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3,377,077

POWER INSTALLED SCREW ANCHOR WRENCH

Filed Jan. 21, 1966

2 Sheets-Sheet 1

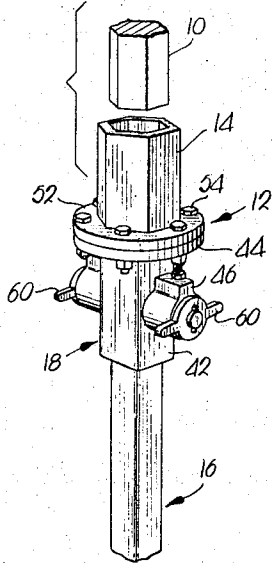


Fig. 1.

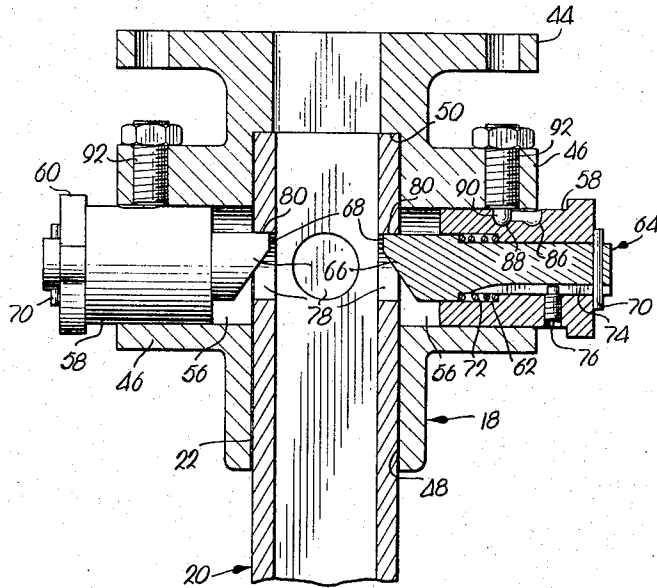
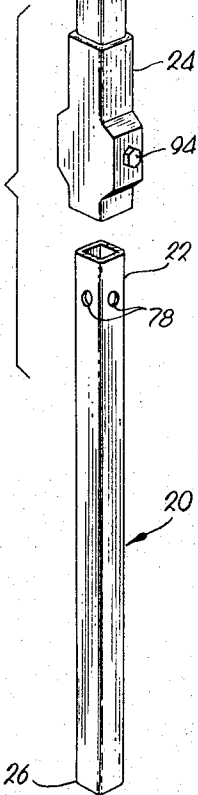


Fig. 3.

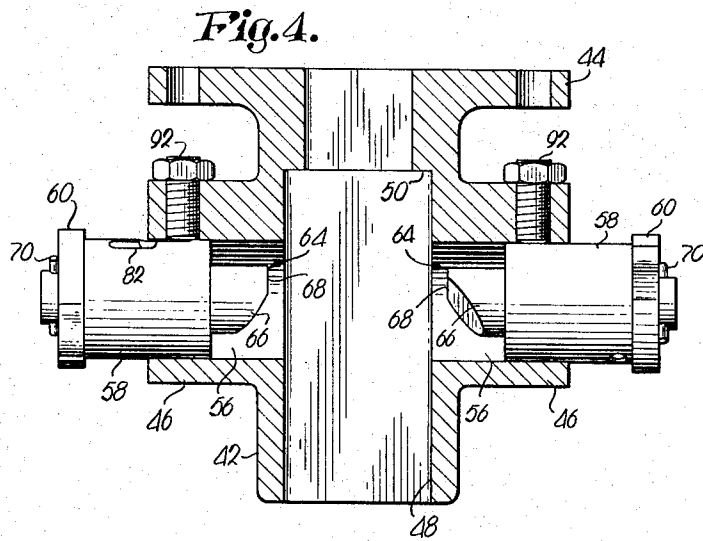


Fig. 4.

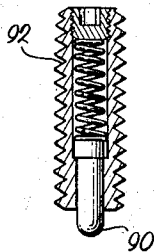


Fig. 6.

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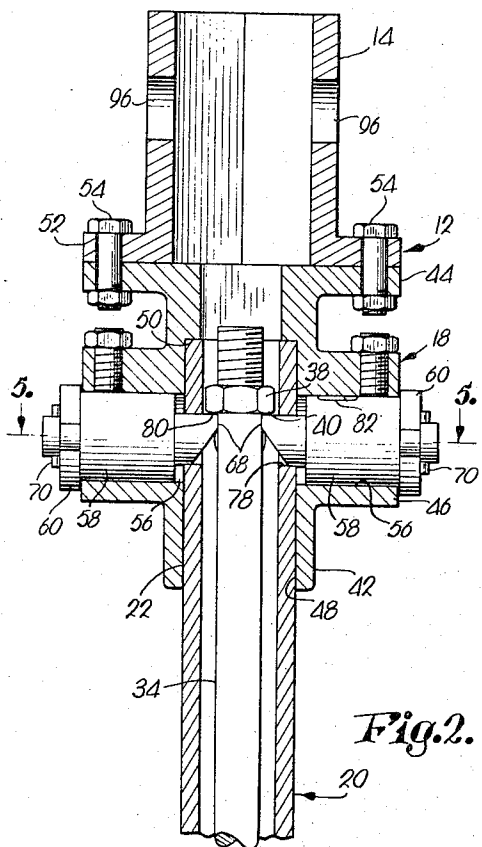


Fig.2.

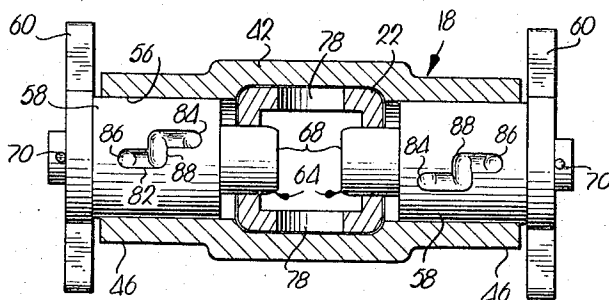
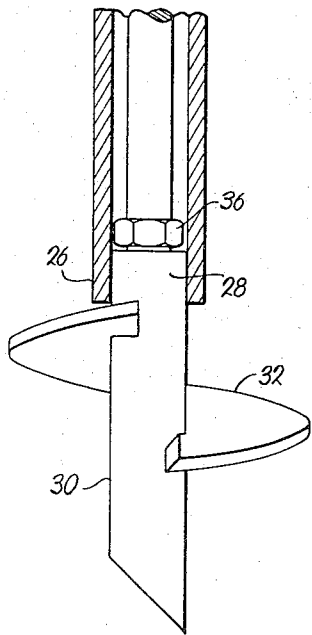
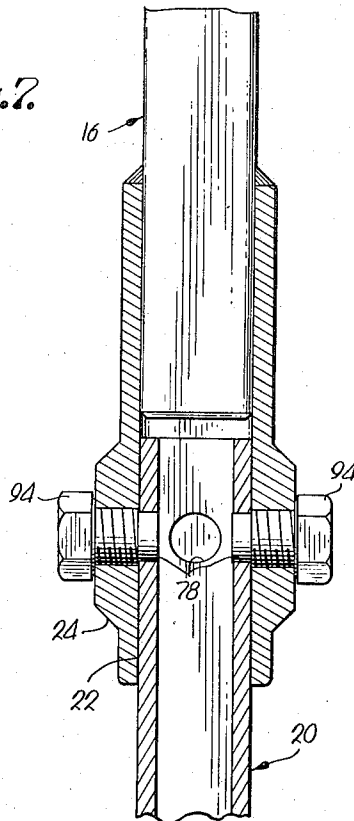


Fig. 5.

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POWER INSTALLED SCREW ANCHOR WRENCH

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10 Claims. (Cl. 279-1)

This invention relates to improvements in power-driven apparatus for installing an earth anchor in the ground

Earth anchors are utilized in a variety of applications and, in the electrical power transmission field, are widely employed as a means of securing the ends of tower guy wires to the ground. When utilized to anchor the guy wires of large tower structures, this often requires that the anchors be rotatably driven into the ground to a considerable depth. This is accomplished by a power-operated digger which transmits torque to a kelly bar which is advanced longitudinally toward the ground and simultaneously rotated about its longitudinal axis. An installing wrench in the form of an elongated torque tube intercouple the kelly bar and the anchor and is inserted into the ground along with the anchor until the desired depth is reached, whereupon the torque tube is withdrawn.

Since the torque transmitting wrench must have a length commensurate with the depth to which the anchor is to be installed, the length of the torque tube renders the installation equipment unwieldy to transport and operate unless a sectionalized wrench is utilized. However, due to the very high torque transmitted by the installing wrench, the employment of a sectionalized torque tube necessarily creates problems in providing a wrench which may be readily disassembled and transported from place-to-place and yet, when assembled for use, will possess the necessary structural strength. Additionally, to provide a practical and efficient unit, assembly and disassembly of the various components thereof, as well as insertion and withdrawal of the anchor from the tube, must be accomplished rapidly with minimum operator effort.

It is, therefore, the primary object of this invention to provide an improved power-installed screw anchor wrench of sectionalized construction which may be utilized to install an anchor at a considerable depth by adding torque tube extensions to the assembly periodically during installation of the anchor as each section of the tube is advanced into the ground.

As a corollary to the foregoing object, it is an important aim of the invention to provide improved structure for locking the anchor in the wrench to prevent longitudinal shifting with respect thereto, while simultaneously releasably coupling the upper end of the torque tube to the kelly bar in a manner such that extensions may be added during installation of the anchor until the desired depth is reached.

A further object is to provide an adapter for a screw anchor wrench having selectively positionable dogs which serve to retain the anchor in the wrench, permit withdrawal of the wrench after installation of the anchor, and releasably connect the tube section or sections to the kelly bar to permit the adding of extensions during anchor installation.

An additional object is to provide an adapter as aforesaid having interchangeable, kelly bar receiving sockets which enable the adapter to accommodate kelly bars of different sizes and cross-sectional configurations.

In the drawings:

FIGURE 1 is an exploded, perspective view of the wrench;

FIG. 2 is a longitudinal sectional view of the wrench showing the latter with an earth anchor inserted therein;

FIG. 3 is an enlarged, longitudinal sectional view of the adapter body and the upper segment of the torque tube, showing one of the anchor retaining dogs and its associated housing in longitudinal section;

FIG. 4 is a view similar to FIG. 3 illustrating the positions of the dogs and associated housings when the torque tube is separated from the adapter body;

FIG. 5 is a sectional view taken along line 5-5 of FIG. 2, the dogs and housings therefor being illustrated in plan;

FIG. 6 is a detail of a spring-loaded detent; and

FIG. 7 is a fragmentary, longitudinal sectional view showing the interconnection of a drive end torque tube and extension therefor.

Referring to FIG. 1, the numeral 10 designates the normally lowermost end of the output member or kelly bar of a power-operated digger (not shown). The digger is commonly mounted on the bed of a truck vehicle and includes derrick structure for raising the kelly bar a sufficient distance above the ground to permit the installing wrench to be coupled between the kelly bar and the screwhead of the anchor. The wrench of the instant invention includes an adapter 12 having an upright socket 14 for receiving bar 10, a torque tube extension 16 having an upper end portion received within the body or housing 18 of adapter 12, and a drive end torque tube 20 having an upper, integral end segment 22 telescoped within a coupling section 24 which forms the lower end of extension 16.

FIGURES 2-5 show the wrench in detail and illustrate torque tube 20 directly coupled with adapter 12. It should be understood that the manner of interconnection of extension 16 and adapter 12 is exactly the same as shown in detail for torque tube 20. Thus, the adapter may be coupled to either a drive end torque tube or an extension therefor as desired, depending upon the depth to which the anchor is to be driven. The manner in which the apparatus is utilized to add extensions to the drive end tube 20 will be set forth hereinafter.

Tube 20 is of square cross-sectional configuration throughout its length, the lower end thereof forming a female wrench portion 26 which receives a male wrench part 28 integral with the head 30 of the earth anchor. Head 30 is provided with a screw flight 32, as is conventional in anchors of this type. A guy rod 34 is threaded into head 30 and secured by a nut 36. The upper end of rod 36 is externally threaded to receive a nut 38 which presents an annular shoulder 40.

Body 18 includes an upright barrel portion 42 integral with an annular top plate 44, and is provided with a pair of opposed bosses 46 integral with the midportion of barrel 42 and projecting laterally therefrom. Barrel 42 has an upright bore 48 of square cross-sectional configuration which is reduced at its upper extremity to present a seat or shoulder 50. Socket 14 is coaxial with bore 48 and is provided with a radially extending, annular flange 52 at its lower extremity which overlies and engages plate 44. A plurality of nut and bolt assemblies 54 secure plate 44 and flange 52 together as illustrated.

Each boss 46 has a cylindrical opening 56 therethrough communicating with bore 48 and having an axis extending in radial relationship to the longitudinal axis of the bore. A cylindrical housing 58 is slidably received by each opening 56, respectively, and is provided with a knob or handle 60 at its outer end. As is particularly clear in FIG. 3, each housing 58 has an axial passage 62 receiving an elongated dog 64 having a head 66 presenting the inner end 68 of the dog. The outer end of each dog projects from the associated housing 58 and is provided with a crosspin 70. A coil spring 72 is contained within an enlarged portion of passage 62 which receives head 66,

spring 72 being disposed between the head and an annular shoulder provided by the reduced portion of passage 62. Rotation of dogs 64 with respect to their associated housings 58 is precluded by a keyway 74 in each dog which receives a key in the form of a setscrew 76 threaded into the side of the dog housing.

The upper end segment 22 of torque tube 20 is provided with four circular apertures 78 in the respective sides thereof, opposed apertures 78 being aligned as is clear in FIG. 3. When tube 20 is fully inserted into bore 48 and engages seat 50, a pair of opposed apertures 78 are aligned with respective dogs 64 such that the inner ends 68 thereof are capable of being inserted into the opposed apertures. Referring to FIG. 2, it may be seen that, when dogs 64 are fully inserted into apertures 78, the upper surfaces 80 of the inner ends 68 of respective dogs underlie the shoulder 40 presented by nut 38 to prevent longitudinal shifting of the anchor with respect to tube 20.

The position of each housing 58 is controlled by a Z-shaped groove 82 in the surface thereof having a circular recess 84 at its inner end and a circular recess 86 at its outer end. Each groove 82 is also recessed at 88 in the central section of the groove forming the offset portion. A spring-loaded detent 90 (shown in detail in FIG. 6) rides in groove 82 and is carried by a hollow plug 92 threaded into boss 46 perpendicularly of the axis of housing 58 to provide detent 90 with a line of action which forces the detent into the various recesses of groove 82 under spring pressure as the housing is shifted.

Referring to FIG. 7, it may be seen that torque tube 20 is telescoped within coupling section 24 of extension 16 when it is desired to increase the length of the wrench. An opposed pair of the apertures 78 now receive the inner ends of a pair of opposed lock bolts 94 which are threaded into section 24. The upper end portion of extension 16 would then be inserted into bore 48, and is provided with apertures (not shown) identical to apertures 78 in torque tube 20 so that interconnection of the tube extension with the adapter is perfected in the same manner as shown for the drive end torque tube 20.

In use, dog housings 58 are initially disposed at their innermost positions as illustrated in FIGS. 2 and 5 after segment 22 is seated in bore 48. This interlocks adapter 12 and torque tube 20 to prevent relative shifting thereof longitudinally of the tube, since apertures 78 would be sized to complementally receive the heads 66 of dogs 64. Note that each dog head has a downwardly facing bevel which converges toward the associated end 68, but that each head extends into the corresponding aperture 78 a sufficient distance to dispose the bevel entirely within the outer diameter of the tube.

Insertion of guy rod 34 of the earth anchor into the lower end of the tube brings the upper side of nut 38 into engagement with the bevelled faces of head 66, thereby shifting dogs 64 against the action of springs 72 to permit nut 38 to pass into clearing relationship to the dogs, whereupon the latter return to the positions illustrated in FIG. 2 under spring pressure. It is important to note that the upper surfaces 80 of the inner ends 68 of the dogs now directly underlie shoulder 40 and engage the latter, the tolerances being sufficiently closely controlled to preclude the formation of any substantial spacing between surfaces 80 and shoulder 40. Thus, the anchor is restrained against any longitudinal movement with respect to tube 20. Note that dog housings 58 remain in their inner positions due to the action of detents 90 which are seated in recesses 86.

Adapter 12 may now be coupled with kelly bar 10 by telescoping socket 14 over the end thereof, and a cross-bolt or cotter (not shown) may be inserted through opposed holes 96 in socket 14 into a mating cross opening (not shown) in kelly bar 10. The digger apparatus may then commence the installation operation, torque being transmitted to the anchor head 30 by engagement of wrench portion 26 with wrench part 28.

If the depth to which the anchor is to be driven cannot

be reached by tube 20, driving of the anchor is halted as adapter 12 approaches ground level. The operator then grasps knobs 60 and pulls outwardly thereupon until detents 90 fall into recesses 88, whereupon the knobs are rotated slightly to permit the housings to be further withdrawn until the detents fall into recesses 84. Housings 58 are now in the positions illustrated in FIG. 4; thus, adapter 12 may be separated from torque tube 20, leaving the tube and the anchor embedded in the ground.

Extension 16 is then connected between adapter 12 and tube 20 by inserting the upper end portion thereof into bore 48 and attaching coupling section 24 to segment 22 in the manner as described above and shown in FIG. 7. Prior to interconnection of extension 16 and tube 20, a rod extension (not shown) is added to guy rod 34, such rod extension having a nut at its upper end located in the same relative position as nut 38. Thus, dog housings 58 may be returned to their inner positions illustrated in FIGS. 2 and 5 to both lock the extension in the adapter and hold the anchor against longitudinal shifting with respect to the wrench. The installing operation is then continued, and it will be appreciated that as many extensions 16 may be added as required until the desired depth is reached.

Withdrawal of the wrench from the ground after the anchor is installed is effected by shifting dog housings 58 outwardly to intermediate positions where detents 90 seat in recesses 88. This position of the dogs is illustrated in FIG. 3 where it may be appreciated that the anchor is released but the torque tube section or sections remain coupled with adapter 12. Thus, the power digger may be actuated to withdraw the tube sections since surfaces 80 of the dog ends 68 engage the upper tube section within the opposed apertures 78 into which the dogs are inserted.

The Z-shaped configuration of grooves 82 is utilized as a safety precaution to preclude the possibility of inadvertent shifting of the dog housings from their intermediate positions (FIG. 3) to their inner positions (FIGS. 2 and 5) during withdrawal of the tube sections from the ground. If such would occur, the dogs would engage shoulder 40 of the lower guy rod 34 or a guy rod extension and likely cause shearing of the dogs under the withdrawal force applied by the power digger.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In an assembly for rotatably installing an anchor in the ground through the medium of power-driven mechanism having a rotatably driven output member, where the anchor comprises an elongated guy rod provided with a screw at the normally lowermost end thereof, a wrench-engaging part adjacent the screw, and means proximal to the normally uppermost end of the rod presenting a shoulder, torque transmitting structure comprising:

an elongated torque tube adapted to be telescoped over said rod having a wrench portion at the normally lowermost extremity thereof engageable with said part, and a normally uppermost extremity presented by a segment of molecular cross-sectional configuration;

an adapter body having an upright bore complementally receiving said segment;

means coupled with said adapter body for connecting the latter to said output member for rotation of the body and the tube by the member about the longitudinal axis of said tube,

said segment having a lateral aperture therein; and a locking dog carried by said adapter body for movement transversely of said bore into and out of said aperture, between an inner position interlocking the body and the tube and with the dog disposed for engagement with said shoulder to hold the anchor against longitudinal shifting relative to the tube, and an outer position clearing said segment to thereby permit separation of the body and the tube.

2. The invention of claim 1,

said connecting means including a socket coaxial with said bore for complementally receiving said output member,
 said socket being provided with a radially extending flange,
 said body having a top plate in underlying engagement with said flange; and
 a plurality of releasable fasteners rigidly securing said flange to said plate, whereby to permit the use of interchangeable sockets in order to accommodate output members of different configurations.

3. The invention of claim 1; and
 an elongated extension for said tube having a normally uppermost end portion adapted for complemental reception by said bore, and a normally lowermost section adapted to be relatively telescoped with said segment whereby, upon separation of the body and the tube, said extension may be coupled therebetween to enable the mechanism to drive the anchor to a greater depth; and
 a releasable fastener engageable with said section and receivable by said aperture, when said section and said segment are relatively telescoped, for interlocking the same to prevent relative longitudinal shifting thereof.

4. The invention of claim 1,
 said body being provided with means associated with said dog for releasably maintaining the latter in a position intermediate said inner and outer positions thereof where the dog is in engagement with said segment in said aperture but is spaced from the longitudinal axis of said tube a sufficient distance to clear said shoulder when the rod is in the tube, whereby to release the anchor after installation thereof and permit the body and the tube to be withdrawn as a unit.

5. The invention of claim 1; and
 a reciprocable housing in said body mounting said dog for movement of the latter with the housing between said positions of the dog,
 said housing including means permitting shifting of the dog relative thereto away from a normal disposition with respect to the housing and outwardly of the longitudinal axis of said tube in a substantially radial direction,
 said dog having an inner end engageable by said shoulder-defining means, during telescoping of the tube over the rod and when the dog is at said inner position thereof, to shift the dog in said direction; and
 yieldable means coupled with said dog and biasing the latter toward said normal disposition, whereby to return the dog to said inner position thereof after said shoulder-defining means clears said end.

6. The invention of claim 5,
 said body being provided with detent means engageable with said housing for releasably maintaining the latter in a position intermediate said inner and outer positions thereof where the dog is in engagement with said segment in said aperture but is spaced from said axis of the tube a sufficient distance to clear said shoulder when the rod is in the tube, whereby to release the anchor after installation thereof and permit the body and the tube to be withdrawn as a unit.

7. The invention of claim 6,
 said body having an elongated opening therein communicating with said bore and extending in substantially radial relationship to said axis of the tube,
 said aperture communicating the tube with the opening,
 said opening receiving the housing for movement of the latter longitudinally of the opening,
 said housing having an elongated groove in its outer periphery extending in parallelism with the longitudinal axis of said opening,

said groove having an offset recess intermediate the ends of the groove,
 said intermediate position maintaining means comprising a spring-loaded detent engaging the housing in said groove,
 said ends of the groove being disposed to define said inner and outer positions of the dog, with said recess defining said intermediate position thereof.

8. In an assembly for rotatably installing an anchor in the ground through the medium of power-driven mechanism, where the anchor comprises an elongated guy rod provided with a screw at the normally lowermost end thereof, a wrench-engaging part adjacent the screw, and means proximal to the normally uppermost end of the rod presenting a shoulder, the combination with said anchor of:
 an elongated torque tube telescoped over said rod and having a wrench portion at the normally lowermost extremity thereof engageable with said part;
 an anchor locking dog;
 a dog housing,
 said torque tube being provided with structure, remote from said wrench portion, mounting said dog housing for reciprocal movement transversely of the tube toward and away from said rod between an inner position and an outer position,
 said housing mounting said dog for movement therewith and,
 for reciprocal movement with respect to the housing along a path of travel extending in substantially radial relationship to the longitudinal axis of said tube,
 said dog having an inner end presenting a normally uppermost surface spaced from said part, when said rod is fully inserted in the tube, a distance substantially equal to the distance between said shoulder and said part,
 said end being engageable by the shoulder-defining means, as the rod is inserted into the tube, when said housing is in said inner position to shift the dog away from said axis along said path; and
 yieldable means coupled with said dog and biasing the latter toward said axis upon said shifting of the dog away from the axis by engagement of the shoulder-defining means therewith whereby, as said shoulder clears said end and reaches the level of said surface, the dog returns to a position beneath the shoulder to prevent longitudinal shifting of the anchor in the tube,
 said housing carrying said dog therewith to a disposition where said end clears said shoulder upon movement of the housing to said outer position thereof, whereby to release the rod to permit separation of the tube from the anchor.

9. The invention of claim 8,
 said structure including a supporting body having an elongated opening therein communicating with said tube and extending therefrom in substantially radial relationship to said axis of the tube,
 said opening receiving said housing for movement of the latter longitudinally of the opening between said inner and outer positions; and
 a detent engageable with said housing and mounted in said body for movement into said opening transversely thereof,
 said detent being provided with yieldable means biasing the detent toward said housing to releasably maintain the latter in either of said positions upon movement of the housing to said inner or outer position.

10. The invention of claim 9; and
 a second anchor locking dog;
 a second housing for said second dog,
 said structure mounting said second housing in opposed relationship to the first mentioned housing for reciprocal movement of the second housing trans-

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versely of the tube toward and away from said rod between an inner, anchor-retaining position and an outer, anchor-releasing position,
 said second housing mounting said second dog for movement therewith and for reciprocal movement with respect thereto along a path of travel extending in substantially radial relationship to said axis of the tube,
 said second dog having an inner end presenting a normally uppermost surface disposed at the same level as said surface of the inner end of the first-mentioned dog,
 said end of the second dog being engageable by said shoulder-defining means, as said end of the first-mentioned dog is engaged thereby, when said second housing is in its inner position to shift the second dog away from said axis along said path of the second dog; and

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yieldable means coupled with said second dog and biasing the latter toward said axis upon said shifting of the dogs away from the axis, whereby said dogs act in unison to permit insertion of the rod into the tube when the housings are at said inner positions thereof, and thereafter lock the anchor against movement longitudinally of the tube.

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