

R. McKEE.
EXPLOSIVE ENGINE.
APPLICATION FILED MAR. 19, 1909.

1,061,308.

Patented May 13, 1913.
2 SHEETS—SHEET 1.

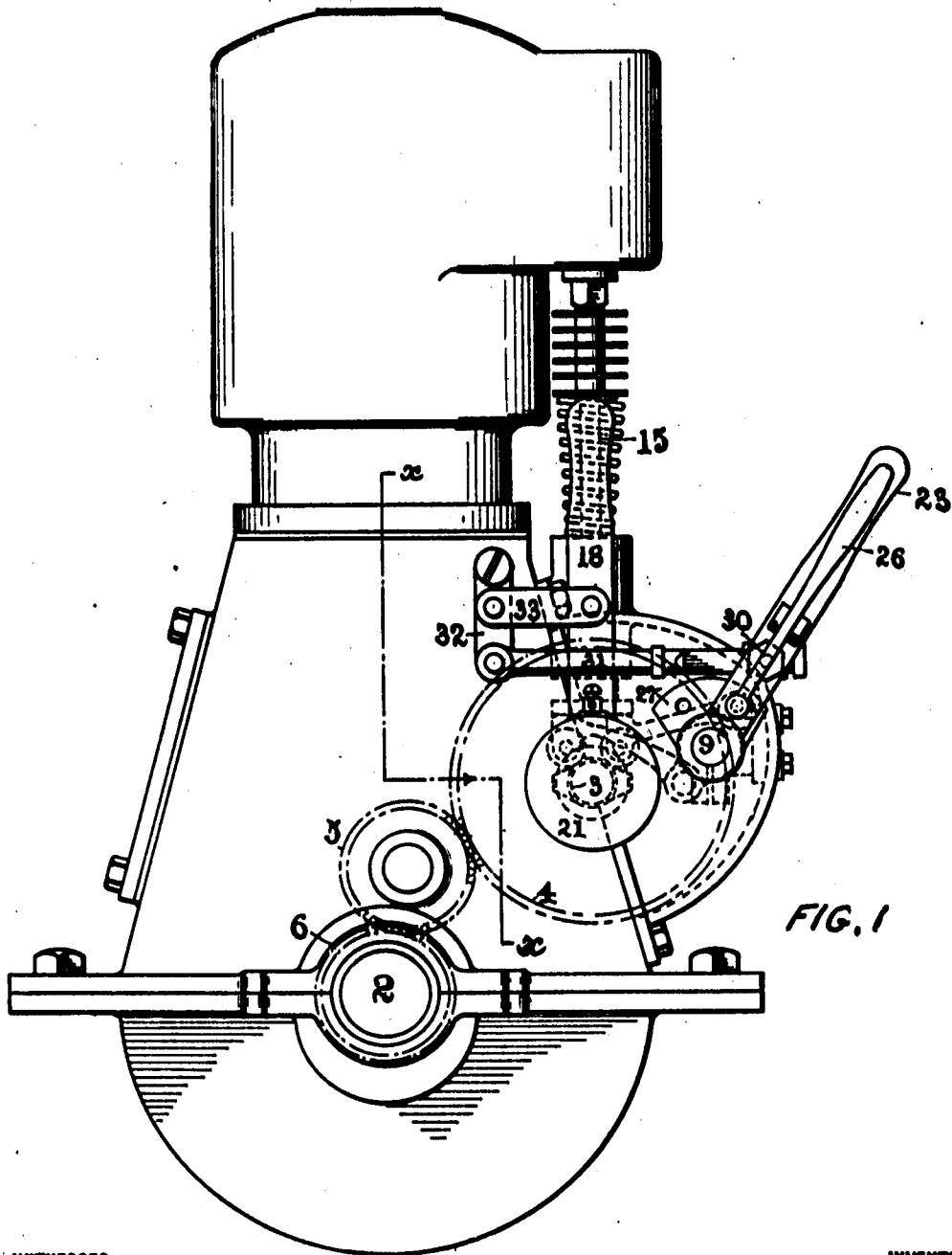


FIG. 1

WITNESSES

Daniel Webster, Jr.
A. M. Kelly.

INVENTOR

Robert McKee
BY *[Signature]*
ATTORNEY

B. McKEE.
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2 SHEETS-SHEET 2.

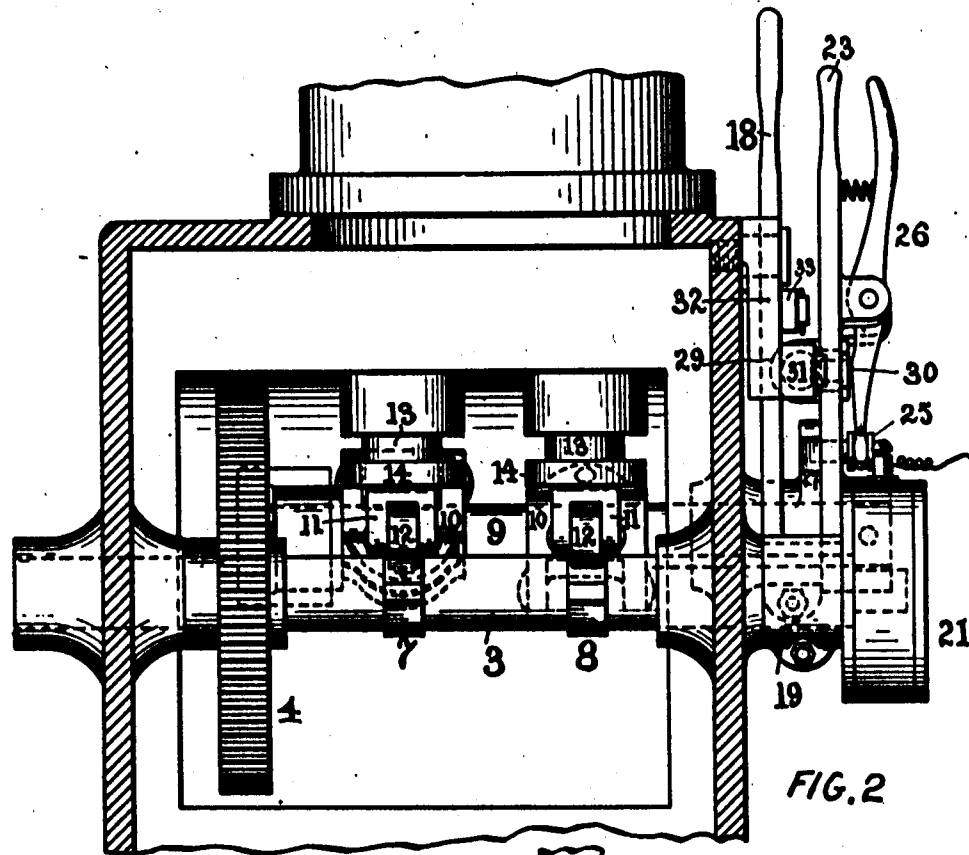


FIG. 2

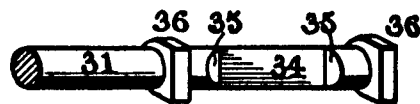


FIG. 5

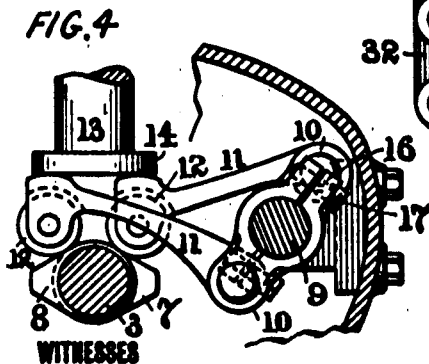


FIG. 4

WITNESSES

Daniel Webster, Jr.
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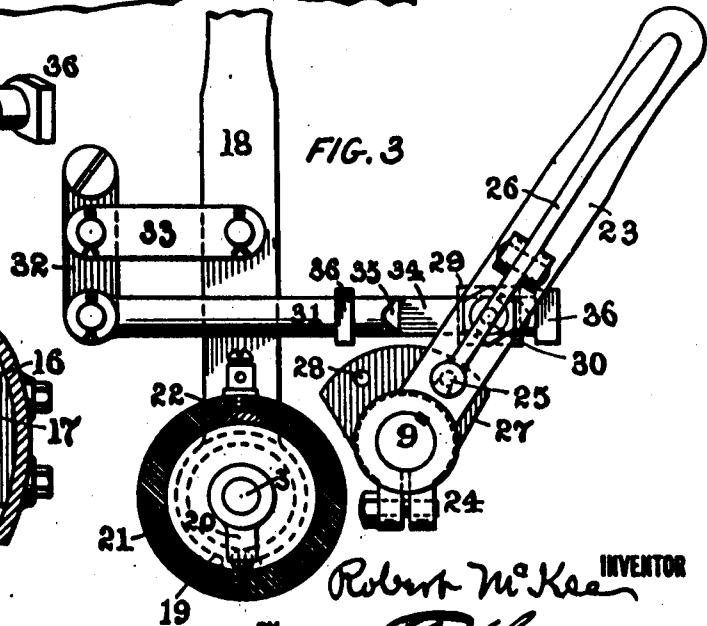


FIG. 3

Robert McKee INVENTOR

BY

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UNITED STATES PATENT OFFICE.

ROBERT McKEE, OF PHILADELPHIA, PENNSYLVANIA.

EXPLOSIVE-ENGINE.

1,061,308.

Specification of Letters Patent.

Patented May 13, 1913.

Application filed March 19, 1909. Serial No. 484,364.

To all whom it may concern:

Be it known that I, ROBERT McKEE, a citizen of the United States, and resident of the city and county of Philadelphia, State of Pennsylvania, have invented an Improvement in Explosive-Engines, of which the following is a specification.

My invention has reference to explosive engines and consists of certain improvements which are fully set forth in the following specification and shown in the accompanying drawings which form a part thereof.

The object of my invention is to provide means for reversing an explosive engine so that it may be directly used for forward or backward running and dispense with reversing gearing in the power transmitting devices.

My object is also to so construct the reversing devices that the engine may be reversed without being brought to a condition of rest.

My invention consists of the usual rotating cam shaft having supply and exhaust cams, combined with operating heads for the intake and exhaust valves, lifters interposed between the cams and operating heads, and means for shifting the said lifters to change the lead of the cams upon the operating heads; further in the foregoing features when combined with means for automatically adjusting the igniting devices to change the time of ignition to suit the reversed operation of the engine; further in the foregoing features when combined with hand lever devices and connecting means whereby the act of advancing the time of ignition also adjusts the lifters to change the leads of the operating cams for the intake and exhaust valves.

More generally considered, my invention consists of an explosive engine having the usual cam shaft and cams for operating the intake and exhaust valves or either of them combined with means, independent of the cam shaft and its operative gears, for changing the lead or time of action of the cam or cams upon the valve or valves.

My invention also comprehends details of construction which, together with the features above specified, will be better understood by reference to the drawings, in which:

Figure 1 is a side elevation of an explosive engine embodying my invention; Fig. 2 is a sectional elevation of a portion of the same on line $x-x$; Fig. 3 is an enlarged view

of the reversing hand operated devices shown in Fig. 1; Fig. 4 is a cross section through the cam shaft and the means for adjusting the lifters; and Fig. 5 is a perspective view of the connecting link between the reversing levers.

The general construction of the explosive engine may be of any character desired.

My improvements are specially designed for changing the lead of the cams for operating the valves and also for changing the time of ignition, and preferably so that both of these operations take place by the same hand manipulation.

Referring more particularly to the drawings, 2 represents the main crank shaft which is rotated by the usual pistons and connecting rods.

3 is the cam shaft and this is positively geared with the crank shaft by means of supporting gearing 4, 5 and 6. It is immaterial what form of gearing connects the shafts 2 and 3 so long as the shaft 3 is made to rotate relatively to the crank shaft 2 always the same, that is to say, if the shaft 3 rotates to the right when the crank shaft 2 is rotated to the right, then when the crank shaft 2 is reversed, the cam shaft 3 will also be reversed. Moreover, it is not intended that there shall be any change in the power transmitting connections between the shafts 2 and 3 so far as my invention is concerned. The cam shaft 3 is provided with cams 7 and 8 arranged 180 degrees apart and one of said cams may operate the exhaust valve and the other the intake valve.

15 represents one of the valve operating rods and may be made of any ordinary construction, the particular form of the valve being immaterial. 13 represents operating heads for moving the exhaust and intake valves said heads being guided vertically in the main frame or casing of the engine. The lower ends of these operating heads are preferably enlarged by flanges 14.

11 are lifters which are provided at their free ends with rollers 12 which engage the cams 7 and 8. The upper portions of these lifters immediately above the rollers operate upon the flanged lower portions 14 of the operating heads 13 for the valves. These lifters 11 are respectively hinged to arms 10 which are adjustably clamped upon a rock shaft 9 journaled in the casing of the engine. There are two arms 10, one for each of the lifters 11 and said arms are secured to the

rock shaft 9 on directly opposite sides. These arms 10 are split at 16 and provided with clamping screws 17 by which they may be adjusted circumferentially and longitudinally upon the rock shaft 9.

From an examination of Fig. 4 it will be seen that when the rock shaft is in the position shown one of the lifters is thrust forward and the other backward so that the rollers of the two lifters are arranged about 90 degrees apart with reference to the cam shaft 3. In this position it will be observed that one of the cams just leaves the lifter as the other cam begins to operate upon its lifter, so that at no time will both valves be open during the normal running of the engine. By rocking the shaft 9, it is evident that the positions of the lifters may be reversed and this will change the angular difference in the operation of the cams 90 degrees which would be necessary for reversing the engine. As the upper portion of the lifters always operates upon the flat under surface of the heads 13, it is immaterial in which position the lifters are placed. The upper parts of the lifters which engage with the heads 13 are made somewhat rounded so that when the lifters are rocked in changing their positions they will not objectionably disturb the heads. The end of the rock shaft 9 is secured to a hand lever 23 by which it may be rocked. This hand lever is provided with a latch lever 26 which operates a locking pin 25 carried by the hand lever and adapted to engage holes 28 in an adjustable bracket 27 which may be adjustably clamped upon the hub of the bearing of the shaft 9 on the casing by means of the clamp 24. In this manner the bracket may be adjusted to the proper position to insure the proper rocking of the shaft 9. Hinged to the hand lever 23 is a block 29 through which the cam link 31 passes said rod having stops 36 between which the block 29 may play and which are adapted to be struck by the said block for shifting the rod 31. The end of the link 31 is pivoted to a hinged arm 32 which is connected by a link 33 with a second hand lever 18. The hand lever 18 is frictionally clamped upon the hub or bearing of the shaft 3 by means of a clamp 19 and said arm carries the contact box 21 having the contact 22 of the sparking device. The end of the shaft 3 is provided with the contact arm 20 which during its rotation closes its circuit with the contact 22 for exploding the mixture in the engine.

In Fig. 3 the lever 18 is in an intermediate position, such as will cause an adjustment of the timer to induce the explosion to take place exactly on the dead center of the engine. To make the engine operate properly, the lever 18 should be thrown to the right or to the left according to the direction in which the engine is to run and so

that the ignition takes place just before the crank reaches the highest point in its travel and preferably so that the explosion takes place slightly before the crank passes the dead center. However, for causing the engine to reverse its direction of travel, it is necessary to throw the lever 18 to a greater distance from the vertical with the object of causing the explosion to take place some considerable time before the dead center is reached and thereby cause the crank shaft to be rotated in the reverse direction.

Assuming that the engine was running in a direction corresponding to the travel of the hands of a watch and it was desired to reverse the engine, the operation would be as follows: The hand lever 18 would be pulled to the left and this action would move the contact 22 considerably to the left so that the ignition would take place at some time before the crank had reached the top of its stroke with the result that the crank shaft would be reversed. At the same time that the lever 18 is moved to change the position of the contact 22 it also operates the rod 31 and this first unlatches the lever 23 and then shifts it to rock the shaft 9 to change the positions of the lifters 11, and consequently the time of action of the cams 7 and 8 upon the valves. To cause the hand lever 23 to be operated by the operation of the lever 18, the following devices are employed. The rod 31 is notched at 34 and this notched portion terminates in cam portions 35 at each end (Fig. 5). A pin 30 extends through the block 29 and is adapted to be operated by coming in contact with the cams 35. This pin 30 presses upon the latch lever 26 and when forced outward by coming in contact with either of the cams 35, it rocks the latch lever 26 and withdraws the detent pin 25 from the holes 28 in the segment 27. It will now be understood that when the rod 31 is moved to the left (Fig. 3) the cam part 35 (which is immediately back of the pin 30) will first force the pin outward and operate the latch lever 26 and withdraw the detent pin 25, after which, a further movement of the rod 31 will cause the right-hand stop 36 to strike the block 29 and forcibly throw the lever 23 from the position shown in Fig. 3 to a new position approximately 90 degrees to the left. When this is accomplished, the engine will continue to revolve in the reverse direction, but as the ignition will be taking place after the crank has considerably passed its dead center, it is necessary to obtain the full power of the engine to readjust the lever 18 and its contact 22 to substantially the vertical position again so as to induce the ignition at or about the time the crank is at its highest position. When making this readjustment, the rod 31 will be moved to the right, and as it slides through the block 29 the pin 30

is released, and the spring actuated latch lever 26 presses the detent pin 25 into the hole 28 at the left part of the segment 27. The valve mechanism will be then definitely adjusted and no further slight adjustment of the lever 18 will affect it, but said lever 18 may be more or less adjusted to vary the time of ignition to suit the requirements or desires of the operator. While the ignition with the crank on its dead center is ordinarily satisfactory, in those cases where the engine runs at high speed it is preferable that the ignition shall take place slightly before the dead center is reached, and this may be accomplished with the improvements herein described without interfering with the operation of the valves. As the lever 18 is separately held upon the hub of the bearing for the shaft 3 and with sufficient friction to retain its position, it may be moved to any position desired, and will normally remain there.

While I have shown a connection between the levers 18 and 23 whereby the latter may be automatically operated by the former, it is evident that this connection may be dispensed with if desired and the two levers 18 and 23 be separately operated by hand.

From the foregoing description it will be understood that the essential feature of improvement herein set out resides in means for changing the time of action of the cams upon the valves and also for automatically changing the time of ignition at or about the time of changing the time of operation of the cam mechanism, and while I prefer the construction shown as being excellently adapted for the purposes of the invention, I do not restrict myself thereto as the details may be modified without departing from the spirit of the invention.

It is also to be understood that while I have shown a single cylinder engine, the invention is equally adapted to a multiple cylinder engine such as commonly employed on automobiles.

I further desire it to be understood that while I have shown the reversing mechanism to secure adjustment as to time of operation of both the intake and exhaust valves, the embodiment of my invention may be had when the adjustment relates alone to the exhaust valve.

It is also to be understood that while I have shown a special form of construction interposed between the cam shaft and the valves of the engine, any suitable means so interposed may be employed in lieu of those shown for accomplishing the same results and still be an embodiment of the essential features of my invention.

Having now described my invention what I claim as new and desire to secure by Letters Patent, is:

1. In a reversible explosive engine, the

combination of the crank shaft, a valve operating cam shaft having inlet and exhaust cams, gearing for causing the cam shaft to be operated by and maintain the same relative directions of rotation with respect to the direction of rotation of the crank shaft, inlet and exhaust valves, reciprocable parts for operating the valves, means for operating the reciprocable parts, actuated by the cams and adjustable circumferentially about the axis of the cam shaft but always in operative relation between the same cams and reciprocable parts, and hand operated adjusting devices for adjusting the means for operating the reciprocable parts for changing the time of action of the cams upon the valves both in opening and closing.

2. In a reversible explosive engine having ignition devices, the combination of the crank shaft, a valve operating cam shaft having inlet and exhaust cams, gearing for causing the cam shaft to be operated by and maintain the same relative directions of rotation with respect to the direction of rotation of the crank shaft, inlet and exhaust valves, reciprocable parts for operating the valves, means for operating the reciprocable parts actuated by the cams and adjustable circumferentially about the axis of the cam shaft but always in operative relation between the same cams and reciprocable parts, means for changing the time of action of the ignition devices, and hand operated adjusting devices for adjusting the means for operating the reciprocable parts for changing the time of action of the cams upon the valves both in opening and closing, and also for operating the means for changing the time of action of the ignition devices whereby the time of ignition and the angular adjustment of the means for operating the reciprocable parts are caused to be simultaneously adjusted.

3. In a reversible explosive engine, the combination of the crank shaft, a valve operating cam shaft having one inlet and one exhaust cam for each cylinder, gearing for causing the cam shaft to be operated by and maintain the same relative directions of rotation with respect to the direction of rotation of the crank shaft, inlet and exhaust valves, reciprocable parts for operating the valves, means for operating the reciprocable parts actuated by the cams and adjustable circumferentially about the axis of the cam shaft, hand operated adjusting devices for adjusting the means for operating the reciprocable parts for changing the time of action of each of the cams upon the valves both in opening and closing, and locking devices to positively retain the means for operating the reciprocable parts in their circumferentially adjusted positions.

4. In an explosive engine, the combination of the crank shaft and a cam shaft

geared together so as to always rotate in the same relative directions and said cam shaft having its cam surfaces upon only a portion of its circumference so as to intermittently act, valves for the engine, operating heads for the valves having extended lower surfaces, lifters interposed between the extended surfaces of the operating heads and the cams of the cam shaft, and means for bodily shifting the lifters simultaneously in relatively opposite directions for reversing the engine.

5. In an explosive engine, the combination of the crank shaft and a cam shaft geared together so as to always rotate in the same relative directions, valves for the engine, sliding operating heads for the valves, lifters interposed between the operating heads and the cams of the cam shaft and intermittently operated by the cams, and means for shifting the lifters simultaneously in opposite directions for reversing the engine, consisting of a rock shaft, means for adjusting the rock shaft and holding it in its adjusted positions, and oppositely directed arms secured on the rock shaft to which the lifters are respectively connected and by which they are moved.

6. In an explosive engine, the combination of the crank shaft and a cam shaft geared together so as to always rotate in the same relative directions, valves for the engine, operating heads for the valves, lifters interposed between the operating heads and the cams of the cam shaft and intermittently operated by the cams, and means for shifting the lifters simultaneously in opposite directions for reversing the engine consisting of a rock shaft, means for adjusting the rock shaft and holding it in its adjusted positions, and oppositely directed arms adjustably secured on the rock shaft whereby they are relatively circumferentially adjustable and to which the lifters are respectively connected and by which they are moved.

7. In an explosive engine, the combination of the crank shaft and a cam shaft geared together so as to always rotate in the same relative directions, valves for the engine, operating heads for the valves, lifters interposed between the operating heads and the cams of the cam shaft, means including a rock shaft for shifting the lifters simultaneously in opposite directions for reversing the engine, means for adjusting the rock shaft, means to control the time of ignition of the engine, a lever to operate the said ignition means, and connecting devices between the said lever and the means for adjusting the rock shaft whereby the latter is automatically adjusted by the movement of the lever when changing the time of ignition.

8. In an explosive engine, the combination

of the cam shaft, a rock shaft, valves for the engine, two lifter devices for operating the valves of the engine bodily adjustable relatively to the cams under the action of the rock shaft for changing the time of action of the cams upon the valves both in opening and closing, a hand lever for rocking the rock shaft, and detachable locking means for retaining the lever in its extreme adjusted positions.

9. In an explosive engine, the combination of the cam shaft, a rock shaft, valves for the engine, two lifter devices for operating the valves of the engine adjustable relatively to the cams under the action of the rock shaft for changing the time of action of the cams upon the valves, a lever for rocking the rock shaft, means for retaining the lever in its extreme adjusted positions, a cam rod for releasing the operating lever and moving it, and means for reciprocating the cam rod.

10. In an explosive engine the combination of the cam shaft, a rock shaft, valves for the engine, two lifter devices for operating the valves of the engine adjustable relatively to the cams under the action of the rock shaft for changing the time of action of the cams upon the valves, a lever for rocking the rock shaft, means for retaining the lever in its extreme adjusted positions, a cam rod for releasing the operating lever and moving it, means for reciprocating the cam rod, and means for changing the time of ignition of the engine operated by the means for reciprocating the cam rod.

11. In an explosive engine the combination of the cam shaft, a rock shaft, valves for the engine, two lifter devices for operating the valves of the engine adjustable relatively to the cams under the action of the rock shaft for changing the time of action of the cams upon the valves, a lever for rocking the rock shaft, means for retaining the lever in its extreme adjusted positions, a latch lever carried by the operating lever, a block 29 secured to the operating lever, a pin 30 extending through the block for operating the latch lever, a reciprocating rod 31 extending through the block 29 and having stops 36 at a distance apart for striking the block and shifting it and also having cams 35 for operating the pin 30 for releasing the latch lever, a hand lever 18, and connections between the hand lever and the rod 31 to reciprocate it.

12. In an explosive engine the combination of the cam shaft, a rock shaft, valves for the engine, two lifter devices for operating the valves of the engine adjustable relatively to the cams under the action of the rock shaft for changing the time of action of the cams upon the valves, a lever for rocking the rock shaft, means for retaining the lever in its extreme adjusted positions,

a latch lever carried by the operating lever, a block 20 secured to the operating lever, a pin 30 extending through the block for operating the latch lever, a reciprocating rod 5 31 extending through the block 20 and having stops 36 at a distance apart for striking the block and shifting it and also having cams 35 for operating the pin 30 for releasing the latch lever, a hand lever 18, connections between the hand lever and the rod 10 31 to reciprocate it, and igniting devices for changing the time of ignition arranged to be adjusted by the movement of the hand lever.

15 13. In an explosive engine, a cam shaft having a cam portion, and a valve adapted to be operated thereby for controlling admission of fuel to the cylinder, combined with an operating head for moving the valve having an extended surface arranged transversely to and parallel with the axis of the cam shaft, a single lifter device arranged between the cam shaft and the operating head and constantly resting by gravity upon 25 the cam shaft and cam and adjustable transversely relatively to the shaft and to the head without changing its vertical operative relation thereto when fully shifted in its extreme positions, means manually controlled 30 for shifting the lifter device while maintaining its contact with the cam shaft to change its time of contact with the cam approximately 90 degrees and thereby advance the time of action of the cam upon the valve 35 to reverse the engine, and means connected with the shifting means for the lifter device for controlling the time of ignition to correspond to the change of time of the operation of the valve.

40 14. In an explosive engine a cam shaft and valve, an operating head for moving the valve, a lifter device arranged between the cam shaft and the operating head, and means manually controlled for bodily shift-

ing the lifter device relatively to the axis of 45 the cam shaft and approximately 90 degrees about its circumference to change the time of action of the valve during the normal rotation of the cam shaft, said means consisting of a rock shaft having an arm to which 50 the lifting device is hinged, a lever secured to the rock shaft for rocking it, and detachable locking means for securing the lever in its adjusted positions.

15. In an explosive engine, a valve for 55 controlling communication between the interior and exterior of the cylinder, combined with means for reciprocating the said valve commensurate with the rotation of the crank shaft and wholly changing its time of re- 60 ciprocation to reverse the engine consisting of a cam shaft and cam positively rotated by the engine at the same relative speeds, a lifter device having a free end arranged to continually rest upon the cam shaft and be 65 operated by the cam for reciprocating the valve, a movable fulcrum or hinge for the end of the lifter most distant from the cam shaft having hand operatable means for shifting the lifter device through an angle about 70 the cam shaft of approximately 90 degrees the construction being such that while maintaining its operative relation with the valve it wholly changes the time of operation of the valve relatively to the crank of the en- 75 gine for reversing the engine but without varying its relative frequency of operation relative to the crank, and means connected with the means for shifting the lifter device for changing the time of ignition to corre- 80 spond to the change of time of operation of the valve.

In testimony of which invention, I hereunto set my hand.

ROBERT McKEE.

Witnesses:

R. M. HUNTER,
R. M. KELLY.