P. H. MACK.

WELL PACKER.

APPLICATION FILED SEPT. 19, 1916.

1,248,882. Patented Dec. 4, 1917.

FIG. 1.

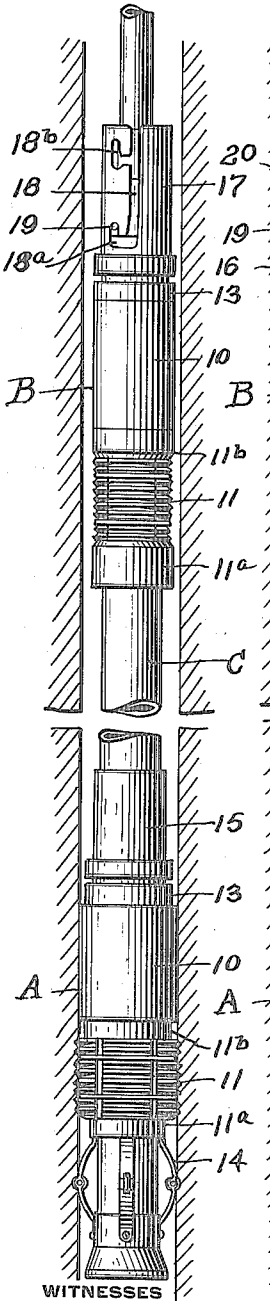


FIG. 2.

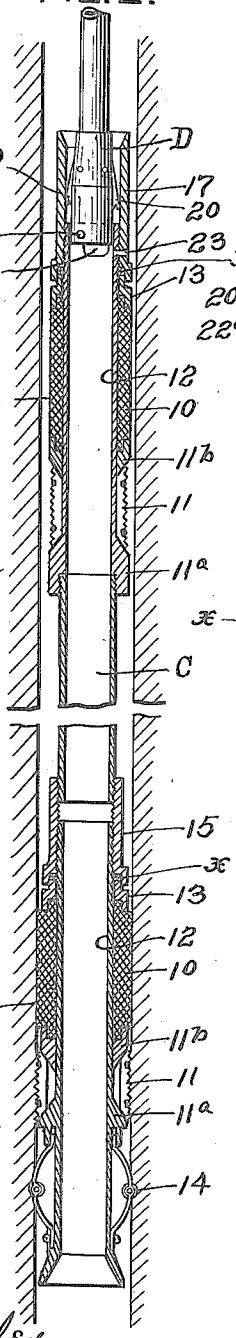


FIG. 3.

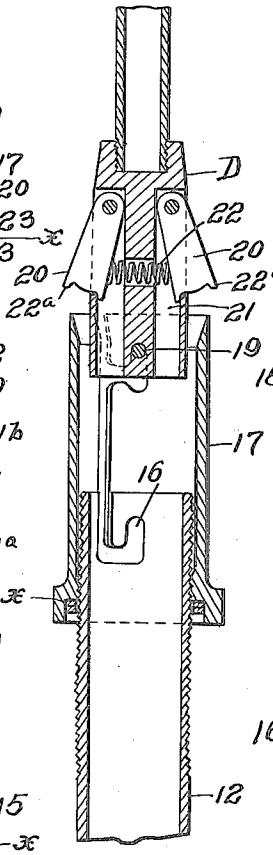


FIG. 5.

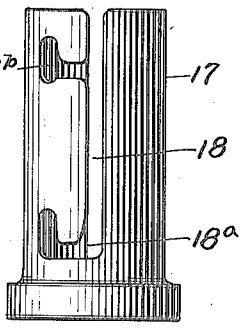
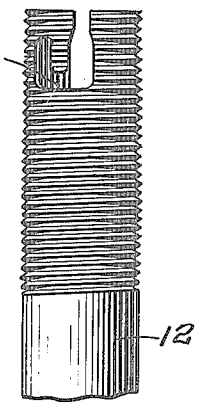


FIG. 4.



WITNESSES

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WELL-PACKER.

1,248,882. Specification of Letters Patent. Patented Dec. 4, 1917.

Application filed September 19, 1916. Serial No. 120,976.

To all whom it may concern:

Be it known that I, PATRICK H. MACK, a citizen of the United States, residing at Bradford, in the county of McKean and State of Pennsylvania, have invented certain new and useful Improvements in Well-Packers, of which the following is a specification.

My invention relates to improvements in well packing structures, being particularly designed for the purpose of isolating the contents of certain stratum or strata from the contents of other levels in the construction and operation of wells.

For instance, in the drilling of oil wells, the geological formation may be such that a water sand may be located between oil sands or gas sands. In such case, it is desirable to isolate the water sand from the oil or gas sands, and this may be accomplished by placing my double packer so that it will "pack off" both above and below the water sand.

Various ways for accomplishing this result have been suggested, but the means have generally been unsatisfactory or have involved requiring considerable manipulation.

The prime objects of my invention are, the production of a packing structure for the purposes specified which is simple and efficient in operation, durable in construction, readily manipulated, and which can be manufactured and installed at a relatively low cost.

In the accompanying drawings,

Figure 1 is a diagrammatic sectional view of an oil well showing my improved packing structure in position, the lower packer being shown as set, the letting-in tool being in the position it occupies in setting this packing.

Fig. 2 is a view similar to Fig. 1, with the packing structure shown in section.

Fig. 3 is a detail sectional view of the construction at the top of the upper packer, the view showing the letting-in tool in position to set the upper packer.

Fig. 4 is a detail elevation of the upper end of the body member of the upper packer.

Fig. 5 is a view in elevation of the setting member of the upper packer.

Referring to the drawings, A represents the lower packer, B the upper packer, these packers being connected by a suitable tubing connection C, the length of which is sufficient to extend through the formation it is desired to isolate.

Each of the packers, as illustrated, includes an expansible packing 10, a slip structure 11 preferably comprising a plurality of segments, the latter being mounted exteriorly of two cone-shaped members 11^a and 11^b movable toward and from each other, the relative movements causing the segments to be moved outwardly into contact with the well walls. Each of the packers also includes a tubular body member 12; this member carries one of the cone members, the other cone member being loosely mounted on the body member and forming a holding member for the expansible packing. Each packer further preferably has a loose annular member 13 which coöperates with the opposite end of the expansible packing, this member 13 being movable in the direction of length of the body member through the action of a setting member threaded to one end of the body member, these setting members, in the two packers, differing from each other in certain respects, as presently referred to. The lower packer additionally carries rotation-preventing means indicated at 14; these means may be of any desired form, that shown being such as to permit the packing structure to readily pass downward in the well while the means contacts with the well wall, but which is effective to prevent rotation of the particular part on which the means is mounted, when the packing structure is rotated in setting the packer.

The arrangement of the parts above described is such that when the packing structure is lowered to the desired point, the lower packer may be set by the rotation of its cap and its travel in the direction of length of the body member, this movement applying pressure on to the loose cone member through member 13 and the expansible packing 10. This pressure causes the said cone member to move toward the fixed cone member carried by body portion 12 and thus acts to expand the slip structure 11. When contact of the slip structure with the wall of the well is such as to provide a resistance greater than the pressure of the loose cone member, further threading action of the cap structure will act to expand the expansible packing 10 until the latter has been set.

During this operation, the body member is held against rotation by the rotation-preventing means 14. The cap structure is rotated from the top of the well.

The upper packer differs from the lower packer mainly in the form of the cap structure and the omission of the rotation-preventing means of the lower packer. The cap structure 15 of the lower packer is threaded to the lower end of connection C, the upper end of said connection being threaded to the body member of the upper packer. In this manner, the body member of the upper packer is rigidly connected to the cap structure of the lower packer, so that if the body member of the upper packer is rotated, it will provide the rotating movement of the setting cap for the lower packer.

As it is desired to insert the packing structure as an entirety, and both packers are set by the relative threading movements of the cap structure and the body member of the packer, it will be readily understood that if the upper packer be so arranged as to practically prevent this relative movement between its body member and cap structure, while permitting similar relative movement between the cap structure and body member of the lower packer, the lower packer may be set without setting the top packer, the latter simply rotating bodily while the setting action is being produced on the lower packer.

Prevention of relative movement between the cap structure and body member of the upper packer is accomplished through the action of a letting-in tool in coöperation with complemental configurations carried by the cap structure and body member of the upper packer. As shown in Figs. 3 and 4, the body member 12 of the upper packer has its end formed with bayonet slots 16 extending inwardly from the upper end of the member. These slots 16 correspond in configuration with the lower end of a slot configuration carried by the cap 17 of the upper packer. As shown more particularly in Fig. 5, cap structure 17 is formed with what may be termed a double bayonet slot 18, the lower end 18^a of which is, in one position, complemental to slot 16 of member 12, while the upper portion of slot 18 has its laterally extending portion, indicated at 18^b, spaced from the upper end of the cap but at such point as to be above the top plane of member 12 throughout any relative threading movement which may be required to set the upper packer. To accommodate for this double slot arrangement, the cap 17 is generally of greater length than cap 15.

To set the packers a letting-in tool is employed. This tool, indicated generally at D, is provided with a pin 19 adapted to engage the bayonet slots; also with a pair of pivotally mounted pawls 20 movable into and out of recesses 21 formed in the body of the tool. Suitable means such as a spring 22 are employed to project these pawls outwardly beyond the face of the tool when the outer portions of the pawls are free from restraint. As will be readily seen, if pawls 20 be moved inwardly a distance sufficient to permit their lower ends to pass into the interior of cap 17, the pins 19 may be moved inwardly throughout the length of slots 18 provided slots 16 are in proper relationship with slots 18.

The position of the letting-in tool above mentioned is shown in Figs. 1 and 2, the pawls 20 being housed and contacting with the inner wall of cap structure 17. This is the position occupied by the tool during the introduction of the packing structure into the well and during the setting operation for the lower packer. It will be readily understood that rotation of the letting-in tool will, through the pins 19 entered in slots 16, cause rotation of cap 15 through the positive connection of the latter with body member 12 of the upper packer, while at the same time cap 17 is prevented from having an independent rotation relative to the body member of the upper packer by reason of the pin structure also extending into slots 18^a.

After rotation of the letting-in tool has positively set the lower packer and the connections between the two packers and the body of the upper packer, the tool is moved backward a distance sufficient to bring the pins into alinement with the straight vertical portions of slots 16 and 18, whereupon, the letting-in tool is withdrawn a distance at least sufficient to carry the pawls 20 above the upper end of cap 17, whereupon, spring 22 becomes active to project these pawls, thus placing them in position where they will act as stops to prevent return movement of the letting-in tool beyond a certain point. These pawls preferably have lugs 22^a designed to limit the pivotal movements of the pawls. If the withdrawal movement has not carried the pin structure entirely out of slots 18, downward movement of the letting-in tool until this movement is stopped by the pawls, brings the pins 19 opposite the entrance to upper slots 18^b, whereupon, the letting-in tool is rotated to bring the pins into these slots. When this position is had, and with the lower packer and its connections set, rotation of the letting-in tool acts to rotate cap 17 alone, the result being that the setting operation of the upper packer takes place through expanding slips 11 and expansible packing 10, this rotating action continuing until the resistances indicate that the packer has been properly set. Upon completion of this operation, the letting-in tool is turned backward a distance sufficient to place the pins within the main portion

of slots 18, whereupon, the tool may be withdrawn leaving both packers properly positioned and with the entire passageway through the packing structure unobstructed in any way.

As will be readily understood, threading action of cap 17 on body member 12 will vary the relative positions of the laterally extending portion of slots 16 and 18[a], the arrangement being such, however, that the cap, in one position, will have these portions of the slots properly alined. This position is provided before introducing the packing structure into the well, the letting-in tool being introduced into proper position at such time. To aid in maintaining this relation, and more particularly to preserve this relation at the time when the letting-in tool is being released from its first operative position, I preferably connect cap 17 with the upper body member by a rivet 23, preferably of copper or other easily broken or severed material. This rivet prevents relative movement of cap and body member while the pin structure is being moved into alinement with the straight portion of slots 18 and 16, insuring that such pin structure can be properly withdrawn. When the letting-in tool exerts pressure on cap structure 17 to begin the rotation of the latter, this pressure acts to shear rivet 23 to permit the cap to move relative to the body portion.

In changing its position, should the letting-in tool be withdrawn entirely above cap structure 17, it is simply dropped until the pins contact with the top of cap 17, whereupon, the tool is rotated until the pins enter the open ends of slots 18 as in usual practice.

As will be seen, the letting-in tool is initially adjusted with the packing structure before being introduced into the well, the necessary sections of tubing or other form of support being added as the packers and tool are lowered. When the desired point is reached, the lower packer is set. The letting-in tool is then withdrawn a distance sufficient to prevent return of the pins to the lower end of slot 18, the pins introduced into slots 18[b], and the upper packer set. The letting-in tool is then withdrawn in the usual manner by raising it and disconnecting sections. No extensive or time-consuming manipulation of the letting-in tool or other auxiliary devices is required. In addition, no necessity is had for applying setting weight since the setting operation is not dependent upon any weight factor. And since the packers are set independently, assurance is had that both packers are properly set.

Each cap carries one or more washers x, preferably of suitable metal, brass for instance, which washer contacts with the upper end of member 13 when the cap is being threaded to apply pressure, thus giving a swiveled effect to the pressure-applying means.

What I claim is:—

1. In well packing structures, the combination with an upper and a lower packer adapted to be set by independent threading actions, means for effecting the setting of each packer including a rotatable element connecting the packers, and means effective to rotate the connection for setting the lower packer and rendering it non-rotatable during the setting operation of the upper packer.

2. In well packing structures, the combination with an upper and a lower packer adapted to be set by independent threading actions, means for effecting the setting of each packer including a rotatable element connecting the packers, and means effective to rotate the connection for setting the lower packer and rendering it non-rotatable during the setting operation of the upper packer, said latter means including a letting-in tool adapted to engage the body of the upper packer in one position and be disengaged therefrom in another position.

3. In well packing structures, the combination with an upper and a lower packer adapted to be set by independent threading actions, means for effecting the setting of each packer including a rotatable element connecting the packers, and means effective to rotate the connection for setting the lower packer and rendering it non-rotatable during the setting operation of the upper packer, said latter means including a body portion and a setting cap of the upper packer and a letting-in tool adapted to engage the cap and body in one position and be disengaged from the body in another position.

4. In well packing structures and in combination, a pair of spaced packers, threading means for independently setting the packers including a rotatable element connecting the packers together to form a unitary packing structure, and means adapted to engage the structure and operative in the setting of both packers for setting the packers successively.

5. In well packing structures and in combination, a pair of spaced packers, threading means for independently setting the packers including a rotatable element connecting the packers together to form a unitary packing structure, and means adapted to engage the upper packer and operative in the setting of both packers for setting the packers successively.

6. In well packing structures and in combination, a pair of spaced packers, rotatable means connecting the packers together to form a unitary packing structure, and means adapted to engage the upper packer

and operative in the setting of both packers for setting the packers successively, said means having shiftable operative engagements with the upper packer to provide such successive operations.

7. In well packing structures and in combination, a pair of spaced packers, threading means for independently setting each packer, rotatable means for connecting said packers together to provide successive setting of the packers, and a setting implement adapted to maintain the upper packer unset during setting of the lower packer.

8. In combination, a pair of packers connected together to form a packing structure unit, said packers being adapted to be set independently, threading means for setting each packer, and a removable letting-in tool operative to set both packers.

9. In combination, a pair of packers connected together to form a packing structure unit, said packers being adapted to be set independently, threading means for setting each packer, and a removable letting-in tool operative to set both packers, said tool engaging the upper packer during the setting operations of both packers.

10. In combination, a pair of packers each having a body portion and a setting cap threaded on said body portion, each packer being set by the relative threading action of its body portion and cap, a connection between the body portion of the upper packer and the cap of the lower packer, and means for retaining the cap and body portion of the upper packer against relative threading movements during setting of the lower packer.

11. In combination, a lower packer having a body portion and a setting cap threaded thereto, said body portion carrying rotation-preventing means, whereby threading movements of the cap will provide setting of the packer, an upper packer having a body portion and a threading setting cap, a connection between the body portion of the upper packer and the cap of the lower packer, whereby movements of the body portion of the upper packer will set the lower packer, and means for maintaining the upper packer unset during such lower packer setting movements.

12. In combination a lower packer having a body portion and a setting cap threaded thereto, said body portion carrying rotation-preventing means, whereby threading movements of the cap will provide setting of the packer, an upper packer having a body portion and a threading setting cap, a connection between the body portion of the upper packer and the cap of the lower packer, whereby movements of the body portion of the upper packer will set the lower packer, and means for maintaining the upper packer unset while permitting free rotational movement thereof during such lower packer setting movements.

13. In combination, a lower packer having a body portion and a setting cap threaded thereto, said body portion carrying rotation-preventing means, whereby threading movements of the cap will provide setting of the packer, an upper packer having a body portion and a threading pressure setting cap, a connection between the body portion of the upper packer and the cap of the lower packer, whereby movements of the body portion of the upper packer will set the lower packer, and means for maintaining the upper packer unset during such lower packer setting movements, said connection and the set lower packer forming rotation-preventing means for the body portion of the upper packer.

14. In combination, a pair of packers, the upper packer including a body portion and a setting cap threaded thereto and adapted to provide setting of the packer by threading movements of the cap, a connection between said body portion and the lower packer, and a packer setting implement adapted to engage both said body portion and cap to cause said parts to move in unison when the implement is rotated, whereby said packers may be set independently.

15. In combination, a pair of packers, the upper packer including a body portion and a setting cap threaded thereto and adapted to provide setting of the packer by threading movements of the cap, a connection between said body portion and the lower packer, and a packer setting implement adapted to engage said cap at either of a plurality of points and the body portion at one point, whereby said packers may be set independently.

16. In combination, a pair of packers, the upper packer including a body portion and a setting cap threaded thereto and adapted to provide setting of the packer by threading movements of the cap, a connection between said body portion and the lower packer, and a packer setting implement adapted to engage said cap at either of a plurality of points, one of said points being within the threaded zone of the body portion to cause said cap and body to move in unison and the other exterior of said body, whereby said packers may be set independently.

17. In combination with an upper and a lower packer, said upper packer having a body portion, a setting cap threaded thereto and adapted to set the packer by threading movements, and a letting-in tool, said cap and body portion each having a seat for said tool within the threading zone, whereby said tool may move both cap and body portion in unison to set the lower packer.

18. In combination with an upper and a lower packer, said upper packer having a

body portion, a setting cap threaded thereto and adapted to set the packer by threading movements, and a letting-in tool, said cap and body portion each having a seat for said tool within the threading zone, whereby said tool may move both cap and body portion in unison to set the lower packer, and a connection between the cap and body portion adapted to be broken by relative movements of cap and body portion when said tool is released from said seats.

19. In combination with an upper and a lower packer, said upper packer having a body portion, a cap threaded thereto and adapted to set the packer by cap threading movements, and a letting-in tool, said cap and body portion having means complemental to said tool to cause the cap and body portion to move in unison during rotation of the tool to set the lower packer, said cap having additional means coöperative with the tool to provide threading movements of the cap on said body portion when the tool is rotated.

20. In combination with an upper and a lower packer, said upper packer having a body portion, a cap threaded thereto and adapted to set the packer by cap threading movements, and a letting-in tool, said cap and body portion having means complemental to said tool to cause the cap and body portion to move in unison during rotation of the tool to set the lower packer, said cap having additional means coöperative with the tool to provide threading movements of the cap on said body portion when the tool is rotated, said tool having means coöperating with the cap to locate the tool in position to provide such independent movement.

21. In combination with an upper and a lower packer, said upper packer having a body portion, a cap threaded thereto and adapted to set the packer by cap threading movements, and a letting-in tool, said cap and body portion having means complemental to said tool to cause the cap and body portion to move in unison during rotation of the tool to set the lower packer, said cap having additional means coöperative with the tool to provide threading movements of the cap on said body portion when the tool is rotated, said tool having means coöperating with the cap to locate the tool in position to provide such independent movement, said latter means being inactive when the tool is in position to provide movements in unison.

22. In combination with an upper and a lower packer, said upper packer having a body portion, a cap threaded thereto and adapted to set the packer by threading movements of the cap, and a letting-in tool, said cap being slotted to permit insertion of the tool, the slotting extending into the threading zone of the cap, said body portion being similarly slotted within said zone, whereby said tool may be positioned to move the cap and body portion in unison to set the lower packer.

23. In combination with an upper and a lower packer, said upper packer having a body portion, a cap threaded thereto and adapted to set the packer by threading movements of the cap, and a letting-in tool, said cap being slotted to permit insertion of the tool, the slotting extending into the threading zone of the cap, said body portion being similarly slotted within said zone, whereby said tool may be positioned to move the cap and body portion in unison to set the lower packer, the slotting of said cap and body portion being relatively located to retain the upper packer unset when the tool is within said zone.

24. In combination with an upper and a lower packer, said upper packer having a body portion, a cap threaded thereto and adapted to set the packer by threading movements of the cap, and a letting-in tool, said cap being slotted to permit insertion of the tool, the slotting extending into the threading zone of the cap, said body portion being similarly slotted within said zone, whereby said tool may be positioned to move the cap and body portion in unison to set the lower packer, the slotting of said cap providing an alternative seat for said tool at a point removed from the body portion slotting.

25. In combination with an upper and a lower packer, said upper packer having a body portion, a cap threaded thereto and adapted to set the packer by threading movements of the cap, and a letting-in tool, said cap being slotted to permit insertion of the tool, the slotting extending into the threading zone of the cap, said body portion being similarly slotted within said zone, whereby said tool may be positioned to move the cap and body portion in unison to set the lower packer, the slotting of said cap providing an alternative seat for said tool at a point removed from the body portion slotting, said letting-in tool having means to locate the tool in the plane of said seat.

26. A letting-in tool for packing structures comprising a member having pins adapted to engage the packer, and movable means for limiting the length of inserting movement of the tool.

27. A letting-in tool for packing structures comprising a member having pins adapted to engage the packer, and means for limiting the length of inserting movement of the tool, said means including a pair of pivoted members movable into and out of position to engage the top of the cap structure on which it is adapted to be operative.

28. A letting-in tool for packing structures comprising a member having pins

adapted to engage the packer, and means for limiting the length of inserting movement of the tool, said means including a pair of pivoted members movable into and out of position to engage the top of the cap structure on which it is adapted to be operative, said pivoted members being spring supported to provide automatic projection of the members when released from the cap.

29. In combination, a pair of packers each having a body portion and a setting cap threaded on said body portion, each packer being set by the relative threading action of its body portion and cap, an annulus between each cap and the expansible member of the packer, a metallic washer between the cap and annulus, a connection between the body portion of the upper packer and the cap of the lower packer, and means for retaining the cap and body portion of the upper packer against relative threading movements during setting of the lower packer.

In testimony whereof I affix my signature in presence of two witnesses.

PATRICK H. MACK.

Witnesses:
W. E. BURDICK,
A. L. STOVER.