Jan. 25, 1966 R. J. KILBURG 3,231,850

ELECTRICAL CONNECTOR

Filed Oct. 7, 1963 2 Sheets-Sheet 1

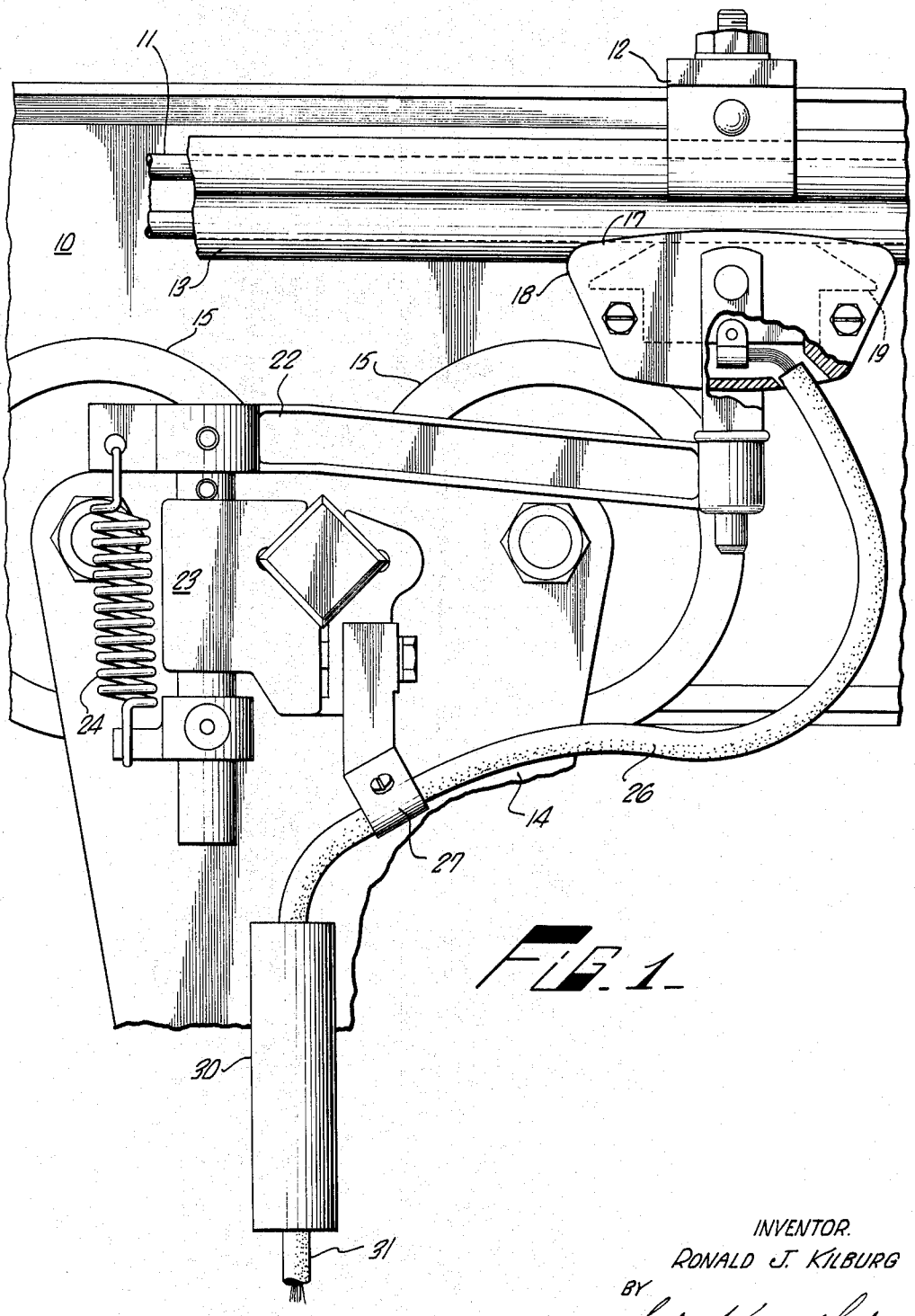


FIG. 1

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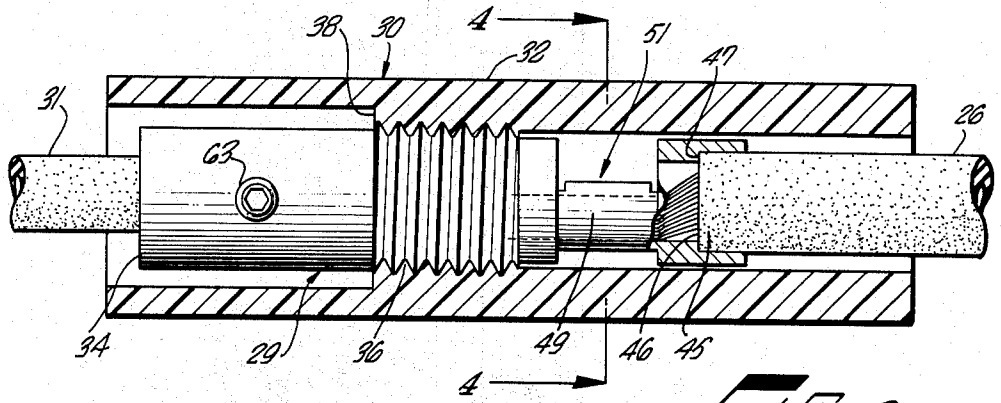


FIG. 2

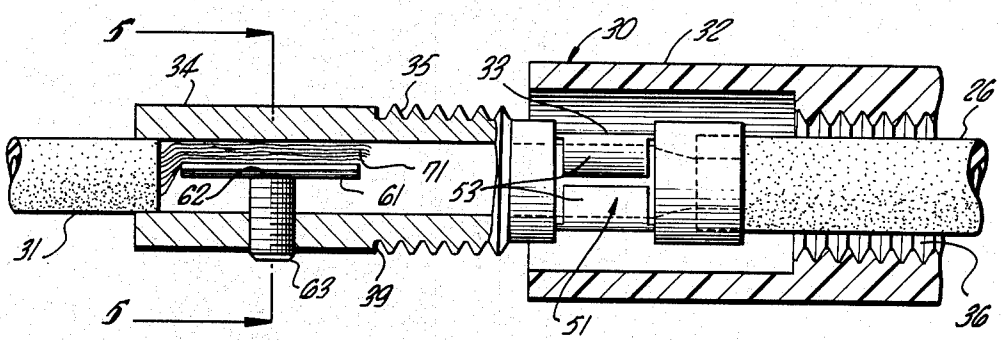


FIG. 3

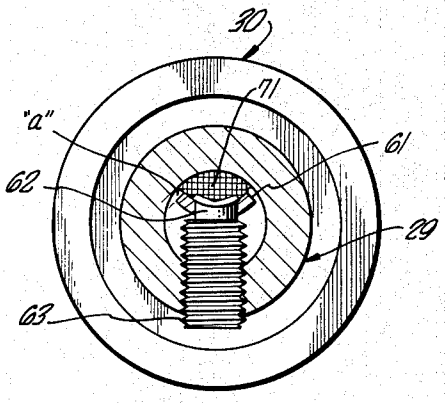


FIG. 5

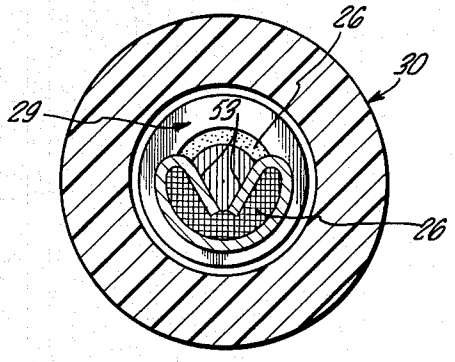


FIG. 4

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3,231,850

ELECTRICAL CONNECTOR

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2 Claims. (Cl. 339—213)

This invention relates generally to connectors and more particularly to connectors for electrically joining multi-strand wire cables of different sizes.

In systems in which electrification systems are used to transfer current mobile power and control circuits, it is necessary to provide some means for connecting such external circuits to the collector head of the system. Previously, this hook-up has been accomplished by the user wiring his own multi-strand power cable into a terminal block forming an integral part of the current collector means or by connecting it directly to the head and taping it to parts of the collector means.

One of the disadvantages of allowing a customer or user of an electrification system to connect his own power cable directly to the contact shoe of the current collector is that he will often fail to take into account the extreme conditions under which such electrification systems usually operate. The contact shoe which runs along the fixed conductor bar of the system must have freedom to move in all directions; therefore, any cable connected from the shoe to a power control circuit must withstand large bending and vibrational stresses.

In order to compensate for these extreme but normal operating conditions, mobile systems should be provided with extra-flex, multi-strand cables which are designed to absorb the generated energy properly. In too many cases, however, relatively inflexible cable is connected to the shoe. Not only do such cables tend to fatigue and break after a short period of time but inflexible cables will cause the operation of the electrification systems to be degraded.

Then, too, because such systems more often than not use a plurality of collector head assemblies associated with a series of conductor bars which are mounted in close proximity to one another, the cables connecting the power and control circuits to the respective collector heads should be dressed and maintained in fixed planes to avoid lateral interference. Failure to do this results in the degeneration of the operation of the entire electrification system.

To cope with these problems, a simple connector has been devised to accept one end of an extra-flex cable which is connected at its other end to the collector head and selected to insure proper operation of the overall mobile system. Moreover, the connector destructably clamps the extra-flex cable to discourage users from connecting relatively inflexible cables to the collector head.

The principal objects of the present invention, therefore, are to provide an insulated electrical connector that is easy to fabricate, economical to manufacture, simple in operation, and which will accept, within limits, different size cables.

A more specific object of the invention is to provide an electrical connector for use with electrification systems of the type described which is destructibly connected to the electrification system pigtail cable at one end and impermanently connected to the cable of a remote power and control circuit at its other end—all to the end that the electrification system will operate satisfactorily.

In a preferred embodiment of the present invention, an extra-flexure cable is connected between the collector shoe of the electrification system and the destructible end of the connector forming the subject matter of the instant invention. The means by which the connector secures

the pigtail cable and the power and control circuit cable form a material part of the instant invention.

The exemplary embodiment of the electrical connector has three principal features. First, at one end means are provided for properly positioning the stripped end of the pigtail cable interior one end of the connector immediately adjacent a pair of flanges formed by an interior section of the body of the connector. These flanges are destructibly moved inwardly in the normally tubular body to clamp the pigtail wire against an inside wall of the tube. Second, in the other end of the connector there is provided a pad with externally controllable means for adjusting its movement transverse to the longitudinal axis of the connector body so that it will act to grip the ends of a stripped cable from a power and control circuit between the pad and an inner surface of the body. And third, an insulating cover is provided for threadedly or otherwise over-riding the connector body to insulate it from external effects or contact by personnel using the system or power and control circuits associated with it.

Broadly, the present invention is an insulated connector for electrically joining cables which combines crimping means to lock one cable interior of the connector and means to impermanently secure another cable interior thereof.

These and other objects, advantages and features of the present invention may be more fully understood when the following detailed description is read with reference to the drawings in which:

FIG. 1 illustrates the component parts of an exemplary electrification system including the electrical connector forming the subject matter of the present invention;

FIG. 2 is a partial cross-sectional view of the electrical connector;

FIG. 3 is a plan view of the connector of FIG. 2;

FIG. 4 is a section view taken along line **4—4** of FIG. 2 showing the end of the connector in which the pigtail assembly of the electrification system is destructibly and permanently connected; and,

FIG. 5 is a section taken along line **5—5** of FIG. 3 illustrating the construction of the movable pad and adjusting means therefor.

Looking generally to FIG. 1, a typical electrification system can be seen to include one or more conductor bars **11** of generally figure 8 cross-section and one or more current collector means or assemblies **17** supported to slidably contact the conductor bars. The conductor bar **11** is mounted on an I-beam track by hanger clamps **12** and the current collector **17** is mounted on a carriage **14** which is moveable along the track. All but one longitudinal surface of the bar **11** is normally covered with an insulating sheath **13**.

The current collector means **17** includes a contact shoe **19** supported by a collector head **18** which is connected to one end of an arm **22**. The arm **22** in turn is pivotally connected at its other end to a collector base **23**. A collector spring **24** urges contact shoe **19** against the exposed surface of the collector bar **11**.

The pigtail assembly of the collector means includes the extra-flex pigtail cable **26**, the anchor or loop clamp **27** attaching it to the collector base and connector **30**.

An example of an extra-flex cable satisfactory for use with an electrification system capable of handling a 100-ampere load is the No. 4 cable manufactured by the Simplex Wire and Cable Company of Cambridge, Massachusetts. This cable has 1078 strands of No. 34 wire and insulating cover rated at 600 v.

The operation of this electrification system can be described briefly. Assembly **17** is restricted to move along the path of the collector or current bar **11** but with sufficient freedom to allow side-to side and up-and-down movement. Because of this multidegree of freedom move-

ment of the collector head and shoe member, the cable **26** is subjected to a substantial amount of flexing.

Bending stresses build up at the point of attachment to the contact shoe **19**, at the anchor or loop clamp **27**, and adjacent the connector **30**.

In many cases the customer or user of such electrification systems will connect his own cable **31** to the collector head **18**. If it is not the proper type of cable, fatigue will shortly cause the cable insulation and/or wire to break. This will require the service to be interrupted while the entire carriage assembly is removed from the track so that the cable connected to the lower part of collector head **18** can be replaced.

The present invention provides a ready means for connecting the power and control circuit cable **31** to the system without endangering its proper operation. Looking more particularly to FIGS. 2 through 5, connector **30** is shown to include a generally tubular body member **29** and an insulating cover **32** captured on the flexible cable **26**.

Tubular body member **29** includes a reduced section **33** at one end and an enlarged section **34** at its other end. Intermediate or towards the inner side of the enlarged portion **34** is a threaded portion **35** adapted to receive threads **36** formed inside of the insulating cover **32**. With threaded sections **35** and **36** in mating relation, the insulating cover **32** completely encompasses the connector body **29** thereby preventing contact with the connector body itself.

It will also be noted that the insulating cover or sleeve **32** has a shoulder **38** at the left edge (with respect to the left side of the FIG.2 drawing) of threads **36** which will abut a shoulder **39** on the connector body **29** to prevent further movement of the insulating cover to the left. The cover **32** is adapted to move from left to right to expose the connector body **29** but it cannot be moved beyond the connector body in the direction of the customer's cable **31**. The insulating cover **32** is movable along the pigtail cable **26** so that the connector can be connected to customer's cable and so that it cannot be lost.

The connector body **29** is hollow in the exemplary embodiment, but it is only necessary that it be partially apertured to encompass the sheath of the pigtail cable **26**. When the end **46** of the sheath on the cable **26** abuts shoulder **47**, formed interior of the connector body **29**, it positions the stripped portion **49** of the pigtail cable **26** immediately under the section of the connector generally designated as **51**.

The crimping section or means **51** for the pigtail cable **26** is formed by cutting a pair of more or less rectangular flanges **53** in one section of the connector body **29**, as particularly illustrated in FIG. 3. With the stripped end **49** of the cable **26** positioned directly under the flanges **53**, they are displaced interior of the connector body **29** to force the stripped end of the cable **26** against an inner wall of the body **29**. By driving the flanges **53** inwardly, it is difficult if not impossible to substitute cables.

At the other end of connector body **29** there is provided a pressure pad **61** disposed generally along the longitudinal axis of the connector body **29**. It generally has an arcuate shape, as particularly illustrated in FIG. 5. The pad **61** is apertured on its concave side to receive a flanged end **62** of an Allen set screw **63** or the like, which acts as a universal or ball joint. Set screw **63** is threaded through the side of connector body **29** so that pad **61** may be externally moved against an inside surface of the connector body **29** to grasp a wire therebetween.

It will be noted that the arcuate configuration of the pressure pad (see FIG. 5) is such that the distance marked *a* between the edge of the pressure pad and the interior surface of the connector body **29** is too small for the end **71** to normally move therebetween. Hence, it cannot become lodged between the threads of the set screw and an interior wall of the connector body **29**. This assures that the pressure pad **61** always acts positively against the stripped end **71** to force it against an inside surface of body connector **29**.

Normally, electrification systems such as those described briefly above have current collectors for different service loads. This being the case, the size of the opening in the end of the connector that receives the cable from a remote power consuming device can be proportioned to accept cables up to the rated capacity of the collector means but not beyond. By this means, it is possible to substantially prevent users from overloading the collector means of the system.

While the present invention has been described with reference to an exemplary embodiment, it should be understood that various other configurations and modifications can be envisioned by those skilled in the art without departing from the spirit and scope of the present invention.

What is claimed is:

1. A connector for joining electrical cables comprising, in combination,

a body member having two ends,

first and second insulated cables having one set of their ends stripped of their insulating sheaths,

one end of said body member having a first opening formed therein to accept the sheath of said first cable,

a shoulder formed longitudinally interior of said first opening to stop the interior movement of the insulating sheath of said first cable,

said one end also having at least one flange formed of a section of said body member intermediate said ends,

said flange movable interior of said body member to irreversibly and securely hold the stripped end of said first cable,

the other end of said body member having a greater external cross-section than said one end and having an opening therein adapted to accept the sheath of said second insulated cable,

a movable pressure pad interior of said other end,

means cooperating with said body member externally operable to move said pad into abutting relation with an inner wall of said body member, and a hollow elongate insulating cover captured on said cable by said body member and adapted to slide over said body member to fully enclose said body and prevent external contact therewith.

2. A connector for joining electrical cables of different wire sizes comprising, in combination,

a hollow metal connector body having a longitudinal axis therethrough and two end portions, one end portion of reduced external cross-section;

first and second insulated cables having one set of their ends stripped of their insulating sheaths;

said second cable having a preselected diameter not necessarily the same as that of said first cable;

the one end portion of said body adapted to accept the sheath of said first cable;

a shoulder longitudinally disposed interior of the first end portion to stop the interior longitudinal movement of the insulating sheath of said first cable;

said first end also having transversely oriented flanges formed intermediate said two end portions and movable interior of said body to irreversibly and securely hold the stripped end of said first cable against a wall of said connector body;

the other end portion of said connector body having a greater external cross-section than said one end and having an opening therein adapted to accept the sheath of said second insulated cable even when it is of a different diameter than said first cable;

a movable pressure pad having a pre-selected width disposed along said longitudinal axis interior of said other end;

locking means externally operable to move said pad

transversely into abutting relation to an inner wall of said connector body;

the width of said pad pre-selected to prevent the wire of said second cable that is to be secured between the pad and an interior wall of said body from lodging between the pad and said locking means;

a series of threads formed on the outer surface of the larger cross-section part of said body member intermediate said two ends; and,

a tubular insulating cover longer than the connector body and adapted to fit over it,

said cover having threads formed along an intermediate interior portion thereof to engage the threads on said body member when the cover fully surrounds said connector body and an internal shoulder to abut a part of said other end portion immediately adjacent the external threads on said connector body so that the cover cannot be moved longitudinally over said other end portion.

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