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2,158,406

LINER SETTER

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Fig. 1

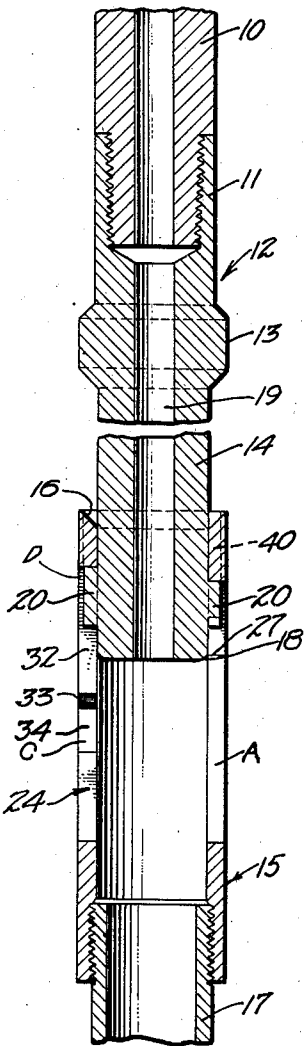


Fig. 2

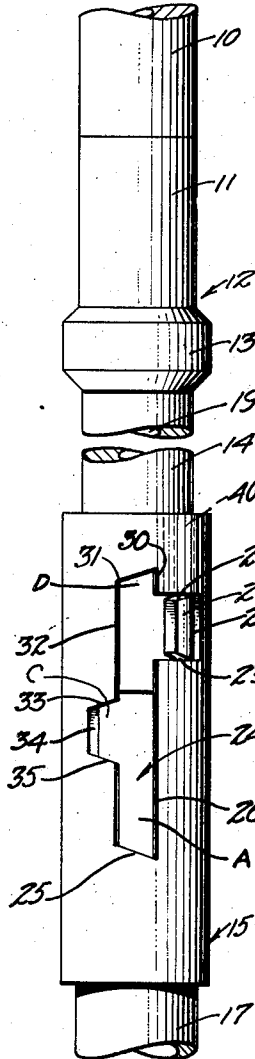


Fig. 3

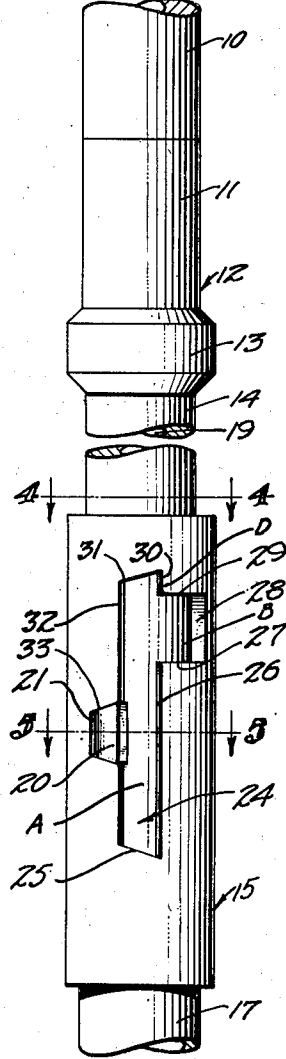


Fig. 4

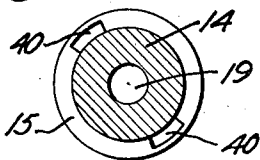
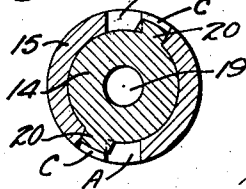


Fig. 5



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LINER SETTER

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6 Claims. (Cl. 255—27)

This invention relates to oil well production equipment, and particularly pertains to a liner setter.

In the construction and maintenance of oil wells it is usual practice to set a liner in the well and at times to withdraw the liner for cleaning or in order to substitute other liners therefor. After the liners have been in use they may become lodged in the well, and it is the principal object of the present invention to provide a liner setter by which a liner may be lowered into a well, may thereafter be rotated as desired and set, the structure also being designed to permit disconnection of the liner from the lowering means as well as to permit it to be reengaged therewith and to thereafter deliver jarring blows which would tend to dislodge the liner if stuck.

The present invention contemplates the provision of a mandrel adapted to be connected with a string of drill pipe and to interlock with an adapter which may be threaded to a liner, or liner hanger, the interlocking means between the adapter and the mandrel being such as to permit the mandrel to impart rotational movement to the adapter as well as to produce a longitudinal jarring action in either direction and to permit the mandrel to be disconnected from the adapter and withdrawn from the well.

The invention is illustrated by way of example in the accompanying drawing in which:

Figure 1 is a view in central vertical section showing the element of the invention with the adapter and the liner suspended from the mandrel.

Fig. 2 is a view showing the structure with the mandrel and the adapter in position for disengagement.

Fig. 3 is a view in elevation showing parts of the device in position for delivering a longitudinal blow tending to dislodge the adapter and the liner.

Fig. 4 is a view in transverse section through the structure as seen on the line 4—4 of Fig. 3 showing the position of the mandrel lugs with relation to the adapter when the parts are to be disengaged.

Fig. 5 is a view in transverse section through the liner setter with the lugs in an initial position to produce a jarring blow.

Referring more particularly to the drawing, 10 indicates a drill string having a threaded pin at its lower end to engage the threaded box 11 of a mandrel 12. The mandrel is formed with an enlarged shoulder 13 intermediate its end and a lower tubular portion 14 which extends into an adapter sleeve 15. The upper end of the adapter

sleeve 15 has a tapered mouth 16 to facilitate in lowering the mandrel therinto and the lower end of the sleeve 15 is internally threaded to receive a liner 17 or a liner hanger. The mandrel section 14 is slightly rounded at its lower end as indicated at 18 to facilitate in guiding the mandrel into the sleeve and a central passageway 19 is formed entirely through the mandrel to establish circulation of fluid. Mounted upon diametrically opposite sides of the mandrel are lugs 20. These lugs are of a desired length to give them strength and have opposite parallel longitudinally extending sides 21. The opposite ends of the lugs are designated at 22 and 23 and are oppositely tapered or inclined with relation to a transverse plane of the mandrel. The lugs extend into slotted passageways 24 formed through the wall of the adapter sleeve 15 upon diametrically opposite sides thereof. Each of these passageways is defined by a lower tapered end face 25 agreeing in taper with that of the lower face 23 of a lug 20. Extending longitudinally from this end face upon one side of the slot is a straight face 26 which terminates at a transverse flat face 27 extending partially around the body of the sleeve. Extending longitudinally from the end of the flat face 27 is a longitudinally extending face 28 which terminates with a flat face 29 transversely disposed of the sleeve and in spaced parallel relation to the transverse face 27. The face 29 terminates with a short longitudinal face 30 which is in longitudinal alignment with the face 26 previously described. Extending transversely of the sleeve is a transversely inclined face 31 which is in longitudinal alignment with the inclined face 25 previously described, but is disposed at an opposite angle thereto agreeing with the angle of inclination of the upper face 22 on a lug 20. Extending downwardly from the upper face is a longitudinal face 32 spaced from and parallel to the longitudinal faces 26 and 30. This face terminates with a transverse inclined face 33 agreeing in angularity with the face 22 of a lug 20. At the end of the face 33 is a longitudinally extending face 34 which terminates at the beginning of an inclined face 35, being of the same angularity as the lower inclined face 23 on a lug 20. From the foregoing explanation it will be seen that there will be a longitudinal slot A at one side of which a transverse recess B occurs having transverse flat end faces 27 and 29 and a longitudinal edge 28. It will also be seen that at the opposite side of the longitudinal slot A and staggered with relation to the recess B is a recess C which has opposite end faces 33 and 35 oppositely

tapered, the edge of the recess being defined by the longitudinal face 34. Attention is also directed to the fact that due to the recess B occurring at a point lower than the upper end of the slot A, a notch D will occur for a purpose to be hereinafter described.

In operation of the device the mandrel 12 may be assembled with the adapter sleeve 15 by moving the lugs 20 downwardly through a pair of diametrically opposite slots 40 formed in the bore of the sleeve 15 and extending downwardly from the mouth 16 thereof to the recess B, after which the lugs 20 are rotated in a clockwise direction until they encounter the longitudinal faces 32 of the grooves at opposite sides of the sleeve 15. The mandrel 12 and the sleeve 15 may then have relative longitudinal movement with each other so that the upper ends of the lugs 20 will seat within the notches D of the sleeve. Thus the liner which hangs by its own weight from the lugs and the sleeve will be maintained in engagement therewith to prevent relative rotation between the mandrel and the sleeve. When desired to forcibly move the liner downwardly the mandrel may be moved downwardly so that its lugs 20 will pass to the bottom end of the slot portion A and encounter the faces 25. It will also be evident that the liner may be lifted when the lugs 20 are in the notches D. If, however, it is desired to apply impact to the sleeve 15 either to produce a downward force or an upward force the mandrel may be moved downwardly while under a clockwise strain so that as it slides along the face 32 it will find the notch C and slip into this notch with its inclined faces 22 and 23 between the inclined faces 33 and 35 of the notch. By maintaining the mandrel in this rotated position and then pulling lengthwise on the mandrel it will be evident that the faces 22 and 33 of the lug and the notch respectively will be held in frictional relation to each other by a force determined by the inclination of the engaging faces of the lug and the notch and that when the pull on the mandrel is sufficient to overcome this friction the lugs will back out of the notches and will become released so that they will move upwardly in the slotted passageways A and deliver a violent blow when their upper faces strike the end faces 31 of the slotted passageways. It will be evident that when the lugs and notches have been engaged and weight is imposed upon the mandrel the engagement between these parts will be maintained until the frictional resistance between the inclined faces has been overcome and a counter torque has been placed in the drill string supporting the mandrel. The load will then be delivered to the lower face 25 of the passageway A when the lower face 23 of a lug strikes it. A jarring action of this kind may be repeated until the liner is loosened. In fact, by increasing and holding a desired amount of torque in the drill string the locking and release of the mandrel lugs with the notch may be controlled to establish the magnitude of blow delivered by the lugs to the adapter sleeve 15. When the liner has been dislodged the mandrel may be turned counterclockwise so that its side face 21 will engage the face 26 of the opening A after which the mandrel may be drawn upwardly until the lugs 20 move into the recess B. When the side face of the lugs engages the face 28 of the recess the mandrel may be pulled upwardly to cause the lugs 20 to move lengthwise of the longitudinal grooves 40 until the mandrel and the adapter sleeve have become disengaged.

It will thus be seen that by the construction here disclosed a liner setting tool is provided which makes it possible for a connection between the liner and a drill string to be readily made, which insures that the liner may be easily manipulated in any direction and that when desired the parts will interlock in a manner to permit longitudinal blows to be delivered in upward or downward directions as controlled by tension and torque upon the drill string.

While we have shown the preferred form of our invention, as now known to us, it will be understood that various changes might be made in the combination, construction, and arrangement of parts, by those skilled in the art, without departing from the spirit of the invention as claimed.

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

1. In combination with a drill string and a well liner, a tubular adapter attached to the well liner, a mandrel attached to the drill string and being separate from the adapter, lugs carried by the mandrel, receiving means for the lugs formed in the adapter whereby the mandrel and the adapter may be telescoped into interlocking relation with each other, and the mandrel and the adapter may have restrained longitudinal movement with relation to each other, and receiving means carried by the adapter and into which the lugs of the mandrel may fit in an intermediate position whereby the mandrel will be held against longitudinal movement with relation to the adapter and will move to one limit of its restrained longitudinal movement when longitudinal force is applied to the mandrel and the lugs are moved from their seated position, and additional receiving means formed in the adapter sleeve to receive the lugs of the mandrel upon manipulation of the drill string to lock the mandrel and the adapter sleeve against relative longitudinal movement.

2. In combination with a drill string and a well liner, a tubular adapter sleeve attached to the well liner, a mandrel carried by the drill string to be moved to a telescoping position within the adapter sleeve, a slotted passageway within the adapter sleeve open at the upper end thereof and continuing in a transversely extending passageway and a longitudinally extending passageway, lugs carried on the mandrel and adapted to move through said passageways to positions where the mandrel and the sleeve will be interlocked for limited longitudinal movement with relation to each other, and a transverse passageway at a point intermediate the length of said longitudinal passageway to receive said lugs and temporarily hold the mandrel against movement in either direction with relation to the lugs.

3. In combination with a drill string and a well liner, a tubular adapter sleeve attached to the well liner, a mandrel carried by the drill string to be moved to a telescoping position within the adapter sleeve, a slotted passageway within the adapter sleeve open at the upper end thereof and continuing in a transversely extending passageway and a longitudinally extending passageway, lugs carried on the mandrel and adapted to move through said passageways to positions where the mandrel and the sleeve will be interlocked for limited longitudinal movement with relation to each other, a transverse passageway at a point intermediate the length of said longitudinal passageway to receive said lugs and temporarily hold the mandrel against movement in either

direction with relation to the lugs, and cooperating means on the walls of said transverse passageway and the ends of the lugs whereby a predetermined longitudinal strain upon the mandrel will cause the lugs to move from the transverse passageway into the longitudinal passageway and strike a blow at the end thereof.

4. In combination with a drill string and well liner a tubular adapter attached to the well liner, a mandrel attached to the drill string and being movable relative to the adapter, lugs carried by the mandrel at substantially the lower end thereof having oppositely inclined upper and lower faces, receiving means for the lugs formed in the adapter whereby the mandrel and the adapter may be telescoped into interlocking relation with each other and the mandrel and the adapter will have limited longitudinal movement with relation to each other, the receiving means carried by the adapter being formed with a longitudinally extending slot, the opposite ends of which are inclined to substantially agree with the oppositely inclined faces of the lugs, said longitudinally extending slot being formed with a recess at one side thereof intermediate the ends thereof having oppositely inclined faces substantially agreeing with the inclined faces of the lugs carried by the mandrel and receiving the same, a second recess formed on the opposite side of said longitudinally extending slot substantially at the upper end thereof and having parallel upper and lower faces, movement of the drill pipe manipulating the mandrel to move the lugs through the slot to engage the intermediate recess of the adapter sleeve whereby when longitudinal force is applied in either direction subsequent jarring action will occur as the complementary inclined faces of the lug and recess move out of engagement and the lug strikes the end of the slot in the direction of said applied force.

5. In combination with a drill string and well liner a tubular adapter attached to the well liner, a mandrel attached to the drill string and being movable relative to the adapter, lugs carried by the mandrel at substantially the lower end thereof having oppositely inclined upper and lower faces, receiving means for the lugs formed in the adapter whereby the mandrel and the adapter may be telescoped into interlocking relation with each other and the mandrel and the adapter will have limited longitudinal movement with relation to each other, the receiving means carried by the adapter being formed with a longitudinally ex-

tending slot, the opposite ends of which are inclined to substantially agree with the oppositely inclined faces of the lugs, said longitudinally extending slot being formed with a recess at one side thereof intermediate the ends thereof having oppositely inclined faces substantially agreeing with the inclined faces of the lugs carried by the mandrel and receiving the same, a second recess formed on the opposite side of said longitudinally extending slot substantially at the upper end thereof and having parallel upper and lower faces, movement of the drill pipe manipulating the mandrel to move the lugs to position in the second named recess to hold the mandrel and the adapter in a position to prevent relative longitudinal movement with relation to each other.

6. In combination with a drill string and well liner a tubular adapter attached to the well liner, a mandrel attached to the drill string and being movable relative to the adapter, lugs carried by the mandrel at substantially the lower end thereof having oppositely inclined upper and lower faces, receiving means for the lugs formed in the adapter whereby the mandrel and the adapter may be telescoped into interlocking relation with each other and the mandrel and the adapter will have limited longitudinal movement with relation to each other, the receiving means carried by the adapter being formed with a longitudinally extending slot, the opposite ends of which are inclined to substantially agree with the oppositely inclined faces of the lugs, said longitudinally extending slot being formed with a recess at one side thereof intermediate the ends thereof having oppositely inclined faces substantially agreeing with the inclined faces of the lugs carried by the mandrel and receiving the same, a second recess formed on the opposite side of said longitudinally extending slot substantially at the upper end thereof and having parallel upper and lower faces, movement of the drill pipe manipulating the mandrel to move the lugs carried thereby to a position where the lugs will be positioned in the first or second named recess whereby when the lugs are positioned in the first named recess and longitudinal force is applied in either direction a subsequent jarring action will occur or to the second named recess whereby the mandrel and the adapter will be held against longitudinal movement with relation to each other.

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