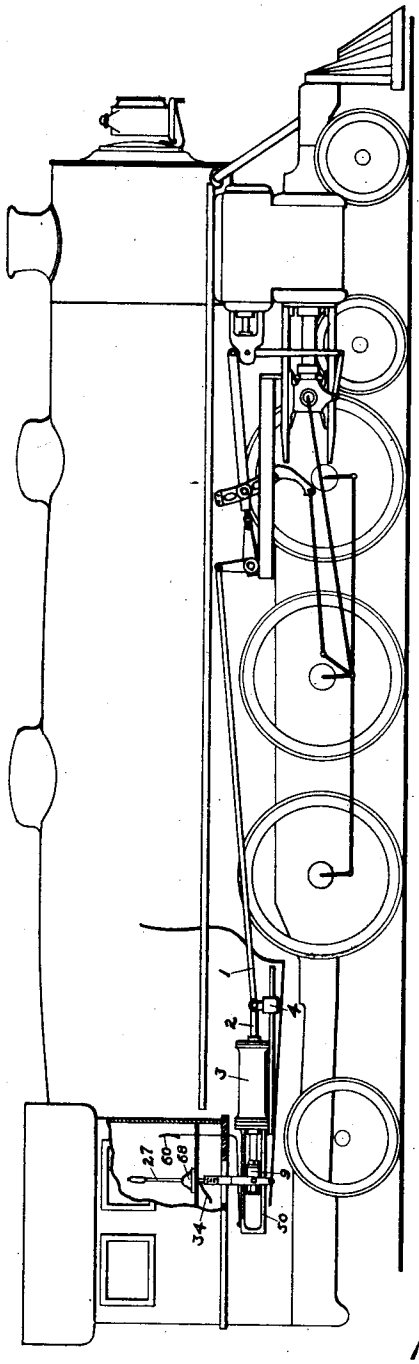
Aug. 20, 1929. H. D. GREGORY 1,724,926

POWER REVERSE MECHANISM

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FIG. 1



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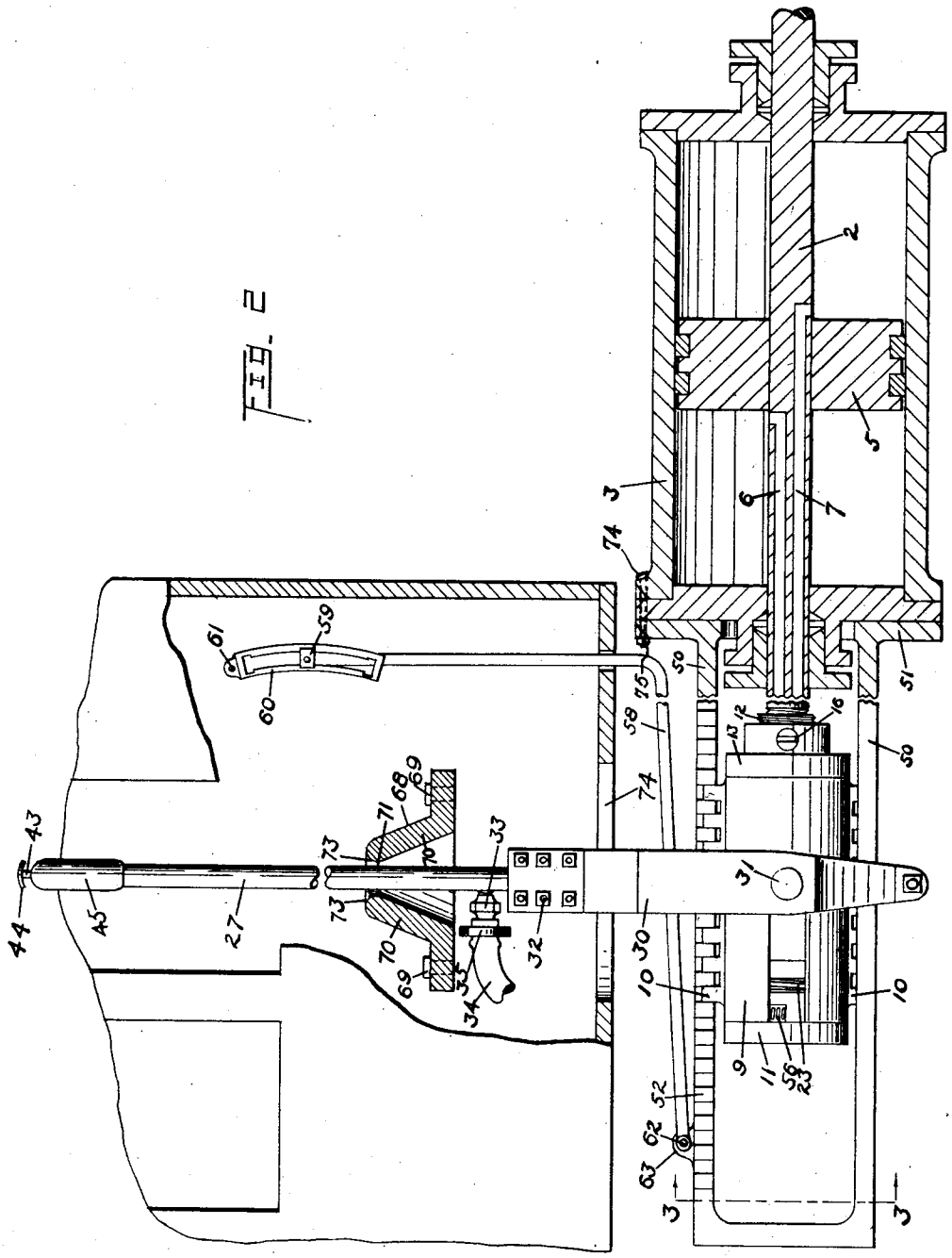
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FIG. 2



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FIG. 3

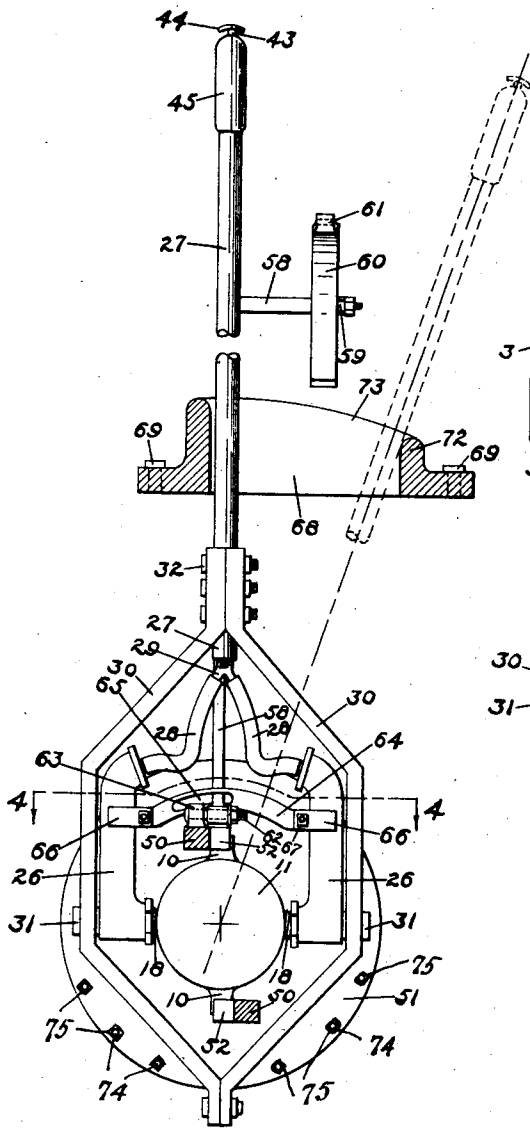


FIG. 11

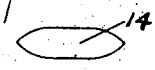
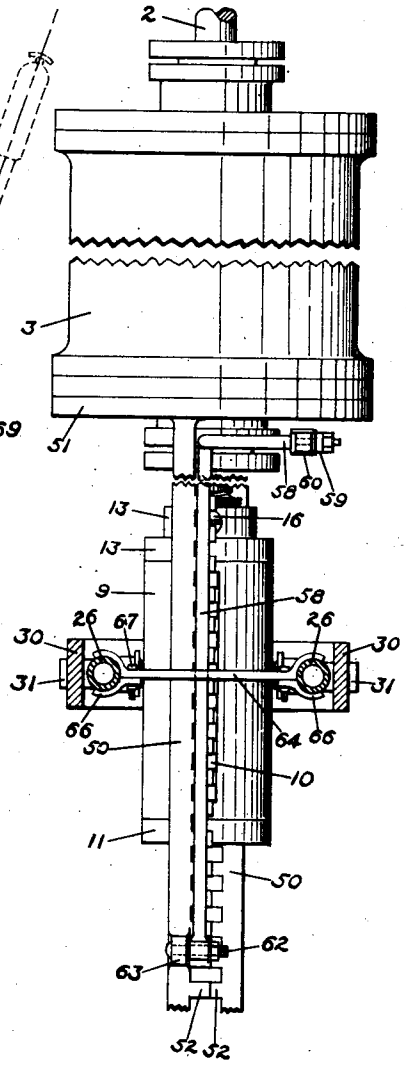


FIG. 4



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FIG. 5

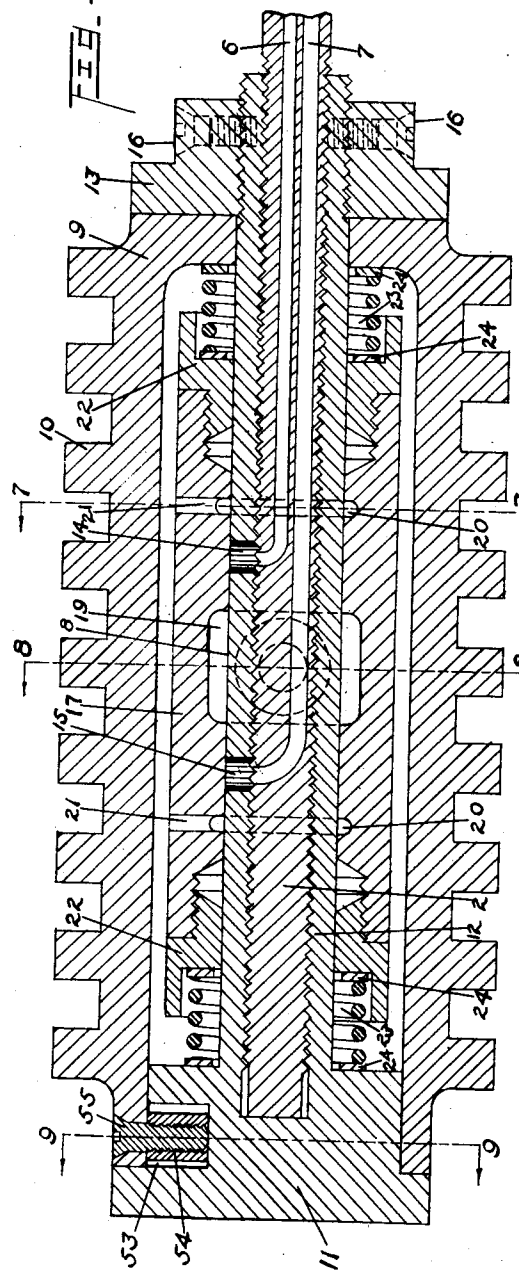
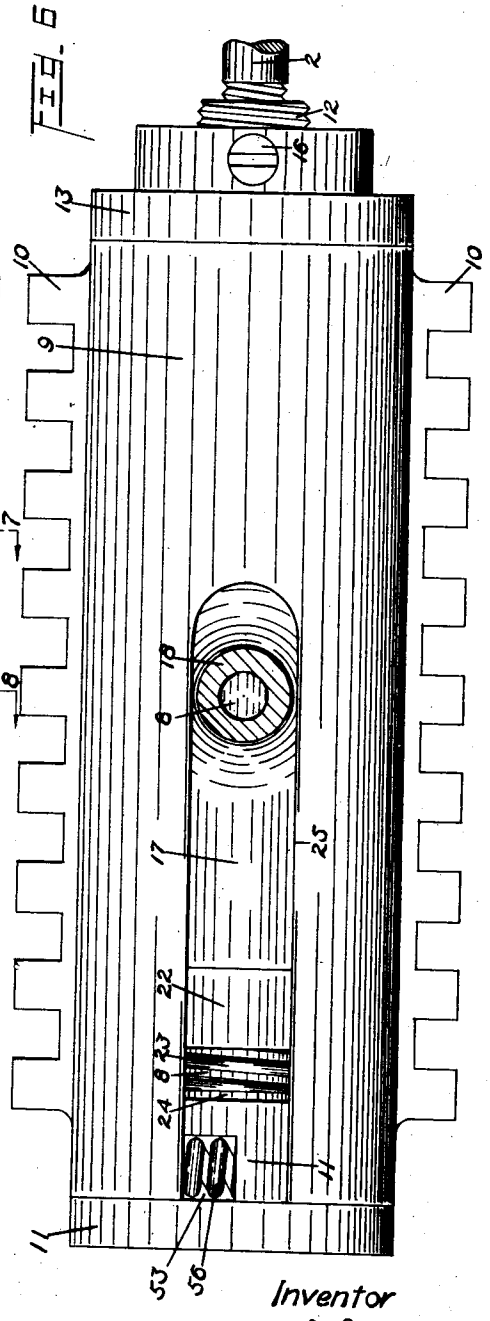


FIG. 6



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FIG. 7

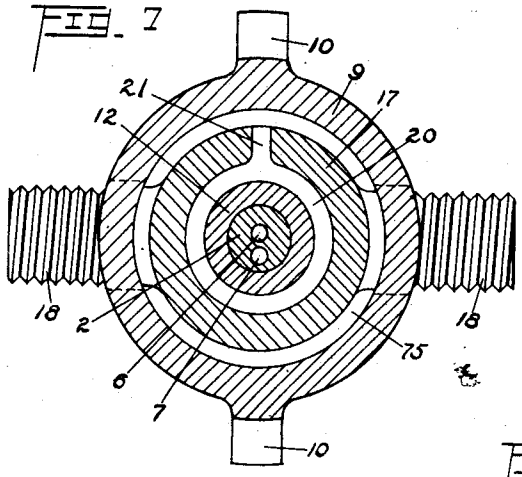


FIG. 8

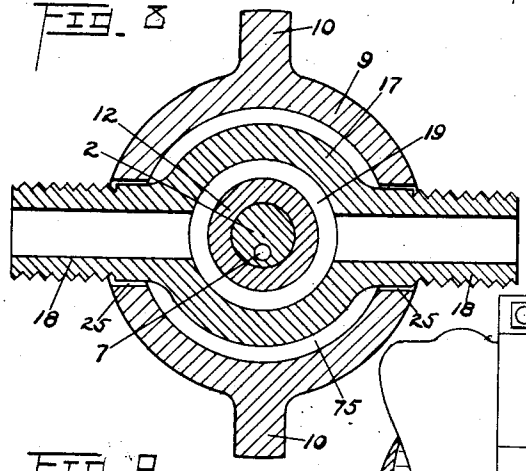


FIG. 9

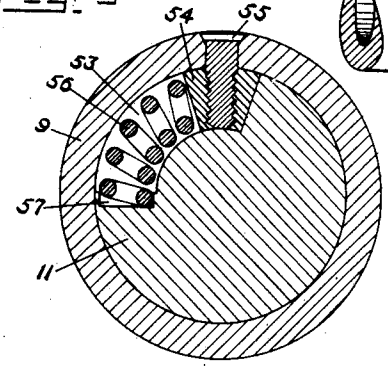
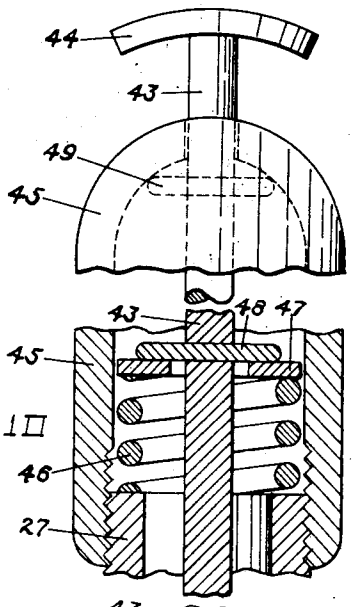
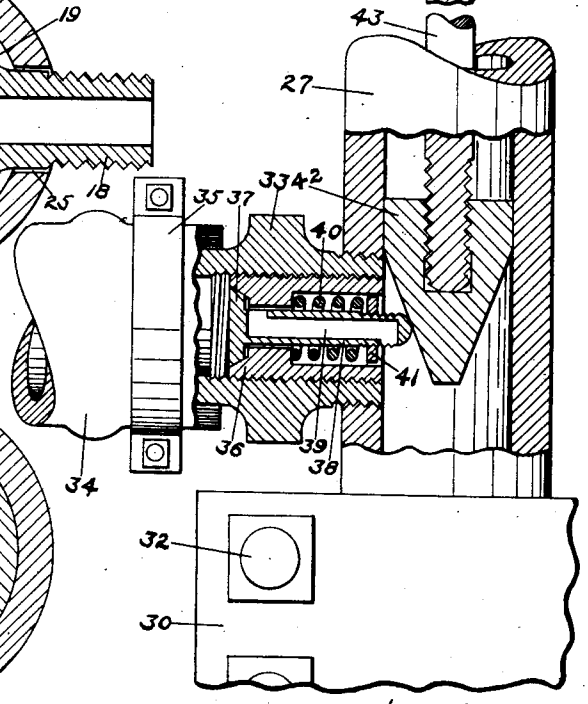


FIG. 10





Inventor

Harold D. Gregory

Patented Aug. 20, 1929. 1,724,926

UNITED STATES PATENT OFFICE.

HAROLD D. GREGORY, OF WASHINGTON, DISTRICT OF COLUMBIA.

POWER REVERSE MECHANISM.

Application filed September 28, 1921. Serial No. 503,817.

My invention relates to improvements in power reverse mechanism for operating or shifting the valve gear of steam engines, particularly railway locomotives, while not necessarily restricted to this use.

One of the objects of the invention is to provide positive means for holding the piston, which shifts the valve gear, against movement when such piston is inactive, said means in no way depending upon friction of the parts for its proper operation.

A further object of the invention is to provide a simple and accurate indicator which will show the slightest shifting of the valve gear of a steam engine by the power reverse mechanism and indicate the exact relative positions of the link and the radius bar.

A further object of the invention is to provide means for shutting off steam to the power mechanism when it is inactive, thereby relieving the steam packing of said mechanism from unnecessary subjection to the steam.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a side view, in elevation, of a locomotive, illustrating the application of my invention in connection with a Walschaert valve gear,

Fig. 2 is a side elevation, partly in section, of the reversing cylinder and its accessories,

Fig. 3 is an end view of Fig. 2, taken on the line 3—3,

Fig. 4 is a horizontal section on the line 4—4 of Fig. 3,

Fig. 5 is a vertical longitudinal central section through the operating valve and locking means, combined,

Fig. 6 is an outside side view, in elevation, of the operating valve and locking means, combined,

Fig. 7 is a transverse section on the line 7—7 of Fig 5,

Fig. 8 is a transverse section on the line 8—8 of Fig. 5,

Fig. 9 is a transverse section on the line 9—9 of Fig. 5,

Fig. 10 is a side elevation, partly in section, showing details of the manual control of the mechanism and the means of controlling admission of steam to the operating valve of said mechanism, and

Fig. 11 is a horizontal section through one of the steam ports, showing the shape which I prefer to make said ports.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of my invention, the numeral, 1, designates the reach rod for actuating a Walschaert valve gear of the usual construction, the said reach rod being connected to the piston rod, 2, by a suitable crosshead, 4.

As shown in Fig. 2, a piston, 5, is adapted to reciprocate within the cylinder, 3, and is rigidly connected to the piston rod, 2, said piston rod extending through both ends of the cylinder and being provided with steam ports, 6 and 7. Each of the said steam ports forms a passage from a part of the piston rod extending outside of the cylinder, 3, to one side of the piston, 5.

As more clearly shown in Figs. 5 and 6, one end of the piston rod, 2, is threaded, and carries a valve seat, 8, on which valve seat a cylindrical shell or toothed member, 9, having teeth, 10, is adapted to rotate. The valve seat comprises a head, 11, and a hollow spindle, 12, the said spindle being internally threaded to fit the threaded end of the piston rod, 2. The end of said spindle is also threaded externally, and an end piece, 13, is screwed thereon. The spindle, 12, is provided with steam ports, 14 and 15, which communicate, respectively, with the steam ports, 6 and 7, in the piston rod, 2, when the said spindle is completely screwed upon the end of the piston rod, as shown in Fig. 5. The end piece, 13, the valve seat, 8, and the piston rod, 2, are securely held against relative movement, with respect to one another, by means of set screws 16, the purpose being to cause the piston rod, 2, and the valve seat, 8, to function as though they were one part, and further, to maintain the distance between the head, 11, and the end piece, 13, constant at all times. The distance between said head, 11, and the end piece, 13, is just sufficient to permit the cylindrical shell, 9, to rotate freely on the valve seat, 8.

As shown in Figs. 5, 7 and 8, a valve, 17, is slidably fitted on the spindle, 12, of the valve seat, 8, and contained within the cylindrical

shell, 9, the said valve being free to reciprocate and rotate with respect to the said spindle. The valve, 17, is provided with steam inlet pipes, 18, which lead to an annular steam chamber, 19. The valve, 17, is further provided with annular exhaust chambers, 20, one on each side of the steam chamber, 19, said exhaust chamber communicating with the atmosphere through passages, 21. At each end of the valve, 17, is a stuffing box, 22, against which springs or valve-centralizing means, 23, press, said springs tending to keep the valve, 17, in a central position with respect to the valve seat, 8. Washers, 24, may be placed at the ends of the springs, 23. In assembling the parts, and in causing the valve, 17, to slide back and forth on the valve seat, 8, the steam inlet pipes, 18, of the valve, 17, move along slots, 25, cut in the cylindrical shell, 9, and further, in causing the valve, 17, to rotate with respect to the said valve seat, the steam inlet pipes, 18, will engage the sides of the slots, 25, and cause the cylindrical shell, 9, to rotate with the said valve, on the valve seat, 8.

As shown in Figs. 2, 3 and 4, pipe connections, 26, are screwed and rigidly secured to the steam inlet pipes, 18, of the valve, 17, said pipe connections leading to a tubular handle, 27, through flexible hose pieces, 28, and a Y-shaped part, 29. A frame, made in two parts, 30, which are pivoted on bosses, 31, integral with the pipe connections, 26, is secured to the handle, 27, by bolts, 32.

As shown in detail in Fig. 10, a nipple, 33, connected to the handle, 27, with a steam supply hose, 34, said hose being joined to the nipple, 33, by means of a suitable clamp, 35. A valve seat, 36, is screwed into one end of the nipple, 33. A valve, 37, provided with a stem, 38, having a steam passage, 39, therein, is adapted to be held against said valve seat by means of a spring, 40, and a retaining nut, 41, for said spring. A conical wedge piece, 42, is screwed to one end of a rod, 43, and is designed to force the stem, 38, to the left, upon being moved downwardly when a button, 44, fastened to the other end of the rod, 43, is pressed down upon the top of a hand-grip, 45, screwed to the end of the handle, 27, thereby causing the valve, 37, to open and admit steam to that part of the handle, 27, below the said conical wedge. The conical wedge, 42, is held out of operative engagement with the valve stem, 38, by means of a spring, 46, which acts against the end of the handle, 27, and a washer, 47, held in place by a peg, 48. The upward travel of the rod, 43, is limited by a second peg, 49, which engages the hand-grip, 45, so that the conical wedge, 42, just touches the end of the valve stem, 38, thereby permitting the valve, 37, to assume a closed position. Packing, not shown, should be placed between the conical wedge, 42, and the handle, 27, to prevent steam from entering the handle above said conical wedge.

The locking means which I employ to hold the piston against movement when the mechanism is inactive, and which forms an important part of my invention, is shown in Figs. 2 to 9, inclusive. A locking member, comprising two toothed arms, 50, located on opposite sides of and extending parallel with the piston rod, 2, is bolted to one end of the cylinder, 3, by means of a flange, 51, integral with the said arms, bolts, 74, and nuts, 75, as shown in Fig. 2. Only one bolt, 74, and nut, 75, are shown, but it is to be understood that in actual practice many are used and that they are placed at frequent intervals, as shown in Fig. 3. As shown in Fig. 2, the piston, 5, is locked against movement when the teeth, 10, of the cylindrical shell, 9, are in mesh with the teeth, 52, on the arms, 50. The teeth, 10 and 52, should be slightly tapered to facilitate their proper meshing with one another. As shown in Figs. 5 and 9, an annular slot, 53, is cut in the head, 11, of the valve seat, 8, said slot extending through approximately ninety degrees. A block, 54, fitting in and adapted to slide in the slot, 53, is secured to the inside of the cylindrical shell, 9, by means of a screw, 55. One end of a spring, 56, rests within a recess, 57, in one end of the slot, 53, and the other end of said spring presses against the block, 54, thereby holding said block constantly against the other end of said slot. As shown in Fig. 9, a counterclockwise movement of the cylindrical shell, 9, will be resisted by the spring, 56, since the head, 11, is prevented from rotating by the set screws, 16, as explained above, the effect being to hold the teeth, 10, of the cylindrical shell, 9, in mesh with the teeth, 52, of the arms, 50. As shown in Figs. 3 and 9, a movement of the handle, 27, to the right, will cause the valve, 17, and the cylindrical shell, 9, to rotate on the valve seat, 8, against the resistance of the spring, 56, and the teeth, 10 and 52, to disengage, thereby unlocking the movable from the fixed parts of the mechanism and giving the piston, 5, freedom of movement in the cylinder, 3. The spring, 56, should be of sufficient strength to insure the immediate return of the handle, 27, to its normal position in a vertical plane, without manual aid, and the accompanying rotation of the valve, 17, back to its normal position and the cylindrical shell, 9, back to its proper locking engagement with the arms, 50, through the agency of the teeth, 10, on said cylindrical shell.

The indicator, which I employ, to show the effect on the valve gear of a steam engine by a movement of the piston, 5, and the exact relative positions at all times of the link and the radius bar of said valve

gear, is shown in Figs. 2, 3 and 4. One end of a rod, 58, bent at an angle slightly greater than ninety degrees, extends upward into the cab of the locomotive, and carries a block, 59, pivoted thereon, said block being adapted to slide within a miniature link, 60, pivoted at 61, to the wall or other part of the cab. The other end of the rod, 58, is pivoted at 62 to a boss, 63, on the arm, 50. A strap, 64, provided with a slot, 65, through which the rod, 58, passes, is securely fastened between the pipe connections, 26, by means of clamping pieces, 66, and bolts, 67.

As shown in Figs. 2 and 3, a casting, 68, is fastened to the floor of the cab by means of bolts, 69. The longer sides, 70, of the casting, 68, converge upwardly, providing a slot, 71, in which the handle, 27, is free to move, said handle being limited in its movement in one direction along the slot, 71, by one side, 72, of the casting, 68. As shown in Fig. 2, the inside edges, 73, of the converging sides of the casting, 68, will act as fulcrums for the handle, 27, when said handle is moved forward and backward.

The operation of the device is as follows: When a movement of the valve gear of the locomotive is required, the button, 44, is pressed down against the hand-grip, 45, causing the conical wedge, 42, to move downward and force the valve, 37, off the valve seat, 36, thereby permitting steam to flow through the passage, 39, the lower part of the handle, 27, the Y-shaped part, 29, the flexible hose pieces, 28, the pipe connections, 26, the steam inlet pipes, 18, of the valve, 17, and thence into the steam chamber, 19. The handle, 27, together with the frame secured thereto by means of the bolts, 32, is then swung to the right, as shown in Fig. 3, against the resistance of the spring, 56, till said handle strikes against the side, 72, of the casting, 68. At the same time, the said frame, on account of its connection with the pipe connections, 26, through the bosses, 31, integral with said pipe connections, will cause the valve, 17, to rotate on the valve seat, 8, and the steam inlet pipes, 18, of the said valve, to engage the sides of the slots, 25, cut in the cylindrical shell, 9, thereby causing the said cylindrical shell to likewise rotate on the valve seat, 8, and to disengage the teeth, 10 and 52. The movable and fixed parts of the mechanism will now be out of engagement with each other and the piston, 5, will be free to move in the cylinder, 3. As shown in Figs. 2 and 5, a movement of the upper part of the handle, 27, to the right, will cause the lower part of the said handle and the two parts, 30, to move to the left, the inside edge, 73, of the right-hand, converging side of the casting, 68, acting as a fulcrum for the said handle. The parts, 30, through their connection, 31 and 26, with the steam inlet pipes, 18, of the valve, 17, will cause said valve to slide to the left, on the valve seat, 8. The steam chamber, 19, will communicate with the steam port, 15, of the spindle, 12, and steam will be free to flow through the steam port, 7, in the piston rod, 2, to the right-hand side of the piston, 5. At the same time, the exhaust chamber, 20, to the right of the steam chamber, 19, will communicate with the steam port, 14, of the spindle, 12, and the left-hand side of the piston, 5, will be open to the atmosphere, through the steam port, 6, in the piston rod, 2, the passage, 21, the space, 75, between the valve, 17, and the cylindrical shell, 9, and the slots, 25, in the said cylindrical shell. The dimensions of the parts should be such that the steam chamber, 19, and the exhaust chamber, 20, begin to communicate with the ports, 15 and 14, respectively, at the same time. Since the right-hand side of the piston, 5, is now under steam pressure and the left-hand side open to the atmosphere, the said piston will move to the left, together with the reach rod, 1, the crosshead, 4, the piston rod, 2, and the valve and locking parts, screwed to the end of the said piston rod. The piston will continue to move to the left as long as the upper part of the handle, 27, is forced to the right with sufficient force to maintain communication between the port, 15, and the steam chamber, 19; and the port, 14, and the exhaust chamber, 20, against the resistance of the springs, 23, which always act to return the valve, 17, to its central position, with respect to the valve seat, 8. If the handle, 27, be released, the springs, 23, will immediately force the valve, 17, back to its central position, and the spring, 56, will, at the same time, return the handle, 27, to its normal position in a vertical plane, as explained above, thereby locking the piston, 5, against movement in the cylinder, 3. The steam supply will also be shut off, since the valve, 37, will close upon the return of the conical wedge, 42, to its normal position, under the action of the spring, 46, as explained above. In the latter part of the operation, as explained above, assume that the upper part of the handle, 27, is moved to the left. It is clear that the effect will be to move the valve, 17, to the right, against the resistance of the springs, 23, bring the steam chamber, 19, into communication with the port, 14, and permit steam to flow through the steam port, 6, to the left-hand side of the piston, 5. At the same time, the exhaust chamber, 20, to the left of the steam chamber, 19, will communicate with the steam port, 15, and the right-hand side of the piston will be open to the atmosphere through the steam port, 7. The piston will then move to the right. The backward and forward movement of the lower part of the handle, 27, with its attached frame, may be limited by the sides

of the opening, 74, in the bottom of the cab, in which opening the said handle and frame move, or other suitable means, such as the sides of the casting, 68, as shown in Fig. 2, may be employed to limit this movement.

The pipe connections, 26, as explained above, are screwed and rigidly secured to the steam inlet pipes, 18, of the valve, 17, and do not change their positions with respect to said valve, while the two parts, 30, due to their swinging action on the bosses, 31, as the piston, 5, moves back and forth, do change their positions with respect to the said valve. It is therefore necessary to connect the handle, 27; which is secured to and moves with the two parts, 30; and the pipe connections, 26, by means of flexible hose pieces, 28, as explained above.

Since the strap, 64, is securely fastened between the pipe connections, 26, the said strap will move back and forth with the piston, 5. As shown in Figs. 2, 3 and 4, when the piston, 5, moves to the right, the upper side of the slot, 65, will engage the rod, 58, and force said rod to swing downward, thereby causing the block, 59, to slide downward in the miniature link, 60, which link will swing on its pivot, 61, and adjust itself to its new position with respect to the block, 59. When the piston, 5, moves to the left, the lower side of the slot, 65, will force the rod, 58, to swing upward, thereby causing the block, 59, to slide upward in the miniature link, 60, which link will again adjust itself to its new position with respect to the block, 59, by swinging on the pivot, 61. When the piston, 5, is at its extreme positions in the cylinder, 3, the block, 59, will be in its extreme positions in the miniature link, 60, in exact correspondence with the respective extreme positions of the link and the radius bar of the valve gear on the locomotive. As indicated in Fig. 3, the center of curvature of the slot, 65, is on the longitudinal axis about which the pipe connections, 26, are caused to rotate when the handle, 27, is swung to the right, so that this movement of the said handle, which changes the position of the slot, 65, with respect to the rod, 58, will not cause the said rod to change its position, or the block, 59, to slide in the miniature link, 60.

As shown in Fig. 11 the ports, 14 and 15, in the spindle, 12, are tapered in directions in which the valve, 17, slides on the valve seat, 8. The effect of the taper will be to throttle the steam admitted to the ports from the steam chamber, 19, and thereby permit a gradual admission of steam to the cylinder, 3, and likewise a gradual exhaust from said cylinder.

If the steam supply should fail, the mechanism can be unlocked in the usual manner and the piston, 5, shifted by manual force alone. The position of the casting, 68, with respect to the handle, 27, should be such that enough leverage is allowed to enable a man to shift the said handle and cause movement of the piston, 5, without the aid of steam pressure. In shifting the piston, 5, by hand, the stuffing boxes, 22, of the valve, 17, will engage the head, 11, of the valve seat, 8, or the end piece, 13, as the case may be.

From the foregoing it will be seen that cylinder 3, piston 5 operable therein, piston rod 2, and valve 17 for effecting difference in pressure between opposite sides of the piston by way of passages 6 and 7, constitute means for adjusting the reach rod or controlling member 1 for the valve gear of the engine, that the toothed shell 9 and the rack arms 50 constitute means for holding the adjusting means and the reach rod in adjusted position, and that the manually-operable handle 27 is common to said adjusting and holding means and is operable to actuate the same successively.

It will be seen, furthermore, that the action of springs 23 in returning valve 17 to and in holding the same in central position is to maintain the adjustment of piston 5, and that the interlocking toothed members 50 and 9 coact with each other and cooperate with valve 17 and the centralizing springs 23 therefor to hold the piston in its position of adjustment in cylinder 3, the toothed member 9 being connected to the reach rod 1 through the piston rod 2 and being supported for pivotal movement, the other interlocking member comprising rack arms 50 being fixed against movement in a direction axially of cylinder 3.

The form of my invention herewith shown and described is a preferred example of the same, and various changes in the shape, size, and arrangement of the parts may be resorted to without departing from the spirit of the invention, or the scope of the subjoined claims. Air, as well as steam, may be used to operate the mechanism.

I claim as my invention and desire to secure by Letters Patent:

1. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within said cylinder, a piston rod fixed to the said piston, said piston rod being provided with a passage for the admission of fluid under pressure to the cylinder, a valve fitted to and slidably mounted on the said piston rod and adapted to control the admission of fluid under pressure to the cylinder, connections adapted to admit fluid under pressure to the said valve, and manually-operable means adapted to cause the said valve to slide on the said piston rod to permit of adjustment of said piston axially of said cylinder.

2. In a power reverse mechanism, the combination of a cylinder, a piston adapted

to reciprocate within said cylinder, a piston rod fixed to the said piston, said piston rod being provided with a passage for the admission of fluid under pressure to the cylinder, a valve slidably mounted on the said piston rod and adapted to control the admission of fluid under pressure to the cylinder, connections adapted to admit fluid under pressure to the said valve, manually-operable means adapted to cause the said valve to slide on the said piston rod to permit of adjustment of said piston axially of said cylinder, and means adapted to hold said piston in adjusted position.

3. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within said cylinder, a piston rod fixed to the said piston, said piston rod being provided with a passage for the admission of fluid under pressure to the cylinder, a valve slidably mounted on the said piston rod and adapted to control the admission of fluid under pressure to the cylinder, connections adapted to admit fluid under pressure to the said valve, manually-operable means adapted to cause the said valve to slide on the said piston rod by a movement of said means in one direction to permit of adjustment of said piston axially of said cylinder, and means adapted to hold said piston in adjusted position or to permit of adjustment thereof, said holding means being operated by a movement of said manually-operable means in another direction.

4. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within said cylinder, a piston rod fixed to the said piston, a valve adapted to control the admission of fluid under pressure to the cylinder, a locking part adapted to be rotated about the axis of the said piston rod, means to prevent relative movement of the said locking part and the said piston rod in the direction of movement of the said piston rod, means fixed with respect to the said cylinder and adapted to be engaged by the said locking part, and means to cause the said locking part to rotate about the axis of the said piston rod in one direction to engage the said fixed means and to rotate about the axis of the said piston rod in the opposite direction to disengage the said fixed means.

5. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within said cylinder, a piston rod fixed to the said piston, a valve adapted to control the admission of fluid under pressure to the cylinder, a vertically arranged elongated member provided with an arcuate slot extending longitudinally thereof and supported in proximity to the said mechanism for pivotal movement about a substantially horizontal axis, a block adapted to slide in the said member, and connections between the block and the piston rod whereby the said block is caused to slide in the said member upon movement of the said piston rod.

6. The combination with the valve gear of a fluid-pressure engine, a controlling member therefor, and means for adjusting said member and holding the same in adjusted position, of an indicating part comprising a vertically arranged elongated member provided with an arcuate slot extending longitudinally of the same, a second indicating part comprising a block fitted in said slot for relative sliding movement longitudinally with respect to said member, and means operatively connecting one of said parts to said adjusting means for causing said parts to change their relative positions with respect to each other in accordance with the change in the relative positions of the controlling parts of said valve gear upon operation of said adjusting means, the other of said indicating parts being supported against movement with said adjusting means.

7. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within said cylinder, a piston rod fixed to the said piston, a valve adapted to control the admission of fluid under pressure to the cylinder, locking parts adapted to engage with each other, one of said parts being fixed against relative movement with respect to the piston rod and the other of said parts being fixed against relative movement with respect to the cylinder, the said locking parts being adapted to engage or disengage with each other by a rotating movement of one of the said parts.

8. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within the said cylinder, a piston rod fixed to the said piston, a valve mounted upon the said piston rod and slidable with respect to the same, the said valve having a concave wearing surface, the said piston rod being provided with a passage for the flow of a fluid between the said cylinder and the said valve, and manually operable means adapted to cause the said valve to slide on the said piston rod.

9. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within the said cylinder, a piston rod fixed to the said piston, a valve mounted upon the said piston rod and slidable with respect to the same, the said valve having a concave wearing surface, the said piston rod being provided with a passage for the flow of a fluid between the said cylinder and the said valve, manually-operable means adapted to cause the said valve to slide on the said piston rod, and holding means adapted to prevent any movement of the said piston within the said cylinder.

10. In a power reverse mechanism, the

combination of a cylinder, a piston adapted to reciprocate within the said cylinder, a piston rod fixed to the said piston, a valve surrounding the said piston rod and slidable with respect to the same, the said piston rod being provided with a passage for the flow of a fluid between the said cylinder and the said valve, and manually-operable means adapted to cause the said valve to slide on the said piston rod.

11. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within the said cylinder, a piston rod fixed to the said piston, a valve surrounding the said piston rod and slidable with respect to the same, the said piston rod being provided with a passage for the flow of a fluid between the said cylinder and the said valve, manually operable means adapted to cause the said valve to slide on the said piston rod, and holding means adapted to prevent any movement of the said piston within the said cylinder.

12. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within the said cylinder, a piston rod fixed to the said piston, a valve surrounding the said piston rod and slidable with respect to the same, the said piston rod being provided with independent passages for the flow of a fluid between either side of the said piston and the said valve, the said valve being adapted to effect a substantial increase in pressure on one side of the said piston and a substantial decrease in pressure on the other side of the said piston at substantially the same instant, and manually operable means adapted to cause the said valve to slide on the said piston rod.

13. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within the said cylinder, a piston rod fixed to the said piston, a valve surrounding the said piston rod and slidable with respect to the same, the said piston rod being provided with independent passages for the flow of a fluid between either side of the said piston and the said valve, the said valve being adapted to effect a substantial increase in pressure on one side of the said piston and a substantial decrease in pressure on the other side of the said piston at substantially the same instant, manually-operable means adapted to cause the said valve to slide on the said piston rod, and holding means adapted to prevent any movement of the said piston within the said cylinder.

14. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within the said cylinder, a piston rod fixed to the said piston, a valve adapted to effect a change in pressure within the said cylinder, means adapted to actuate the said valve by a movement of the said means in one direction, and locking means adapted to prevent any movement or permit a movement of the said piston within the said cylinder, the said locking means being operated by a movement of the said means in another direction.

15. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within the said cylinder, a piston rod fixed to the said piston, a valve mounted upon the said piston rod and slidable with respect to the same, the said valve having a concave wearing surface, the piston rod being provided with a passage for the flow of a fluid between the said cylinder and the said valve, means adapted to cause the said valve to slide on the said piston rod by a movement of the said means in one direction, and locking means adapted to prevent any movement or permit a movement of the said piston within the said cylinder, the said locking means being operated by a movement of the said means in another direction.

16. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within the said cylinder, a piston rod fixed to the said piston, a valve adapted to effect a change in pressure within the said cylinder, means adapted to actuate the said valve by a movement of the said means in a plane substantially parallel with the said piston rod, and locking means adapted to prevent any movement or permit a movement of the said piston within the said cylinder, the said locking means being operated by a movement of the said valve actuating means in a plane substantially perpendicular to the said piston rod.

17. In a power reverse mechanism, the combination of a single fluid-tight cylinder, a piston adapted to reciprocate within the said cylinder, a piston rod fixed to the said piston, a valve adapted to effect a change in pressure within the said cylinder, and mechanically operating locking parts adapted solely by virtue of their mechanical operation to prevent any movement or permit a movement of the said piston within the said cylinder, the said locking parts being adapted to engage with each other by a rotating movement of one of the said parts.

18. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within the said cylinder, a piston rod fixed to the said piston, a valve adapted to effect a change in pressure within the said cylinder, and locking parts adapted to prevent any movement or permit a movement of the said piston within the said cylinder, the said locking parts being adapted to engage with each other by a rotating movement of one of the said parts about an axis substantially parallel with the said piston rod.

19. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within the said cylinder, a piston rod fixed to the said piston, a valve adapted to effect a change in pressure within the said cylinder, an arm provided with teeth, the said arm being parallel with the said piston rod and fixed against movement in the direction of the same, a rotatable locking part provided with teeth, the teeth of the said arm and the teeth of the said rotatable locking part being adapted to mesh.

20. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within the said cylinder, a piston rod fixed to the said piston, a valve adapted to effect a change in pressure within the said cylinder, an arm provided with teeth, the said arm being parallel with the said piston rod and fixed against movement in the direction of the same, and a locking part rotatable about an axis substantially parallel to the said piston rod, the said locking part being provided with teeth adapted to mesh with the teeth of the said arm.

21. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within the said cylinder, a piston rod fixed to the said piston, a valve adapted to effect a change in pressure within the said cylinder, a locking member fixed against movement in the direction of the said piston rod, and a second locking member surrounding the said piston rod and adapted to engage with the first mentioned locking member by a rotating movement about an axis substantially parallel with the said piston rod.

22. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within the said cylinder, a piston rod fixed to the said piston, a valve adapted to effect a change in pressure within the said cylinder, a locking member provided with teeth and fixed against movement in the direction of the said piston rod, and a second locking member provided with teeth and surrounding the said piston rod, the said teeth being adapted to mesh upon a rotating movement of one of the said locking members about an axis substantially parallel with the said piston rod.

23. In a power reverse mechanism, the combination of a cylinder, a piston adapted to reciprocate within the said cylinder, a piston rod fixed to the said piston, a valve adapted to effect a change in pressure within the said cylinder, a miniature link mounted in proximity to the said mechanism, an indicating element associated with the said miniature link and movable with respect to the same, and means actuated upon a movement of the said piston within the said cylinder, the said means being adapted to cause a change in the relative positions of the miniature link and the indicating element with respect to each other and including a member associated with said piston for movement therewith and means supported for pivotal movement and for coaction with said member.

24. The combination with the valve gear of a fluid-pressure engine, a controlling member therefor, and means for adjusting said member and holding the same in adjusted position, of a vertically arranged elongated link provided with an actuate slot extending longitudinally thereof, said link being mounted for pivotal movement at a point in proximity to said adjusting means, a block slidably fitted in said slot for movement longitudinally of said link, and means operatively connecting said block to said adjusting means for causing said movement thereof in accordance with the change in the relative positions of the controlling parts of said valve gear upon operation of said adjusting means.

25. The combination with the valve gear of a fluid-pressure engine, a controlling member therefor, means for adjusting said member, and means for holding said adjusting means in adjusted position, of means common to said adjusting and holding means for actuating the same, said last-named means being movable in one direction to actuate said adjusting means and in a different direction to actuate said holding means.

26. The combination with the valve gear of a fluid-pressure engine, a controlling member therefor, means for adjusting said member, and means for holding said adjusting means in adjusted position, of means common to said adjusting and holding means for actuating the same, said last-named means being movable in a given plane to actuate said adjusting means and in a different plane to actuate said holding means.

27. The combination with the valve gear of a fluid-pressure engine, a controlling member therefor, means for adjusting said member, and means for holding said adjusting means in adjusted position, of means common to said adjusting and holding means for actuating the same, said last-named means being movable in a given plane to actuate said adjusting means and in a plane substantially perpendicular to said given plane to actuate said holding means.

28. The combination with the valve gear of a fluid-pressure engine and the controlling member therefor, a relatively fixed cylinder, a piston arranged in said cylinder, and a piston rod connected to said member and said piston and provided with passages communicating with opposite sides of said piston, of valve means slidably mounted on said piston rod and providing means for ad-

mitting fluid under pressure to either side of said piston by way of said passages, means for admitting fluid under pressure to said valve means, and manually operable means for actuating said valve means whereby fluid under pressure may be admitted to either side of said piston in varying amounts to effect adjustment of said piston axially of said cylinder.

29. The combination with the valve gear of a fluid-pressure engine and the controlling member therefor, a relatively fixed cylinder, a piston arranged in said cylinder, and a piston rod connected to said member and said piston and provided with passages communicating with opposite sides of said piston, of a sleeve valve fitted about said piston rod for axial movement with respect thereto and providing means for effecting a difference in pressure between opposite sides of said piston by way of said passages, means for admitting fluid under pressure to said valve, and manually operable means for actuating said valve to effect adjustment of said piston axially of said cylinder.

30. The combination with the valve gear of a fluid-pressure engine and a controlling member therefor, a relatively fixed cylinder, a piston arranged in said cylinder, and a piston rod connected to said member and said piston and provided with passages communicating with opposite sides of said piston, of a sleeve valve fitted about said piston rod for axial movement with respect thereto and providing means for effecting a change in pressure on opposite sides of said piston by way of said passages, means for admitting fluid under pressure to said valve, means for actuating said valve to effect adjustment of said piston axially of said cylinder, and means for returning said valve to central position upon release of said actuating means.

31. The combination with the valve gear of a fluid pressure engine and a controlling member therefor, means for adjusting said member, and controlling means for said adjusting means, of means for holding said adjusting means in adjusted position and comprising complementary toothed members, one of said toothed members being relatively fixed, the other of said toothed members being associated with said adjusting means, said toothed members being arranged for relative movement into and out of interlocking relation with each other upon rotary movement of one of the same, and means for effecting said rotary movement of said last-named member.

32. The combination with the valve gear of a fluid-pressure engine, the controlling reach rod therefor, a relatively fixed cylinder, a piston arranged in said cylinder, a piston rod fixed to said piston and connected to said reach rod, valve means for effecting a change in pressure on opposite sides of said piston in such wise as to permit of adjustment of the latter axially in said cylinder, actuating means for said valve means, and means for supplying fluid under pressure to said valve means, of a second valve associated with said last-named means for controlling the supply of fluid under pressure to said valve means, and means carried by said actuating means for operating said second valve.

33. The combination with the valve gear of a fluid pressure engine and a controlling member therefor, a relatively fixed cylinder, a piston arranged in said cylinder, a piston rod connected to said member and said piston, a valve having a central position and adapted to effect a change in pressure on opposite sides of said piston upon movement in either direction from said position, means for actuating said valve to effect adjustment of said piston axially of said cylinder, and means for admitting fluid under pressure to said valve, of means normally acting to urge said valve to and to hold the same in said central position thereof, and means including a toothed member for maintaining the adjustment of said piston in said cylinder.

34. The combination with the valve gear of a fluid pressure engine and a controlling member therefor, a relatively fixed cylinder, a piston arranged in said cylinder, a piston rod fixed to said piston and connected to said member, valve means associated with said cylinder and having a neutral position and being adapted to effect a change in pressure on opposite sides of said piston to permit of adjustment of the same axially in said cylinder upon movement of said valve means to either side of said neutral position thereof, means for admitting fluid under pressure to said valve means, and actuating means for said valve means, of means for normally holding said valve means in said neutral position thereof and adapted to return said valve means to said neutral position thereof upon release of said actuating means and independently of relative movement of said piston with respect to said cylinder, and means including a toothed member for maintaining the adjustment of said piston in said cylinder.

35. A power reverse mechanism comprising a single fluid-tight cylinder, a piston operable therein, valve means associated with said cylinder and having a central position and being operable upon movement from said position to effect difference in pressure between opposite sides of said piston, manually-operable means connected to said valve means for controlling the same in such wise as to permit of adjustment of said piston axially of said cylinder, means coacting with said valve means for returning the

same to said central position thereof to hold said piston in adjusted position, and a plurality of toothed members supported for coaction with each other and for cooperation with said last-named means to hold said piston in adjusted position, one of said members being movable with said piston and being fixed against relative movement with respect thereto in a direction axially of said cylinder, another of said members coacting with said last-named member and being fixed against bodily movement with respect to said cylinder in a direction axially of the same, one of said last-named members being supported for rotary movement about its longitudinal axis to permit of said adjustment of said piston.

36. In mechanism of the character described, a single fluid-tight cylinder, a piston operable therein, valve means for effecting difference in pressure between opposite sides of said piston to cause movement thereof axially of said cylinder, means operable to hold said piston against said movement and including a rack, a toothed member cooperable with the latter and supported for rotary movement about its own longitudinal axis, and manually-operable means for causing cooperative actuation of said valve means and said holding means in such wise as to permit of adjustment of said piston axially of said cylinder.

37. In a locomotive having a valve gear and a controlling reach rod therefor, mechanism connected to said rod for adjusting the same longitudinally and comprising a single relatively fixed fluid-tight cylinder and a piston movable axially therein, said mechanism operating upon such axial movement of said piston to effect said adjustment of said rod, valve means having a central position and operable upon movement in either direction therefrom to effect difference in pressure between opposite sides of said piston, manually-operable means connected to said valve means for causing movement of the same to either side of said central position thereof to effect adjustment of said piston axially of said cylinder, means coacting with said valve means and operable upon release of said manually-operable means to cause return movement of said valve means to and to maintain the latter in said central position thereof, and means cooperable with said reach rod and said piston for preventing axial movement of the latter due to strains set up in said reach rod during operation of said valve gear, said last-named means including a toothed member connected to said reach rod and supported for pivotal movement about a substantially horizontal axis.

38. In power mechanism of the character described, a single fluid-tight cylinder, a piston operable therein, valve means having a central position and operable upon movement therefrom to effect difference in pressure between opposite sides of said piston, manually-operable means connected to said valve means for causing said movement of the same in such wise as to permit of adjustment of said piston axially of said cylinder, means cooperable with said piston to prevent movement thereof axially of said cylinder independently of adjusting movement of said manually-operable means, said last-named means including a toothed member supported for pivotal movement about a fixed horizontal axis and a second member cooperable with the latter and supported against bodily movement in a direction axially of said cylinder, and means cooperable with said toothed member and said valve means for centralizing the latter.

39. In mechanism of the character described for adjusting a control element, a single fluid-tight cylinder, a piston adjustable axially therein, valve means having a central position and movable therefrom to control fluid pressure conditions on opposite sides of said piston, manually-operable means for actuating said valve means in such wise as to effect adjusting movement of said piston, a toothed member supported for pivotal movement about a relatively fixed substantially horizontal axis and connected to said element, a second member interlocking with said toothed member in such wise as to hold said element in adjusted position, and means cooperable with said toothed member and said valve means for centralizing the latter.

In testimony whereof I affix my signature.

HAROLD D. GREGORY.