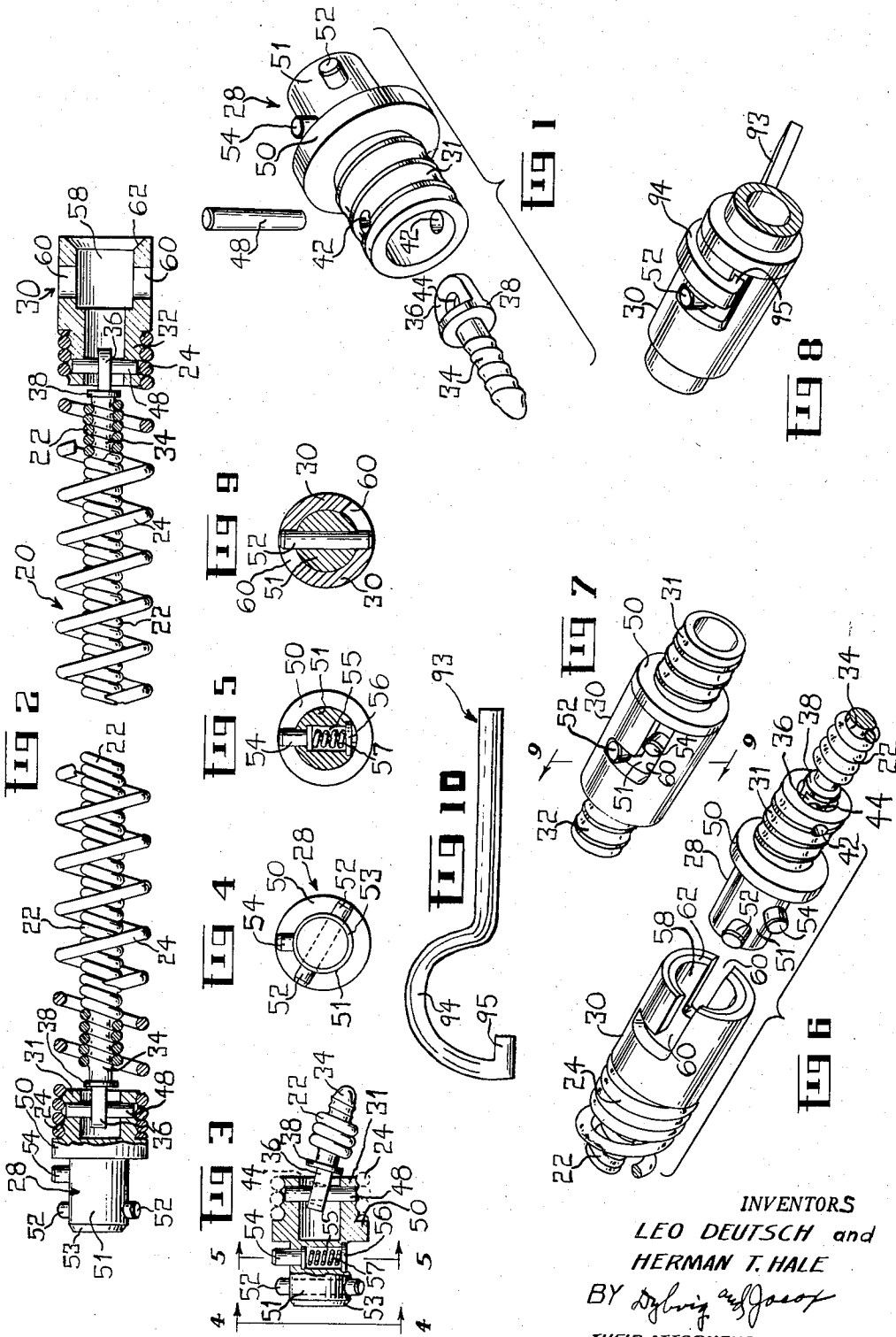


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PIPE CLEANING APPARATUS

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1

2,880,435

PIPE CLEANING APPARATUS

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12 Claims. (Cl. 15—104.3)

This invention relates to a pipe cleaning apparatus. It relates more particularly to a pipe cleaning apparatus for use in cleaning out sewer pipes. However, the invention is not so limited in that it may be used for other purposes.

This application is a continuation-in-part of our copending application Serial No. 397,364, for Pipe Cleaning Apparatus, filed on or about December 10, 1953.

It is an object of this invention to provide a pipe cleaning cable which is capable of bending easily and readily as it follows the turns and bends of a pipe into which it is inserted.

Another object of this invention is to provide a cleaning cable which does not kink and become distorted in shape when subjected to any normal torque transfer requirements.

Another object of the invention is to provide a cable for cleaning an obstruction from within a pipe, which cable is made of two helical portions so constructed that if one helical portion should break it is possible to remove the cleaning cable by means of the other helical portion.

Another object of the invention is to provide a cleaning cable for pipes which feeds foreign matter back from the point of stoppage within the pipe.

Another object of this invention is to provide a cable coupler and lock assembly for sections of cleaning cable, which coupler and lock assembly can be quickly and easily attached and detached.

Another object of the invention is to provide a cable coupler and lock assembly which firmly joins sections of cable and which assembly can easily follow the curves and bends within a pipe and thus can be readily wormed through a pipe.

Another object of the invention is to provide a universal type of connection between a cable coupler and a section of cleaning cable.

Other objects and advantages reside in the construction of parts, the combination thereof and the mode of operation, as will become more apparent from the following description.

In the drawing, Figure 1 is a perspective exploded view of a cable coupler of a pipe cleaning apparatus of this invention.

Figure 2 is a side elevational view, with parts broken away, of a section of cable with coupler means of this invention, and disclosing the connection means between the cable and the couplers.

Figure 3 is a fragmentary side elevational view, with parts broken away, disclosing the connection means of the inner and outer helical members to a cable coupler of this invention.

Figure 4 is an end view taken substantially on line 4—4 of Figure 3.

Figure 5 is a sectional view taken substantially on line 5—5 of Figure 3.

Figure 6 is a fragmentary perspective view disclosing two cable coupler sections of this invention adapted to be attached one to the other.

2

Figure 7 is a perspective view disclosing two cable coupler sections of this invention in attached relation.

Figure 8 is a perspective view showing two cable coupler sections of this invention joined one to the other and wrench means for detaching the sections one from the other.

Figure 9 is a sectional view taken substantially on line 9—9 of Figure 7.

Figure 10 is a side elevational view of a wrench which may be used for upcoupling the coupler members of this invention.

Referring to the drawing in detail, reference numeral 20 indicates generally a cleaning cable of this invention. The cleaning cable 20 comprises an elongate inner helical member 22 and an elongate outer helical member 24. The outer helical member is rigidly attached at one end thereof to a male coupler 28 and at the other end thereof to a female coupler 30 by means of threaded engagement with a hollow threaded extension 31 provided on coupler 28 and a hollow threaded extension 32 on the coupler 30. The convolutions of the outer helical member 24 which engage the threaded extensions 31 and 32 are in juxtaposed relation while the intermediate convolutions thereof are spaced apart.

The inner helical member 22 is threadedly attached to a threaded finger connector or stud 34 provided with a lug or lug head 36. The finger connector 34 is also provided with a collar 38 adjacent the lug 36. Each of the threaded extensions 31 and 32 of the couplers 28 and 30, respectively, is provided with diametrically opposed aligned apertures 42. The lug 36 is provided with an aperture 44, as shown in Figure 1. The lug 36 is adapted to be positioned within the hollow threaded extension 31 or 32 of the cable couplers 28 or 30 so that the aperture 44 of the lug 36 is in alignment with the apertures 42. A pin 48 is positioned in the apertures 42 and through the aperture 44 of the lug 36, retaining the finger connector 34 to the coupler 28 or 30. The aperture 44 of the lug 36 is considerably larger in diameter than the apertures 42 and is thus larger than the pin 48. The pin 48 fits somewhat tightly in the apertures 42. However, due to the fact that the aperture 44 of the lug 36 is comparatively large with respect to the pin 48, the lug 36 is slidably and loosely attached to the pin 48.

This provides a limited universal type of connection between the finger connector 34 and the cable couplers 28 and 30. The amount of universal movement of the connector finger 34 with respect to its cable coupler 28 or 30 is limited only by the collar 38 which is engageable with the threaded extensions 31 or 32, as clearly shown in Figure 3.

As clearly shown in Figures 2 and 3, the terminal convolutions of the outer helical member 24 cover the apertures 42 of the threaded extensions 31 and 32 after the pin member 48 has been positioned within the threaded extension 31 or 32.

Figure 2 shows a section of cleaning cable with its couplers. The couplers may be used to attach a plurality of sections in series relation one to the other according to the total length of cable required during a cleaning process. The cleaning cable 20 of this invention is adapted to be rotatively moved as it is wormed through a pipe during the cleaning process. One section of cleaning cable is added to the others within the pipe as the process proceeds. A method of rotatably driving and feeding a cleaning cable of this invention is shown and described in the aforementioned copending application Serial No. 397,364.

Both ends of the inner helical members 22 are attached to both ends of the outer helical member 24 by means of the couplers 28 and 30. As is clearly shown in Figure 2,

3

the inner helical member 22 is wound in a righthand direction while the outer helical member 24 is wound in a lefthand direction. However, it is to be understood that the winding directions of these two helical members 22 and 24 could be reversed. As a result of this arrangement, the cable 20 will not kink and twist as large torque loads are applied thereto. The reason for this is that as a torque load is applied, the outer helical member 24 attempts to bend and twist in one direction and the inner helical member 22, being wound in the opposite clockwise direction, attempts to twist in the opposite direction. The twisting force of the inner helical member neutralizes the twisting force of the outer helical member; therefore, the cable 20 remains substantially in the same shape and form within a pipe when no torque load is applied as when high torque loads are applied thereto.

Even though the cleaning cable remains in substantially the same shape and form, regardless of the torque load applied thereto, the cleaning cable 20 is very flexible due to the fact that it comprises flexible helical members 22 and 24. It is, therefore, possible to maneuver the cleaning cable through a plurality of bends and turns and angles as it follows the inner surface of a pipe during the cleaning process.

The male coupler 28 is provided with a flange 50 separating a cylindrical portion 51 from the threaded extension 31. Adjacent the end of the cylindrical portion 51 and extending diametrically therethrough and projecting therefrom is a fixed pin 52. The end of the cylindrical portion 51 is provided with a tapered portion 53.

Intermediate the fixed pin 52 and the flange 50 is a locking pin 54. The locking pin 54 is disposed in a plane substantially parallel to the plane of the pin 52, but the locking pin 54 is angularly disposed with respect to the pin 52. The locking pin 54 is recessed in a cavity 55 which is closed by a cover 56. The cavity 55 contains a spring 57 which biases the locking pin 54 outwardly, as best shown in Figures 3 and 5.

The coupler 30 is provided with a socket 58 adapted to receive the cylindrical portion 51 of the coupler 28 of another section of cleaning cable. The coupler 30 is provided with diametrically disposed L shaped slots 60 which are adapted to receive the protruding ends of the fixed pin 52. The inner edge of the mouth of the socket 58 has a beveled portion 62 adapted to engage the resiliently mounted locking pin 54 and to force the locking pin 54 into the cavity 55 against the biasing pressure of the spring 57 as the cylindrical portion 51 is inserted into the socket 58 of the coupler 30.

The tapered portion 53 at the end of the coupler 28 aids in aligning the cylindrical portion within the socket 58 of the coupler 30. As stated above, couplers 28 and 30 are attachable one to the other as sections of cable 20 are added one to the other in series relation. The fixed pin 52 of coupler 28 is directed through the L shaped slots 60 as the cylindrical portion 51 of the coupler 28 is inserted into coupler 30. The resiliently mounted locking pin 54 is forced downwardly into the cavity 55 of the cylindrical portion 51 by the beveled portion 62 and by the inner wall of the socket 58 of the coupler 30 as the cylindrical portion 51 of the coupler 28 is inserted into the socket 58 of the coupler 30.

When the fixed pin 52 has abuttingly engaged the end of the longitudinal legs of the L shaped slots 60, the coupler 28 may be rotated, moving the pin 52 along the transverse leg portion of the L shaped slots 60. As the pin 52 approaches the end of the transverse legs of the L shaped slots 60, the locking pin 54 reaches the opening provided by the longitudinal leg of one of the L shaped slots 60. The resiliently mounted locking pin 54 is thereby permitted to snap upwardly into the slot 60, as best shown in Figure 7.

When the locking pin 54 has snapped upwardly, the coupler 30 is locked to the coupler 28 due to the fact that the locking pin 54 and one of the projections of the fixed

4

pin 52 are disposed in one of the L shaped slots 60 and the other projection of the fixed pin 52 is positioned in the other L shaped slot 60. Therefore, the coupler 28 may not be rotated with respect to the coupler 30 until the locking pin 54 has been depressed, permitting the locking pin 54 to engage the inner walls of the socket 58 of the coupler 30 and allowing the pin 52 to move within the L shaped slots 60. Thus, a bayonet type of joint is provided in the connection between the coupler members 28 and 30.

Therefore, it may be understood that the coupler 28 may be easily and readily attached manually to a coupler 30 by grasping the coupler 30 in one hand and the coupler 28 in the other hand, moving one coupler toward the other so that the cylindrical portion 51 of the coupler 28 is inserted into the socket 58 of the coupler 30 with the pin 52 moving through the slots 60. The coupler 28 is then rotated slightly within the socket 58 of the coupler 30 so that the fixed pin 52 follows the L shaped slots 60 allowing the locking pin 54 to lock within one of the slots 60. A plurality of sections of cleaning cable 20 may be easily and quickly attached together in series relationship by the method above described.

When it is desired to uncouple a coupler 30 from a coupler 28, a wrench, such as wrench 93, shown in Figures 8 and 10, may be employed. The wrench 93 has an arcuate portion 94 adjacent the end thereof and a projection 95 at the end thereof. For the uncoupling operation the wrench 93 is fitted to the couplers so that the projection 95 forceably depresses the locking pin 54 below the surface of the cylindrical portion 51 of the coupler 28. With the locking pin 54 depressed, the wrench 93 is rotated, thus rotating the coupler 30 with respect to the coupler 28. This rotation brings the fixed pin 52 along the transverse leg of the slots 60 so that the fixed pin 52 may be withdrawn through the L shaped slots 60 and the cylindrical portion 51 may thus be withdrawn from the socket 58.

As shown and described in our copending application, Serial No. 397,364, a cutting tool may be attached to a coupler at the end of the most remote section of a series of sections of cleaning cable 20. Various types of cutting tools may thereby be attached. As the cutting tool rotatably removes material from an obstruction in a pipe, much of the cut material is carried back out of the pipe by the convolutions of the outer helical member 24 as the cable 20 is rotated.

From the foregoing description, it is understood that this invention provides a cleaning cable which is so very flexible that it may be easily inserted into a pipe which has various curves and bends, and yet the cleaning cable has such rigidity, as a result of the reverse convolutions of the helical members, that the cleaning cable will remain in fixed position and shape even though large torque loads are applied to it.

The coupler means provided in this invention enables cable sections to be easily attached one to the other and also provides means by which a cable may be readily attached to a driving means. The coupler members also provide means by which cutting tools may be easily attached to the cleaning cable. The coupler members are so connected to the sections of cleaning cable that the cable sections may easily turn and bend with respect to the couplers.

Although the preferred embodiment of the device has been described, it will be understood that within the purview of this invention various changes may be made in the form, details, proportion and arrangement of parts, the combination thereof and mode of operation, which generally stated consist in a device capable of carrying out the objects set forth, as disclosed and defined in the appended claims.

Having thus described our invention, we claim:

1. In a cable assembly comprising a pair of elongate helical members, one helical member being disposed

5

within the other helical member, one helical member being an outer helical member and the other helical member being an inner helical member, the inner diameter of the outer helical member being greater than the outer diameter of the inner helical member permitting relative lateral movement between said helical members, the outer helical member having spaced apart convolutions, a pair of connector fingers, there being one connector finger threadedly attached to each end of the inner helical member, a pair of couplers, each of said couplers being provided with a bore therein a portion of the length thereof, each of said connector fingers extending into the bore of one of said couplers, and a pin member extending transversely through each of said couplers within said bore and through said connector finger attaching the connector finger to the coupler, each connector finger having an aperture therein through which its respective pin extends, the aperture being considerably larger than the pin so that the connector finger is axially, laterally, and angularly movable with respect to the pin, each coupler having an exterior threaded surface, each end of said outer helical member being attached to the threaded surface of one of said couplers.

2. A cable coupler assembly for joining sections of helically wound cable comprising a first cylindrical coupler provided with a longitudinal bore therein open at one end thereof, one end portion of the length of the cylindrical coupler having a greater diameter than the remainder thereof, the remainder of the length of the coupler being provided with outer helical threads adapted to receive thereon a first helical cable, a transverse pin extending through said remainder of the coupler, the pin being disposed substantially normal to the bore in the coupler, a finger connector provided with an aperture therethrough adjacent one end thereof, the aperture being considerably larger than said pin extending through the coupler, a portion of the finger connector being positioned within said bore so that the pin also extends through said aperture of the finger connector, the finger connector thus being longitudinally, laterally, and angularly movable with respect to the coupler, the remainder of the finger connector being threaded and extending from said coupler, said remainder of the finger connector being adapted to threadedly receive thereon a second helically wound cable, the end portion of the first cylindrical coupler which has a greater diameter being provided with a longitudinal socket therein, the socket having a wall provided with an L-shaped slot therein, the L-shaped slot having one leg thereof substantially parallel to the axis of the coupler, said leg of the slot being open at the open end of the socket, a second cylindrical coupler, the second cylindrical coupler being provided with a longitudinal bore extending a portion of the length thereof, a connector finger partially disposed within said bore, the connector finger having an aperture therethrough, a fixed pin extending through said cylindrical coupler and through said connector finger, the pin being considerably smaller than the aperture of the connector finger through which it extends, the connector finger thus being longitudinally, laterally, and axially movable with respect to the second cylindrical coupler, the connector finger being threaded for attachment to a second helically wound cable, the second coupler having outer helical threads adapted to receive a first helical cable, the second cylindrical coupler having a portion removably positioned within the socket of the first coupler, and a resiliently and radially movable locking pin and a rigidly secured locking pin attached to the second coupler and movable into the slot of the first coupler for securing the couplers one to the other, the fixed pin of said second coupler being adapted to move into the open end of the leg of the L-shaped slot followed by movement into the other leg of the L-shaped slot of the first coupler, the movable pin being inserted and depressed within the socket and being radially movable

6

into the leg of the L-shaped slot which is open at the end thereof.

3. In a pair of cable couplers adapted to be attached one to the other, each of said couplers being provided with a cavity therein, a pair of connector fingers, there being one connector finger extending into the cavity of each coupler, each connector finger being considerably smaller than the cavity into which it extends and being laterally and angularly movable therein, the portion of each connector finger extending into each cavity being provided with an aperture therein, and a pair of pin members, there being one pin member extending through each coupler and through the aperture of each of the connector fingers, each pin member being considerably smaller than the aperture through which it extends so that each connector finger is longitudinally, angularly and laterally movable with respect to the pin extending through the aperture thereof, one of said couplers being provided with a cylindrical portion and the other of said couplers being provided with a socket within which the cylindrical portion is removably disposed, the socket having an L-shaped slot in the wall thereof, and a radially and resiliently movable locking pin and a rigidly secured locking pin carried by the coupler having the cylindrical portion, the locking pins being removably disposed in the L-shaped slot for attachment of the couplers one to the other, the rigidly secured locking pin of one coupler being movable into one leg of the L-shaped slot of the other coupler followed by movement into the other leg of the L-shaped slot, the resiliently movable locking pin being depressed and inserted within the socket and radially movable into the first said leg of the slot.

4. In a pair of cable couplers adapted to be attached one to the other to form a bayonet type of joint, a first coupler, the first coupler being provided with a cylindrical wall adjacent one end thereof forming a socket therein, the cylindrical wall of the socket having a pair of diametrically disposed L-shaped slots therein, each of the L-shaped slots having one leg thereof substantially parallel to the axis of the coupler, said leg of the slots being open at the open end of the socket, the other end of said first coupler being provided with a connector finger extending longitudinally therefrom, the connector finger being pivotally attached to the first coupler and longitudinally and transversely movable with respect thereto, a second coupler, the second coupler being provided with a cylindrical portion adjacent one end thereof, a connector finger pivotally attached to said second coupler adjacent the other end thereof and extending longitudinally therefrom, a fixed pin extending diametrically through said cylindrical portion and having the ends thereof protruding from the cylindrical portion, a locking pin resiliently supported by said cylindrical portion and disposed angularly with respect to said fixed pin, the locking pin being disposed intermediate the fixed pin and the connector finger, the locking pin having an end thereof extending radially from said cylindrical portion, said cylindrical portion of the second coupler being removably positioned within said socket of the first coupler, the fixed pin of said second coupler being adapted to move into the open end of the legs of said L-shaped slots followed by movement into the other legs of the slots of the first coupler, the locking pin being inserted and depressed within the socket and being radially movable into the leg of the slot which is open at the end thereof.

5. In a pair of couplers adapted to be attached one to the other to form a bayonet type of joint, one of said couplers being provided with a wall surface having a plurality of L-shaped slots therein, each of the slots having a first leg and a second leg, the legs being angular one with respect to the other, said coupler also being provided with a socket therein, each of the slots having an end open at the open end of the socket, the other of said couplers being provided with a rigid portion removably positioned within the socket of the first said coupler, a

7

plurality of projections protruding from the rigid portion and so spaced as to be movable within the slots in the first said coupler, an axially movable locking pin disposed within the rigid portion substantially normal to the line of movement of the rigid portion into and out of the socket, a spring member resiliently urging the locking pin in a direction from the rigid portion, each of the projections being movable in one of the L-shaped slots from the first leg thereof into the second leg thereof as the locking pin is depressed within the socket by the walls thereof and moved into the first leg of one of the slots for securing the couplers one to the other, each of said couplers being provided with a connector finger attached thereto and extending therefrom for attachment to a cable, pin means loosely extending through each connector finger, thus attaching the connector finger to its respective coupler so that the connection finger is angularly longitudinally and laterally movable with respect to the coupler to which it is attached.

6. A coupler assembly for joining two sections of helically wound cable, the combination comprising a pair of couplers adapted to be removably attached one to the other, the first of said couplers being provided with a socket in one end thereof, the socket having a pair of slots in the wall surfaces thereof, each of the slots having a leg open at the open end of the socket, each of the slots also having a portion angular with respect to the leg, the second of said couplers being provided with a portion removably positioned within the socket of the first of said couplers, the second of said couplers also being provided with pin members extending from said portion thereof and movable in the slots of the first of said couplers, one of said pin members being outwardly movable from said portion, spring means urging outward movement of said pin member, each of the remaining pin members being movable into the open end of the leg of a slot, followed by movement along the slot and into the portion of the slot which is angular with respect to the leg, the outwardly movable pin being outwardly movable from said portion of its coupler and into the leg of a slot, and a pair of connector members, there being one connector member pivotally attached to each of said couplers, each of said connector members being provided with threaded portions for receiving a helically wound cable.

7. In a cable comprising a pair of elongate helical members, one helical member being disposed within the other helical member, one helical member being an outer helical member and the other helical member being an inner helical member, the inner diameter of the outer helical member being greater than the outer diameter of the inner helical member so as to permit relative lateral movement of the helical members, the outer helical member having spaced apart convolutions, an adaptor attached to each end of the inner helical member, and a pair of couplers, each of said adaptors being attached to one of said couplers, each end of said outer helical member being attached to one of said couplers, one of said couplers having a cylindrical wall provided with a pair of diametrically disposed L-shaped slots and provided with a socket therein, the slots being in the wall of the socket and having an open end at the open end of the socket, the other of said couplers being provided with a cylindrical portion, a fixed pin having ends extending diametrically from said cylindrical portion, a locking pin angularly disposed with respect to said fixed pin, the locking pin being positioned intermediate the fixed pin and the end of the coupler to which said outer helical member is attached, said locking pin being resiliently supported within said cylindrical portion and extending radially therefrom, the ends of the fixed pin being adapted to move into the L-shaped slots of a coupler like that first described attached to another helical cable and to be positioned in the transverse portion of the L-shaped slots, the locking pin being adapted to be depressed within the socket until the ends of the fixed pin are disposed in the

8

transverse portion of the slots, the locking pin being resiliently movable into the longitudinal portion of one of the slots.

8. In a pair of cable couplers adapted to be attached one to the other, one of said couplers being provided with a cylindrical wall having a pair of diametrically disposed L-shaped slots therein, said coupler also being provided with a socket therein, the L-shaped slots being formed through the wall of the socket, the longitudinal legs of each of the slots extending in an axial direction and being open at the open end of the socket, the other of said couplers being provided with a cylindrical portion, a rigid pin diametrically disposed within said cylindrical portion and having the ends thereof extending therefrom, and a locking pin supported by said cylindrical portion, the locking pin extending radially from the cylindrical portion and disposed angularly with respect to said rigid pin, a spring engaging the locking pin and urging outward radial movement thereof, the ends of the rigid pin being adapted to move in a straight line through the longitudinal legs of the L-shaped slots followed by movement into the transverse portion of the slots upon rotation of the couplers one with respect to the other, the locking pin being adapted to move into the socket while depressed by the walls thereof and being adapted to resiliently move radially from the cylindrical portion and into the longitudinal leg of one of the L-shaped slots upon rotation of the couplers one with respect to the other, thus locking the two couplers together, each of said couplers including pivotal means for attaching a flexible helical cable thereto.

9. A pipe cleaning assembly comprising a plurality of sections of cleaning cable, each of said sections including a pair of elongate helical members, one of said helical members being an inner helical member and being of a lesser outer diameter than the inner diameter of said other helical member, the inner helical member being disposed within the outer helical member, one of said helical members having clockwise convolutions and the other of said helical members having counterclockwise convolutions, a plurality of couplers, the couplers being of two types and adapted to be attached one to the other, each of said sections having complementary couplers of said types at its ends, one type of said coupler having a wall surface provided with a pair of L-shaped slots and a socket therein, the slots being in the wall of the socket, each of the slots being open at the open end of the socket, the other of said types of coupler being provided with a cylindrical portion removably disposed within the socket, a pair of rigid projections radially protruding from said cylindrical portion and adapted to move within the slots in the wall of the socket, a locking pin extending radially from said cylindrical portion and resiliently supported therein, the locking pin being movable into the socket and depressed by the walls thereof, the locking pin being resiliently and radially movable into one of the slots upon rotation of the couplers one with respect to the other, the sections being attached one to the other in linear relation by attachment of couplers of one type to couplers of the other type connected end to end to provide an assembly of a desired length.

10. In a pair of cable couplers adapted to be attached one to the other, one of said cable couplers being provided with a cylindrical wall having a plurality of angularly shaped slots therethrough, each of the slots having a portion parallel to the longitudinal axis of the coupler and also having a portion angular with respect to the longitudinal axis of the coupler, said cable coupler also being provided with a socket therein, the slots being formed in the walls of the socket and having the said parallel portion open at the open end of the socket, the other of said couplers being provided with a cylindrical portion removably positioned within the socket, a plurality of projections protruding from the cylindrical portion and so spaced as to be movable within both portions

9

of the angularly shaped slots in the first said coupler, and a locking pin supported by said cylindrical portion and extending radially therefrom, spring means urging radial movement of the locking pin, the locking pin being so spaced with respect to one of the projections that during insertion of the projections into the slots the locking pin is depressed by the walls of the socket until the projections pass into the angular portions of the slots, each of said couplers including means for attaching a flexible cable thereto.

11. In a pair of couplers adapted to be attached one to the other, one of said couplers being provided with a socket therein having a plurality of L-shaped slots in the wall thereof, one leg of each of the slots being open at the open end of the socket, the other of said couplers being provided with a solid portion removably disposed within the socket of the first said coupler, a plurality of projections protruding from the solid portion and so spaced as to be movable within the slots in the first said coupler, a locking pin reciprocally axially movable and carried by the second said coupler and depressible within the solid portion thereof, resilient means urging movement of the locking pin in a direction from the solid portion, the locking pin being disposed substantially normal to the movement of the solid portion as the solid portion moves into and out of the socket, the locking pin being spaced from the projections so that the projections

10

enter the socket before the locking pin, the locking pin being depressed and axially moved by the walls of the socket during insertion of the projections into the L-shaped slots, the pin being released for movement into one of the slots when the projections are substantially fully inserted into the slots, and a pair of connector members, there being one connector member pivotally attached to each of said couplers, each of said connector members being provided with threaded portions for receiving a helically wound cable.

12. A plurality of cables as defined by claim 7 connected in end to end relationship.

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