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INTERNAL COMBUSTION ENGINE PISTON

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This invention relates to an engine piston and more particularly pertains to pistons of internal combustion engines and to the ignition systems of the latter.

An object of the invention is to provide a construction in an internal combustion engine piston for effecting spark ignition of the engine fuel by movement of the piston to the termination of the compression stroke thereof, whereby the use of the conventional spark plugs may be dispensed with, and whereby the ignition will be effected through the piston rather than through the engine head as now commonly practiced so that the electrically conductive leads to the ignition points will be housed and protected within the engine thus permitting the employment of high tension electrical current in the ignition system without danger to persons contacting the external parts of the engine.

Another object is to provide an engine piston with an ignition element in which the parts are so constructed and arranged as to afford a plurality of spark gaps whereby a series of ignition sparks will be simultaneously developed at spaced points on the outer end of the piston so as to insure ignition of the explosive fuel.

Another object is to provide an effective means for directing electrical current to the ignition element on the piston during reciprocation of the latter and in a manner whereby making and breaking of the circuit will be timed by the movement of the piston to and from its outermost position.

Another object is to provide a mode of mounting an ignition element on a piston such as to afford adequate insulation of the electrically conductive parts from the piston, except as to a ground connection, and in a manner to facilitate assemblage of the parts.

Another object is to provide a simple and durable means for affording electrical connection between the ignition elements on the end of a piston and an electrical conductor carried by an oscillating piston rod.

A further object is to provide a means whereby ignition of the compressed fuel in an internal combustion engine may be effected through the medium of a plurality of electrical spark developing elements arranged in series and operated by alternating electrical current in a manner to insure ignition of the explosive fuel.

With the foregoing objects in view, together with such other objects and advantages as may subsequently appear, the invention is carried into

effect as illustrated by way of example in the accompanying drawing, in which:

Fig. 1 is a plan view of the piston showing the spark ignition elements thereon;

Fig. 2 is a view in cross section taken on the line 2—2 of Fig. 1 with parts shown in elevation;

Fig. 3 is a view in cross section taken on the line 3—3 of Fig. 2;

Fig. 4 is a diagram of a fragmentary portion of an internal combustion engine as seen in longitudinal section depicting the application of the invention;

Fig. 5 is a detail in section as seen on the line 5—5 of Fig. 4 with parts shown in elevation;

Fig. 6 is an enlarged view in elevation of the contact element indicated by the arrow 6 in Fig. 5;

Fig. 7 is an enlarged detail in section taken on the line 7—7 of Fig. 1.

Referring to the drawing more specifically, A indicates generally a conventional piston of an internal combustion engine B, which piston is provided with an end wall 10 and cylindrical side wall 11 and is fitted with the usual wrist pin 12 to which the head 13 on the outer end of a piston rod 14 is mounted for turning movement; the rod 14 connecting with a crank 15 on a crank-shaft 16 in the usual manner.

In carrying out the invention a pair of superimposed insulating disks 17 and 18 are applied and fastened to the outer face of the piston end wall 10 which disks are formed of laminations of mica so as to resist the high temperatures to which the upper end of the piston is subjected during operation of an engine to which it is applied.

Mounted on and secured to the outer insulating disk 17 is a series of four electrically conductive bars a, b, c and d which are arranged in rectangular formation with the contiguous ends of the bars a—b, b—c, and c—d spaced slightly apart to form spark gaps e, f, and g respectively, the bar d being spaced remotely from the bar a to be out of electrical relation thereto. A fifth bar h leads from the center of the disk 17 toward the bar a and has its outer end spaced from the inner margin of the latter to form a spark gap i. The bars a, b, c, d and h are connected to the disk 17 as by rivets 19 and the bar d is connected to the end wall 10 of the piston as by a screw 20 to effect an electrical ground connection therewith. The end wall 10 of the piston is formed with a central opening 21 in which is inserted an insulating sleeve 22 having an end flange 23 arranged to seat on the inner face of the wall

10 when the sleeve 22 is positioned in the opening 21 with its end abutting the inner insulating disk 18, as shown in Figs. 2 and 3. A screw 24 is passed through and engages the inner end of the bar *h* and projects through the disks 17 and 18 and through the sleeve 22 and has its threaded shank screwed into engagement with an electrically conductive metallic block 25 which serves as a nut. A lock washer 26 is interposed between the block 25 and the flange 23 of the sleeve 22 and is clamped therebetween on tightening the screw in the block.

Mounted on the block 25 is a spring contact member 27 formed of a metallic strip of substantially arcuate form which is seated intermediate its ends in a recess 28 in the block 25 and is held in place therein as by a screw 29; the ends of the strip protruding from the opposite sides of the block 25 and extending astride the head 13. Contact points 30 on the end portions of the strip 27 bear under the tension of the latter on a contact strip 31 carried by and extending transversely of the head 13 and insulated from the latter by an insulating strip 32. The contact strip 31 connects with an electrical conductor 33 extending longitudinally of the piston rod 14 and insulated therefrom by an insulating sheath 34.

The conductor 33 leads to a roller contact member 35 projecting from an insulating block 36 on the face of the piston rod and which roller contact is adapted to effect electrical connection with a spring contact member 37 when the piston A reaches its uppermost position in the engine cylinder in which it is mounted. The contact member 37 projects from a bus-bar 38 arranged in the engine crank case and is electrically connected to a source of high tension alternating electrical current through the usual converter and transformer connections with the generator and battery circuit associated with the engine to which the piston is applied, and which is not necessary to be here shown.

As a means for insuring electrical connection between the roller contact 35 and the spring contact 37 occurring only when the piston A is in its uppermost position an insulating striker block 39 is mounted on the underside of the spring contact 37 to project obliquely across the elliptical path of travel of the roller 35 indicated by the broken lines *j* in Fig. 6, so that on upstroke of the piston rod the roller 35 will strike the block 39 and elevate the spring contact member 37 slightly as the roller approaches its uppermost position. The block 39 serves to retain the roller 35 out of electrical contact with the contact 37 until the roller reaches its uppermost position as determined by the uppermost position of the piston A, at which point the roller 35 rides off the insulating block 39 whereupon the contact 37 snaps into contact with the roller 35, as indicated in Fig. 6. When the spring contact member 37 thus meets the contact roller 35 electrical current will be directed to the roller and will flow along the conductor 33 to the contact plate 31 on the piston to the bar *h* through the block 25 and screw 24. The current then flows successively through the bars *h*, *a*, *b*, *c* and *d* to ground and in jumping the gaps *i*, *e*, *f*, and *g* will gen-

erate a series of sparks which serve to ignite explosive gases compressed above the piston in the engine cylinder in which the piston operates.

In this fashion ignition of the gases occurs at the termination of the up-stroke of the piston and is timed by movement of the piston. The circuit through the spark gaps endures for the interval of time during which the piston and the roller 15 are maintained in their uppermost position as the crank passes vertical center and starts downward from its uppermost position, and until the roller moves away from the outer end of the spring contact 37.

While I have shown and described a specific embodiment of my invention I do not limit myself to the exact details of construction set forth, and the invention embraces such changes, modifications and equivalents of the parts and their formation and arrangement as come within the purview of the appended claims.

I claim:

1. In an internal combustion engine piston having an end wall, a series of electrically conductive elements on said end wall insulated therefrom arranged with adjacent of said elements spaced apart to form spark gaps therebetween, electrically conductive means connecting with end elements of said series, including one insulated from said piston and one grounded to said piston.

2. An engine piston having an end wall, electrical insulation on the outer face of said end wall, a series of electrically conductive elements on said insulation arranged with adjacent of said elements spaced apart to form spark gaps therebetween, a ground connection between the element at one end of the series and the piston, and electrically conductive means leading through and insulated from said piston connecting with the element at the other end of the series.

3. The structure called for in claim 2 in which the elements are disposed in rectangular arrangement with the spark gaps located at the corners of the rectangle.

4. An engine piston having an end wall, a wrist pin and a piston rod turnable on said wrist pin, an electrical conductor carried by and insulated from said piston rod, a plurality of ignition elements on said piston end wall, an electrical connection leading from said conductor to said ignition elements, including a contact plate on the head of said piston rod, and a wiper contact member carried on the inner side of the piston end wall electrically engaging said contact plate.

5. In an internal combustion engine, a piston, a piston rod on said piston, an ignition element on said piston including a plurality of spark gaps arranged in series, means controlled by reciprocal movement of said piston rod for making and breaking flow of electrical current to said ignition element when said piston and rod are at and moving away from their uppermost positions including a contact roller on said piston rod, and a spring contact arm projecting in the path of travel of said roller and arranged to contact the roller when the piston rod is in its uppermost position.

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