Oct. 25, 1949. H. P. FOLKER 2,486,271

TRAIN CONTROL SYSTEM

Filed March 10, 1947 3 Sheets-Sheet 1

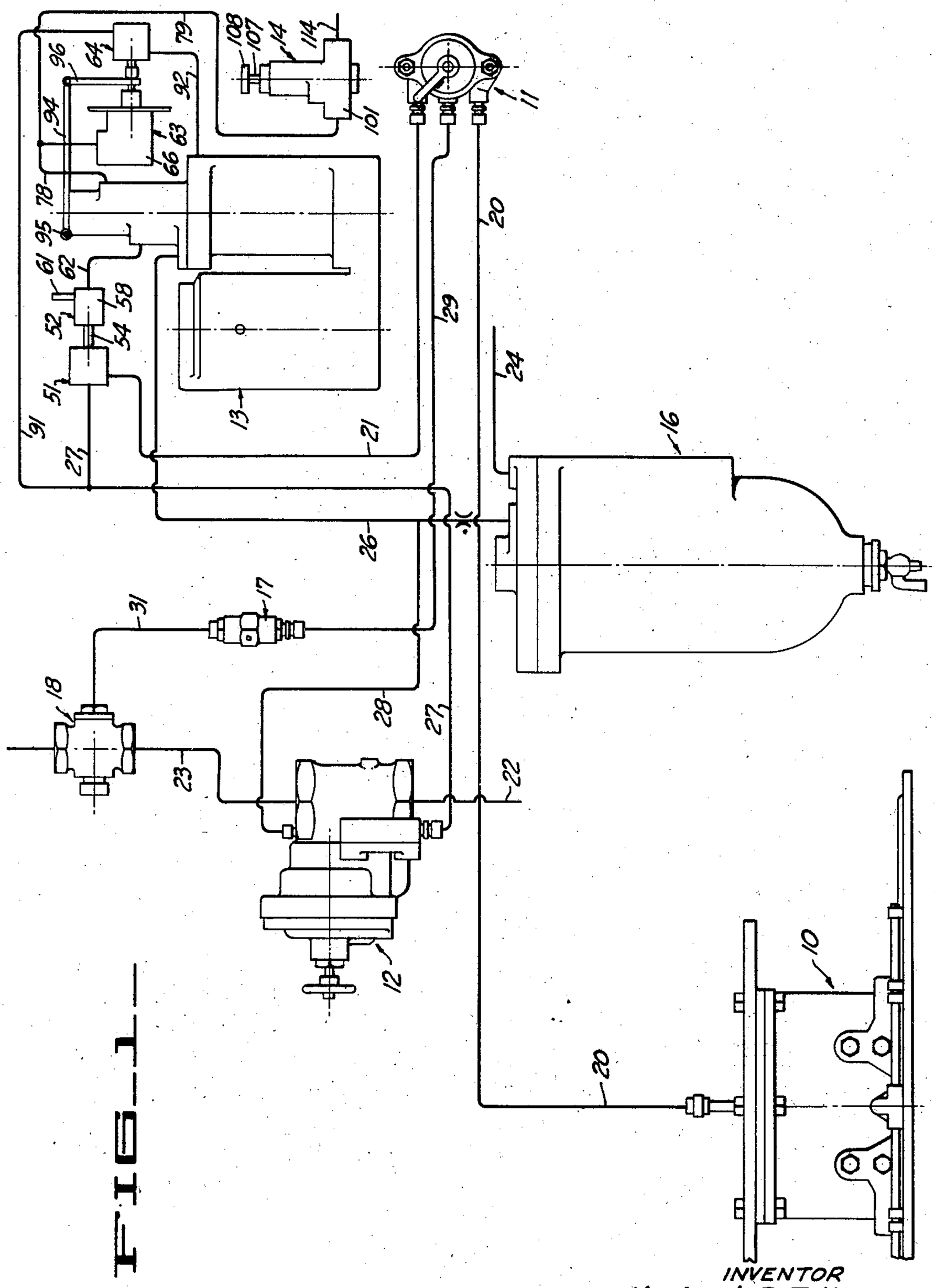


FIG. 1

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TRAIN CONTROL SYSTEM

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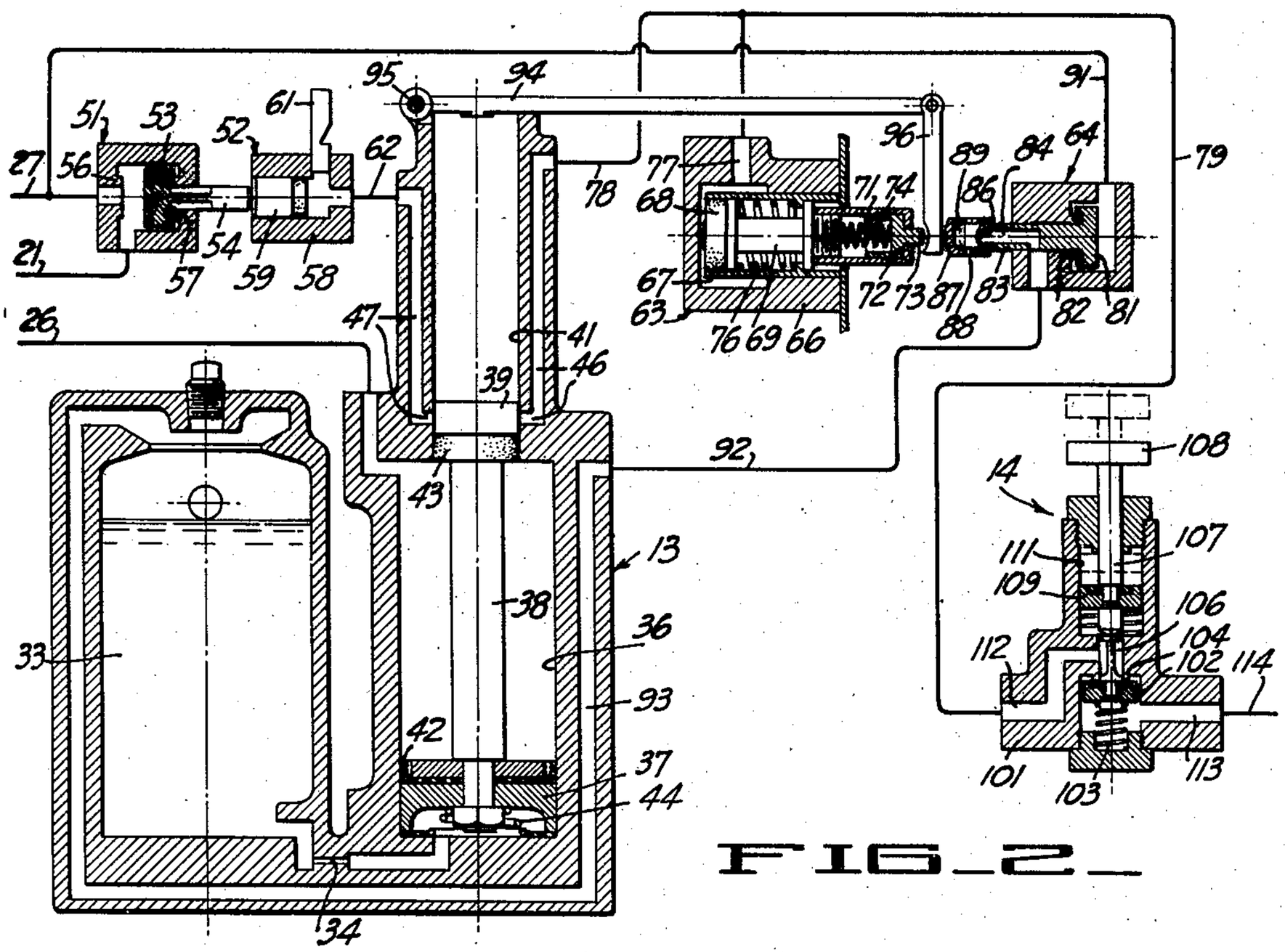


FIG_2_

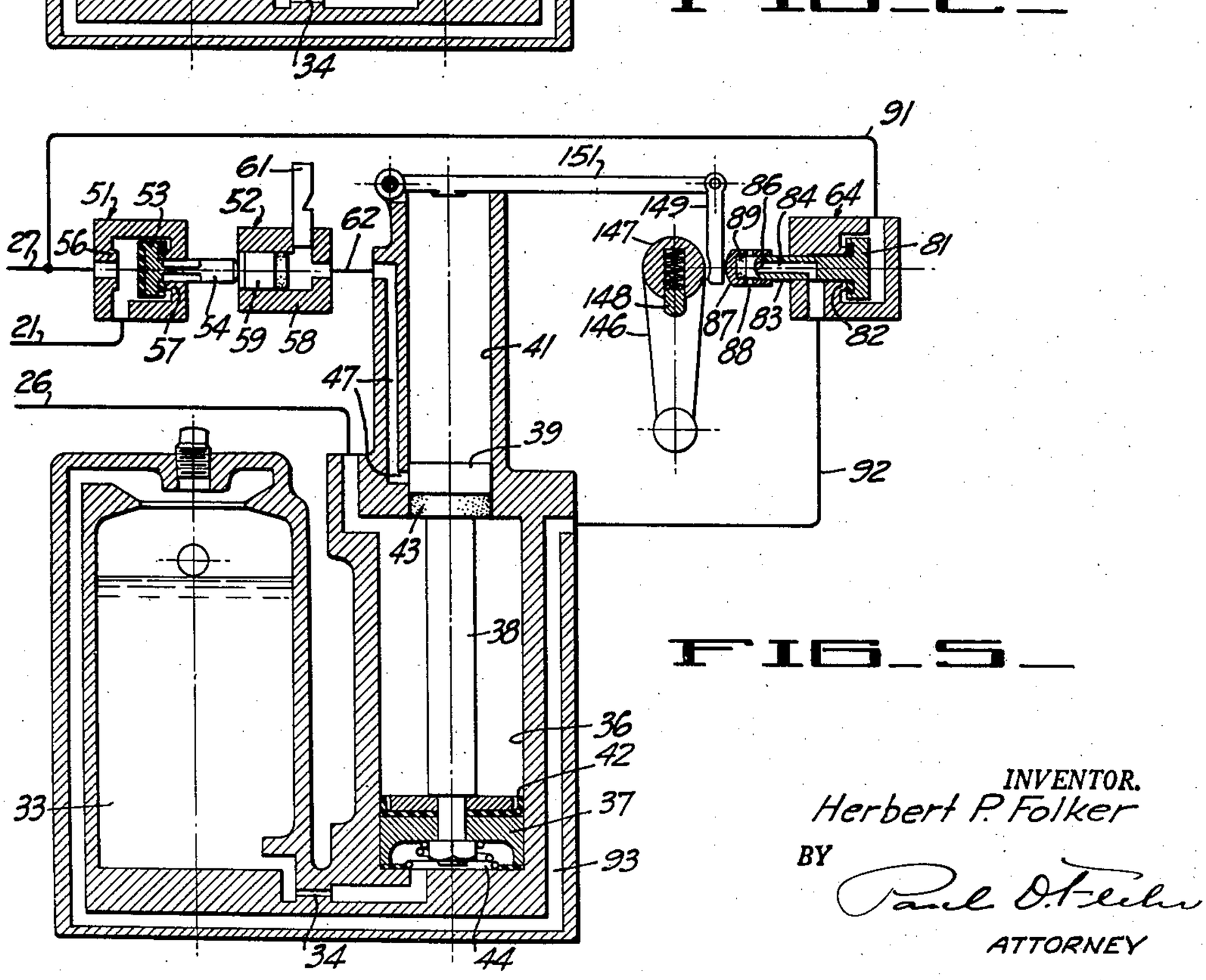


FIG_5_

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TRAIN CONTROL SYSTEM

Filed March 10, 1947 3 Sheets-Sheet 3

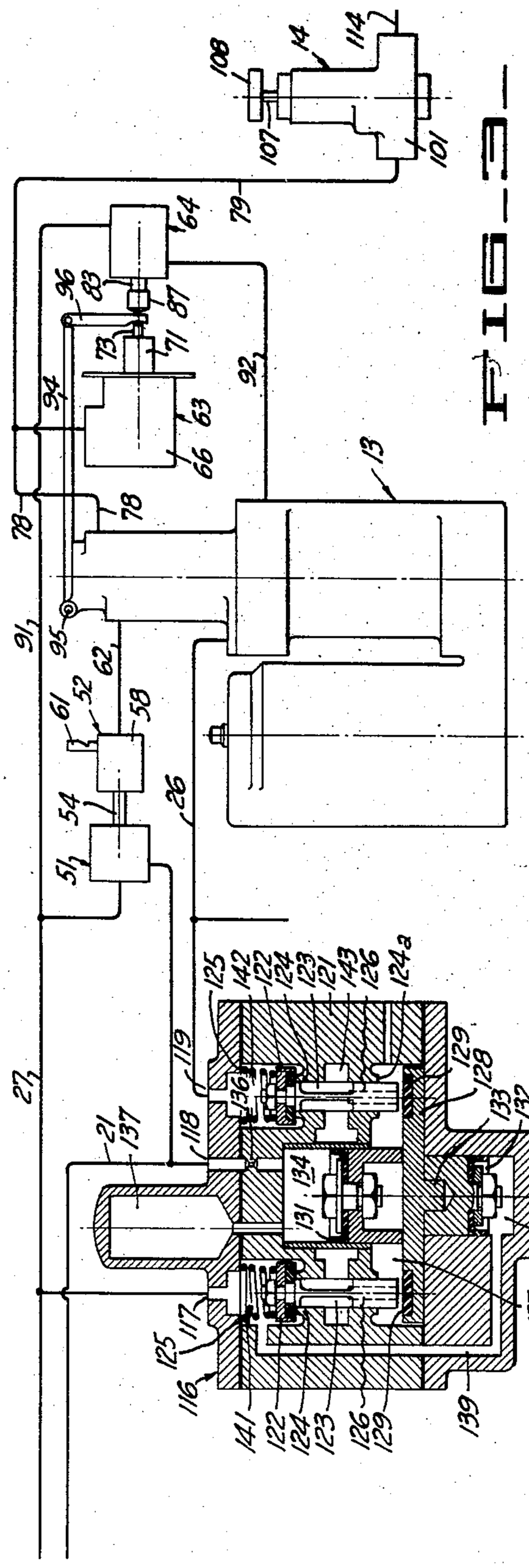


FIG. 3

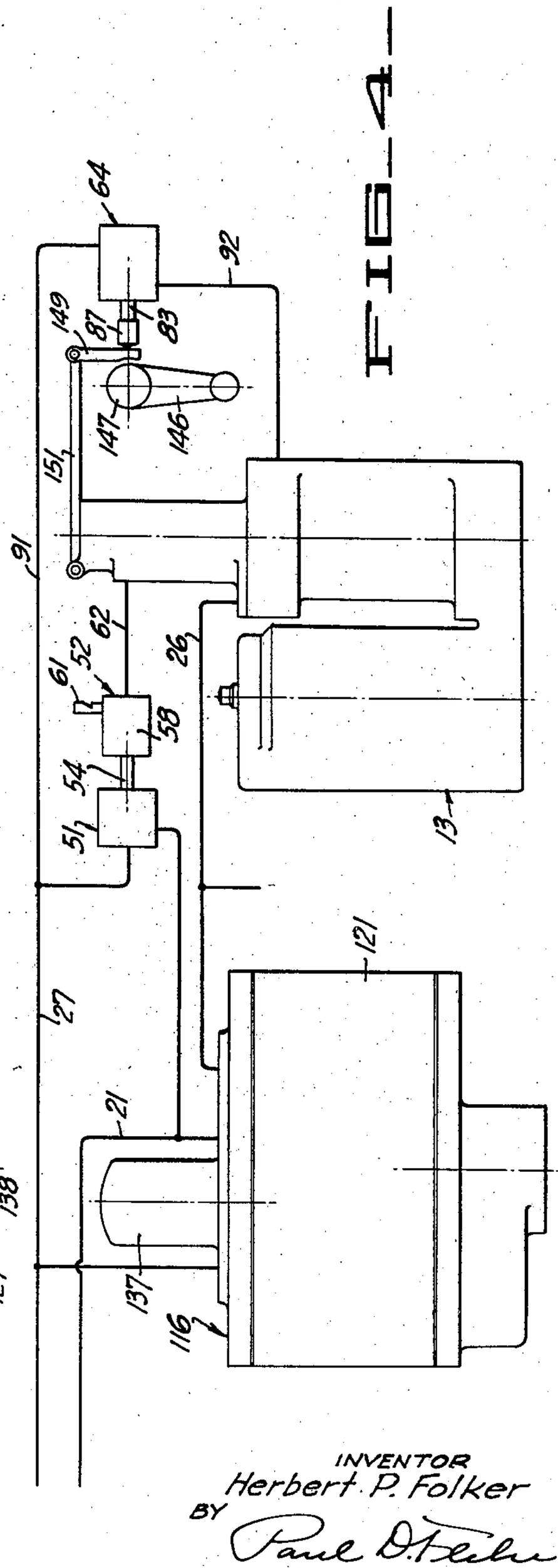


FIG. 4

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2,486,271

# UNITED STATES PATENT OFFICE

2,486,271

## TRAIN CONTROL SYSTEM

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Application March 10, 1947, Serial No. 733,476

10 Claims. (Cl. 303—18)

1.

This invention relates generally to train control systems of the type adapted to effect automatic brake applications and to enable a manual forestalling operation to prevent brake application under certain conditions.

In the past train control systems have been known which incorporate means on the locomotive adapted under certain conditions to receive a track impulse which serves to vent the main brake pipe of the pneumatic braking system of the train to thereby effect an automatic application of the brakes. Forestalling devices such as are used with such systems incorporate a time delay mechanism having an automatic cycle which is put in operation when the engineer actuates a forestalling lever. In the event a track impulse is received by the system during the time delay afforded by the forestalling mechanism, a brake application does not occur. Should the engineer fail to make timely operation of the forestalling lever, an automatic brake application occurs in response to a track impulse, and the train is then stopped, thus requiring the engineer to thereafter carry out a release or restoring operation. In train control systems of the type described in Folker et al. 1,439,081 and 1,690,816 a magnetic track impulse is utilized which directly operates one of a pair of valves incorporated in a "duplex control valve," whereby a line leading to an "automatic stop valve" is vented to secure a brake application. The forestalling unit as previously utilized with a system of the Folker type (see Patent 1,592,930) serves to automatically shut off the line leading from the automatic stop valve to the duplex control valve, and to vent the line leading to the duplex control valve to thereby prevent operation of the same in response to a track impulse for a given period of time.

Forestalling units of the type disclosed in Folker 1,592,930, or as modified to include a forestalling unit of the hydraulic type, have not been well adapted to operation of the forestalling unit from a position remote from the time delay means employed. This is a disadvantage in making installations on modern passenger trains, such as trains of the streamlined Diesel type, because it is frequently desirable in such installations to provide a small manually operated device at a position at a considerable distance from the time delay means of the forestalling unit, for initiating the forestalling operation.

An additional disadvantage of the prior Folker train control system, as described above is that when the forestalling unit is located a

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considerable distance from the automatic stop valve and from the duplex control valve, the length of the connecting pipes is such that pressure cannot be quickly built up in the pipe leading to the duplex train control valve, with the result that at the end of the forestalling period when the shut-off valve previously described is automatically opened, pressure from the automatic stop valve may be lowered to such a point that an automatic brake application occurs.

It is an object of the present invention to improve the Folker type of train control system whereby the forestalling means is simplified and made adaptable to a wide variety of installations, including installations where the member which is manually actuated for a forestalling operation is located a considerable distance from the forestalling time delay means.

A further object of the invention is to improve upon systems of the above character whereby the pipe leading from the forestalling unit to the duplex train control valve may be extended to any length desired, without causing an undesired brake application at the end of a forestalling period.

Another object of the invention is to provide a novel and automatic means for quickly recharging the line leading from the forestalling unit to the duplex train control valve with air under pressure from a secondary source, at the end of a forestalling period.

Additional objects and features of the invention will appear from the following description in which the preferred embodiments of the invention have been set forth in detail in conjunction with the accompanying drawing.

Referring to the drawing:

Figure 1 is a diagrammatic view, partly in section, illustrating a train control system incorporating the present invention.

Figure 2 is a diagrammatic view, partly in section, illustrating the forestalling unit and associated parts incorporated in Figure 1.

Figure 3 is a diagrammatic view illustrating a modification of Figure 1 to incorporate line charging means.

Figure 4 diagrammatically illustrates a control system similar to Figure 3 but with direct manual rather than remote operated forestalling means.

Figure 5 is a diagrammatic view in section illustrating the construction of the direct manual forestalling unit illustrated in Figure 4.

The train control system as illustrated in Figure 1 consists of a duplex train control valve 10

of the type adapted to be operated by a magnetic track impulse and as disclosed for example generally in Letters Patent 1,439,081, 1,439,082, 1,592,930 and 1,690,816. As presently explained in detail the duplex control valve **10** is used in conjunction with the release or restoring valve **11**, the automatic stop valve **12** (see 1,529,058) and the forestalling unit **13**. Located at a point remote from the forestalling unit **13** there is a manually operated forestalling valve **14**. In addition to the parts just mentioned the system may include an air strainer **16**, a double heading interlocking valve **17**, and a double heading cut-out cock **18**.

The release or restoring valve **11**, and valves **17** and **18**, can be substantially as shown and described in Folker 1,690,816.

The piping for the various parts mentioned above is as follows: A control pipe **20** extends from the duplex control valve **10** to the restoring valve **11**, and an extension **21** of the same extends from the restoring valve to the forestalling unit. Line **22** which connects to the automatic stop valve **12** is the brake application pipe of a conventional pneumatic train braking system. Pipe line **23** leads from the stop valve **12** to the engineer's brake valve, and is equipped with a double heading cock **18**. Line **24** represents a connection to the main air supply reservoir of the braking system. Line **26** is an extension of line **24** beyond the filter **16** and connects with the time delay means of the forestalling unit as will be presently explained. Pipe line **27** connects from the stop valve **12** to certain parts of the forestalling unit as indicated and in effect is an extension of the control line **21**. Another pipe **28** connects stop valve **12** with the air supply pipe **26**. Pipe **29** connects the restoring or release valve **11** with the interlocking device **17**, and line **31** connects this device to the double heading cock **18**.

For a normal position of the various parts, that is a position in which the system is in condition to be responsive to a track impulse to effect an automatic brake application, brake pipe **22** is maintained closed against venting to the atmosphere by the stop valve **12**, while air pressure is maintained in control pipes **20** and **21**, and cock **18** is open to permit control of the braking system from the engineer's cab. Pipe **28** leads to the main air reservoir and is in restricted communication with the control pipes **20** and **21**. Each of the two valves in the duplex control valve **10** are retained closed magnetically, and when the control valve passes over a track magnet, the field of which has not been neutralized by a signal current, one of the two duplex control valves (normally held closed magnetically) is open to vent the control pipe, the particular valve operated dependent upon the direction of movement of the train. Venting of control pipe **20** to the atmosphere resulting from opening of one of the two control valves, reduces holding pressure upon the operating diaphragm of the stop valve **12**, and as a result the valve member of the stop valve moves to a position to cause venting of the brake pipe **22** to the atmosphere, and the non-release valve incorporated in the same closes communication between pipes **23** and **22**.

The forestalling unit incorporated in Figure 1, together with the remote forestalling valve **14**, is illustrated in greater detail in Figure 2. The forestalling means illustrated consists of time delay means of the hydraulic type, including a



reservoir **33** adapted to contain a quantity of suitable liquid such as oil. Restricted orifice **34** establishes communication between the lower portion of reservoir **33** and the lower portion of a vertically extending cylinder **36**. A piston **37** is slidably fitted in cylinder **36** and is attached to the lower end of a rod **38**. The upper end of rod **38** is attached to a member **39** which can be termed a piston valve, and which is slidably fitted in a second cylinder **41**. Piston **37** is provided with suitable sealing means such as the cup leather **42**, and like means such as a cup leather **43** is provided for piston **39**. A compression spring **44** is shown positioned at the lower end of cylinder **36** and is adapted to be compressed when the piston **39** completes its final downward movement. The lower portion of the cylinder **41** is provided with ports **46** and **47** which are closed by the piston valve **39** for the lowermost position of the same as illustrated in Figure 2, but which are exposed for communication with the upper portion of cylinder **36** when the piston valve moves upwardly.

As will be presently explained during a forestalling period piston **37** together with piston valve **39** is caused to move upwardly at a regulated rate by application of line pressure to the reservoir **33**, and after reaching the upper limit of their travel, these members move downwardly to their initial position. The space above piston **37** is in continuous communication with the main reservoir supply pipe **26**.

In conjunction with timing means I provide a shut-off valve **51** together with a valve actuator **52**. The shut-off valve is double seated and consists of a movable valve member **53** carried by the fluted stem **54**. The valve member in its one limiting position closes upon a stationary seat **56** and in its other limiting position on seat **57** surrounding the stem **54**. The orifice **56** connects with the pipe line **27** as illustrated, and a space between seats **56** and **57** connected with the control line **21**. In the normal position of the shut-off valve as illustrated in Figure 2, lines **21** and **27** are placed in free communication. However when stem **54** is actuated to close valve member **53** upon seat **56**, line **21** is vented to the atmosphere past stem **54** and line **27** is closed.

The actuator **52** consists of a body forming a cylinder **58** and fitted with the piston **59**. The space on one side of piston **59** connects with the signal whistle **61**, and with line **62** which connects with the port **47** of the timing means. Thus when air pressure is applied to pipe or duct **62** piston **59** is urged in a direction to move stem **54** and thereby close valve member **53** upon seat **56**. While such pressure is applied to pipe **62** the signal whistle **61** is operated.

In addition to the foregoing the forestalling unit includes the pneumatic actuator **63**, and a combination vent and closure valve **64**. Actuator **63** consists of a body **66** fitted with the cylinder **67**. A piston **68** is fitted in cylinder **67** and is attached to the rod **69**. A tube **71** is also attached to rod **69** and extends to the exterior of the device. A plunger **72** provided with a projecting stud **73** is slidably fitted within tube **71** and is yieldably urged toward projected position by the compression spring **74**. Another compression spring **76** urges the piston together with the tubular member **71** toward retracted position. Duct **77** communicating with one side of piston **68** is connected by pipe **78** to the port **46** of the timing means, and also by pipe **79** to the remote valve **14**.

Valve 64 consists of a valve member 81 adapted to close upon the stationary seat 82 and carried by the stem 83. The valve stem is provided with a duct 84 which communicates with the orifice 86 formed on the outer end of the stem. The outer end of the stem loosely carries a cup 87 provided with vent openings 88, and with a seating disc 89. One side of the seat 82 is connected by pipe 91 with the line 27 leading to the automatic stop valve. The other side of seat 82 is connected by line 92 to a duct 93 in the timing means whereby this pipe is in communication with the space in the upper part of the liquid reservoir 33.

The timing means, the pneumatic actuator 63 and the valve 64 are correlated by latching means which can be constructed as follows: A latch lever 94 as diagrammatically illustrated has a stationary pivotal mounting 95 and has a portion of the same interposed in the path of movement of the piston valve 39. The free end of lever 94 carries what can be termed a latch bolt 96, the lower end of which for purposes of schematic illustration is normally interposed between the aligned stud 73 and the cap 87. The arrangement of parts in this connection can be similar to that illustrated in Patent 1,592,930 (see Figures 5 and 6 of same) assuming that the plunger stem 74 corresponds to the plunger stud 73 in the present instance.

The latching means just described can be similar to that disclosed and claimed in said Patent No. 1,592,930, and functions as follows: When no pressure is being applied to the piston 68 of the pneumatic actuator 63 the parts occupy substantially the operating positions illustrated in Figure 2. Valve member 81 is closed upon its seat 82 and line 92 is vented to the atmosphere through ducts 84, 86 and 88. When pneumatic pressure is applied to piston 68 by way of duct 77, movement of this piston transmits motion to the stud 73 and such motion is transmitted through the lower end of latch bolt 96, to close cap 87 upon orifice 86, and to move the valve member 81 to open position with respect to seat 82. Thereafter when piston valve 39 strikes latch lever 94 and swings the same upwardly a limited distance, latch bolt 96 is retracted from its normal position between stud 73 and cap 87, whereby valve member 81 is permitted to close and cap 87 permitted to move to open the venting orifice 86. As will presently be explained in greater detail this initiates a downward movement of the piston valve 39 and after piston 37 has completed its downward movement, pneumatic pressure upon piston 68 is relieved whereby this piston is permitted to return to its initial position under the urge of compression spring 76, thereby enabling the latch bolt 96 to again drop down into its former position illustrated in Figure 2.

The remote valve 14 may be located a considerable distance from the main parts of the forestalling unit. It consists of a body 101 provided with a valve member 102 normally urged by spring 103 against stationary seat 104. A fluted stem 106 is attached to the valve member and is adapted to be engaged by the lower end of an operating rod 107. The operating rod extends to the exterior of the valve body where it is provided with an operating button 108. Within the body the operating rod is attached to a piston 109 fitted in the cylinder 111. One side of the piston 109 is vented to the atmosphere through the space about rod 107, and the other side is normally in communication with the outflow passage 112. The inlet passage 113 of the valve is connected to the main reservoir supply pipe 114, while the outflow passage 112 connects with the line 79, which connects with the pneumatic actuator 63 and with the timing means.



Operation of the system as described above with reference to Figures 1 and 2, can be reviewed as follows: Assuming that the system is in normal condition ready to receive a track impulse, and that the double heading cock 18 is turned to open position to permit control from the engineer's cab as desired, the two valves of the duplex control valve 10 are in closed position and retained closed against the pressure of air in control pipe 20, by the magnetic field of a permanent magnet as described in aforesaid Patent No. 1,548,593. The paths of the forestalling unit are substantially in the position as illustrated in Figure 2, and the double seated shut-off valve 51 is in the position illustrated whereby pipes 21 and 27 are in free communication. By virtue of pressure maintained in pipe 27 the valve member of the automatic stop valve 12 is maintained in such a position that the valve means of the same maintains pipe 22 in nonventing condition. At the same time however pipes 20, 21 and 27 are in restricted communication with the main source of air supply through the stop valve.

Assuming that a track impulse is received by the duplex control valve without operation of the forestalling unit, line 20 is vented to the atmosphere by the opening of one of the valve members of the duplex control valve, and it serves to vent line 27 from the stop valve 12, whereby the stop valve automatically operates to vent the brake pipe 22 to the atmosphere. This serves to effect an automatic brake application. In order to restore the system to normal operation the engineer must then move the handle of the restoring valve 11 to restoring position, whereby pipe 20 is vented to the atmosphere and temporarily disconnected from pipe 21, and pipe 21 is connected to pipe 29 and thereby vented to the atmosphere through the interlocking valve 17. This retains the brakes applied and permits the pressure in pipe 20 to drop to atmospheric, whereby the valve member of the duplex control valve which has been actuated to open position, is permitted to return to closed position. Thereafter when the handle of the restoring valve 11 is returned to normal position, pipe 20 is reconnected with pipe 21.

Assuming now that the engineer is alert and carries out a forestalling operation to prevent a brake application by a track impulse, button 108 of the remote forestalling valve 14 is depressed whereby valve 102 is unseated to permit application of air pressure from the main supply through pipe 79 to the pneumatic actuator 63. Operation of actuator 63 serves to close the venting orifice 86 and unseat the valve member 81, whereby pressure from line 27 through line 91 is applied through pipe or duct 92 and duct 93 of the timing means to the space above the liquid in reservoir 33. Liquid from reservoir 33 now commences to flow through the restricted orifice 34 to the space beneath the piston 37. The initial movement of this piston is aided by the compression spring 44. Piston valve 39 moves upwardly with piston 37, and when port 46 is exposed this port together with line 78 is placed in free communication with the space above the piston 37. In connection with the upward movement of the piston 37 it will be noted that the full pressure of the main reservoir supply is applied at all times to the space above

piston 37. However the upper area of piston 37 minus the upper area of piston 39 is less than the bottom area to which the liquid pressure is applied. Therefore a differential force acts to urge the piston upwardly. Exposure of port 46 to the space above the piston applies the full main reservoir pressure to the pipe 78, to the pipe 79 and the pneumatic actuator 63. The pressure thus supplied to the actuator can be termed the holding pressure, and thereafter the operator may release the button 108, without interfering with automatic continuation of the forestalling cycle. Release of button 108 permits this button to raise to the position illustrated in dotted lines in Figure 2, due to the fact that piston 109 is urged upwardly by pressure applied to passage 112.

Simultaneously with exposure of port 46 port 47 is likewise exposed to the line pressure existing in the upper portion of cylinder 36. Therefore main reservoir pressure is applied through pipe 62 to the pneumatic operator 52 whereby the piston 59 of this operator operates the shut-off valve 51 to close the valve member 53 upon seat 56. Thus shortly after the commencement of the forestalling period the control line 21 is shut off from communication with the remainder of the control line 27, and likewise that portion of the control line leading to the duplex control valve by way of pipe 21 is vented to the atmosphere. Thus a track impulse will not operate either one of the two control valves.

The piston 37 moves upwardly at a predetermined speed and when it reaches substantially the upper limit of its travel, piston valve 39 strikes the latch lever 94 with the result that latch bolt 96 as diagrammatically illustrated is effectively withdrawn from between stud 73 and the cap 87 (ignoring for the sake of diagrammatic illustration the additional lever 85 shown in Patent 1,592,930, which would customarily be used in place of a single latch bolt). This serves as a motion transmitting element to permit closure of valve member 81 and to cause venting of line 92 through orifice 86. Reduction of pressure upon the liquid in reservoir 33 to atmospheric pressure results in downward movement of the piston 37 under the urge of air pressure from the main reservoir supply. During the last portion of the downward travel of piston 37 ports 46 and 47 are again exposed to the atmosphere about the upper part of piston valve 39, whereby air is no longer supplied to the pneumatic actuator 52. Thus the shut-off valve 51 is permitted to open and reestablish communication between pipes 21 and 27. Air discharging from port 46 to the atmosphere reduces the pressure in pipes 78 and 79 to atmospheric whereby button 108 is permitted to drop down to its normal position by gravity. This serves to indicate to the operator that the forestalling period has ended. The forestalling period and its termination can also be indicated by a small signal whistle connected to line 79.

A particular feature of the system as described above is the simplicity of the novel means employed for maintaining holding pressure upon the pneumatic actuator 63. As previously described this is accomplished by the line 78 which makes a direct connection from the actuator to the port 46. Piston valve 39 serves to automatically control the application of the main reservoir supply through the port 46 and the pneumatic actuator whereby the holding pressure is automatically applied shortly after the forestalling period commences and is automatically removed at the end of the forestalling operation. This simple means eliminates the necessity of using more complicated devices for this purpose, as for example a supplemental diaphragm or piston operated valve. A further feature of the apparatus is the use of a booster spring 44 below the piston 37. This spring speeds up the initial movement of the piston 37, thus reducing the period of time required for the operator to hold the button 108 depressed.



In certain installations of the system described above it is desirable to locate the forestalling unit at a considerable distance from the duplex control valve. This introduces the problem of quickly recharging the extended pipe line leading from the duplex control valve, at the end of a forestalling operation. Where the control line is of considerable length it is impossible to charge the same with air at the end of the forestalling operation by air supplied from the automatic stop valve, without causing undesired operation of the latter with false momentary application of the train brakes. In the system of Figure 3 this difficulty is overcome by the use of a line charger 116. This line charger has one duct 117 connected with the line 27 leading to the stop valve, another duct 118 which is connected to the control line 21, and a duct 119 which connects with the line 26 leading from the main reservoir supply, or some equivalent supplemental source of air. In general this line charger serves to supply charging air from the main reservoir supply or equivalent supplemental source to the control line at the end of the forestalling operation, to quickly build up the pressure in the same, after which the connection to the supplemental source is automatically discontinued for normal operation of the system.

The particular line charger illustrated consists of a body 121 within which are the two valve members 122. Each of these valve members is carried by a guided and fluted stem 123, and is adapted to close under the urge of spring 125 upon a stationary seat 124. A second stationary seat 124a can be provided about each stem. The lower portions of the stems 123 have central passages 126 which open through the lower ends of the stems into the space 127. This space is vented to the atmosphere as illustrated. Below the stems 123 there is a yoke bar 128 which is provided with valve seat inserts 129. The yoke bar 128 is interposed between two opposed pistons 131 and 132. A retention stud 133 is carried by the lower side of the yoke 128 and is fitted within a central opening provided in piston 132. Space 134 above the piston 131 is in restricted communication through orifice 136 with the duct 118, and is in unrestricted communication with a closed air chamber 137. This chamber may be a cavity formed within the body of the device, or it may be a separate chamber connected to the device by suitable extension pipes. Space 138 below the smaller piston 132 is connected by duct 139 with a space 141 above the left hand valve member 122, and which space likewise communicates with duct 117. Space 142 above the right hand valve member 122 is in direct communication with duct 119. Intermediate space 143 surrounds the intermediate portions of the stems 123 and communicates with the upper portions of ducts or passages 126. Thus when both of the valve members 122 are closed as illustrated in Figure 3, space 143 is vented to the atmosphere through the ducts 126 and cavity 127.

Operation of the line charger described above is as follows: For a normal condition of the system with line pressure in control lines 21 and

27, valves 122 are closed as illustrated. At the beginning of a forestalling operation double seated shut-off valve 51 is operated in a manner previously described to shut off communication between pipes 21 and 27, and to vent pipe 21 to the atmosphere. This serves to vent air through the orifice 136 from both spaces 134 and the cavity or chamber 137. This in turn results in such a reduction of pressure in space 134 as to cause the lower (and smaller) piston 132 to force the yoke bar 128 together with piston 131 upwardly to cause the seat inserts 129 to engage and lift the valve stems 123. This operation serves to move the valve members 122 to full open position and at the same time ducts 126 are closed to interrupt communication between spaces 127 and 143. Seals are also established about the stems 123 because of engagement of inserts 129 with seats 124*a*. When in open position spaces 141 and 142 are in communication with space 143 through the flutes of the valve stems 123. Thus pressure from the main reservoir supply line 26 is supplied through space 142 and space 143 to the space 141 above the left hand valve member 122 where it assumes the same value as the pressure in pipe 27. From space 141 pressure is transmitted through duct 139 to the space 138 below the smaller piston 132. Application of pressure to space 141 in effect forms a direct connection between the main reservoir supply line 26 and the line 27 leading from the automatic stop valve.

At the end of the forestalling operation the double seated shut-off valve 51 is moved to open position in the manner previously described, to re-establish communication between lines 21 and 27. Simultaneously air pressure from line 27 is supplied through the shut-off valve 51 to lines 21 to 20 to quickly build up pressure in the latter to normal value. This charging operation does not substantially reduce the pressure in line 27 because during that interval this line is also directly connected with the main reservoir supply line 26 or equivalent supplemental source, through spaces 141, the flutes of the left hand valve stem, space 143, the flutes of the right hand valve stem, and space 142.

When the pressure in line 21 has been built up to substantially normal value, pressure in the chamber or cavity 137 has likewise increased to such a value that piston 131 is now urged downwardly with sufficient force to overcome the upper force of the piston 132. Therefore the yoke bar 128 is moved downwardly to cause all of the parts to return to normal position as illustrated in Figure 3.

Restriction 136 serves the useful purpose of retarding building up of pressure in the cavity 137 toward the end of the charging interval. Cavity 137 provides an increased capacity for space 134 and thus together with restriction 136 provides a proper interval before cut out, that is before the pressure in space 134 builds up to a sufficient value to move pistons 131 and 132 in a direction to cause valve members 122 to close and interrupt further supply of air from the main reservoir supply or other supplemental source of air.

It will be apparent from the foregoing that the line charger as described serves to automatically recharge the control lines connected from the forestalling unit to the duplex control valve, without occasioning a drop in pressure in the pipe line leading from the automatic train stop valve. Thus the lines connected from the forestalling unit to the duplex control valve may be any length desired without in any way interfering



with proper operation of the system. It will be appreciated that for connecting lines of different lengths leading from the duplex control valve to the forestalling unit, the cavity or chamber 137 should be adusted accordingly as to volumetric capacity and likewise restriction 136 can be adjusted. A larger cavity and/or a smaller restriction serves to increase the time period of the charging operation to adapt the system to longer connecting lines.

In the event a track impulse is received by the duplex control valve to cause actuation of the same, while the line charger is supplying air to the line 27, the venting of air from line 21 will be insufficient to prevent building up of pressure in the same, because of the relatively high available rate of air supply from the charger. Therefore after the normal charging period valve members 122 of the line charger close, and thereafter continued venting by the duplex control valve causes a brake application.

The system illustrated in Figure 4 likewise uses a line charger 116 but the forestalling unit in this instance is directly operated manually, rather than from a remote point. Thus the valve 14 in this instance is omitted, and in place of the pneumatic actuator 63 there is a hand lever 146 mounted upon the rotatable shaft 147. As diagrammatically illustrated the shaft carries a spring pressed lug 148 adapted to engage and transmit force to the lower end of the latch bolt 149. Thus when the hand lever is turned clockwise 270° as viewed in Figure 5, the cap 87 of the valve 64 is operated whereby the valve member 81 is unseated. This operation is the same as when the pneumatic actuator 63 of Figure 2 is operated by air pressure, and it effects commencement of a forestalling cycle. Latch bolt 149 is pivotally attached to the latch bolt 151, corresponding to the latch arm 94 of Figure 2. When the piston 37 reaches the upper end of its travel latch lever 151 is operated to retract the bolt 149, with a result that valve 64 is permitted to return to its normal initial position, and the forestalling lever 146 permitted to return to its initial position as illustrated. In actual practice the parts just described can be similar to corresponding parts disclosed in Patent 1,592,930.

The direct manual forestalling means of Figure 5 cooperates with the line charger 116 in the same manner as the remote operated forestalling means of Figure 3. Here again the line charger serves to supply air to the control line 21 at the end of the forestalling period to avoid an improper application of the brakes.

I claim:

1. In a pneumatic train braking system of the type including a control valve adapted to vent a control pipe of the system in response to a track impulse to thereby effect automatic application of the train brakes, a valve adapted to be manually opened and having its inlet side connected to the main air supply reservoir of the system, and a forestalling unit set in cyclic operation by opening of said valve and serving to effect shut off of said control pipe for a predetermined time period to thereby prevent a brake application during such period upon venting of said control pipe by said control valve, said unit including a cylinder, a piston movable within the cylinder, an oil reservoir in restricted communication with one end of said cylinder, the reservoir being adapted to receive air under pressure to expel the liquid in the cylinder to thereby move the piston, valve means serving to control application of

pneumatic pressure to said reservoir, a pneumatic actuator for said last named valve means provided with a chamber adapted to receive air under pressure to actuate the same, a connection between said chamber and the discharge side of said manually operated valve, a pneumatic connection from the other side of said cylinder and a source of air under pressure, additional valve means operated by movement of said piston and serving to automatically connect the chamber of said pneumatic actuator to said air supply shortly after said piston is moved from its normal position toward the said other end of the cylinder, a shut-off valve interposed in said control pipe, another pneumatic actuator serving to operate said shut-off valve, another valve means serving to apply pneumatic pressure to said last named actuator during the travel of said piston from its normal position, and means actuated by the piston at the end of its travel from said initial normal position for rendering the first named actuator ineffective to maintain its associated valve means closed.

2. A system as in claim 1 in which the valve means serving to connect the chamber of the first named pneumatic actuator with said cylinder consists of a second piston attached to the first piston, a second cylinder in which the second piston operates, and a port exposed by the second piston after initial movement of the same and connected to said first named actuator.

3. In a pneumatic train braking system including a control valve adapted to be opened in response to a track impulse to vent a control line and an automatic stop valve connected to the control line whereby when the control line is vented said automatic stop valve vents the main brake pipe to thereby effect a brake application, a forestalling unit including time delay means and a shut-off valve operated during the time delay period to interrupt the control line and to vent that portion of said line leading from the control valve to the shut-off valve and operated at the end of the forestalling period to reconnect said portion of the control line to the automatic stop valve, and automatic pneumatic line charging means connected to the control line and serving to supply air under pressure to the same only for a short interval at the end of the forestalling period.

4. In a pneumatic train braking system including a control valve adapted to be opened in response to a track impulse to vent a control line and an automatic stop valve connected to the control line whereby when the control line is vented said automatic stop valve vents the main brake pipe of the train braking system, a forestalling unit associated with the control line, said unit including time delay means having an automatic cycle of operation adapted to be initiated by an operator, and a shut-off valve in said control line and adapted at the beginning of the forestalling cycle to close that portion of the control line leading to the automatic stop valve and to vent that portion of the control line leading to said control valve, said shut-off valve at the end of the forestalling cycle serving to re-establish communication between both portions of the control line, and line charging means connected to that portion of the control line leading from the automatic stop valve and serving for a short charging interval to automatically supply said portion of the control line with supplemental air under pressure to recharge the entire control line at the end of the forestalling cycle and to interrupt such supply of supplemental air at the end of said charging interval.



5. In a pneumatic train braking system as in claim 4 in which said line charging means has pneumatic connections with both that portion of the control line leading from the automatic stop valve and that portion leading from the control valve, and incorporates valve means for automatically supplying that portion of the control line leading from the stop valve with air under pressure from a supplemental source of air supply, to recharge that portion of the control line leading from the control valve, at the end of the forestalling cycle.

6. In a pneumatic train braking system as in claim 4 in which said line charger comprises a body having a pneumatic connection with the main reservoir supply of the train braking system, a connection to that portion of the control line leading from the automatic stop valve, and a connection to that portion of the control line leading from said control valve, a pair of valve devices in said body, and fluid pressure operated means in the body for effecting operation of said valve devices, said valves and fluid operated means serving to admit air from the main reservoir supply to that portion of the control line leading from the stop valve at the end of the forestalling cycle and until the pneumatic pressure in that portion of the control line leading from the control valve has been built up to substantially normal value.

7. In a line charger, a body having a passage for connection with a source of air under pressure, a second passage having connection with a line to be charged with air, and a third passage for connection with a line which is adapted for communication with said first named line, a pair of valve means within said body, each valve means including a valve member movable in opposite directions between open and closed position, a stationary seat formed within the valve body and cooperating with said valve member, a valve stem attached to each valve member, and a valve orifice formed in one end of said stem, said valve body being provided with two spaces on that side of each of the stationary valve seats which the corresponding valve member engages, the first space being in communication with the first named passage, the second space being in communication with the third named passage, a vented space within the body in communication with the ends of said valve stems and also in communication with the atmosphere, an intermediate space in the valve body located intermediate the valve seats and said last named vented space, said intermediate space serving to interconnect both the first and second spaces when said valve members are in open position, aligned cylinders formed in the valve body, a pair of aligned pistons disposed within said cylinders, a yoke bar interposed between said pistons and having seating surfaces formed on their end portions adapted to engage the adjacent ends of the valve stems, means forming a pneumatic connection between the space on one side of one of the pistons and said third line, a flow restricting orifice interconnecting the space on one side of the other one of said pistons with said second line, and a cavity or chamber likewise in communication with said last named space, said pistons functioning in response to pneumatic pressure applied to the same to move said yoke bar in opposite directions between limiting positions, the valve members in one limiting position being both open and having the orifices in

their stems closed, and in the other limiting positions the valve members being both closed and said yoke bar being free with respect to the ends of the stems whereby said intermediate space is vented to the atmosphere through said stem orifices.

8. In a line charger, a body having a passage for connection with a source of air under pressure, a second passage having connection with a line to be charged with air, and a third passage for connection with a line which is adapted for communication with said first named line, a pair of valve means within said body, each valve means including a valve member movable in opposite directions between open and closed position, a stationary seat formed within the valve body and cooperating with said valve member, a valve stem attached to each valve member, and a valve orifice formed in one end of said stem, said valve body being provided with two spaces on that side of each of the stationary valve seats which the corresponding valve member engages, the first space being in communication with the first named passage, the second space being in communication with the third named passage, a vented space within the body in communication with the ends of said valve stems and also in communication with the atmosphere, an intermediate space in the valve body located intermediate the valve seats and said last named vented space, said intermediate space serving to interconnect both the first and second spaces when said valve members are in open position, aligned cylinders formed in the valve body, a pair of aligned pistons disposed within said cylinders, a yoke bar interposed between said pistons and having seating surfaces formed on their end portions adapted to engage the adjacent ends of the valve stems, means forming a pneumatic connection between the space on one side of one of the pistons and said third line, a flow restricting orifice interconnecting the space on one side of the other one of said pistons with said second line, and a cavity or chamber likewise in communication with said last named space, said pistons functioning in response to pneumatic pressure applied to the same to move said yoke bar in opposite directions between limiting positions, the valve members in one limiting position being both open and having the



orfices in their stems closed, and in the other limiting positions the valve members being both closed and said yoke bar being free with respect to the ends of the stems whereby said intermediate space is vented to the atmosphere through said stem orifices.

9. In a pneumatic train braking system as in claim 4 in which said line charging means incorporates means serving to automatically interrupt supply of supplemental charging air to the control line at the end of a short charging period irrespective of operation of the control valve during such interval.

10. In a pneumatic train braking system including a control valve adapted to be opened in response to a track impulse to vent a control line and an automatic stop valve connected to the control line whereby when the control line is vented said automatic stop valve vents the main brake pipe of the train braking system, a shut-off valve in the control line and adapted in one position of the same to close that portion of the control line leading to the automatic stop valve and to vent that portion of the control line leading to said control valve, said shut-off valve in the other position of the same serving to re-establish communication between both portions of the control line, and line charging means connected to that portion of the control line leading from the automatic stop valve and serving for a short charging interval to automatically supply said portion of the control line with supplemental air under pressure to recharge the entire control line when said shut-off valve is moved to said other position to re-establish communication between both portions of the control line, said line charging means also serving to automatically interrupt such supply of supplemental air at the end of said charging interval.

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