United States Patent

Tarter

[15] **3,683,873**

[45] **Aug. 15, 1972**

[54] **SPARK PLUG HOLE CONSTRUCTION AND METHOD**

[72] Inventor: **Carl M. Tarter**, Healdsburg, Calif.

[73] Assignee: **T&W Manufacturing Corp.**, Santa Rosa, Calif.

[22] Filed: **June 8, 1970**

[21] Appl. No.: **44,162**

[52] **U.S. Cl.**.....**123/41.82,** 123/32 R, 29/401, 29/427, 29/479, 123/169 R

[51] **Int. Cl.**.....**F02f 1/36,** F22d 19/10

[58] **Field of Search** 123/32, 41.82; 29/401, 402, 29/427, 479

[56] **References Cited**

UNITED STATES PATENTS

2,795,221	6/1957	Braendec	123/169 R
2,547,986	4/1951	Denmark	29/401
2,687,142	8/1954	Law	1/479
3,187,729	6/1965	Morrison	123/32
3,351,043	11/1967	Morrison	29/402
3,449,816	6/1969	Swick	123/32

OTHER PUBLICATIONS

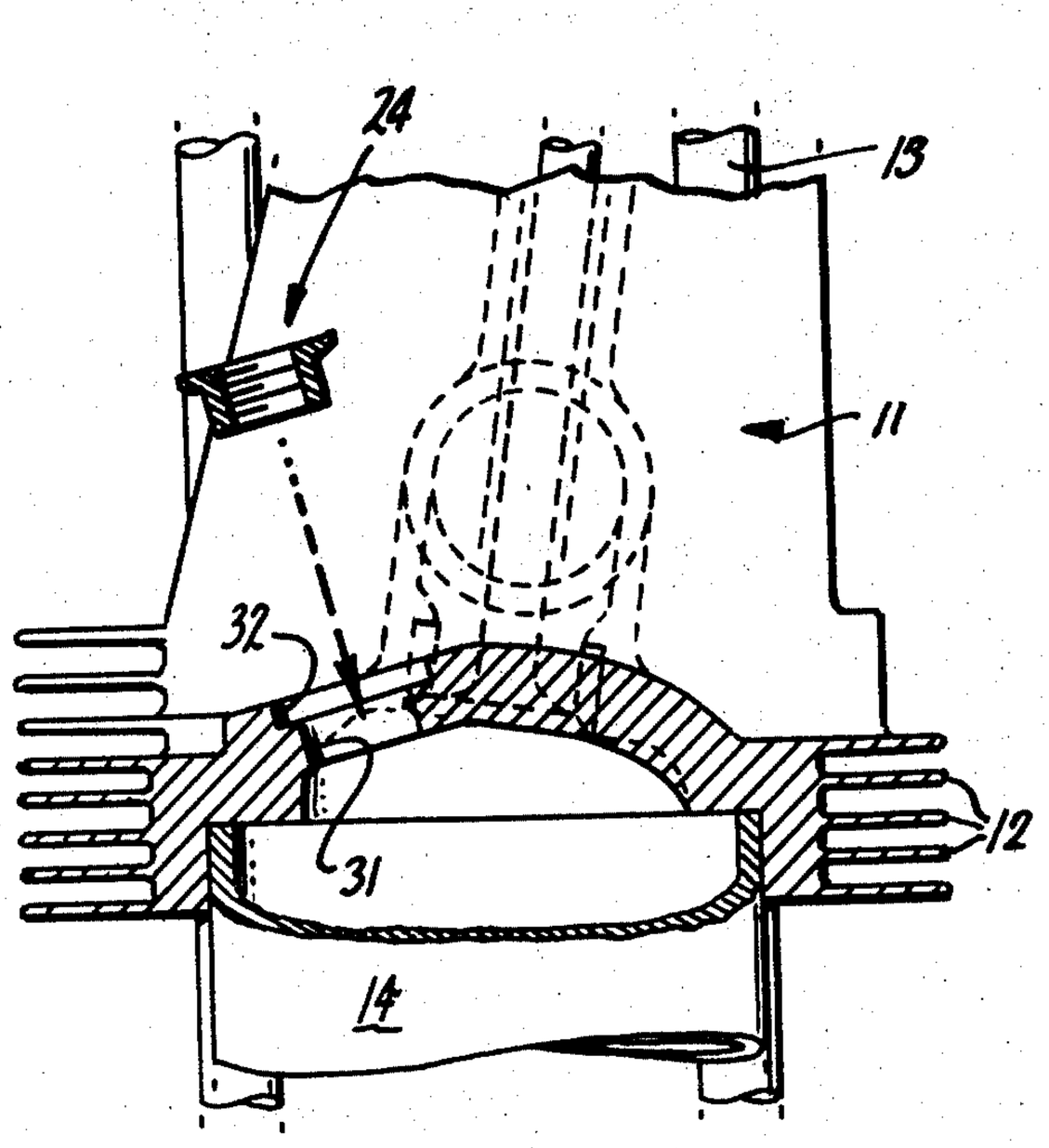
"Machine Design" Fasteners Book issue, 1963, Penton Publishing pages 103–107, 165–181

Primary Examiner—Laurence M. Goodridge
Assistant Examiner—Ronald B. Cox
Attorney—Flehr, Hohbach, Test, Albritton & Herbert

[57] **ABSTRACT**

The spark plug hole of an engine part is provided with a bushing including an internally threaded collar united in a gas tight manner, only at its inner end, to the engine part and the outer end providing upon a radial flange a seat for the spark plug. The method of engine part construction includes reboring the original spark plug hole so that the bushing may be mounted therein, welding only the interior disposed end of the bushing and correcting any distortion of the internal threads in the bushing.

4 Claims, 6 Drawing Figures



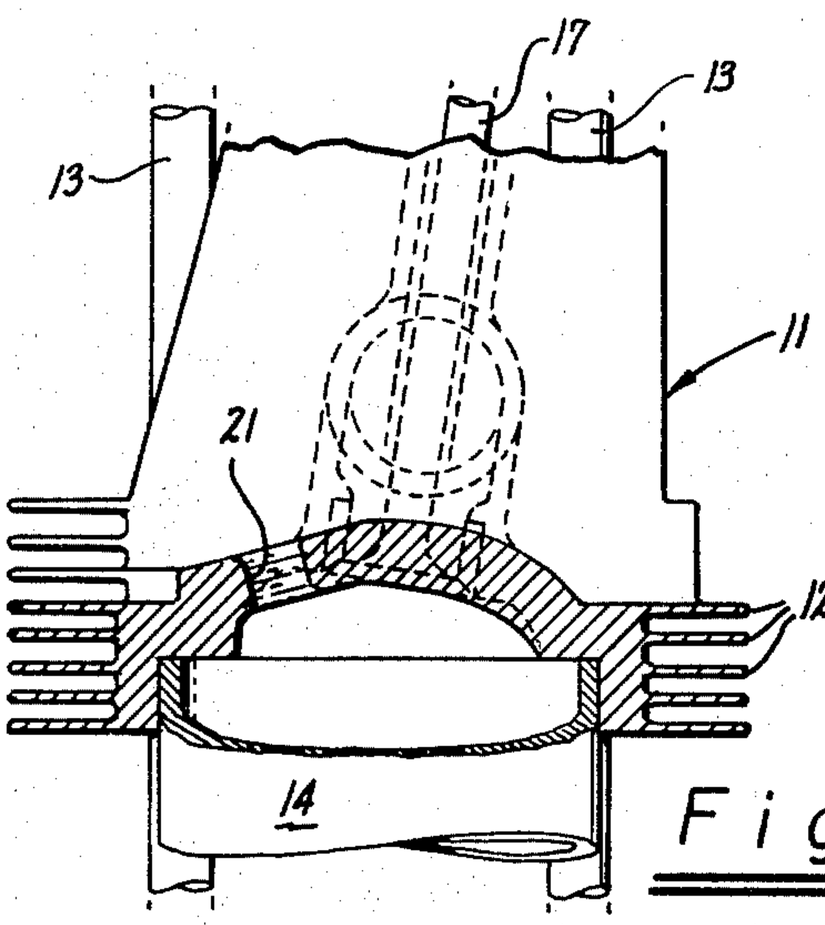


Fig. 2

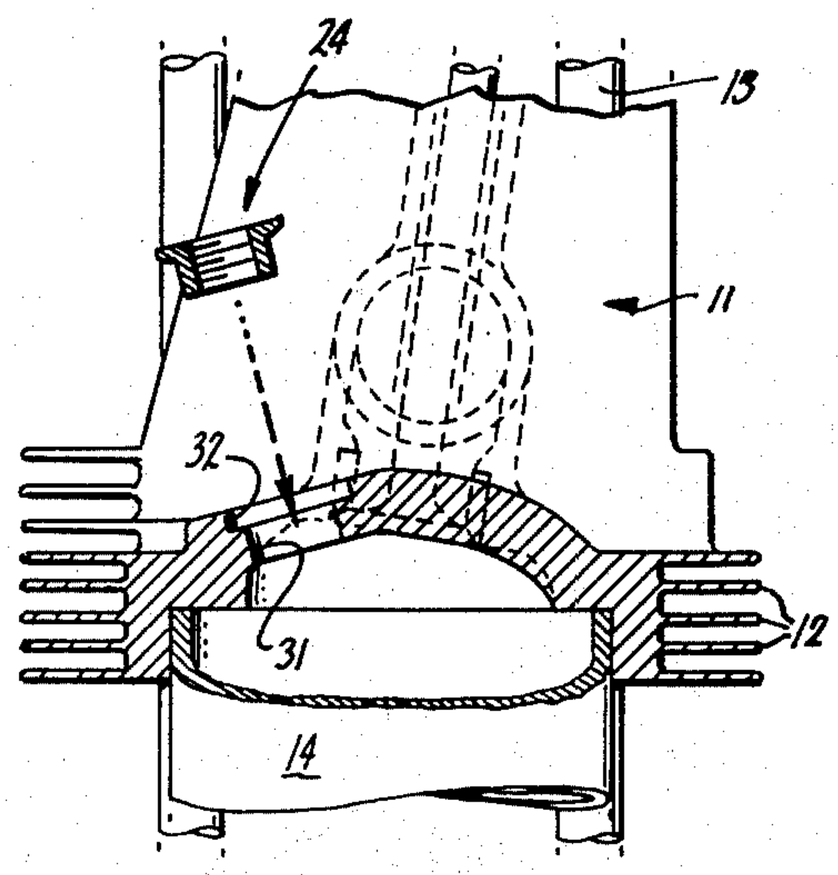


Fig. 4

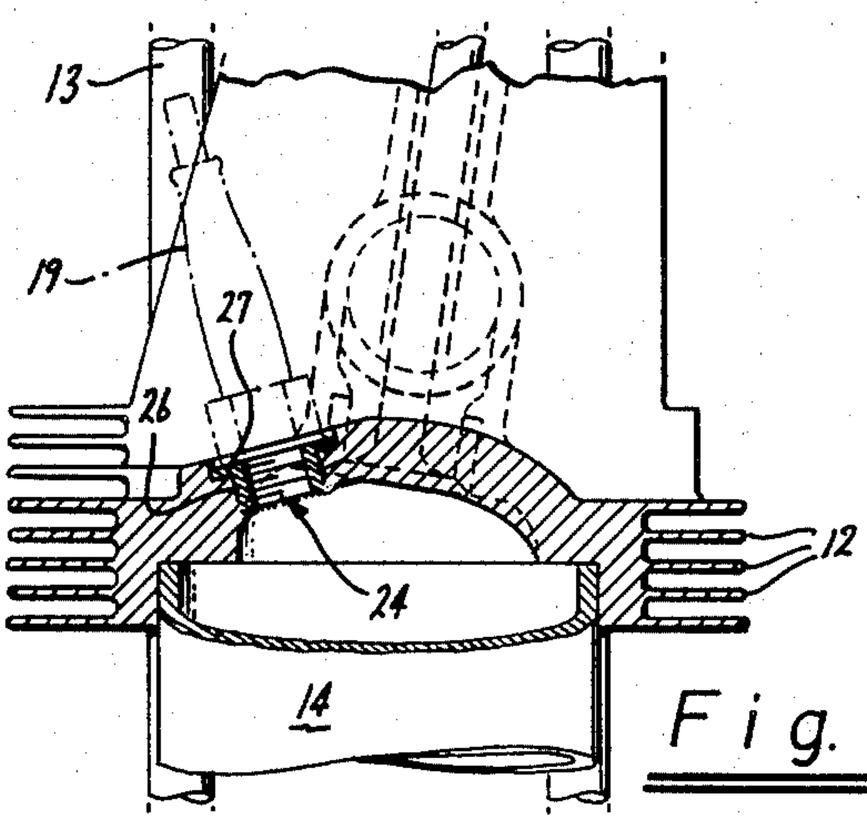


Fig. 1

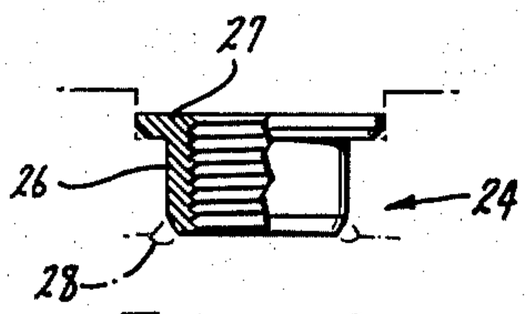


Fig. 6

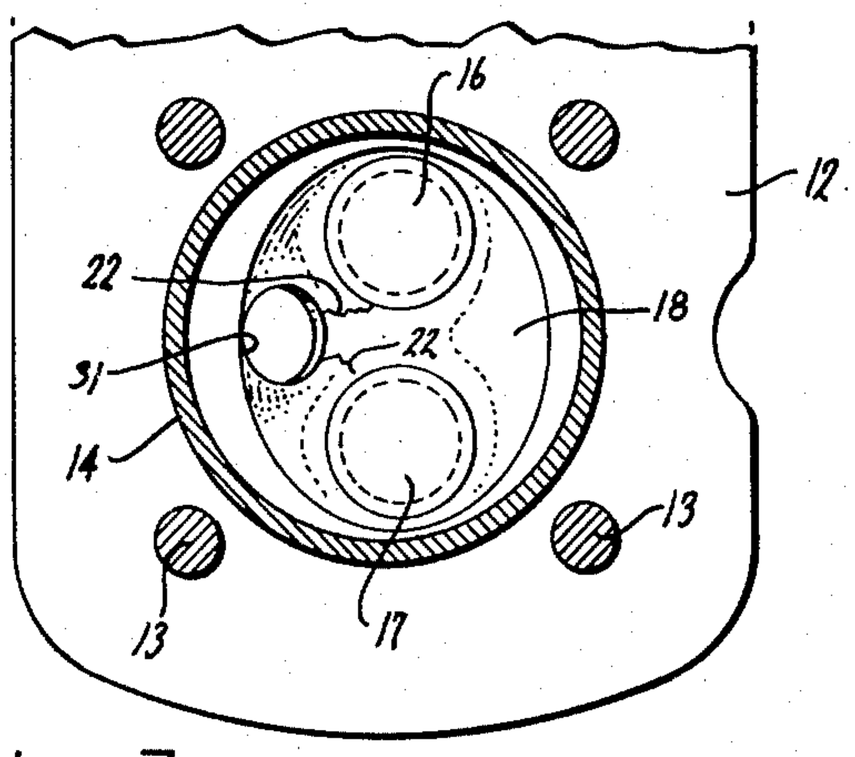


Fig. 3

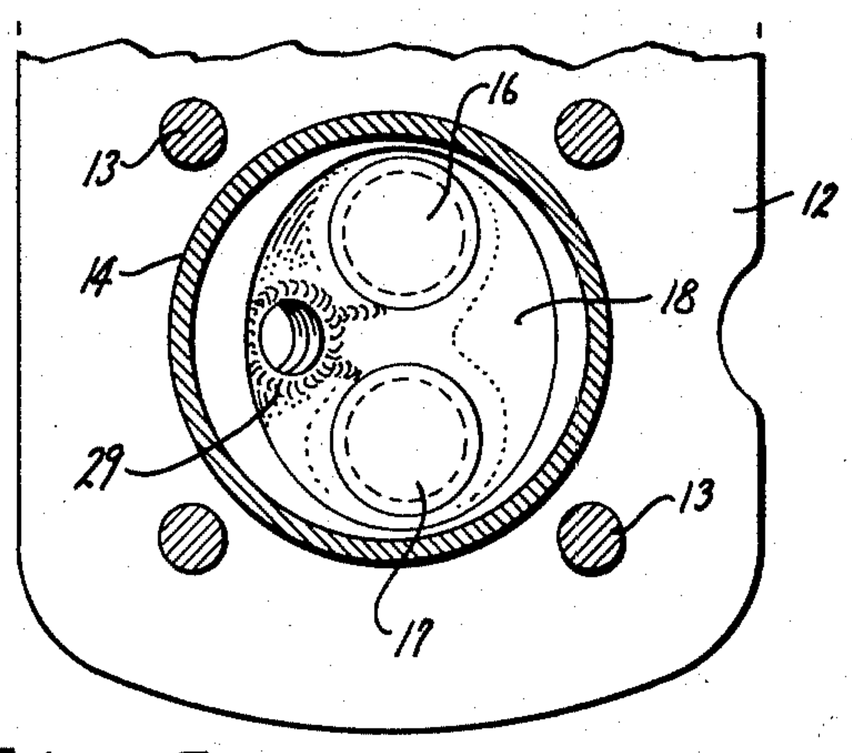


Fig. 5

INVENTOR.
Carl M. Tarter
BY Flehr, Hohbach, Test, Albritton & Herbert
Attorneys

SPARK PLUG HOLE CONSTRUCTION AND METHOD

BACKGROUND OF THE INVENTION

With engines made from non-ferrous metals, it is not uncommon that the threads for the spark plug hole become damaged or stripped causing leakage and improper sealing of the spark plug. Furthermore, cracks frequently develop between the valve seats and spark plug holes during the life of an engine and it is desirable that these conditions be remedied during engine overhaul.

Conventional practice included inserting "heli-coils" into the spark plug holes to supplement the damaged threads therein. It was found that this arrangement is unsatisfactory because the "heli-coils" within the spark plug holes did not insure a gas-tight seal, and frequently the engine's pressures would cause the "heli-coils" and spark plug to loosen. Another expedient for repairing a damaged spark plug hole was to rebore and retap the hole for the next larger spark plug size. However, the removal of metal and substitution of the next larger plug size weakened the engine part structure and increased susceptibility to cracking between the valve seats and spark plug hole.

SUMMARY OF THE INVENTION AND OBJECTS

In summary, the invention pertains to a spark plug hole construction involving an engine part having a surface which forms at least part of a combustion chamber, there being a hole therein opening through the surface. A bushing having internal threads for receiving a spark plug is mounted through the hole with one end of the bushing terminating adjacent to the surface of the combustion chamber. The bushing and the engine part are formed of materials which have substantially the same coefficients of expansion and the bushing has an outside diameter which is slightly greater than the inside diameter of the hole and is mounted therein in a press fit. A weldment secures the end of the bushing to the engine part so that a gas-tight seal is formed therebetween with the remainder of the bushing being capable of expanding axially when the engine part becomes hot.

The method of constructing a spark plug hole in the engine part includes reboring the defective spark plug hole so as to remove the original threads and to provide a relatively smooth bore, positioning the above bushing in the rebored spark plug hole and welding the end of the bushing to the engine part so that the bushing is substantially flush with the surface of the combustion chamber and forms a gas-tight seal therewith.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a vertical sectional view through an engine part taken at a plane extending vertically through the spark plug and hole therefore and illustrating the present invention.

FIG. **2** is a view like FIG. **1** of the engine part in the original state.

FIG. **3** is a horizontal sectional view looking from below of the engine part of FIG. **1** at one stage of remanufacture.

FIG. **4** is a view like FIG. **1** showing another stage of engine part remanufacture.

FIG. **5** is a view like FIG. **3** showing still a further stage in engine part remanufacture.

FIG. **6** is an enlarged sectional view of a bushing employed in the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the accompanying drawing there is shown an internal combustion engine part **11** which may be either a cylinder block or head and more particularly of the type used in air-cooled engines wherein fins or registers **12** dissipate the engine heat to the atmosphere. The engine part **11** may be of any suitable metal such as an aluminum alloy of the type commonly used in such internal combustion engine parts. For the purposes of this invention, the engine part **11** is the part which carries the spark plug or plugs in an internal combustion engine. Such an internal combustion engine can be of any type which uses spark plugs such as a stationary, automotive, or motorcycle engine. The engine part **11** which is shown in the drawing is the head of an air-cooled internal combustion automotive engine of the type manufactured by "Volkswagon." The head is removably secured to the associated engine block (not shown). A cylinder liner **14** is mounted in the engine block for each of the cylinders (not shown) in the engine block. Intake and exhaust valves **16** and **17** are mounted in the head **11** for each cylinder of the engine. The valves **16** and **17** cooperate with valve seat inserts **19** mounted in the head **11**. The valve seat inserts are constructed in the manner disclosed in U.S. Pat. No. 3,487,823. Intermediate the poppet valves **16** and **17** a spark plug **19** is positioned. Referring to FIG. **2**, there is shown the cylinder head **11** having therein the original spark plug hole **21** which during the service life of the engine may have become cross threaded or the combustion chamber may have developed cracks **22** (FIG. **2**) extending from the spark plug hole and propagating towards the valves. FIG. **1** shows a bushing **24** mounted in the cylinder head, the bushing including an internally threaded collar **26** having a radially extending flange **27**. The threads of the collar **26** are complimentary to the standard threads of the spark plug **19** while the axial length of the bushing **24** is equivalent to the reach of the spark plug intended for the engine. To this end, the radial flange **27** provides a surface upon which the spark plug **19** seats.

The bushing **24** is preferably formed of material having generally the same coefficient of expansion as the cylinder head. The bushing, for example, may be formed of 2011–T3 aluminum while the cylinder head may be formed of an aluminum base alloy of the type commonly used in such internal combustion engine parts. As shown in FIGS. **1** and **6**, the bushing **24** is rigidly secured as by welding to the block or head **11** at only the inner end thereof which is beveled at **28** to accommodate the welded metal to insure the forming of a gas-tight seal between the engine part and bushing **24**. Preferably, the outside diameter of the collar of the bushing is formed from 0.001 to 0.003 inches oversize with respect to the associated hole **31** so as to form an interference fit between the bushing and the cylinder head. To provide a seat for the radial flange **27**, the cylinder head is counterbored as at **32** so that the bushing and the spark plug it will accommodate can project

the proper distance with respect to the combustion chamber.

The method of reconditioning engines in accordance with this invention is as follows:

The original spark plug hole **21** is rebored as shown in FIG. **3** to accommodate the bushing **24** thus removing the original spark plug threads from the hole. At the time of the boring of the new hole **31**, the counterbore **32** may be formed on the outside of the cylinder head. The bushing **24** is provided as shown in FIG. **6** and should have an outside diameter in the collar portion on the order of from 0.001 to 0.003 inches larger than the hole **31**. The bushing **24** is inserted in the hole by force so as to achieve the press fit. The radial flange **27** seats securely within the counterbored portion **32**, as shown in FIG. **4**. As a next step, weld metal **29** is deposited in the Vee formed by the bevel **28** and the walls of the hole in the cylinder head. In this operation, any cracks **22** extending between the hole **31** towards the valves may be welded thus reinforcing the combustion chamber. As a follow-up operation, the internal threads of the collar may have become deformed and a tap may be run through the bushing so as to chase or clean up the threads and relieve whatever distortion may have been induced therein by either the welding or the press fitting operation.

It will be recognized from the above that the bushing is fixed only at one end to the cylinder head. Thus, as the engine temperature rises during engine operation, the metal bushing will expand axially only in an outward direction and not further into the combustion chamber. The advantage is that the spark plug electrode position does not change appreciably during engine operation albeit the plug is mounted in a bushing member.

The machine operations for overhauling the spark plug hole may be performed with conventional machine tools including the welding operation which may be performed by the inert gas shielded arc process.

The representations in the text and drawings have been intended merely to facilitate the practice of this invention by persons skilled in the art and no unnecessary limitations are intended thereby, for the scope of the invention is delimited in the following claims.

I claim:

1. In a method for constructing a spark plug hole in an engine part having a surface which forms at least part of a combustion chamber and having a defective threaded spark plug hole therein extending through the said surface by utilizing a bushing having internal threads serving to accommodate a spark plug, reboring the defective spark plug hole of the engine part from 0.001 to 0.003 inches undersize with respect to the bushing so as to remove the original threads and to provide a relatively smooth bore, press fitting the bushing into the rebored spark plug hole so that one end of the bushing is substantially flush with the surface forming the combustion chamber, and welding said end of the bushing to the engine part so that the bushing is substantially flush with said surface and forms a gas-tight seal with the engine part, the remainder of the bushing being free to expand in an axial direction in the engine part at engine operating temperature.

2. The method as in claim **1** wherein said bushing has a radial flange at one end, together with the step of counterboring the engine part at the exterior around the spark plug hole to a diameter at least as large as the radial flange of the bushing and to a depth at least as great as the thickness of the flange.

3. In a spark plug hole construction, an engine part having a surface which forms at least part of a combustion chamber, said engine part having a hole therein extending through the engine part and opening through said surface, a bushing mounted in said hole, said bushing having internal threads serving to receive a spark plug, one end of said bushing terminating adjacent said surface, said bushing and said engine part being formed of materials which have substantially the same coefficients of expansion, said bushing having a generally smooth exterior side wall continuous throughout its circumference and having an outside diameter which is on the order of 0.001 to 0.003 inches greater than the inside diameter of said hole, and being mounted with a pressed fit in said hole so that said bushing frictionally engages the side walls of the engine part forming the hole, a weldment securing said end of the said bushing to said engine part so that a gas-tight seal is formed between said bushing and said engine part, the remainder of said bushing being capable of expanding axially when the engine part becomes hot.

4. A construction as in Claim **3** wherein said bushing is provided with a flange on its outer end and said engine part is provided with a counterbore which receives said flange.

* * * * *