April 29, 1952 B. F. KELLEY 2,594,446

SLIP LIFTER LOCK

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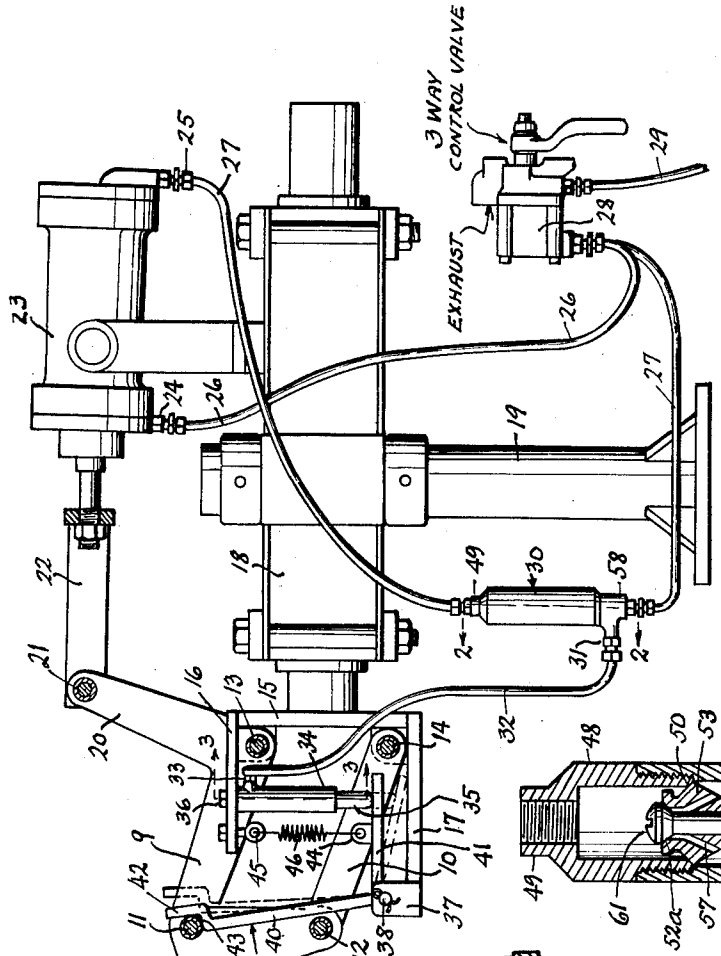


Fig. 1.

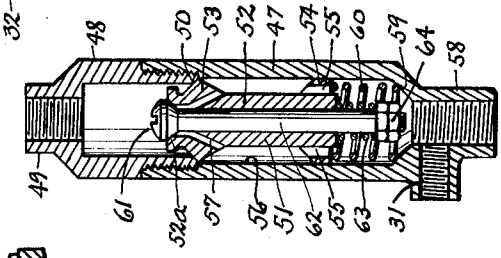


Fig. 2.

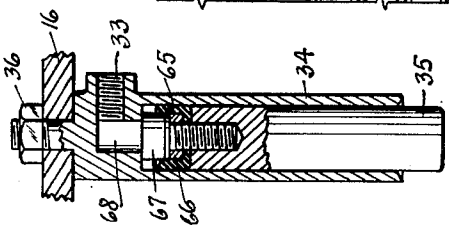


Fig. 3.

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SLIP LIFTER LOCK

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2 Claims. (Cl. 24—263)

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This invention relates to safety latches or locks to be used particularly in conjunction with the operation of pipe slips and slip spiders employed in well drilling and well servicing operations.

In my United States Patent No. 2,340,597 issued February 1, 1944, there is described and claimed an improved form of rotary slip lifter which is adapted particularly for raising and lowering pipe gripping slips into and out of engagement with drill pipe or casing being run in and out of a well through a conventional rotary table or other slip support, without removing the slips and the slip spider from the rotary table or other support.

In the operation of slip lifters, both of the kind described in the patent above referred to, as well as of other types generally in use, the slips normally remain in generally circular position about the well opening throughout the drilling or servicing operation so that they may be lowered into the slip bowl or other support when it is desired to have them grip and support the drill pipe or casing which is inserted in the well, or so that the slips may be lifted from the slip bowl or other support and retracted so as to release the pipe or casing for movement in the well.

The retraction of the slips in the latter case is normally sufficient only to permit free movement of the pipe and connecting collars through the space encompassed by the slips and their supporting spider, since, in the interest of speedy and efficient operation, it is desirable not to remove the slips completely from the vicinity of the well mouth and to retain them in readiness for prompt reinsertion in the slip bowl whenever required.

The movements of the pipe into and out of a well are normally accomplished by means of flexible cables which are attached to the upper end of the pipe string and which pass over suitable pulley blocks mounted in the top of a derrick and thence to draw works which provide the necessary power for these operations. The vertical movement of the pipe string, due to its suspension from flexible cables, is accompanied normally by some lateral swinging movements which may cause the pipe to bump into the slips and their supports and in downward movement of the pipe may cause the collars connecting joints of the pipe to catch on the top of the slips or their support rings or spiders. When this occurs, the result in the absence of suitable protective devices, may be to drive the slips back down in the slip bowl and into tight gripping engagement with the pipe being lowered. Since the pipe is normally lowered at relatively high speeds and

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since strings of pipe weigh many tons, much damage may result from such an inadvertent setting of the slips.

Accordingly it is a principal object of this invention to provide a safety latch adapted to lock the slips in their retracted position so that contact of the pipe or collars with any portion of the slips or their supports will not cause uncontrolled setting of the slips.

Another object of this invention is to provide such a safety latch which is automatic in operation in relation to the movements of the slips.

A further object of this invention is to provide a safety latch which is automatically operative to lock the slips upon their retraction, and to automatically release the slips upon their advancement into engagement with the pipe.

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

In the drawings:

Fig. 1 is a side elevation of an assembly of apparatus illustrative of one embodiment in accordance with this invention and showing in full lines the position of parts of the apparatus employed with slip retracting and advancing mechanism when the slips are in the retracted position and showing in dashed outlines the position of the apparatus when the slips are in the advanced position.

Fig. 2 is a longitudinal sectional view taken along line 2—2 of Fig. 1, and

Fig. 3 is a longitudinal sectional view taken along line 3—3 of Fig. 1.

Referring to the drawings, a slip bowl 4, of generally conventional form, is shown in half-sectional view, and has mounted thereon a circular spider 5 adapted to be raised and lowered relative to the top of the slip bowl. A group of pipe gripping slips 6—6 are suspended from spider 5 by means of linkages 7 which are operative to advance and retract the slips relative to the slip bowl as spider 5 is raised or lowered. The spider 5 is rollably mounted in a yoke 8 to which is attached a parallelogram hinge consisting of hinge members 9 and 10 which are pivotally connected at one end thereof to yoke 8 by means of hinge pins 11 and 12 and at the opposite ends thereof by means of hinge pins 13 and 14 to a bracket consisting of a rear plate 15 and upper and lower plates 16 and 17, respectively. The rear plate 15 of the bracket is firmly mounted on a hori-

zontal arm 18 which is rigidly supported on a pedestal 19.

The above described arrangement of slip bowl, slips, lifting spider and hinge mechanism is described in detail in the before mentioned U. S. Patent No. 2,340,597 and of itself forms no part of the present invention.

Hinge arm 9 has integral therewith an angularly extending lever arm 20 which is pivotally connected at 21 with the end of a piston rod 22 which is reciprocably mounted in a cylinder 23 and adapted to be reciprocated therein by any suitable actuating pressure fluid such as air, gas, steam, liquid or the like. As shown, cylinder 23, is mounted on arm 18 and, therefore, also supported by pedestal 19.

Cylinder 23 is fitted at its opposite ends with fittings 24 and 25 for the introduction and discharge of the fluid employed in the cylinder to actuate piston rod 22. Pipes 26 and 27 connect fittings 24 and 25, respectively, to a three-way control valve 28, which is of conventional design, the form illustrated in Fig. 1 being manufactured commercially by Hydraulic Products Company, Chicago, Illinois. A pipe 29 connects valve 28 to an appropriate source of a suitable actuating pressure fluid. A back-pressure valve, designated generally by the numeral 30, is interposed in pipe 27 and is provided at one end with a side fitting 31 which is connected by means of a pipe 32 to the inlet 33 of a dash pot 34 which is fitted with a plunger 35. Dash pot 34 is rigidly fastened at 36 to upper plate 16 of the hinge support bracket and extends downwardly therefrom.

A bracket 37 mounted on the end of lower plate 17 of the hinge support bracket provides pivotal support by means of a pin 38 for a latch member, designated generally by the numeral 39, and consisting of a generally vertical arm 40 having a horizontal arm 41 rigidly connected thereto. Vertical arm 40 has an offset portion 42 at its upper end forming a shoulder 43 adapted to engage hinge pin 11. Horizontal arm 41 extends below the end of plunger 35 which is in constant engagement therewith and has mounted on its upper face an eye 44 located between the point of contact of plunger 35 with horizontal arm 41 and the junction of horizontal arm 41 with vertical arm 40. Upper plate 16 of the hinge support bracket has mounted on the lower face an eye 45 located directly above eye 44. A coil spring 46 is connected between eyes 44 and 45 and is normally in tension.

Back pressure valve 30 includes a hollow cylindrical body 47 fitted with a cap portion 48 which is screwed into body 47, forming generally an extension thereof. Cap portion 48 is fitted with a threaded connection 49 for attachment of pipe 27. The bore of cap portion 48 is slightly smaller in diameter than the bore of body 47 forming an annular shoulder 50 which is adapted to serve as a valve seat and is appropriately tapered for this purpose.

Body 47 has mounted in the bore thereof a valve member 51 of smaller diameter than the bore of body 47. Valve member 51 is also bored internally at 52 and is provided with a tapered head 53 of somewhat larger diameter than valve member 51 and adapted to seat against shoulder 50. The upper end of bore 52 is chamfered to form an outwardly tapering seat 52a. Valve member 51 is provided at the end opposite to tapered head 53 with a flange 54, the outer circumference of which forms a sliding fit with the interior wall of the bore of body 47. Ports 55 extend through flange 54 and provide communication between the bore of body 47 below valve member 51 and the annular space 56 between valve member 51 and the bore of body 47 above flange 54. Passageways 57 extend through tapered head 53 to provide communication between annular space 56 and bore 52 adjacent seat 52a.

The lower end of body 47 is fitted with an internally threaded connection 58 for connection into pipe 27. Side outlet 31 communicates with the bore of connection 58. The bore of body 47 is reduced at the point of attachment to connection 58 forming a tapered shoulder 59. A coil spring 60 is mounted in the bore of body 47 between the lower face of flange 54 and shoulder 59 and is normally in compression to normally force head 53 of valve member 51 into engagement with shoulder 50. A tappet type valve is mounted in bore 52 and consists of a head 61 adapted to be seated in seat 52a and a stem 62 which extends through bore 52 and for a short distance beyond the lower face of flange 54. A coil spring 63 of smaller diameter than coil spring 60 surrounds the extending end of stem 62 and is held in compression against the lower face of flange 54 by means of nuts 64 screwed on the end of stem 62.

The inner end of plunger 35 is fitted with a resilient cup 65 which is fastened in place by means of a cap screw 66 which is inserted through a ring 67 mounted on the cup and screwed into the end of the plunger. The cap screw compresses the cup and forces it into sealing engagement with the inner wall of the dash pot. A passageway 68 provides communication between inlet 33 and the interior of dash pot 34 above cup 65.

The operation of the structure above described will now be explained, referring first to parts as illustrated in full lines in Fig. 1. As there shown, slips 6 and the supporting spider 5 are in the raised or retracted position, resulting from the admission of actuating fluid through pipe 29, control valve 28, pipe 26 and connection 24 into the forward end of cylinder 23 which forces piston 22 rearwardly in cylinder 23. This movement acts on lever arm 20, thence through hinge arms 9 and 10 and hinge pins 11—12 and 13—14 to raise spider 5 and its attached slips 6 to the position shown. The operation of control valve 28 in effecting these movements is to place the exhaust of the control valve in communication with pipe 27, thence to connection 25 at the rear end of cylinder 23. These connections thus become an exhaust system for the actuating fluid in the rear end of cylinder 23. The actuating pressure fluid exhausts through pipe 27 into the interior of back-pressure valve 30 where the exhausting fluid forces valve member 51 downwardly and away from shoulder 50 and permits the fluid to flow past valve head 53 through annular space 56 and ports 55, thence through connection 58 to the exhaust passage of control valve 28. This system being in exhaust, pressure is also relieved from the top of plunger 35 through inlet 33 and pipe 32 and connections 31 and plunger 35 is thus forced into retracted position by the counter-action of coil spring 46 acting to pull arm 41 of the safety latch upwardly against the end of the plunger. This action of arm 41 operates through hinge pin 38 to swing the vertical arm 40 of the latch forwardly and bring offset shoulder 43 into latching engagement underneath hinge pin 11, thereby locking spider 5 in the raised position as shown.

In order to lower slips 6 into slip bowl 4, the handle of control valve 28 is turned in a con-

ventional and appropriate manner to place the exhaust passage of this valve in communication with pipe 26 and, at the same time, to place the source of actuating pressure fluid through pipe 29 into communication with pipe 27. The actuating fluid passing through pipe 27 entering the lower end of back pressure valve 30 through inlet 58 forces valve member 51 upwardly and head 53 against shoulder 50. This forces the pressure fluid to be diverted through passageways 57 against head 61 of the tappet valve, lifting it from seat 52*a* and admitting the fluid into the upper part of valve 30, thence through connection 49 and pipe 27 to the rear end of cylinder 23. There the fluid acts to drive piston 22 forward which, acting through the linkage previously described, will operate to lower the spider 5 and slips 6. However, this action could not occur until the latch is disengaged from hinge pin 11. The disengagement is effected automatically while the actuating fluid is flowing to the rear end of cylinder 23, as previously described. While the fluid is flowing through back pressure valve 30 to the rear end of cylinder 23, the system is under pressure of the fluid, and the fluid, therefore, also flows through connection 31, pipe 32 and inlet 33 into dash pot 34 where it acts on the top of plunger 35 to force it downwardly against the free end of latch arm 41. This forces the latter downwardly and acts to drive arm 40 of the latch rearwardly and out of engagement with hinge pin 11, thereby releasing spider 5 and allowing it to be lowered by the action of piston 22 and the inter-connecting linkage previously described. The position of the parts of the latch operating mechanism when the latch is thus disengaged is shown in dashed outlines in Fig. 1. While piston 22 is being forced forward by the action of the fluid entering the rear of cylinder 23, the fluid in the forward end of the cylinder will be exhausting through connection 24 and pipe 26 to the exhaust passage of the control valve.

When it is desired to raise the slips and lock the spider in the raised portion, the fluid connections are returned to the positions previously described and upon relief of the fluid pressure on dash pot 34, coil spring 46 will act to engage the latch with hinge pin 11.

Should any of the fluid connections break when the slips are in the raised position, coil spring 46, being in tension will act independently to keep spider 5 locked in the raised position. Thus once, the slips are in the raised position, they are automatically held locked in that position and are not subject to the usual hazards attendant upon drilling and servicing operations.

While air is the preferred actuating fluid for use with the embodiment of the invention herein described, it will be understood that other pneumatic or hydraulic pressure fluids may be used with advantage.

Where desired, dash pot 34 may be connected directly to a source of pressure fluid, and the locking mechanism may be operated thereby independently of the system employed to operate the raising and lowering mechanism.

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

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

1. Apparatus for operating a slip spider, comprising, a lifting yoke attachable to a slip spider, a reciprocating piston connected to said yoke and actuable by fluid pressure to raise and lower same, a pivoted latch element normally disposed in the path of downward movement of said yoke, a plunger engaged with said latch element and actuable by fluid pressure to move said latch element out of said path, and means for supplying actuating fluid sequentially first to said plunger and second to said piston when the latter is to be moved in a direction to lower said yoke, said means comprising a pressure fluid supply conduit connecting said piston with said plunger, and back-pressure check valve means interposed in said conduit automatically operative by the fluid flowing therethrough toward said piston to divert a portion thereof to said plunger in advance of that flowing toward said piston.

2. Apparatus for operating a slip spider, comprising, a lifting yoke attachable to a slip spider, a reciprocating piston connected to said yoke and actuable by fluid pressure to raise and lower same, a pivoted latch element disposed below said yoke for movement into and out of the path of movement thereof, an operating arm connected to said latch element, spring means connected to said arm to normally yieldably urge said latch element into said path, a plunger engaged with said arm and actuable by fluid pressure to move said latch element out of said path, means for supplying actuating fluid sequentially first to said plunger and second to said piston when the latter is to be moved in a direction to lower said yoke, said means comprising a pressure fluid supply conduit connecting said piston with said plunger, and back-pressure check valve means interposed in said conduit automatically operative by the fluid flowing therethrough toward said piston to divert a portion thereof to said plunger in advance of that flowing toward said piston.

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