Oct. 16, 1945. C. E. BANNISTER 2,387,002

APPARATUS FOR CEMENTING THE WALL OF AN EARTH-BORING

Filed June 24, 1942 2 Sheets-Sheet 1

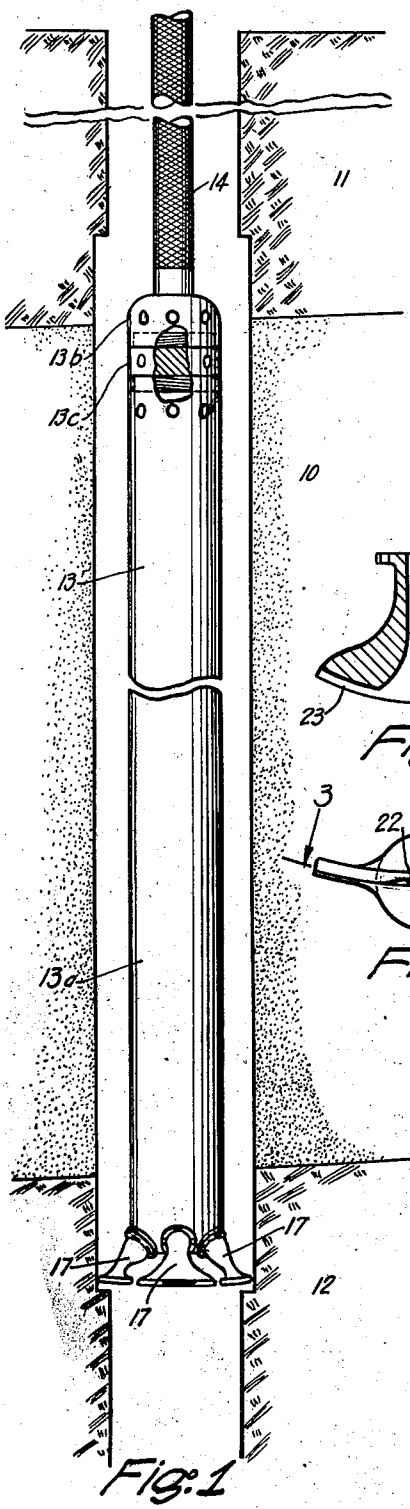


Fig. 1

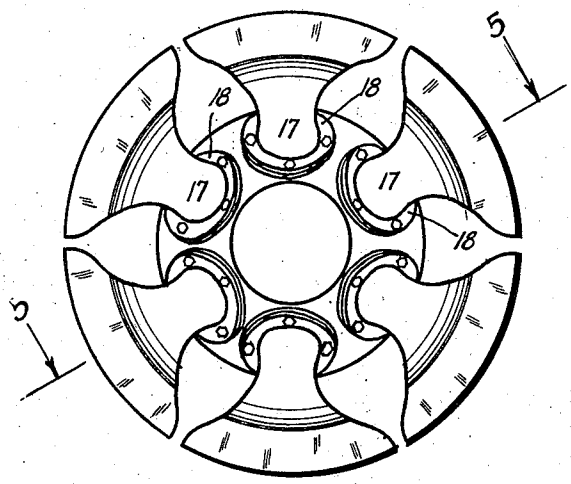


Fig. 2

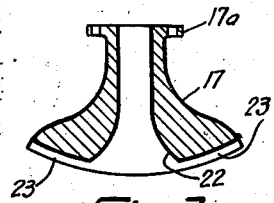


Fig. 3

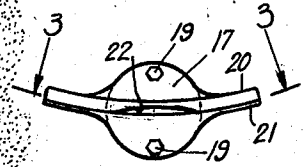


Fig. 4

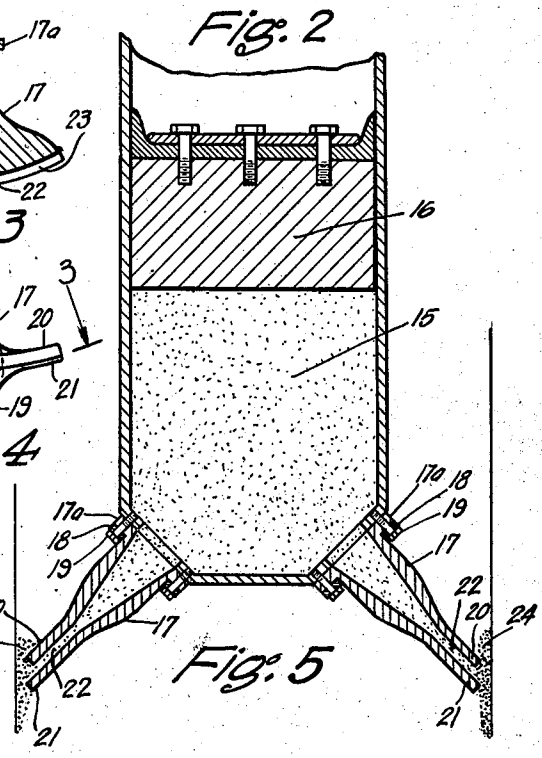


Fig. 5

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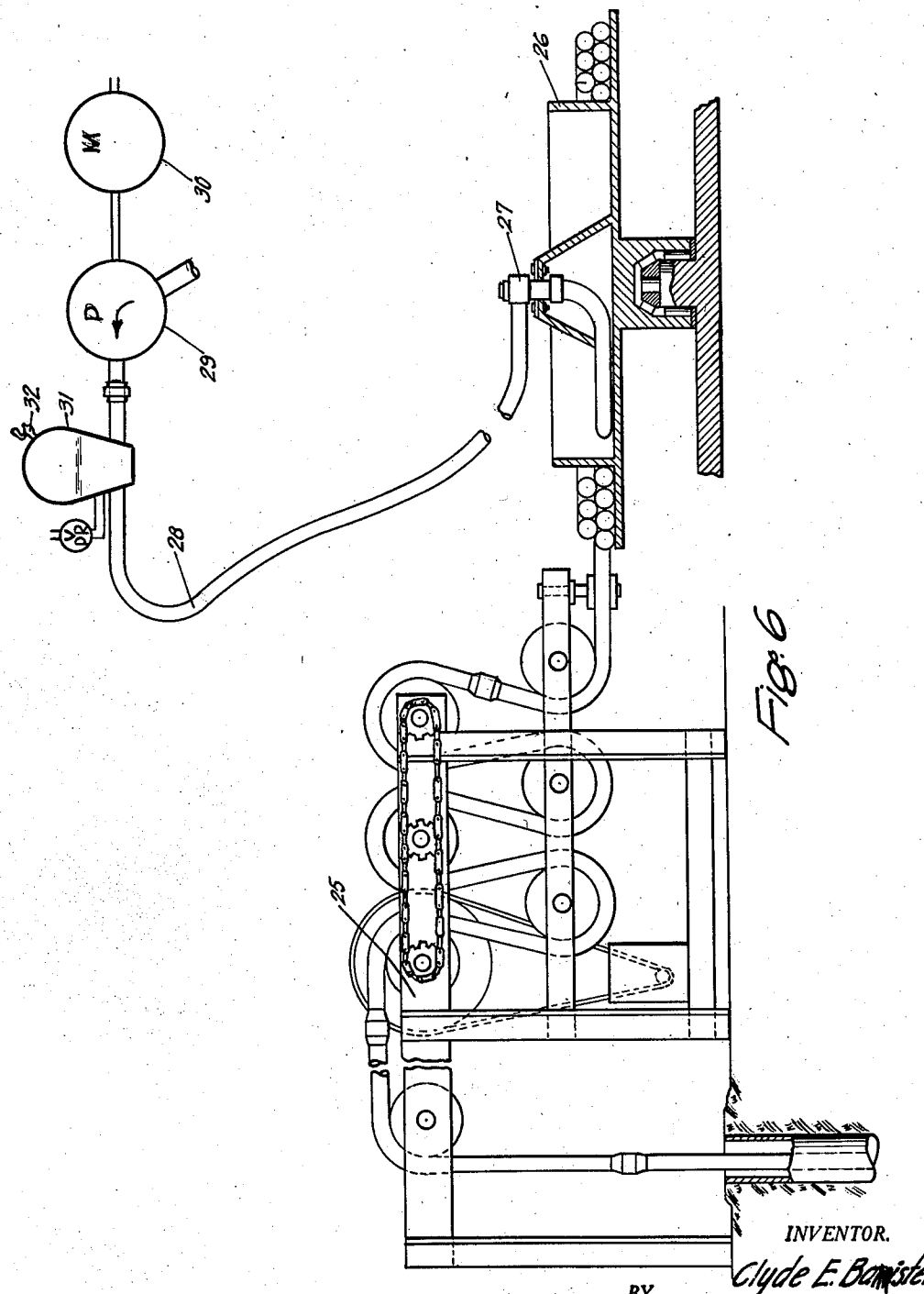


Fig. 6

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APPARATUS FOR CEMENTING THE WALL OF AN EARTH BORING

Clyde E. Bannister, Houston, Tex.

Application June 24, 1942, Serial No. 448,194

3 Claims. (Cl. 166—1)

This invention relates to apparatus for applying a coating of Portland cement or the like to the wall of an earth-boring, as in the case of an oil well drilled through a stratum of sand which requires to be walled off to prevent caving.

My chief objects are to provide economy of time, labor and materials.

Of the accompanying drawings:

Fig. 1 is an elevation of parts of apparatus embodying and adapted for the practice of my invention in its preferred from, the earth formations and parts of the apparatus being shown in section.

Fig. 2 is a view of the same from below.

Fig. 3 is a middle, generally horizontal section, on line 3—3 of Fig. 4, of a deformable cement-nozzle member of which six are shown in Fig. 2.

Fig. 4 is an end view of the same.

Fig. 5 is a section on line 5—5 of Fig. 2.

Fig. 6 is an elevation, with parts in section, of parts of the apparatus mounted at the top of the hole.

I attain the above stated objects by virtually plastering the wall of the sand formation, 10, with the self-setting cement, preferably after reaming out the previously drilled hole to a larger diameter in the part of it that passes through the sand and, preferably, for a little distance in the harder strata 11, and 12 above and below the sand.

Referring to the drawings, Figs. 1 and 5 show an elongated cement-containing barrel 13 connected at its top to a pressure-applying hose 14 which extends to the top of the hole and may be employed, without additional means, for lowering and raising the barrel 13 in the hole.

The barrel comprises a lower, main body part 13^a, an upper cap part 13^b, and an annular coupling member 13^c having right-and-left threads for securing the other two parts together after a suitable quantity of flowable cement 15 (Fig. 5) has been placed in the lower part, and after floating piston 16 has been placed within the barrel on top of the cement.

At its lower end the barrel is formed with at least one circumferential series of outlet apertures, the mouths of which preferably are at about 45° to the axis of the barrel, and each outlet aperture is in communication with a spewing and plastering nozzle 17, which preferably is formed of a resiliently deformable material such as vulcanized soft rubber. The nozzles are shown as being formed with external base flanges 17^a, 17^a by which they are secured to the cement barrel by means of respective clamping rings 18, 18 and cap-screws 19, 19.

Each of the spewing and plastering nozzles 17 preferably is of approximately cylindrical form near its base, with a graduation of cross-section such that at and near its outer end it consists of upper and lower lips 20, 21 which in their middle radial zones are separate, so that in that region they can be forced apart to provide a spewing aperture 22, and preferably the lower lip 21 projects a little beyond the upper lip 20 so that in an upward stroke the lower lip acts in the manner of a putty knife for plastering the wall of the hole, while the relative shortness of the upper lip permits lateral flow of cement along the marginal ledges 23, 23 (Fig. 3) which are a part of the lower lip, and may permit also a little upward escape of cement to provide a working bank 24 of cement (Fig. 5).

Preferably the outer margins of the lips are curved to approximately the curvature of the hole to be plastered, and, when there is only one circumferential series of the nozzles, their flare preferably is such that the outer margins of the series of lips approximately fill out the circle.

Preferably the outer margins of each pair of lips are a little higher at their sides than at their middle, as shown clearly in Fig. 4; for stiffness to provide plastering pressure and also to prevent excessive lateral escape and dropping of cement in case the lips do not completely fill out the circle.

At the top of the ground the hose 14 passes through a pull-out and let-off device 25 in being wound onto or drawn off from a vertical-axis hose reel 26, on which the hose has axis connection, through a swivel 27, with a conduit 28 leading from a pump 29 driven by a motor 30, and the conduit 28 is provided with an air-dome 31 provided with a pet-cock 32 in its upper part and a pressure relief valve 32 connected to it below the normal water level.

In one method of operation the lower part of the barrel 13 is charged with cement at the top of the ground, the piston 16 being placed on top of the cement, and the two sections 13^a and 13^b of the barrel are secured together by the coupling 13^c.

The barrel is then lowered in the hole by means of the hose 14, without pressure on the cement except that of its own weight and the weight of the piston 16, the stiffness of the lips 20, 21 being such in relation to the flow-resistance of the cement as to prevent escape of cement through the nozzles.

As the barrel is lowered through the small-diameter part of the hole, in the hard formation 11, the nozzles flex upwardly to permit the barrel to descend, but when the large-diameter, reamed part of the hole is reached, in the sand stratum 10, the nozzles spring back to the positions in which they are shown in Fig. 1.

When the nozzles have reached the lower end of the large-diameter part of the hole, fluid pressure is applied above the piston 16, through the hose 14, which preferably is preliminarily filled with water before the closing of the cement barrel, water being preferable to air because of its incompressibility and because of its providing a better seal of the piston.

Concurrently with the application of the pressure, which causes a spewing of the cement through the nozzles, the barrel is raised along the wall that is to be plastered, and the nozzles, stiffened somewhat by the pressure, act in the manner of a trowel or a putty knife and apply a layer of cement to the wall.

The barrel can then be lowered, with the pressure off, for one or more repetitions of the operation, to assure a sufficiently thick and imperforate layer of the cement on the wall.

In an alternative procedure the barrel is first lowered to the lower end of the wall to be plastered, with the barrel and the hose empty. A slug of cement is then pumped down the hose and when it has arrived in the barrel, as determined by timing it or by control of the amount of fluid pumped into the system, the barrel is raised in a plastering operation such as that just described.

I claim:

1. Apparatus for cementing the wall of an earth boring, said apparatus comprising a cement chamber adapted to be freely lowered and raised in the boring and formed with outlets leading from its lower portion, a plurality of flexible resilient extrusion means mounted on said chamber in constant communication with said outlets and projecting outwardly from the chamber, an imperforate piston directly contacting the inner face of said chamber and movable downward therein for forcing cement downward ahead of it, and reelable means comprising a hose for lowering and raising the chamber in the boring and conducting pressure fluid from the top of the boring into the space in the chamber above the piston, each of the said flexible, resilient extrusion means comprising one of a circumferential series of nozzles formed of resiliently deformable material, each nozzle being formed with a passage whose vertical cross-sectional dimension decreases and whose horizontal cross-sectional dimension increases in the direction from the base of the nozzle toward its outer end.

2. Apparatus for cementing the wall of an earth boring, said apparatus comprising a cement chamber adapted to be freely lowered and raised in the boring and formed with outlets leading from its lower portion, a plurality of flexible resilient extrusion means mounted on said chamber in constant communication with said outlets and projecting outwardly from the chamber, an imperforate piston directly contacting the inner face of said chamber and movable downward therein for forcing cement downward ahead of it, and reelable means comprising a hose for lowering and raising the chamber in the boring and conducting pressure fluid from the top of the boring into the space in the chamber above the piston, each of the said flexible, resilient extrusion means comprising one of a circumferential series of nozzles formed of resiliently deformable material, each nozzle being formed with a passage whose vertical cross-sectional dimension decreases and whose horizontal cross-sectional dimension increases in the direction from the base of the nozzle toward the outer end, and the most restricted part of the passage through the nozzle being of such size at low pressure that there is substantially no flow of cement through the nozzle but the nozzle being of such resilient deformability that at higher pressure the passage enlarges and thus permits relatively free flow of cement.

3. Apparatus for cementing the wall of an earth boring, said apparatus comprising a cement chamber adapted to be freely lowered and raised in the boring and formed with outlets leading from its lower portion, a plurality of flexible resilient extrusion means mounted on said chamber in constant communication with said outlets and projecting outwardly from the chamber, an imperforate piston directly contacting the inner face of said chamber and movable downward therein for forcing cement downward ahead of it, and reelable means comprising a hose for lowering and raising the chamber in the boring and conducting pressure fluid from the top of the boring into the space in the chamber above the piston, each of the said flexible, resilient extrusion means being formed with an outlet vertically narrower than it is horizontally wide and having a relatively shorter upper lip and a relatively longer lower lip projecting outwardly beyond said upper lip and adapted to serve as trowelling means.

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