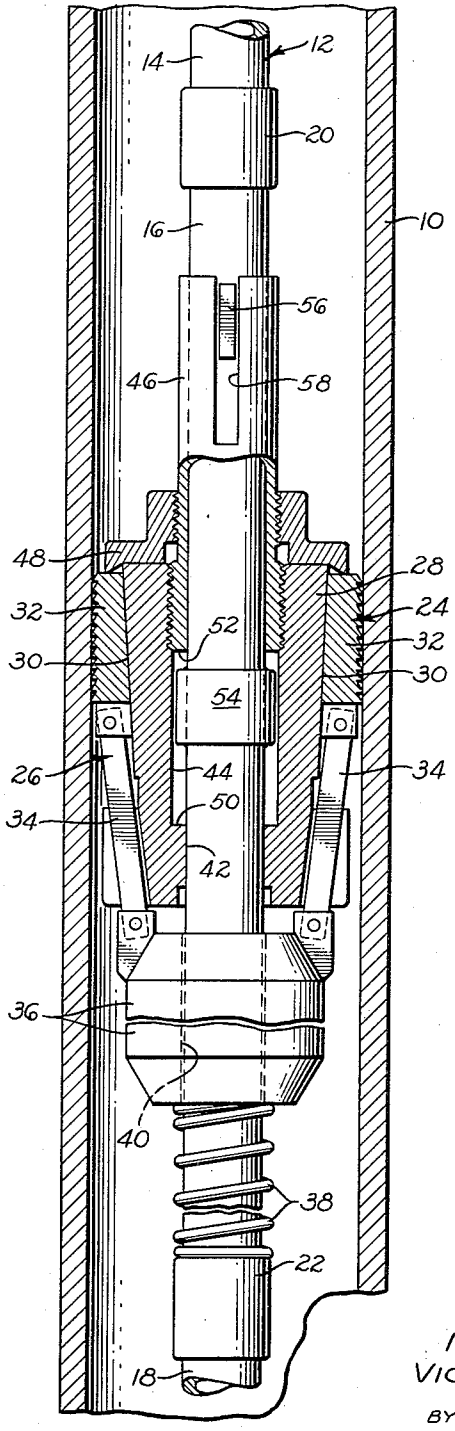
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TUBING CATCHING APPARATUS

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The present invention relates in general to a tubing catching apparatus, such apparatus finding particular utility in the oil industry as a safety device for catching a tubing string in an oil well should it start to fall in the well for any reason. As a matter of convenience, the invention will be considered in such connection herein.

As disclosed in detail in my Patent No. 2,127,900, issued August 23, 1938, a tubing catching apparatus of the character referred to includes a tubing catcher means which is mounted on a tubing string set in a well casing and which includes a tubing catcher body provided with upwardly diverging guides, jaws or slips movable along the guides, and an inertia member connected to the jaws for moving them upwardly and outwardly along the guides and into engagement with the well casing in response to a sudden downward movement of the tubing string. The tubing catcher means thus prevents the tubing string from dropping in the well in the event of a break in the tubing string above the tubing catcher means, or in the event of deliberate or inadvertent release of the tubing string at the surface, the tubing catcher means preferably being located near the lower end of the tubing string.

A primary object of the invention is to provide a tubing catching apparatus of the foregoing character having a lost-motion connection between the tubing catcher means and the tubing string which permits limited relative movement of the tubing catcher means and the tubing string in the vertical direction. Specifically, the tubing catcher or tubing catching apparatus of the invention includes a tubing section which is connectible in the tubing string and which extends through the tubing catcher means with a vertical lost-motion connection therebetween, i. e., with a vertical lost-motion connection between such tubing section and the body of the tubing catcher.

More particularly, an object of the invention is to provide a lost-motion connection between the tubing section which carries the body of the tubing catcher means and the tubing catcher body, comprising interengageable annular shoulders on the tubing section and the tubing catcher body, such lost-motion connection preferably including a collar on the tubing section which is disposed in a bore in the tubing catcher body and which is engageable with annular shoulders at the ends of such bore.

Another object is to provide means for transmitting rotation of the tubing section of the tubing catcher to the tubing catcher body, such rotation transmitting means preferably including a lug on the tubing section which is disposed in a vertical slot in the tubing catcher body.

The foregoing tubing catching apparatus of the invention has a number of advantages. For example, in the event that the tubiing catcher means tends to stick in the well casing after actuation thereof, which is frequently the case, the vertical lost-motion connection between the tubing string and the tubing catcher means permits jarring the tubing catcher means loose. This is accomplished by lowering the tubing string until the tubing section of the apparatus is at the lower limit of its travel relative to the tubing catcher means and then pulling upwardly on the tubing section abruptly so as to produce an impact force tending to jar the tubing catcher means loose when

the tubing section reaches the upper end of its travel relative to the tubing catcher means. Thus, the tubing catcher means may be released from the well casing readily, which is an important feature of the invention.

The provision of the rotation transmitting means between the tubing section of the tubing catching apparatus and the tubing catcher means itself also permits torque to be applied to the tubing catcher means, as well as impact forces, to assist in releasing the tubing catcher means, which is another feature of the invention.

Another advantage of the tubing catching apparatus of the invention is that, in the event that the tubing catcher means is purposely set in the well casing to support a tubing string, the loss-motion connection between the tubing string and the tubing catcher means compensates for any inaccuracies in setting the tubing catcher means, in that the tubing string may be shifted vertically through a limited range to set it in any desired vertical position in such range even if the tubing catcher means is already set. Also, the lost-motion connection compensates for tubing string expansion or contraction with temperature changes when the tubing catching apparatus is used in this manner, tubing string expansion resulting, for example, from the introduction of oil into the tubing string from the producing formation, such oil frequently being at a relatively high temperature. More specifically, after the tubing catcher means is set, the tubing may be pulled up as far as the lost-motion connection permits and may then be set, whereupon the tubing may expand downwardly a substantial distance, due to temperature increases, for example, without resting on the tubing catcher means, which keeps the tubing straight and prevents tubing and sucker rod wear.

The foregoing objects, advantages and features of the present invention, together with various other objects, advantages and features thereof which will become apparent, may be attained with the exemplary embodiment of the invention illustrated in the single figure of the accompanying drawing and described in detail hereinafter.

Referring to the single figure of the drawing, which is partly in vertical section and partly in elevation, the numeral **10** designates a well casing in which is inserted a tubing string **12** shown as including tubing sections **14**, **16** and **18**, the tubing sections **14** and **16** being interconnected by a coupling **20** and the tubing sections **16** and **18** being interconnected by a coupling **22**. The tubing section **16** forms part of a tubing catcher or tubing catching apparatus **24** of the invention which includes a tubing catcher means **26** through which the tubing section **16** extends.

The tubing catches means **26** is similar to that disclosed in my aforementioned patent so that only a brief description herein is required. The tubing catcher means **26** includes a tubing catcher body **28** provided with upwardly diverging guides **30** for jaws or slips **32** which are movable along such guides and which are engageable with the casing **10** as shown. The jaws **32** are connected, as by pivoted links **34**, to an inertia member **36** which is supported by a compression spring **38** seated on the coupling **22**. In the operation of the tubing catcher means **26**, any sudden dropping of the tubing string **12** and the tubing catcher body **28** in the well casing **10** results in upward movement of the jaws **32**, relative to the body **28**, into engagement with the casing to interrupt such dropping, such upward movement of the jaws being produced by the inertia member **36** and the spring **38** as more fully discussed in my aforementioned patent. Ordinarily, as disclosed in my aforementioned patent, the tubing string **12** is connected directly to the tubing catcher body **28** so that any tendency of the tubing string to drop, either through breakage, or inadvertent or deliberate

release, is transmitted directly to the tubing catcher body to cause the inertia effect of the inertia member **36** to move the jaws **32** upwardly and outwardly along the guides **30** and into engagement with the casing **10**.

In accordance with the present invention, however, the tubing string **12** is not connected directly to the tubing catcher body **28**, but is connected thereto through a vertical lost-motion connection which will now be described. As will be apparent, the tubing section **16** extends through a bore **40** in the inertia member **36**, a bore **42** in the tubing catcher body **28**, a counterbore **44** therein, and a sleeve **46** threaded into the upper end of the counterbore **44** and forming part of the tubing catcher body, an annular retainer **48** for preventing upward movement of the jaws **32** out of the guides **30** being threaded onto the sleeve **46**. The counterbore **44** is closed at its lower end by an annular shoulder **50** and is closed at its upper end by an annular shoulder **52** formed by the inner end of the sleeve **46**. Disposed within the counterbore **44** between the shoulders **50** and **52** is a collar **54** which is fixed on the tubing section **16**, as by welding, or otherwise. The length of the collar **54** is less than the distance between the shoulders **50** and **52** so that limited vertical movement between the tubing section **16** and the tubing catcher body may take place, such relative movement being limited by engagement of the collar **54** with the shoulder **50**, or the shoulder **52**. Relative rotation between the tubing catcher body **28** and the tubing section **16** is prevented by a rotation transmitting means shown as comprising a lug **56** on the tubing section **16** disposed in a vertical slot **58** in the sleeve **46**, two or more such lugs and slots being employed if desired.

In operation, when the tubing string **12** is lowered into the casing **10**, the weight of the tubing catcher means **26** is supported by the spring **38**, at least in part, so that the spring is compressed, part of the weight of the inertia member **36** being supported by the jaws **32**, which are in engagement with the lower ends of the guides **30** under such conditions. The weight of the tubing catcher body **28**, and thus part of the weight of the inertia member **36**, is carried by the collar **54** on the tubing section **16**, the shoulder **52** being seated on the collar **54** under such conditions.

With the foregoing conditions obtaining, if the tubing string **12** drops suddenly, either through breakage above the tubing catcher means **26**, or through inadvertent or intentional release of the tubing string, the collar **54** disengages the shoulder **52** and engages the shoulder **50**, thereby causing the tubing catcher body **28** to drop suddenly also. The inertia of the inertia member **36**, together with the upward force applied thereto by the spring **38**, tends to cause the inertia member **36** to remain stationary while the tubing catcher body drops, thereby causing the jaws **32** to move upwardly along the guides **30** and outwardly into engagement with the casing **10** to catch the tubing string. The lost-motion connection between the tubing section **16** and the tubing catcher body **28** plays a role in setting the tubing catcher means **26** in that the collar **54** strikes the shoulder **50** with an impact that causes the tubing catcher body **28** to start to move downwardly much more abruptly than it would if it were rigidly connected to the tubing string **12**, thereby insuring much more effective setting of the tubing catcher means because the full inertia effect of the inertia member **36** is thereby attained, which is a feature of the invention.

When it is subsequently desired to release the tubing catcher means **26**, this can be done very easily by pulling upwardly on the tubing section **16**, either by pulling upwardly on the tubing string **12**, or by means of a fish, not shown, engaging the tubing string **12**, or the tubing section **16**. As a result of such upward movement of the tubing section **16**, the collar **54** strikes the shoulder **52**, thereby producing a jarring effect which facilitates loosening of the tubing catcher means **26**, thereby making removal of the tubing catcher a much easier job. If desired, torque may be applied to the tubing catcher means **26** during the releasing operation also, this being permitted by the rotation transmitting connection between the tubing section **16** and the tubing catcher body **28** provided by the lug **56** and the slot **58**.

In addition to facilitating release of the tubing catcher means **26** in the manner hereinbefore described, the lost-motion connection between the tubing section **16** and the tubing catcher body **28** also compensates for expansion and contraction of the tubing string **12** because of temperature or other effects, as hereinbefore discussed.

Although I have disclosed an exemplary embodiment of my invention herein for illustrative purposes, it will be understood that various changes, modifications and substitutions may be incorporated in such embodiment without departing from the spirit of the invention as defined by the claims which follow.

I claim as my invention:

1. In a tubing catching apparatus, the combination of: a tubing catcher body; outwardly movable jaws carried by said tubing catcher body; inertia means connected to said jaws and vertically movable relative to said tubing catcher body for moving said jaws outwardly relative to said tubing catcher body in response to sudden downward movement of said tubing catcher body; a tubing section extending through said tubing catcher body and through said inertia means and connectible in a tubing string; and a lost-motion connection between said tubing section and said tubing catcher body permitting limited relative longitudinal movement while preventing relative rotation therebetween, said inertia means comprising a relatively heavy mass guided solely by said tubing section.

2. In a tubing catching apparatus, the combination of: a tubing catcher means including a tubing catcher body provided with upwardly diverging guides, jaws movable along said guides, and an inertia member connected to said jaws and movable vertically relative to said tubing catcher body for moving said jaws upwardly and outwardly along said guides relative to said tubing catcher body in response to a sudden downward movement of said tubing catcher body; a tubing section extending through said tubing catcher means and connectible in a tubing string; and a lost-motion connection between said tubing section and said tubing catcher body permitting limited relative longitudinal movement while preventing relative rotation therebetween, said inertia member comprising a relatively heavy mass guided solely by said tubing section.

3. A tubing catching apparatus as defined in claim 2 wherein said lost-motion connection includes interengageable annular shoulders on said tubing section and said tubing catcher body.

4. A tubing catching apparatus as defined in claim 2 wherein said lost-motion connection includes a collar on said tubing section disposed in a bore in said tubing catcher body and engageable with shoulders at the ends thereof.

5. A tubing catching apparatus as defined in claim 2 wherein said means preventing relative rotation includes a lug on said tubing section disposed in a vertical slot in said tubing catcher body.

6. A tubing catching apparatus according to claim 2 including spring means interconnecting said tubing section and said inertia member for biasing said inertia member upwardly relative to said tubing section.

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