Jan. 3, 1967 J. L. LE BAIGUE 3,296,387

SHOCK ABSORBING ELECTRICAL CONNECTOR

Filed Nov. 2, 1964

FIG. 1

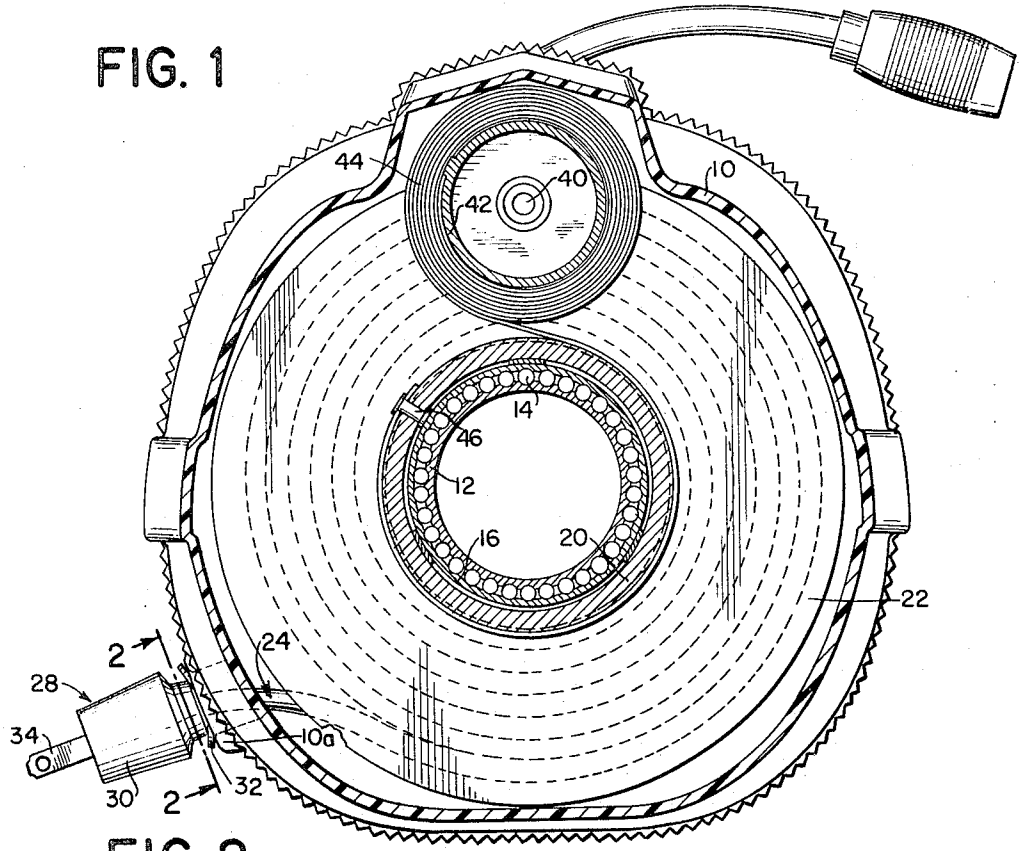


FIG. 2

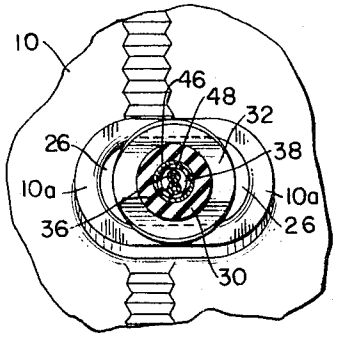


FIG. 3

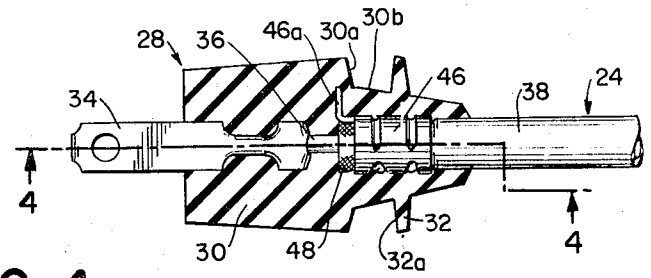
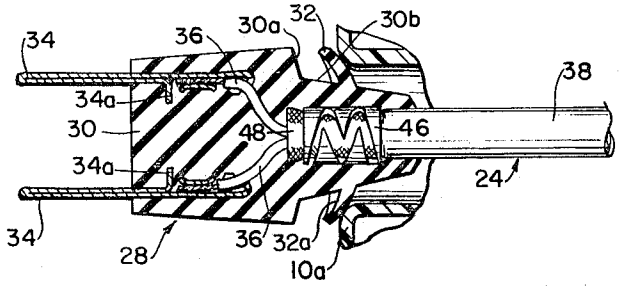


FIG. 4



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United States Patent Office 3,296,387 Patented Jan. 3, 1967

3,296,387

SHOCK ABSORBING ELECTRICAL CONNECTOR

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Filed Nov. 2, 1964. Ser. No. 408,041
4 Claims. (Cl. 191—12.4)

My invention pertains, in general, to electrical connectors for use with cordwinders; and, more particularly, to an electrical connector, such as a male plug, which includes a bumper integrally formed with the body portion of the connector for absorbing the shock produced by the sudden arresting of the rotation of the cordwinder's drum when the electric cord to which the connector is attached is fully retracted.

Cordwinders for flexible electric cords are usually provided with a spring motor which is wound by the rotation of the winding drum during withdrawal of the cord, the spring motor thus being conditioned to rotate the drum for rewinding the cord. An ordinary spring motor having a spiral spring produces a maximum torque when fully wound, the torque dropping off as the spring becomes unwound. Consequently, the torque approaches a minimum value as the cord becomes fully rewound, with the result that the drum is rotating at a minimum speed at the end of the rewinding. The rotation of the drum is usually stopped by the plug on the electric cord striking the cordwinder housing, it being too large to pass through the cord opening in the housing, or by a bumper of relatively hard material slidably mounted on the cord, in the latter case the plug being relied on to limit the displacement of the bumper along the cord.

However, an improved rewinding action is obtained if a Neg'ator ® spring is employed to drive the winding drum. A spring of this nature is capable of producing a constant torque throughout the entire rewinding operation and consequently the winding drum does not slow down, but rather tends to increase its speed of rotation to a maximum value at the time the cord becomes fully rewound. This greatly increases the impact of the plug against the housing of the cordwinder, with the result that the electrical connection between the cord and the plug may be quickly damaged.

Therefore, one object of my invention is to incorporate a shock absorbing member directly in an electrical connector, such as a male plug, for the purpose of preventing damage to the electrical connection between the cord and connector when the connector strikes the cordwinder housing at the time the cord is fully retracted into the housing. Thus, I eliminate the need, and expense, of supplying the separate bumper element which heretofore has been required for protective purposes.

Another object of my invention is to provide an easily fabricated connector and cord assembly; said connector comprising a body and shock absorbing member which are molded as a unit about a subassembly comprising an electric cord having contact elements connected to the conductors thereof and a strain relief element crimped to the cord's jacket and embedded in the connector's body during the molding operation.

Further objects and advantages of my invention will be apparent from the following description considered in connection with the accompanying drawings which form part of this application and of which;

FIG. 1 is a cross-sectional-view of a cordwinder including an electric plug according to one embodiment of my invention and the plug is shown at the instant it strikes the cordwinder housing;

FIG. 2 is a cross-sectional view taken on the line 2—2 of FIG. 1;

FIG. 3 is a view of a longitudinal cross-section of the

electric plug of my invention shown prior to striking the cordwinder housing; and

FIG. 4 is a cross-sectional view taken along the section line 4—4 in FIG. 3 and showing the electric plug at the instant it makes impact with the cordwinder housing, in the same manner as shown in FIG. 1.

Referring to the drawings, reference character **10** designates the housing of a cordwinder. Integral with or secured to the housing **10** is a central hollow shaft **12** which forms the inner race of a ball bearing **14**. The outer race **16** of the bearing is secured in the hub **20** of a reel or winding drum **22**. A flexible electric cord **24** has one end secured to the drum **22** and is adapted to be wound up thereon, as is shown in FIG. 1. The cord **24** extends through a preferably elongated opening **26** defined within the raised wall portion **10***a* formed in the housing **10** in radial alignment with the drum **22** and the outer end of the cord is electrically and mechanically connected to the electric plug **28** which is provided by my invention.

Rotatably mounted within the housing **10** on a shaft **40** is a spool **42** around which is wound a Neg'ator ® spring **44**. The opposite end of spring **44** is secured to the hub **20** of the drum **22**, as by the rivet **46**. This spring is so formed that it tends to wrap itself tightly around the spool **42**. However, when the reel **22** is rotated in a clockwise direction, as by pulling the cord **24** outwardly through the opening **26**, the spring **44** is unwound from the spool **42** and is wound in a reverse direction around the hub **20**, and the length of the spring is so chosen with respect to the length of the cord that when the latter is completely unwound from the drum **22** most of the spring is unwound from the spool **42** and wound up on the hub **20**.

Under these conditions, the spring tends to rewind itself around the spool **42** and in doing so exerts a torque tending to rotate the drum **22** in a counterclockwise direction, and when the drum is released the spring causes it to rotate in this direction so as to retract and wind up the cord **24**. Due to the nature of the spring **44**, as above mentioned, the torque exerted thereby is the same, regardless of the amount of spring remaining on the spool **42**, throughout the entire rewinding operation. The more the cord is rewound, the less friction there is between the remaining unwound portion of the cord and the surface, usually the floor, across which it is dragged during the rewinding and hence there is a tendency for the winding drum to increase its speed of rotation. This means that the cord is traveling at a maximum speed, which may amount to 20 miles per hour, when it becomes fully rewound. Also, practically all of the cord being wound on and rotating with the drum, the mass and inertia of the latter is at a maximum, and experience has proved that if a conventional plug is relied upon to stop the drum **22**, the resulting shock is sufficient to sever the plug from the cord after a relatively few operations.

A cross-sectional view, somewhat enlarged, of the electric plug **28** in accordance with my invention is shown in FIG. 3. In this view the cord **24**, having the plug **28** at one end, is illustrated as being retracted toward, but not having reached, the cordwinder housing **10**.

As illustrated, the plug **28** is comprised of: a body **30** molded from a suitable elastomeric material such as vinyl plastic, rubber, or the like; a shock-absorbing disc-like collar **32** integrally formed with the body **30** and being of the same elastomeric material; the pair of contact elements **34**, or blades, embedded in the body **30** and connected with the conductors **36** which are within the jacket **38** of the cord **24**; and the strain relief member **46** which is firmly crimped about a short length of electrical insulating tape **48** which has been wrapped around and bonded to the cord's jacket **38**.

To achieve the plug and cord assembly shown in FIGS. 3 and 4 the bared copper strands of the two conductors **36** are electrically connected to the respective blades **34**. Afterward the adhesive insulating tape **48** is wrapped around the end portion of the jacket **38**. Then the metallic strain relief element **46** is crimped around the tape **48** and exerts a relatively high pressure on the cord's jacket **38**. Thus, a strong mechanical connection between the jacket **38** and element **46** is assured and, advantageously, the tape **48** protects the jacket **38** from being pierced by the metallic strain relief element **46** during the crimping operation.

As indicated in FIGS. 3 and 4 the relief element **46** has a projecting element **46***a* integrally formed therein. This element **46***a* may have a generally semicircular cross-section and serves the purpose of transmitting a pulling force applied to the cord jacket **38** directly to the body portion **30** of the plug.

As shown in FIG. 4 each of the blades **34** is formed by bending part of a long blade element back on itself and further bending a portion of the blade element to form a projection **34***a* which is directed at a right angle to the blade **34**. These projections **34***a* also serve as strain relief elements; i.e., they transmit pulling forces applied to the blades **34** when the plug is pulled out of a female receptacle directly to the body portion **30** of the plug.

After assemblying the taped cord, blades and strain relief elements, in the manner hereinbefore described, the entire assembly is placed in a mold which conforms to the shape of the plug's body **30** and shock absorbing collar **32**. Thereafter the mold is filled with a substance which when cured has suitable elastic properties; e.g., vinyl plastic, rubber, or the like.

FIGS. 1, 2 and 4 show how the collar **32** deforms to absorb shock when the plug **28** strikes the wall **10***a* of the housing **10**. As a result of the collar's bending (FIG. 4) a relatively small part of the impact force is transmitted to the plug's body **30** and, therefore, the connection between the cord **24** and the plug body **30**, effected by the strain relief element **46**, receives a minimal inpact force.

As is shown in FIGS. 3 and 4 there is provided a sufficient space between the face **30***a* of the body **30** and face **32***a* of collar **32** so that at high impact forces the face **32***a* of the collar can bend toward face **30***a* through a substantial arc without touching face **30***a*. in fact in the particular embodiment shown at FIGS. 3 and 4 a portion of the face **32***a* could bend until it about lies flat on the surface **30***b* of body **30** without touching the face **30***a* at all.

While I have shown one more or less specific embodiment of my invention, it is to be understood that this has been done for the purpose of illustration only and that the scope of my invention is not to be limited thereby, but is to be determined from the appended claims.

What I claim is:

1. An electrical connector adapted for use with an electric cord which includes a plurality of conductors situated within a tubular dielectric jacket and is arranged for retraction into a cordwinder housing through an opening in the housing by being wound on a drum in the housing by a substantially constant torque spring motor which rotates said drum, said connector comprising an elastic body of dielectric material, a plurality of electrical contact elements, each contact element having a terminal portion thereof embedded in said body and connected to a different one of said conductors, a strain relief element secured to an end section of the cord's jacket and embedded together with said end section in said body, said body including an integral elastic collar portion near that end of the body which receives said cord, said collar portion extending radially outward from the surface of said body and being normally disposed in a plane which is perpendicular to the longitudinal centerline of the cord, said collar portion being larger than said opening in the housing so that at the instant said cord is fully retracted into the housing said collar portion contacts that portion of the housing adjacent said opening, arresting retraction of the cord, and flexes toward the surface of said body thereby absorbing the impact of said contact whereby a relatively small force is transmitted through said body to the strain relief element effecting the connection between the cord and the body.

2. A male electric plug for an electric cord which has a plurality of conductors situated within a tubular dielectric jacket and is arranged for retraction into a cordwinder housing through an opening in the housing by being wound on a drum in the housing by a substantially constant torque spring motor which rotates said drum, said male plug comprising an elastic body of dielectric material, a plurality of blades protruding from said body, each blade having a terminal portion thereof embedded in said body and connected to a different one of said conductors, a strain relief element secured to an end section of the cord's jacket and embedded together with said end section in said body, said body including a relatively thin elastic annular collar portion near that end of the body which receives said cord, said collar portion extending radially outward from the surface of said body and being normally disposed in a plane which is perpendicular to the longitudinal centerline of the cord, said collar portion being larger than said opening in the housing so that at the instant said cord is fully retracted into the housing said collar portion contacts that portion of the housing adjacent said opening, arresting the cord's retraction, and flexes toward the surface of said body thereby absorbing the impact of said contact whereby a relatively small force is transmitted through said body to the strain relief element effecting the connection between the cord and the body.

3. An electrical connector adapted for use with an electric cord including a plurality of conductors situated within a tubular dielectric jacket, said cord being adapted for retraction into a cordwinder housing through an opening in the housing by being wound on a drum in the housing by a substantially constant torque spring motor which rotates said drum, said connector comprising: an elastic body of dielectric material havinge two axially-aligned contiguous body portions of different cross-sectional areas and a thin elastic annular disc integral with and extending radially outward from the body portion having the smaller cross-sectional area, said contiguous body portions defining at their juncture an annular wall surface which faces said disc, said disc being spaced from said wall surface by a distance which is sufficient to permit the disc to flex toward said wall surface and make contact with the surface of the body portion with which said disc is integral without touching said wall surface, a plurality of electrical contact elements, each contact element having a terminal portion embedded in the body portion having the larger cross-sectional area and connected to a different one of said conductors, and strain relief means secured to an end section of said jacket and embedded together with said end section in said body, said strain relief means being embedded in both body sections whereas the substantial portion of said end section is embedded in the body section of smaller cross-sectional area; said disc being normally disposed in a plane which is perpendicular to the longitudinal centerline of the cord and being larger than said opening in the housing so that at the instant the cord is fully retracted into the housing said disc contacts that portion of the housing adjacent the opening, arresting the cord's retraction, and flexes toward said annular wall surface thereby absorbing the impact of the contact whereby a relatively small force is transmitted through said body to the strain relief means which effects the connection between the cord and body.

4. In combination with an electric cord including a plurality of conductors situated within a tubular dielectric jacket, said cord being adapted for retraction into a cord-

winder housing through an opening in the housing by being wound on a drum in the housing by a substantially constant torque spring motor which rotates said drum, an electrical connector receiving an end of the cord, said connector comprising an elastic body of dielectric material, a plurality of electrical contact elements, each contact element having a terminal portion thereof embedded in said body and connected to a different one of said conductors, a strain relief element secured to an end section of the cord's jacket and embedded together with said end section in said body, said body including an integral elastic collar portion near that end of the body which receives said cord, said collar portion extending radially outward from the surface of said body and being normally disposed in a plane which is perpendicular to the longitudinal centerline of the cord, said collar portion being larger than said opening in the housing so that at the instant said cord is fully retracted into the housing said collar portion contacts that portion of the housing adjacent said opening, arresting the cord's retraction, and flexes toward the surface of said body thereby absorbing the impact of said contact whereby a relatively small force is transmitted through said body to the strain relief element effecting the connection between the cord and the body.

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