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(54) IMPROVEMENTS IN OR RELATING TO AN IMPLEMENT

(71) We, C. VAN DER LELY N.V., of 10, Weverskade, Maasland, The Netherlands, a Dutch Limited Liability Company,

do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an implement, particularly, although not exclusively, a chisel plough.

According to the present invention there is provided an implement comprising a frame and an operative portion mounted on the frame, the operative portion, in normal operation, being rigidly connected to the frame in an operative position by locking means, which comprises a hydraulic cylinder and piston unit of which the cylinder is connected to one and the piston to the other of the operative portion and the frame, the cylinder and piston unit providing, in normal operation of the implement, a closed chamber containing hydraulic fluid which prevents relative displacement between the operative portion and the frame, a pressure relief valve being provided which opens upon the occurrence of excessive pressure in the cylinder as a result of overload of the operative portion, thereby permitting hydraulic fluid to flow out of the chamber, enabling the operative portion to move relatively to the frame, resilient return means being provided for returning the operative portion to the operative position after overload.

For a better understanding of the present invention and to show how it may be carried into effect, reference will now be made, by way of example only, to the accompanying drawings, in which

Figure 1 is a horizontal side elevational view of an agricultural implement attached to the three-point lifting device of a tractor;

Figure 2 is an enlarged plan view of part of the implement in the direction of the arrow II in Figure 1;

Figure 3 is a partly sectional elevational view taken on the line III-III in Figure 2;

Figure 4 is an enlarged partly sectional elevational view taken on the line IV-IV in Figure 2; and

Figure 5 is a horizontal side elevation of part of an alternative embodiment of the agricultural implement.

The agricultural implement shown in Figure 1 is a chisel plough comprising at least one, but preferably several, operative portions in the form of soil working tines 1 mounted on the top of a substantially horizontal hollow frame beam 2 which extends transversely of the intended direction of operative travel of the plough, which is indicated by an arrow A. The frame beam 2 is connected at the front with a three-point trestle 3. The three-point trestle 3, as shown, is coupled with the arms of a three-point lifting device 4 of an agricultural tractor (not shown).

Referring to Figures 2 and 3, the tine 1 has a shank or fastening portion 5 which is pivotally mounted on a stub shaft 6. The fastening portion 5, which in this embodiment, is a flat part, is located between two lugs 7 which extend substantially parallel to the fastening portion 5 one on each side, (see Figure 2). The stub shaft 6 is supported on both sides of the portion 5 in openings in the lugs 7. Near their lower edges, the lugs 7 have outwardly directed flanges 8, which are substantially horizontal and are rigidly secured to the beam 2 by tensile bolts 9, one on each side of the beam 2, and clamping plates 10. The lugs 7 extend from the top of the beam 2 upwardly and in the direction A to a location in front of the three-point trestle 3.

The tine 1 comprises a curved portion 11 extending from the fastening portion 5 and tapering so as to terminate in a tip 12. The free end of the tip 12 is in this embodiment, located substantially in a vertical plane extending tranversely of the direction A and containing the pivotal axis of the stub shaft 6.

At the top edge of the fastening portion 5 there is locking means 13, which at least in normal operation, rigidly connects the frame formed by the beam 2 with the cultivator tine 1. The locking means 13 is pivotally arranged between a stub shaft 14

located at the front of the lugs 7, and a stub shaft 15 which is journalled in a tag 16 on the top of the fastening portion. The stub shafts 14 and 15 are parallel to the stub shaft 6. The plane containing the pivotal axes afforded by the stub shafts 14 and 15 is substantially horizontal when the plow is in the operative state as shown in Figure 1.

The locking means 13 is connected with the stub shaft 14 by means of an eyelet 17 having a bearing 18 for the stub shaft 14. The eyelet 17 is on a piston rod 19 which extends into a cylinder 20 and is connected with a piston 21 which is slidable in the cylinder 20. The cylinder 20 extends in the direction A and is provided at the rear with a forked end portion 22, the limbs of which hold a bearing 23 surrounding the stub shaft 15. At the end away from the end portion 22, the cylinder 20 has an end portion 24, which is screwed onto the end of the cylinder 20 (Figure 3). The end portion 24 guides the piston rod 19 in a bore 26, the centreline 26A of which coincides with the centreline of the cylinder 20. The bore 26 is provided at each end with seals 27 surrounding the piston rod 19. The end portion 24 also has a cylindrical recess 28, the centreline of which coincides with the centreline 26A of the bore 26. The diameter of the recess 28 is slightly smaller than the internal diameter of the cylinder 20. The end wall of the recess 28 is perpendicular to the centreline 26A and is located behind the parallel end wall of the cylinder 20 to form a space 29. The space 29 is bounded by the face of the piston 21 and the outer surface of the piston rod 19. The outer surface of the end portion 24 has a tapped bore 30. In the direction towards the centreline 26A the bore 30 is extended by a coaxial bore 31; these bores 30 and 31 are perpendicular to the centreline 26A. The bore 31 opens into the space 29. The bore 31 communicates through a bore 32 which is parallel to the centreline 26A with a conduit 33. The conduit 33 extends parallel to the centreline 26A and is in liquid-tight relationship with the end portion 24. The conduit 33 is connected at its end away from the end portion 24 by means of a seal 35 in a liquid-tight manner with the end portion 22 and communicates with a bore 36 in the end portion 22, which is also parallel to the centreline 26A. The bore 36 opens into a bore 37, which is perpendicular to the centreline 26A. The outer surface of the end portion 22 has a tapped bore 38 which communicates with the bore 37 and is parallel to the bore 37. The bore 37 receives a guide member 39 having an external screwthread co-operating with the internal screwthread of the bore 38 (see Figure 4). The guide member 39 has an uninterrupted tapped hole 40. The hole 40 receives a set screw 41, the shank 42 of which has an external screwthread co-operating with the screwthread of the hole 40. The set screw 41 comprises an adjusting ring 43 provided with a dial for indicating the setting of a limit value of the fluid pressure or a force at which a valve 44 to be described more fully hereinafter opens. The adjusting ring 43 is adjustable with respect to an indicator 43A secured rigidly to the end portion 22. The bore 37 accommodates a compression spring 45, one end of which bears on a projecting part of the shank 42, the other end surrounding and holding a stem 46 of the adjustable pressure relief valve 44. The valve 44 has a conical end 47, which, in normal operation, engages the transitional region between the bore 37 and a bore 48 communicating therewith, the conical end 47 separating the bores. The bore 48 opens into a chamber 49 afforded by a recess 50 in the end portion 22, the centreline of which coincides with the centreline 26A. The recess 50 has a cylindrical wall and a wall which is perpendicular to the centreline 26A, which is located some distance behind the parallel end face of the cylinder 20. A bore 51 also opens into the chamber 49 and it is parallel to the bore 48. The bore 51 communicates with a bore 52, which again communicates with a bore 53. The outer surface of the end portion 22 has a further tapped bore 54 communicating with the bore 53. The bores 51, 52, 53 and 54 are coaxial and perpendicular to the centreline 26A. The bore 54 contains a plug 55 having an external screwthread co-operating with the screwthread of the bore 54.

The plug 55 has a bore 56 which is coaxial with the bore 51, this bore 56 communicating with the bore 52. The plug 55 has a further bore 57, which is perpendicular to the centreline 26A. The bore 57 communicates with a bore 58 in the end portion 22, which is coaxial wth the bore 57 and which communicates with the bore 37. The bore 52 accommodates a compression spring 59, one end of which bears on a boundary wall between the bores 51 and 52, the other end surrounding and holding a stem 60 of a non-return valve 61. The valve 61 has a conical valve member 62 which, in normal operation, engages the interface between the bores 52 and 56, these bores being thus separated from one another. The bore 58 communicates with a hole 63 in the outer wall of the end portion 22, into which is screwed a sealing plug 64.

The chamber 49 communicates with a space 20A in the cylinder 20 on the side of the piston 21 facing an end portion 22. The space 20A holds a resilient element in the form of a compression spring 65 which does not touch the inner surface of the cylinder and which presses the piston 21 and the piston rod 19 away from the end portion 22.

Figure 3 shows that the bore 30 contains a guide member 66 having a screwthread co-operating with the screwthread of the bore 30. This guide member has a bore 67, which is coaxial with the bore 30. The bore 67 opens into a reservoir 68 arranged on the top of the end portion 24. In the reservoir 68 there is a piston 69 which is a close fit with the inner wall of the reservoir 68. The piston 69 has a guide rod 70 which passes out of the reservoir 68 through an opening in a cover 71. Between the inner side of the cover 71 and the top of the piston 69 acts a light compression spring 72. The cover 71 has an opening 73 establishing a communication between the interior of the reservoir 68 above the piston 69 and the open air.

There is hydraulic fluid in the hydraulic circuit including the interior of the cylinder 20 and the space 29, the bore 31 and the bore 32, the conduit 33, the bores 36, 37, 48, the chamber 49, the bores 51, 52, 56, 57, 58 and 67 and the interior of the reservoir 68 below the piston 69. The bores 51, 52, 56, 57, 58 constitute a by-pass of the bores 37 and 48.

In normal operation the eyelet 17 is mounted by the bearing 18 on the stub shaft 14 and the limbs of the forked end portions 22 are fitted to the stub shaft 15 by the bearing 23. In normal operation, the compression spring 45 presses the conical end 47 of the valve 44 into the entry of the bore 48 with a force which can be adjusted by the adjusting ring 43. Adjustment of the adjusting ring or knob 43 results in axial displacement of the shank 42 owing to the threaded engagement of the two parts.

From the position shown in Figure 3 of the piston 21 in the cylinder 20, the piston 21 and the piston rod 19 can be urged towards the end portion 22 if such a great force is exerted on the operative portion constituted by the tine 1, that some means for safeguarding against overload is desirable. The locking means 13 constitutes such a means. If the piston 21 is urged towards the end portion 22 by a force near the adjusted limit value of the valve 44, the fluid pressure in the space 20A as well as the fluid pressure in the bores 50 and 48 will attain a high value. When the limit value set by the valve 44 is reached, the fluid pressure on the valve 44 will lift it against the pressure of the spring 45 so that the fluid flows from the chamber 49 to the space around the piston rod 19 on the other side of the piston 21 through the bore 48, the bores 37, 36, the conduit 33, the bores 32, 31 and the space 29 so that unlocking of the locking means occurs and the piston 21 can move towards the end portion 22. Since the volume of the piston rod 19 inside the cylinder 20 increases when the piston 21 moves towards the end portion 22 (since the piston rod 19 projects only from one end of the cylinder 20), a quantity of hydraulic fluid corresponding to the extra volume of the piston rod 19 has to be discharged. When the valve 44 is lifted in the event of overload, some hydraulic fluid will flow through the conduit 31 to the reservoir 68 to lift the piston 69 against the relatively light pressure of the spring 72. The piston 69 prevents air bubbles from getting into the hydraulic fluid in the reservoir 68. The construction described thus avoids excessive forces occurring between an operative portion and a frame which are rigidly interconnected in normal operation. The locking means described will be unlocked by excessive fluid pressure which is solely a function of the operational force exerted on the operative portion 1. After unlocking the spring 65 in the cylinder 20 ensures that the operative portion will turn back in the direction of the arrow B into the operative position, the fluid then flowing from the space in the cylinder around the piston rod 19 through the space 29, the bores 31 and 32, the conduit 33 the bores 36, 37, 58, 57, 56, past the non-return valve 61 towards the bores 52 and 51 so that it can flow back into the space 20A in the cylinder 20 through the chamber 49. After the tine 1 has returned into its operational position, the rigid connection between the operative portion and the frame is re-established so that the locking means can again respond via the adjustable valve 44 at an overload limit value set by the adjusting ring.

In the embodiment shown in Figure 5, the compression spring 65 of the locking means is dispensed with. Parts corresponding with those of the first embodiment are designated by the same reference numerals. The rear of the beam 2 is provided with a tag 74 and the tine 1 is provided in the region between the fastening portion 5 and the curved portion 11 with an angle bracket 75. The angle bracket 75 has a bore through which passes a bolt 76 having nuts 77, which prevent the bolt from mowing towards the tag 74. The bolt 76 has an eyelet 78 on the side facing the tag 74 through which passes the end of a tension spring 79. The end of the spring 79 away from the eyelet 78 passes through a bore 80 in the tag 74.

The locking means 13 in the variant shown in Figure 5 operates largely like the first embodiment. After the cause of overload has been eliminated the tensile spring 79 can draw the operative portion 1 back into the operational state. An advantage of this embodiment is that the spring tension can be adjusted simply by means of the bolt 76. This adjustment may be advantageous if it is desired to adjust the time required for the tine to return from the upturned position shown in Figure 1 in dashed outline

back into the operational state about the pivotal axis of the stub shaft 6 in the direction of the arrow B in Figure 1. It should be noted that it is convenient to choose the place of the stub shaft 6 so that its pivotal axis is located in the vertical plane extending transversely of the direction A and containing the free end of the tip 12. With this arrangement, in the event of overload the operative portion formed by the tine 1 turns in a direction opposite the arrow B so that the tip 12 moves upwardly without any initial downwards movement and can thus directly turn away from behind an obstacle.

It should furthermore be noted that the locking means 13 may be employed for locking an operative portion of an agricultural machine on a frame and can also be used with machinery other than agricultural machinery. It is an important advantage that the operation of the locking means as a unit associated with the operative portion 1 is performed completely independently of the hydraulic circuit of the tractor and also independently of hydraulic circuits of locking devices on neighbouring parts. The locking means 13 can be particularly effectively used for safeguarding an individual plough body against overload, whilst the locking system may be advantageously employed in an operative portion arranged on a frame by means of a polygonal hinge. The locking device may then be arranged in one of the arms of in the junction of the arms.

WHAT WE CLAIM IS:—

1. An implement comprising a frame and an operative portion mounted on the frame, the operative portion, in normal operation, being rigidly connected to the frame in an operative position by locking means, which comprises a hydraulic cylinder and piston unit of which the cylinder is connected to one and the piston to the other of the operative portion and the frame, the cylinder and piston unit providing, in normal operation of the implement, a closed chamber containing hydraulic fluid which prevents relative displacement between the operative portion and the frame, a pressure relief valve being provided which opens upon the occurrence of excessive pressure in the cylinder as a result of overload of the operative portion, thereby permitting hydraulic fluid to flow out of the chamber, enabling the operative portion to move relatively to the frame, resilient return means being provided for returning the operative portion to the operative position after overload.

2. An implement as claimed in claim 1, in which the operative portion is connected to the frame in such a way as to pivot upon overload.

3. An implement as claimed in claim 1 or 2, in which the return means returns the operative portion to a position determined by the locking means.

4. An implement as claimed in any one of claims 1 to 3, in which the cylinder of the cylinder and piston unit is pivotally connected with the operative portion.

5. An implement as claimed in claim 4, in which the piston is connected to a piston rod which is connected to the frame.

6. An implement as claimed in claim 5, in which the cylinder and the piston rod are connected by stub shafts with the operative portion and the frame respectively.

7. An implement as claimed in claim 6, in which, upon overload, the stub shafts move towards one another.

8. An implement as claimed in claim 6 or 7, in which, upon overload, the operative portion is pivotable about a pivotal axis which is parallel to the stub shafts.

9. An implement as claimed in any one of claims 6 to 8, in which the return means urges the stub shafts to move away from one another.

10. An implement as claimed in any one of the preceding claims, in which the pressure relief valve, upon overload, establishes communication between the regions of the interior of the cylinder on each side of the piston.

11. An implement as claimed in any one of the preceding claims 5 to 11, in which the pressure relief valve is adjustable.

12. An implement as claimed in claim 11, in which the pressure relief valve is provided with an adjusting knob for adjusting the desired limit value at which the pressure relief valve opens.

13. An implement as claimed in any one of the preceding claims, in which a by-pass circuit is provided which by-passes the pressure relief valve.

14. An implement as claimed in claim 13, in which the by-pass circuit includes a non-return valve.

15. An implement as claimed in claim 14, in which the non-return valve is disposed so that, after overload and during return of the operative portion to the operative position, the fluid can flow back into the cylinder.

16. An implement as claimed in any one of the preceding claims, in which the interior of the cylinder communicates with a fluid reservoir.

17. An implement as claimed in claim 16, in which the fluid reservoir is in communication with the region of the interior of the cylinder in which the piston rod extends.

18. An implement as claimed in claim 16 or 17, in which the fluid reservoir contains a piston which is upwardly movable against spring pressure.

19. An implement as claimed in any one of claims 16 to 18, in which the fluid reservoir has a fluid volume corresponding at

least to the volume variation occurring in the cylinder upon overload.

20. An implement as claimed in any one of the preceding claims, in which the return means comprises a resilient element.

21. An implement as claimed in claim 20, in which, in normal operation, the resilient element is substantially horizontal.

22. An implement as claimed in claim 20 or 21, in which, at least in normal operation, the resilient element extends in the intended direction of operative travel of the implement and is located above a frame beam of the frame.

23. An implement as claimed in any one of claims 20 to 22, in which the resilient element is disposed in the cylinder and exerts pressure on the piston.

24. An implement as claimed in any one of claims 20 to 22, in which the resilient element is a tensile spring and is disposed outside the cylinder.

25. An implement as claimed in any one of claims 20 to 24, in which the force applied by the resilient element is adjustable.

26. An implement as claimed in any one of the preceding claims, in which the operative portion is one of a plurality of operative portions mounted on the frame, each operative portion being provided with a respective locking means.

27. An implement as claimed in any one of the preceding claims, in which the locking means is disposed entirely above the operative portion.

28. An implement as claimed in claim 2 or in any one of claims 3 to 27 when appendant to claim 2, in which the foremost free end of the operative portion is located in a vertical plane extending transversely of the intended direction of operative travel of the implement and containing the pivotal axis of the operative portion.

29. An implement as claimed in any one of the preceding claims, in which the frame comprises a three-point trestle.

30. An implement as claimed in any one of the preceding claims, in which the operative portion is returned to the operative position when the implement is raised.

31. An implement as claimed in any one of the preceding claims, which is a chisel plough, the operative portion being a tine.

32. An implement as claimed in claim 31, in which, upon overload, the tine pivots rearwardly with respect to the intended direction of operative travel of the plough.

33. A chisel plough, substantially as described herein with reference to and as shown in the accompanying drawings.

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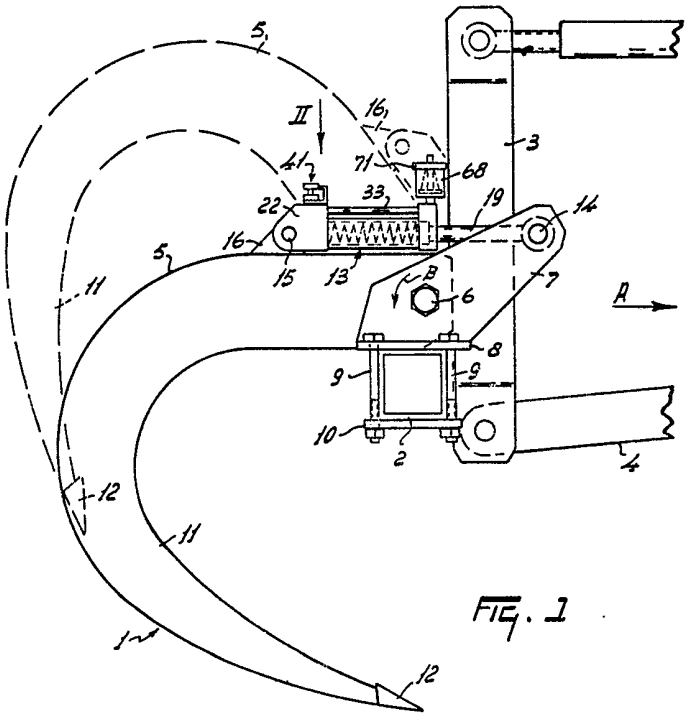

FIG. 1

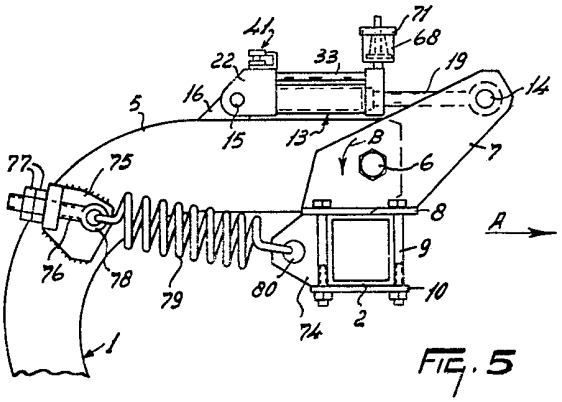

FIG. 5

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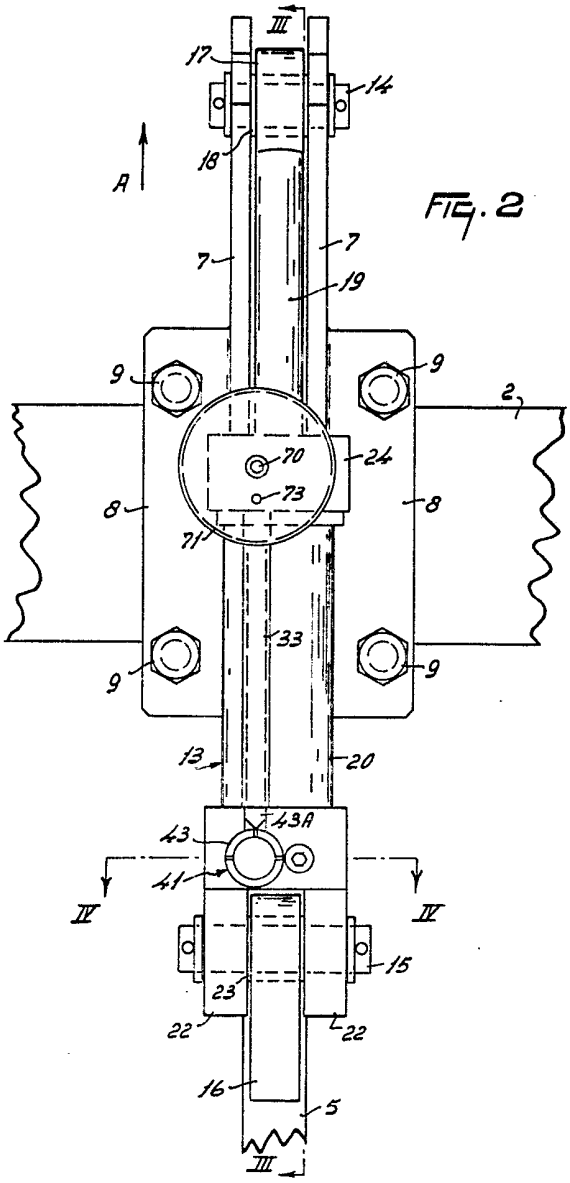
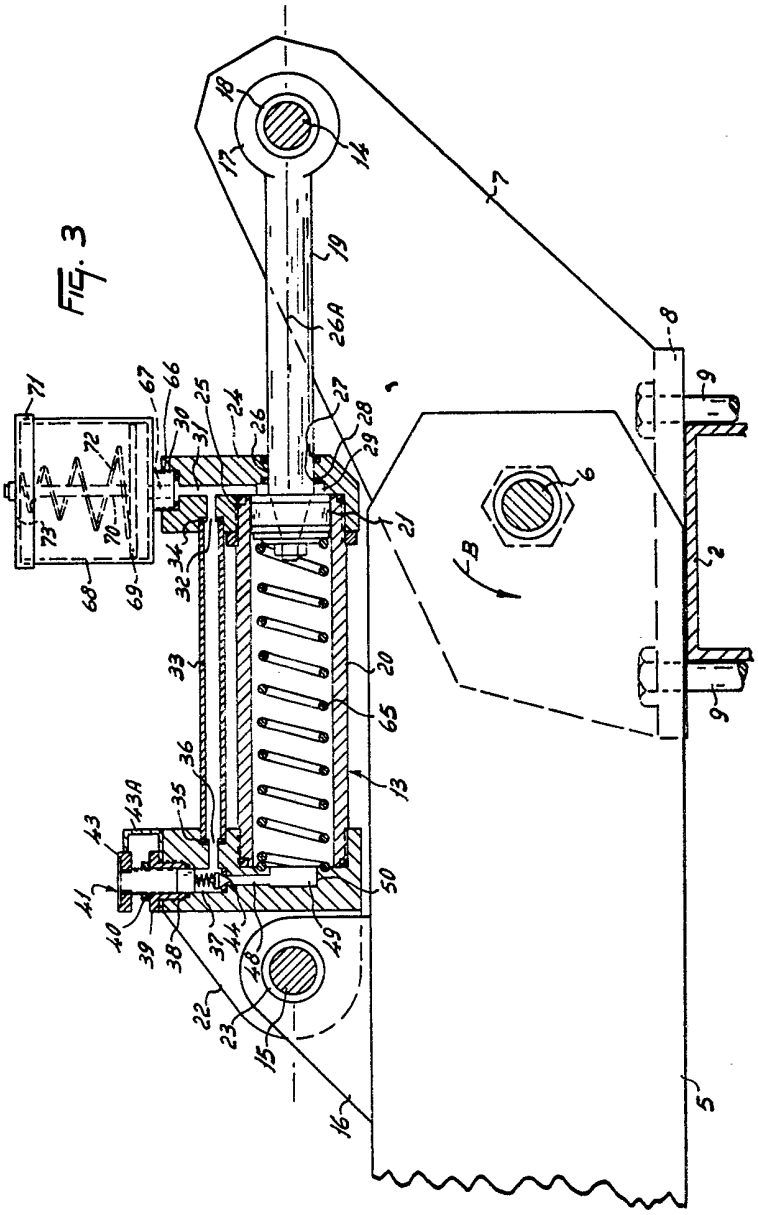


FIG. 2

FIG. 3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Sheet 4

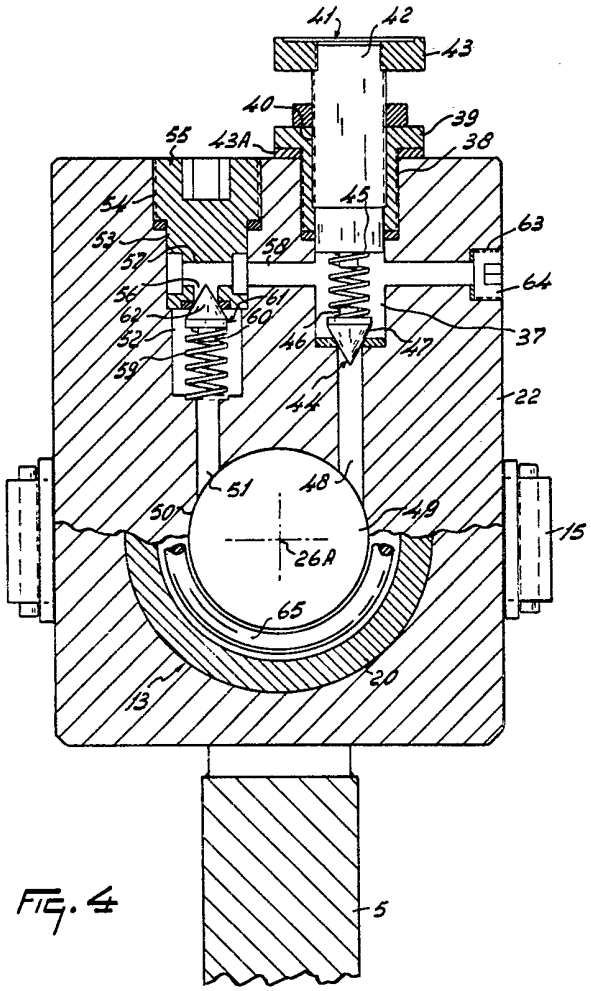

FIG. 4