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J. N. HIENSCH ET AL

2,270,166

METHOD OF MAKING ELECTRICAL CONNECTIONS

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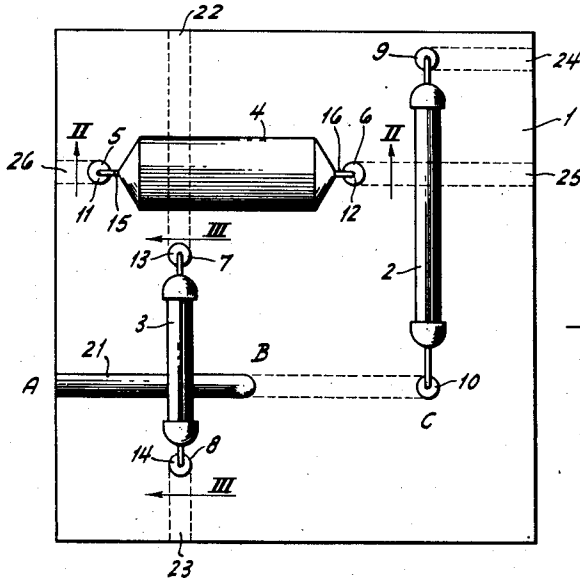


Fig. 1

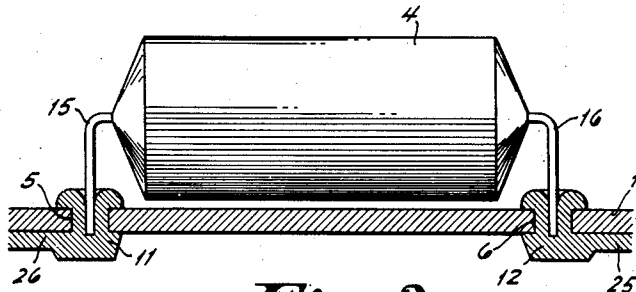


Fig. 2

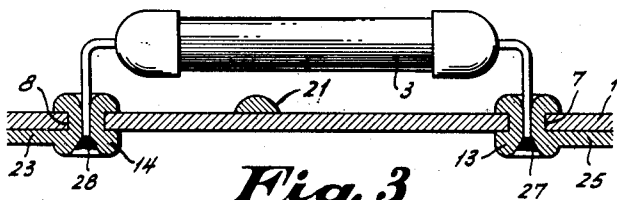


Fig. 3

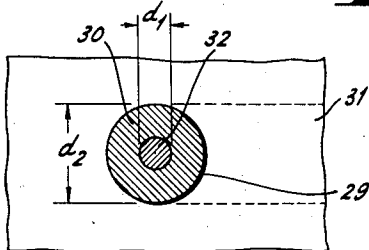


Fig. 4

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METHOD OF MAKING ELECTRICAL CONNECTIONS

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Application July 26, 1939, Serial No. 286,602
In Germany September 2, 1938

1 Claim. (Cl. 29—155.55)

The U. S. A. patent application Ser. No. 210,803, filed May 28, 1938, by Johannes Nathanael Hiensch relates to an electrical apparatus, for example, a radio-receiving apparatus, in which the system of conductors is manufactured by means of the die-cast method.

The present invention has for its purpose an improved method of manufacturing such an apparatus. The method according to the invention is characterised by the fact that the carrier plate is furnished with openings, whose inner walls upon the subsequent die-casting of the conductor system are covered with a metal coating, after which the connecting wires of the parts to be fastened to the conductor system are passed through the said openings and fixed accordingly. Thus upon manufacturing the conductor system the sleeves for the connection of the parts with the conductor system are formed at the same time in openings of the carrier plate. In order to be sure that the sleeves stick well to the openings and the connecting wires may be properly secured to the sleeves, the dimensions of the openings in the plate are so chosen as to be in average at least 0.2 mm. larger than the corresponding cross-dimensions of the connecting wires or strips to be fastened in these openings. Reference is made to our allied patent application Serial No. 288,351, filed August 4, 1939.

Using the method according to the invention offers several advantages. The parts, for example, need not be mounted on the carrier plate until the conductor system is completed. Consequently, this mounting can be effected when the carrying plate is taken out of the matrice, in which the conductor system and at the same time the connecting sleeves are arranged on the carrier plate. For manufacturing the conductor system the matrice is consequently only used during the time necessary for the arrangement of the conductor system, in contradistinction to the method described in the prior application, in which at first the parts are disposed in the matrice, and then in the same matrice the conductor system is arranged on the carrier plate by means of the die-cast method. While according to the prior application the matrice is used as a jig for mounting the parts on the carrier plate, in the method according to the invention the carrier plate itself is used as a mount jig. As mentioned above, this is due to the fact that the carrier plate is furnished with openings at the points of junction of the parts with the conductor system and the connecting wires or strips of the

various parts may be passed through these openings after arrangement of the conductor system on the carrier plate.

With the method according to the invention the connecting wires or strips of the parts are used for fastening these parts to the conductor system. These connecting wires or strips may be obtained, for example, by punching and folding a tag-shaped strip from the contact bushes secured to various parts.

The fastening of the connecting wires or strips of the parts to the conductor system may be effected in different manners. It is possible to fasten the connecting wires or strips to the conductor system by riveting or welding. According to the invention it is advisable, however, that these parts should be fastened to the conductor system by soldering. For this purpose the material of the conductor system or that of the connecting wires or strips may be used. The soldering is preferably effected, however, with a material having a lower melting point than the material of the conductor system and the connecting wires or strips.

As material for the carrier plate use may be made, for example, of several kinds of artificial resin. The conductor system may consist, for example, of lead or a lead-alloy.

The invention will be more clearly understood with reference to the accompanying drawing representing, by way of example, one embodiment thereof.

Fig. 1 is a plan view of a carrier plate showing part of the conductor system for a radio-receiver according to the invention. In the drawing Fig. 2 is a cross-sectional view of the carrier plate taken along the line II—II of Fig. 1, whereas Fig. 3 shows a cross-section of this plate taken along to the line III—III of Fig. 1. Fig. 4 is a cross-sectional view of an opening in the plate with a sleeve arranged in it during the die-casting of the conductor system, and a connecting wire fastened in this sleeve.

Referring to the Figs. 1, 2 and 3, the carrier plate 1 has two resistances 2 and 3 and a condenser 4 arranged on it. The plate 1 is furnished at first with openings at the point of the joints of the parts with the conductor system. The openings for the condenser 4 are designated by 5 and 6, those for the resistance 3 by 7 and 8, and those for the resistance 2 by 9 and 10. Furthermore, in the matrice the conductor system is arranged on the carrier plate 1 by means of the die-cast method.

The arrangement of the conductor systems ap-

appears from Fig. 1. At the same time with the arrangement of the conductor system the walls of the openings in the plate 1 are furnished with a metal coating thus forming sleeves in the openings in the plate 1. These sleeves are clearly shown in the Figs. 2 and 3 and are designated by 11, 12, 13 and 14. Since the matrice of these openings has a core in it, these sleeves exhibit a central bore. After the conductor system has been completed, the carrier plate with the conductor system may be taken out of the matrice and the parts may be mounted on the carrier plate. For this purpose the parts with their connecting wires or strips are passed into the sleeves through the central openings. These openings are so proportioned as to be practically equal in diameter to that of the corresponding connecting wires. Next the ends of the connecting wires are fastened to the sleeves, for example, by soldering. In the form of construction according to Fig. 2, the connecting wires 15 and 16 are secured to the sleeves 11 and 12 by softening the material of the latter. In the form of construction according to Fig. 3 use is made of a solder having a lower melting point than the material of the system of conductors and the connecting wires so that the soldering is easily effected, particularly when the material of the conductor system has a high melting point, for example of the order of magnitude of 400° C. In order that the solder drops 27 and 28 may stick well to the sleeves 13 and 14, the latter is slightly conical in the carrier plate, as shown in Fig. 3.

Besides the afore-mentioned advantage of the method according to the invention, i. e. that the carrier plate 1 itself is used as a mount jig for the different parts, there is another advantage. Due to the fact that upon die-casting of the conductor system the different parts are still on the carrier plate, the arrangement of the different conductors on the carrier plate may be practically chosen according to requirements.

In particular, conductors may be passed between the two points of junction of some part with the conductor system. Thus the conductor system may be executed very compact; for the arrangement of a conductor one can always choose practically the shortest way on the carrier plate. Fig. 1 shows, for example, that a conductor 21 passes between the points of connection 1 and 8 of the resistance 3 and is located on the same side of the carrier plate as this resistance

as appears also from Fig. 3. Such a crossing of a part and a conductor, both of which are arranged on one side of the carrier plate, is practically impossible when upon arrangement of the conductor system the parts are already mounted on the carrier plate.

As described in the aforesaid patent application Ser. No. 210,803, it is also possible in the present invention to cause a given conductor to extend in part on one side and in part on the other side of the carrier plate. The conductor 21, for example, extends from A—B above and from B—C below the carrier plate. All conductors 22, 23, 24 and 25 extend below the carrier plate 1.

Fig. 4 is a cross-sectional view of an opening 29 in the carrier plate 1 with the sleeve 30 in it which is obtained at the same time with the conductor 31 by die-casting, and with the connecting wire 32 of some part fastened in the sleeve 30. The inner diameter d_1 is so proportioned as compared with the outer diameter d_2 of the sleeve 30, which is equal to the inner diameter of the opening 21, that the wall thickness

$$\frac{d_2 - d_1}{2}$$

is in average at least 0.2 mm. Thus one is always assured that the sleeve acquires the required firmness so that a good connection between the conductors and the parts is established.

What we claim is:

In a method of providing electrical connections between various elements of electrical apparatus which are adapted to be mounted on a panel of insulation material and wherein each element has terminal connection wires, which method includes the steps of forming perforations on the panel at points thereof where connections are to be made, die-casting on the panel electrical connectors between desired ones of said perforations, terminating said connectors at the perforations in rivet-like footings substantially filling the perforations and overlapping slightly both surfaces of the panel immediately adjacent the perforations, providing each of said footings during die-casting with a central bore, inserting each of said connection wires in a respective one of said die cast central bores and then fastening each of the ends of the connection wires in a respective one of said central bores.

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