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SHIELDED ELECTRICAL CONNECTION

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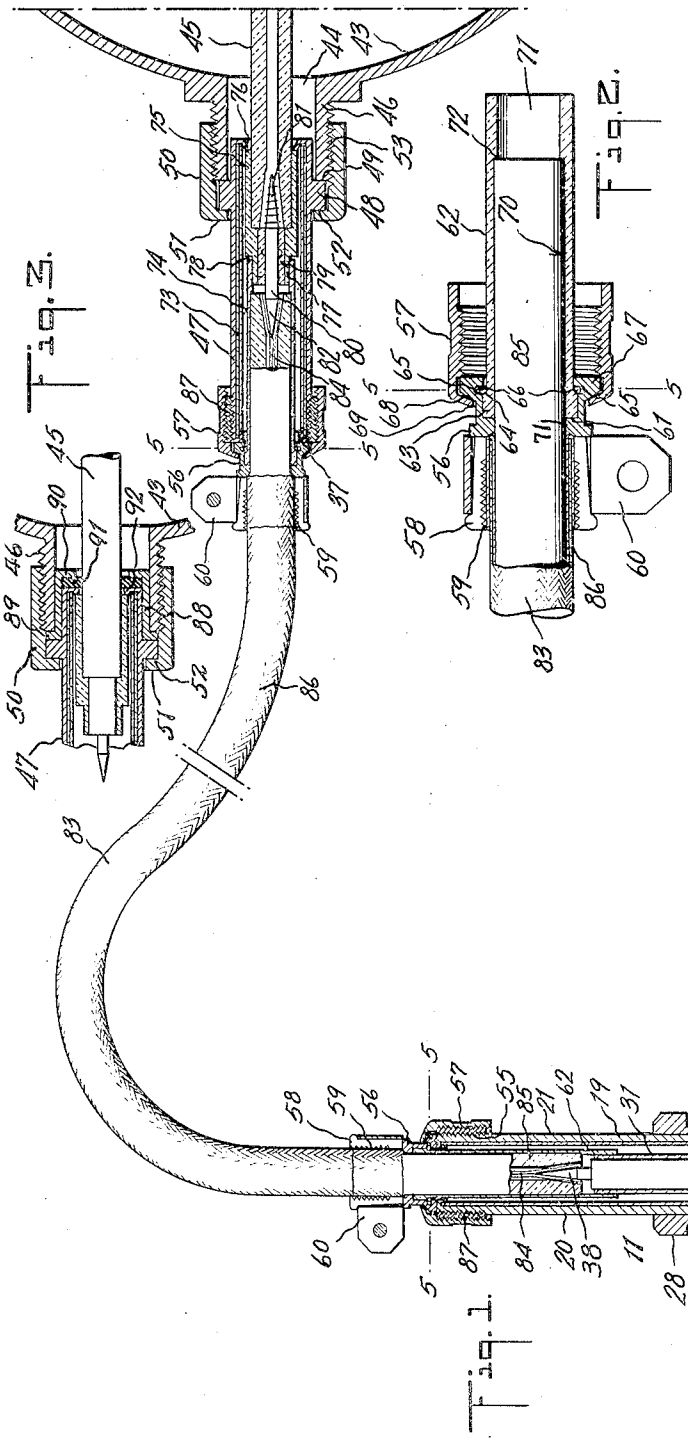


Fig. 1.

Fig. 2.

Fig. 3.

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SHIELDED ELECTRICAL CONNECTION

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The invention relates to a shielded ignition system of the type in which a spark plug of an engine cylinder and a harness connect the spark plug to the ignition manifold or other source of high tension electric current supply and in which a contained conductor of the high tension electric current is insulated from a grounded electric shield enclosing the system.

More specifically defined, the invention relates to the organization of a shielded spark plug to which one end of a shielded cable forming part of the harness is detachably connected and the other end of which cable is anchored to the ignition manifold.

The primary object of the invention considered generally is to provide an improved form of such system which will insure a more complete insulation of the high tension current conductor running through the system from its external sheathing than has been possible heretofore, to provide a structure which will avoid the deleterious effects of metal elbows at opposite ends of the cables in known structures and at the same time to provide a simple form of construction which will permit an easily attained connection and disconnection of the component parts of the system so as to permit inspection and substitution of damaged or worn parts.

The invention particularly features an organization of the component parts of the system which will permit a ready and easy replacement of the connecting flexible cable without necessity of removing either the spark plug from the engine or removing the associated manifold conductor from its position passing out through the opening in the manifold.

Various other objects and advantages of the invention will be in part obvious from an inspection of the accompanying drawing and in part will be more fully set forth in the following particular description of one form of system embodying the invention, and the invention also consists in certain new and novel features of construction and combination of parts as hereinafter set forth and claimed.

Referring to the accompanying drawing:

Fig. 1 is a view partly in axial section and partly in side elevation of a shielded ignition assembly constituting a preferred embodiment of the invention;

Fig. 2 is an enlarged sectional view of the union and associated insulating bushing shown at opposite ends of the shielded cable of Fig. 1;

Fig. 3 is a detailed sectional view of a modified form of coupling connecting with the manifold.

Referring first to the parts forming the spark plug and associated parts forming the left end of the showing in Fig. 1, there is disclosed an engine cylinder 10 threaded into which is a spark plug 11 constituting an improved form of the similar spark plug disclosed in the United States patent to Lewis Franklin Hahn, No. 2,055,408 granted September 22, 1936.

The spark plug includes a steel shell 12 provided with threads 13 entered into the engine cylinder and provided adjacent its lower end within the cylinder 11 with an annular shell electrode 14. The lower portion 15 of the bore of the shell is of small-diametered cylindrical form and the upper end 16 is enlarged thereover and is internally threaded as shown at 17. The portion of the bore between its upper threaded end 17 and the lower cylindrical portion 15 is of frustoconical form to provide an upwardly facing annular seat 18.

Demountably fitted in the shell is a readily replaceable unit 19 which includes a one-piece metal barrel 20, preferably made of brass. The upper portion of the barrel is a thin walled tube 21 and the lower portion of which is a rugged base 22 of a relatively large mass of metal.

Snugly but slidably mounted to encircle the tube 21 is a nut 28 in screw threaded engagement with the threads 16 and bearing on the base 22 to seat the same.

A long cylindrical form of spindle wrapped with mica cigarette insulation 31 is centered in the base 22, projects above the same into the bore of the tube 21 and projects below the same into the cylindrical portion 15 of the shell. The spindle is provided at its lower end with a head 33 the lower end of which forms a spindle electrode 34 located within the outlines of the shell electrode 14 as hereinafter described.

Referring to the parts at the ignition manifold or other source of electric energy shown to the right of Fig. 1 and at the other end of the assembly from the spark plug 11, there is disclosed the usual ignition manifold 43 provided with outlets, one for each spark plug and one of which outlets is shown at 44. Also following conventional practices, an unshielded ignition cable 45 extends out through each of the outlets but in this case distinguishes from the usual constructions in that it terminates just beyond its associated outlet. The outlet illustrated is defined by an externally threaded boss 46 which projects outwardly from the manifold. A long brass barrel 47 forms in effect a continuation of the boss 46 and has one end intruded into the outlet to receive the

end of the cable 45. The barrel is provided adjacent the intruded end with an outwardly projecting integral stop collar 48, one side of which forms a stop shoulder 49 engaging the outer end of the boss 46. The barrel is held in position by a manifold nut 50 provided at one end with an inturned flange 51 which overlaps a shoulder 52 formed at the outer side of the collar 48. The nut is provided internally with threads 53 which engage with the threads on the boss 46 to secure the barrel rigidly in place engaging the boss and thus engaging the manifold.

Except as hereinbefore noted, the manifold barrel 47 and the tube part 21 of the spark plug barrel 20 are of identical construction so that the detailed description of one will be sufficient for the other. The outer ends of the barrels both 20 and 47 are provided externally with threads 55, in each case designed to be engaged by the union and associated parts particularly shown in Fig. 2 for securing opposite ends of a cable to the spark plug and manifold. The connecting parts, sometimes hereinafter referred to as a union, are of identical construction so that they are replaceable one for the other. Each union as by reference to Fig. 2 comprises two metal parts, one a split sleeve 56 and the other a swivel nut 57. One end of the sleeve 56 is provided with parallel slits 58 and provided internally with threads 59 for biting into the braiding on the cable hereinafter described. A band clamp 60 encircles the slitted end of the sleeve to spring this end into engagement with the cable and thus securely hold the cable in place with its braided shielding secured mathematically and electrically to the sleeve.

The other end of the sleeve has its bore enlarged to form a stop shoulder 61 for limiting the movement therein of a tubular bushing 62 of insulating material. This bushing has a slightly enlarged head 63 forming a shoulder 64 between the same and the cylindrical remaining portion of the bushing. Just below the shoulder 64 the sleeve is provided with an annular groove 65 in which is fitted a U-shaped spring 66. The ends of the spring project into the bore of the sleeve and engage shoulder 64 to form a spring retaining clip which will act to permit the withdrawal of the bushing by forceful manual action but which will tend to resist accidental separation of the bushing from the sleeve. The lower end of the sleeve is provided with an outwardly extending integral flange 67 providing a downwardly and outwardly inclined beveled face 68 over which is peened the adjacent flange end of swivel nut 57 to provide a line contact 69 between the nut and the sleeve. The bore 70 of the bushing at its head end is equal in diameter to the diameter of the constricted portion 71 of the bore through the shell. At its free end, the bore 70 is slightly reduced to form a stop shoulder 72 for limiting the intruded movement of the cable into the insulating bushing.

In the showing in Fig. 1, and referring first to the connection at the spark plug, it is noted that the insulating bushing 62 is of sufficient length to telescope over the insulation 31 at the upper end of the spindle and in this way one insulation telescopes and thus overlaps the other and the bushing completely encircles the spindle terminal and adjacent end of the spindle.

Referring to the barrel 47, sometimes referred to as an adaptor, at the manifold end of the assembly there is disclosed a double layer of insulation coextensive with and constituting a permanent lining for the barrel. It is obviously within the scope of the disclosure to similarly double line the tube 21 of the spark plug barrel. The double layer constitutes two snugly fitting telescoping cylindrical parts, the outer tube being a thin wrapped layer of cigarette mica 73, and the inner tube 74 being preformed of insulating material such as a plastic resin, having sufficient rigidity to maintain its initial tubular form.

Referring to the connection at the ignition manifold, the end of the ignition cable is intruded into the double lined barrel or adaptor 47 and is provided with a barrel-like bushing 75 of insulating material, more or less snugly fitting within the inner tubular lining 74 of the barrel. The bushing 75 and with it the cable 45 is held in place by means of integral flange 76 which resembles flange 37 and which is peened inwardly not only to secure the two mica linings 73 and 74 but also to secure the bushing 75 from accidentally slipping out of place. At the opposite or inner end of the bushing 75 there is provided an integral projection 77 forming a sleeve of reduced diameter. The sleeve coacts with the enlarged portion of the bushing to form a shoulder 78 which limits the movement thereon of bushing 62. Fitted within the sleeve 77 is a tube 79 of insulating material in which is centered a double pointed end connector 80, one end of which is provided with threads 81 for threading into the end of the ignition cable 45 to make electric contact with its associated conductor. The other end of the connector is formed into a point 82 forming a terminal corresponding to the pointed terminal 38 of the spark plug.

Extending between these two barrels is a shielded cable 83 of conventional form including a centrally disposed conductor 84 surrounded by insulation 85 and which in turn is encased within a metal braid or shield 86. It frequently happens that the threads at the outer ends of the barrel become damaged when the unions or terminals are carelessly screwed on and off and this ruins the barrel. It is suggested that a readily replaceable adaptor ring, or bushing, 87 preferably formed of a material harder than the brass barrel and threaded both internally and externally be screwed on to the barrel threads. In such case the swivel union nut 57 engages the external threads of this ring 87 rather than engaging directly with the threads 55 on the barrel. This arrangement may also be of advantage in those cases where some form of harness, other than the harness herein disclosed, is employed with a coupling nut having a different diameter or threading.

It is a feature of this disclosure that the cable 83 does not extend into the ignition manifold and simply has its ends, each equipped with one of the unions, intruded into the outer exposed ends of the spark plug barrel and the manifold barrel in such way that the conductor 84 can be pushed over the pointed terminals 38 and 82 and thus effect a quick electrical connection between the conductor of the ignition cable and the conductor of the spark plug formed by the spindle.

In preparing the cable for use, the requisite length, which should be no more than is necessary to reach between the located spark plug and its associated manifold outlet, is cut off. The metal braid 86 on the outside of the cable is stripped back from opposite ends for a short distance depending upon the distance which the ends are to be intruded into their respective barrels and preferably the ends of the braid are doubled back

upon themselves to form a double layer of braid at the place where it is to be grasped by the split ends of the union sleeves.

Two of the unions are prepared to receive each of the cables. This is done in each case for forcing a bushing 62 into place against the resistance of its associated spring 66 until the ring snaps into its bushing locking position. One of the stripped back ends of the cable is then passed through the union sleeve and into the bushing until it engages the stop 72. The clamp 60 is then tightened which effectively secures the cable to the union and the braid in firm electric contact with the sleeve. In practice it will be usual to prepare and hold in stock a number of these cable lengths with their unions in place so that a new cable can be quickly installed to replace a worn or damaged cable.

Should this cable become damaged in any way, it is simply necessary to unscrew the union nuts 57 from their associated barrels, and fit a new cable into position as above outlined, after which the unions at opposite ends of the new cable are screwed in position which automatically reestablishes the electric connection at the terminal of the spark plug and ignition manifold.

In order to prevent leakage of moisture into the manifold it is suggested that the cylindrical portion of a thin brass metal cup 88, be fitted into the bore of the boss 46. This cup includes an external flange 89 at one end overlapping the outer end of the boss and an inturned flange 90 at the other end forming a gasket seat. A gasket 91 of rubber or equivalent distortable material is snugly fitted about the cable 45 and is located between the seat 90 and the inturned flange 92 corresponding to flange 76 forming the adjacent end of the barrel 47. Tightening nut 50 acts to squeeze the gasket into position to insulate the interior of the manifold from the external atmosphere. The brass barrel 47 with the brass cup 88 coacts to form a two piece brass adaptor, forming a continuation of the barrel 47.

If in the Fig. 3 disclosure, the threaded boss 46 be considered as the upper threaded end of the tube 21 in Fig. 1 and cable 45 be considered as if it was the spark plug spindle 30, then the showing in Fig. 3 can be regarded as a modification of the connection between the cable and the spark plug shown at the top of the spark plug in Fig. 1.

I claim:

1. In a device of the class described, the combination of a metal barrel externally threaded at one end, a cigarette insulating lining snugly engaging the inner surface of the barrel, one end of the barrel being peened over the adjacent end of the insulating lining to hold the same from shifting out of said end of the barrel, a bushing of insulated material in the opposite end of the barrel and said opposite end of the barrel peened over to secure both the lining and bushing in place, a wall closing the bushing at one end, a metal connector carried by said wall and having its opposite ends projecting axially therefrom with one end intruding into the bushing and the other end intruding into the lined barrel, said connector adapted to connect a cable in the lined barrel with a cable in the bushing.

2. In a device of the class described, the combination of an ignition manifold provided with a threaded outlet, a one-piece long metal barrel having its upper portion exposed for air cooling and having one end intruded into the outlet, insulating means lining the barrel, a coupling nut connecting the intruded end of the barrel with the manifold, a cable from the manifold passing out therefrom through the outlet and into the lined bore of the barrel, a terminal within the barrel, demountably secured to the manifold cable, another cable having an end intruded into the barrel and having a telescopic engagement with the terminal, and a union including a sleeve clamped to the other cable and a nut swivelled to the collar and in threaded engagement with the threads on the barrel.

3. In a device of the class described, the combination of an ignition manifold provided with a threaded outlet, a one-piece long metal barrel having its upper portion exposed for air cooling and having one end intruded into the outlet, insulating means lining the barrel, a coupling nut connecting the intruded end of the barrel with the manifold, a cable from the manifold passing out therefrom through the outlet and into the lined bore of the barrel, a terminal within the barrel, demountably secured to the manifold cable, another cable having an end intruded into the barrel and having a telescopic engagement with the terminal, a union including a sleeve clamped to the other cable and a nut swivelled to the collar and in threaded engagement with the threads on the barrel, and an insulating bushing on the intruded end of the other cable carried by the sleeve and encircling the terminal.

4. In a device of the class described, the combination of a metal barrel forming an adapter, means at one end for mounting it in position, a cable intruded into said end, a bushing of insulating material fitted to the intruded end of the cable, a metal connector carried by the bushing and provided at one end with a screw threaded into the cable and provided at its opposite end with a smooth pin-like point forming a terminal for the cable and adapted to be intruded into an end of a cable inserted into the other end of the adapter when forced telescopically and axially of the adapter on to the smooth pin-like point.

5. In a device of the class described, the combination of a metal barrel, a double lining for the barrel comprising an outer layer of cigarette mica and an inner rigid tube of insulating material, a cable provided at one end with a bushing of insulated material intruded into one end of the barrel, said end of the barrel provided with an integral flange bent into position overlapping the adjacent ends of the double lining and also overlapping the adjacent end of the bushing to secure the same in place.

6. In a device of the class described, the combination of a boss provided with an opening, a lead extending through the opening, a coupling including a barrel having an end intruded into the opening and having a stop collar, a cup having an external flange fitted between the stop collar and boss and having an internal flange forming a gasket seat and through which extends the lead, a gasket encircling the lead and located between the seat and the adjacent end of the barrel and threaded means having a swivel connection with the collar and engaging the boss to clamp the gasket about the lead and seal the joint between the barrel and cup.

7. In a shielded ignition device, the combination of a tubular member provided with threads, a cup including a barrel portion fitted in the bore of said tubular member and provided at its inner end with an internally projecting flange forming a gasket seat and provided at its outer end with an external flange engaging the adjacent outer end of the tubular member, a barrel having one

end intruded into the cup, an electric cable extending through the cup, an annular gasket snugly encircling the cable and contained between the seat and adjacent end of the barrel and a nut engaging the threads on the tubular member bearing on the barrel for squeezing the gasket in place about the cable and thus providing a hermetically sealed joint at the gasket.

8. An adaptor forming a rigid part of a shielded ignition system leading to a spark plug, comprising a metallic tube threaded at one end and provided adjacent the other end with an outwardly extending flange, a second tube forming a continuation of the first named tube in co-axial alignment therewith and having an outturned flange abutting the first named flange, a gasket between the tubes, a spark plug supplying cable having an end intruded into the threaded end of the first named tube, a current supplying conductor extending into and through the second tube and having an end intruded into the first named tube and in electric engagement with the cable, a union clamped to the cable and in threaded engagement with the threads on the first tube and clamping means engaging the flanges for securing the two tubes in place.

9. An article of manufacture constituting a readily replaceable electric connector between a manifold and a spark plug, including a shielded cable provided with a covering of metal braid, having coupling means at one end for connecting the cable and its braid to a spark plug, a metal tube having a lining of insulation forming an adapter into one end of which the other end of the cable is intruded, a swivel coupling securing the cable and its braid to the intruded end of the adapter with the cable end adjacent the mid-length of the tube, and means for securing the adapter to a manifold including a nut swivelled to the other end of the adapter.

10. In a device of the class described, the combination of a manifold provided with a cable outlet and having a tubular extension projecting beyond the outlet and having its outer end externally threaded, a lining of insulating material for the extension, a manifold cable terminating adjacent the outlet, an insulated cable having an end intruded into the extension and having a terminal in electric engagement with the manifold cable, said last named cable provided at said terminal end with a long tubular bushing of insulating material telescoping within said lining and means remote from said terminal and including a nut engaging the threads on the extension for securing the last named cable to the manifold.

11. An article of manufacture constituting a readily replaceable electric connection between a manifold and a spark plug, including an insulated cable provided with a metallic shield and having a coupling at one end for connecting the cable and its shield to a spark plug, another coupling at the other end for detachably connecting the cable and its shield to the manifold, said connection at the end intended to engage the manifold including a tubular barrel constituting a terminal housing and adapted to extend rigidly from the manifold, a lining for the barrel and into which the manifold end of the cable is intruded with the cable end located in spaced relation to both ends of the tubular barrel, said cable at its manifold end provided with a terminal, a coupling for securing the cable and its shield to said tubular barrel, a tubular insulation member surrounding the manifold end of the cable, extending beyond its terminal and spaced inside the coupling end of said barrel a distance at least as great as the diameter of said barrel whereby the tendency to flash over between the cable terminal and the coupling is eliminated.

12. A shielded ignition system for an internal combustion engine including a manifold provided with an outlet in the form of a tubular projection, a tubular extension from the outlet having an insulating lining, a manifold cable having a terminal adjacent said outlet, a separate shielded lead provided with a terminal in electric engagement with the terminal of the manifold cable, a threaded coupling for connecting the shielded lead to the tubular extension and for grounding its shielding onto said manifold through said projection, insulating means carried by said shielded lead and adapted to be inserted therewith into the tubular extension, said insulating means and said insulating lining being proportioned to provide telescopic relation therebetween a distance at least as great as the diameter of said tubular extension and said insulating means enclosing and projecting axially in both directions beyond the interengaged terminals of the manifold cable and the shielded lead.

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