

Oct. 7, 1941.

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PLUG FOR USE IN WELLS
Filed Aug. 26, 1938

2,257,784

FIG. 1.

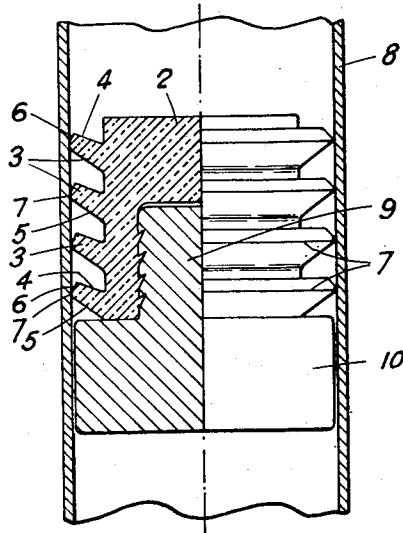


FIG. 2.

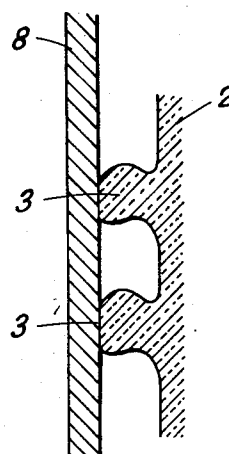
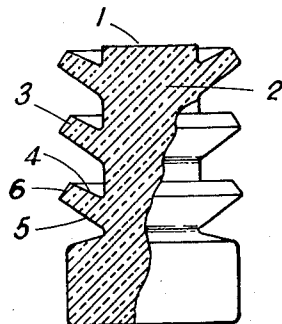


FIG. 3.



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2,257,784

PLUG FOR USE IN WELLS

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Application August 26, 1938, Serial No. 226,938
In Great Britain June 3, 1938

3 Claims. (Cl. 166—1)

This invention relates to a plug for use in forcing material through pipes, for example for forcing cement down in the casing of an oil well, but the plug is not restricted to use in oil wells and is capable of other applications.

When a well, for example an oil well, is sunk it is usually necessary to guard against the risk of water from superposed water carrying strata from flowing down outside the well casing and the separation of two strata is effected by what is known as back cementation. This operation consists in forming a cement joint between the exterior of the casing and an impervious stratum which has been reached by drilling and to which the casing has been lowered, such stratum, of course, being below the water carrying stratum. In carrying out the operation a quantity of cement is inserted at the top of the casing and a plug is inserted in the casing above the charge of cement. Mud is then introduced above the plug and is pumped into the casing in order to force the plug, and with it the cement, down towards the bottom of the casing. At the bottom the cement finds its way, under the force exerted on it by the plug, into the annular space between the casing and the material of the surrounding impervious stratum where it sets and makes a water-tight joint between the casing and the material. The plug which has hitherto been used has a cup-shaped portion made of a flexible material such as leather or rubber which is so dimensioned that the rim of the cup presses slightly against the inner walls of the casing, the base and the remainder of the plug passing easily through the casing. The apparent reason for designing the cup in this way was to allow the pressure exerted on the upper face of the plug, i. e. on the inner walls of the cup during its downward movement to cause the sides of the plug to press with increased pressure against the sides of the casing. Owing, however, to the small difference in pressure on the upper and lower faces of the plug the pressure exerted on the sides of the casing cannot be great. Whatever it may be I have discovered that the known type of plug does not prevent a substantial quantity of cement from finding its way past the plug to the casing space above the plug. Actual measurements have shown that, using a well-known rubber plug, as much as 2.7 cubic feet of cement per 1" diameter of casing per length of 1000 ft. has formed as a film on the casing and thus been wasted. This waste of cement has been masked by its admixture with the mud which is almost universally used as a displacement fluid in casing

cementation and consequently the wastage has gone unperceived.

An object of the present invention is to provide a plug which, in use, prevents the large wastage of jointing material which occurs in the known practice.

Another object of the invention is to provide a plug which is capable of exerting a scraping action on the interior walls of pipes in deep wells as it is moved down in the pipes.

A further object of the invention is to provide a plug which will exert a scraping action on the interior walls of pipes in deep wells as it is moved down in the pipes independently of the pressures exerted on the end, the upper and lower faces of the plug.

A further object is to provide a plug which is adapted to exert a scraping action on the inside walls of a pipe independently of the pressures on the opposite faces of the plug whereby the plug is adapted, by its passage through the pipe, to clear a pipe of viscous fluid, for example crude oil, which tends to adhere to the walls of the pipe.

A still further object of the invention is to provide a plug having scraping edges adapted to press resiliently on the walls of a pipe independently of fluid pressures exerted on opposite ends of the plug.

Examples of plugs constructed according to the present invention are shown in the accompanying drawing in which—

Fig. 1 is a part sectional elevation of a plug disposed inside a pipe.

Fig. 2 is a fragmentary sectional elevation showing the form assumed by the rings of the plug on application of a force tending to reverse its direction of travel.

Fig. 3 is a part sectional elevation of a plug particularly adapted for the smaller diameter pipes employed in deep oil well sinking.

Referring to the drawing, the plug 1 comprises a body portion 2 of a resilient material such, for example, as rubber. From the body portion 2 project annular ring-shaped portions 3 which, as shown, are integral with the body portion. The preferred form of cross-section of the portions 3 are shown in Figs. 1 and 3, and this cross-section is generally rectangular in form with the sides 4, 5 converging slightly and terminating in a side 6 which is obliquely disposed with respect to the axis of the plug. As is shown in Fig. 1, the portions 3 form a circular edge 7 which presses against the inner walls of the pipe 8. It will be appreciated that the maxi-

imum external diameter of the plug, i. e. the diameter of the circular edge 7, when out of the pipe 8 is greater than the internal diameter of this pipe so that the portions 3 suffer an appreciable compression force when the plug is inserted in the casing and this is in direct contrast to the known plugs used in oil well sinking which latter plugs move easily in the well casing.

The body portion 2 fits tightly over a solid comparatively rigid core 9 or is otherwise fixedly secured to this core. The core may be of any desired material, but when the plug is for use in oil well sinking it is made of a material substantially unaffected by water or cement which can readily be broken up in the known manner. Such materials are known and used in the art and per se do not constitute the present invention. It will be understood that the plug may be used as the "bottom plug" in the "two plug" method of back cementation in which case it precedes the ordinary plug and the cement to prevent contamination with fluid or mud in the well. When formed for use as a "bottom plug" the plug has a central bore which is normally closed in known manner by a friable disc, this disc being arranged to burst and open the passage whenever a predetermined pressure differential is exceeded.

The plug shown in Fig. 3 has a solid body portion and the projecting annular ring portions are integral with this portion, the whole plug being made of a resilient material, for example rubber.

In Fig. 2 the projecting annular ring portions of the plug 2 are shown in a highly compressed form such as they would adopt if the pressure of the displacement fluid above the plug were to fall for any reason, such as an accidentally burst pipe. It will be seen that the resistance to backward movement is raised to a high value with the object of providing a certain degree of safety in case of breakdown for the work already accomplished.

In Fig. 1 a guide portion 10 is shown integral with the core 9, but the portion 10 may alternatively be secured, as by screws, to the core.

I claim:

1. A plug for use in forcing material through a pipe which comprises a body portion of resilient material, at least one annular ring portion terminating outwardly in a circular edge defining the greatest diameter of the plug, said edge being defined by two converging surfaces which extend respectively from the edge towards opposite ends of the plug and inwardly towards the body portion, a core portion of relatively rigid and friable material, a cylindrical guide member of relatively rigid and friable material concentric with the axis of the plug and adjacent an end face of the body portion, and means connecting said guide member with said core portion.

2. A plug for use in forcing materials through pipes which comprises a body portion and at least one annular ring portion of resilient material projecting outwardly from said body portion, each said annular ring portion having a cross-section defined by two flat sides extending outwardly and upwardly from said body portion and terminating in a flat side extending inwardly towards the upper end of the plug, each said ring portion having a thickness of the same order of magnitude as its radial extension and having a stiffness sufficient to hold said scraping edge in scraping relation to said pipe when no pressure is exerted on the plug.

3. A plug for use in forcing materials through pipes which comprises a body portion and at least one annular ring portion, of resilient material projecting outwardly from said body portion, each said annular ring portion having a cross-section defined by two flat sides extending outwardly and upwardly from said body portion and converging towards and terminating in a flat side extending inwardly towards the upper end of the plug, each said ring portion having a thickness of the same order of magnitude as its radial extension and having a stiffness sufficient to hold said scraping edge in scraping relation to said pipe when no pressure is exerted on the plug.

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