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J. H. McEVOY

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PACKER FOR WELLS

Filed Jan. 11, 1927

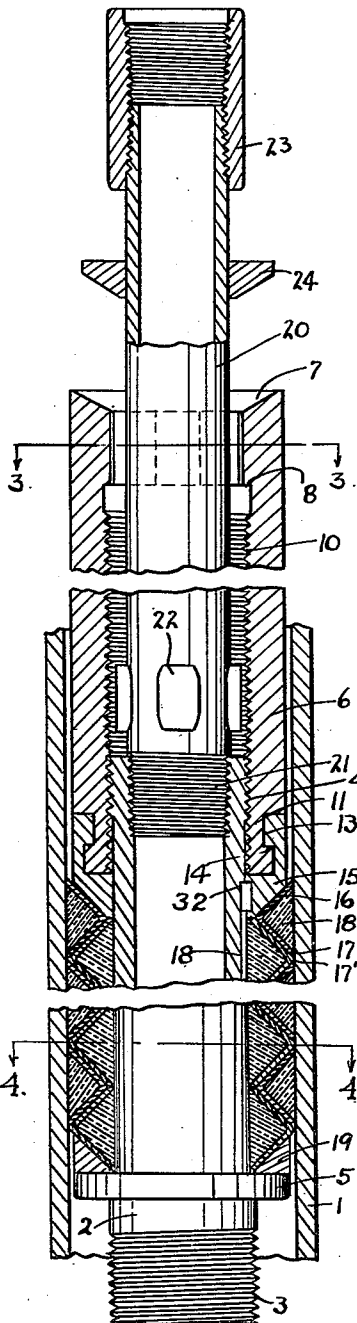


Fig. 1.

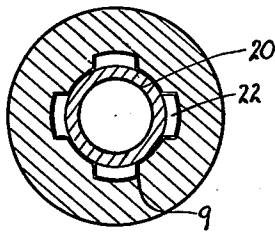


Fig. 3.

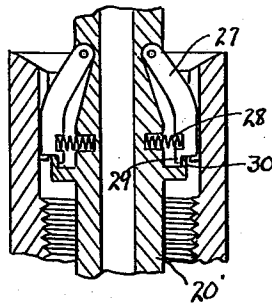


Fig. 5.

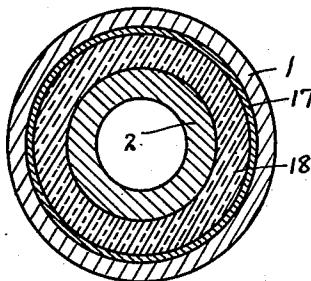


Fig. 4.

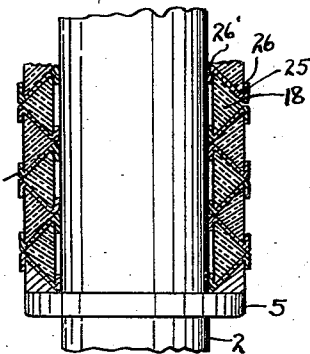


Fig. 2

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PACKER FOR WELLS

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My invention relates to packers to be employed in wells to close the space between the liner, or screen, and the well casing.

In the packers now most commonly used, particularly in setting screens in wells, the packer is placed in position and then a setting tool, secured upon a pipe or drill stem, extending from the surface down to the packer, is employed to telescope the parts of the packing along the pipe and compress the same longitudinally so as to close the space within the casing about the upper end of the screen or pipe. In performing this operation, it usually requires a heavy pressure upon the packer to expand it and sometimes a weight of several tons is necessary. The placing of pressure of this nature upon the screen frequently has the effect of distorting the same so as to cause bulges and breaks in the screen.

It is, therefore, an object of my invention to provide a packer which may be compressed longitudinally and expanded in the casing without the necessity of exerting a longitudinal pressure upon the screen pipe.

It is desired that the setting tool may be released from the screen and then employed to screw the setting sleeve upon the packer downwardly in such manner as to compress the packer.

It is another object to provide a particularly efficient packing means to be employed for this work and which will form a tight closure about the upper end of the screen and between the same and the wall of the well, and still be capable of release and removal, when desired.

It is also contemplated that the setting tool employed with my packer may be of simple and sturdy construction, or if desired, the usual setting tool now employed with the old types of packer may be used without departing from the spirit of the invention.

Referring to the drawing herewith, Fig. 1 is a broken central longitudinal section through the upper end of the screen pipe and casing, said construction embodying my invention. Fig. 2 is a detail illustrating a slightly different form of packing. Fig. 3 is a transverse section on the plane 3—3 of

Fig. 1. Fig. 4 is a similar section on the plane 4—4 of Fig. 1; and Fig. 5 is a broken detail of an old type of setting tool showing said tool employed with my invention. Like numerals of reference are employed to designate like parts in all the views.

In the drawing, the well casing is indicated at 1. Within the casing is a pipe 2, forming a mandrel to receive the packing, which may be connected at its lower end 3 with the well screen or with a liner or similar pipe which is to be set in the well and about the upper end of which a packer is to be set. The said mandrel 2 is threaded at its upper end and said thread is extended downwardly for a suitable distance so as to allow the compression of the packer. This threaded surface, indicated at 4, extends but a short space and below this area the diameter of the mandrel is slightly decreased to allow the movement thereon of the setting sleeve. The mandrel is also formed with a flange 5 adjacent the lower end. Said flange comprises a ring fixed upon the mandrel by being shrunk in place or welded or by any similar means of connection.

Connected to the upper end of the mandrel 2 is a setting sleeve 6 which comprises a section of heavy pipe, the upper end of which is beveled inwardly to provide an inwardly tapered seat 7. The upper end of the sleeve is of slightly smaller internal diameter than the rest of the sleeve for a short distance extending from the upper end to a shoulder 8 on the inner side of the pipe. This inner area above the shoulder 8 is formed with a plurality of vertical grooves or keyways 9 therein, best indicated in Fig. 3. Below these keyways the inner diameter of the sleeve is slightly enlarged and is threaded at 10, said thread extending for the full length of the sleeve below said keyways.

The lower end of the sleeve is reduced in external diameter and formed with a circumferential groove 13 therein, the lower side of said groove forming a shoulder 14. Within this groove and supported upon the shoulder 14 is a rotatable ring 15. Said ring is fixed in position rotatably upon the lower end of the setting sleeve by being formed

and then cut and placed thereon and welded together in the construction of the tool. The lower end of said ring 15 is tapered downwardly to provide a beveled surface 16 to contact with the packer.

Between the lower tapered surface of the ring 15 and the flange 5 upon the mandrel 2 is placed the packing material. It is understood, of course, that any desirable type of packing material may be employed. I have shown, however, a preferred form of material which comprises a series of rings 17 V-shaped in cross section and made up of lead or some similar alloy of soft metal. The rings 17 have the inner angle of the ring placed toward the mandrel 2 with the outer edges presented toward the casing 1. The space within the angular portion of the rings is filled with a packing material 18 of some compressible substance, which may be rubber or composition or of any preferred type of packing material, adapted to be compressed when the rings are forced together. The rings 17' next adjacent the ring 17 are similar in construction to the rings 17 but have the angular side placed outwardly with the compressible packing 18 presented toward the mandrel 2. These rings alternate in position relative to each other, the lower ring resting upon a washer 19 of metal. Said washer is provided with a cupped upper face interfitting with the packing, as shown in Fig. 1.

The setting tool which I employ may be any ordinary section of pipe forming a nipple 20. The lower end of said nipple is threaded at 21 to screw within the upper end of the mandrel 2; this thread being a left-hand thread adapted to be unscrewed with a right-hand turn of said tool.

Above the threaded lower end a short space I have fixed to the setting tool a plurality of keys 22 extending radially from the setting tool and adapted to be inserted through the keyways 9 in the upper end of the setting sleeve. I have shown four keyways and there are four keys upon the setting tool to receive said keys. It is to be understood, of course, that any desired number of keys and keyways may be employed. The upper end of the setting tool is threaded for connection with a collar 23, serving as a means of connection between the setting tool and a pipe extending to the surface. A ring or washer 24 may be placed in position upon the setting tool 20 and if deemed desirable may be slidable thereon, the lower side being tapered to fit within the seat 7 at the upper end of the setting sleeve. The ring is shown spaced upwardly from the seat but in use it is understood that this ring will rest by gravity upon, or within the seat 7 and prevent trash and dirt from finding entrance to the interior of the packer sleeve.

In the use of my packer, the strainer or pipe which is to be set in the well will be in-

serted down to the lower end of the well and the packer will then be expanded by first unscrewing from the mandrel the lower end 21 of the setting tool. This will be done by a right-hand rotation of the pipe and the setting tool. When the setting tool is thus released it may be elevated sufficiently to bring the keys 22 on the setting tool within the keyways 9 at the upper end of the setting sleeve. The upper ends of the keys 22 are slightly rounded to assist in bringing them into the keyways when this operation is performed. When the tool is thus engaged with the sleeve the right-hand rotation of the setting tool will serve to screw the setting sleeve 6 downwardly upon the mandrel in an obvious manner and in so doing the swivel connection between the setting sleeve and the ring 15 will tend to prevent any twisting or distortion of the packing other than that of compression due to the screwing of the setting sleeve downwardly thereon. The ring 15 is held from rotation by a key 32 fitting in a keyway in the mandrel 20. The screwing down of the setting sleeve may be continued until the packing below is compressed to firmly seal off the space between the mandrel and casing. The setting tool may then be withdrawn by a straight upward pull thereon. The packing may be thereafter released and the same pulled upwardly in the well by the use of the setting tool rotated in a left-hand direction to unscrew the connection between the sleeve 6 and the mandrel.

In Fig. 2 I have shown a modified form of the packing shown in Fig. 1. In this view the packing is shown as made up of triangular sections of compressible material 18 the same as in the previous modification, but these rings are separated by rings 25 of soft metal, such as lead, said rings having an approximately Z-shape in cross section, each alternate ring being inclined in the opposite direction, as shown in the drawing. By forming the rings 25 in this manner, there is an outer vertically directed flange 26 to grip the packing rings 18 on the outer side and a similar oppositely directed flange 26' on the inner side and gripping the adjacent ring in a similar manner. This packing is compressed and serves to seal off the space between the casing and the mandrel in the same manner as that shown in the first embodiment.

While I have shown a setting tool of simple and strong construction, it is understood that the old type of tool may be employed, if desired, as shown in Fig. 5. Its structure is old and will be understood as comprising a setting nipple 20' having thereon a series of dogs 27, said dogs being pivoted in recesses in the mandrel and pressed outwardly against the setting sleeve by means of springs 28, setting in recesses in the side of the setting tool. The dogs are limited in their out-

ward movement by fingers 29 on their lower ends, fitting behind flange 30, formed on the setting tool to engage therewith. These dogs will naturally be forced by their springs within the keyways 9, and when the setting tool is rotated, they will serve to connect the tool with the setting sleeve so as to communicate rotative movement to said sleeve.

The particular advantages resulting from my construction reside in the strong and simple construction of the operating parts, and further in the fact that the packing may be compressed without the exertion thereon of a heavy downward thrust which might serve to distort the pipe and screen. The setting tool is of particularly simple construction. There are no springs or other parts tending to get out of order and the tool is particularly positive in its action. The construction of the packing is such that it will wear for indefinite periods without material deterioration and also permits of the release and withdrawal of the packer without difficulty. The further advantages of the device will be obvious to those skilled in the art.

What I claim as new and desire to protect by Letters Patent is:

1. In a well packer a mandrel, a support thereon, compressible packing on said support, a ring on said packing, interengaging means on said ring and mandrel to prevent rotation of said ring, a setting sleeve having a swivel connection with said ring, said sleeve having a threaded connection with said mandrel, and means to screw said sleeve downwardly on said mandrel to compress said packing longitudinally.

2. In a well packer, a mandrel, a packing support thereon, packing on said mandrel above said support, a ring on said packing, means to prevent rotation of said ring, and a setting sleeve on said mandrel adapted to be screwed down on said ring to move said ring downwardly and compress said packing longitudinally.

In testimony whereof I hereunto affix my signature this 30th day of December, A. D. 1926.

JOSEPH H. McEVOY.