

R. W. CUSHING.
 CASING PLUG.
 APPLICATION FILED DEC. 16, 1915.

1,193,769.

Patented Aug. 8, 1916.

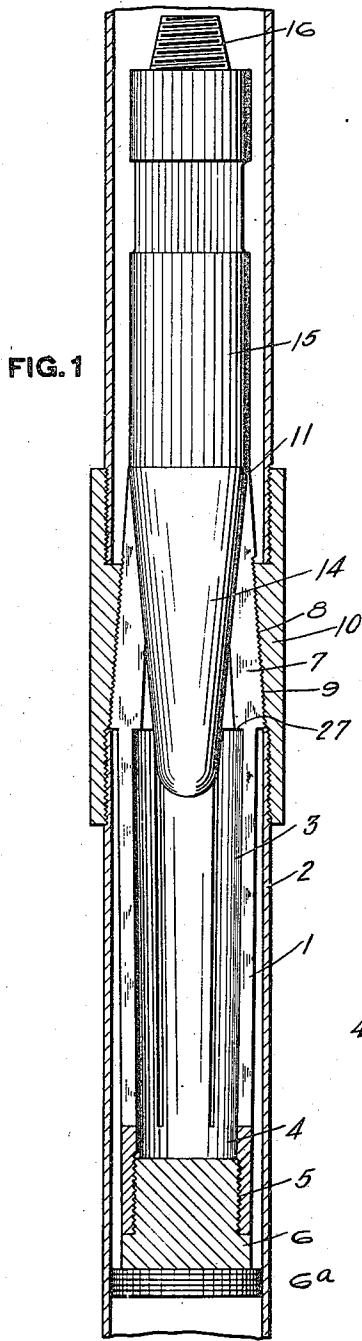


FIG. 1

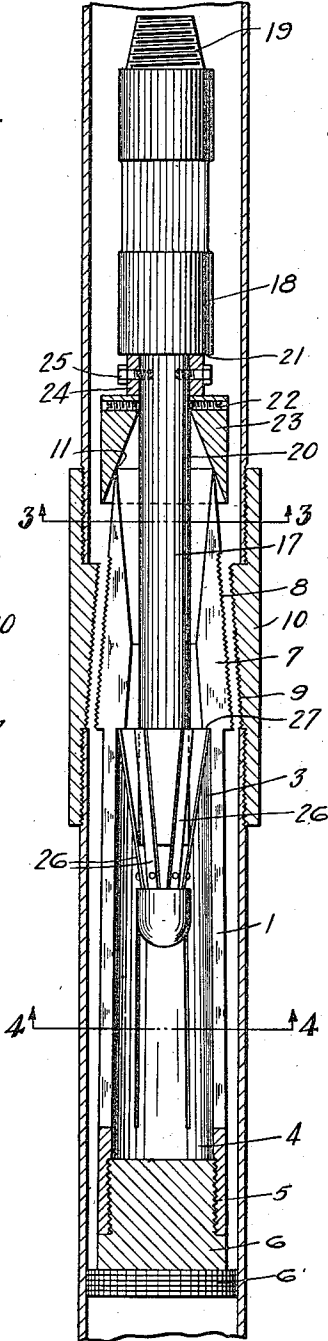


FIG. 2

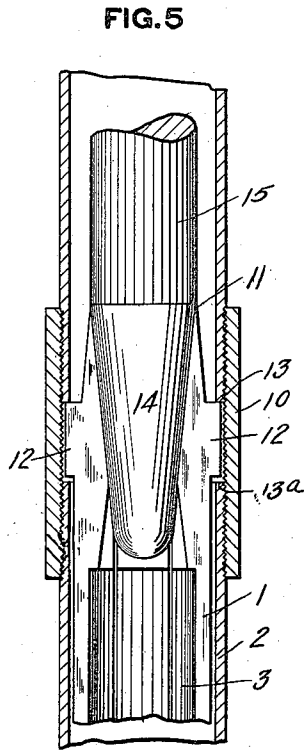


FIG. 5

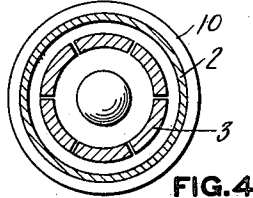


FIG. 4

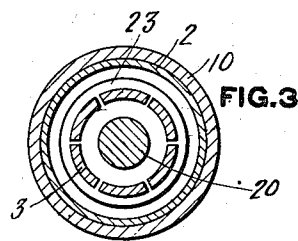


FIG. 3

WITNESSES
W. F. Johnson
Walter S. Klemanski

INVENTOR
Robert W. Cushing
 by *William B. W. Hart*
 his attorney

UNITED STATES PATENT OFFICE.

ROBERT W. CUSHING, OF LEETONIA, OHIO.

CASING-PLUG.

1,193,769.

Specification of Letters Patent.

Patented Aug. 8, 1916.

Application filed December 16, 1915. Serial No. 67,171.

To all whom it may concern:

Be it known that I, ROBERT W. CUSHING, a resident of Leetonia, in the county of Columbiana and State of Ohio, have invented a new and useful Improvement in Casing-Plugs, of which the following is a specification.

This invention relates to a casing plug for use in oil and other drilled wells.

In drilling deep oil or gas wells water is almost invariably struck at different levels. When water is encountered it is usual practice to case the well throughout each water bearing stratum and to lower therethrough a string of casing of a lesser diameter through which drilling is continued. It is of great advantage in lowering such a string of casing into wells that the lower end of the casing be plugged, so that when water is reached, the resistance of the water will tend to support the string of casing and take a large proportion of the strain due to the weight of the casing from the upper portion of the casing, the lowering tackle and the derrick. It is also of great advantage to exclude water from the interior of the casing, as this does away with the necessity of pumping water from the interior of the casing before drilling may be resumed. Heretofore when plugs were used for this purpose, namely, to close the lowermost portion of a string of well casing, the plugs have not been removable; plugs which could be broken by dropping weights upon them having been used. Where the water is 2500 feet deep or over a heavy plug or disk is required, and the bottom of the casing is very liable to be damaged when breaking this plug or disk.

The object of the present invention is to provide a casing plug which may be securely applied to the lowest section of a string of casing and completely plug the same, and which may be readily attached to the casing and also readily removed therefrom without injury to the plug or casing.

A further object of the invention is to provide a casing plug in combination with means whereby it may be brought into position in a casing or removed completely therefrom by operations performed at the mouth of the well.

A still further object of the invention is to provide a casing plug with the advantages above described, which is simple in construc-

tion, cheap to manufacture, and which possesses great strength and durability.

In the accompanying drawings Figure 1 is a vertical sectional view of the casing plug showing the same in position in the casing with the expanding mandrel therein; Fig. 2 is a vertical sectional view of the plug illustrating the removing spear during the operation of breaking the engagement between the plug and casing and showing the engagement of the spear and plug; Fig. 3 is a cross sectional view on the line 3—3 Fig. 2; Fig. 4 is a cross sectional view on the line 4—4 Fig. 2; and Fig. 5 is a view illustrating a modified form of engagement between the plug and casing.

The body "1" of the plug is tubular in form and is of a size to fit loosely within the casing "2" which is generally of a standard diameter. The body "1" is split vertically for the greater part of its length into a plurality of arms "3," leaving a lower cylindrical portion "4" which is screw threaded internally as at "5" to provide a secure engagement with a plug or stopper member "6." This plug member is provided with a packing disk or ring "6a" of rubber, leather, or some suitable composition, which is of sufficient diameter to engage the casing wall closely to prevent the passage of fluid through the casing. The body member "1" of the plug is formed of a suitable resilient metal so that the arms "3" possess considerable elasticity and may be readily forced into or out of contact with the interior of the casing. Each of the arms is modified at its upper extremity to form a locking member "7" provided with a plurality of teeth "8" arranged to engage similar teeth "9" formed on the interior of the casing section, or preferably on the interior of a special tubular section "10" secured in the casing "2" between adjacent sections thereof. The engaging parts "7" of the plug arms "3" are substantially wedge shaped in cross section and are brought to an edge "11" at their upper extremities for a purpose which will be described hereinafter. As illustrated in Figs. "1" to "4" of the drawings the toothed surface on the parts "7" is inclined upwardly and inwardly and the circumferentially toothed portion on the interior periphery of the member "10" is inclined downwardly and outwardly. This gives an engagement

between the toothed portions of the plug body and the casing which assists in preventing upward displacement of the plug in the casing due to pressure upon the lower extremity of the plug.

As illustrated in Fig. 5 of the drawings, the contacting toothed surfaces "8" and "9" of the arms and member "10", respectively are vertical, but each of the arms is provided with a projection "12" which engages with continuous shoulder "13", "13^a", on the inner periphery of the member "10". This engagement secures the plug from either upward or downward displacement in the casing without decreasing the interior diameter of the casing at this point, and thereby interfering with the insertion of a drilling tool when the plug is removed.

When a string of casing is to be lowered into a deep well in which water is present the casing plug is placed in position at the lower extremity of the casing. The portions "7" of the resilient arms "3" are then forced outwardly by means of mandrel "14" so that the toothed surfaces "8" and "9" are brought into engagement. The mandrel "14" is provided with a shank "15" which carries a screw threaded nub "16" to which may be attached a rod of any suitable character for lowering the mandrel within the casing. The mandrel is tapered so that it may readily enter between the members "7" of the arms "3" for expanding the same and may also be readily withdrawn therefrom. When the plug is in position the packing disk or ring "6^a" on the plug or stopper member "6" will be forced upwardly by pressure from beneath so that it will act to tightly close the casing "2", and at the same time this pressure will cause toothed surfaces "8" and "9" of the members "7" and "10" to become more firmly locked against upward displacement.

It is important that the plug may be readily removed from the casing and drawn to the surface of the well when the casing reaches the bottom of the hole. For removing the plug from the casing the spear "17" is provided. This removing spear comprises a shank "18" having at its upper extremity a screw threaded nub similar to that upon the mandrel so that it may be connected to a long rod for insertion and removal by means operable from the mouth of the well. The lower portion "20" of the spear shank is of decreased diameter and forms a circumferential shoulder "21". Secured to the portion "20" of the spear shank by means of tap bolts "22" is a cupped collar "23" which is spaced from shoulder "21" by spacing blocks "24" held in place by tap bolts "25". The lower rim of the cup shaped collar "23" is brought to an edge, so that when it is forced downwardly against the edges "11" of the resilient arm members

"7" it will enter between the edges "11" of the arms and the interior casing wall to force the arms inwardly and break the engagement between them and the toothed portion of the member "10". At the lower extremity of the shank portion "20" of the spear there are secured a plurality of radially disposed spring arms "26" arranged to be compressed on their passage between the arm members "7" and to snap outwardly after passing these arm members and engage shoulders "27" thereon. These springs furnish a locking engagement whereby the plug may be withdrawn from the casing by withdrawal of the spear. The engagement between the arm members "7" and the portion "10" of the casing with which they contact, having been broken by the insertion of the collar "23" as above described.

When the spear and plug have been completely withdrawn from the well, the spear may be readily removed from within the body of the plug. In order to remove the spear the stopper member "6" is first unscrewed from the lower portion of the plug body, and a tube of the proper size is inserted from the bottom of the plug and pushed upwardly therein to compress the spring arms "26" so that they are disengaged from the shoulders "27" on the arms "3". Spacing blocks "24" are then removed, tap bolts "22" are withdrawn, and collar "23" is slid upwardly on the spear shank so that its lower rim is withdrawn from the tips of the arms "3", upward movement of the collar on the spear shank being limited by the circumferential shoulder "21". The spear may then be withdrawn completely from the plug and the tube removed. To prepare the plug for another insertion into a well casing, it is necessary merely to replace the stopper member "6".

The particular purpose which the plug above described is designed to accomplish is that of plugging the lowermost extremity of a string of casing during its insertion into a water filled oil or gas well as has been above described. It is obvious however, that the plug may be used advantageously in lowering the casing to the bottom of an Artesian well, since in that case also it will greatly relieve the strain on the upper portion of the casing and the lowering tackle during the operation of inserting the casing.

It is obvious that the device above described is susceptible of a number of modifications without departing from the spirit of the invention and no limitations other than those contained in the appended claims are to be imposed.

What I claim is:—

1. A well casing plug comprising a tubular body having an expansible locking portion, means for expanding said portion,

and means on said body for closing the well casing.

2. A well casing plug comprising a tubular body, resilient members on said body arranged to engage the well casing, means on said body arranged to close said casing, and means for causing said arms to engage said casing.

3. A well casing plug comprising a longitudinally split body of resilient material, means for expanding a portion of said body to cause the same to engage the casing wall, and a member secured to said body and arranged to close said casing.

4. A well casing plug comprising a toothed casing portion, a body member provided with toothed arms, means for bringing said toothed arms into engagement with the toothed portion of said casing, and means secured to said body member for closing said casing.

5. A removable closure for well casings comprising a casing portion, a plug, interlocking connections between said plug and casing portion, means for maintaining said members in mutual engagement, and means for breaking said engagement and removing said plug.

6. A removable closure for well casings comprising a casing portion, a plug, interlocking connections between said plug and casing portion, means operable from the well mouth for establishing engagement between said plug and casing, and means for breaking said engagement between said plug and casing member and removing said plug.

7. A removable closure for well casings comprising a casing portion, a plug, interlocking connections between said plug and casing portion, means operable from the well mouth for maintaining the connection between said members, and means operable from the well mouth for breaking said engagement and removing said plug.

8. A removable closure for well casings comprising a casing portion, a plug, arms on said plug arranged to be expanded to engage said casing portion, and removing means arranged to enter between said arms and casing, to break the engagement therebetween and to engage said plug.

9. A removable closure for well casings comprising a casing portion, a plug, arms on said plug arranged to be expanded to engage said casing portion, and a removing spear having a portion arranged to break the connection between said arms and casing and a resilient portion arranged to engage said plug.

10. A removable closure for well casings comprising a casing portion, a plug, arms on said plug arranged to be expanded to engage said casing portion, and a removing spear having a portion arranged to enter between said arms and casing for breaking

the connection therebetween and a resilient portion arranged to engage said plug for withdrawing the same from the casing.

11. A removable closure for well casings comprising an internally toothed casing portion and arranged at its lower extremity to close the casing, a plug body split vertically into a plurality of resilient arms, toothed portions on said arms arranged to engage the toothed portion of the casing wall, means for maintaining said toothed portions and said casing portion in mutual engagement, and means arranged to break said engagement and withdraw said plug from the casing.

12. A removable closure for well casings comprising a casing portion, a plug, interlocking connection between said plug and casing portion, means for establishing the connection between said members and a removing spear having a portion arranged to break the connection between said plug and casing and a resilient portion arranged to engage said plug for removing the same from the casing.

13. A closure for well casings comprising a plug, resilient securing means on said plug, and a mandrel operable from the well mouth for expanding said resilient means and securing the plug in a casing.

14. A removable closure for well casings comprising a plug, resilient securing means on said plug, a mandrel operable from the well mouth for expanding said securing means, and means operable from the well mouth for breaking the connection between said securing means and the casing wall.

15. A removable closure for well casings comprising an internally toothed casing portion, a plug split vertically into a plurality of resilient toothed arms arranged to engage the toothed portion of said casing, said toothed casing portion and toothed arms having an engagement tending to prevent upward displacement of said plug, and means for establishing engagement between said plug and casing.

16. A removable closure for well casings comprising a casing portion having an internally toothed surface inclined downwardly and outwardly of said casing, a plug, resilient members on said plug having toothed surfaces inclined upwardly and inwardly of the plug body and arranged to engage the toothed surface of the casing portion, and means for establishing engagement between said plug and casing.

17. A removable closure for well casings comprising a casing portion having an internally toothed downwardly and outwardly inclined surface, a plug split vertically into a plurality of resilient arms having surfaces inclined upwardly and inwardly of the plug body and arranged to engage the toothed surface of the casing portion, and means for

establishing engagement between said plug and casing.

18. A removable closure for well casings comprising a casing portion having an internal outwardly and downwardly inclined toothed surface, a plug split vertically into a plurality of resilient arms having upwardly and inwardly inclined toothed surfaces, and means operable from the well mouth for maintaining the toothed portions of said arms in engagement with said toothed casing portion.

19. A removable closure for well casings comprising a plug, a casing portion having a toothed downwardly and outwardly inclined internal surface, means on said plug arranged to engage the internal surface of said casing portion, means for locking said engaging means in position, and means arranged to break the engagement between said plug and said casing.

20. A removable closure for well casings comprising a casing portion, a plug, interlocking connection between said plug and said casing portion, means for establishing said connection and a removing spear having a portion arranged to break the connection between said plug and casing and a plurality of resilient members arranged to engage

shoulders on said plug for removing same from the casing.

21. A removable closure for well casings comprising a casing portion, a plug split vertically into a plurality of resilient arms arranged to engage said casing portion, means for maintaining said arms in engagement with said casing portion, and a removing spear having a portion arranged to enter between said casing portion and said arms for disengaging the latter and a plurality of resilient members arranged to engage shoulders on said plug for removing the same from the casing.

22. A removable closure for well casings comprising a tubular member arranged to engage the interior of a casing and having a closed lower extremity for completely closing the casing, means situated interiorly of said plug for maintaining the plug in engagement with said casing, and means for removing said plug from said casing.

In testimony whereof, I have hereunto set my hand.

ROB'T W. CUSHING.

Witnesses:

HARRY E. READY,
EDWARD DALZELL.