Nov. 7, 1961 W. P. BARNES 3,007,987

ENGINE ACCESSORY

Filed Aug. 5, 1960

FIG. 2

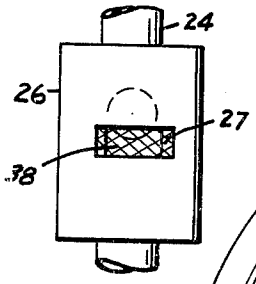


FIG. 1

FIG. 4

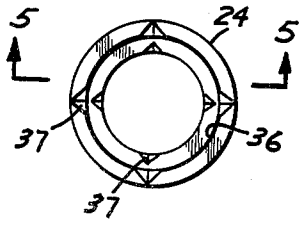


FIG. 5

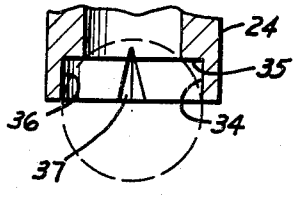
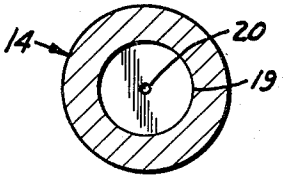


FIG. 3



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ENGINE ACCESSORY

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This invention relates to an accessory for an internal combustion engine.

It is an object of this invention to provide an ignition accessory which provides in addition to the spark gaps supplied in the cylinders by the respective spark plugs, a second auxiliary gap which is open at certain engine conditions and shorted out at others, so that the maximum spark is provided to the spark plugs at starting and at low engine speeds, and the auxiliary gap is placed in the ignition circuit at higher engine speeds.

It is a further object of this invention to provide an ignition accessory relating to the advancement and retardation of the spark which operates in conjunction with a standard diaphragm actuator for a spark advance mechanism. The objective of this portion of the invention is to provide means for slowing down the advancement of the spark when the engine is speeded up, thereby averting momentary ping, and unfavorable spark adjustments during and immediately after engine acceleration.

A feature of an accessory according to this invention comprises an auxiliary spark gap disposed at the distributor head between the source of the spark and the rotor, which spark gap is adapted to be opened at fast engine speeds to provide an auxiliary gap in the circuit to the spark plugs, and to be closed when the engine is at starting or idling speeds, so that at these speeds each spark plug will have the maximum spark in the cylinder.

A related but optional feature of this invention resides in a flow restrictor connected between the diaphragm-actuated means which control the spark advance mechanism and the carburetor which permits fluid to flow faster toward the diaphragm than away from it, thereby retarding the spark advance so as to slow down its advancement, and avoid the engine ping which results when the spark advance occurs too rapidly.

The above and other features of this invention will be fully understood from the following detailed description and the accompanying drawings, in which:

FIG. 1 is a side elevation, partly in cutaway cross-section, showing an accessory according to the invention;

FIG. 2 is a fragmentary elevation taken at line 2—2 of FIG. 1;

FIG. 3 is a cross-section taken at line 3—3 of FIG. 1;

FIG. 4 is an end view of a portion of FIG. 1; and

FIG. 5 is a cross-section taken at line 5—5 of FIG. 4.

A conventional distributor 10 is shown in FIG. 1 with terminals 11 to which spark plug connections are made. The distributor contains conventional stator and rotor devices. At the left side of the distributor, there is a conventional diaphragm-actuated advance means 12, which comprises a diaphragm connected by linkage to a plate mounting the breaker points whose rotary movement caused by diaphragm actuation serves to advance or retard current to the spark plug relative to the crank shaft position. These conventional elements are not shown in detail, because they are completely conventional and form no part of the invention.

The diaphragm-actuated spark advance means has a port 13 to which a flow restrictor 14 is connected. This flow restrictor is in turn connected to a conduit 15 connected to a flow section in the engine, such as in the throat of the carburetor near the butterfly valve where the positive pressure is inversely proportional to engine speed, that is, in which the vacuum rises as the speed of the engine increases. It is conventional to connect a

diaphragm-actuated spark advance means to such a location in the carburetor, and this invention supplies the flow restriction as an improvement to the conventional technique.

Flow restrictor 14 includes an inlet port 16 which terminates at a shoulder 17, the shoulder surrounding the right-hand end of inlet port 16 and connecting with an enlarged passage 18. Within this passage there is a disc 19 whose outer diameter is less than that of the passage, and which is able to seat against shoulder 17. Disc 19 has a hole 20 of lesser diameter than port 16 through its center. A spring 21 lightly biases the disc toward the shoulder and keeps it parallel to the shoulder. Passage 18 connects with port 13 in the spark advance means. It will be seen that when the disc is seated firmly against the shoulder, the flow passageway between inlet port 16 and passage 18 is that of a passageway the size of hole 20, but that when the disc is unseated from the shoulder, the flow passage is larger, that is, it is the total of the hole area plus that of the annular region between the inside wall of passage 18 and the outside periphery of disc 19. Flow from right to left will therefore be slower than flow from left to right as the device is illlustrated in FIG. 1.

The body 22 of the flow restrictor is side-tapped by a conduit 22a on the opposite side of the flow restrictor from the diaphragm-actuated spark advance means. This conduit interconnects to ignition terminal 22b at the top of the distributor, and taps into a chamber 23 in a ball seat member 24. Member 24 is electrically conductive to receive the terminal end 25 of an ignition lead. The other end of member 24 is seated in a support member 26, which latter member is made of insulating material and is mounted to the top of the distributor. Member 26 has a side port 27 slit through its side wall. At its upper end it carries an adapter 28 to hold the lower end of member 24.

At its lower end, member 26 carries an adapter that receives a conductive sleeve 29. This sleeve is interiorly threaded, and receives an adjustment screw 30. The adjustment screw has a crown 31 on its upper end. Sleeve 29 fits into conductive means 32 that are connected to the rotor of the distributor.

A hardened conductive ball 33 is fitted inside the chamber within the insulating body.

The lower end of member 24 is shown in detail in FIG. 5. It has a counterbore 34 on its lower end that forms a shoulder 35 and an interior wall 36. The diameter of interior wall 36 is large enough that the ball can be drawn up into it as shown in dotted line in FIG. 1, where it is stopped by shoulder 35, thereby leaving a spark gap between the ball and the crowned end of the adjustment screw. The axial length of the interior wall is such that when the ball is in the position shown in solid line in FIG. 1, the ball falls away from the shoulder and leaves a significant flow area between it and the interior wall, so that low-velocity fluid (air) can pass by it without pulling the ball along with it. At this position, the ball makes contact with the crowned end of the adjustment screw and the lower edge of the interior wall, thereby forming a conductive path directly between body 34 and the adjustment screw. Thus in the dotted line position shown in FIG. 1, there is an open gap, and in the solid line position, there is no gap. The size of the gap can, of course, be adjusted by turning the adjustment screw. Alternate constructions can readily be envisaged for the lower end of member 24, such as a longer counterbore, with wide slots cut axially therein.

The lower end of member 24 has notches 37 which extend across the internal wall and the shoulder to provide a restricted fluid path past the ball even when the ball is drawn against the shoulder. Such flow tends to keep the ball better centered.

A dust screen 38 is placed across side port 27 to exclude dust and other foreign material from the system.

The operation of this device will now be described. With the engine at rest before starting, atmospheric pressure exists in conduit 15, in conduit 22*a*, and at port 13 of the diaphragm-actuated spark advance means. The spark at this time is fully retarded. Also, pressure is at atmospheric level in chamber 23, so that the ball is in the rest position shown in solid line in FIG. 1. It will be noted that at this time the ball leans against one side of the bottom of the tube, and rests upon the crown of the adjustment screw. Therefore, current will flow from terminal 25 through member 24, and the ball, and sleeve 29 to the rotor without a gap.

As the engine is started, the vacuum (negative pressure) will increase; that is, the positive pressure will decrease at the flow section to which conduit 15 is connected. As soon as the negative pressure reaches about 5″ of mercury, the diaphragm-actuated spark advance means would, in the absence of flow restrictor 14, snap over and suddenly advance the spark. Particularly under conditions of starting and acceleration, this is undesirable because the spark is advanced faster than the motor's response to conditions in the carburetor. Therefore, it is advantageous for this spark advance to be delayed, and that is the purpose of the flow restrictor. As the differential pressure drops on the side of port 16, the bias of spring 21, and the differential pressure caused by higher pressure to the right of the disc in FIG. 1, will move disc 19 against shoulder 17. This reduces the passage between ports 13 and 16, slowing down the fall of positive pressure at the diaphragm-actuated means so that the spark will not advance so quickly. After a delay of about 5 to 10 seconds when hole 20 is 0.010″ in diameter, the spark advance snaps over, but by that time the motor is in full operation and no ping will result. The spark will be advanced as soon as the engine really can accommodate it. In slowing down and at idle speeds, it is desirable for the spark to be retarded again, and this as fast as possible. Under these conditions, positive pressure builds up at port 16, and unseats the disc from shoulder 17. This adds the flow passage of the annular space around the disc to that of the central hole which is all that is needed for a quick increase in pressure in the diaphragm-actuated means. This allows the spark to retard quickly. Thus this arrangement retards the advancement of the spark, and still permits it to be retarded as rapidly as necessary.

The operation of the auxiliary gap feature will now be described. When the engine speeds up, it is desirable in many engines to have an auxiliary gap in each spark plug circuit. There are on the market spark plugs which have an auxiliary gap in their bodies, in addition to the main gap that is exposed in the cylinder. This invention provides the benefits of the auxiliary gap while still enabling standard spark plugs to be used. The advantages of the auxiliary gap are provided for each cylinder, but in this invention, only a single extra gap is needed. In addition, it is placed in the circuits only when it is advantageous, and is cut out of the circuit at conditions where its presence would not be an advantage.

While the auxiliary gap is useful in many engines when operating at high rates of speed, it is a disadvantage when starting the engine and at idling speeds. At these latter times, the hottest spark possible is desired in the cylinder. Accordingly, when the engine is standing still or starting, or operating at relatively low speeds, the air flow through side port 27 is insufficient to sweep up the ball and draw it into the opening in the bottom of tubing 24. Thus, the ball leans against side wall 36, and rests on crown 31, and shorts out the auxiliary gap. However, when the engine operates at a high rate of speed, air flow through the side port is rapid, and the ball is swept up to the position shown in dotted line, at which time an auxiliary gap is provided between the ball and the crown. The length of this gap is adjustable by turning the screw, and will ordinarily be about 0.020″. The full gap is ordinarily provided when induction system pressure to which the device is connected is about 5″ of mercury vacuum. At lesser values of vacuum, the ball may float freely so that there is no sticking and will thereby provide a shorter gap because the ball will be closer to the crown of the adjusting screw, and usually will make contact with member 24. If it floats momentarily in the center, two lesser gaps will be formed, but this latter is the lesser probability, because ordinarily the ball will tend to contact the wall.

Because of the floating action and the clearance between the interior wall and the ball, the device is self-cleaning, the ball tending to scour and knock loose any dirt particles, which will then be swept along into the induction system, leaving the device clean.

Under heavy engine loads, the vacuum drops in the induction system, and the ball drops to close the auxiliary gap, thereby improving the spark condition in the cylinder when the engine is under excessive load. Intermediate and normal operation conditions are provided for by the floating action of the ball, and by its seating against the shoulder.

In the device illustrated, four notches are shown. More or fewer can be used. The primary purpose of the notches is to bypass some air to prevent the ball from sticking in its upper position. A symmetrical notch pattern provides better flow conditions than a non-symmetrical pattern, but both work well. The bypassed air also serves to cool the region of the auxilary gap.

This invention thereby provides an engine accessory which coordinates and regulates the spark advance, and also provides an auxiliary gap when needed. The device is inexpensive to manufacture, and is simple to install in standard engine installations.

This invention is not to be limited by the embodiment shown in the drawings and described in the description which is given by way of example and not of limitation, but only in accordance with the scope of the appended claims.

I claim:

1. In an engine installation which includes a distributor for distributing a spark from a central terminal to individual spark plugs and diaphragm-actuated means for advancing and retarding the spark, and a fuel-charge flow section whose pressure varies inversely with engine speed, the improvement comprising: a support member mounted to the distributor having a chamber therein; a conductive sleeve in said support member in conductive contact with the distributor; a conductive adjustment screw threaded in said sleeve and projecting into said chamber; a ball seat member having a conduit, said ball seat member entering said chamber with its conduit opening thereinto; a conductive ball in said chamber so disposed and arranged as to seat against the ball seat member, leaving an auxiliary gap between itself and the adjustment screw in a first position, and to rest on the adjustment screw and contact the ball seat member in a second position; and a port through the support member, the conduit in the ball seat member being connectible to said fuel-charge flow section so that the pressure of the section is substantially transmitted to the conduit, said ball seat member being above the adjustment screw whereby the force of gravity tends to move the ball toward the adjustment screw, suction in the conduit tending to pull the ball upward against the force of gravity to seat against the ball seat member.

2. An auxiliary spark gap device for an engine adapted to be attached to the central terminal of a distributor, comprising: a support member mounted to the distributor having a chamber therein; a conductive sleeve in said support member in conductive contact with the distributor; a conductive adjustment screw threaded in said sleeve and projecting into said chamber; a ball seat member

having a conduit, said ball seat member entering said chamber with its conduit opening thereinto; a conductive ball in said chamber so disposed and arranged as to seat against the ball seat member, leaving an auxiliary gap between itself and the adjustment screw in a first position, and to rest on the adjustment screw and contact the ball seat member in a second position; and a port through the support member; the conduit in the ball seat member being connectible to a fuel-charge flow section in the engine where the pressure varies inversely with engine speed, so that the pressure of the section is substantially transmitted to the conduit, said ball seat member being above the adjustment screw whereby the force of gravity tends to move the ball toward the adjustment screw, suction in the conduit tending to pull the ball upward against the force of gravity to seat against the ball seat member.

3. Apparatus according to claim 2 in which means are provided for connecting the ignition lead of the engine to the ball seat member.

4. Apparatus according to claim 2 in which a screen is placed over the port in the support member.

5. Apparatus according to claim 2 in which the end of the ball seat member in the chamber where the conduit terminates is counterbored to form an interior wall and a shoulder, said shoulder being contactible by the ball to limit the passage of the ball into the conduit, the interior wall being contactible by the ball while it contacts the adjustment screw.

6. Apparatus according to claim 5 in which the end of the adjustment screw facing the ball seat member is convexly crowned.

7. Apparatus according to claim 6 in which notches are provided across the interior wall and the shoulder to provide for fluid flow across the shoulder when the ball is seated thereon.

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