To all whom it may concern:

Be it known that I, JACOB RUSH SNYDER, a citizen of the United States, and resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Power Reverse-Gears, of which the following is a specification.

The invention relates to valve reversing mechanism for steam engines and the like, particularly for steam locomotives.

When valve reversing mechanisms for locomotives are power-operated, it is important that they be constructed so that when left in neutral position they will not for any reason accidentally move to a position to operate the gear of the locomotive to start the engine. In some cases where locomotives equipped with power-operated valve reversing gears have been left standing in round-houses or switch-yards, the reversing gear has moved from neutral position, with the result that the engine has been moved without being under the control of an operator and has caused damage to property and to the engine itself.

The present invention has been devised to overcome this difficulty. The fluid pressure motor for operating the valve reversing mechanism is arranged so that when in neutral position both ends of the cylinder are exhausted. Consequently there is no tendency for the valve reversing gear to move when the valve mechanism controlling the same is in neutral position, as there would be in case fluid pressure were trapped in one end of the cylinder. In addition, a fluid pressure lock is provided which positively locks the valve reversing mechanism when in neutral position. This fluid pressure lock may be operated by compressed air from the main reservoir of the air brake system of the train, which reservoir is generally located on the engine. When the engine is placed in a round-house, however, a supply of compressed air is often not maintained so that fluid pressure for operating the lock is not readily or conveniently available. It is desirable, nevertheless, to have the lock positively operated so as to provide what might be termed a night-latch for positively locking the valve reversing gear in neutral position. During the time that the engine is in the round-house, steam is generally maintained in the boiler thereof, and in the present invention this steam pressure is employed to operate the fluid pressure lock to provide a night-latch for the valve reversing gear.

One of the objects of the invention is to provide an improved power-operated valve reversing mechanism in which the locking means is actuated by steam from the locomotive boiler.

A further object is to provide an improved valve mechanism for controlling the motive fluid supply to the valve reversing mechanism.

Other objects and advantages of the invention will appear in the following specification.

An embodiment of the invention is illustrated in the accompanying drawings. The views of the drawings are as follows:

Figure 1 is an elevation and partial cross section of the valve reversing mechanism applied to a locomotive.

Fig. 2 is a cross section of a drip valve from the steam-operated lock for the valve reversing mechanism.

Fig. 3 is a front elevation of the mechanism for operating the rotary valve which controls the motive fluid supply to the power cylinder which operates the valve reversing gear.

Fig. 4 is a cross section of the mechanism shown in Fig. 3 and of the rotary valve mechanism.

Fig. 5 is a cross section of the steam pressure operated lock, said view also showing one end of the power cylinder which operates the valve reversing gear.

Fig. 6 is a plan view of the graduating rotary member of the valvular mechanism for controlling the motive fluid supply to the power cylinder.

Fig. 7 is a plan view of the main rotary member of the valvular mechanism.

Fig. 8 is a plan view of the valve seat of the valvular mechanism.

Fig. 9 illustrates the relative positions of the rotaries and the valve seat when the valvular mechanism is in neutral position.

Fig. 10 illustrates the relative positions of the rotaries and the valve seat when the valvular mechanism has been moved to unlock the locking means and admit motive fluid to one end of the power cylinder.

Fig. 11 illustrates the relative positions of the rotaries and the valve seat when the valvular mechanism has been moved to fully
open the port to one end of the power cylinder.

Fig. 12 illustrates the relative positions of the rotaries and the valve seat when the valvular mechanism has been moved in the opposite direction to unlock the locking means and admit motive fluid to the opposite end of the cylinder. This position is the reverse of that shown in Fig. 10.

Fig. 13 is a cross section of the rotaries and of the valve seat taken on the line 13—13 of Fig. 9.

The mechanism comprises in general a fluid pressure motor 1 for operating the valve reversing mechanism, a fluid pressure lock 2 for locking said mechanism, a valve mechanism 3 for controlling the motive supply of fluid to the locking means, a fluid pressure motor 4 for operating the valve 5, a valvular mechanism 6 for controlling the motive supply to both the fluid pressure motors 1 and 4, and an operating mechanism 8 for actuating the valvular mechanism 6.

The fluid pressure motor illustrated comprises a cylinder having a piston 7 therein connected by a piston rod 8 to a cross head 9 to which is attached a reach rod or link 10 connected to the usual link mechanism of the valves of a locomotive, not shown.

When the link mechanism of the locomotive is in neutral position the piston 7 is stationed midway of the length of the cylinder, as shown in Fig. 1. In order to drive the engine forwardly, the reach rod 10 is moved to the right, viewed in Fig. 1, by admitting pressure to the left-hand end of the cylinder through the pipe 11, and to reverse the engine the rod 10 is moved toward the left, viewed in Fig. 1, by admitting fluid pressure into the right-hand end of the cylinder through the pipe 12.

The fluid pressure lock 2 is illustrated more particularly in Fig. 5. It comprises a member 13 engaging one side of the piston rod 8 and a pivoted clamping member 14 for gripping the opposite side of said rod. The pivoted member 14 is actuated to grip the rod by means of a movable abutment, such as the diaphragm 15, in a small power cylinder 16, said abutment carrying a projection 17 contacting with the end of an adjustable screw 18 carried by the outer end of the movable member 14. Steam pressure can be admitted to and exhausted from the cylinder 16 through the pipe 19. When pressure is admitted into said cylinder the movable abutment 15 actuates the member 14 to grip the rod 8 and thus positively lock the latter in position. The end of the member 14 which is arranged to grip the rod is provided with a suitable gripping surface 20 made of asbestos or the like. The bolt 18 is screw-threaded into the outer end of member 14 and by adjusting said bolt the movable member 14 may be adjusted relative to the movable abutment to compensate for wear on the gripping surface 20 and to obtain variations in the force with which the member 14 grips the rod when pressure is admitted to the cylinder.

It will be noted that this locking means is positively actuated by the fluid pressure to lock the rod and firmly hold it in position, but nevertheless the locking means is frictional, that is, the clamping members engage a smooth rod and therefore under extraordinary abnormal conditions permit the rod to be forcibly moved without breaking any of the parts as would be the case with toothed and similar mechanical locks. The lock will lock the rod 8 in any position of the latter and does not require that the rod be in a certain position with a notch therein or a projection thereon registering with complementary projections or notches on the locking means. The force with which the lock grips the rod may be varied by adjusting the bolt 18 and said bolt may be adjusted to compensate for all wear on the gripping surface. The motive fluid for actuating the lock is in this mechanism preferably steam, though of course other fluids might be used.

When steam is used to operate the lock, provision is made to automatically drain the water of condensation from the lock cylinder without opening the latter to the atmosphere. For this purpose a pipe 21, shown in Fig. 1, connects the cylinder chamber 16 to a water trap 22, shown in Fig. 2, in which trap the water accumulates until the float 23 is lifted sufficiently to open the discharge valve 24, whereupon a portion of the water is discharged from the trap, but as soon as the water level in the trap sinks to a predetermined level the valve 24 closes, so that at all times a water seal is maintained, and the cylinder never open to the atmosphere. Other suitable draining means may be employed, if desired.

The valve mechanism 3 for controlling the steam supply to the locking means 2 comprises a suitable three-way valve having an outer casing 25 and an inner rotary member 26 actuated by a lever 27. A pipe 28 communicating with the steam supply 15 and the pipe 19 communicating with the cylinder of the lock 2 are connected to the valve. The valve casing has an exhaust port 29 which is in one position of the rotary member 26 is connected by the recess 30 therein with the pipe 19 to exhaust the cylinder of the lock, whereas in the position of the valve illustrated, the recess 30 connects the pipe 19 with the pipe 28 to the steam supply, so that full steam pressure is admitted to the lock. When the arm 27 is moved to the right, viewed in Fig. 1, communication between the pipes 19 and 28 is cut off, and in the extreme right-hand position of the lever 27 the pipe 19 is connected to the exhaust 20.
port 29 to vent the pressure from the lock to atmosphere.

The valve 3 is controlled by the fluid pressure motor 4 which comprises a cylinder 31 having a piston 32 therein, the piston rod 33 of which is connected to the lever 27 by a pin and slot connection. The piston 32 is normally biased to the left-hand end of the cylinder by a spring 34 in which position it is shown in Fig. 1. In this position, the valve 3 connects the steam supply pipe 28 with the pipe 19 to the lock 2, thereby admitting steam pressure to the lock. The valve 3 is thus normally biased through the medium of its actuating motor to a position to maintain steam pressure in the lock and hold the reversing mechanism in position.

In order to release the lock 2, fluid pressure is admitted to the left-hand end of cylinder 31 through the pipe 35, which causes the piston 32 to move to the right, thereby operating valve 3 to cut off the steam supply and connect the pipe 19 with the exhaust port 29 to exhaust motive fluid from the lock 2 to unlock the same. The valvular mechanism 5, which will be hereinafter described in more detail, controls the motive fluid supply to the pipes 11 and 12 connected to the respective ends of the fluid motor 1 and also to the pipe 35 connected to the motor 4. When the valvular mechanism 5 is actuated to move the reversing gear, fluid pressure is admitted to the pipe 35 to cause the piston 32 to valve to the right and exhaust steam from the lock 2, thereby unlocking the mechanism. Simultaneously with this action or slightly subsequent thereto, fluid pressure is admitted to one end of the cylinder 1, thereby causing the reversing mechanism to move.

The valvular mechanism 5 is arranged to move in synchronism with the reversing gear and for this purpose the cross head 9 to which the piston rod 8 of the main motor is connected is also connected by reach rod 36 to a pivoted member 37, one end of which has a pin and slot connection with the rod 36 and the other end of which carries a semicircular rack 38 engaging a pinion connected to one of the rotary members of the valvular mechanism 5. As the reversing gear and cross head 9 move, the pivoted member 37 is moved synchronously therewith to actuate one of the rotary members of the valvular mechanism, the valvular mechanism being so arranged that when the reversing gear reaches the end of the required travel, said mechanism is automatically returned to neutral position, in which position motive fluid is exhausted from both ends of the cylinder through the pipes 11 and 12 and also from the pipe 35, thereby permitting the spring 34 to move the piston 32 back to its normal position which in turn actuates valve 3 and disconnects the pipe 19 to the lock 2 from the exhaust port 29 and connects said pipe to the steam supply pipe 28, thereby permitting pressure to the lock and locking the piston rod 8 in the position to which it has been moved.

From the above description it will be observed that when the valvular mechanism 5 is operated, fluid pressure is admitted to the motor 4 to actuate the valve 3 to exhaust steam pressure from the lock 2 to unlock the reversing gear and simultaneously or slightly subsequent to this action pressure is admitted to one end of the cylinder 1 to actuate the reversing gear. As the reversing gear moves the valvular mechanism 5 is actuated synchronously therewith and is automatically returned to neutral position, in which position motive fluid is exhausted from both ends of the power motor 1 and from both ends of the power motor 4, thereby automatically stopping the reversing mechanism and locking it in position. The lock 2 is maintained in locking condition irrespective of the condition of the motive fluid supply to the valvular mechanism 5. Such supply may be entirely cut off and still the locking means will be maintained in locking condition as long as steam is maintained in the locomotive boiler to which the pipe 28 is connected. Consequently, when a locomotive is left in a round-house or terminal yard its reversing gear will be automatically locked in position as long as steam is maintained in the boiler irrespective of the condition of the fluid pressure supply in the fluid pressure reservoirs of the air brake system.

The valvular mechanism 5 for controlling the admission and release of motive fluid to and from the ends of the cylinder 1 and to and from the cylinder 31 controlling the lock 3 is of the rotary type, as illustrated in Figs. 3 to 13 inclusive. It comprises a valve seat 40, shown in Figs. 4, 8 and 13, with which co-operates a main rotary member 41 having a hub 42 to which is connected a spur gear 43 meshing with the rack 38 carried by the pivoted member 37. Co-operating with the rotary member 41 is a graduated rotary 44 having a hollow stem 45 to which is connected a spur gear 46 meshing with a rack 47 carried by a pivoted controlling lever 48.

The valve seat 40 as shown in detail in Fig. 8 is provided with a plurality of concentric annular recesses 50, 51 and 52, each of which is connected with one of the valve seat ports. The valve seat is provided with three ports, as follows: A port 53 connecting with the groove 50 and to which is connected the pipe 12 leading to the right-hand end of the power cylinder 1; a port 54 communicating with the groove 51 and connected by means of pipe 11 with the left-hand
end of cylinder 1; a port 55 communicating with the groove 52 and connected to the pipe 35 leading to the left-hand end of the cylinder 4. The valve seat is provided with a central bore 56 through which extend the hollow hubs of the main and graduating rotaries. The inside of the bore 56 is provided with a recess 57 shown in Fig. 13 and in dotted lines in Fig. 8, which recess communicates with an exhaust opening 58, as shown in Fig. 13. The hub of the main rotary has a port communicating with the recess 57 and the exhaust opening 58, whereby a passage is opened to atmosphere, as will be hereinafter described.

The main rotary 41 is illustrated in detail in Figs. 7 and 13. Its surface which cooperates with the valve seat 40 is provided with a plurality of concentric annular recesses 60, 61 and 62 which register with the corresponding recesses 50, 51 and 52 in the valve seat. The opposite side of the rotary has three bearing surfaces 63, 64 and 65 and a hub bearing surface 66. The remainder of this face of the rotary is recessed so as to provide a cavity in which fluid pressure may be maintained. This recessed or depressed portion of the face of the rotary will be designated generally by the reference numeral 67. The main rotary has five ports, as follows: a port 68 in the bearing surface 63 extending through the rotary and communicating with the annular recess 61 on the opposite side thereof which in turn communicates with the recess 51 in the valve seat and through its port 54 to the left-hand end of the cylinder 1; a port 69 in the bearing surface 64 extending through the rotary and communicating with the annular recess 60 on the opposite face of the rotary which in turn communicates with the recess 50 on the valve seat and through its port 53 with the pipe 12 to the right-hand end of the cylinder 1; a port 70 in the bearing surface 65 communicating through a cored-out passage 71 extending through the body of the rotary and the hub thereof with the recess 57 in the valve seat 40 and the opening 58 to atmosphere; a port 72 on the bearing surface 68 communicating through a cored-out passage 73 with the annular recess 62 on the opposite side of the rotary which registers with the recess 52 in the valve seat which in turn has a port 55 connected to the pipe 35 leading to the cylinder 4 which controls the valve mechanism for the lock.

The graduating rotary 44 shown in Figs. 4, 6 and 13 has three arms 75, 76 and 77 which cooperate with the main rotary as follows: The arm 75 works on bearing surface 63, the arm 76 on bearing surface 64 and the arm 77 on bearing surface 65. The arm 75 has an opening 78 therein communicating through the cored-out passage 73 with the central bore or opening 80 in the hub of the graduating rotary. The opening 80 communicates with the atmosphere and accordingly, when the opening 78 registers with the port 68 which is in communication with the left-hand end of the cylinder, the pressure in this end of the cylinder is exhausted to atmosphere. The arm 76 is made relatively narrow so that when the graduating rotary is moved to a pre-determined extent the port 68 in the main rotary is uncovered and it communicates with the chamber 81 formed by the depressed portion 67 of the main rotary and the casing 82 of the valvular mechanism, as shown in Fig. 4. The fact that the graduating rotary has three arms instead of being cylindrical permits the fluid pressure in the chamber 81 to communicate with the depressed surface of the main rotary and the three arms tend to divide the chamber into three portions. For this purpose of having these portions communicate with each other, the arms may be recessed, as indicated at 83, in Fig. 13. It will be noted that the main rotary 41 is maintained in engagement with the valve seat by fluid pressure in the chamber 81 and that the graduating rotary is also maintained in engagement with the main rotary by fluid pressure. In addition, these ports are biased into engagement by a spring 84 illustrated in Fig. 4.

The arm 76 of the rotary is provided with an opening 85 communicating through a cored-out passage 86 with the central opening 80 in the hub of the rotary. When the opening 85 registers with the port 69 in the main rotary which communicates with the right-hand end of the power cylinder 1, fluid pressure from this end of the cylinder is exhausted to atmosphere.

The arm 77 is provided with an irregular shaped recess 87 which cooperates with the ports 70 and 72 in the bearing surface 65 of the main rotary for the purpose of controlling the admission and release of fluid pressure to the locking means, as will be hereinafter described.

The valvular mechanism has five functional positions, as follows:

1. Neutral position.

This position is shown in Fig. 9. The opening 78 in the arm 75 of the graduating rotary registers with the port 68 in the main rotary and the opening 85 in the arm 76 communicates with the port 69 in the main rotary, and hence both ends of the cylinder 1 are exhausted. The recess 87 in the arm 77 of the graduating rotary registers with the port 70 in the main rotary which in turn communicates through the passage 74, the recess 87 and port 58 with the atmosphere. The recess 87 also registers with the port 72 communicating through the passage 73 and the annular recesses 62.
and 52 with the port 55 to the cylinder controlling the steam valve mechanism for the lock. The cylinder 4 is accordingly exhausted to atmosphere, allowing the piston 52 and the valve mechanism 3 to be maintained in the position shown, thereby admitting steam to the lock 2 which is maintained in locking position.

2. Lock releasing position.

This position is shown in Fig. 10 and is assumed by moving the graduating rotary slightly contra-clockwise from the position shown in Fig. 9. In this position the recess 87 in the arm 77 has passed beyond the port 70 communicating with the atmosphere and said port is accordingly blanked. At the same time the left-hand edge of the recess 87 has passed slightly beyond the edge of the bearing surface 65 on the main rotary and therefore communicates with the chamber formed by the depressed portion of the main rotary and the valve casing, in which chamber motive fluid is maintained under pressure. The recess 87 still communicates with the port 72 connected to the cylinder 1 controlling the pressure to the lock and accordingly motive fluid passes through the recess 86 to the cylinder 4, moving the piston 32 to the right, thereby shutting off steam to the lock 2 and exhausting the pressure in the lock to atmosphere to unlock the valve reversing gear. At the same time the left-hand edge of arm 76 has passed slightly beyond the edge of the port 69 in the main rotary so as to slightly uncover said port, thereby putting it in communication with the chamber in which motive fluid is maintained. The movement of the graduating rotary is, of course, continuous and, as it moves farther, the port 69 is uncovered further, thereby admitting fluid pressure to the right-hand end of the cylinder for moving the piston 7 to the left to actuate the reversing gear. In this position of the valvular mechanism the opening 79 in the arm 75 continues in communication with the port 68 and maintains the left-hand end of the cylinder 1 in communication with the atmosphere.

5. Operating position.

In this position, which is illustrated in Fig. 11, the graduating rotary has been moved still farther in a contra-clockwise direction from the position shown in Fig. 10. The recess 87 in the arm 77 is in full communication with the pressure chamber formed by the depressed portion of the main rotary and the valvular casing and is also in full communication with the port 73 connected to the cylinder 4 controlling the locking means, so that fluid pressure is maintained in the cylinder 4, thereby keeping the piston at the right-hand end of the cylinder and maintaining the valve mechanism 3 in such position as to connect the cylinder of the lock 2 with atmosphere. The valve reversing mechanism is thus maintained unlocked. In this position, port 69 is fully uncovered and motive fluid at full pressure is admitted to the right-hand end of the cylinder to actuate the reversing mechanism. The opening 78 in the arm 75 still registers with the port 68 and connects the left-hand end of the cylinder 1 with atmosphere.

The movement of the graduating rotary relative to the main rotary causes the functional operations of the valvular mechanism to be performed. The graduating rotary is, 130
as hereinbefore described, connected to the gear 46 meshing with a rack 47, operated by a controlling lever 48. This lever has a handle 90 and a latch 91 controlling a pawl 92 engaging a semi-circular rack 93 fixed to the valve casing or any other suitable support. By unlocking the latch 91 and moving the handle 90, the gear 46 is rotated to actuate the graduating rotary. The gear ratio is such that a slight movement of the handle 90 causes a relatively large movement of the gear 46, as a consequence of which fine graduations in movement of the valvular mechanism may be obtained. This is important because it enables the engineer to set the valve reversing mechanism in any desired position and at the same time the mechanism may be moved to the limit of its movement without an extensive movement of the controlling handle.

The gear 46 has a pin 94 projecting therefrom into a recess 95 in the gear 43 connected to the main rotary. The two gears 46 and 43 therefore have only a limited relative movement. When the handle 90 is moved to actuate the gear 46, the gear is rotated until the pin 94 strikes the end of the slot 95, whereupon further movement of the handle is prevented. This movement, however, moves the graduating rotary sufficiently to release the fluid pressure lock 2 and admit fluid pressure to one end of the cylinder. Piston 7 accordingly moves and actuates the reversing gear which carries the reach rod 36 with it and actuates the pivoted member 37 carrying the rack 38 meshing with the gear 43 connected to the main rotary. The gear 43 thus moves in the same direction as the gear 46 when the handle 90 is moved to set the reversing mechanism, and causes the slot 95 to move farther around, thereby permitting the handle 90 to be further moved. In practice, the operation is continuous because, as soon as the handle 90 is moved, the reversing mechanism starts to move and the gear 43 continues to rotate, thus permitting further movement of the handle 90 to any desired position.

When the engineer desires to operate the reversing gear he simply moves the handle 90 in the required direction, the first portion of the movement starting the reversing gear and rotating the gear 43 which permits further movement of the handle 90 to a position corresponding to the position to which he desires to move the reversing gear. When the handle 90 is stopped at the desired point, it is automatically latched in position, and the gear 46 is held stationary. The valve reversing mechanism continues to move, carrying with it the gear 43 attached to the main rotary until the main rotary occupies the position relative to the graduating rotary corresponding to neutral position, in which position both ends of the power cylinder are exhausted as well as the cylinder 4 and the reversing gear is automatically stopped and locked in position.

It will thus be seen that by reason of the pin and slot connection between the gears 46 and 43 the relative positions of the main and graduating rotaries cannot be changed beyond certain limits. The main rotary can, however, be moved to any position relative to the valve seat without affecting the operation of the valvular mechanism. Consequently the ratio between the rack 47 carried by the operating lever and the gear 46 and the gear 43 may be made such, if desired, that the gear 46 is rotated one or more times in moving the valve reversing mechanism from one position to the other. This gives a very finely graduated control of the valve reversing mechanism, as will be readily apparent.

It is to be understood that the mechanism shown is for purposes of illustration only and that other structures may be devised which come within the spirit and scope of the appended claims.

What is claimed is:

1. A power reverse gear having a fluid pressure motor, a reversing rod operated thereby, a fluid pressure lock for locking said rod, fluid pressure operated means for controlling the motive fluid to and from said lock, and valvular mechanism for separately controlling the motive fluid to and from the motor and to and from the fluid pressure controlling means.

2. A locomotive valve reverse gear comprising a fluid pressure motor, a valve reversing rod operated thereby, a fluid pressure operated lock for locking said rod, fluid pressure operated means for controlling the flow of motive fluid to and from said lock, and valvular mechanism for controlling motive fluid to and from said motor and said fluid pressure controlling means, and independent motive fluid supply connections to said valvular mechanism and to said fluid pressure controlling means.

3. A power reverse gear comprising a fluid pressure motor, a reversing rod operated thereby, a fluid pressure lock for locking said rod, fluid pressure operated means for controlling the motive fluid to and from said lock, said means being normally biased to keep the lock applied, and valvular mechanism for separately controlling the motive fluid to and from said motor and to and from said fluid pressure controlling means.

4. A locomotive valve reverse gear comprising a fluid pressure motor, a reversing rod operated thereby, a fluid pressure applied lock for locking said rod, fluid pressure operated means for controlling the flow of motive fluid to and from said lock, said means being normally biased to admit motive fluid to keep the lock applied, valvular
5. A power reverse gear comprising a fluid pressure motor, a reversing rod operated thereby, a fluid pressure lock for locking said rod, fluid pressure operated means for controlling the flow of motive fluid to and from said lock, and valvular mechanism for separately controlling the motive fluid to and from said motor and to and from said fluid pressure controlling means, said mechanism being arranged to normally exhaust motive fluid from both sides of the motor and the fluid pressure controlling means when operated to admit motive fluid to one side of the motor and to the fluid pressure controlling means to unlock the lock.

6. A valve reversing mechanism for steam engines comprising a fluid pressure motor, a reversing rod operated thereby, a fluid pressure applied lock for locking said rod, fluid pressure operated means for controlling the flow of motive fluid to and from said lock, valvular mechanism for controlling the motive fluid to and from said motor and said fluid pressure controlling means, said mechanism being arranged to normally exhaust motive fluid from both sides of the motor and from the fluid pressure controlling means and when operated to admit motive fluid to one side of the motor and to the fluid pressure controlling means to unlock the lock, valvular mechanism for controlling the motive fluid to and from said motor and said fluid pressure controlling means, said mechanism being arranged to normally exhaust motive fluid from both sides of the motor and from the fluid pressure controlling means and when operated to admit motive fluid to one side of the motor and to the fluid pressure controlling means to unlock the lock and actuate the motor.

7. A power reverse gear comprising a fluid pressure motor, a reversing rod operated thereby, a fluid pressure applied lock for locking said rod, fluid pressure operated means for controlling the flow of motive fluid to and from said lock, valvular mechanism for separately controlling the motive fluid to and from said motor and to and from said fluid pressure controlling means, said mechanism being arranged to normally exhaust both sides of the motor and the fluid pressure controlling means so that the motor is inactive and the lock applied and when operated to admit motive fluid to one side of the motor and to the fluid pressure controlling means to exhaust motive fluid from the lock.

8. A power reverse gear for steam engines comprising a fluid pressure motor, a reversing rod operated thereby, a fluid pressure applied lock for locking said rod, fluid pressure operated means for controlling the flow of motive fluid to and from said lock, said means being normally biased to admit motive fluid to keep the lock applied, valvular mechanism for controlling the motive fluid to and from said motor and said fluid pressure controlling means, said mechanism being arranged to normally exhaust both sides of the motor and the fluid pressure controlling means to keep the motor inactive and the lock applied and when operated to admit motive fluid to one side of the motor and to the fluid pressure controlling means to unlock the lock and actuate the motor, and independent fluid supply connections to said valvular mechanism and to said fluid pressure controlling means.

9. A power reverse gear having a fluid pressure motor, a reversing rod operated thereby, a fluid pressure applied friction lock for locking the rod, a fluid pressure-operated means for controlling the motive fluid to and from the lock, said means being normally biased to admit motive fluid to the lock to keep it applied, and valvular mechanism for separately controlling motive fluid to and from the motor and to and from the fluid pressure controlling means, said mechanism being arranged to normally exhaust both sides of the motor and the fluid pressure controlling means and when operated to admit motive fluid to one side of the motor and to the fluid pressure controlling means to unlock the lock and actuate the motor.

10. A power reverse gear comprising a fluid pressure motor, a reversing rod operated thereby, a fluid pressure lock for locking said rod, fluid pressure operated means for controlling motive fluid to and from said lock, valvular mechanism for separately controlling the motive fluid to and from said motor and to and from said fluid pressure controlling means, and connections between the reversing rod and the valvular mechanism to automatically return the valvular mechanism to neutral position after the rod has moved the required extent.

11. A power reverse gear comprising a fluid pressure motor, a reversing rod operated thereby, a fluid pressure applied lock for locking said rod, fluid pressure operated means for controlling the motive fluid to and from said lock, said means being normally biased to admit motive fluid to the lock, and valvular mechanism for separately controlling the motive fluid to and from said fluid pressure controlling means, said mechanism being arranged to normally exhaust both sides of the motor and the fluid pressure controlling means so that the motor is inactive and the lock applied and when operated to admit motive fluid to one side of the motor and to the fluid pressure controlling means to exhaust motive fluid from the lock.

12. A power reverse gear for steam engines comprising a fluid pressure motor, a reversing rod operated thereby, a fluid pressure applied lock for locking said rod, fluid pressure operated means for controlling the motive fluid to and from said lock, said means being normally biased to admit motive fluid to keep the lock applied, valvular mechanism for controlling the motive fluid to and from said motor and said fluid pressure controlling means, said mechanism being arranged to normally exhaust both sides of the motor and the fluid pressure controlling means to keep the motor inactive and the lock applied and when operated to admit motive fluid to one side of the motor and to the fluid pressure controlling means to unlock the lock and actuate the motor, and independent fluid supply connections to said valvular mechanism and to said fluid pressure controlling means.
motive fluid to apply the lock, valvular mechanism for controlling the motive fluid to and from said motor and said fluid pressure controlling means, independent motive fluid supply connections to said valvular mechanism and to said fluid pressure control means, and connections between the reversing rod and the valvular mechanism for automatically returning the mechanism to neutral position after the rod has moved the required extent.

13. A power reverse gear comprising a fluid pressure motor, a reversing rod operated thereby, a fluid pressure applied lock for locking said rod, fluid pressure operated means for controlling the motive fluid to and from said lock, said means being normally biased to admit motive fluid to the lock to keep it applied, valvular mechanism for separately controlling the motive fluid to and from said motor and to and from said fluid pressure controlling means, said mechanism being arranged to normally exhaust both sides of the motor and the controlling means, and connections between the reversing rod and the valvular mechanism for automatically returning the mechanism to neutral after the rod has moved the required extent.

14. A power reverse gear for steam engines comprising a fluid pressure motor, a reversing rod operated thereby, a fluid pressure applied lock for locking said rod, fluid pressure operated means for controlling the motive fluid to and from said lock, said means being normally biased to admit motive fluid to keep the lock applied, valvular mechanism for controlling the motive fluid to and from said motor and said fluid pressure controlling means, said mechanism being arranged to normally exhaust both sides of the motor and the controlling means, independent motive fluid supply connections to said valvular mechanism and to said fluid pressure controlling means, and connections between the valvular mechanism and the reversing rod to automatically return the mechanism to neutral position after the rod has moved the required extent.

15. A power reverse gear having a fluid pressure motor, a reversing rod operated thereby, a fluid pressure lock for locking said rod, a valve for controlling the motive fluid to and from said lock, a fluid pressure motor for operating said valve, and valvular mechanism for controlling the motive fluid to and from both of said fluid pressure motors.

16. A power reverse gear comprising a fluid pressure motor, a reversing rod operated thereby, a fluid pressure applied lock for locking said rod, a valve for controlling the motive fluid to and from said lock, a fluid pressure motor for operating said valve, said motor being normally biased to cause the valve to admit motive fluid to keep the lock applied, and valvular mechanism for controlling the motive fluid to and from both of said fluid pressure motors.

17. A power reverse gear for steam engines comprising a fluid pressure motor, a reversing rod operated thereby, a steam pressure applied lock for locking said rod, a valve for controlling the steam to and from said lock, a fluid pressure motor for operating said valve, said motor being normally biased to position the valve to admit steam to keep the lock applied, and valvular mechanism for controlling the motive fluid to and from both of said fluid pressure motors.

18. A power reverse gear comprising a fluid pressure motor, a reversing rod operated thereby, a fluid pressure applied lock for locking said rod, a valve for controlling the motive fluid to and from said lock, said fluid pressure motor for operating said valve, said motor being normally biased to position the valve to admit fluid pressure to keep the lock applied, and valvular mechanism for controlling the motive fluid to and from both of said fluid pressure motors.

19. A power reverse gear for steam engines comprising a fluid pressure motor, a reversing rod operated thereby, a steam pressure applied lock for locking said rod, a valve for controlling the steam to and from said lock, a fluid pressure motor for operating said valve, said motor being normally biased to admit steam to apply the lock, and valvular mechanism for controlling the motive fluid to and from both of said motors, said mechanism being arranged to normally exhaust both sides of the reversing rod motor and when operated to admit motive fluid to one side of the reversing rod motor and to the valve controlling motor.

20. A power reverse gear comprising a fluid pressure motor, a reversing rod operated thereby, a fluid pressure applied lock for locking said rod, a valve for controlling the motive fluid to and from both of said fluid pressure motors.
and slot connection with the pivoted member for causing the rotary valvular mechanism to move in synchronism with the reversing rod, whereby the mechanism is automatically returned to neutral when the rod has moved the required extent.

23. A power reverse gear comprising a fluid pressure motor, a reversing rod operated thereby, a fluid pressure lock for locking the rod, valvular mechanism for controlling the motive fluid for actuating the motor and the lock, said valvular mechanism having a valve seat and a main rotary member provided with cooperating annular recesses whereby fluid pressure connections between the same are maintained in all relative positions of the members and a graduating rotary member arranged to be moved relative to the main rotary to vary the fluid pressure connections therewith, and connections between the reversing rod and the graduating rotary for moving said graduating rotary in synchronism with the reversing rod to automatically return the graduating rotary to its normal position relative to the main rotary after the reversing rod has moved the required extent.

In testimony whereof, I have hereunto set my hand.

JACOB RUSH SNYDER.

Witnesses:
L. C. Schantz,
W. T. Holman.