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WELL CEMENTING DEVICE

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The present invention relates to apparatus that is particularly useful in cementing casing in well bores.

This application is a division of our application for "Well cementing devices," filed March 16, 1942, Serial No. 434,912, now abandoned.

It is an object of the present invention to provide an improved cementing apparatus employed in connection with the cementing of casing or other conduits in a well bore, which allows fluid to pass through it in a downward direction to a point of discharge in the casing below the apparatus, and which allows discharge of cement slurry therefrom in a downward direction below the casing above such point while preventing return flow of the cement slurry into the casing.

The invention has other objects which will become apparent from a consideration of the embodiment shown in the drawing accompanying and forming part of the present specification. This embodiment will now be described in detail to illustrate the general principles of the invention, but it is to be understood that such detailed description is not to be taken in a limited sense, since the scope of the invention is best defined by the claims appended hereeto.

Referring to the drawing:

Figure 1 is a longitudinal section through an apparatus exemplifying the invention with some of its parts disclosed in one operative position; and

Figure 2 is a view similar to Figure 1 with the parts disclosed in another operative position.

The apparatus disclosed in the drawing includes a collar 10 forming part of the casing or similar string by being threaded or otherwise suitably coupled to adjoining casing sections 11, 12. A generally tubular body 13 is secured in the collar, as by means of threads 14 on an external body flange 15 screwed into cooperable threads on the collar positioned below its outlets or ports 16. The upper portion 17 of this body is generally cylindrical in shape and is spaced from the inner well wall of the collar to form an annular chamber 18, in which a back pressure valve is located for preventing return flow of fluids from the exterior of the casing through the collar ports 16 and body ports or outlets 19 to the interior of the casing string. As disclosed in the drawing, such back pressure valve consists of a flexible sleeve 20 having one end anchored to the body in any suitable manner, as by clamping it between the upper body portion 17 and a body head 21 threaded thereon. However, it is to be noted that the lower end of this sleeve 20 of rub-
into engagement with the stop shoulder 27. Circulation may thereafter be established down through the casing for outward passage through the body and collar ports 19, 16, and for upward movement through the annulus around the casing. If the cement slurry also follows this path of movement, with its return flow into the casing prevented by the back pressure valve 20 covering the body ports 18.

For the purpose of preventing return flow of cement slurry or other heavy fluids into the casing around its lower end or perforations positioned below the apparatus, it is preferred to incorporate a downwardly opening back pressure valve in the apparatus. In the present instance, this back pressure valve consists of a housing 29 formed as a portion of the tubular body 13 depending from the threaded flange 16 or shoulder 27. This housing contains a back pressure ball 30, preferably buoyant in mud or cement slurry, whose downward motion is limited by its engagement with spaced radial stop fingers 31 extending inwardly from the housing. These fingers may be welded to the housing or integrally formed therewith, as desired. The back pressure valve permits downward passage of fluids entirely through the body 13, but prevents return flow of fluids or upward flow of fluids through the apparatus by engaging its cooperating valve seat 32 formed in the housing portion of the body.

The inclusion of the back pressure device 30, 32 for closing the central passage of the apparatus not only prevents upward flow of fluids therethrough, but also acts as a means for enabling the casing string to be floated into the well. Any tendency for cement slurry deposited in the annulus around the casing adjacent and above the collar 10 to move downwardly around the casing string to its interior through casing perforations would be prevented by the back pressure ball 30, since only slight upward movement of fluids in the casing immediately insures the engagement of the ball with its seat 32 to close the casing against upward flow of fluids, and in so doing also prevent downward flow around the casing.

The parts within the collar are all preferably made of readily drainable material to allow their easy removal after the cement has set and hardened, and thereby leave an unobstructed bore through the casing.

It is, therefore, apparent that a cementing apparatus has been provided which enables the casing string to be floated into the well, allows circulation to be established below the apparatus for as long as desired, and then permits the placement of cement slurry laterally through the apparatus, while preventing its return flow either through the lateral ports or through the lower portion of the casing string. In this connection, disposition of the back pressure valve in the annular chamber affords it protection while lowering the casing string in the well bore.

We claim:
1. Apparatus of the character described, including a ported tubular member adapted to form part of a casing string, a tubular body having ports within said member and provided with portions contacting the inner wall of said member and a medial portion between said wall contacting portions of lesser external diameter than the diameter of the inner wall of said tubular member to form an annular chamber communicated with said tubular member ports, said medial portion having said body ports therein, valve means within said chamber for preventing return flow of fluids from said chamber through said body ports to the body interior, means having an initial position preventing passage of fluids through said body ports, said preventing means being slidable along an inner wall of said body and means for sliding said preventing means within said body and along its inner wall to a position opening said body ports.
2. Apparatus of the character described, including a ported tubular member adapted to form part of a casing string, a tubular body within said member and provided with end portions contacting the inner wall of said member and a ported medial portion of lesser external diameter than the diameter of the inner wall of said tubular member to form an annular chamber communicated with said tubular member ports, valve means within said chamber for preventing return flow of fluids from said chamber through said body ports to the body interior, means having an initial position preventing passage of fluids through said body ports, said preventing means being slidable along an inner wall of said body and means for sliding said preventing means within said body and along its inner wall to a position opening said body ports.
3. Apparatus of the character described including a ported tubular member adapted to form part of a casing string, a tubular body having ports within said member and provided with portions contacting the inner wall of said member and a medial portion between said wall contacting portions of lesser external diameter than the diameter of the inner wall of said tubular member to form an annular chamber communicated with said tubular member ports, valve means within said chamber for preventing return flow of fluids from said chamber through said body ports to the body interior, means having an initial position preventing passage of fluids through said body ports, said preventing means being slidable along an inner wall of said body and means for sliding said preventing means within said body and along its inner wall to a position opening said body ports.
tacting portions of lesser external diameter than the diameter of the inner wall of said tubular member to form an annular chamber communicating with said tubular member, said medial portion having said body ports therein, valve means within said chamber for preventing return flow of fluids from said chamber through said body ports to the body interior, a sleeve valve within and slidable along the inner wall of said body, frangible means securing said sleeve valve to said body in position to prevent passage of fluid through its ports, and means for closing the bore through said sleeve valve to enable hydraulic pressure to disrupt said frangible means and shifting of said sleeve valve along the inner wall of said body to a position permitting passage of fluid through said body ports.

5. Apparatus of the character described, including a tubular member adapted to form part of a casing string, a tubular body having ports within said member and provided with portions contacting the inner wall of said member and a medial portion between said wall contacting portions of lesser external diameter than the diameter of the inner wall of said tubular member to form an annular chamber communicating with said tubular member ports, said medial portion having said body ports therein, valve means within said chamber for preventing return flow of fluids from said chamber through said body ports to the body interior, a sleeve valve having an initial position preventing passage of fluids through said body ports, and a back-pressure valve for preventing upward passage of fluids through said body comprising a valve seat on said body and a valve member movable upwardly to engage said seat.

6. Apparatus of the character described, including a tubular member adapted to form part of a casing string, a tubular body having ports within said member and provided with portions contacting the inner wall of said member and a medial portion between said wall contacting portions of lesser external diameter than the diameter of the inner wall of said tubular member to form an annular chamber communicating with said tubular member ports, said medial portion having said body ports therein, valve means within said chamber for preventing return flow of fluids from said chamber through said body ports to the body interior, a sleeve valve in position to prevent passage of fluid through its ports, and means for closing the bore through said sleeve valve to enable hydraulic pressure to disrupt said frangible means and shifting of said sleeve valve to said body in position to prevent passage of fluids through its ports, and means adapted to gravitate through the casing string into engagement with said sleeve valve to close the bore through said sleeve valve in order to enable hydraulic pressure to disrupt said frangible means and shifting of said sleeve valve along the inner wall of said body to a position permitting passage of fluid through said body ports, said gravity means having a maximum diameter substantially less than the inside diameter of said casing string.

7. Apparatus of the character described, including a tubular member having ports and adapted to form part of a casing string, a tubular body having ports within said member and provided with portions contacting the inner wall of said member and a medial portion between said wall contacting portions of lesser external diameter than the diameter of the inner wall of said tubular member to form an annular chamber therewith, said medial portion having said body ports therein, valve means within said chamber for preventing return flow of fluids from said chamber through said body ports to the interior of said body, the interior of said body, body ports, chamber and tubular member ports being communicable with each other to form a passage for the flow of fluid from the interior of said body to the exterior of said tubular member, said chamber therewith, said medial portion having said body ports therein, back pressure valve means within said chamber for preventing return flow of fluid from said chamber through said body ports to the interior of said body, the interior of said body, body ports, chamber and tubular member ports being communicable with each other to form a passage for the flow of fluid from the interior of said body to the exterior of said tubular member.

8. Apparatus of the character described, including a tubular member adapted to form part of a casing string, a tubular body having ports within said member and provided with portions contacting the inner wall of said member and a medial portion between said wall contacting portions of lesser external diameter than the diameter of the inner wall of said tubular member to form an annular chamber therewith, said medial portion having said body ports therein, back pressure valve means within said chamber for preventing return flow of fluid from said chamber through said body ports to the interior of said body, the interior of said body, body ports, chamber and tubular member ports being communicable with each other to form a passage for the flow of fluid from the interior of said body to the exterior of said tubular member, means having an initial position closing such passage to prevent such flow of fluid therethrough, and means operable hydraulically by the application of pressure to the fluid to completely fill said casing thereabove for shifting said preventing means to open said passage and permit flow of fluid from the interior of said body to the exterior of said tubular member.

9. Apparatus of the character described, including a tubular member having ports and adapted to form part of a casing string, a tubular body having ports within said member and provided with portions contacting the inner wall of said member and a medial portion between said wall contacting portions of lesser external diameter than the diameter of the inner wall of said tubular member to form an annular chamber therewith, said medial portion having said body ports therein, valve means within said chamber for preventing return flow of fluids from said chamber through said body ports to the interior of said body, the interior of said body, body ports, chamber and tubular member ports being communicable with each other to form a passage for the flow of fluid from the interior of said body to the exterior of said tubular member.

10. Apparatus of the character described, including an open ended tubular member having ports and adapted to form part of a casing string, a tubular body having ports within said member and provided with portions contacting the inner wall of said member and a medial portion between said wall contacting portions of lesser external diameter than the diameter of the inner wall of said tubular member to form an annular chamber therewith, said medial portion having said body ports therein, back pressure valve means within said chamber for preventing return flow of fluid from said chamber through said body ports to the interior of said body, the interior of said body, body ports, chamber and tubular member ports being communicable with each other to form a passage for the flow of fluid from the interior of said body to the exterior of said tubular member, said chamber therewith, said medial portion having said body ports therein, back pressure valve means within said chamber for preventing return flow of fluid from said chamber through said body ports to the interior of said body, the interior of said body, body ports, chamber and tubular member ports being communicable with each other to form a passage for the flow of fluid from the interior of said body to the exterior of said tubular member.
including a tubular member having ports and adapted to form part of a casing string, a tubular body having ports, said body being engageable with and positioned within said member and provided with portions contacting the inner wall of said member and a medial portion between said wall contacting portions of lesser external diameter than the diameter of the inner wall of said tubular member to form an annular chamber therewith, said medial portion having said body ports therein, back pressure valve means within said chamber for preventing return flow of fluid from said chamber through said body ports to the interior of said body, the interior of said body, body ports, chamber and tubular member ports being communicable with each other to form a passage for the flow of fluid from the interior of said body to the exterior of said tubular member, means having an initial position closing such passage to prevent such flow of fluid therethrough, and means adapted to gravitate down through the casing string to close the axial passage through said body and enable the pressure of the fluid completely filling the casing thereabove to shift said preventing means to a position opening said passage and permitting flow of fluid from the interior of said body to the exterior of said tubular member.

12. The apparatus defined in claim 9, wherein said hydraulically operable means comprises a member adapted to be sent down said casing string to close the passage through said tubular body.

13. The apparatus defined in claim 9, including a back pressure valve for preventing upward passage of fluid through said body, comprising a valve seat on said body and a valve member movable upwardly to engage said seat.

14. Apparatus as defined in claim 11, wherein said gravitational means has a maximum external diameter substantially less than the inside diameter of the casing string.

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The following references are of record in the file of this patent:

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