

Aug. 30, 1927.

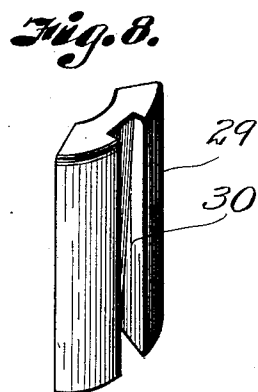
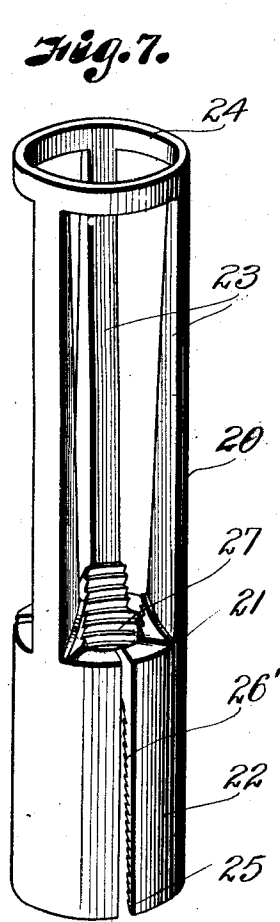
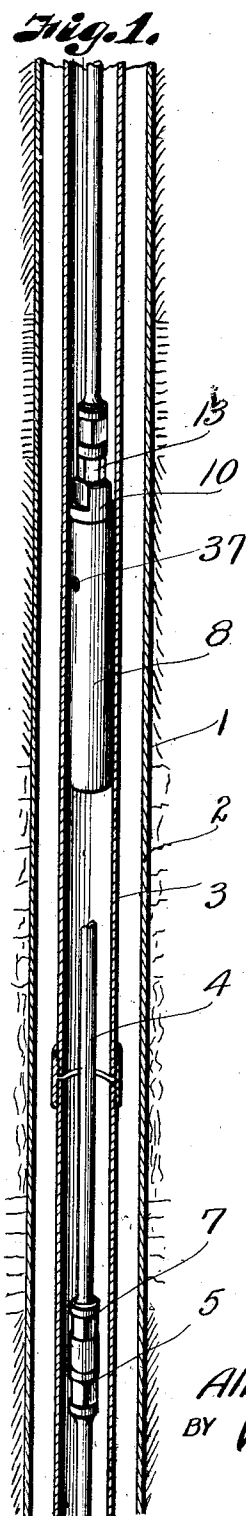
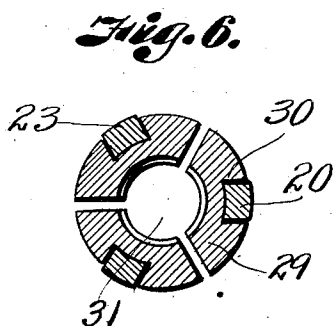
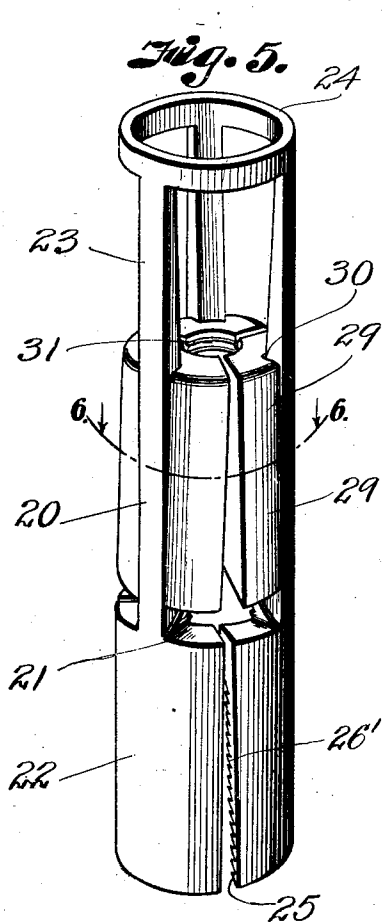
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A. H. NEILSON

MULTIPLE SUCKER ROD SOCKET

Filed Aug. 31, 1925

3 Sheets-Sheet 1



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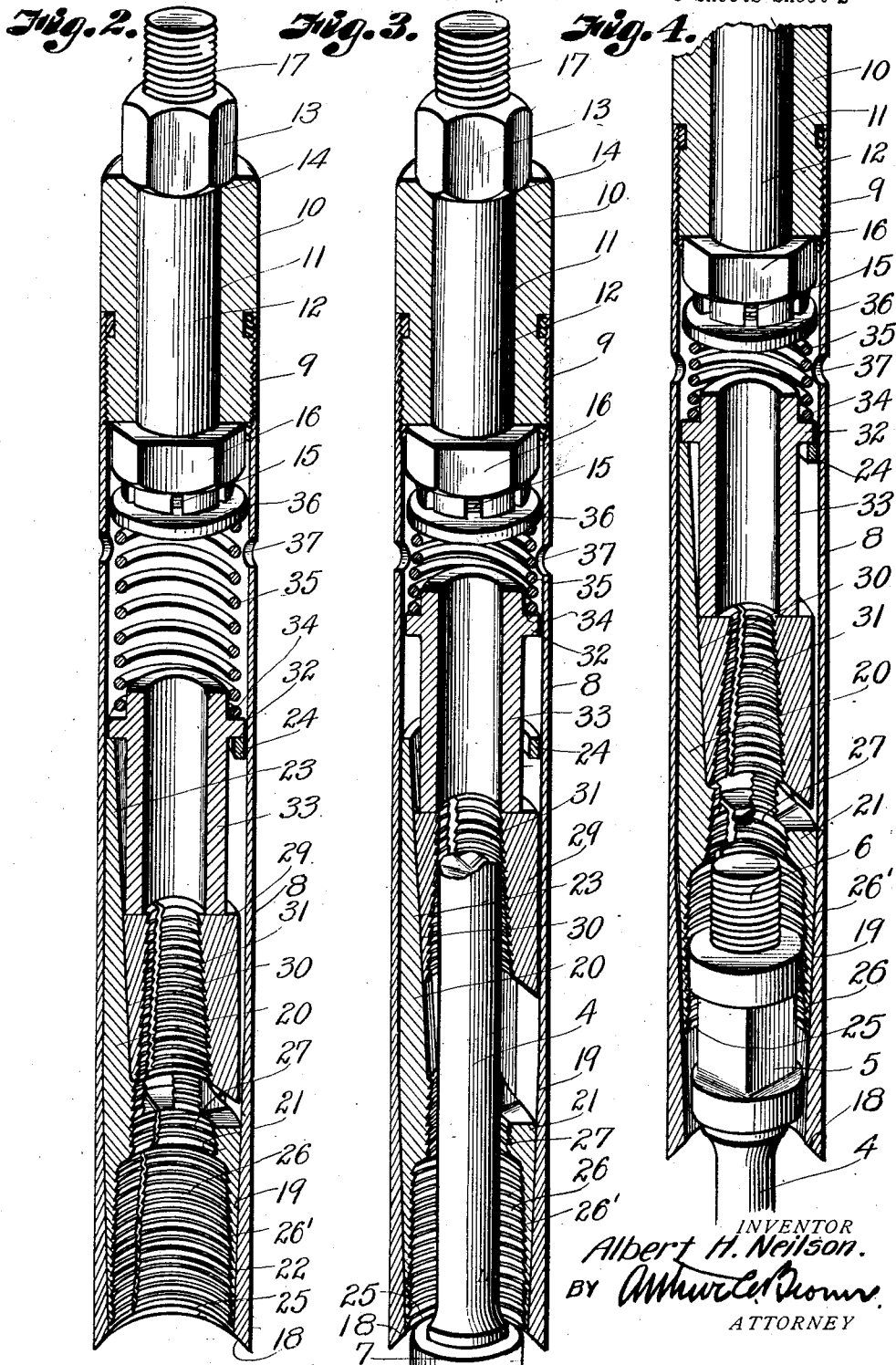
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Fig. 9.

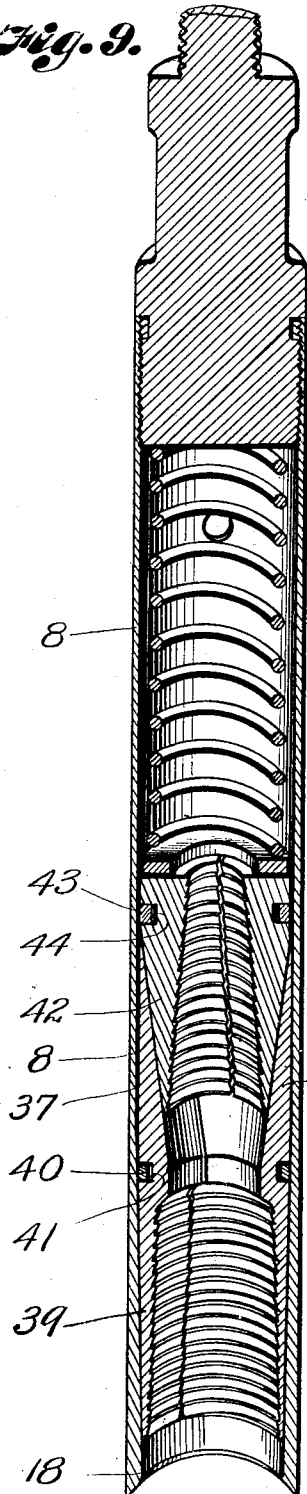


Fig. 10.

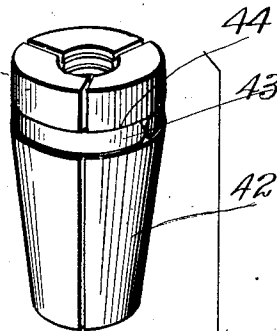


Fig. 12.

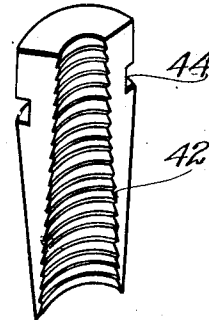


Fig. 13.

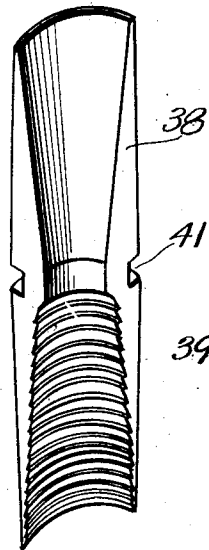
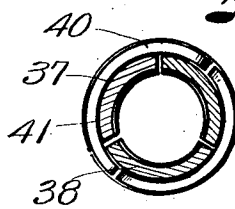


Fig. 11.



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UNITED STATES PATENT OFFICE.

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MULTIPLE SUCKER-ROD SOCKET.

Application filed August 31, 1925. Serial No. 53,510.

My invention relates to sucker rod sockets and constitutes an improvement over the sockets disclosed in my prior Letters Patent of the United States, No. 1,382,602 of June 21, 1921, and No. 1,433,146 of October 24, 1922.

As explained in my prior patents, a tool of this kind is employed for the removal of broken sucker rods from a well and that, as the break may occur in either the rod section or at the box joint, a multiple gripping surface must be provided to accommodate the tool to the diameter of the rod at the point of severance. This diameter may be that of the rod proper, as where the break is in the rod section, of a mushroomed rod, as where the break is in the rod section and subjected to hammering, of the box pin when rod sections have become disconnected, or of the box itself, when the break in the rod is adjacent the upper end of the box.

In my earliest Letters Patent I disclosed a single set of slips, having a tapered gripping surface graduated to receive either the box or rod, but found this construction not altogether satisfactory because of the required length of the slips.

In my second Letters Patent I disclosed a reversible set of slips having a gripping surface at one end adapted for receiving the rod, and a gripping surface at the opposite ends for receiving the box. While this construction has been generally satisfactory, it is objectionable in that it is not always possible to determine beforehand just which end should be presented for the work, and it sometimes becomes necessary to remove the tool and reverse the slips.

It is the principal object of the present invention to provide a tool combining the advantages of both of my prior constructions, in that it affords the substantially continuous gripping surface for the box or rod found in the first patent, without the excessive length of that construction, and also affords the relatively independent box and rod gripping sections of the second patent, without the necessity there present for reversal of the tool for box or rod engagement.

In accomplishing these and other objects of the invention I have provided improved details of structure, the preferred forms of

which are illustrated in the accompanying drawings, wherein

Fig. 1 is a perspective view of my improved socket about to be applied to a broken sucker rod.

Fig. 2 is an enlarged, longitudinal section of the socket, the parts being in normal position.

Fig. 3 is a similar view showing the parts as they appear when engaging a broken sucker rod.

Fig. 4 is a similar view showing the parts as they appear when engaging a sucker rod box.

Fig. 5 is a detail, perspective view of the slip cage.

Fig. 6 is a transverse section on the line 6-6, Fig. 5.

Fig. 7 is a detail, perspective view of the cage, with the secondary slips removed to better illustrate the throat jaws.

Fig. 8 is a detail, perspective view of one of the secondary slips.

Fig. 9 is an enlarged, longitudinal section of a modified form of socket.

Fig. 10 is a detail, perspective view of the modified form of cage and secondary slips.

Fig. 11 is a transverse section on the line 11-11, Fig. 10.

Fig. 12 is a detail, perspective view of one of the secondary slips.

Fig. 13 is a similar view of one of the primary or cage slips.

Referring more in detail to the drawings:—

1 designates a well hole; 2 the casing; 3 the tubing and 4 a sucker rod—all of ordinary construction, the sucker rod being formed in sections, each section having a head 5 (Fig. 4) and pin 6 at one end and a box 7 (Fig. 3) for receiving the pin of an adjacent section at the other end.

As wells in which my socket is adapted for use range from a few hundred to several thousand feet in depth, it is necessary to employ a number of sections of sucker rod, and it not infrequently happens that the rods break, due to some defect in material or unusual strain, or become separated at a joint. It then becomes necessary to remove the retained upper sections of the rod and then fish for the lower portion with a

tool capable of first finding the rod and then gripping it so that the lower portion may be removed. If the break is in the body of the rod and the broken end has not been
 5 hammered, a cross section of the diameter of the rod is presented to the gripping tool. If the end of the rod has been mushroomed by hammering a larger diameter is presented to the tool, and if the break is at the
 10 joint or the severance due to disconnection of the box and pin, then a still larger diameter is presented for the gripping tool.

This condition requires that the tool be graduated in order that it may adapt itself to whichever condition is encountered, it being impossible to foretell the condition because of the depth of the rod in the well.

The socket which I have designed to meet these conditions consists of a tubular barrel
 20 8 having an interiorly threaded upper end 9 whereby it is attached to a sleeve 10 having an interior bore or bearing 11 of substantial diameter.

Extending through the bore 11 is a bolt
 25 12 having a hexagonal boss 13 at its upper end provided with a curved lower surface bearing in a concave seat 14 at the top of the sleeve 10 and provided with a screw shank 15 at its lower end.

Threaded onto the shank 15 is a castellated nut 16 which serves to hold the bolt securely to the sleeve, but anchored to the shank to provide a swiveling movement for the socket.

The upper end of the bolt has a threaded shank 17 corresponding to the pin of a
 35 sucker rod joint and whereby the socket may be suspended from a sucker rod, as illustrated in Fig. 1.

The barrel 8 is only of slightly less diameter than the tube 3 within which it works, and is provided at its lower end with a bevel face 18 so that the barrel may move freely in the tube, but when lowered to the broken rod, may find the rod irrespective of whether
 45 the rod is standing straight or lying against the tube, and the rod be directed to the interior of the barrel. The barrel 8 is of substantial thickness at its lower end but expands gradually for about six inches to form
 50 a downwardly constricted bore 19 therein.

Slidably mounted within the bore 19 is a cage 20, comprising a longitudinally split head 21 forming individual slip members
 55 22 preferably three in number, having arms 23 at their upper ends connected at their ends opposite the slip members by a ring 24.

The cage is of such diameter as to fit snugly within the barrel with the slip members compressed, the lower edges 25 of the slip members being bevelled to form substantially a continuation of the bevelled edge
 60 18 of the barrel 8, so that when the socket is lowered over a broken sucker rod, the latter will be directed to the interior of the cage.

The cage 21 has an outer surface tapered oppositely to the bore 19 of the barrel 8, so that it will fit the tapered bore snugly when in normal position therein, and so that the slip members may be expanded under
 70 tension of the arms 23, or pressure from the rod, as will presently be described, when the socket is moved over a broken rod, the slip members having their inner faces tapered upwardly to form a constricted
 75 socket 26 of a diameter to receive a sucker rod head 5 or box 7 or a mushroomed rod.

At the upper ends of the slip members 22 the cage is thickened to form a throat
 80 27 of substantially less diameter than the socket 26 and within which a mushroomed rod may be received and gripped, the throat also tapering toward a restricted upper end, as in the case of the socket 26.

The socket 26 and the throat 27 are ribbed
 85 to form gripping surfaces, the ribs being down-cut to form ratchet faces, which may be lowered over a rod, pin or box, but which will tend to grip the same when the socket is lifted, the gripping face on the throat
 90 being extended a short distance up along the arms 23 of the cage to provide a more extended gripping surface.

Located within the cage are secondary slips 29, also preferably three in number, and each having a longitudinal groove 30
 95 in its outer face seating a corresponding arm 23, the arms 23 being bevelled to form a downwardly-constricted, skeleton bore, and the bases of the grooves 30 being reversely tapered to permit the slips to expand when
 100 moved upwardly within the cage. The inner faces of the slips are tapered to form an upwardly-constricted bore, and are provided with down-cut teeth corresponding to those
 105 of the primary socket 26 and throat 27, the dimensions of the throat 27 and secondary slip bore 31 being such as to provide a continuous, graduated bore when the parts are in normal position, there being an
 110 offset between the bore of the throat and that of the primary socket, for the reason that the primary socket is intended to take over a sucker rod, pin or box, whereas the throat and secondary socket are intended
 115 to take over a straight or mushroomed rod.

Suspended from the ring 24 by a flange 32 is a plunger 33, the lower end of which terminates adjacent the top of the secondary slip socket, and the upper end of which projects above the flange to form a seat 34.

Seating on and rising from the seat 34 within the barrel 8 is a coil spring 35, and interposed between the upper end of the spring and the lower end of the castellated
 125 nut 16 is a washer 36 forming a stop against which the spring is compressed when the plunger 33 is moved upwardly, either from the cage proper or from the secondary slip socket, as will presently be described. 130

37 designates drain holes in the barrel preferably adjacent its upper end.

The bolt and sleeve connection at the top of the socket affords a swivel which will permit the socket and suspended portion of the sucker rod to turn and prevent twisting and possibly further breakage during the pulling of the rod.

In using the device and first assuming that the rod is broken at the joint, or that the joint has become separated so that the part exposed to the fishing tool is of the thickness of the box or pin, the upper end of the broken rod is first removed from the tube and then the socket let down by means of a sucker rod. Reaching the box or pin the bevelled end of the socket directs the same into the barrel and into the primary socket 26 formed by the slips that are integral with the cage. When the pin or box contacts with the teeth 26' it slides over the teeth for a distance until the constriction in the socket bars the pin or box, when the cage is held while the barrel moves over it, the tapered contact of the barrel and cage permitting the cage, and particularly the slips 22, to expand to further seat the pin or box, the sliding movement of the barrel on the cage being cushioned by the spring 35 which is compressed between the washer 36 and the plunger seat 34 as the barrel moves downwardly, the plunger in turn being held by the ring 24 of the cage. The spring having reached the limit of its compression, the pin or box is forced into the cage slips and when the socket is lifted the teeth hold to the pin or box and as the constricted barrel is lifted along the cage the bevelled face of the barrel and cage tend to compress the slips against the pin or box and tightly grip the same so that the rod is lifted out of the well with the socket.

Assuming next that the break is a clean one in a rod section, then the socket, being lowered as before described, passes over the end of the rod until constriction of the secondary slips causes them to engage the rod, and the slips are pushed upwardly and expanded because of their tapered contact with the cage arms to provide a better grip on the rod when travel of the socket is reversed. In this case the spring is again compressed between the washer 36 and the plunger seat 34, but pressure of the plunger is against the upper ends of the secondary slips, the cage moving downwardly with the barrel.

When the socket is seated over the rod its travel is reversed and the slips gripping the rod tend to move downwardly along the cage arm, such tendency being opposed by the slips against the rod so that the down-cut teeth bite the rod and hold it securely in the socket.

Should a rod be mushroomed so that its upper end presents a gripping surface too

small to be engaged by the primary slips and too large for the secondary slips, it is gripped in the throat 27, this operation being the same as described in connection with the pin or box break.

In Figs. 9 to 13 inclusive I have shown a modified form of cage wherein the secondary slips are unconfined except by the compression spring. In this form the cage 37 is of solid construction, split longitudinally to form the individual slips 38 and the upper confining portions 39, the slips being held together by a split spring band 40 seating in an annular groove 41 at the center of the cage. The slips 38 have the upwardly-constricted tooth bore of the preferred form, but the throat of the cage is not adapted for gripping but merely for the passage of a rod therethrough. The upper slips 42 have tapered seat on the solid upper face of the cage and have an upwardly-constricted toothed bore, as in the preferred form, and are held in assembled relation by a split spring band 43 seating in the annular groove 44. Operation of the modified form of socket is substantially similar to that of the preferred form, any slight difference being readily apparent from observation of the drawings, and the operation will, therefore, not be specifically described.

What I claim and desire to secure by Letters Patent is:—

1. In a socket of the character described, an interiorly-tapered barrel, an expansible set of exteriorly-tapered primary slips within the barrel, having interiorly tapered extensions, and an expansible set of externally-tapered, secondary slips within the extensions of the primary slips.

2. In a socket of the character described, a primary set of relatively expansible slips movable longitudinally within the barrel, and a secondary set of relatively expansible slips movable longitudinally within the primary set of slips, the primary slips having downwardly restrictive relation with the barrel and the secondary slips having corresponding relation with the primary slips to effect selective gripping relation of the slips with contained stationary objects when the socket is raised along the objects following a preliminary gripping contact of the slips with the objects.

3. In a socket of the character described, an interiorly-tapered barrel, an expansible set of exteriorly tapered primary slips within the barrel, having interiorly tapered extensions, an expansible set of externally-tapered, secondary slips within the extensions of the primary slips, and means yieldingly resisting longitudinal movement of either set of slips.

4. In a socket of the character described, an interiorly-tapered barrel, an expansible set of exteriorly tapered primary slips with-

in the barrel, having interiorly tapered extensions, an expansible set of externally-tapered secondary slips within the extensions of the primary slips, a plunger operable under thrust from either set of slips, and a spring yieldingly restraining thrust movement of the plunger.

5. In a socket of the character described, an interiorly-tapered barrel, an expansible set of exteriorly-tapered primary slips within the barrel, having interiorly tapered extensions, an expansible set of exteriorly-tapered, secondary slips within the extensions of the primary slips, a plunger suspended from the said extensions and engageable by said secondary slips, and a spring confined within the barrel in restraining relation to the plunger.

6. In a socket of the character described, a primary set of slips comprising separate gripping jaws and extensions on said jaws connected remote from the jaws to form a cage and permit the jaws to spread, and a secondary set of slips confined within the cage.

7. In a socket of the character described, a primary set of slips comprising separate gripping jaws and extensions on said jaws connected remote from the jaws to form a cage and permit the jaws to spread, and a secondary set of slips confined within the cage and slidable longitudinally on said extensions.

8. In a socket of the character described, a primary set of slips comprising separate gripping jaws and extensions on said jaws connected remote from the jaws to form a cage and permit the jaws to spread, and a secondary set of slips confined within the cage and slidable longitudinally on said extensions, the extensions being tapered to permit the slips to spread.

9. In a socket of the character described, a primary set of slips, having tapered, jaw-faced inner surfaces forming an upwardly-constricted channel having tapered, jaw-faced extensions connected remote from the slips to form a cage, a secondary set of slips confined within the cage and having tapered, jaw-faced inner surfaces forming an upwardly-constricted channel, graduated relative to the channel in the primary set of slips.

10. In a socket of the character described, a primary set of slips, jaw-faced inner surfaces forming an upwardly-constricted channel and having tapered, jaw-faced extensions connected remote from the slips to form a cage, a secondary set of slips confined within the cage and having tapered, jaw-faced inner surfaces forming an upwardly-constricted channel, graduated relative to the

channel in the primary set of slips, the meeting faces of said extensions and said secondary slips being tapered oppositely to permit the slips to expand when moved longitudinally within the cage.

11. In a socket of the character described, a primary set of slips having tapered, jaw-faced inner surfaces forming an upwardly-constricted channel and having tapered, jaw-faced inner extensions connected remote from the slips to form a cage, a secondary set of slips confined within the cage and having tapered, jaw-faced inner surfaces forming an upwardly-constricted channel, graduated relative to the channel in the primary set of slips, and single means for resisting longitudinal movement of either set of slips.

12. A socket of the character described, comprising a barrel having a tapered inner wall, a cage slidable in the barrel comprising a longitudinally split head and arms on the head members connected to form a cage, the head members having tapered and toothed inner walls, slips slidable in the cage, the slips and cage arms being reversely tapered to contract the slips or permit them to expand, the slips having tapered and toothed inner walls, a plunger in said cage engageable by the cage or by the slips, a head for the barrel, and a cushion interposed between the plunger and said head.

13. In a socket of the character described, a barrel, a cage slidable within the barrel, comprising a set of primary slips, a set of secondary slips slidable within the cage, a plunger slidable within the cage operable by the cage or by the secondary slips, a head on said barrel, and a cushion between the head and plunger.

14. In a socket of the character described, a barrel, a cage slidable within the barrel, comprising a set of primary slips, a set of secondary slips slidable within the cage, a plunger slidable within the cage having a flange overlying the top of the cage, a head on the barrel, and a coil spring seating on said flange about the plunger and retained by said head.

15. In a socket of the character described, a barrel, a head in the barrel, a belt rotatable in the head having a head seated on the barrel head and provided with a pin, and having a nut engaging the other end of the barrel head, a cage in the barrel comprising a primary set of slips, a secondary set of slips within the cage, a plunger in the cage operable by either the cage or the secondary slips, and a spring interposed between the plunger and said nut.

In testimony whereof I affix my signature.

ALBERT H. NEILSON.