May 28, 1935. L. J. TETLOW 2,002,803

SPARK PLUG

Filed July 24, 1931

FIG. 1.

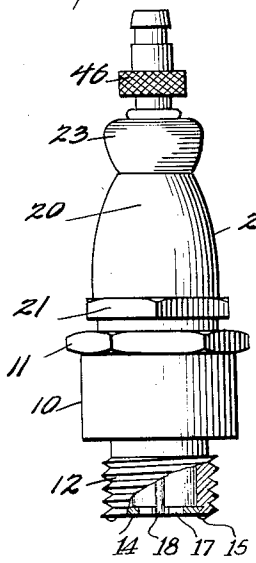


FIG. 2.

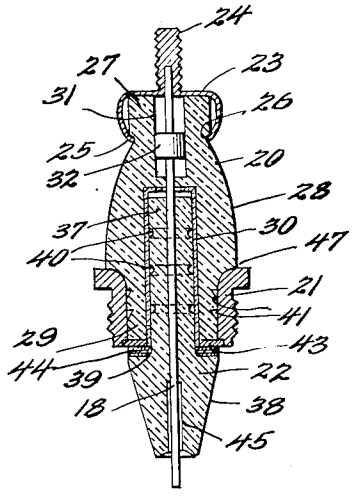


FIG. 3.

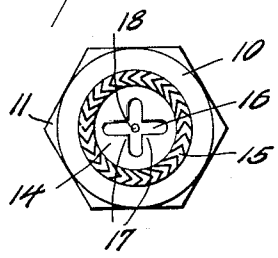


FIG. 5.

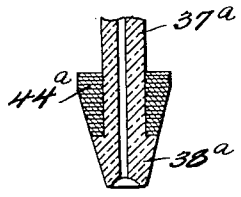
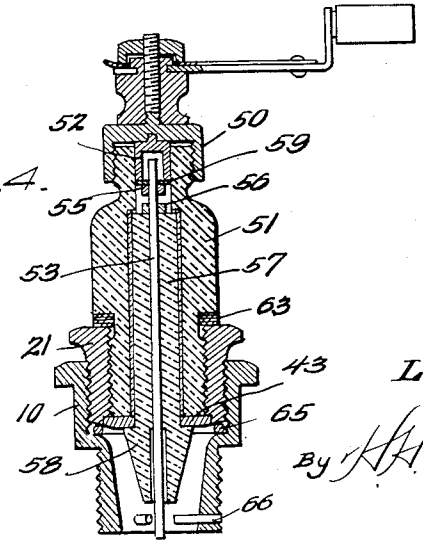


FIG. 4.



Inventor

Lewis J. Tetlow,

By H. H. Snelling

Attorney

Patented May 28, 1935

2,002,803

UNITED STATES PATENT OFFICE

2,002,803

SPARK PLUG

Lewis J. Tetlow, Holyoke, Mass.

Application July 24, 1931, Serial No. 552,975

22 Claims. (Cl. 123—169)

This invention relates to spark plugs of multiple telescoping insulator construction and has for its object the provision of a spark plug of exceptional sturdiness in which provision has been made to assure against a loss of spark even tho one or more of the telescoping insulating sleeves should crack.

Further objects of the present invention relate to specific details such, for example, as the provision of mica washers between the two insulator pieces which make up the body of the plug.

Other objects of the invention will be apparent from study of the claims and from the accompanying drawing which illustrates forms that the invention may take.

In the drawing:

Figure 1 is an elevation.

Figure 2 is a central section.

Figure 3 is a bottom plan view.

Figure 4 is a somewhat modified form.

Figure 5 is a detail showing a modification of one of the spark plug elements.

In the form of device illustrated in Figure 1, the shell 10 is of ordinary and well known form having an integral nut 11 at the top and a threaded portion 12 to fit into the cylinder of an engine. A slight variation from ordinary practice is the provision at the bottom of the shell of a disk 14 having a knurled periphery 15 and having two bisecting slots 16 forming a cross, the cusps 17 of which are the sparking points. The central electrode 18 should be so positioned that it is equi-distant from all four of the cusps.

The body of the plug consists of four major portions, a top insulator section 20, a nut or bushing 21 surrounding the top section, a lower insulator section or core 22 and cap 23. The latter consists of a threaded terminal 24 integral with the cup portion which, when the device is assembled, is spun so that its peripheral portion 25 snugly and permanently engages the groove 26 in the upper insulator section 20. In the form shown in Figure 2 the central electrode 18 is driven into a small hole in the cup and is held to the cup by such engagement prior to assembly of the various parts of the plug.

The top insulator section has a cylindrical top portion 27 snugly fitting the cap 23, a mid portion which is the frustum of an ellipsoid 28, and a lower cylindrical portion 29 which fits snugly the central bore of the bushing or nut 21.

Thru the center of the upper insulating body are three coaxial bores, the lower bore 30 being fairly large and intended to receive the core section, the upper portion of the bore 31 being somewhat smaller and of a size to receive a collar 32 which is shrunk on a central electrode 18, while the intermediate bore section 34 is just of size to receive well the central electrode. By reason of the three bores two annular shoulders are formed, the upper one to receive an additional collar 32 when desired and the lower annular shoulder to abut the upper cylindrical surface of the core which however is not intended to abut firmly against the shoulder.

The core 22 consists of an upper cylindrical section 37 and a lower conical section 38, these two being integral and joined by an appreciable fillet 39 to prevent the formation of a sharp angle between the two integral sections. Between the wall of the larger bore in the upper insulating section and the appreciably smaller cylindrical wall of the top section 37 of the core I place a cylinder of mica preferably in spiral form. This mica, when the spark plug is finished, is securely held to both the inside of the upper insulating section 20 and the outside of the lower insulating section or core, the latter preferably having a number of annular grooves 40 to aid in the holding of the cementing material, the annular grooves 41 in the cylindrical lower portion of the section 20 being for the same purpose and cooperating with a roughened surface of the nut.

A steel disk 43 is force fitted into the bottom of the nut, this construction being much more satisfactory in practice than the obvious equivalent of making the washer and nut integral. Between the washer 43 and the surface at the top of the cone 38 I apply a number of annular mica disks 44 which cushion the core 22 against the nut or bushing 21 and also against the inner section 20 should the washer not be used. While the central electrode 18 fits the core as snugly as is possible in practice throughout the upper section of the core I desire that the size of the opening to receive the central electrode shall be appreciably larger thru the conical section as is indicated at 45, this permitting the rather necessary movement of the lower end of the electrode.

In assembling the device I drive the central electrode into the cup and then apply the terminal nut 46, placing the one or more collars 32 at desired positions along the rod 18. The sleeve of mica or other tough non-cracking insulating material which, while preferably in the form of a roll made of an integral sheet, can consist of a number of different sheets, is secured to the upper section 20 and packed in place, the nut 21

likewise being secured in the same manner and preferably at the same time. After applying the mica washers 44 I next insert the core into position threading it on the central electrode 18 should that be placed into position first. Preferably, however, I apply the electrode and cap after the body of the plug has been completely secured together as in this way I am able to secure a better distribution of the cementing material, using the collar 32 as a piston to force the cement into the bore below this collar. It is to be noted that the actual joint between the nut and the body portion 20 is at 47 so that there is no pressure on the washer 43 and it is also to be noted that the joint between the two porcelain sections is at the top of the cone 38 and not at the top of the cylindrical portion 37. Due to the construction set forth I am able to secure great advantages as I can make the upper section 20 of a grade of porcelain much better able to withstand the rough treatment that this portion will be subjected to and I can also make the lower section of material which will stand much greater heat. Ordinarily the composition of the porcelain must be a compromise between fineness and ability to withstand heat and toughness and ability to withstand blows but by using the two telescoping sections I am able to secure the maximum advantage of each of these parts without any sacrifice whatsoever. Furthermore because of the provision of the relatively heavy mica sleeve 30 I secure a much greater life as the mica sleeve located between the inner heat resisting section and the outer tougher section obviates any possibility of loss of current because of the cracking of either of the outer or inner porcelain sections or both.

In the modified form shown in Figure 4 the cap 50 is threaded to the upper porcelain section 51 and carries a mercury cup 52 into which the central electrode 53 penetrates. On this central electrode near its top are two spaced collars 55 and 56, the latter engaging snugly the upper face of the cylindrical portion 57 of the core 58 and the former holding a mica washer 59 against the downwardly turned open end of the mercury cup 52. Either or both of these collars may be omitted but I prefer to use the two of them. They may be made either of brass or copper and may be held to the electrode in any desired manner. My preference is to shrink these collars to the electrode with a reasonable tightness but not so great as to prevent a desired shifting of the collars should it be necessary. In this modified form I place a series of washers 63 between the upper section of the body and the bushing 21. The shell 10 is the same as in Figure 1 but instead of having the lower plate 14 I use the more conventional horizontal electrodes 66 radially disposed in the shell at 120° apart and made slightly adjustable for accurate spacing. In this form of plug I prefer that the copper gasket 65, which forms a gas tight joint between the coupler nut or bushing and the shell, shall be sufficiently small as not to engage the washer 43.

What I claim is:

1. A spark plug insulator comprising an inner core of ceramic material having high heat resistance, an outer shell of ceramic material having high resistance to breakage, and a mica tube between the shell and the core, the grain of the mica being parallel with the surface of the core.

2. A spark plug insulator consisting of an inner core, an outer body portion of insulating material, and a sleeve of fibrous material such as mica between the core and body portion said sleeve having high tensile strength.

3. In a spark plug, an insulator having a connector cap supporting end and a shell engaging end, a relatively large bore in said insulator divided near the cap end by a partition having a small central bore connecting said large bores, a shouldered tube of insulation extending within said larger bore at the shell engaging end, a metal washer surrounding the tube and engaging said shoulder and having an outer diameter greater than that of the shell engaging end, said washer separating the said shell engaging end and said shoulder.

4. The device of claim 3 in which the tube and insulator are separated by a mica sleeve extending from said washer to said partition.

5. In a spark plug an insulator body having a head, a central electrode and a cap, a bore in said head, a washer in said bore in force fit engagement with said electrode, said cap having a central bore in which said electrode is in force fit engagement, and said cap being spun on said head whereby when fully assembled the length of electrode between the washer and cap is under compression.

6. In a spark plug, a main insulator body having a relatively large bore extending from the bottom toward the top, a tube of mica fitted in the bore, a second insulator body fitting in said mica tube, an integral shoulder on the lower end of said second body, a washer between said shoulder and the lower end of said main body and extending beyond said body forming an annular ledge for engaging the shell of the plug, an electrode thru the center of said bodies and carried thereby.

7. A spark plug insulator consisting of a central core having a cylindrical portion and a conical portion, an insulating sleeve entirely surrounding the cylindrical portion of the core, a bushing permanently secured to the sleeve, and an electrode thru the core, a cap on the sleeve and in electric contact with the electrode.

8. A spark plug insulator consisting of a central core having a cylindrical portion and a substantially conical portion, an insulator sleeve entirely surrounding the cylindrical portion of the core, a bushing permanently secured to the sleeve, an electrode thru the core, a cap on the sleeve and in electric contact with the electrode, and a collar on the electrode spaced from the cap and within said sleeve.

9. A core for a spark plug consisting of a conical section adapted to be spaced within the bore of the electrode carrying shell and an integral cylindrical section, said cylindrical section and said conical section being joined by an annular fillet and said cylindrical section having an annular groove in its outer surface whereby it may be cemented to a supporting element surrounding said cylindrical section.

10. A spark plug having a central electrode, an insulating member of ceramic material surrounding a portion of the electrode, a mica sleeve surrounding a portion of said member and an insulating jacket of ceramic material surrounding said mica sleeve.

11. In a spark plug insulator, a central electrode, an insulating sleeve surrounding the greater portion of the electrode, a second insulating sleeve surrounding the greater portion of said first sleeve, and an insulating tube of mica or the like between said sleeves.

12. In a spark plug insulator, a body of two

sections, one a core and the other an outer and top section, said core being supported by said outer section, a metal bushing carrying the top section to secure it to a shell, said bushing having an abutment to engage the core to prevent transfer of pressure from the core to the top section.

13. In a spark plug having a shell, a baffle plate held in place by a turned over edge of said shell, said edge being knurled.

14. In a spark plug, a shell, a core mounted in the shell and spaced therefrom, a metal bushing having threaded engagement with the shell, means carried by the bushing to engage the core to prevent the core from moving away from the shell and insulating means for shielding the upper portion of the core, said insulating means having a curved surface of downwardly increasing radius to deflect dust and dirt from the core and terminal means carried by said deflecting means.

15. In combination, a shell having an inwardly directed electrode, a bushing having threaded engagement with said shell, a core having a cylindrical sleeve portion within the bushing and having an enlarged portion fitting against the bushing whereby the enlarged portion of the core is suspended between the bushing and the inwardly directed electrode, a sleeve of insulating material surrounding the cylindrical sleeve portion of the core and resting on a portion of the bushing and a second insulating sleeve surrounding said first insulating sleeve and being permanently attached to the bushing but out of contact with the enlarged portion of the core, said core being supported by said first insulating sleeve.

16. In a spark plug insulator, a bushing adapted to be secured to a shell, a top insulator section permanently secured to the bushing and having an extended portion firmly seated on the top of the bushing, a core section of the insulating body telescoping within the top section of the body, an annular washer seated in the bushing below the top section of the body, an enlarged portion on the core below said washer, and yielding insulating disks between said enlarged portion and said washer.

17. In a spark plug insulator, the combination with a bushing having a bore of diameter to receive a body member, said bushing also having a restricted bore communicating with the first mentioned bore and of size to receive a core, a core of insulating material having a cylindrical portion of a size to fit snugly within the smaller bore of the bushing and having a head below said smaller bore, and a plurality of insulating yielding disks surrounding the cylindrical portion of the core and being held in place against the lower face of the bushing by the enlarged portion of the core.

18. In a spark plug, a shell carrying a ground electrode, an insulating member carrying a central electrode, a bushing having a threaded engagement with the shell and with the insulator, and a cap having a threaded engagement with the insulator and adapted to be placed in electrical communication with the central electrode.

19. In a spark plug, a bushing, an outer porcelain body permanently secured to said bushing, a porcelain core extending into said body and separated therefrom by a cushioning tube of mica, said body, core and bushing being cemented together to form a unit, and a shell for receiving said unit by means of threaded engagement with said bushing, said core being free of said shell when the bushing is screwed therein.

20. A spark plug consisting of a central core having a cylindrical portion and a conical portion, an insulator sleeve entirely surrounding the cylindrical portion of the core, a bushing secured to the sleeve, and an electrode thru the core, said electrode being free of the core where it passes thru said conical portion whereby contraction and expansion of the electrode puts stresses only on the cylindrical portion of said core.

21. The device of claim 20 having a shell in threaded engagement with said bushing, an internal shoulder on said shell, a gasket between said shoulder and the base of said bushing, said sleeve and said core being entirely separated from said shell and said gasket whereby compression of said gasket between the shell and bushing puts strain only on the sleeve and cylindrical portion.

22. In a spark plug, a main insulator body having a relatively large bore extending from the bottom to a point just above the center, a tube of mica fitted in the bore, a second insulator body fitting in said mica tube, an integral shoulder on the lower end of said second body, a washer between said shoulder and the lower end of said main body and extending beyond said body forming an annular ledge for engaging the shell of the plug, an electrode thru the center of said bodies and carried thereby.

LEWIS J. TETLOW.