June 28, 1949. L. R. ROBINSON ET AL 2,474,690

FLEXIBLE CONNECTOR

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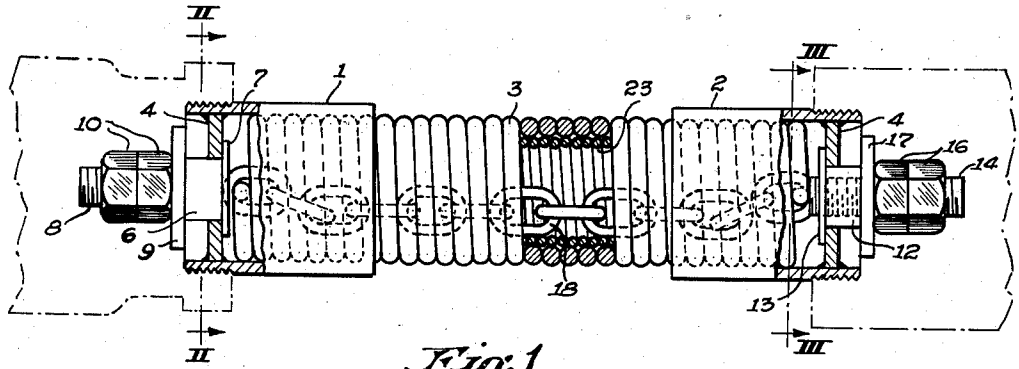


Fig. 1.

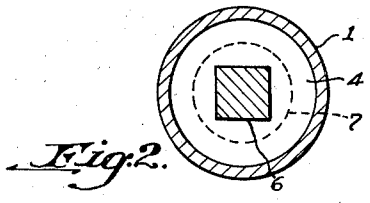


Fig. 2.

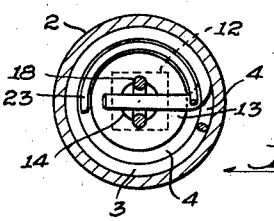


Fig. 3.

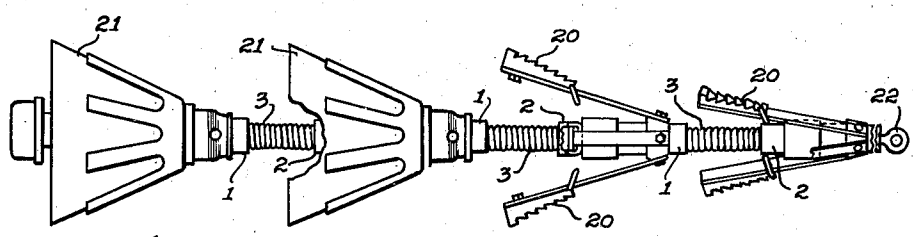


Fig. 4.

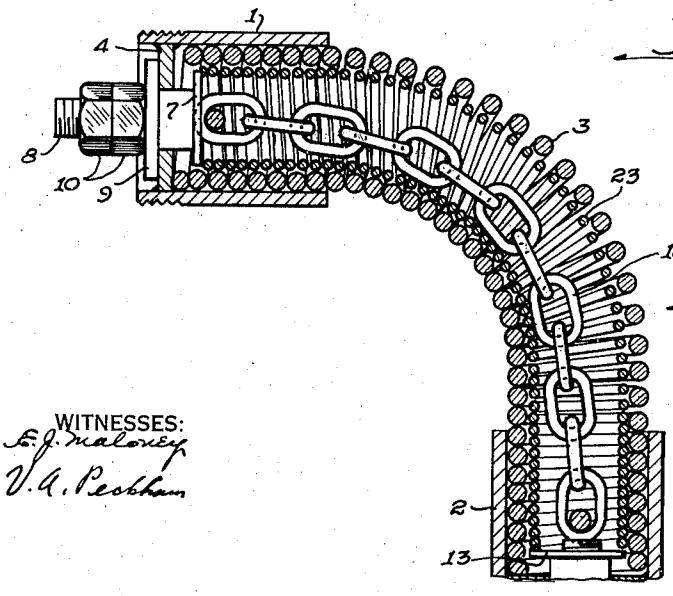


Fig. 5.

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UNITED STATES PATENT OFFICE

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FLEXIBLE CONNECTOR

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3 Claims. (Cl. 287—85)

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This invention relates to flexible connectors, and more particularly to those that connect axially spaced elements of pipe cleaning apparatus.

In one type of apparatus for cleaning deposits from the inside of tubes and pipes, a plurality of scraping devices are disposed in tandem relation in front of a series of fluid pressure cups, and all of these elements are connected together by flexible means which permit them to travel around bends in pipes when fluid pressure is applied to the back of the cups to force them through the pipes. In the past the different elements have been coupled together by strong coil springs flexible enough to permit the cleaning apparatus to travel around pipe bends if not too sharp. However, in going around 90° bends such coil springs often would bend so far that they would buckle or kink and not return to their original straightness. The cleaning apparatus then would no longer perform properly and might become stuck in the pipe.

It is among the objects of this invention to provide a flexible connector which is especially suitable for pipe cleaning apparatus, which is strong and durable, which will not break in use, and the bending of which is positively limited so that it can not buckle or stretch out of shape.

In accordance with this invention a normally straight flexible tubular member, preferably a coil spring, supports couplings at its opposite ends. Extending through the coil is a normally slack flexible tension member, such as a chain, connected to the couplings. The slack in the chain is such as to permit the coil to be bent in an arc of about 90° before the chain is stretched taut to prevent further bending of the coil. The coupling members most suitably are sleeves slidably mounted on the ends of the coil and provided with cross members or transverse walls having central openings in which are mounted anchor members to which the ends of the chain are connected. These anchor members preferably are slidable axially to a limited extent in the sleeves and are prevented from rotating therein. A second coil spring may be disposed in the outer coil to reinforce it.

The preferred embodiment of the invention is illustrated in the accompanying drawings in which Fig. 1 is a side view, partly broken away, showing our flexible joint; Figs. 2 and 3 are cross sections taken on the lines II—II and III—III, respectively, of Fig. 1; Fig. 4 is a reduced side view showing several of these connectors in use in

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pipe cleaning apparatus; and Fig. 5 is a longitudinal section through the connector showing it bent about 90°.

Referring to Figs. 1 to 3 of the drawings, a pair of coupling sleeves 1 and 2 are slidably mounted on the opposite ends of a heavy straight coil spring 3. The sleeves project from the ends of the coil and have their outer end portions threaded so that they can be screwed into other couplings by which this connector is joined to the elements it is to connect. Beyond the end of the coil each sleeve is provided interiorly with a transverse wall 4 having a central opening through it. Slidably mounted in the opening in sleeve 1 is the head 6 of an anchor member which has a flange 7 on its inner end engageable with wall 4. The head is considerably thicker than the wall and has a threaded stem 8 integral with its outer end. A washer 9 is held against the outer end of the head by a pair of lock nuts 10 screwed on the stem.

The anchor member in the other sleeve includes a nut-like member 12 having a flange 13 at its inner end engageable with wall 4. Threaded through this member is a stud 14 on which a pair of lock nuts 16 are mounted for pressing a washer 17 against the outer end of the nut member. This stud projects from the inner end of the nut member.

Welded to flange 7 of the first anchor member and to the inner end of stud 14 are the end links of a chain 18 by which the two anchor members are connected. This chain therefore holds the sleeves on the opposite ends of coil 3. The ends of the coil are bent radially inwardly and extend through the end links of the chain to limit outward movement of the sleeves on the coil and to prevent the two anchor members from turning on their common axis relative to each other. By making the openings in walls 4 of the sleeves square or some other non-circular shape, and making the portions of the anchor members therein the same shape, the sleeves will not be able to turn on the anchors. As each sleeve is prevented from rotating relative to the other, any elements that are connected together by this connector are held in predetermined positions relative to each other. This is especially desirable when the connector is used for connecting the scrapers 20 and driving cups 21 of pipe cleaning apparatus such as shown in Fig. 4. In such apparatus the back set of scrapers should be staggered relative to the front set and not allowed to rotate to the point where they will track behind the front scrapers. This pipe clean-

ing apparatus can be forced through a pipe by hydraulic or pneumatic pressure against the inside of the cups, or it can be dragged through by a cable connected to the eye-bolt 22 projecting from the front set of scrapers.

There normally is slack in chain 18 so that the coil 3 can bend axially to allow the cleaning apparatus to pass through a bend in the pipe being cleaned. As it is the purpose of this invention to provide a connector that will bend in an arc of about 90°, the spring should permit that much bending of the coil, but no more. However, due to space limitations inside the coil, and to the fact that the slack chain is likely to kink if there are too many links in it, the chain is not provided with enough slack to permit a 90° bend of the coil if the end links remain in the positions they occupy in Fig. 1. The shortness of the chain is compensated for by the fact that when the coil bends, the tension on the chain causes its end links to bend the radial ends of the spring therein inwardly into the body of the coil. The chain therefore slides head 6 and nut member 12 inwardly in transverse walls 4 of the coupling sleeves until washers 9 and 17 strike those walls. Further tension on the chain pulls the sleeves inwardly on the coil spring until their walls 4 engage the ends of the spring, all as shown in Fig. 5. By this time the coil has bent about 90° between the two sleeves, but any attempt of the spring to bend further, which might cause it to buckle, is prevented by engagement of the taut chain with the coil at the inside of the bend. To reinforce the coil and to eliminate any chance of the chain being broken by the strain placed on it, another coil spring 23 may extend through the outer coil loosely enough to avoid binding therein. The inner coil increases the resistance of the outer coil to buckling, and thereby relieves the chain of some strain that otherwise would be placed on it. However, the inner coil does not interfere with resilient flexing of the connector as would be the case if only the outer coil were used and it was made of heavier stock. Best results are obtained by using an inner coil that is wound in the direction opposite to the winding of the outer coil.

According to the provisions of the patent statutes, we have explained the principle and construction of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood, that within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. A flexible connector comprising a normally straight coil spring, coupling sleeves mounted on the opposite ends of said coil and projecting therefrom, the projecting portions of the sleeves being provided interiorly with transverse walls having central openings therethrough, a normally slack flexible tension member extending through the coil, means anchored in one of said openings and connected to one end of said tension member, a threaded stud connected to the other end of the tension member, a nut-like member mounted on said stud and disposed in the other of said openings, and means for retaining said nut-like member in said other opening.

2. A flexible connector comprising a normally straight coil spring, coupling sleeves mounted on the opposite ends of said coil and projecting therefrom, the projecting portions of the sleeves being provided interiorly with transverse walls having central openings therethrough, a normally slack flexible tension member extending through the coil, means anchored in one of said openings and connected to one end of said tension member, a threaded stud connected to the other end of the tension member, a nut-like member on said stud and slidably disposed in the opening in the other of said walls from which it projects outwardly, means mounted on the inner end of said nut-like member for limiting movement of it outwardly in said wall, a washer mounted on the portion of said stud projecting from said nut member, and a nut screwed on said stud and pressing said washer against the outer end of said nut member.

3. A flexible connector for axially spaced pipe cleaning devices, comprising a normally straight coil spring, coupling sleeves loosely mounted on the opposite ends of said coil and projecting therefrom, the projecting portions of the sleeves being provided interiorly with transverse walls having non-circular central openings therethrough, non-circular anchor members mounted in said openings, and a normally slack chain extending through said coil and connected to said anchor member, the ends of said coil extending through the chain links at the opposite ends of said chain, whereby the pipe cleaning devices are held against rotation relative to each other.

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