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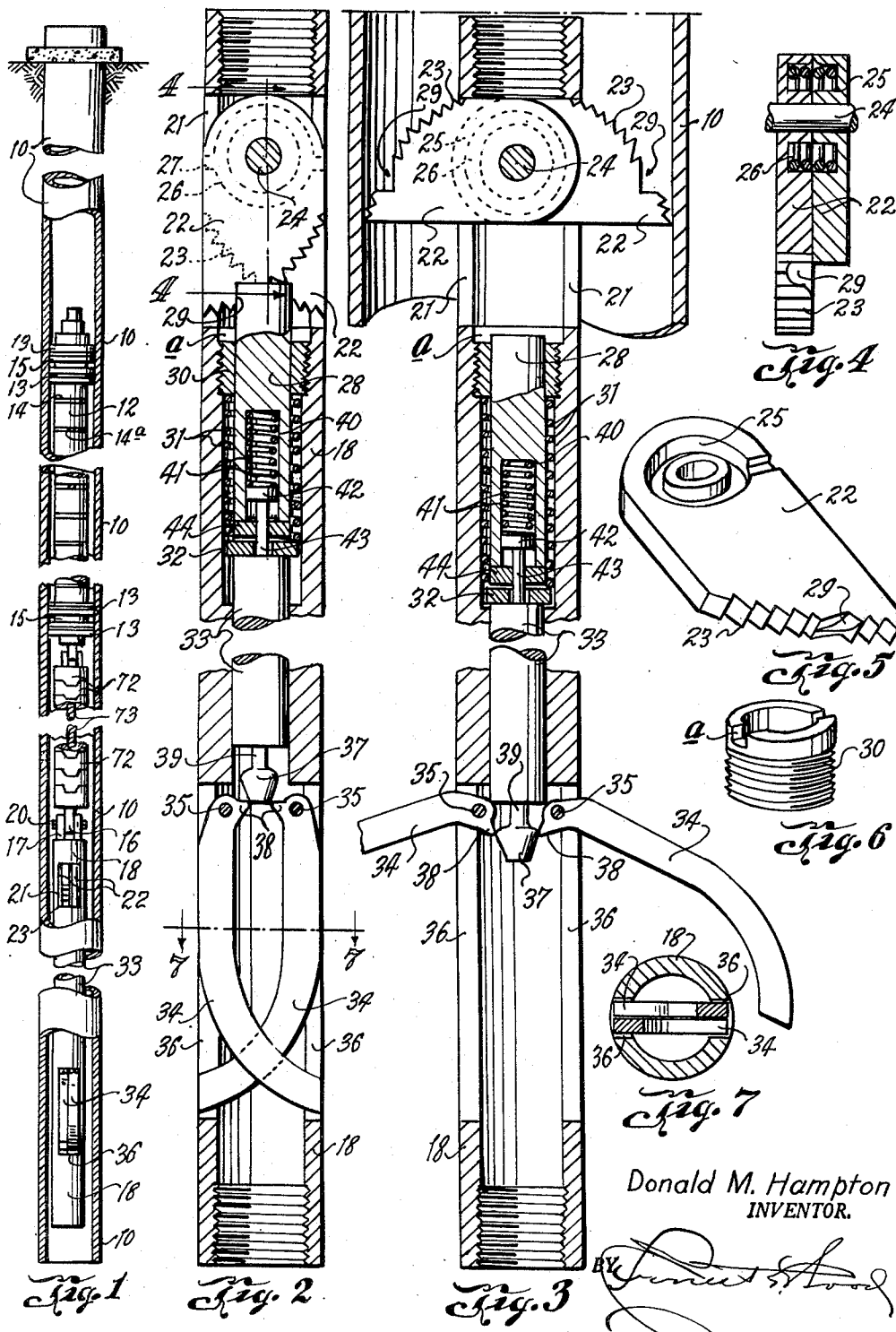
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2,547,461

WELL TOOL

Filed Sept. 15, 1947

2 Sheets-Sheet 1



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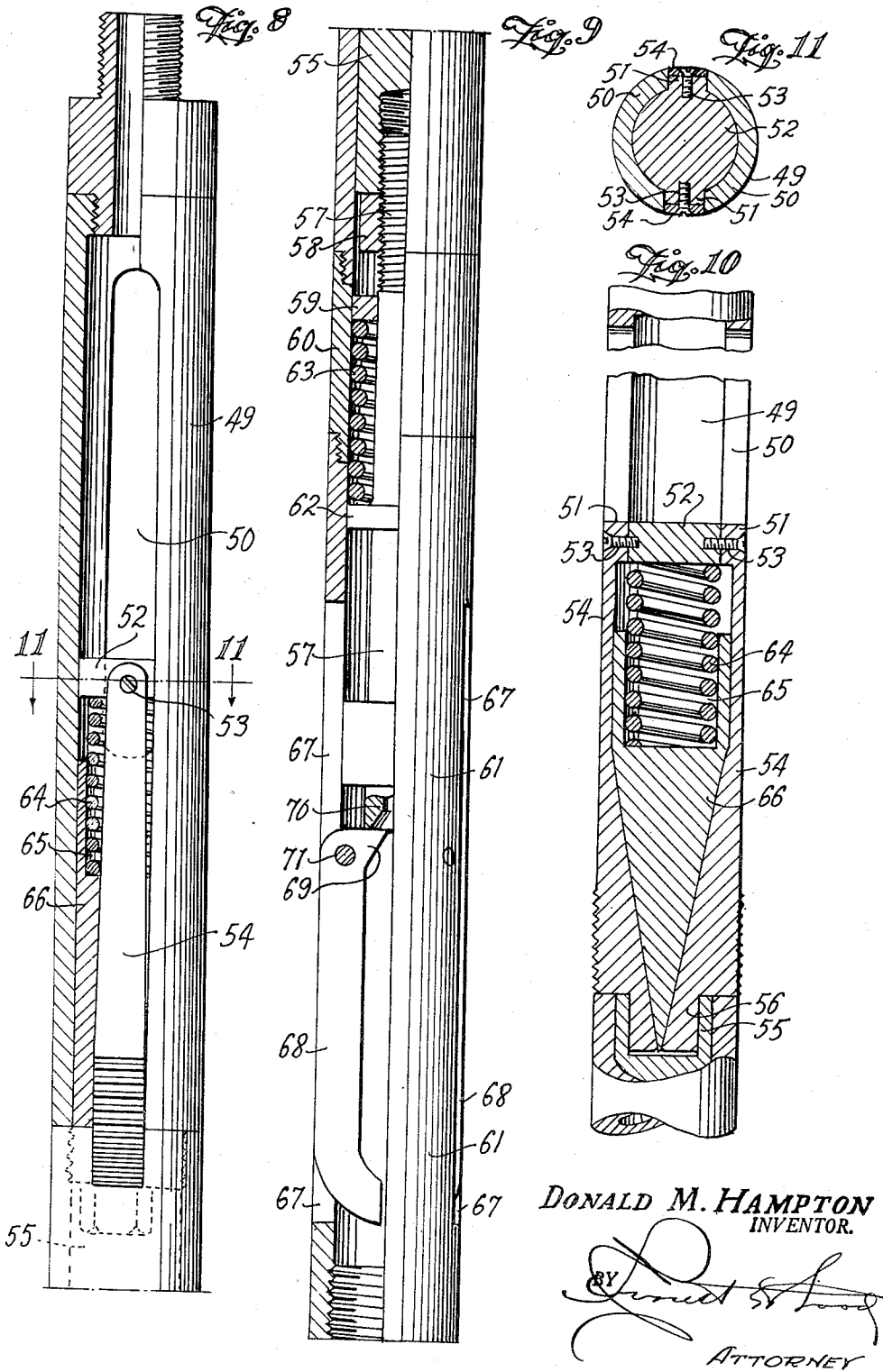
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UNITED STATES PATENT OFFICE

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WELL TOOL

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2 Claims. (Cl. 166-13)

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This invention relates to well tools and equipment and more particularly to apparatus generally known to the trade as "mud chasers."

The principal object of the invention is to provide a tool of the character set forth consisting generally of aligned tubular sections, the upper tubular sections of the tool containing expansible slips, combined with a spring loaded wedge for actuating the slips. Included in the string of tubular sections is a series of replaceable and interchangeable weights, contributing to the force of the spring primarily effective to actuate the slips. Subjacent the weight assembly are two or more pivoted fingers, normally held in collapsed position by the wall of the surrounding pipe but upon release from confinement at the lower end of the latter, expansion of these fingers is effective to release the slips to the action of the spring and expanding wedge to arrest further downward movement of the tool in the well.

Another object of the invention is to provide a tool adapted to be incorporated in a string of well or drill pipe in the course of drilling or producing a well, which is so constructed and arranged that in event of the twisting off or parting of a section of the pipe string, the lower or severed section will be intercepted and constrained against further downward movement in the well, when the pivoted fingers of the invention expand after reaching open hole to release the slips thereabove to engage the casing walls after which removal of the upper section and subsequent retrieval of the suspended lower section of pipe may be effected.

Still another object of the invention is to provide for the packing off of the well pipe to preclude upward passage of well fluid or drilling mud, the packing means being optionally included, depending upon conditions encountered in using the tool.

Yet another object of the invention is to provide, with but minor variations, a catcher for arresting downward movement in a well pipe of tools of various kinds which may be accidentally released as by the twisting off of sections of pipe string in a well, the said catcher being designed for adaptation to mud chasers, well plugs or any other tool which may be run into a well.

With the foregoing objects as paramount, this invention has further reference to certain features of accomplishment which will become apparent as the description proceeds, taken in connection with the accompanying drawings, wherein:

Figure 1 is a longitudinal sectional view of a well pipe showing the invention suspended therein.

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Figure 2 is a vertical sectional view of the catcher, per se.

Figure 3 is a similar view but showing the slips in expanded position to arrest downward movement of the tool in a pipe.

Figure 4 is a detail sectional view of the slips, per se, taken on line 4-4 on Figure 2.

Figure 5 is a detail perspective view of one of the slips.

Figure 6 is a detail perspective view of a spring retaining collar.

Figure 7 is a view of the catcher in transverse section, taken on line 7-7 on Figure 2.

Figure 8 is an elevational view of a modified form of tool, shown partly in section.

Figure 9 is a continuation of Figure 8, showing the lower portion of the tool in half longitudinal section.

Figure 10 is a detail view of the slips and associated parts in longitudinal section, rotated 90° from the position shown in Figure 8, and

Figure 11 is a view in transverse section, taken on line 11-11 on Figure 8.

Continuing with a more detailed description of the drawings, reference is primarily made to Figure 1 wherein numeral 10 denotes the pipe in a well into which the tool embodying the invention is dropped. A packer consisting of a tubular element 12 carries a plurality of packing rings 13, a predetermined number of which are attached to the tube 12 by means of annular grooves 14, spaced throughout the length of tube 12 for retaining split rings 14a which support spacing rings 15 intermediate the packing rings 13.

The lower end of the tubular element 12 has a boss 16 depending therefrom which is receivable by the bifurcated end 17 of the upper end of the tubular body 18 of the catcher, to be presently described. Members 16 and 17 are secured together.

The instrument catcher illustrated in detail in Figures 2 to 7 inclusive consist of the tubular body 18 whose upper end is interiorly threaded to receive the bifurcated suspension means 17 or its equivalent and immediately the upper end are diametrically opposed slots 21, through which operate slips 22. The slips 22 each have a curved, serrated face 23 and are mounted on a common pivot, consisting of a pin 24 extending transversely through the tubular body 18. Each of the slips 22 has an annular recess 25 in one face thereof and these recesses, when the slips are juxtapositioned in the slots 21, define a cavity for a torsion spring 26, one end of the latter extending into a channel 27, tangent to the recess 25 in

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one slip while the opposite end lies in a similarly arranged channel in the companion slip. The torsion spring thus imposes a normal outward pressure on the slips, urging them to the extended positions shown in Figure 3.

The slips 22 are held in retracted position against the resistance of the torsion spring 26 by means of a plunger 28, reciprocable longitudinally in the tubular body 18 below the slips. The upper end of this plunger engages in recesses 29 in the arcuated faces of the slips and is slidable through a sleeve 30 whose upper end is slotted at α (Fig. 6) to receive a tool for installing the same in the body 18 and for withdrawing the same therefrom.

The collar 30 serves as a guide for the plunger 28 as well as an abutment for a coiled spring 31 therebelow, the lower end of the latter bearing against a washer 32 on the upper end of a rod 33 and exerting a downward force on the latter. Resisting the downward pressure of spring 31 on the rod 33 is a pair of fingers 34, each pivoted on a pin 35 and disposed in elongated, diametrically opposed slots 36 in the tubular body 18.

The fingers 34 are held in collapsed or folded positions in the slots 36 by their confinement in the well pipe 10. In the event a section of well pipe is twisted off below the surface or caused by some means to become separated from the upper sections, the fingers 34 of the catcher will expand into open hole when the latter is lowered to a point below the break in the pipe, since they will be out of the restraining influence of the pipe. When this occurs, the force exerted by the spring 31 will act to urge the rod 33 downwardly, causing the beveled head 37 on the lower end of the latter to transfer the pressure of the spring to inwardly directed lugs 38 on the upper ends of the fingers 34, urging the lower ends of the latter outwardly in opposite directions, as shown in Figure 3.

Following actuating of the fingers 34 in the manner described, the upper end of the plunger 28 recedes from its position in the recesses 29 of the slips 22, in the manner to be presently explained, thereby releasing the latter to the action of the torsion spring 26. The slips spring outwardly and engage the walls of the well pipe 10 and arrest the catcher and any other tool or instrument carried thereby, in its descent in the well pipe. The catcher and suspended tools and instruments are thus held until retrieved in any conventional manner.

By virtue of the peculiar design of the head 37 carried on the lower end of the trip rod 33, the fingers 34 are returned to collapsed position in the slots 36 immediately after they are tripped in the manner described. The lugs 38 of the fingers fall into the annular recess 39 above the head 37 as the fingers fall back into relative parallelism in the slots 36 by their own weight and when the catcher is retrieved, the fingers may be reset by raising the rod 33 to again dispose the head 37 above the said lugs 38 and again confining the fingers 34 in the well pipe.

During normal movement of tools in a well, the tools are frequently subjected to severe shocks. In the absence of some agency to prevent, the spring 31 may yield to such shocks to an extent sufficient to release the plunger 28 from its engagement with slips 22 and permit the same to expand. Such an eventuality is obviated by a small coiled spring 40, situated in an axial bore 41 in the plunger 28 and whose lower end bears on a head 42, carried by a stem 43 on the upper

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end of the trip rod 33. The lower end of the bore 41 is closed by a cap 44, preferably welded in place.

It is apparent that when the fingers 34 are in collapsed position and confined in the well pipe 10, the rod 33 will not yield to any downward force. Accordingly, the force of spring 40 will tend to keep the upper end of plunger 28 in engagement with slips 22 as against any jars or shocks to which the tool may be subjected in the normal movements of well tools in the well pipe aside from actual performance expected of the catcher.

The bore 41 which contains the small spring 40 is greater in length than the spring but this difference is made up by the stem 43. When the fingers 34 are actuated as described, and the rod 33 moved downwardly by the force of spring 31, the energy of spring 40 is expended, hence, it is no longer effective to urge the plunger 28 operatively towards the slips 22, therefore it recedes under its own weight from engagement with the slips to release the latter as described.

When the tool is to be withdrawn from the well, together with drill pipe or other equipment to which it is attached, a conventional fishing tool may be employed. Upward movement will of course be exerted first on the upper body section 18 which will restore the slips 22 to their original contracted position and the trip fingers 34 will have assumed a parallel position in the slots 36 so that they may be brought again within the confines of the well pipe 10 and will not interfere with the withdrawing operation of the tool and attendant pipe.

In Figures 8 to 11 inclusive, is shown a slight modification of the tool just described. Referring to Figure 8, it will be observed that the upper tubular body section 49 is provided with longitudinal aligned slots 50 which slidably receive the ears or projections 51 of a plate or disc 52, the latter being slidably disposed in the body section 49. To the projections 51 are affixed by means of screws 53, the upper ends of slips 54.

The slips 54 are held in contracted position by a retaining member 55 whose upper end is annularly recessed to receive the lower ends 56 of the slips (Fig. 10) and whose lower end is tapped and threaded to receive the upper end of a rod 57, the latter being provided with an adjusting nut 58. This rod passes through a ring 59, welded to the interior of a body section 60 intermediate the upper section 49 and a lower body section 61 and terminates in a head 62 within said lower section 61. Compressed between the ring 59 and head 62 is a coiled spring 63 whose function is to impose a downward thrust on the rod 57 to effect disengagement of the slip retaining element 55 from the lower ends of slips 54, releasing the latter to the action of a spring 64, disposed in a cavity 65 in a wedge 66 and which exerts upward pressure against the plate 52, causing the same to travel upwardly in the body section 49 effecting expansion of the slips 54 by virtue of their sliding engagement with the tapered walls of the wedge 66.

The lower body section 61 is provided with opposed, longitudinal slots 67 in which are disposed fingers 68 which serve as trips for the slips 54 when the tool has traveled downwardly in the well pipe to bring the fingers into open hole.

The fingers 68 are held normally within the confines of the casing and their inwardly directed ends 69 bear against the lower end 70 and support the rod 57 against downward pressure of

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spring 63. However, in event the pipe or drill stem is twisted off below the tool, the fingers 68, by virtue of their pivotal engagement at 71 with the lower body section 61, will spring outwardly when they reach open hole, permitting the rod 57 to be thrust downwardly by spring 63, causing the slip retainer 55 to be pulled downwardly out of engagement with the lower ends 56 of the slips 54. When this occurs, spring 64 will become effective to exert an upward thrust against the plate 52, pulling the slips upwardly over the tapered surface of the wedge 66, urging them to expanded position to engage and grip the walls of the well pipe to arrest further downward movement of the tool and attendant elements.

By elongating the slots 67 in which are pivoted the fingers 68, the fingers may assume an inverted position or nearly so and held in such position by downward pressure of spring 63 in order that the tool may be retrieved through the well pipe by conventional means.

Either of the two forms of the invention described is used in conjunction with the articulated member interposed between the packing assembly and tubing catcher (Fig. 1) and which consists of a plurality of annular weights 72 strung on a cable 73 which latter is anchored at each end in the upper and lower elements of the articulated member in any suitable manner, as by babbitted sockets. When the catcher is dropped into a well pipe with the packing and weight assembly in attendance, the flexibility of the latter enables the same to follow the catcher through crooked pipe and the added weight contributed thereby imposes the force needed to propel the slips of the catcher into holding engagement with the wall of the pipe, once the trip fingers of the tool emerge from the lower or severed end of the pipe, releasing the slips for operation.

Manifestly, the construction as shown and described is capable of some modification, and such modification as may be construed to fall within the scope and meaning of the appended claims is also considered to be within the spirit and intent of the invention.

What is claimed is:

1. A well tool including in combination with a pipe string adapted to be released in an open ended well pipe, a packing assembly, a body in tu-

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bular, axially aligned sections, expansible slips carried by one of said sections, spring loaded means for holding said slips in contracted position, means confined by said well pipe, operative upon release from its lower end to yield said slip holding means to its spring to release said slips, means for expanding said slips to arrest downward travel of said tool in said well pipe, a wire line connecting said packing assembly and said tubular body, a plurality of interchangeable weights in longitudinally aligned relationship on said wire line for accelerating the expanding action of said slips.

2. In a well tool adapted to be dropped in an open ended well pipe, a body in tubular sections, the upper of which carries spring loaded expansible slips, a well packing member detachably connected to the upper end of said body means under spring tension for holding said slips in inoperative position, means confined within said well pipe operative upon release from its lower end to yield said slip holding means to the action of its spring to release said slips, means for expanding said slips against the walls of said well pipe to arrest downward travel of said tool in said pipe, a wire line connected at its upper end to said well packing member and at its lower end to the upper end of said body, a plurality of interchangeable weights strung on said wire line for accelerating the descent of said tool in said well pipe and for setting said slips in the wall of the latter subsequent to the expanding action thereof.

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