

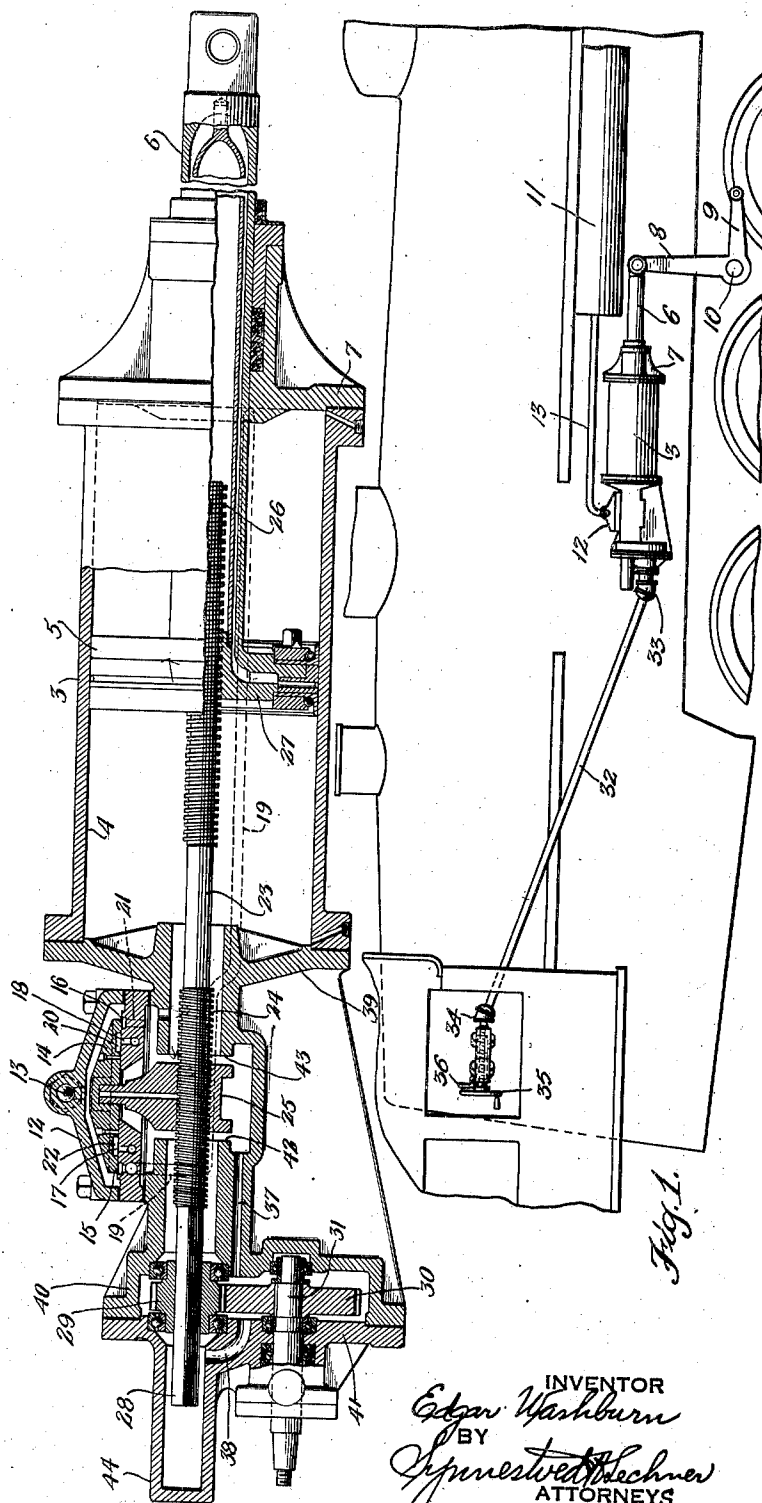
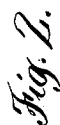
April 8, 1941.

E. WASHBURN

2,237,400

POWER REVERSE GEAR

Filed Nov. 30, 1938



INVENTOR
Edgar Washburn
BY
Spurvested & Lechner
ATTORNEYS

UNITED STATES PATENT OFFICE

2,237,400

POWER REVERSE GEAR

Edgar Washburn, Baltimore, Md., assignor to
Franklin Railway Supply Company, New York,
N. Y., a corporation of Delaware

Application November 30, 1938, Serial No. 243,062

11 Claims. (Cl. 121-41)

This invention relates to fluid pressure actuated power reverse gears of the servo-motor type, such as are used on locomotives. Power reverse gears of this type are illustrated in United States Patent to M. H. Roberts, No. 1,500,685, and the present invention is in the nature of an improvement on the device therein disclosed.

The primary object of the invention is to provide a device of this general type which overcomes all possibility of injury to the operator.

As an incident to the foregoing it is also an object of the invention to eliminate the possibility of injury to the operator by means of a construction which is practically irreversible under any conditions of operation, either normal or otherwise, which are liable to be encountered.

Another object of the invention is to accomplish the foregoing without unduly increasing either the length of time required to make the desired adjustments or the degree of power which it is necessary for the engineman to apply.

Still another object of the invention is to provide a mechanism of the kind described wherein the various parts involved in the improvement can be applied as a unit to existing power reverse gears so as to avoid excessive costs to the railroads in making the change-over from the old type to the new type.

How the foregoing, together with such other objects as may appear hereinafter or are incident to my invention, are attained is illustrated in preferred form in the accompanying drawing wherein.

Figure 1 is a more or less diagrammatical side elevation of the rear end of a locomotive with my improvements applied thereto; and

Figure 2 is a vertical longitudinal section through my improved power reverse gear servo-motor.

In the drawing, the power reverse gear servo-motor is illustrated as a whole by the reference character 3. It includes the usual cylinder 4 in which reciprocates a piston 5 having a trunk extension 6 projecting through the forward or right hand head 7. The trunk 6 is suitably connected to the reverse shaft lever 8, movement of which will raise or lower the reverse shaft arm 9, the motion taking place around the pivot formed by the reverse shaft 10. All of this is well understood in the art and it need only be said that the reverse shaft arm 9 is connected to the valve mechanism of the locomotive which is adjusted by means of the power reverse gear.

Under normal operating conditions movement of the piston 5 is effected by means of air pres-

sure from the reservoir 11 which is connected to the valve chest 12 through the pipe 13. Within the valve chest is the usual slide valve 14 which controls the supply and exhaust of air pressure to the two ends of the piston 5 through the inlet ports 15 and 16 and outlets ports 17 and 18, which latter discharge to the atmosphere through a suitable exhaust connection, not illustrated. When the valve is moved to the right air pressure will pass through the port 15 into the connecting pipe or duct 19 which delivers to the cylinder on the forward side of the piston. At the same time that this occurs the port 16 is connected to the discharge 18 by means of the cavity 20, so that the pressure on the left or rear side of the piston is vented while pressure is being delivered to the forward end of the piston. When the valve is moved to the left the port 16 is opened to the pressure in the valve chest, so that air pressure will be delivered through the duct 21 to the forward end of the cylinder, while at the same time the pressure at the rear end is discharged through the duct 19, port 15, cavity 22 and passage 17.

The valve is displaced in one direction or the other as may be necessary to cause the requisite change in the position of the locomotive valve gear by rotating the shaft 23 which has a thread 24 passing through a correspondingly threaded opening in the valve actuating member 25. The shaft is also provided with another thread 26 which passes through a correspondingly threaded nut 27 in the piston 5. The threads 24 and 26 are opposed to each other, and the thread 26, preferably, is twice the pitch of the thread 24.

The left hand end 28 of the shaft 23 is a squared end and is adapted to slide freely within the interior of the gear 29 which meshes with the driving gear 30. The driving gear 30 is fixed upon the shaft 31, which latter is rotated by means of the shaft 32 which is connected by suitable universal joints 33 and 34 with the hand operating wheel 35, which latter can be held in any desired position by a latch 36 in a manner well understood in this art and more fully described in the Roberts Patent No. 1,500,685 mentioned above. There is a two to one ratio between the gears 29 and 30, so that one revolution of the gear 30 will cause two revolutions of the gear 29 and the shaft 23.

In order to equalize the pressure on the two sides of the gear 29, connecting ducts 37 and 38 are provided.

The valve chest and associated parts are supported upon the cylinder head 39 by means of the

extended portion 40, the open outer end of which is closed by the closure casting 41.

The valve actuating member 25 is adapted to reciprocate between a pair of stops 42 and 43.

The principle of operation of a servo-motor of the type described is very well known to those skilled in this art, but it might be said that upon displacement of the valve in either direction by rotation of the shaft 23 the air will be admitted to one side or the other of the piston and exhausted from the opposite side. This will immediately cause a movement of the piston sufficient to return the valve to its neutral or mid-position unless the shaft 23 is continuously turned so as to hold the valve in one or the other of its side positions. Therefore, by continuously rotating the hand wheel 35 it is possible to move the piston 5 to one end or the other of its cylinder 4, but just as soon as the hand wheel is stopped the piston 5 will immediately come to rest in its adjusted position where it is held by a balancing of the pressures in the two ends of the cylinder.

By way of contrast I should like to point out that in the old style gear such as illustrated in the Roberts patent referred to above, every revolution of the threaded shaft corresponded to one revolution of the hand wheel, and the device was made of such size and proportions as to make it necessary to turn the hand wheel approximately eighteen times in order to move the piston from one end to the other of the cylinder. With the device of the present application the pitch of the threads 26 is made so that it will require thirty-six turns of the shaft 23 in order to move the piston 5 from one end to the other of the cylinder. In the absence of the driving gears 29 and 30 this would require thirty-six revolutions of the hand wheel, but this would be extremely tiring to the engineer and would also require more time than is permissible to effect the necessary change in the locomotive valve gear. For this reason the driving gears 29 and 30 are introduced so that for the thirty-six revolutions of the shaft 23 necessary to move the piston from one end to the other of the cylinder only eighteen revolutions of the hand wheel are required.

This provision, however, obviously increases the amount of power which the engineer would have to apply to the hand wheel, and in order to minimize this increase in power to as great an extent as possible I introduced the threads 24 which pass through the valve operating member 25, these threads, as stated, being of less pitch than the threads 26. As a matter of preference the thread entering the piston has a single Acme thread, one and one-half inches in diameter, right hand, with three threads per inch, while the thread 24 which passes through the valve operating arm has a left hand thread, one and one-half inches in diameter, with six threads per inch.

With the foregoing in mind, the operation of my improved device will be better understood. Let us assume that it is intended to move the piston 5 to the left. This will require movement of the valve to the right so that pressure can reach the forward end of the cylinder while the rear end is connected to exhaust. In order to accomplish this the hand wheel is rotated so as to turn the shaft 23 in a clockwise direction, which will tend to move the shaft to the right as viewed in Figure 2. This motion in itself will tend to move the valve to the right, but the motion of the valve is made more quick by virtue of the thread 24 which is of opposite pitch to the thread 26. Rotation of the shaft 23 therefore in

a clockwise direction will serve to move the valve actuating member 25 and consequently the valve 14 to the right. In this way the power of the actuating air pressure is more quickly brought into play, so that the piston 5 can be moved as desired. What actually happens is that the motion of the valve due to the rotation of the thread 26 in the piston nut 27 is augmented by rotation of the thread 24 in the valve operating member 25. This action serves to offset to a certain extent the increase in power which would otherwise be required by virtue of the use of the thread 26 and the gears 29 and 30.

During operation of the power reverse gear it will be understood of course that the shaft 23 is moved longitudinally of the device a distance corresponding to the length of the thread which passes through the valve actuating member 25. For this reason the closure 41 is provided with the extension 44, which extension forms a housing for the squared end 28.

When the piston 5 is to be moved to the right just the reverse operation takes place.

I wish to point out that the improvements of the present invention can be applied to gears of the old type merely by changing the nut in the piston and applying a new head 39 to the cylinder 4, the head 39 carrying the shaft 23, the valve operating member 25, the valve, the valve chest, and the operating gears 29 and 30. In other words, the device of the present invention can be applied as a unit to the old style reverse gear shown in the Roberts patent.

The pitch of the threads 26 in the nut 27 is of such a nature as to make the device practically irreversible under any operating condition which is liable to be encountered, either normal or abnormal. In this connection it might be pointed out that conditions some times arise under which very powerful forces are set up which tend to cause abnormal movements of the piston 5. In the old style gear such an unusual force applied to the piston 5 frequently resulted in motion of the piston sufficiently far in one direction or the other to bring the valve operating member 25 sharply against one of the two stops 42 or 43. This would cause a sudden rotation of the operating shaft and consequently of the hand wheel and cause injury to the engineer. With the improved arrangement of the present application, however, such force applied to the piston 5 cannot rotate the hand wheel because the pitch of the threads 26 makes this reverse operation practically an impossibility.

Another feature of the present construction is the location of the driving gears 29 and 30. If these were placed somewhere in the neighborhood of the hand wheel 35 it will readily be understood that any friction or other losses in the driving connection between the hand wheel and the squared end 28 of the shaft 23 would be multiplied, but by placing them in the location illustrated in Figure 2 no multiplication of such losses occurs. Furthermore, as will be seen upon inspection of Figure 2, the gears 29 and 30 are preferably mounted in anti-friction bearings.

It will be understood, of course, that I do not wish to be limited to the specific gear ratios or pitches disclosed and described because the principles of the invention can be employed with other ratios and pitches. Those given were introduced simply for the sake of more clearly illustrating the invention. The essential features of my invention are pointed out in the accompanying claims.

I claim:

1. A fluid pressure actuated power reverse gear servo-motor having a cylinder, a piston, a valve for controlling the fluid pressure supply and exhaust ports, an operating shaft having threaded relationship with the piston and oppositely threaded relationship with the valve, and means for rotating said shaft to move said valve to open a supply port, said valve and said shaft being adapted to move longitudinally with the piston to effect closure of said supply port upon cessation of shaft rotation.

2. An operating unit for the piston of a fluid pressure actuated power reverse gear servo-motor, said unit including a nut for the piston, a valve for controlling the fluid pressure, an operating shaft having a threaded connection with said nut and an oppositely threaded relationship with said valve, and means for rotating said shaft to move said valve to fluid pressure supplying position, said valve and said shaft being adapted to move longitudinally with the piston to return said valve to its original position upon cessation of shaft rotation.

3. The device of claim 1 wherein the pitch of the piston threads is greater than that of the valve threads.

4. A fluid pressure actuated power reverse gear servo-motor having a cylinder, a piston, a valve for controlling the fluid pressure supply and exhaust ports, an operating shaft having threaded relationship with the piston and oppositely threaded relationship with the valve, and means for rotating said shaft to move said valve to open a supply port, the pitch of the piston threads being such as to prevent rotation of the shaft by the piston.

5. A fluid pressure actuated power reverse gear servo-motor having a cylinder, a piston, a valve for controlling the fluid pressure supply and exhaust ports, an operating shaft having threaded relationship with the piston and oppositely threaded relationship with the valve, and means for rotating said shaft to move said valve to open a supply port, the pitch of the piston threads being greater than that of the valve threads and sufficient to prevent rotation of the shaft by the piston.

6. A fluid pressure actuated power reverse gear servo-motor having a cylinder, a piston, a valve for controlling the fluid pressure supply and exhaust ports, a valve operating member reciprocable between a pair of stops, a shaft having threaded engagement with said valve operating member and oppositely threaded relationship of greater pitch with said piston, and means for rotating the shaft to move said valve to open a supply port, said valve and said shaft being adapted to move longitudinally with the piston to effect closure of said supply port upon cessation of shaft rotation.

7. A fluid pressure actuated power reverse gear servo-motor having a cylinder, a piston, a valve for controlling the fluid pressure supply and exhaust ports, a valve operating member reciprocable between a pair of stops, a shaft having

threaded engagement with said valve operating member and oppositely threaded relationship of greater pitch with said piston, and means for rotating the shaft to move said valve to open a supply port, the pitch of the piston threads being sufficient to prevent rotation of the shaft by the piston in the event that thrust on the piston brings the valve operating member against one of said stops.

8. A fluid pressure actuated power reverse gear servo-motor having a cylinder, a piston, a valve for controlling the fluid pressure supply and exhaust ports, an operating shaft having threaded relationship with the piston and oppositely threaded relationship with the valve, and means for rotating said shaft to move said valve to open a supply port, together with a hand wheel for turning the shaft and a gear connection for multiplying the revolutions of the hand wheel.

9. A fluid pressure actuated power reverse gear servo-motor having a cylinder, a piston, a valve for controlling the fluid pressure supply and exhaust ports, an operating shaft having threaded relationship with the piston and oppositely threaded relationship with the valve, and means for rotating said shaft to move said valve to open a supply port, together with a hand wheel, a shaft turned by the hand wheel, and a gear connection between the hand wheel shaft and the threaded operating shaft for multiplying the revolutions delivered by the hand wheel.

10. A fluid pressure actuated power reverse gear servo-motor having a cylinder, a piston, a valve for controlling the fluid pressure supply and exhaust ports, a valve operating member reciprocable between a pair of stops, a shaft having threaded engagement with said valve operating member and oppositely threaded relationship of greater pitch with said piston, means for rotating the shaft to move said valve to open a supply port, the pitch of the piston threads being sufficient to prevent rotation of the shaft by the piston in the event that thrust on the piston brings the valve operating member against one of said stops, a hand wheel, a shaft turned by the hand wheel, and a gear connection between the hand wheel shaft and the threaded operating shaft for multiplying the revolutions delivered by the hand wheel.

11. An operating unit for the piston of a fluid pressure actuated power reverse gear servo-motor, said unit including a cylinder head, a nut for the piston, a valve for controlling the fluid pressure, a valve actuating member reciprocable between a pair of stops, a shaft having a threaded connection with said nut and an oppositely threaded connection with said valve actuating member, and a gear drive for rotating the shaft to move said valve to fluid pressure supplying position, said valve and said shaft being adapted to move longitudinally with the piston to return said valve to its original position upon cessation of shaft rotation.

EDGAR WASHBURN.