

July 15, 1941.

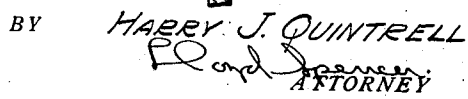
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2,249,170

-LINER HANGER

Filed Oct. 14, 1938

2 Sheets-Sheet 1



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LINER HANGER

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2 Sheets-Sheet 2

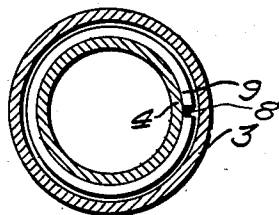


FIG. 5

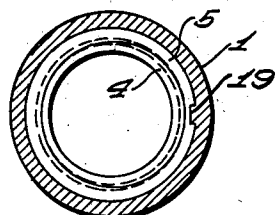


FIG. 6

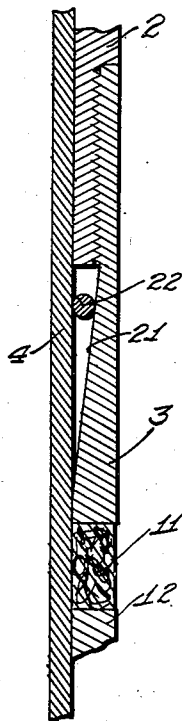


FIG. 7

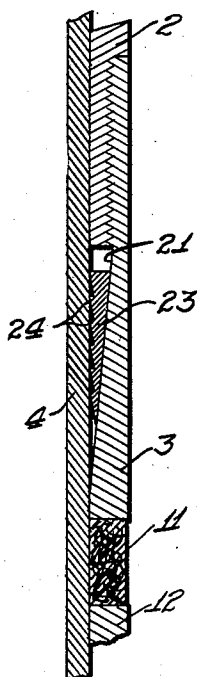


FIG. 8

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2,249,170

LINER HANGER

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Application October 14, 1938, Serial No. 234,942

5 Claims. (Cl. 166—12)

My invention relates to liner hangers, and among the objects of my invention are:

First, to provide a liner hanger which is particularly designed for use under conditions in which the producing zone is washed before setting the liner hanger, so that return circulation may be had between the liner and the casing in which it is to be set;

Second, to provide a liner hanger of this character which may be readily set at will, even though the liner suspended therefrom becomes sanded in and cannot move;

Third, to provide a liner hanger which remains set even though the liner should subsequently cease to be sanded in due to gradual washing away of the sand in the course of production;

Fourth, to provide a liner hanger which, insofar as the driller is concerned, operates identical to a conventional liner hanger and requires no special tools or other equipment; and

Fifth, to provide a liner hanger incorporating a slip joint between the hanger and the liner supported thereby which is particularly economical of manufacture, durable, efficient in its action, and which in no manner interferes with the normal operation of the liner hanger or liner.

With the foregoing and other objects in view, which will appear hereinafter, reference is made to the accompanying drawings, in which:

Figure 1 is an elevational view of my liner hanger shown in position in a well with a portion of the well casing and the liner indicated fragmentarily;

Figure 2 is an enlarged fragmentary, longitudinal sectional view of my liner hanger taken through 2—2 of Figure 1;

Figure 3 is a sectional view similar to Figure 2, but showing only one wall of the liner hanger, this view indicating the position of the parts assumed when the liner hanger is seated under normal conditions, that is, when the liner is free to move downwardly;

Figure 4 is a view similar to Figure 3, showing the position of the parts of the liner hanger when the liner is sanded in and cannot drop downward;

Figures 5 and 6 are transverse sectional views through 5—5 and 6—6, respectively, of Figure 2;

Figure 7 is an enlarged fragmentary sectional view showing a modified form of slip joint;

Figure 8 is another fragmentary sectional view showing a further modified form of slip joint.

My liner hanger, indicated generally by A, is adapted to be lowered in a conventional manner

on a tubing string T with one or more stands of perforated liner L, depending therefrom. Usually the liner hanger is positioned near the lower end of the well casing C, which has been previously cemented in place so that the liner extends into the open hole below the casing drilled into the producing zone indicated by P.

Before setting the liner hanger, it is often desirable to wash the formation confronting the liner of accumulations or deposits of drilling mud and the like. Circulation is usually established down the tubing T and upwardly along the outside of the liner, around the liner hanger and upwardly through the casing to the surface. During the course of this washing or circulating operation it often happens that the lower end of the liner becomes sanded in so that the liner cannot be moved downwardly as required in order to set the conventional liner hanger, it being noted that the washing operation must take place before the liner hanger is set in order to have a return circulation. By providing a slip joint between the liner and the liner hanger I am able to set my special liner hanger even though the liner is sanded in.

With reference more particularly to Figure 2, my liner hanger comprises an upper collar 1 which is screwthreaded to the threaded upper end of a nipple 2, the lower end of which is screwthreaded to a sleeve 3. Fitted within the collar, nipple and sleeve is a tubular mandrel or body 4. The upper end of the body 4 receives a threaded ring 5. The inside of the nipple 2 is of slightly smaller diameter than the collar 1 so that the ring 5 may seat on a shoulder 6 formed by the upper end of the nipple 2.

Between the lower end of the nipple 2 and sleeve 3 there is formed an annular channel 7 in which fits a latch ring 8. This ring is split or segmental and is adapted to fit into any one of a series of annular notches 9 formed around the mandrel 4. The latch ring 8 and notches 9 are so arranged that the mandrel may slide upwardly with respect to the sleeve 3, nipple 2 and collar 1, but once moving upwardly cannot again drop down. In order to prevent accidental upward movement of the mandrel a shear pin 10 extends through the nipple 2 into the mandrel 4.

The mandrel 4 is attached at its lower end directly to the liner and surrounding the mandrel below the sleeve 3 are a series of packing rings 11 and spacer rings 12 arranged alternately. Below these rings there is provided a cone sleeve 13 upon which ride a plurality of slips 14 connected by reins 15 to a cage 16 adapted to engage

frictionally the walls of the casing C. The cage 16 is provided with a latch member 17 which engages a pin 18 provided on the mandrel 4 for the purpose of holding the slips in their retracted position, as shown in Figure 1, during descent of the liner hanger. The packing rings, spacer rings, cone sleeve, slips and cage are all conventional in construction.

In order to prevent rotation of the mandrel 4 with respect to the collar 1, so that the tubing T can be turned in order to move the pin 18 clear of the latch 17, a keyway is formed in the ring 5 which receives a key 19 provided on the inner wall of the collar 1.

Operation of the liner hanger is as follows: In normal operation the liner hanger is unlatched, but not set; then, after the washing operation is completed the liner hanger is set, that is, weight is applied to the tubing so as to move the mandrel downwardly, and doing so the collar 1, nipple 2 and sleeve 3 are forced downwardly on the packing rings 11, while the cone 13 is held by the slips 14, with the result that the parts of the liner hanger assume the position shown in Figure 3. In such normal operation the shear pin 10 remains intact.

If, however, the liner is sanded in and cannot move downward, the shear pin 10 is severed and the collar 1, nipple 2 and sleeve 3 slip downwardly over the mandrel, causing the latch ring 8 to assume a new position with respect to the notches 9, as shown in Figure 4. If precaution is taken to first release the latch 17 from the pin 18 there is no need to either rotate the mandrel or liner, or to move them longitudinally, in order to set the liner hanger.

In Figure 7 there is illustrated a modified form of slip connection between the mandrel 4 and sleeve 3. In this construction the sleeve 3 is provided with a conical recess 21 in place of the channel 7, and a series of balls 22 are placed therein to form an over-riding clutch connection between the sleeve 3 and the mandrel 4. In this construction the notches 9 may be omitted. In Figure 8 a similar construction of the sleeve 3 is shown, but instead of the balls 22 a split or segmental ring 23 is provided, on the inner surface of which is formed a series of teeth 24 capable of gripping the mandrel 4. Similarly, this construction does not require teeth, or the like, on the mandrel 4. Both arrangements, shown in Figures 7 and 8, operate in the same manner as the previously described construction, to permit upward movement of the mandrel, but to lock the same in its proper position with respect to the sleeve 3.

Though I have shown and described particular embodiments of my invention, I do not wish to be limited thereto, but desire to include in the scope of my invention the constructions, combinations and arrangements substantially as embraced in the appended claims.

I claim:

1. A liner hanger comprising: an anchor structure including a connecting means for initially suspending the liner hanger from a tubing string, and a slip and cone means for securing the liner hanger to a surrounding casing, said slip and cone means adapted to set by a predetermined downward movement of said connecting means; a mandrel suspended from said connecting means and adapted to support a liner; and a unidirectional slip joint between said mandrel and connecting means to restrain said mandrel against downward movement relative to said anchor means, but permit downward setting movement of said anchor means relative to said mandrel.

2. A liner hanger comprising: a mandrel; a coupling for initially connecting said mandrel to a tubing string; a unidirectional slip joint interposed between said mandrel and coupling; and a cone slip and cage assembly fitting said mandrel and operable to secure the liner hanger in a surrounding casing.

3. A liner hanger comprising: a mandrel; a coupling for initially connecting said mandrel to a tubing string; a unidirectional slip joint interposed between said mandrel and coupling; a cone slip and cage assembly fitting said mandrel and operable to secure the liner hanger in a surrounding casing; and means interlocking said mandrel and coupling against relative rotation.

4. A liner hanger comprising: a mandrel; a coupling for initially connecting said mandrel to a tubing string; a unidirectional slip joint interposed between said mandrel and coupling; a cone slip and cage assembly fitting said mandrel and operable to secure the liner hanger in a surrounding casing; and frangible means restraining longitudinal movement of the elements of said slip joint.

5. A liner hanger comprising: a mandrel; a coupling for initially connecting said mandrel to a tubing string; a unidirectional slip joint interposed between said mandrel and coupling; a cone slip and cage assembly fitting said mandrel and operable to secure the liner hanger in a surrounding casing; means interlocking said mandrel and coupling against relative rotation; and frangible means restraining longitudinal movement of the elements of said slip joint.

HARRY J. QUINTRELL.