

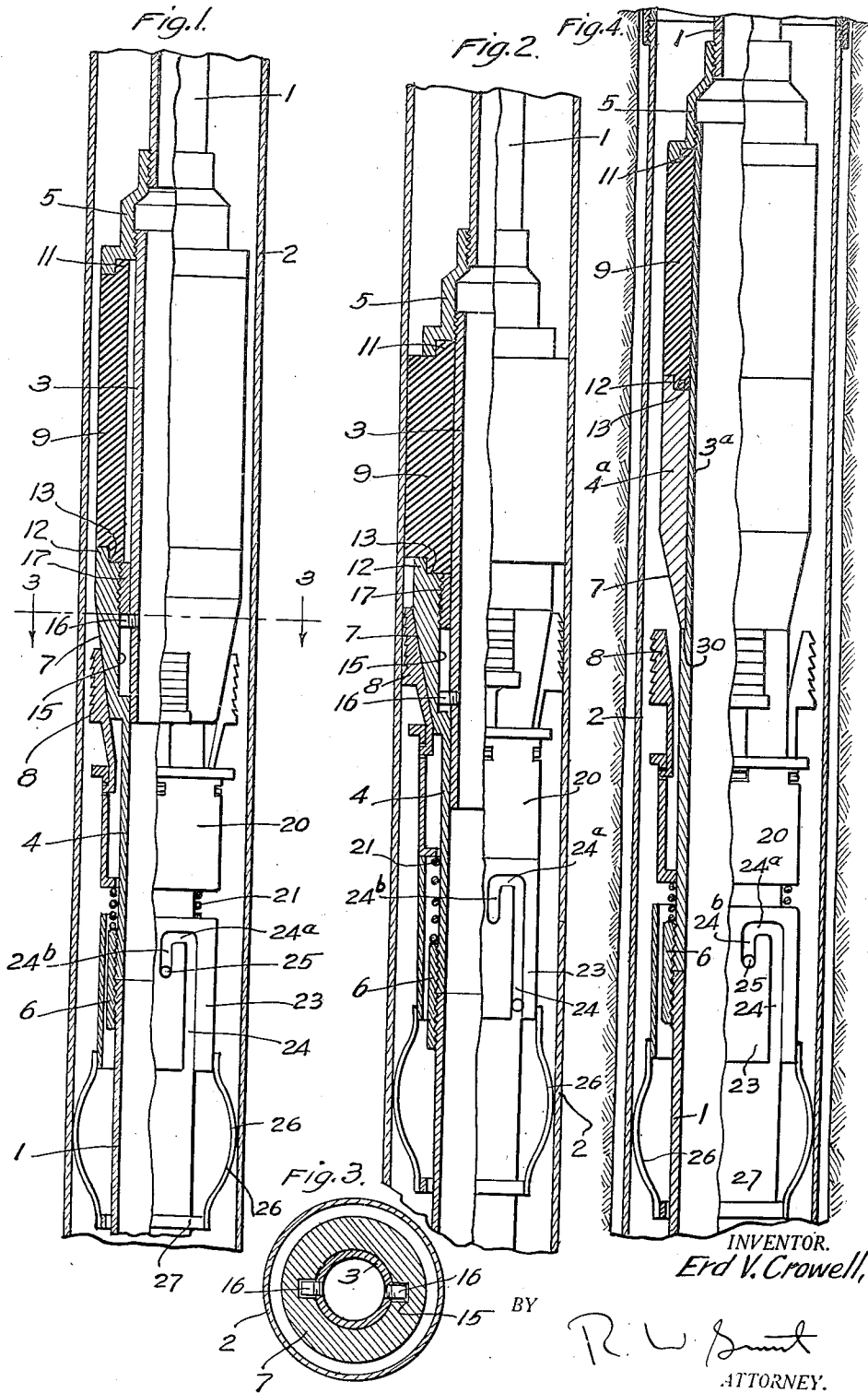
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PACKER

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UNITED STATES PATENT OFFICE

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PACKER

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This invention is a packer such as may be employed for packing off between well tubing and casing, and it is the object of the invention to manually control operative expansion of the packing at any desired level in a well, and to also provide for automatically catching the tubing on which the packing is mounted in the event of the tubing breaking during either its insertion or withdrawal from a well.

It is a further object of the invention to provide for operative expansion of the packing when the tubing is either manually or automatically anchored in order to automatically park off the tubing and consequently eliminate fire hazard.

It is another object of the invention to arrange the packer so as to cushion and finally arrest movement of the string of tubing when it is either automatically or manually anchored in a well, thereby insuring operation of the anchoring means without excessive jar.

It is a still further object of the invention to provide an extremely simplified construction permitting of convenient assembly of parts to produce a sturdy structure which will be reliable and certain in its action.

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 well casing showing the packer in inoperative position as it is lowered in the casing.

Fig. 2 is a similar view showing the packer in operative position anchored in the well casing.

Fig. 3 is a transverse section on the line 3—3 of Fig. 1.

Fig. 4 is a view similar to Fig. 1 but showing a modified construction.

The invention is illustrated as applicable to a usual string of tubing 1 which is adapted for reception in well casing 2, and provides for manually controlling anchoring of the tubing at any desired level in the casing or automatically catching the tubing in the event of it breaking during either its withdrawal or insertion, with packing between

the tubing and casing automatically expanded to operative position by either the manual anchoring or automatic catching of the tubing.

In the embodiment of the invention shown in Figs. 1 to 3, the string of tubing includes relatively telescopic sections 3—4 mounted in the string by means of couplings 5—6, and the lower telescopic section 4 is provided with inclined surfaces 7 at its upper end adapted for engagement by slips 8 when either the manual anchor or the automatic catcher is operated, in order to expand the slips into operative engagement with the wall of casing 2 for anchoring the section 4 and the depending string of tubing.

The upper telescopic section 3 then telescopes within the anchored lowered section 4 so as to axially compress a packing sleeve 9 which is mounted on section 3 between the upper end of section 4 and the upper coupling 5, and the packing is thereby radially expanded into engagement with the wall of casing 2 for packing off between the casing and tubing. The axial compression of the packing cushions and finally limits the downward telescopic movement of section 3 and thereby anchors the tubing without excessive jar.

The packing sleeve 9 may be of any suitable packing material such as rubber, and its ends are preferably provided with projecting annular tongues 11 which are received within peripheral flanges 12 on cooperating annular abutment surfaces 13 formed by the upper coupling 5 and the end of telescopic section 4, the packing being of a diameter spacing it from the wall of casing 2 when the telescopic sections 3—4 are in expanded position, but adapted to form a tight packing engagement with the wall of the casing when sections 3—4 are telescoped by operation of the manually controlled anchor or the automatically operated catcher.

Means are provided for limiting relative expansion of sections 3—4 so that the entire string of tubing may be readily withdrawn from a well, and the telescopic sections 3—4 are fixed against relative turning movement so that turning the portion of the string of tubing which extends upwardly to the ground

level will also rotate the telescopic section 4 for actuating the manually controlled anchor as will be hereinafter described.

As an instance of this arrangement the upper end of the bore of section 4 may be countersunk and provided with axial slots 15 below the countersunk end adapted to receive projecting gudgeons 16 on the lower end of section 3 so as to permit relative telescoping but prevent relative turning of the sections 3—4, and a bushing 17 may be threaded in the countersunk end of the bore of section 4 in back of gudgeons 16 so as to provide an abutment for said gudgeons for preventing disengagement of the sections 3—4.

The means whereby slips 8 are moved into operative engagement with the inclined surfaces 7 for manually anchoring the string of tubing at any desired level in a well or automatically catching the tubing in the event of the string breaking during withdrawal or insertion, includes a sleeve 20 slidable on section 4 and carrying the slips 8 so that they are expanded by the inclined surfaces 7 when the string of tubing is lowered through the sleeve. The slips when thus expanded are adapted to engage the wall of casing 2 and thereby anchor telescopic section 4 and the depending tubing.

The automatic catcher may comprise a coil spring 21 mounted on section 4 between the lower end of sleeve 20 and the coupling 6, so that the spring is normally compressed by the weight of the sleeve for positioning the slips in inoperative position below the inclined surfaces 7 as shown in Fig. 1. If the string of tubing breaks during either its insertion or withdrawal from a well, the sudden dropping of the tubing results in expansion of spring 21 which thereby retards the fall of slips 8 so that they are engaged by the inclined surfaces 7 and are thus expanded to operative position.

The means for manually controlling anchoring of the tubing at any desired level in a well, may comprise a sleeve 23 slidable on section 4 below the sleeve 20. A vertical slot 24 opens through the lower end of sleeve 23 and has a transverse slot 24^a at its upper end terminating in a relatively short depending slot 24^b. A lug 25 on the coupling 6 is slidable in the slots, and when seated in the slot 24^b limits sliding of section 4 relative to sleeve 13 so as to space the sleeves 20 and 23 as shown in Fig. 1. Bowed springs 26 depend from sleeve 23 and are connected at their lower ends by a collar 27 which is slidable on the string of tubing; and these springs frictionally engage the wall of casing 2 to hold the sleeve 23 against turning in the casing. Section 4 may thus be turned relative to sleeve 23 so as to move lug 25 along transverse slot 24^a and into alinement with slot 24; and with the parts in this position, downward movement of the section 4 will move lug 25 down-

wardly through slot 24 and will thus move the sleeve 20 downwardly against the sleeve 23 which is held against longitudinal displacement by its springs 26. Sleeve 20 is thus shifted upwardly so as to slide the slips 8 along the inclined surfaces 7 for expanding the slips into operative engagement with the casing wall as shown in Fig. 2. The section 4 may be turned relative to sleeve 23 by rotating the string of tubing at the ground level, since the slot and gudgeon connection 15—16 insures sections 3—4 turning together.

With section 4 and the depending tubing thus anchored either by the manual control or by automatic actuation if the tubing breaks, the section 3 and the upwardly extending portion of the tubing drops by its own weight so as to telescope sections 3—4 at the slot and gudgeon connection 15—16, and the packing 9 is thus radially expanded as previously described in order to pack off between the well casing and the anchored tubing, and the downward movement of the upper portion of the string of tubing is cushioned and finally arrested by the axial compression of the packing.

To release the anchored tubing it is simply necessary to elevate the string at the ground level, thereby expanding the telescopic sections 3—4 for releasing the packing from its radially expanded operative position, and the abutment of gudgeons 16 against bushing 17 will then elevate the section 4 so as to disengage the inclined surfaces from the slips 8 and consequently permit the slips to again assume inoperative position released from locking engagement with the casing wall. If the tubing has been anchored by the manually controlled means the lug 25 will move upwardly through slot 24 during release of the anchoring engagement; and if desired the string of tubing may be turned when lug 25 aligns with transverse slot 24^a so as to again seat the lug in slot 24^b and thereby lock the manually controlled anchoring means in inoperative position. The automatic catcher then remains ready for operation in the event of the tubing breaking; and if desired the string of tubing instead of being turned so as to seat lug 25 in slot 24^b and thereby render the manually controlled anchor inoperative, may be left with the lug in alinement with slot 24 so that the entire mechanism may be withdrawn as a unit by the abutment of the lug against the upper end of slot 24, but the lug will readily slide downwardly through the slot to operate the manually controlled anchor in the event of the tubing breaking, and will thereby increase the safety factor provided by the spring actuated automatic catcher.

In the modification of the invention shown in Fig. 4, operation of the device is the same as that which has been described, but the relatively telescopic sections 3—4 are eliminat-

ed. Instead of such construction the string of tubing includes a section 3^a mounted in the string by means of the couplings 5-6, and a sleeve 4^a is slidable on section 3^a and is limited in its downward movement thereon by shoulders 30. The sleeve 4^a forms the inclined surfaces 7 normally spaced above slips 8 but adapted for engagement thereby to anchor the sleeve when either the manual anchor or the automatic catcher is actuated. Packing sleeve 9 is mounted on section 3^a between sleeve 4^a and the upper coupling 5, and with sleeve 4^a anchored in the well casing the relative downward movement of the string will thereby axially compress the packing for cushioning and finally arresting the string of tubing and radially expanding the packing to operative position as previously described.

The automatic catcher and the manually controlled anchor are arranged as previously described, the sleeves 20 and 23 being mounted on section 3^a with spring 21 between sleeve 20 and coupling 6, and the lug 25 projects from coupling 6 for cooperation with slots 24, 24^a and 24^b.

The invention thus provides a construction whereby packing may be operatively expanded and anchored at any desired level in a well, with tubing on which the packing is mounted adapted to be automatically caught and held in the well in the event of the tubing breaking during either its descent or withdrawal. The axial compression of the packing for radially expanding it to operative position provides for cushioning and finally arresting the descent of the tubing, and the arrangement of parts results in simplified means for operatively expanding the packing and also adapts the device for economical manufacture and convenient assembly and replacement of its parts.

I claim:

1. In combination, tubing adapted for reception in a well bore and comprising relatively telescopic upper and lower sections, a wedging member fixed to the lower tubing section, packing mounted on the wedging member with the upper tubing section abutting against the upper end of the packing, a slip slidably mounted on the lower tubing section below the wedging member, a spring mounted on the lower tubing section and supporting the slip, the spring being normally compressed by the weight of the slip for spacing the slip below the wedging member but adapted for expansion for positively elevating the slip relative to the tubing and engaging the slip by the wedging member in the event of sudden dropping of the tubing, a sleeve slidable on the lower tubing section below the spring, manually releasable means for locking the sleeve and lower tubing section against relative axial movement, and means tending to frictionally hold the sleeve in the

well bore so as to permit lowering of the lower tubing section relative to the frictionally held sleeve upon manual release of said locking means, said lowering of the lower tubing section relative to the sleeve abutting the slip against the sleeve for elevating the slip relative to the tubing and thereby engaging the slip by the wedging member, with said engagement of the slip by the wedging member, either by expansion of the spring or by lowering of the tubing relative to the sleeve, expanding the slip against the wall of the well bore for anchoring the wedging member in the well bore, and abutment by the upper tubing section against the upper end of the packing axially compressing the packing against the anchored wedging member so as to anchor the tubing in the well bore and radially expand the packing to operative engagement with the wall of the well bore.

2. In combination, tubing adapted for reception in a well bore and comprising relatively telescopic upper and lower sections, a wedging member fixed to the lower tubing section, packing mounted on the wedging member with the upper tubing section abutting against the upper end of the packing, a slip slidably mounted on the lower tubing section below the wedging member, a spring mounted on the lower tubing section and supporting the slip, the spring being normally compressed by the weight of the slip for spacing the slip below the wedging member but adapted for expansion for positively elevating the slip relative to the tubing and engaging the slip by the wedging member in the event of sudden dropping of the tubing, a sleeve slidable on the lower tubing section below the spring, manually releasable means for locking the sleeve and lower tubing section against relative axial movement, and means tending to frictionally hold the sleeve in the well bore so as to permit lowering of the lower tubing section relative to the frictionally held sleeve upon manual release of said locking means, said lowering of the lower tubing section relative to the sleeve abutting the slip against the sleeve for elevating the slip relative to the tubing and thereby engaging the slip by the wedging member, with said engagement of the slip by the wedging member expanding the slip against the wall of the well bore for anchoring the wedging member in the well bore, and abutment by the upper tubing section against the upper end of the packing axially compressing the packing against the anchored wedging member so as to anchor the tubing in the well bore and radially expand the packing to operative engagement with the wall of the well bore.

3. In combination, tubing adapted for reception in a well bore and comprising relatively telescopic upper and lower sections, a wedging member fixed to the lower tubing

section, packing mounted on the wedging member with the upper tubing section abutting against the upper end of the packing, a slip slidably mounted on the lower tubing section below the wedging member, a spring mounted on the lower tubing section and supporting the slip, the spring being normally compressed by the weight of the slip for spacing the slip below the wedging member but adapted for expansion for positively elevating the slip relative to the tubing and engaging the slip by the wedging member in the event of sudden dropping of the tubing, a sleeve slidable on the lower tubing section below the spring, a bayonet slot connection between the tubing and sleeve providing a means releasable by manually turning the tubing for locking the sleeve and tubing against relative axial movement, and means tending to frictionally hold the sleeve in the well bore so as to permit lowering of the tubing relative to the frictionally held sleeve upon manual release of said bayonet slot connection by turning the tubing relative to the frictionally held sleeve, said lowering of the tubing relative to the sleeve abutting the slip against the sleeve for elevating the slip relative to the tubing and thereby engaging the slip by the wedging member, with said engagement of the slip by the wedging member, either by expansion of the spring or by lowering of the tubing relative to the sleeve, expanding the slip against the wall of the well bore for anchoring the wedging member in the well bore, and abutment by the upper tubing section against the upper end of the packing axially compressing the packing against the anchored wedging member so as to anchor the tubing in the well bore and radially expand the packing to operative engagement with the wall of the well bore.

In testimony whereof he has annexed his signature to this specification.

ERD V. CROWELL.

4. In combination, tubing adapted for reception in a well bore and comprising relatively telescopic upper and lower sections, means for fixing said telescopic sections against relative rotation, a wedging member fixed to the lower tubing section, packing mounted on the wedging member with the upper tubing section abutting against the upper end of the packing, a slip slidably mounted on the lower tubing section below the wedging member, a spring mounted on the lower tubing section and supporting the slip, the spring being normally compressed by the weight of the slip for spacing the slip below the wedging member but adapted for expansion for positively elevating the slip relative to the tubing and engaging the slip by the wedging member in the event of sudden dropping of the tubing, a sleeve slidable on the lower tubing section below the spring, a bayonet slot connection between the lower tubing section and sleeve providing a means releasable by manually turning the tubing for locking the sleeve and lower tubing section against relative axial movement, and