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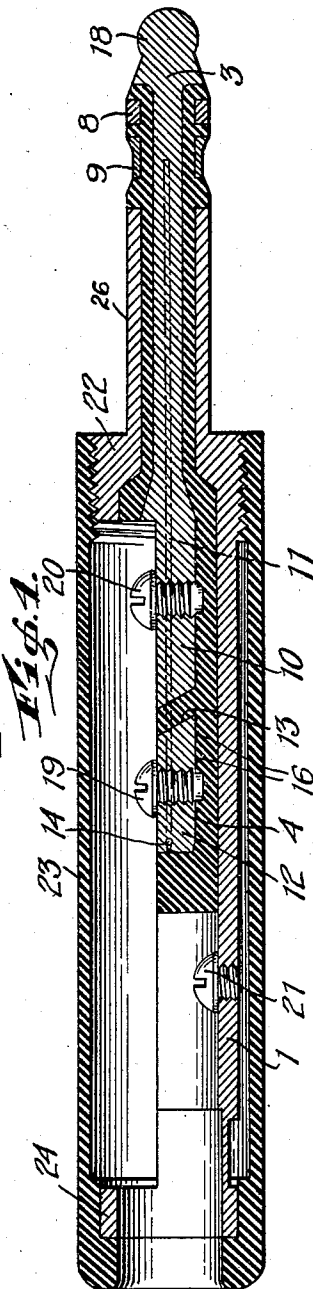
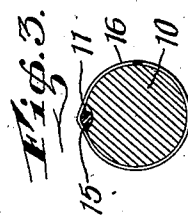
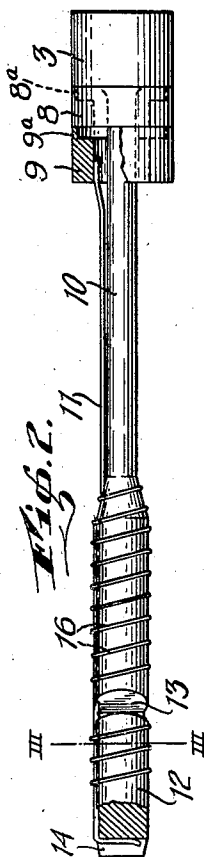
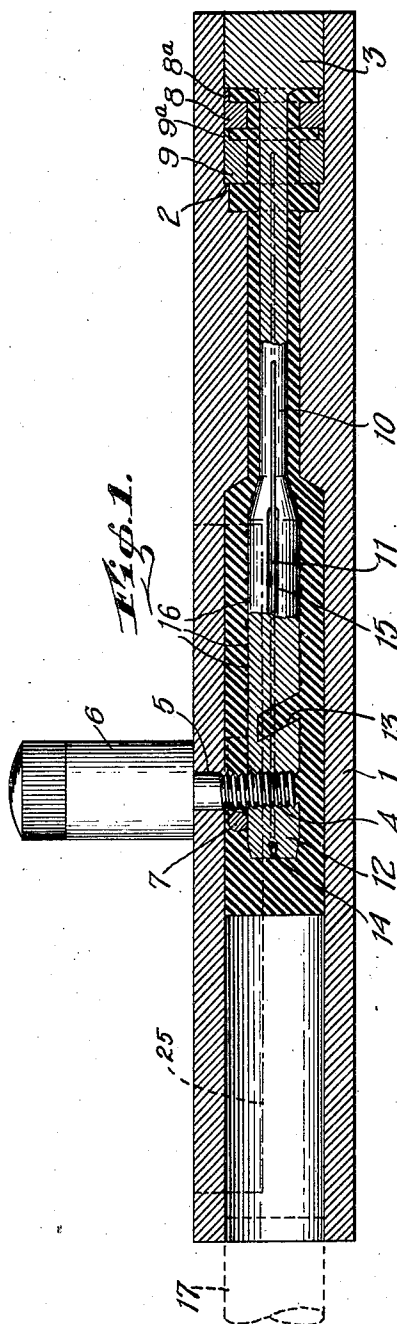
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2,401,451

PROCESS OF MAKING JACK PLUGS

Filed April 20, 1943

2 Sheets-Sheet 1



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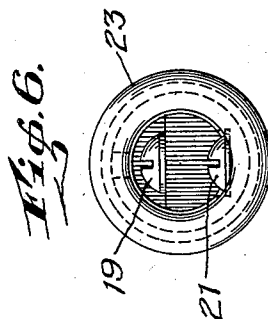
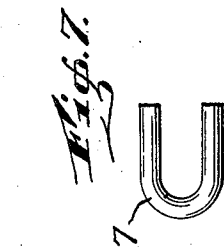
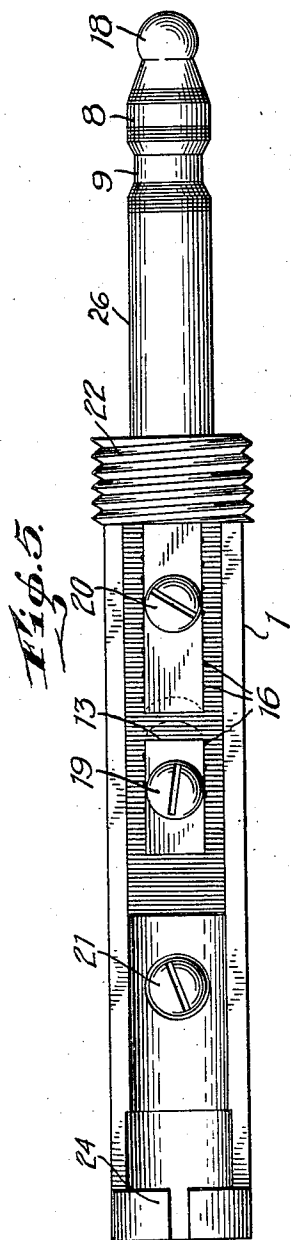
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PROCESS OF MAKING JACK PLUGS

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2 Sheets-Sheet 2



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PROCESS OF MAKING JACK PLUGS

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15 Claims. (Cl. 29—155.55)

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The object is to reduce the production cost and improve the construction and durability of jack plugs and like forms of electric contact devices. The invention resides in the method of manufacture, as exemplified in the accompanying drawings wherein

Fig. 1 is a longitudinal section of the component parts of a three-circuit jack plug according to this invention, in an early stage of its manufacture,

Fig. 2 is a view of the core structure ready for assembly in a plug body,

Fig. 3, a larger scale cross-section of such structure on line III—III of Fig. 2,

Fig. 4, a longitudinal section of the completed plug of Fig. 1,

Fig. 5, a plan thereof, the cover sleeve being removed,

Fig. 6, an end view of Fig. 4, and

Fig. 7, a detail.

According to this invention a section of metal rod is provided with an axial bore of two or more diameters, forming what may be termed the rough plug body, marked 1. Its cross-section is desirably circular and the metal brass, but it can be formed of other metal, die-cast if desired, and the number and dimensions of its internal diameters can be selected as preferred, according to the internal connections required in the finished product. Its length can be exactly that of the finished plug. In the present case, it is desirable that the bore at the tip (right hand) end of the rough body be formed with a correctly located internal shoulder as indicated at 2, for a purpose presently explained. No external work need be done on this body prior to its assembly with its internal core-structure, except as convenient and by way of advance preparation for the final profiling. It is herein regarded as incompletely profiled, whether such preliminary shaping has been done or not.

With the rough body properly internally shaped and finished, a core structure, separately shown in Fig. 2, is inserted in it from the tip end. This structure includes or carries all the internal metallic parts of the plug, which are thus introduced all together and in a proper arrangement. It includes a central or stem part formed of one solid piece of metal having a relatively large head, marked 3, at its tip end and a somewhat smaller enlargement at its opposite or butt end capable of being passed through the small diameter of the body bore. The head part 3 is sized to fit the tip end of the body bore, when assembled, and therein serves two functions, viz.,

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to support the core structure centrally in the body and also to close the end of the bore so as to prevent escape of insulation during the molding operation presently described. It may be termed a closure head.

The other, or butt, end of the stem part is provided with a transverse screw-hole 4 which registers with a lateral hole 5 in the plug body wall when the core structure is assembled therein, at which time a jig screw 6 is screwed into these registering holes, and by the aid of an intervening spacer 7 (Fig. 7), constitutes the means of holding this end of the core rigidly and centrally in the body bore. The core so held is out of contact with the body except at these two points of support, which is to say, the central or stem part of the core 10 is separated from the body by an annular cavity or air space all around it and which is presently to be filled with insulation.

The spacer 7, just referred to, is introduced from the butt end of the plug body and may consist of nothing more than a piece of wire bent to U-shape and dropped over the screw before it is tightened. Other means for adapting this or an equivalent jig screw for temporarily but rigidly supporting the core in its correct position could be readily devised.

Prior to its introduction, the core structure may have placed upon it one or more metal rings. In the present case there are two such rings, marked 8 and 9, respectively. They are later to constitute the ring contacts at the tip of the finished plug and, as assembled, may be termed rough ring contacts. Each is of larger internal diameter than the stem part 10 of the core which they surround, and each is externally dimensioned to fit the body bore so as to be thereby centered with respect to the stem 10 and therefore out of contact with it. One or more of these rough rings are provided with, or associated with, thin peripheral, cylindrical spacers which can be flanges on the rings, marked 8a and 9a, respectively, the purpose of which is to establish a desired axial separation or location of the body parts of the rings. The rings are passed over the butt portion of the stem part before its assembly in the body, and when it is then inserted into the body, the ring nearest the butt, such as 9, abuts against the spacing shoulder 2 above referred to, thus quickly establishing the proper endwise position of the core in the body, bringing the two holes for the jig screw 6 into alignment.

Also prior to the insertion of the core struc-

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ture one or more of the rough rings is connected by a wire or wires with one or more points of the butt part of the core. For example, the ring 9 is connected by a wire 11 with a part of the core butt, marked 12, which part is the part containing the screw hole 4 and is demarked from the rest of the butt by means of a recess or partial cut 13 previously made in the butt opening on its under side. The wire 11 is insulated by lacquer, and connected to the inner face of the ring, preferably by solder, the other end being connected to the butt portion 12, as by being pinched in a nick cut therein or otherwise, and as indicated as at 14. If more than one of the rough rings are to be connected with strands of the plug cord a similar wire can be extended from another of the rings to another portion of the core butt which will then be in like manner initially demarked from the rest of the butt by another recess or notch cut from below like the cut 13. In the present case only one ring is to be connected to the plug cord and accordingly the ring 8 is not wire-connected. This ring is merely a bridging contact for electrically connecting parts within the jack.

To reduce risk of wastage, the ring-connecting wire 11 is held in place on the core by means of a thread wrapping 16, touched with shellac, with the wire desirably laid in a groove 15, formed in the core structure for greater compactness. The wrapping has only the temporary function of preventing injury to the wire connection prior to assembly and allows for core structures to be safely stored and handled in bulk.

With the metal parts assembled, indicated in Fig. 1, the body is next up-ended on a suitable support and a measured amount of some synthetic resin such as Bakelite powder or any other suitable moldable insulating material is introduced into its open butt end, whereupon a plunger, indicated at 17, is inserted in the bore to press the insulation solidly into the bore against the closure head, and into all of its vacant cavities round about the core and between the rings, if present, heat being also applied if the insulation is of the usual thermosetting kind, which kind is preferred. The use of a predetermined measure of insulation material obviously produces a barrier body of insulation of the exact length required and without any waste, and which is integral throughout; no insulating sleeves or washers being involved in this construction. The considerable thickness of the walls of the rough plug body at this stage (thicker than in the finished product) gives the body the strength to resist high molding pressure without risk of any distortion or stretching, thereby avoiding the need of special molding dies which have been proposed in the prior art. In this case, the body is its own die and the open end of its bore is the power cylinder for the plunger 17 which forces the material into place.

When the insulation has set, the plunger is withdrawn and the plug is then externally finished to the required profile and this involves externally machining it with a cut so deep as to remove all the metal by which the core structure and the parts thereon have till now been in metallic contact. Thus the tip end of the assembly is turned down so that the ball contact 18 for the tip of the finished plug is formed out of the closure head 3, and what is left of the body around the stem 10 forms the neck of the plug. The ring contacts 8 and 9 are deprived of their spacers (8a and 9a) which are cut away, thus leaving

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the stem and the ball 18 at its end, and each of the rings, entirely insulated and separated from each other and from the plug body save for such wire connection as may have been made thereto.

The external profiling includes also the slabbing off of the butt portion of the plug assembly, the jig screw 6 having first been removed, and in this operation the milling cut is deep enough (see dotted line 25 in Fig. 1) to cut away the spacer, including the insulation, and meet the recess or recesses previously cut or made in the butt of the core. This isolates the demarked part of the butt leaving it as a metallic island, imbedded in and entirely surrounded by insulation, but still connected by the wire to ring 9 and it leaves the remainder of the screw hole 4 therein to serve as the screw hole for a binding screw 19 by which this island is connected to one of the strands of the plug cord. A similar screw hole is then made in the remaining now flattened part of the butt to take a binding screw 20, whereby the ball tip 18 is connected to the cord through the stem 10 with which it is integral. Also and if desired, still another screw hole and binding screw, indicated at 21, can be located in the wall of the plug body proper for connection to another strand of the plug cord, thereby to put the neck 26 of the plug in circuit with some part of the jack. These binding screws can of course be substituted by any other type of strand-attachment means.

The precise sequence of the profiling operations just described can be seen to be inconsequential so long as they result in the eventual removal of metal necessary to leave the separate parts properly insulated from each other. The external machining or profiling of the plug is preferably so ordered as to leave a full diameter shoulder 22, between tip and butt which is threaded or otherwise configured to receive and hold the outside insulating cover sleeve 23, the other end of which fits over or bears upon a circular portion 24 of the body which is left after the slabbing cut has been made. This can be split and used as a means of clamping the plug to its cord.

It should be apparent that the plug produced as described possesses unusual durability as well as simplicity. It is of particular advantage that the stem part is in one piece and integral with the ball tip so that the latter can not possibly fall off or become loose in use, nor can the stem pull out of the neck, while the insulation is all in one solid piece constituting a continuous and very dense barrier of high dielectric strength between all of the metal parts. Being molded in place and in pressure contact with the metal, it is devoid of any interstices to harbor moisture and it is anchored firmly to the metal in any event so that it cannot slip lengthwise. Extra assurance in this connection can be provided, if desired, by scoring or grooving the interior metal surfaces to increase the anchorage effect. Further security against possible derangement can be had by cutting the notch 13 in the core butt at an inclination, as indicated, so as to leave the contact plate 21 dovetailed in the insulation.

I claim:

1. The process of making jack plugs and the like, which consists in assembling a core structure within an incompletely profiled plug body, fixing said core structure centrally within the body in metallic contact therewith at one or more points, forcing plastic insulation material into said body around the fixed core structure and into the cavities between the same and the body, and when the

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insulation material has hardened, eliminating said metallic contact by externally machining said body to complete the profile thereof.

2. The process defined by claim 1 wherein the forcing of the plastic into the internal cavities of the body is done by plunger action in the end of the body itself serving as a cylinder.

3. The process of making jack plugs and the like, which comprises the steps of making a plug body, making a core structure including a stem and a closure head, assembling said structure in the body so that said head enters within and closes one end of the bore of the body with metallic contact therewith, forcing plastic insulation into the other end of the bore while closed by said head, and subsequently removing the contacting metal.

4. The process defined by claim 1 wherein the core structure includes a stem part and a rough ring contact both initially in metallic contact with each other and with the body when assembled in the latter, and the subsequent external machining to complete the profile removes the contacting portions of said body and core structure, thereby leaving the stem and ring contact electrically separated from the body and each other.

5. The process of making jack plugs and the like which consists in preparing a metal core structure for assembly in a plug body by forming a recess in the metal thereof, assembling said structure in the body, molding insulation around said structure and so as to fill said recess and thereafter removing the metal at the recess to electrically separate the parts on opposite sides of the latter.

6. The process of making articles having insulated contact elements comprising preparing a metal structure for assembly in a body by forming a partial cut through the metal thereof, assembling the structure with the body, molding plastic insulation into the cut and the space between said structure and body, and then machining away the body metal and the molded insulation to an extent removing the metal that was uncut in said core structure, thereby leaving the metal on opposite sides of the cut as electrically separate contact elements.

7. The process of making jack plugs and the like, comprising making a plug body, making a core structure including a ball contact stem and a transversely recessed butt portion, assembling such structure centrally in the bore of the body and in metallic contact therewith at one or more points, molding insulation into the space around the core within the body and within said recess and thereafter machining the body so as to cut away the metal at said points and the metal at the recess, thereby electrically separating the parts of the butt portion on opposite sides of the recess.

8. The process of making jack plugs which comprises assembling a core structure within a tubular thick-walled body which is to form the shell of the plug, spacing and supporting such core structure centrally inside the body by providing rigid metallic supporting connection between it and the body, forcing plastic insulation under pressure into all the cavities in said body while the core structure is so fixed, and then reducing the wall thickness of the body to that desired for finished shell of the plug and also removing the metal constituting said metallic supporting connection, by externally machining said body to its final profile.

9. The process of claim 8 in which the forcing

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of the plastic insulation is done by a plunger introduced into the plug body itself and in which the space occupied by said plunger serves, after its withdrawal, as a wire-attachment space in the plug.

10. The process of making jack plugs with ring contacts comprising making a tubular plug body, centralizing a core structure within the bore thereof, said structure having a stem and a head (later to form a ball tip) and a metallic rough ring on said stem back of said head provided with peripheral spacing means bearing on said head and spacing the ring therefrom, forcing plastic insulation into the space between said core structure and plug body and into the space formed between said head and rough ring, and thereafter profiling said head and ring to form a ball tip and at the same time cut away said spacing means to leave the ring metallically separate from the stem and tip.

11. The process of making jack-plugs which consists in forming an initial plug-body having an axial bore of the internal dimensions desired for the finished plug and having a thickness of wall adapting it to withstand the internal pressure of plastic insulation later to be pressed into said bore, without external support; inserting into such bore a metallic core structure having a tip end or head later to be profiled into a ball or tip contact electrically isolated from said body; supporting said core structure on the plug body by means of rigid but temporary supporting means adapted to hold the core structure in a central position in the body spaced from the wall of the bore; and while the core is so supported, pressing temporarily-plastic insulating material into said bore so as to fill the space between core and body, the pressure exerted on said material being within the tensile strength of the wall of said initial plug-body so as not to deform the same; and after the insulating material has hardened, profiling said body including said tip end and insulation so as to reduce the body wall thickness and remove the material that constituted said temporary supporting connection means for the core, thereby giving the plug its final external dimensions and desired contour.

12. The process of making jack-plugs which consists in forming an initial plug-body having an axial bore of the internal dimension desired for the finished plug and having a thickness of wall adapting it to withstand the internal pressure of plastic insulation later to be pressed into said bore, without external support; inserting into such bore a metallic core having a butt end and a head later to be profiled into a tip contact and electrically isolated from said body; supporting said core on the plug-body by means of two rigid but temporary supporting means at the butt end and head of the core, respectively, and adapted to hold the core in a central position in the body spaced from the wall of the bore; and while the core is so supported, pressing temporarily-plastic insulating material into said bore so as to fill the space between core and body, the pressure exerted on said material being within the tensile strength of the wall of said initial plug-body so as not to deform the same; and after the insulating material has hardened, profiling said body so as to reduce the body wall thickness and remove the material at both ends of the core that constituted said temporary supporting means therefor, thereby giving the plug its final external dimensions and desired contour.

13. The process of making jack-plugs which

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consists in forming a metallic plug-body with an axial bore having wider diameters at its ends than at its intermediate portion which represents the stem part of the finished plug; inserting in such bore a metallic core having a stem with a head thereon which is later to form the tip contact of the plug; fitting said head into the opening of the corresponding wide end of said bore so as to close such end and support the core centrally in the body, spaced from the wall thereof; pressing temporarily-plastic insulating material into said bore so as to fill the space around the core stem within said wider part of the bore, back of said head; and when the insulating material has hardened, cutting away the end of the body containing said wider bore and shaping the head of the core and the now exposed insulating material back of it to a plug tip contact.

14. The process of making jack-plugs which consists in forming an initial, metallic plug-body, having an axial bore of wider diameter near its ends than at its intermediate part and having a thickness of wall adapting it to withstand the internal pressure of plastic insulation later to be pressed into said bore, inserting into such bore a metallic core structure having a stem with a head thereon which is later to form the tip contact of the finished plug, fitting said head into the opening of the bore at the corresponding end of said body so as to close the same and support the core stem centrally within and spaced from said body; while the core is thus supported, pressing temporarily-plastic insulating material into said bore so as to fill the space around the core stem and back of its head in said wider

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bore part, the pressure exerted on said material being within the tensile strength of said plug-body walls so as not to deform the same; and after said insulating material has hardened, profiling said plug-body to reduce the wall thickness thereof and remove the metal containing said wider bore part and shaping the core head and the hardened insulation associated therewith to a plug tip contour.

15. The process of making jack-plugs which consists in forming a metallic plug-body with an axial bore having wider diameters at its ends than at its intermediate portion which represents the stem part of the finished plug; separately forming a metallic core having a relatively thick butt end, a slender stem and a head on the stem; locating a metallic ring around said stem so that an axially-directed peripheral flange-like spacer on said ring is in contact with said head; inserting said core with the ring and spacer on it into the opening of said bore so that the head of the core closes the same and confines said ring and its spacer centrally in the wide part of said bore; while the parts are so held pressing temporarily-plastic insulating material into said bore so as to fill the space around the core within said wider part of the bore, back of said head and within said ring; and when the insulating material has hardened, cutting away the end of the body containing said wider part of the bore and said spacer, and shaping the head of the core, the ring, and the now exposed insulating material to a plug tip contact.

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