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MEANS FOR WITHDRAWING CASING FROM WELLS OR BORE HOLES

Filed April 7, 1939

3 Sheets-Sheet 1

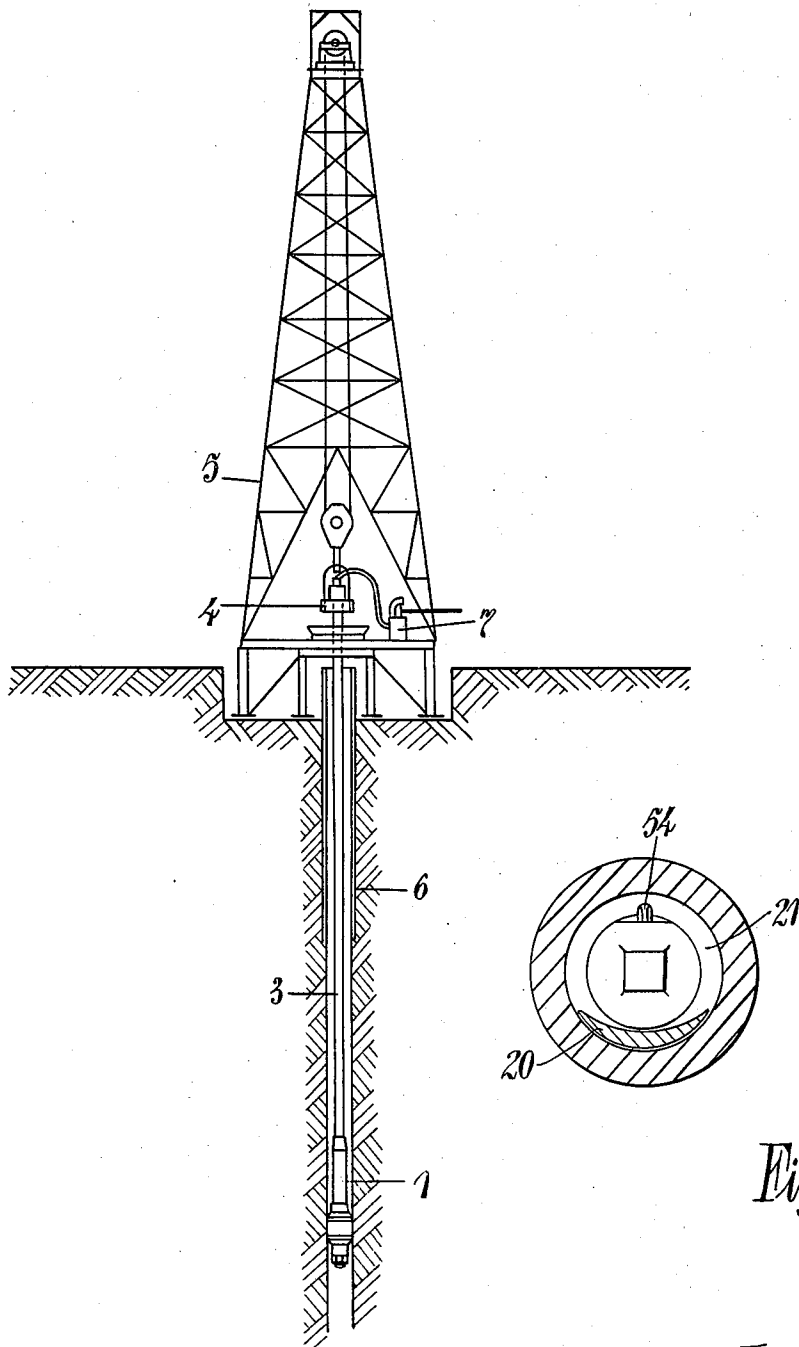


Fig. 1

Fig. 5

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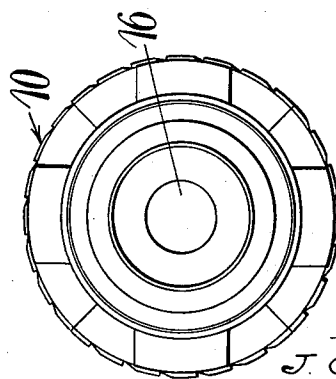
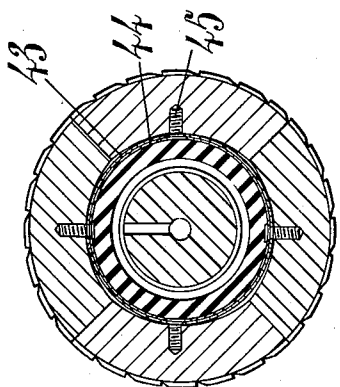
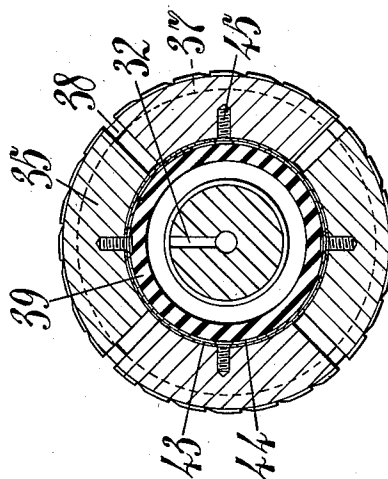
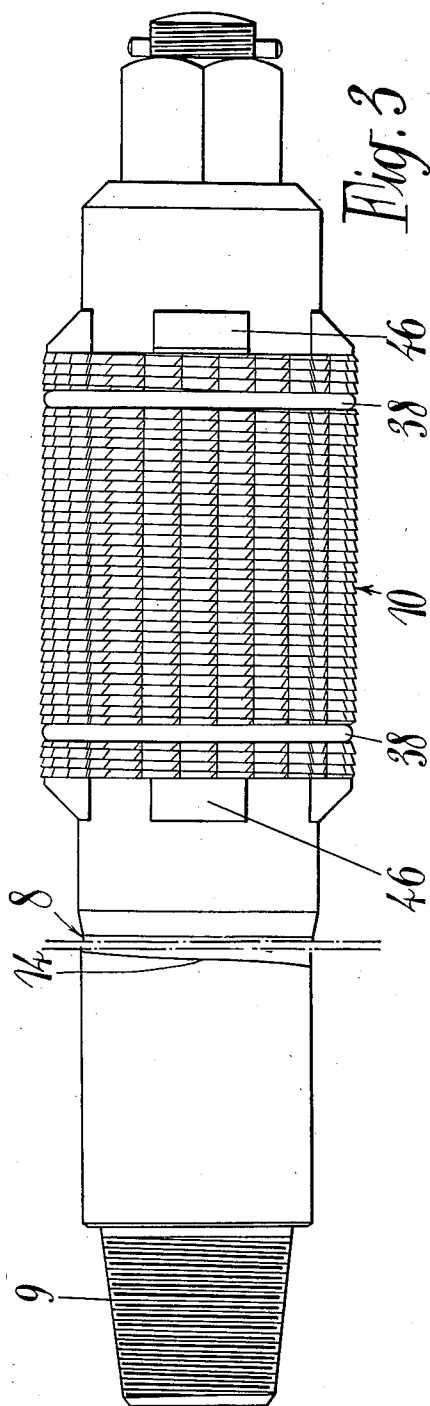
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MEANS FOR WITHDRAWING CASING FROM WELLS OR BORE HOLES

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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MEANS FOR WITHDRAWING CASING FROM
WELLS OR BOREHOLESJames Cuthill, Bramhall, England, assignor to
The Oil Well Engineering Company Limited,
Stockport, Cheshire, EnglandApplication April 7, 1939, Serial No. 266,685
In Great Britain December 19, 1938

7 Claims. (Cl. 294—93)

This invention relates to means for withdrawing casing from wells or bore holes.

The main object of the present invention is to provide an improved means or device for the purpose described above, which is more reliable in operation and is capable of being recovered under more difficult or adverse circumstances than the known forms of tool.

According to the invention a device for the purpose described comprises a body adapted to be lowered into the well or bore hole and having jaws movable into engagement with the casing by the application of fluid pressure. The fluid pressure may be supplied and controlled from the top of the well and led to the jaws through tubing or drill pipe on which the body of the device is suspended.

According to a further feature of the invention the jaws are arranged for inward and outward radial movement and movement is transmitted to the jaws through an expansible or deformable member to one side of which the fluid pressure is allowed to have access. Such expansible member may conveniently be in the form of a sleeve which is preferably formed of elastic material and the fluid pressure is admitted to the interior of the sleeve to expand the same and thereby force the jaws outwardly into engagement with the casing.

According to a further feature of the invention the sleeve is formed with internal sealing lips for retaining the pressure fluid within the sleeve. Preferably these sealing lips comprise annular portions directed inwardly from the ends of the sleeve, and adapted to engage with that portion of the body on which the sleeve is mounted and to be maintained in sealing engagement therewith by the fluid pressure which is admitted to the interior of the sleeve through passage means in the said body portion. The sleeves may be provided with portions interengaging with parts of the body portion of the device to prevent rotation of the sleeves. Elastic members, which may conveniently be in the form of endless bands encircling the jaws, may be provided for returning the jaws to their initial or withdrawn position upon relaxation of the pressure in the operating fluid.

According to a further feature of the invention a non-return valve is provided in the device for shutting off the fluid supply in such a way that the pressure applied to the jaws is maintained, and when the latter have been expanded into engagement with the casing they will not be withdrawn when the supply of pressure fluid is cut off.

Preferably means is also provided for opening the aforesaid non-return valve and releasing the jaws when desired. Such means are adapted to be controlled from the top of the well or bore

hole, and according to a further feature of the invention a valve actuating member is arranged to be brought into operation to open the valve by effecting relative rotation between two parts of the body of the device. Thus for example, the body may comprise a pair of parts in threaded engagement, and by rotating the drill pipe upon which the body is suspended, one of the said parts may be partially unscrewed from the other to effect the operation desired.

The serrations on the jaws are preferably of helical formation to facilitate disengagement thereof from the casing.

A further feature of the invention consists in the association with the jaws of spring members preferably in the form of split sleeves arranged to overlap or overlie the gaps between adjacent jaws, in conjunction with the expansible sleeve for actuating the jaws to prevent portions of the sleeve from entering the aforesaid gaps when pressure is applied to the interior of the sleeve.

One preferred mode of carrying the invention into effect will now be described, but it will be understood that this is given by way of example and to allow of better understanding of the invention, and that the details given may be widely varied. In the accompanying drawings:

Figure 1 is a diagrammatic view showing a bore hole lined with casing and a device constructed according to the present invention suspended in the bore hole;

Figure 2 is an elevation chiefly in section of a casing spear constructed in accordance with the invention;

Figure 3 is an outside elevation of the spear;

Figure 4 is a plan view looking at the upper end of the spear;

Figure 5 is a section through the spear taken on the line 5—5 in Figure 2;

Figures 6 and 7 are cross-sections on the line 6—6 in Figure 2 with the jaws in collapsed and in expanded position respectively.

In carrying the invention into effect according to one convenient mode with reference to Figure 1 of the drawings a casing spear 1 constructed as hereinafter described is adapted to be lowered into a well or bore hole 2 upon tubing or drill pipe 3 which is suspended from a swivel 4 carried by a derrick structure 5 of the usual type. The bore hole is lined with steel casing 6 and the spear is suspended within the innermost casing. A pump 7 is mounted at the head of the bore hole, conveniently on the derrick, and is connected to the tubing 3 for supplying water under pressure to the spear and effecting the operation thereof in the manner hereinafter to be described. The spear comprises an elongated cylindrical body 8 which is adapted to be lowered endwise into the hole and at its upper end has the usual tapered screw joint connection 9 for at-

tachment to the tubing or drill pipe. The slips indicated generally at 10 are arranged at the lower end of the body 8. The body consists of two separable parts 11 and 12 which are joined by a coarse threaded connection. The upper part 11 is formed as a threaded plug 13 which screws into the lower part 12, and the exterior of these two parts forms a continuous cylindrical surface as clearly shown in Figure 3. The abutting faces of these parts, i. e. the shoulder at the base of the plug part 13 and the end face of the lower body part 12, are helical as indicated at 14 in Figure 3, but include an interruption which affords abutting surfaces 15 lying in a longitudinal plane and forming a stop which prevents the plug part being screwed up beyond a certain point. This obviates any possibility of jamming the two parts together when screwing up. The plug part 11 has a central bore 16 to communicate with the tubing to which it is connected. At the lower end of the plug 13 there is a reduced threaded portion 17 upon which is screwed a collar 18 which is secured by a lock nut 19. The collar has a downward extension or horn 20 which is crescent shaped in cross-section as may be seen in Figure 5, and when the plug part 11 is rotated in the lower body part 12 this horn 20 is free to rotate around a cylindrical cavity 21 in said part for a purpose hereinafter to be described. The bore of the plug 13 is threaded internally at its lower end to receive a screwed bushing 22 carrying a wire screen or filter 23 to prevent grit and other foreign matter penetrating to the lower part of the spear.

As previously indicated the upper end of the lower body portion 12 forms an internally threaded socket for receiving the plug portion 13. Below this internal thread there is a recess which receives a hydraulic packing ring 24 the purpose of which is to prevent escape of pressure fluid between the parts. The socket chamber is continued downwardly to accommodate a valve carrying member to be described later. Below the valve carrying member the body is bored out to provide a reservoir chamber 25 for fluid to hold an amount sufficient for operating the spear and to allow for slight leakage during operation. Below this chamber portion the body is reduced in outside diameter and this reduced cylindrical portion 26 is provided with longitudinally extending splines 27 at either end. Beyond the lower set of splines 27 is a further reduced portion 28 which is threaded to receive a nut 29 which holds the slip assembly together. From the reservoir chamber 25 a narrow bore 30 leads to a point 31 about midway of the reduced cylindrical portion 26 and there joins with a transverse bore 32. A pair of collars 33 are fitted one at each end of the cylindrical part 26, these collars having internal splines engaging with the splines 27. The inwardly directed faces of the collars 33 are recessed at 34 and between the collars are the jaws 35 which have serrated outer surfaces for engagement with the casing of the bore hole. Any convenient number of jaws may be provided, but in the preferred arrangement as shown in the drawings there are four jaws which are of segmental form. The ends of these jaws have projections or lips 36 which extend into the recess 34 in the collars 33 in such a way that the jaws are permitted to move radially outwards from the centre line of the spear. The arrangement and dimensioning of the parts is such that when the jaws occupy their innermost or collapsed position as shown in Figure 6 their serrated edges

are entirely free from engagement with the steel casing of the hole. The jaws however are free to move outwardly into gripping engagement with the casing when expanded by the means later to be described. One or more annular grooves 37 are provided in the outer surfaces of the sleeves to accommodate endless bands 38 of elastic material which normally hold the jaws in collapsed position.

Between the free surfaces of the jaws 35 and the cylindrical portion 26 is an annular space and this space is occupied by a sleeve member 39 of deformable or elastic material for example rubber. The ends of said sleeve fit the cylindrical portion 26 closely and have inwardly directed annular extensions or lips 40 which lie closely against the cylindrical portion 26 and are separated from the sleeve proper by an annular space. These lips are arranged so that when fluid pressure is admitted within the sleeve the lips are forced into close contact with the cylindrical surface of the portion 26 and form a seal which prevents leakage of fluid between the ends of the sleeve and the said surface.

When fluid is admitted through the central bore 30 in the lower end of the spear it passes out through the transverse bore 32 into the interior of the elastic sleeve 39 and expands the same outwardly. The expansion of the sleeve 39 displaces the jaws 35 radially into engagement with the wall of the well casing. At the upper and lower ends respectively of the sleeve 39 there are steel rings 41 and 42 which are adapted to hold the sleeve in position on the cylindrical portion 26. The lower ring 42 is recessed into the collar 33.

To prevent portions of the sleeve 39 from being forced into the spaces between the jaws 35 when the latter move outwardly there are provided split tubular spring members 43 and 44 which are secured to the jaws by screws 45 and are disposed in two layers overlying or bridging the gaps between the jaws. The serrated edges of the jaws are cut on a helix so that if any difficulty is experienced in disengaging the jaws from the casing the spear may be rotated until the jaws free themselves from the casing by reason of the helically cut serrations.

To prevent relative rotation between the jaws and the body of the spear when the latter is rotated, each of the jaws is provided with a projection or lug 46 at either end thereof and these lugs fit into corresponding recesses in the collars 33 between which the jaws are held. These collars are themselves prevented from rotating by the splines 27 as previously described. The valve for controlling the supply of fluid to actuate the jaws is accommodated in the lower end 21 of the socket chamber formed in the body portion 12 of the spear. This chamber 21 communicates with the reservoir chamber 25 by a bore 47 of reduced diameter which is internally threaded to receive the valve casing member 48 which is screwed therein with an interposed hydraulic packing 49. The valve casing comprises a cylindrical body which lies within the socket chamber leaving a surrounding annular space. The valve body carries a radially acting valve 50 controlling a transverse bore and held to its seat by a spring 51 which bears against a screw cap 52. The transverse bore communicates with a longitudinal bore 53 leading to the reservoir chamber 25. The valve stem 54 projects into the annular space 21 surrounding the valve body. Liquid under pressure passing downwardly from the up-

per end of the spear into the said annular space will open the valve against its spring 51 and so obtain access to the reservoir chamber 25 and thence to the space within the elastic sleeve 39 for actuating the jaws.

When the jaws 35 have been engaged with the casing by the fluid pressure means, the fluid in that portion of the spear below the valve will be held under pressure by the action of the valve as a non-return valve. The fluid pressure in the upper portion of the spear above the valve and any tubing from which the spear is suspended, may then be released and as the tubing, together with the casing engaged thereby, is pulled out of the hole the various joins of the tubing may be safely uncoupled at the surface and laid aside while the remainder of the tubing within the casing is still held in suspension during the process of drawing out.

Should it be found impossible for any reason to pull the casing upwardly the valve may be opened and the jaws released. This is done by rotating the suspension tubing 3 through part of a revolution. This unscrews the upper plug portion 11 of the spear and causes this portion to rotate within the lower portion 12. In this way the inner curved surface of the horn 20 on the plug is brought into engagement with the projecting end of the valve stem 54. As clearly shown in Figure 5 the horn 20 is crescent shaped in section and engages the valve stem 54 with a wedging action thereby forcing the valve 50 off its seat and allowing the fluid which has been trapped under pressure in the lower part of the spear to escape outwardly past the valve into the annular space 21 surrounding the valve body and thence upwardly through the central hole of the spear to the surface. In this way the fluid pressure within the elastic sleeve 39 is released and the elastic bands 38 surrounding the jaws 35 cause the latter to collapse into withdrawn position (Figure 6) out of engagement with the well casing. The spear may then be pulled out of the hole and recovered.

If any difficulty is encountered in releasing the jaws the spear is rotated by rotating the tubing 3 in the usual manner and the jaws will cut themselves free by reason of the helical form of the serrations.

If when the jaws are engaged with the casing the tool is rotated such rotation will be transmitted to the casing and the latter may be uncoupled from the lower portion of the casing at a screw joint below the tool.

In the event that the spear should become immovably fixed in the bore hole the upper plug portion 11 may be readily unscrewed and removed from the hole.

I claim:

1. A device for withdrawing casing from wells or bore holes comprising a body, jaws for gripping the casing movably mounted upon the body, a sleeve of elastic material arranged within the jaws, said sleeve being formed with inwardly directed sealing lips engaging a part of the body, and means for admitting fluid pressure to the interior of the sleeve to force the jaws outwardly into engagement with the casing, the aforesaid sealing lips being maintained by the pressure in engagement with the body and thereby preventing leakage of the fluid.

2. A device for withdrawing casing from wells or bore holes comprising a body having two rela-

tively rotatable parts, jaws for gripping the casing mounted for inward and outward movement on the body, a chamber having a deformable wall arranged within the jaws, means affording access for pressure fluid to said chamber for deforming the wall thereof to force the jaws outwardly, a non-return valve controlling the admission of pressure fluid to the chamber, and means operative on relative rotation of the said parts of the body to open the non-return valve.

3. A device for withdrawing casing from wells or bore holes comprising a body having two parts in threaded engagement, jaws for gripping the casing mounted on the body for inward and outward movement, a chamber having a deformable wall arranged within the jaws, means affording access for pressure fluid to said chamber for deforming the wall thereof to force the jaws outwardly, a non-return valve controlling the admission of pressure fluid to the chamber, and means operative on relative rotation of the said threaded parts of the body to open the non-return valve.

4. A device for withdrawing casing from wells or bore holes comprising a body composed of a plug part screwed into a socket part, jaws for gripping the casing mounted for inward and outward movement on one of the parts, a chamber having a deformable wall arranged within the jaws, and means affording access for pressure fluid to said chamber for deforming the wall thereof to force the jaws outwardly, said parts having abutting faces including an interruption forming a stop which prevents the plug part from being screwed into the socket part beyond a given point.

5. A device for withdrawing casing from wells or bore holes comprising a body, jaws adapted to grip the casing mounted for inward and outward movement on the body, an expansible sleeve arranged within the jaws and forming a chamber to which fluid pressure may be admitted to force the said jaws radially outwardly into engagement with the casing, and means overlapping the gaps between the jaws when the latter move outwardly to prevent the material of the expansible sleeve from entering the said gaps.

6. A device for withdrawing casing from wells or bore holes comprising a body, jaws adapted to grip the casing mounted for inward and outward movement on the body, an expansible sleeve arranged within the jaws and forming a chamber to which fluid pressure may be admitted to force the said jaws radially outwardly into engagement with the casing, and split sleeve elements attached to the jaws and arranged to overlap the gaps formed between adjacent jaws when the latter move outwardly under the applied fluid pressure, whereby the material of the expansible sleeve is prevented from entering the said gaps.

7. A device for withdrawing casing from wells or bore holes comprising a body, jaws adapted to grip the casing and movably mounted upon the body, a sleeve of elastic material arranged within and to the rear of the jaws and capable of expansion under fluid pressure to actuate the jaws outwardly, means for affording a continuous surface of contact between the sleeve and the jaws as the latter move outwardly and means enabling fluid pressure to be admitted to the interior of the sleeve to expand the same and force the jaws into engagement with the casing.

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