

March 12, 1935.

J. A. HARDCASTLE

1,994,072

CEMENTING PLUG

Filed May 19, 1932

2 Sheets-Sheet 1

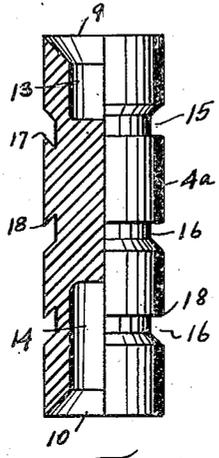
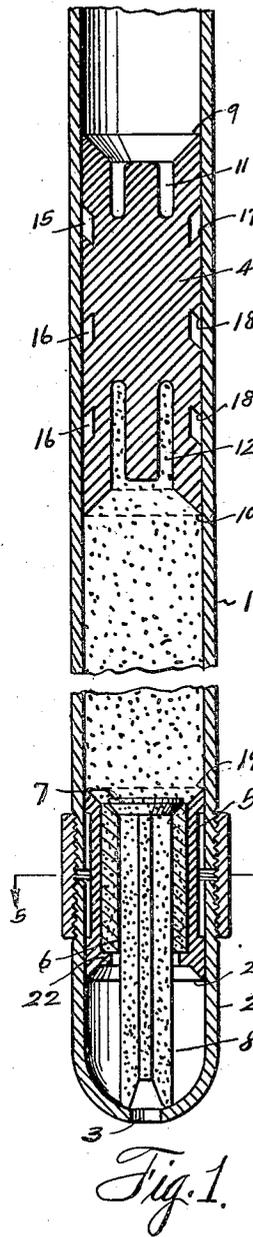


Fig. 2.

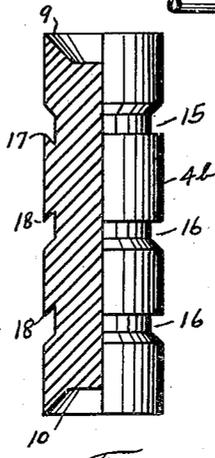


Fig. 3.

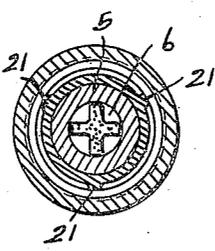


Fig. 5.

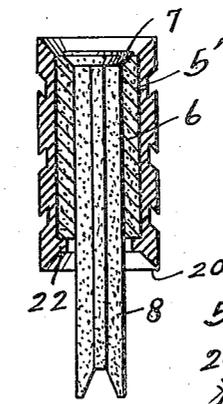


Fig. 4.

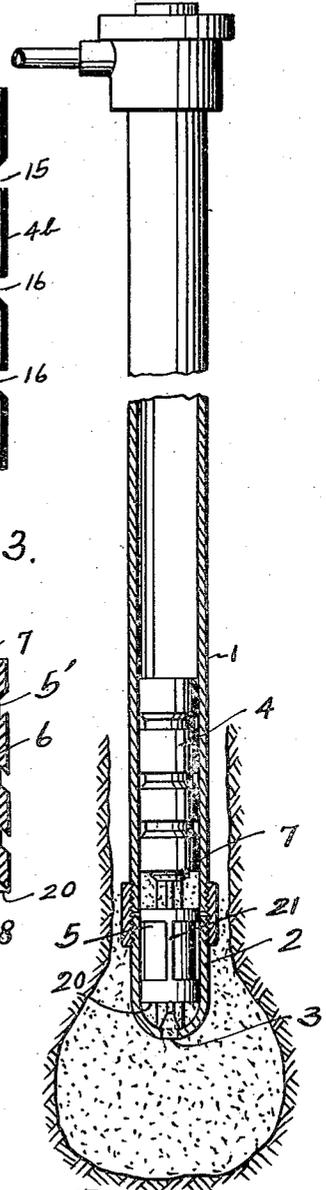


Fig. 6. Inventor
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2 Sheets-Sheet 2

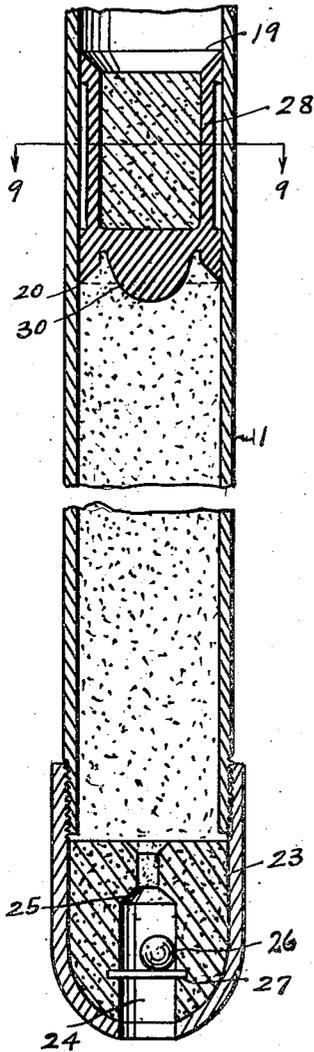


Fig. 7.

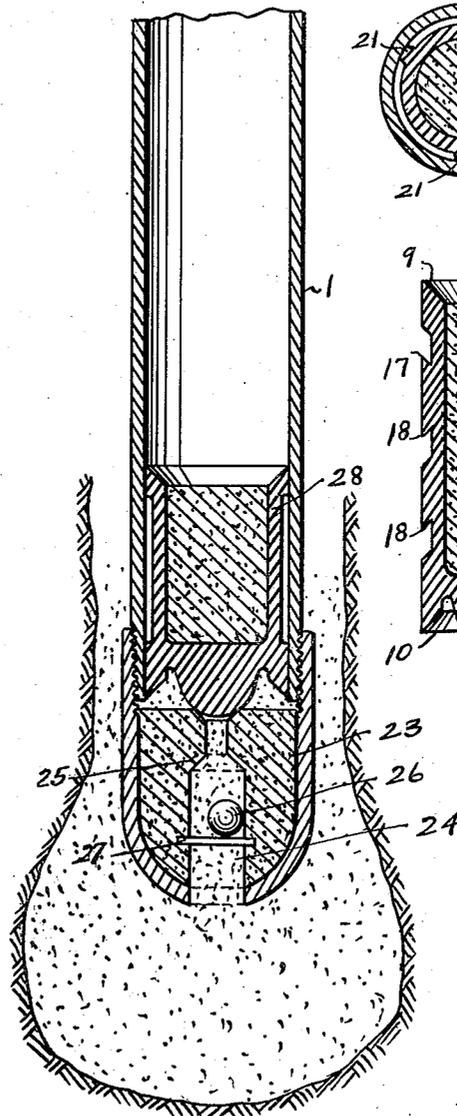


Fig. 8.

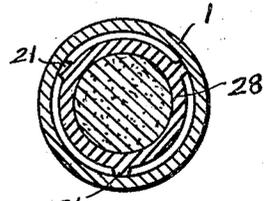


Fig. 9.

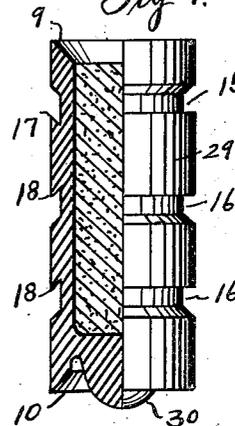


Fig. 10.

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UNITED STATES PATENT OFFICE

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CEMENTING PLUG

Jasper A. Hardcastle, Angleton, Tex.

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7 Claims. (Cl. 166—1)

This invention relates to a cementing plug.

An object of the invention is to provide a plug of the character described specially designed for use in lowering a load of cement down through a pipe in a well bore for cementing around the lower end of said pipe.

Another object of the invention is to provide a cementing plug which is of such special formation that there will be no leakage past the plug and between the plug and pipe as the load of cement is lowered.

Another object of the invention is to provide a cementing plug of such formation that it will not be liable to hang in or be injured by the pipe through which it is being lowered.

Another object of the invention is to provide a cementing plug having its lower end so shaped that it will form a close fit with the float shoe, at the lower end of the pipe to be cemented so as to close the passageway through said shoe when the load of cement has been discharged.

With the above and other objects in view this invention has particular relation to certain novel features of construction, arrangement of parts and use an example of which is given in this specification and illustrated in the accompanying drawings, wherein:—

Figure 1 shows a vertical sectional view of a pipe to be cemented with upper and lower plugs therein with a load of cement between them.

Figure 2 shows a side elevation partly in section of one form of plug.

Figure 3 shows a similar view of another form of the plug.

Figure 4 shows a vertical sectional view of a bottom plug illustrating the invention.

Figure 5 shows a cross sectional view taken on the line 5—5 of Figure 1.

Figure 6 shows a vertical sectional view of a pipe to be cemented, having a guide shoe thereon and cementing plugs of the particular design herein described discharged, their lower positions showing the load of cement discharged.

Figure 7 shows a vertical sectional view of a pipe having a float shoe on the lower end, thereof, and showing a special type of plug designed to close the passageway through said shoe.

Figure 8 shows a similar view showing the plug closing said passageway.

Figure 9 shows a cross sectional view taken on the line 9—9 of Figure 7, and Figure 10 shows still another form of upper plug.

Referring now more particularly to the drawings wherein like numerals of reference designate similar parts in each of the figures, the

numeral 1 designates a pipe to be cemented in a well and having the guide shoe 2 on the lower end thereof having the lower end opening 3.

The cement to be lowered is located between the upper and lower plugs 4, 5 and fluid pressure then applied to force said plugs and the load between them down through said pipe. The lower plug 5 has an axial passageway 6 therethrough whose upper end may be closed by an upwardly opening valve 7 whose stem 8 extends down through said passageway and on beneath the lower plug. When the lower end of the stem 8 lands on the lower end of the shoe 2 the lower plug 5 will move on down and the valve 7 will be lifted and the cement may pass on down through said lower plug and out of the opening 3 and up around the lower end of the pipe where it is allowed to set to cement said pipe in the well, all as shown in Figure 6.

The method of lowering the load of cement and of discharging the same into the bore around the pipe forms no part of the present invention, the novelty residing in the type of plug employed. The plugs 4, 4a, 4b, may be formed of rubber, or similar yieldable material and their upper and lower ends are flared forming the annular lips 9, 10. The plug 4 has the deep annular end chambers 11, 12, concentric therewith and the plug 4a has the upper and lower end cavities 13, 14, while the plug 4b is solid throughout except at its flared ends. The fluid, under pressure in the chambers 11, 12 or in the cavities 13, 14 will expand the corresponding ends of the plugs out closely against the walls of the pipe to prevent leakage past said plugs.

The plugs 4, 4a, 4b, may have a plurality of external annular grooves 15, 16 therearound and undercut to present the external, annular, upwardly directed lip 17 and the annular downwardly directed lips, 18, 18. The pressure fluid above the plug passing by the upper lip 9 will enter the groove 15 and press the lip 17 outwardly to maintain a close seal with the pipe and the fluid under pressure beneath said plug and which may escape up past the lower lip 10 will enter one or both of the grooves 16 and press the lips 18 out against the pipe to maintain a tight seal. This general type of plug may have a core of wood, concrete, or the like as hereinafter described and shown in Figure 10.

The bottom plug 5, as shown, has a tubular concrete core surrounded by a rubber sheath having the flared upper and lower annular lips

19, 20 and the external, longitudinal ribs 21 which form guides to prevent the plug from hanging in, or being injured by the joints between the sections of the pipe 1. The rubber sheath around the core of the plugs 5, 5' has an internal, annular ledge 22 to support said core therein.

In some cases only an upper plug will be employed to force the load of cement downwardly through the pipe. Either of the forms shown in Figures 1, 2 and 3 may be used for this purpose or either of the forms shown in Figures 7 and 10 may be used.

In lowering the pipe 1 into the bore a float shoe as 23 may be attached to the lower end of the pipe which may be closed against the inlet of fluid from the well so that the pipe will be partly sustained by said fluid and thus "floated" in. The shoe 23 may have a passageway 24 axially therethrough whose upper end is reduced forming a valve seat 25 which may be closed by the valve 26 in said passageway beneath and which is retained in place by a retainer rod 27 across the passageway beneath said valve. As the pipe 1 is lowered through the fluid in the well the valve 26 will be held against the seat 25 by the pressure of the fluid and said fluid will be prevented from entering the pipe. When the pipe is lowered and located in the bore fluid may be forced down through the pipe and through the passageway 24. The shoe 23 may be formed of an outer metallic shell with a concrete plug therein so that the shoe may be readily drilled out when it is desired to deepen the bore beneath.

When it is desired to cement around the lower end of the pipe, as shown in Figure 8 a load of cement may be introduced into the upper end of said pipe after the pipe is located in the bore and a solid plug, as 28, or 29 may then be inserted into the pipe above said load and the plug and cement ahead of it then forced down by fluid pressure from above and when the cement reaches the bottom of the pipe it will pass out through the passageway 24 into the bore around said pipe, as shown in Figure 8 where the cement is allowed to set. The plug 28, or 29, as the case may be will finally land on the float shoe 23, and said plug has a downwardly projecting nose 30 which fits into the flared upper end of the passageway 24 to completely close said passageway so that the pressure fluid above, even though it might escape past the plug, can not pass downwardly through the passageway 24 and contaminate or wash away the cement. When said plug lands on the float shoe the pump for delivering said pressure fluid will be stalled

to indicate to the operator that the job has been completed.

The plugs 28, 29 may be of solid rubber or may be formed with concrete cores. The external surface of the plug 28 is the same as that shown in Figure 5 while the external surface of the plug 29 is the same as that shown in Figures 2 and 3.

The drawings and description disclose what are now considered to be preferred forms of the invention, by way of illustration only, while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. A cementing plug having a rigid core and a one piece sheath around and extending each way beyond the core and formed of yieldable material and having annular end lips formed integrally therewith, the lip at one end facing a direction the opposite of that of the other end lip, said sheath also having intermediate annular lips around the sheath which face one in a direction the opposite of that of another.

2. A cementing plug of cylindrical contour and having annular end lips formed of yieldable material and external, lengthwise, ribs spaced apart around the plug.

3. A cementing plug having a core formed of rigid material, a sheath around the core formed of resilient material and having annular end lips which face in opposite directions, and annular, intermediate lips around the sheath which face in opposite directions.

4. A cementing plug having a tubular core of rigid material and a sheath around the core formed of resilient material and having annular, outwardly tapered, end lips which face in opposite directions, and an annular inside abutment in the sheath against which one end of the core abuts.

5. In a cementing plug, a hollow sheath formed of resilient material having a smooth interior and having annular, oppositely directed external lips, and an annular inside abutment in the sheath adjacent one end thereof.

6. A cementing plug having annular end lips formed integrally therewith and tapering to thin edges and facing in opposite directions one end of the plug having a cavity of greater depth than width.

7. In a cementing plug, a hollow sheath formed of resilient material, having a smooth interior and having annular oppositely disposed external lips and an inside abutment in the sheath adjacent one end thereof.

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