K. STEINBECKER.

VALVE GEAR FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED MAR. 13, 1912.

1,080,495. Patented Dec. 2, 1913.

Fig. 1.

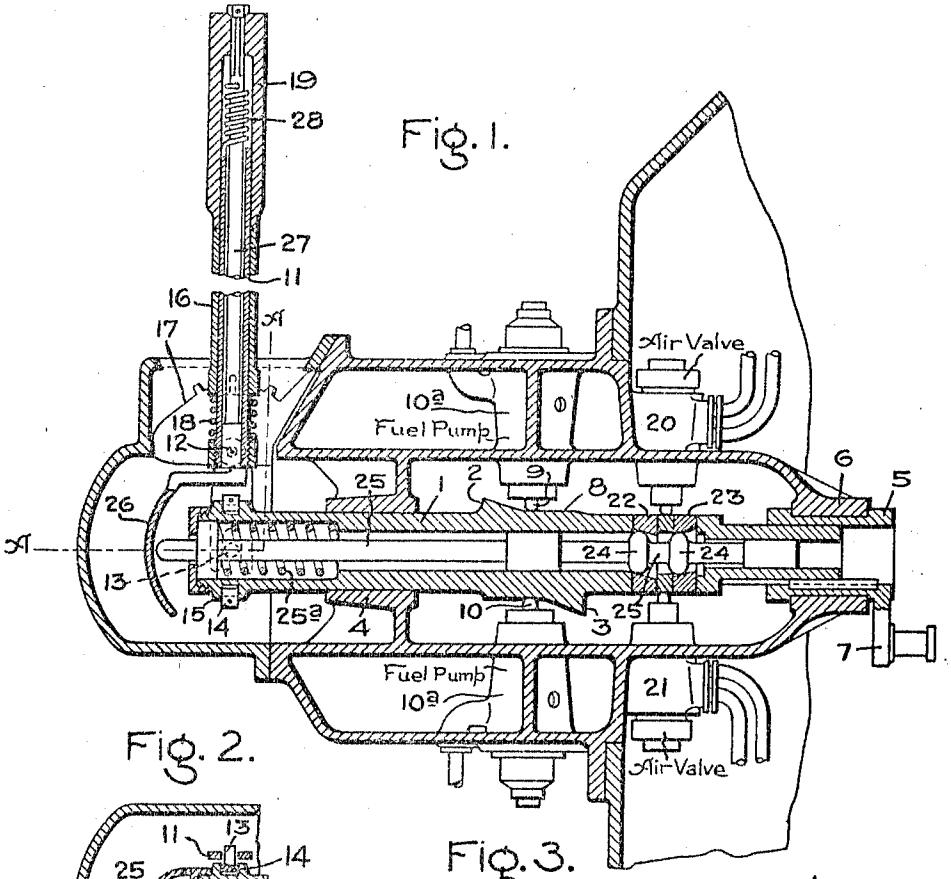


Fig. 2.

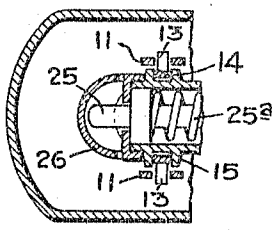


Fig. 3.

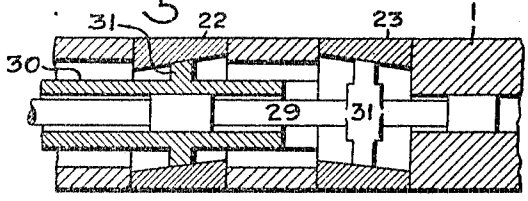


Fig. 5.

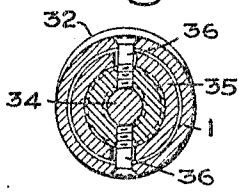
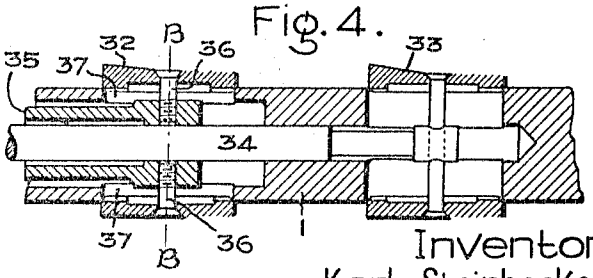


Fig. 4.



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UNITED STATES PATENT OFFICE.

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VALVE-GEAR FOR INTERNAL-COMBUSTION ENGINES.

1,080,495. Specification of Letters Patent. Patented Dec. 2, 1913.

Application filed March 13, 1912. Serial No. 683,500.

To all whom it may concern:

Be it known that I, KARL STEINBECKER, subject of the King of Prussia, residing at Charlottenburg, Germany, have invented certain new and useful Improvements in Valve-Gears for Internal-Combustion Engines, of which the following is a specification.

This invention relates to internal combustion engines of the type in which a liquid combustible is fed into the working cylinder together with a charge of compressed air, the resulting mixture being ignited by the heat due to the high compression in said cylinder. Valve gear for such engines has been heretofore devised in which, upon a hollow shaft provided with fixed cams for operating the inlet valves for the combustible, auxiliary cams are provided which are brought into temporary engagement with the admission valves for the compressed air, the shifting of the auxiliary cams being effected by a rod which is axially adjustable in the shaft. Furthermore, a reversing arrangement for internal combustion engines to be started by compressed air has been proposed in which cams that are rotatable in planes perpendicular to a hollow shaft are actuated by wedge members on a rod which is axially adjustable in the shaft. These constructions have the disadvantage that the actuation of the cams can be effected only in an exactly fixed sequence, so that without providing special handles a selective movement of certain cams into operative position is impossible.

The present invention aims to make it possible to secure a mutual independence of the individual cams by so constructing and arranging their actuating members that they will be capable of longitudinal movement either simultaneously or in any desired combination.

By this construction, one power producing means may be substituted for another, or one direction of rotation may be changed to the other.

In the accompanying drawing, Figure 1 shows a longitudinal section through a starting and reversing device for internal combustion engines of the type named, having cams which are adjustable in part axially and in part radially; Fig. 2 is a cross section on the line A—A, Fig. 1; Fig. 3 shows a modification in which the cams are movable radially only; Fig. 4 is another modification in which the cams are movable longitudinally only, and Fig. 5 is a cross section on the line B—B, Fig. 4.

Referring first to Figs. 1 and 2, the tubular shaft 1 is provided with the cams 2, 3 for forward and backward rotation respectively. This shaft can be slid lengthwise in the journal bearing 4 and in the sleeve 5 to which it is splined; said sleeve being journaled in a suitable bearing 6, so as to be capable of rotation. By means of a crank 7 on said sleeve movement is imparted to the shaft from the engine. The cams 2, 3 are arranged on either side of a cylindrical portion 8 of the shaft, which forms a neutral or non-operating section on which the pump actuating rollers 9, 10 rest when the machine is not running, or when making the transition from forward to backward motion. The rollers 9, 10 and their attached rods operate the pumps 10^a, of which two are shown, said pumps forcing the liquid combustible to the cylinders of the engine. The axial movement of the shaft 1 in order to bring either the cam 2 or the cam 3 into operation is effected by means of a main oscillating or rocking lever 11 fulcrumed at 12. The lower end of the lever is forked and engages with lateral pivots 13 on a sleeve 14 mounted on the shaft between the collars 15. The lever is tubular and carries a sleeve 16 provided with a latch which coöperates with a notched quadrant 17 to lock the lever in three positions corresponding to the forward and backward running positions of the machine and its intermediate or neutral non-running position. A spring 18 keeps the latch removably engaged with the notches in the quadrant. The sleeve 16 can be slid lengthwise on the lever to disengage the latch, by means of a tubular handle 19 telescoping on the upper part of the lever 11, and abutting on the upper end of the sleeve.

At 20, 21 are the two valves which control the admission of compressed air to the engine cylinder for starting, one valve being used for running forward and the other for reversing. To operate the proper valve, two cams 22, 23 are mounted in recesses in the shaft 1, said cams being capable of movement transverse to said shaft. Normally, their outer surfaces lie flush with that of the shaft so that the valves 20, 21 will not be operated when the shaft is shifted longi-

tudinally. In order to thrust the cams outwardly into operative position, their inner surfaces are made oblique and are engaged by wedge members 24 on a rod 25 running lengthwise through the shaft 1. From an inspection of Fig. 1 it will be seen that when this rod is moved to the right the cams 22, 23 will be forced radially outward in opposite directions. The movement of this rod is effected by a peculiarly shaped actuator 26 attached to a spindle 27 rotatable in the tubular lever 11 and splined to the handle 19. A torsion spring 28 returns the spindle to its normal or initial position after it has been rotated by a twist of the handle. The shape of the actuator is such that the rocking movement of the lever 11 does not affect the rod 25, but a turn of the spindle 27, in any position of the lever, will cause the actuator to give the rod a longitudinal thrust. To state the matter another way the actuator 26 is provided with a curved surface that faces the end of the rod 25, and is in line therewith, Fig. 1, said face being struck from a center located at the intersection of the axis of the pivots 13 and that of the rod 25. From this it follows that rocking movements of the lever 11 will swing the part 26 in the arc of a circle and hence its relation to the end of the rod 25 will be preserved at all times under such movement. On the other hand if the rod 27 is twisted irrespective of the position of the lever, the rod 25 will be given an axial movement. This latter action is due to the fact that the sides of actuator 26, as viewed in Fig. 2, forms a cam whose center of generation does not coincide with the center upon which the vertical portion is formed as above referred to.

When the engine is at rest, the shaft 1 is held in its neutral position with the cylindrical portion 8 in the plane of the pump rod rollers 9, 10 and the cams 22, 23 on either side of the rollers on the stems of the valves 20, 21; said cams lying flush with the surface of the shaft. In order to start the engine, the lever 11 is thrown one way or the other far enough to bring one of the cams 22 or 23 into line with the stems of the valves 20, 21. The handle 19 is then twisted to cause the wedge members 24 to force out these cams and open one of the air valves to admit air to an engine cylinder and start the engine. The length of the cylindrical portion 8 is great enough to permit this action to occur without bringing either of the cams 2, 3 into operation, if so desired. When the engine has been started by the compressed air, the shaft 1 may be shifted still farther to cause one of the cams 2, 3 to pump the combustible; the supply of compressed air being shut off by allowing the spring 28 to return the actuator 26 to its normal or initial position and permitting the spring 25a to withdraw the rod 25 and retract the cams, 22, 23 into the shaft. If desired, the shaft may be shifted far enough at starting to cause the cams 2, 3 to admit a small charge of combustible with the compressed air. In order to stop the engine, it is sufficient to return the lever 11 to its central or neutral position. If it is desired to produce a braking effect, the shaft 1 may be shifted in the opposite direction to cause the cam controlling the reversing air valve to come into operative position, and admit air to the cylinder.

In the modification shown in Figs. 3 and 4 the main shaft 1 is not longitudinally adjustable. The reversing cams 22, 23 in Fig. 3 are radially movable, the same as in Fig. 1, but they are separately actuated by the rod 29 and the sleeve 30 co-axially mounted and each provided with a wedge member 31 acting upon its respective cam.

In Fig. 4 the cams 32, 33 are movable lengthwise on the exterior of the shaft 1 by means of the rod 34 and the sleeve 35 respectively, connected with said cams by the transverse pins 36 playing in longitudinal slots 37 in the shaft 1.

In all these devices, the reversing cams are first brought into operative position by the common movement of all the parts, whereupon, by the actuation of one or more of said parts independently the cam or cams corresponding therewith are brought into working position. After previous adjustment of the cams, a reversal may be effected by the simultaneous shifting of all the parts. It is evident that the number of the cams is immaterial.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In an internal combustion engine, the combination of a pump for supplying fuel thereto, a valve for controlling the admission of fluid thereto for starting, a hollow shaft that is common to the pump and valve and carries sets of forward and reverse cams for actuating the pump and valve, means for moving the shaft longitudinally to move all the corresponding cams into operative position, and means located within the shaft and acting independently thereof to put one set of cams into and out of operation.

2. In an internal combustion engine, the combination of a hollow shaft having fuel and starting cams, a casing in which the

shaft is supported, a fuel pump supported by the casing and in alinement with the fuel cam, a starting valve also supported by the casing and in alinement with the starting cam, a means extending into the shaft for moving the starting cam into and out of action, and a device for actuating said means.

3. In an internal combustion engine, the combination of a hollow shaft having sets of fuel and starting cams arranged for forward driving and reversing, a casing for the shaft, a pair of oppositely disposed fuel pumps carried by the casing and registering with the fuel cams, a pair of oppositely disposed valves carried by the casing and registering with the starting cams, a lever for moving the shaft axially to cause one fuel cam or the other to register with the pumps and also to move the corresponding starting cam into register with the valves, a means extending into the shaft and movable longitudinally therein for moving the starting cams into operative relation to the valves, and means for rotating the shaft.

4. In an internal combustion engine, the combination of a longitudinally movable and rotatable shaft, a set of normally inactive cams driven by the shaft which are movable radially thereon, a rod in said shaft, wedges in the shaft for moving the cams radially that are actuated by the rod, valves arranged to coöperate with and be actuated by said cams, a second set of normally active cams mounted on the shaft and rotated thereby, members coöperating with and actuated by said second set of cams, a lever for moving the shaft axially to position the first named cams and to move the second set of cams into operative relation to said members, and an actuator for moving the rod in a manner to cause said wedges to move the first named cams into operative relation with the coöperating valves.

5. In an internal combustion engine, the combination of a longitudinally movable and rotatable shaft, a set of normally inactive cams driven by the shaft which are movable radially thereon, a rod in said shaft, wedges in the shaft for moving the cams radially that are actuated by the rod, valves arranged to coöperate with and be actuated by said cams, a second set of normally active cams mounted on the shaft and rotated thereby, members coöperating with and actuated by said second set of cams, a tubular lever for moving the shaft axially to position the first set of cams and to move the second set of cams into operative relation to said members, and an actuator located in the lever for moving said wedges in a manner to force said first set of cams into coöperative relation with the valves.

In witness whereof, I have hereunto set my hand this 21st day of February, 1912.

KARL STEINBECKER.

Witnesses:
HENRY HASPER,
WOLDEMAR HAUPT.