ELECTRICAL CONNECTOR AND METHOD OF MANUFACTURING THE SAME

Filed July 10, 1940

Inventor:
George B. Benander,
by Harry E. Sundberg
His Attorney.
ELECTRICAL CONNECTOR AND METHOD OF MANUFACTURING THE SAME

George B. Benander, Oaklawn, R. L., assignor to
The Monowawi Electric Corporation, a corpora-

tion of Connecticut

Application July 10, 1940, Serial No. 344,742

4 Claims. (Cl. 18—59)

The present invention relates to electrical con-
nectors comprising a casing of insulating ma-
terial having contact members embedded therein
counected to electrical conductors, and passages
leading to the contact members for the reception
of the uprights or blades of an electric plug.

It is now well known to construct electric plug
connectors comprising an insulating body of
molded rubber in which the inner ends of
the uprights or blades are embedded and to which
the conductors of an electric cord are connected,
the outer ends of the uprights or blades project-
ning beyond the body and being of a size and so
space that they may be inserted into engage-
ment with the contacts of a connector or recep-
tacle. Such plug connectors having bodies of
molded rubber have well recognized advantages
and it has been appreciated that it was desirable
to similarly construct electrical connectors.

However, for such electrical connectors, the
Underwriters' requirements are difficult to meet
inasmuch as it is required that a connector for
an 110 volt circuit shall withstand 1000 suc-
cessive connections and disconnections at 250 volts,
15 amperes. Connectors having molded rubber
cases have been constructed which meet these
requirements but they have been relatively com-
plicated and expensive to manufacture.

The object of the present invention is to pro-
vide an improved electrical connector which
while simple in structure and capable of being
manufactured at low cost, will meet the Under-
writers' requirements, and to provide an im-
proved method of manufacturing the same.

For a consideration of what I believe to be a
novel and my invention, attention is directed to
the following specification and the claims ap-
pended thereto.

In the accompanying drawing, Fig. 1 is a ver-
tical sectional view on line 1—1, Fig. 2, of an elec-
trical connector embodying my invention; Fig. 2
is a top plan view of the electrical connector;
Fig. 3 is a sectional view of a pre-molded rubber
casing used in constructing an electrical con-
ctor embodying my invention; Fig. 4 is a sectional
detail view illustrating the method used in con-
structing my improved connector, and Fig. 5 is an
exploded view further illustrating the method
of manufacture.

Referring to Figs. 1 and 2, the electrical con-
nector comprises a body 1 of molded rubber
having recesses 2 in which are located the elec-
trical contacts 3. The molded body 1 is prefer-
ably molded of rubber of a degree of firmness
so that the body is reasonably pliable, although
the degree of hardness of the rubber may vary
according to the requirements to which the con-

nector is to be put. Each contact 3 comprises a
longer outer leg 4 and a shorter inner leg 5,
the two legs being integral with each other and
being embedded in the body and spaced apart
sufficiently to receive the uprights or blades of
a plug connector or attachment plug. The open-
ings 2 are of a width equal to the width of the
uprights or blades of a standard plug connec-
tor, the outer ends 6 of the openings corresponding
in dimensions to the dimensions of such uprights.
The outer ends of the contacts are spaced back
from the face 7 of the body ad each end is bent
at an angle as shown at 8 and 9, such ends being
embedded in the material of the body to hold
the contacts in place. 10 indicates an electric
cord which may be of any suitable type and has
two conductors, the bared ends of which are
connected to the inner ends of the contacts as
indicated at 11. As shown particularly in Figs.
1, 4 and 5, the bared ends of the conductors are
inserted between the inner ends of the contacts
and may, if found desirable, be spot welded in
place.

Referring particularly to Fig. 1, it will be noted
that the outer ends of the outer contact legs 4
terminate at a point beyond the outer ends of the
inner legs 5 so that when the blades of an at-
tachment plug are pulled from engagement with
the contacts, the circuit is finally broken at the
outer ends of the outer contact legs 4. Also, it
will be noted that the outer ends of the contact
legs 4 and 5 terminate well below the surface 1
of the connector body, thus providing a region
above each contact which forms an arc snuffing
space or chamber.

As a result, when an electrical attachment plug
is removed from the connector, the plug blades
separate from the contacts at the upper ends of
the outer contact arms 4 so that the length of
the path between the contacts where the break
occurs is a maximum. This tends to prevent
flashover between the contacts. Also, the spaces
6 above the contacts, which spaces are of the size
of the attachment plug uprights, serve to con-
fine the arc and prevent destructive action on
the portion of the body which lies between the
passages 6, this being the portion indicated as
being within the bracket A in Fig. 1. Herefore,
failure of connectors of this type have occurred
generally due to the carbonizing of the portion
of the connector indicated by the bracket a, such
portion gradually carbonizing and eventually
permitting flashover and failure. By my im-
proved arrangement whereby I have increased the length of the path between the contacts and predecessors, and confining and snuffing chambers, I have eliminated the carbonizing effect on this portion of the connector to an extent such that difficulty is not experienced from this cause.

In constructing my improved connector, I follow preferably the following method:

1. First mold from suitable rubber a casing 14 as shown in perspective in Fig. 5 and in section in Figs. 3 and 4. This casing has a circular opening 15 at its lower end through which the conductors enter and a rectangular opening 16 which extends down from the upper end of the plug and terminates at its lower end to form shoulders 17. At the central portion, the rectangular opening is enlarged to form a circular passage as indicated at 18, which passage is in line with the opening 15. Opening 16 is of a width equal to the width of the contacts 3. After casing 14 has been formed, the contacts 3 with the conductors 10 attached are assembled in the casing as shown in Fig. 4 and the casing is placed in the cavity 19 of the mold part 20, this being a stationary part of a suitable mold which may be a single cavity mold or a multi-cavity mold. The contacts 3 are of a width equal to that of opening 16 so that they fit snugly therein. They are located with their inner ends against shoulders 17. Since contacts 3 are of a width equal to that of opening 16, the sides of the opening serve to seal or enclose the space between legs 4 and 5 of the contacts.

In assembling the contacts and casing, the wire 10 may be first passed through the casing 14, as shown in Fig. 5, and the ends of the bare conductors connected to the inner ends of the contacts, as shown in Fig. 5, after which the contacts may be pulled down into the casing to the positions shown in Fig. 4. The mold is shown as being provided with a side opening 20a for the insertion of the wire 10.

Next the movable mold member 21, which is provided with two rectangular pins 22 of a size in a transverse section equal to that of passages 6, is closed on the lower mold part 20, as shown in Fig. 4, the pins entering the spaces between the legs 4 and 5 of contacts 3, thus sealing the openings between their outer ends and forcing the openings 4 firmly against the adjacent surfaces of the casing 14 and embedding the outer turned ends of the arms in the material of the casing. The mold member 21 has a central opening 23 and next a plug 24 of uncured rubber or other suitable uncured molding material is inserted in this opening, after which the mold plunger 25 is lowered to force the material of plug 24 into the opening 16 between the contacts and down into opening 15, entirely filling such openings and embedding the contacts, a portion of the cord 10 which lies in opening 15, and the connections between the conductors and the contacts in the material of the plug. The result is a substantially solid integral structure, as shown in Fig. 1. Since the contacts 3 fit snugly in opening 16 and pins 22 close the spaces between the arms of the contacts at their outer ends, no rubber can get into the spaces between such legs.

The mold is suitably heated and after the material of the plug has been cured, the mold is opened and the finished electrical connector is removed.

When the mold is opened, pins 22 are withdrawn from the molded body, leaving the passages 8 leading to the contacts 3, which passages are of a size in cross-section to receive the uprights or prongs of a plug connector.

In the drawing, the mold is shown only diagrammatically, the supports and operating mechanism being omitted as this forms no part of the present invention. Molds of this type are known and in carrying out the invention, any suitable mold structure may be used.

From the foregoing, it will be seen that my invention may be carried out by use of a simple mold structure and that the only parts required in constructing the connector are the outer casing, the two connectors, and the plug insert. In manufacture, the parts can be quickly assembled and placed in the mold.

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

1. The method of manufacturing an electrical connector which comprises forming a casing of moldable material having a rectangular opening, inserting contacts each comprising spaced contact arms of a width equal to that of the opening into the opening at opposite ends thereof and with their outer ends below the face of the casing, placing removable rectangular pins in the spaces between the arms of the contacts, said pins being of a size such as to fill such spaces and force the outer of the spaced contact arms into the material of the outer side walls of the rectangular openings, filling the portion of the opening between the contacts with moldable material, and then removing said pins.

2. The method of manufacturing an electrical connector which comprises forming a casing of moldable material having a rectangular opening with shoulders at its lower end, and a second opening for the passage of conductors, inserting contacts each comprising spaced contact arms of a width equal to that of the rectangular opening and having conductors extending through said second opening attached thereto into the rectangular opening at opposite ends thereof and with their inner ends resting on said shoulders and their outer ends below the face of the casing, placing removable rectangular pins in the spaces between the arms of the contacts, said pins being of a size such as to fill such spaces and force the outer of the spaced contact arms into the material of the outer side walls of the rectangular openings, filling the portion of the opening between the contacts with moldable material and then removing said pins.

3. The method of manufacturing an electrical connector which comprises forming a casing of moldable material having a rectangular opening with shoulders at its lower end, and a second opening for the passage of conductors, inserting contacts each comprising spaced contact arms of a width equal to that of the rectangular opening and having conductors extending through said second opening attached thereto into the rectangular opening at opposite ends thereof and with their inner ends resting on said shoulders and their outer ends below the face of the casing, the free ends of said contact arms having outwardly turned ends, placing removable rectangular pins in the spaces between the arms of the contacts, said pins being of a size such as to fill such space and force the outer of the spaced contact arms into the material of the outer side walls of the rectangular openings, filling the portion of the openings between the contacts with moldable material and in which the outwardly turned ends of the inner contact...
arms are embedded, and then removing said pins.

4. In an electrical connector of the type wherein the body comprises flexible material molded directly onto the contacts and the electric cord, the combination of a body of molded flexible material having spaced transversely extending open-ended passages adapted to receive the uprights of a connector plug, contacts located in said passages, each contact comprising two parallel arms embedded in the opposed side walls of the passage in which it is located, and an electric cord having an end molded directly into said body at a point remote from the open ends of said passages, bared ends of the conductors of said cord being connected to the inner ends of said contacts whereby the outer ends of the contacts are free of cord connecting means, the outer ends of the arms of said contacts being spaced back from the outer open ends of the passages to form arc snuffing chambers and the free end of the outer arm of each contact extending beyond the free end of the inner arm to provide an arcing gap of maximum length between the contacts.

GEORGE B. BENANDER.