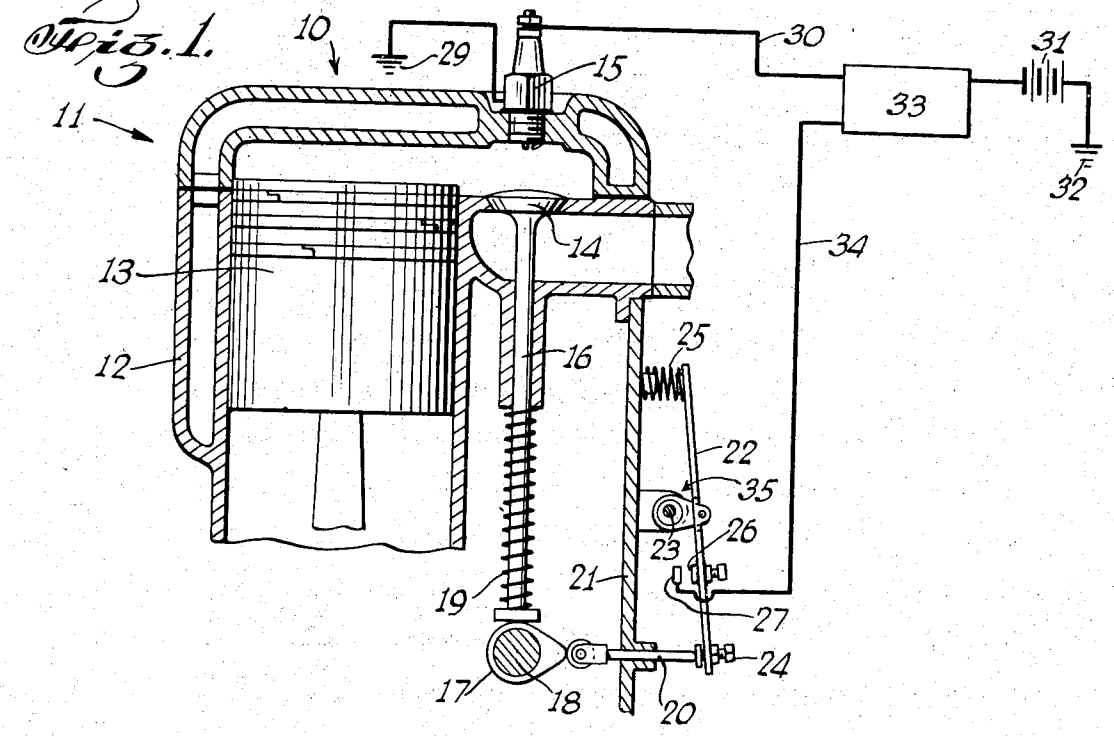
Sept. 17, 1940. A. LEFEBVRE 2,215,106

IGNITION SYSTEM FOR INTERNAL COMBUSTION ENGINES

Filed Sept. 16, 1939

Fig. 1.



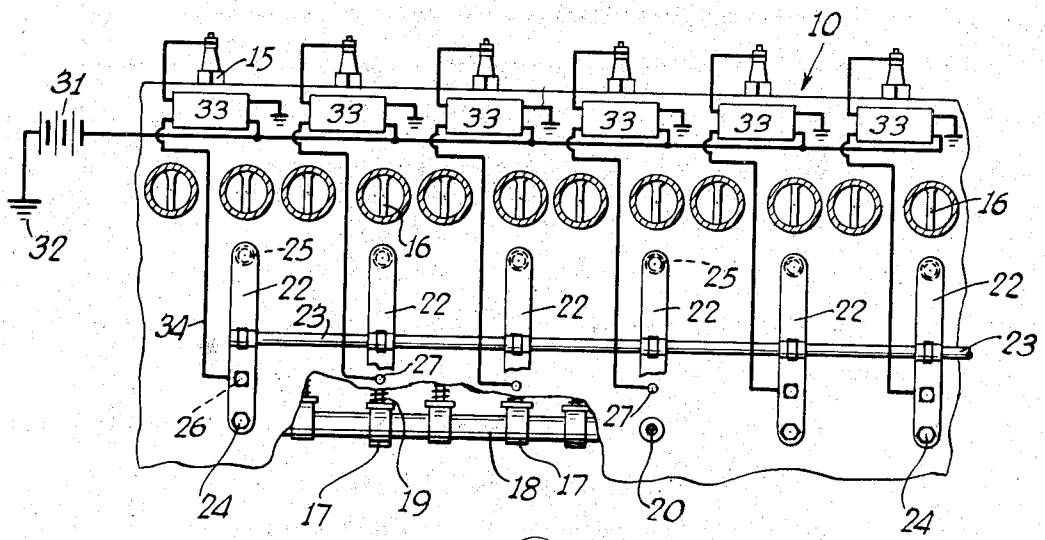


Fig. 2.

INVENTOR
Alde Lefebvre
BY
John Thumacher
ATTORNEY

Patented Sept. 17, 1940 2,215,106

UNITED STATES PATENT OFFICE

2,215,106

IGNITION SYSTEM FOR INTERNAL COMBUSTION ENGINES

Alde Lefebvre, New York, N. Y., assignor of one-half to Philip G. Steindler, New York, N. Y.

Application September 16, 1939, Serial No. 295,196

7 Claims. (Cl. 123—146.5)

This invention relates to ignition systems for internal combustion engines of the type adapted for high speed operation.

One object of the invention is to provide such an ignition system wherein the sparking switch shall not be subject to the effects of fatigue or lag as in the high speed switches now in use.

I have perceived that when the internal combustion engine is operated at a high range of speed, the combustible mixture may fail to be properly ignited in certain cylinders of the usual multi-cylinder engine. This condition is not confined to a particular cylinder, but would haphazardly occur first in one and then in another of the cylinders. The indications were that there was either entire or partial failure of a sufficient arc across the spark plug electrodes. These results I traced to the operation of the multi-switch unit or "distributor" which controls the current supply to the different spark plugs. Such unit is provided with a single spring contact arm which upon rotation engages successive contacts for the different spark plugs. Upon further study, I perceived that this spring contact is subjected to bending strains at such high speed and in such extremely rapid succession as to fail to establish proper engagement with each of its companion contacts, so that the lack of ignition or "skipping" heretofore referred to occurs.

The invention therefore aims to provide improved means whereby a sparking switch shall operate at high rapidity, and with the period of its successive operations being nevertheless greatly reduced. In other words, in a six cylinder motor, for example, the switch shall operate only once for each complete cycle of a cylinder, to thus afford a movable contact of actuator spring an opportunity for properly returning to normal position without the effects of lag or fatigue which heretofore resulted.

A further object of the invention is the provision of a device of the nature set forth having few and simple parts, and which is inexpensive to manufacture, install, and adjust, and which shall be free of missing or skipping and avoid backfire while affording maximum speed and power especially in motors of high capacity, and which shall be durable, reliable, and efficient in use.

Other objects and advantages of the invention will become apparent as the specification proceeds.

With the aforesaid objects in veiw, the invention consists in the novel combinations and arrangements of parts hereinafter described in their preferred embodiments, pointed out in the subjoined claims, and illustrated in the annexed drawing, wherein like parts are designated by the same reference characters throughout the several views.

In the drawing:

Figure 1 is a diagrammatic cross sectional view of an internal combustion engine, with an ignition system according to the invention applied thereto.

Fig. 2 is a fragmentary schematic side view of a multi-cylinder engine with the ignition system applied thereto, generally in accordance with the view of Fig. 1.

The advantages of the invention as here outlined are best realized when all of its features and instrumentalities are combined in one and the same structure, but, useful devices may be produced embodying less than the whole.

It will be obvious to those skilled in the art to which the invention appertains, that the same may be incorporated in several different constructions. The accompanyng drawing, therefore, is submitted merely as showing the preferred exemplification of the invention.

Referring in detail to the drawing, 10 denotes a device embodying the invention. The same may include an internal combustion engine 11 that may comprise a plurality of motors, as, for example, six or any other desired number. Each motor may have a piston 13, and a valve means 14, a spark plug 15 being provided for a combustion chamber of any desired arrangement. According to conventional practise, the valve means 14, which may represent preferably an exhaust valve, may have a slide rod 16 engageable by a cam 17 of a cam shaft 18. An expansion coil spring 19 may tend to move the valve stem into engagement with its cam 17. Each motor will thus have two cams on the cam shaft 18, one for the exhaust and one for the inlet valve, and each of the series of motors 12 will have its individual cams on the cam shaft, all in accordance with well known practise.

The ignition system according to the invention may include switches for the individual motors 12, each switch operated in response to a valve cam of its motor. Thus assuming a six cylinder engine, there will be six switches, all alike, except that each is timed according to its particular cylinder or motor.

More particularly, the cam 17 may actuate a follower rod 20 slidably mounted in a supporting member or wall 21 of the engine. This follower 20 may engage a contact or switch member 22,

which may be pivotally mounted at 23. At one end, the member 22 may carry an adjustable set screw 24 for engagement with the follower 20. At its other end, an expansion coil spring 25 may act between the member 22 and the motor block so as to move the member 22 into constant engagement with its cam follower 20. Carried by the member 22 is a contact 26 engageable with a fixed contact 27 which may be grounded to the motor block. Likewise the one terminal of the spark plug 15 may be grounded at 29. From the other terminal thereof extends a conductor 30 to the circuit of the fixed contact 27. A source of electrical current 31, grounded at 32, feeds current to a transformer and condenser unit 33, schematically shown, and which by a like showing is connected at 34 to the contact 27.

In operation, the spring 25 tends to move the member 22 to close the sparking switch 26, 27. When the cam 17 moves to the position shown, it moves the rod 20 toward the right, causing oscillation of the member 22 and opening the switch 26, 27. The break of the branch circuit through the switch 26, 27 causes a flow of current which produces an arc across the spark plug electrodes. It will be understood that the circuit herein shown is merely illustrative, and that any well known circuit may be substituted therefor, and that the invention does not depend on the characteristics of any particular circuit. A unit including a sparking switch 26, 27 and transformer and condenser elements therefor as above described is provided for each of the cylinders of the engine 11. It will be perceived that since the sparking switch is operated from the cam shaft, no accidental change in timing is possible. By utilizing valve cams 17, the need for extra cams is dispensed with. Also the troublesome distributor gear at present in use is eliminated.

If it be desired to advance or retard the spark, a common adjustment for the switches 26, 27 of all of the cylinders may include a rod 23 which forms the pivot hereinbefore mentioned and which is provided with a series of rotary eccentrics 35. In other words, each sparking switch may have its own eccentric. By giving the rod 23 a slight turn in one or in an opposite direction the members 22 are all bodily moved toward the right or toward the left. Individual adjustment for the sparking switches is afforded by the set screws 24.

It will be readily appreciated that the switch 26, 27 represents any suitable type capable of rapid operation, and that the switch will be operated only once for each cycle of its motor. Thus if the engine 11 has six cylinders, each switch will be operated only one sixth as many times as the switch of the distributor now in use. This affords ample time intervals for the switch to rest and avoid fatigue and lag, with consequent skipping or missing at high speeds. Hence still higher motor speeds are available, and uniformly more power and higher motor efficiency will be obtained because all the fuel in the cylinders will be fired; and the even balancing of the motor crank shaft will be maintained to minimize vibration. Nor can any accidental change so affect the time of firing as to cause backfire, since the timing is that caused directly by the cam shaft. These advantages are especially striking with very powerful motors of the types used in tractors, large trucks and aircraft. While a single transformer and condenser unit could be used with all of the sparking switches, it is for certain purposes advantageous to provide a separate such unit for each switch. Thus inspection and repair is greatly facilitated, and if a circuit for one cylinder should for any reason fail, the other cylinders will continue to operate to prevent stalling of the vehicle.

I claim:

1. An ignition system for an internal combustion engine comprising a multi-cylinder motor having a cam shaft for the valves thereof, and means for causing sparks across the electrodes at the different cylinders, including individual switches for the different cylinders, each switch having a plurality of contacts separate of those of the other switches, and individual means operated by the cam shaft for separately actuating the different switches, common means for adjusting all the switches to advance or retard the sparking action, and means for individually adjusting the switches to advance or retard the sparking action, said common means including an adjustable shaft, each switch having a switch arm for a contact, and eccentric mounted on the adjustable shaft for moving the individual switch arms upon manually turning the shaft in one or in an opposite direction.

2. A device including a multi-cylinder internal combustion engine comprising a shaft having cams for individually actuating the exhaust valves of the different cylinders, individual electrical switches for the spark plugs of the different cylinders, and means to control said switches comprising elements for the respective switches individually actuated by the different cams, said elements being wholly separate and independent of said valves and constituting followers in direct engagement with the cams so that said switches are operated at accurately timed intervals irrespective of any retardation or sticking of the valves.

3. A device including a multi cylinder internal combustion engine comprising a shaft having cams for individually actuating the exhaust valves of the different cylinders, individual electrical switches for the spark plugs of the different cylinders, and means to control said switches comprising elements for the respective switches individually actuated and the different switches being disposed in direct juxtaposition to their corresponding cylinders with the said elements extending from the cams directly to their respective switches at right angles to said shaft.

4. A device including a multi cylinder internal combustion engine comprising a shaft having cams for individually actuating the exhaust valves of the different cylinders, individual electrical switches for the spark plugs of the different cylinders, and means to control said switches comprising elements for the respective switches individually actuated by the different cams, said means also comprising individual springs for the different switches to oppose said elements, said means being wholly separate and independent of said valves with said elements constituting followers in direct engagement with the cams for causing accurately timed operation of the switches irrespective of the valve response to the cams, said motor having a wall for mounting said switches and said springs, guide means for the said elements carried by said wall, said elements being rods longitudinally slidably carried by the guide means and extending from the cams directly to their respective switches at right angle to said shaft.

5. A device including a multi cylinder internal combustion engine comprising a shaft having

cams for individually actuating the exhaust valves of the different cylinders, individual electrical switches for the spark plugs of the different cylinders, and means to control said switches comprising elements for the respective switches individually actuated by the different cams, said elements being wholly separate and independent of said valves and constituting followers in direct engagement with the cams so that said switches are operated at accurately timed intervals irrespective of any retardation or sticking of the valves, each switch having a swingable arm for opening and closing the switch, and means for mounting said arms comprising eccentric means and a common shaft for the different arms, said shaft having fixed bearings and being rotatable relative to said arms, and the shaft and eccentric means coacting with each other so that an angular movement of said shaft bodily moves all of said arms to thus advance or retard the timing of all the switches by a single adjusting movement.

6. A device including a multi cylinder internal combustion engine comprising a shaft having cams for individually actuating the exhaust valves of the different cylinders, individual electrical switches for the spark plugs of the different cylinders, and means to control said switches comprising elements for the respective switches individually actuated by the different cams, said elements being wholly separate and independent of said valves and constituting followers in direct engagement with the cams so that said switches are operated at accurately timed intervals irrespective of any retardation or sticking of the valves, said switches having a first series of contacts and a second series of contact for opening and closing of the switches, a common shaft for mounting one of said series of switches, fixed bearings for said shaft and eccentrics for said shaft coacting therewith so that a turning movement of the shaft causes a variation in gaps between the contacts for advancing or retarding the timing of the switches.

7. A device including a multi cylinder internal combustion engine having individual switches for the spark plugs of the different cylinders, each switch having a first contact and a second contact, a lever for the second contact, a spring for each lever tending to move the same in one direction, elements operated by a cam shaft for the cylinder exhaust valves for causing individual movement of the levers in an opposite direction, a common shaft for pivotally mounting the different levers, fixed bearings for said shaft, and eccentrics for the shaft cooperating with the lever so that an angular turn of the shaft causes bodily movement of the levers relative to the first contacts for advancing or retarding the timing of all the switches.

ALDE LEFEBVRE.