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Textrom

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[54] **DUO COIL CONNECTING DEVICE**

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[52] **U.S. Cl.** **267/168,** 85/79
[51] **Int. Cl.** **F16f 1/06**
[58] **Field of Search** 267/167, 168; 85/79, 85/67

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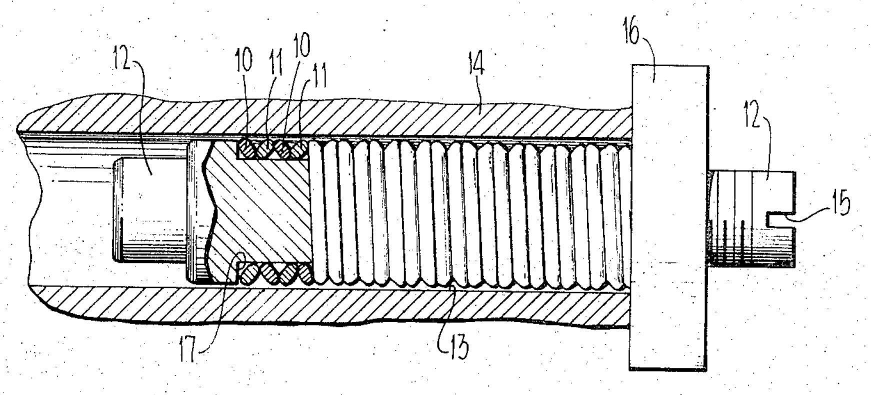
[57] **ABSTRACT**

This invention relates to a coil spring-type connecting device which may be used to connect two pieces of material together, as an expansion bolt, for example, in masonry; as a quick-operating clutch; or a tube connector; or the like. Coil spring invention devices are known as are also the use of double coil springs. The present invention differs from the prior art in that the complete device comprises two coil springs formed of flattened wire. The two coils are identical, except that the long axis of the flattened wire is tilted at opposed angles to the perpendicular axis of the coil. That is, one coil formed of flattened wire has what might be called a "positive" angle (such as facing to the right in the various figures) to the axis of the cooperating bolt, while the second coil has a negative angle (such as facing to the left). Preferably, the pitch of both coils is identical, and in the preferred form the pitch is approximately twice the distance which a single coil occupies axially of the device. Usually a preferred angle for the two coils is approximately 60°, as shown in FIGS. 2, 5, and 6, but it can be any other angle, such as approximately 30° shown in FIG. 4. The coils can be made of flat strip as shown in FIG. 5 and the pitch can be larger than normal, so that the individual coils are spaced apart as shown in FIGS. 6 and 7; and in fact, a spacing or third coil may be placed between the angular coils and lying flat against the cooperating bolt. It is believed obvious that compression of the spring will twist the normal angle from that shown in FIG. 2 to that shown in FIG. 3, whereby the coil tightly engages the hole or cavity in which the connecting device is placed. If the coils are made of flat strip, as shown in FIG. 5, it is obvious that the edges of the coils will cut into one or the other or both of the cooperating members, i.e., the bolt or the cavity. When the connecting device is to be used for an expansion bolt in masonry, brickwork, or other material which has a tendency to crumble, it is preferred that the coils be spaced apart as shown in FIGS. 6 and 7, so that material displaced from the cavity wall by the expansion of the connecting device will have a place to rest without interfering with the actions of the coils.

12 Claims, 9 Drawing Figures



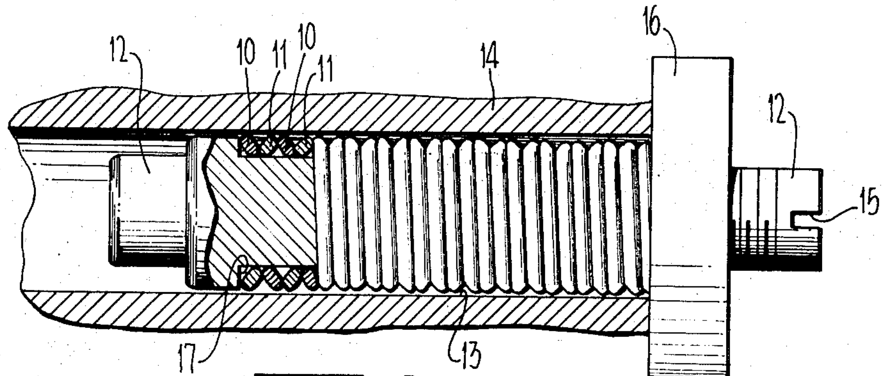


Fig. 1

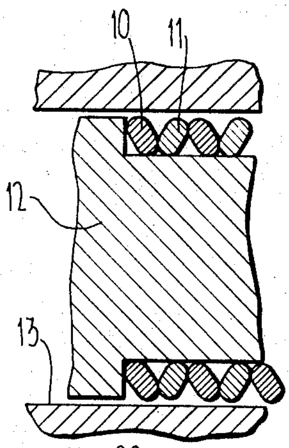


Fig. 2

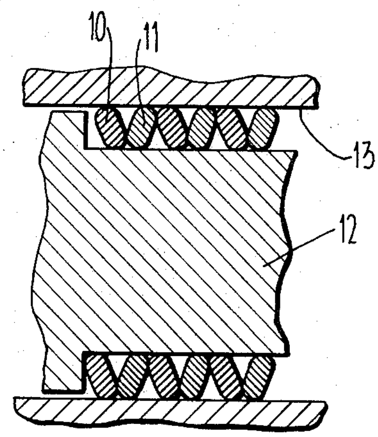


Fig. 3

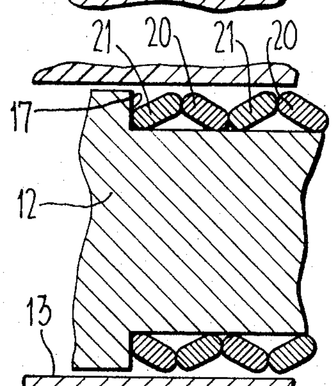


Fig. 4

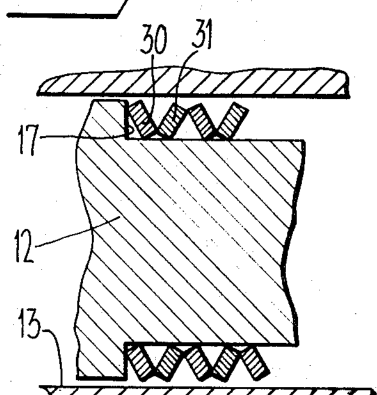


Fig. 5

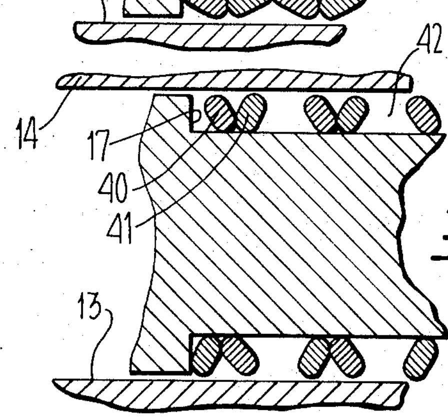


Fig. 6

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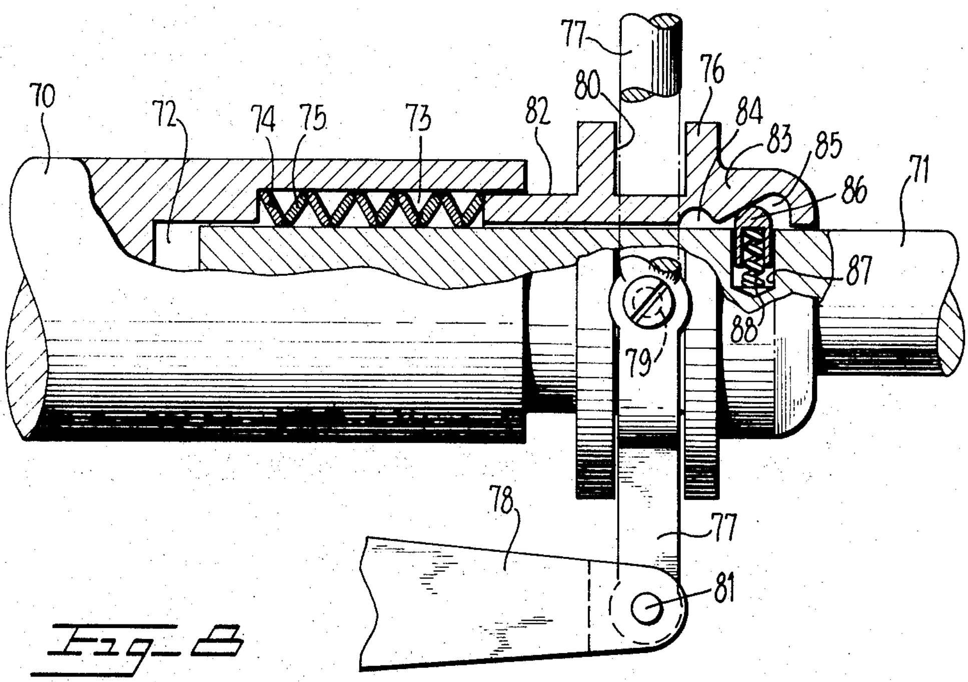

Fig. 8

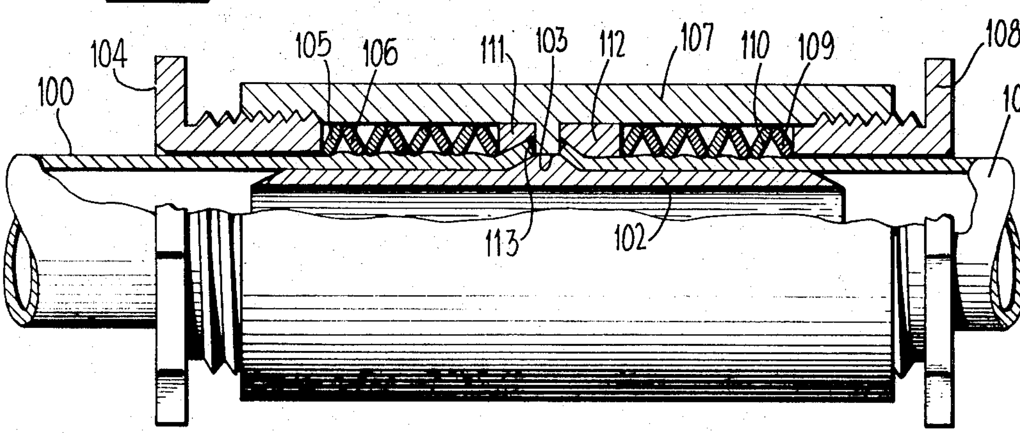

Fig. 9

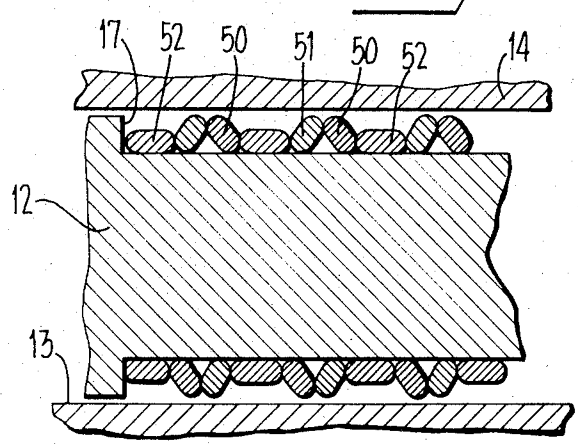

Fig. 7

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DUO COIL CONNECTING DEVICE

OBJECTS

It is a primary object of the present invention to provide a quick-acting and strong connecting device.

It is another important object of the present invention to provide an expansion bolt suitable for rigidly holding a bolt or stud in masonry, or the like.

It is another important object of the present device to provide an improved flexible coil connecting device.

It is another important object of the present invention to provide an improved spring clutch or brake, which may be used either to selectively connect and disconnect a movable member to a moving one, or a movable member to a fixed one.

Another object of the invention is to provide an adjustable friction element to hold a rotatable element in a selected position with respect to a non-rotatable one, as for example, a hinge to hold a door in any selected position.

It is another object to provide an adjustable friction device for limiting torque, as in torque release wrenches, screwdrivers, and the like.

Still another important object of the present invention is to provide a tube connecting device which is both strong and easily assembled and disassembled.

Another important object is to provide a quick-acting adjustable connecting device which can readily be attached or detached from the cooperating elements.

These and other important objects of the present invention will be understood from the detailed description which follows, taken in conjunction with the attached drawings in which:

FIG. 1 is a view, partly in cross-section, showing the device of the present invention being used as an expansion bolt for affixing a stud in a blind receptacle, such as a cavity in masonry.

FIG. 2 is an enlarged detail of a partial cross-section of the device of the present invention showing the connecting device in a relaxed condition.

FIG. 3 is a view similar to the device in FIG. 2 showing the operation of the coil springs when the bolt is tightened to compress the springs.

FIG. 4 is a partial cross-sectional view of a device similar to that shown in FIGS. 1 to 3, but in which the principal axis of the spring is formed at a different angle from that illustrated in FIGS. 1 to 3.

FIG. 5 is a view of the connecting device similar to that of the previous figures in which the coiled springs are formed of flat strip with rectangular edges as distinguished from the flattened round wire shown in FIGS. 1 to 4.

FIG. 6 is a partial cross-sectional view showing a device of the present invention formed of flattened wire, as in FIGS. 1 to 4, but in which the turns of the spring have a greater pitch than shown in FIGS. 1 to 4 whereby the turns of the pair of springs are separated from the adjacent turns.

FIG. 7 is a partial cross-sectional view of another form of the device of the present invention in which the adjacent turns of the coiled springs are held separated one from another by a third spacing coil.

FIG. 8 is the device of the present invention applied to a quick-acting clutch or brake; and

FIG. 9 is the device of the present invention when applied to a tube connector.

Many forms of coiled spring coupling devices have been known in the past. For example, there are many forms of coiled spring expansion bolts, coiled spring couplers or bushings, coiled spring clutches, and the like. The present invention relates to an improved device of this classification in which the connecting element is a pair of coiled springs **10** and **11**. In most applications the springs **10** and **11** can be most economically made from flattened round wire, as illustrated in FIGS. **1** through **4**. Each of the springs **10** and **11** is made of identical diameter and identical pitch. The one difference between the two springs is that one of them is formed with what might be called a negative tilt, or angle, while the other is formed with a positive one, as is illustrated in these figures. More specifically, as shown in the drawings, coil spring **10** is formed with the major axis of the wire of the coil forming an angle to the left with the axis of the expansion bolt **12** with which it is associated, while the wire of coil **11** forms a similar angle to the right.

For most installations it will be preferable to form the two coils **10** and **11** with a pitch for each coil equal to approximately twice the axial distance between the extreme edges of the coil. The coils are inter-threaded, so that throughout their entire length each portion of each coil abuts two adjacent sections of the other coil. The diameter of the coils is such as to engage one or the other of the cavity wall **13** in some material **14** in which the expansion bolt is to be placed, or the surface of the expansion bolt **12**, but not both. If designed to engage the cavity wall, the spring normally would be exactly the size of the cavity or slightly larger, while if (as shown in these figures) it is preferred to form the double coil spring to engage the bolt, it will fit snugly against the bolt as shown. When the expansion bolt **12** is to be used in a "blind" location, as shown in FIG. **1**, it will be desirable to provide some means at the outer end of the stud **12** to hold it against rotation, as by means of screw slot **15** while the nut **16** is tightened. Then, when a nut **16** on the threaded portion of stud **12** is tightened, the springs **10**, **11** are compressed.

It is believed that the operation of the present device will be obvious to those skilled in the art. FIG. **1** illustrates the double coil spring connecting device of the present invention when utilized as an expansion bolt which is adapted to be easily inserted into a cavity **13** and then tightened to expand it to form a very tight and strong holding grip with the cavity. FIGS. **1** and **2** illustrate the device in the relaxed, or non-attaching, position. In this condition the coils of the spring engage the surface of the bolt but do not engage the cavity wall **13**. However, when the bolt **12** is held against rotation and the nut **16** is tightened, the shoulder **17** on the inner end of the bolt is drawn toward the opening of the cavity and the two springs **10** and **11** are compressed. Since they lie at an angle to each other, this compression of the two springs causes them to rock slightly to a position more closely approaching the perpendicular with respect to the axis of the bolt. When so rotated, the springs engage the cavity wall **13** as shown in FIG. **3**. Thus, the tightening of the nut **16** on the bolt causes the springs **10** and **11** to move from the position shown in FIG. **2** to that shown in FIG. **3**, thereby forming a tight friction fit with the cavity **13** in which the expansion bolt **12** is located.

An expansion bolt of this type can be used advantageously for aligning components accurately, as is common in the air and space industries when attaching a metal skin to a metal frame.

In most installations it will be preferred to form the two coils with respective positive and negative angles of approximately 60°, or even greater, with respect to the axis of the bolt with which it is associated. This form is illustrated in FIGS. **1** to **3**. However, the double coil spring of the present device does not have to be formed at any particular angle. For example, FIG. **4** illustrates the application of this invention to coils in which the two wires **20** and **21** are tilted at an angle of the nature of 30° with respect to the axis of the stud **12**. The latter form is particularly desirable when the cavity in which the expansion bolt of FIG. **1** is to be used may be slightly larger than would normally be encountered, or the material in which the cavity is formed is unusually soft. The important point to note is that the angles of repose of the two coils **10** and **11** with respect to the axis of the bolt and the coil springs may be adjusted to suit the conditions. Usually it is preferred to form them at an angle of approximately 60° to the axis of the coil spring, as is shown in FIGS. **1** to **3**, although an angle of 30° or even less has been found satisfactory in many installations. In hard materials for seat, bolt and spring the higher the angle of contact the greater the gripping force with any given increment of compression. Hence angles of about 75° or even a little more, are satisfactory for particular applications where friction to a precision bore is critical. On the other hand, the less the angle of inclination, the less the total friction, but the greater the movement normal to the axis; and provides a device useful in inserts for a soft material, such as wood.

FIG. **5** illustrates another embodiment of the present invention in which the two coil springs **30** and **31** are formed of flat strip material having relatively sharp rectangular edges instead of the flattened round wire of FIGS. **1** to **4**. It will be obvious that such springs will have a tendency to dig into soft material, such as wood, and thereby form a tighter bond than would be possible with rounded corners, as illustrated in FIGS. **1** through **4**.

FIG. **6** illustrates still another embodiment formed of flattened round wire, as in FIGS. **1** through **4**, but differing from the earlier embodiments in that the pitch of the springs **40** and **41** is roughly about four times the length of the wire of a coil with respect to the axis of the bolt **12**. This provides a construction in which there is a substantial space **42** between adjacent turns of the coils, so that the adjacent turns of the pairs of coils are removed from each other a considerable distance —in this case by about the length of the pair of coils with respect to the axis of the bolt **12**. This type of construction is particularly suitable when the material **14** in which the expansion bolt is to be inserted is inclined to crumble, as in brick and the like. As the coils **40** and **41** bite into the material **14** forming the cavity wall **13**, it (the material) will crumble somewhat and the space between the adjacent turns of the wires **40** and **41** will permit the disintegrated material to accumulate without interfering with the action of the coils. When the coils abut each other as shown in FIGS. **2** and **3**, such granular material would be inclined to catch

between the spaces between adjacent turns and interfere with the normal twisting of the coils illustrated in FIGS. **2** and **3**. In the embodiment shown in FIG. **6**, such material can accumulate in the space **42** between the adjacent turns of the spring.

FIG. **7** illustrates a preferred form of the spaced springs shown in FIG. **6**. In this embodiment the abutting pair of coils **50, 51** are spaced apart from the adjacent turns of the springs as in FIG. **6**. However, in this form a third spring **52** is used to separate the adjacent turns of the coils **50, 51**. The spacer **52**, likewise is a coiled spring, and preferably is formed of wire similar to the flattened round wire of coils **50, 51**, and normally would be of approximately the same size. Thus, as the nut of the expansion bolt **12** is tightened, the spacing coil **52** prevents longitudinal displacement of the angled coils, such as **40, 41** in FIG. **6**, thereby providing for more rapid gripping of the coils **50, 51** with the material **14** of the cavity **13**.

FIG. **8** illustrates the application of the double coil spring of the present invention when applied to a quick-acting clutch. In this figure, a driving shaft **70** is rotated by any suitable source, such as an electric motor, not shown. The driving shaft **70** is effective at the will of the operator to rotate a driven shaft **71**. In the embodiment shown, the driving shaft **70** is provided with a cavity **72** adapted to rotatably hold the inner end of the driven shaft **71**. It is also provided with a shorter but larger diametered cavity **73** adapted to hold a pair of coiled springs **74, 75** of the present device.

The clutch is operated by a collar, or actuator, **76** which is slidably mounted on the driven shaft **71**. The collar **76** is shifted axially along the driven shaft **71**, by any suitable means, such as a handle **77** pivoted as on pin **81** on any suitable fixed bracket, or boss, **78**. The handle **77** carries a roller **79** (or if the handle **77** is formed as an encircling yoke, a pair of rollers **79**) which lies within a groove **80** formed in the outer peripheral wall of the collar **76**. It is obvious that the collar **76** can be shifted toward the driving shaft **70** or away from it by operation of the handle **77**. The collar **76** carries a cylindrical wall **82** which fits within the bore **73** and engages the pair of coil springs **74, 75**. The shifting of the handle **77** and collar **76** compresses the springs **74, 75** to cause them to rock, or tilt, to embrace both the driven shaft **71** and the interior wall of the cavity **73** on driving shaft **70**. Such action causes a driving engagement between the driving and driven shaft.

Preferably, the collar **76** is provided with a detent means to hold it in either adjusted position. One such detent is illustrated in the figure and comprises a second cylindrical wall **83** extending to the right in this figure. This second wall is provided with an inner groove **84** and an enlarged outer groove **85**, as shown. Cooperating with the grooves **84, 85** is a detent pintle **86** inserted in a cavity **87** in the driven shaft and biased into engagement with the annular grooves **84, 85** by a suitable compression spring **88**.

It is believed that the operation of the clutch just described is obvious. Leftward motion of the handle **77** causes the collar **76** and its shoulder **82** to move to the left to compress the double coil springs **74, 75** and thereby cause them to tilt to positively engage both the driving and the driven shaft, thereby rotating the latter. Rocking of the handle **77** to the right causes the collar to shift to the right and thereby release the springs, so they can assume their normal relaxed positions.

The device of FIG. 8 can also be used as a brake, or a device to lock a rotatable part in a selected position with respect to a fixed part, or as a torque limiting device. In the first instance, if the shaft 72 should be rigidly secured to a machine frame, not shown, and shaft 71 carried a wheel, also not shown, it is obvious that with the handle 77 in the position shown the shaft 71 could rotate freely. However, shifting of the handle 77 to the left would compress springs 74, 75 and cause them to rock so as to engage both shafts 70 and 71. Thus, the inter-coiled, oppositely tilted springs of the present invention can also be used to form an effective brake to lessen or completely stop the rotation of a moving part. Another form of brake is that for locking a rotatable part, such as a door, in some adjusted position with respect to a fixed part, such as a door frame. If the pintle of a door hinge were constructed as is illustrated in FIG. 8, it is obvious that with the handle in the position shown, the door would open and close freely, but if the handle were rocked to the left in this figure, the resultant compression of springs 74, 75 would lock the door in any selected position between fully closed and fully open. A torque limiting device is one form of a brake in which the brake is set for a predetermined torque force, and the parts slip when that force is exceeded. Thus, the device of FIG. 8 could also be used as a torque limiting device for a screwdriver, wrench, or the like.

FIG. 9 illustrates another valuable use for the connector of the present invention, namely, that of connecting a pair of tubes by readily disconnectable means. This figure illustrates the connection of two tubes or pipes 100 and 101, which can be either flexible or not. The connecting device comprises an interior sleeve 102 preferably provided with an intermediate shoulder 103 against which the inner ends of the two sections of tubing 100, 101 may abut. When assembling the tube connector of this device, the nut 104 and a pair of intertwined coiled springs 105, 106 are inserted over the tubing 100 and the tubing then inserted over the sleeve 102 until the end of the tubing 100 abuts the shoulder 103. The ferrule or outer sleeve 107 is then threaded onto the nut 104 to compress springs 105, 106, thereby firmly gripping the tube 100 between the walls of the inner sleeve 102 and the ferrule 107. A second nut 108 and a second pair of coil springs 109, 110 are inserted over the tube 101 and the assembly inserted in the outer ferrule 107 and the nut 108 tightened to compress the springs 109, 110. This grips the second tube 101 tightly between the walls of the inner sleeve 102 and the ferrule 107, forming a solid connection between the ends of the two tubes. Preferably, the ferrule 107 is provided with an inwardly extending shoulder 113 adapted to abut the shoulder 103 of the inner sleeve. In most installations it will be desired to place gaskets 111, 112 around the outer end of the two tubes, as shown in FIG. 9, to provide a fluid-tight seal around the inner ends of the two tubes 100 and 101.

It is believed that many applications of the connecting device of the present invention will be apparent to those skilled in the art. It can be used as the blind stud expansion bolts, hose or tube couplings, and clutches, brake or torque devices, as described above; and also as flexible shaft couplings, for adjustable bushings, packing glands, such as for the water sight glass on boiler installations, and the like. In fact, the device can be used in almost any installation in which an interior member is desired to be connected to an exterior one, either for driving engagement, for fastening or for forming a fluid-tight seal. Accordingly, the appended claims should be as liberally and broadly construed as permitted by the state of the art.

I claim:

1. A releasable fastening device comprising a pair of coiled springs formed of flattened wire, the major axis of one of said coils being tilted in one direction with respect to the axis of the spring and the major axis of the other coil being tilted in the opposite direction, said springs being coiled in the same direction and one threaded within the other.

2. The fastening device of claim 1 wherein the coiled springs are formed of flattened round wire.

3. The fastening device of claim 1 wherein the coiled springs are formed of rectangular strip material.

4. The fastening device of claim 1 wherein the coiled springs are tilted at angles of the order of about 60° with respect to the axis of the coil.

5. The fastening device of claim 1 wherein each spring is tilted at approximately an angle of the order of about 30° from the axis of the spring.

6. The fastening device of claim 1 wherein the inter-threaded coils abut one another.

7. The fastening device of claim 1 wherein the pitch of each spring is greater than the distance of the material along the axis of the spring, whereby abutting turns of the pair of coils are separated from the adjacent turns of the springs.

8. The fastening device of claim 1 comprising also a third spring, the main axis of which is parallel to the axis of the coil, whereby adjacent turns of he tilted springs are separated one from another.

9. A fastening device comprising:

a. a bolt,

b. a shoulder on one end of said bolt,

c. a threaded portion on the other end of said bolt,

d. a nut adapted to engage the threaded portion of the bolt, and

e. a pair of tilted coiled springs formed of flattened material, the major axis of one of said springs being tilted in one direction with respect to the axis of the bolt and the major axis of the other of said springs being tilted in the other direction with respect to the axis of said volt, said springs having a length to reach from the nut on said bolt to the shoulder of said bolt, and said springs being inter-threaded, thereby one coil spring lies between adjacent turns of the other coil spring.

10. The fastening device of claim 9 wherein the adjacent turns of the inter-threaded springs abut one another substantially throughout their length.

11. The fastening device of claim 9 wherein adjacent turns of the inter-threaded springs are separated from one another.

12. A fastening device according to claim 9 wherein the tilted coil springs have a pitch greater than twice the length along the axis of each coil and comprising also a third flat spring, the main axis of which is parallel

to the axis of said coiled springs, and inter-threaded between the two adjacent coils of the tilted coil springs.

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