

Sept. 14, 1948.

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2,449,356

METHOD OF MAKING SHIELDED IGNITION LEADS

Original Filed Dec. 16, 1942

2 Sheets-Sheet 1

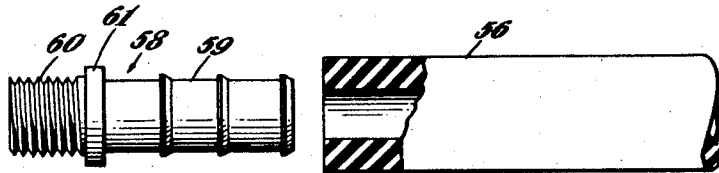


Fig. 1

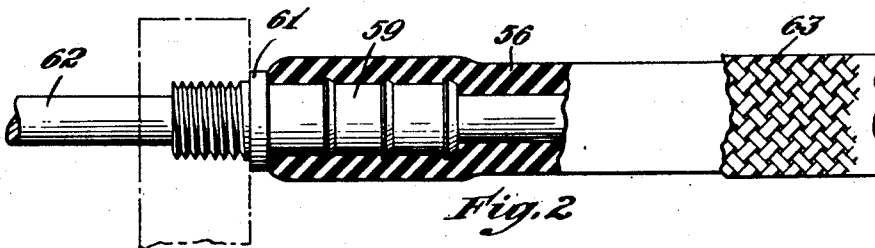


Fig. 2

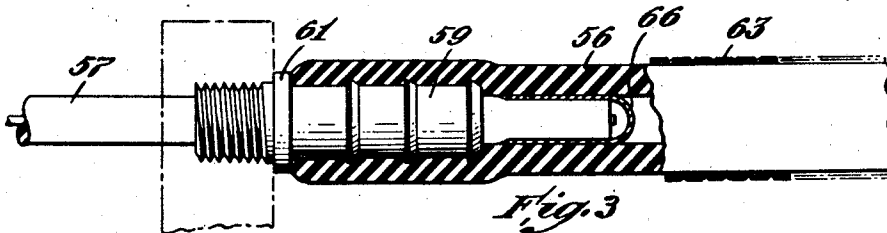


Fig. 3

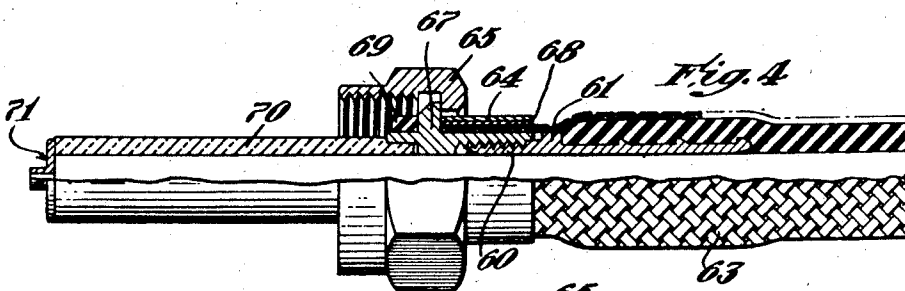


Fig. 4

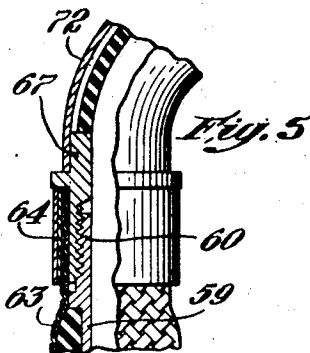


Fig. 5

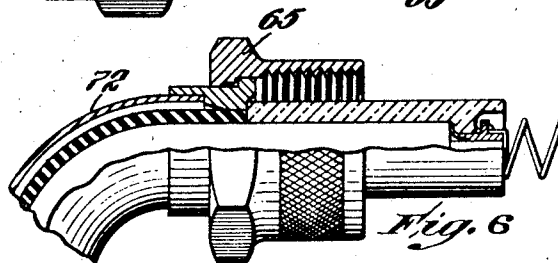


Fig. 6

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2 Sheets-Sheet 2

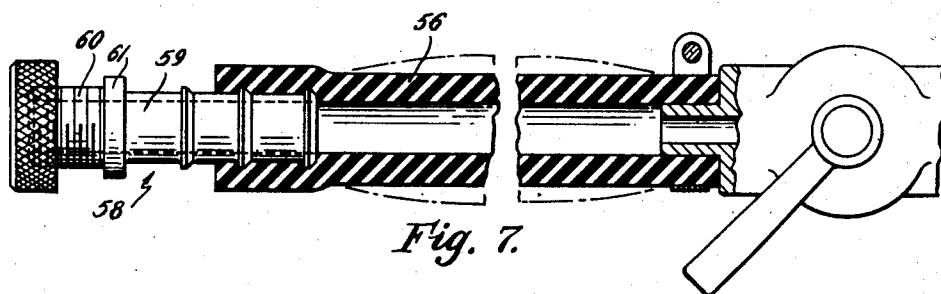


Fig. 7.

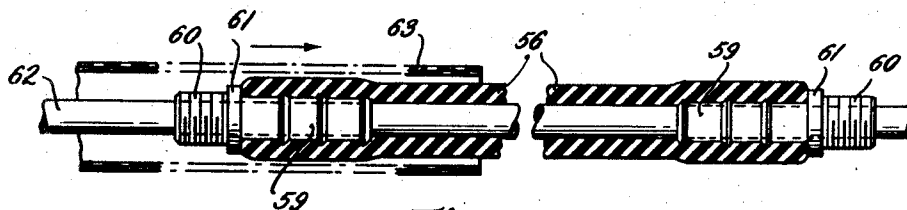


Fig. 8.

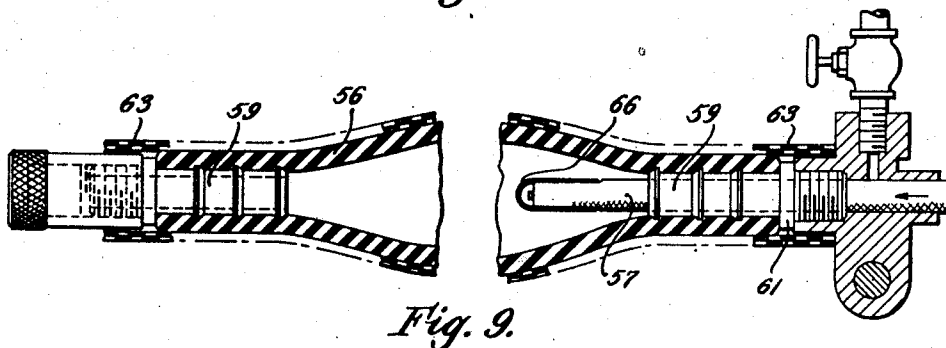


Fig. 9.

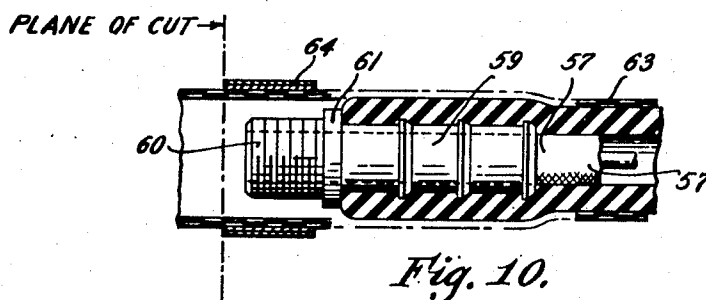


Fig. 10.

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UNITED STATES PATENT OFFICE

2,449,356

METHOD OF MAKING SHIELDED IGNITION
LEADS

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Original application December 16, 1942, Serial
No. 469,185. Divided and this application Sep-
tember 26, 1944, Serial No. 555,810

7 Claims. (Cl. 29-155.5)

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This invention pertains to ignition harness for internal combustion engines and relates more particularly to an improved method of making spark plug leads for such harness, the present application being a division of my copending application Serial No. 469,185, filed December 16, 1942, which has become Patent Number 2,433,081, dated December 23, 1947.

An ignition harness comprises an assemblage of the various conductors leading from the distributor of the internal combustion engine to the spark plugs.

In order to protect the conductors from mechanical injury and to avoid radio interference, it is necessary that each individual conductor be enclosed within metal from the time it leaves the generator until it connects with the spark plug terminal. Thus the ignition manifold is made of metal or is encased with metal and where each conductor leaves the manifold, an outlet fitting is secured to the manifold to which is connected a metal covered conduit, usually flexible, which encloses the conductor and which extends to the spark plug to which it is secured by a special connection.

The present invention has for its principal object the provision of a novel method of preparing spark plug leads, particularly leads for ignition harness.

Other and further objects and advantages of the invention will be pointed out in the following more detailed description and by reference to the accompanying drawings, wherein:

Fig. 1 is a fragmentary longitudinal section of an insulating tube used in forming one of the ignition leads, and also showing, in elevation, a connector which is employed at each end of the tubing;

Fig. 2 is a fragmentary side elevation, with parts broken away and parts in vertical section, illustrating the step of securing the connector of Fig. 1 to one end of the tubing;

Fig. 3 is a fragmentary vertical section illustrating the step of introducing the conductor into the tubing;

Fig. 4 is a fragmentary elevation, partly in vertical section, illustrating a further step in the operation of preparing the ignition lead;

Figs. 5 and 6 are fragmentary elevations partly in vertical section, showing the completed opposite end portions, respectively, of the spark plug elbow;

Fig. 7 is a fragmentary more or less diagrammatic elevation partly in longitudinal section illustrating the step of introducing one of the terminal connectors into the tubing;

Fig. 8 is a view generally similar to Fig. 7 illustrating the step of drawing the metallic armor over the tubing;

Fig. 9 is a generally similar view illustrating the step of dilating the tubing preparatory to the introduction of the insulated conductor; and

Fig. 10 is a fragmentary diagrammatic longitudinal section showing one end portion of the tubing and illustrating the step of cutting off the metallic armor.

In accordance with the present invention the individual spark plug leads, designed to be detachably secured to the harness manifold, are made substantially as follows:

There is first provided a length 56 (Fig. 1) of Vinylite or Neoprene tubing of an internal diameter slightly less than that of the conductor 57 which is to be placed within it. There are then provided terminal connections 58, all of identical construction and each being a metallic tube having one end portion 59 (Fig. 1) externally knurled, ribbed or roughened, and having an external screw-thread at its other end 60, there being an external shoulder 61 between the inner end of the screw thread and the ribbed or roughened portion. The end portion 59 of this connection is of somewhat larger external diameter than the bore of the tube 56. The end of the tube 56 is inflated by air pressure and the knurled end portion of one of the connections 58 is inserted in this inflated end and the end is then allowed to contract over, it thus permanently securing the connection to the tube. This mode of introducing a part into the end of an expansible tube is well known in the arts, for example as clearly disclosed in the patent to Wiltse, 2,090,014, August 17, 1937. A similar connection 58 is then applied to the opposite end of the tube.

A supporting wire or arbor 62 (Fig. 2) is now passed lengthwise through the tube and a length of braided metallic armor 63 is drawn over the length of tubing. Two swedging rings 64 and a hexagonal nut 65 are then slipped on over the armor.

The supporting wire or arbor 62 is now withdrawn and the tube with its armor covering is placed in a blowing jig of the general type illustrated by way of example in the patents to Loughhead, 1,461,130, July 10, 1923, and 1,599,905 September 14, 1926, in which the terminal connections 58 are screwed into suitable spaced fittings, one of which is indicated in broken lines at F in Fig. 3, both of which are hollow. One end of the conductor 57, which is to be placed within the tube 56 (Fig. 3), is introduced through one of the hollow tubular fittings 58, said conductor hav-

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ing first previously been provided with a thimble 66 at its advancing end. Air pressure is now admitted in such a way as simultaneously to expand the tube 56 and to project the conductor wire longitudinally through the expanded tube. When the wire has thus been projected through the tube, the air pressure is released, thus allowing the tube to shrink tightly about the wire.

While the parts are still in the glowing jig, but after the air pressure has been released as just above noted, the armor material 63 is stretched out tightly lengthwise and its end portions are preferably wrapped with electrical tape. Cutters then sever the armor at its taped portions to the exact desired length of the completed lead, the tape preventing the armor from fraying during the cutting operation. The device is then removed from the jig and a fitting 67 comprising an internally screw-threaded sleeve portion screwed onto the end of each of the terminal connections 58. A split lead gasket 68 is placed over the end portion of the armor and then one of the swedging rings 64 is slipped along over this lead gasket and the swedging ring is subjected to pressure, thus contracting it tightly about the lead gasket and compressing the armor tightly against the outer surface of the sleeve portion of the fitting 67. A soft packing gasket 69 is then slipped into the fitting at one end of the tube. The conductor wire is of such length as to project out through the fitting 67 and is passed through a sleeve 70 of ceramic material (Fig. 4), one end of which is seated in a recess in the fitting 67. A terminal contact 71, having a central bore for the reception of the conducting wire, is now slipped over the conducting wire and into the bore of the ceramic sleeve, and the projecting end of the contact 71 is swedged about the conducting wire so as to hold the parts in assembled relation.

At the opposite end of the ignition lead the wire is pushed through the usual spark plug elbow and the lead gasket and swedging ring are applied in the same way as was done at the opposite end. At this end the terminal connections for the conductor wire may be of any conventional type.

While certain desirable method steps useful in the production of the structures described have been disclosed, it is to be understood that the invention is not to be limited to these precise procedures but is to be regarded as broadly inclusive of any and all equivalents.

I claim:

1. Method of making ignition leads, said method comprising as steps providing a length of flexible, synthetic resin tubing of an internal diameter slightly less than the diameter of the ignition lead conductor which it is intended to house, inserting one end of a rigid connector into each end of the tube, drawing a length of flexible tubular armor over the tube, introducing a flexible conductor into the tube, wrapping each end of the armor tube with tape, cutting off the armor tube to final length by incisions passing through the taped portions of the armor tube, arranging a swedging ring over each end portion of the armor tube, and subjecting the swedging rings to pressure thereby to compress the armor tube and the resin tubing firmly about the end portion of the rigid connector.

2. Method of making ignition leads, said method comprising as steps providing a length of flexible insulating tubing, expanding the tubing, introducing into it a conductor and permitting the tube to shrink about the conductor, the conduc-

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tor being of such length as to project beyond the ends of the tubing, removing the insulation from one projecting end of the conductor, passing the conductor wire through a sleeve of ceramic material, inserting a contact terminal into the outer end of said ceramic sleeve, and swedging the projecting end of the wire against the contact terminal thereby to hold the parts in assembled relation.

3. Method of making ignition leads, said method comprising as steps providing a length of flexible insulating tubing, dilating each end of the tubing, introducing a rigid tubular terminal connector into each end of the tubing and allowing the ends of the tubing to contract about the respective terminal connectors, expanding the tubing intermediate said connectors and introducing into it an insulated conductor of such length that its opposite ends project from the respective terminal connectors, attaching a rigid tubular fitting to each terminal connector, stretching a tubular metallic armor lengthwise over the tubing, compressing the ends of the armor tightly about the respective fittings and permanently securing the ends of the armor to the respective fittings.

4. Method of making ignition leads, said method comprising as steps providing a length of flexible insulating tubing, dilating each end of the tubing, introducing a rigid tubular terminal connector into each end of the tubing and allowing the ends of the tubing to contract about the respective terminal connectors, drawing a flexible tubular metallic armor over the tubing, dilating the tubing intermediate said connectors and introducing into it a length of insulated conductor, allowing the tube to contract about the conductor, stretching the flexible armor longitudinally, cutting it accurately to the desired length, securing a tubular rigid fitting to each tubular connector and permanently fixing the ends of the armor to the respective fittings.

5. Method of making ignition leads, said method comprising as steps providing a length of flexible synthetic tubing of an internal diameter slightly less than that of the ignition lead conductor which it is intended to house, dilating each end of the tube, inserting into each such end while dilated one end of a rigid tubular connector, allowing the ends of the tube to contract about the inserted connectors, drawing a length of flexible metallic armor over the tube, dilating the tube intermediate said connectors, introducing a flexible insulated lead conductor into the dilated tube, stretching the armor longitudinally and permanently fixing the opposite ends of the armor relatively to the connectors.

6. Method of making ignition leads, said method comprising as steps providing a length of flexible synthetic resin tubing of an internal diameter slightly less than that of the insulated lead conductor which it is intended to house, providing a pair of terminal connectors each having an externally rough tubular end portion, dilating each end of the tubing and introducing into each such end, while dilated, one of the rough ends of one of the respective connectors, permitting the ends of the tubing to contract about the respective connector ends, introducing a rigid support into the bore of the tube, drawing a flexible tubular metallic armor over the tube, removing the support from the bore of the tube, dilating the tube intermediate said connectors, introducing an insulated ignition lead conductor into the dilated tubing, allowing the tubing to contract about the conductor, cutting the armor

to the desired final length, attaching a rigid tubular fitting to each end connector and permanently securing the opposite ends of the armor to the respective fittings.

7. Method of making ignition leads which comprises as steps providing a length of flexible synthetic resin tubing of an internal diameter slightly less than that of the insulated lead conductor which it is intended to house, providing a pair of terminal connectors each having a tubular end portion, dilating each end of the tube and introducing into each such end the tubular end of one of the respective connectors, permitting the tubing ends to contract about the respective connector ends, introducing a rigid support into the bore of the tubing, drawing a flexible tubular metallic armor over the tubing, removing the support from the bore of the tubing, dilating the tubing intermediate the connectors by air pressure, introducing an insulated conductor into the dilated tubing, allowing the tubing to contract about the conductor, attaching a tubular fitting to each respective connector,

positively anchoring the opposite ends of the armor to the respective fittings and securing a terminal to each end of the conductor.

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