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INTERNAL COMBUSTION ENGINE

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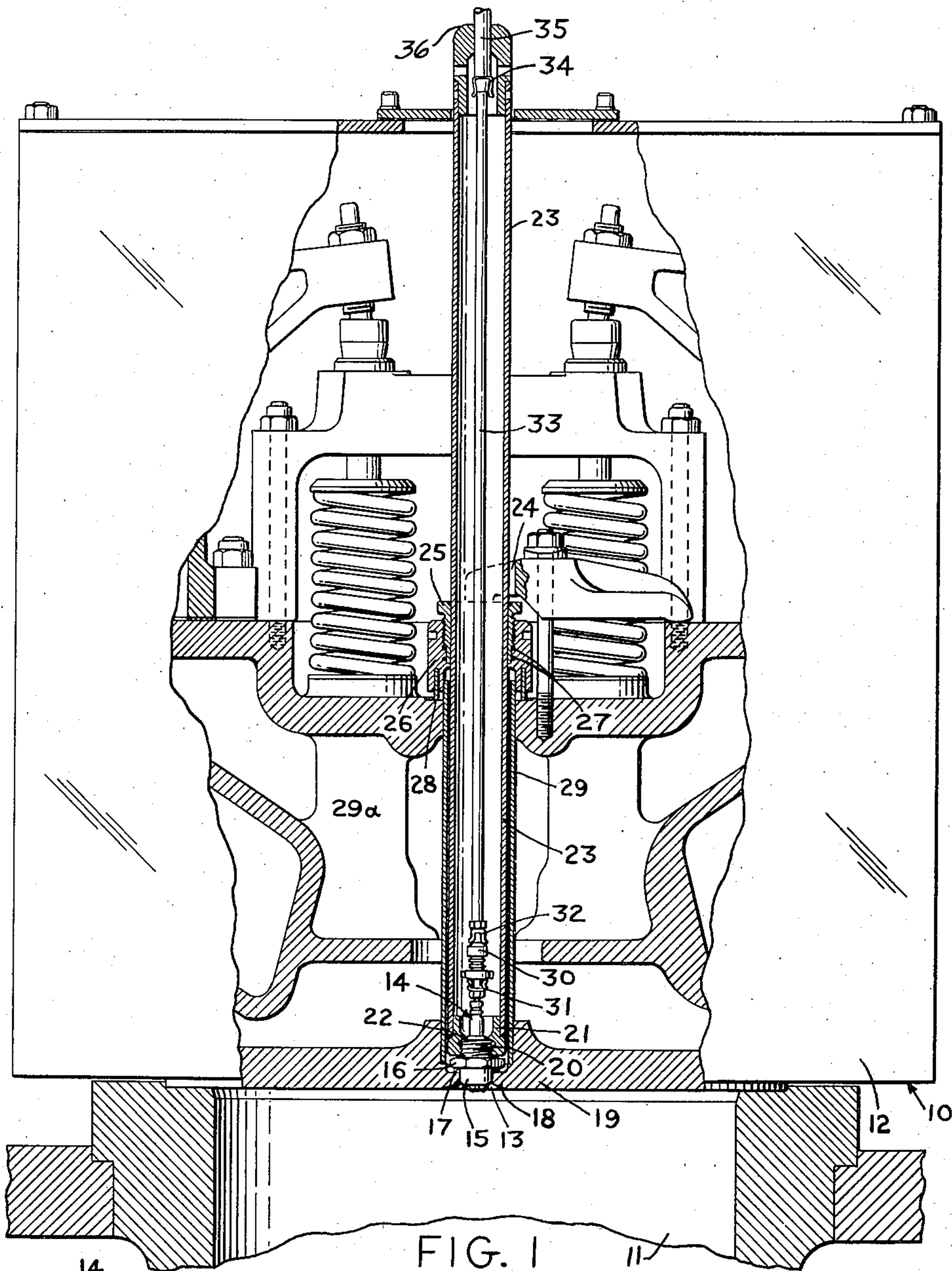


FIG. 1

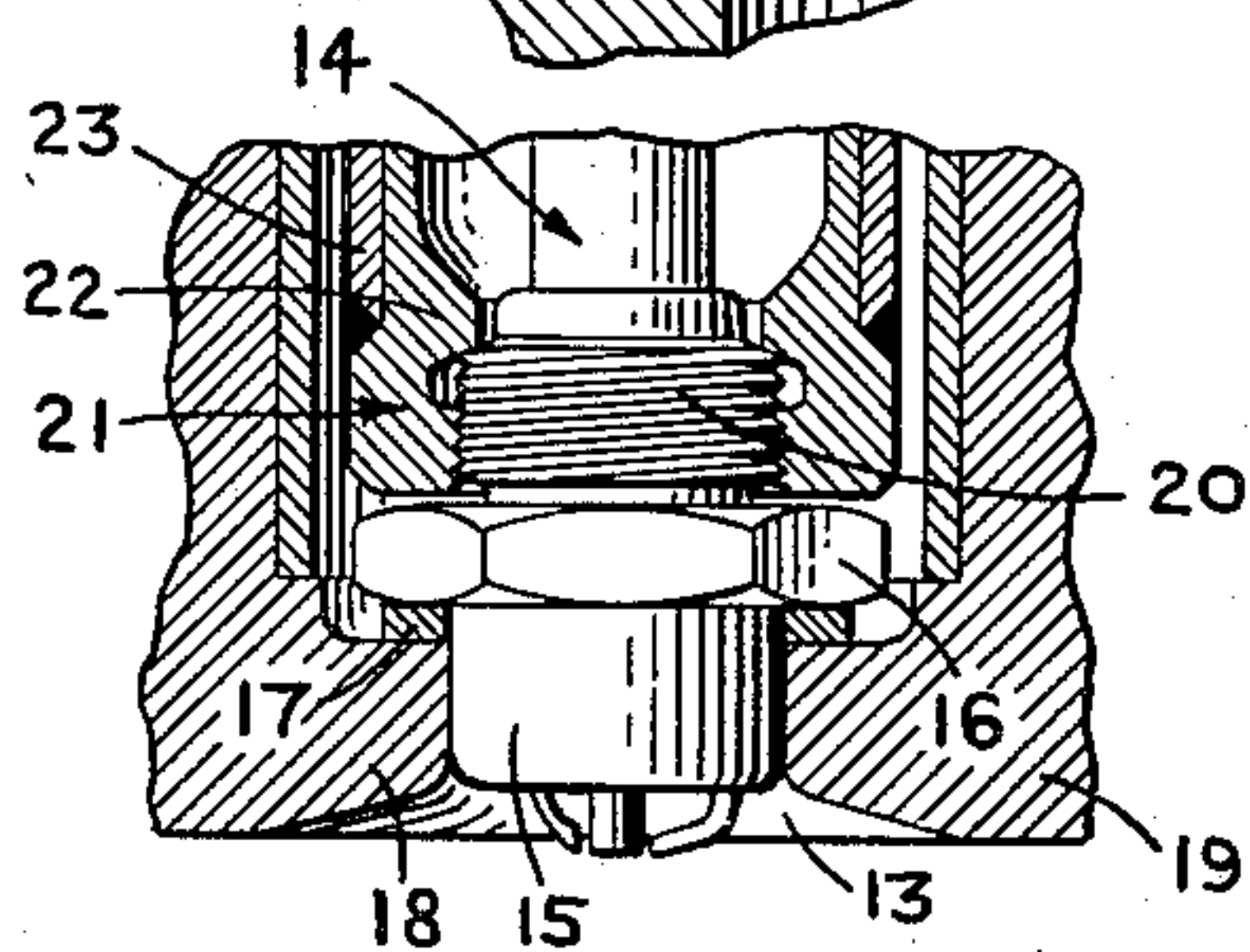


FIG. 2

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## INTERNAL COMBUSTION ENGINE

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5 Claims. (Cl. 123—169)

The present invention relates to an internal combustion engine and more particularly to means for converting a compression ignition engine to a spark ignition engine.

In the internal combustion art it is well known that an engine designed for compression ignition and operating with full diesel components can be readily changed from diesel oil fuel operation to gas operation by providing pilot fuel injection for ignition of the air-gas mixture. This type of power, namely, dual fuel, is used where the gas supply is unreliable or where the quantity of gas may vary such as in sewage installations. Where a reliable supply of gas is available, the engine may be converted to spark ignition operation by providing a spark plug in place of the fuel injection nozzle. However, the problem of installing a standard spark plug in the long vertical opening of the injection nozzle has been made difficult because of the threaded shank normally used in the construction of standard spark plugs. This generally required a special oversized thread and special thread in the injection nozzle opening.

Furthermore, when it is desired to provide an engine with full diesel components that can be readily converted to a spark ignition engine, it is necessary that the spark plug high tension system be insulated from the metallic portions of the cylinder head and the spark plug porcelain be kept oil-free to prevent carbonization, and thereby, shorting of the spark plug which would cause erratic operation of the engine. The spark plug must be held firmly against the seat machined in the cylinder head, and also be provided with adequate heat conducting means to permit transfer of heat to the cooled cylinder head deck. The spark plug must also be provided with a tube that is clamped into place by the same apparatus or device that is used for holding the oil spray fuel nozzle which tube means must prevent lubricating oil from entering therein and which must be properly vented outside of the cylinder head structure.

In accordance with the present invention, a spark plug assembly means which permits an engine operating with full diesel components on oil or gas fuel for converting the engine to a spark ignition engine is provided which satisfies the abovementioned requirements.

The present invention further provides a spark plug assembly means that can readily be removed or installed without any change to the existing diesel engine cylinder head.

The spark plug assembly means of the present invention comprises a spark plug having a cylindrically-shaped lower portion adapted to be inserted into the fuel spray nozzle opening of a diesel engine, an annular adapter member having a shoulder thereon adapted to retain the spark plug in the opening, and a tube member enclosing the adapter member and held under compression by clamping means normally used to retain the fuel spray nozzle in a diesel engine.

The invention will be better understood from the following description when considered in connection

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with the accompanying drawing forming a part thereof and in which:

Figure 1 is a fragmentary view, partly in section, of a diesel engine embodying the spark plug assembly of the present invention and,

Figure 2 is an enlarged view of the lower portion of the plug assembly of Figure 1.

Referring to the drawings, the reference numeral 10 designates a diesel engine having a cylinder 11 with a cylinder head 12 disposed thereon with a fuel injection nozzle opening 13 therein communicating with the cylinder. A spark plug 14 having a smooth cylindrically-shaped lower portion 15 is arranged within the nozzle opening to permit the engine to be converted from compression ignition operation to spark ignition operation. The spark plug is provided with a horizontally extending hexagonally-shaped flange 16 disposed thereon above portion 15. Flange 16 is adapted to seat on a ring gasket 17 disposed on an annular shoulder or seat 18 formed on the cylinder head deck 19 and extending inwardly in the nozzle opening 13.

Spark plug 14 is held seated against the ring gasket 17 and shoulder 18 by an inwardly extending shoulder 22 on an annular adapter member 21 adapted to seat against the upper portion 20 of the spark plug above flange 16. Portion 20 is provided with external threads adapted to threadably engage the internal threads provided on the adapter member 21 below the inwardly-extending shoulder 22 thereon. Adapter member 21 is enclosed within the lower end of a vertical tube extending through the cylinder head and engine compartment containing the rocker arms and controlled mechanism for the cylinder valves, not shown. Adapter member 21 is fixedly connected to the lower end of the tube by welding or other similar means. Tube 23 is held under compression by a clamp 24 disposed on the cylinder head within the engine compartment which engages an externally threaded thrust collar 25 welded to the outer periphery of the tube adjacent the median portion thereof. A packing nut 26 having sealing rings 27 inserted therein is threaded on thrust collar 25. After tube 23 is clamped in place, then packing 26 may be threaded downwardly on the thrust collar 25 by a spanner wrench inserted in holes provided on the outer periphery of nut 26 to compress the oil seal ring 28 inserted in the lower end of the nut against the top of the cylinder head. A copper sleeve 29 extending through the water jacket 29a encloses the portion of spark plug tube 23 within the cylinder head.

A spark plug resistor 30 is disposed in tube 23 and is connected to spark plug terminal 31 into a terminal 32 on an ignition stem 33 disposed in tube 23. The upper end of stem 33 is connected to terminal 34 of electrical cable 35. Cable 35 extends through an insulating cap 36 covering the top of tube 23 and is connected to a voltage source, not shown.

Thus, the present invention provides means for converting an engine from compression ignition operation to spark ignition operation. This is accomplished by providing a spark plug assembly incorporating a spark plug having no threaded portion below the flange thereon but having a threaded portion thereabove for screwing it on to a tube assembly.

In addition, the spark plug assembly of the present invention permits the use of the clamping device for the diesel oil nozzle to retain the spark plug in position, thus permitting rapid changeover to spark ignition operation. The spark plug assembly of the present invention is properly vented, insulated, and free from oil leakage to the porcelain section of the plug and can be built as a complete unit and installed in the diesel head of a diesel engine.

It will be understood that the invention is not to be



limited to the specific construction or arrangement of parts shown but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. In combination, a compression ignition engine having a cylinder head with a fuel injection nozzle opening therein, and means for converting said engine into a spark ignition engine comprising a spark plug disposed in said opening, an annular adaptor member having a shoulder thereon adapted to retain said spark plug in said opening, a tube member enclosing said adaptor member and fixedly connected thereto, a thrust collar arranged on said tube member and fixedly connected thereto, and clamping means on said cylinder head bearing against said collar to maintain said adaptor member in engagement with said spark plug.

2. The combination of claim 1 wherein said spark plug is provided with a cylindrically shaped lower portion disposed in said opening.

3. The combination of claim 1 wherein said spark plug is provided with an upper portion and said shoulder is adapted to seat against said portion.

4. The combination of claim 1 wherein said spark plug comprises a cylindrically shaped lower portion disposed in said opening and an externally threaded upper portion, said adaptor member is internally threaded, and said spark plug is threaded into said adaptor member to abut the shoulder thereon.

5. In combination, a compression ignition engine having a cylinder head with a fuel injection nozzle opening therein, and means for converting said engine into a spark ignition engine comprising a spark plug having a cylindrically shaped lower portion disposed in said opening, and an externally threaded upper portion, an internally threaded annular adaptor member having an inwardly extending shoulder thereon, said upper portion being threaded in said annular member to abut said shoulder, a tube member enclosing said adaptor member and fixedly connected thereto, said tube member extending above said cylinder head, an externally threaded annular thrust collar fixedly connected to the outer periphery of said tube member adjacent the top of said cylinder head, a packing nut threaded on said collar, sealing means on the lower portion of said nut adapted to engage the top of said cylinder head and clamping means mounted on said cylinder head and bearing against said collar to retain said spark plug in said opening.

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