

July 29, 1924.

A. S. OSBOURNE

POWER REVERSE GEAR

Filed June 21, 1920

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FIG. 3.

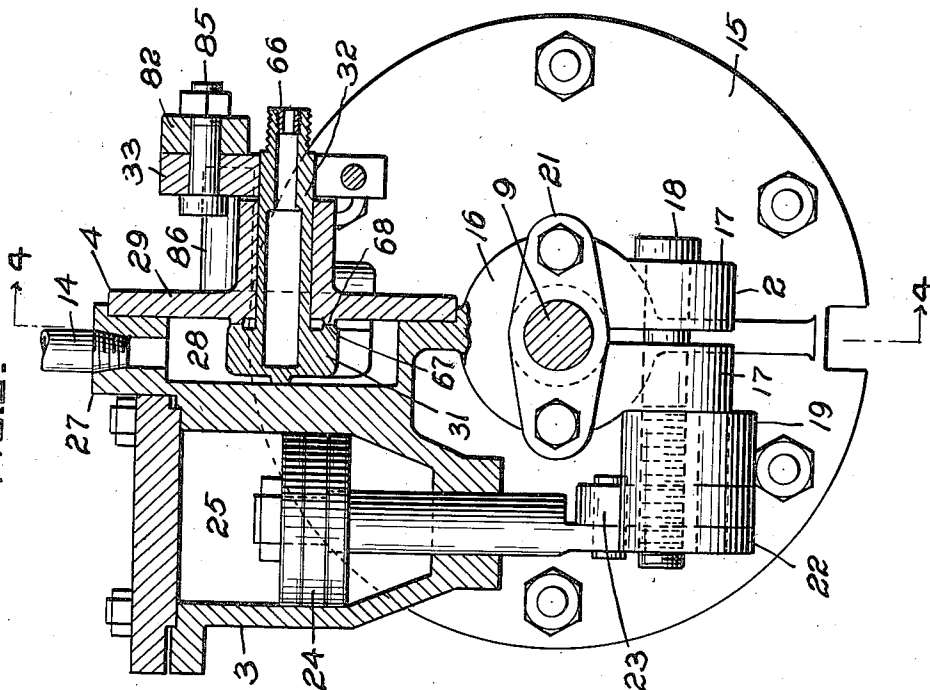
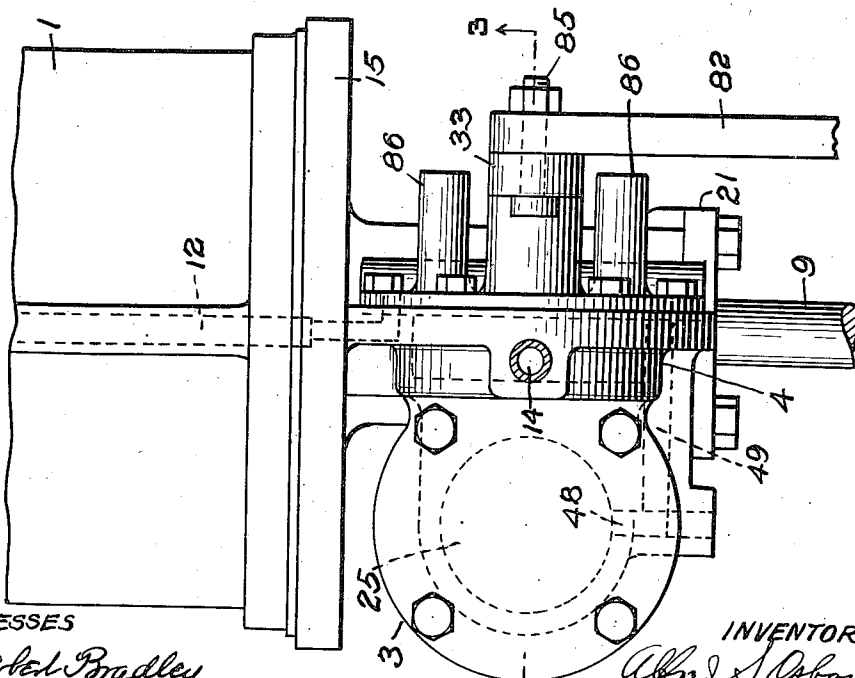


FIG. 2.



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FIG. 5.

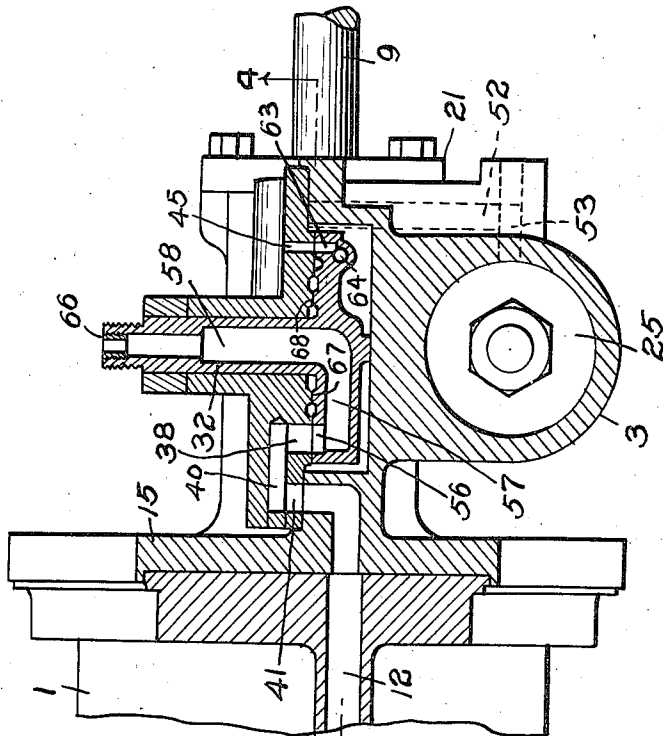
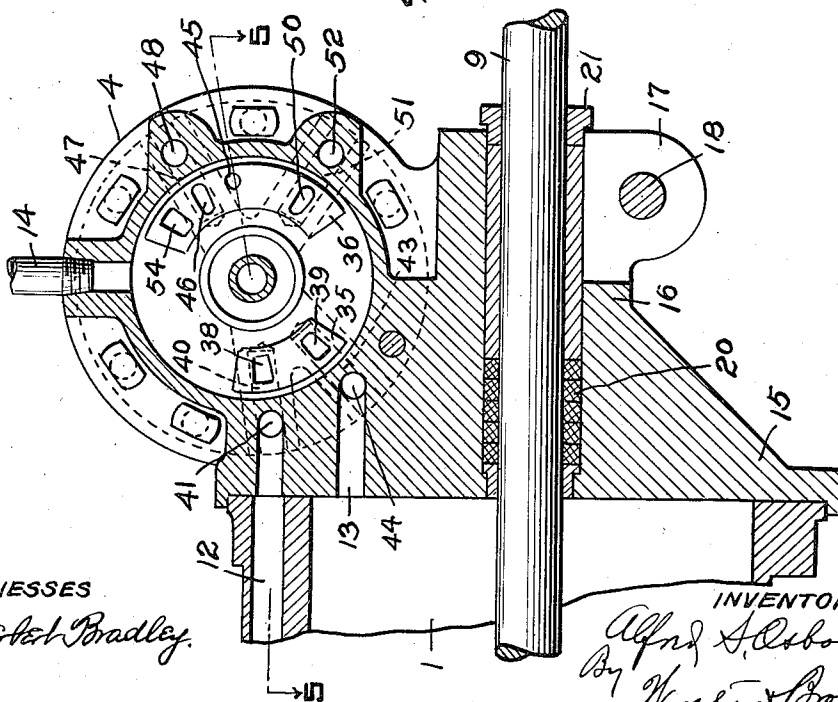


FIG. 4.



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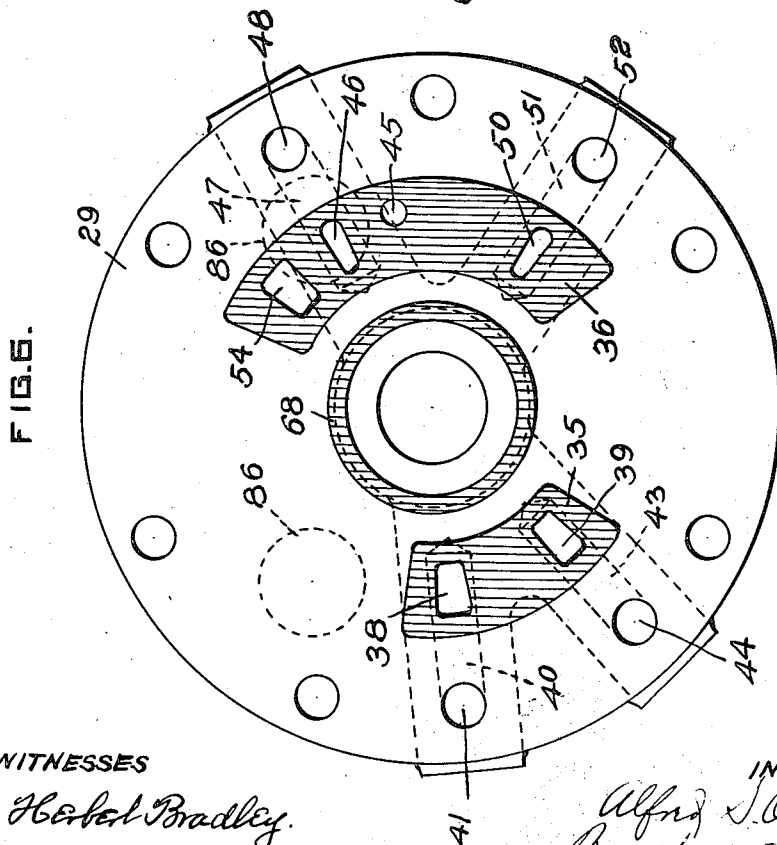
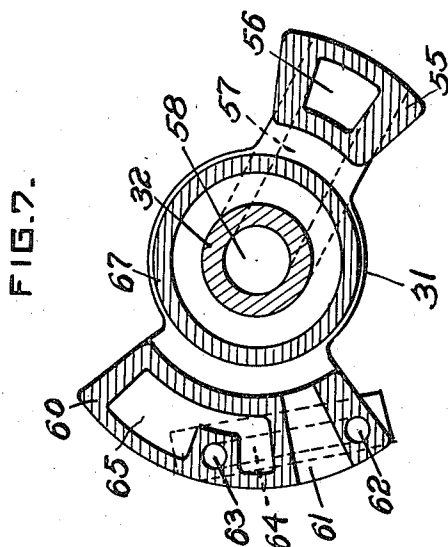
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FIG. 9.

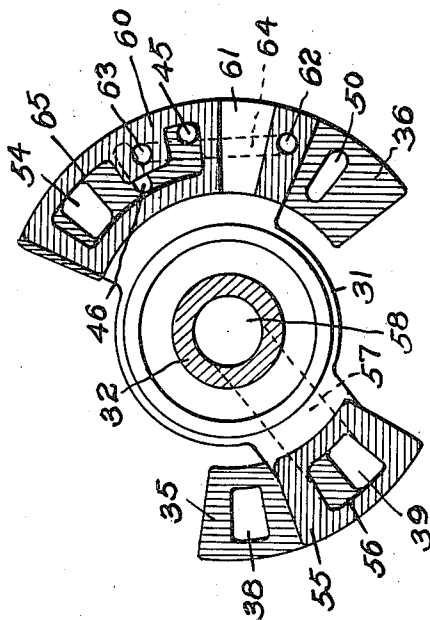


FIG. 10.

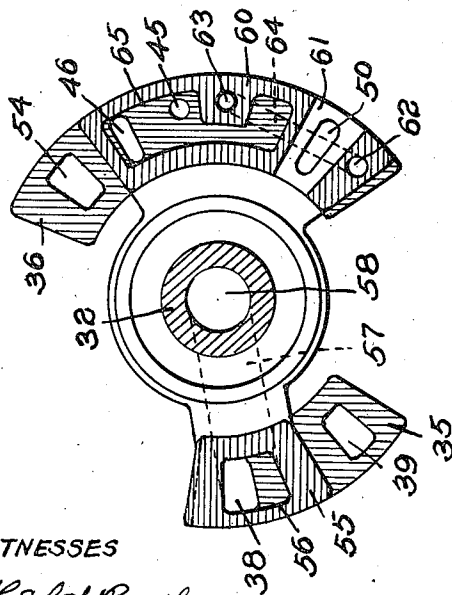
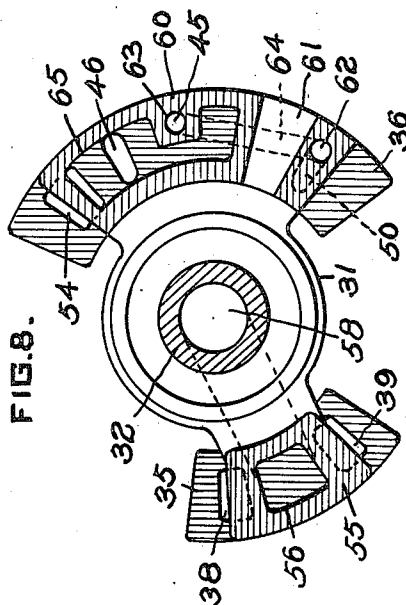


FIG. 8.



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UNITED STATES PATENT OFFICE.

ALFRED S. OSBOURNE, OF INGRAM, PENNSYLVANIA.

POWER-REVERSE GEAR.

Application filed June 21, 1920. Serial No. 390,329.

To all whom it may concern:

Be it known that I, ALFRED S. OSBOURNE, a citizen of the United States, a resident of Ingram, 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 power reverse gears, and particularly to power operated mechanism for reversing and controlling the valve gear or link motion of locomotives.

The object of the invention is to provide an improved power reverse gear which secures an easy and steady movement of the gear-shifting piston and which at the same time prevents creeping of the valve gear, and also has all of the other advantages of the most improved power reversing mechanism.

In the accompanying drawings Fig. 1 is a side elevation of the improved reversing gear, with parts broken out to show the construction and with the mechanism in neutral position; Fig. 2 is a top plan view of the forward end of the power cylinder on an enlarged scale; Fig. 3 is a vertical transverse sectional view on the line 3—3, Fig. 1; Fig. 4 is a central longitudinal section on the line 4—4, Figs. 3 and 5; Fig. 5 is a horizontal sectional view on the line 5—5, Fig. 4; Fig. 6 is a plan view of the valve seat; Fig. 7 is a corresponding view of the rotary valve member; and Figs. 8, 9 and 10 are diagrammatic views illustrating the different positions of the valve.

The reverse gear illustrated comprises in its general combination a fluid pressure motor 1, a lock 2 operated by a fluid pressure motor 3, a valve mechanism 4 for controlling the flow of motive fluid to and from the motor and the lock, manual control means 5 for operating the valve mechanism, and means for connecting the reversing rod and the valve mechanism so as to automatically return the latter to neutral position after the reversing rod has been moved the required distance.

The fluid pressure motor illustrated comprises the power cylinder 1 in which operates a piston 8 connected to the piston rod 9 attached to the cross head 10 to which the reversing rod (not shown) is secured. The cross head 10 slides on the guide bar 11 which may be attached to the cylinder 1, or otherwise suitably supported. The motor

is actuated to move the reversing rod to the right, viewing Fig. 1, by continually supplying fluid pressure to the rear end of the cylinder through the passage or pipe 12 connecting said end of the cylinder with the valve mechanism 4, and at the same time exhausting fluid pressure from the front end of the cylinder, and is actuated to move the reversing rod in the opposite direction by continually supplying fluid pressure to the front end of the cylinder through the passage 13 connecting said end of the cylinder with the valve mechanism 4 and at the same time exhausting fluid pressure from the rear end of the cylinder. The fluid pressure, from any suitable source, is supplied to the valve mechanism 4 through pipe connection 14.

The lock, its fluid pressure actuating means, and the control valve are all formed integrally with, or mounted on parts which are integral with the front head of the power cylinder. As shown, the front head 15 of the cylinder is provided with an axial bore for the piston rod 9 and with a tubular extension 16 around said bore, which extension at its outer end is split inwardly from some distance and provided with parallel perforated ears 17 through which extends a compression bolt 18 provided with a nut 19, working on threads so formed that when said nut is given a partial turn the front end of the tubular extension is contracted to tightly clamp the piston rod 9 and thus form a friction lock for holding said rod immovable. Suitable packing means 20 and compression gland 21 are provided in the axial bore of the head to form a stuffing box around the piston rod. The nut 19 is provided with a crank arm 22 which is connected by a short link 23 to the lower end of the rod of a piston 24 working in a vertical cylinder 25 which is shown as an integral part of the cylinder head 15. This cylinder is of the double acting type and therefore serves to rotate the nut 19 in both directions, to both clamp and unclamp the friction lock described relative to the piston rod 9. The piston in this power cylinder is controlled by the valve mechanism herein-after described. The lock illustrated firmly grips and holds the piston rod in whatever position the latter may occupy, and yet frictionally so that if undue strain occurs it can yield and not damage or break any of the parts.

The valve mechanism 4 for controlling both the fluid pressure motor 1 and the lock applying motor 25 has a casing comprising a stationary portion 27 which is cast integrally with the cylinder head 15, and lies in substantially the central vertical plane of said cylinder head and in turn has the cylinder 25 above referred to formed on one of its faces. The opposite face of the member 27 is recessed to form the valve chamber 28 with which the fluid supply passage 14 connects. The valve chamber 28 is closed by the removable casing member or head 29 which is secured to the member 27 by suitable bolts or the like, and which member is provided on its inner face with the seat for the rotary valve member 31, which is provided with a hollow stem 32 extending out through a central bore in the casing member 29 and to its outer end has secured a crank arm 33 by means of which it is actuated, as will hereinafter be described. The rotary member 31 is normally held to its seat by the fluid pressure which is always present in the valve chamber 28.

The contacting faces of the seat and of the rotary member 31 are cut away so as to provide only points of contact, in order to reduce friction. As shown the seat is provided with two segmental raised portions 35 and 36 and with the following ports and passages: The segmental portion 35 is provided with a pair of ports 38 and 39 located fairly close together, and of which the port 38 communicates with the passage 40 leading to registering holes 41 in the casing members 29 and 27 respectively, and which holes communicate with the pipe or passage 12 leading to the rear end of the cylinder 1; and the port 39 communicating through passage 43 with registering holes 44 in the casing members 29 and 27, and which holes communicate with passage 13 leading to the front end of the cylinder 1. The segmental projection 36 is provided with a port 45 leading to the atmosphere and which forms the exhaust for the lock cylinder 25; a port 46 which communicates through passage 47 with the aligning holes 48 in the casing members 29 and 27, and which holes communicate with passage 49 leading into the upper end of the cylinder 25; a port 50 which communicates through passage 51 with registering holes 52 in the casing members 29 and 27, and which holes communicate with passage 53 entering the cylinder 25 near its lower end; and with a supply cavity 54 for a purpose hereinafter described.

The rotary member 31 comprises in effect a T-head on its hollow stem 32, and is provided with faces for contacting the segmental faces 35 and 36 of the valve seat and is provided with ports and passages cooperating with those in the valve seat. One

arm of this rotary member is provided with the contacting face 55 of sufficient width to partially overlap both of the cylinder ports 38 and 39 in the valve seat, said face being provided with an exhaust cavity 56 which communicates through the radial passage 57 with the opening 58 in the stem 32 of said valve, and which at its outer end is open to the atmosphere and forms the exhaust for the cylinder 1. The other arm of said rotary member is provided with a contact face 60, which is of considerable dimension widthwise of the rotary member and which is provided with the following ports and passages: A transverse passage 61 which in one position of the valve registers with port 50 of the valve seat to admit fluid pressure underneath the lock piston 24; a pair of ports 62 and 63 located at opposite sides of the transverse passage 61 and connected by a longitudinal cored passage 64; and a large cavity 65 which extends partially around and to both sides of the port 63.

It being understood that there is fluid pressure constantly on top of the rotary member 31, the control of the fluid flow in the following described positions of the valve will be apparent. This valve has three positions:

1. Neutral position, shown in Fig. 8. In this position the rotary member 31 is positioned centrally with reference to the several ports in the valve seat. Its contact face 55 only partially overlaps both of the cylinder ports 38 and 39, thus allowing fluid pressure to constantly supply both ends of the reversing cylinder 1, through restricted ports, but nevertheless in sufficient quantity to compensate for any leakage of the cylinder, and therefore maintains substantially equal pressures on both sides of the piston 8 with the result that there can be no tendency for the valve gear to creep. The contact face 60 of the rotary member is so positioned that the supply cavity 54 in the valve seat is open both to the chamber 28 in the valve casing and to the cavity 65 in the rotary member, as a consequence of which fluid pressure can flow to the port 46 communicating with the upper end of the lock applying cylinder 25, thus holding said lock applied. At the same time port 50 in the valve seat, which is connected to the lower end of the lock applying cylinder 25, is overlapped by port 62 in the rotary member and hence is connected through passage 64 to port 63, which registers with exhaust port 45, so that the lower end of this cylinder is exhausted. Consequently, in this position the piston rod 9 is locked in position, while both ends of the cylinder 1 are supplied with equal pressure.
2. Forward position, shown in Fig. 9. This position is assumed when the rotary

member 31 has been moved counter-clockwise from neutral position. In this position contact face 55 of the rotary member has fully uncovered cylinder port 38; thus admitting fluid pressure in a greater quantity than in normal position to the rear end of cylinder 1, and at the same time the exhaust port 56 overlaps cylinder port 39, thus exhausting the forward end of cylinder 1 through passage 57 and hole 58 in the stem of the rotary member. The other arm of the rotary member is moved to such position that cavity 65 directly connects port 46 with exhaust port 45, thus exhausting fluid pressure from the upper end of lock applying cylinder 25; while port 50 is fully uncovered, thus admitting fluid pressure to the lower end of cylinder 25, as a result of which the piston 24 in cylinder 25 is lifted and the lock released. This releasing of the lock occurs simultaneously with, or slightly before the cylinder port 39 is connected to exhaust, so that in this position the lock is released and the piston rod moved forwardly.

3. Reverse position, shown in Fig. 10. This position is assumed when the rotary member moves clockwise from the neutral position, and in functional operation corresponds exactly to position 2 except that the power cylinder is actuated in the reverse direction from that of position 2. In this position the cylinder port 39 is uncovered while cylinder port 38 is connected to exhaust; lock applying port 46 is connected through cavity 65 directly to exhaust port 45, while lock releasing port 50 is uncovered by transverse passage 61.

It will thus be seen that normally both ends of the reversing cylinder are being supplied with fluid pressure, to compensate for leakage, and in a manner to maintain equal pressures on both sides of piston 8. There can be no such unbalancing of pressure as to cause the valve gear to creep, particularly against the resistance of the friction lock. Furthermore, when moved to either operating position the fluid pressure on one side of the piston 8 must be exhausted, and therefore the fluid pressure in that end of the piston acts as a steadying medium to prevent the piston 8 from "jumping" and insures a gradual and uniform movement of the piston 8 through its entire range of movement. The rapidity of the exhaust from this cylinder can be controlled by means of removable and interchangeable bushings 66 in the outer end of the stem 32 of the rotary member 31.

To prevent leakage around the stem of the rotary valve member, the hub of said member and the valve seat are provided with contacting annular faces 67 and 68 respectively, which are located sufficiently far from the stem of the rotary member that

they can be accurately ground to make a close fit.

The mechanism so far described constitutes a unit which can be attached as such to the locomotive at any convenient point. The manual control means for operating the valve is, of course, located in the cab, but this is a very simple construction and occupies a minimum amount of space. It is so arranged that the movement of a simple lever either forwardly or backwardly, to the desired extent, actuates the valve 4 to bring such action of the reverse gear as to drive the locomotive in the same direction as the engineer's hand is moved.

As shown, the manual control means comprises a stationary segment 70 provided with rack teeth 71 and having pivoted thereto at 72 a hand lever 73 provided with a dog 74 for engaging the rack teeth of segment 70, with a spring-pressed hand-piece 75 for releasing said dog, all as is common in ordinary ratchet levers. Stops 76 on segment 70 limit the movement of the lever in either direction. The lower end of the lever 73 is pivotally connected at 77 to an operating rod 78 extending from the cab to a position slightly forward of the power cylinder 1, and is there pivotally connected at 79 to the upper end of a lever 80, which has its lower end fulcrumed at 81 on the cross head 10, and which lever therefore moves with the cross head. A link 82 connects a wrist pin 83 on the lever 80 near its upper end with a wrist pin 85 on the crank arm 33 on the outer end of the stem 32 of the rotary valve member 31. The head 29 of the valve casing is provided with a pair of fixed stops 86, one on either side of crank arm 33, which limit the extent of rotation of the valve member 31 in either direction.

In neutral or normal position of the valve mechanism the hand lever 73 is in central position. To drive the locomotive forwardly the engineer moves the upper end of this lever forwardly, and this through the connecting rod and levers described rotates the valve member 31 from the position shown in Fig. 8 to the position shown in Fig. 9 above described, thus bringing about a relation of ports which releases the lock, admits more fluid pressure to the rear end of the cylinder 1 and exhausts the fluid pressure from the forward end of said cylinder. The extent to which the engineer can initially move the lever 73 is limited because as soon as arm 33 strikes stop 86 movement of the valve, and also of lever 73 is stopped. This movement, however, has been sufficient to bring about the port connections above described, and consequently if the valve gear is in operative condition, the piston 8 and the piston rod 9 are moved forwardly, carrying with them the cross head 10 and reversing rod. This also carries the lower end

of lever 80 forwardly, and as the upper end is now held stationary (by connecting rod 78 and lever 73) the valve 31 is moved in the reverse direction, thus carrying the arm 5 33 out of engagement with the stop 86, so that the engineer can again move the lever 73 in the direction in which he has already moved it. This reverse movement of the valve, due to the forward movement of the cross head 10, so quickly follows after the initial movement of the lever 73 that the engineer can practically move the lever 73 forward continuously until he brings it to a position commensurate with that of the de- 15 sired link movement, when he will allow it to come to rest and lock it to the segment 70. Should the engineer be unable to move this lever after its slight initial movement, it will be a warning that the valve mechanism is not in working condition. After the lever 73 has been locked in the desired position, fluid pressure will continue to enter the cylinder 1 until the continued forward movement of the cross head 10 brings valve member 31 back to its neutral position, whereupon the lock is automatically applied, and the cylinder 1 brought to a balanced pressure condition on both sides of its piston. This brings the reversing mechanism to a stop at the desired position and locks the same in this position.

To drive the locomotive backwardly, the lever 23 is moved to the rear, thus bringing the valve to the position shown in Fig. 10, whereupon the foregoing operations are repeated, except that fluid pressure is now admitted to the forward end of cylinder 1 and exhausted from the rear end thereof.

The mechanism described is of simple construction, includes a positive lock for the reversing motor, with the motor, its lock, and the valve mechanism assembled as a single unit, and the operating mechanism in the form of a simple lever so arranged as to secure the desired travel of the locomotive by the movement of the operating lever in the same direction. Consequently there is no likelihood of confusion on the part of the engineer, as all he has to do is to move the lever 73 in the direction he desires to travel and to a distance commensurate with the required speed, and stop there. The mechanism described then automatically brings about the desired movement.

I claim:—

1. A power reverse gear comprising in combination, a fluid pressure motor, a reversing rod operated thereby, a source of fluid pressure supply, a fluid pressure controlled lock arranged to normally hold the rod against movement, a valvular mechanism controlling the flow of fluid to and from the motor and to and from the lock and comprising a fixed stationary seat and a single rotatable valve member capable of ro-

tative movement only cooperating with the seat and arranged when in normal position to maintain the lock applied and to connect both sides of the motor to the supply source, manual means for rotating said valve member in either direction to exhaust one side of the motor and simultaneously release the lock including a floating lever pivotally connected at one end to and movable with the reversing rod, said rotatable valve member being operatively connected to the said floating lever and actuated thereby to re-connect both sides of the motor to the supply source and reapply the lock. 70 75

2. A power reverse gear comprising in combination, a fluid pressure motor, a reversing rod operated thereby, a source of fluid pressure supply, a fluid pressure controlled lock arranged to normally hold the rod against movement, a valvular mechanism controlling the flow of fluid to and from the motor and to and from the lock and comprising a fixed stationary seat and a single rotatable valve member capable of rotative movement only cooperating with the seat and arranged when in normal position to maintain the lock applied and to connect both sides of the motor to the supply source, said rotatable valve member being rotatable in either direction to exhaust one side of the motor and simultaneously release the lock, a floating lever operatively connected to both the said rotatable valve member and the said reversing rod whereby the rotatable valve member is actuated in response to the movement of the reversing rod to resume its normal position when the said rod has moved a predetermined distance. 80 85 90 95 100

3. A power reverse gear comprising in combination, a fluid pressure motor, a reversing rod operated thereby, a source of fluid pressure supply, a fluid pressure controlled lock arranged to normally hold the rod against movement, a valvular mechanism controlling the flow of fluid to and from the motor and to and from the lock and comprising a fixed stationary seat and a single rotatable valve member capable of rotative movement only cooperating with the seat and arranged when in normal position to maintain the lock applied and to connect both sides of the motor to the supply source, said rotatable valve member being manually rotatable in either direction to exhaust one side of the motor and simultaneously release the lock and being automatically operated in response to the movement of the reversing rod to reconnect both sides of the motor to the supply source and reapply the lock. 105 110 115 120 125

4. A power reverse gear comprising in combination, a fluid pressure motor, a reversing rod operated thereby, a source of fluid pressure supply, a fluid pressure controlled lock arranged to normally hold the

rod against movement, valvular mechanism comprising a fixed stationary seat and a single rotatable valve member cooperating therewith and arranged in normal position to connect both sides of the motor and the lock to the supply source, said rotatable valve member being arranged to be moved in either direction to connect one side of the motor and the lock to exhaust while
10 maintaining the connection of the other side of the motor to the supply source, and means operated in synchronism with the reversing rod for automatically returning the rotatable valve member to normal position when the
15 reversing rod has moved a predetermined distance.

5. A power reverse gear comprising a fluid pressure motor, a reversing rod operated thereby, valvular mechanism comprising a fixed stationary seat and a single rotatable valve member capable of rotative movement only cooperating therewith and arranged in normal position to connect both sides of the motor to the supply source,
25 said rotatable valve member being arranged to be manually moved in either direction to connect one side of the motor to the exhaust while maintaining the connection of the other side to the supply source, and
30 means operated in synchronism with the reversing rod for automatically returning the rotatable valve member to normal position when the reversing rod has moved a predetermined distance.

35 6. A power reverse gear comprising in combination, a fluid pressure motor, a reversing rod operated thereby, a lock for said reversing rod, a fluid pressure motor for both applying and releasing the said lock, a valvular mechanism controlling the flow of fluid to and from the reversing motor and to and from the lock motor and arranged when in normal position to connect both sides of the reversing motor and one

side of the lock motor to the supply source and connect the other side of the lock motor to exhaust, said valvular mechanism comprising a fixed stationary seat and a single rotatable valve member cooperating therewith, said rotatable valve member being capable of rotative movement only and arranged to be manually rotated in either direction and when so moved to connect one side of the reversing motor to exhaust and reverse the connections to the two sides of the lock motor.

7. A power reverse gear comprising in combination, a fluid pressure motor, a reversing rod operated thereby, a lock for said reversing rod, a fluid pressure motor for both applying and releasing the said lock, a valvular mechanism controlling the flow of fluid to and from the reversing motor and to and from the lock motor and arranged when in normal position to connect both sides of the reversing motor and one side of the lock motor to the supply source and connect the other side of the lock motor to exhaust, said valvular mechanism comprising a fixed stationary seat and a single rotatable valve member cooperating therewith, said rotatable member being capable of rotatable movement only and arranged to be manually moved in either direction and when so moved to connect one side of the reversing motor to exhaust and reverse the connections to the two sides of the lock motor, and means operated in synchronism with the reversing rod for automatically returning the rotatable valve member to normal position when the rod has been moved a predetermined distance.

In testimony whereof, I have hereunto set my hand.

ALFRED S. OSBOURNE.

Witness:

HOWARD L. SNIVELY.