

Feb. 8, 1955

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2,701,867

CABLE CONNECTOR

Filed May 4, 1951

2 Sheets-Sheet 1

FIG. 1.

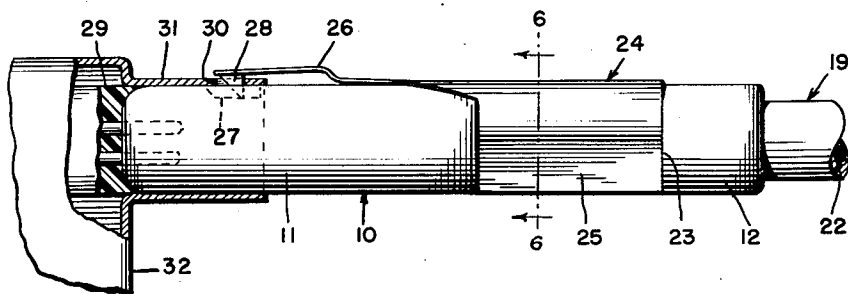


FIG. 2.

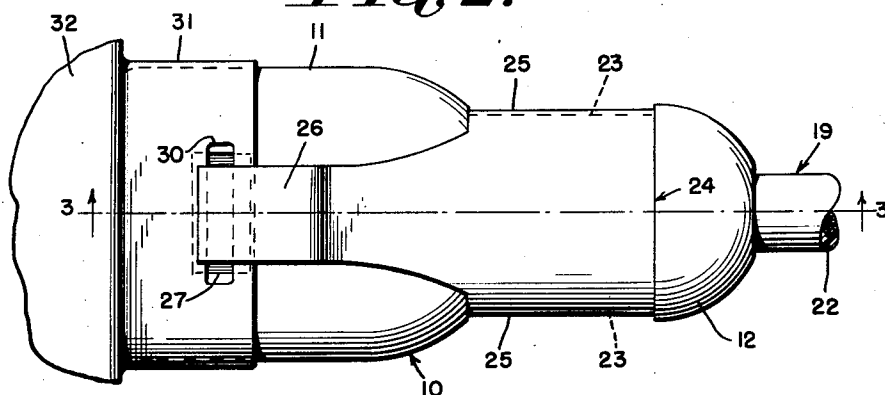


FIG. 3.

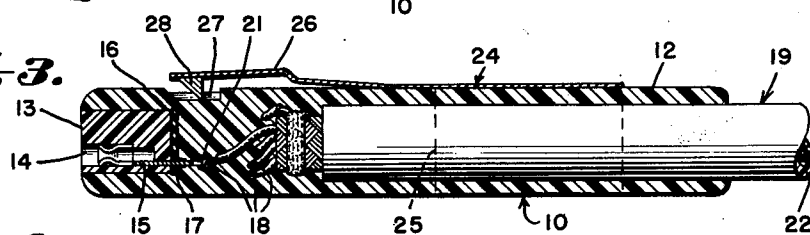
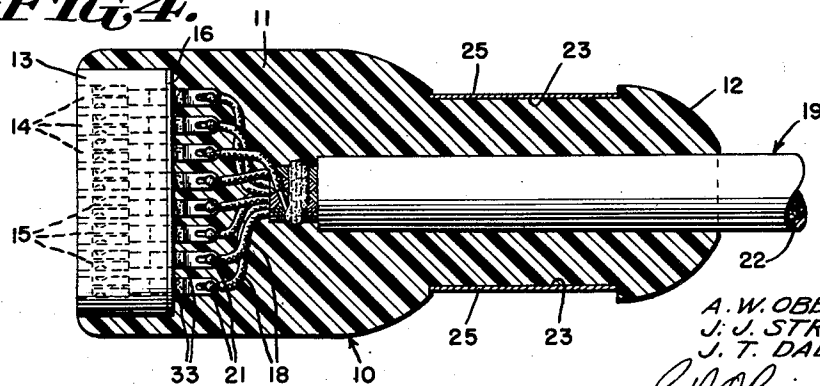


FIG. 4.



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FIG. 5.

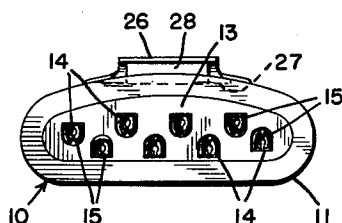


FIG. 6.

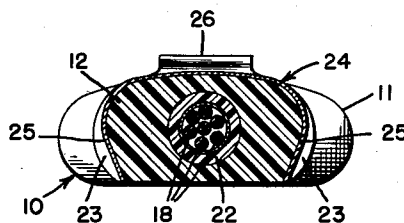


FIG. 7.

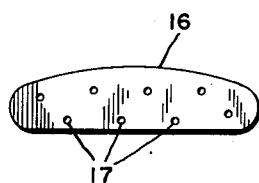


FIG. 8.

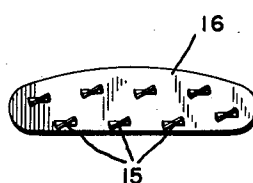
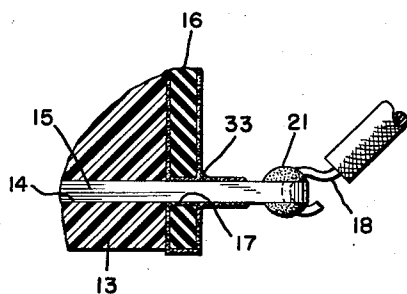


FIG. 9.



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CABLE CONNECTOR

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3 Claims. (Cl. 339—102)

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The present invention relates to cable connectors and, more particularly, to cable connectors sealed against air and moisture for use in electronic circuits and subjected to a wide range of humidity and temperature changes such, for example, as the conditions encountered in the firing circuits of rockets or the like.

Prior art cable connectors have been found to be not waterproof, thus permitting the entry of moisture through the cable and into the firing circuit of the rocket, thus lowering the insulation resistance thereof and causing malfunctioning of the firing circuit. A further disadvantage of prior art cable connectors is that rubber is employed to form the casing thereof. It has been found that rubber deteriorates when stored in temperatures of 145° F. and over, thus reducing the insulation resistance between the contacts thereof below the acceptable limit. A further disadvantage of the usual rubber casings is the flexibility thereof. Such casings when flexed in normal service cause breakage either of the conductors themselves or the connections thereof to the contact members.

The cable connector of the present invention substantially overcomes the disadvantages of the prior art by providing a rigid thermoplastic casing molded about the contacts and individual conductors, the heat-resistant phenolic contact base having a synthetic rubber disk or gasket cemented thereto, the shank ends of the contacts extending through small perforations in the disk. A suitable rubber base adhesive is employed to completely seal the perforations through which the contacts extend. The casing, formed of a suitable thermoplastic resin, is injection molded about the contact and conductor assembly to form a rigid body sealed against the ingress of water and air.

A clip having a wedge-shaped, spring urged keeper is clamped around the connector for engagement with a flange member surrounding a fixed connector plug to which the connector of the present invention is adapted to be attached in order to ensure against accidental displacement thereof.

An object of the present invention is to provide an improved connector for electrical conductors which is sealed against the ingress of air and moisture.

Another object of the present invention is to provide a connector for electrical conductors which prevents the ingress of air and moisture into the cable attached thereto and containing such conductors.

Still another object is to provide an improved connector having a rigid casing which prevents breakage of the conductors within the connector.

A further object is to provide a thermoplastic injection molded casing having a leak-proof seal between the contacts and the supporting base therefor for preventing leakage of the plastic material therebetween during the molding thereof.

A still further object is to provide a connector for electronic circuits which maintains high insulating values through a wide range of conditions of temperature and humidity.

Another object is to provide a molded plastic casing for a cable connector which shrinks slightly when cooled after the molding thereof thus to tightly grip the enclosed parts thereof to produce a water and airtight seal therewith.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following

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detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is a view in side elevation of the cable connector of the present invention attached to a fixed connector plug shown partly in section;

Fig. 2 is a top plan view of the device illustrated in Fig. 1;

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 2 and showing the connector removed from the fixed plug;

Fig. 4 is a view of the connector showing the casing in section and the parts covered thereby in elevation;

Fig. 5 is an elevation of the contact end of the connector;

Fig. 6 is a sectional view taken along line 6—6 of Fig. 1;

Fig. 7 is an elevation of the sealing gasket;

Fig. 8 is a view in elevation of the gasket and showing the ends of the contacts twisted; and

Fig. 9 is an enlarged sectional view illustrating the method of cementing the gasket to the contact base or insert and to the contacts.

Referring more particularly to the drawings wherein like numerals of reference indicate like parts throughout the several views, 10 indicates generally an injection molded thermoplastic casing having an enlarged portion 11 and a reduced portion 12. The portion 11 of casing 10 is molded about a heat resistant phenolic insert or base member 13 having a plurality of bores 14 therein. Each of the bores 14 has a slotted end and an enlarged end and has inserted therein a preferably gold-plated metallic contact member 15, the shank end of which extends through the slotted end of the bore and beyond the end of insert member 13.

A flexible synthetic rubber disk or gasket 16 is cemented by a suitable rubber base adhesive to the inner end of member 13 and has formed therein a plurality of small perforations or openings 17 coinciding with the bores in member 13. The perforations 17 are of smaller area than the cross sectional area of the shank ends of contacts 15 in order to tightly grip that portion of each of the contacts which passes through the disk 16.

In assembling the device of the present invention, the slotted end of insert 13 is roughened; the contacts 15 are inserted in bores 14, the shank portions thereof extending through the slotted ends of the bores; the roughened end of insert 13 and the protruding surfaces of contacts 15 are washed with a suitable solvent such, for example, as methyl ethyl ketone and air dried; all surfaces of disk 16 are wiped with a cloth saturated with another suitable solvent such, for example, as toluene and thereafter air dried; the disk 16 is mounted in spaced relation with respect to insert 13 on the extended ends of the contacts by forcing the contacts through the openings 17; with the assembly held such that the extended ends of the contacts are pointing downwardly, a coat of the aforementioned cement is applied to the roughened end of insert 13, the inner face of the disk 16 and the exposed surfaces of the contacts 15; the cemented surfaces are air dried until tacky, the disk 16 is pressed firmly against the roughened surface of insert 13, care being taken that contacts 15 are not displaced during this operation and that the adjacent surfaces of the insert and disk are completely joined. The cement is air dried for about 10 minutes longer. Each of the exposed shank ends of contacts 15 is twisted as indicated particularly in Fig. 8 to prevent movement of the contacts with respect to insert 13. A coating of the aforementioned cement is applied to the exposed face and edges of disk 16 and extending a short distance along the exposed surfaces of contacts 15 as indicated at 33 in Fig. 9. The coating is air dried for about 15 minutes and a second coating of the cement over the same surfaces is applied. The second coating is air dried for about five minutes. The contact assembly is baked in an oven at high temperature (300°±10° F.) for about 30 minutes. The purpose of the foregoing procedure is to completely seal the bores 14 against the ingress of the thermoplastic material by reason of the high pressure present during the injection molding of casing 10 and to seal the slotted ends of the bores against

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the ingress of air and moisture into the conductor cable during use thereafter.

In proceeding with the assembly of the connector of the present invention the conductors 18 of cable 19 are soldered as at 21 to the shank ends of the contacts, a sufficient length of each of the conductors 18 extending from the end of covering 22 of cable 19 to prevent strain on the soldered connections of the conductors.

The next operation is the injection molding of the casing 10 about the assembly consisting of the insert member 13, contacts 15, disk 16, conductors 18 and cable 19. The cable 19 is spirally wrapped along that portion of the length thereof which is to be covered by the casing 10 with a coil of suitable thermoplastic material of a diameter sufficient to center the cable in a heated injection mold (not shown). The insert member 13 is centered in the mold by an insert block (not shown) having a plurality of pins projecting therefrom, the pins being inserted in the bores 14 of the insert member 13 and in the gripping ends of contacts 15. The foregoing assembly is placed in the mold (not shown), the mold and the injection cylinder being heated at a temperature sufficient to maintain the thermoplastic material at a suitable state of fluidity for injection molding and to prevent injury to the conductors and connections during the molding operation.

A suitable thermoplastic resin is employed in the molding of casing 10 which has the following qualities: sufficient elasticity to prevent cracking of the casing when subjected to low temperatures and to withstand rough handling; low power factor and high insulation resistance to provide low current loss and high performance when used in high frequency electronic circuits and the ability to maintain such characteristics after long periods of storage at high temperature and humidity; sufficient physical strength properties, such as tensile, flexural, and impact to perform satisfactorily in service; rigidity to prevent breakage of the electrical connections; and the quality of shrinking slightly upon cooling after the molding operation to more thoroughly grip the enclosed assembly thus to more thoroughly prevent the ingress of moisture.

The aforementioned resin is forced from the injection cylinder into the mold at a pressure of approximately 6000 pounds per square inch for a period of one minute, after which the material is held in the mold for a period of three minutes. Thereafter the molded casing and the contact and cable assembly contained therein are removed from the mold and cooled, the shrinkage occurring during the cooling process to cause a close adhesion of the casing with the enclosed assembly thus ensuring an airtight and watertight seal therebetween.

It will be noted that the casing 10 is provided at the reduced portion 12 thereof with a pair of recesses 23 for receiving the spring ears 25 of a metallic clip 24, the ears 25 having gripping engagement with the casing 10. A spring finger 26 of clip 24 extends along the length of casing 10 and ends adjacent a recess 27 in the side of the casing. A wedge-shaped keeper 28 is secured by silver soldering or other suitable securing means to the inner side of finger 26 and nests in recess 27. By an inspection of Fig. 1 it is obvious that locking engagement of keeper 28 of clip 24 with the opening 30 of flange or plate 31 fixed to a housing 32 will retain the connector of the present invention on the fixed plug 29. It is also apparent that the wedge-shaped keeper is arranged to cam over the outer edge of flange 31 as the connector is brought into engagement with the plug in housing 32.

Obviously many modifications and variations of the present invention are possible in the light of the above

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teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A connector for electrical conductors comprising, in combination, a heat resistant phenolic block having inner and outer faces, a plurality of contact members mounted in said block, a heat resistant sealing gasket mounted adjacent said inner face, a first coating of cement disposed between said inner face and the adjacent side of said gasket for providing a moisture-proof seal, said gasket having a plurality of reduced openings therein, said contact members extending through said openings and fitting snugly therein, a second coating of cement on the other side of said gasket and covering the portion of the extended portions of said contact members adjacent said gasket, a plurality of conductors secured to the extended portions of said contact members, a moisture-proof sheath for said plurality of contact members, and a unitary rigid thermoplastic casing sealing therein, said block, said gasket, said extended portions of the contact members, said conductors and a portion of the length of said sheath.

2. A connector for electrical conductors comprising, in combination, an insulator block having mounted therein a plurality of contact members, a sealing gasket having one end of said contact members extending there-through, a first cement seal between said block and said gasket, a second cement seal between said gasket and said contact members, a length of sheathed multi-conductor cable, the conductors thereof being secured to said contact members, and a rigid unitary thermoplastic casing sealing therein said block, said contact members, said sealing gasket and a portion of the length of said conductors.

3. A waterproof connector for electrical conductors comprising, in combination, a phenolic block having inner and outer faces, said block having a plurality of bores therein extending from the inner face to the outer face, a plurality of contact members mounted in said bores and extending outwardly from said inner face, a heat resistant sealing gasket cemented to said inner face and having reduced orifices through which the extended portions of said contacts pass, a coating of cement on each of said contacts where the contacts pass through said gasket, a second coating of cement on the outer side of said gasket, a plurality of conductors fixed to the extended portions of said connectors, a waterproof sheath covering said plurality of conductors, and a unitary rigid thermoplastic casing engaging, in watertight relation, the block, the gasket, the extended ends of the connectors, the conductors and a portion of the sheath.

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