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3,248,129

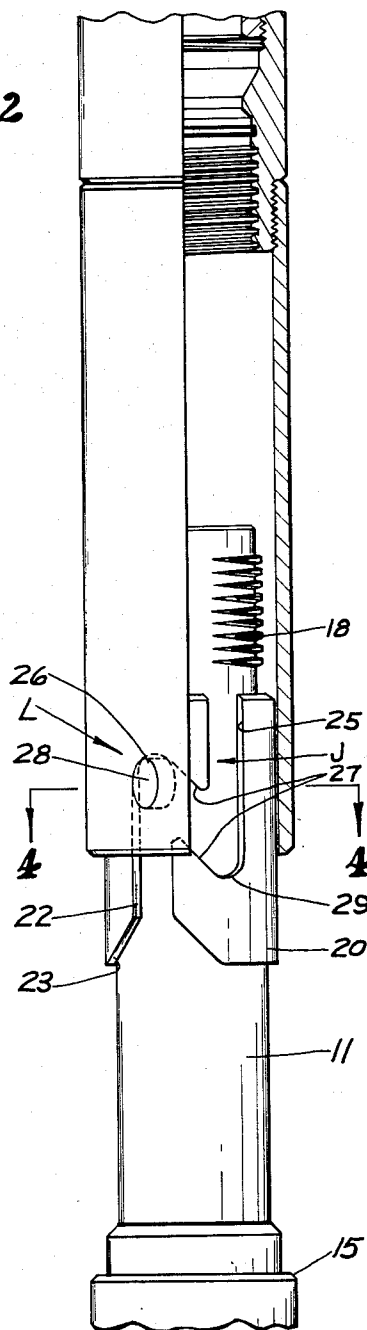
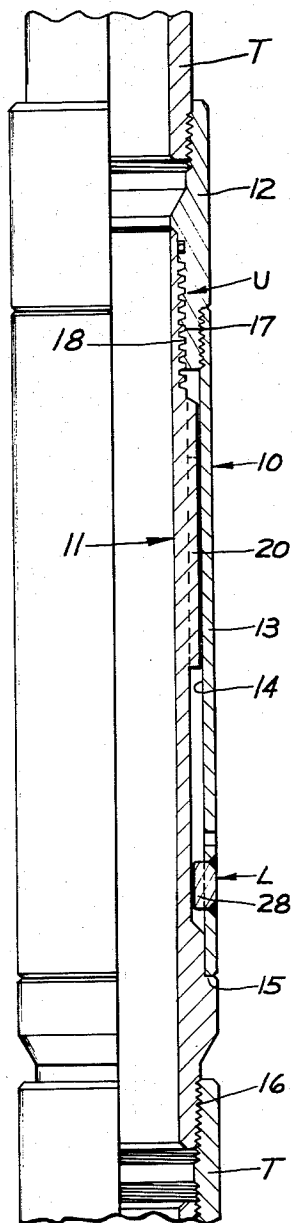
DUAL RELEASE SAFETY JOINT

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2 Sheets-Sheet 1

*Fig. 1*

*Fig. 2*



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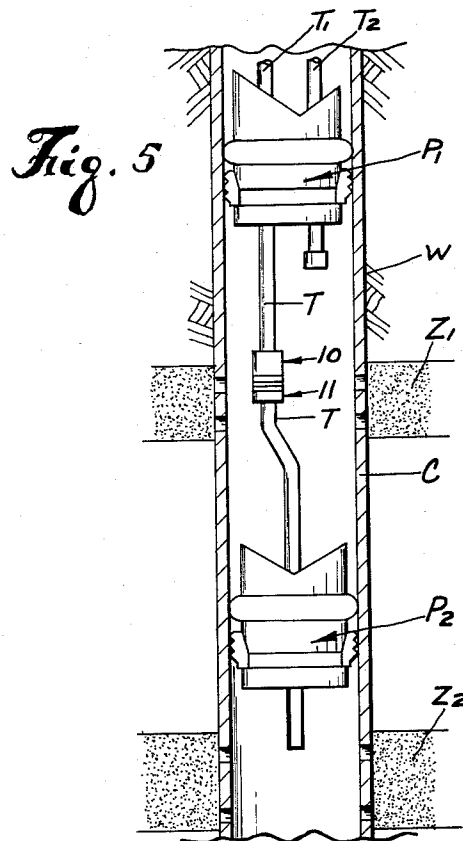
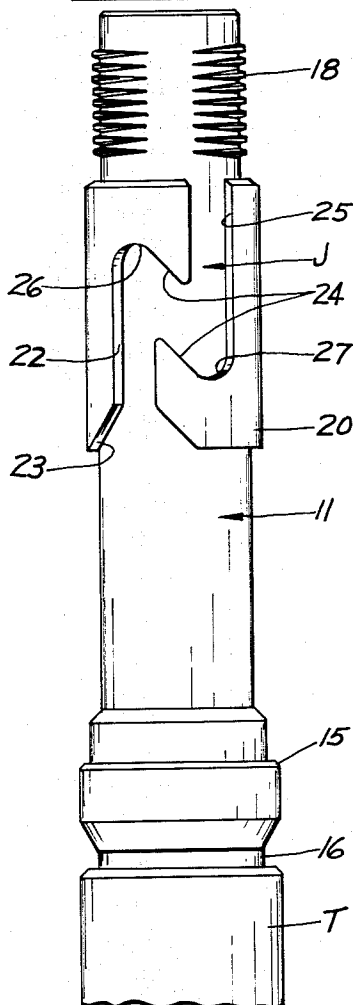
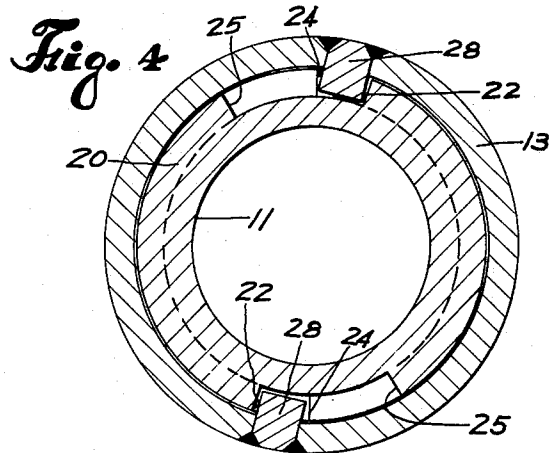
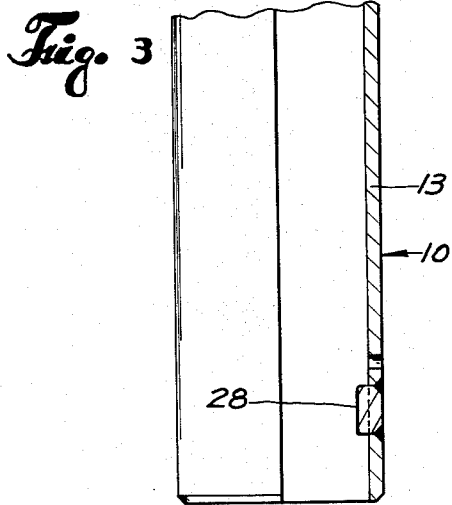
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DUAL RELEASE SAFETY JOINT

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2 Sheets-Sheet 2



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3,248,129

**DUAL RELEASE SAFETY JOINT**  
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**Filed Aug. 14, 1963, Ser. No. 302,090**  
**3 Claims. (Cl. 285-18)**

This invention relates to safety joints for use in well pipe strings, and more particularly to a safety joint employing two releasable connections.

Conventional safety joints generally comprise telescoping pin-and-box connections employing either left-hand threads, which are releasable by right-hand rotation of the pipe string into which it is inserted, or by means of shear pins which may be broken when sufficient torque or pull is applied between members of the joint.

In some well installations, particularly in multiple packer installations, it is the general practice to install a safety joint in the tubing strings between any upper and lower packers. As indicated, the safety joint connection usually employs a coarse, easily released left-hand thread or a shear pin release.

In the usual multiple packer installation, when a thread connection-type safety joint is used, a right-hand rotation of the tubing string at the surface will function to release the upper packer and also to release a safety joint between the upper and lower packers. The upper packer is then retrieved from the well, leaving the lower packer and the section of tubing below the safety joint in the well. A retrieving string is then run into the well and attached to the portion of the tubing string which remains attached to the lower packer and by suitable manipulation of the retrieving string, the lower packer may be released and retrieved from the well. The reason for this two-stage removal of the packers is that the lower packer frequently becomes "sanded-up" (sand deposits accumulate on top of the packer) from the production zone between the two packers, thereby making it difficult to effect release of the lower packer. Consequently, an attempt to release both packers often results in failure and the practice has been to use the usual safety joint as described above, and release the packers separately.

It is a primary object of this invention to provide an improved safety joint which employs two releasable connection means, one of which makes-up securely and will not allow relative longitudinal movement of the safety joint parts, and a second releasable connection means which is engageable when the first connection means is released and which is adapted to transmit right-hand rotation and longitudinal movement of the tubing string, and which may be easily released with minimum manipulation of the tubing string.

An important object is the provision of a dual release type safety joint employing a left-hand thread type connection as the primary connection and a bayonet or Jay-type connection as the second connection.

While the thread connection employed in the safety joint in accordance with the present invention, may employ any conventional coarse left-hand thread commonly used in safety joints, it is preferred to use the "criss-cross" thread arrangement, such as disclosed in C. C. Brown Patent No. 3,083,767, and in such event this invention may be deemed to be an improvement in that patented device.

In using the dual release safety joint in accordance with this invention in a multiple packer installation, it is possible to disengage the threaded connection and release the upper packer by right-hand rotation and thereafter effect re-engagement through the second connection between the safety joint members through which rotational and longitudinal force may be exerted on the lower packer. If the latter is then found to be releasable in

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response to these operations, both packers and the entire tool string may be withdrawn from the well at the same time. On the other hand, if such manipulations fail to release the lower packer, the second releasable connection, being of the Jay-type, may be fully disengaged by limited movement of the operating string, permitting withdrawal of the upper packer from the well and leaving the well clear for the introduction of a conventional retrieval string for engagement with the safety joint element which has been left in the well attached to the lower packer and through which retrieval operations may be conducted in the conventional manner.

Other and more specific objects and advantages of this invention will become more readily apparent from the following detailed description when read in conjunction with the accompanying drawing which illustrates a useful embodiment in accordance with this invention.

In the drawing:

FIG. 1 is a longitudinal cross-sectional view, showing a safety joint in accordance with this invention, installed in a tubing string in fully made-up condition;

FIG. 2 is a partly sectional, partly elevational view, showing the safety joint with the first connection released and the second connection engaged;

FIG. 3 is a view generally similar to FIG. 2, showing the safety joint fully disengaged;

FIG. 4 is a cross-sectional view taken along line 4-4 of FIG. 2; and

FIG. 5 is a schematic view showing the safety joint installed in a tubing string between upper and lower packers set in a well casing.

Referring to the drawing, the safety joint includes an outer box member, designated generally by the numeral 10, and an inner pin member, designated generally by the numeral 11, telescopically insertable in the box member. The latter includes a tubular releasing box 12 adapted to be threadedly connected at its upper end to a section of tubing T and an elongate sleeve 13 threadedly secured in a flush connection to the exterior of releasing box 12 and concentrically spaced from the exterior of pin member 11 by a substantial annular space 14. Pin member 11 is provided with an external shoulder 15 abuttable by the lower end of sleeve 13 when the two safety joint members have been fully made up. Pin member 11 carries at its lower end an externally threaded pin 16 for threaded engagement with a sub-adjacent section of tubing T. Thus, pin member 11 is connected to a lower section of tubing T and box member 10 of the safety joint is connected to an upper section of tubing T.

Two releasable connections are provided between the box and pin members, an upper connection, designated generally by the letter U and a lower connection, designated generally by the letter L (seen in fully engaged position in FIG. 2). Upper connection U is formed by coarse left-hand threads 17 on the interior of releasing box 12 and complementary external threads 18 about the upper or inner end portion of pin member 11. Threads 18 may be formed entirely of the usual coarse left-hand type, but, as indicated previously, are preferably of the criss-cross type illustrated and described in the aforementioned Patent No. 3,083,767. The principal advantage of this criss-cross type thread is that when fully released, the pin member of the joint may be connected to a retrieving tool specially adapted to engage the right-hand portion of the thread section by conventional right-hand rotation of the retrieving string, all as fully described in the aforesaid patent.

Pin member 11 is provided, beginning at a point just below threads 18 and terminating at a point spaced well above shoulder 15, with an enlarged diameter section 20 having an external diameter such as to form a free but close sliding fit in the bore of sleeve 13. The distance

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between the lower end of enlargement 20 and shoulder 15 will be made somewhat greater than the length of the section of threads 18. Enlargement 20 has cut in and along diametrically opposite sides thereof a pair of double-bayonet or Jay-type slots, designated generally by the letter J. This type of slot is sometimes called a "running J" slot, a "zig-zag" or "Z" slot, and comprises a longitudinally extending leg 22 opening to the lower end of enlargement 20 through a flaring guide opening 23, a lateral leg 24 extending downwardly in the counterclockwise direction about the enlargement and communicating at re-entrant angles the upper end of leg 22 with a longitudinally extending outlet leg 25, angularly off-set with respect to inlet leg 22, and opening to the upper end of enlargement 20. The juncture of inlet leg 22 with lateral leg 24 defines a downwardly facing shoulder 26 and the juncture of lateral leg 24 with outlet leg 25 defines an upwardly facing shoulder 27. Inlet leg 22 and outlet leg 25 are generally made about equal in length so that lateral leg 24 will be located at about the mid-point of enlargement 20. Sleeve 13 is provided near its lower end with a pair of diametrically spaced inwardly projecting cylindrical Jay-pins 28 adapted to enter Jay-slot J, being positioned on the sleeve to be spaced below the lower end of enlargement 20 by a substantial distance when the safety joint members are fully made up, as shown in FIG. 1.

FIG. 5 illustrates the safety joint as employed in a conventional multiple packer installation. As illustrated, the installation includes an upper packer P<sub>1</sub> and a lower packer P<sub>2</sub> installed in a well casing C lining a well bore W. Tubing string T, which has the safety joint installed therein, extends from the surface through both packers, as shown, into communication with a lower production zone Z<sub>2</sub>. A second tubing string T<sub>2</sub> extends from the surface through upper packer P<sub>1</sub> into communication with the space between the packers which is in communication with an upper production zone Z<sub>1</sub>.

In operation of the tool installed as shown in FIG. 5, tubing string T will be rotated to the right, which will be operative to release upper packer P<sub>1</sub> and at the same time will actuate the left-hand threads forming upper connection U to dis-connect box member 10 from pin member 11. During this rotation J-pins 28 will be below the lower end of enlargement 20 and will, therefore, rotate freely until the threads have been fully disengaged. Also, the distance between Jay-pins 28 and the lower end of enlargement 20 will permit the limited upward movement of box member 10. The spacing normally provided between Jay-pins 28 in their lowermost position and the lower end of enlargement 20 will be about 12 inches, thereby permitting an upward movement of this length which will be sufficient to effect completion of the rotational movements required to release upper connection U. When the upper packer and upper connection U have been completely released, tubing string T will be picked up and rotated, if necessary, to align Jay-pins 28 with opening 23 which will then guide the Jay-pins into inlet legs 22 of the Jay-slots. Continuing upward movement of the operating string will bring Jay-pins 28 against shoulders 26 and upward movement of the tubing string will thereby be temporarily stopped. By this engagement of Jay-pins 28 with shoulders 26, the second or lower releasable Jay-connection will thus become engaged and both right-hand rotational torque and longitudinal pull may be applied to the tubing string and transmitted through the thus-connected safety joint members to apply releasing forces to lower packer P<sub>2</sub>. If the latter and its attached tubing string are not sanded-up or otherwise held against ready release, the rotational torque and longitudinal pull applied through the lower Jay-connection will function to release lower packer P<sub>2</sub>. When this is accomplished, tubing string T can be picked up to withdraw the upper and lower packers from the well simultaneously.

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On the other hand, if it is found that lower packer P<sub>2</sub> is not readily releasable, complete release of the upper packer may be effected simply by lowering the operating string very slightly and rotating it slightly in the left-hand or counterclockwise direction to align Jay-pins 28 with outlet legs 25. A signal that Jay-pins 28 are in alignment with the outlet legs will be given to the operator through the tubing string when further downward movement causes the Jay-pins to engage shoulders 27 at the bottoms of outlet legs 25. From the latter position, the tubing string will be picked up which will serve to withdraw the Jay-pins straight upwardly out of outlet legs 25 and thereby effect release of lower connection L, thus accomplishing complete dis-engagement of safety joint members 10 and 11. Thereupon, the upper part of tubing string T, carrying upper packer P<sub>1</sub> and safety joint member 10, may be withdrawn from the well. Thereafter, a retrieval string of generally conventional design will be run into the well to engage pin member 11 in a manner suitable to enable the retrieval string to release the lower packer for withdrawal of the latter with the lower portion of the string from the well.

From the foregoing, it will be seen that the described safety joint provides a simple, easily operated structure capable of fulfilling the several objects of this invention with minimum difficulty.

It will be understood that various modifications and alterations may be made in the details of the illustrative embodiment within the scope of the appended claims but without departing from the spirit of this invention.

What I claim and desire to secure by Letters Patent is:

1. A dual release safety joint, comprising, a tubular box member and a pin member telescopically receivable in the box member, complementary threads disposed on the inner end portions of the pin and box member for securing the members when in fully engaged relation and releasable by rotation of the box member in one direction relative to the pin member, said pin member having an annularly enlarged section, said enlarged section commencing at a point axially spaced from said threaded end portion and extending axially to a second terminal point on said pin member, a Jay-type slot element extending longitudinally entirely through said enlargement and having a generally Z-shaped configuration comprising an inlet leg, an outlet leg offset circumferentially from the inlet leg and a lateral leg interconnecting said inlet and outlet legs, said inlet and outlet legs extending longitudinally of said pin member, said lateral leg being disposed obliquely to said inlet leg, and being spiraled downwardly from the inlet leg to the outlet leg in a direction opposite to said one direction, and forming a downwardly facing shoulder across said inlet leg and an upwardly facing shoulder across said outlet leg, a Jay-pin member on said box member in position to engage in said Jay-type slot element, said Jay-pin member being spaced a greater distance from said box member threads than the terminal end of said annularly enlarged section is spaced from said pin member threads plus the length of said pin member threads, said inlet shoulder having sufficient axial extent to overlap opposite sides of said Jay-pin member to prevent rotation of said box member relative to said pin member when said Jay-pin and shoulder are in engagement, said inlet leg having a guide opening with cam shoulders on opposite sides thereof for guiding said Jay-pin member into said inlet leg, whereby said pin member may be rotated relative to said box member for unscrewing said threads and axial movement of said pin out of said box member causes said Jay-pin to engage said inlet shoulder and said engagement permits rotational and longitudinal manipulation of the members before release and provides an indication of the position of said pins in said Z-shaped slot.

2. A dual release safety joint according to claim 1 wherein said upwardly facing outlet shoulder has sufficient axial

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extent to overlap opposite sides of said Jay-pin member to prevent rotation of said box member relative to said pin member when said Jay-pin and outlet shoulder are in engagement.

3. A dual release safety joint according to claim 1 5 wherein said pin member threads are criss-cross type threads whereby the pin member may be threaded into a box member having internal threads, and after removal of the box member the pin member may be threaded into a retrieving tool having internal threads advancing in a direction of rotation opposite to said box member threads. 10

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