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PUSH-PULL CABLE ASSEMBLY

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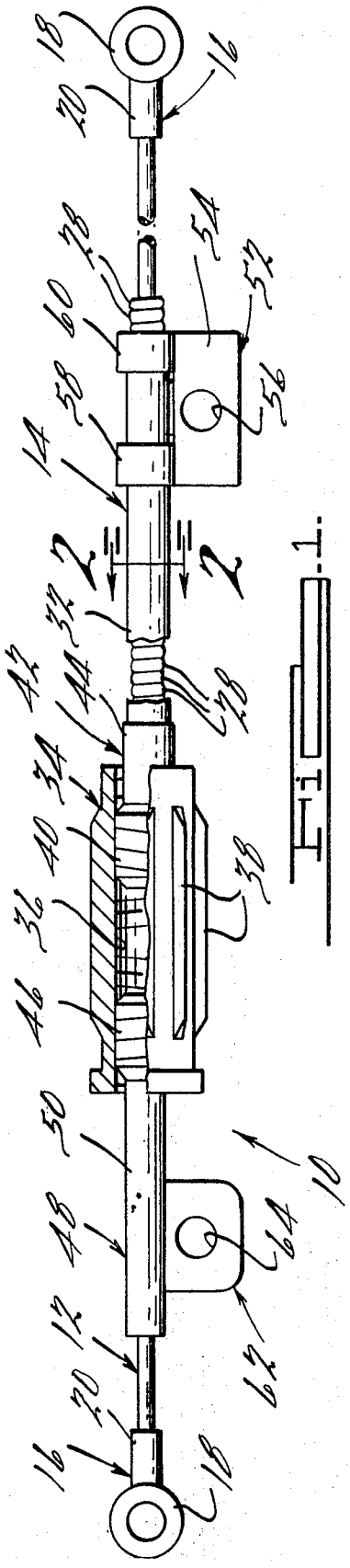


Fig. 1.

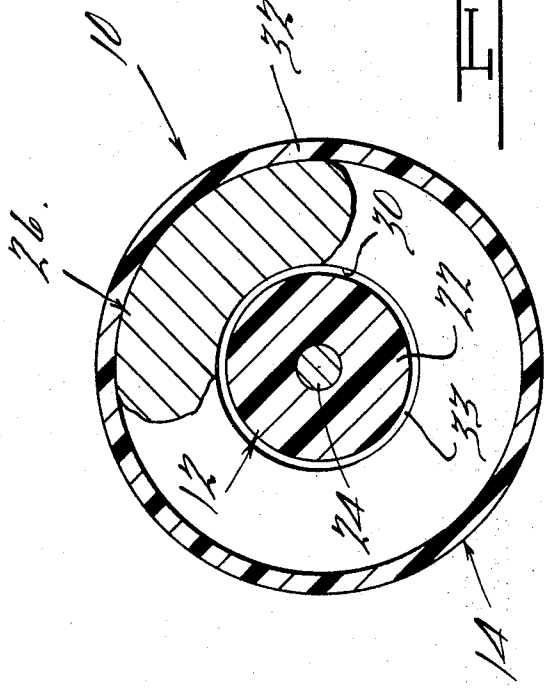


Fig. 2.

INVENTOR.
Hans B. Nielsen
BY
Harness, Dickey & Pierce.
ATTORNEYS.

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PUSH-PULL CABLE ASSEMBLY

Hans B. Nielsen, Birmingham, Mich., assignor, by mesne assignments, to Microdot Inc., New York, N.Y., a corporation of California

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ABSTRACT OF THE DISCLOSURE

A push-pull cable assembly for operating a remotely located mechanism in response to movement of an actuating device, the assembly comprising an elongted, relatively light weight cylindrically configured cable member extending between the mechanism and the actuating device; means operatively connecting one end of the cable member to the mechanism and the opposite end of the cable member to the actuating device; an elongated helically configured housing member disposed in surrounding relationship with respect to the cable member and spaced radially outwardly from the periphery of the cable member a predetermined distance, whereby the assembly may be bent to various arcuate and/or angular configurations without impairing the push-pull reciprocal movement of the cable member with respect to the housing member.

BACKGROUND OF THE INVENTION

It has heretofore been the practice in the manufacture of automotive vehicles to provide some type of linkage or connecting means for operatively connecting the various remotely located accessories, such as the vehicle heaters, air vents, etc., with the control levers or handles for actuating these accessories which are conventionally mounted on the vehicle dashboard or instrument panel. Of the various types of connecting means currently available for operatively connecting the vehicle accessories to their respective control levers, push-pull or "Bowden" type cable assemblies have become one of the most frequently used. As is well known in the art, push-pull cable assemblies conventionally consist of an elongated flexible cable member adapted to be reciprocably mounted within a relatively fixedly mounted tubular housing member, with one end of the cable member being connected to the associated operating lever on the vehicle instrument panel and the opposite end of the cable being connected to some vehicle accessory, whereby movement of the lever will effect longitudinal shifting movement of the cable member with respect to the housing, resulting in actuation or deactuation of the accessory.

Although push-pull cable assemblies of the aforedescribed type have been found to be highly preferable over a large number of various other type devices, due primarily to the low cost, ease of assembly and minimum maintenance requirements, push-pull cable arrangements have been objectionable from the standpoint that when the cables are bent or deformed into substantially acute angles, relatively free sliding movement of the cable members with respect to the associated housing becomes somewhat impaired or restricted, thereby making it extremely difficult, if not impossible, to effect longitudinal sliding movement of the cable members. Severe impairment of free sliding movement of the cable members has also frequently resulted from the fact that heretofore known and used push-pull cable assemblies have been subjected to moisture which results in objectionable corrosive adherence between the cable members and housings.

In accordance with the principles of the present invention, a new and improved push-pull cable assembly is provided which is adapted to overcome all of the aforementioned objectionable characteristics of similar type cable assemblies heretofore known and used. Generally speaking, the cable assembly of the present invention comprises an elongated, generally cylindrically shaped cable member which is fabricated of synthetic material, such as Delrin or the like, and which is designed to be supported within an elongated, generally tubular shaped housing member. In accordance with the present invention, the housing member is dimensioned such that the inner periphery thereof is spaced radially outwardly from the outer periphery of the cable member a predetermined amount, whereby the assembly may be bent or deformed to various arcuate and/or angular configurations without impairing the sliding movement of the cable member within the housing. This feature, together with the fact that the synthetic material of the cable member is not susceptible to corrosive adherence to the housing member itself, assures free sliding movement of the cable member. A further feature of the present invention resides in the fact that the housing member is provided with an external jacket which is coextensive thereof and is adapted to prevent any moisture, road dirt or the like from penetrating the housing member and accumulating interiorly thereof, thus further assuring against any impairment of the free sliding movement of the cable member within the housing.

SUMMARY OF THE INVENTION

This invention relates generally to cable assemblies and, more particularly, to a new and improved push-pull cable assembly for operatively connecting remotely located operating and actuating mechanisms.

It is accordingly a general object of the present invention to provide a new and improved push-pull cable assembly.

It is a more particular object of the present invention to provide a new and improved cable assembly of the above character which exhibits superior flexibility and low frictional characteristics.

It is another object of the present invention to provide a new push-pull cable assembly of the above character which comprises an elongated cylindrical cable member that is operatively supported within a generally helically configured housing member.

It is still another object of the present invention to provide a new and improved push-pull cable assembly as above described wherein one of the members is constructed of a light-weight polymeric resin material, whereby to minimize frictional resistance upon relative movement of the members.

It is a further object of the present invention to provide a new and improved push-pull cable assembly wherein the housing member is provided with an external moisture and dust proof jacket for preventing moisture, road dirt and the like from accumulating therewithin.

It is yet another object of the present invention to provide a new and improved cable assembly of the above type wherein the cable member is provided with an internal reinforcing member, and wherein the inner periphery of the housing member is spaced radially outwardly from the outer periphery of the cable member in order to permit bending of the assembly within predetermined limits without impairing the push-pull characteristics thereof.

It is another object of the present invention to provide a new and improved push-pull cable assembly of the above character which is of an extremely simple design, is easy to assemble and economical to commercially manufacture.

It is yet a further object of the present invention to provide a new and improved assembly of the above charac-

ter which is of an extremely durable construction and therefore will have a long and effective operational life.

Other objects and advantages of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawing:

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevational view, partially broken away, of a preferred embodiment of the push-pull cable assembly of the present invention, and

FIG. 2 is an enlarged transverse cross-sectional view taken substantially on the line 2—2 of FIG. 1.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now in detail to the drawing, a push-pull cable assembly **10**, in accordance with a preferred embodiment of the present invention, is shown as comprising an elongated, flexible and generally cylindrical shaped cable member **12** and a flexible cable housing member **14** which is of a generally tubular configuration and has the cable member **12** extend coaxially therethrough. Generally speaking, the cable member **12** is adapted to extend between and operatively connect an actuating or operating handle, lever or the like (not shown), and an operable mechanism or device such as an automobile accessory or the like (also not shown) with one end of the member **12** being connected to the actuating handle, lever, etc., and the opposite end being connected to the accessory, whereby movement of the handle will effect longitudinal movement of the cable member **12** with respect to the housing **14** and actuation of the associated accessory. Means in the form of a pair of eyelet members, generally designated **16**, may be and preferably are provided on the opposite ends of the cable member **12** for operatively connecting the member **12** to the associated handle, lever, etc., and accessory, with each of the eyelets **16** comprising a generally ring-shaped connecting section **18** and a hollow sleeve-like mounting section **20** adapted to receive one of the ends of the cable member **12** and be fixedly secured thereto by any suitable crimping operation or the like.

Referring now in detail to the cable member **12**, in a preferred construction of the present invention, the member **12** is fabricated of a polymeric resin material, herein designated by the numeral **22**, whereby to minimize frictional resistance opposing free longitudinal sliding movement of the cable member **12** within the housing **14**. One preferred polymeric resin which has been found to be highly satisfactory is Delrin, this material having desirable flexible and easily fabricatable characteristics, as well as being economical and extremely noncorrosive. It will be apparent, of course, that other resinous materials, or other flexible and noncorrosive materials that are easily moldable or adapted to be formed by well known extrusion techniques may be used in the fabrication of the cable member **12**.

The cable member **12** preferably comprises and is provided with a central reinforcing or strengthening core **24** which extends coaxially thereof and is preferably fabricated of a strong metallic wire. As will be apparent, in the operation of the assembly **10**, the core **24** functions to reinforce the cable member **12** when the same is in a state of tension, while the Delrin material **22** functions to give the cable member **12** sufficient "body" or mass and thus acts as a stabilizing means to prevent core **24** from deforming or buckling when the cable member **12** is under a state of compression.

Referring now in detail to the construction of the housing member **14**, as best seen in FIG. 1, the member **14** is shown as comprising an internal casing **26** which is formed from a single length of wire, preferably heavy gauge galvanized wire, that is wound into a series of uniform diameter, tightly oriented helical convolutions, generally designated by the numeral **28**, and which define an elongated cylindrical bore or passage **30** within which the cable member **12** is slidably disposed. The housing member **14** also comprises an external covering or jacket **32** which is preferably fabricated of vinyl or other suitable flexible and moisture-proof material that may, for example, be initially fabricated in a generally tubular configuration and surmounted around the outer periphery of the casing **26**. Alternatively, the jacket **32** may be provided on the casing **26** by dipping the casing **26** into a liquid bath of vinyl or similar material, in a manner well known in the art.

In accordance with one of the principles of the present invention, the casing **26** and cable member **12** are dimensioned such that upon assembly thereof, the periphery of the bore **30** is spaced radially outwardly from the surface of the member **12**, thereby defining an annular space, generally designated **33**, between the members **12** and **26** (see FIG. 2), which space **33** is adapted to function in a manner hereinafter to be described in providing free reciprocal or push-pull movement of the cable member **12** with respect to the housing member **14**. In accordance with still other principles of the present invention, the relative sizes of the various components of the assembly **10** are selected in a manner which has been found to maximize to the extreme, freedom of movement of the cable member **12** longitudinally of the housing member **14** when the assembly **10** is disposed in a relatively acute angular or arcuate configuration. That is, it has been discovered that when the various components of the assembly **10** are constructed such that a predetermined ratio exists between the sizes of the cable member **12**, housing member **14** and annular space **33** therebetween, the assembly **10** will exhibit especially desirable effortless operation, regardless of whether or not the assembly **10** is disposed in a linear or relatively straight configuration or, alternatively, assumes a somewhat angular or arcuate shape. More particularly, it has been found that optimum performance of the assembly **10** is achieved when the diameter of the reinforcing core **24** is equal to approximately five (5) times the radial distance or spacing **33** between the cable member **12** and casing **26**, and that when the outside diameter of the cable member **12** is equal to approximately twenty (20) times the radial spacing **33**, and the outside diameter of the casing **26** is equal to approximately forty (40) times the spacing **33**. By way of example, in a typical operational embodiment of the assembly **10** that has been found to exhibit very desirable operating characteristics, the size of the radial spacing **33** is .005 inch; with the core **24** being .024 inch in diameter; the diameter of the entire cable member **12** being .098 inch, and the diameter of the casing being .216 inch, with the wire from which the casing **26** is formed being .054 inch. It will be apparent, of course, that construction of the assembly **10** is not necessarily limited to the above described dimensions, but that optimum performance thereof, even when the assembly is arcuately or angularly disposed, will be best achieved when the various components of the assembly **10** are constructed commensurate with the aforedescribed ratio of sizes or dimensions.

In order to provide for universality of application, the push-pull cable assembly **10** of the present invention is provided with means for selectively adjusting the effective length of the housing member **14**, whereby the size (length) of the housing member **14** may be adjusted to accommodate various installations. As best illustrated in FIG. 1, such adjustment means is provided by an elongated cylindrical turnbuckle member, generally designated **34**, which defines a central coaxially extending internally threaded bore **36**. The outer periphery of the turnbuckle member **34** is provided with a plurality of longitudinally extending, circumferentially spaced serrations or ribs **38** which are adapted to facilitate manual adjustment of the member **34**. The internally threaded bore **36** of the member **34** is adapted to threadably receive at one end thereof the externally threaded, enlarged diameter head section **40** of an adjustment collar member, generally designated **42**. It will be seen that the member **42** comprises a gener-

ally cylindrically shaped sleeve section **44** which is integrally connected to one end of the head section **40** and is adapted to be fixedly secured, as by crimping or the like, around the outer periphery of the adjacent end of the housing member **14**. The adjustment collar member **42** is formed with an internal bore (not shown) through which the cable member **12** extends, whereby the cable member **12** is freely longitudinally movable with respect to the adjustment collar member **42** and member **34**. The end of the bore **36** opposite that within which the adjustment collar member **42** is mounted is adapted to threadably receive the externally threaded head section **46** of a second adjustment collar member, generally designated **48**. As illustrated, the member **48** comprises an elongated tubular configured section **50** which is integrally connected at one end thereof to the head section **46**, and together with the section **46**, is formed with an internal bore or passage (not shown) through which the end of the cable member **12** extends. As shown in FIG. 1, the internal threads at the opposite ends of the bore **36** are of opposite-hand, whereby rotation of the turnbuckle member **34** in one direction will effect threadable advancement of the head sections **40** and **46** of the members **42** and **48**, respectively, toward one another to reduce the effective length of the assembly **10**. Similarly, rotation of the turnbuckle member **34** in the opposite direction will effect threadable advancement of the head sections **40**, **46** away from one another, thereby causing an increase in the effective length of the assembly **10**. Thus, by proper rotational adjustment of the turnbuckle member **34**, the length of the assembly **10** may be selectively adjusted pursuant to various installation requirements and conditions.

The push-pull cable assembly **10** of the present invention may be and preferably is provided with one or more support means for fixedly securing the assembly **10** in some predetermined operative position. As illustrated in FIG. 1, such means is preferably provided by a suitable support bracket, generally designated **52**, which comprises a generally flat or planar mounting section **54** defining a central opening **56** adapted to receive a suitable mounting screw, bolt or the like (not shown). Integrally connected to one edge of the bracket section **54** is a pair of tab-like elements **58** and **60** which are of a circular configuration and are adapted to be positively secured to the outer periphery of the housing member **14** in a manner so as to prevent any relative movement between the bracket **52** and housing **14**. Where mounting requirements so dictate, the adjustment collar member **48** may also be provided with a mounting bracket in the form of a generally flat or planar element **62** which is formed with a central screw or bolt receiving opening **64** and is preferably integrally connected to the sleeve section **50** of the member **48**.

It will be seen from the above description, that the present invention provides a new and improved push-pull cable assembly that is of a relatively light-weight flexible construction and, as such, may be easily shaped to accommodate various mounting requirements, with the adjustment turnbuckle member **34** and associated adjustment screw members **42** and **48** providing for convenient adjustment of the overall length of the assembly **10**. By virtue of the novel provision of the annular space **33** provided interjacent the outer periphery of the cable member **12** and the inner periphery of the cylindrical passage **30**, together with the novel design of the ratio of the relative sizes of the cable member **12** and housing member **14**, the assembly **10** will be found to exhibit superior friction free operation, even though the assembly **10** may be bent or deformed to relatively extreme arcuate or angular configurations. It will be noted, of course, that although use of the assembly **10** is referred herein to operative association with automotive vehicles and in particular accessories therefore, the assembly **10** of the present invention is not intended to be limited to this specific application, since the assembly **10** will find wide and varied use in virtually all industries.

While it will be apparent that the preferred embodiment illustrated herein is well calculated to fulfill the objects above stated, it will be appreciated that the push-pull assembly **10** of the present invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. In a push-pull cable assembly for operating a remotely located mechanism in response to movement of an actuating device,

an elongated, generally cylindrically configured cable member extending between the mechanism and the actuating device,

said cable member being fabricated of a flexible plastic material,

means operatively connecting one portion of said cable member to the mechanism and another portion of the cable member to the actuating device, and

an elongated helically configured housing member disposed in surrounding relationship with respect to the cable member and comprising a plurality of helical convolutions spaced radially outwardly from the periphery of said cable member and defining therewith an annular space between said cable and housing members,

the dimensions of said housing member and cable member being such that the diameter of said cable member is approximately 20 times the radial dimension of said annular space,

whereby the assembly may be bent to various arcuate and angular configurations without impairing push-pull reciprocal movement of said cable member with respect to said housing member.

2. An assembly as set forth in claim **1** wherein said cable member has an internal steel reinforcing core coextensive thereof.

3. An assembly as set forth in claim **2** wherein the diameter of said core is equal to approximately five times the dimension of the radial spacing between the outer periphery of said cable member and the inner periphery of said housing member.

4. An assembly as set forth in claim **2** wherein the diameter of said housing is equal to approximately forty times said dimension of said radial spacing.

5. An assembly as set forth in claim **2** wherein said cable member is approximately .100 inch in diameter, wherein the outside diameter of said housing member is approximately .20 inch, wherein the radial spacing between the outer periphery of said cable member and the inner periphery of said housing member is approximately .005 inch, and wherein the diameter of said core is approximately .024 inch.

6. An assembly as set forth in claim **1** wherein said helical convolutions of said housing member are tightly oriented.

7. An assembly as set forth in claim **1** wherein said resinous material of said cable member is Delrin.

8. An assembly as set forth in claim **1** which includes an external moisture impervious jacket surrounding said housing member.

9. An assembly as set forth in claim **1** wherein said housing member comprises first and second longitudinal sections and which includes coupling means adjustably engageable with said sections for varying the effective length of said housing member.

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MILTON KAUFMAN, Primary Examiner