Jan. 20, 1931. F. H. WILLIAMS 1,789,573

DEVICE FOR AUTOMATICALLY CONTROLLING IGNITION TIMING

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Fig. 1.

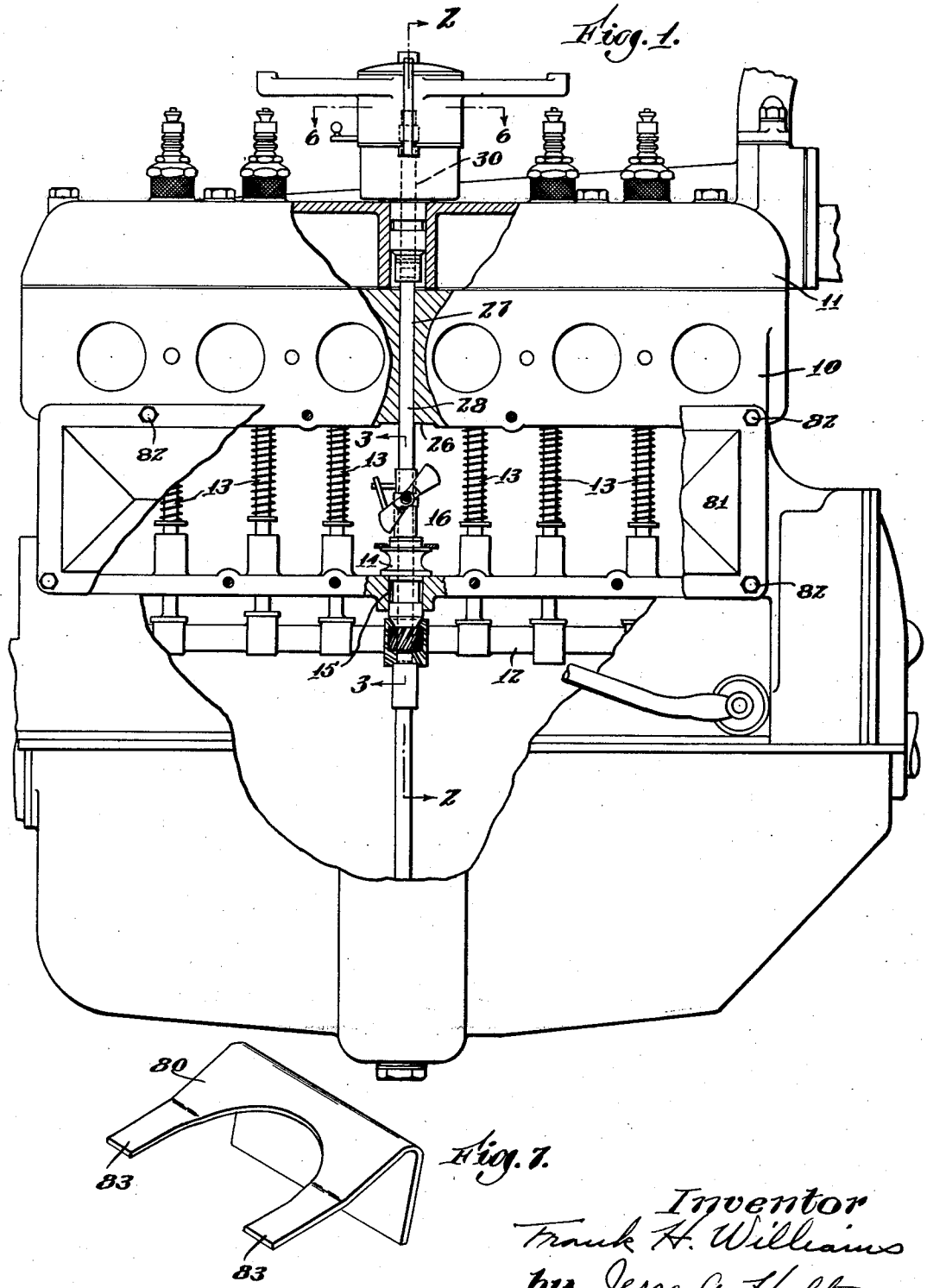

Fig. 7.

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Fig. 6.

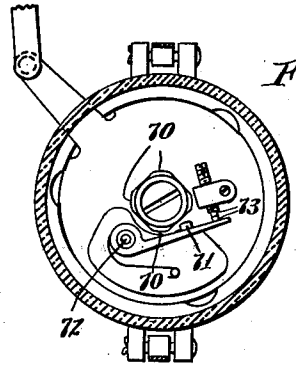


Fig. 7.

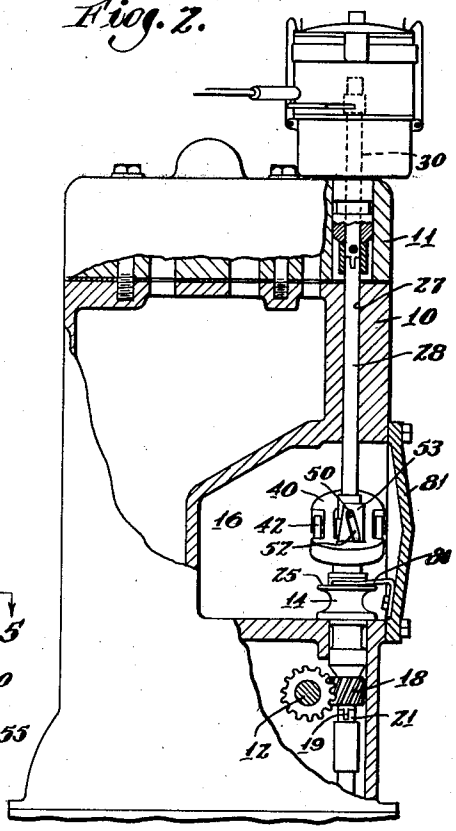


Fig. 4.

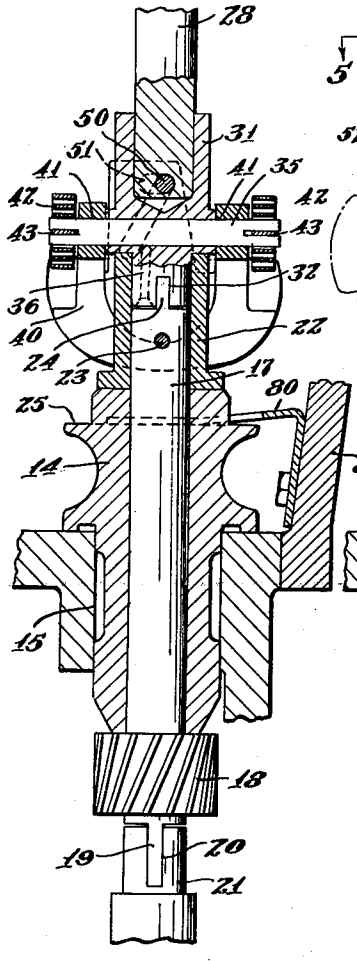


Fig. 3.

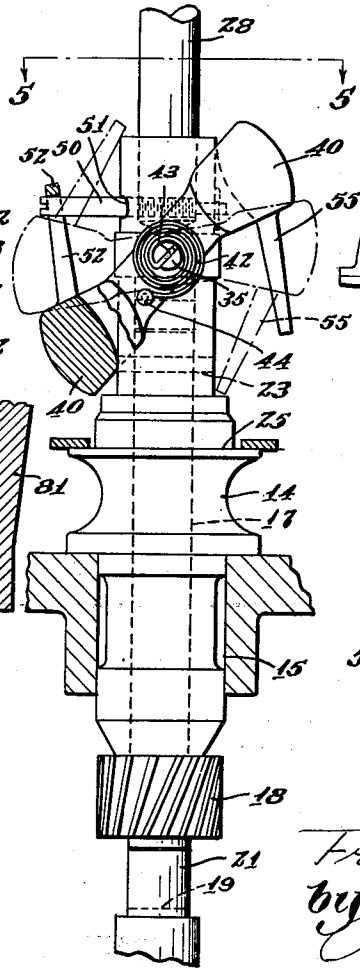
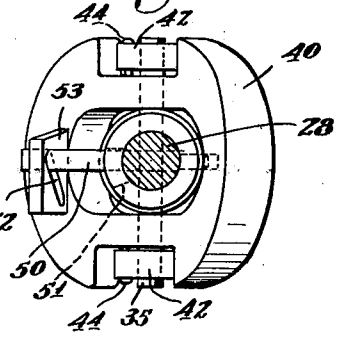


Fig. 5.



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UNITED STATES PATENT OFFICE

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DEVICE FOR AUTOMATICALLY CONTROLLING IGNITION TIMING

Application filed January 18, 1930. Serial No. 421,712.

This invention relates to devices for automatically controlling ignition timing and, with regard to certain more specific features thereof, to means responsive to variations in speed of an internal combustion engine whereby the sparking time in the respective cylinders is varied relatively to the movements of the pistons therein.

Various types of apparatus have been previously proposed and used for varying the point of circuit interruption in the primary circuit of electrical ignition devices in order that the discharge to the secondary may be advanced or retarded in relation to the movements of the pistons in their respective cylinders. Speed governors have been previously used located somewhere within the distributor base and connected to rotatively advance a circuit breaker shaft as the engine speed is increased. This circuit breaker shaft is usually provided at its upper end with a plurality of cam points corresponding to the number of cylinders in the engine. These points are effective to periodically break the electrical ignition circuit by separating a pair of contacts usually mounted in the distributer base. The breaking of the contacts causes a discharge of built-up current in a primary coil to a secondary coil from whence it is discharged through a circuit including the respective spark plugs, producing the igniting spark for the compressed gases in the cylinders.

The present invention involves a novel location and arrangement of governor devices for regulating or controlling the parts of the timer-interrupter of an ignition device and has for one of its objects to provide an installation of automatic controlling devices which shall be extremely inexpensive to manufacture and install, which shall be highly efficient in operation, durable and efficient.

A further object of the invention is to provide a controlling device interchangeable with a standard intermediate shaft located between the distributer shaft, so-called, and another shaft driving from the cam shaft to the oil pump of the engine, so as to provide automatic timing variation in a standard automobile engine without sacrificing any of the normal functions of the mechanism and without undue difficulty or expense in making the change.

It is a further object of the invention to locate the automatic governor in the valve chamber of the cylinder block where it will be continuously operated in an oil vapor and, in consequence, continuously lubricated. Attaining this object calls for certain modifications or alterations in the standard retaining devices for the oil pump shaft and involves the provision of easily attached, simple and inexpensive means for taking the place of those formerly used in the standard construction, so as to retain the principle of holding the oil pump shaft against upward pressure, even though the automatic governor has been applied which necessitated the removal of the original means provided for that purpose.

In certain aspects the invention is broadly for an improved internal combustion engine, in that certain standard parts are eliminated at a particular region and a new assembly substituted whereby the engine is provided with an improved ignition system, causing it to operate smoothly and with less vibration over a greater range of speeds than formerly. It is well understood by those skilled in the art that an electric motor is used in conjunction with an automobile engine and temporarily connected therewith through a device known as the "Bendix drive" for starting the engine and is subsequently disconnected automatically when the engine comes into operation under its own power. The Bendix drive involves a spring connection which is sensitive and is frequently ruptured by reason of the spark of ignition being advanced, so that combustion takes place before the piston has

reached the top of its up-stroke in the cylinder. This retards the rotation of the engine crank shaft and, consequently, the fly wheel attached thereto; whereas the electric torque of the motor is continuous and the motor armature is temporarily geared to a ring gear on the fly wheel. This produces opposing forces and the spring connection of the Bendix drive is frequently ruptured from this cause. With the automatic control provided by the present invention, a retarded spark on starting is insured, that is, one which will allow the piston to pass over its high point of compression and be receding when combustion takes place.

According to the present invention, no changes are necessary within the timer-interrupter or distributer housing or casing. The automatic governor is located outside of the said housing or casing and in a position of easy access behind the valve chamber cover and within the valve chamber.

The invention accordingly consists in the various features of construction, combinations of elements and arrangements of parts, which will be exemplified by the following description and illustrated in the accompanying drawings, and the scope of the application of which will be indicated in the appended claims.

In the drawings:—

Figure 1 is a side view of an internal combustion engine adapted for use in an automobile of standard design. Portions of the cylinder block, cylinder head and valve chamber cover are broken away to show more clearly the interior construction.

Figure 2 is a sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a view of the automatic governor and associated parts.

Figure 4 is a sectional view of the parts shown in Figure 3 taken on the line 3—3 of Figure 1.

Figure 5 is a sectional view taken on the line 5—5 of Figure 3.

Figure 6 is a sectional view of the timer-interrupter mechanism.

Figure 7 is a view of the means for holding the oil pump shaft against upward pressure.

Referring now more particularly to the drawings, an engine cylinder block is indicated at 10, having a cylinder head 11, a cam shaft indicated at 12, and valves indicated at 13. A bearing sleeve 14 is loosely fitted in a bore 15 at the bottom of a valve chamber 16 in the cylinder block. Within the sleeve 14 there is rotatively journalled a short shaft 17 carrying at its lower end a spiral gear 18 cut integral with the shaft 17. The shaft is continued on below the spiral gear for a short distance and has a tongue 19 for a connection with a groove 20 on the upper end of a shaft 21, which extends downwardly and drives an oil pump (not shown). At the upper end of the shaft 17 there is secured a sleeve 22 by a pin 23, and this sleeve extends slightly above a tongued end 24 of the shaft 17. As the engine is originally built and marketed, this tongued end 24 of the shaft 17 is fitted with a grooved end of an intermediate shaft member, the opposite end of which is connected by a tongue and groove connection with the lower end of the timer-interrupter shaft of an ignition device. Where the present invention is used as a substitute or interchangeable device, this intermediate shaft is removed and discarded, and a coiled spring surrounding it and bearing upon the shoulder 25 of sleeve 14 and reacting against a surface 26 of the valve chamber is also removed and discarded. In place of this shaft and having its bearing in the same bore 27 in the cylinder block, an intermediate shaft 28 of corresponding diameter is used. The shaft 28 couples with the timer-distributer shaft 30 with the usual tongue and groove connection. The lower end of shaft 28 is loosely fitted in a sleeve 31, and the lower end of the sleeve 31 is grooved as indicated at 32 to receive the tongue 24 of the standard shaft 17 on which is cut the spiral gear 18. As shown in Figure 4 of the drawings, the lower end of sleeve 31 is also fitted within the upward extension of sleeve 22. Passing diametrically through the sleeve 31 is a shaft pin or stud 35 held in fixed position by a screw 36. Mounted for pivotal movement on this pin is a weighted governor device 40 having bearings at opposite sides of the sleeve as indicated at 41 and arranged at opposite ends of the pin 35 are helical springs 42, the inner ends of which are fixed to the pin 35 in the slots 43 and the outer ends of which are fixed on pins 44 extending from the weighted governor 40. The action of the springs 42 is to hold the governor normally in the position shown in Figure 3. This position is affected by progressively increased speed of the shafting 21 and 17 until at certain predetermined higher speeds, the governor assumes the almost horizontal position shown by the dot and dash lines of Figure 3.

Fixed in the lower end of the shaft 28 is a pin 50 which extends outwardly through a slot 51 in the sleeve 31. The outer end of this pin is extended through a cam slot 52 in an upstanding arm 53 of the weighted governor 40. This arm may be integral with the governor or may be separately constructed and attached, and there may be another arm 55 on the opposite side of the governor extending in the opposite direction also provided with a cam slot for a purpose which will hereinafter appear. It follows from the construction just described that as centrifugal action on the weighted governor overcomes the force of the springs 42 and raises the governor toward the horizontal position shown by the dot and dash lines in Figure 3,

the action of the cam slot 52 on the pin 50 will cause the shaft 28 to rotatively advance relatively to the sleeve 31 and all parts driven in unison therewith such as the shaft 17, the spiral gear 18, and the oil pump shaft 21. There is, therefore, the condition of a relative advance of the intermediate shaft 28 over all the shafting below. This, by reason of the tongue and groove connection at the top of the intermediate shaft with the cam shaft of the timer-distributer, causes a relative advance, of the cams on said shaft, indicated at 70 in Figure 6, with respect to a member 71 pivotally located on the distributer housing at 72, so that it will be operated earlier with respect to the rotation of the crank shaft of the engine than formerly. This causes an earlier break in the electrical circuit at the contacts 73 and, consequently, an earlier spark in the combustion chambers of the respective cylinders.

Inasmuch as the standard coil spring used for holding the sleeve 14 against upward pressure from the oil in the engine has been removed and cannot be replaced owing to the governor arrangement, a forked leaf member 80, preferably resilient, is bolted or riveted to the inside of the valve chamber cover 81, so that when the valve chamber cover is secured in position by bolts 82, forked ends 83 of the member 80 are located over the flange 25 of the oil pump drive gear sleeve 14 and serve to hold the entire shafting against upward displacement.

In case special conditions should require that the advance of timer-distributer cam shaft 30 be less than that provided by the cam slot 52 in arm 53 of the governor device, a cam slot of less angularity is provided in the diametrically opposed arm 55 of the governor. By reversing the position of the governor, this cam slot of less angularity can be used in conjunction with the pin 50, and the requisite lesser amount of advance provided.

Due to the installation of the automatic governor control, the time of ignition is substantially retarded during the starting operation of the engine or should the speed be through a substantially low range. In many automobiles there is objectionable vibration and irregularity of operation at speeds of ten miles an hour and below, unless the manual controls, usually providing for such apparatus, are used. By the use of automatic control, the speed of the car may be reduced to five or even three miles an hour without noticeable vibration and without hand manipulation of any parts or levers. The present invention relates particularly, however, to the construction which makes it possible to introduce such automatic control to a standard type of automobile and at a point where it is easily accessible and constantly running in an oil vapor. It is to be noted that the tongue and groove connections of the combined shaft and sleeve of the governor device are off-center in the same manner as they are off-center in the standard intermediate shaft, which is replaced by the governor device. The reason for having the grooves and tongues off-center of their respective parts is so that in assembly the timing will always be uniform. This feature is carried through to the present invention, but is not claimed as original.

The timer-distributer device is, of course, subject to the regular manual variation as is usual in most standard makes of automobiles today.

What I claim is:—

1. In an internal combustion engine, in combination, a cylinder block having a valve chamber, a cylinder head, a timer-distributer unit mounted on said head, and a speed responsive advance and retard device for the timer-distributer, which is located in the valve chamber and includes a shaft adapted to journal in the cylinder block above the valve chamber and rotatively detachably connect with the timer-distributer unit.

2. In an internal combustion engine, in combination, a cylinder block having a valve chamber, a cylinder head, a timer-distributer unit mounted on said head, a speed responsive advance and retard device for the timer-distributer, which is located in the valve chamber and includes a shaft adapted to journal in the cylinder block above the valve chamber and rotatively detachably connect with the timer-distributer unit, and an engine driven part located in the cylinder block and projecting upwardly into the valve chamber, means for coupling said part with the advance and retard device, a valve chamber cover, and means projecting from said cover to resist upward movement of said engine driven part.

3. In an internal combustion engine, in combination, a cylinder block having a valve chamber, a cylinder head on said block, a timer-distributer unit arranged on said head, means for varying the operating periods of said timer-distributer unit, comprising a speed responsive governor pivotally mounted on a sleeve in the valve chamber, a shaft extending from said sleeve through the cylinder block and connecting with the timer-distributer unit and connections between the shaft and sleeve including a pin on said shaft extending into the cam slot on said governor.

4. In an internal combustion engine, in combination, a cylinder block having a valve chamber, a timer-distributer assembly arranged above said block, a part projecting into said valve chamber and driven in timed relation with the engine cam shaft, an assembly for rotatively coupling said part with the timer-distributer assembly, comprising a shaft journalled in the cylinder block above the valve chamber, a sleeve receiving the

lower end of said shaft, means permitting relative rotative movement between the shaft and sleeve, and a weighted governor device pivoted on said sleeve and operating in the valve chamber to cause variations in relative rotative positions of said shaft and sleeve.

5. In an internal combustion engine, in combination, a cylinder block having a valve chamber, a timer-distributer assembly arranged above said block, a part projecting into said valve chamber and driven in timed relation with the engine cam shaft, an assembly for rotatively coupling said part with the timer-distributer assembly, comprising a shaft journalled in the cylinder block above the valve chamber, a sleeve receiving the lower end of said shaft, means permitting relative rotative movement between the shaft and sleeve, a weighted governor device pivoted on said sleeve and operating in the valve chamber to cause variations in relative rotative positions of said shaft and sleeve, and a member arranged to resist displacement of the said projecting driven part.

6. In an internal combustion engine, in combination, a cylinder block having a valve chamber, a cover for the valve chamber, a cylinder head on the block, a make and break ignition device on said head comprising a vertical actuating shaft, a governor device comprising a sleeve located in said valve chamber, a weighted governor pivoted on said sleeve, a shaft having its lower end associated with said sleeve, having a bearing in the cylinder block and having its upper end rotatively coupled to the vertical actuating shaft of the make and break device, connections between the weighted governor and the shaft associated with the sleeve whereby pivotal movement of the governor causes relative rotative movement of the sleeve and associated shaft, and means driven in timed relation to the cam shaft of the engine and rotatively connected to said sleeve.

7. In an internal combustion engine, in combination, a cylinder block having a valve chamber, a cylinder head on said block, a valve actuating cam shaft, a shaft driven therefrom, a timer-distributer on said cylinder head having a cam shaft for periodically making and breaking an ignition circuit, a coupling shaft between the timer-distributer shaft and the said shaft driven from the valve actuating cam shaft, said coupling shaft having a sleeve extension with provision for relative rotative movement between the sleeve and coupling shaft, and a speed controlled governor located in said valve chamber adapted to vary the relative rotative positions of the coupling shaft and sleeve.

8. In an internal combustion engine, in combination, a cylinder block having a valve chamber, a cylinder head on said block, a timer-distributer located on said head, a sleeve located in said block and projecting into the valve chamber, an engine driven shaft in said sleeve, a unit assembly for coupling the engine driven shaft with the timer-distributer, comprising a shaft and sleeve related by a pin and slot connection and a spring regulated governor having a cam slot receiving said pin, a cover for said valve chamber and means projecting from said cover into the valve chamber to oppose upward movement of the first said sleeve.

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