

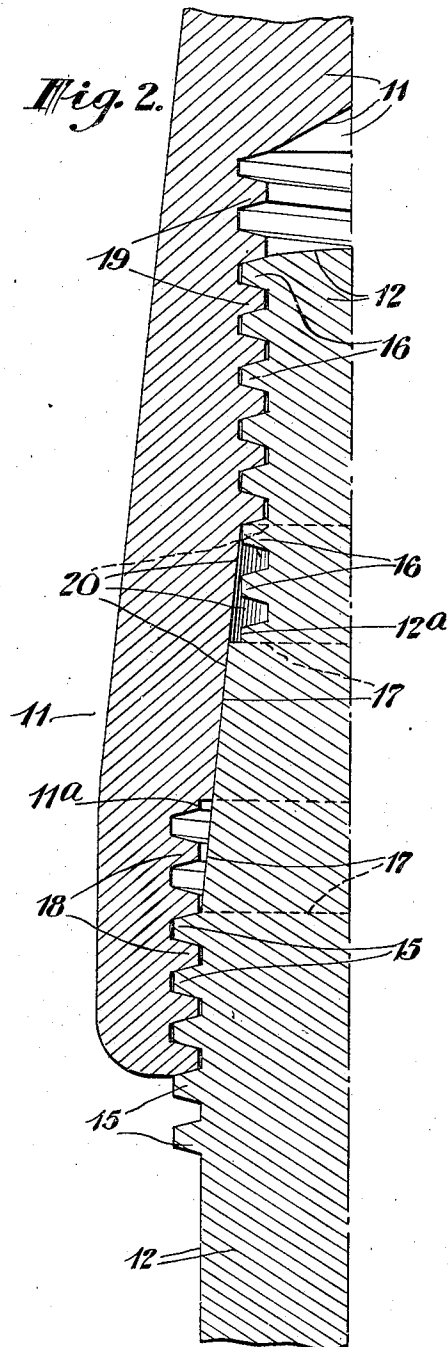
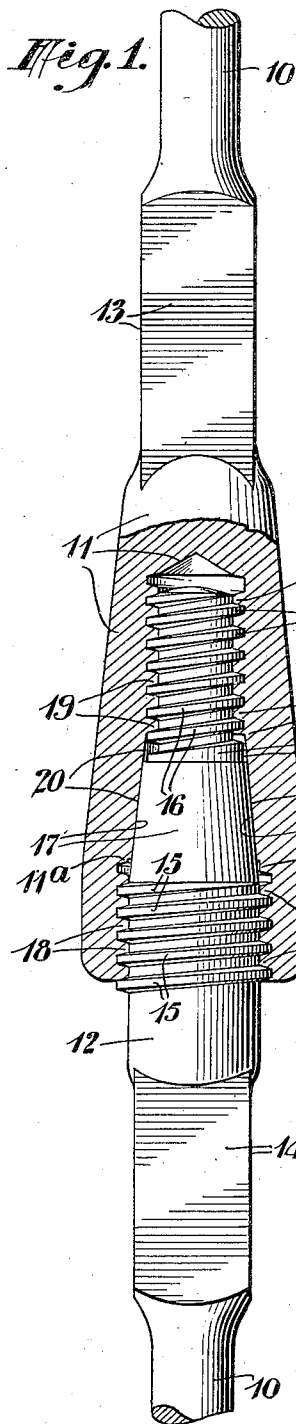
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SUCKER ROD

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SUCKER ROD

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This invention relates to improvements in sucker rods and other members comprising screw thread coupled sections, and particularly to sectional rod-like members (such as oil well pump sucker rods) that are subject to severe vibration and to severe bending and axial stresses when in use and are required to withstand heavy loads or pulls in tension.

The invention has for its principal objects to provide a simple and efficient, separable joint for sections of such members; to provide articles of the kind mentioned the sections of which are so separably jointed one to the other as to eliminate or largely avoid breakage or fracture in the joints and accidental uncoupling of the jointed sections; to provide a combined screw thread and friction joint for sections of such members which will withstand severe axial, torsional, bending and lateral vibratory stresses and heavy loads in tension without breakage and without release or partial release of the friction grip between jointed sections and which will effectually prevent cocking movements between the sections in the joints; and to provide a joint for two sections of a sucker rod wherein said sections are directly and positively thread coupled at two longitudinally spaced points and frictionally locked against unscrewing at an intermediate point.

A further object of the invention is to provide a sucker rod joint wherein threaded and frictional gripping portions, such as conoidal portions, are so combined and arranged as to prevent belling out of the box by action between the frictional gripping portions under lateral stresses, prevent cocking between the engaged threads, and augment the frictional holding effect between the engaged threads.

Other advantages will appear from the following description in detail of the preferred embodiment of the invention illustrated in the accompanying drawings.

In the drawings:

Fig. 1 is a view, partly in central longitudinal section, of a portion of an oil well pump sucker rod, embodying the invention, the adjacent ends of two rod sections being shown fully coupled; and

Fig. 2 is a fragmentary central longitudinal sectional view on an enlarged scale of the rod joint shown in Fig. 1, the adjacent ends of the rod sections being shown partly screwed together to the point at which the two friction cone surfaces just contact each other.

The sucker rod illustrated in the drawings comprises a plurality of identical metallic rod section each having a main body portion of circular profile in transverse section, a box 11 at its lower end, a pin 12 at its upper end, and two squared wrench-receiving portions 13 and 14 respectively located between the main body portion and the box and pin. The usual pin collar abutted by the end face of the box mouth (found in present standard sucker rods) is omitted and there is no end abutment of the box mouth against the other rod section.

The pin 12 is non-tapering for a substantial portion of its length at each end, said non-tapered portions of the pin being cylindrical portions of which that adjacent wrench-receiving portion 14 of the rod is of materially greater diameter than the other and is formed with an external screw thread 15. The other non-tapered portion of the pin, which extends to the outer extremity of the pin, is formed with an external screw thread 16 of the same kind, hand and lead or pitch as thread 15, and there are preferably several more turns of thread 16 than of thread 15, as shown. The minor or root diameter of thread 16 is preferably the same as the diameter of body portion 10, as shown.

Thread 15 extends to the larger or lower end of an intermediate conical or tapered frictional gripping portion 17 of the pin. Conical gripping or locking portion 17 of the pin is preferably relatively long as compared with the threaded portions or the total length of engagement of the pin and box. Its smaller or upper end is preferably of slightly greater diameter than the reduced outer non-tapered portion 12^a of the pin in which thread 16 is cut. Portion 12^a directly joins portion 17, and thread 16 extends from the outer end of portion 12^a to the inner end

of said portion or as near thereto as practicable in manufacture.

The box 11 for a distance inward or upward from its mouth has a cylindrical bore 11^a preferably of slightly greater diameter than the larger end of cone portion 17 of the pin, as shown, in which is cut an internal thread 18 of the same kind, hand and lead as its complementary thread 15, while the inner non-tapered or cylindrical portion of the box cavity is of reduced diameter and provided with an internal thread 19 of similar kind, hand and lead as its complementary thread 16 and longer than thread 18. The box cavity has a tapered conical friction gripping portion 20 extending from the inner or upper end of bore 11^a to the lower or outer end of thread 19.

Cone portions 17 and 20 have the same slope relatively to the rod axis and are of the same length. The major diameter of portion 17 in the construction shown corresponds with the minor or root diameter of thread 15, and the minor diameter of said portion 17 is slightly greater than the major diameter of threads 16 and 19. The major diameter of portion 20 is less than that of portion 17 and its minor diameter is less than that of portion 17. The major diameter of portion 20 is greater than the minor diameter of portion 17 and less than the minor diameter of threads 15 and 18, while the minor diameter of said portion 20 corresponds with the major diameter of thread 19.

It will, of course, be understood that the leading in ends of the pair of external threads start at points in the same longitudinal plane as do also the leading in ends of the pair of internal threads, and that the pairs of threads are so spaced that any turn of one thread is spaced from any turn of the other thread a multiple of the thread pitch or lead, as shown, so that the rod sections may screw together as illustrated in the drawings.

The relative sizes of the cone surface portions 17 and 20 are preferably such that they just contact or seat one on the other, as shown in Fig. 2, when thread 18 is engaged with several turns of thread 15 but is one or two turns short of the inner or lower end of thread 15, so that by screwing the parts one turn farther together the cone surfaces will be forcibly telescoped and tightly jammed together with surface 20 elastically stretched about surface 17. This elastic friction grip between the conoidal metal friction surfaces tightly locks the rod sections together against accidental unscrewing. The slope of the cone surfaces 17 and 20 relatively to the rod and thread axes is preferably slight and within the angle of friction of said surfaces and the rod metal, the slope illustrated being six degrees, to afford a powerful friction grip with a slight elastic deformation of the telescoped cones and one which is

not dependent upon continued axial pressure to maintain the friction grip.

By making the smaller diameter threads 16 and 19 longer than the larger diameter threads and spacing the larger diameter threads 15 and 18 therefrom as shown and described, the smaller diameter threads engage first and lead the larger diameter threads into engagement, thus facilitating coupling of the rod sections and, further, a larger number of turns of the threads on the reduced portions of the pin and box will be engaged when the rod sections are fully coupled.

It will be observed that both pairs of threads are engaged before the cones contact so that the effort of stretching the outer cone on the inner cone is taken by both pairs of threads at opposite ends of the cone, which arrangement also prevents elongation of either cone during the screwing together of the rod sections. It will be also observed that the two rod sections are positively thread-coupled directly one to the other both above and below the locking cone portions thereof so that neither cone can elongate and its grip on the other be thus loosened under the heavy axial load imposed by the weight of the rod and by resistance of oil in the well to rod reciprocation, as well as the severe tension stretching stresses and shocks incident to rapid reciprocation of the sucker rod in the well.

The long cone engagement resists cocking of the sections and threads and, with the added resistance of the engaged threads at both ends of the cone to development of play between the cones, prevents the frequent pin fractures heretofore occurring by eliminating the causes of such fractures. It is impossible for the cones to loosen by elongation or vibration and develop destructive wobbling mandrel stresses in the joint. The box expanding stress in tightening up of the joint is furthermore about midlength of the box and not at either end, and the resultant effect in screwing the sections from Fig. 2 position to the locked or fully coupled position of Fig. 1 is to cause a more powerful friction thread grip between the rod sections than would be the case between the threads of a single pair of threads. Furthermore, the rod sections are so positively-coupled that if the smaller portion of the pin fails they will not fall apart.

It will be obvious that the two pairs of complementary threads of like lead and constant pitch from end to end formed on rod portions of different diameters may be of other known kind or type than that shown.

By forming the cone surfaces with a very slight taper and locating them between two pairs of threaded portions of such different diameters that the smaller-diameter externally threaded part of the male member just

clears the internal cone surface, long locking cone surfaces of maximum gripping efficiency and maximum joint stabilizing efficiency in resisting cocking stresses may be used without the necessity of so reducing the smaller-diameter threaded part of the pin that the rod will be unduly weak at this portion or of making the maximum diameter of the joint unduly large.

10 What I claim is:

1. A jointed sucker rod comprising two units having adjacent male and female end portions coupled at two longitudinally spaced points by two pairs of engaged screw threads thereon, said female end portion having an internal annular conoidal non-threaded surface and said male portion having an external annular conoidal non-threaded surface upon which the conoidal surface of the female portion is held forcibly wedged and elastically stretched by the two screw thread connections between the adjacent ends of said screw thread connections, said conoidal surfaces tapering toward the rod axis in the direction of the entering end of the male end portion.

2. A jointed rod comprising units engaging each other and held in assembled relation end to end solely through the medium of two coaxial pairs of engaged screw threads thereon and the peripheral engagement of a pair of non-threaded conoidal surfaces of the units one of which is held forcibly wedged and stretched upon the other by said pairs of threads between the adjacent ends of said pairs of threads.

3. A jointed rod comprising adjacent units having interfitted male and female end portions, wherein said male end portion has two coaxial external screw threads and an intermediate non-threaded part, and the female end portion has two coaxial internal screw threads and an intermediate non-threaded part stretchable by said non-threaded part of the male portion, said units being screwed together with the leading and following external threads engaging the following and leading internal threads and with the non-threaded part of the female portion elastically expanded on the non-threaded part of the male portion, and said threads and non-threaded parts of the end portions being correlated for partial screwing together of both pairs of threads prior to contact between said non-threaded parts during coupling of the units.

4. A jointed rod as claimed in claim 3, wherein the non-threaded parts have coactive conoidal surfaces coaxial with their threads tapering toward the rod axis in the direction of the entering end of the male member and one held forcibly wedged and stretched upon the other by the screw thread connections between the end portions.

5. A sucker rod comprising two axially

aligned members directly coupled through the medium of their adjacent end portions, one of which end portions has two externally threaded non-tapered end parts and an intermediate non-threaded part of circular profile in cross section, and the second one of which end portions has an axial bore provided with two threaded non-tapered end parts and an intermediate non-threaded part of circular profile in cross section, the threaded end parts of the first end portion being screwed into the threaded end parts of the bore of the second end portion, and the intermediate non-threaded part of the first end portion being forcibly telescoped in the intermediate non-threaded part of the bore of the second end portion, the normal peripheral sizes of said intermediate parts of said first end portion and bore being such that the second end portion is elastically expanded on and elastically grips said intermediate part of the first end portion between the adjacent ends of the two screw thread connections between said end portions, whereby accidental unscrewing of said members of the rod is prevented, and separation of the elastically gripped surfaces of the coupled end portions of the members under tension stress on the rod is prevented.

In testimony whereof I hereunto affix my signature.

LEWIS B. BRIDGES.

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