May 23, 1939. C. E. STROM 2,159,640

DEEP WELL CEMENTING DEVICE

Filed Aug. 29, 1938

FIG. 1.

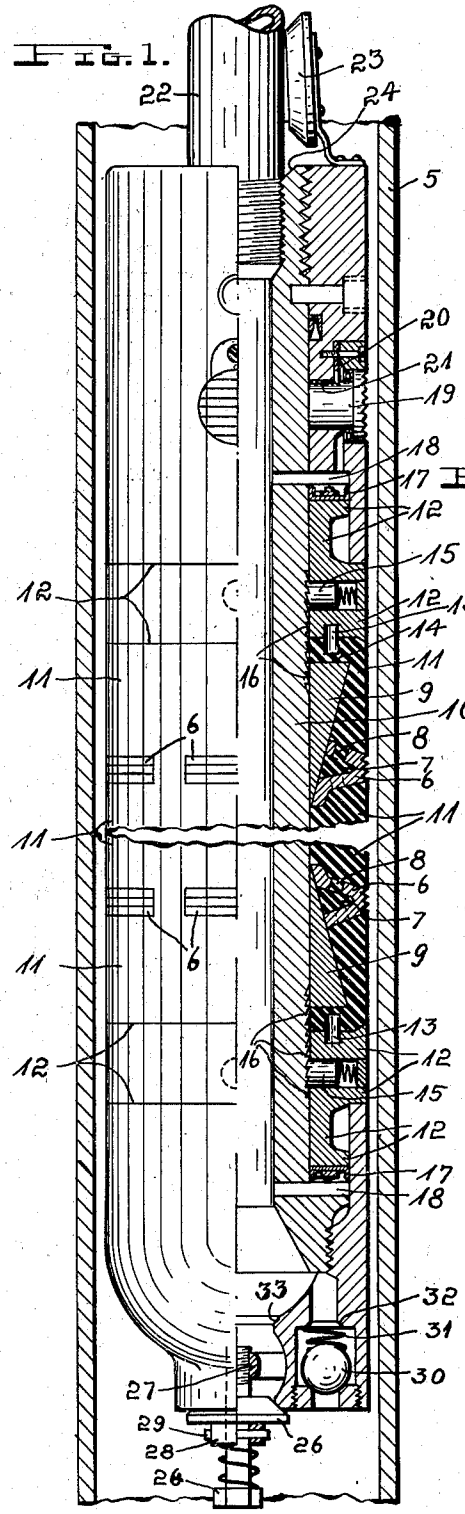


FIG. 4.

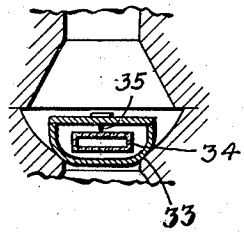


FIG. 2.

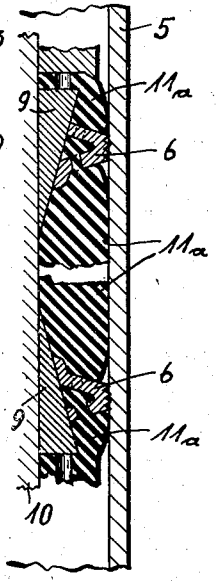
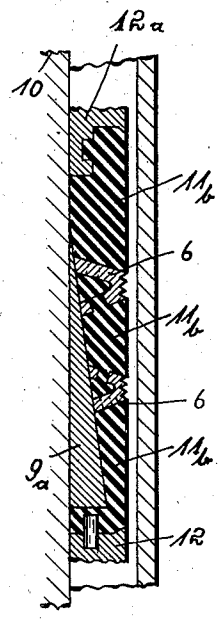


FIG. 3.



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DEEP WELL CEMENTING DEVICE

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11 Claims. (Cl. 166—12)

This invention relates to devices used for controlling the injection of cement in deep wells.

One of the objects of this invention is to provide a construction that can easily be assembled.

Another object is to provide sturdiness and compactness by combining the metal catch members and the expansible sealing material firmly by being produced together, with the metal catch members vulcanized into the sealing material.

Another object is to provide means whereby the pressure medium normally applied to the whole device can be utilized for actuating the catch members and sealing material.

Another object is to provide means that will eliminate itself at a suitable point of pressure, to allow the passage of cement.

Another object is to provide means for retaining the catch members and sealing material in effective position.

Other objects will appear from the following description and appended claims as well as from the accompanying drawing, in which—

Fig. 1 is a fragmentary view of a device designed in accordance with this invention, half of which being shown in side elevation, while the other half is shown in mid-section, the parts being in inoperative position.

Fig. 2 is a fragmentary mid-sectional view of the catching and sealing parts in expanded and effective position.

Fig. 3 is a fragmentary mid-sectional view of a slightly modified form of catching and sealing parts.

Fig. 4 is a fragmentary mid-sectional view of a self-destructive control valve.

The whole cementing device is shown in a portion of a well casing, indicated at 5.

While the double-wedge arrangements, such as illustrated in Figs. 1 and 2 may be more effective and preferred under certain conditions, the single-wedge arrangement illustrated in Fig. 3 can also be made very effective.

The principal feature involved in either arrangement is the firm uniting of the catching members and the sealing material.

Though rubber is perhaps the most feasible material by which such a uniting may easiest be accomplished, it should not be held a limitation to this invention, since an embedding of catching members in expansible sealing material should not be said to be dependent on rubber alone.

As illustrated, the catching members are preferably in form of ring-segments 6, made of any sort of more firm material, which, most suitably, would, perhaps, be metal that is not only tough but suitable for a desirable tempering.

These catching members are also preferably designed to facilitate a firm embedding, by being hollowed, as indicated at 7, and being apertured, as indicated at 8, in Fig. 1, by means of which any expansible, elastic material may be forced to surround suitable portions of such catching members as to become thoroughly embedded in such material.

The united catching members and sealing material is shaped so as to provide room for cooperating wedges 9.

In the fully assembled device, the united catching members 7 and enclosing sealing material 11, with the also, though somewhat loosely, enclosed wedges 9, are mounted jointly to slide on a central tubular member 10.

Any pressure endwise on these combined and assembled wedges and catching members will force the catching members to slip upwardly on the wedges, to result in the expanding of the sealing material in the manner illustrated in Fig. 2, to seal against the casing 5.

To effect such endwise moving of the catching members 6 with respect to the wedges 9, sleeves 12 are slidingly mounted on the tubular member 10 and designed at their front ends t. engage over the ends of the assembled wedge and catching unit.

Inasmuch as a sealing must also be effected between the sleeves 12 and the wedges 9, the sealing material extends between these parts, having, however, certain provisions whereby the action of the sleeves is made positively effective with respect to the wedges.

Pins 13 are provided for this purpose, being proportioned so that the sealing material may be compressed suitably to a certain extent before the pins come to act on the wedges, there being a small amount of sealing material, as indicated at 14, between the pin-end and the wedge which will be punctured by the pin as it moves forward, but which provides for a compressing of the sealing material between the sleeve 12 and the wedge to a suitable extent for sealing purposes at these points.

As soon as the pins come into contact with the wedges, any further advance of the sleeves acts then directly on the wedges which causes the wedges to slip between the central tubular member 10 and the larger portion of the sealing material at the center of the assembled unit until it acts on the catching members 6 to slide up-

wardly on the wedges until the whole sealing material is expanded for proper sealing, the catching members 6 being at the same time forced into engagement with the well-casing 5, as indicated in Fig. 2, thereby preventing any undesired back-slip.

Small spring-actuated plungers 15 are disposed in the sleeves to engage with cooperative teeth 16 in the central tubular member 10, to furthermore hold the expanded and sealed unit in effective position.

Any material normally used in and through the device, by which cement is supplied through the device under pressure, may at the same time be used as a medium for actuating the sleeves 12.

The sleeves are therefore in parts designed in form of annular pistons, or plungers, with annular cup-rings 17 at their ends.

The pressure medium is brought from the hollow center of the device through the central tubular member 10 by way of conduits 18, to act on the cups.

The device is therefore held so much more intensely in place within the well-casing 5, the more pressure is applied for the transfer of cement through the device.

In cases where additional friction means, or locking, or catching means are desired, they may easily be provided, as at 19, this being also in form of a plunger, and also to be operated by the same pressure medium, a spring-latch 20 serving to lock this plunger in catching position cooperatively with the teeth 21 in the plunger.

While the most common use may be by transferring cement through the device, the whole device may also be left locked in a well for holding cement above the device, for which purpose the upper connecting pipe 22 may be detached, and for which the valve 23 is provided, to close the hollow at the top end of the device, with the valve 23 to settle in the seat 24.

The lower end of the device is commonly held closed while the device is lowered to the point, or level, at which a cementing is desired in a well.

For keeping the lower end closed quite a variety of valves are known, a simple form being indicated at 25 mounted on a bolt 26, the bolt being secured in a cross-spider 27 in the device, the valve being normally held closed by a collar-ring 28, pinned to the bolt by a shear-pin 29.

The shear-pin is proportioned so that it will withstand any pressure that may be applied while the device is being lowered and up to the point wedges and catching segments are brought into engagement, but at any pressure beyond that the pin 29 will be shorn off so that the valve 25 then opens, serving to allow cement to pass into the space below the locked device, and the pressure may then be increased to overcome any pressure in the well.

In some cases it may be desirable to release the well-pressure to some extent, for which purpose a valve 30 is provided that may open a side passage through the device up to a certain pressure, depending on the strength of the spring 31, against which the valve may close the passage by becoming seated on the seat 32 when the pressure is beyond certain limits.

A different form of valve for keeping the device closed towards the bottom is illustrated in Fig. 4, this valve being made to seat at 33 indicated in Fig. 1.

This valve is intended to depend on the destruction of the material of this valve by any suitable acid, and, since various acids act differently on different materials, the material may be selected according to the acid to be used.

For holding the acid, a bottle is disposed inside of this type of valve, as indicated at 34.

Having then selected a certain material, eventually zinc, as being soluble by certain acids that may have been put in the bottle 34, this valve is additionally designed so that it will puncture the bottle, as by a pointed pin portion 35, the top being suitably large and flat to easily dent upon a certain pressure, to bring the pin-portion 35 into crushing contact with the bottle.

This valve is furthermore proportioned so that it will withstand the low pressure used while the device is being lowered into the well and for latching purposes, but will dent in upon more intense pressures.

The slightly modified form in Fig. 3 illustrates a single-wedge arrangement for the sealing and catching of the device, the sealing material being engaged at one end to the sleeve 12_a; while at the other end abutting against a sleeve as already described; two catching members 6 being disposed on the one wedge 9_a in this case, and the sealing material being of slightly different form correspondingly.

Having thus described my invention, I claim—

1. In a well cementing device, a body including a hollow tubular center-member by which a pressure medium and cementing material can be passed into a well and having a portion forming a cylinder, actuating sleeves shiftably mounted on the center-member and in operative relation to the cylinder, a conduit forming communication between the hollow of the center-member and the cylinder and bringing the pressure medium to act upon the sleeves axially, and a packing made of a material facilitating the embedding of metal catching devices during the manufacture of the packing and having the catching devices embedded so as to protrude from one side of the packing with a sliding surfacing and from the opposite side with a catching surfacing and having furthermore wedges loosely disposed in the packing against said sliding surfacing whereby the catching devices are forced against the inner side walls of a surrounding well-casing as the packing is compressed by means of said sleeves through the pressure medium.

2. In a well cementing device, a valve inclosing a bottle containing a certain acid and designed to break under pressure, the valve being made of material soluble by said acid.

3. In a well cementing device, a valve inclosing a bottle containing a certain acid, the valve being made of material soluble by said acid, the valve having puncturing means to act upon the bottle for breaking it so as to free the acid to act on the material of the valve when the pressure acting upon the valve reaches certain limits.

4. In a well cementing device, a center-tube, wedges slidably mounted on the center tube, resilient sealing material surrounding the wedges and having catching members embedded therein riding on the wedges and protruding from the outside of the sealing material for engaging the inner wall of a well casing, and means actuatable by the fluid pressure in the center-tube to actuate the wedges to expand the sealing material and move the catching members into frictional engagement with the well casing.

5. In a well cementing device, a center-tube, wedges slidably mounted on the center-tube, resilient sealing material surrounding the wedges and having catching members embedded therein

riding on the wedges and protruding from the outside of the sealing material for engaging the inner wall of a well casing, means actuatable by the fluid pressure medium passing through the center-tube to actuate the wedges to expand the sealing material and move the catching members into frictional engagement with the well casing, and other catching means under influence of such pressure medium for radially moving from the device for engagement with the inner wall of the well casing for steadying the whole cementing device in the well casing during the expanding and preparatory to the engagement of the first-named catching members.

6. In a well cementing device, a packing made of a material facilitating the embedding of metal catching devices during the manufacture of the packing, and catching devices embedded in the packing protruding therefrom on one side with a sliding surfacing and on the opposite side with a catching surfacing.

7. In a well cementing device, a packing made of a material facilitating the embedding of metal catching devices during the manufacture of the packing, and catching devices embedded in the packing protruding therefrom on one side with a surface in an incline to the general longitudinal configuration of the packing and on the opposite side with a catching surfacing adapted to engage another surface against which the packing may be expanded.

8. In a well cementing device, a packing made of a material facilitating the embedding of metal catching devices during the manufacture of the packing, and catching devices embedded in the packing protruding therefrom on one side with a conical surface adapted to ride on a wedge and on the opposite side with a catching surfacing adapted to engage another surface against which the packing may be expanded.

9. In a well cementing device, a packing made of a material facilitating the embedding of metal catching devices during the manufacture of the packing, the packing having a conical recess in its inner surface and being of cylindrical configuration on its outside, and metal catching devices embedded in the packing and protruding from the opposite conical and cylindrical surfaces.

10. In a well cementing device, a packing made of a material facilitating the embedding of metal catching devices during the manufacture of the packing, the packing having a conical recess in its inner surface and being of a general cylindrical configuration on its outside, and metal catching devices embedded in the packing and protruding with their opposite ends from the opposite conical and cylindrical surfaces.

11. In a well cementing device, a packing having a conical recess in its inner surface and being of a generally cylindrical configuration on its outside, metal catching devices embedded in the packing and protruding with their opposite ends from the opposite conical and cylindrical surfaces, wedges disposed in the recess of the packing, annular piston-like members disposed against the opposite ends of the packing, and a supporting structure including cylinder-like portions and a central bore with communications between the bore and cylinder-like portions whereby a pressure medium in the bore may act on the piston-like members disposed in the cylinder-like portions for simultaneously wedging the catching devices outwardly and expanding the packing adapted to engage and seal the structure within a well casing.

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