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2,795,221

SELF-TAPPING INSERT

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FIG. 1.

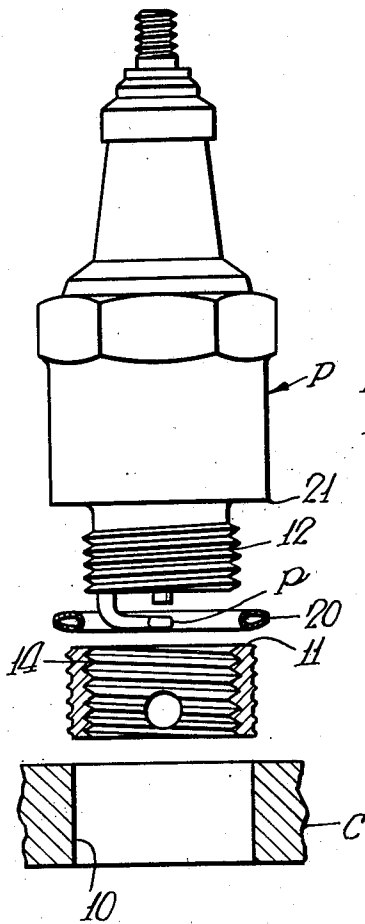


FIG. 2.

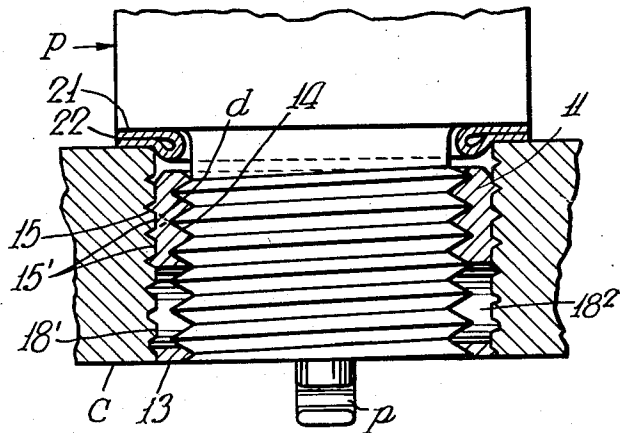


FIG. 4.

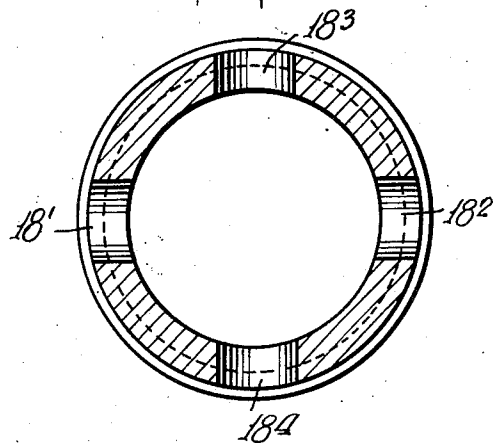
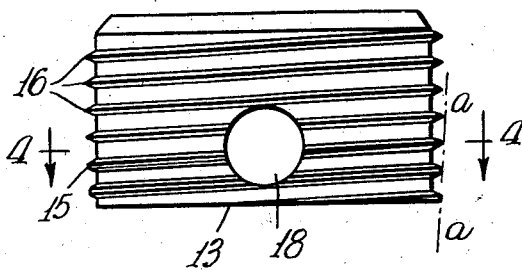


FIG. 3.



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2,795,221

SELF-TAPPING INSERT

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10 Claims. (Cl. 123—169)

The present invention is more especially concerned with the mounting of spark plugs in the aluminum or aluminum alloy heads of internal combustion engines.

As conducive to a clear understanding of the invention, it is noted that the steel bushing of a spark plug tends, especially in hasty replacement, to strip the mounting threads in such cylinder heads, so that affixing in such heads of inserts of harder metal to accommodate the spark plugs, is desirable, especially if such inserts are of the economical self-tapping variety. The jamming of the metal washer interposed between the spark plug and the insert would tend to bond these parts together so firmly that the insert would frequently back out as if it were an integral part of the spark plug in removing such spark plug for inspection, repair or replacement. To remedy this difficulty by locking the insert in place by resort to a locking pin is a cumbersome and costly procedure, and moreover, a void left by such pin at the entry end of the insert results frequently in objectionable pre-ignition or knocking, just as do the voids between the segments of the insert formed by conventional open-ended self-tapping slots therein.

It is accordingly among the objects of the invention to provide an insert suitable for ready self-tapping installation into the bored aluminum head of an internal combustion engine, which, despite its self-tapping conformation, does not leave any voids to trap combustible mixture and thus does not result in objectionable pre-ignition or knocking; which assures a thoroughly gas-tight mount for the spark plug and in the absence of the objectionable locking pin for the insert, yet obviates any tendency for the insert to loosen and back out of the cylinder head incident to removal of a spark plug for inspection, repair or replacement.

The present application is a continuation-in-part of my copending application Serial No. 291,675, filed June 4, 1952, now abandoned.

In the accompanying drawings in which are shown one or more of various possible embodiments of the several features of the invention,

Fig. 1 is a dropped side elevation showing one embodiment of the spark plug mount and its insert in relation to the engine head in which it is to be installed and the spark plug to be mounted therein, parts being shown in section,

Fig. 2 is a fragmentary view in longitudinal cross-section, on a larger scale, showing the parts installed and the spark plug in place therein,

Fig. 3 is a side elevation of the insert, and

Fig. 4 is a transverse sectional view taken on line 4—4 of Fig. 3, showing a modification.

Referring now to the drawings, there is shown a fragment of a more or less conventional aluminum cylinder head C of an internal combustion engine having installed in originally cylindrical bore 10 thereof, the self-tapping insert 11 of the present invention which accommodates the steel bushing 12 releasably threaded therinto of a spark plug P which has sparking points p and which ex-

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tends substantially flush when installed with the inner end 13 of the insert, which itself is installed substantially flush with the inner surface of the cylinder head C.

Referring now to Figs. 3 and 4 of the drawings, the insert is a sleeve tapped with a machine screw thread 14 of diameter, length and pitch to accommodate the steel bushing 12 of the spark plug. The insert could be made of any material of hardness sufficiently greater than the material into which it is threaded, effectively to cut its own thread therinto. For application to structures of aluminum alloys or other light metals, inserts of unhardened stainless steel are satisfactory, though in general inserts of casehardened and plated steel are preferred.

The outer thread diameter of the insert is materially less than the diameter of the shoulder 21 of the spark plug. To this end, while the otherwise standard 60-degree thread 15 is employed as suggested in dash lines at d on Fig. 2, it is truncated at its root diameter, or, otherwise stated, the root of the standard thread is filled in at 15'. The external machine thread 15 of truncated root diameter, as shown, is of uniform pitch and uniform diameter, desirably from end to end, except that, from the entry end for several turns, usually from one and one-half (1½) to three (3) turns, the external thread 15 is tapered at its exterior as by chamfering off the crowns or crests along a conical locus as at a—a, such chamfered end affording a pilot for introduction of the extremity of the insert into the bore 10 in the cylinder head.

To afford the self-tapping edge, the insert, according to the present invention, has in the outer threads 15 thereof, one or more interruptions which do not extend to the free end of the insert but are spaced therefrom slightly, to leave the entry end of the insert uninterrupted or intact. That interruption is of length longitudinally of the insert to extend at its upper limit past the tapered or chamfered threaded section a—a somewhat into the unchamfered threaded section 16.

While each thread cutting interruption may be a depression machined or rolled across the external threads 15, it is preferred that such interruption be an aperture clear through the wall of the insert, because such aperture contributes to ease of discharge of the chips cut in the self-tapping operation.

While the interruption, whether in the form of a depression or an aperture, may be of any desired shape, such as a closed-ended slot, it is preferred that such conformation be circular, among other reasons because it may be machined with greatest facility.

In a preferred embodiment, for convenience and economy, the thread interruption is simply a circular bore 18 through the wall of the insert and of diameter and location to extend at the entry of the innermost end of its upright diameter (the diameter longitudinally of the insert) adjacent the entry extremity 13 of the insert, i. e., ordinarily in the order of 1/16 inch from the extremity, and at the opposite or outermost end of such upright diameter, to extend beyond the area of the tapered or chamfered crown or crest a—a of the external threads and into the area of the unmodified cylindrical external thread 16, as best shown in Fig. 3.

While a single aperture 18, preferably bored radially of the insert is suitable, it affords a cutting edge so short as in some relations to require excessive torque, for which reasons it is preferred, as shown in Figs. 2 and 3, to drill diametrically clear through the entire insert, thus to afford two diametrically opposed apertures 18' and 18² (Fig. 2).

If still greater ease of application is required, additional apertures may be provided to afford additional length of cutting edge, as for instance in the embodiment of Fig. 4 in which the insert is subjected to two drilling

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operations clear through the insert, in directions diametrically thereof, one desirably at right angles to the other. Thereby four such apertures 18', 18², 18³ and 18⁴ would be provided.

By the arrangement set forth, the trailing edge of each insert aperture 18, when turned in clockwise direction for tapping, does the tapping and presents a progressively steeper cutting angle, so that the thread cutting operation gradually increases in effectiveness until the cutting edge along the horizontal diameter of the aperture takes hold. Most of the chips drop through the cylinder head and any remnants are readily blown out from the cutting aperture.

The insert is introduced for its self-tapping action into the engine cylinder head by resort to insert tools of type known in the art and which need not be described.

It will be seen that each cutting interruption or aperture 18 is completely sealed in use, both at the inner extremity 13 of the insert and at the bushing 12 of the spark plug, so that it has no communication with the combustible mixture. The insert thus presents a flat uninterrupted end 13 to the combustible mixture, so that despite the self-tapping character of the insert, no combustible mixture can be trapped at the interruption determined by the self-tapping edge and such self-tapping insert yet operates as satisfactorily as does an uninterrupted one that necessitates pretapping of the bore, that is, without objectionable premature ignition or knocking due to the self-tapping conformation of the insert.

To assure a gas-tight seal at the spark plug, the usual copper washer 20 about the bushing of the spark plug is clamped by the shoulder 21 of the spark plug against the cylinder head.

In the absence of other safeguards, the spark plug when tightened in place might so firmly jam the copper washer 20 against the insert, that such insert backs out as a unit with the spark plug when such spark plug is unscrewed. To obviate this difficulty, the insert, as shown, is made somewhat shorter than the thickness of the cylinder head. Accordingly the insert, when screwed home, that is, until its inner end is flush with the inner face of the cylinder head, is materially depressed or countersunk at its outer end below the outer face of the cylinder head. The originally rounded copper washer 20, shown in Fig. 1, thus becomes compressed and flattened at its outer portion, as at 22, between the shoulder 21 of the spark plug and the cylinder head, and even though it spreads considerably at its inner part, due to that compression to protrude into the cylinder bore, it will not exert pressure against the end of the insert, and in the preferred embodiment shown, the compressed washer 20 does not even touch the insert C.

The insert is thus self-tapping into the cylinder head, as shown, and the resultant chips are readily removed in the manner previously set forth, the spark plug being adequately sealed in gas-tight relation by the compression of the copper washer between the spark plug shoulder and the cylinder head.

In use the insert and spark plug being flush at their inner ends with the inner wall of the cylinder, no pre-ignition will occur.

In the removal of the spark plug for inspection, repair or replacement, there is no tendency for the insert to be loosened or backed out, since there is no frictional bond and indeed no contact between the washer and the insert, and since the hold at the external area of the insert which is screwed into the cylinder head is materially greater than that at its internal area which engages the removable spark plug bushing.

While specially designed for outstanding utility in the particular application noted, it will be understood that the insert of the present invention also has utility for more general application, especially where the insert is of case-hardened steel.

As many changes could be made in the above con-

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struction and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description, or shown in the accompanying drawings, shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is:

1. In an insert suitable for self-tapping into an untapped cylindrical bore in the soft metal head of an internal combustion engine and for accommodation of a spark plug therein, said insert comprising a tube of metal internally threaded throughout substantially its entire length, releasably to accommodate a threaded member, said insert having an external machine thread of uniform root diameter extending from substantially the inner extremity of along the major portion of the length of the insert, the crest of said exterior thread being tapered off on a conical locus along the entry portion of the insert, said insert having an interruption at its outer threaded portion, the innermost end of which interruption is near but spaced from the entry end of the insert and the outermost end of which extends past the tapered threaded section into the fully threaded section, the wall of said interruption defining a thread cutter.

2. The combination recited in claim 1 in which the interruption is an aperture clear through the wall of the insert.

3. The combination recited in claim 2 in which the aperture which determines the thread cutting edge is a circular bore.

4. The combination recited in claim 1 in which the interruption defining the thread cutting edge is a circular bore whose axis is at right angles to the axis of the insert and which extends clear through the insert, defining diametrically opposed openings in the tube.

5. The combination recited in claim 1 in which the tube is of casehardened and plated steel and the extremity of the aperture nearest the entry end is spaced from said entry end by a distance in the order of $\frac{1}{16}$ inch.

6. The combination recited in claim 4 in which there are two openings clear across the insert on axes at right angles to each other, defining four equidistant apertures therein.

7. The combination recited in claim 1 in which the external thread diameter of the insert is materially less than the shoulder diameter of a spark plug to be accommodated therein and a washer interposed between such spark plug and the engine cylinder head is clamped therebetween in installation of the spark plug.

8. The combination recited in claim 7 in which the insert is substantially flush with the cylinder head at its inner end and is well below the outer end of the cylinder head to afford clearance to preclude pressure of the washer against said insert.

9. The combination recited in claim 7 in which the external thread diameter of the insert is of the truncated root type.

10. In an internal combustion engine, a spark plug mount of the type which comprises a hardened-metal self-tapping insert in the cylinder head, and in which a metal washer, clamped downward by the shoulder of the spark plug effects a leak-tight seal; the combination in which the outer thread diameter of the self-tapping insert is materially smaller than the shoulder diameter of the spark plug, in which the self-tapping conformation of the insert is wholly above the uninterrupted inner end of said insert and the external thread thereof has a truncated root, and in which said insert is of length substantially less than the thickness of the cylinder head so that a material depression is afforded in the cylinder head above the outer end of the insert as installed with its inner end substantially flush with the inner wall of the cylinder head, thereby to accommodate without pressure against the in-

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sert, the inner peripheral portion of the washer that is pressed inward as a result of the compression of the washer by the spark plug shoulder against the cylinder head.

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