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WELL TOOL

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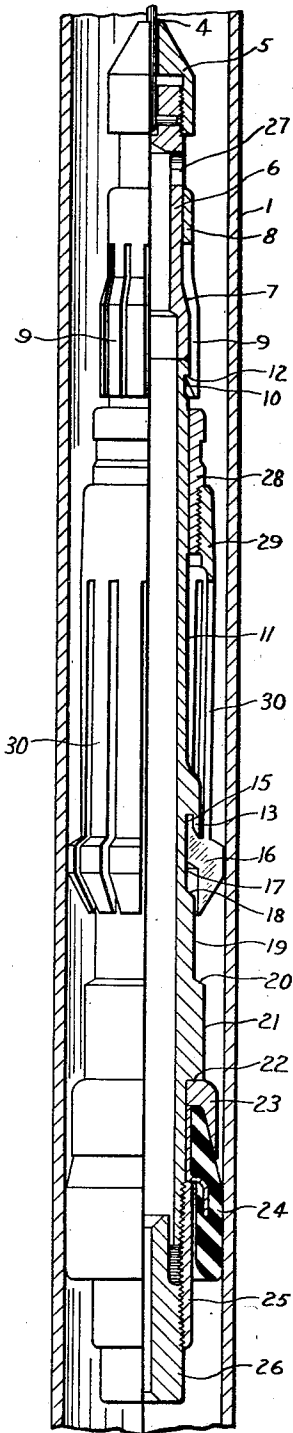


Fig. 1

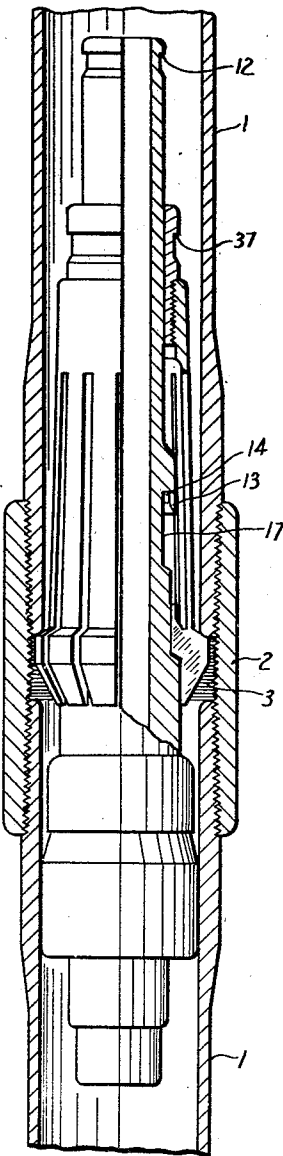


Fig. 2

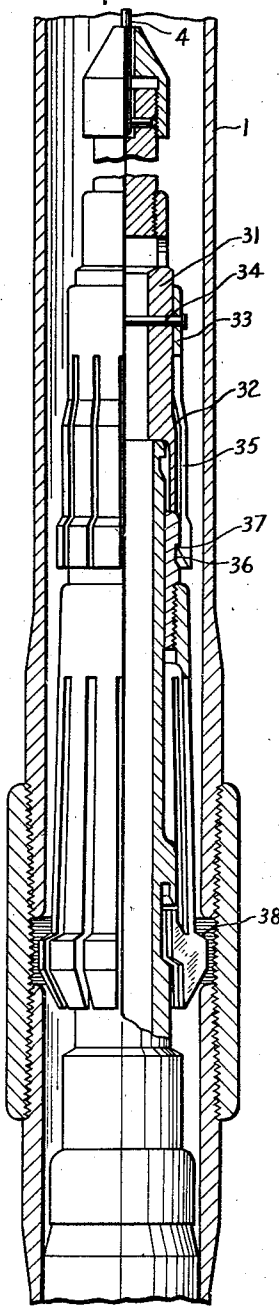


Fig. 3

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WELL TOOL

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This invention relates to well tools such as for example, retrievable bottom hole chokes and more particularly relates to well tools of the type to be locked in the well tubing at a tubing joint. It is provided with locking members and is provided with means to hold the locking members inwardly or against the mandrel when the mandrel is being inserted within the tubing. When the mandrel is raised slightly relative to the locking members, the said locking members are released so that spring arms will move the locking members outwardly so that they will seat within the next tubing joint which they engage.

Another novel feature is the provision of a backing or holding surface on the mandrel to hold the locking means in engagement with the tubing joint.

Another novel feature is the provision of a shoulder at the lower end of the backing member to absolutely prevent the mandrel and its associated parts being raised by the pressures of the well.

Other objects and advantages of the invention will appear in the detailed specification and claims which follow.

In the drawing in which I have shown the preferred form of the invention by way of illustration,

Figure 1 shows the relative position of the parts when the tool is being run into the well, the figure being cross-sectional in part,

Figure 2 is an elevational view, partly in cross-section, with a choke set in the tubing and with the running in tool removed, and

Figure 3 is an elevational view, partly in cross-section, showing the retrieving tool attached to the choke and with the parts being shown in their relative positions with the choke ready to be removed.

It is common to have well tubing 1 provided with coupling collars 2 so that there is a space between successive sections of the tubing, thereby forming an internal annular recess 3 between the adjacent tubing sections having a diameter greater than the diameter of the tubing 1. I propose to utilize this recess for the reception of locking members, as will hereinafter be described.

A conventional wire line 4 has secured thereto a socket member 5 to which is secured a member 6 having a cone surface 7 near the lower end thereof. The member 6 has secured thereto a collar 8 from which depend spring fingers 9 having a catch 10 at the lower end of each of the fingers 9. These parts constitute the running in tool.

A mandrel 11 is provided with a shoulder 12 which overlies the catches 10 when the device is being run into the tubing, as is shown in Figure 1. It will be noted in this figure that the lower end of the member 6 contacts the upper end of the mandrel 11. The mandrel 11 is also provided with a downwardly extending flange 13 providing a channel 14 in which is initially seated an upwardly extending locking finger 15 of a locking member 16 to retain the locking member in retracted position. The inner circumference of the channel 14 extends downwardly forming a reduced circular wall 17 having a cam shoulder 18 at the lower end thereof. Below the shoulder 18 is an intermediate circular wall 19 having a greater diameter than that of the circular wall 17 and forming a backing wall for the locking member when the parts are in the position shown in Fig. 2, and at the lower end of the wall 19 is a shoulder 20. Extending below the shoulder 20 is an enlarged circular wall 21 terminating in a shoulder 22, against which rests a downwardly extending thimble 23 for the reception of a packer cup 24. As this type of packer cup is well known, a detailed description thereof is unnecessary. At the lower end of the mandrel is a collar 25 to which is secured a choke bean 26.

As is well known in the art, the choke bean has a smaller internal diameter than the internal diameter of the mandrel, so as to reduce the upward flow of fluid which passes upwardly through the mandrel and outwardly through the hole 27.

A collar 28 is slidable on the upper portion of the mandrel and is connected to a cage 29 having spring arms 30 depending therefrom, and which spring arms are connected at their lower ends to the various locking members 16.

The locking members 16 are of a sufficient thickness to substantially occupy the space between the reduced wall 17 and the inner surface of the tubing, and the spring arms 30 tend to push the locking member 16 outwardly. Of course, this tendency is restrained somewhat when the choke is being run into the tubing because the finger 15 of each of the locking members is held against material outward movement radially by means of the flange 13 but not to the extent to prevent the outer surfaces of the locking members from dragging against the tubing. The parts would be in the position as shown in Figure 1 while the choke is being lowered in the tubing, and the locking member 16 could not be moved outwardly into the internal annular recess 3 between the tubing joints, because of the said flange 13 and fingers 15. As it is thus being low-

ered, the well fluid would by-pass upwardly through the choke bean, through the mandrel and outwardly through the hole 27.

When the operator desired to set the device, he would raise the wire line 4 slightly, thereby raising the mandrel 11. The locking member 16 would tend to drag against the inner surface of the tubing because of the spring arms 30. This would release the fingers 15 of the locking member 16 from the flange 13, so that the spring arms 30 could now move the locking members into the internal annular recess 3 when the retrievable bottom hole choke had been raised sufficiently so that the locking members 16 were adjacent one of the tubular joints. Continued upward movement of the mandrel would move the backing wall 19 behind the locking members so that the locking members would have the wall 19 as a backing member, and further, the locking member would be seated on the shoulder 20, as is shown in Figure 2. It would now be impossible to move the mandrel to a higher position, and the spring fingers 9 would yield so that the catches 10 would be released from the shoulder 12, and the wire line carrying the members 5, 6, 8, 9 and 10 could be removed from the well. The retrievable bottom hole choke is now positioned in the well. A reduced amount of well fluid could pass upwardly through the choke bean 26 and through the mandrel, but the well fluid could not pass upwardly around the mandrel because the higher the well pressures the more the packer cup 24 would be expanded, and the tighter would be the seal between the mandrel and the tubing. These upward pressures would tend to move the mandrel upwardly, but the mandrel is positively locked in the position shown in Figure 2.

When it is desired to remove or retrieve the well tool, a retrieving tool is employed which is shown in Figure 3. This retrieving tool is lowered into the tubing by the wire line 4 and carries a cone member 31 provided with a cone surface 32. The cone member 31 is provided with a collar 33, and a shear pin 34 connects the collar 33 to the cone member 31. The collar 33 is provided with depending spring fingers 35 which at their lower ends are provided with catches 36. The collar 28 is provided with a shoulder 37 adapted to be engaged by the catches 36.

When it is desired to remove the tool from the well, the retrieving tool is run in, and the lower portion of the cone member 31 engages the upper end of the mandrel 11 pushing it downwardly so that the backing wall 19 no longer restrains the locking member 16 from being moved inwardly, that is, it moves the mandrel downwardly so that the reduced wall 17 is adjacent the inner ends of the locking member 16, as is shown in Figure 3. The spring fingers 35 yield so as to permit the catches 36 to ride downwardly over the upper surface of the collar 28 so that the catches 36 engage the shoulder 37. When the wire is now pulled upwardly, the member 31 raises the collar 33 by means of the shear pins 34, and the spring fingers 35 raise the collar 28 and locking member 16. No upward motion has as yet been imparted to the mandrel. The cam surface 38 of the locking members engage the lower portion of the upper section of the tubing and cam the locking members inwardly, permitting them to be received into the tubing bore. Further upward movement of the locking members thereby raises the mandrel and the packer cup so that the entire assembly may be raised to the surface of the well and removed therefrom,

It is conceivable that the device might be virtually locked in the tubing due to sand or other causes. A predetermined strain on the wire line 4 would in such a case cause the shear pins 34 to shear. The cone member 31 would now be raised with the wire line, while the collar 33 would remain stationary until the cone surface 32 engaged the spring fingers 35 and moved them outwardly thereby releasing the catches 36 from the shoulder 37 so that the retrieving tool could be raised to the surface without rupturing the wire line.

I realize that many changes may be made in the specific form of the invention as shown herein by way of illustration, and I desire to claim the invention broadly except as I may limit myself in the appended claims.

Having now described my invention, I claim:

1. A well tool of the type to be lowered by a running-in device into a well tubing having an internal annular recess at the tubing joints, said tool including a mandrel, a locking member slidable on the mandrel and adapted to drag against the inner wall of the tubing when the tool is being raised or lowered, means initially engaged forming parts of the mandrel and member to prevent the locking member from moving into any recess as the tool is being lowered into the tubing, said locking member being released from the mandrel when the mandrel is raised relative to the locking member, spring means to project said locking member into said recess when the locking member has been released from the mandrel and the tool is raised so that the locking member is adjacent a recess and a shoulder carried by the mandrel to engage the locking member to prevent further upward movement of the locking member after it is locked in said recess.

2. A well tool of the type adapted to be lowered into a well tubing having an internal annular recess at the tubing joints, said tool including a mandrel having a stepped exterior forming a reduced, intermediate and enlarged circular walls, a shoulder between the intermediate and enlarged walls, a downwardly extending flange carried by the mandrel and overhanging the upper portion of the reduced circular wall, a collar slidable on the mandrel, spring arms carried by said collar, locking members carried by said arms, said locking members having upwardly extending fingers adapted to be received within the flange when the locking members are in their uppermost position relative to the mandrel, the spring arms causing the locking members to drag against the inner surface of the tubing as the well tool is moved in the tubing, but the flange and fingers limiting the outward movement of the locking members, said locking members tending to remain stationary relative to the tubing when the mandrel is raised so that as the mandrel is raised, the flange moves above the fingers of the locking members while the locking members are backed by the reduced wall, but the locking members are free to be projected by the spring arms into the first recess encountered, said mandrel being movable upwardly after the locking members are seated in said recess a limited distance equal to the height of said intermediate wall, said intermediate wall serving as a means to lock the locking members in said recess and said shoulder engaging said locking members preventing further upward movement of said mandrel.

3. A well tool of the type adapted to be lowered by a running-in device into a well tubing having

an internal annular recess at the tubing joints, said tool including a mandrel, a depending flange, said mandrel including an external circular wall behind and extending below said flange and an external backing wall below and of greater diameter than the circular wall, a collar slidable on the mandrel, spring arms carried by said collar, a locking member carried by each of said spring arms and having a locking finger adapted to be received within the depending flange of the mandrel when the mandrel is being run into the tubing, said mandrel moving upwardly relative to said collar, arms and locking members when the mandrel is raised by the running-in device, thereby releasing the locking members from the depending flange, said spring arms urging said locking members outwardly when they are released from the said flange so that the locking members will be projected outwardly into the recess of a tubing joint as the mandrel is raised, the backing wall of said mandrel serving as a means to prevent the locking members from moving out of the recess when the mandrel is raised sufficiently to position the said backing wall behind said locking members.

4. A well tool of the type adapted to be lowered by a running-in device into a well tubing having an internal annular recess at the tubing joints, said tool including a mandrel, a collar slidable on said mandrel, locking members, spring arms carried by said collar and supporting said locking members and tending to urge them outwardly away from the mandrel, means carried by said mandrel and locking members to hold said locking members against outward movement but releasable upon upward movement of the mandrel relative to the locking members, said spring arms moving said locking members into the first tubing recess which is reached as the mandrel is raised after said means is released, and a backing wall forming a part of the mandrel to prevent the locking members from moving out of the tubing joint and locking the mandrel against further upward movement.

5. A well tool of the type adapted to be lowered by a running-in device into a well tubing having an internal annular recess at the tubing joints, said tool including a mandrel, said mandrel being provided with a depending flange, and outer surfaces of relatively reduced, intermediate and enlarged diameters, said intermediate surface forming a backing wall, locking means having an upstanding finger adapted to be received within the flange when the mandrel is being lowered and the locking means is adjacent the reduced outer surface of the mandrel, spring means tending to urge said locking means outwardly from said mandrel, said locking means being released from the flange when the mandrel is raised relative to the locking means so as to permit the spring means to snap the locking means into a tubing recess as the mandrel is raised, the intermediate backing wall moving upwardly behind the locking means when the mandrel is further raised to lock the locking means in the tubing recess and a shoulder between the intermediate and the enlarged outer surface by engaging with the locking means preventing any further upward movement of the mandrel.

6. A well tool of the type adapted to be lowered by a running-in device into a well tubing having an internal annular recess at the tubing joints, said tool including a mandrel, a collar slidable on the mandrel, locking members, springs

interconnecting the collar and locking members and tending to move the locking members outwardly, means whereby the locking members are locked against or released from the mandrel, said springs moving the locking members into the tubing joint recess as the mandrel is pulled upwardly by the setting tool, a backing wall carried by the mandrel and positioned behind the locking members when the mandrel is elevated after the locking members have been set in the recess to prevent the locking members from being retracted out of said recess.

7. A well tool of the type adapted to be lowered by a running-in device into a well tubing having an internal annular recess at the tubing joints, said tool including a mandrel having an external circular wall and an external backing wall below and of greater diameter than the circular walls with a cam shoulder between said walls, a cage slidable on the mandrel, spring arms depending from said cage, locking members carried by said spring arms, means forming parts of the mandrel and the locking members whereby said locking members initially interengaged are retained adjacent the circular wall and above the shoulder until the mandrel is moved upwardly relative to the cage when they are disengaged, said shoulder serving as a means to move the locking members upwardly with the mandrel until the locking members are raised sufficiently high so that the spring arms can project the locking members into a tubing joint recess so that the backing wall can then be moved behind the locking members to lock the said members in the tubing joint recess, and means to prevent further upward movement of the mandrel.

8. A well tool of the type adapted to be lowered by a running-in device into a well tubing having an internal annular recess at the tubing joints, said tool including a mandrel having an external circular wall and an external backing wall below and of greater diameter than the circular wall with a cam shoulder between said walls, a cage slidable on the mandrel, spring arms depending from said cage, locking members carried by said spring arms, means forming parts of the mandrel and the locking members whereby said locking members initially interengaged are retained adjacent the circular wall and above the shoulder until the mandrel is moved upwardly relative to the cage when they are disengaged, said shoulder serving as a means to move the locking members upwardly with the mandrel until the locking members are raised sufficiently high so that the spring arms can project the locking members into a tubing joint recess so that the backing wall can then be moved behind the locking members to lock the said members in the tubing joint recess, and a shoulder to prevent further upward movement of the mandrel.

9. A well tool of the type adapted to be lowered by a running-in device into a well tubing having an internal annular recess at the tubing joints, said tool including a mandrel having an external circular wall and an external backing wall below and of greater diameter than the circular wall with a cam shoulder between said walls, a cage slidable on the mandrel, spring arms depending from said cage, locking members carried by said spring arms, means forming parts of the mandrel and the locking members whereby said locking members initially interengaged are retained adjacent the circular wall and above

the shoulder until the mandrel is moved upwardly relative to the cage when they are disengaged, said shoulder serving as a means to move the locking members upwardly with the mandrel until the locking members are raised sufficiently high so that the spring arms can project the locking members into a tubing joint recess so that the backing wall can then be moved behind the locking members to lock the said members in the tubing joint recess, and a shoulder on the mandrel below the backing wall to engage the locking members to prevent further upward movement of the mandrel.

10. A well tool of the type adapted to be lowered by a running-in device into a well tubing having an internal annular recess at the tubing

joints, said tool including a mandrel having an external circular wall and an external backing wall below and of greater diameter than the circular wall with a cam shoulder between said walls, a cage slidable on the mandrel, spring arms depending from said cage, locking members carried by said spring arms, means forming parts of the mandrel and the locking members whereby said locking members initially interengaged are retained adjacent the circular wall and above the shoulder until the mandrel is moved upwardly relative to the cage when they are disengaged, said spring arms serving as a means to tend to move said locking members outwardly from the mandrel.

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Disclaimer

2,392,244.—*Donald B. Hooser*, Dallas, Tex. WELL TOOL. Patent dated Jan. 1, 1946. Disclaimer filed Oct. 31, 1947, by the assignee, *The Guiberson Corporation*.

Hereby enters this disclaimer to claim 6 in the said specification.
[*Official Gazette December 9, 1947.*]