Oct. 7, 1941. D. SCARAMUCCI 2,257,765

CEMENTING DEVICE FOR WELL CASINGS

Filed Sept. 30, 1939

Fig. 1.

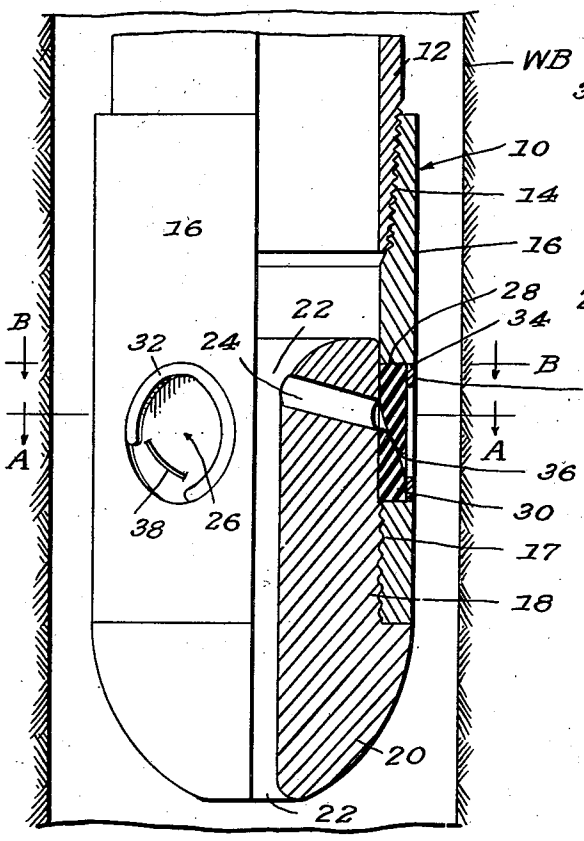


Fig. 4.

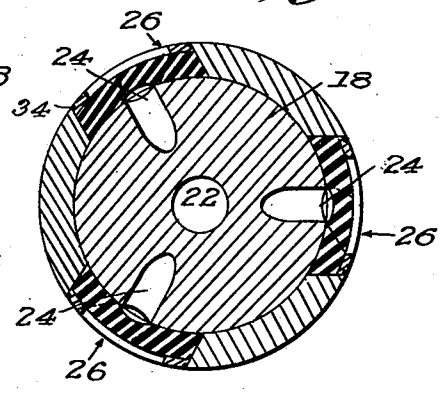


Fig. 3.

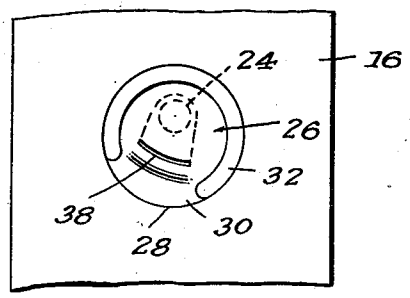


Fig. 5.

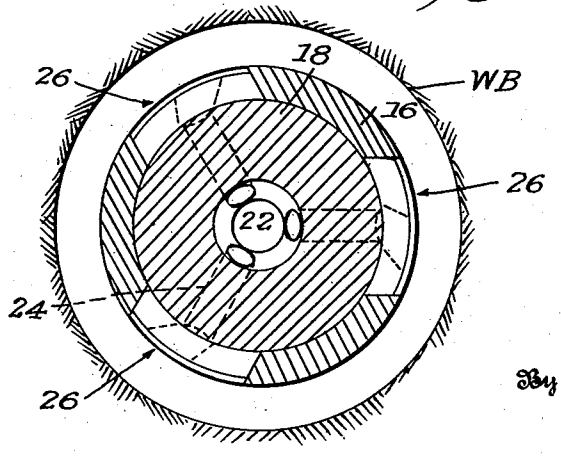
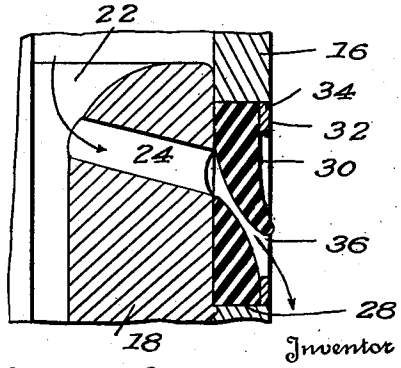


Fig. 2.



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CEMENTING DEVICE FOR WELL CASINGS

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12 Claims. (Cl. 166—9)

The present invention pertains to cementing devices for well casings, and, in particular, to cementing guide shoes.

In the main, the object of this invention is to provide an improved form of cementing shoe for oil well casings which is adapted to perform efficiently the combined functions of conditioning a well bore by washing out obstructions and of distributing and placing cement at a subsequent stage of the casing operation.

It is well recognized that the operation of lowering a string of casing into the deep wells of today requires the utmost precaution in effecting successful completion. An important precaution to be taken is the removal of obstructions in advance of the casing as it is lowered. The practice of employing a single centrally positioned fluid passageway in a guide or float shoe does not effect a positive washing and well conditioning which is wholly satisfactory.

Where, as in the deeper wells, caving and bridging of the bore hole constitute a serious problem, the trend has been towards the use of side delivery devices or attachments. With this type of equipment, the casing string may be set on bottom during the cementing operation. Improved distribution of cement around the casing with a minimizing of the possibility of channeling is obtained.

A principal object of the invention is the provision of bore hole conditioning equipment in the form of side-delivery guide or float shoes which discharge at spaced peripheral locations.

A characteristic of the invention is the provision of means for substantially varying the angle of fluid discharge between the casing attachment and bore hole wall to meet the different requirements which are encountered in casing practice. Specifically, a side-delivery casing shoe that may be adapted readily to downward, side or upward fluid distribution is contemplated.

A further and specific object of the invention is attained by the use of individual side ports which are valved so as to prevent obstruction caused by entrance of formation or bore hole matter.

Other features of improvement are to be recognized in the various details of construction which facilitate assembly of the cementing device to meet specific conditions.

Further novel features contributing to the improvement of manufacture and use of devices of this nature will be perceived and readily understood from reading the following detailed description of a preferred embodiment of the invention in connection with the accompanying drawing, in which

Fig. 1 is a side elevation, partly in longitudinal section of the device in operative position in a well bore;

Fig. 2 is a fragmentary, enlarged section showing in detail a side port and one position of the valve means therefor;

Fig. 3 is a partial side elevation of the device with the ports in the positions of Fig. 2;

Fig. 4 is a cross-sectional view of the device taken through port and valve means, on the plane of line AA of Fig. 1; and

Fig. 5 is a similar cross-sectional view taken on line B—B of Fig. 1.

In the drawing, 10 designates the attachment generally and 12 is the end of a well casing section to which the attachment 10 is adapted to be joined by means of a threaded connection 14. A tubular member 16 in the form of a steel guide shoe has a threaded connection at its lower end with a frangible and drillable plug 18, preferably of cementitious material, Bakelite or aluminum. As shown best in Fig. 1, the plug 18 fits within the shoe 16 except for a downwardly projecting and pointed end portion 20 which guides the section through a well bore WB in a conventional manner. The guide end 20 is of such a diameter adjacent the lower edge of the shoe 16 as to form a smooth continuation of the outer surface thereof.

Note is next taken of a relatively large longitudinal passageway 22 which extends through the drillable plug 18 and serves as a conduit for well fluid and cement respectively. Near its inner end, the passageway 22 connects with a plurality of lateral passages 24 arranged as side ports in the plug 18. In the present embodiment, three such radial passages 24, are provided at equal peripheral spacings, but any convenient number which is found desirable may be used. At their outer ends, the laterally extending passages 24 are each provided with nozzle, valve or orifice means designated generally as 26 and fitted into complemental circular openings 28 passing transversely through the tubular member or shoe 16.

Each of the nozzle means 26 comprises a slotted rubber member or disc 30 which is molded to the symmetrical outline of the shoe opening 28 and the curvature of the adjacent portion of the plug 18, as seen best in Figs. 3 and 4. A retainer member in the form of a segmental ring 32 has a welded connection 34 with the adjacent opening portion of the shoe 16. Like the rub-

ber member 30, the ring 32, which may be of steel, conforms to the cross-sectional curvature of the adjacent portion of the shoe 16. Each rubber disc 30 is provided with a transverse slit or channel 36 having the particular direction and configuration illustrated best in Figs. 1 and 3. It is preferred that the slit 36 extend diagonally of the rubber member 30 and that it have a widened exterior mouth 38. The portions of the rubber disc adjacent the extremities of the slit 36 may be faired away or rounded, as shown in Figs. 1 and 2, to insure smooth flow conditions through the normally closed valve means.

Of outstanding importance is the fact that the valve means provided by the side discharging orifice members 26 can be conveniently disposed to provide a wash-down action at any desired angle with the vertical axis of the attachment 10, or the member 26 may be rotated through an angle approximately 180 degrees to afford upward delivery side ports. The nature of this improved form of port construction will be further understood by considering its method of assembly. First, the openings 28 will be drilled in the tubular member 16, in the manner illustrated, and the plug 18 provided with the longitudinal passageway 22 will be threaded therein, as has been described. The lateral passages 24 are then drilled through the plug 18 to provide communication with the central passageway 22, and disposed so that they will align approximately with the inner end of the slit 36 of one resilient disc member 30, which is inserted with the axis of the slit at the desired angle and the exterior mouth 38 pointed in the selected direction. Finally, the segmental metal ring members are welded into place so as to retain each of the rubber discs 30 and not to interfere with the exterior mouths 38 thereof (see Figs. 1 and 3).

Certain other details of the attachment construction will be brought out in the following description of its operation. As previously noted, the valve means provided by the nozzle or jet members 26 are normally self-closed by the resilient action of the rubber-like material from which they are made; and, when so closed, effectively prevent entrance of foreign matter from the well bore WB. With the wash-down arrangement of the present embodiment, bridges and other obstructions will be removed during the descent of the casing 12 by the jetting action of fluid under pressure issuing downwardly through the longitudinal passageway 22 and laterally in swirls from the side ports 26. The longitudinal passageway 22 and lateral passages 24 are proportioned and arranged to give the required vigor to this action which is also beneficial in conditioning the well bore by washing down the formation. It will be obvious that the swirling motion of the side delivered fluid is due to the angular arrangement of the jets or slits 26 with respect to the vertical axis of the device.

In similar manner, the device of this invention is capable of producing better cementing with a minimum of channeling. The cementing operation can be performed before or after the casing is landed. In the former event, a cement slurry will be discharged through the longitudinal passageway as well as the side ports; and in the latter, the gyratory discharge from the sides of the device will be adequate for the purpose. If the latter mode of operation is contemplated in advance, it may be desirable to insert the diagonal slits so that they will discharge upwardly rather than downwardly. From what has been said, it will be apparent that the device of the present invention will efficiently serve to guide the casing, remove obstructions or condition the formation, and as a means for discharging cement.

While valve means may be included with the shoe 16 in order that the casing may be floated, it is preferable in deep well practice to employ only a guide shoe on bottom and to install one or more valved float collars in the proximate casing joints.

Although described in connection with a guide shoe, it will be apparent that the principles of this invention are readily applicable to float and guide shoes, in the manner stated above, and to a side delivery collar. This universal aspect has been emphasized by the use of generic terms and the scope of the appended claims. Moreover, variations can obviously be made in the details of construction which will come within the spirit and scope of the following claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, a tubular member adapted to be connected to the end of a well casing section, said tubular member having a side opening; and a resilient valve member retained in alignment with the side opening, said valve member having a normally closed slit therethrough arranged to open in response to fluid pressure on its inner side.

2. A cementing device which includes, in combination, a metallic tubular member adapted to be connected to a well casing, said tubular member being provided with a plurality of spaced openings; rubber discs complemental in outline to the respective openings supported therein, said discs each having a normally closed diagonally extending opening therethrough; and a metallic ring welded to the tubular member within each opening and arranged to secure the respective discs against outward displacement.

3. A well casing attachment comprising a metallic tubular member having an opening in its side and a rubber-like valve member arranged to close the opening, said valve member having a normally self-closed channel extending therethrough, the opening of which is regulated by fluid pressure on the valve member.

4. A well casing attachment comprising a tubular member having a lateral opening connecting its inside and outside, and a resilient valve member constructed and arranged to close the opening, said valve member having a normally self-closed channel extending therethrough, the opening of which is regulated by fluid pressure thereon.

5. A cementing device for well casing comprising a tubular member adapted for connection with the end of a casing, said tubular member having a plurality of peripherally spaced openings in its sides; a drillable plug secured within the tubular member, said plug having a longitudinal passageway therethrough with outwardly opening passages extending laterally therefrom in alignment with the respective tubular member openings; and a rubber disc member having an inclined slit therethrough secured to the tubular member at the outer end of each lateral passage.

6. A cementing device for well casing comprising a tubular member adapted for connection to an end of the casing, said tubular member having a plurality of peripherally spaced openings extending therethrough; and a rubber member secured in each opening so as to close the same,

said rubber members having each a normally closed transverse slit extending therethrough.

7. A cementing device for well casing comprising a tubular member adapted for connection with the end of a casing, said tubular member having a plurality of peripherally spaced openings in its sides; a drillable plug with a guide end secured at its other end within the tubular member, said plug having a longitudinal passageway therethrough with outwardly opening passages extending laterally therefrom in alignment with the respective tubular member openings; and a rubber valve member having an inclined slit therethrough secured to the tubular member at the outer end of each lateral passage.

8. A cementing device for well casing comprising a tubular member adapted for connection to an end of the casing, said tubular member having a plurality of peripherally spaced openings extending therethrough; a rubber member mounted in each opening so as to close the same, said rubber members having each a normally closed transverse slit extending therethrough; and a retaining ring secured to the tubular member at the periphery of each opening.

9. A cementing device for well casing comprising a tubular member with a plurality of side openings and adapted for connection with the end of a casing; a drillable plug secured within the tubular member, said plug having a longitudinal passageway therethrough with outwardly opening passages extending radially therefrom; and a rubber member having an inclined slit therethrough secured within each side opening of the tubular member at the outer end of the radial passages.

10. A cementing attachment for well casing comprising a tubular member adapted for connection to an end of the casing, said tubular member having a plurality of peripherally spaced openings extending therethrough; and a deformable rubber valve member secured in each opening so as to close the same, said rubber valve members having each a normally closed transverse slit extending therethrough, and the openings and valve members being of corresponding symmetrical outline to permit the slit to be disposed at any desired angle with respect to the tubular member.

11. A cementing attachment for well casing comprising a tubular member adapted for connection to an end of the casing, said tubular member having a plurality of peripherally spaced openings extending therethrough; and a rubber valve member secured in each opening so as to close the same, said rubber valve members having each a normally closed channel extending therethrough arranged to be opened by fluid pressure inside the tubular member.

12. A wash-down, cementing and guiding device comprising a tubular casing shoe with spaced side openings; drillable plug means secured within the lower end of said shoe and provided with a pointed guide end below the shoe, said plug means having a main longitudinal passageway therethrough and lateral passages extending therefrom to the respective side openings in the casing shoe; a rubber member across each casing shoe side opening, said rubber members each having a diagonal slit extending downwardly therethrough at an angle with the longitudinal axis of the device, and each slit being widened at its outer or discharge end; and a ring secured to the casing shoe about each side opening for retaining the rubber members.

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