrating the slide valves.

Figs. 9, 10 and 11 are longitudinal sections on the respective lines 10—10, 11—11 and 12—12 of Fig. 8.

Fig. 12 is a perspective view of one slide valve.

Fig. 13 is a perspective view of the other slide valve of the device illustrated in Figs. 8, 9, 10 and 11.

Figs. 14 and 15 are horizontal sections taken on the lines 15—15 and 16—16 of Fig. 8.

Fig. 16 is a longitudinal section of the cut-off valve.

Fig. 17 is a median section of the valve devices controlled by the clear and caution electromagnets or electro-responsive devices.

Fig. 18 is a sectional view of the valve device which is attached to the engineer's brake valve.

Fig. 19 is a diagrammatical view of the electrical track equipment.

The present invention, generally considered, includes a pneumatic equipment carried by the train, street car, or other vehicle, and an electrical equipment carried by the train or other vehicle and coöperating with track devices. Said equipments will be taken up in detail in the order stated.

Pneumatic equipment.

The pneumatic system includes the main air reservoir 1 of the air brake system of the train or other vehicle to which reservoir an air supply pipe 2 is connected. The pipe 2 is connected to a duplex valve 3 comprising a cylindrical casing 4 formed at diametrically opposite points with alining ports 7—8 and 9—10 arranged in pairs in spaced planes disposed side by side. Mounted for rotation within the casing 4 is a turn plug 11 having the passage or bore 12 adapted to aline with the ports 7—8 when the plug is in one position, and having a second passage or bore 13 adapted to aline with the ports 9—10 when the plug is in another position, said passages registering with their ports alternately, so that when the passage 12 is in register with its ports, the passage 13 is out of registration with its ports, and vice versa. The plug 11 is further provided with a

branch passage 14 extending at an angle from the passage 12 and adapted to register with the port 7 when the plug is in still another position. The casing 4 has a fifth port 15 communicating with the atmosphere. When the plug is turned to bring the passage 12 in communication with the port 15, the branch passage 14 communicates with the port 7, thus connecting the port 7 with the atmosphere.

Secured to one end of the plug 11 is an angularly extending arm 16 for rotating said plug, and said arm 16 has an outstanding lug 17 for operating a stem 19 slidable in suitable bearings 18. The stem or spindle 19 is provided at one end with a contact head 20 adapted to contact with and bridge the contacts 21 when the stem 19 is advanced by the lug 17. In order to normally remove the contact head or switch member 20 from the contacts 21, a coiled wire expansion spring 22 surrounds the stem 19 and has one end secured to said stem and its other end bearing against one of the bearings 18.

In the normal position of the arm 16, see Figs. 1, 2 and 3, the passage 12 registers with the port 15 and the branch passage 14 with the port 7, and when the arm 16 is swung in one direction, the passages 12 and 14 are moved out of registration with said ports, and the passage 12 is moved into registration with the ports 7—8 thus permitting air from the main air reservoir to flow through the valve 3. Upon further movement of the arm 16, the passage 12 is moved out of registration with the ports 7—8, and the passage 13 is moved into registration with the ports 9—10, and in this latter movement of the arm, the lug 17 abuts the adjacent end of the stem 19 and slides said stem against the action of the spring 22 to bring the contact head 20 into engagement with the contacts 21.

A pair of parallel adjacent cylinders 24 and 36, see Figs. 8, 9, 10 and 11, have united therewith the respective valve casings 28 and 34 which are attached together as illustrated. The outer end of the cylinder 24 is connected with the port 7 of the duplex valve 3 by a pipe 27 which supplies air under certain conditions into the cylinder 24 against the piston 25 working in said cylinder, which piston is provided with a stem 26 projecting into the bore 29 of the valve casing 28. The said bore or chamber 29 communicates with the cylinder 24 at one end. The other end of the chamber 29 is closed. A slide valve 32 is attached to the stem 26 in any suitable manner and contacts with the valve seat 30 of the chamber 29. The valve casing 28 is provided with passages 23, 33, 76, 77′, 111 and 112 extending upwardly to the valve seat 30, and the slide valve 32 is provided with a pair of cavities 31 and 49. Normally, the piston 25 is adjacent the outer end of the cylinder 24, as seen in Fig. 9, and in this position of the piston 25, the slide valve 32 is in a position with the cavity 31 establishing communication between the passages 23 and 76, allowing the pressure fluid to charge through the same to an auxiliary reservoir 86, as will hereinafter more fully appear. The passage 76 communicates with the interior of the cylinder 24, as seen in Fig. 10, and a pipe 80 is connected to the passage 23. In this position of the slide valve 32, the cavity 49 is over the passage 112, as seen in Fig. 11, and the valve 32 closes the passages 33 and 111. When the slide valve 32 is in normal position, pressure fluid reaches the chamber 29 by way of the passage 77′, since the slide valve 32 has a port 110 registering with said passage 77′ when the valve 32 is in normal position, and said port 110 communicates with the chamber 29 and the corresponding end of the cylinder 24. The valve casing 34 is provided with a chamber 77 communicating at one end with the cylinder 36, and said casing 34 has a lower valve seat 78 upon which a slide valve 35 is movable. This slide valve 35 is attached to the stem 38 of a piston 37 working within the cylinder 36, and a pipe 57 is attached to the outer end of the cylinder 36. The valve 35 is provided with a pair of cavities 47—48, and the valve casing 34 is provided with passages 43, 44, 45, 46, 79, 80′, 81 and 82 extending upwardly to the valve seat 78. The casing 34 is provided at that end of the chamber 77 remote from the cylinder 36 with a port 39 to which a pipe 119 is connected. The casings 28—34 are provided with a passage 40 connecting the passages 33 and 81, and the passage 77′ extends into the casing 34 from the casing 28 and is in communication with the chamber 77 and respective end of the cylinder 36, the valve 35 at no time interfering with the passage of fluid through the passage 77′. The casing 34 has a passage 42 communicating with the passage 43, and pipes 115 and 115′ are connected to the casing 34 in communication with the passage 42. A pipe 113 is connected to the passage 111 of valve casing 28, and a pipe 118 connects passages 112 and 46 of the two valve casings 28—34. A pipe 41 is connected to the passage 82, and a pipe 89 is connected to the passage 79, while the passage 80′ leads to the atmosphere as does also the passage 44. When the piston 37 is at the inner end of the cylinder 36, while the piston 25 is at the outer end of the cylinder 24, as seen in Fig. 9, the passages 46, 79, 44 and 80′ are closed by the valve 35, while cavities 47 and 48 establish communication between the respective passages 43—45 and 81—82, as seen in Figs. 10 and 11. When the fluid pressure in the chamber 77 which communicates

with the cylinder 36 and in said cylinder becomes greater at the inner side of the piston 37 than at the outer side thereof, said piston will be moved to the outer end of the cylinder 36, thereby sliding the valve 35 likewise. This will open the passages 46 and 79, will close passages 43 and 81, and will bring the cavities 47 and 48 into registration with the respective passages 44—45 and 80′—82. Should the piston 25 be moved from normal position toward the inner end of the cylinder 24, the valve 32 will be slid to bring cavity 49 into registration with the passages 111 and 112, and to bring the cavity 31 into registration with the passages 23 and 33. The passage 76 is therefore cut off from the passage 23, but the passage 77′ being uncovered by the valve 32 still communicates with the chamber 29.

A speed or governor controlled valve 51 is provided, the same being illustrated in detail in Fig. 5. This valve includes a vertical casing 52 formed between its upper and lower ends with a partition 53 defining the chambers 54 and 55. The pipe 57 above referred to is connected with the casing 52 to communicate with the chamber 55, and at its other end is connected to the outer end of the cylinder 36. The casing 52 has a port 56 communicating with the chamber 54 and a pipe 109 is connected to the port 56. The casing 52 is provided with another port 60 opening into the atmosphere, and a valve member 58 is slidable through the upper end of the casing 52 and through the partition 53. Said valve member 58 has a longitudinal passage 58′ communicating at its lower end with the chamber 55, and said passage 58′ is provided at its upper end with a port 59 normally communicating with the port 60 and adapted to communicate with the chamber 54 when the valve member 58 is depressed. When the valve member 58 is depressed to bring the port 59 in the chamber 54, the passage 58′ will now establish communication between the two chambers 54 and 55, thereby connecting the pipes 57 and 109. When the valve member 58 is raised, as seen in Fig. 5, the port 59 in registering with the port 60 will connect the chamber 55 with the atmosphere.

This valve member 58 is controlled by a governor including a collar 61, rotatably carried by an arch 61ª preferably mounted upon the upper end of the valve casing 52, and said collar is operatively connected through the medium of a suitable gearing G to one of the axles A of the train, whereby the collar 61 is rotated at a speed proportional to the speed of the train. Pivotally connected with the collar 61 are upwardly diverging links 62 which have pivoted to their upper remote ends governor arms 63. Said governor arms are pivoted between their ends to the links and have their adjacent ends pivotally connected with the upper terminal of the valve member 58, and the lower remote ends of the downwardly diverging governor arms 63 have suitable weights 64. The adjacent ends of the arms 63 are raised under the influence of an expansion spring 65 disposed between collar 61 and a collar 66 mounted adjustably upon the valve member 58 below the arms 63. Said collar 66 can be adjusted to regulate the tension of the spring 65, and to control the operation of the valve member 58 at different speeds of the train, as will be apparent.

When the train is traveling above a predetermined speed, the weights 64 fly outwardly by centrifugal force, thereby forcing the valve member 58 downwardly into the casing 52, to bring the chambers 54—55 into communication. The speed at which the weights 64 fly outwardly to slide the valve 58 downwardly is determined by the tension of the spring 65, controlled by the adjustment of the collar 66. When the train is running at a slow velocity, that is, below a predetermined speed, the valve member 58 will remain in raised position, with the port 59 in communication with the port 60 to connect the pipe 57 to the atmosphere.

A modified form of speed control valve is illustrated in Fig. 6, and may be considered here, since it performs the same functions as the valve 51 shown in Fig. 5. The modified speed controlled valve 51ª embodies an upright casing 52ª having the chamber 54ª to which the pipe 109 is connected, and a sliding valve member 58ᵇ is movable within the chamber 54ª against a valve seat 58ᶜ provided therein. The valve member 58ᵇ has a stem 58ª projecting upwardly and connected to the governor which is the same as above described. The casing 52ª is provided with a port 60ª communicating with the atmosphere, and is further provided with a passage 50ª one end of which is normally closed by the valve member 58ᵇ. The pipe 57 is connected to the casing 52ª between the port 60ª and passage 50ª, and the valve member 53 has a cavity 59ª connecting the pipe 57 and port 60ª which leads to the atmosphere, when the valve member 58ᵇ is in raised position. Said valve member being in raised position closes the upper end of the passage 50ª, and when the valve member is moved downwardly, it closes the port 60ª and the cavity 59ª then establishes communication between the pipe 57 and the upper end of the passage 50ª, thereby connecting the pipes 57 and 109 by way of the chamber 54ª, passage 50ª, and cavity 59ª.

The numeral 67, see Fig. 16, designates a cut off valve embodying the casing 68 provided between its ends with a valve seat 69 against which a valve disk or head 70 is seatable. This valve disk 70 has a stem 71 slidable through one end of the casing 68

and through one end of a cylinder 73, said stem 71 being attached to a piston 72 working in said cylinder. Threaded into said end of the cylinder 73 is an adjusting collar 74 through which the stem 71 is slidable, and a coiled wire expansion spring 75 is confined between the collar 74 and the confronting face of the piston 72, tending to move the piston 72 away from the casing 68 to unseat the valve disk 70. The pipe 113 above mentioned is connected to the casing 68 to communicate therewith at the valve side of the seat 69, while a pipe 114 is connected to the casing 68 to communicate with that chamber thereof at the opposite side of the valve seat. A pipe 120 is connected to that end of the cylinder 73 toward which the piston 72 is moved by the spring 75. The pipe 114 is connected with the pipe 27 communicating with the port 7 of valve 3 so as to be connected indirectly with the air supply pipe 2, but if desired, said pipe 114 can be connected with the pipe 2 ahead of the duplex valve 3. The pipe 109 extending to the speed control valve 51 is also connected to the pipe 2. The pipe 115′ is connected to the pipe 27 as well as the pipe 114.

Referring now to Fig. 1 equalizing piston 84 is slidable within a cylinder 83, and the upper end of the cylinder 83 is connected by a short pipe 85 with one end of the auxiliary or equalizing reservoir 86 in order that said cylinder will continually be in open communication with said reservoir. The inner end of the reservoir 86 is connected by a pipe 87 to the pipe 80 through the intervention of a regulated-port check valve 88. The pipe 89 is also connected to the pipe 87. An expansion reservoir 90 is connected to the pipe 41. The lower portion of the cylinder 83 is always in open communication with the train line pipe 121 by means of a pipe 91 connecting the cylinder 83 between its ends with the pipe 121. A pipe 92 connects the pipe 91 with the pipe 120, and is also connected to the port 9 of the duplex valve 3. The piston 84 has attached thereto a valve 95 which when the piston 84 is moved downwardly, closes the end of a pipe 96, and when the piston 84 is raised, the valve 95 is unseated to permit the air within the lower portion of the casing 83 to bleed to the atmosphere by way of the pipe 96.

A cylinder 93 has one end connected by a short pipe 94 with the pipe 92, and a piston 97 works within the cylinder 93. That end of the cylinder 93 remote from the pipe 94 has an adjusting collar 99 similar to the collar 74, and a coiled wire expansion spring 98 is disposed between the collar 99 and the piston 97 tending to force said piston toward the pipe 94. The piston 97 has a stem 100 passing slidably through the collar 99, and an insulated switch member 101 is carried by the protruding portion of the stem 100 and is normally spaced from a contact 102 when the piston 97 is moved against the spring 98 to compress it. When the pressure of air is reduced in the pipe 92, the piston 97 is moved toward the pipe 94 under the influence of the spring 98, which will bring the switch member 101 into engagement with the contact 102 to close an electrical circuit. This circuit also includes a pair of insulated contacts 132 projecting within the chamber 29 of the valve casing 28 and arranged for the engagement of an insulated peg or switch member 133 carried by the slide valve 32, in order that when the valve 32 is moved to the left, as seen in Fig. 9, by the similar movement of the piston 25, the switch member 133 will engage the contacts 132 to bridge the gap between them.

It may be here stated that the slide valve 32 carries a spring 32^a bearing against that wall of the chamber 29 opposite the seat 30, to hold the valve 32 seated, and the valve 35 carries a similar spring 35^a for holding it seated.

Considering the operation of the parts so far described, the plug 11 of the duplex valve 3 is normally in a position with the passage 12 in register with the port 15 and the branch passage 14 in register with the port 7, thus establishing communication between the outer end of the cylinder 24 and the atmosphere by way of the pipe 27, port 7, passages 14—12 and port 15. The air within the casing 28 will therefore force the piston 25 toward the outer end of the cylinder 24 taking with it the slide valve 32. As long as the valve plug 11 remains in this position and the valve member 58 is raised under the action of the spring 65, the slide valve 35 will remain at the right hand end of the chamber 77, as seen in Fig. 9, due to the fact that the piston 37 will be moved away from the chamber 77 by the air pressure, and the air adjacent the outer end of the cylinder 36 will be forced to the atmosphere by way of the pipe 57, chamber 55, passage 58′, and ports 59—60. Furthermore, in this position of the valve plug 11 and valve member 58, the valve member 32 is in a position to cut off communication between the passages 111 and 112, and between the passages 23 and 33, while communication is established between the auxiliary reservoir 86 and chamber 29 by way of the pipe 87, check valve 88 which opens in a direction away from the reservoir 86, pipe 80, passage 23, cavity 31 and passage 76. The piston 25 is therefore forced toward the outer end of the cylinder 24. Communication is established between the auxiliary reservoir and chamber 77 by way of the pipe 87, pipe 89, and passage 79, thus moving the piston 37 toward the right, as seen in Fig. 9. Communication is established between the passage 112 in valve seat 30 and the passage 46

in valve seat 78 by way of the pipe 118. The pressure fluid in flowing into the upper end of the cylinder 83 from the auxiliary reservoir recharges the cylinder 83, due to the fact that the train line air pressure has previously been reduced and is less underneath the piston 84 than the air pressure from the reservoir 86, which will result in the valve 95 being seated due to the downward movement of the piston 84, thereby preventing any further reduction of the train line pressure. As long as valves 32 and 35 remain in normal position (at the right as seen in Fig. 9), passages 43 and 81 of valve seat 78 will be closed by the valve 35, and the expansion reservoir 90 will be in communication with the atmosphere by way of the pipe 41, passage 82, cavity 48 of valve 35, and passage 80′ leading to the atmosphere. Two cylinders 134 and 140, hereinafter referred to in detail, are in open communication with the atmosphere by way of the pipe 115 which is connected to one end of the cylinder 134 and a pipe 139 connecting one end of the cylinder 140 and the pipe 115, said pipe 115 communicating with the atmosphere by way of the passage 45, cavity 47, and passage 44 leading to the atmosphere. This establishes communication, as will hereinafter appear, between the main reservoir pipe 2 and the engineer's brake valve 5, and allows the motive power to be put on through the movement of a rod 143 retarded by a dash pot 151 (described in detail hereinafter). When, however, the arm 16 is swung to a position to establish communication between the ports 7 and 8 by way of the passage 12 in plug 11, air from the main reservoir 1 flows by way of the pipe 2, passage 12 and pipe 27 into the outer end of the cylinder 24, resulting in the piston 25 being moved against the action of air pressure in chamber 29, thereby moving the valve 32 to the left, as seen in Fig. 9. This results in communication being established between the passages 111 and 112, and between the passages 23 and 33 by way of the respective cavities 49 and 31. Should the train be running above the speed determined by adjustment of the spring 65, the governor weights 64 will fly outwardly by centrifugal action, and the valve member 58 will be moved downwardly to cut off communication between the outer end of cylinder 36 and the atmosphere, and to establish communication between the outer end of said cylinder 36 and the pipe 109, by way of said pipe 109, port 56, chamber 54, port 59, passage 58′, chamber 55, and pipe 57. The cylinder 36 is thus connected with the air supply pipe 2, and the air in entering the cylinder 36 will force the piston 37 toward the inner end of said cylinder to slide the valve 35 in the corresponding direction, which will result in passages 46, 79, 44 and 80′ being closed, while passages 43 and 45 are brought into communication by way of the cavity 47 and passages 81 and 82 are brought into communication by way of the cavity 48 of valve 35. Since passages 111 and 112 are now connected air can flow from pipe 2 through passage 12, part of pipe 27, pipe 114, valve casing 68, pipe 113, passage 111, cavity 49, passage 112, pipe 118 to passage 46 when the train pipe pressure has been reduced sufficiently to permit spring 75 to open valve 70. Communication is also established between the auxiliary reservoir 86 and the expansion reservoir 90 by way of the pipe 87, check valve 88, pipe 80, passage 23, cavity 31, passage 33, passage 40, passage 81, cavity 48, passage 82, and pipe 41. The expansion of air from the auxiliary reservoir into the expansion reservoir thus effects a reduction of pressure at the top of the equalizing piston 84, causing said piston to raise and unseat the valve 95, which will permit the air to bleed from the train line pipe to the atmosphere, the amount of reduction at this time being dependent upon the relative size of the reservoirs 86 and 90. Air can flow from the train line pipe 121 to the atmosphere by way of the pipe 91, cylinder 83 and pipe 96. This reduction in the train line pressure causes the spring 98 to move the piston 97 downward, bringing the switch member 101 into engagement with the contact 102, and the spring 75 will also move the piston 72 to the left, opening the valve 70 to permit of the flow of air through the casing 68.

When the speed of the train has been reduced sufficiently, the governor weights 64 move inwardly, and restore the valve member 58 to normal position thereby cutting off communication between the pipes 57 and 109, and restoring communication between the pipe 57 and the atmosphere, whereby the air within the cylinder 36 between the piston 37 and outer end of said cylinder will be discharged to the atmosphere, and the piston 37 moved to the outer end of said cylinder pulling with it the slide valve 35. When the slide valve 35 is restored to normal position, the cylinders 134 and 140 are connected to the atmosphere by way of the pipe 115, passage 45, cavity 47 and port 44. The cavity 48 now registers with passages 82 and 80′ so that pressure may exhaust from the expansion reservoir to the atmosphere by way of the pipe 41, passage 82, cavity 48 and passage 80′. Passage 46 is now uncovered, so that when the valve 35 is restored to normal conditions, air will be supplied to the air brake pipe from the main reservoir through the pipe 2, pipe 114, valve casing 68, pipe 113, passage 111, cavity 49, passage 112, pipe 118, passage 46, chamber 77, port 39, pipe 119 and pipe 121, and when the pressure in the air brake pipe is restored to normal, such

pressure overcomes the action of spring 75 and slides the piston 72 with the result that the valve 67 is closed, thereby cutting off the communication between the air brake pipe and the main reservoir. At the same time, the auxiliary reservoir is charged to normal train line pressure causing the equalizing piston 84 to close the valve 95, pressure flowing from the chamber 77 through passage 79, and pipes 89—87 to the auxiliary reservoir. When the arm 16 is restored to normal position, the outer end of cylinder 24 is brought into communication with the atmosphere, so that the piston 25 will be moved back to normal position in the cylinder 24 under the action of the air in the chamber 29.

The cylinder 134 above referred to is provided therein with a piston 135 provided with a piston rod or stem 136 projecting slidably through that end of the cylinder 134 remote from the pipe 115, and provided with a valve 137 interposed between the engineer's brake valve 5 and the air supply pipe 2. A coiled wire expansion spring 138 surrounds the stem 136 and acts upon the piston 135 to normally hold the valve 137 open, but when the piston 135 is moved by air pressure, the valve 137 is closed. This cuts off communication between the main reservoir 1 and the engineer's brake valve 5.

The cylinder 140 above referred to is provided therein with a piston 141 equipped with a stem 142 projecting slidably through that end of the cylinder 140 opposite the pipe 139 and having the rod 143 attached thereto. Said rod has its terminal pivotally attached with one end of a lever 144 fulcrumed between its ends, as at 145, and having its other end pivotally connected with the stem 146 of a valve 147 located in the steam pipe leading from the steam dome of the boiler to the drive cylinders of the engine. When air flows into the pipe 115, incident to the operation of the valves 3 and 58, such air passes into the cylinder 134 and slides the piston 135 against the action of the spring 138 to close the valve 137, thereby preventing re-charging of the train line through the engineer's brake valve, taking the release of the brakes out of the hands of the engineer. At the same time, air passes through the branch pipe 139 into the cylinder 140, and slides the piston 141 with the effect to swing the lever 144, and so actuate the valve 147 to cut off the flow of fluid from the steam chamber of the boiler to the drive cylinders of the engine. This cuts off the power, and although as illustrated, the lever 144 operates a steam valve, it is to be understood that this mechanism is not limited in this respect, but can be used for operating a cut-out switch or controller, or any other device, for cutting off the power of the train or vehicle whether it be propelled by steam, electricity, gasolene or the like. The valve 147 can therefore be taken to typify means for cutting off the power which propels the vehicle.

A bracket 148 supported in any suitable manner by the car or vehicle forms a bearing for the sliding rod 143, and a collar 149 is secured to the rod 143, an expansion spring 150 being confined between the bracket 148 and collar 149. This spring 150 acts upon the rod 143 to return it to normal position, whereby to restore the valve 147 to open position immediately following the release of air from the cylinder 140. It is preferable to provide a dash pot 151, or other retarding device, to limit the speed of the rod 143 when the latter is actuated by the spring 150, so as to prevent a too sudden application of the motive power due to the opening of the valve 147. When the pipe 115 opens into the atmosphere through the passage 45, cavity 47, and port 44, the air is released from the cylinders 134 and 140 so that the pistons of said cylinders are restored to normal positions.

Fixed to the rod 143 is a solenoid core 152, and a solenoid 153 surrounds said rod 143 adjacent to the core 152, and said solenoid 153 is connected in circuit with a generator or other source of electrical energy 154. A conductor 123 connects one pole of the generator 154 and one of the contacts 132, and the other of said contacts is connected by a conductor 126 with the switch member 101. The coöperating contact 102 is connected by a conductor 124 with one terminal of the solenoid 153, and the other terminal of said solenoid is connected by a conductor 125 with the other pole of the generator 154, thus completing the circuit in which the generator 154, contacts 132, switch member 101, and solenoid 153 are connected in series. One contact 21 is connected by a branch conductor 123′ to the conductor 123, while the other contact 21 is connected to the conductor 124 by the branch conductor 124′. It is therefore evident that when the contacts 132 are bridged by the switch member 133 and at the same moment switch member 101 touches contact 102, the circuit will be closed, and the same result is provided when the switch member 20 bridges the contacts 21, since the contacts 21 are connected in parallel with the contacts 132 and switch member 101. When the circuit is closed in either manner, the solenoid 153 will be energized. Thus, should slide valve 32 be moved from normal to its other position under caution or safety conditions, and should the train line pressure be reduced below normal to a certain predetermined amount, the circuit will be closed by the switch member 133 engaging contacts 132 and the switch member 101 touching contact 102, thus causing the solenoid to be energized. When said solenoid is energized, it will tend to

hold the armature core 152 against the action of the spring 150, until the train line pressure is again restored to normal, at which time the piston 97 is raised to remove the switch member 101 from the contact 102, which will open the circuit and de-energize the solenoid. This releases the core 152 and permits the piston 151 to move under the influence of the spring 150, to open the valve 147.

In Fig. 18, there is illustrated a valve device for attachment to the engineer's brake valve 5 which takes the place of the valve casing 68 and valve 70, with their connected parts, in controlling the passage of air between pipes 113 and 114. This device embodies a cylinder 104 having one end connected by a pipe 100′ with the emergency exhaust port 98′ of the casing 99′ of the valve 5. The cylinder 104 is provided adjacent said end with the port 103 leading to the atmosphere, and a piston 105 provided with a leather cup or follower is movable within the cylinder 104, said piston having a sleeve 108 projecting therefrom away from the pipe 100′. A valve stem 127 is slidable within the sleeve 108 and is provided at its end with a valve 110′. A coiled expansion spring 107 surrounds the sleeve 108 and is confined between the piston 105 and a collar 116 secured upon the valve stem 127. This valve stem 127 projects through the central opening of a cap 117 secured to that end of the cylinder 104 remote from the pipe 100′, and a coiled wire expansion spring 106 of greater tension than the spring 107 is disposed within the cylinder 104 and is confined between the piston 105 and the cap 117, tending to move the piston 105 toward the pipe 100′ to close the port 103. When the engineer makes a service application of the air pressure through port 98′, it passes on through the pipe 100′ into the cylinder 104, and moves the piston 105 partially away from the port 103 to uncover the same, whereby the air can flow to the atmosphere. When the piston 105 is moved by the air pressure, air pressure must overcome the tension of the spring 106, which retards the movement of the piston, and as the piston is moved, the spring 107 between it and the valve stem 127 is compressed, said spring 107 being compressed before the valve 110′ is moved. Thus, when an emergency application is made, the sudden rush of air causes the piston 105 to completely uncover the port 103, instead of partially uncovering it as in a service application, the spring 107 being compressed until the piston 105 strikes the end of the valve stem 127, thus moving the valve 110′ positively and seating it. If the valve 110′ is used in place of the valve disk 70, for opening and closing the passage between the pipes 113 and 114, should an emergency application be made, even when the apparatus is in the act of re-charging the train line, the valve 110′ would be positively seated, thus allowing the engineer to stop the train during the period that the apparatus is re-charging the train line. During a service application, however, the valve 110′ is not seated positively, so that the re-charging of the train line is not disturbed.

A pneumatic mechanism is provided for operating the duplex valve 3, and is illustrated in detail in Fig. 17. This mechanism embodies a horizontal cylinder 201 mounted upon an appropriate support, and within which a piston 202 is movable, said piston having a stem 203 slidable through one end thereof. A second horizontal cylinder 204 is disposed in alinement with the cylinder 201, and a piston 205 works therein, the piston rod or stem 203 projecting slidably through the respective end of the cylinder 204 and being attached to the piston 205, so that the pistons 205 and 202 reciprocate in unison. The cylinder 204 is of smaller diameter than the cylinder 201. A third cylinder 206 is carried by the same support and is preferably disposed in alinement with the cylinders 201 and 204, and has a piston 207 therein. The cylinder 206 is approximately one-half the length of the cylinder 201, and the cylinders 206 and 204 are located at the opposite ends of and spaced from the cylinder 201. The cylinders 201 and 206 are of substantially the same diameter, and the piston 207 has a piston rod or stem 208 passing slidably through one end of the cylinder 206 and projecting toward the cylinder 201. The protruding end of the stem 208 is provided with a sleeve or socket member 209 slidably receiving the protruding terminal of a rod or stem 210 attached to the piston 202 opposite the stem 203 and moving through the respective end of the cylinder 201.

Mounted upon the cylinders 201 and 206 are the respective valves 211 and 212 of duplicate construction, each embodying an upstanding casing 213 provided with a chamber 214 adjacent its upper end, and a chamber 215 adjacent its lower end, said chambers being connected by a passage 216 having the valve seats 217 and 218 at its upper and lower ends, respectively. Passing loosely through the passage 216 is a vertical stem 219 whose lower end terminates within the chamber 215, and said stem passes through the chamber 214 and the upper end of the casing 213. Secured to the stem 219 adjacent the lower end thereof and within the chamber 215 is a valve disk 220 adapted to seat upwardly against the seat 218 in the uppermost position of the stem 219, and secured to the stem 219 within the chamber 214 is a valve disk 221 seatable downwardly against the seat 217 when the stem 219 is in

its lowermost position, said valves being seated and unseated alternately. Thus, when the valve disk 220 is seated, the valve disk 221 is unseated, and vice versa. A spring 222 is disposed within the chamber 215 and presses the stem 219 upwardly, thereby normally tending to seat the valve disk 220. The casing 213 is provided with a passage 223 having one end communicating with one end of the respective cylinder, either 201 or 206, and the other end of the passage 223 communicates with the passage 216 between the ends thereof. Said casing 213 also has an exhaust port 224 leading from the chamber 214 to the atmosphere. A pipe 225 has one end connected to the air supply pipe 2 of the air brake system, and its other end is connected to that end of the cylinder 204 remote from the stem 203. Leading from the pipe 225 is a branch pipe 226 connected to the casing 213 of valve 211 to communicate with the chamber 215, and a second branch pipe 227 is connected to the pipe 226 and is connected to the casing 213 of valve 212 to communicate with its chamber 215. The chambers 215 of the valves 211 and 212 and one end of the cylinder 204 are thus connected with the main air reservoir.

The valves 211 and 212 are under the control of electroresponsive devices 228 and 229, respectively, and in the present instance, each of said devices embodies an electromagnet 230 mounted upon the upper end of the respective casing 213 around the upper protruding end of the stem 219, and an armature 231 is secured to the upper terminal of the stem 219 above the electromagnet, to be attracted when the electromagnet 230 is energized, whereby to depress the stem 219 against the tension of the spring 222, to seat the valve disk 221 and unseat the valve disk 220. Ordinarily, when the electromagnets are deënergized, the valve disks 220 will be seated by the springs 222, thus shutting off communication between the pipes 226—227 and the passages 216—223, thus preventing the air from entering the cylinders 201 and 206. When the "clear" device 228 is energized so as to attract the armatures 231 thereof, the stem 219 of valve 211 is moved downwardly, thus seating the valve disk 221 and unseating the valve disk 220. This permits air to flow from the pipe 226 and chamber 215 into the passage 216, the valve disk 221 being seated to prevent the escape of air to the atmosphere by way of the chamber 215, thus compelling the air to flow through the passage 223 into the end of the cylinder 201, whereby to move the piston 202 to the right as seen in Fig. 17. The stem 210 is drawn with the piston 202, and the stem 203 is moved ahead by said piston to move the piston 205 against the air pressure in the cylinder 204, it being noted that the diameter of the piston 202 is larger than the diameter of the piston 205, whereby said pistons will be moved to the right as seen in Fig. 17. Should the device 228 now be deënergized, the stem 219 would be released, and would be raised by the spring 222, thus seating the valve disk 220 and unseating the valve disk 221. The flow of air into the cylinder 201 is now shut off, and the air would force the piston 205 backwardly to initial position, thus forcing the piston 202 with it. The air in the cylinder 201 ahead of the piston 202, would be forced outwardly through the passages 223 and 216 into the chamber 214 and from thence through the port 224 to the atmosphere, whereby the piston 202 can return to initial position without interference. When the piston 202 is moved, the stem 210 thereof can slide freely relative to the sleeve 209 without disturbing the piston 207. The operation of the valve 212 is somewhat the same, since when the "caution" device 229 is energized, the valve disk 221 is seated and the valve disk 220 is unseated, whereby air will flow by way of the pipes 225, 226, and 227 into the chamber 215 and from thence by way of the passages 216 and 223 into the cylinder 206, to move the piston 207, the stem 208 thereof striking the stem 210 and moving the piston 202 and stem 203 to move the piston 205. Since the cylinder 206 is short in length, the movement of the stem 208 is limited, whereby when the piston is moved by the air, the stems 210 and 203 and the piston 205 are only moved about half as far as when air is admitted into the cylinder 201 to move the piston 202. The cylinder 204 and the piston 205 act as a restoring device to return the pistons 202 and 207 to initial position, when one or both of the devices 228—229 are deënergized.

The stem or rod 210 is operatively connected with the duplex valve 3, and for this purpose, a lever 294 is fulcrumed between its ends, as at 295, and has one arm connected by a pin and slot joints, as at 296, with the stem or rod 210, and the other end or arm of the lever 294 is connected by a link 293 with the arm 16 of the duplex valve 3.

When the electroresponsive device 228 is energized, so that the piston 202 is moved as above described, the lever 294 is swung to rotate the plug 11 to bring the passages 12 and 14 thereof into register with the respective ports 15 and 7. Assuming that the electroresponsive device 228 is normally deënergized, the piston 202 will be moved by the air, and due to the movement of said piston, the lever 294 will be moved a full stroke so as to bring the passages 12—14 of the plug 11 into register with the respective ports 15—7, whereby the cylinder 24 is con-

nected to the atmosphere, communication between the pipes 27—115′ and the air supply pipe 2 being cut off, and the exhaust port 10 being closed.

Should the device 228 become deënergized, while the device 229 is energized, the cylinder 201 will be connected with the atmosphere, as above described, and the piston 202 will be moved back by the piston 205, until the stem 210 strikes the stem 208 of the advanced piston 207. This results in the lever 294 being moved to intermediate position, whereby the plug 11 is rotated to bring the passage 12 thereof into registration with the ports 7—8, thereby connecting the supply pipe 2 with the pipes 27—115′, to effect a "caution" application of the brakes, as above described, in the event of the train running above a predetermined speed during the time that the device 229 is energized and the device 228 deënergized. Should both of the devices 228—229 become energized, the pistons 202—207 will be returned to initial position by the restoring piston 205, thus moving the lever 294 whereby the plug 11 is rotated to bring its passage 13 into registration with the ports 9—10, thus permitting the air to bleed from the train line to the atmosphere, to provide an emergency application of the brakes.

In Fig. 19, a simplified electrical equipment is illustrated. The numeral 300 designates track sections, and 304 the U-shaped core of a choke coil 305 having its terminals connected by conductors 306 and 307 with an armature switch 308. The armature switch 308 is controlled by an electromagnet 302 connected by conductors 301 and 303 with the rails whereby the magnet 302 is energized and deënergized in any suitable manner. Said magnet 302 may be connected in series with a signal operating means.

When the magnet 302 is energized, the switch 308 is closed, and when said magnet is deënergized, said switch is opened. The train apparatus includes a choke coil 311 wound upon an inverted U-shaped core 311′ adapted to pass over the coil 305, the conductors 310 and 312 being in circuit with the electroresponsive devices 228 and 229 through conductors 416 and 398.

It might be further stated that no claim is made in this application for the structure disclosed by Fig. 19, but the same is herein illustrated merely to disclose the fact that the device is controlled by certain traffic conditions.

Having thus described the invention, what is claimed as new is:

1. In a train controlling apparatus, the combination of a brake pipe, pressure fluid supply means, a mechanism for establishing communication between the brake pipe and atmosphere, track controlled means controlling said mechanism, speed controlled means controlling said mechanism in connection with the second mentioned means to render said mechanism operative above a predetermined speed, and means whereby the brake pipe is recharged from the first mentioned means through said mechanism, said mechanism including a pressure fluid operated equalizing device for shutting off communication between the brake pipe and atmosphere when the pressure in the brake pipe falls below a predetermined amount, and said mechanism including means controlled thereby for controlling the flow of pressure fluid to and from said device in opposition to brake pipe pressure.

2. In a train controlling apparatus, the combination of a brake pipe; pressure fluid supply means; a mechanism for establishing communication between the brake pipe and atmosphere including a track controlled and a speed controlled valve normally preventing said communication, an equalizing pressure fluid operated valve normally cutting off said communication, said mechanism supplying pressure fluid to the equalizing valve when the track and speed controlled valves are in normal position, said track and speed controlled valves when moved providing for the flow of pressure fluid from the equalizing valve; track and speed controlled means controlling the track and speed controlled valves; and means controlled by pressure in the brake pipe for establishing communication between the brake pipe and first mentioned means through the two first mentioned valves.

3. In a train controlling apparatus, the combination of a brake pipe; pressure fluid supply means; a mechanism for establishing communication between the brake pipe and atmosphere including a track controlled and a speed controlled valve normally preventing such communication, an equalizing pressure fluid operated valve normally cutting off such communication, the two first mentioned valves when operated permitting pressure fluid to flow from the equalizing valve and when in normal position permitting pressure fluid to flow to the equalizing valve; track and speed controlled means controlling the respective track and speed controlled valves; and means controlled by the pressure in the brake pipe for establishing communication between the brake pipe and first mentioned means through the track controlled valve when operated and speed controlled valve when in normal position.

4. In a train controlling apparatus, the combination of a brake pipe; pressure supply means; a mechanism for establishing communication between the brake pipe and atmosphere including a track controlled and

a speed controlled valve normally preventing such communication, an equalizing pressure fluid operated valve normally cutting off such communication, an expansion reservoir, the two first mentioned valves when in normal position permitting pressure fluid to flow to the equalizing valve and the two first mentioned valves when operated connecting the equalizing valve and expansion reservoir whereby the equalizing valve opens; track and speed controlled means controlling the respective track and speed controlled valves; and means controlled by pressure in the brake pipe for establishing communication between the brake pipe and first mentioned means through the track controlled valve when operated and speed controlled valve when in normal position.

5. In a train control apparatus, the combination of a brake pipe, pressure fluid supply means, a mechanism for establishing communication between the brake pipe and atmosphere, track controlled means controlling said mechanism, speed controlled means controlling said mechanism in connection with the second mentioned means to render said mechanism operable above a predetermined speed, an expansion reservoir, said mechanism including an equalizing pressure fluid operated valve for normally cutting off communication between the brake pipe and atmosphere, said equalizing valve being supplied with pressure fluid when the mechanism is in normal position and being connected with the expansion reservoir when said mechanism is operated, and means whereby the brake pipe is recharged from the first mentioned means through said mechanism.

6. In a train control apparatus, the combination of a brake pipe; pressure supply means; a mechanism for establishing communication between the brake pipe and atmosphere including a track controlled and speed controlled valve normally preventing such communication, an equalizing pressure fluid operated valve normally cutting off such communication, pressure fluid operated means for operating each of the two first mentioned valves, an expansion reservoir, the two first mentioned valves when in normal position permitting pressure fluid to flow to the third mentioned valve, and the two first mentioned valves when operated connecting the third mentioned valve and expansion reservoir whereby the third mentioned valve opens; track and speed controlled means for establishing communication between the first mentioned means and the respective operating means of the track and speed controlled valves; and means controlled by the pressure fluid in the brake pipe for establishing communication between the brake pipe and first mentioned means through the track controlled valve when operated and speed controlled valve when in normal position.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

DANIEL HERBERT SCHWEYER.

Witnesses:

G. M. WELLER,

J. G. WELLER.