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2,390,821

METHOD OF MAKING SPARK PLUG UNIT BUSHINGS

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Fig. 1.

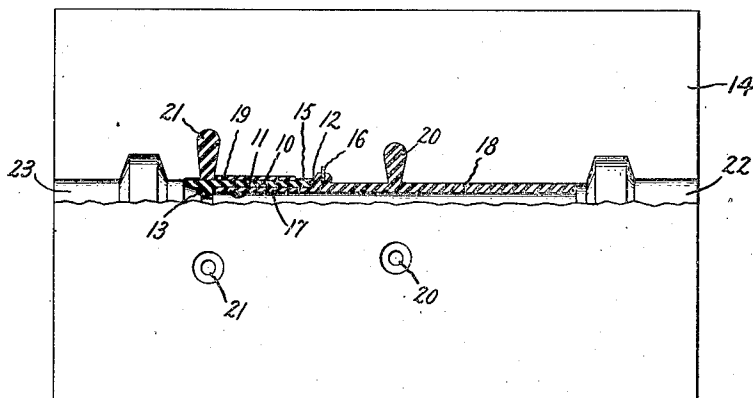


Fig. 2.

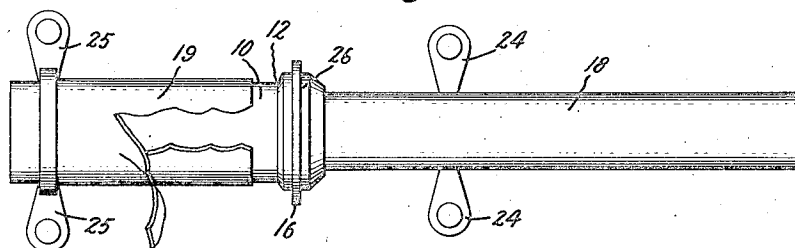
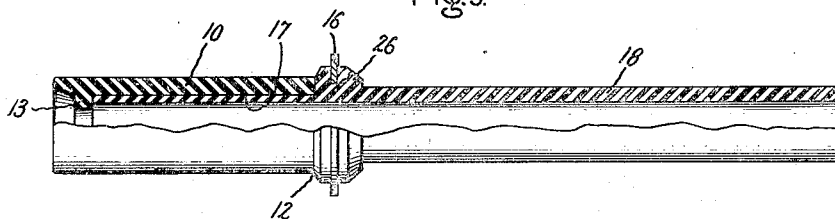


Fig. 3.



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METHOD OF MAKING SPARK PLUG
UNIT BUSHINGSThomas N. Willcox, Pittsfield, Mass., assignor to
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Application October 11, 1943, Serial No. 505,731

10 Claims. (Cl. 18—59)

My invention relates to an improved method of making a bushing for a spark plug unit.

In molding bushings of resilient insulating material to provide a resilient lining within a relatively rigid insulating boot of a frangible material such as a ceramic or a boro-silicate-mica composition, considerable difficulty has been experienced due to the cracking of the boot during the molding operation. I have found that this cracking can be prevented by molding the resilient insulating material under pressure about substantially all surfaces of the boot, such that all parts of the boot are subjected to substantially the same temperature and pressure.

An object of my invention is to provide an improved method of making a bushing for a spark plug unit in which a resilient sleeve is intimately bonded to the inner surface of a relatively rigid insulating boot.

Another object of my invention is to provide an improved method of molding resilient insulating material under pressure about a relatively rigid insulating boot.

Further objects and advantages of my invention will become apparent and my invention will be better understood from the following description referring to the accompanying drawing and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In the drawing, Fig. 1 is a plan view, partly broken away, showing a mold used in my improved process and a bushing made by this process; Fig. 2 is an enlarged view of the bushing made in the mold shown in Fig. 1 illustrating this bushing after it has been removed from the mold and before finishing; and Fig. 3 is a partial sectional view of the bushing shown in Figs. 1 and 2 in its finished condition.

Referring to the drawing, I have shown a method of carrying out my invention which includes making a bushing for a spark plug unit by forming a relatively rigid tubular insulating material boot 10 with an adhesively roughened or otherwise treated inner surface 11 which extends from one end 12 to an inwardly extending flange 13 near the opposite end of the boot. This surface may be treated in any suitable manner, as by etching it with dilute 4% hydrochloric acid at room temperature, abrading this surface with a file, said blasting this surface, carefully washing this surface with wetting agents, such as a 1½% solution of Aerosol or a 5% solution of Naconol, or by coating this surface with a suit-

able cement, such as a synthetic rubber cement and using it either baked or unbaked to provide a surface to which a resilient insulating material, such as a synthetic rubber, will become intimately bonded when molded under heat and pressure.

The boot 10 is then arranged in a mold 14 which is formed to provide a molding space about substantially all surfaces of the boot except for a relatively small supporting portion 15 which is adapted to hold the boot in position during the molding operation. The mold also is formed with a supporting groove into which a ring 16 of electrically conductive material is placed and about which a collar can be molded of the resilient insulating material which will extend about the end 12 of the boot 10 and be integrally connected with a sleeve portion 17 of the resilient material which may be molded in a tubular molding space extending through substantially the full length of the boot. The mold also is formed with a tubular section extending from the collar space away from the boot into which an axially extending sleeve portion 18 may be formed. As shown in Fig. 1, a tubular molding space also is formed about the outside of the boot 10 into which a sleeve of insulating material 19 is adapted to be molded.

In carrying out the molding operation, a fluid resilient and yieldable insulating material is molded under heat and pressure into the above-described molding spaces through two pairs of gates 20 and 21 in the mold which feed the resilient insulating material under pressure into the molding spaces and about substantially all sides of the boot 10, and the air within the mold is allowed to escape through slight clearances around the molding pins 22 and 23 in the ends of the mold 14. After this molding operation, the bushing is removed from the mold and is in the form shown in Fig. 2 with a pair of ears 24 extending from the sleeve portion 18 and with a pair of ears 25 extending from the sleeve 19 which extends over the outside of the boot 10. The ears 24 are then removed from the sleeve portion 18 and the molded insulating material forming the outside sleeve 19 is removed from the outside of the boot in any suitable manner, as by peeling it off as shown in Fig. 2, and from about the end of the boot away from a collar 26 formed over the end 12 of the boot 10. This forms a unitary bushing including the boot 10 of relatively rigid material such as a ceramic or boro-silicate-mica, provided with a lining 17 of resilient material which is intimately bonded to substantially the

entire inner surface of the boot 10, as shown in Fig. 3. This bushing construction is the joint invention of Hubert H. Race and the applicant and forms the subject matter of patent application, Serial No. 505,730, filed October 11, 1943, and is assigned to the same assignee as this application.

While I have illustrated and described a particular embodiment of my invention, modification thereof will occur to those skilled in the art. I desire it to be understood, therefore, that my invention is not to be limited to the particular method disclosed, and I intend in the appended claims to cover all modifications which do not depart from the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The method of making a bushing which includes forming a relatively rigid tubular insulating boot of frangible material, molding a resilient insulating material sleeve under pressure about substantially all surfaces of the boot for preventing cracking of the boot during said molding and to provide a sleeve extending through substantially the full length of the boot, and removing the molded resilient material from the outside of the boot.

2. The method of making a bushing which includes forming a relatively rigid tubular boot of frangible material with a roughened inner surface, molding a resilient material sleeve about substantially all surfaces of the boot for preventing cracking of the boot during said molding and to provide a sleeve extending through substantially the full length of the boot having an intimately bonded connection with the inner boot surface, and removing the molded resilient material from the outside of the boot.

3. The method of making a spark plug unit bushing which includes forming a relatively rigid tubular insulating boot of frangible material with an adhesively treated inner surface, molding a resilient insulating material sleeve under pressure about substantially all surfaces of the boot for preventing cracking of the boot during said molding and to provide an intimately bonded connection between the inner boot surface and the engaging surface of the resilient material sleeve, and removing the molded resilient material from the outside of the boot.

4. The method of making a bushing which includes forming a relatively rigid tubular boot of frangible material with a roughened inner surface, molding a resilient material sleeve under pressure about substantially all surfaces of the boot for preventing cracking of the boot during said molding and to provide a sleeve extending through substantially the full length of the boot with a molded collar extending over one end of the boot and having an intimately bonded connection between the inner boot surface and the engaging surface of the resilient material sleeve, and removing the molded resilient material from the outside of the boot and from the end of the boot away from the molded collar.

5. The method of making a bushing which includes forming a relatively rigid tubular insulating boot of frangible material with an adhesively treated inner surface, molding a resilient insulating material sleeve under pressure about substantially all surfaces of the boot for preventing cracking of the boot during said molding and to provide a sleeve with a molded collar extending over one end of the boot and a tubular sec-

tion extending from the collar away from the boot and to provide an intimately bonded connection between the inner boot surface and the engaging surface of the resilient material sleeve, and removing the molded resilient material from the outside of the boot and from the end of the boot away from the molded collar.

6. The method of making a spark plug unit bushing which includes forming a relatively rigid tubular insulating boot of frangible material with a treated inner surface, molding a resilient and yieldable insulating material sleeve under pressure around substantially all surfaces of the boot except a small supporting portion for preventing cracking of the boot during said molding and to provide a sleeve extending through substantially the full length of the boot with a molded collar extending over one end of the boot and a tubular section extending from the collar away from the boot to provide an intimately bonded connection between the inner boot surface and the engaging surface of the resilient material sleeve, and removing the molded resilient material from the outside of the boot and from the end of the boot away from the molded collar.

7. The method of making a spark plug unit bushing which includes forming a relatively rigid tubular insulating boot of frangible material with an adhesively treated inner surface, arranging this boot in a mold formed to provide a molding space about substantially all surfaces of the boot except a small supporting portion, molding a resilient and yieldable insulating material sleeve under pressure into the molding space to provide an intimately bonded connection between the inner boot surface and the engaging surface of the resilient material sleeve, removing the bushing from the mold, and removing the molded resilient material from the outside of the boot.

8. The method of making a spark plug unit bushing which includes forming a relatively rigid tubular insulating boot of frangible material with a treated inner surface, arranging this boot in a mold formed to provide a molding space about substantially all surfaces of the boot to provide a tubular molding space extending through substantially the full length of the boot with a space for molding a collar extending over one end of the boot and outwardly therefrom, molding a resilient insulating material sleeve into the molding spaces to provide an intimately bonded connection between the threaded inner boot surface and the engaging surface of the resilient material sleeve, removing the bushing from the mold, and removing the molded resilient material from the outside of the boot and from the end of the boot away from the molded collar.

9. The method of making a spark plug unit bushing which includes forming a relatively rigid tubular insulating boot of frangible material with a roughened inner surface, arranging this boot in a mold formed to provide a molding space about substantially all surfaces of the boot except a small supporting portion to provide a tubular molding space extending through substantially the full length of the boot with a space for molding a collar extending over one end of the boot, molding a resilient insulating material sleeve under pressure into the molding spaces to provide an intimately bonded connection between the roughened inner boot surface and the engaging surface of the resilient material sleeve, removing the bushing from the mold, and removing the molded resilient material from the out-

side of the boot and from the end of the boot away from the molded collar.

10. The method of making a spark plug unit bushing which includes forming a relatively rigid tubular insulating boot of frangible material with an adhesively roughened inner surface, arranging this boot in a mold formed to provide a molding space about substantially all surfaces of the boot except a small supporting portion to provide a tubular molding space extending through substantially the full length of the boot with a space for molding a collar extending over one end of

the boot and a tubular section extending from the collar space away from the boot, molding a resilient and yieldable insulating material sleeve under pressure into the molding spaces to provide an intimately bonded connection between the roughened inner boot surface and the engaging surface of the resilient material sleeve, removing the bushing from the mold; and removing the molded resilient material from the outside of the boot and from the end of the boot away from the molded collar section.

THOMAS N. WILLCOX.