United States Patent

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[73] Assignee **Mission Manufacturing Company Houston, Texas a corporation of Delaware**

[54] **SWAB MANDREL**
4 Claims, 3 Drawing Figs.

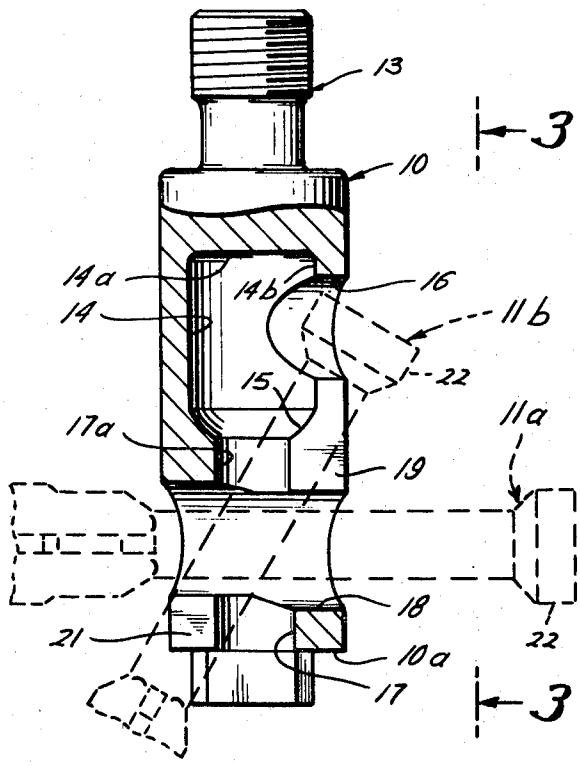
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[51] **Int. Cl.** **F04b 21/04,** F01b 1/10
[50] **Field of Search** 103/225, 225A; 92/180; 166/180, 182, 181

[56] **References Cited**
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ABSTRACT: This patent discloses a swabbing assembly for swabbing wells. The swab rubbers are carried on a mandrel which is supported in a knuckle joint body of the quick detachable type to permit the swab rubbers to be readily interchanged.



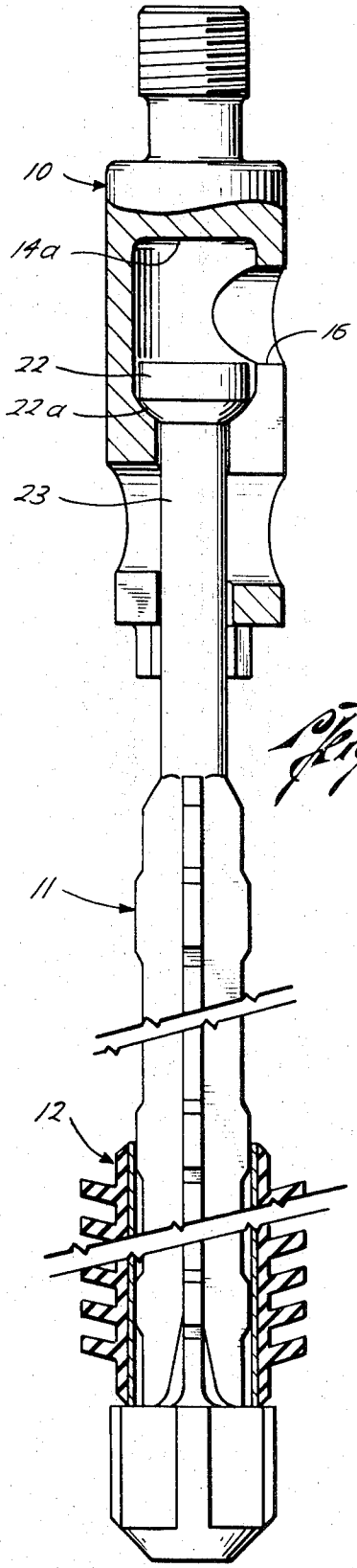


Fig. 1

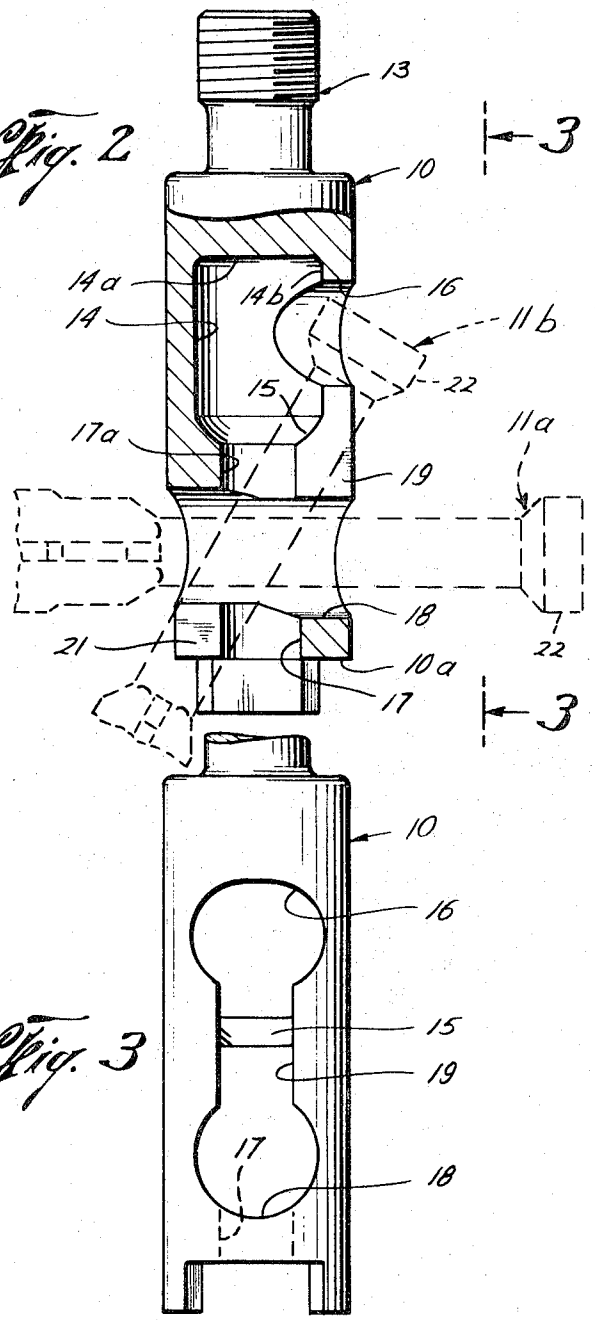


Fig. 2

Fig. 3

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SWAB MANDREL

This invention relates to swabbing assemblies for swabbing wells.

It is frequently necessary to swab a well. A swab assembly is run into a well on a wireline to a desired depth and then returned to the surface, lifting fluid out of the well. Swabbing activities are customarily carried out through a lubricator. As the swab elements are made of rubber and must be replaced periodically, the mandrel is desirably of a quick disassembly type to eliminate the problems encountered in the past in removing a nut or in some manner disassembling the mandrel so that swab rubbers may be replaced.

While quick disassembly mandrels have been previously proposed, see for instance U.S. Pat. No. 2,998,990, they have all been subject to the problem of knuckling and possible disassociation of the mandrel proper from its supporting knuckle joint body when the swab assembly is being introduced into the lubricator. When the mandrel with its associated swab cups is first introduced into the lubricator, there is very little weight tending to drop the assembly and, on occasions, the cups will tend to stick as they are introduced into the lubricator. Slacking off of the wireline will result in the knuckle joint body from which the swab mandrel depends knuckling or swinging over the head on the mandrel and possibly even becoming detached from the mandrel. Note in U.S. Pat. No. 2,998,990 that if one of the swab cups hangs in the lubricator and the wireline is loosened, the socket members 1 and 5 can swing about the heads 59 on the mandrels. If the operator permits either of the sockets 1 or 5 to swing to the horizontal position, it would be possible, if the swabs at that moment became free, for the swab and mandrel to drop free of the socket and fall into the hole, necessitating a fishing job.

It is an object of this invention to provide a quick-release swab assembly in which the mandrel is held by the knuckle joint body against substantial swinging movement in any direction to prevent knuckling of the body relative to the swab when the swab is being introduced into the lubricator.

Another object is to provide a quick-release swab assembly wherein the mandrel may be manipulated to remove it from the supporting knuckle joint body and wherein hanging of the swab elements in the lubricator and the slacking off of the wireline will not result in knuckling movement of the knuckle joint body; and the knuckle joint body and mandrel will be held in vertically alined position to prevent any possibility of disassociation of the mandrel from the body and dropping of the mandrel and swab elements into the well.

Another object is to provide a swab assembly in which, upon the swabs hanging in the lubricator with the knuckle joint body above the lubricator, will not result in swinging movement of the body relative to the mandrel upon tightening and slacking off of the wireline to effect introduction of the entire assembly into the lubricator.

Other objects, features and advantages of the invention will be apparent from the specification, the drawings and the claims.

In the drawings, wherein an illustrative embodiment of this invention is shown, and wherein like reference numerals indicate like parts;

FIG. 1 is a view partially in cross section and partially in elevation of a swab assembly constructed in accordance with this invention;

FIG. 2 is a view partially in elevation and partially in cross section through the knuckle joint body showing the upper section of the mandrel in phantom and illustrating how the upper section of the mandrel is introduced into the knuckle joint body; and

FIG. 3 is an elevational view of the knuckle joint body along the line 3–3 of FIG. 2.

The swab assembly of this invention includes the knuckle joint body indicated generally at 10, the mandrel indicated generally at 11, and the swab cup indicated generally at 12. Other than the upper section of the mandrel, the mandrel 11 may take any desired form. The particular mandrel shown is described in U.S. Pat. application Ser. No. 544,902 of Jack C. Webber and reference is made to such application for a disclosure of the advantages of the structure of mandrel 11. The swab cup 12 is of a well known type sold by Mission Manufacturing Company of Houston, Texas. Any other desired form of swab cup such as, for instance, the type shown in U.S. Pat. No. 2,998,990, may be utilized.

The knuckle joint body 10 includes a threaded pin 13 for securing the body to the conventional wireline.

The knuckle joint body has a socket cavity 14 therein. Preferably this socket cavity is substantially cylindrical about an axis extending longitudinally of the assembly. The cavity terminates at its lower end in a seat 15 which is preferably spherical in form. This seat faces upwardly to support the mandrel 11 in the manner shown.

A hole 16 is provided in the wall of the body opening into the cavity 14 on the side of the body which will be herein referred to as the front of the body. The relative size of the hole and the body are such that the hole passes through the wall of the body above the seat 15, so that when the mandrel is supported by the seat 15 there will be no opportunity for the mandrel to move toward the front of the body as would be the case if the hole where drilled into the seat section of the body. Thus with the mandrel in suspended condition, the seat will be effective to hold the upper end of the mandrel against lateral movement. It is further preferred that the hole 16 be drilled below the roof 14*a* of the cavity so that in the event that the mandrel and body are moved toward each other the mandrel will engage the roof of the cavity and the depending flange portion 14*b* of the body will be provided to prevent lateral movement of the upper end of the mandrel. Of course, the remainder of the body above the level of the hole 16 will cooperate with the portion 14*b* to prevent lateral movement of the head of the mandrel.

A longitudinal passage 17 is provided in the body and extends downwardly through the seat 15 and the entire lower end of the body. As shown in FIG. 1, the mandrel extends through this passage.

A transverse passageway 18 extends through the body below the seat 15 and above the lower end of the body. This transverse passageway intersects the longitudinal passageway 17. While the particular angle of the transverse passageway is not critical, it is preferred that the passageway extend normal to the longitudinal axis of the body as shown.

As shown in FIG. 2, the mandrel 11 is introduced through the transverse passageway 18 in connecting the mandrel to the knuckle joint body. In order to permit the mandrel to swing from the horizontal position shown at 11*a* through the dashed-line position shown at 11*b* to the vertical position shown in FIG. 1, a pair of slots are provided. The front slot 19 extends through the front side wall of the body and between the transverse passageway 18 and the hole 16 to permit the mandrel to swing from the horizontal to the vertical as shown in FIG. 2. In like manner, a back slot 21 is provided through the back side wall of the body, that is, on the side opposite the front slot. This back slot extends between the transverse passageway 17 and the lower end of the body to permit the mandrel to swing through this section of the body to the position shown in FIG. 1. It will be noted that below the transverse passageway 18 and the front slot 19 the body 10 has a portion 10*a* which is solid to prevent swinging movement of the mandrel toward the front of the knuckle joint body. In like manner, the body is solid at 17*a* above the back slot 21 which prevents the mandrel from swinging toward the back of the knuckle joint body when it is hanging in the body.

The mandrel has a head portion 22 at its upper end joined to the remainder of the mandrel by a neck portion 23.

The relationship of the several passageways, slots, holes, mandrel head and neck is such that the mandrel can be introduced into the knuckle joint body and will hang by the head 22. The head is larger than the longitudinal passageway 17. It is also larger than the front slot so that when it is supported in the seat 15 it will be held against lateral movement by the body on opposite sides of the front slot. The under surface of

head 22*a* is spherical in form to mate with the spherical seat 15. The head is slightly smaller than the cavity 14 to provide a broad area of support between the head and seat 15 so that shear forces across the head will be well distributed.

The head is smaller than the transverse passageway 18 so that it may be introduced therethrough, and it is also smaller than the hole 16 so that it can be swung up through the hole 16.

The neck, of course, is smaller than the head and additionally is smaller than each of the transverse and longitudinal passageways and the front and rear slots. of course, it is also smaller than the hole 16.

With the relationship just described, the mandrel may be introduced through the transverse passageway from the back of the knuckle joint head to the horizontal dashed-line position shown in FIG. 2. The mandrel may then be swung downwardly through the dashed-line position shown at 11*b* to the vertical orientation in which the head 22 is within the socket cavity 14. The mandrel is then free to move downwardly relative to the knuckle joint body to permit the head and seat to engage to lock the mandrel against substantial swinging movement relative to the body. This is accomplished by the passageway 17*a* being only slightly larger than the neck 23, and thus the neck will engage the body just below the seat 15 if there is any tendency of the mandrel to swing in any direction except toward the slot 19. If there is a tendency to swing in this direction the neck engages the portion 10*a* of the body at its lower end to prevent swinging movement in this direction. Of course, the disassembling of the mandrel and head to permit a new swab rubber to be telescoped over the mandrel from its upper end is accomplished by reversing the above-described movement.

It should be noted that the portion of the body just below the seat prevents swinging movement of the mandrel toward the rear of the socket. While it is preferred to continue the body downwardly as shown and cut the back slot 21 therein to a dimension just slightly larger than the neck dimension, it is apparent that the only portion of the body which is necessary below that immediately adjacent seat 15 is the section 10*a* in front of the body which prevents the neck from swinging to the front through slot 19. In other words, the back slot 21 may preferably be slightly larger than the neck of the mandrel, or it may be considered to be so large as to cover everything except the stop 10*a* and extend more than 180° about the lower end of the body. The word "slot" as used herein, and in the claims, is meant to include a slot which is sufficiently large that it takes in all of the body below that portion shown in cross section in FIG. 2 with the exception of the stop portion 10*a* and sufficient metal on at least one side of the transverse passage 18 to support the stop 10*a*. If the connection between the stop portion 10*a* of the body only exists on one side of the transverse passageway, then the neck could be introduced by longitudinal movement or side movement, as the passageway would be open to one side. This also is contemplated by the claims, and the term "transverse passage" is intended to include a passageway which is surrounded by the body in its entirety or only in part.

In assembling the swab support, one or more swabs 12 are first telescoped over the mandrel 11. The mandrel 11 is then introduced longitudinally from the back or left side of the body as viewed in FIG. 2 until the neck resides in the transverse passage 18. The mandrel is then swung generally about the point represented by the intersection of the transverse and longitudinal passageways in the manner illustrated in FIG. 2 to swing the head of the mandrel up into the socket cavity and place the mandrel and body in longitudinal alinement. The mandrel is then permitted to move downwardly until the head is supported on seat 15 at which time the mandrel is held against swinging movement in all directions except for a few degrees. Disassembly of the unit is of course the reverse operation. If in use the swab cups tend to stick in the lubricator, there will be no tendency for the knuckle joint body to swing relative to the mandrel. As the wireline is slacked off. the knuckle joint body may move downwardly over the neck of the mandrel. However, the initial movement is such that the head does not come into register with hole 16 because the hole 16 is spaced upwardly above the seat 15. Thus, slight slackening and tightening of the wireline will not permit relative swinging movement of the body and mandrel. Even if the wireline is slacked off a substantial amount, swinging movement will not occur because the body will fall down around the neck of the mandrel and the head of the mandrel will move up into the tip of the socket cavity and engage the roof 14*a* thereof. As the head now is positioned above the hole 16, the mandrel and head are still held against relative swinging movement.

While it is theoretically possible for conditions to arise under which the head could reach the exact position for swinging movement about the mandrel and swing to where its longitudinal axis is normal to the mandrel, this will not occur as a practical matter as the tolerances between the sizes of the passageways, neck, slots, holes, etc. are maintained relatively close in the preferred embodiment, and the parts must be substantially exactly alined to permit them to be disengaged. Thus as a practical matter, there is no danger of disengagement of the mandrel and knuckle joint body particularly when in a well.

The foregoing disclosure and description of the invention are illustrative and explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction, may be made within the scope of the appended claims without departing from the spirit of the invention.

It is claimed:

1. A swabbing assembly comprising:
- a knuckle joint body having a socket cavity therein with an upwardly facing seat;
- a hole in the side wall of the body extending into the socket above said seat;
- a longitudinal passage in the body extending downwardly through said seat and the lower end of the body;
- a transverse passage extending through the body below said seat and above the lower end of the body and intersecting said longitudinal passage;
- a front slot through the side wall of the body extending between said transverse passage and said hole;
- a back slot through the side wall of the body on the side opposite said front slot extending between the transverse passage and the lower end of the body;
- a swab mandrel having a head at its upper end and a neck immediately adjacent the head;
- said head being larger than said longitudinal passage and said front slot and smaller than said transverse passage and said hole and adapted to engage said seat;
- said neck being smaller than each of said passages, slots and hole;
- whereby the head and neck of the mandrel may be inserted from the back of the body through the transverse passage;
- the mandrel swung to pass the neck through said slots and the head through said hole; and
- the mandrel moved downwardly relative to the body to engage the head and seat to lock the mandrel against substantial swinging movement relative to the body.

2. The swabbing assembly of claim 1 wherein said hole is below the upper portion of the cavity whereby movement of the mandrel upwardly relative to the body will move said head into the cavity above said hole and the mandrel will be held against substantial swinging movement.

3. The swabbing assembly of claim 1 in combination with a swab member supported on the mandrel.

4. A swabbing assembly comprising:
- a knuckle joint body having a socket cavity therein with an upwardly facing seat;
- a hole in the side wall of the body extending into the socket above said seat;
- a longitudinal passage in the body extending downwardly through said seat and the lower end of the body;

a transverse passage extending through the body below said seat and above the lower end of the body and intersecting said longitudinal passage;

a front slot through the side wall of the body extending between said transverse passage and said hole;

a back slot through the side wall of the body on the side opposite said front slot extending between the transverse passage and the lower end of the body;

a swab mandrel having a head at its upper end and a neck immediately adjacent the head;

said head being dimensioned to pass through said front slot and transverse passage and said hole and to engage said seat;

said neck being smaller than each of said passages, slots and hole;

whereby the head and neck of the mandrel may be inserted from the back of the body through the transverse passage;

the mandrel swung to pass the neck through said slots and the head through said hole; and

the mandrel moved downwardly relative to the body to engage the head and seat to lock the mandrel against substantial swinging movement relative to the body.