June 1, 1943. D. SCARAMUCCI 2,320,670

WELL CASING ATTACHMENT

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Fig. 1.

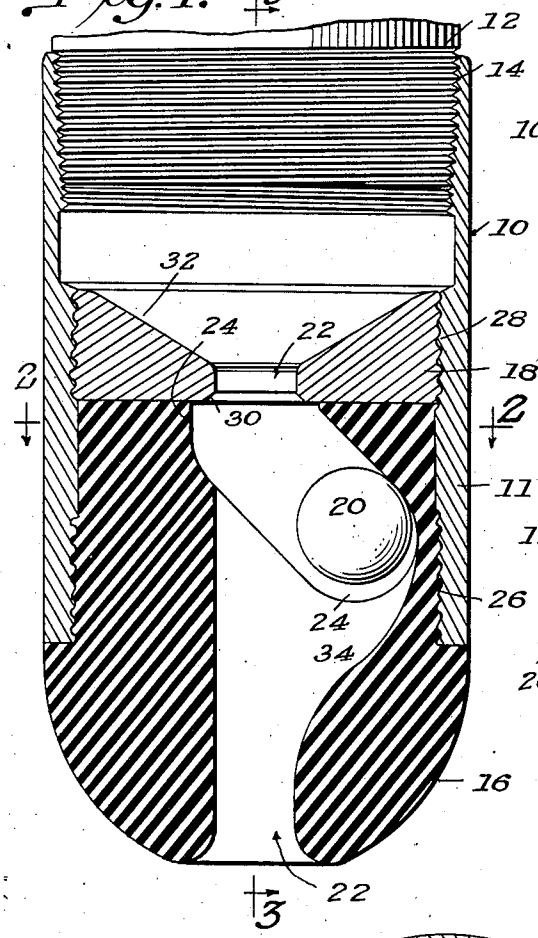


Fig. 3.

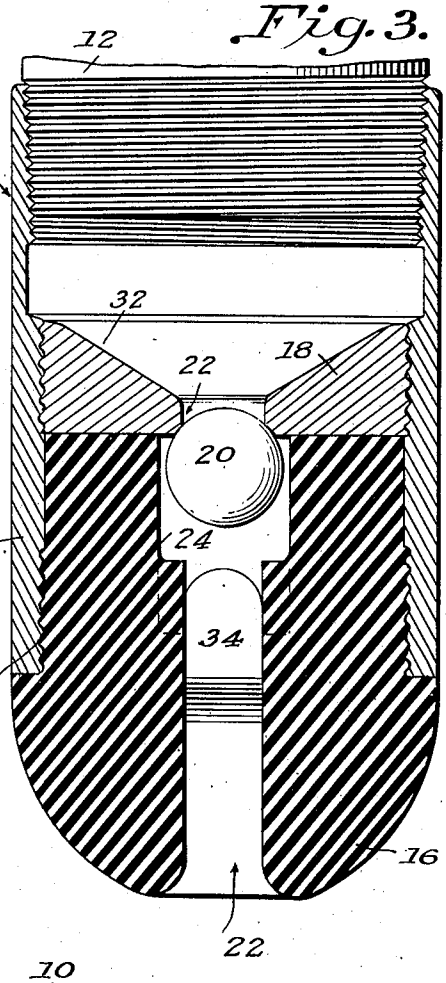
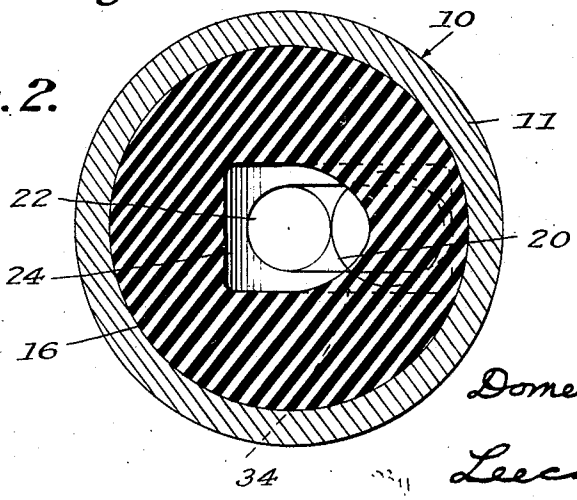


Fig. 2.



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Fig.4.

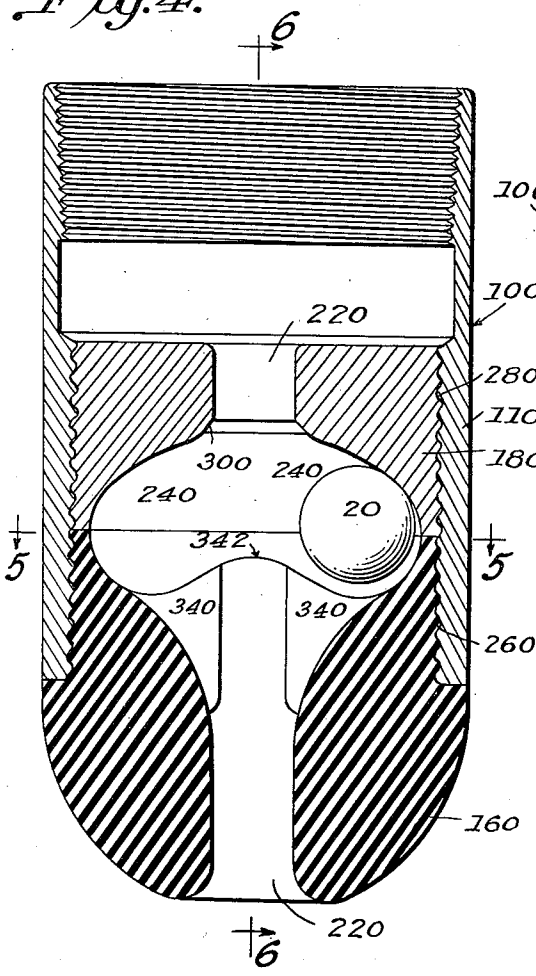
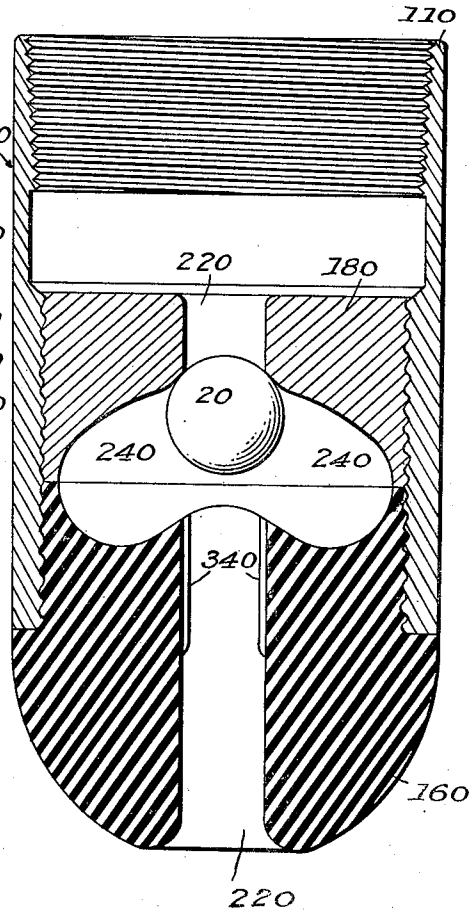


Fig.6.



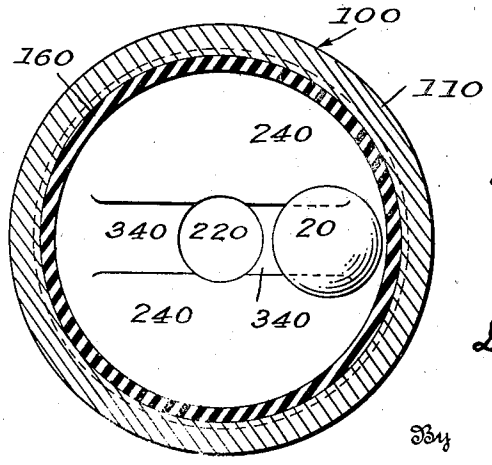


Fig.5.

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Fig. 7.

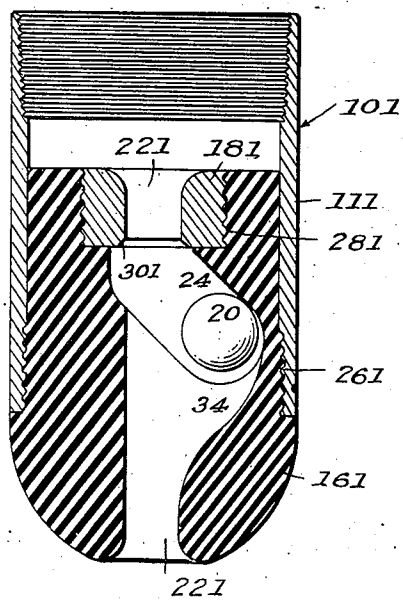


Fig. 9.

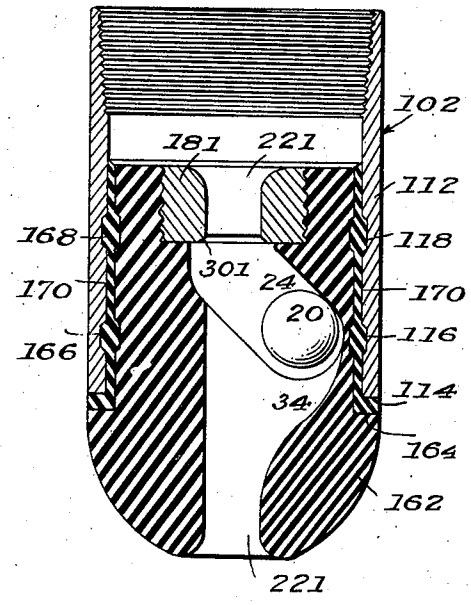


Fig. 8.

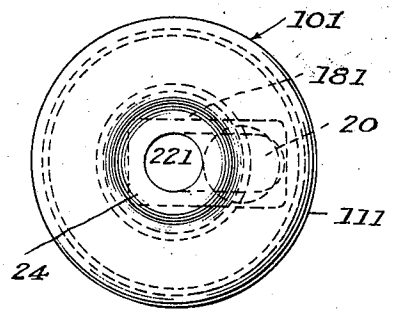
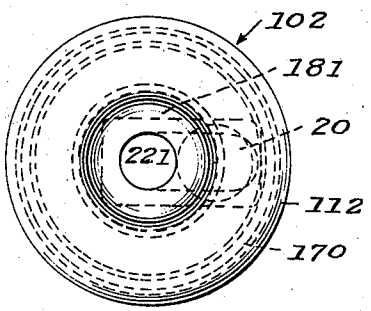


Fig. 10.



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Patented June 1, 1943

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UNITED STATES PATENT OFFICE

2,320,670

WELL CASING ATTACHMENT

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Application July 12, 1939, Serial No. 284,084

9 Claims. (Cl. 166—1)

The present invention relates to a well casing attachment, and more particularly, to the type adapted for use in a rotary drilling operation.

Hitherto, attachments of this nature have permitted the extrusion of cement from the bottom and the sealing of the foot of the well casing string against reverse flow, but they have failed uniformly to provide means for temporarily withdrawing whatever form of valve means was used for the sealing to a position which would give through access in a straight line and permit tools within the casing to be lowered below the casing into the well bore proper.

Broadly stated, the purpose of this invention is to provide a casing attachment in the form of a bored shoe or collar provided with valve means capable of lateral movement, so as to clear the bore for the flow of cement or the insertion of any instrumentality therethrough from the inside of the casing.

Although the prior devices for this purpose have provided ample passageway through the shoe, the valve structure itself has remained on the axis of the passageway and tended to obstruct fluid flow, particularly when the slurry stiffened during a cementing operation. The attendant increase in friction at the valve increases the hydraulic pressure and requires more power to pump the slurry. It is not uncommon for gravel, sticks, and other foreign matter to knock the valve downward and to obstruct the passageway during the circulating operation. In these instances, the reverse function of the valve in response to back pressure is also impaired.

There are constructions known to the art in which the lower portion of the passageway or outlet is of larger diameter than the overlying valve, so that the valve member can escape out into the well bore. Naturally, removal of the valve member permits unobstructed downflow, but it also makes it impossible to effect a back or upflow seal.

With the present types of casing-floating equipment, it is impossible to communicate with the well bore below the casing shoe. That is to say, no means has existed whereby the operator could pass an instrument or tool through the float shoe to perform some special function. Therefore, an object of this invention is to provide a casing attachment which will not only guide, float, and act as a back pressure valve after cement slurry has been forced out into the well bore, but is also operable to permit certain improvements in the general practice of landing casing in a well.

A specific object resides in the provision of a tubular casing attachment with a ball valve which is laterally and vertically movable of a passageway in response to up or down fluid pressure, and which can be retained in a position clear of the passageway.

Additional objects will appear from the following detailed description of a preferred embodiment and several modifications.

Reference is made to the drawings, in which

Fig. 1 is a longitudinal section of the attachment applied to the end of a well casing;

Fig. 2 is a transverse section on the line 2—2 of Fig. 1;

Fig. 3 is a vertical section taken along the line 3—3 of Fig. 1;

Fig. 4 shows in vertical section a modified form of the attachment;

Fig. 5 represents a transverse section on the line 5—5 of Fig. 4;

Fig. 6 is a vertical section taken along the line 6—6 of Fig. 4;

Fig. 7 illustrates in vertical section and to a more reduced scale another modification of the attachment;

Fig. 8 is a bottom plan view of the Fig. 7 attachment;

Fig. 9 shows in vertical section a further modification of details of the attachment; and

Fig. 10 is a bottom plan view of the Fig. 9 modification.

In the drawings 10 indicates a casing attachment in the form of a float or guide shoe which is adapted to be joined to a casing 12 (Fig. 1) by means of a threaded connection 14. The attachment comprises a tubular member 11, which may be of steel, frangible plug means comprising a Bakelite plug 16 and an aluminum valve seat body 18, and a ball valve 20 of Bakelite or other suitable material which will float into position.

It will be observed in Figs. 1 and 3 that the plug means formed by plug 16 and the valve seat body 18 has a continuous, longitudinal passageway 22 therethrough. An enlarged portion or recess 24 intermediate the passageway 22 receives and guides the valve ball 20, which ball has a diameter greater than the adjacent portions of said passageway.

Preferably, the enlarged portion 24 is formed wholly in the upper end of plug 16, and inclines downwardly therefrom to one side of the passageway, as illustrated in Fig. 1; its size and disposition are such that it can retain the ball 20 in a position lateral of the passageway axis and thereby leave a clear longitudinal channel or conduit. The plug 16 is tapered at its lower end for guiding

purposes and is inserted into the tubular member or shoe 11 from below, a threaded connection 26 securing it to the lower end of said tubular member.

After the valve ball 20 has been inserted in its recess 24, the valve seat body 18 is placed in the shoe 11 from above, and threadedly connected thereto at 28. The adjacent faces of plug 16 and valve seat body 18 are brought into engagement in this manner, so that the portion of the passageway 22 in the valve seat body 18 restricts the upper end of recess 24 and retains the ball valve 20 therein. A circular seat 30 in the lower face of body 18 complementally receives the ball 20 to check fluid flow through the attachment 10 from below or outside of the casing 12.

Attention is directed also to the widely flared mouth 32 on the upper face of body 18. The mouth 32 serves to reduce friction when the cement slurry is flowing through the passageway 22, and to center whatever tool it is desired to extend through said passageway from within the casing 12.

To insure the ball 20 of the valve means floating into the closing position upon cessation of downward flow, means for causing it again to close the passageway to upward flow are provided. In Fig. 1 this means comprises a conduit or groove 34 formed in the plug means 16 and leading from the longitudinal passageway 22 to the lower portion of the recess 24 in such a manner that unbalanced fluid pressure below or external the plug means will urge the check ball 20 into engagement with seat 30. The conduit 34 may be of the same width as the passageway 22 above and below recess 24.

When the attachment 10 has served its final purpose as a guide, float, or back pressure valve after cementing, the plug means, 16, 18, may readily be removed by drilling. The aluminum valve seat body 18 fractures readily into small segments and is made of that or similar material because a more accurate valve seat 30 can be provided therein.

Figs. 4, 5, and 6 show a modified form of the invention which affords several special advantages now to be disclosed. For the most part this attachment 100 is similar to the form which has been described previously in detail, in that it comprises a steel casing shoe or tubular member 110, a frangible plug 160 of Bakelite or the like, an abutting valve seat body 180 of readily shatterable metal, and a floating ball valve 20 disposed for cooperation with a passageway 220 in the plug means 160, 180. For the purpose of preventing any tendency of the ball valve 20 to balance itself in an unseated position which will obstruct passageway 220 a different enlarged portion or recess 240 is provided.

Before specifying the characteristics of the recess 240, attention is directed to the division of this recess between plug 160 and the valve seat body 180 (Figs. 4, 6), and to threaded connection 260 between the former and the shoe 110, and threaded connection 280 for the latter and said shoe 110. These connections are arranged so that the valve means (20, 220, 240) can be assembled by screwing valve seat body 180 and plug 160 into the shoe 111 from below or, more simply, inserting body 180 from above.

The enlarged portion or recess 240 is annular and concentric with the other portions of passageway 220, and of such an extent as to receive the ball 20 in a lateral position clear of said passageway. For retaining purposes, the recess 240 is inclined downwardly with respect to the operative position of the attachment 100.

A pair of opposed grooves or conduits 340, 340, somewhat narrower than the portion of passageway 220 in plug 160, lead from said passageway to the enlarged portion or annular chamber 240. These conduits 340, 340 are arranged to expose the ball 20 to an upward hydraulic pressure tending to force it against the circular seat 300 in body 180. It will be appreciated that the convexity of the bottom of the recess 240, indicated generally as 342 in Fig. 4, makes it impossible for the ball 20 to remain balanced in an obstructing position. The flared construction of the opposite ends of annular recess 240 will permit fluid bypassing at the instant the ball valve 20 rides at the top of the grooves 340, 340.

Otherwise the operation of this modification is similar to that which has been described.

Figs. 7 and 8 illustrate a further modification in which an attachment 101 comprises a tubular shoe 111, a plug 161, and a valve seat body 181. In this instance the valve seat body 181 is of lesser diameter than the plug 161, into the top of which it is threaded in the assembly of the valve means constituted by the valve ball 20, the recess 24, the auxiliary conduit 34, and a slightly different passageway 221. Ball 20 engages a circular seat 301, similar to that which has been described, when it is in a closed position. With this assembly, the valve means can be readily incorporated in the plug 161 before the latter is threaded at 261 onto the casing shoe 111.

The additional embodiment of Figs. 9 and 10 agrees in a majority of details with the casing attachment shown in Figs. 7 and 8. Corresponding items have been given the same reference numerals. In one very important essential it is different, namely, the manner in which plug means 162 is united with casing shoe 112. The outside diameters of this shoe or tubular member 112 and the portion of plug 162 extending below it are approximately the same, but the portion of said plug 162 within tubular member 112 is made substantially smaller than the inside diameter of said tubular member 112 for the following purpose.

The upper end of plug 162 is placed within the shoe 112 so that its circumferential shoulder 164 opposes bottom edge or end 114 of the tubular shoe 112 in spaced relation. While the shoe 112 and plug 162 are maintained in the separated condition just indicated, a lining 170 of rubber in plastic condition is forced between and into recesses or annular grooves 116 and 118 formed inside the shoe 112 and opposed grooves 166 and 168, respectively, in the outer surface of the plug 162. In this manner, the resilient lining 170 is arranged to insulate the frangible plug means from direct contact with the shoe. When the lining 170 has been vulcanized or caused to set in any other suitable way, it will securely unite the members in question and provide a cushion between plug shoulder 164 and the lower end 114 of shoe 112, and also between the inside of said shoe 112 and the adjacent surface of plug 162. Obviously, other plastics having the desired characteristics may be utilized in place of rubber.

Those familiar with the art to which this invention pertains will realize that a resilient, rubber lining of the thickness shown will act as a shock absorber, and thus cushion the plug against breakage when it encounters obstruction in the well during the casing landing operation.

By vulcanizing or cementing the rubber lining to the shoe 112 and plug 162, a positive fluid seal is obtained which is effective under high pressure. A seal of this efficiency is not attainable with a threaded plug or a cast cement plug. In the case of the latter, there is invariably considerable shrinkage in setting. Where the optimum seal is desierd, a hard rubber compound should be employed.

Except where otherwise specified, the various elements of the modified forms of the invention have the same physical and functional attributes which have been ascribed to them in the more elaborate description of the embodiment of Fig. 1.

This invention which has been described is broadly novel in its conception of a valve means which is temporarily displaceable laterally of a continuous linear passageway extending through a casing attachment of the type specified. Before the present invention, no means existed for so displacing a valve member or for retaining it temporarily to one side of the passageway.

By using suitable apparatus in conjunction with this attachment, it is possible to work through the attachment. As examples: reverse flow may be established without removing the valve means, a jetting action may be obtained for cleaning obstructions during casing landing, placing cement slurry in the well bore far below the casing shoe and logging electrically below the shoe so that the casing string may be positioned at the proper depth.

While the preferred form and several modifications of this invention have been fully disclosed, it is to be understood that various changes may be made and sub-combinations utilized without departing from the invention as claimed.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A casing attachment which comprises a tubular member adapted to be joined to a casing; frangible plug means in the tubular member, said plug means having a passageway therethrough with an enlarged portion intermediate its ends; valve means in the form of a floating ball within the enlarged portion of said plug passageway and having a diameter greater than the portions of the passageway adjacent the enlarged portion; and means for guiding the ball out of the passageway and retaining it laterally thereof when fluid is flowing through said passageway from above.

2. A casing attachment which comprises a tubular member adapted to be joined to a casing; plug means in the tubular member, said plug means having a passageway therethrough with an enlarged portion intermediate its ends; a floating ball check valve within the enlarged portion of said passageway, said ball having a diameter greater than the portions of the passageway adjacent said enlarged portion; and a downwardly inclined recess in the plug means leading from said enlarged portion for guiding the ball out of the passageway and retaining it in that position when fluid is flowing therethrough from above.

3. A casing attachment which comprises a tubular member adapted to be joined to a casing; frangible plug means in the tubular member, said plug means having a passageway therethrough with an intermediate enlarged portion, and said plug means including a valve seat body threaded to the inside of the casing and having a widely flared mouth on its upper side; valve means in the form of a floating ball within the enlarged portion of said plug passageway and having a diameter greater than the portions of the passageway adjacent the enlarged portion; and means for guiding the ball out of the passageway and retaining it laterally thereof when fluid is flowing through said passageway from above.

4. A casing attachment which comprises a tubular member adapted to be joined to a casing; plug means in the tubular member, said plug means having a passageway therethrough and an enlarged portion intermediate its ends; a floating ball check valve within the enlarged portion of said passageway, said ball having a diameter greater than the portions of the passageway adjacent said enlarged portion; and a downwardly inclined recess in the plug means leading from said enlarged portion for guiding the ball out of the passageway and retaining it in that position when fluid is flowing therethrough from above, said plug means comprising an aluminum valve seat body connected to the inside of the tubular member and a Bakelite plug also connected to the inside of the casing and engaging the valve seat body.

5. A casing attachment which comprises tubular means adapted to be joined to a casing; plug means in the tubular means, said plug means having a continuous, longitudinal passageway therethrough, which passageway is provided with an enlarged portion intermediate its ends; and valve means in the form of a floating ball within the enlarged portion of said passageway and having a diameter greater than the portions of the passageway adjacent the enlarged portion, said plug means having also an annular recess extending downwardly from the enlarged portion of the passageway for guiding the ball out of the passageway and retaining it in such a position while fluid is flowing therethrough from above, and said plug means also including a conduit leading from the longitudinal passageway to the recess for forcing the ball upwardly to close the passageway when fluid tends to flow from below.

6. A casing attachment which comprises tubular means adapted to be joined to a casing; plug means secured within the tubular means by threaded connection, said plug means having a continuous, longitudinal passageway therethrough and connected with an intermediate annular chamber of greater cross section than the adjacent portions of the passageway; valve means in the form of a floating ball within the chamber of said passageway, said intermediate annual chamber being inclined downwardly for guiding the ball out of the passageway and retaining it in such a position while fluid is flowing therethrough from above, and said plug means also including opposed grooves leading from the longitudinal passageway to the bottom of the annular chamber for forcing the ball upwardly to close the passageway when fluid tends to flow from below.

7. A casing attachment which comprises a tubular member adapted to be joined to a casing; frangible plug means extending continuously in the tubular member, said plug means having a passageway therethrough; a valve seat body secured to the upper end of the plug means and arranged to form a part of the passageway; flow-responsive valve means associated with said passageway and arranged to permit fluid to flow therethrough from above; and means formed in the plug means for retaining the valve means

out of the passageway when fluid is flowing therethrough from above.

8. Apparatus for floating well casing or the like, comprising, in combination, a tubular member adapted to be joined to the casing or the like as a continuation thereof; plug means in the tubular member, said plug means having a passageway therethrough with an enlarged portion intermediate its extremities; ball valve means within the said enlarged portion and having a diameter greater than the portions of the passageway adjacent the said enlarged portion; means associated with the plug means for guiding the ball check valve means transversely of the passageway and retaining it in a position out of the passageway and thus permitting free downward fluid flow through said passageway; and means also formed in the plug means for seating the ball valve means positively in a position to prevent upward fluid flow through said passageway.

9. Apparatus for floating well casing or the like, comprising, in combination, a tubular member adapted to be joined to the casing or the like as a continuation thereof; frangible plug means in the tubular member, said plug means having a substantially straight passageway therethrough with an enlarged portion intermediate its extremities; a floating ball check valve within said enlarged portion and having a diameter greater than the portions of the passageway adjacent said enlarged portion; downwardly inclined guide means formed in the plug means and constructed and arranged for directing the ball check valve transversely of the passageway and retaining it in a position permitting substantially unobstructed downward fluid flow throughout said passageway; and means for seating the ball check valve to close the upper end of the passageway adjacent the enlarged portion in response to upward flow.

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