

Jan. 27, 1953

F. E. BERSTLER

2,626,595

SPARK PLUG

Filed Sept. 21, 1950

2 SHEETS--SHEET 1

Fig. 1

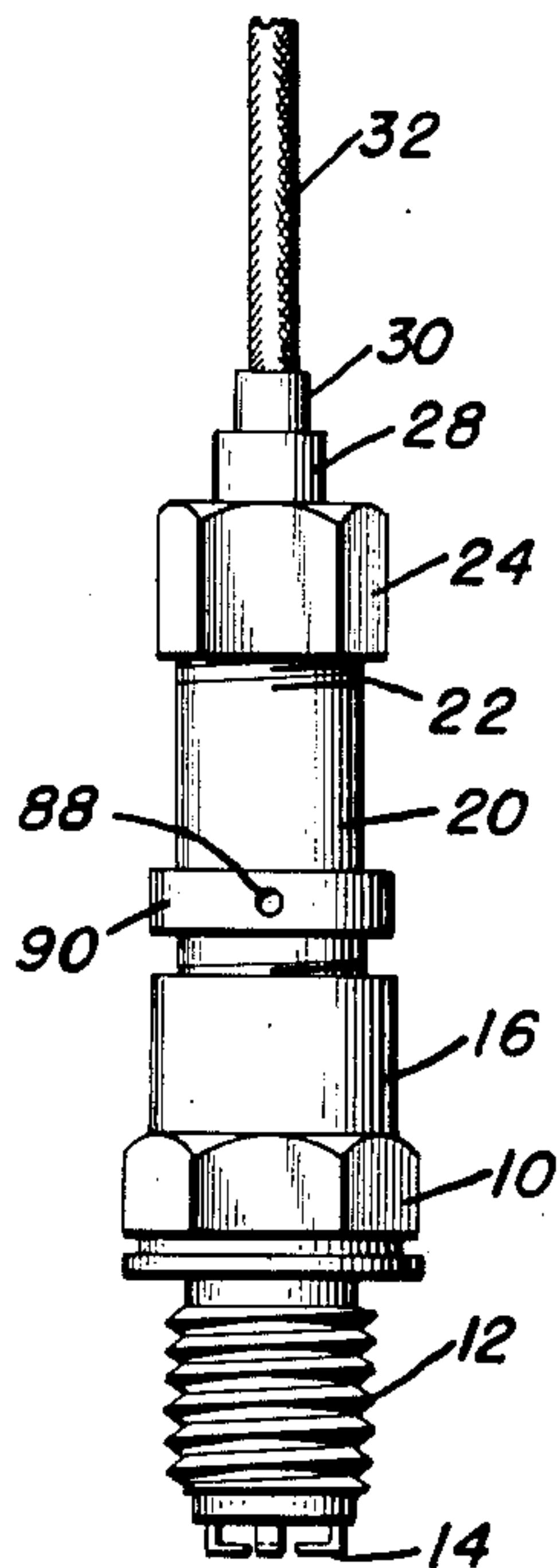


Fig. 5

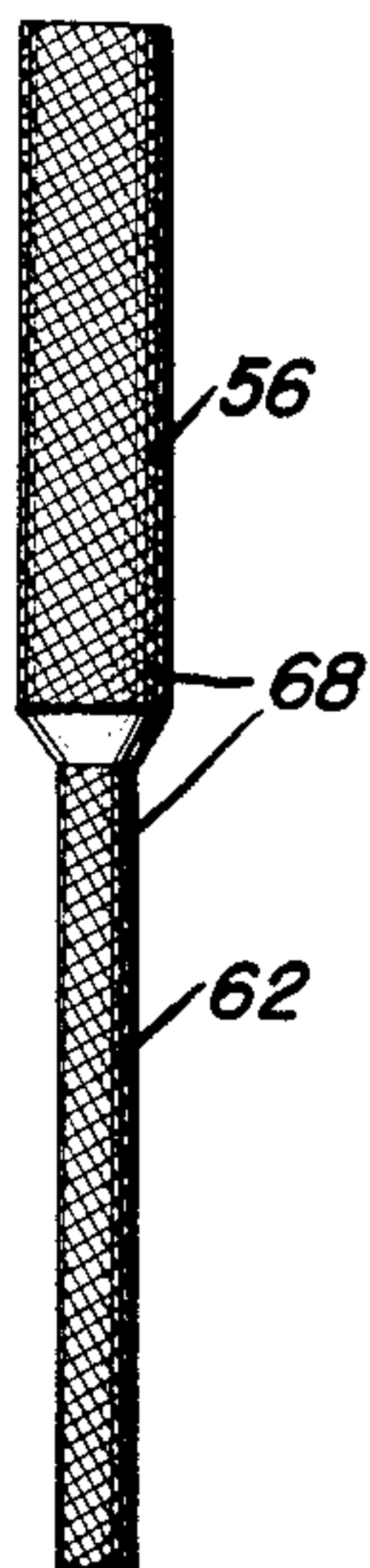


Fig. 6

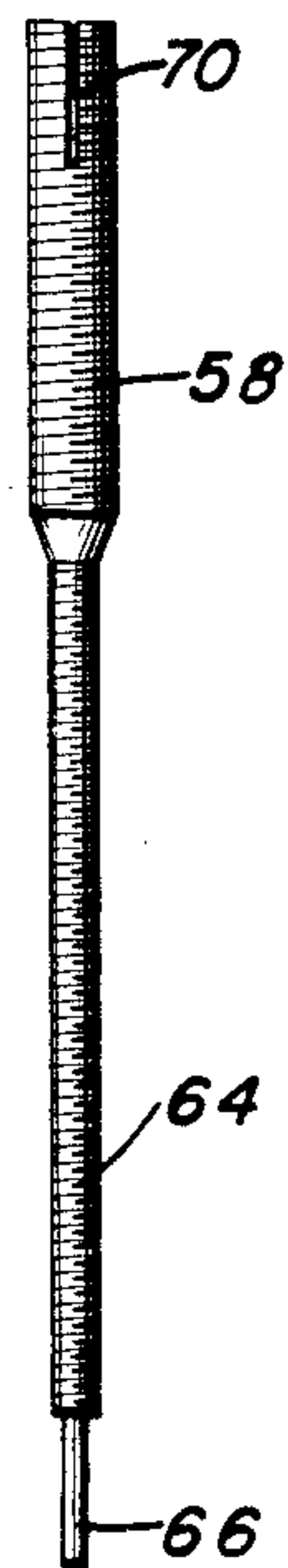


Fig. 7

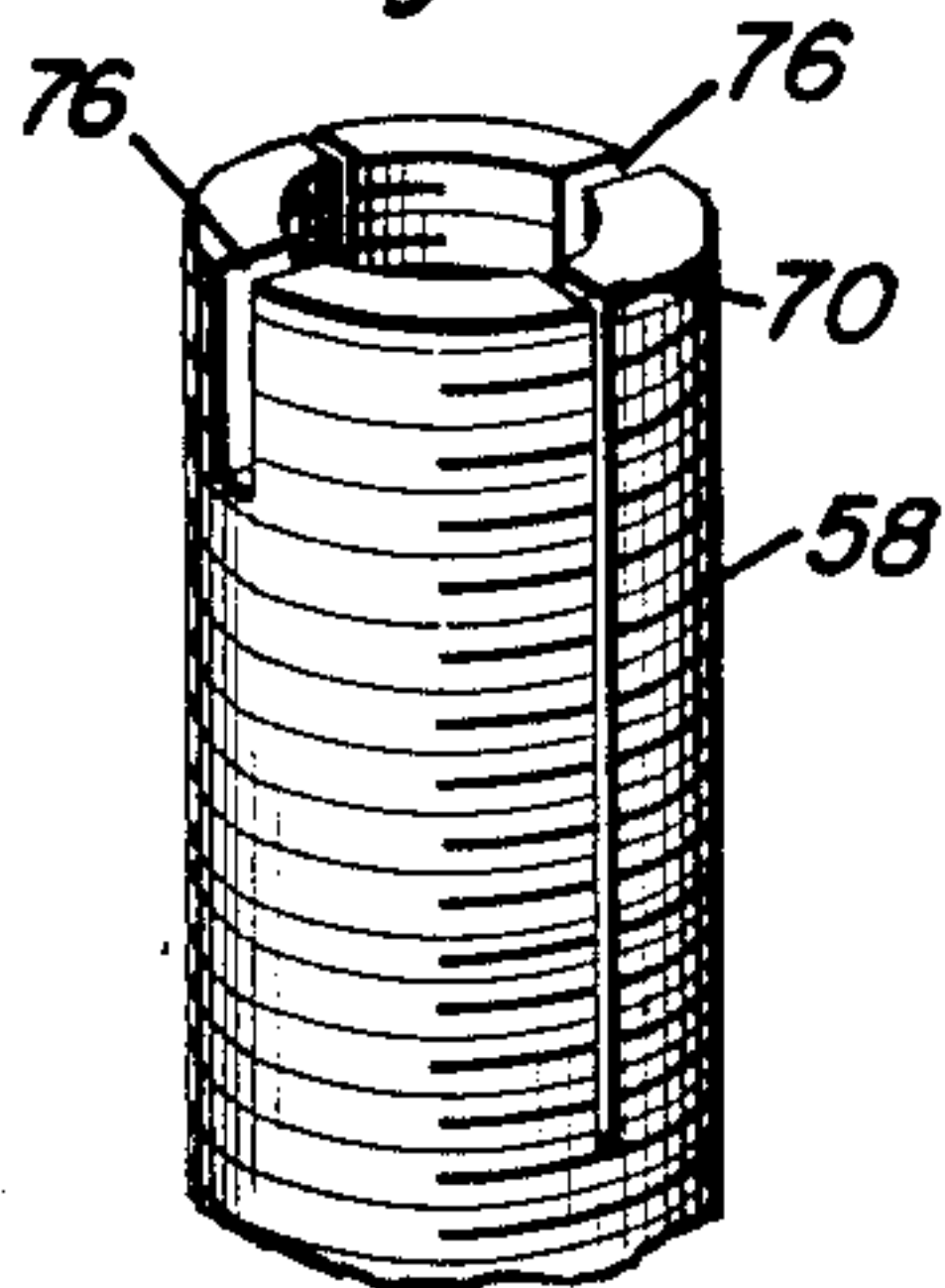


Fig. 3

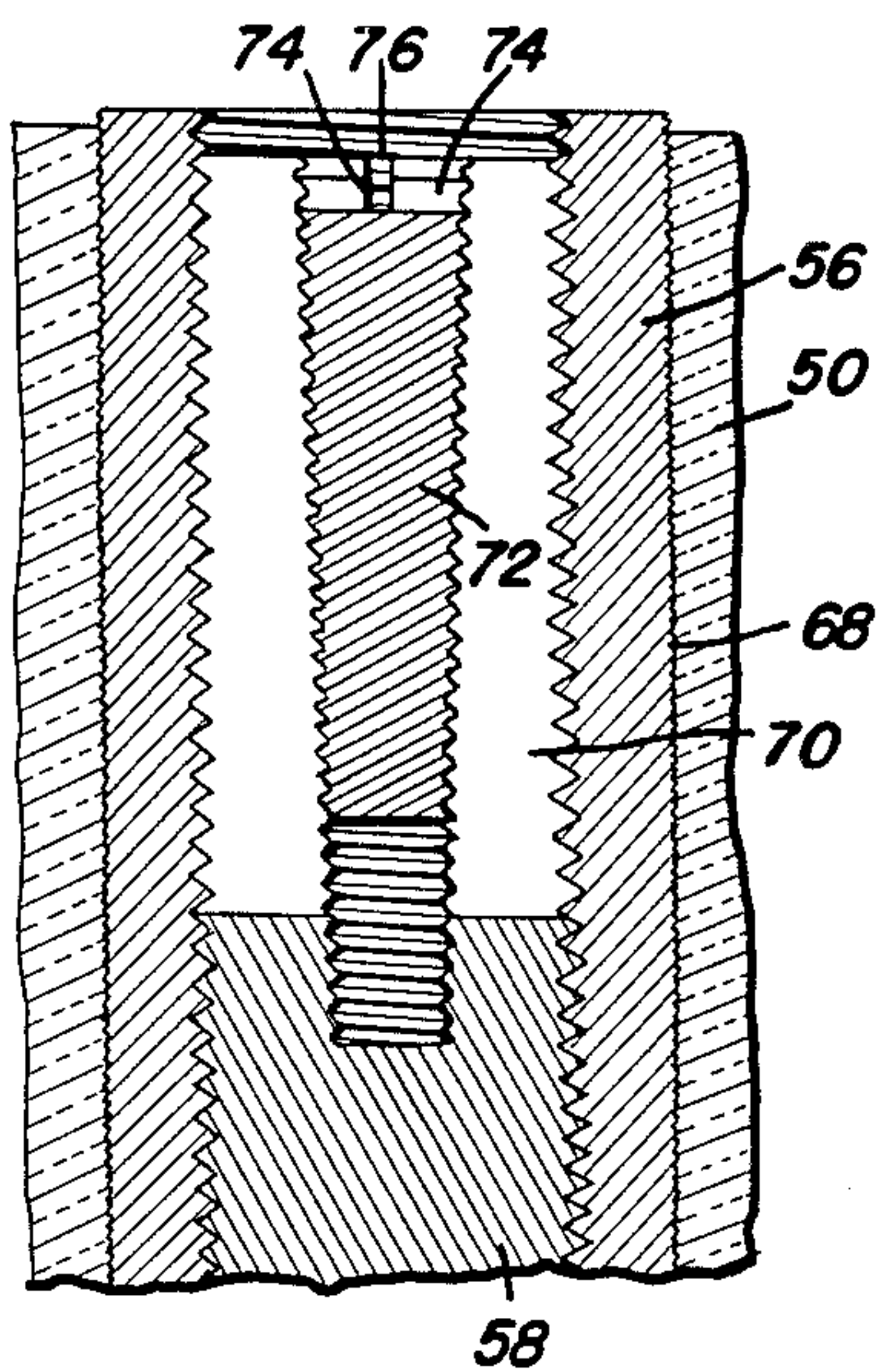
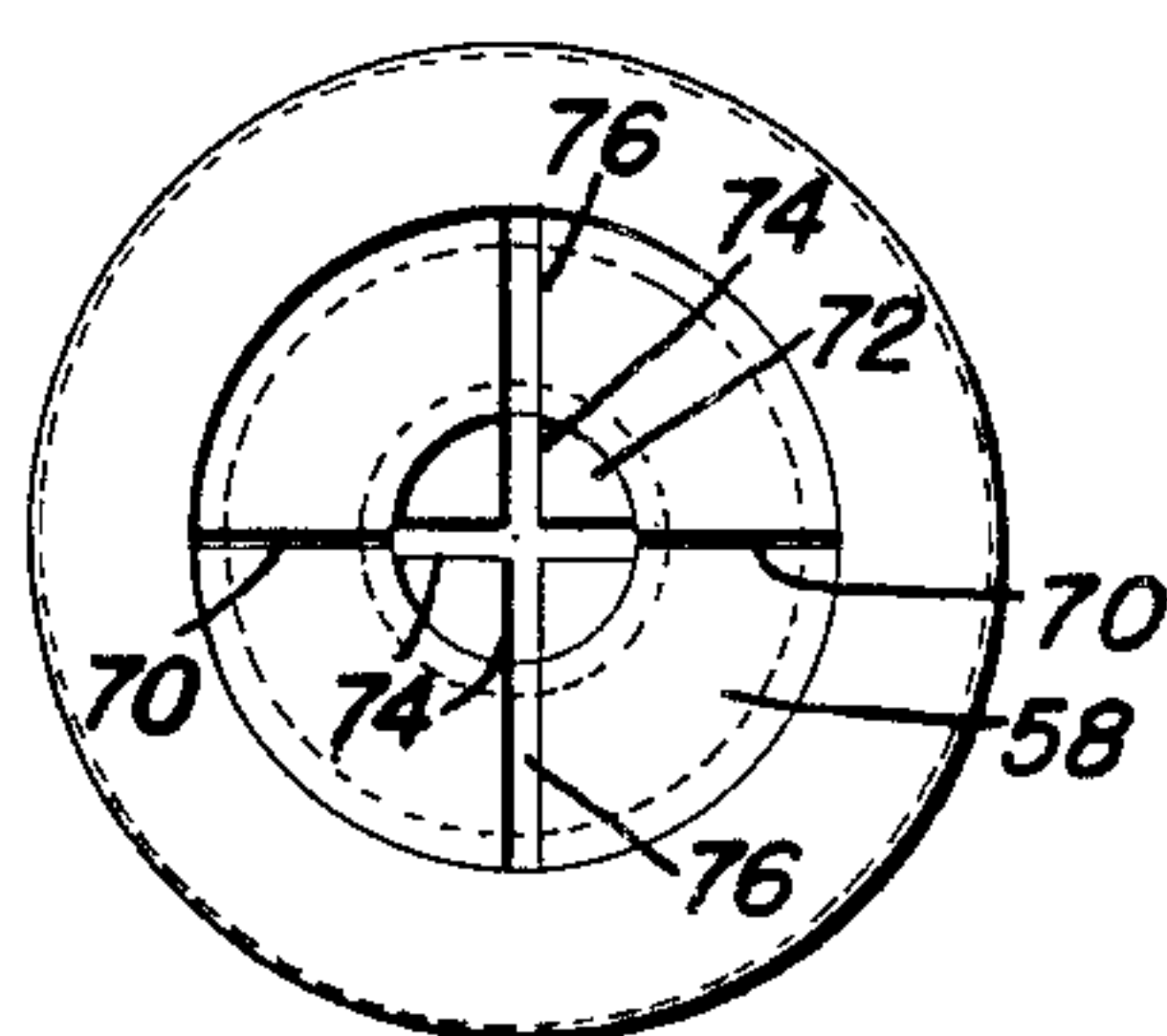


Fig. 4



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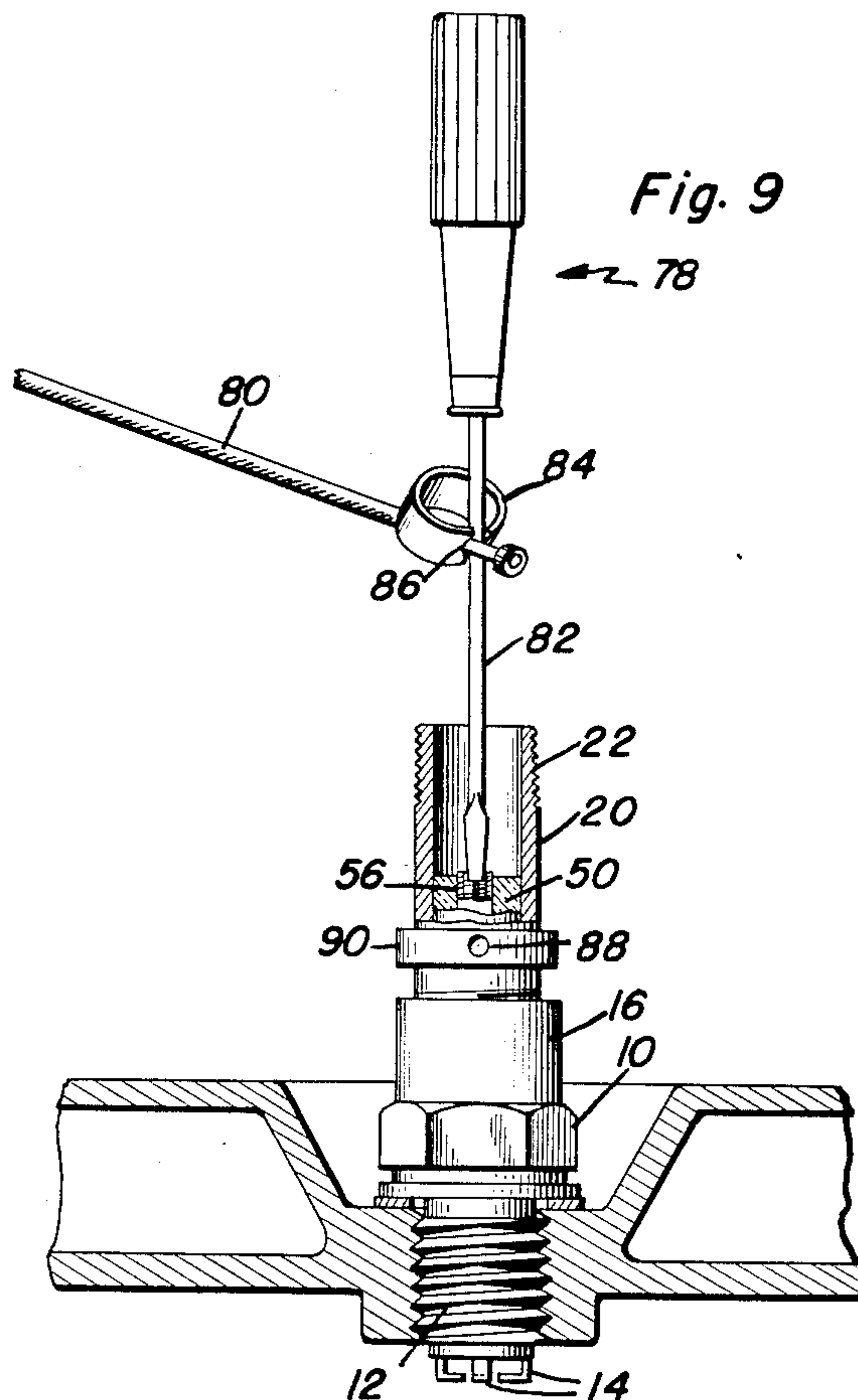
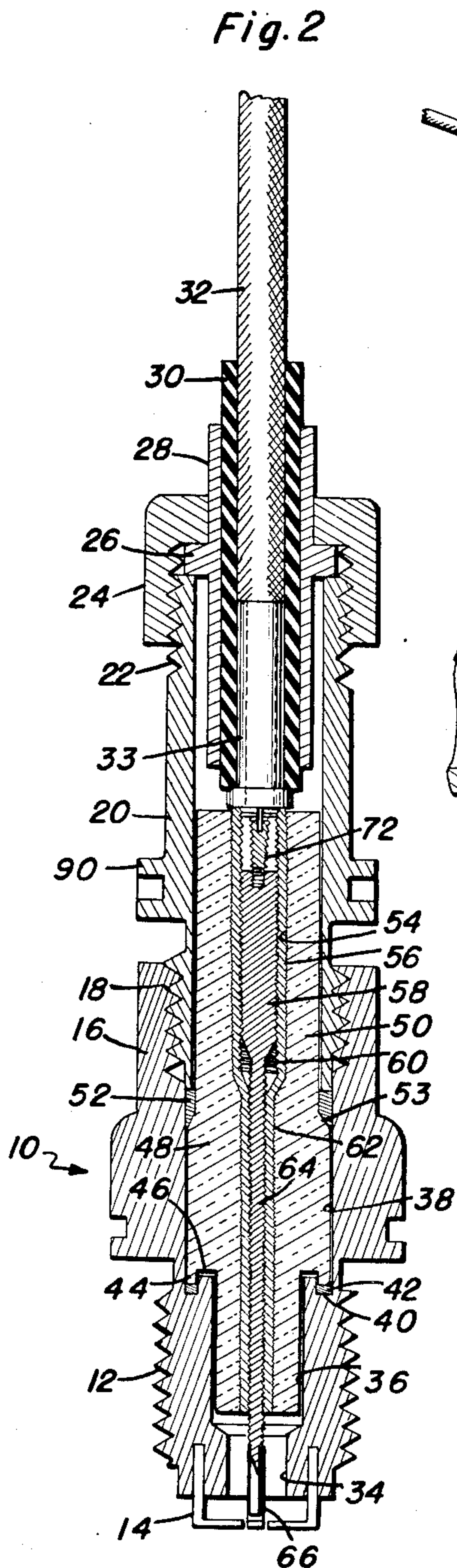
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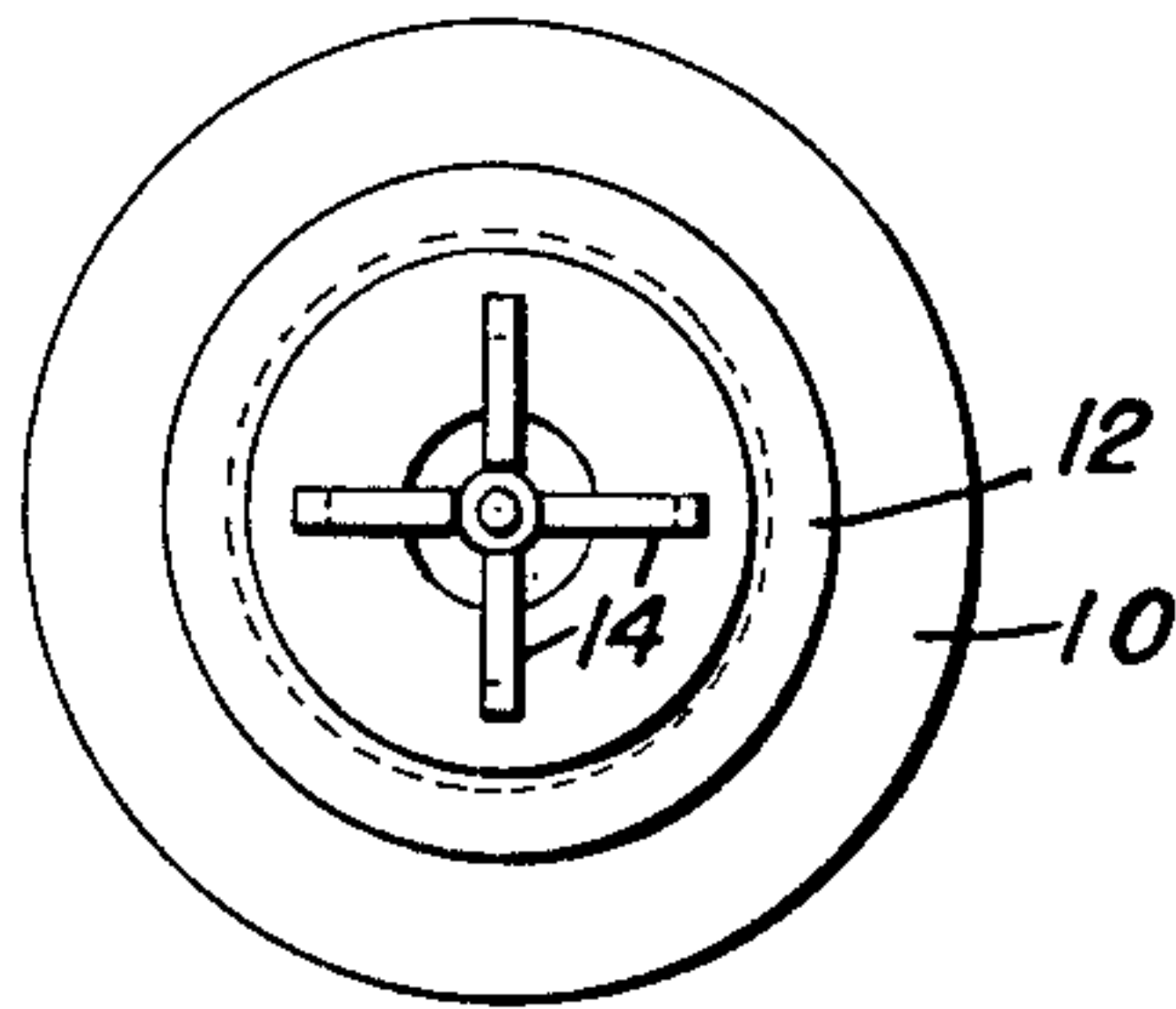
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2 SHEETS--SHEET 2



**Fig. 8**



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# UNITED STATES PATENT OFFICE

2,626,595

## SPARK PLUG

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4 Claims. (Cl. 123—169)

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This invention relates generally to spark plugs, and more particularly to that type of spark plug having an adjustable center electrode.

A primary object of the invention is to provide a spark plug which will not become fouled under ordinary conditions of usage, and which will resist infiltration of carbon particles into the inner portions of the plug, thus insuring against breakdown of insulation within the plug.

Another object of this invention is to provide a spark plug which will not allow compression leakage, even after long periods of use.

Yet another object of this invention is to provide for adjustability of the center electrode, the ignition lead attaching means being removable so that adjustment of this center electrode may be accomplished during the operation of the plug, one end of the adjustable electrode being exposed for engagement by a screwdriver or similar tool when said attaching means is removed.

Another object of this invention is to provide special means for locking the adjustable electrode after adjustment thereof.

Yet another object of this invention is to provide a spark plug wherein the center electrode is easily replaceable as well as adjustable.

A last object to be mentioned specifically is to provide a spark plug which is relatively inexpensive and practicable to manufacture, which is simple and convenient to install and to service; and which will give generally efficient and durable operation.

With these objects definitely in view, this invention resides in certain novel features of construction, combination and arrangement of elements and portions as will be hereinafter described in detail in the specification, particularly pointed out in the appended claims, and illustrated in the accompanying drawings which form a material part of this application, and in which:

Figure 1 is a side elevational view of the assembled spark plug;

Figure 2 is a vertical central longitudinal sectional view of the assembled spark plug;

Figure 3 is an enlarged fragmentary sectional view of the upper end of the center electrode and adjacent structure including the upper end of the part hereinafter referred to as the electrode supporting tube;

Figure 4 is a top plan view of the structure indicated in Figure 3;

Figure 5 is an elevational view of said electrode supporting tube;

Figure 6 is an elevational view of the center electrode;

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Figure 7 is a view, in perspective, of the upper end portion of the electrode supporting tube shown in Figure 5;

Figure 8 is a lower end plan view of an assembled spark plug, the view being taken as from the bottom of Figure 2; and

Figure 9 is an elevational view of a spark plug constructed according to this invention, the upper portion of the spark plug having parts broken away and the underlying parts shown in vertical section and in elevation, and the figure including portions of a cylinder of an engine wherewith the spark plug will be used, together with a screwdriver used in the adjustment of the center electrode, and ignition lead and a clamp for securing this ignition lead to the shank of the screwdriver, the figure being adapted to indicate how the center electrode can be adjusted during operation of the spark plug in a motor.

Similar characters of reference designate similar or identical elements and portions throughout the specification and throughout the different views in the drawings.

Referring now to the drawings in detail, this spark plug includes a body 10 having a reduced externally threaded neck portion 12 adapted to be screwed into the head of a motor and carrying a plurality of fixed electrodes 14. These electrodes 14 are each of angular construction, one leg of each electrode being embedded in the end of the reduced neck portion 12, while the other leg or terminal of the electrode extends radially toward the axial center of the plug. The spark plug body 10 also includes a reduced portion on the other side of the central portion of the plug, indicated at 16, this second reduced portion 16 being internally threaded as indicated at 18 to receive a coacting threaded portion of a generally cylindrical shell 20, this shell being, of course, hollow and having the outer end 22 thereof threaded externally for engagement on the internally threaded cap nut 24. An annular flange 26 on a tubular member or fitting 28 comprises means for securing this tubular member 28 axially of the plug, with the annular flange 26 clamped between an end of the threaded portion 22 and the cap nut 24. Another tubular insulating member 30 is compressed between the insulated ignition lead wire 32 and the member 28, and the terminal 33 of the lead 32 extends and is exposed beyond the end of the tubular member 30.

The reduced threaded portion 12 has an axial bore 34 which is internally enlarged, as indicated at 36, and still further enlarged as indicated at



38 to provide an annular shoulder between the portions 36 and 38 of the axial bore, it being understood that at least a part of the portion 38 of the axial bore will ordinarily extend throughout a major portion of the body 10. The shoulder between the portions 36 and 38 is provided with an annular undercut or groove 40, in that portion of the shoulder remote from the axis of the plug. An annular gasket 42 is inserted in this groove 40, and a shoulder 44 with an undercut 46 in a sleeve 48 coacts with the undercut shoulder in the body 10, and with the gasket 42, to provide a perfect seal between the sleeve 48 and the body 10. It should be particularly noted that the gasket 42 is disposed so as to give adequate sealing action, while being spaced a considerable distance from the elements at the center of the spark plug which tend to become very hot. This arrangement provides for better and more lasting sealing action by the gasket 42, it being remembered that the sleeve 48 will always be constructed of material which is a good electrical insulator as well as a reasonably good heat insulator, such as porcelain or a similar product.

The porcelain sleeve 48 has a reduced portion 50, and another gasket 52 is inserted between the inner end of the shell 20 and a shoulder 53 between a centrally enlarged portion of the porcelain sleeve 48 and the reduced portion 50 thereof.

The reduced portion 50 of the porcelain sleeve 48 is provided with an axial bore, the enlarged portion 54 of which accommodates the enlarged end of the electrode supporting tube 56, and the enlarged end of the center electrode 58 is threaded into the enlarged end 56. As illustrated at 60, this internally threaded portion 56 of the electrode supporting tube is longer than the enlarged portion 58 of the electrode so that the latter is adjustable longitudinally thereof. The reduced portion 62 of the electrode supporting tube is also threaded to receive a reduced portion 64 of the center electrode, the sparking terminal 66 of which extends beyond the corresponding end of the electrode supporting tube and also extends through the bore 34, so that the center electrode may be brought into juxtaposition with the fixed electrodes 14. It should be carefully noted that the exterior surface 68 of the electrode supporting tube, as indicated in Figure 3, is knurled, threaded or otherwise roughened and sealed into the sleeve 48, the sleeve 48 being preferably molded upon the electrode supporting tube during the manufacture of the spark plug.

Special means is provided for locking the center electrode after adjustment relative to the electrode supporting tube. With this end in view, the end of the enlarged portion 58 of the center electrode is socketed and split or provided with diametrically opposite slots 70, extending a somewhat shorter distance than the length of a tapered expander screw 72 which is threaded into the split screw-threaded end of the electrode. This construction is best illustrated in Figure 3, when read in conjunction with Figures 4-7. The socketed end of the enlarged portion 58 of the electrode is also provided with screw-driver receiving slots or kerfs 76, and the larger end of the expander screw 72 is provided with screw-driver receiving slots or kerfs 74 forming a cross, so that the screw can be adjusted by turning the same through as little as ninety degrees while still allowing a screwdriver of a wider blade dimension to be inserted into the slots 76 as well as a pair of the slots 74 in the head of the

screw 72. In other words, this construction allows adjustment of the screw 72 by turning the same through intervals of ninety degrees, which has been found sufficiently accurate adjustment in practice. Of course, when the screw is turned in the screw-threaded socket of the electrode, the expansible portions of the electrode are spread apart into locking engagement with the electrode supporting tube 56.

A screwdriver 78 is indicated in Figure 9 as being used to adjust the electrode, after the screw 72 has been backed out sufficiently to release the electrode from the electrode supporting tube. An ignition lead 80 is connected to the shank 82 of the screwdriver 78 by a simple split ring clamp 84, this arrangement of elements being used when it is desired to adjust the electrode during the actual operation of a motor and the actual operation of the particular spark plug concerned, since the electrical circuit is completed through the shank of the screwdriver. If it becomes necessary to dismantle the spark plug, the shell 20 can be turned relative to the body 10 and/or the cap 24, and recesses 88 are provided in a shoulder 90 on the shell to facilitate securement thereon of a spanner wrench, it being understood that the body 10 and the cap 24 will ordinarily each be provided with wrench receiving faces.

It has been observed that carbon deposits in spark plugs induce magnetic qualities causing the same to cling to electrodes constructed of magnetic material. The occurrence of the magnetic qualities in the deposits, in the strength observed, is not fully understood although it is believed to be possibly due to the presence of finely divided particles of matter other than carbon in the deposits. At any rate, it has been discovered that electrodes constructed of a non-magnetic, heat resistant, electrically conductive substance such as stellite or stainless steel greatly lessens the deposition of carbon deposits on the electrodes. The center electrode and/or the fixed electrodes 14 are constructed of such material according to this invention.

It should be noted that all the proposed improvements in spark plugs envisaged and implemented in this invention are designed with a single end in view, namely, the increased efficiency and dependability of the spark plugs.

The operation of this invention will be clearly understood from a consideration of the foregoing description of the mechanical details thereof, taken in connection with the above recited objects and the drawings. It will be clear that all of the objects are amply achieved with this invention, and further description would appear to be unnecessary.

Having described the invention, what is claimed as new is:

1. A spark plug comprising a base forming body having a main body portion with an axial bore and a screw-threaded attaching neck, the bore of said neck being of a diameter less than that of the portion of the bore in said main body portion, the junctural portion between the neck and main body portion providing a shoulder and said shoulder having an endless annular groove defining an endless annular wall radially inward of the groove, an elongated tubular shell carried by said body and having a bore axially aligned with the bore in said body, a sleeve of insulation material having an enlarged upper end fitting in the bores of said shell and main body portion and having a reduced lower end



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portion telescoping into the bore of said neck and defining a second shoulder opposed to said first named shoulder, said second shoulder having an annular endless groove of a diameter less than that of said first named groove and providing an annulus depending deeply into said first named groove, said wall fitting completely up and telescoping entirely into said second named groove and providing a position interlocking joint, a packing ring lodged wholly in said first named groove and interposed between the bottom of the latter and said annulus and providing a positive gas-proof seal, said sleeve providing a bore, a metal electrode tube embedded in said sleeve and lining and leak-proofing the last mentioned bore, said tube being internally screw-threaded, and an externally screw-threaded electrode adjustably threaded into said tube and providing a further leak-proof association of parts.

2. The structure of claim 1, wherein the upper end portion of said tube is enlarged in diameter and the upper end portion of said electrode is proportionately increased in diameter.

3. The structure specified in claim 2 wherein the upper end of said electrode is longitudinally slitted to render it expansible and contractible and is axially formed with an internally screw-threaded socket and is, in addition, provided with screwdriver kerfs, and an expander screw screwed into said socket and provided at its upper end with a screw driver kerf.

4. For use in a spark plug, an insulator sleeve having a reduced lower end surrounded by an annular groove defining an endless annular interlocking and packing compressing annulus, said sleeve having an axial passage which is screw-threaded, the upper end portion of said passage being increasing in diameter, and an externally screw-threaded electrode tube screwed into said passage and lining the same and having an enlarged upper portion corresponding with the

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enlarged upper portion of the passage in said sleeve, said electrode tube having its lower reduced end portion internally screw-threaded and its upper enlarged portion internally screw-threaded, an electrode having an externally screw-threaded reduced lower end portion screwed into the corresponding portion of said electrode tube and having an externally screw-threaded enlarged upper end portion screwed into the corresponding upper end portion of said electrode tube, the upper end of said electrode having diametrically opposite slits and having in addition diametrically opposite screw driver kerfs, said kerfs and slits being at equidistant circumferentially spaced points, said upper end portion having an internally screw-threaded socket, an externally screw-threaded tapered expander screw screwed into said socket, the upper end of said expander screw being provided with screw driver kerfs.

FRANCIS EDWARD BERSTLER.

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