April 9, 1940. C. E. BURT 2,196,657

WELL CEMENTING APPARATUS

Filed April 21, 1939

Fig. 1.

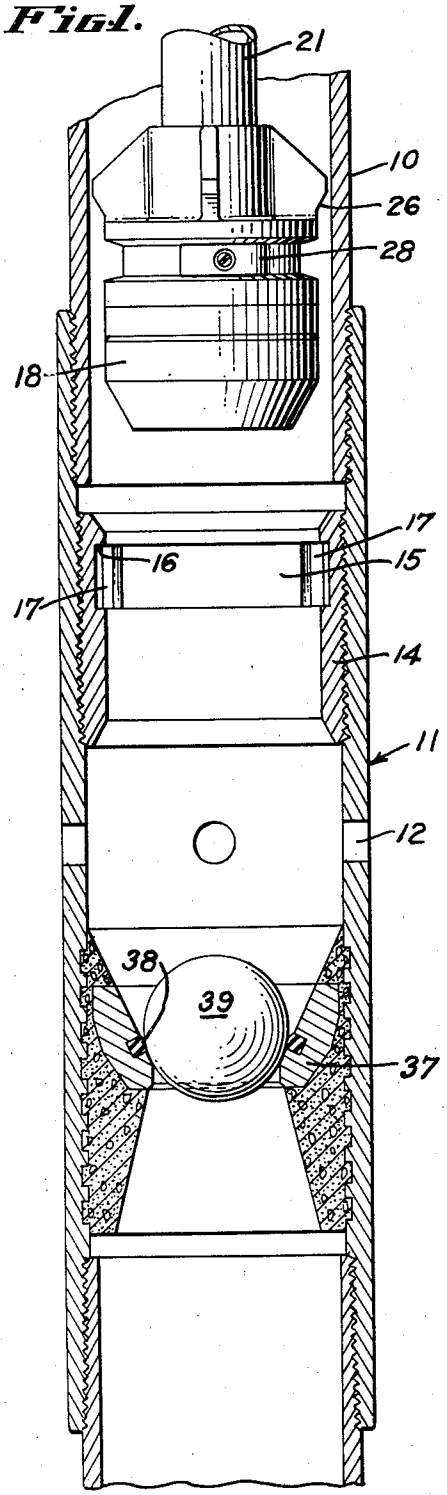


Fig. 2.

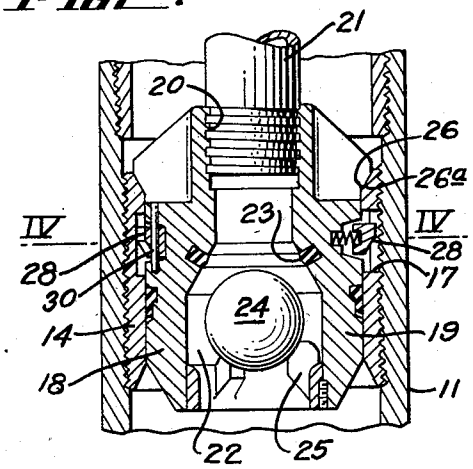


Fig. 4.

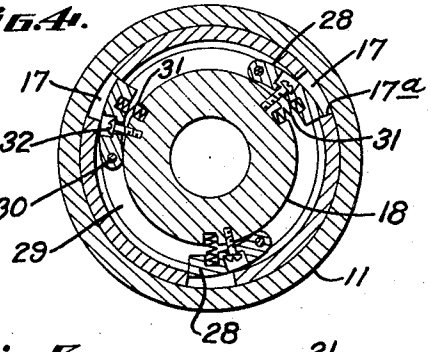
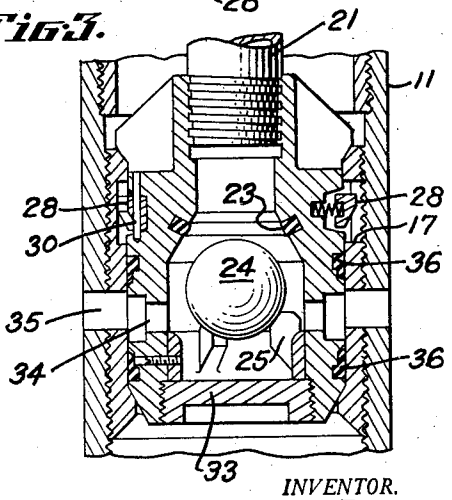


Fig. 3.



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WELL CEMENTING APPARATUS

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8 Claims. (Cl. 166—1)

This invention relates to well cementing apparatus having particular utility in the placing of cement slurry directly in the annular space between the wall of the well bore and a well casing or liner disposed in said bore.

In the drilling of deep wells, it is, in many instances, desirable to conduct a cementing operation at a predetermined point along the well casing through lateral ports or openings. Therefore, it is the principal object of my present invention to provide an improved apparatus by means of which cementing operations at selected predetermined points along the well casing may be efficiently carried out.

In practice I provide the well casing with a cementing collar having lateral cementing ports, which is lowered into the well bore in conjunction with the casing. I also provide a novel form of valved packer which may at any time be run into the casing and latched therein in proper relationship to said cementing ports so that cement may be forced downwardly through the running in tubing and thence through the packer and the lateral cementing ports. The latching of the packer is so effected that thereafter the running in tubing may be disconnected from the packer and removed from the casing without permitting the back flow of the cement slurry into the casing and upwardly through the packer.

In one embodiment of my apparatus I provide a means for bridging the casing below the cementing ports after the casing has been lowered into the well and just prior to the commencement of the cementing operation.

The invention is exemplified in the following description and illustrated by way of example in the accompanying drawing, in which:

Fig. 1 is a central vertical sectional view through a well casing showing my improved apparatus in connection therewith.

Fig. 2 is a central sectional view through the apparatus disclosing one form of the valved packer employed.

Fig. 3 is a similar view showing a second form of valved packer employed.

Fig. 4 is a transverse sectional view taken on line IV—IV of Fig. 2.

Referring more particularly to the accompanying drawing, 10 indicates a well casing or tubing, between lengths of which is fitted a collar 11 which forms a part of my improved apparatus. This collar is formed with lateral cementing ports 12 so that cement under pressure discharged into the collar may discharge outwardly through the ports 12 into the space surrounding the well casing. The collar 11 may be positioned at any desired point along the length of the casing at which it is desired to cement.

In one form of the apparatus, illustrated particularly in Figs. 1 and 2, a latching sleeve 14 is secured interiorly of the collar. This sleeve is annularly bored as at 15 to provide an annular latch shoulder 16. In register with the bore 15 and extending the vertical length thereof the latching sleeve is formed with three openings 17 spaced equal distances apart about the circumference of the sleeve, these openings providing abutments forming back up stops 17a as will be described.

For cooperation with the latching sleeve 14 is what I prefer to term a valved packer 18, such as illustrated in Figs. 2 and 3. Referring to Fig. 2, it will be seen that this valved packer comprises a cylindrical body 19, the upper end of which is formed with a centrally located and threaded bore 20, the threads being left-handed so that the run in tubing 21 may be disconnected therefrom, as will be described.

The cylindrical body 19 is formed with a valve chamber 22, the upper end of which is provided with a valve seat 23 with which a buoyant ball valve 24 cooperates. Spaced lugs 25 are provided in the lower end of the valve chamber 22 to enable the ball valve 24 to unseat but to prevent it from passing out of the valve chamber. This arrangement enables fluid or cement slurry to be pumped downwardly through the tubing 21 and thence through the valve chamber 22 around the ball valve 24 and discharge into the collar 11, and thence outwardly into the space surrounding the casing through the lateral ports 12.

It will be noticed that the diameter of the lower portion of the cylindrical body 19 is just slightly less than the internal diameter of the latching sleeve 14. The upper end of the cylindrical body member 19 has a number of stop abutments 26 to contact a stop abutment shoulder 26a at the upper end of the latch sleeve 14 so as to permit proper positioning of the valved packer 18 relative to the sleeve 14, and to prevent the valved packer 18 from passing completely through the sleeve 14.

I also call attention to piston type of packing 27 carried by the cylindrical body 19 so as to prevent the passage of fluid upwardly between the cylindrical body 19 and the sleeve 14, when the valved packer 18 is positioned with respect thereto for cementing purposes.

It is necessary and desirable that after the valved packer 18 is positioned for use in the collar

11, that it be latched against upward dislodgment. I accomplish this by means of complemental latch means on the valved packer 18 and the collar 11, part of which means is the latching shoulder 16 in the sleeve 14. To cooperate with this annular latch shoulder 16 are three latch members 28 carried by the cylindrical body 19 of the valved packer 18. For accommodation of these latch members 28 the cylindrical body 19 is formed with an annular groove 29. The latch members 28 are elongated and contoured so as to lie circumferentially in the groove 29 and to nest therein. They are pivoted at one end as at 30 and springs 31 interposed between the free ends and the cylindrical body member 19 constantly urge the free ends of the latch members radially outward, as illustrated in Fig. 4. Stop members 32 are provided to limit the outward movement of the latch members.

It will be noticed that the outer faces of the latch members 28 are beveled and also that the stop abutment shoulder 26a is likewise beveled so that when the valved packer is lowered into the casing and the latch members 28 register with the stop abutment shoulder 26a, that the corresponding beveled faces will force the latching members 28 into the groove 29 so that the same may pass into the sleeve until they register with the groove or bore 15 below the annular latch shoulder 16. At this point they move radially outward because of the springs 31 and thereafter prevent upward movement of the valved packer because of engagement with the annular latch shoulder 16.

I also desire to point out that when the latching members 28 are in proper register with the openings 17 in the latching sleeve 14, that the free ends of the latching members 28 project slightly into the openings 17 so that any attempt to turn the valved packer in a clockwise direction will be prevented by engagement of the ends of the latching members with the back up stops 17a. This, of course, enables unscrewing of the tubing 21 from the cylindrical body 19 so that the tubing may be withdrawn from the well casing.

The form of the valved packer shown in Fig. 3 is identical with that shown in Fig. 2 in all respects except that the lower end of the valve chamber 22 is blanked off and closed by means of a plug 33, and that the cement, instead of discharging downwardly through the valve chamber, discharges through radial ports 34 in the cylindrical body member 19 which register with cementing ports 35 formed radially through the latch sleeve 14 and the collar 11.

Also in the form of the device shown in Fig. 3 opposed piston packings 36 are disposed on the cylindrical body member 19 at opposite sides of the ports 34 so as to prevent fluid pumped outwardly through the ports 34 from leaking between the cylindrical body 19 and the latch sleeve 14 in either an upward or a downward direction.

When employing the form of valved packer shown in Fig. 2, when cementing at a point intermediate the ends of the casing, it is desirable to be able to bridge the casing just prior to the cementing operation. In Fig. 1 I have shown a means of bridging the collar 11 just below the ports 12. This means comprises a bridging plate or bridging ball seat 37 secured in the collar 11 and having a seat 38 formed in its upper end to receive a bridging ball 39 which may be sent down the casing at any time prior to the cementing operation. Prior to sending the bridging ball down to seat on the bridging plate or seat, fluid may be pumped down the casing in an uninterrupted fashion.

In practice, I construct the collar 11 as illustrated and interpose it in the casing string at the desired point, which may be at any point between the lower and upper terminals of the casing, so that after the casing has been positioned in the well bore, the position of the collar 11 therein will correspond with the point at which it is desired to cement. The collar 11 is, of course, fitted with the latching sleeve 14 and when it is desired to use the type of valved packer shown in Fig. 2, the collar is fitted with the bridging plate or seat 37. After the casing has been positioned in the well bore and assuming that cementing is to be accomplished by means of the valved packer 18 shown in Fig. 2, the bridging ball 39 is sent down the casing, and when it seats on the seat 38, bridging of the casing at that point is effected. This bridging is, of course, below the cementing ports 12. The valved packer 18 is threaded on the left-hand threads at the lower end of the running in tubing 21 and run down the casing until the stop abutments 26 contact the stop abutment shoulder 26a, which stops the running in and assures the operator that the latch members 28 are positioned to engage the annular latch shoulder 16 and prevent upward movement of the packer. Cement slurry or other fluid may then be pumped downwardly through the running in tubing 21 and will by-pass the ball 24 and discharge into the collar 11, and thence outwardly through the ports 12.

Upon the cessation of the pumping operations, the back-pressure of the fluid cannot pass upwardly into the tubing 21 due to the provision of the back-pressure valve 24. The tubing 21 may then be unscrewed from the valved packer 18 by turning it in a clockwise direction inasmuch as the cylindrical body 19 of the packer cannot revolve in this direction due to engagement of the latch members 28 with the back up stops 17a. After the tubing has been removed and the cement has set, the packer, together with the bridge, may be drilled out, if desired.

It is seen that if the device is used at the lower terminal of the casing, the lateral ports 12 may be dispensed with and the cement pumped directly out of the bottom of the casing and then upwardly around the same.

If the type of valved packer shown in Fig. 3 is employed, no bridging is necessary in that the lower end of the valved packer is closed and the cement which is discharged emerges through the ports 34 in the valved packer and ports 35 in the latching sleeve 14 and collar 11.

It is obvious, of course, to one skilled in the art that prior to the sending down of the bridging ball 39, or prior to the running in of the packer 18, that cementing through the lower end of the casing, or through a point in the casing below the collar 11, may be carried on, either by pumping cement directly down through the casing, or by lowering tubing down through the casing to the selected point.

From the foregoing it is obvious that I have provided a comparatively simple and very effective way for cementing off a well casing at predetermined points along the same, and while I have illustrated and described the preferred embodiments of my invention, it is to be understood that various changes may be made therein by those skilled in the art without departing

from the spirit of the invention as defined in the appended claims.

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

1. In an apparatus of the nature disclosed, the combination of a tubular body adapted to be incorporated in a well casing to form a portion of its normally open axial flow passage, said body having a lateral discharge port in its side wall, means for bridging said flow passage below said discharge port, a packer valved against back-pressure and adapted to be connected to a cementing string of tubing and lowered into said casing thereby to a cementing position in which cement slurry flowing through said packer will be discharged through said lateral port, and complemental latch elements on said body and said packer for latching said packer in cementing position.

2. In an apparatus of the nature disclosed, the combination of a tubular body adapted to be incorporated in a well casing to form a portion of its normally open axial flow passage, said body having a lateral discharge port in its side wall and being formed to provide an internal annular seat below said port, a bridging element adapted to be sent down said well casing to engage said seat and bridge said flow passage below said discharge port, a packer valved against back-pressure and adapted to be connected to a cementing string of tubing and lowered into said casing thereby to a cementing position in which cement slurry flowing through said packer will be discharged through said lateral port, and complemental latch elements on said body and said packer for latching said packer in cementing position.

3. In an apparatus of the nature disclosed, the combination of a tubular body adapted to be incorporated in a well casing to form a portion of its normally open axial flow passage, said body having a lateral discharge port in its side wall, means for bridging said flow passage below said discharge port, a packer valved against back-pressure and adapted to be screwed on the lower end of a cementing string of tubing and lowered into said casing thereby to a cementing position in which cement slurry flowing through said packer will be discharged through said lateral port, and complemental latch elements on said body and said packer for latching said packer in cementing position, said latch elements being capable of preventing rotation of the packer in one direction to enable the tubing string to be unscrewed therefrom and withdrawn from the well casing.

4. In an apparatus of the nature disclosed, the combination of a tubular body adapted to be incorporated in a well casing to form a portion of its normally open axial flow passage, said body having a lateral discharge port in its side wall and being formed to provide an internal stop abutment and to provide an internal annular latch shoulder disposed above said port, means for bridging said flow passage below said discharge port, a tubular packer valved against back-pressure and adapted to be connected to a cementing string of tubing and lowered into said casing to engage said stop abutment and be supported thereby in position to discharge cement slurry through said discharge port, and latch means carried by said packer and adapted for cooperation with said latch shoulder to prevent withdrawal of the packer.

5. In an apparatus of the nature disclosed, the combination of a tubular body adapted to be incorporated in a well casing to form a portion of its normally open axial flow passage, said body having a lateral discharge port in its side wall and being formed to provide an internal stop abutment and to provide an internal annular latch shoulder disposed above said port, means for bridging said flow passage below said discharge port, a tubular packer valved against back-pressure and adapted to be screwed on the lower end of a cementing string of tubing and lowered into said casing to engage said stop abutment and be supported thereby in position to discharge cement slurry through said discharge port, and latch means carried by said packer and adapted for cooperation with said latch shoulder to prevent withdrawal of the packer, said body adjacent said latch shoulder being provided with back up stops and said latch means being capable of engaging said stops to prevent rotation of the packer in one direction to enable the tubing string to be unscrewed therefrom and withdrawn from the well casing.

6. In an apparatus of the nature disclosed, the combination of a tubular body adapted to be incorporated in a well casing, a packer valved against back-pressure and adapted to be detachably connected to the lower end of a cementing string of tubing and lowered into said casing thereby to a cementing position, and complemental latch elements on said body and said packer for latching said packer in cementing position against subsequent withdrawal.

7. In an apparatus of the nature disclosed, the combination of a tubular body adapted to be incorporated in a well casing, a packer valved against back-pressure and adapted to be screwed on the lower end of a cementing string of tubing and lowered into said casing thereby to a cementing position, and complemental latch elements on said body and said packer for latching said packer in cementing position against subsequent withdrawal, said latch elements being capable of preventing rotation of the packer in one direction to enable the tubing string to be unscrewed therefrom and withdrawn from the well casing.

8. In an apparatus of the nature disclosed, the combination of a tubular body adapted to be incorporated in a well casing, a tubular packer adapted to be screwed on the lower end of a cementing string of tubing and lowered into said casing thereby to a cementing position, and coacting latch means on said body and said packer for latching said packer in cementing position against withdrawal from the casing and functioning to prevent rotation of the packer in one direction to enable the tubing string to be unscrewed from the latched packer and withdrawn from the casing.

CLARENCE E. BURT.