April 28, 1953 W. E. LILJESTRAND 2,636,241

POWER-OPERATED SLIP

Filed April 9, 1947 4 Sheets-Sheet 1

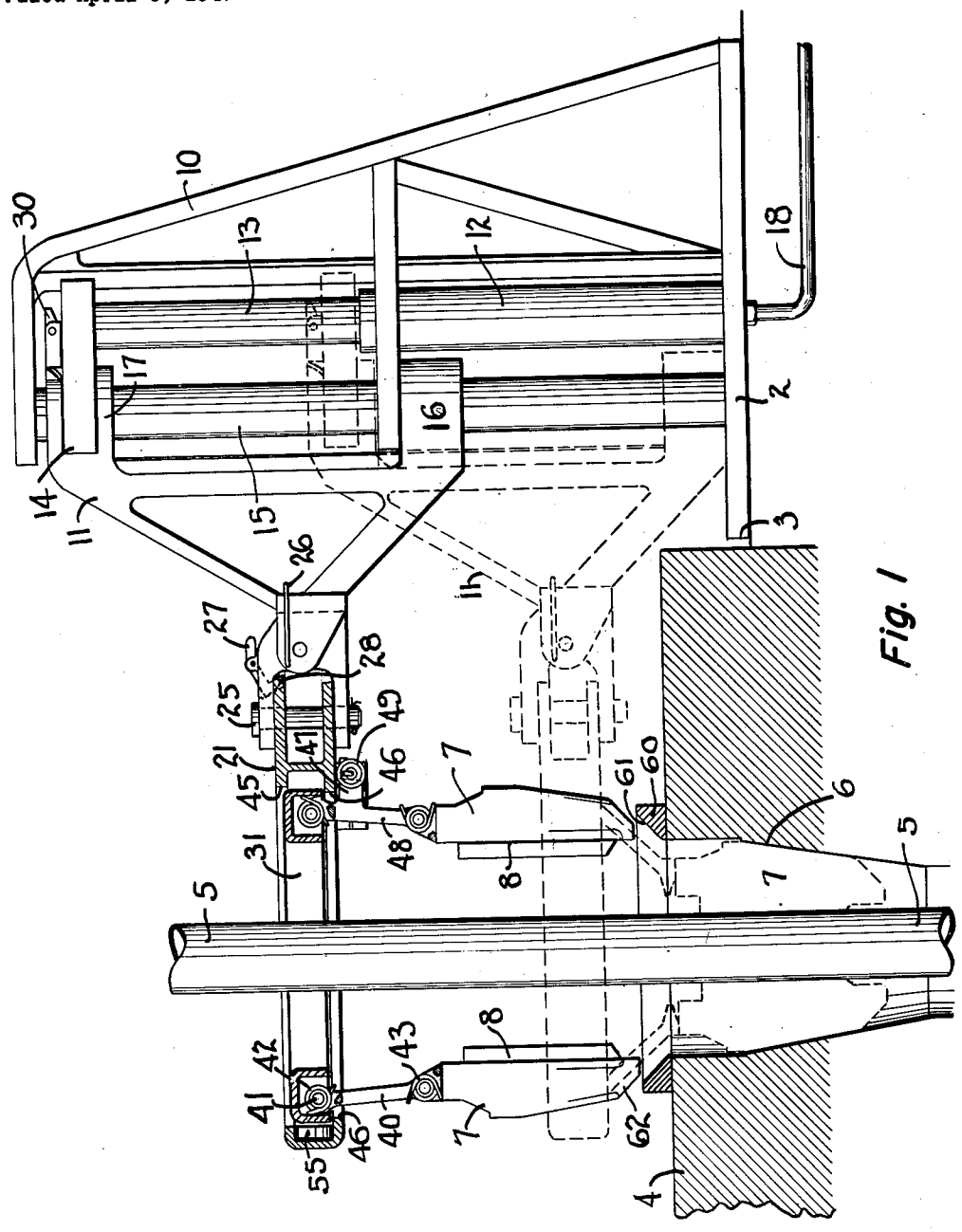


Fig. 1

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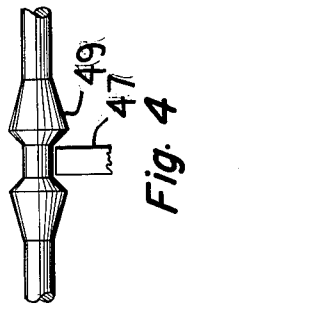


Fig. 4

Fig. 3

Fig. 2

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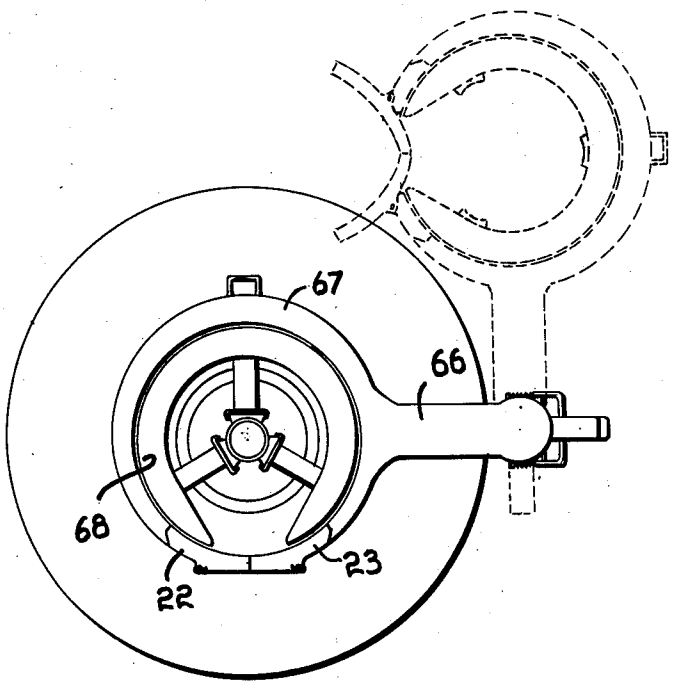


Fig. 5

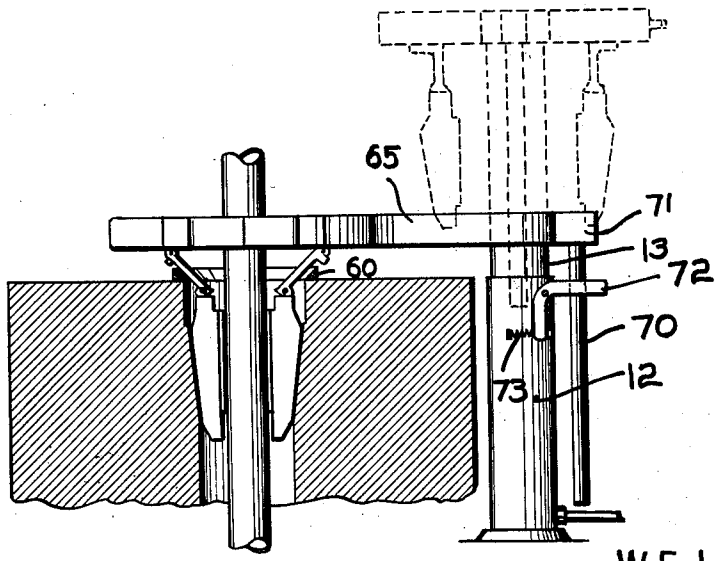


Fig. 6

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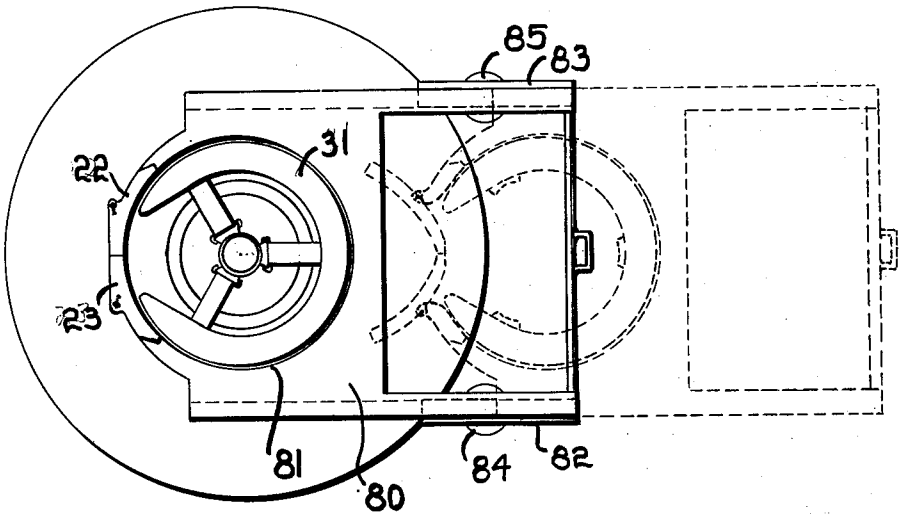


Fig. 7

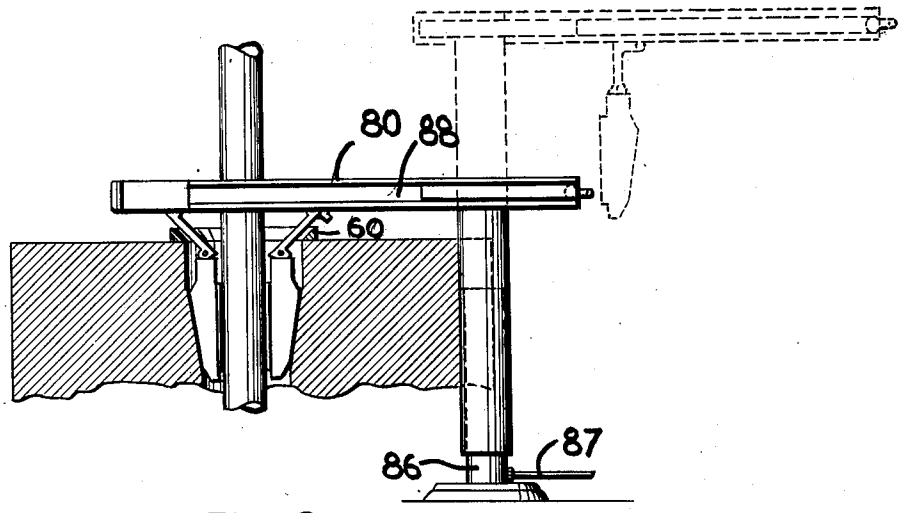


Fig. 8

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UNITED STATES PATENT OFFICE

2,636,241

POWER-OPERATED SLIP

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2 Claims. (Cl. 24—263)

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The invention relates to a power operated slip and particularly to a simple and economical arrangement thereof, whereby the slips may be inserted and withdrawn from pipe supporting position without interfering with the various operations in connection with the drilling of wells by the rotary method.

On object of the invention is to provide a power operated slip which will have a jackknife action in folding toward and away from the pipe which is to be supported.

Another object of the invention is to provide a power operated mechanism for raising and lowering pipe supporting slips for use in well drilling, wherein the support may be folded backwardly so as to clean the area about the pipe for other operations or swung toward the pipe so as to be arranged in pipe supporting position.

Another object of the invention is to provide a power operated slip, wherein a pair of supporting rings may be turned to permit withdrawal of the slips from about the pipe while the pipe remains in position in the well.

Another object of the invention is to provide a folding mechanism for power operated slips so that the slips may be swung to and from the pipe.

Another object of the invention is to provide a pair of swinging doors for a power operated slip assembly which will permit movement of the assembly to and from the pipe.

Another object of the invention is to provide a pair of ring members for suspending pipe supporting slips in such a manner that the entire assembly may be swung to and removed from the pipe to be supported.

Another object of the invention is to provide a power operated slip mechanism which is arranged to suspend slips from a ring so that when the slips are retracted from the bowl they will hang vertically and in alignment with the bowl so that they may be reset in the bowl without manual manipulation.

Another object of the invention is to provide a power operated slip mechanism for raising and lowering pipe supporting slips in which the slips are supported from a ring, which ring is in turn supported by an outer ring, there being means to restrain the two rings from relative rotation when the slips are not engaged with the pipe but arranged so that the two rings may rotate relative to each other when the slips are engaged with the pipe.

Another object of the invention is to provide a power operated slip mechanism which will raise the slips to a position above the rotary

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table so that they may be swung laterally toward and away from the pipe.

Another object of the invention is to provide a power operated mechanism for manipulating pipe supporting slips where the movement of the mechanism may be either along a straight line, the arc of a circle, or any combination of arcs of circles.

Other and further objects of the invention will be readily apparent when the following description is considered in connection with the accompanying drawings, wherein:

Fig. 1 is a side elevation of the slips and operating assembly with the slips in raised position.

Fig. 2 is a top plan view looking down on the mechanism of Fig. 1 and showing the slip assembly, in dotted lines, in retracted position.

Fig. 3 is a broken detail plan view of one of the door pivots.

Fig. 4 is a broken elevational view of the detail of construction.

Fig. 5 is a top plan view looking down on a modified arrangement of the power operating mechanism.

Fig. 6 is a side elevation of the mechanism of Fig. 5.

Fig. 7 is a modification where the operating mechanism slides laterally in carrying the slip assembly to and from the pipe.

Fig. 8 is a side elevation of the modification of Fig. 7.

In Fig. 1 the derrick floor or support structure 2 has the opening 3 therein for the rotary table 4 by which the pipe 5 is rotated.

Such rotary tables have a tapered slip bowl 6 therein for receiving a plurality of slip members 7 so that the inner surface 8 of the slips will grip the periphery of the pipe 5 as seen in dotted lines of Fig. 1.

In view of the fact that the pipe 5 may be a drill pipe used for rotating the bit in the rotary method of drilling wells to tremendous depths and may have a substantial weight approximating one hundred or one hundred fifty tons, it is very evident that the slips will become securely wedged in the slip bowl when the load of the pipe is supported thereby.

It is often difficult to remove the slips, and the present invention contemplates a slip assembly which will be power operated for exerting sufficient pressure to release the slips when the load is relieved thereon, and to thereafter remove the slips entirely from adjacent the pipe.

This slip operating mechanism is in the form of a frame 10 which is affixed in position and is

arranged to impart vertical movement to a carriage portion or arm 11. This movement is accomplished by applying pressure in a cylinder 12 from a pressure line 18 so as to effect the raising of the plunger 13 which is slidably arranged in the cylinder. Such pressure may be fluid or hydraulic. In order to guide the sliding movement of the plunger 13, a cross head 14 is affixed thereon and engages about a guide shaft 15. The carriage arm 11 has a lower collar 16 and an upper collar 17 which is also slidable upon the guide shaft 15 in such a manner that such carriage arm will move vertically when pressure is applied or relieved in the cylinder 12.

As best seen in Fig. 2 the carriage arm 11 can be swung laterally to the dotted line position shown and in such movement carries the slip assembly 20 from the full line to the dotted line position as seen in Fig. 2 so as to retract the assembly entirely away from the pipe 5.

Such lateral movement of the slip assembly 20 is permitted due to the fact that the outside support ring 21 is provided with a pair of opposite gate members 22 and 23. This outer support ring 21 is mounted on a pivot pin 25 carried by the outer end of the carriage arm 11 in such a manner that a folding or jackknife movement may be obtained as shown by the dotted lines respectively in Fig. 2.

The carriage arm 11 has the handles 26 thereon and also carries a pivoted latch 27 which is arranged to drop into a recess 28 in the outer assembly ring 21 so as to latch the ring against folding movement when it is in actual operation over the rotary table 4. A latch 30 is also provided to in turn latch the carriage relative to the plunger 13 and cross head 14 so that there may be no folding action until such latch is released.

The slip assembly 20 is made up of the outer ring 21 and an inner ring 31, the carriage arm 11 and the support ring 21 serving as a carriage for the inner ring 31. The inner ring is circular except for the opening 32 therein which is somewhat wider than the diameter of the pipe 5 and when the ring is arranged in the position as seen in Fig. 2, it has been passed about the pipe 5 and the gates 22 and 23 snapped into the full line or closed position by virtue of the spring 34 which is positioned off-center with respect to the pivot pin 35 on which the gates are mounted for turning movement.

When the slips are being operated, the parts will be in position as shown in full lines in Fig. 1 with the slip segments 7 supported by the hanger arms 40 through the pivot shaft 41. The coil springs 42 about said shaft normally tend to move the arms 40 in a direction so as to retract the slips to the full line position as seen in Fig. 1. Each of the arms 40 carries an additional spring 43 in the lower end which swings the slips toward the pipe, while retaining them in a vertical position.

The inside ring 31 fits in through the opening 45 in the outer ring but is arranged to be supported upon the flange line portion 46 of the outer ring in order that the slips may be raised and lowered.

In some instances the rotary table 4 may be rotated while the slips are engaging the pipe as shown in dotted lines in Fig. 1 and when this occurs, the inside ring 31 will, of necessity, rotate with the pipe while the outer ring 21 remains stationary. When this operation occurs, the extension 47 on the arm 48 is pivoted downwardly away from the latch member 49 and out of position so that the extension does not come in contact with the latch member at all during rotation.

When the slips are elevated from the bowl and the assembly is to be removed from the pipe, or to be swung to the pipe, the opening 32 of the inner slip supporting ring 31 must be aligned with the opening caused by the gates 22 and 23 in the outer supporting ring. In order to restrain, but not lock the slips with this alignment only when the rings are being removed from the rotary bowl, the extension 47 on the arm 48 is arranged to strike on the conical end of the latch member 49 and force arm 48 toward the pipe until the extension 47 can drop back into the groove on latch member 49. Springs 50 are provided on each end of latch member 49 to restrain the latch member in a central position and to move endwise on spindle 51 when a forced disengagement of extension 47 is necessary. Fig. 4 shows a detail of another type of latch member in which the need for springs is eliminated by providing conical sides on the groove.

The rotating operation of the inner ring 31 is permitted in the outer ring 21 by virtue of the rollers 55 mounted on the stub shafts 56 in the inner ring. A plurality of such rollers are seen in Fig. 2 so that there may be ready rotation. The extension 47 can be readily moved around to abut the stop 49 which advises the operator that the opening 32 is then in alignment with the gates 22 and 23.

A guide ring 60 is arranged on the top of the rotary table and has a beveled surface 61 which will be engaged by a coupling beveled face 62 on the lower end of the slip segments 7.

Figs. 5 and 6 show a slightly modified form of the power mechanism portion of the assembly in which the guide post 15 has been omitted and the cylinder 12 and the plunger 13 are connected directly to a carriage 65 which is in the nature of a substitute mechanism for the carriage illustrated in Figs. 1 and 2. In other words, the member 65 includes a support arm 66 and the outside ring 67 which have been made as a unitary structure. The inside ring 68 is the same as the ring 31 described in connection with the modification of Fig. 1. The gates 22 and 23 are the same as previously described.

In order to guide the combination carriage and yoke, a guide spindle 70 is affixed to the extension 71 on the carriage and pivoted latch 72 limits the swinging movement by moving the forked arm of 72 about the guide spindle 70. The spring 73 normally urges the arm into position to receive the spindle. The pressure of the arm releases the carriage for turning movement to the dotted line position seen in Fig. 5.

In Fig. 7 the same support structure as illustrated in Fig. 5 has been provided except that the carriage is in the form of a rectangular platform 80. This platform has an opening 81 therein so that it is equivalent of the outer ring 21 of Fig. 2, and the portion 67 of the carriage in Fig. 5. The inner slip supporting ring 31 is carried by the platform. The platform in turn is arranged for sliding movement in the guides 82 and 83, which guides are mounted respectively by the cylinders 84 and 85. These cylinders are each mounted over a plunger 86 through which fluid pressure through the line 87 may be applied so as to lift the guides and consequently lift the platform 80. The platform has the grooves 88 in each side thereof which receive the guides 82 and 83.

Broadly the invention contemplates a simple

and economical construction for supporting and operating power actuated slips.

The invention claimed is:

1. A slip operating mechanism including an outer support ring adapted for placement over a rotary drilling table, said ring having an opening and a pair of gate members for said opening operable to permit passage of the ring to and from a pipe, said ring being carried by and pivoted to a supporting carriage adapted to be moved upwardly and downwardly by power actuated means, said supporting carriage being carried by a supporting frame and guided by and pivoted upon a guide member, an inner slip ring mounted within and concentrically disposed with respect to said outer support ring for rotative movement relative thereto, said inner slip ring being provided with an opening wider than the diameter of said pipe, pipe supporting slips suspended from said slip ring, said support ring and said carriage when moved about said pivots being adapted to swing laterally of the pipe to be supported when said slips are not in pipe engaging relationship and the opening in said inner slip ring is aligned with the pair of gate members in said outer supporting ring, whereby a full well hole opening is presented.

2. A slip operating mechanism including an outer support ring adapted for placement over a rotary drilling table, said ring having an opening and a pair of gate members for said opening operable to permit passage of the ring to and from a pipe, said ring being carried by and pivoted to a supporting carriage adapted to be moved upwardly and downwardly by power actuated means, said supporting carriage being carried by

a supporting frame and guided by and pivoted upon a guide member, an inner slip ring mounted within and concentrically disposed with respect to said outer support ring for rotative movement relative thereto, said inner slip ring being provided with an opening wider than the diameter of said pipe, pipe supporting slips suspended from said slip ring, means on said outer support ring to resiliently retain said slip ring in nonrotatable relation with respect to said outer support ring while said slips are not engaged with said pipe, said support ring and said carriage when moved about said pivots being adapted to swing laterally of the pipe to be supported when said slips are not in pipe engaging relationship and the opening in said inner slip ring is aligned with the pair of gate members in said outer supporting ring, whereby a full well hole opening is presented.

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