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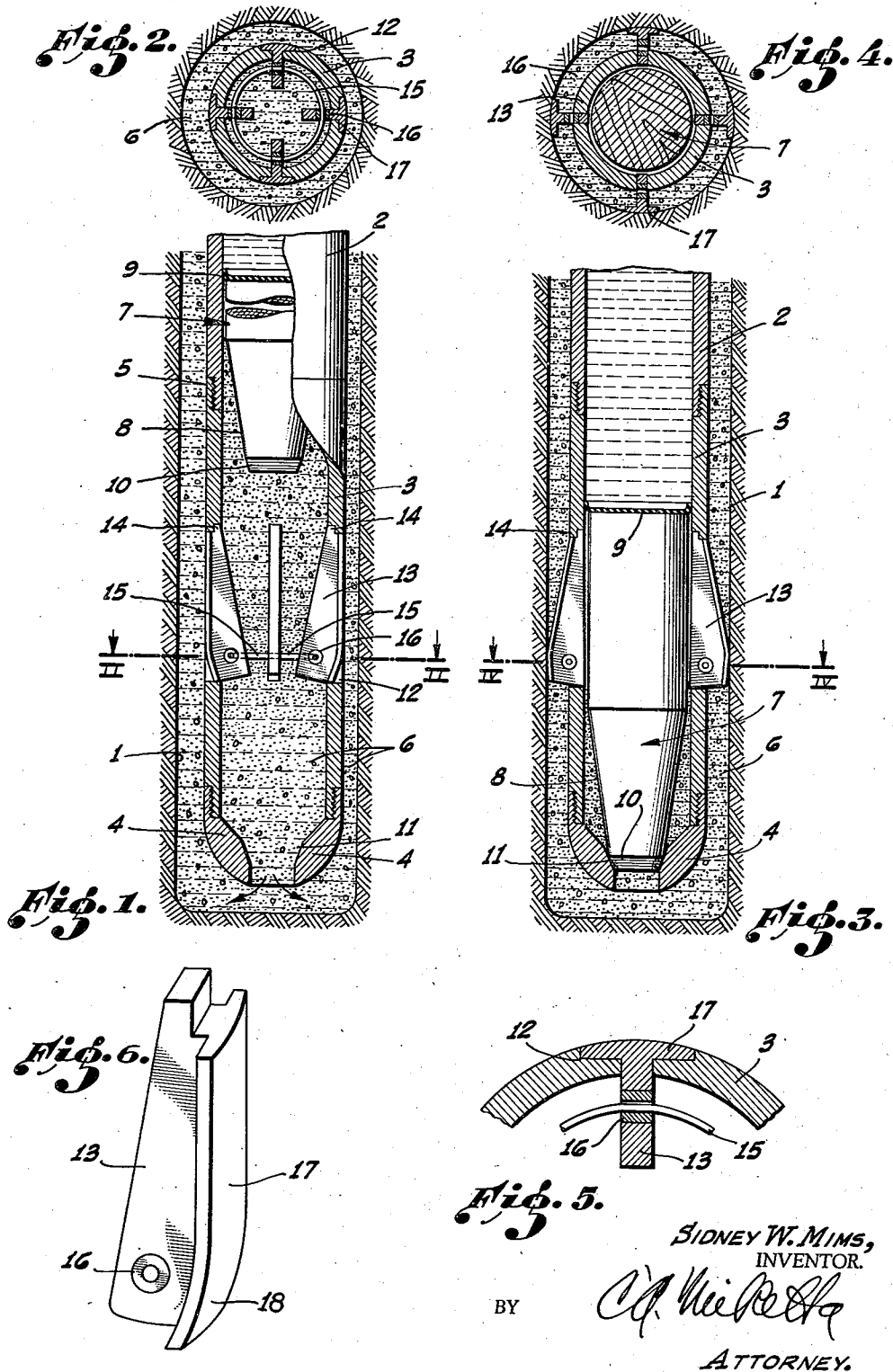
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APPARATUS FOR WELL CEMENTING

Filed Nov. 30, 1939

2 Sheets-Sheet 1



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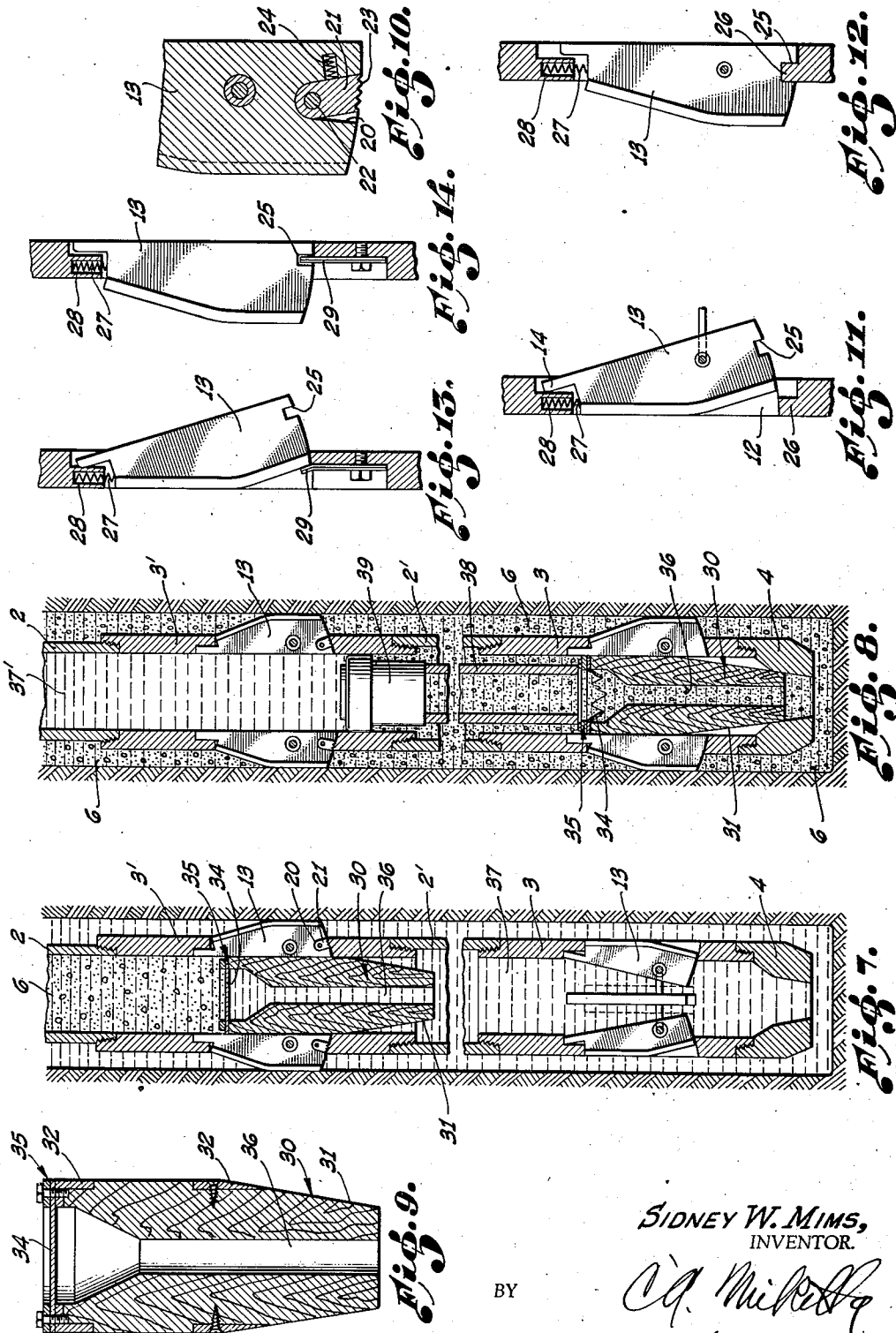
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2 Sheets-Sheet 2



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2,295,418

APPARATUS FOR WELL CEMENTING

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Application November 30, 1939, Serial No. 306,868

29 Claims. (Cl. 166—1)

This invention relates to an apparatus for cementing a casing or the like in a deep well bore, and particularly refers to means positioned in the casing string at and above the casing shoe and adapted to be positively and uniformly radially extended therefrom by means operable from the top of the casing to contact the wall of the bore, and align the casing and shoe therein, as well as to controllably position a charge of cement outside the casing and also inside the casing and shoe. This application constitutes a continuation-in-part of my copending application Serial No. 257,469 filed February 20, 1939, as to common subject matter.

Heretofore casing to be cemented into a well bore has been permitted to assume its own position with respect to the axis of the bore, or at best has been provided with vertically extended outwardly bowed thin metal springs secured at one end to the outside of the casing and intended to contact the bore and center the casing shoe. With a truly vertical hole and in shallow wells such means were sometimes successful, but with deep wells, approaching three miles as a present maximum, the deviation of the lower part of the well can hardly be measured, much less controlled, so that the long and heavy casings will unavoidably lie against one side of the bore. Positively acting means are needed to center the casing and provide a truly concentric space for the cement to form an adequate seal around the casing and shoe.

Broadly speaking, this invention comprehends means positioned adjacent to or associated with the cementing shoe at the lower end of a well casing, or at a desired intermediate location in the casing string, said means adapted to be positively and uniformly extended outwardly therefrom to contact the wall of the well bore by means controllably operated from the surface of the casing string, which last-named means may constitute the plug which is sometimes used to follow the charge of cement down inside the casing string and to expel it outwardly at the shoe or through valves in the casing wall to fill the space surrounding the casing and form a fluid-tight seal between the casing and the well bore. Ordinarily, this means would be placed at the bottom of the string, but the invention could equally well be utilized at any desired number of intermediate points in the casing string by proper proportioning and positioning the parts so that the extensible means would be placed at the desired point and the cement confined below the plug or equivalent actuating means to be ex-

pelled and placed behind the casing string to seal the same.

In its more specific embodiments, the invention also comprehends latching means which positively hold the extensible means in their extended position independently of a plug or other longitudinally movable means controllable from the surface. It also contemplates a novel form of plug provided with an obturating member whereby the charge of cement or other sealing medium used may be controlled, the obturating member permitting the release of the cement at the desired time and in the intended manner.

It is an object of this invention, therefore, to provide an improved apparatus for cementing a well casing or the like into a well bore, and to isolate the cement charge from the fluid already in the well until such time as it is desired to release it, and then controllably to place it in its intended position within and without the casing.

A further object of the invention is to provide an improved and positively actuated deep well casing centralizing means that may be controllably actuated from the top of the casing string as by a plug, a string of drill pipe or the like, to provide a truly uniform annular passage around said casing for the reception of cement or a similar sealing medium.

Another object is to provide a casing centralizing means that has relatively few parts and that may be made of materials adapted to be easily drilled up or side-tracked into the formation by subsequent drilling operations.

Another object is to provide a casing centralizing means or the like that may be positioned at the casing shoe or at any desired point in the casing string and adapted to be actuated by a plug or its equivalent carried downwardly on top of the cement charge, said plug serving not only to actuate the device to expand its movable parts into uniformly extended radial contact with the well bore, but also serving to seal the cement charge from the body of water or drilling fluid used to force the said charge downwardly and to hold it in place until it has set.

Another object is to provide radially expansible means for a casing centralizing device that are enlarged on their outer faces and which may be curved longitudinally to give a uniform and extended bearing against the formation, to prevent gouging out or digging into the latter by movement of the casing string incident to the cementing operation or from other causes, said means also serving to anchor the casing after the cement has hardened.

Another object is to provide a casing centralizing means for well casing that includes radially outwardly swinging tapered members or feet that are positively restrained against undesired movement in all positions and which will effectively seal the casing against outward leakage of fluid from the latter.

Another object is to provide a casing centralizing device that has no parts extending outwardly from the wall of the casing string or the casing shoe during its introduction into the well bore or into a string of casing already cemented therein, so that flush joint casing, which requires minimum clearance and accurate centering, may be used in restricted bores or through tight casing strings.

A still further object of the invention is to provide centralizing means adapted to be positioned at various points in the length of the casing, such means being actuated serially to centralize the casing within a well, each of said means being provided with latches of various types effective to hold expandable feet in expanded position.

Another object is to provide an improved arrangement of plugs and a spacer means, together with a plug construction that will retain a charge of cement in its desired position between the plugs until the lowermost plug reaches its desired location in the casing, whereupon a means in the plug operable by fluid pressure from the top of the casing may be actuated selectively to permit the cement to pass outwardly into the well bore around the bottom and sides of the casing, and sufficient cement will be retained inside the casing to make effective the seal thus formed.

These and other objects and advantages of the invention will be further apparent from the following description, and from the accompanying drawings, which form a part of this specification and illustrate preferred embodiments of the invention as applied to a casing shoe and at an intermediate point in the casing above the shoe which is to be cemented into a well bore at a desired location.

Fig. 1 is a vertical section view of a device constructed according to this invention in place in flush-joint casing at the bottom of a well bore in which the casing is to be cemented.

Fig. 2 is a horizontal section taken along the plane II—II of Fig. 1 showing the outwardly movable foot members in their retracted position within the body of the device.

Fig. 3 is a vertical section of the device illustrated in Figs. 1 and 2 after a plug has expanded the outwardly movable feet and has centralized the casing within the well bore.

Fig. 4 is a transverse section taken along the plane IV—IV of Fig. 3 showing the feet in their expanded position.

Fig. 5 is a transverse sectional view to an enlarged scale showing the foot member in its retracted position and illustrating means for normally holding the foot in such closed or retracted position.

Fig. 6 is a perspective view of a preferred form of a tapered movable member or foot illustrating its curved outer flange and other features.

Fig. 7 is a vertical sectional view of a casing and a centralizing cementing shoe with a second centralizing unit above the shoe, and an improved lower cementing plug in place to actuate the last named unit.

Fig. 8 is a vertical sectional view of the arrangement of Fig. 7 in which the lower plug has been forced to its lowest position to actuate the

centralizing units in the shoe, the upper units being retained in place by the means provided, and with an upper plug and spacer seated on the lower plug and fluid flow control means in the latter ruptured to permit the cement to flow therethrough.

Fig. 9 is a vertical detail view to an enlarged scale of a plug which is useful to practice the invention.

Fig. 10 is a vertical sectional view through the center web of a centralizing foot, to an enlarged scale, showing one arrangement for retaining it in its expanded position.

Fig. 11 is a detail vertical and part sectional view of an alternative arrangement of a flanged centralizing foot retaining means, in its retracted position.

Fig. 12 is a detail vertical and part sectional view of the arrangement of Fig. 11 with the foot in its expanded or actuated position.

Fig. 13 is a detail vertical and part sectional view of another alternative arrangement of a centralizing foot retaining means, in its retracted position.

Fig. 14 is a detail vertical and part sectional view of the arrangement of Fig. 13 with the foot in its expanded or actuated position.

Referring to the drawings, and particularly Figs. 1 and 2, 1 indicates a well bore into which extends a casing 2 carrying a hollow cylindrical body 3 and a cement shoe or guide 4. Usually the casing 2, and body 3 are of steel and the cement shoe or guide 4 is of cast iron, "Bakelite" or similar brittle or friable material adapted to be drilled up and disintegrated by subsequent drilling operations. The shoe 4 may be provided with a ball valve if desired, in accordance with conventional cementing practice. In this example, casing 2 is illustrated as being of the flush-joint type so that body 3 is preferably secured thereto by the inside threaded joint 5 and the outer diameter of body 3 is virtually equal to the outside diameter of casing 2. At the stage of operations illustrated, a body of relatively fluid hydraulic cement or equivalent sealing medium 6 has been introduced into the casing and is being forced out of the shoe 4, this charge of hydraulic cement being followed by a plug 7 which has been introduced into the top of the casing and is being pumped down through the casing, the plug being followed by a suitable body of other fluid, such as water, mud fluid or the like. The plug 7 which may be of hard wood and is preferably provided with a tapered nose portion 8 and a flexible packing or sealing means 9 is placed upon the charge of cement 6 and serves positively to separate it from the water or mud fluid used to force the cement and plug downwardly through the bore of the casing 2 and upwardly around the exterior of the body 3 and casing so as to fill the well hole 1 to the desired height. When the bore of body 3 is smaller in internal diameter than that of the flush-joint casing 2, the body portion of the plug 7 is made to be a fairly snug fit in the body 3 and the sealing means 9 should be of a larger diameter so as to fit the somewhat larger bore of the casing 2. It is to be understood that when conventional coupled casing is used, the inside diameter of the bore and casing may be equivalent. If desired, the lower or small end of the plug 7 may be provided with a nose 10 made of packing rings of soft metal, rubber or the like, capable of being received in the tapered seat 11 of the shoe or

guide 4 so as to form a positive seal when the plug makes contact with the shoe 4.

Intermediate the ends of the body 3 of the device and preferably equally spaced around its circumference are a plurality of longitudinal slots 12. A longitudinally tapered, movable foot member 13 extends through each of these slots. Each foot member is retained from moving outwardly at its upper end by the cooperation of a lug 14 with a notch formed on the inner surface of the body 3 and each foot member is retained from moving outwardly at its lower end by a shear ring or wire 15 passing through the foot. Each foot member is provided with a hard steel bushing or shearing insert 16 through which the shear wire 15 extends. The foot members 13 are preferably made of bronze or other drillable material. The shearing wires 15 may be of aluminum, aluminum alloy, soft bronze, brass or other similar material having a strength sufficient to retain the feet in their retracted position and capable of being broken or sheared off during the subsequent operation of the device.

The outer face of each foot is preferably flanged transversely or in a circumferential direction relative to the body of the device as best shown at 17 in Fig. 6 and the body itself is correspondingly recessed to receive this flange as shown in Fig. 5. Also it may be desirable to curve the outer face of each shoe longitudinally as indicated at 18 so that when it is extended outwardly to contact the wall of the hole (Fig. 3) it will have an extended bearing thereagainst, the flange preventing "digging in" in soft or broken formations. The slots 12 may be similarly recessed to permit this curvature and should generally form a snug but moving fit with the feet 13 which they are adapted to receive.

In operation, the feet 13 are assembled in the body 3 by being inserted into the slots 12 from the outside. The shear ring 15 is placed through the bushings or inserts 16 and is so arranged or tightened that the outer flanged faces of feet 13 are brought flush with the outside of the body 3. It will be noted that the feet 13 are retained at their upper ends from undesired outward motion by the lug 14 and are retained at their lower ends by the shear 15. Flanges 17 prevent undesired inward motion in the slots 12. Thus assembled, the body 3 is secured to the casing 2 and is lowered to the desired position in the well hole 1. Fluid cement 6 is then pumped downwardly through the casing 3 followed by the plug 7, on top of which is the water fluid, this operation causing the cement to be discharged through the shoe 4 outwardly and upwardly around the body of the device and the casing 2 to the desired preliminary height.

As the tapered nose portion 8 of the plug 7 contacts the inner faces of the longitudinally tapered feet 13, it will force them outwardly, the ring 15 being first sheared by the cooperation of the hard insert bushings 16 with the inner wall of the body 3 at the edges of the slots 12. Thereafter, the wider lower ends of the feet 13 may be positively and uniformly radially extended by the remainder of the tapered nose 8 and by the cylindrical portion of the plug 7 into contact with the walls of well hole 1, thereby centralizing the lower end of the casing in the fluid cement which fills the space around the casing and device within the well hole. Fig. 3 illustrates the device with the feet of the centralizer in their extended position and with the body of the plug holding them in such position. The packing

rings 10 at the bottom of the plug positively act to seal the outlet of shoe 4 to hold the cement 6 in place until it sets. Mud fluid is retained on top of the sealing means 9 of the plug 7 for this period and is prevented from mixing with the cement by the plug. After the cement has hardened, the plug 7 and the shoe 4 may be drilled up and the well bore continued downwardly in the customary manner.

It will be noted that the feet are positively actuated by means controlled from the surface of the well and are uniformly radially extended a predetermined distance from the casing to align the latter in the well hole in which a cementing operation or the like is to be performed.

In many instances, it is desirable to use centralizing means at some distance away from the bottom of the casing and at some distance above the shoe 4. Figs. 7 and 8 exemplify an arrangement wherein another centralizer having the body 3' is inserted into the casing 2 at some desirable distance above the centralizer 3 located near the bottom of the casing. The casing separating the two centralizing devices and connecting the same is indicated at 2'. The normally retracted but projectable elements or feet 13 for use in the upper centralizer 3' are preferably provided with means adapted to hold the feet in expanded position. Each of the feet 13 is therefore provided with a slot 20 formed in the lower edge thereof and with a dog 21 pivotally mounted therein as at 22, the lower edge of the dog being provided with serrations or teeth 23. A spring 24 may be used to urge the toothed, lower face of the dog 21 in engagement with the slot 12 in which the foot is mounted, so that when the means for forcing the dog outwardly (as by means of a plug) is withdrawn, the dog 21 will engage the lower surface of its slot and hold the foot in its extended position. If desired, this arrangement could obviously be reversed, placing the toothed dogs 21 in the wall of the body 3' to engage the lower face of the foot members 13.

Instead of pivoted dog illustrated in Fig. 10, other latching or holding means may be used. The arrangement illustrated in Figs. 11 and 12 shows a notch 25 formed in the lower end of foot 13 with a corresponding lug 26 in the bottom of the slot 12. The notch formed in the body of the centralizer adjacent the upper end of the slot 12 is desirably somewhat longer in order to retain the lug 14 on the foot 13 when the latter slides downwardly to engage the lug 26 in the bottom of slot 12, as shown in Fig. 12. Means such as a spring 27 may be placed in a suitable recess 28 in the wall of the cylindrical body 3 above the slot 12 so as to press the foot downwardly into positive engagement with the lower lug 26 when the foot is in expanded position. Such spring means may be employed not only in the arrangement illustrated in Figs. 11 and 12, but may also be employed in the arrangement shown in Figs. 7 and 8.

An alternative arrangement to that just described is shown in Figs. 13 and 14 in which a notch 25, formed in the lower face of the foot member, is adapted to engage a spring 29 secured to the body in a suitable slot formed in the outer face of the body. The springs 29 act to hold the foot members 13 in their retracted position when going into the bore of the well hole by engaging the flanged outer faces of the feet and then when the feet are forced outwardly, the springs 29 engage the notches 25 so as to hold the feet in their expanded position

independently of the plug or other means employed in expanding such feet.

Figs. 7, 8 and 9 illustrate an improved lower cementing plug 30 which is used, among other purposes, to force outwardly the expandable feet 13 so as to centralize the casing and the shoe in the well hole. Fig. 7 shows the plug while expanding the feet in the upper centralizer 3'. So long as the plug 30 or any similar rigid object is in position within the body of the centralizer, the dogs 21 do not function nor are they particularly necessary, but if the plug 30 were to be withdrawn upwardly, as for example, on a wire line, or forced downwardly, as by fluid pressure or the like exerted on the casing 2, then the dogs 15 or other latching or retaining means act to engage the wall of the cylindrical body portion or sleeve 3 to hold the feet in their expanded position.

As shown in Fig. 9, the plug 30 may be made of a cylindrical block of wood or other drillable material of sufficient strength and rigidity, the lower part being preferably tapered as indicated at 31, and protected against splitting or undue wear by means of a ring or ferrule 32 secured to the body of the plug as by screws. At the upper end of the plug there is shown a flanged reinforcing ring, on top of which is secured a thin diaphragm or burstable disc 34 held in position by means of a suitable clamping ring, cap screws or the like generally indicated at 35. The disc 34 may be made of soft copper, bronze, aluminum, aluminum alloy, soft steel or the like, its thickness being computed according to well known formulae and serves to close a longitudinally extending bore 36 provided in the plug 30 until such time as it is desired to establish a fluid passage through the plug. The burstable disc 34 is therefore an obturating member.

The mode of operation exemplified in Figs. 7 and 8 contemplates the introduction of the plug 30 on top of mud fluid 37 which is customarily present in a well hole, fluid hydraulic cement or other sealing material 6 being then pumped into the casing 2, thereby forcing the mud downwardly until a predetermined quantity has been introduced for the particular condition surrounding the operations to be carried out in the well. A spacer member is then introduced into the top of the casing to act as a separator and additional mud fluid pumped downwardly into the casing. In the example illustrated, a hollow spacer 38 is shown between the plug 30 and a top separator or plug 39. The spacer 38 may be made of light wood. The top-most charge of mud fluid 37' forces the top plug 39 downwardly together with the cement 6 and bottom plug 30 causing the plug 30 to first expand the feet in the upper centralizer 3' and then the feet of the lower centralizer 3.

The burstable disc 34 carried by the plug 30 is so designed that it will not rupture under the force necessary for the plug 30 to expand the feet in the upper centralizer 3' so that the plug continues downwardly under desired fluid pressure and is forced through the centralizer 3 to expand the feet therein. After the plug has seated itself in the shoe 4 or other retaining means, the pressure on the mud fluid 37' is maintained or increased, if necessary, to rupture the burstable disc 34 in the plug 30, thereby opening a port or passage through the plug so that the fluid cement 6 is forced through the longitudinally extending port in the plug 30 and out into the annular space surrounding the casing

and centralizing device. This operation will continue until the spacer member 38 seats itself on the top of the lower plug 30 whereupon the mud fluid pressure on the surface will build up and indicate to the operator that both plugs have been seated. The fluid 37' in the casing is then shut in until the cement 6 has hardened, the spacer 38 serving positively to assure that some cement has been retained in the lower end of the casing to a height that will provide a positive seal around the bottom of the shoe 4. Subsequent drilling, chemical treatment or other operations may be carried out in the usual manner on the cement inside of the casing and shoe in order to continue drilling operations or perform other desired acts, such drilling being facilitated when all of the parts which remain inside of the casing are of drillable or disintegratable material, as has been pointed out hereinabove.

Also, if it is merely desired to actuate means such as the centralizing members or other structures in the wall of the casing by means of a rigid member pumped down through the bore, these means being actuated by fluid pressure from the top of the casing, the upper plug, spacer and cement fluid obviously will not be required. Under such circumstances, the ported plug and burstable disc will serve to actuate the means in the casing, the increased fluid pressure subsequently bursting the disc so that normal circulation of mud fluid, for example, may be continued.

It will be appreciated that a new apparatus for cementing and centralizing a casing in a well bore has been described and illustrated in this specification, and, although a specific example of the equipment and mode of operation have been disclosed, there are many variations that will be obvious to one skilled in the art, and those modifications and changes that are within the scope of the appended claims are embraced thereby.

I claim:

1. In combination, a tubular well string having interposed therein normally retracted but projectable elements adapted to be extended outwardly from various sides of the string and to engage the wall of a bore hole for centering the string therein, a plug adapted to travel down the string and provided with means for projecting said centering elements, and latching means co-operating with said elements for holding the same in projected position.

2. A centralizing device for well casing and the like, comprising a hollow body adapted to be secured to a casing, longitudinally restrained radially extensible members positioned in said body intermediate its ends, means for holding said members in a retracted position in said body to be substantially flush with its outer surface, rigid means adapted to be introduced into said body to fill the bore thereof to release said holding means and positively extend said members radially from said body, and means associated with said extensible members to retain them in an extended position independently of said rigid means.

3. A centralizing device for well casing and the like, comprising a hollow body adapted to be secured to a casing, longitudinally restrained radially extensible members movably positioned in said body, means for holding said members in a retracted position in said body, said extensible members and said holding means adapted to be

actuated by means operable from the top of said casing to release said holding means and positively extend said members from said body, and means associated with said extensible members for holding them in their expanded position independently of the surface operable means.

4. A centralizing device for well casing and the like, comprising a hollow body adapted to be secured to a casing, a plurality of longitudinal slots circumferentially spaced in said body, a longitudinally tapered foot in each of said slots, means at one end of said slots for retaining said feet against inward or outward motion therein, the wider ends of said feet adapted to be displaced outwardly from said body by a rigid object introduced therein, and means associated with said feet for holding them in their expanded position independently of said rigid object.

5. A centralizing device for well casing and the like, comprising: a tubular body member adapted to be connected to a well string; longitudinal slots in said body member, a longitudinally restrained radially extensible element positioned in each of said slots, and holding means for normally holding said elements in retracted position, said holding means being releasable by a rigid object introduced into the body member to move said elements outwardly from said body member.

6. A centralizing device for well casing and the like comprising: a tubular body member adapted to be connected to a well string; longitudinal slots in said body member, a longitudinally restrained radially extensible element positioned in each of said slots, means at one end of each of said slots for restraining said elements against outward movement; and holding means for normally holding said elements in retracted position, said holding means being releasable by a rigid object introduced into the body member to move said elements outwardly from said body member.

7. A centralizing device for well casing and the like comprising: a tubular body member adapted to be connected to a well string; longitudinal slots in said body member, a longitudinally restrained radially extensible element positioned in each of said slots, each of said elements including a tapered foot and a shieldlike flange carried by the outer face of the foot, and holding means for normally holding said elements in retracted position, said holding means being releasable by a rigid object introduced into the body member to move said elements outwardly from said body member.

8. A centralizing device for well casing and the like comprising: a tubular body member adapted to be connected to a well string; longitudinal slots in said body member, a longitudinally restrained radially extensible element positioned in each of said slots, holding means for normally holding said elements in retracted position, said holding means being releasable by a rigid object introduced into the body member to move said elements outwardly from said body member, and latch means cooperating with said elements for holding the same in extended position.

9. In combination, a tubular well string having interposed therein normally retracted but projectable elements adapted to extend outwardly from various sides of the string, and a valved plug adapted to travel down the string, said plug being adapted to cooperate with said projectable elements to extend the same outwardly into contact with the wall of a bore hole for centering the string therein.

10. In combination, a tubular well string hav-

ing interposed therein normally retracted but projectable elements adapted to extend outwardly from various sides of the string, and a ported plug provided with an obturating member, said plug being adapted to cooperate with said projectable elements to extend the same outwardly into contact with the wall of a bore hole for centering the string therein.

11. A centralizing device according to claim 2 in which said last named means comprise movable dogs on said extensible means, said dogs acting to engage said hollow body upon the withdrawal of said rigid means.

12. A centralizing device according to claim 2 in which said last named means comprise spaced interengaging notches and lugs on said expandible means and said hollow body, and means for holding said expandible members with the said notches and lugs in their engaged position.

13. A centralizing device according to claim 2 in which said means for holding said extensible members in their retracted position and their extended position comprise a single means.

14. A centralizing device for well casing and the like comprising a hollow body adapted to be secured to a casing, radially extensible members movably positioned in said body, and means selectively adapted to hold said members in a retracted and in an expanded position in said body, said members and said means adapted to be actuated by means operable from within said body to positively extend said radially extensible members from said body.

15. A centralizing device for well casing and the like according to claim 4, in which said last named means comprise movable dogs on said feet, said dogs adapted to engage a wall of said slot.

16. A centralizing device for well casing and the like according to claim 4, in which said last named means comprise spaced interengaging notches and lugs on said feet and said body.

17. A centralizing device for well casing and the like according to claim 4, in which said last named means comprise means interconnecting the wide ends of said feet and said body when said feet are in their expanded position.

18. In combination with a body having a passage therethrough and adapted to be placed in a string of casing or the like, a plurality of longitudinal slots in the wall of said body, a longitudinally tapered circumferentially flanged foot retained at its narrow end in each of said slots, means for retaining the wide ends of said feet in a retracted position so that they project into said passage and are adapted to be displaced outwardly beyond the circumference of said body by a rigid object introduced into said body through said casing string, and means for retaining said feet in their expanded position independently of said rigid body.

19. An apparatus for cementing wells or the like, comprising means positioned in the wall of a casing, said means being extensible outwardly to engage the wall of a well bore to centralize said casing therein, a first plug adapted to be pumped down said casing to actuate said expandible means, said plug having a bore therethrough and a burstable disc normally closing said bore, and a second plug adapted to transmit fluid pressure to a quantity of fluid cement between said plugs to burst said disc and force said cement through the bore of said first plug and into said casing.

20. A centralizing device for well casing and

the like, comprising: a tubular body member adapted to be connected to a well string; longitudinal slots in said body member, a radially extensible element positioned in each of said slots and holding means for normally holding said elements in retracted position, said holding means being releasable by a rigid object introduced into the body member to move said elements outwardly from said body member.

21. A centralizing device for well casing and the like, comprising: a tubular body member adapted to be connected to a well string; longitudinal slots in said body member, a radially extensible element positioned in each of said slots, and holding means for normally holding said elements in retracted position, said holding means being releasable by a destructible plug insertable in said well string and adapted to be moved down said string by pressure of fluid above said plug to move said elements outwardly from said body member.

22. A centralizing device for well casing and the like, comprising a hollow body secured to the lower end of a casing, a plurality of longitudinal slots circumferentially spaced in said body, a longitudinally tapered foot in each of said slots, means at one end of said slots for retaining said feet against inward or outward motion therein, the wider ends of said feet adapted to be displaced outwardly from said body by a solid object introduced therein.

23. A device according to claim 22, with the addition of means for retaining the wider ends of said feet in retracted position in said slots.

24. A device according to claim 22, with the addition of shearable means connection the wider ends of said feet in retracted position in said slots, said shearable means adapted to be severed by a solid object introduced into said body to displace said feet outwardly from said body.

25. A centralizing device for well casing and the like comprising a hollow body portion, longitudinally extending circumferentially spaced slots in such body portion, a longitudinally tapered foot in each of said slots, each foot being provided with a circumferentially extending flange adapted to fit the casing, and means for holding said feet in a restrained position within said body, said last-named means being releasable by a rigid object introduced into said body to move said feet and positively extend the same outwardly from the outer surfaces of said body.

26. A plug for well cementing and casing centralizing purposes, comprising a generally cylindrical body having a longitudinal bore, a burstable metal disc normally closing said bore, a tapered lower portion on said body, and a wearing ring around said body intermediate its ends.

27. A centralizing device for well casing and the like, comprising a hollow body adapted to be secured to a casing, longitudinally tapered, radially extensible feet carried by said body, each of said feet being retained at its narrow end in said body and adapted to have its wide end displaced outwardly from said body by a solid object introduced thereinto, means for holding said feet in a retracted position in said body to be substantially flush therewith, and a solid object adapted to be introduced into said body to fill the bore thereof to release said holding means and positively extend said feet from said body.

28. A device according to claim 27 in which each of said radially extensible feet is provided with a circumferentially flanged outer face.

29. A device according to claim 27 in which each of said radially extensible feet is provided with a circumferentially flanged and longitudinally curved outer face.

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