

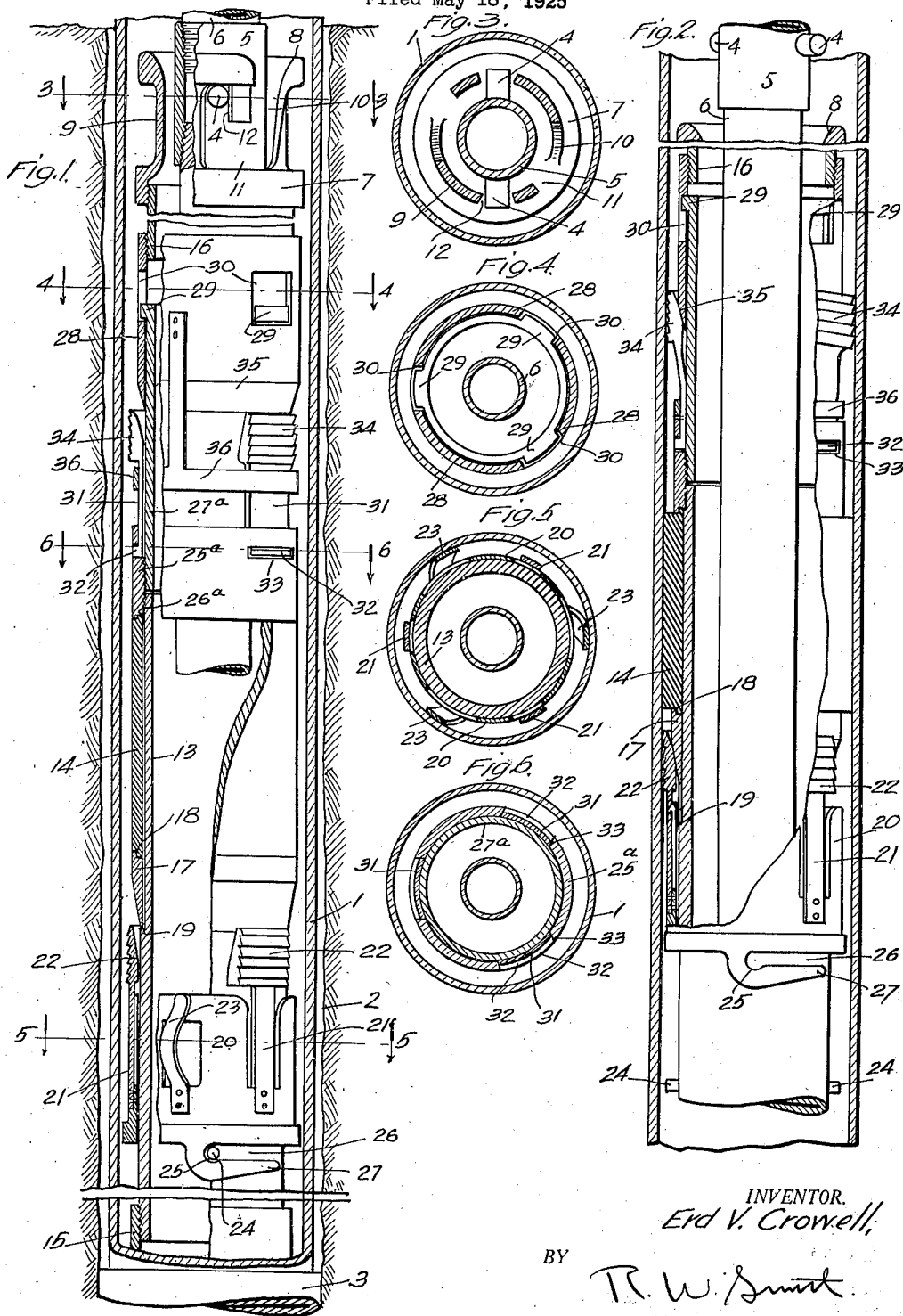
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CASING EXTENSION

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CASING EXTENSION.

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This invention is an extension for the casing of an oil and gas well adapted to extend into the oil sand below the standard casing, with a tight packing between the extension and the standard casing, so that gas cannot escape directly through the casing but is constrained to flow through the oil and thence into the casing extension for exerting an expulsive force in driving the oil from the sand into the well bore and lifting the oil from the bottom of the bore to the surface of the ground.

It is the object of the invention to provide a casing extension which may be introduced into the bore of the well after the standard casing has been lowered therein, and which is positively held against axial displacement in either direction while susceptible to ready removal when so desired.

It is a further object of the invention to provide for lowering the casing extension into the well by a string of tubing which may be then left in the well for use as a conduit for the discharge of the fluid in accordance with standard practice.

Further objects of the invention will be readily understood from the following description of the accompanying drawings, in which:

Fig. 1 is a vertical section through the bore of a well, showing the casing extension in inoperative position as it is being lowered into the standard casing.

Fig. 2 is a similar view showing the casing extension in place in the well.

Figs. 3, 4, 5, and 6 are transverse sections on the lines indicated in Fig. 1.

Casing 1 of standard construction extends downwardly in the well bore 2 with a casing shoe 3 at its lower end below the water stratum and above the oil sand and preferably resting upon the cap rock (not shown).

The extension for the standard casing includes a connection whereby it is lowered into the casing by means of the usual well tubing, and packing means below said connection adapted to form a tight packing between the casing and its extension when the latter is in place, with a pipe depending from the packing into the oil sand below the casing shoe, and locking means on the packing

structure for holding the parts against axial displacement in either direction until such time as it is desired to withdraw the casing extension from the well.

The means for lowering the casing extension by the usual string of well tubing comprises gudgeons 4 projecting from opposite sides of a coupling collar 5 of the string of tubing 6, and a cage 9 connected at its lower end 7 to the casing extension and having a bell mouth 8 at its upper end.

Slots 10 for the passage of the gudgeons 4 open downwardly from the upper end of the cage and terminate in circumferential slots 11 which are recessed at their upper sides in spaced relation from slots 10 as shown at 12.

In lowering the casing extension into the well it is mounted on the string of tubing 6 with cage 9 turned so that gudgeons 4 move through slots 10 and 11 and seat in recesses 12. The weight of the casing extension is thus carried by the string of tubing and may be lowered to the desired level and fixed against axial displacement as herein-after described. The string of tubing is then lowered slightly to disengage gudgeons 4 from recesses 12, and the string of tubing is turned to move the gudgeons through slots 11 and into slots 10, so that the tubing may then be raised relative to the fixed casing extension, to clear coupling 5 from cage 9 and position the tubing at the desired level as shown in Fig. 2.

The packer for the casing extension comprises a shell 13 with a packing rubber 14 mounted thereon, and the pipe 15 which extends below the casing 1 into the oil sand depending from the shell. A slip construction adapted to engage casing 1 and hold the casing extension against downward movement is mounted on the packer shell between rubber 14 and pipe 15; and a second slip construction for engaging the casing to prevent upward movement of the casing extension is positioned between rubber 14 and a connecting pipe 16 which extends upwardly to the cage 9.

The slip structure below the packing rubber comprises a sleeve 17 slidable on shell 13 and recessed at its upper end as shown at 18

for abutment of the rubber 14. The sleeve tapers downwardly to form a wedge, and its downward movement on shell 13 is limited by its abutment against a shoulder 19 formed thereon.

A slip support 20 is slidable on shell 13 below the wedge, and slips 21 extending upwardly from the support and provided with teeth 22 are expanded for engaging the wall of casing 1 by movement of wedge 17 downwardly in back of the slips.

Outwardly bowed springs 23, fixed at one end to the slip support, are adapted to frictionally engage the wall of casing 1 so as to tend to hold the slip support against axial displacement; and a locking engagement between the slip support and shell 13 provides for either dependent axial movement of these parts against the holding tendency of the springs, or sliding movement of the shell through the slip support when the locking engagement is released.

The releasable locking engagement preferably comprises gudgeons 24 projecting from shell 13, and adapted either for engagement in the recessed ends 25 of circumferential slots 26 formed by hooks 27 depending from the slip support, or adapted for disengagement from said slots by turning shell 13 relative to the slip support held by its spring 23, to permit lowering of the packer shell relative to the slip support.

The slip structure above packing rubber 14 comprises a slip support 25^a extending upwardly from shell 13 and recessed at its lower end as shown at 26^a to form an abutment for the upper end of the rubber. A sleeve 27^a is fixed to and projects upwardly from the slip support, with a sleeve 28 slidably mounted on the upper end of sleeve 27^a and limited in its relative axial and turning movement by lugs 29 on sleeve 27^a received in elongated slots 30 in sleeve 28. The sleeve 28 is connected to the pipe 16 which extends upwardly to the cage 9.

Slips 31 are positioned between the slip support 25^a and sleeve 27^a, with their lower ends forming lugs 32 received in slots 33 in the slip support, and their upper ends forming teeth 34 which normally lie below a tapering wedge 35 formed at the lower end of sleeve 28. The slips are expanded for engaging the wall of casing 1 by movement of wedge 35 downwardly in back of the same when sleeve 28 is lowered relative to the slip support. An annulus 36 depends from sleeve 28 and is received over the slips so that elevation of sleeve 28 relative to the slip support will not only disengage wedge 35 to permit contraction of the slips, but will positively contact the slips by the movement of the annulus along the same.

The teeth of slips 21 and 31 extend in opposite directions as shown in Fig. 1, so that engagement of the respective slips with the

wall of the casing will hold the casing extension against axial movement in both directions.

In operation, the parts assume the position shown in Fig. 1 when lowering the casing extension into a well. Shell 13 is fixed relative to slip support 20 by gudgeons 24 engaged in slots 26, and wedge 17 rests upon shoulder 19. Packing rubber 14 is consequently not compressed axially and therefore does not bulge radially but lies flat against the shell 13 in spaced relation from the wall of casing 1.

Wedge 17 is in non-engagement with slips 21 so as not to expand the latter to locking engagement in the well casing; and the weight of the packing means shifts the same relative to sleeve 28 so that wedge 35 is also in non-engagement with its cooperating slips 31. The slips 31 are thus free for contraction by annulus 36 so as not to lock in the well casing. Springs 23 tend to frictionally engage the casing wall but the weight of the casing extension lowers the same to the desired level against the holding tendency of the springs.

When the device has been lowered so that pipe 15 projects into the oil sand the desired distance below casing shoe 3, tubing 6 is turned so that the abutment of gudgeons 4 against the walls of recesses 12 turns cage 9 and thereby rotates shell 13 relative to slip support 20 which is held against both axial and rotary displacement by the springs 23.

Gudgeons 24 are thus released from slots 26 so that further lowering of the string of tubing will shift shell 13 downwardly through the slip support 20 as shown in Fig. 2. Slips 21 are thus expanded by wedge 17 to engage the casing wall and lock the wedge against further downward movement, and continued lowering of the string of tubing will thus shift shell 13 downwardly relative to the wedge so as to axially compress rubber 14 between shoulders 18—26^a and thereby radially bulge the rubber for tight packing engagement with the wall of casing 1.

Shell 13 is thus locked against further lowering in the well casing, so that a still further lowering of the string of tubing 6 will slide sleeve 28 downwardly on sleeve 27^a in order to wedge slips 31 against the casing wall and thereby lock the casing extension against upward movement in the well casing.

Pipe 15 is thus held against axial displacement in either direction, and a tight packing is provided between the pipe and casing so that gas from the oil sand cannot rise directly through the casing but must enter pipe 15 and thus force the oil into the pipe and upwardly through the bore of the well.

When the casing extension is to be withdrawn, cage 9 is elevated in suitable manner. Sleeve 28 is thus shifted upwardly on sleeve

27^a for releasing slips 31 and retracting the same by annulus 36. The abutment of lugs 29 against the ends of slots 30 will then elevate shell 13 relative to slip support 20 until
 5 shoulder 19 abuts against wedge 17, the elevation of the shell relieving the axial pressure on packing 14 so that it may return to normal position spaced from the casing wall.

The abutment of shoulder 19 against the
 0 wedge 17 will then disengage the wedge from slips 21 so that the slips are released from locking engagement with the casing wall. The parts are then again in the position shown in Fig. 1 with the packing rubber and
 15 the locking slips spaced from the wall of the casing so that the casing extension may be freely withdrawn from the well.

I claim:

1. An extension adapted for introduction
 20 into a well casing, and means for locking the extension against axial displacement in either direction by lowering the extension relative to the locking means.

2. An extension adapted for introduction
 25 into a well casing, slips having teeth adapted to positively engage the wall of the casing for locking the extension against axial displacement in either direction, and means for forming a tight packing between the casing
 30 and the extension operated by engagement of the slips.

3. An extension adapted for introduction into a well casing, means for locking the extension against axial displacement in either
 35 direction by lowering the extension relative to the locking means, and means for releasing said locking engagement.

4. An extension for a well casing adapted to receive a string of well tubing, and means
 40 on one of the couplings which connect lengths of the string of tubing for lowering the extension into the casing by the string of tubing with the latter projecting downwardly through the extension.

5. An extension for a well casing adapted to receive a string of well tubing, means for engaging the extension by the string of tubing for lowering the extension into the casing, and means for locking the extension
 50 against axial movement in either direction in the casing by lowering the extension relative to the locking means, said engaging means between the extension and tubing being adapted for disengagement to permit
 55 movement of the tubing through the extension when the latter is locked in the casing.

6. An extension adapted for introduction into a well casing, slips having teeth adapted to positively engage the wall of the casing
 60 for locking the extension against axial displacement in either direction, said slips being operated by lowering the extension relative thereto, means for forming a tight packing between the extension and the casing operated by engagement of the slips, and means
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for releasing the slips and the packing engagement.

7. An extension for a well casing adapted to receive a string of well tubing, means for engaging the extension by the string of tubing for lowering the extension into the casing, means for locking the extension against
 70 axial displacement in either direction by lowering the extension relative to the locking means, means for forming a tight packing between the casing and the extension by
 75 said lowering of the extension relative to the locking means, said engaging means between the tubing and the extension being adapted for disengagement to permit movement of
 80 the tubing through the extension when the latter is locked in the casing, and means for releasing the locking and packing engagements between the extension and casing.

8. The combination of an extension for a
 85 well casing, a string of tubing extending therethrough, said string comprising lengths of tubing and collars having hollow bores and threaded at their ends to engage cooperating threaded ends of next adjacent lengths
 90 of the string of tubing, means for locking the extension in the casing, and means on one of said coupling collars of the string of tubing for engaging the casing extension to actuate the locking means.
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9. An extension adapted for introduction into a well casing, and normally inoperative slips having teeth adapted to positively engage the wall of the casing for locking the
 100 extension against axial displacement in either direction, said slips being operated by lowering the extension relative to the slips.

10. An extension adapted to be received in a well casing, packing on said extension, a member slidable on the extension and
 105 adapted to engage the packing for expanding the same to form a tight packing between the extension and the well casing, and means actuated by longitudinal movement of the extension relative to said means for
 110 sliding said member and locking the extension against axial displacement in either direction in the casing.

11. A conduit adapted to be received in a well casing, means for locking the conduit
 115 against downward movement in the well casing by lowering the conduit relative to the locking means, slips on the conduit, and a member adapted to telescope relative to the conduit and expand the slips for locking
 120 the conduit against elevation in the well casing.

12. A conduit adapted for introduction into a well casing, means for locking the conduit against axial displacement in either
 125 direction by lowering the conduit relative to the locking means, and means for forming a tight packing between the conduit and the well casing.

13. An extension adapted to be received in
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a well casing, packing on said extension, a member slidable on the extension and adapted to engage the packing for expanding the same to form a tight packing between the extension and the well casing, and means actuated by longitudinally movement of the extension relative to said means for sliding said member and locking the extension against downward movement in the well casing, slips on the extension, and a member adapted to telescope relative to the extension and expand the slips for locking the extension against elevation in the well casing.

In testimony whereof I have affixed my signature to this specification.

ERD V. CROWELL.