

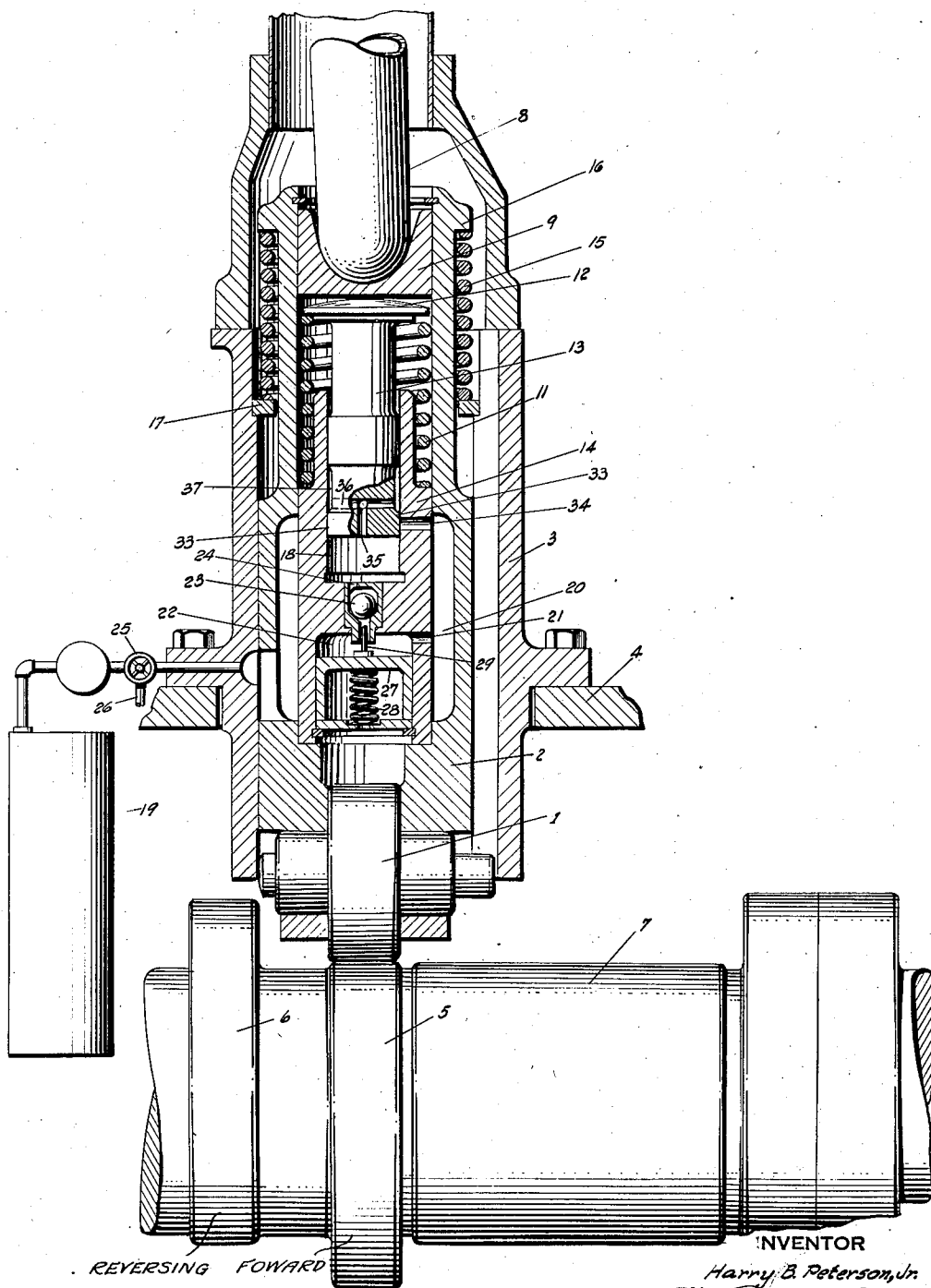
May 15, 1945.

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2,376,182

REVERSING MECHANISM FOR ENGINES

Filed March 23, 1943



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REVERSING MECHANISM FOR ENGINES

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Application March 23, 1943, Serial No. 480,255

5 Claims. (Cl. 123-41)

This invention relates generally to an internal combustion engine reversing mechanism of the type in which cam follower rollers are lifted clear of the valve operating cam thereby to permit the camshaft to be axially shifted from a forward set of cams to a reversing set or vice versa.

My invention is particularly an improvement upon the specific type of reversing apparatus disclosed in the application of Max Essl, Serial No. 407,381, filed August 18, 1941, now Patent No. 2,346,737, issued April 18, 1944, in which a hydraulically controlled mechanism is arranged to lift the cam follower and also to take up automatically any valve tappet clearance that may occur.

It is an object of my invention to provide an improved combination for rapidly lifting the cam follower upon initiation of the lifting operation. A further object is to accomplish rapid lifting of the cam follower mechanism from the camshaft as well as rapid restoration of the operative relation of the follower to the camshaft but still maintain the necessary nicety of operation and control for taking up valve tappet clearance.

Other objects and advantages will be more apparent to those skilled in the art from the following description of the accompanying drawing in which the figure is a sectional view of my improved hydraulic lifting mechanism shown in its relation to fragmentary portions of a camshaft and push rod assembly, the usual poppet valves and engine structure being omitted.

Inasmuch as my invention is an improvement on said Essl invention it will suffice to describe the same only briefly, it being understood that any details of construction not herein described are the same as those disclosed in said Essl application and that the disclosure herein would be duplicated for each engine valve. A cam follower, specifically a roller 1, is suitably journaled in a push rod sleeve 2 which is vertically guided in a stationary guide housing 3 suitably secured to a usual camshaft housing 4 of any usual reciprocating type engine employing poppet valves. The cam follower is operated from either forward or reversing cams 5 and 6 respectively formed on a usual camshaft 7 driven from and in timed relation to the engine crankshaft. The sleeve 2 is operatively connected to a push rod 8 whose upper end is connected in any usual manner to a valve rocker arm (not shown) while the lower end of the push rod is spherically seated in a member 9 slidably supported within the upper bore of sleeve 2. The member 9 is normally biased to its upper position by a spring 11 interposed between an

enlarged head 12 of a plunger 13 and a body 14 which is fixed in sleeve 2 to move therewith as a unit, the head 12 bearing against the member 9. A lifting spring 15 is interposed between a shoulder 16 on sleeve 2 and a suitable stationary shoulder 17. To move plunger 13 to its upper normally operating position the plunger is slidably supported in a bore 18 to which pressure fluid may be supplied from any suitable source diagrammatically indicated as a pressure tank 19 and thence through an annular chamber 20 and port 21 to the interior of a control cylinder 22 formed in the lower end of body 14. Fluid is transmitted from cylinder 22 upwardly through a passage controlled by a ball check 23 and port 24 to the underside of plunger 13. Fluid pressure to the chamber 22 is suitably manually or otherwise controlled by a valve 25. Normally, fluid cannot flow downwardly past check valve 23 but during a reversing operation fluid in chambers 20 and 22 is discharged through valve 25 to a suitable exhaust 26 whereupon a control piston 27 is moved upwardly by a spring 28 to cause a small pin 29 to lift valve 23 thereby to discharge fluid from beneath plunger 13 and accordingly allow the relatively heavy spring 15 to overcome the force of spring 11 and accordingly lift sleeve 2 and cam follower roller 1. This operation, in effect, constitutes a collapsing or shortening of the length of the push rod mechanism which broadly constitutes the rod 8 and sleeve 2. When the follower roller 1 is sufficiently lifted clear of the maximum elevation of cam 6, then camshaft 7 can be axially shifted a relatively short distance to bring cam 6 beneath roller 1 whereupon fluid pressure is admitted from tank 19 to chambers 20 and 22 to again move plunger 13 upwardly relative to sleeve 2 or, actually, to move member 14 and sleeve 2 downwardly against the force of spring 15 thereby to bring roller 1 into contact with the cam.

It is desirable to lift the cam follower at the greatest possible speed. To accomplish this and still not interfere with the nicety of operation and control for automatically taking up valve tappet clearance, I provide an auxiliary outlet from beneath plunger 13 to chamber 20 whereby when this chamber is open to exhaust through pipe 26, fluid will first flow downwardly past check valve 23 to allow plunger 13 to move downwardly a short distance until annular spool 33 on the plunger uncovers a port 34. Fluid will then flow rapidly from beneath plunger 13 through an axial port 35 and radial ports 36 to an annular plunger chamber 37 and thence out

through port 34 to chamber 20 and exhaust passage 26 thereby to increase the speed with which spring 15 can lift sleeve 2. On the other hand, when fluid pressure is admitted from tank 19 to chamber 20 to restore contact of roller 1 with the cam, fluid pressure will flow not only upwardly past check valve 23 but also rapidly through port 34 until this latter port is covered by spool 33. This insures rapid restoration of contact of the follower roller with the newly selected set of cams.

The foregoing structure and mode of operation will not interfere in any way with the valve tappet clearance take up operation. During the take up operation, if valve tappet clearance should develop the constant upwardly biasing force of spring 11 will push plunger 13 and valve rod 8 upwardly to take up the clearance, and this will be accompanied by flow of fluid from chambers 20 and 22 upwardly past check valve 23 to become trapped beneath plunger 13. This trapped fluid cannot escape downwardly past the check valve and thus the equivalent of a solid link is created from roller 1 through body 14 and thence to the trapped fluid beneath plunger 13 to operate push rod 8. This operation is well known in the art as is also the fact that the spring 11 exerts a force far less than the force of the usual valve spring.

As a result of my improved structure and mode of operation, it is seen that the cam follower roller may be lifted rapidly and positively and yet be controlled with a high degree of precision through operation of piston 27 and its pin 29. The structure for accomplishing this improved result is relatively simple and compact and economical in construction, operation and maintenance with no additional moving parts other than what are already embodied in said Essl invention. Any tendency towards leakage upwardly past plunger 13 is immediately accompanied by admission of compensating fluid upwardly past check valve 23. As a result of being able to compensate for such leakage, it is seen that the use of a port such as 34 does not in any way limit the effectiveness of the device for taking up valve tappet clearance.

It will of course be understood that various changes in details of construction and arrangement of parts may be made by those skilled in the art without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. A control device for a reversing mechanism for internal combustion engines of the type having a valve selectively operated by forward or reverse sets of cams on a camshaft which is axially shiftable to bring either set of cams into operation comprising, in combination, a push rod structure adapted to be operated by one or the other of said sets of cams, means for collapsing said push rod structure so as to move a portion thereof out of operative relation to said cams thereby allowing said camshaft to be shifted axially to bring either set of cams into operative relation with the push rod structure, and means for accelerating the rate of collapse of said push rod structure automatically in response to initial operation of said collapsing means.

2. A control device for a reversing mechanism for internal combustion engines of the type having a valve selectively operated by forward or reverse sets of cams on a camshaft which is axially shiftable to bring either set of cams into operation comprising, in combination, a push

rod structure adapted to be operated by one or the other of said sets of cams, hydraulically controlled means for collapsing said push rod structure so as to allow said camshaft to be shifted axially to bring one or the other of said sets of cams into operative relation to said push rod structure, and auxiliary means controlled by said hydraulically controlled means for automatically accelerating the collapse of said push rod structure after initial operation of said hydraulic means.

3. The combination in a control device for a reversing device for collapsing a push rod structure of an internal combustion engine comprising, a cam follower sleeve having a cam follower at its lower end, a push rod seat slidably supported on the upper end of said sleeve, a bore located internally of said sleeve, a plunger disposed within said bore for relatively moving said push rod seat and cam follower away from each other, means for moving said sleeve in a direction toward said seat thereby to collapse the push rod structure, means for supplying and controlling pressure fluid to said bore for determining said relative movement between the sleeve and push rod and for exhausting fluid from said bore to effect collapse of the push rod structure, and an auxiliary port normally closed by said plunger and adapted to be opened upon initial collapsing movement of the plunger so as to discharge fluid from said bore to accelerate said collapsing movement.

4. The combination in a control device for a reversing device for collapsing a push rod structure of an internal combustion engine comprising, a cam follower sleeve having a cam follower at its lower end, a push rod seat slidably supported on the upper end of said sleeve, a bore located internally of said sleeve, a plunger disposed within said bore, means including a check valve for supplying pressure fluid to said bore for relatively moving said plunger and bore to maintain the cam follower in its normal operative position, fluid pressure controlled piston for unseating said check valve to allow discharge of fluid from said sleeve to effect initial collapse of the push rod structure, a port in said sleeve normally closed by said plunger but adapted to be open upon initial collapsing of the push rod structure, and means allowing communication between said port and bore after said port is open thereby to increase the rate of discharge of fluid from said cylinder and accordingly accelerate the collapsing of the push rod structure.

5. A control device for a reversing mechanism for internal combustion engines of the type having a valve selectively operated by forward or reverse sets of cams on a camshaft which is axially shiftable to bring either set of cams into operation comprising, in combination, a push rod structure adapted to be operated by one or the other of said sets of cams, means for collapsing said push rod structure so as to move a portion thereof out of operative relation to said cams thereby allowing said camshaft to be shifted axially to bring either set of cams into alignment with the push rod structure and thereafter for restoring the push rod structure to its operative relation with the new cam, and means for accelerating the rate of restoration of said push rod structure automatically in response to initial restoration of said collapsing means.

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