May 5, 1931. O. A. CAVINS 1,803,839

WELL CASING AND METHOD OF REMOVING THE SAME FROM A WELL

Filed Jan. 2, 1929

Fig. 1

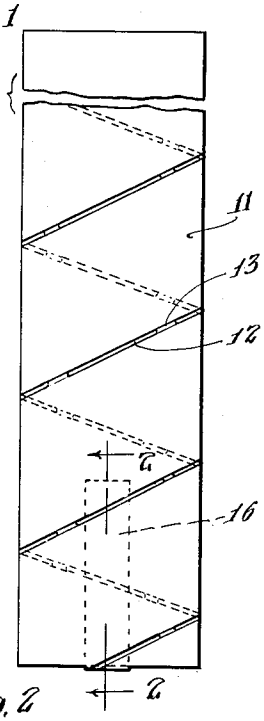


Fig. 2

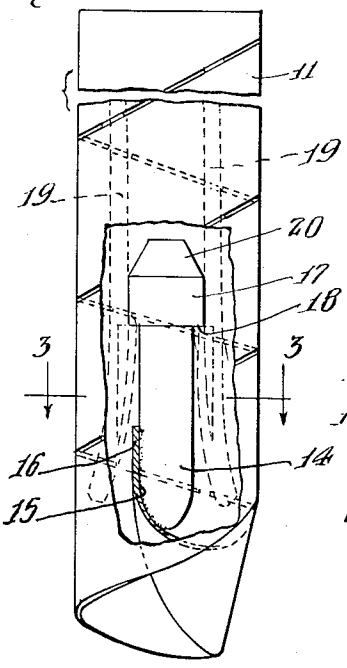


Fig. 3

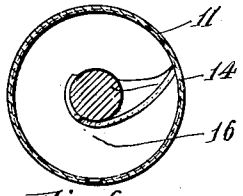


Fig. 6

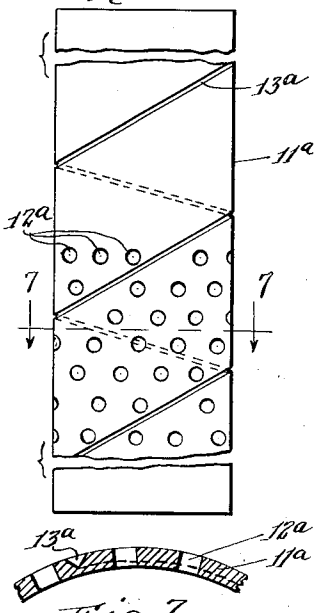


Fig. 7

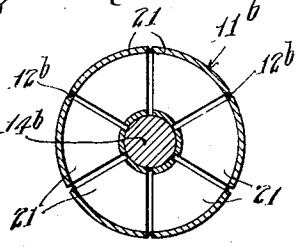
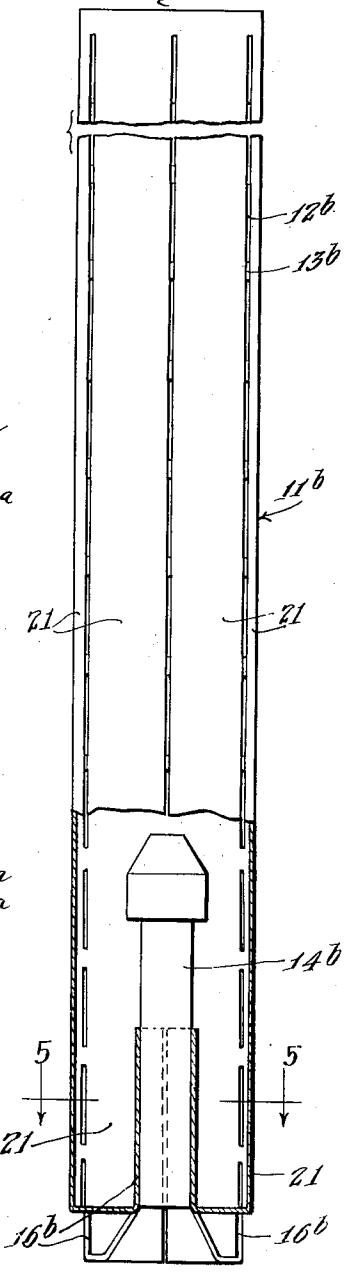


Fig. 5

Fig. 4



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UNITED STATES PATENT OFFICE

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WELL CASING AND METHOD OF REMOVING THE SAME FROM A WELL

Application filed January 2, 1929. Serial No. 329,721.

This invention relates to well casings and also relates to the methods of removing well casings from wells.

The invention is particularly applicable to perforated well casings or strainers. Such perforated casing is employed in wells at the level of the producing strata to admit the well fluids into the casings so that said fluids may flow or be pumped from the well.

The application of the invention will be readily understood when considered in connection with an oil well. It is customary, in the drilling of an oil well, to place a test string of perforated casing at the level of a stratum which core tests have indicated may be productive of oil. If, after the test string has been installed, the stratum being tested proves to be unproductive, it is usual to drill the hole deeper until there is encountered another stratum which is shown by core tests to possibly contain oil.

In testing a stratum, during the drilling of a well, it is customary to cement casing above the stratum to be tested to shut out water and to then lower a string of perforated casing inside of and below the level of the cemented casing so that the perforations are at the level of the formation to be tested. The drilling fluid is then withdrawn from the casing to relieve the artificial pressure against the formation and to permit of the well fluid flowing or being pumped out through the perforated string.

The reduction of pressure will ordinarily cause the formation being tested to cave and pack so firmly against the exterior of the perforated casing as to make it impossible to withdraw the perforated string, especially if more than twenty feet, depending on the nature of the formations, projects below the cemented casing. Accordingly, a section of perforated casing becomes frozen, as it is termed, in the hole, resulting in drilling difficulties in the event that it is desired to proceed with deeper drilling.

Practically, the only way at present that the perforated casing frozen in the hole may be sufficiently disposed of, so that the downward drilling may be continued, is by what is known as "sidetracking", in which operation the metal of the perforated casing is jammed or forced to one side of the hole turned so that the drill bit may continue downwardly past it. This operation is laborious and not always feasible, and leaves the hole in bad condition for continued and deeper drilling.

One of the principal objects of this invention is to make it possible to entirely remove the section of perforated casing that becomes frozen in the well, as explained above.

It will be apprehended that many advantages flow from the accomplishment of the foregoing object. Among these are reduction in time and cost required in drilling a well. Another advantage is that the drill bit is not deflected to one side, thus tending to make a bend in the hole at the level of the wedged-in casing section.

Other objects and advantages will appear in the subjoined, detailed description.

The accompanying drawings illustrate several forms of the invention.

Figure 1 is a view of a well casing constructed in accordance with the provisions of this invention, a portion of the casing being broken away to contract the view.

Figure 2 is a broken view, partly in elevation and partly in vertical section on the line indicated by 2—2, Figure 1. The socket of a fishing tool is indicated in broken lines in engagement with the mandrel.

Figure 3 is a horizontal section on the line indicated by 3—3, Figure 2.

Figure 4 is a broken view, partly in elevation and partly in section, of a different form of the invention than that shown in Figure 1.

Figure 5 is a horizontal section on the line indicated by 5—5, Figure 4.

Figure 6 is a view of another form of casing in which the invention is embodied. Portions of the casing are broken away.

Figure 7 is an enlarged broken horizontal section on the line indicated by 7—7, Figure 6.

First describing the form of the invention illustrated in Figures 1, 2 and 3, the well casing comprises a tubular section or member 11. In this instance, the well casing section 11 is provided with perforations 12 so that

it will act as a strainer, in a manner well understood in this art. It is to be understood that the perforations 12 may be of any suitable shape and that they may be arranged in any suitable manner. In the present instance, the perforations are elongated or in the form of slots and they are arranged in a spiral series.

The perforations 12 constitute portions of a weakened or tear line and the other portions of said line are constituted by grooves 13 which connect the ends of adjacent perforations 12 so as to make a continuous weakened or tear line or lines extending from end to end of the casing. In this particular instance, the weakened or tear line extends in a spiral.

At the lower end of the casing and within the same is provided a member 14 which is welded or otherwise secured, as indicated at 15, to the casing at approximately the place where the tear line terminates at the lower end. In this instance the portion of the casing that is secured to the member 14 is in the form of a tongue 16 which extends inwardly from the lower end of the casing adjacent to the tear line, thence upwardly along one side of the member 14. The member 14, in this particular instance, is in the form of a cylindrical mandrel provided with a head 17 which forms, beneath said head, an annular shoulder 18 adapted to be engaged by the jaws 19 of a fishing tool which is fragmentarily indicated in broken lines in Figure 2. The head 17 terminates upwardly in a tapered portion 20 which functions to spread the jaws 19 when said jaws are lowered into engagement with the mandrel. It is to be understood that the fishing tool, of which only the jaws 19 are indicated, is only lowered into the casing and engaged with the shoulder 18 at the time that it is desired to remove the casing from the well. When, therefore, it is desired to remove the casing, the fishing tool is lowered and engaged with the shoulder 18, as indicated in Figure 2, and power is then applied to the fishing tool to exert an upward pull on the member 14.

As the member 14 rises it takes with it the tongue 16. As soon as the tongue becomes taut, the metal of the casing begins to tear upwardly along the spiral weakened or tear line and the strip of metal thus torn away is pulled upwardly inside of that portion of the casing that still remains intact. Thus the casing is turned outside in during its removal and removed as a ribbon or strip of metal.

From the foregoing, it will be readily understood, that the perforations 12 and the grooves 13 together constitute a slot which enables the casing to be torn along a predetermined line of weakening. Furthermore, it will be quite evident that the slot may or may not include the perforations or, in other words, that the continuous slot may be formed of a groove or grooves that are entirely separate from the perforations as illustrated in Figures 6 and 7, in which views the elements that functionally correspond to those above described are indicated by the same reference characters with the addition of the letter "a."

Now referring to the form of the invention illustrated in Figures 4 and 5, the elements that functionally correspond with those above described in connection with Figures 1 to 3, inclusive, are indicated by the same reference characters with the addition of the letter "b." In this instance, the slots, formed by the perforations 12*b*, grooves 13*b*, are arranged in a plurality of longitudinally extending series and, at its lower end, the casing is connected with the mandrel 14*b* at a plurality of points, being connected between each two adjacent series of slots. Thus, there is a plurality of tongues 16*b*, each of which is secured to the mandrel and connects with one of the strips or ribbons of metal lying between two adjacent slots.

In order that the strips of metal, as they are torn away, will not interfere with one another, it is preferable to extend alternate tongues to different levels at the lower end of the casing so that, upon pulling the member 14*b* upwardly, the tongues extending to the higher level will first operate to pull their associated strips 21 inwardly and, following this, the tongues extending to the lower level will pull inwardly and upwardly their associated strips 21. Thus alternate tongues will be caused to overlap so that their edges will not be caused to abut one another and thus prevent sufficient inward movement of the strips to enable said strips to be turned outside in and to allow them to ascend through the portion of the casing that is still intact.

From the foregoing, it will be readily understood that in some instances the slots may include the perforations while in other instances the slots are distinct from the perforations. The term slot is used in this specification in a generic sense to include a groove, as in Figure 6, or a series of alternately occurring grooves and perforations, as in Figures 1 and 4. The grooves may be cut, rolled or otherwise produced.

I claim:

1. A well casing comprising a tubular member of tearable material provided with a slot extending from end to end thereof, and a pull member inside of said tubular member connected with the lower end of the tubular member adjacent to the slot at a point that produces tearing of the tubular member along the line of said slot when the pull member is drawn upwardly.

2. A well casing comprising a tubular member of tearable material provided with

a slot extending from end to end thereof, and a pull member inside of the tubular member connected with the lower end of the tubular member adjacent to the slot, the second mentioned member being provided with means engageable by a fishing tool at a point that produces tearing of the tubular member along the line of said slot when the pull member is drawn upwardly.

3. A well casing comprising a tubular member of tearable material provided with a slot extending from end to end thereof, portions of said slot including perforations, and a pull member inside of the tubular member connected with the lower end of the tubular member adjacent to the slot at a point that produces tearing of the tubular member along the line of said slot when the pull member is drawn upwardly.

4. A well casing comprising a tubular member of tearable material provided with a spirally extending slot from end to end of said member, and a pull member inside of the tubular member connected with the lower end of the tubular member adjacent to the slot at a point that produces tearing of the tubular member along the line of said slot when the pull member is drawn upwardly.

5. A well casing comprising a tubular member of tearable material provided with perforations and provided with a groove extending from end to end of the tubular member, and a pull member inside of the tubular member connected with the lower end of the tubular member adjacent to the groove at a point that produces tearing of the tubular member along the line of said groove when the pull member is drawn upwardly.

6. The method of removing well casing from a well which consists in grooving a section of said well casing from end to end, tearing the section upwardly along said groove, and pulling the torn-off portion upwardly through the intact portion of the casing.

7. The method of removing well casing from a well consisting in spirally grooving a section of the casing, tearing the casing upwardly along the groove, and pulling the torn-off portion upwardly through the intact portion of the casing.

8. The method of removing well casing from a well consisting in forming a plurality of grooves lengthwise of a section of the casing, tearing said section from its lower end upwardly along the grooves into strips, and pulling said strips upwardly through the intact portion of the casing.

9. The method of removing well casing from a well consisting in forming grooves lengthwise in a casing section so as to delimit strips, and pulling the strips inwardly and upwardly in overlapping relation through the intact portion of the casing.

10. A well casing comprising a tubular member of tearable material provided with a groove extending from end to end of the tubular member, and a pull member inside of the tubular member connected with the lower end of the tubular member adjacent to the groove at a point that produces tearing of the tubular member along the line of said groove when the pull member is drawn upwardly.

11. A well casing comprising a tubular member of tearable material provided with a spiral groove extending from end to end of the tubular member, and a pull member inside of the tubular member connected with the lower end of the tubular member adjacent to the groove at a point that produces tearing of the tubular member along the line of said groove when the pull member is drawn upwardly.

12. The method of making well casing consisting in producing a weakened line in a casing section of tearable material extending from end to end of said section so that the section will tear and turn inside out when being removed from a well.

13. In a method of constructing a well, the steps of grooving a section of well casing of tearable material from end to end, installing the section thus grooved in the well, and exerting an upward pull on the lower end of the section at a point that produces tearing of the section along the line of the groove and turning of the section inside out as the tearing progresses.

14. The method of removing a casing section from a well in which it has been installed, consisting in tearing the section upwardly inside out from its lower end along a weakened tear line previously provided in the section.

15. The method of removing a casing section from a well in which it has been installed, consisting in tearing the section upwardly into a strip inside out through the section.

Signed at Los Angeles, California, this 26th day of November, 1928.

OMAR A. CAVINS.