

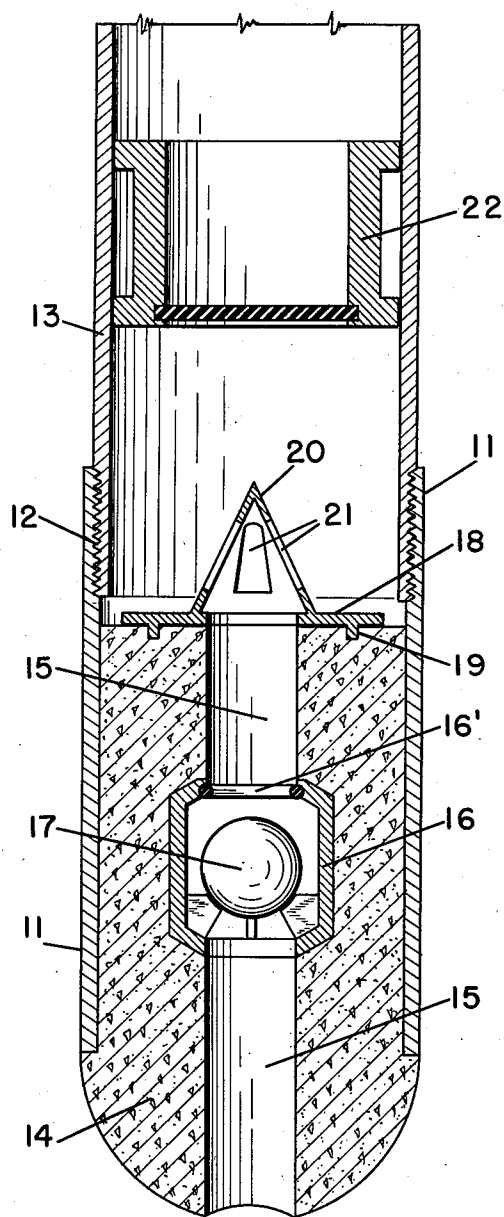
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APPARATUS FOR CEMENTING WELLS

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APPARATUS FOR CEMENTING WELLS

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The present invention is directed to improved apparatus for introducing cementitious material in a well bore. More particularly, the invention is directed to an improved float collar or cement shoe.

It has been common to employ two-plug cementing apparatus in introducing cement into a well. It is also conventional to employ float collars or cement shoes on the end of a string of pipe when introducing cementitious material into a well bore. In such operations employing two plugs in cementing wells the plug placed ahead of the cement is usually provided with a flapper type valve which is opened by pump pressure when it contacts the float collar. Thus, in the conventional operations it is necessary to cause actuation of the flapper valve by controlling the pump pressure when the bottom plug, which is placed ahead of the cement, reaches the float collar on the end of the string of tubing. The conventional technique employing a dual plug with a conventional float collar is disadvantageous since the apparatus ordinarily employed may result in inefficient cementing practices. For example, the conventional apparatus provided with a flapper valve when operated to allow the cement to be introduced into the well bore does not provide the top plug with a seat. Thus, when the top plug reaches the bottom plug which has been opened by pump pressure and when the mud column follows the top plug, the top plug may become distorted or deformed and thus fail to provide a seal and allow the mud to become admixed with the cement. In short, the conventional apparatus does not assure complete shut-off of circulation at all times.

It is, therefore, the main object of the present invention to provide an improved apparatus for introducing cementitious material in a well bore.

Another object of the present invention is to provide an improved float collar adapted to be attached to a string of pipe.

A still further object of the present invention is to provide an improved float collar which allows the dispensing with the flapper type valve in the bottom plug employed in dual plug cementing operation.

Still another object of the present invention is to provide apparatus for releasing cement from a column of cement to be introduced in a well bore.

Other objects of the present invention will become apparent from the description of the drawing in which the sole figure is a sectional elevation of a preferred embodiment of the apparatus of the present invention.

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Referring now to the drawing, numeral 11 designates a float collar or float shoe which is attached by threaded connections 12 to a conduit 13. Float collar 11 includes a concrete plug 14 defining a central passageway 15. Arranged in central passageway 15 is a plastic cage 16 defining with its upper end rubber seat 16'. Seat 16' is adapted to form a close fit with plastic ball valve 17 when fluid pressure exerted upwardly therein forces it against the seat 16'. Rigidly affixed to concrete plug 14 is a plate member 18 which is held firmly to concrete plug 14 by means of footings 19. Plate member 18 defines a rupture cone 20 which is provided with perforations 21. Rupture cone 20 may be constructed of a metal such as cast iron which may be readily disintegrated with a drill bit. Arranged in conduit 13 is a rubber bottom cement plug 22, above which is the column of cement which is introduced into the well and which is followed by a second top plug not shown. The top plug is conventional and does not form a part of my invention.

The cement plug 22 may be constructed so that its outer periphery will form a tight seal against the conduit 13. It should also be constructed of an easily rupturable material, such as rubber, which will allow the rupture cone 20 to perforate; besides rubber, the bottom of the cement plug 22 may be constructed of an easily rupturable metal such as sheet magnesium, sheet aluminum, sheet zinc, lead and the like.

It is understood, of course, that the conduit 13 and the float collar 11 will form the bottom section of a string of pipe which is lowered into the well bore.

Assuming that the conduit 13 and the float collar 11 have been suitably attached to a string of pipe and lowered into the well bore at a point slightly above the bottom thereof, the bottom plug 22 is introduced into the tubing and immediately followed by a column of cement. After the cement has been all introduced into the tubing, a top plug is placed thereon which may be similar to the conventional top plug employed in cementing practices. Drilling fluid is then introduced as a column on top of the top plug and the cement forced down into the tubing. As the bottom plug 22 comes into contact with rupture cone 20, the weight of the column of cement and the drilling fluid above it causes the bottom plug to come in contact with the pointed member of rupture cone 20 which perforates the bottom of the plug 22 and releases the column of cement for introduction into the well bore. The cement flows from the column through perforations 21

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and central passageway 15 into the well bore and upwardly therein to allow the tubing to be cemented in place as desired. As the top plug reaches the bottom plug 22 it will become readily apparent that the bottom plug will form a seat therefore and allow the top plug to shut off circulation.

While the present invention has been described and illustrated with the pointed member in the form of a cone, it will be apparent to the skilled workman that the pointed member which pierces the rupturable bottom of the cement plug 22 may be constructed in other shapes as desired. For example, it may simply be a short plunger, such as a tubular member, provided with an up thrusting point which will pierce the bottom of the cement plug 22 and provide a passageway for the cement to flow into central passageway 15. Numerous modifications of the up thrusting member 20 will be apparent to the skilled workman. Similarly, float collar 11 may be suitably modified in accordance with the present invention. There are many cement float collars on the market and it is within the purview of my invention that any float collar may be modified by providing an up thrusting pointed member such as a rupture cone rigidly attached to the concrete plug to allow perforation of the bottom plug in dual plug cementing operations.

It is also considered within the purview of my invention to attach the float collar to the conduit by other means. Thus, the float collar may be attached to the conduit by welding, for example.

While the float collar of the present invention has been shown as embodying a concrete plug, it is also considered within the scope of the invention to construct the plug of other drillable materials such as plastic or resins. In this connection it is also considered that the device of the present invention may be employed in intro-

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ducing other cementitious material besides cement into a well bore. For example, resin and plastic may be introduced into a well bore.

The nature and objects of the present invention having been fully described and illustrated, what I wish to claim as new and useful and to secure by Letters Patent is:

1. Apparatus for introducing cementitious material in a well bore comprising, in combination, a conduit adapted to be attached to a string of pipe, a collar rigidly attached to a free end of said conduit, a fixed plug in said collar defining a central passageway and a valve seat, a valve member arranged in said central passageway and engageable with said seat adapted to close said central passageway, a fixed upwardly extending member defining a sharp point and at least one passageway fluidly communicating said conduit with said central passageway and rigidly attached to said fixed plug at the upper end thereof, and a slidable plug in said conduit defining a rupturable bottom member adapted to be perforated on moving into contact with said pointed member.

2. Apparatus in accordance with claim 1 in which the pointed member is a cone.

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