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(54) IMPROVEMENTS IN AND RELATING TO FLUID  
 CONDUIT AND ELECTRICAL CONNECTING ASSEMBLY

(71) We, DAYCO CORPORATION, an American Corporation organized under the laws of the state of Delaware, United States of America, having its principle place of business at 333, West First Street, Dayton, Ohio 45402, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a fluid conduit assembly suitable, for example, for a tank or cannister type vacuum cleaner. Many vacuum cleaners employ a fluid conduit assembly connected to a suitable tank at one end and a cleaning tool, or the like, at the other end and with such cleaning tool often comprising a device, such as a cleaning brush which is powered by an electric motor.

Fluid conduit assemblies proposed heretofore and used with tank type vacuum cleaners have mating electrical components which are easily separated and disconnected during normal operation of their associated vacuum cleaners. Accordingly, the need exists for a simple and economical fluid conduit assembly which may be used in tank type vacuum cleaners, or the like, and which employs electrical components which are locked together during use so as to prevent their inadvertant separation.

According to the present invention there is provided a fluid conduit assembly comprising a first and a second conduit constructed to be connected and disconnected, a first electrical connecting device carried by the first conduit, a second electrical connecting device carried by the second conduit, and axially operating locking means locking the electrical devices together with the first and second conduits connected, said locking means providing that an axially applied force sufficient to effect connection

is substantially less than that axial force required to effect disconnection, said disconnection being effectable by axial force alone, said locking means assuring electrical continuity through the devices even when forces tending to pull said devices apart are exerted.

Following is a description by way of example only and with reference to the accompanying drawings of methods of carrying the invention into effect.

In the drawings:—

Figure 1 is a perspective view with parts in cross section, parts shown schematically, and parts broken away illustrating a vacuum cleaning apparatus which employs an exemplary fluid conduit assembly of this invention;

Figure 2 is an enlarged vertical cross-section taken through a hose connector and female electrical connecting device of Figure 1 and showing a side view of a male electrical connecting device minus its associated supporting or carrying conduit prior to installing such male connecting device in position within the female electrical connecting device;

Figure 3 is a view similar to Figure 2 particularly illustrating a transverse cross-section through the female electrical connecting device of Figure 1 taken 90 degrees from the plane of the cross-section of Figure 2 and showing a bottom view of the male connecting device;

FIG. 4 is a view similar to FIG. 3 again minus the conduit which carries the male connector device and illustrating the electrical connector devices connected and locking means thereof holding such devices locked together;

FIGS. 5 and 6 are views similar to FIGS. 3 and 4 respectively, illustrating another exemplary embodiment of a conduit assembly of this invention and another embodiment of locking means for electrical

devices thereof;

FIGS. 7 and 8 are views of a pair of modified electrical connector devices each of which may be used in lieu of the male

5 electrical connector device of FIGS. 5 and 6.

Reference is now made to FIG. 1 of the drawings which illustrates a tank or canister type vacuum cleaning apparatus 20 which employs one exemplary embodiment 10 of a fluid conduit assembly of this invention which is designated generally by the reference numeral 21. The apparatus 20 has a suitable tank 22 which is provided with a vacuum tube 23 extending therefrom 15 which is adapted to have the fluid conduit assembly suitably detachably connected thereto at 24 in a manner which is well known in the art. The apparatus 20 is provided with electrical power for operating 20 a vacuum unit thereof from a suitable power source and in a manner which is well known in the art and thus such vacuum unit and power source are not shown. The apparatus 20 has a female electrical receptacle 25 25 mounted on its tank 22 and the receptacle 25 supplies power through a suitable electrical cord 26 to electrical means comprising the conduit assembly 21 and the electrical means in the conduit assembly supplies 30 electrical power to an electric motor 30 provided at the terminal end of the assembly 21 and such motor is used to operate a cleaning brush or other suitable cleaning instrument.

35 The conduit assembly 21 comprises a first conduit 31 and a second conduit 32 which will be described in more detail subsequently. The conduit assembly 21 has a first electrical connector device 34 carried by the conduit means 31 (see FIGS. 2-4) and a 40 second electrical connector device 35 carried by the conduit means 32. The assembly 21 has locking means 36 and 45 which assures electrical continuity through the devices 34 and 35 even upon exerting forces tending to pull the conduit means 31 and 32 apart and in this example of the invention, even upon exerting forces on conduit means 31-32 45 which are parallel to a longitudinal axis 37 at the area of junction of the conduit means 31-32 and tending to pull the electrical connector devices 34 and 35 apart.

The first conduit means 31 is in the form of a flexible hose assembly and will also be 55 referred to as hose assembly 31 hereinafter; and such hose assembly is comprised of a flexible polymeric hose 40 and a collar 41 which is suitably fixed to an end portion of the hose 40. In this example of the invention, the collar 41 is in the form of a hose 60 connector 41 which is made of a polymeric material and is bonded to the polymeric hose 40 as an integral part thereof. The collar or hose connector 41 has a pair of 65 shoulders each designated by the same

reference numeral 42 defined therein and the shoulders 42 comprise part of an opening or recess 43 which is adapted to receive the electrical connector device 35. The shoulders 42 in this example are disposed 70 transverse the axis 37 and preferably are disposed perpendicular to such axis.

The electrical connector device 35 is in the form of a male electrical plug 35 having a pair of electrical wires or leads 44 suitably 75 mechanically and electrically connected thereto. The device 35 also has a pair of yielding resilient shoulders each designated by the reference numeral 45 provided thereon and in the process of moving the device 80 35 within the recess 43, the shoulders 45 are compressed inwardly as indicated by the dotted lines at 46 in FIG. 3 and as a terminal end surface 47 of the device 35 bottoms against a cooperating surface 48 85 within the connector 41, the shoulders snap outwardly so that tip portions of inclined surfaces 49 thereof engage the shoulders 42. The snap action provided by the shoulders 45 is due to the fact that the device 35 is 90 made of a compressible resilient polymeric material in which the cooperating shoulders 45 are defined thereon as an integral part thereof.

The connector device 35 is in the form 95 of a male connector device having a pair of pins 50 extending therefrom. The connector device 34 is in the form of a female connector device having a pair of tubular members 51 and the tubular members are embedded 100 within the polymeric material defining the hose connector 41. Upon connecting and locking the electrical connector devices 34 and 35 together, as indicated, above the pins 50 are received within the 105 tubular members 51 and provide a firm electrical connection while the locking action is provided by the shoulders 45 springing into position against the shoulders 42 of the hose connector 41. 110

The tubular members 51 comprising the female connector 44 are suitably fixed to associated electrical leads or wires each designated by the same reference numeral 52 in FIG. 2 of the drawings; and, it will 115 be appreciated that the electrical wires 52 may be in the form of spring wires which serve both as electrical conductors and as means holding the comparatively thin 120 tubular portion of the polymeric hose 40 against collapse and in a well known manner.

The hose connector 41 with its female electrical connection device 34 is provided at one end of the flexible hose assembly 31; 125 and, it will be seen that the connector 41 has a tubular inlet 53 provided with an annular groove 54. The conduit means 32 comprises a comparatively rigid tubular portion 55 which is adapted to be received 130

in the inlet 53 and the tubular portion has an annular bead or convolution 56 therein which is nested within the groove 54 and assures the conduit means 32 is held firmly in position during operation of the apparatus 20.

The conduit means or flexible hose assembly 31 also has a hose connector 57 at its opposite end which has a comparatively rigid tubular portion 58 suitably fixed thereto and the portion 58 is adapted to be detachably connected to the vacuum tube 23 extending from the tank 22. Further, the hose connector 57 may also be made of a polymeric material similar to the connector 41 and may have suitable electrical connector means embedded therein with such connector means being adapted to receive a mating connector of the electrical cord 26.

In this disclosure of the invention it will be seen that in FIGS. 2-4 of the drawings the conduit means 32 of the conduit assembly 21 has not been shown except for the electrical connection device 35 of such conduit means 32 and this has been achieved for ease of drawing presentation; however, it is to be understood that the conduit assembly 21 is comprised of fluid conduits 31 and 32.

Other exemplary embodiments of the fluid conduit assembly of this invention are illustrated in FIGS. 5-8. The fluid conduit assemblies illustrated in FIGS. 5-8 are similar to the fluid conduit assembly 21; therefore, such conduit assemblies will be designated by the reference numeral 21A in FIGS. 5-8, respectively and component portions of each conduit assembly which are similar to corresponding portions of the assembly 21 which will be designated in the drawings by the same reference numerals as in the assembly 21 (whether or not such component portions are mentioned in the specification) followed by the associated letter designation A and not described again in detail. Only those component portions of each conduit assembly which are different from corresponding portions of the conduit assembly 21 will be designated by a new reference numeral also followed by the associated letter designation and described in detail.

As in the case of the conduit assembly 21, it will be seen that in each embodiment of the invention the fluid conduit means corresponding to the conduit means 32 of assembly 21 is not shown interconnected with its corresponding hose connector; however, it is to be understood that fluid conduit means similar to conduit means 32 and associated component portions is in each instance connected to a hose connector similar to connector 41. Accordingly, assembly 21A is defined by hose assembly 31A and conduit means 32A.

In the conduit assembly 21A of FIGS. 5-8, the tubular member 51A has slot means 59A defined therein, such slot means being provided with edge means or rear edges 60A. In addition, each of the pins 50A of the electrical male connector device 35A has a pair of wedge-shaped portions 61A extending from diametrically opposite side edges thereof and the male connector plug 35A is of rectangular outline and is received within a corresponding opening in the hose connector 41A which is also of rectangular peripheral outline and is designated by the reference numeral 62A.

The locking means of conduit assembly 21A is designated by the reference numeral 36A and is defined by the wedge-shaped portions 61A being received within the slot means 59A and once received therewithin, transverse surface portions 63A provided on the wedge-shaped portions 63A are received in locking engagement against edges 60A comprising the slot means 59A and lock the male connector plug 35A in position. Accordingly, the locking means 36A is defined by parts of components which provide the electrical contact and electrical continuity between the electrical connector devices of assembly 21A and in particular are provided by portions of the female connector device 34A and the male connector device 35A.

Modifications of the locking means of FIGS. 5 and 6 are illustrated in FIGS. 7 and 8. In FIG. 7, it will be seen that the male connector plug 35A has pins 50A provided with diametrically arranged barb-like portions 64A extending from diametrically opposite locations thereof and the barb-like portions are adapted to be received within the slot means 59A and held in locking engagement by inclined surface portions 65A thereof engaging the edges 60A provided on the tubular members 51A comprising the female connector device 34A. In FIG. 8, the male connector plug 35A has pins 50A provided with enlarged substantially frustoconical head portions 66A and the head portions 66A are adapted to be received within the tubular members 51A in a wedged manner. The slot means 59A provided in each tubular member 51A allow radially outward expansion of a tubular member 51A once a frustoconical portion 66A is pushed therein and once a pin 51A and head portion 66A are pushed in position surface portions 67A of portions 66A prevent withdrawal of the pin 50A and hence its male connector plug 35A.

The hose assemblies 31 and 31A with their various hose connectors may be made of any suitable polymeric material known in the art. The electrical connectors may have any suitable material comprising their electrically conducting portions and their

non-conducting or insulating portions may be made of a suitable polymeric material. Any suitable polymeric material may be used such as high molecular weight polymers including but not being limited to polyvinyl chloride, polyethylene, polypropylene and nylon.

While present exemplary embodiments of this invention, and methods of practicing the same, have been illustrated and described, it will be recognized that this invention may be otherwise variously embodied and practiced within the scope of the following claims.

#### WHAT WE CLAIM IS:

1. A fluid conduit assembly comprising, a first and a second conduit constructed to be connected and disconnected, a first electrical connecting device carried by said first conduit, a second electrical connecting device carried by said second conduit, and axially operating locking means locking said devices together with said first and second conduits connected, said locking means providing that an axially applied force sufficient to effect connection is substantially less than that axial force required to effect disconnection, said disconnection being effectable by axial force alone, said locking means assuring electrical continuity through said devices even when forces tending to pull said devices apart are exerted.

2. An assembly as set forth in claim 1 in which said first conduit is a flexible polymeric hose and further comprises a collar fixed to said hose, said collar having at least one shoulder therein disposed transverse a longitudinal axis of said hose, and said second electrical device having a co-operating shoulder provided thereon, said shoulders comprising said locking means with said co-operating shoulder being constructed to be urged in locking engagement against said one shoulder in said collar.

3. An assembly as set forth in claim 2 in which said collar comprises a hose connector bonded to said polymeric hose so as to form substantially an integral part thereof, said hose connector being made of a polymeric material.

4. An assembly as set forth in claim 3 in which said first electrical connecting device comprises a female connecting device embedded in said hose connector, said hose connector serving as a support for said female connecting device and said second electrical connecting device comprises a male connecting device.

5. An assembly as set forth in claim 4 in which said male connecting device is comprised of a compressible resilient polymeric material having said cooperating

shoulder defined thereon.

6. An assembly as set forth in claim 5 in which said cooperating shoulder has a compressible apex which is constructed to be yieldingly compressed into engagement with said at least one shoulder, said compressible apex serving to yieldingly hold said male connecting device in locking engagement.

7. An assembly as set forth in claim 1 in which said first electrical connecting device is a female connecting device having a pair of tubular members and said second electrical connecting device comprises a male connecting device having a pair of pins, each of said pins being constructed to be received in an associated tubular member.

8. An assembly as set forth in claim 7 in which each of said tubular members has a slot defined therein.

9. An assembly as set forth in claim 8 in which each of said pins has at least one wedged-shaped portion therein constructed to be received in an associated slot, said wedge-shaped portion cooperating with said slot to define said locking means.

10. An assembly as set forth in claim 8 in which each of said pins has a barb-like portion thereon constructed to be received in an associated slot, said barb-like portion co-operating with said slot to define said locking means.

11. An assembly as set forth in claim 8 in which each of said pins has an enlarged substantially frustoconical head portion which is constructed to be received in an associated tubular member in wedged relation, said slot of each tubular portion allowing radial expansion thereof and receipt of said frustoconical head portion therewithin.

12. An assembly as set forth in claim 1 in which said first conduit is a flexible polymeric hose and further comprising a polymeric hose connector bonded to said polymeric hose as an integral part thereof, said first electrical connecting device comprises a female connecting device embedded in said hose connector with said hose connector serving as a support for said female connecting device, and said second electrical connecting device comprises a male connecting device.

13. A hose assembly as claimed in claim 1 and substantially as herein described with reference to any one of the accompanying drawings.

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