

June 10, 1941.

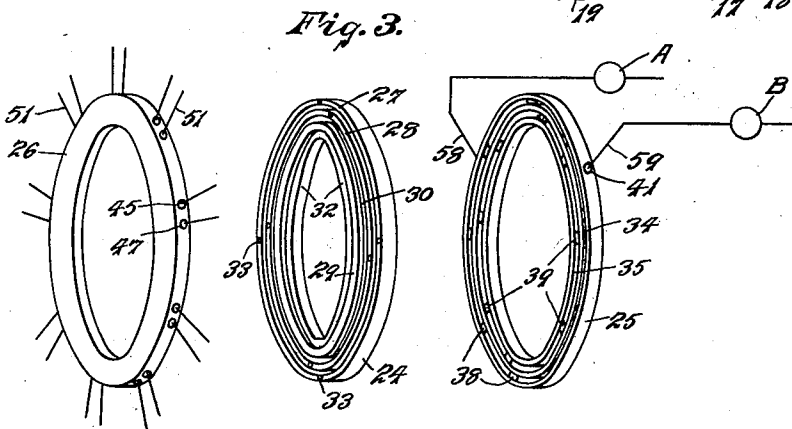
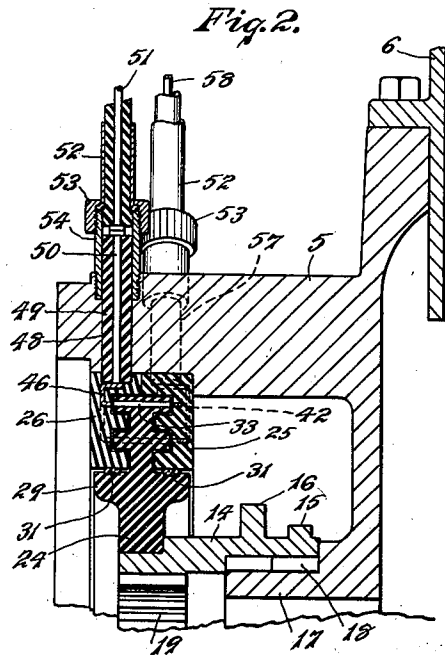
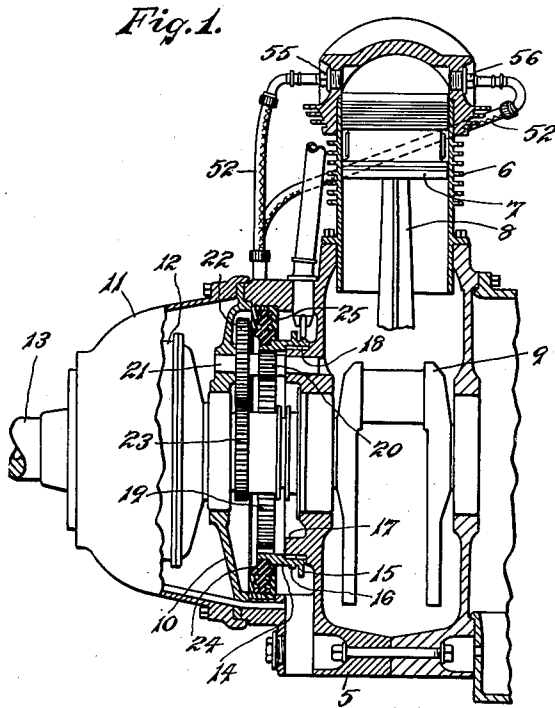
J. JOYCE

2,245,402

IGNITION DISTRIBUTOR

Filed Jan. 18, 1939

2 Sheets-Sheet 1



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June 10, 1941.

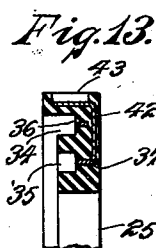
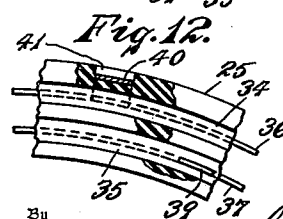
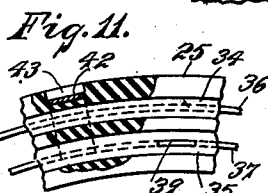
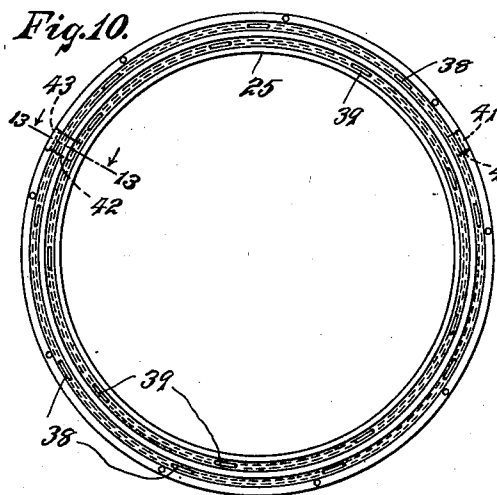
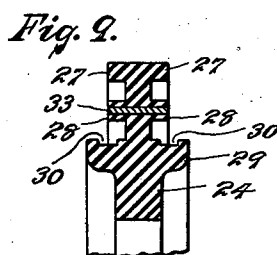
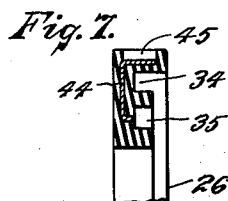
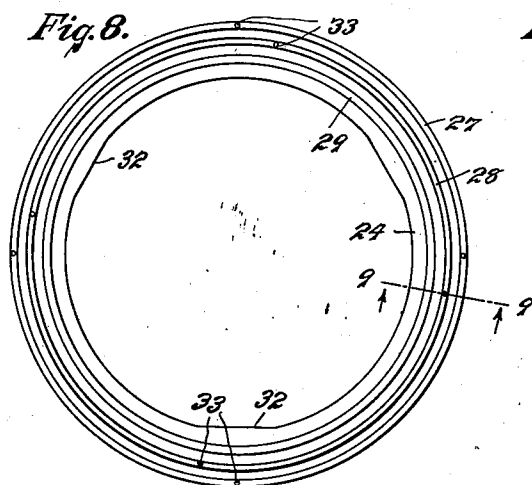
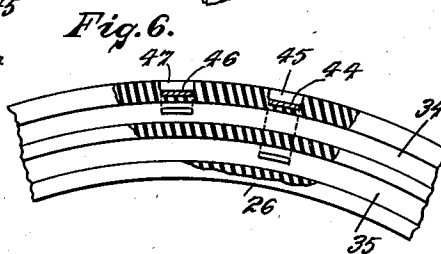
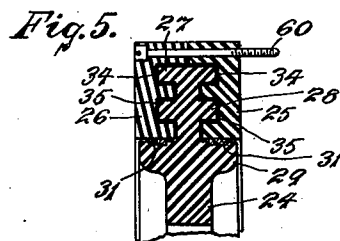
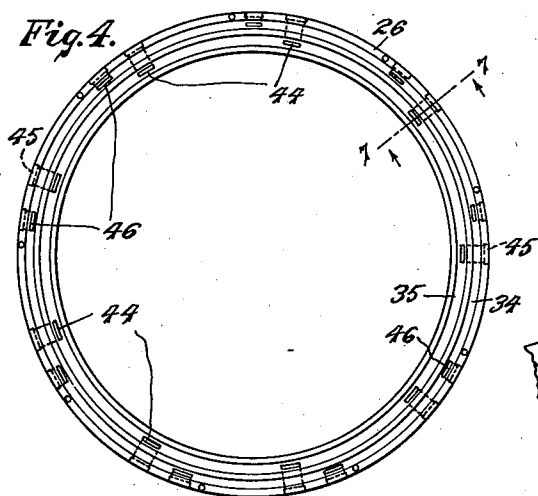
J. JOYCE

2,245,402

IGNITION DISTRIBUTOR

Filed Jan. 18, 1939

2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,245,402

IGNITION DISTRIBUTOR

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Application January 18, 1939, Serial No. 251,571

12 Claims. (Cl. 123—146.5)

This invention relates to ignition distributors for internal combustion engines and is particularly adapted for engines of the radial type and such as used on aircraft.

A primary object of the invention is to provide a distributor which may be incorporated in the mechanism of a radial engine, to reduce the number of parts heretofore necessary in the conventional type of distributors and also to increase the efficiency of the engine.

A further object of the invention is to provide a distributor which is adapted to be driven directly by, and with, the valve operating cam member of an engine so that the timing of the ignition may be set with a greater degree of accuracy than has heretofore been possible through the ordinary forms of drives for distributors.

A further object of the invention is to provide a distributor which is constructed in the form of rings that are adapted to be mounted between the cam member and the crank case of an engine and contained entirely within the said case.

A further object is to provide such a distributor whereby the connections from the distributor to the spark plugs and the cylinders of the engine may be made in a more direct and satisfactory manner.

Further objects of my invention will be clearly understood from the following description and from the drawings in which:

Figure 1 is a view, partly in central vertical section, through a portion of a radial engine.

Figure 2 is a fragmentary view, on an enlarged scale, in central vertical section and showing an embodiment of my invention.

Figure 3 is a diagrammatic view illustrating the ignition circuit, as distributed by means of my improved distributor.

Figure 4 is a plan view, in side elevation and on a different scale, showing one of the members in my improved distributor.

Figure 5 is an enlarged view, in central vertical section, illustrating the parts of my improved distributor as assembled.

Figure 6 is an enlarged view, in front elevation and partly broken away, showing a portion of the member illustrated in Figure 4.

Figure 7 is an enlarged view, in central vertical section, on line 7—7 of Figure 4.

Figure 8 is a view, in side elevation, of the rotor member of my improved distributor.

Figure 9 is an enlarged view, in central vertical section, on line 9—9 of Figure 8.

Figure 10 is a view, in side elevation, of the

member used opposite to the member illustrated in Figure 4.

Figure 11 is an enlarged view of a portion of the member illustrated in Figure 10.

Figure 12 is a similar view of another portion of said member.

Figure 13 is an enlarged view, in central vertical section, on line 13—13 of Figure 10.

As illustrated in the drawings, the numeral 5 denotes the crank case of an engine of the radial type having a plurality of cylinders 6 mounted thereon which include the usual piston 7 which is connected, by means of the connecting rod 8, to the crank shaft 9.

A gear cover plate 10 is secured to the front of said crank case and a housing 11 is also mounted upon said crank case for housing a transmission unit 12 through which a driving shaft 13 is connected to the crank shaft.

Radial engines, of the type illustrated, are provided with a cam member 14 which is usually in the form of a ring having a row of cam projections 15, for operating the exhaust valves on the cylinders, and another row of similar cam projections 16 for operating the intake valves. The said cam member is mounted on an extension 17 in the crank case and is usually provided with a ball or roller bearing 18. The said cam member is also provided with a row of gear teeth 19, around the inside circumference thereof, which mesh with a pinion 20 on a shaft 21 that is mounted in the crank case and which is rotated by means of a gear 22 that is driven by a gear 23 which rotates with the crank shaft for driving the said cam member.

My invention provides for a distributor which includes a rotor 24, of suitable insulating material, that is mounted directly upon the cam member 14 to rotate therewith.

The said distributor also includes a stationary portion which comprises two halves, 25 and 26, that are joined together to form a casing within which a portion of the rotor 24 extends. Said rings are also formed of insulating material and have molded therein conducting members to be hereinafter described.

The said rotor 24 is provided with parallel annular ribs 27 and 28 extending laterally therefrom from opposite sides thereof and also has annular ribs 29 forming a flange at each side of the rotor which are grooved, as at 30, to receive packing strips 31 for sealing the said distributor against the passage of oil or dirt into the casing formed by the halves 25 and 26. The said rotor is also provided with irregular por-

tions 32 on the inside circumference thereof for keying it to the cam member 14 so that it will rotate therewith.

Electrical conductor pins 33 are mounted in the ribs 27 and 28 and extend through the rotor to the surfaces of the ribs in the opposite sides.

The rings 25 and 26 are each provided with oppositely corresponding outer grooves 34 and inner grooves 35 which are parallel to each other and receive the extending ribs 27 and 28 of the rotor 24.

The ring 25 has encased therein, by molding process, an electrical conductor 36, in the form of a ring, which extends annularly therein and in alignment with the groove 34, and a similar conductor ring 37 in alignment with the groove 35 in said ring. The ring 36 is provided with a series of extensions 38 which are exposed within the groove 34 of said ring and the conductor 37 is provided with similar extensions 39 which are exposed within the groove 35. The conductor ring 36 is electrically connected to a connector 40, which extends into a recess 41 in the periphery of the ring 25, and the conductor 37 is connected to a similar connector 42 which extends into a separate recess 43, also in the periphery of said ring 25.

The ring 26 is provided with a series of conductors 44 which are molded therein, are exposed within the groove 34 and extend into recesses 45 in the periphery of the said ring, and a series of similar conductors 46 which are exposed within the groove 35 and extend into separate recesses 47 in the periphery of said ring 26.

The crank case 5 of the engine is provided with a series of apertures 48 which are in alignment with the series of recesses 45 and 47 in the distributor ring 26. Insulating bushings 49 extend through each of said apertures, into each of said recesses 45 and 47, and contain conducting rods 50 which are adapted to contact with a conductor 44 or 46 in said recesses and conducting wires 51 which extend through flexible sheaths 52 to the spark plug in each cylinder of the engine; the said sheaths and conductor wires 51 being held in connected position by means of nuts 53 which are threaded to sleeves 54 which in turn are threaded in the crank case of the engine as clearly illustrated in Figure 2 of the drawings. Thus, an electrical connection is provided leading from each of the conductors 44 and 46, in the ring 26, to a spark plug in the engine.

Each of the said conductors 44, which are exposed in the groove 35 of the ring 26, are connected to the spark plugs 55 at the front sides of the cylinders and each of the conductors 46, which are exposed in the groove 34, of the ring 26, are connected to the spark plugs 56 at the rear sides of the cylinders.

An aperture 57 is also provided in the crank case 5, in alignment with the recess 43, and a flexible connection, such as just described, extends through said aperture for connecting the conducting member 40, through a wire 58, to one side of a magneto, as indicated at A in Figure 3 of the drawings. A similar connection is made from the connector 40, through the wire 59, to one side of a second magneto, as indicated at B. The other side of each of said magnetos is grounded to the engine and each of the spark plugs are also grounded thereto in order to complete the electric circuit through said spark plugs.

As illustrated in Figure 5 of the drawings, it will be noted that a screw 60 may be used for joining the two halves 25 and 26 together. The

said screw may also extend into the crank case of the engine so as to secure the said rings thereto in fixed position.

The distributor illustrated in the drawings, is designed particularly for engines of the radial type having nine cylinders. Therefore, the ring 25 includes nine sets of conductors 44 and 46 which are disposed in proximity to each other and evenly distributed around the circumference of the ring. Also, the ring 25 contains nine sets of extensions 38 and 39 which are disposed directly opposite the said conductors 44 and 46.

The rotor has four sets of conducting pins 33, extending through the ribs 27 and 28, and the said pins in each set are so spaced that they will pass between the opposite conductors 46 and extensions 39 and conductors 44 and extensions 38 at the same time; thus simultaneously establishing an electrical connection from the conductors 36 and 37 to both spark plugs, 55 and 56, of each cylinder in rotation as the rotor is revolved with the cam member 14.

The rotor 24 is rotated at the rate of one revolution for every eight revolutions of the crank shaft and there are four sets of conducting pins extending around said rotor. Therefore, ignition is caused in each of said cylinder for every two revolutions of the crank shaft providing the usual timing for a four-cycle engine.

The ignition circuit and the distribution thereof is as follows:

The current is provided from the magneto A, through the wire 58 to the inner conductor 37, which is exposed in the groove 35 of the ring 25, and from the magneto B through the wire 59 to the outer conductor 36 which is exposed in the groove 34 of said ring.

As the pins 33 are rotated past the exposed portions of said conductors, the current from each will be conducted through the said pins to the opposite conductors 44, in the groove 34, and conductors 46 in the groove 35 in the ring 26. The current will then pass from said conductors through the conductor pins 49 and the wires 51 to the spark plugs at opposite sides of the cylinders where, the said spark plugs being grounded with the magneto, a spark is caused to ignite the gas in the respective cylinders in rotation. Therefore, by means of my improved distributor, the gas in each cylinder is ignited exactly at the proper time with relation to the position of the valves therein for the reason that the rotor of the distributor is directly operated by the cam member 14 which also operates the valves; thus closely associating the operation of said valves with the timing of the ignition.

While, in the embodiment illustrated in the drawings, I have shown a distributor for a double ignition, or, which provides for distributing to two sets of spark plugs from two separate magnetos, my invention may also be applied in engines having a single ignition. In such cases, the rotor 24 would be provided with only one rib and one set of pins 33, and the rings 25 and 26 would each be provided with only one groove oppositely disposed relative to the groove in the opposite half.

My improved distributor also provides for the elimination of complicated mechanism such as gears, rotors, long connections, etc., which have been heretofore used in magnetos where the distributors have been included as a part of the mechanism thereof, since the magnetos used in connection with my improved distributor re-

quire only an armature and a breaker box and coil.

My invention further provides a valuable advantage in that the connections from the distributor to the spark plugs are made in a more direct manner than has heretofore been possible and, therefore, permitting a more satisfactory and simpler arrangement of the various parts needed for the distributor of ignition in engines of the class described.

While the embodiment illustrated shows a distributor which is intended for a set ignition, the same may be also modified to provide for adjustment of the stationary portion of the distributor, which is formed by the rings 25 and 26, so that the same may be slightly rotated to advance or retard the ignition as may be desired.

I claim:

1. In an internal combustion engine comprising a casing, a plurality of cylinders mounted in said casing, spark plugs in said cylinders, and an ignition system for supplying current to said spark plugs; a distributor in said ignition system comprising a plurality of opposed annular members mounted to the casing of said engine, a rotor extending partially between said annular members; said annular members having opposed grooves therein, current conductors exposed within said grooves, means connecting the said conductors in one of said annular members to the said spark plugs, a source of current, means for connecting said current to the said conducting means in the other of said annular members, and conducting means in said rotor successively movable between the said conductors in said annular members for distributing said current supply to the said spark plugs.

2. In an internal combustion engine including a casing, a plurality of cylinders, and spark plugs in said cylinders; an ignition system including a distributor comprising a pair of opposed rings stationarily mounted in said casing, one of said rings having a conductor imbedded therein with portions thereof exposed in the direction of the opposite ring, means connecting a supply of current to said conductor, the said opposite ring having a series of conducting members imbedded therein and exposed oppositely to the exposed portion of said conductor and spaced therefrom, means connecting each of said conducting members to one of said spark plugs, a rotor, and means in said rotor movable between the exposed portions of said conductor and said conducting members for successively connecting said source of current therebetween and thereby operating said spark plugs.

3. For an internal combustion engine comprising a casing, an ignition system including spark plugs, a distributor comprising a plurality of grooved opposed rings stationarily mounted in said casing, interrupted electrical conducting members exposed within the grooves of said rings, means for connecting a supply of current through said conducting members to said spark plugs, a rotor extending between said rings, ribs on said rotor extending into the grooves of said rings, conducting members in said rotor exposed on the surfaces of said ribs, and means for rotating said rotor and thereby successively moving the conducting members therein between the conducting members in grooves of said rings for distributing said source of current to said spark plugs.

4. For an internal combustion engine of the character described comprising a casing, cylin-

ders mounted on said casing, spark plugs in said cylinders, an ignition system including a distributor comprising a ring mounted to said casing, a plurality of conductors imbedded in said ring, extensions from said conductors exposed on the surface of said ring, connecting members extending from said conductors into recesses in the periphery of said ring, means fitting into said recesses for connecting the supply of current to said connecting members, a separate ring disposed in opposed relation to the first of said rings, conducting members imbedded in said separate ring and exposed on the surfaces thereof opposite to said exposed extensions in the first ring; the said conducting members in the second ring leading into recesses on the periphery thereof, means fitting within said recesses for connecting each of said conducting members to one of said spark plugs, a rotor extending between said rings, and conducting rods imbedded in said rotor and exposed at opposite sides thereof for conducting the said supply of current from said extensions in the first of said rings to the conducting members in the second ring during the movement of said rotor between said rings.

5. In an internal combustion engine comprising a casing, a plurality of cylinders radially disposed on said casing, spark plugs in said cylinders, a member rotatably mounted in said casing, a crank shaft, and a gear train between said crank shaft and member for rotating said member at a reduced speed; an ignition system for providing a spark at said spark plugs; said ignition system including a distributor comprising an annular stationary portion mounted directly to the casing of said engine, an annular rotor carried by said member, interrupted electrical current conductors in said stationary member, means for supplying current to said conductors, radially disposed current connecting means extending from said conductors and through said casing to said spark plugs, and means carried in said rotor for successively connecting the said supply of current through said interrupted conductors for operating said spark plugs in timed relation.

6. A distributor for an ignition system of an internal combustion engine comprising a ring of insulating material having concentric annular grooves therein, spaced conducting members leading from the bottoms of said grooves to recesses in the periphery of said ring, another ring opposed to the first of said rings and having concentric annular grooves therein opposite to the grooves of the first ring, conductors imbedded in said second ring, extensions from said conductors extending into the bottom of the grooves thereof opposite the said conducting members in the first ring, a rotor having a portion extending between said rings, ribs on said portion extending into said grooves, and conductors extending through said rotor in said ribs and exposed upon the surfaces of said ribs whereby, upon the rotation of said rotor between said rings, the said conductors will successively establish an electrical connection between the said opposed extensions and conducting members.

7. The subject matter set forth in claim 6 including sealing means between said rotor and rings for closing the space between said rings.

8. For the ignition system of an internal combustion engine, an annular member having a distribution recess therein, a rotor movable within said recess and means between said rotor and annular member for sealing said recess.

9. For the distributor system of an internal combustion engine comprising a gear casing, a stationary member mounted to the interior of said casing, a rotatable member; one of said members having a distributing recess therein, 5 electrical conductors interrupted by said recess, a projection on the other member, means in said projection for transmitting electric current across said recess through said electric conductors and sealing means between said members for sealing said recess from the interior of said casing.

10. In an internal combustion engine comprising a casing, a member rotatably mounted in said casing, a stationary member in said casing, 15 a rotor carried by said rotated member and movable partly within said stationary member, and ignition conducting means associated with said stationary member and extending through the said casing to the exterior thereof.

11. In an internal combustion engine including a casing; an ignition distributing system comprising an annular member of insulating material mounted directly to the said casing, conducting means extending from said member through the casing of said engine and connected to said spark plugs, and a rotor movable relative to said stationary member.

12. For an internal combustion engine comprising a casing; an ignition distributing system comprising a plurality of annular members mounted directly to the casing of the said engine, a rotor movable between said annular members, means connecting an electric current supply to one of said annular members, electric conductors in the other of said annular members, and means extending through said rotor for distributing the supply of current to the said conductors in successive relation.

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