Dec. 8, 1942. J. OLSSON 2,304,472

CONTROL MECHANISM FOR INTERNAL COMBUSTION ENGINES

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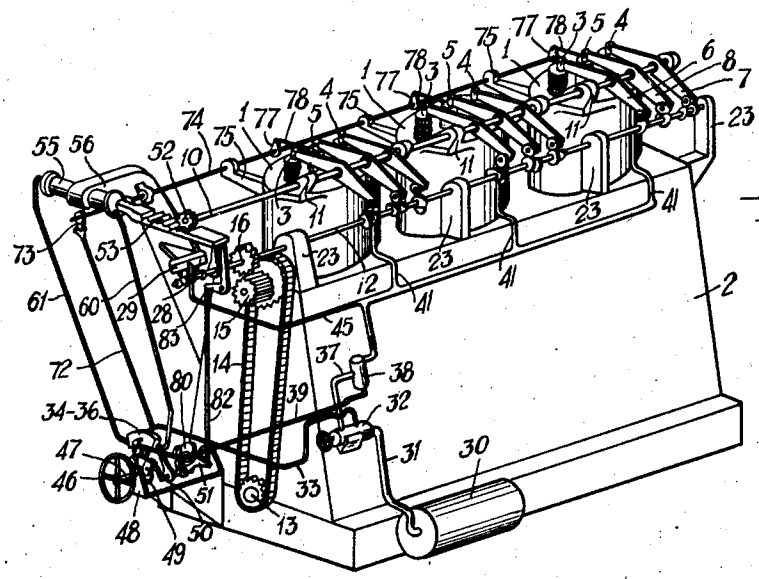

Fig. 1

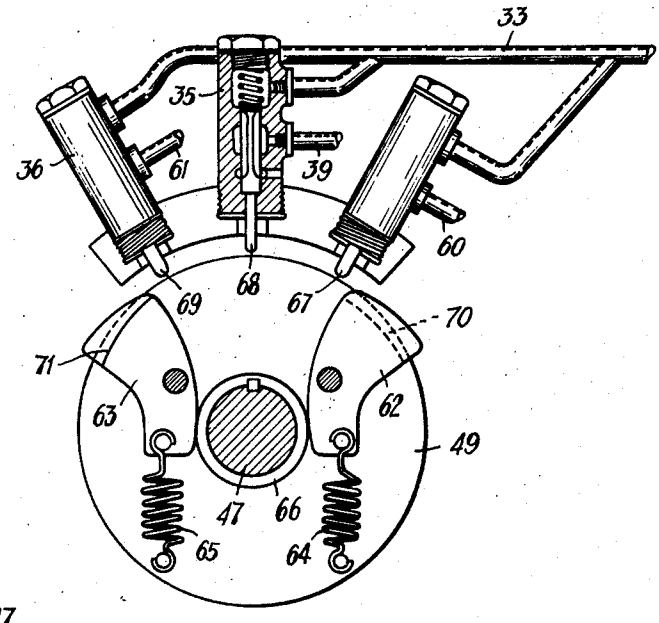

Fig. 3

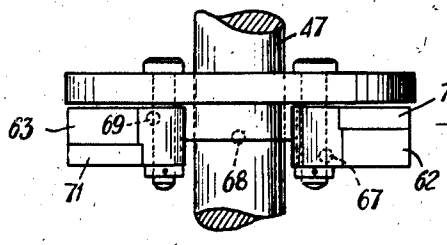

Fig. 4

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Fig. 2

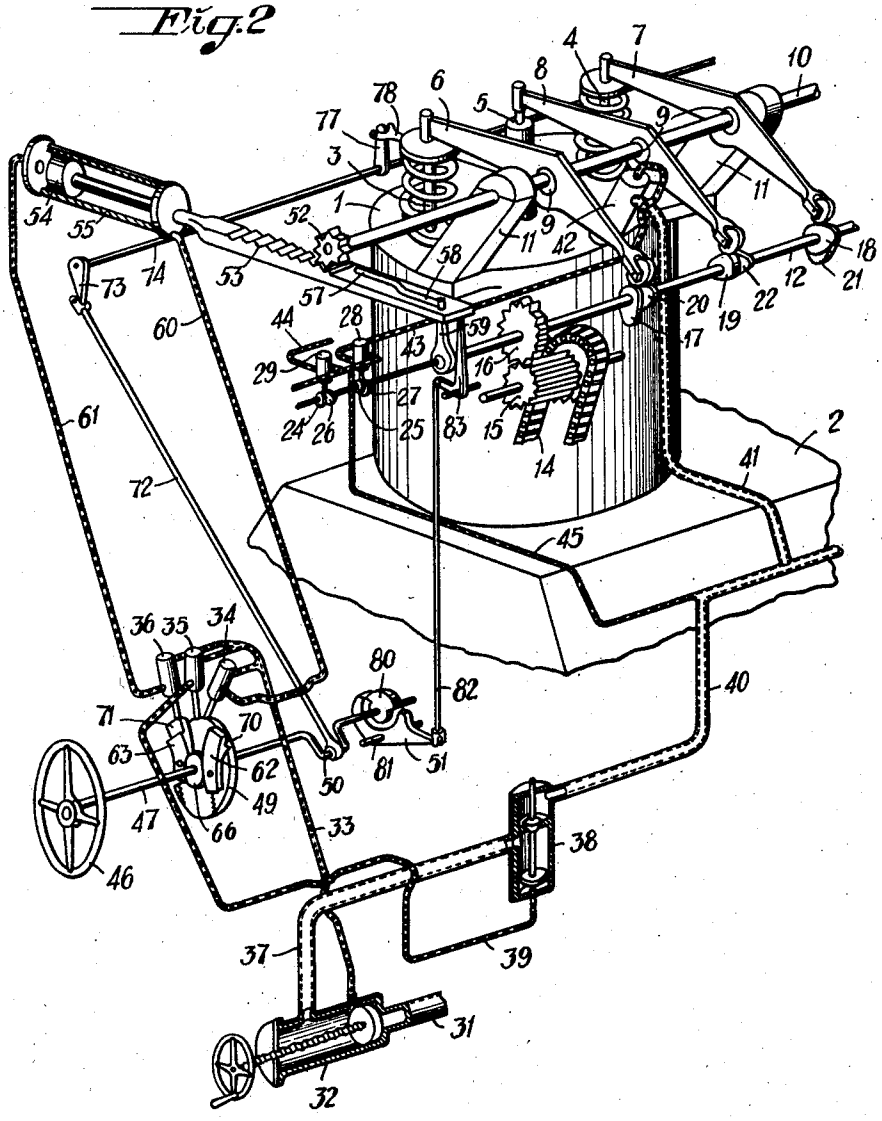

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Fig. 5

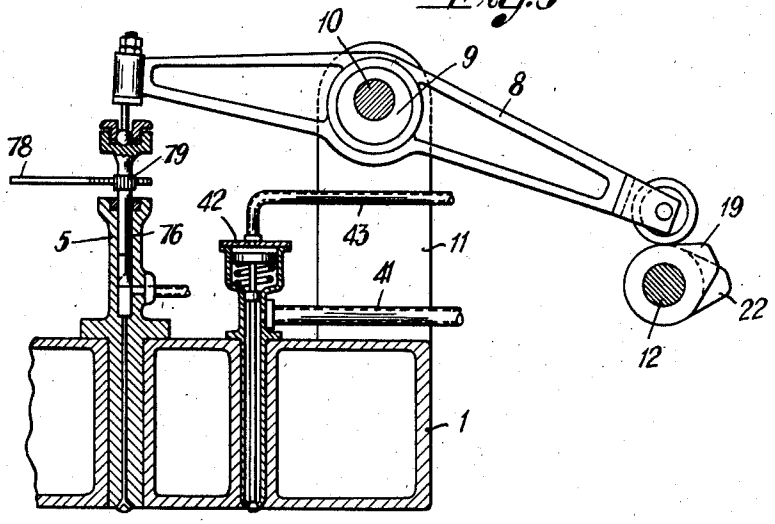
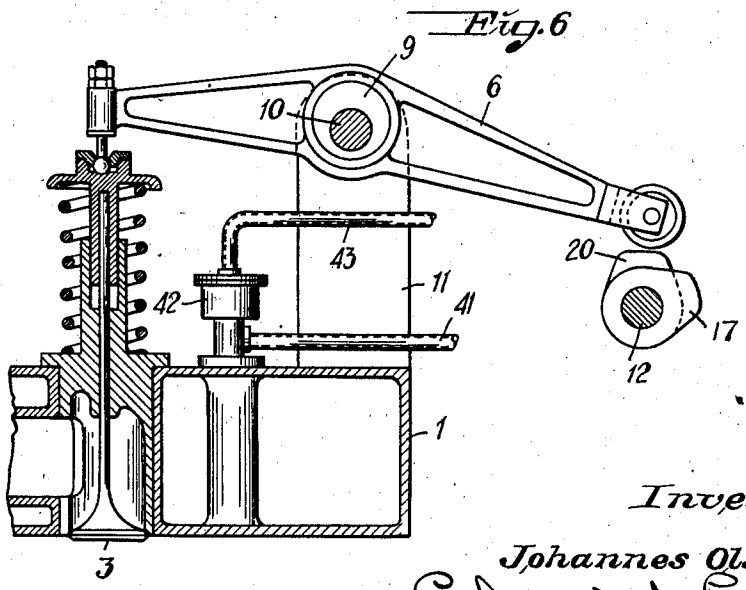


Fig. 6



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CONTROL MECHANISM FOR INTERNAL COMBUSTION ENGINES

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3 Claims. (Cl. 60—16)

This invention relates to reversible internal combustion engines and particularly to control mechanisms for engines of this type having a control member movable at will in two different directions from a neutral position and provided with means for reversing, starting and fuel control for operation ahead or reverse.

The invention is particularly intended for four cycle engines but may also be employed for two cycle engines provided with reversing gears of any kind capable of being set for operation of the engine ahead or reverse. Such gears may, for instance, comprise mechanisms for setting control cams for in- and/or outlet valves, fuel valves, fuel pumps, starting air distributor valves or the like for operation ahead or reverse.

One object of the invention is to provide a simple and reliable mechanism for manipulating the reversing gear of a reversible internal combustion engine by means of pressure medium controlled mechanisms.

For this purpose I provide three pressure medium valves adjacent the control member and connect said valves to the operating gear of the engine in such a manner that actuation of one valve causes the operating gear to be set for operation of the engine ahead, whereas actuation of another valve causes the operating gear to be set for operation of the engine reverse, and that actuation of the third valve, which may be achieved subsequently to the actuation of one of the other valves, causes compressed air to be supplied to starting air valves of the engine.

In the annexed drawings one embodiment of a control mechanism according to the invention is illustrated by way of example.

Fig. 1 is a perspective view of a three cylinder four cycle reversible internal combustion engine according to the invention.

Fig. 2 is a diagrammatic perspective view on a larger scale of the top portion of a cylinder of the internal combustion engine illustrated in Fig. 1 and a portion of the control mechanisms for said engine.

Fig. 3 is a cross section through the control shaft of the engine and illustrates three air valves provided adjacent said shaft and actuating means for said valves.

Fig. 4 illustrates a portion of the control shaft, which carries said actuating means, as viewed from above.

Figs. 5 and 6 illustrate details of the valve gear partly in section,

In the drawings 1 designates the top of the cylinders of a four cycle three cylinder Diesel engine 2. 3 and 4 designate in- and outlet valves, respectively, for the cylinders and 5 fuel injection pumps. Said parts are actuated by rocker levers 6, 7 and 8, respectively, which are journalled on eccentrics 9 carried by a shaft 10, which is mounted in supports 11. A cam shaft 12 driven from the main shaft 13 of the engine by means of a chain transmission 14 and gear wheels 15, 16 is provided with two sets of cams 17, 18, 19 and 20, 21, 22, one of which is intended for operation of the rocker levers upon operation ahead and the other upon operation reverse. The cam shaft 12 is mounted in bearings 23 and carries two further sets of cams 24, 25 and 26, 27, which are adapted to actuate starting air distributors 28, 29 for controlling the starting air supply to the engine cylinders upon starting ahead or reverse.

Compressed air is supplied to the engine from a source of compressed air 30 through a conduit 31 over a main valve 32, from which a conduit 33 leads to three valves 34, 35 and 36 and another conduit 37 to a pilot valve 38. When the main valve 32 is opened, compressed air is at first admitted to the conduit 33 and then to the pilot valve 38, which is kept open or closed according to the actuated or non-actuated position of the valve 35. For this purpose the valve housing of the pilot valve 38 is connected to the valve housing of the valve 35 by means of a conduit 39. From the valve 38 a conduit 40 and branch conduits 41 lead to starting air valves 42 of conventional type at the engine cylinders. The opening and closing of the starting air valves is controlled in known manner by means of compressed air, which according to the actuated or non-actuated position of the starting air distributors 28, 29 open or close the starting air valves. For this purpose the starting air distributor 28 is connected with the starting air valve 42 through a conduit 43, whereas the starting air distributor 29 through a conduit 44 is connected to another starting air valve at another engine cylinder, which is not illustrated in Fig. 2. Compressed air is supplied to the starting air distributors through a conduit 45 connected with the conduit 40.

For operation of the engine a control wheel 46 and a control shaft 47 are provided, said shaft being mounted in bearings 48 and carrying means 49 for reversing the engine and for starting the engine ahead or reverse according to the turning of the control wheel 46 in one direction or the other, means 50 for controlling the fuel supply upon operation ahead or reverse according to the degree of turning of the control wheel 46 in one direction or the other, and means 51 for blocking

the turning movement of the control shaft 47 in a direction corresponding to a direction of rotation of the engine contrary to the momentary direction of rotation.

The illustrated engine is reversed by momentarily bringing the rocker levers out of engagement with one set of the cams of the cam shaft 12, displacing the cam shaft longitudinally and bringing the rocker levers into engagement with the other set of cams. For this purpose the shaft 10 is provided with a toothed gear 52 meshing with a toothed rack 53, which at one end forms a piston rod and a piston 54 displaceable in a servo motor cylinder 55 carried by a support 56. The other end of the toothed rack 53 is provided with a guide groove 57, 58 engaged by one end of an arm 59 secured on the cam shaft 12. In Figs. 1 and 2 the cam shaft 12 is illustrated in the left position of displacement, in which the right hand cam of each pair of cams is in operative position and the arm 59 engages the extreme portion of the groove 58 in the toothed rack 53. Upon displacement of the toothed rack from this position the toothed gear 52 and the shaft 10 are at first turned half a turn so that the eccentrics 9 are turned to the position illustrated in Fig. 6, in which the rocker levers are raised out of engagement with the cams of the cam shaft leaving the cam shaft free to be displaced in longitudinal direction. Upon further displacement of the toothed rack the arm 59 moves from the groove 58 to the groove 57 causing simultaneously a displacement of the arm 59 and the cam shaft 12 to the right in Figs. 1 and 2 so that the cams 17, 18, 19 register with the rocker levers 6, 7, 8. Upon further displacement of the toothed rack 53 the eccentrics 9 are turned a further half turn so that the rocker levers 6, 7, 8 are lowered into engagement with the cams 17, 18, 19 whereas the arm 59 is not more actuated.

Air conduits 60, 61 are provided at the ends of the cylinder 55, said air conduits being connected each per se to the valves 34 and 36, respectively, and adapted according to the actuation of one of these valves or the other to admit compressed air to one end or the other of the cylinder 55 causing the piston 54 and the toothed rack 53 to be displaced in one direction or the other.

The starting and reversing means 49 provided on the control shaft 47 and illustrated on a larger scale in Figs. 3 and 4 comprises a disk wedged onto the shaft 47 and carrying two cams 62 and 63, which are pivotally mounted on said disk and are normally held in the position illustrated in Figs. 1, 2 and 3 by comparatively soft springs 64, 65. The ends of the cams connected with the springs are prevented from swinging towards the center of the control shaft 47 by a boss 66. The valves 34, 35, 36 are provided with valve stems 67, 68, 69 and the cams 62, 63 with recesses 70, 71 disposed in such a manner that the cam 63 upon turning of the control shaft 47 in clockwise direction actuates the valve stems 69 and 68 in this mentioned sequence so that, if the main valve 32 is completely open, compressed air is at first admitted to the cylinder 55 through the conduit 61 and moves the piston 54 to the right in Figs. 1 and 2 and subsequently to the pilot valve 33, which opens the compressed air supply to the starting air valves 42 causing the engine to start and to be operated on the starting air. Upon continued turning of the control shaft 47 in clockwise direction the cam 63 passes the valve stem 67 without actuating said valve stem, since the valve stem 67 registers with the recess 71, as illustrated in Fig. 4, in which the positions of the valve stems 67, 68 and 69 are indicated in dotted lines. When the control shaft is returned to the neutral position illustrated in Fig. 3 the cam 63 strikes the valve stems without displacing them, since the cam upon passage of the valve stems is swung away against the action of the soft spring 65. When the control shaft is turned in anticlockwise direction the cam 62 actuates in sequence the valve stems 67 and 68 causing compressed air to be admitted to the right end of the cylinder 55 so that the piston 54 and the toothed rack 53 are displaced to the left in Figs. 1 and 2, in case they are not already in this position, and the engine is started in opposite direction to the one described hereinabove.

Fuel control is obtained by turning the control wheel 48 in one direction or the other past the starting positions. For this purpose a connecting rod 72 is journalled on the crank 50 and connected with an arm 73 secured to a shaft 74 mounted in bearings 75, said shaft upon turning of the control wheel in one direction or the other being always turned the same way and thereby in a manner known per se changes the fuel quantity supplied by the pistons 76 of the fuel pumps 5, for instance by changing the effective length of the pump stroke. The shaft 74 for this purpose carries levers 77, which by means of toothed racks 78, Figs. 1, 2 and 5, and a toothed portion 79 on the piston 76 are capable of turning said piston and thereby changing the length of the effective stroke of the fuel pump.

The blocking device 51 may be of any well known construction and may, for instance, as indicated in Figs. 1 and 2, comprise a cam 80 provided on the shaft 47 and cooperating with the swingable blocking member 51, which is journalled on a shaft 81 and adapted to take two different turning positions and which in one of these positions prevents turning of the control shaft to the left and in the other position to the right, as illustrated in Figs. 1 and 2, one of the abutments of the blocking member 51 being always in the path of the cam 80. The blocking member 51 is connected by means of a rod 82 to one arm of a pivotally mounted bell crank lever 83, the other arm of which is connected with the toothed rack 53 so that said arm follows the movements of the toothed rack. Consequently, the toothed rack 53 upon displacement in one direction or the other swings the bell crank lever 83 in one direction or the other and thereby moves the blocking member 51 into position for blocking the turning of the control shaft 47 in one direction or the other.

The control mechanism above described should only be considered as an example and the invention is not limited to the illustrated embodiment but may naturally be modified in several different ways within the scope of the claims. For instance, the fuel control devices may be of any other well known type than the illustrated, and similarly the blocking means for preventing not desired movements of the control wheel or the like may be of any other known type. The operating gear of the engine and the reversing gear may also be of any known construction. Thus, instead of the displaceable cam shaft the servo motor 55 or another means actuated and displaced due to the actuation of the valves 34, 35, 36 may be provided for reversing the engine, for instance a mechanism, in which the cams of the cam shaft in a manner known per se are disengaged and displaced and locked again upon a

change of the direction of rotation of the engine.

What I claim is:

1. In a reversible internal combustion engine, an operating gear capable of being set for operation of the engine ahead or reverse, respectively, a control member movable at will in two different turning directions from a neutral position, three pressure medium valves disposed adjacent said control member and connected with said operating gear, a cam on the control member capable of actuating one of said valves upon turning of the control member in one direction only from said neutral position thereby causing the operating gear to be set for operation of the engine ahead, a second cam on the control member capable of actuating another one of said valves upon turning of the control member in opposite direction only from said neutral position thereby causing the operating gear to be set for operation of the engine reverse, both cams being capable each per se to subsequently actuate said third pressure medium valve upon continued turning of the control member in the particular turning direction thereby causing compressed air to be supplied to starting air valves at the engine for starting the engine ahead or reverse, respectively.

2. In a reversible internal combustion engine, an operating gear capable of being set for operation of the engine ahead or reverse, respectively, a control member movable at will in two different turning directions from a neutral position, three pressure medium valves disposed adjacent said control member and connected with said operating gear, a cam pivotally mounted on the control member and capable of actuating one of said valves upon turning of the control member in one direction only from said neutral position thereby causing the operating gear to be set for operation of the engine ahead, a second cam pivotally mounted on the control member and capable of actuating another one of said valves upon turning of the control member in opposite direction only from said neutral position thereby causing the operating gear to be set for operation of the engine reverse, both cams being capable each per se to subsequently actuate said third pressure medium valve upon continued turning of the control member in the particular turning direction thereby causing compressed air to be supplied to starting air valves at the engine for starting the engine ahead or reverse, respectively.

3. In a reversible internal combustion engine, an operating gear capable of being set for operation of the engine ahead or reverse, respectively, a control member movable at will in two different turning directions from a neutral position, a pressure medium valve causing upon actuation setting of said operating gear for operation of the engine ahead, a second pressure medium valve causing upon actuation setting of the operating gear for operation the engine reverse, starting air valves at the engine, a third pressure medium valve causing upon actuation compressed air to be supplied to said starting air valves at the engine for starting the engine ahead or reverse, respectively, a disk secured on said control member, a cam pivotally mounted on said disk and registering with said first and third pressure medium valves and capable of actuating said valves in sequence upon turning of the control member in one direction only from said neutral position thereby causing the operating gear to be set for operation of the engine ahead and starting air to be supplied for starting the engine ahead, and a second cam pivotally mounted on the disk and registering with said second and third pressure medium valves and capable of actuating said valves in sequence upon turning of the control member in opposite direction only from the neutral position thereby causing the operating gear to be set for operation of the engine reverse and starting air to be supplied for starting the engine reverse.

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