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SHOCK ABSORBING DEVICE

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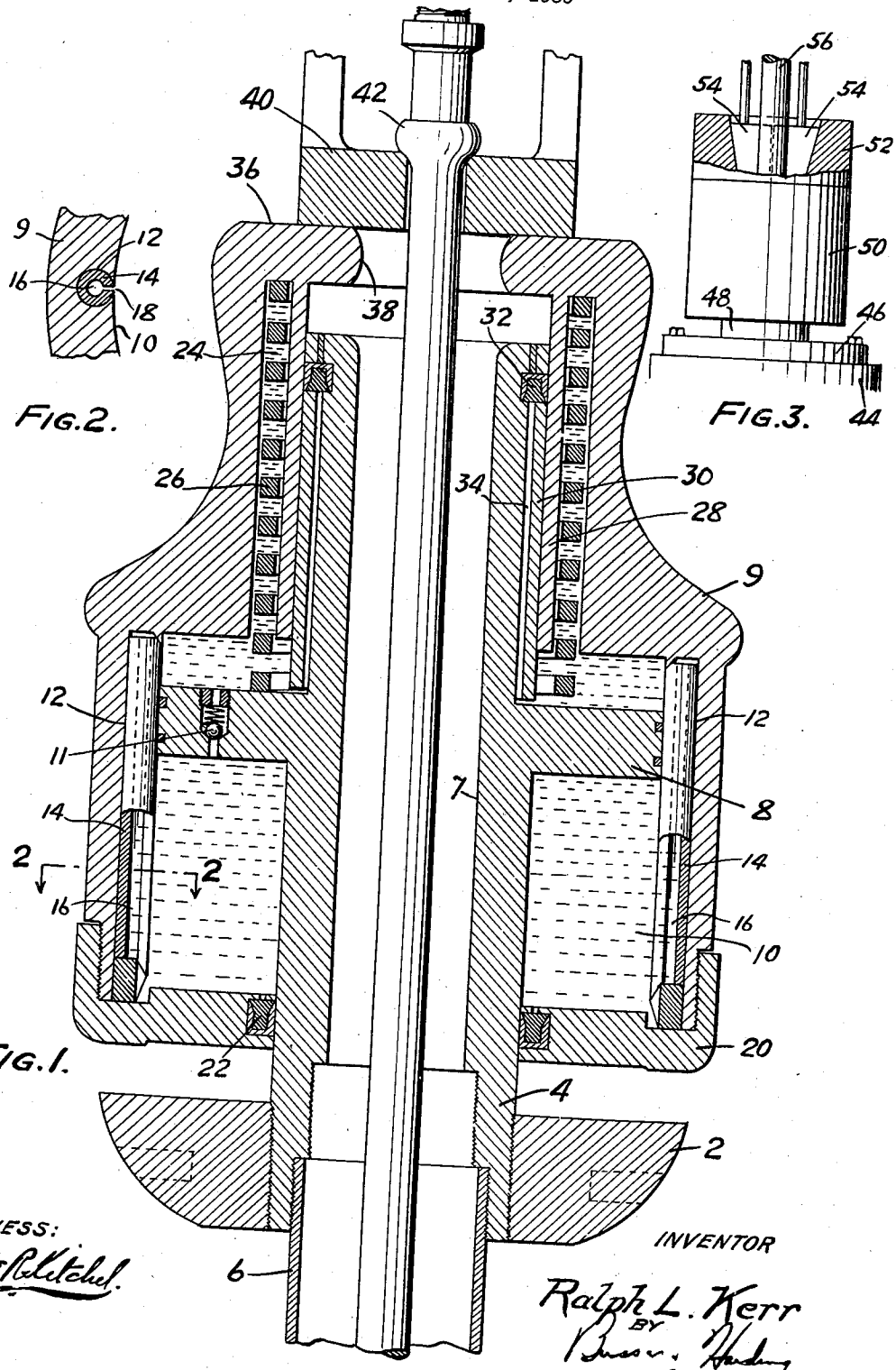


FIG. 1.

FIG. 2.

FIG. 3.

WITNESS:

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SHOCK ABSORBING DEVICE

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8 Claims. (Cl. 255—1)

This invention relates to a shock absorbing device designed for the purpose of cushioning the shocks incident to the handling of rods or tubing within a bore hole.

In drilling a bore hole, it is repeatedly necessary to lower into and withdraw from the hole strings of rods or tubing which support bits or other devices. The withdrawals and replacements of such strings are necessary, for example, to change bits as well as for other less frequent purposes. In the customary apparatus for the handling of these strings of rods or tubing, there are used elevators, slips, and the like which in the lowering of the strings which they support involve the production of impacts of enormous amounts when the strings are brought to rest, since these strings may be several thousand feet in length and of corresponding weight.

It is the object of the present invention to provide means for minimizing damage to the various parts involved during the handling of tool strings of the types indicated. Specifically, the present device is in the nature of a cushioned spider preferably of hydraulic type to gradually absorb the shocks attendant upon stopping of the lowering so as to bring the strings to rest more gradually. The invention is applicable to various specific forms of handling devices, for example, to the elevators generally used for the handling of rods and slips for the handling of tubing.

The broad object just indicated, as well as subsidiary objects relating to details, will be apparent from the following description, read in conjunction with the accompanying drawing, in which:

Figure 1 is a vertical sectional view of the improved type of shock absorbing spider in a form particularly adapted for cooperation with an elevator for the handling of rods;

Figure 2 is a fragmentary section taken on the plane indicated at 2—2 in Figure 1, and particularly showing the flow restricting arrangement used for shock absorption; and

Figure 3 is a diagrammatic view partially in section showing the modification involved in adapting the device of Figure 1 for use on a rotary table in conjunction with slips for handling tubing.

Referring first to Figures 1 and 2, there is illustrated therein a base member 2 surrounding the fixed element 4 in order to strengthen the same and, under some circumstances, provide a base therefor. The fixed member 4 is internally threaded to be adapted for location upon the upper end of one or more sizes of casings, indicated at 6, the casing in this modification serving for the support of the spider at the mouth of the hole.

The member 4 is internally bored as indicated at 7 for the passage of the rods which are to extend into the hole, one section of a rod string being indicated at 42.

The member 4 is provided with a piston 8, provided with an opening including an upwardly opening check valve 11, which piston is fixed in this modification and which is surrounded by a cylinder 10 formed in a moving member 9. The wall of this cylinder 10 is bored in a plurality of locations about its circumference as indicated at 12, the bores intersecting the cylinder walls. Within each of these bores there is located a cylindrical filler indicated at 14 provided with a longitudinal hole 16 and a slit 18 running lengthwise of it and communicating with the interior of the cylinder. These fillers 14 may be held in position by the member 20 which provides a lower head for the cylinder 10. Packing 22 is provided in this head to form a liquid tight joint with the outer cylindrical surface of the member 4.

The movable member 9 may be cast with an annular socket 24 adapted to receive a strong spring 26 arranged to bear upon the upper face of the piston and thus normally urge the movable member upwardly with respect to the fixed member 4. A cylindrical wall 28 is provided on the inside of the member 9 for the reception of the upper extension 30 of the fixed member 4. Packing 32 is located between these members and there are preferably provided liquid passages indicated at 34 for the purpose of exerting pressure on the packing to maintain a liquid tight contact with the wall 28.

At its upper end the movable member 9 is provided with an abutment face 36 through which there is a bore 38 corresponding in diameter to the bore 6 of the fixed member 4. The face 36 is designed to provide a rest for an elevator 40 used for the handling of the rods 42.

In the operation of this device the cylinder is filled with a suitable liquid such as oil the viscosity of which may be chosen relative to the slits 18 to secure the desired amount of cushioning. Normally, the movable member within which the cylinder 10 is formed will occupy an upper position by reason of the action of the spring 26. When the string of rods extending through the device are lowered and the elevator 40 contacts with the face 36, the impact will be

absorbed by the passage of oil from the cylinder space above the piston 8 to the cylinder space below the piston through the restricted passage formed by the slits 18 and the openings 16 through the fillers 14. The movable member can move under the restraint imposed by the oil or other liquid until it engages the member 2, whereupon it will be definitely arrested. However, by the time such contact takes place, the major portion of the inertia of the string will have been absorbed in the liquid. Upon release of the elevator 40 the device is restored to its original position by the action of the spring 26, the valve 11 opening to permit a rapid return

It will be obvious that the apparatus may take various forms. For example, the piston and cylinder may be interchanged so that the former is on the movable member and the latter on the fixed member, or a plurality of pistons and cylinders may be provided. Desirably any such modification should provide not only for the cushioning of the shock, but for the return of the device to normal condition for the reception of a subsequent shock. Instead of using hydraulic cushioning means, it will, of course, be obvious that spring means alone may be used; but these are not as satisfactory since the resistance offered by a hydraulic shock absorbing device is dependent upon the imposed velocity of movement and very definitely slows down that movement, particularly under heavy shocks.

In order to provide an illustration of the adaptation of this device to a somewhat different handling of strings of tubing within well bores, there is illustrated in Figure 3 at 44 a rotary table on which may be secured the member 46 forming the base of the fixed member of the shock absorbing device indicated at 48, which fixed member corresponds to 4 of the previous modification. The movable member is indicated at 50. Though not shown in Figure 3, it will be understood that the members 48 and 50 are provided with a piston and cylinder respectively and associated with a spring such as 26 and the other devices of the previous modification. The movable member in this form of the device is provided with an upper portion 52 adapted for the reception of slips 54 adapted to engage the tubing indicated at 56. It will be obvious that the shock absorbing action of this modification is the same as that of the modification previously described in detail.

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

1. Means for absorbing shocks of devices being moved within a bore hole comprising a fixed member provided with a central passage for said devices and adapted to be secured above the end of a hole, a member guided by and movable relative to said fixed member, said movable member being provided with means engageable to arrest said devices when they are lowered, and shock absorbing means between said members.

2. Means for absorbing shocks of devices being moved within a bore hole comprising a fixed member provided with a central passage for said devices and adapted to be secured above the end of a hole, a member guided by and movable relative to said fixed member, said movable member being provided with means engageable to arrest said devices when they are lowered, and hydraulic shock absorbing means between said members.

3. Means for absorbing shocks of devices being moved within a bore hole comprising a fixed member provided with a central passage for said devices and adapted to be secured above the end of a hole, a member guided by and movable relative to said fixed member, said movable member being provided with means engageable to arrest said devices when they are lowered, shock absorbing means between said members, and means for restoring the movable member to its original position after a load is removed therefrom.

4. Means for absorbing shocks of devices being moved within a bore hole comprising a fixed member provided with a central passage for said devices and adapted to be secured above the end of a hole, a member guided by and movable relative to said fixed member, said movable member being provided with means engageable to arrest said devices when they are lowered, hydraulic shock absorbing means between said members, and means for restoring the movable member to its original position after a load is removed therefrom.

5. Means for absorbing shocks of devices being moved within a bore hole comprising a fixed member provided with a central passage for said devices and adapted to be secured above the end of a hole, a member guided by and movable relative to said fixed member, said movable member being provided with means engageable to arrest said devices when they are lowered, a hydraulic shock absorbing means between said members, said hydraulic shock absorbing means comprising piston and cylinder elements one connected to said fixed member and the other connected to said movable member, and means providing restricted bypass of liquid about the piston element during relative movement of said elements.

6. Means for absorbing shocks of devices being moved within a bore hole comprising a fixed member provided with a central passage for said devices and adapted to be secured above the end of a hole, a member guided by and movable relative to said fixed member, said movable member being provided with means engageable to arrest said devices when they are lowered, a hydraulic shock absorbing means between said members, said hydraulic shock absorbing means comprising piston and cylinder elements one connected to said fixed member and the other connected to said movable member, and means providing restricted bypass of liquid about the piston element during relative movement of said elements, and means for restoring the movable member to its original position after a load is removed therefrom.

7. Means for absorbing shocks of devices being moved within a bore hole comprising a fixed member provided with a central passage for said devices and adapted to be secured above the end of a hole, a member guided by and movable relative to said fixed member, said movable member being provided with means engageable to arrest said devices when they are lowered, a hydraulic shock absorbing means between said members, said hydraulic shock absorbing means comprising piston and cylinder elements one of which is connected to said fixed member and the other of which is connected to said movable member, said cylinder element providing an annular liquid space about said central passage of the fixed member, and means providing a restricted passage of liquid past said piston element during relative movements of the cylinder and piston elements.

8. Means for absorbing shocks of devices being moved within a bore hole comprising a fixed

member provided with a central passage for said devices and adapted to be secured above the end of a hole, a member guided by and movable relative to said fixed member, said movable member being provided with means engageable to arrest said devices when they are lowered, a hydraulic shock absorbing means between said members, said hydraulic shock absorbing means comprising piston and cylinder elements one of which is connected to said fixed member and the other of which is connected to said movable member, said cylinder element providing an annular liquid space about said central passage of the fixed member, and means providing a restricted passage of liquid past said piston element during relative movements of the cylinder and piston elements, and means for restoring the movable member to its original position after a load is removed therefrom.

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