

Jan. 19, 1960

P. S. BLODOFF
ON AND OFF TOOL

2,921,634

Filed Nov. 12, 1957

2 Sheets-Sheet 1

Fig. 1.

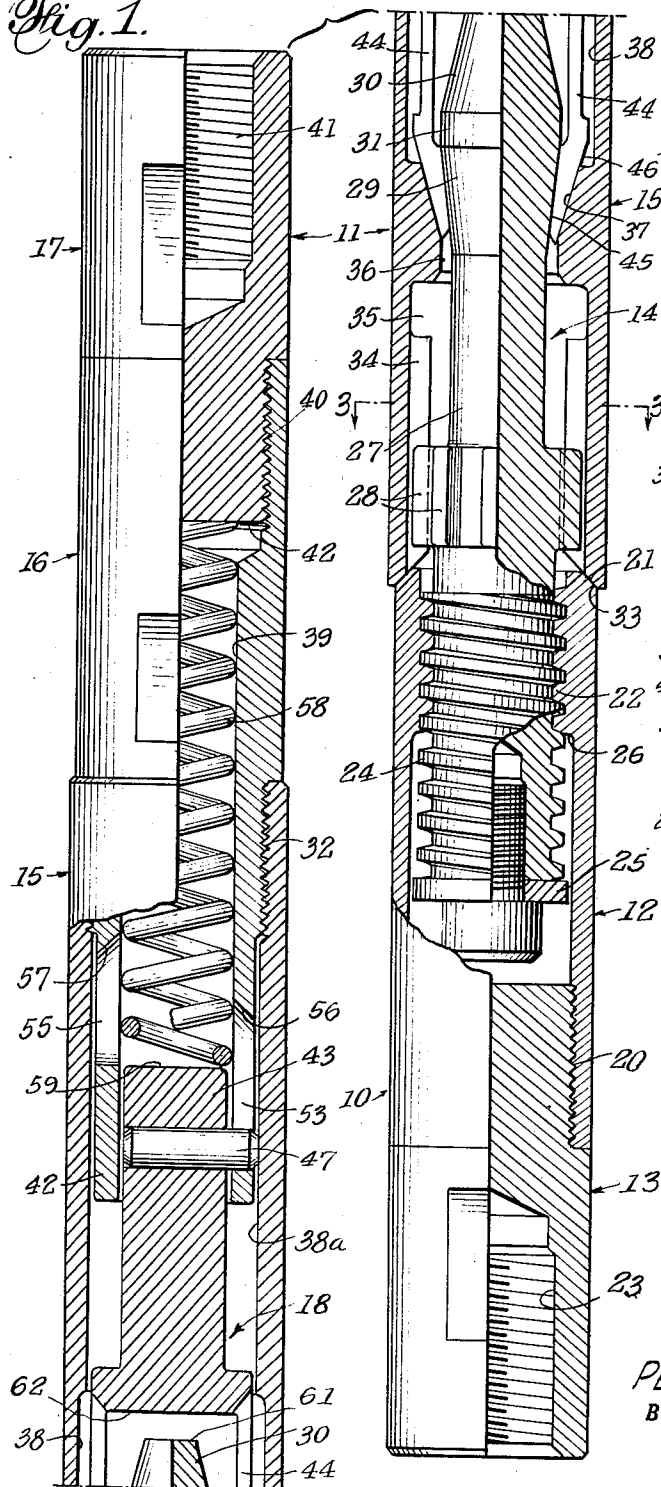


Fig. 2.

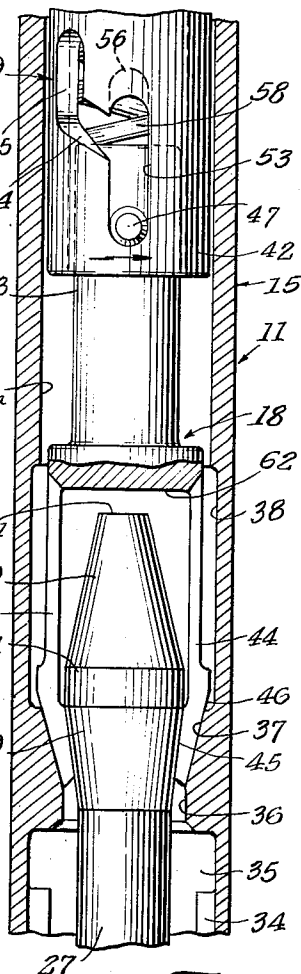
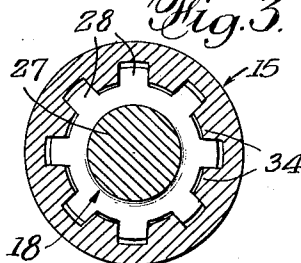


Fig. 3.



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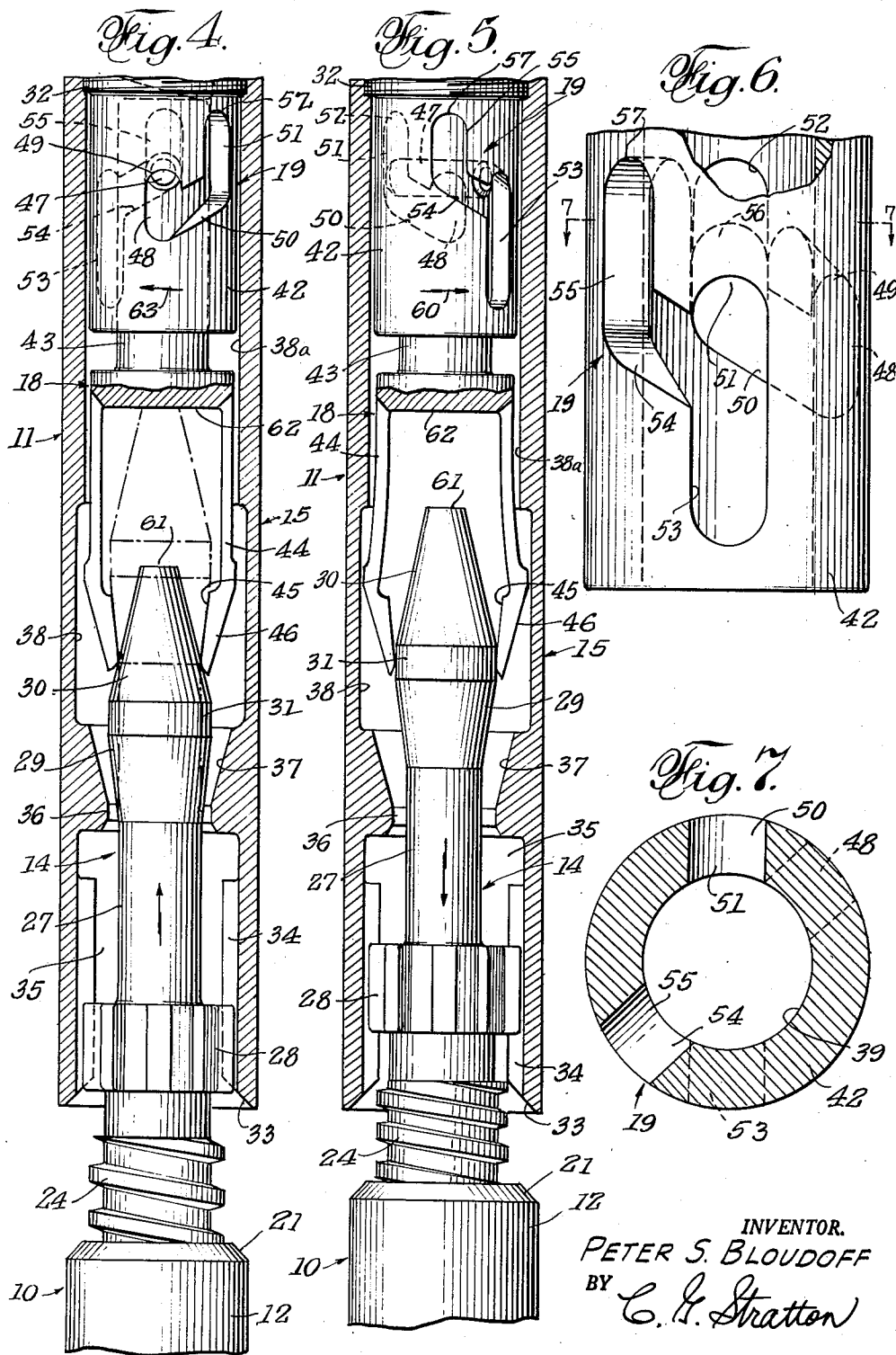
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2 Sheets-Sheet 2



1

2,921,634

ON AND OFF TOOL

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12 Claims. (Cl. 166—219)

This invention relates to an on and off tool used, primarily, for quick and positive attachment and detachment or disengagement of sucker rods deep in a well bore. The same replaces a sucker rod coupling in a string of rods.

An object of the present invention is to provide a tool of the character referred to that has the requisite strength to couple upper and lower sections of a sucker rod string and yet functions with a minimum amount of actuation and/or rotation to effect attachment and detachment, as the case may be. Since actuation must be effected from the surface and frequently many thousands of feet above where the tool is located in the string, control is difficult and a tool, such as the present tool, that requires minimal actuation is highly to be desired.

The present tool has a variety of purposes. For instance, where production requirements exceed the capacity of the pump which may be inserted into the existing tubing string, enlarged sections of tubing are attached to the lower end of said tubing string to accommodate a larger pump. It can be readily seen that the pump, then, cannot be inserted through the tubing and must be run in place at the bottom of the string. Thereafter the actuating string of sucker rods must be inserted into the tubing and attached to the reciprocating element of the pump. When the need for servicing the pump occurs, removal of the sucker rods separately from the tubing is extremely desirable. An on and off tool provides the means whereby the aforementioned attachment and release of sucker rods is readily accomplished. Also, pumps are often run in fluids containing a high percentage of sand. Gravity separation of this sand in annular areas often packs to the point where pumps cannot be removed from the tubing string. An on and off tool to uncouple the rods would allow rods to be pulled, leaving the pump in position to be pulled with the tubing string. Further, in multiple zone pumping installations, adjustment of location and length of available stroke of the lower pump can be more readily accomplished at the surface. Through the incorporation of an on and off tool, upper and lower pumps may be run in place in the tubing to be followed conveniently with the upper rod string.

Since the coupling, deep in a well bore, of the lower and upper sections of a string of sucker rods, is effected mainly by a "stabbing" movement of the upper string section downwardly toward the lower section, much abuse and damage is usually suffered by the parts thus sharply contacted. It is another object of the invention to provide an on and off tool that is formed to effect relatively smooth interconnection and thus largely eliminate the causes of contact damage.

A further object of the invention is to provide a tool of the instant character that does not connect or disconnect at a threaded joint, thus eliminating one of the greatest sources of damage to the tool parts. In prior tools, connect and disconnect threads were the por-

2

tions most frequently damaged by stabbing surfaces, the same often resulting in malfunction of the tool.

A still further object of the invention is to provide an on and off tool that can be more readily controlled from the surface of the well to effect a simple vertical actuation to a positive stop, thereby releasing the operator from trying to "feel" the tool action through several thousand feet of sucker rods.

The invention also has for its objects to provide such means that are positive in operation, convenient in use, easily installed in a working position and easily disconnected therefrom, economical of manufacture, relatively simple, and of general superiority and serviceability.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. However, the drawings merely show and the following description merely describes, one embodiment of the present invention, which is given by way of illustration or example only.

In the drawings, like reference characters designate similar parts in the several views.

Fig. 1 is a longitudinal sectional view of an on and off tool according to the present invention, the view being shown in two side-by-side sections, the section on the right being a lower continuation of the section on the left.

Fig. 2 is a fragmentary longitudinal sectional view of the tool, as in Fig. 1, and taken at right angles to the plane of Fig. 1.

Fig. 3 is a cross-sectional view as taken on the line 3—3 of Fig. 1.

Fig. 4 is a longitudinal sectional view of the tool in the process of being connected or attached.

Fig. 5 is a similar view of the tool in the process of being disconnected or detached.

Fig. 6 is an enlarged fragmentary elevational view of a latch element used in the construction, the same showing the pattern of latch slots provided therein.

Fig. 7 is a cross-sectional view as taken on line 7—7 of Fig. 6.

The present on and off tool comprises, generally, a lower section 10 and an upper section 11.

The lower section 10 comprises, generally, a tubular body 12, a tool joint adapter 13 connected to the lower end of said body, and a spear 14 extending from the upper end of said body.

The upper section 11 comprises, generally, a tubular body 15, a latch 16 extending upwardly from and partly into the body 15, a tool joint adapter 17 connected to the upper end of the latch 16, and a collet member 18 carried by the lower portion of the latch 16, said lower portion being provided with a set of collet-controlling latch slots 19.

The body 12 of the lower section is threadedly connected to the adapter 13 as by threads 20. This connection may be a permanent one and is maintained regardless of the direction of rotation or torque applied to the body 12. The upper end of said body 12 is preferably provided with a conical chamfer 21 and, internally, said body is provided with a left-hand internal thread 22 which is preferably of the square or acme type.

The adapter 13, in the usual manner, is provided with a box 23 for connection with a pin on the end of a sucker rod to which the lower section 10 is connected. Of course, the box may be replaced by a pin to connect with the box on the end of a sucker rod. In either case, the lower section 10 constitutes the upper end of the lower portion of a string of sucker rods.

The spear 14 has a threaded lower end 24 that is engaged in the left-hand threads 22, a stop washer 25 being provided at the lower end of the threads to form

3

an abutment that is adapted to limit the outward movement of the spear on its threads by engaging the shoulder 26. Shank 27 extends upwardly from said threaded end 24 and a set of splines 28 are provided on said shank. On the upper end of the shank 27, there is provided a conically flared part 29 and extending upwardly from said part 29 there is provided a conically tapered part 30. Between the parts 29 and 30 is provided a cylindrical part 31. Thus, the spear is provided with a coupling end that is comprised of oppositely tapered conical parts.

The body 15 of the upper section 11 is connected to the latch 16 by threads 32 at its upper end and the lower end is formed to have a conical seat 33 that is a complement of the chamfer 21 and engages therewith in end-to-end abutment. A set of splines 34 is provided in the body 15 adjacent said seat 33, the same having sliding and keying engagement with the splines 28 of the spear 14. Said splines 34 are provided in a passage 35 of the body 15 and the upper end of said passage is restricted in the form of a smaller passage 36 that flares conically upward at 37. An enlarged passage or chamber 38 is formed in the body 15 above the conical seat 37, the same then narrowing to a passage 38a below the threads 32.

The latch 16 comprises a tubular member that has an internal through passage 39. The upper end of said latch connects by threads 40 to the tool joint adapter 17 which may be similar to the adapter 13 in form and have either a box 41 or a pin, as described in connection with adapter 13. Thus, the upper section 11 may be connected to an upper string of sucker rods and comprise the lower end of said string.

Said latch 16 has a tubular lower end 42 that is below the threads 32 and extends into the passage 38a of the body 15. The passage 39 of said lower end is closed at the top by the end 42 of the adapter 17.

The collet member 18 is formed to have an upper shank 43 that is introduced into the passage 39, and a lower set of clutch fingers 44 that are each formed to have an inner sloping face 45 at an angle to engage the conical part 29 and an outer sloping face 46 at an angle to engage the conical seat 37. As seen in Fig. 2, said fingers are adapted to be introduced between the spear and the seat 37 to prevent the spear from being withdrawn downward through the restricted passage 36. As can be seen, the spear part 31 may be passed through said passage 36 in either direction.

The set of slots 19 are used to variously position the collet member 18 relative to the conical seat 37 so that the fingers 44 thereof are disposed in said seat or raised thereabove. A cross pin 47 extends slidably through the upper end of the collet shank 43 and has bevelled ends that facilitate transverse sliding movement of said pin by the slots 19.

Said slots 19 comprise a shorter slot 48 that has a bevelled upper face 49 and is connected to an upwardly sloping passage 50 from which longitudinally extends a slot 51. Slot 51 has its lower end (where connected to the passage 50) at the level of the upper end of slot 48, the upper end 52 of the slot 51 being disposed thereabove. Said slots 48 and 51 are angularly displaced approximately 50°, the latter slot being to the right. The pin 47 is of a diametral size to fit said slots and of a length, as seen in Fig. 1, to extend through the collet shank 43 and through said shorter slot 48 or slot 51, as the case may be.

Said slots 19 also comprise a longer slot 53 diametrically opposite to the slot 51, an angular passage 54 extending from the upper end of said slot 53 and a longitudinal slot 55 that extends upwardly from said passage. The upper end of slot 53 is at the level of the upper end of slot 48 and is provided with a bevel 56. The lower end of said slot 53 is substantially below the lower end of slot 48, the position thereof being such as to allow the collet fingers to seat in seat 37 when the pin 47 is shifted

4

into said lower end of slot 53. The upper end 57 of slot 55 is at the level of the end 52 of slot 51. Slot 55 is diametrically opposite to the slot 48.

Using the end 42 of adapter 17 as an upper abutment, an expansion spring 58 within the passage 39, biases the collet member 18 downwardly by abutting the upper end 59 of said member.

Figs. 1, 2, and 3 show the tool sections 10 and 11 connected. In this condition, the collet fingers 44 are positioned with their faces 46 engaged in the conical seat 37, the pin 47 is disposed in the lower end of slot 53, the chamfer 21 of the lower section is tightly engaged with the conical seat 33 of the upper section, and the spear 14 is withdrawn downwardly on its left hand thread 24 to draw the conical part 29 into firm contact with the faces 45 of said collet arms. Thus, the abutted sections 10 and 11 move as a unit either upwardly or downwardly because of the opposite interlock created at 21—33 and by the interposition of the collet arms between the spear and the upper body 15.

When it is desired to break the joint between the sections 10 and 11, it being assumed that the lower section 10 is in a position where rotation thereof is prevented, the upper string of sucker rods is rotated from above to cause rotation of the upper seat 11 in the direction of the arrow 60 (Fig. 5). Because of the left hand threads 22, 24, the spear, being rotated through the splines 28, 34, the sections back off relatively, breaking the contact or joint at 21, 33. Since the section 10 is stationary, the spear moves upwardly until its end 61 strikes the face 62 of the collet member. Thus, the spear part 29 first moves upwardly away from the faces 45 of the collet fingers and, then, the spear end 61 raises the collet out of the conical seat 37. Thus, the pin 47 is moved upwardly in slot 53 until it strikes the bevel 56, causing said pin to shift transversely into the lower end of the slot 51. Any continued upward movement of the collet is accommodated by the upper end 52 of said slot 51. When the lower section is separated from the upper section, the spear end 61 releases the collet member. Now, the spring 58 biases said member downwardly, to move the pin 47 from slot 51, through the passage 50, into the lower end of slot 48. Since the slot 48 is higher on the latch 16 than is slot 53, the collet fingers cannot return to the conical seat 37. Fig. 5 shows an intermediate position during the above-described separation of the sections 10 and 11.

When connection of said sections is desired, it being again assumed that the lower section 10 is stationary and that the spear 14 is in the extended position in which it had been placed when the sections were being separated, the upper string of rods is lowered so that the upper end of the spear enters the passage 35 and then passes through the passage 36 as the splines 28, 34 engage. Since the distance across the collet fingers is greater than the diameter of the spear at part 31, the conical spear part 30 first engages said fingers to raise the collet member and move the pin 47 transversely from its position in slot 48 into the lower end of slot 55. The bevel 49 causes such shift. Any continued upward movement of the collet member is accommodated by the upper end 57 of said slot 55.

Now, the upper rod string is rotated in the direction of arrow 63 (Fig. 4), causing the spear, on its lefthand threads, to withdraw into the lower section toward the position of Fig. 1. The spring 58 can now bias the collet member downwardly because, during such rotation the pin 47 moves downwardly in angular passage 54 and into the lower end of slot 53. Thus, the collet fingers can resume their position in seat 37 so that said fingers can be clamped by the retracting spear to achieve the connected position of Figs. 1 and 2. The final rotational movement of the upper section 11 together with the final retractive movement of the spear effects a firm connection at 21, 33 between the sections 10 and 11.

5

While the foregoing specification illustrates and describes what I now contemplate to be the best mode of carrying out my invention, the construction is, of course, subject to modification without departing from the spirit and scope of my invention. Therefore, I do not desire to restrict the invention to the particular form of construction illustrated and described, but desire to cover all modifications that may fall within the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. An on and off tool for connecting and disconnecting upper and lower portions of a string of sucker rods, said tool comprising upper and lower end-abutted sections each, respectively, comprising adjacent ends of said string portions, a spear carried by the lower section, a left-hand threaded connection between said spear and lower section to cause projection of the spear when the same is rotated counter clockwise from above and retraction when the same is rotated clockwise from above, means interconnecting the spear and the upper section to rotate the former on its threads upon rotation of the latter, an upwardly flaring seat in the upper section and into which the spear is entered, a clutch collet member interposed between said spear and said seat, said collet member, spear and seat comprising separable elements effecting separable connection of the tool sections, and slot and pin means connecting the clutch collet member and the upper section and provided with means limiting the position of the clutch collet member between a position engaged with the mentioned seat and a position raised above said seat.

2. An on and off tool for connecting and disconnecting upper and lower portions of a string of sucker rods, said tool comprising upper and lower end-abutted sections each, respectively, comprising adjacent ends of said string portions, a spear carried by the lower section, a left-hand threaded connection between said spear and lower section to cause projection of the spear when the same is rotated counter clockwise from above and retraction when the same is rotated clockwise from above, means interconnecting the spear and the upper section to rotate the former on its threads upon rotation of the latter, an upwardly flaring seat in the upper section and into which the spear enters, a clutch collet member interengaged between said spear and said seat to effect separable connection of the tool sections, said spear having a conical enlargement, said clutch collet member being provided with clutch arms interposed between said seat and said conical enlargement to hold the spear from being withdrawn from the seat, and slot and pin means connecting the clutch collet member and the upper section and formed to limit the position of the clutch collet member between a position engaged with the mentioned seat and a position raised above said seat.

3. A tool according to claim 2 in which the spear and clutch member are provided with end abutting portions whereby upward movement of the spear upwardly withdraws the clutch arms from said seat and frees the spear for retraction downwardly through the seat.

4. A tool according to claim 3 in which the pin of said slot and pin means is slidably carried by the collet member and the slots of said means, in their upper ends, are provided with pin-shifting chamfers to transversely shift said pin from one slot to the other.

5. A tool according to claim 3 in which the pin of said slot and pin means is slidably carried by the collet member and the slots of said means, in their upper ends, are provided with pin-shifting chamfers to transversely shift said pin from one slot to the other, one said slot being longer than the other with the upper ends thereof at the same level, the chamfer of the shorter slot engaging to shift the pin into the longer slot during the mentioned clockwise movement of the upper section and the chamfer of the longer slot engaging to shift said pin

6

back to the shorter slot during the mentioned counter clockwise movement of the upper section.

6. An on and off tool for connecting and disconnecting upper and lower portions of a string of sucker rods, said tool comprising upper and lower end-abutted sections each, respectively, comprising adjacent ends of said string portions, a spear carried by the lower section, a left-hand threaded connection between said spear and lower section to cause projection of the spear when the same is rotated counter clockwise from above and retraction when the same is rotated clockwise from above, means interconnecting the spear and the upper section to rotate the former on its threads upon rotation of the latter, and comprising slidably engaged splines on both the spear and the upper section, an upwardly flaring seat in the upper section and into which the spear is entered, a clutch collet member interposed between said spear and said seat, said collet member, spear and seat comprising separable elements effecting separable connection of the tool sections, and slot and pin means connecting the clutch collet member and the upper section and providing means limiting the position of the clutch collet member between a position engaged with the mentioned seat and a position raised above said seat.

7. A tool according to claim 6 in which the splines in the upper section are disposed between the lower end of the section and the flared seat thereof, and the spear is of such length that the upper end of the same is introduced past said seat before the splines of the spear and of the upper section engage.

8. A tool according to claim 2 in which the clutch arms are resilient and are normally contracted toward each other to a diametral size smaller than the diametral size of the conical enlargement of the spear when the ends of resilient arms are withdrawn upwardly from the upwardly flaring seat and the spear is withdrawn toward said seat, said slot and pin means being adapted upon counter-clockwise rotation of the upper section to project the clutch arms toward said seat and into spreading engagement with the conical enlargement of the spear as the same is upwardly projected during such rotation, and the arms being adapted to be spread by said enlargement during introduction and removal of the spear, as mentioned.

9. In an on and off tool, a first tool section having a conical seat disposed with its smaller end directed toward the end of the section, a second section provided with a spear having a conical end of a size to freely pass from the end of the first section through said seat, said first section having a conical chamber disposed inwardly of the conical seat, said spear being adapted to loosely enter into said chamber after passing through the seat, a collet member disposed in said chamber and provided with collet arms directed toward said seat and adapted to be interposed between the seat and the conical end of the spear to hold the latter against withdrawal through the seat after being entered into said chamber, a slot and pin connection between the first section and the collet member, said connection comprising adjustable means mounting said collet member for movement between positions with the arms thereof either in said seat or thereabove.

10. In a tool according to claim 9, the adjustable means comprising a cross pin carried by the collet member for transverse movement, and two slots in the first section in which the opposite ends of said pin are alternately engaged during relative longitudinal movement of the first section and the collet member, one slot being longer than the other and the longer slot extending below the lower end of the shorter slot.

11. In a tool according to claim 9, the sections having abutting ends, and a threaded connection between the spear and the second section to draw said ends together while drawing together the conical end of the spear and the seat of the first section around the collet arms.

12. In an on and off tool, a first tool section having

a conical seat disposed with its smaller end directed toward the end of the section, a second section provided with a spear having a conical end of a size to freely pass from the end of the first section through said seat, said first section having a conical chamber disposed inwardly of the conical seat, said spear being adapted to loosely enter into said chamber after passing through the seat, a collet member disposed in said chamber and provided with collet arms directed toward said seat and adapted to be interposed between the seat and the conical end of the spear to hold the latter against withdrawal through the seat after being entered into said chamber, adjustable means on the first section mounting said collet with the arms thereof either in said seat or thereabove, the adjustable means comprising a cross pin carried by the collet member for transverse movement, and two slots in the first section in which said pin is engaged, one slot

being longer than the other and the longer slot extending below the lower end of the shorter slot, the upper end of both slots having chamfers and the chamfers engaging the ends of the pin to shift the same upon relative longitudinal movement of the first section and the collet member.

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