J. W. MEAKER.

SPARK PLUG.

APPLICATION FILED AUG. 15, 1914.

1,156,799.

Patented Oct. 12, 1915.

2 SHEETS—SHEET 1.

Fig. 1.

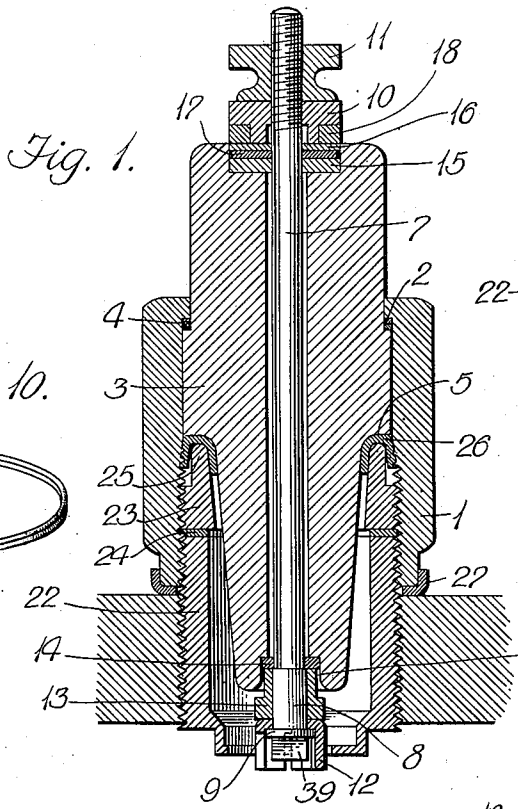


Fig. 10.

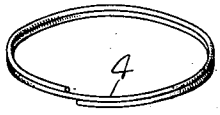


Fig. 11.

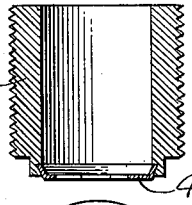


Fig. 12.

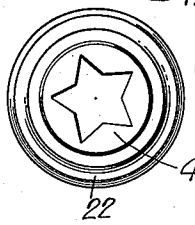


Fig. 7.

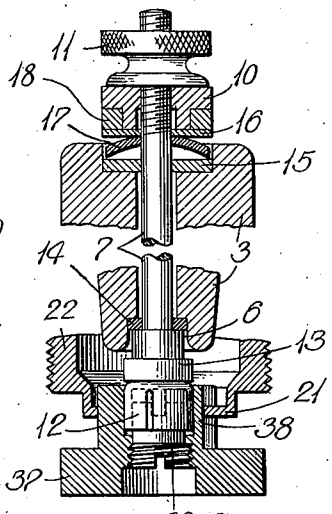
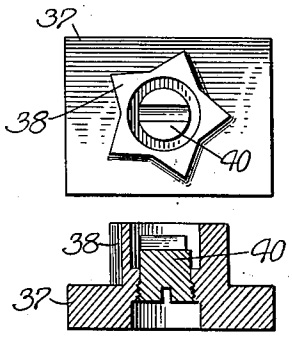


Fig. 2.

Fig. 8.



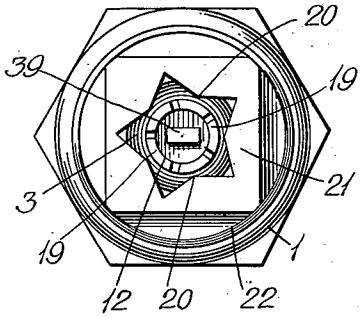


Fig. 9.

Witnesses

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2 SHEETS—SHEET 2

Fig. 3.

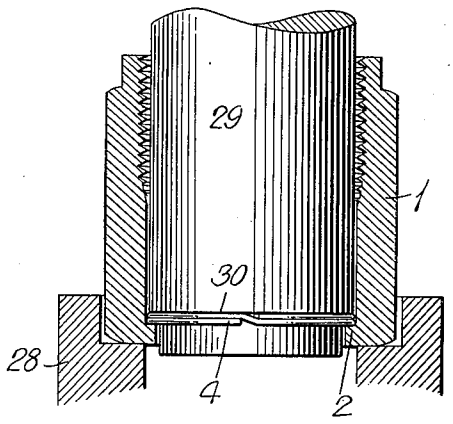


Fig. 4.

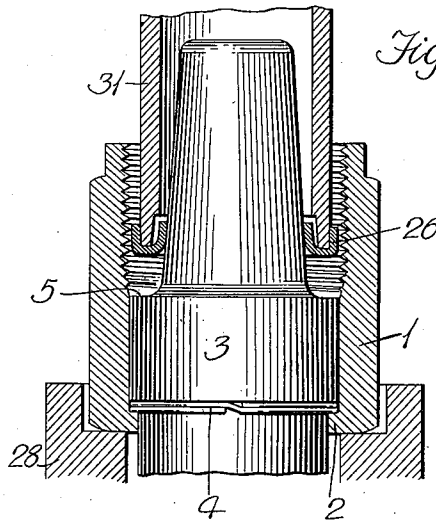


Fig. 5.

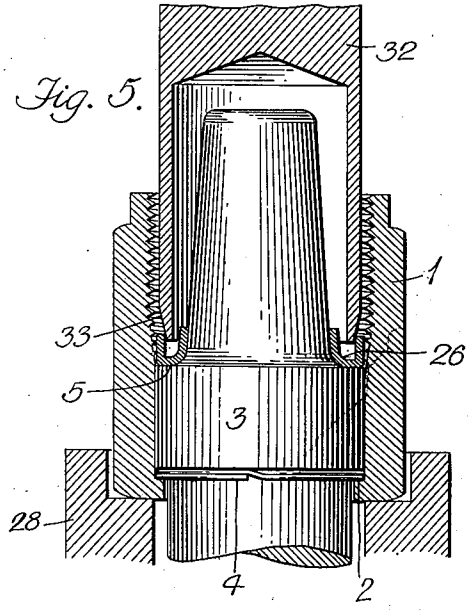
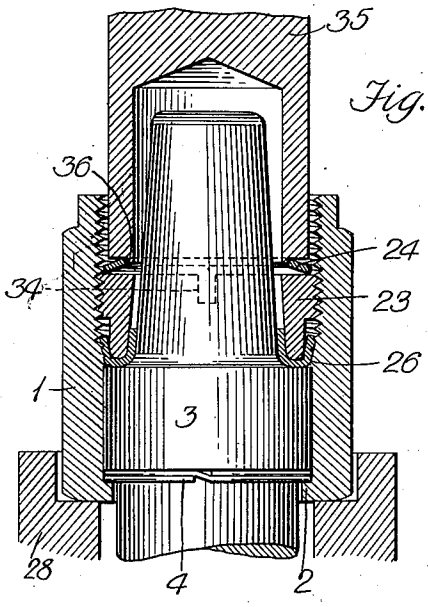


Fig. 6.



Witnesses

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SPARK-PLUG.

1,156,799. Specification of Letters Patent. Patented Oct. 12, 1915.

Application filed August 15, 1914. Serial No. 856,882.

To all whom it may concern:

Be it known that I, JOHN W. MEAKER, a citizen of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Spark-Plugs, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to that class of electrical spark forming devices for internal combustion engines, known as spark plugs and its object is to provide a simple and efficient construction which may be easily and accurately assembled and is cheap to manufacture.

A further object is to provide simple and efficient packing means to prevent leakage, which means is also so constructed as to facilitate assemblage, and to provide certain other new and useful features in the construction, all as hereinafter more fully described, reference being had to the accompanying drawings in which—

Figure 1 is an enlarged longitudinal section through a spark plug embodying the invention; Fig. 2 is a bottom end view of the same; Figs. 3, 4, 5 and 6 are sectional views illustrating the several steps in assembling the device; Fig. 7 is a sectional detail showing the center electrode or rod of the device in elevation and illustrating the manner in which the same is held in position relative to the other parts in assembling and the manner of placing a packing for the rod; Fig. 8 is a plan view, and Fig. 9 a transverse section of a tool or device for holding the center electrode in assembling the spark plug; Fig. 10 is a perspective view of a packing ring; and Figs. 11 and 12 are a longitudinal section and end elevation respectively, of a modified form of nipple.

As shown in Fig. 1, the spark plug in its preferred form comprises a tubular metal body or casing 1 of hexagonal form in cross-section and provided with an inwardly extending annular flange at its upper end forming a narrow shoulder 2 to engage a like shoulder on a center insulating member 3 preferably formed of porcelain, with a packing ring 4 interposed between said shoulders. This ring is preferably made of a single piece of copper or other soft metal wire which is coiled upon itself, making one complete turn with one end of the wire below said turn spaced a short distance from the other end of the wire which lies upon the upper side of said turn, thus nearly completing another turn.

The upper end of the insulating member or porcelain 3 projects outward through the open upper end of the body or bushing 1 and its lower end is reduced in diameter to form an annular shoulder 5 and tapered in the usual manner toward its lower end which is formed with an end recess 6. An axial opening or bore is provided in the porcelain for a center rod 7 which extends therethrough and is provided with an enlarged lower end 8 having an end flange 9 and the upper end of the rod which projects through the upper end of the insulation is screw threaded to receive a nut 10 and a binding nut 11. A cupped member 12 and a sleeve 13 are sleeved upon the enlarged portion 8 of the rod or stem 7 between the flange 9 and a washer 14 which is adapted to seat in the bottom of the recess 6, and a pair of washers 15 and 16 with an interposed packing washer 17 are sleeved upon the stem below a locking ring 18 and the nut 10, to fill a suitable recess in the upper end of the insulating member. The packing washer 17 is formed preferably of soft metal, such as copper, and is normally, or before it is assembled in the spark plug, cupped or of concavo-convex form with an axial opening sufficiently large to loosely fix the rod or stem 7. In assembling, the nut 10 is turned down, forcing the washer 14 firmly to its seat, said cupped packing washer will be compressed, as shown in Fig. 7, or flattened out, as shown in Fig. 1, thus causing it to contract upon the rod and make a very tight joint therewith which will effectually prevent any leakage around the rod, especially where the washers 15 and 16 are seated in the recess of the insulation and cemented therein if found desirable.

The cup member 12 is firmly held in place by the flange 9 when the rod 7 is secured in place as described and this member forms the sparking points for the electrode or rod 7 by having its side wall slitted at intervals inwardly from its edge to form a series of fingers 19 which may be bent inwardly or outwardly to increase or decrease the spark gap between them and the corresponding sparking points or projections 20 of an inwardly projecting flange

21 on the lower end of a nipple 22 which is externally screw-threaded to engage the internally screw-threaded lower end of the body or casing 1. This nipple is screw-threaded throughout its length and is screwed only part way into the casing so that its projecting lower end may serve as a nipple to screw into an opening in an engine cylinder and attach the spark plug thereto in the usual manner. An externally screw-threaded ring 23 is screwed into the body or casing from its lower end and forms a stop for the nipple, a suitable packing ring 24 being interposed between the upper end of the nipple and the lower end of the ring. The ring also serves as a seat for the shoulder 5 of the insulation, it being formed with a longitudinally projecting flange 25 of lesser diameter than the external diameter of the ring to form a rounded seat for a packing ring 26 of soft metal, preferably copper, which is channel-shape in cross section and is forced to place against the shoulder 5 and adjacent side of the casing in the assembling of the parts, as will be hereinafter described. The rounded upper edge of said flange 25 projects into the channel of the ring and securely holds the insulating member in place against the shoulder 2 when the ring is screwed into the casing, and the ring is of such an internal diameter that the tapered lower end of the insulation will project freely therethrough and the space between said end and inner wall of the ring will be filled by the inner flange or wall of the channel packing ring. If found desirable, a metal packing ring 27 having an upturned outer edge to fit over the lower rounded end of the casing 1, may be interposed between said end of the casing and the wall of the engine cylinder into which the spark plug is screwed.

In assembling the spark plug, a suitable seat member 28 is preferably provided having an annular seat for the casing 1 which is placed therein in an inverted position and by means of a suitable plunger 29 having a reduced lower end forming a shoulder 30, the ring 4 is forced accurately to its seat upon the shoulder 2 of the casing and compressed sufficiently to form it to place. The insulating memebr 3 is then placed in the casing with its shoulder engaging the packing ring 4 and the channel packing 26 then forced down upon the reduced end of the insulation and seated upon the shoulder 5 by means of a suitable tubular plunger 31 having a formed lower end to enter the channel of the ring, as shown in Fig. 4. The internal diameter of the ring is slightly less than the diameter of the reduced end portion of the insulation where it meets the shoulder 5 and thus in forcing the ring thereon said ring is formed accurately and closely to the insulator. A second sleeve forming member 32 having a suitably beveled lower end 33 is then inserted and the outer side wall or flange of the channel ring is forced outwardly or expanded into very close contact with the inner surface of the casing 1, thus tightly packing the joint between the insulator and casing.

The screwing of the ring member 23 into the casing by means of a suitable tool (not shown) engaged with notches indicated in dotted lines at 34 in Fig. 6, with its end flange 26 within the channel of the packing ring, securely locks the insulator in place with its longitudinal axis in coincidence with the axis of the casing and the expanded packing ring clamped in place. The ring 4 provides a seat for the insulator which will yield slightly to conform to the irregularities of the shoulder on the insulator and thus prevent breakage of the porcelain when forced to its seat by the plungers 31 and 32, and the locking ring 23. The packing ring 24 is preferably dished or formed concavo-convex, as shown in Fig. 6, so that when it is forced to its seat upon the end of the ring 23 by means of a sleeve plunger 35 having a slight annular rib 36 on its end face to engage within the ring, said ring will be expanded outwardly into close contact with the wall of the casing so that when the nipple 22 is screwed in hard against said ring, a tight joint will be formed which will prevent any leakage through the threads and out past the lower end of the casing. The possibility of any such leakage is further obviated by providing the packing ring 27 shown in Fig. 1. The insulator having been thus firmly secured in the casing, the center electrode or rod 7 is then inserted endwise through the insulator with its member 12, sleeve 13 and washer 14 in place thereon, and to accurately center the sparking fingers 19 within the opening in the lower end of the nipple 22 and hold them in their proper relation to the points 20 on said nipple to give the proper spark gap, a tool 37 shown in Figs. 7, 8 and 9 is employed. This tool has a boss 38 which is externally shaped to accurately fit within the opening in the flange 21 of the end of the nipple, which opening may be in the form of a five pointed star as shown, or of any other desired shape to provide a series of sparking points. This boss 38 is formed hollow to provide a recess for the sparking fingers 19 on the center electrode and to hold the rod 7 against turning while the nuts 10 and 11 are being turned up to hold it in place, the end of said rod is formed with a rib 39 adapted to be engaged by a notch in a plug 40 screwed into an axial opening in the boss 38. The parts may thus be quickly and accurately assembled with the proper spark gap provided and the proper relation of the sparking terminals maintained with-

out the necessity for further adjustment or attention.

In Figs. 11 and 12 a slight modification of the nipple 22 is shown, the inwardly extending flange 21 being a separate piece 41 preferably made from a metal which will not readily burn off at the sparking points, and which is pressed into a suitable groove formed in the lower end of the nipple.

Obviously other changes may be made in the construction and arrangement of parts without departing from the spirit of my invention, and I therefore do not limit myself to the particular construction shown.

What I claim as my invention is:—

1. In a spark plug, the combination of a casing having an inwardly projecting portion forming an annular shoulder, an insulating member formed with an upper annular shoulder to oppose the shoulder on the casing and with a reduced end portion forming a lower annular shoulder, a channel ring with its closed side in contact with the lower side of said lower annular shoulder and the outer wall of the channel bent outwardly into contact with the wall of the casing, a locking ring having screw-threaded engagement with the casing and encircling the reduced end of the insulating member and formed with an annular flange engaging the channel independently of said outwardly bent wall of said ring to lock the insulating member in the casing against the shoulder on the casing.

2. In a spark plug, the combination of a casing having an internal annular shoulder at its upper end and internally screw-threaded at its lower end, an insulating member formed with a shoulder to oppose the shoulder on the casing and with a reduced lower end forming an annular shoulder at a distance below the first named shoulder thereon, a packing ring to engage said lower shoulder on said member, an externally screw-threaded ring surrounding the reduced lower end of the member and engaging the screw-threaded portion of the casing, said ring being formed with an annular portion to engage the packing ring, a nipple externally screw-threaded throughout its length to engage the screw-threaded portion of the casing below the ring and abutting said ring to lock the nipple with one end projecting from the casing to form means for attaching the plug to an engine cylinder, said nipple being formed with a sparking terminal point at its lower end, and an electrode carried by the insulating member and provided with a sparking terminal adjacent to the said point on the nipple.

3. In a spark plug, the combination of an internally screwthreaded casing, an insulating member in the casing having a downwardly facing shoulder, a channel shaped packing member engaging the shoulder, a ring having screwthreaded engagement with the casing and opposed to said shoulder to form a seat for the packing ring, and a nipple exteriorly screwthreaded to engage the casing below said ring and project from the casing to form means for attaching the plug to an engine cylinder, said nipple being adjustable in the casing independently of said ring.

4. In a spark plug, the combination of a casing having an internal annular shoulder near its upper end and internally screw-threaded at its lower end, an insulating member in said casing formed with a shoulder opposing the shoulder on the casing and with a reduced lower end forming an annular shoulder at a distance below the other shoulder thereon, a packing engaging the lower shoulder on said member to seal the joint between said member and the casing, a ring secured in the casing, and opposing said lower shoulder to hold said packing seated thereon and said insulating member seated against the shoulder on the casing, with its upper end projecting through the open upper end of the casing, and an exteriorly screw-threaded nipple engaging the interior screw-thread of the casing with its lower end projecting from the lower end of the casing to form means for attaching the plug to an engine cylinder and with its upper end opposing the ring to lock the nipple in the casing, and limit its inward movement therein.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN W. MEAKER.

Witnesses:

ANNA M. DORR,

LEWIS E. FLANDERS.