March 31, 1953 H. F. CLARK 2,633,201

CEMENTING DEVICE

Filed June 7, 1948 2 SHEETS—SHEET 1

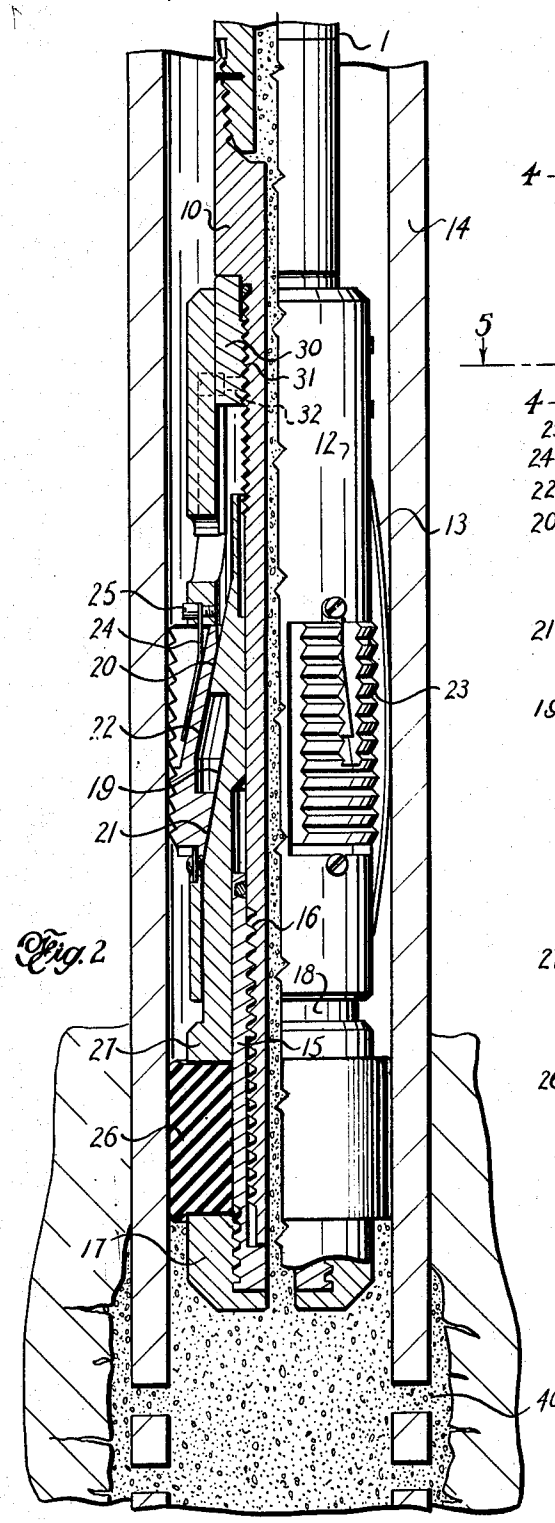


Fig. 2

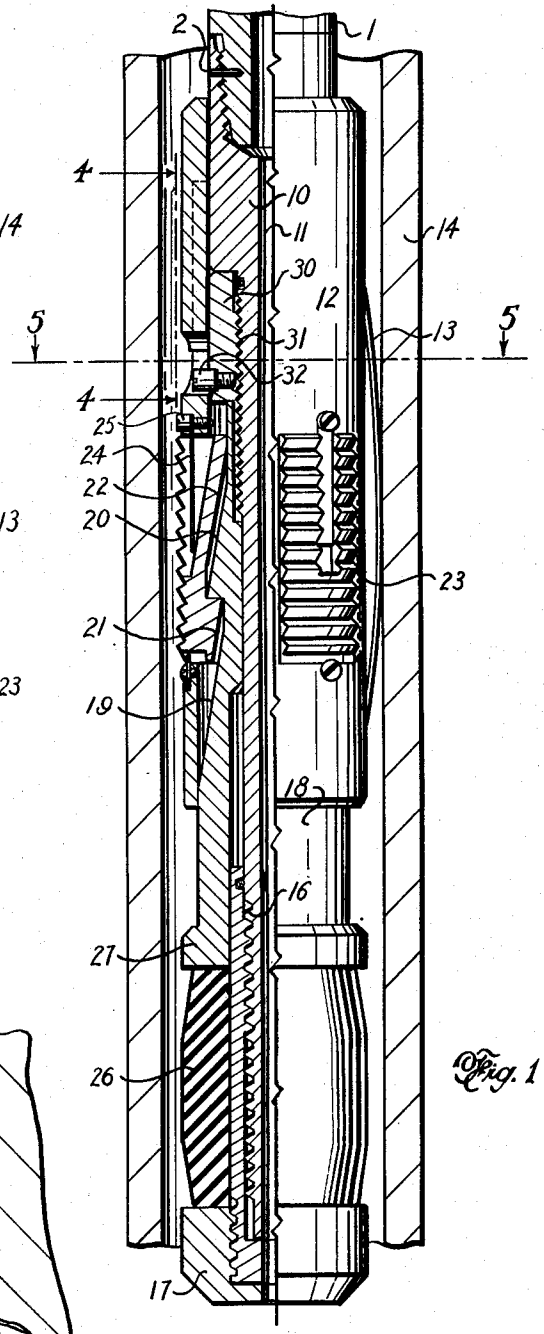


Fig. 1

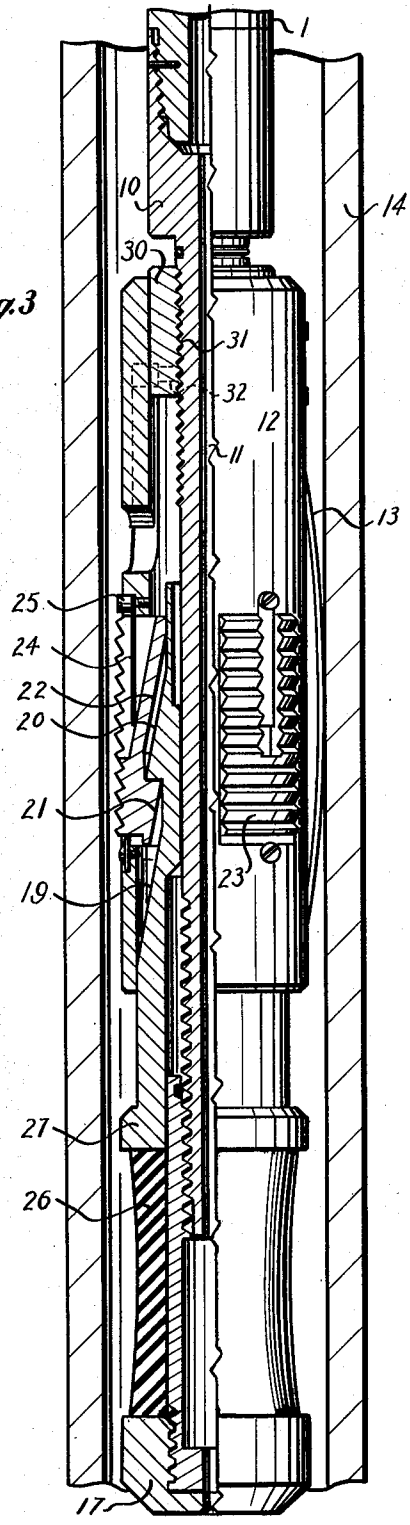
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Fig. 3



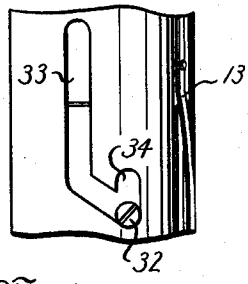


Fig. 4

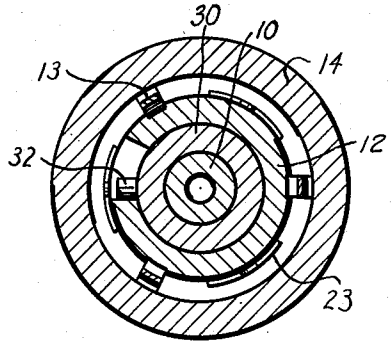


Fig. 5

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UNITED STATES PATENT OFFICE

2,633,201

CEMENTING DEVICE

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Application June 7, 1948, Serial No. 31,442

1 Claim. (Cl. 166—12)

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This invention relates to apparatus used in cementing wells and relates particularly to cementing devices which may be controlled by an operating string extending to the surface of the ground.

It is an object of this invention to provide a cementing device which may be set at any desired level in a well which will effectively perform cementing operations at the desired level.

It is a further object of this invention to provide a device of the character described, of simpler construction, less expensive to make, easier to manipulate and more efficient than similar devices used for a common purpose.

A feature of the invention is the provision therein of a central mandrel by which the tool may be manipulated by connection to an operating string extending to the surface. A further feature is the provision of means on the mandrel to jack up the slip cage if the tool cannot be withdrawn from the well readily so as to maintain the wall engaging means and packing element in retracted position. A further feature is the provision of releasable means on the mandrel to successively leave varying and additional parts of the apparatus in the well if the device becomes stuck and may not be readily removed from the well.

Another feature is the provision of a safety joint in the device so that the varying and additional parts may be readily uncoupled when desired.

A further feature is the provision of a novel J-slot arrangement which further simplifies the manipulation of the device and cooperates to make the invention more positive and efficient in operation.

Other and further objects will appear from the following preferred example which shows novel features of operation, construction and arrangement of parts and which is by way of description and not limitation. Throughout the description reference will be made to the accompanying drawings, wherein

Figure 1 is a longitudinal view, partly in section showing the device as it is going into the well with the slips and packing element in retracted position;

Figure 2 is a view similar to Figure 1 showing the device with slips and packing element expanded during a cementing operation;

Figure 3 is a longitudinal view, partly in section, showing the device with the slip cage jacked up and the slips and packing element in retracted positions;

Figure 4 is an enlarged fragmentary view taken along the line 4—4 of Figure 1 showing the J-slot arrangement; and

Figure 5 is a cross-sectional view taken along the line 5—5 of Figure 1 and shows the J-slot arrangement.

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My device includes a central mandrel 10 which extends axially through the device and has a longitudinal passage 11 therethrough. The upper end of the mandrel 10 is threadedly secured to the lower end of a string of pipe or drill stem 1 which extends to the surface of the ground and by which the tool may be manipulated. A set screw such as shown at 2 may be provided if desired to prevent untimely uncoupling of the mandrel 10 from the pipe 1.

A tubular housing or slip cage 12 is disposed about the upper portion of the mandrel 10 and has a plurality of longitudinal wiper springs 13 spaced about the outer periphery thereof for a purpose to be disclosed later.

A tubular packer support 15 is threadedly secured to the lower end of mandrel 10 by relatively coarse or fast thread 16 and the former is threadedly secured to nose piece 17 at its lower end.

A slip sleeve 18 is slidably disposed intermediate mandrel 10 and slip cage 12 and has upwardly tapering surfaces 19 and 20 adapted to engage cooperating tapered inner surfaces 21 and 22 respectively of slips 23 disposed in said slip cage. As indicated in Figure 1, slips 23 are normally held in retracted position by flat springs 24 which may be secured in cage 12 by screws 25. As shown in the drawings, slips 23 have upwardly inclined teeth to fix the device against upward movement, when the slips frictionally engage the inner wall of the casing 14.

In order to seal off that portion of the well above the desired cementing level, a tubular packing element 26 of any suitable material is disposed about packer support 15 and stops against the upper shoulder of nose piece 17 and the bottom of outwardly flanged radial shoulder 27 at the lower end of slip sleeve 18. Relative upward movement of nose piece 17 with respect to radial shoulder 27 will compress and expand packing element 26 into sealing engagement with the casing 14 as described later.

A ring 30 is threadedly secured to the upper end of mandrel 10 by relatively fine or slow threads 31 and is slidable in housing 12. Pin 32 is threadedly secured to the outer periphery of ring 30 and the former moves in J-slot 33 disposed in the upper portion of slip cage 12. As more clearly shown in Figure 4, the lower end of J-slot 33 is upwardly recessed as at 34 for a purpose later described. While only one J-slot is shown in the drawing, two or more may be used.

In operation my device is assembled as shown in Figure 1 and lowered into a well suspended from a string of pipe, such as shown at 1. While going down into the well, fluid may be pumped through the string of pipe and the device. The engagement of wiper springs 13 with the inner wall of the casing 14 tends to hold slip cage 12 in an elevated position relative to mandrel 10 and

ring 30 so that pin 32 will be in a lowermost position in J-slot 33, as shown in Figures 1 and 4.

Upon reaching an elevation in the well where it is desired to perform a cementing operation, an upward pull on and rotation to the right of the operating string 1 will cause pin 32 to move upwardly in J-slot 33, inasmuch as wiper springs 13 will tend to hold slip cage 12 fixed relative to the casing 14. The described upward pull on the operating string will raise mandrel 10, nose piece 17 and slip sleeve 18 so that inclined surfaces 19 and 20 on the latter will engage cooperating inner surfaces 21 and 22 respectively of slips 23 and urge the slips outwardly into frictional engagement with the inner wall of the casing 14. Thus, the device is fixed against upward movement. Inasmuch as slip sleeve 18 is similarily fixed against upward movement, a continued upward pull on operating string 1 will compress packing element 26 into sealing engagement with the inside of the casing.

When the device is set in the well as described, cement may be pumped down through the operating string, and the central passage 11 in the device and discharged into the casing below the packer. As shown in Figure 2 the casing may be perforated as shown at 40.

When the required amount of cement has been pumped down through the device, the operating string is lowered and rotated to the left, thereby causing pin 32 to move to the lowermost position in J-slot 33. A flushing fluid may be pumped down the operating string to flush out the cement above the packer and in the device. Obviously, flushing fluid may be pumped down the casing and back through the device and tubing if desired.

The device may be withdrawn from the well by exerting an upward pull on the operating string whereby pin 32 will move into recessed portion 34 of J-slot 33. Thus, the slips and packer are maintained in contracted position and the device may be withdrawn from the well.

In the event that pin 32 will not move into the recessed portion 34 of J-slot 33 or if the tool will not come out of the hole readily, the operating string of pipe 1 may be rotated and coarse or fast thread 16 at the lower end of the tool will unthread at a faster rate than relatively fine or slow thread 31 at the top of the mandrel 10 whereby pin 32 will strike the uppermost portion of J-slot 33 and jack up slip cage 12, as shown in Figure 3 so that slips 23 and packing element 26 will be held in contracted position and the device may be withdrawn from the well.

If the cementing device is stuck in the hole, further rotation of the operating string 1 and central mandrel 10 will unthread the latter from packer support 15 before the thread at 31 will become unscrewed. Thus, the tool may be withdrawn from the well leaving only packer support 15, nose piece 17 and packing element 26.

If the tool is still stuck in the well, further rotation of the operating string will unscrew the threaded area at 31 whereby the central mandrel may be withdrawn from the well leaving the rest of the device therein. All parts except the central mandrel are made of drillable material and, if left in the well, may be readily drilled.

It is obvious that I can lower my cementing device to any desired level in a well and by rotating and exerting an upward force on the operating string set the slips and expand the packer into sealing position in the well. The well may then be cemented. The device may then be flushed out and withdrawn by rotating and lowering the operating string and then raising the tool.

In the event the slips and packing element will not remain contracted, the operating string may be rotated to jack up the slip cage thereby holding the slips and packing element in inoperative position and the tool withdrawn from well.

If the tool is stuck in the well, further rotation of the operating string will release various and successively more parts and such successive and additional parts may be left in the well as the occasion requires. It seems obvious that the threaded arrangement on the central mandrel acts as a safety joint.

In some cases it may be desirable to use a bypass valve in the operating string just above the tool to aid in positioning the tool in the well; however, such a valve is not part of this invention, and, accordingly is not shown or described.

While in the example described a certain type of cementing operation has been described, it is obvious that my device may be used for various cementing operations, all well known to those skilled in the art. It is to be understood that my invention may be used for introducing any fluid or semi-fluid substance into a well under pressure. Such substances as acids and various plastics may be effectively and positively injected into the well at any desired level by the use of my invention.

While a preferred embodiment of my invention has been described in connection with a cementing operation, it is obvious that certain changes might be made within the scope of the invention set forth in the following claim.

I claim:

A well cementing apparatus adapted to be secured in casing in a well bore to seal the same comprising a mandrel having an axial bore, a slip cage connected to said mandrel by relatively fine threads and having slips therein, an assembly having a packer thereon, said assembly being mounted on said mandrel beneath said slip cage and connected to said mandrel by a relatively coarse thread, a sleeve slidably disposed about said mandrel intermediate said assembly and slip cage and engaging said slips and the top of said packer, the arrangement being such that the slips and packer can be set in the casing by raising the mandrel to cause said sleeve to actuate the slips and expand the packer, and released from the casing by rotation of the mandrel due to the differential action between said relatively fine and coarse threads.

HILLIARD F. CLARK.

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