Aug. 23, 1932. B. WALKER 1,872,856

INTERNAL COMBUSTION ENGINE

Filed Sept. 11, 1929

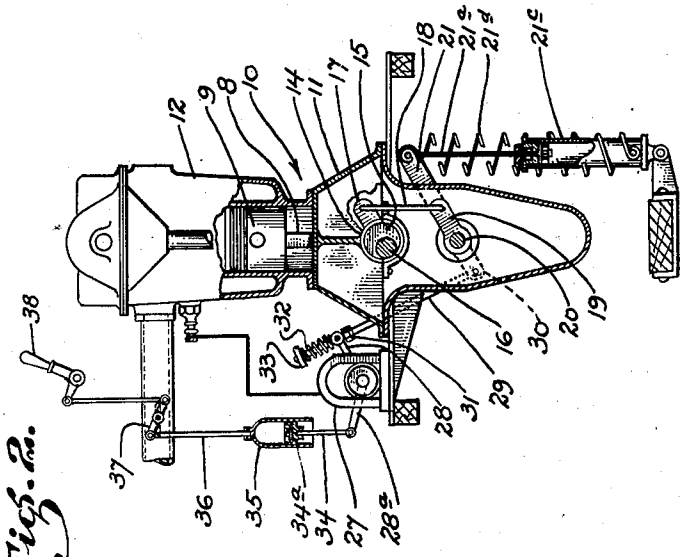


Fig. 2.

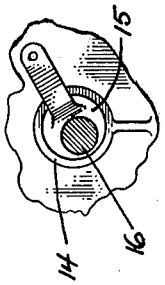


Fig. 3.

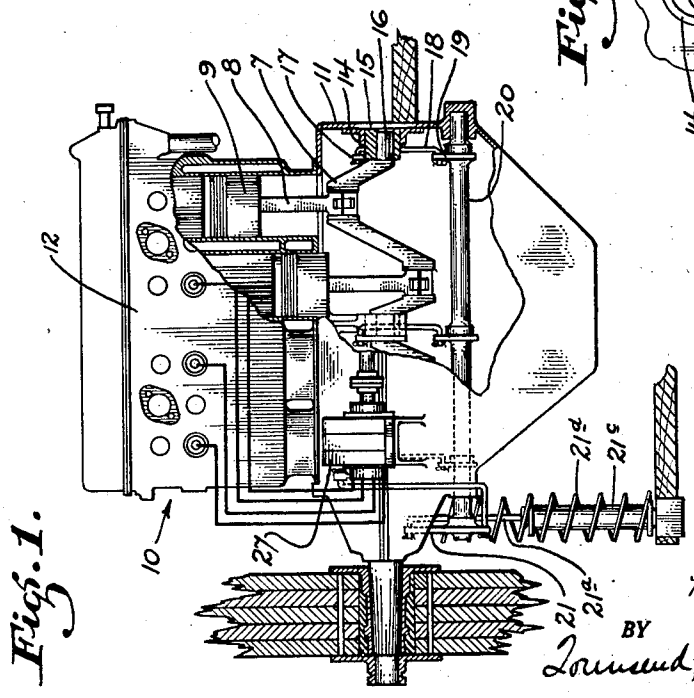


Fig. 1.

INVENTOR.
Brooks Walker.
BY
Townsend, Loftus & Hatfield
ATTORNEYS.

Patented Aug. 23, 1932 1,872,856

UNITED STATES PATENT OFFICE

BROOKS WALKER, OF PIEDMONT, CALIFORNIA, ASSIGNOR OF ONE-THIRD TO CLINTON L. WALKER, OF PIEDMONT, CALIFORNIA, AND ONE-THIRD TO HARRY E. KENNEDY, OF BERKELEY, CALIFORNIA

INTERNAL COMBUSTION ENGINE

Application filed September 11, 1929. Serial No. 391,776.

This invention relates to internal combustion engines of the constant compression type such as described in my prior application entitled "Internal combustion engines" filed September 22, 1928, Serial Number 307,588.

In this prior application I have disclosed an engine wherein the variations in mean effective pressure is utilized to automatically increase or decrease the volume of the combustion chamber so as to maintain substantially a uniform peak compression pressure regardless of the throttle opening.

It has been found by experiment that the best results are obtained in an internal combustion engine by retarding the spark as the piston clearance in the cylinder decreases. That is, of course, assuming that the compression pressure therein remains substantially constant. As the clearance volume in the cylinder varies with different throttle conditions at the same engine speed I have found it advantageous to control the spark automatically to accommodate this change in clearance volume.

The present invention has for its principal object the provision of an internal combustion engine wherein the mean effective pressure is utilized to automatically maintain a uniform peak compression pressure regardless of throttle opening and wherein the spark is automatically controlled so that the proper timing thereof is effected to compensate for changes in piston clearance.

One form which the invention may assume is exemplified in the following description and illustrated by way of example in the accompanying drawing, in which:

Fig. 1 is a diagrammatic view illustrating an engine embodying my invention in side elevation.

Fig. 2 is a diagrammatic view illustrating my invention in central vertical section.

Fig. 3 is a fragmentary view showing the crank shaft in section and the manner in which the eccentric bushing is fitted with a crank arm which controls the spark.

In the prior application referred to, I have pointed out the fact that the mean effective pressure in the combustion chamber is in substantially direct ratio to the amount of mixture taken into the cylinder. This mean effective pressure is utilized to vary the clearance volume and maintain a uniform peak compression pressure.

In the present application I have disclosed an internal combustion engine 10 wherein the cylinders remain stationary relative to the crank case but wherein the crank shaft is raised and lowered relative to the cylinders so that the clearance volume between the pistons and the head may be varied and thereby maintain a substantially uniform peak compression pressure regardless of operating conditions. The variations in mean effective pressure is the medium utilized to operate the crank shaft so as to automatically increase or decrease the clearance volume in the combustion chamber.

Referring more particularly to the accompanying drawing, the engine 10 is fitted with the usual cylinder block 12 stationarily connected to the crank case 11. A piston 9 is arranged in each cylinder which is connected by the connecting rod 8 to a crank 7 of a crank shaft 16. This crank shaft 16 is rotatably supported in what I prefer to term eccentric bushings 15 which are rotatably mounted in main bearings 14 in the crank case 11.

The bushings 15 are fitted with radially projecting crank arms 17 which are connected by means of connecting rods 18 to crank arms 19 fixed on a control shaft 20. This control shaft is journalled in the crank case in parallelism with the crank shaft as illustrated in the drawing. At one end the control shaft 20 is fitted with a radial arm 21 which is connected through the medium of a rod 21*a* to a piston 21*b* which is reciprocable in a cylinder 21*c*. The piston 21*b* is provided with one or more small ports and the cylinder 21*c* is filled with liquid so that the assembly constitutes a dashpot.

It is obvious that as the cylinder 21*c* is practically filled with liquid that the movement of the piston will be retarded by the fluid passing through restricted ports and therefore the speed of movement of the piston will be determined by the pressure applied to the piston. A tension spring 21*d* is

fixed at one end to the lower end of the cylinder and is connected at its upper end to the outer end of the arm 21.

When the maximum mean effective pressure is being developed the clearance volume between the pistons and the head is the greatest. This clearance volume however is limited by the amount of eccentricity of the crank shaft in the bushings 15. When the clearance volume is greatest the crank shaft is in its lowermost position placing the spring 21*d* under tension. As the throttle closes, the mean effective pressure drops and the crank shaft will be raised so as to reduce the clearance volume accordingly. This movement of the crank shaft is effected by the action of the spring acting against the dashpot action in the cylinder 21*c* and the mean effective pressure in the cylinders. The dashpot may be constructed so as to only retard movement of the parts in the direction causing decreasing of the clearance volume.

For the purpose of ignition, I have provided a conventional type of magneto 27 which is equipped with a speed sensitive spark advance. This magneto forms a part of the ignition system with which the engine is equipped. The breaker housing of the magneto 27 is fitted with a control arm 28 slidably connected at its outer end to one end of a connecting rod 29. The other end of this latter element is connected to an arm 30 extending radially from the control shaft 20. At one side of the outer end of the control arm 28 the rod 29 is fitted with a fixed collar 31. At the other side of the arm 28 a compression spring 32 is interposed between the arm and a fixed collar 33 at the outer end of the rod. By this connection, movement of the rod 29 will be accompanied by movement of the control arm 28 of the magneto so as to enable advancing or retarding of the spark coincident with the changes in clearance volume in the cylinders. The provision of the spring 32 enables the arm 28 to move in one direction relative to the rod 29. This provision is made in order to permit the spark to be retarded to accommodate sudden or rapid changes in throttle condition. In other words, assuming that the throttle is opened suddenly, the mean effective pressure suddenly rises. Due to the inertia of the parts which must necessarily be moved to a point establishing equilibrium the compression pressure rise to higher than normal. To accommodate such sudden or rapid changes in throttle conditions, I have provided means for momentarily retarding the spark.

I accomplish this by fitting the breaker housing of the magneto with an additional control arm 28*a* which is connected by a connecting rod 34 to the plunger of a one way dashpot 35. The cylinder of the dashpot 35 is connected by rod 36 to the throttle lever 37 fixed on the stem of the butterfly valve in the carburetor throat. The lever 37 is of course connected to the usual throttle control which is diagrammatically illustrated in Fig. 2 and indicated by the numeral 38.

It is obvious from the foregoing that sudden opening of the throttle will be accompanied by movement of the cylinder 35 and the piston 34*a* and will transmit a certain amount of movement to the auxiliary control arm 28*a* in a direction retarding the spark. However, the arm 28*e* will cause the piston to telescope slowly into the cylinder 35 due to the action of the spring 32. This will occur as the inertia to the parts to be moved is overcome and as the dashpot slowly releases the arm 28*a* the spark timing will be reestablished at the proper position determined by the clearance in the cylinder through the medium of the collar 31 on the rod 29.

In operation of the engine, it is commenced in the usual manner. As the throttle is suddenly opened the spark will be momentarily retarded through the action of the dashpot 35 but as the mean effective pressure rises due to the sudden throttle opening and the clearance volume in the cylinder increases the spark will be gradually advanced.

It is obvious that as the mean effective pressure rises that the crank shaft will be caused to lower and increase the clearance volume. Also as the throttle closes the mean effective pressure in the cylinders will decrease and will be accompanied by upward movement of the crank shaft so as to reduce the clearance volume. This latter movement will be accomplished by the spring 21*d* acting against the dashpot 21*c* and against the mean effective pressure. Thus the clearance volume will be varied to maintain a uniform peak compression pressure regardless of the throttle opening.

From the foregoing it is obvious that I have provided an internal combustion engine wherein the clearance volume in the cylinders is varied so as to maintain a uniform peak compression pressure and wherein the spark timing is automatically controlled so that the best results and the most efficiency will be obtained.

While I have shown the preferred form of my invention it is understood that various changes in its construction may be made by those skilled in the art without departing from the invention as defined in the appended claims.

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

1. In an internal combustion engine wherein the clearance volume varies in accordance with changes in mean effective pressure, said engine having an ignition system, means for automatically retarding the spark as the clearance volume decreases.

2. In an internal combustion engine where-

in the piston clearance is varied by changes in mean effective pressure, said engine having an ignition system, means for automatically retarding the spark as the clearance volume decreases while the engine speed remains substantially constant.

3. In an internal combustion engine, means actuated by changes in mean effective pressure in the combustion chamber for changing the clearance volume, an ignition system for said engine, and means for automatically retarding the spark as the clearance volume decreases.

4. An internal combustion engine comprising a cylinder, a reciprocable piston in the cylinder, a crank shaft connected with the piston, means actuated by changes in mean effective pressure within the combustion chamber of the cylinder for changing the clearance volume in the combustion chamber, an ignition system for said engine, and means for automatically retarding the spark as the clearance volume decreases while the engine speed remains substantially constant.

5. In an internal combustion engine wherein the clearance volume varies in accordance with changes in mean effective pressure, said engine being equipped with an ignition system, means for retarding the spark upon rapid rise of mean effective pressure until a point of equilibrium has been reached.

6. In an internal combustion engine wherein the clearance volume varies in accordance with changes in mean effective pressure, said engine having an ignition system, means for automatically momentarily retarding the spark when the mean effective pressure rapidly rises and gradually advancing the spark to normal until a point of equilibrium has been reached.

7. In an internal combustion engine wherein the clearance volume varies in accordance with the mean effective pressure, said engine having an ignition system, means for automatically retarding the spark as the clearance volume decreases, and automatically operating means for retarding the spark upon rapid rise of the mean effective pressure until a point of equilibrium has been reached.

8. In an internal combustion engine wherein the clearance volume varies in accordance with the mean effective pressure, said engine having an ignition system, means for automatically retarding the spark as the clearance volume decreases, and means for automatically retarding the spark when the mean effective pressure rapidly rises and gradually advancing the spark to normal until the point of equilibrium has been reached.

BROOKS WALKER.