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STOP DEVICE FOR WELL PIPES

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Fig. 1

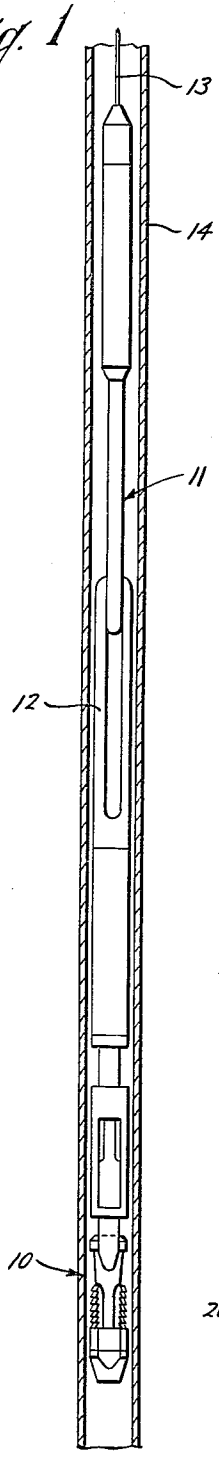


Fig. 2

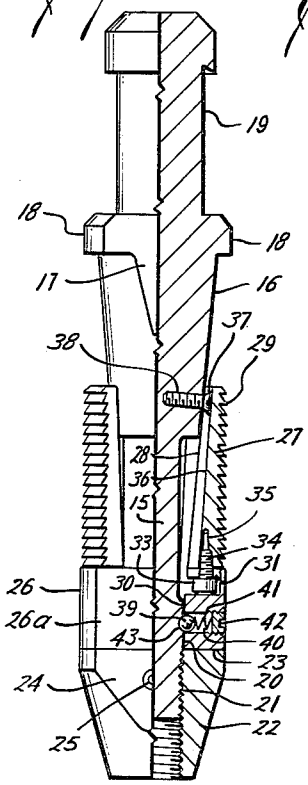
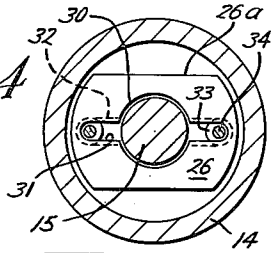


Fig. 4



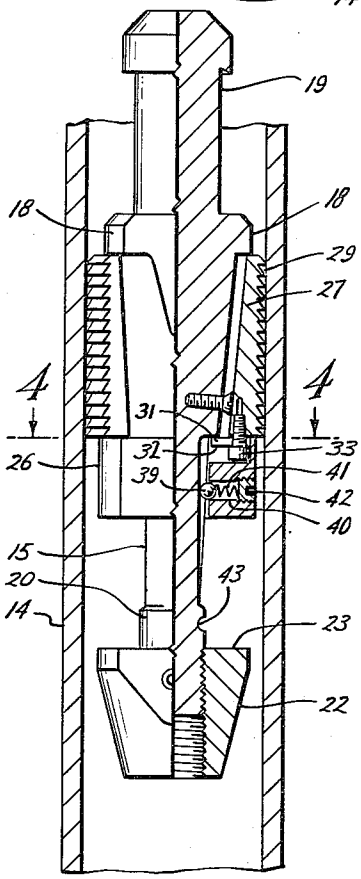


Fig. 5

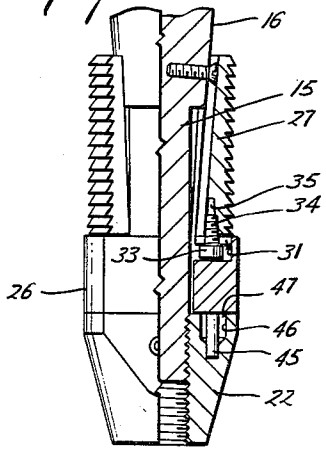


Fig. 3

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STOP DEVICE FOR WELL PIPES

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This invention relates to stop devices for use in well pipes, and particularly to a type of stop device for use in the production tubing of wells and commonly referred to as a "tubing stop."

Stop devices are installed in well pipes, particularly well tubing, to limit the travel of production tools of various types, such as free plungers, which are operated in the tubing. Also, stop devices are employed to prevent various other tools, being operated in a well pipe, from falling through the open end of the pipe string where no other closure is present.

Conventional slip-type tubing stops are subject to a number of difficulties in operation. In some, the slips are so arranged that they tend to set as the device is being run down the tubing. This requires special care in manipulation, and also usually requires that the device travel at a relatively low speed when being installed. Moreover, where premature setting of the slips occurs, the wire line jars, which are ordinarily used to run the device, may be prematurely actuated, requiring removal of the string of tools in order to reset the jars before the device can be run back into the well to this intended location. Other conventional stop devices require drag shoes or springs which frictionally engage the pipe wall throughout their movement in the pipe, and thus often scratch the surface of the pipe, removing the normally protective oxide or other external coating and thereby exposing the underlying bright metal. The exposure of the bright metal to the well fluids leads to intensified galvanic action and resulting corrosion of the pipe.

The device, in accordance with the present invention, is designed to overcome the various defects and disadvantages of existing types of stop devices, and to provide a very simply constructed, easily operated structure which can be set and retrieved by means of conventional wire line tools.

A more specific object is to provide a form of tubing stop employing a body carrying a slip-setting expander and relatively movable slips, the slips being releasably secured to the body in retracted position by latch means which are operable to release the slips for engagement with the expander in response to a downwardly directed jarring impact applied to the body.

An additional object is to provide a device of the character described employing a spring-biased detent as the latch means releasably securing the slips to the body.

In another embodiment of this invention, the latch means may comprise a permanent magnet arranged to releasably hold the slips out of expansive engagement by the expander until released by jarring impact on the body.

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

In the drawing:

FIG. 1 is a generally diagrammatic view showing the device being installed in a well on a wire line string of tools;

FIG. 2 is a longitudinal, partly sectional view showing the details of a tubing stop in accordance with one embodiment of this invention, the parts being shown in the unset position;

FIG. 3 is a view similar to FIG. 2 showing the parts of the device in the set or pipe-engaging position;

FIG. 4 is a cross-sectional view taken long line 4—4 of FIG. 3; and

FIG. 5 is a fragmentary view similar to FIG. 2 of the lower portion of the device showing another embodiment of a latch means for releasably holding the slips in the unset position.

Referring to the drawing, there is shown in FIG. 1 a stop device in accordance with the present invention, designated generally by the numeral 10, suspended from a string of conventional wire line tools, designated generally by the numeral 11, and including jars 12, the string being suspended from a wire line 13 by which the device is run into a well pipe, such as a tubing 14, to be set therein, as will be described subsequently.

Stop device 10, as best seen in FIGS. 2 and 3, comprises an elongate, generally cylindrical body 15 having an upper portion formed to provide an upwardly tapering, generally conical slip expander 16 which, as shown, is integral with body 15, but may be otherwise mounted thereon, as will be evident to those familiar with devices of this general character. The larger upper end of expander 16 is cut away on opposite sides thereof to form the flattened sides 17, the remaining opposite curved portions terminating in overhanging shoulders 18. A fishing neck 19, of generally conventional form, defines an upward extension of the body above shoulders 18. At its lower end, body 15 has a slightly enlarged portion 20 which has its lower end externally threaded at 21 to receive a nut 22 which forms an enlargement about the lower end of the body and defines an upwardly facing shoulder 23 about portion 20 of the body. Nut 22 has flat opposite sides 24 to align with flat sides 17 of the expander and a set screw 25 is provided to secure nut 22 to threaded portion 21 and to maintain this alignment. Slidably disposed about body 15 above nut 22 is a collar 26 which functions as a slip carrier and supports thereon a pair of upwardly extending slips 27 disposed on opposite sides of the body for sliding engagement with the curved portions of expander 16. Slips 27 have inner faces 28 tapered to complement the taper of expander 16 and are provided on their outer faces with pipe-gripping teeth 29. Collar 26 has a bore 30 adapted to have a close but free sliding fit about lower portion 20 of body 15. Opposite sides of collar 26 are also cut away to form the flat sides 26*a* which are adapted to align with flats 17 and sides 24 to be substantially flush therewith.

Slips 27 are secured to collar 26 by means adapted to permit limited radial movement of the slips. This means comprises key-hole slots 31 (see FIG. 5) extending laterally from near the outer surface of collar 26 to opposite sides of bore 30 near the upper end of collar 26. The outer ends of the slots are closed and the slots are undercut to provide channels 32 adapted to receive heads 33 of taper screws 34 which screw upwardly into sockets 35 provided in the lower ends of slips 27. It will be seen that by this arrangement slips 27 may move radially an amount corresponding generally to the length of slots 31, but cannot be dislodged from their connection to collar 26, once the device is assembled. Inner faces 28 of slips 27 are provided with longitudinally extending dove-tail grooves 36 adapted to co-operate with heads 37 of screws 38, which are screwed into expander 16. Heads 37 project from the exterior surface of expander 16 and are tapered to complement the dove-tail tapers of grooves 36 and cooperate with the latter to secure slips 27 to the expander while constraining them to move longitudinally relative to the surface of expander 16.

Suitable releasable latch means are arranged between collar 26 and body 15 to releasably hold collar 26 in its lowermost position against shoulder 23, whereby to hold

slips 27 out of expansive engagement with expander 16. One embodiment of such a latch means is illustrated in FIGS. 2 and 3 and comprises a ball-type detent 39 mounted in a passage 40 extending radially through the wall of collar 26 and opening into bore 30. Detent 39 is resiliently biased toward bore 30 by means of a coil spring 41 which is urged against the ball by means of an adjustment screw 42 threaded into the outer end of passage 40. Portion 20 of the body is provided with a recess 43 registering with the inner end of passage 40 and adapted to form a receiving seat for detent 39. Thus it will be seen that when collar 26 is in its lowermost position detent 39 will project into recess 43 and be held therein under the pressure of spring 41, thereby latching collar 26 to body 15. It will be evident that in order to release collar 26 from body 15, a force exceeding the pressure of spring 41 and directed to effect relative upward movement of collar 26 relative to body 15, will be required. The holding force exerted by detent 39 may be varied by varying the compression of spring 41 by appropriate adjustment of screw 42.

In operation, the device, assembled as illustrated in FIG. 2, with collar 26 latched to body 15 so as to hold slips 27 out of expansive engagement with expander 16, will be connected to the string of wire line tools 11 in the conventional manner, the string of tools being secured to the stop device by attachment to fishing neck 19. The string of tools carrying the stop device will then be lowered through tubing 14 to a point somewhat above that to which the device is to be set. Thereupon, by manipulation of the wire line, in the well-known manner, jars 12 will be actuated to produce a downwardly directed impact against the upper end of body 15, the impact being transmitted through fishing neck 19 and expander 16. This downwardly directed impact will be applied with sufficient force to overcome the force of spring 41 and release collar 26, by reason of its inertia, for movement upwardly relatively to body 15. The upward movement of collar 26 relative to expander 16 will cause the latter to expand slips 27 outwardly into engagement with the surrounding wall of tubing 14. As soon as such engagement occurs, the slips will remain stationary while additional downward force may be exerted through the string of tools to apply additional downward pressure to expander 16 and thereby set the slips strongly into the pipe wall. The lowering string can then be released in the usual manner from the stop device, and the latter will remain in the well in the position substantially as shown in FIG. 3.

When it is desired to remove the stop device, the string of tools will be run back into the well, secured to fishing neck 19, and by an upward pull, or by upward jarring on the fishing neck, expander 16 can be pulled upwardly out of the slips and this upward movement will carry the lower end of body 15 back into the bore of collar 26 where the detent will again engage recess 43. The relative downward movement of collar 26 will, of course, retract slips 27 along the surface of expander 16, and thereby free the stop device from its engagement with the pipe wall and permit it to be withdrawn from the well.

By flattening the opposite sides of the several parts of the device, as described, substantial clearance is provided about the stop device for free passage of fluid through the spaces thus provided, which is particularly desirable when fluid is to be produced through the pipe, or when it may be desired to circulate fluid through the pipe.

FIG. 5 illustrates another embodiment in accordance with this invention, differing from that previously described primarily in the form of releasable latch means which is employed to initially hold collar 26 and slips 27 in the retracted position. In this embodiment, the releasable latch means comprises a permanent magnet 45 which is vertically disposed in the upper end of nut 22, being inserted into a cylindrical recess 46, which provides an air gap 47 between the magnet and the body of nut 22. Collar 26 will be constructed of any suitable material which will be attracted to magnet 45. The latter will be selected to have a strength sufficient to exert the desired holding force on collar 26. This holding force may be varied by employing magnets of different strengths.

This modification of the latch mechanism is actuated in exactly the same manner as the previously described embodiment, namely, by exerting a downwardly directly jarring force on body 15 which is great enough to exceed the holding force of magnet 45, whereupon the collar 26 will be jarred loose and by its inertia caused to move upwardly along body 15 to actuate the slips.

It will be understood that the magnet or magnets, since more than one may be employed, may be mounted in nut 22, as shown, or in collar 26, if preferred.

From the foregoing, it will be seen that the stop device in accordance with this invention may be run into a pipe without danger of prematurely setting the slips and without requiring continuous frictional engagement with the pipe wall while it is being run, thereby overcoming the princpal dfficulties encountered with more conventional devices. Moreover, as will be evident from the foregoing, the structural details of the device are quite simple and provide a device which can be manufactured and assembled easily and relatively cheaply.

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

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

1. A stop device for well pipes, comprising, a body insertable in a well pipe, said body carrying a downwardly tapering slip expander and a laterally enlarged portion defining an upwardly facing external shoulder about the body spaced below said expander, a collar mounted about the exterior of the body above said shoulder for longitudinal sliding movement relative to said expander, a plurality of upwardly extending pipe gripping slips supported on the collar for radial movement, said slips being expandible by engagement with the expander in response to relative longitudinal movement therebetween, latch means releasably securing said collar to the body at a position to initially hold said slips out of expansive engagement with said expander, said latch means including separable latch elements on the collar and the body so constructed and arranged as to release said collar by inertial reaction in response to a downwardly directed impactive force applied to said body, by an impact-imparting means operated through the well pipe and said inertial reaction of said collar being operative upon release of said collar to produce said relative longitudinal movement between the slips and the expander.

2. A stop device according to claim 1 wherein said latch means comprises detent means on the collar, and a co-operating detent-receiving recess in the exterior of said body.

3. A stop device according to claim 1 wherein said latch means comprises a permanent magnet positioned on one of the relatively movable elements comprising the body and the collar, the other of said elements comprising a magnetically attractable material, whereby to normally hold said collar against said enlarged portion by magnetic attraction therebetween.

4. A stop device for well pipes, comprising, a body insertable in a well pipe, said body carrying a downwardly tapering slip expander and a laterally enlarged portion defining an upwardly facing external shoulder about the body spaced below said expander, a collar mounted about the exterior of the body above said shoulder for longitudinal sliding movement relative to said expander, a plurality of upwardly extending pipe-gripping slips supported on the collar for radial movement, said slips being ex-

pandible by engagement with the expander in response to relative longitudinal movement therebetween, latch means releasably securing said collar to the body at a position to initially hold said slips out of expansive engagement with said expander, said latch means including separable latch elements on the collar and the body so constructed and arranged as to release said collar by inertial reaction in response to a downwardly directed impactive force applied to said body, by an impact-imparting means operated through the well pipe, said inertial reaction of said collar being operative upon release of said collar to produce said relative longitudinal movement between the slips and the expander, and means carried by the upper end of the body for connecting a retrieving tool thereto.

5. A stop device for well pipes, comprising, a body insertable in a well pipe, said body carrying a downwardly tapering slip expander and a laterally enlarged portion defining an upwardly facing external shoulder about the body spaced below said expander, a collar mounted about the exterior of the body above said shoulder for longitudinal sliding movement relative to said expander, a plurality of upwardly extending pipe-gripping slips supported on the collar for radial movement, said slips being expandible by engagement with the expander in response to relative longitudinal movement therebetween, means forming a longitudinally slidable connection between the slips and the expander, latch means releasably securing said collar to the body at a position to initially hold said slips out of expansive engagement with said expander, said latch means including separable latch elements on the collar and the body so constructed and arranged as to release said collar by inertial reaction in response to a downwardly directed impactive force applied to said body exceeding the holding force of said latch means, said impactive force being applied by an impact-imparting means operated through the well pipe, said intertial reaction of said collar being operative upon release of said collar to produce said relative longitudinal movement between the slips and the expander, and means carried by the upper end of the body for connecting a retrieving tool thereto.

6. A stop device according to claim 5 wherein said latch means comprises a permanent magnet positioned on one of the relatively movable elements comprising the body and the collar, the other of said elements comprising a magnetically attractable material, whereby to normally hold said collar against said enlarged portion by magnetic attraction therebetween.

7. A stop device for well pipes, comprising, a body insertable in a well pipe, said body including an integral downwardly tapering slip expander and an integral generally cylindrical portion extending from the lower end of the expander, a nut member threadedly connected to the lower end of the cylindrical portion to define an upwardly facing shoulder about said portion, a collar member mounted about said cylindrical portion above said shoulder for longitudinal sliding movement relative to said expander, a pair of upwardly extending pipe-gripping slips supported on the upper end of said collar member on opposite sides of said body, means forming a radially slidable connection between each of said slips and the upper end of the collar member, said slips being radially xpandible by engagement with the expander in response to relative longitudinal movement therebetween, latch means releasably securing said collar member to the body at a position to initially hold said slips out of engagement with said expander, said latch means comprising a ball detent mounted in the collar member biased to project into the bore of the collar member, and a ball-receiving socket positioned in the exterior of said cylindrical portion to register with the ball-detent when the collar member is seated on said shoulder, said latch means being operable to release said collar member by inertial reaction in response to a downwardly directed impactive force applied to said body by an impact-imparting means operated through the well pipe, and said inertial reaction of said collar being operative upon release of said collar to produce said relative longitudinal movement between the slips and the expander, and means integral with the upper end of the body for connecting a retrieving tool thereto.

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