

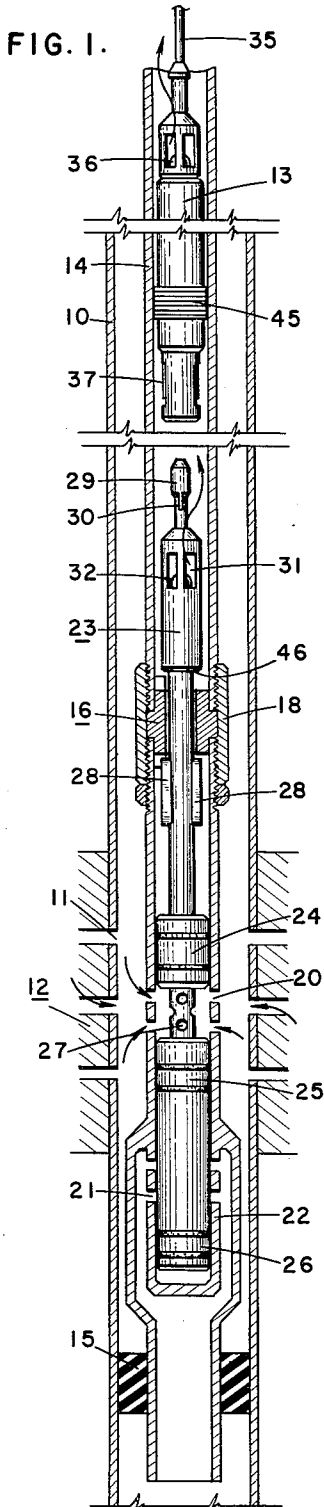
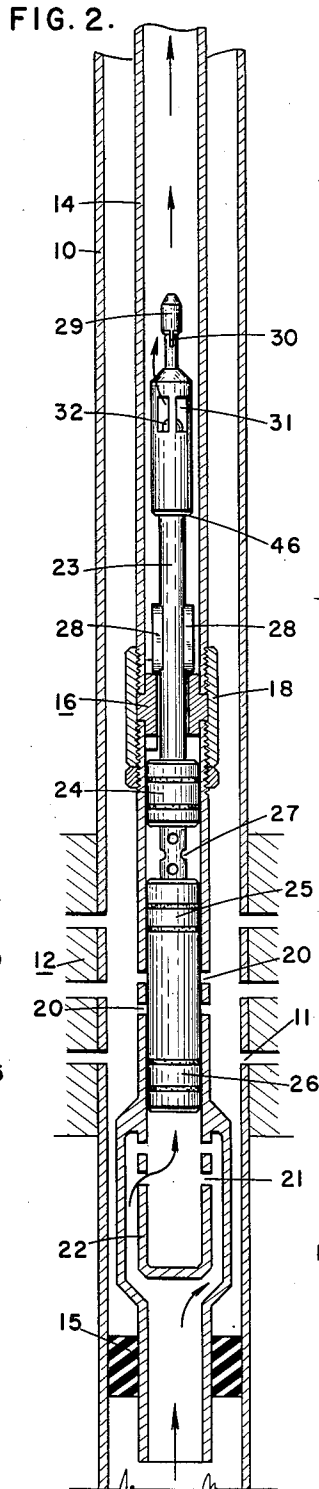
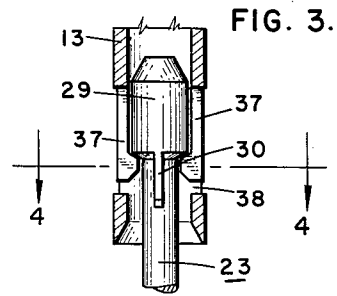
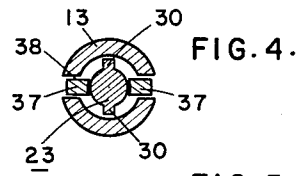
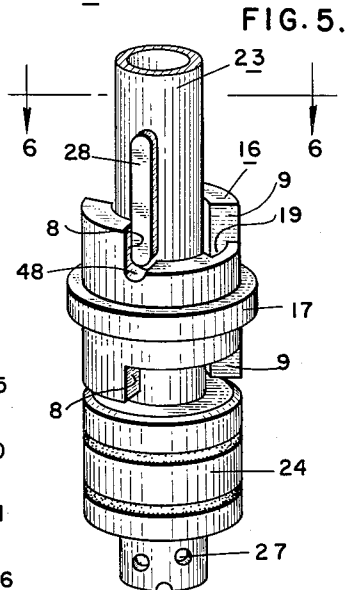
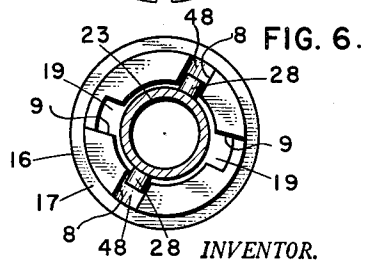
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G. O. HOWARD

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ZONE SELECTOR FOR WELLS

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INVENTOR.
GLENN O. HOWARD,
BY *John S. Schneider*
ATTORNEY.

1

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ZONE SELECTOR FOR WELLS

Glenn O. Howard, Hawkins, Tex., assignor, by mesne assignments, to Jersey Production Research Company, Tulsa, Okla., a corporation of Delaware
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This invention relates to pumping wells and, in particular, it relates to apparatus for selecting for pumping either zone of a dually completed well.

The zone selector apparatus permits changing from one zone to another zone of a dual completion so that each zone may be produced by the maximum bore pump for any particular tubing size. A maximum bore tubing pump is desirable because larger fluid volumes can be lifted. Two zone pumps, in some instances, do not handle sufficient fluid from either zone to produce the full field allowable. However, full field allowable can be produced from either zone when one of the zones is pumped separately by a conventional tubing pump. The zone to be pumped is selected in accordance with the apparatus of the invention by manipulating the sucker rod string; the pumping unit being used to motivate the sucker rods.

Briefly, the invention comprises a longitudinally movable zone selector which in one position fluidly communicates a pump and the upper zone and seals off fluid communication between the pump and the lower zone and in another position fluidly communicates the pump and the lower zone and seals off fluid communication between the pump and the upper zone. The zone selector is also rotatable and means are provided for locking the zone selector in either of its positions by rotation thereof. The sucker rod string is utilized to move and to rotate the zone selector.

Thus, an object of the present invention is to provide an improved sucker rod operated zone selector for dual pumping wells.

This and other objects and advantages of the invention will be apparent from a description of the invention taken in conjunction with the drawings wherein:

FIG. 1 is a sectional view of a borehole showing the apparatus of the invention arranged therein in one position;

FIG. 2 is a view similar to that shown in FIG. 1, except the apparatus is shown in a different position;

FIG. 3 is an enlarged sectional view illustrating the connection between the pump plunger and the zone selector;

FIG. 4 is a view taken on lines 4-4 of FIG. 3;

FIG. 5 is an enlarged isometric view of a portion of the working barrel and the zone selector extending there-through; and

FIG. 6 is a view taken on lines 6-6 of FIG. 5.

Referring to the drawings in greater detail, in FIGS. 1 and 2 is shown a casing 10 perforated as at 11 adjacent an upper formation or zone 12. A tubular member 14 which functions as the working barrel for a pump plunger 13 is arranged in casing 10. A tubing-casing type packer 15 closes off the annulus between tubular member 14 and casing 10 adjacent the lower end of tubular member 14. Tubular member 14 is provided with a guide bushing 16. As seen in greater detail in FIGS. 5 and 6, guide bushing 16 includes a flange 17 adapted to be arranged in a recess in a collar 18 of tubular member 14 and two guide slots 19 extending longitudinally along the interior surface of guide bushing 16. Tubular member 14 is provided with upper ports 20 adjacent perforations 11 and lower ports 21 provided in a closed off portion 22 of tubular member 14.

A hollow zone selector 23 is movably arranged in tubu-

2

lar member 14 and extends through guide bushing 16. Adjacent the lower end of zone selector 23 spaced-apart sealing members 24, 25, and 26 are provided. The sealing elements, which may be O-rings, on these members seal off the spaces between zone selector 23 and the interior of tubular member 14 adjacent these members. Perforations 27 are provided on zone selector 23 between sealing members 24 and 25. Two locking lugs 28 are positioned on zone selector 23 adjacent guide bushing 16. A fishing head 29 is provided on the upper end of zone selector 23 and a lug 30 is arranged below and adjacent to the fishing head. Zone selector 23 is open at its lower end and provided with openings 31 adjacent its upper end. A standing valve 32 is also arranged on zone selector 23 adjacent the upper end thereof.

In FIG. 1 is shown arranged above zone selector 23 a sucker rod string 35 to which is connected pump plunger 13 provided with a traveling valve 36. As seen more clearly in FIG. 3, the lower end of pump plunger 13 is provided with leaf spring latches 37 which releasably engage fishing head 29 of zone selector 23. As seen more clearly in FIG. 4, leaf spring latches 37 are normally retained retracted in recesses 38 formed in pump plunger 13. Pump plunger 13 also is provided with sealing means 45 for sealing off the space between pump plunger 13 and tubular member 14.

In FIG. 1 zone selector 23 is in its down position in which position upper zone 12 is selected for pumping. Zone 12 fluidly communicates with pump plunger 13 via perforations or openings 11, 20, 27, and 31 and the lower zone, not shown, is sealed off from fluid communication with pump plunger 13 by means of sealing members 25 and 26 and packer 15. Upward movement of zone selector 23 is prevented by engagement of the upper end of lugs 28 and the lower surface of guide bushing 16. Downward movement of zone selector 23 is prevented by the closed portion 22 of tubular member 14 or by engagement of a shoulder 46 and the upper surface of guide bushing 16.

In FIG. 2 zone selector 23 is in its up position in which position upper zone 12 is sealed off from fluid communication with pump plunger 13 by means of sealing members 25 and 26 and packer 15 and the lower zone fluidly communicates with pump plunger 13 via perforations or openings 21 and 31. When in this position, upward movement of zone selector 23 is prevented by engagement of the upper surface of sealing member 24 and the lower surface of guide bushing 16 and downward movement of zone selector 23 is prevented by engagement of the lower end of lugs 28 by locking recesses 48 located in the upper surface of guide bushing 16.

In operation, when it is desired to change zones, sucker rod string 35 is manipulated from the surface and moved downwardly until leaf spring latches 37 latch onto fishing head 29, as seen clearly in FIG. 3. Then, assuming that zone selector 23 is in the down position, as seen in FIG. 1, sucker rod string 35 is rotated to the left or counterclockwise until leaf spring latches 37 engage lug 30. Upon engagement thereof, zone selector 23 is rotated counterclockwise until lugs 28 are aligned with guide slots 19 in guide bushing 16. Then, sucker rod 35 and the attached zone selector 23 are raised until the lower end of lugs 28 are positioned above guide bushing 16. Sucker rod 35 then is rotated clockwise, which, in turn, rotates zone selector 23 until lugs 28 are out of alignment with guide slots 19 and in position for locking recesses 48. Surfaces 8 and 9, formed on guide bushing 16, act as stops for locating lugs 28 in their rotative positions. Since guide bushing 16 acts as a stop to prevent upward movement of zone selector 23, as previously explained, pump plunger 13 is disconnected from fishing head 29 by pulling up on sucker rod

3

string 35. Thus, the zone selector by this operation has shifted production from the upper zone 12 to the lower zone. The reverse operation of switching from the lower zone to the upper zone is accomplished in a similar manner except zone selector 23 is rotated counterclockwise and is moved downwardly once lugs 28 are aligned with guide slots 19 by lowering sucker rod string 35 until the upper end of lugs 28 are below the lower surface of guiding bushing 16. Then, after rotation of zone selector 23 clockwise, it is "locked" in the down position because guide bushing 16 engages and prevents upward movement of lug 28.

Having fully described the apparatus, nature, and objects of my invention, I claim:

1. Apparatus for selecting for pumping upper or lower productive zones of a dual-pumping well having arranged therein a casing perforated adjacent said zones to fluidly communicate each of said zones and the interior of said well casing comprising a tubular member provided with upper and lower spaced-apart openings arranged in said casing and forming an annulus therebetween; packer means arranged on said tubular member adapted to close off said annulus between said upper and said lower zones; a hollow zone selector member slidably arranged in said tubular member for movement between upper and lower positions and provided with spaced-apart upper, intermediate, and lower openings fluidly communicating with the interior thereof, said intermediate openings being adjacent said tubular member upper openings when said zone selector member is in its lower position; first sealing means arranged on said zone selector member adapted to close off space between said zone selector member and said tubular member above said tubular member upper openings when said zone selector member is in its upper or lower positions; second sealing means arranged on said zone selector member adapted to close off the space between said zone selector member and said tubular member above said tubular member upper openings when said zone selector member is in its upper position and adapted to close off the space between said zone selector member and said tubular member between said tubular member upper and lower openings when said zone selector member is in its lower position; and third sealing means arranged on said zone selector member adapted to close off the space between said zone selector member and said tubular member between said tubular member upper and lower openings when said zone selector member is in its upper position and below said tubular member lower openings when said zone selector member is in its lower position, and means arranged in said tubular member above said tubular member upper openings and cooperating means arranged on said zone selector member above said first sealing means and below said upper openings adapted to lock said zone selector member in either its upper or lower positions whereby when it is desired to pump said upper zone, said zone selector member is locked in its lower position, in which position production fluids from the upper zone flow through said tubular member upper openings, through said zone selector member intermediate openings, and through said zone selector member upper openings into said tubular member, said tubular member lower openings being closed off between said second and third sealing means, and when it is desired to pump said lower zone, said zone selector member is locked in its upper position, in which position production fluids from the lower zone flow through said tubular member lower openings, through said zone selector member lower openings, and through said zone selector member

4

upper openings into said tubular member, said tubular member upper openings being closed off between said second and third sealing means.

2. Apparatus as recited in claim 1 wherein said cooperating locking means arranged in said tubular member includes a guide bushing provided with at least one longitudinally extending groove and said cooperating locking means arranged on said zone selector member includes a lug movable through said guide bushing groove.

3. Apparatus as recited in claim 2 including means lowerable in said tubular member adapted to engage and move said zone selector member from said first to said second position and vice versa.

4. Apparatus as recited in claim 3 wherein said zone selector member moving means includes a sucker rod string.

5. Apparatus for selecting for pumping an upper or a lower productive zone of a dual pumping well having a casing perforated adjacent said zones to fluidly communicate each of said zones and the interior of said well casing comprising a tubular member provided with upper and lower spaced-apart openings arranged in said casing and forming an annulus therebetween; packer means arranged on said tubular member adapted to close off said annulus between said upper and lower zones; a hollow zone selector means slidably arranged in said tubular member for movement between upper and lower positions and having upper, intermediate, and lower openings fluidly communicating with the interior thereof, said intermediate openings being adjacent said tubular member upper openings when said zone selector means is in its lower position; sealing means arranged on said zone selector means above and below said zone selector means intermediate openings in a manner such that said lower zone is sealed off and said upper zone fluidly communicates with said tubular member above said zone selector means through said tubular member upper openings, said zone selector means intermediate openings, and said zone selector means upper openings when said zone selector means is in its lower position, and said upper zone is sealed off and said lower zone fluidly communicates said tubular member above said zone selector means through said tubular member lower openings, said zone selector means lower openings, and said zone selector means upper openings when said zone selector means is in an upper position; and means arranged in said tubular member and means arranged on said zone selector means cooperating to lock said zone selector means in its upper and lower positions.

6. Apparatus as recited in claim 5 including means lowerable through said tubular member to engage said zone selector means adapted to move said zone selector means from its upper to its lower position and vice versa.

7. Apparatus as recited in claim 6 wherein said zone selector means movable means includes a sucker rod string.

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