Oct. 3, 1933. J. GRANT 1,928,833

CASING HEAD

Filed Sept. 20, 1929

Fig. 1.

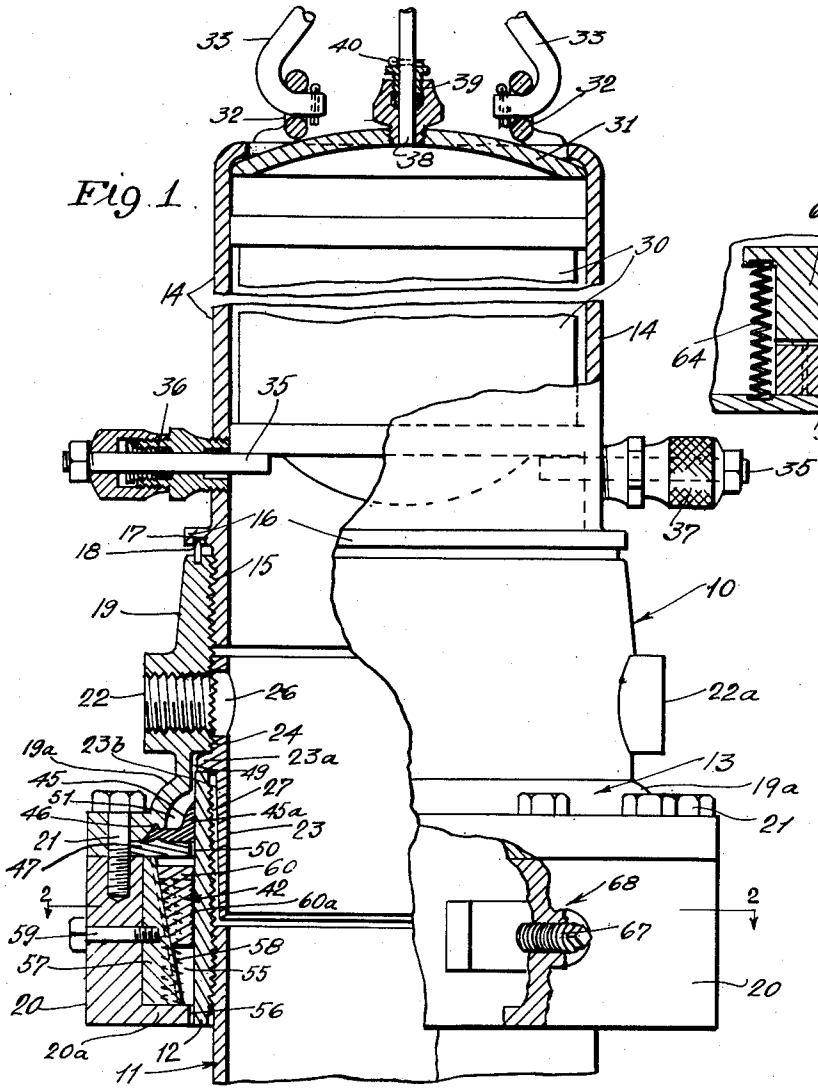


Fig. 3.

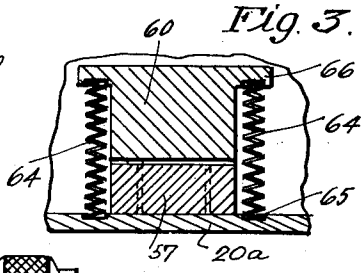
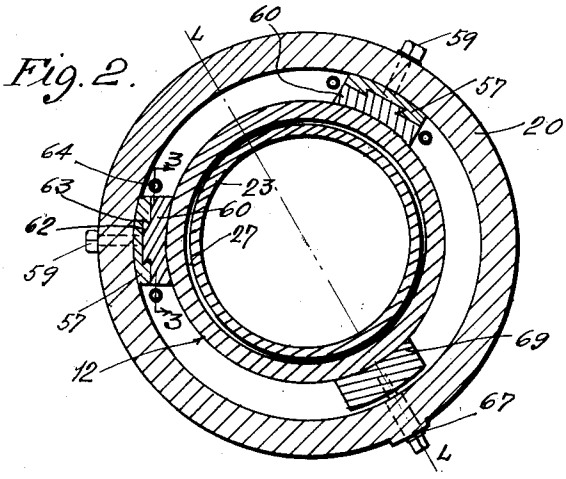


Fig. 2.



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CASING HEAD

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Application September 20, 1929
Serial No. 393,934

13 Claims. (Cl. 285—22)

This invention has reference to circulating and cementing heads for oil wells, the invention having certain general features of similarity to the type of head described in a copending application on well head, Ser. No. 393,935, filed Sept. 20, 1929, by James J. Santiago but differing characteristically in the nature and operation of the means provided for securing the head to the well casing.

Well heads of this general type may be characterized as comprising a capped body adapted to be placed over and around the end of the casing and to be removably secured thereto by gripping elements which are brought by wedge action into gripping engagement with the outside of the casing to prevent upward relative movement of the head. In the referred copending application, the gripping elements comprise a plurality of relatively vertically movable balls arranged circumferentially within the body of the head, and adapted to coact with inclined wedge faces in the body to become wedged between said faces and the casing, thereby preventing upward movement of the head.

It is a general purpose of my invention to provide means for securing circulating and cementing heads to the casing, and particularly in heads where attachment is made to the outside of the casing, by the use of wedge slips mounted in the head and movable vertically relative thereto, the slips being caused to be brought by wedge action into gripping engagement with the outside of the casing. In the operation of applying the head to the casing, the head is lowered to position thereon with the slips in their raised or releasing positions. By movement of the head on the casing as will be described, the slips thereafter are brought into engagement with the casing, and into such positions that upward movement of the head results in the slips becoming wedged between the casing and suitable wedge members carried on the head. Although the slips initially may be brought into engagement with the casing in various ways, for instance by lowering them radially inward against the body carried wedges, it is preferred that this be accomplished by bodily lateral movement of the head, the slips being arranged in such positions as to cause their being brought into engagement with the casing by such movement. To release the slips from the casing and to permit removal of the head, a similar operation is followed, the head being moved laterally relative to the casing in a reverse direction to permit the slips to be automatically raised to their releasing positions. As a preferred and typical embodiment of the invention, it is hereinafter described as applied to a plug carrying type of head, certain parts of which are similar to the form of head described in the referred copending application No. 393,935.

The above characteristics of the invention and numerous additional features will be understood more clearly and discussed to best advantage in the following detailed description of a typical and preferred embodiment of the invention, reference being had to the accompanying drawing, in which:

Fig. 1 is a detailed view showing the circulating head on the well casing, certain parts being shown broken away in section to illustrate the construction most clearly;

Fig. 2 is a reduced horizontal section on line 2—2 of Fig. 1; and

Fig. 3 is a fragmentary enlarged section on line 3—3 of Fig. 2, showing one of the slips and its supporting springs.

Referring first to Fig. 1, the circulating head generally indicated at 10 is shown attached to the upper end of the well casing 11, preferably though not necessarily to the usual pipe collar 12 on the casing. The head may be characterized generally as comprising a body portion 13 and a cap 14, in the present instance of the plug carrying type, threaded at 15 into the upper end of the body. The joint between the cap and body may be rendered fluid tight by forming an annular flange 16 on the lower end of the cap and within which a ring gasket 17 is carried, the annular knife edge 18 on the upper end of the body being seated against the gasket when the joint is taken up. The body portion 13 of the head preferably is formed in two sections, the upper section 19 having an outwardly spreading and depending skirt portion 19*a*, and the lower section comprising a supporting ring 20 secured by screws 21 to the upper section and serving, in one sense, as a lower extension or continuation of the upper skirt portion 19*a*. The usual circulating fluid or cement inlets 22, 22*a*, are provided in the upper body section, and preferably below the lower end of the cap.

An inner depending skirt 23 is threaded at 24 into the lower interior of the body section 19, the skirt having an annular flange 23*a* adapted to rest on the upper end of the collar 12 when the head is in position thereon. In order to provide a sufficient threaded length of the skirt for connection with the body, openings 26 are formed in the skirt and brought into registration with the

body inlets 22 and 22*a*. The outer surface 23*b* of the skirt 23 may be tapered at substantially the same degree as the taper of the threads within the collar, the external diameter of the skirt however, being somewhat less than the internal diameter of the collar to provide an annular space 27 therebetween to permit a certain desired amount of lateral movement of the head relative to the pipe, reasons for which appear hereinafter. Although by virtue of its spacing from the collar the skirt 23 permits some lateral movement of the head, it also serves as a means for centering the head on the pipe within the limits of its lateral movement.

The head may be provided with any suitable cap or closure for its upper end, although I prefer to construct the cap with sufficient length to contain a releasable plug 30, which may be of any suitable size and shape, for lowering within the casing in carrying out well cementing operations. In the form shown, a closure 31 is provided for the upper end of the cap, the latter having integral eyelets 32 within which are inserted the bails 33 by means of which the circulating head is raised or lowered from position on the pipe. The outer diameter of the typical form of plug shown may be substantially equal to the internal diameter of the cap and skirt 23, which in turn may be substantially equal to, or slightly less than the internal diameter of the casing 11. The plug is releasably supported in the cap by means of pins or stops 35 extending through packing glands 36, the stops carrying the knurled caps 37 on their outer ends and the caps normally being threaded on the packing glands. Caps 37 may be unscrewed when it is desired to pull the stops outward to release the plug and to permit its lowering into the casing. In case the plug should tend to lodge within the cap, it may be forced downward by means of a push rod 38 extending through packing gland 39 in the upper end closure 31 of the cap, the rod normally being prevented from dropping within the cap by means of a cotter key 40. It will be noted that by virtue of skirt 23 depending within the collar, a smooth internal surface is provided below the cap, thereby precluding any possibility of the plug becoming lodged due to irregularities within the head or within the pipe collar.

Fluid leakage between the circulating head and the well pipe is prevented by means of the pressure actuated packing ring 45 clamped against the lower end of the upper body section skirt portion 19*a*, and confined near its outer periphery withn an annular recess 46 formed therein in the skirt, by means of a clamping ring 47 held between the body sections as illustrated. It will be noted that the interior of the body section 19 and the inner periphery of the wedge ring 47 are spaced from the collar 12 as at 49 and 50, respectively, to permit the desired amount of lateral movement of the head relative to the pipe, reference to which is previously made. Also the skirt 19*a* of the upper body section has a suitable amount of clearance at 51 from the collar. The packing ring 45 has an inner annular upstanding lip portion 45*a* which is adapted to be forced by fluid pressure on its outer surface, into engagement with the casing. The well fluid, gas or liquid, within the casing being under pressure, a certain amount of fluid leakage may occur around the upper end of the collar when the head is resting thereon, and obviously when the head is raised. The leakage of well fluid between the head and the outside of the casing however is prevented by the lip portion of the packing ring being forced into engagement with the casing by pressure applied thereto by way of spaces 27, 49 and 51.

Upward movement of the head from its adjusted position on the casing is prevented by pipe gripping means generally indicated at 42 and carried within the lower annular body section 20, the gripping means preferably comprising a plurality of wedge slips adapted to be brought into gripping engagement with the casing upon relative upward movement of the head. It will be understood that although I have shown a certain preferred arrangement and number of the wedge slips, the invention in its broader aspects is not to be considered as necessarily limited to this precise embodiment, the present arrangement of the slips and their adjusting means however being preferred due to their simplicity of construction and ease of adjustment.

The lower body ring 20 is interiorly spaced at 55 from the pipe collar, and has radially inward projecting bottom flange 20*a* spaced at 56 from the collar to allow the described lateral movement of the head relative thereto. Mounted at circumferentially spaced positions within the ring is a pair of wedge members 57 having downwardly and inwardly inclined wedge faces 58, the wedges resting on flange 20*a* and being held in place by screws 59. A pair of relatively vertically movable wedge slips 60 having the usual pipe gripping teeth 60*a* on their inner face, is provided to coact with the wedges 57 and to be brought into gripping engagement with the collar in order to secure the head thereto. The slips are confined for vertical movement against their respective wedges by means of dovetail splines 62 on their outer faces fitted within grooves 63 in the wedges. Relative downward movement of the slips is resisted by means of springs 64 seated at their lower end in flange 20*a* as at 65, and terminating at their upper ends against shoulders 66 formed on the slips. It will be noted that the slips are relatively spaced circumferentially within one-half the inner periphery of the ring 20, or the body skirt, in order that both slips may be brought into engagement with the casing by lateral movement of the head in one direction, the angular spacing of the slips within the ring preferably being about 120 degrees. With the head in centered position on the pipe, and with the slips in their uppermost positions, the gripping faces of the slips are spaced slightly from the pipe, the spacing however being less than the extent of lateral movement of which the head is capable by virtue of the spacing of skirt 23 from the collar at 27, and the spacing of ring 47 and flange 20*a* at 50 and 56 respectively. In order to bring the slips into engagement with the pipe, the head is shifted bodily thereon and in a direction whereby the slips are caused to bear evenly against the pipe. As a typical and simple means for causing such bodily movement of the head, there is provided an adjustable take-up generally indicated at 68, and by means of which the head may be moved relative to the pipe in the direction of line L, drawn through the axial center of the head and bisecting the angular distance between the slips, thereby enabling the latter to be caused to evenly engage and disengage the collar. The take-up 68 comprises an adjustment or setscrew 67 threaded radially on line L through ring 20, and carrying on its inner end a segmental cylindrical block or abutment 69 which is brought to bear against the outer surface of the pipe collar. Obviously by simple adjustments of screw

67, the abutment may be brought to bear against the pipe to move the head so as to bring the slips into engagement with the pipe, and likewise the abutment may be loosened from the pipe to release the slips from engagement therewith.

In applying the circulating head to the pipe, the latter is lowered to a central position thereon, this positioning of the head being permitted due to the slips being retained in their uppermost positions by the action of springs 64. Thereafter, screw 67 is adjusted to move the head laterally and to bring the slips into engagement with the pipe. Subsequent upward movement of the head, whether it be mechanically raised or forced upward by pressure within the casing, is resisted due to the slips becoming wedged between the pipe and the wedge members 57, the slips being moved relatively downward against the resistance of springs 64 to a position below that illustrated in Fig. 1. To remove the head from the casing, screw 67 is adjusted so as to release the slips from engagement with the pipe and to permit their being returned to their upper or pipe releasing positions by the action springs 64. It may be mentioned that other means may be employed for raising the slips to releasing positions to permit removal of the head from the casing, the use of means of the character described being preferred however due to the fact that the slips are automatically released from the pipe upon loosening of the take-up adjustment, and without the necessity for manual manipulation.

It will be understood the drawings and description are to be considered merely as illustrative of and not restrictive on the broader claims appended hereto, for various changes in design, structure and arrangement may be made without departing from the spirit and scope of said claims.

I claim:—

1. A circulating head for well pipe, comprising a capped body adapted to be placed over and around the upper end of the pipe, relatively vertically movable pipe gripping means mounted on the body and adapted to engage the outside of the pipe to prevent upward movement of the head, yielding means resisting downward movement of said pipe gripping means relative to the body, and fluid pressure actuated packing means between the body and the outside of the pipe, said packing being forced into pressural engagement with the pipe independently of relative movement between said gripping means and the body by fluid pressure communicated to the packing from the pipe.

2. A circulating head for well pipe, comprising a capped body adapted to be placed over and around the upper end of the pipe, a plurality of relatively vertically movable and circumferentially spaced wedge slips mounted within the body and adapted to grip the pipe to prevent upward relative movement of the head, and means carried on the body and independent of said slips for adjusting said body laterally on the pipe.

3. A circulating head for well pipe, comprising a body having a depending skirt adapted to be placed over and around the upper end of a well pipe, a removable wedge ring carried within said skirt, relatively vertically movable wedge slips coacting with said wedge ring to engage and grip the pipe upon upward movement of the head, packing means between said body and the pipe, and means supporting said packing within the body independently of said wedge means.

4. A circulating head for well pipe, comprising a body having a depending skirt adapted to be placed over and around the upper end of a well pipe, wedge means within said skirt, relatively vertically movable wedge slips coacting with said wedge means to engage and grip the pipe upon upward movement of the head, a packing clamp ring above said wedge means, and a packing ring carried in the body above said clamping ring and in engagement therewith.

5. A circulating head for well pipe, comprising a body having a depending skirt adapted to be placed over and around the upper end of a well pipe, a wedge ring carried within said skirt, relatively vertically movable wedge slips coacting with said wedge ring to engage and grip the pipe upon upward movement of the head, means for raising said slips relative to the body, and a fluid pressure actuated packing ring within the body above said slips, said packing being forced into pressural engagement with the pipe independently of relative movement between said wedge slips and the body by fluid pressure communicated to the packing from the pipe.

6. A circulating head for wells, comprising a body adapted to be placed over and around the upper end of a well pipe, said body being laterally movable relative to the pipe, a relatively vertically movable wedge slip mounted on the body and normally spaced from the pipe, and adjustable means on said body for moving the head and said slip laterally relative to the pipe, whereby said wedge slip is brought into engagement with the pipe to prevent upward movement of the head.

7. A circulating head for wells, comprising a body having a depending skirt adapted to be placed over and around the upper end of a well pipe, said body being laterally movable relative to the pipe, wedge means within said skirt, a relatively vertically movable wedge slip mounted within the skirt and spaced from the pipe in work releasing position, said slip being adapted to coact with said wedge means to prevent upward movement of the head on the pipe, and adjustable means on the skirt and circumferentially spaced from said slip, operable to move the head laterally on the pipe to bring said wedge slip into engagement therewith.

8. A circulating head for wells, comprising a body having a depending skirt adapted to be placed over and around the upper end of a well pipe, said body being laterally movable relative to the pipe, wedge means within said skirt, a relatively vertically movable wedge slip mounted within the skirt and spaced from the pipe in work releasing position, said slip being adapted to coact with said wedge means to prevent upward movement of the head on the pipe, a tubular apron carried on said head and depending within the upper end of said pipe, and adjustable means on the skirt and circumferentially spaced from said slip, operable to move the head laterally on the pipe to bring said wedge slip into engagement therewith.

9. A circulating head for wells, comprising a body having a depending skirt adapted to be placed over and around the upper end of a well pipe, said body being laterally movable relative to the pipe, wedge means within said skirt, a pair of relatively vertically movable wedge slips mounted within the skirt and adapted to coact with said wedge means to prevent upward movement of the head on the pipe, said slips being relatively spaced circumferentially within one half the inner periphery of said skirt and spaced from the pipe in their work releasing positions,

and adjustable means within the other inner peripheral half of the skirt and adapted to engage the pipe to move the head laterally and to bring said wedge slips into engagement with the pipe.

10. A circulating head for well pipe, comprising a body adapted to be placed over and around the upper end of the pipe, said body comprising an upper and a lower section, wedge means carried within said lower section, relatively vertically movable wedge slips coacting with said wedge means to engage and grip the pipe upon upward movement of the head, a clamping ring confined between said body sections, and a packing ring clamped between said ring and the upper body section.

11. A circulating head for well pipe, comprising a body adapted to be placed over and around the upper end of the pipe, said body comprising an upper and a lower section, wedge means carried within said lower section, relatively vertically movable wedge slips coacting with said wedge means to engage and grip the pipe upon upward movement of the head, a clamping ring confined between said body sections, a packing ring clamped between said ring and the upper body section, and a tubular apron carried on said upper section and depending within the upper end of said pipe.

12. A circulating head for well pipe, comprising a capped body adapted to be placed over and around the upper end of the pipe, a relatively vertically movable wedge slip mounted on the body and adapted to engage the outside of the pipe to prevent upward movement of the head, a tubular apron carried on said body and depending within the upper end of the well pipe, a packing ring between said body and the pipe, and means for supporting said packing within the body independently of said wedge slips.

13. A circulating head for well pipe, comprising a capped body adapted to be placed over and around the upper end of the pipe, a plurality of relatively vertically movable and circumferentially spaced wedge slips mounted within the body and adapted to grip the pipe to prevent upward movement of the head, and fluid pressure actuated packing means within the body above said slips, and a ring below said packing and directly above said wedge slips, for clamping the packing within the body.

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