Aug. 1, 1939. W. J. SPENGLER 2,167,694

IGNITION APPARATUS FOR INTERNAL COMBUSTION ENGINES

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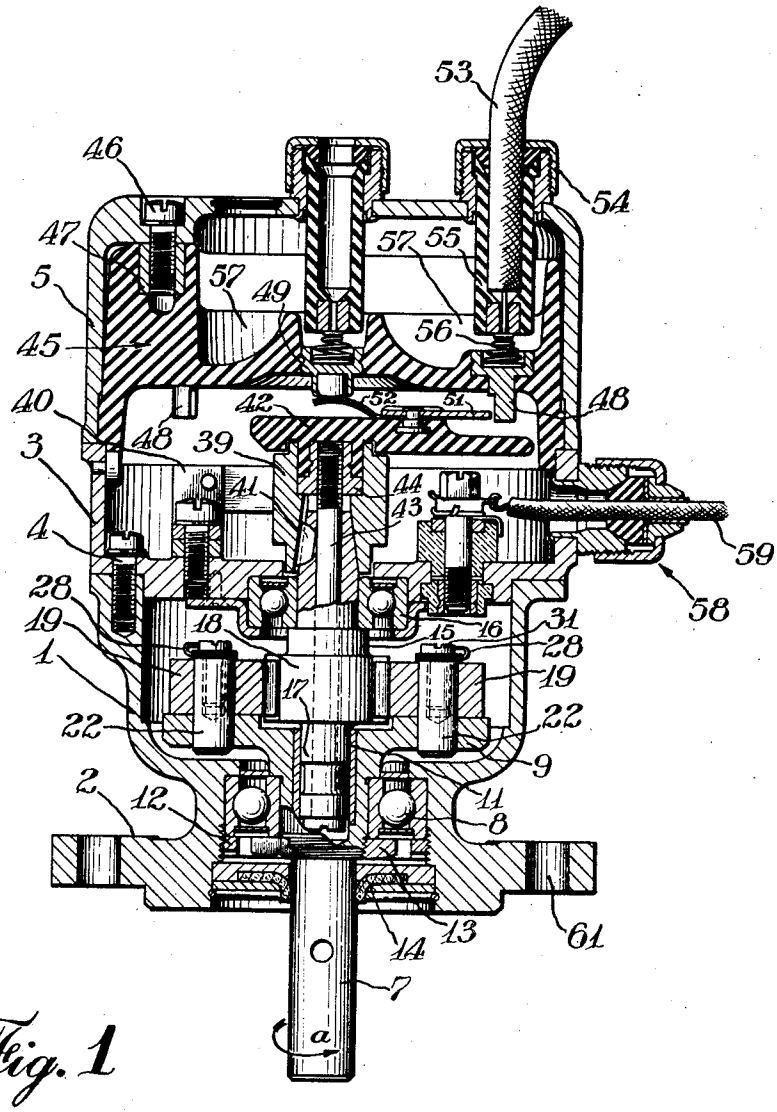


Fig. 1

INVENTOR.

BY Walter J. Spengler
Clinton S. James
ATTORNEY.

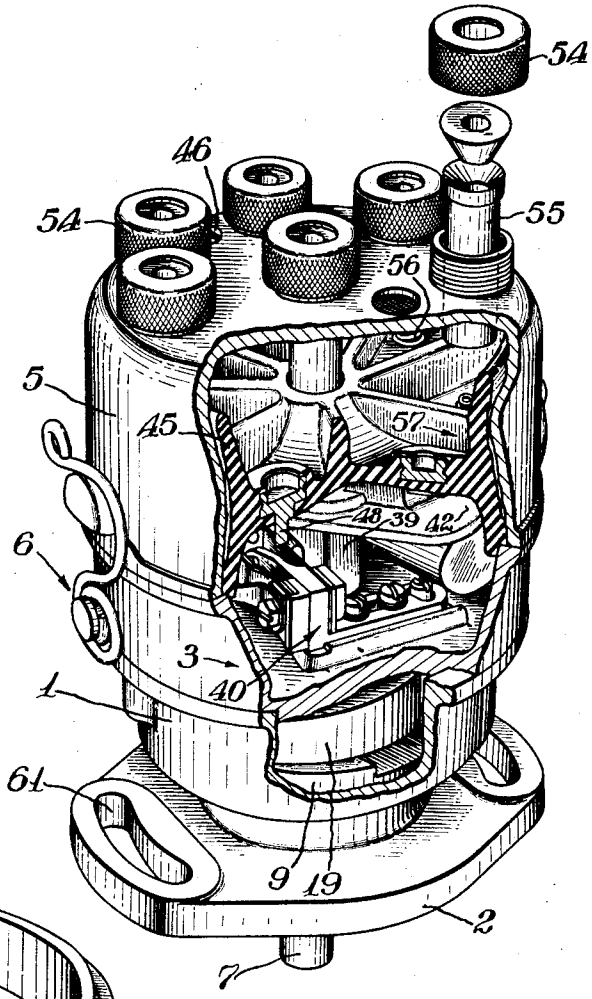
Witness:
Burr W. Jones

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Fig. 2



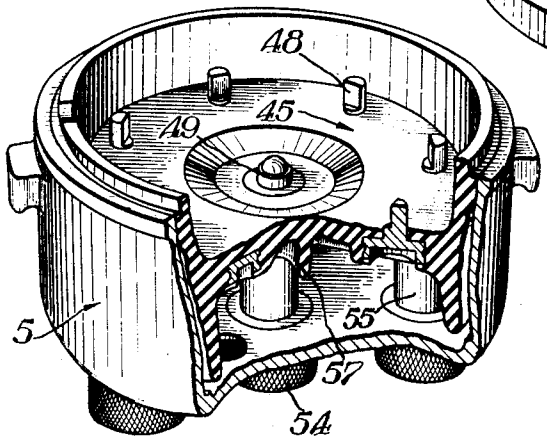


Fig. 3

INVENTOR.

BY Walter J. Spengler
Clinton S. Jones
ATTORNEY.

Witness:
Burr W. Jones

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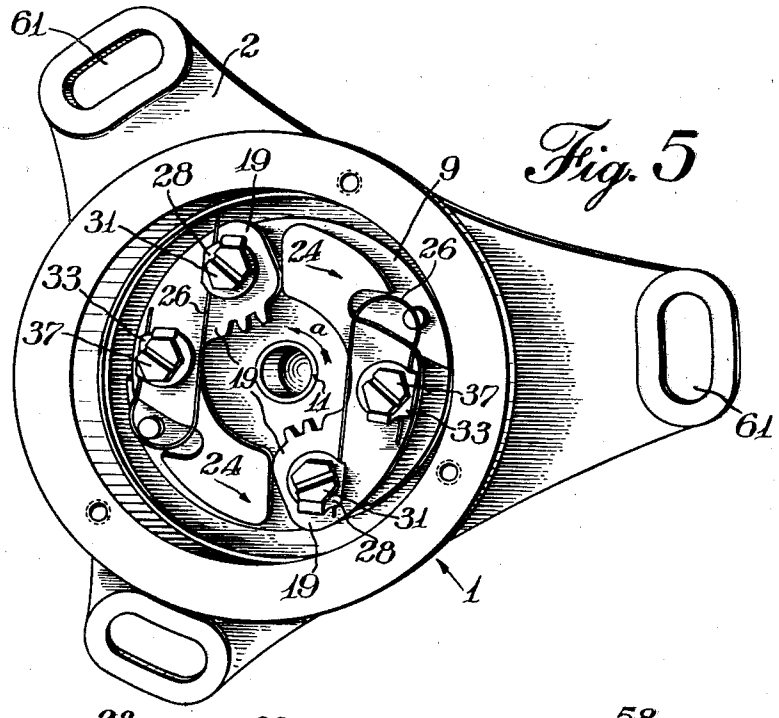


Fig. 5

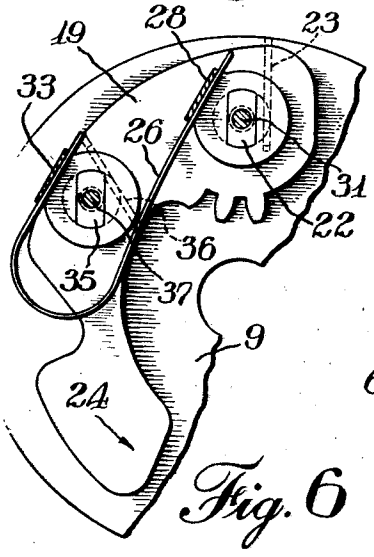


Fig. 6

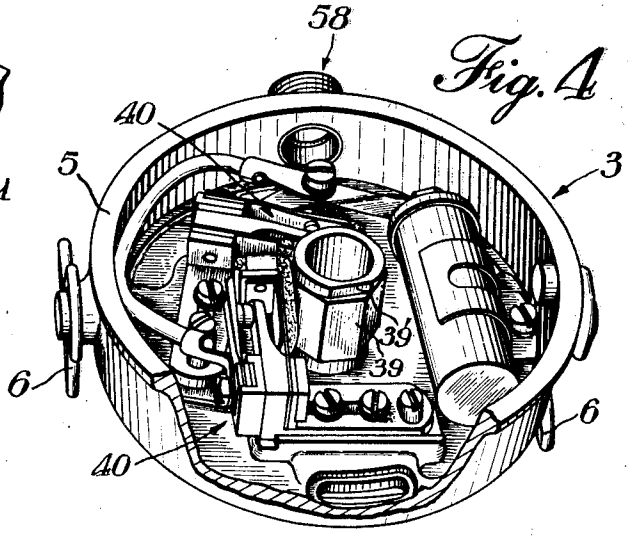


Fig. 4

INVENTOR.

BY Walter J. Spengler
Clinton S. Jones
ATTORNEY.

Witness:
Burr W. Jones

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UNITED STATES PATENT OFFICE

2,167,694

IGNITION APPARATUS FOR INTERNAL COMBUSTION ENGINES

Walter J. Spengler, Sidney, N. Y., assignor to Bendix Aviation Corporation, South Bend, Ind., a corporation of Delaware

Application February 27, 1936, Serial No. 66,077

5 Claims. (Cl. 200—31)

The present invention relates to ignition apparatus for internal combustion engines and more particularly to timer and breaker mechanism of a battery ignition system for aviation engines.

It is an object of the present invention to provide a novel combined breaker and distributor structure which is strong and rigid while simple and light in construction, and efficient and reliable in operation.

It is another object to provide such a device which is completely shielded to prevent radio interference, but is readily disassembled so as to provide easy access for inspection or adjustment.

It is a further object to provide such a device in which there is provided a particularly rigid mounting arrangement for the distributor arm, which cannot vibrate loose.

Another object is to provide such a device embodying special provisions for efficient insulation and to prevent flash-over between high tension conductors.

Another object is to provide such a device embodying a novel form of automatic spark advance which is readily adjustable to control the action thereof.

Further objects and advantages will be apparent from the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a vertical substantially mid-sectional view of a preferred embodiment of the invention;

Fig. 2 is a side view in perspective partially broken away to show the interior construction;

Fig. 3 is a detail in perspective of the casing cap and high tension terminal block, partially broken away to show the construction;

Fig. 4 is a detail in perspective of the intermediate casing section with the breaker mechanism mounted therein;

Fig. 5 is a perspective view from above of the base section of the casing showing the driving member journalled therein with the centrifugal coupling elements mounted thereon; and

Fig. 6 is an enlarged detail, partly broken away, of a centrifugal coupling element and its mounting means.

Referring first to Fig. 1 of the drawings, there is illustrated a metallic shield and casing comprising a cup-shaped base section 1 adapted to be attached to a suitably formed mount on the internal combustion engine by means of a mounting flange 2. An intermediate metallic casing section 3 in the form of a cup is nested on the base section 1, being suitably retained thereon as by means of cap screws 4. A cap section 5 is arranged to fit over the intermediate section 3, being retained thereon by suitable readily detachable fastening means such as indicated at 6 in Fig. 2 whereby a completely enclosed metallic casing is formed.

A drive shaft 7 is journalled in the base section 1 as by means of a ball bearing 8 and carries at its upper end a driving flange 9 centrally apertured and provided with a bearing bushing 11. The bearing 8 is retained in the base section 1 by a ring 12 threaded therein and is rigidly connected to the drive shaft 7 by means of a nut 13 threaded thereon. Suitable packing means 14 is preferably provided in the base section 1 around shaft 7 to prevent excessive lubricant passing up into the distributor assembly, also to retard flow of lubricant out of the distributor assembly.

A driven shaft 15 is mounted in the intermediate casing section 3 by suitable means such as a ball bearing 16 and is provided with a pilot extension 17 entering the bushing 11 in the drive shaft. An intermediate portion of the driven shaft is formed as a pinion 18, and a pair of centrifugal coupling elements in the form of toothed sectors 19 are pivoted on studs 22 in the driving flange 9 in position to engage the teeth of the pinion 18. Studs 22 are fixed in the driving flange 9 as by means of pins 23 (Fig. 6). The coupling elements 19 are weighted as indicated at 24 so as to rotate clockwise, as viewed in Fig. 5, under the action of centrifugal force, and since the drive shaft is rotating counter-clockwise as indicated by the arrow *a*, centrifugal force acts to advance the driven shaft with respect thereto by the action of the sectors 19 on the pinion 18.

U-shaped springs 26 are provided for opposing the action of centrifugal force on the elements 19 and for this purpose one arm of each spring is anchored to its pivot stud 22 by means of an anchor member 28 retained by cap screw 31. The opposite arm of each spring is similarly anchored by means of a member 33 to a stud 35 (Fig. 6) mounted rigidly in the intermediate portion of the element 19 as by means of pins 36, the member 33 being fixed thereto by a cap screw 37. The anchor members 28 and 33 are formed to slidably receive the arms of the springs 26, whereby loosening of the cap screws 31 and 37 permits longitudinal adjustment of the springs whereby their effectiveness may be varied in order to control the action of the centrifugal coupling means.

A breaker cam 39 is keyed on the upper end of the driven shaft 15 as indicated at 41 in position to operate a pair of breaker devices 40 as best seen in Fig. 4. The upper end of the cam 39 is formed with a double D section 39' and a distributor member 42 is formed to fit non-rotatably thereon. The driven shaft 15 is provided with an opening running throughout its length, and a bolt 43 (Fig. 1) is arranged to traverse the open-

ing and thread into a nut 44 molded in the distributor member 42 and thus fix the cam and distributor member rigidly on said shaft.

A terminal block 45 of suitable di-electric material is seated in the cap 5 of the casing, being retained therein as by means of cap screws 46 threaded into nuts 47 molded in the terminal block. A circular series of secondary contacts 48 and a central contact member 49 are molded in the terminal block, and a contact arm 51 is suitably mounted on the distributor member 42 in position to cooperate at its outer end with the terminals 48, and connected at its inner end by a spring strip 52 to the central terminal 49.

High tension cables 53 are arranged to enter the top of the cap 5 through apertures provided with suitable retaining means 54, sleeves 55 of di-electric material being arranged to surround the cables and extend inwardly adjacent the contacts in the terminal block. Spring conductors 56 are provided for connecting the cables to said contacts, and flanges 57 are formed in the terminal block, as best seen in Fig. 2, extending upwardly so as to overlap the sleeves 55 and effectively prevent flash-over from one contact to another.

The intermediate section 3 of the casing is also provided with an opening having insulating and clamping means indicated generally at 58 for receiving and anchoring a cable 59 conducting primary current to the breaker mechanism 40.

In order to provide for a certain amount of fixed timing adjustment, the mounting flange 2 of the casing is preferably provided with elongated openings 61 for receiving suitable means for attaching it to its engine mount.

In the operation of the device, rotation of the driving shaft 7 in the direction indicated by the arrow *a* in Figs. 1 and 5, is transmitted through the centrifugal coupling 18, 19 to the driven shaft 15 to rotate the cam 39 and distributor member 42. The breaker mechanisms 40 are thus actuated by the cam 39, and the distributor arm 51 is caused to rotate to connect the central contact 49 with each of the contacts 48 in sequence, in the usual manner. Rotation of the driving shaft above a predetermined minimum speed causes the weighted sectors 19 to rotate on their pivots and advance the driven shaft 15 with respect to the drive shaft 7 and thereby advance the timing of the breaker and distributor mechanism with respect to the engine functions. The inception and amount of such advancing action can be readily controlled as above set forth by means of the longitudinal adjustment of the U-shaped governing springs 26.

The cap 5 of the casing with the terminal block 45 is removable as a unit, which removal exposes the distributor and breaker mechanism for inspection and adjustment and also exposes the cap screws 4 which attach the intermediate casing section 3 to the base 1. Removal of these cap screws then permits the removal of the intermediate section, thus exposing the centrifugal coupling elements for adjustment. It will thus be seen that there is here provided a completely shielded timer and breaker mechanism built up of units each having its own casing section and each being removable as a unit.

Although but one embodiment of this invention has been shown and described in detail, it will be understood that other embodiments are possible and that various changes may be made in the proportions and arrangement of the parts without departing from the spirit of the invention as defined in the claims appended hereto.

What is claimed is:

1. In an ignition system for internal combustion engines a timer and distributor unit including a drive shaft, a driven shaft, a breaker cam and a distributor arm mounted on the driven shaft, and automatically variable means for coupling said driving and driven shafts including a member operable by centrifugal force to advance the driven shaft with respect to the drive shaft, and means yieldingly opposing such action in the form of a loop of spring material longitudinally adjustable to vary its effectiveness.

2. In an ignition system for internal combustion engines a timer and distributor unit including a drive shaft, a driven shaft, a breaker cam and a distributor arm mounted on the driven shaft, and automatically variable means for coupling said driving and driven shafts including a pivoted member operable by centrifugal force to advance the driven shaft with respect to the drive shaft, and a U-shaped spring opposing such action having one arm anchored to the pivot of the centrifugal member and the other arm anchored to said member, said spring being longitudinally adjustable to vary its stiffness.

3. In a timer and distributor for internal combustion engines a casing, a drive shaft and a driven shaft coaxially journalled therein, a pinion on the driven shaft, a toothed sector pivoted on the drive shaft adapted to mesh therewith, said sector being so weighted that centrifugal force causes pivotal movement thereof in a direction to advance the pinion with respect to the drive shaft, a pivot pin for the sector fixed to the drive shaft, a pin fixed to an intermediate portion of the sector, a U-shaped spring, and means for non-rotatably anchoring the arms of the spring to said pins with provision for longitudinal adjustment to vary the effectiveness of the spring.

4. In a timer and distributor for internal combustion engines a casing, a drive shaft and a driven shaft coaxially journalled therein, a pinion on the driven shaft, a toothed sector pivoted on the drive shaft adapted to mesh therewith, said sector being so weighted that centrifugal force causes pivotal movement thereof in a direction to advance the pinion with respect to the drive shaft, a pivot pin for the sector fixed to the drive shaft, a pin fixed to an intermediate portion of the sector, a U-shaped spring, deformable clamps having sliding engagement with the arms of the spring and non-rotatably mounted on said pins, and means for tightening said clamps and fixing the same on the pins.

5. In a shielded timer and distributor structure for internal combustion engines, a complete metallic casing including a cup-shaped base, an intermediate cup-shaped section and a casing cap, a driving shaft rotated by the engine journalled in the base, a driven shaft journalled in the intermediate section and having at one end a pilot bearing in the driving shaft, a breaker cam keyed on the opposite end of the driven shaft, a distributor rotor mounted non-rotatably on the cam, and a distributor block mounted in the casing cap in position to cooperate with the distributor rotor.

WALTER J. SPENGLER.