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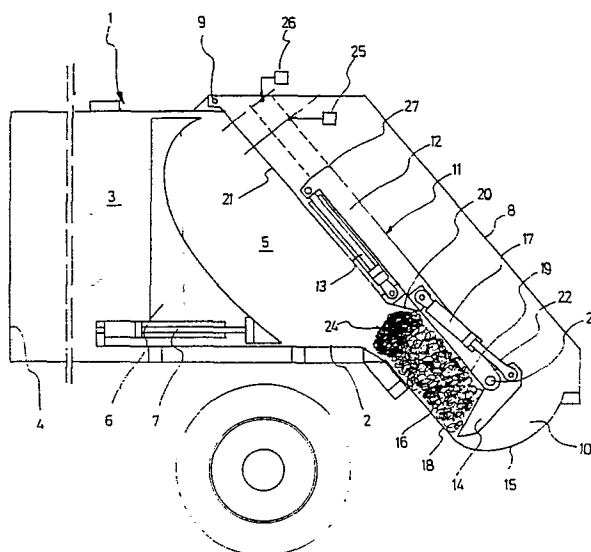
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(54) Process and mechanism for loading a refuse container.

(57) Process and apparatus for loading a refuse container (1), particularly a refuse vehicle by means of a packing arrangement (11) for depositing and compacting the refuse in a supply passage (16) towards the loading opening (5) of the container and whereby the refuse container comprises a counterpressure ejector panel (6) as well as coupling means for periodically connecting resp. disconnecting the movement of the ejector panel to resp. from the movement of the packing arrangement.

According to the invention these coupling means comprise a first detector switch (25) for the critical degree of filling of the supply passage (16) as well as for controlling the release of panel (6) and a second detector switch (26) for the emptied condition of said passage (16) and for again securing the panel (6).



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Process and Mechanism for Loading a Refuse Container

The invention relates to a process and mechanism for loading a refuse container in which the refuse is slightly compacted, so as for example in refuse vehicles.

It is known to load refuse containers such as refuse vehicles at the tail by means of a loading mechanism which essentially comprises a loading hopper and a cyclically functioning packing arrangement which to some extent compacts and pushes the refuse into a supply passage in the direction of the loading opening which extends between the floor and walls of the refuse container. The container usually comprises a sliding ejector panel for unloading the accumulated refuse. When the container is being loaded, the ejector panel exerts a certain counterpressure on the entering refuse, and moves backwards in increments according as more refuse is being pushed into the container. This offers a better compaction of the refuse so that the container can hold a greater weight. It is further known to adapt the maximum counterpressure exerted by the ejector panel during the loading operation to the pressure exerted by the packing arrangement. Upon reaching this maximum counterpressure, the ejector panel is released and moved forward a slight distance towards the front end of the container so that the pressure on the panel is lowered. The ejector panel is secured again as soon as the pressure of the refuse has dropped to a given value and the releasing/securing cycle of the panel is repeated when more refuse is loaded into the container. The control elements for regulating this stepwise movement of the ejector panel are generally steered by conventional



hydraulic or electro-hydraulic control circuits.
For example, the practical maximum counterpressure
of the ejector panel is kept 10 % under the safety
threshold (pressure) of the packing arrangement be-
5 cause the packing pressure, apart from having a use-
ful densification effect on the refuse, is partly
used to overcome the frictional resistance of the
moving refuse against the container walls. This re-
sistance generally increases according as the con-
10 tainer gets filled up. Hence, if the difference be-
tween the packing pressure and the counterpressure
exerted by the ejector panel becomes too small it is
possible that the counterpressure plus frictional
resistance already reach the packing pressure thres-
15 hold before the container is entirely filled. It
will then no longer be possible to move the ejector
panel into its extreme position against the frond end
of the refuse container so that the storage body will
never get entirely filled. The eventual result is
20 that the densification possibilities of the refuse
are limited to the densification pressure which on an
average is 10 % lower than the actual packing pres-
sure.

25 The invention now provides a process and means to
eliminate to a great extent this limited densifica-
tion possibility and thus with the same pressures to
increase the loading capacity of the refuse container
or to reach the same loading density as before with
30 less pressure. In essence the movement of the ejec-
tor panel is for this purpose periodically connected
to and disconnected from the movement of the packing
arrangement in the supply passage towards the loading
opening of the container in such a manner that during
35 the loading operation the normally secured ejector



panel is moved over a certain distance towards the front end of the container each time a given admissible volume of refuse has been accumulated in the supply passage under the influence of the packing arrangement. This distance may be preliminarily determined, but will preferably be calculated as the product of, on the one hand, the movement speed under the influence of the pressure exerted by the refuse against the panel, and on the other hand, the time required by the packing arrangement to push the refuse from the crammed supply passage into the container. In practice, this time approximately corresponds with the time of one to three packing cycles. As soon as the supply passage is empty, the ejector panel is secured again and a new series of packing cycles for filling the supply passage may start and will stop when the predetermined critical volume is reached whereby the panel is released again.

This method permits maximum densification of the refuse, e.g. household waste, in the supply passage (in proportion to the applied packing pressure) prior to pushing it further into the container. It will be advantageous to make this passage slightly convergent, for example as a channel towards the exit (the loading opening of the container). Through this higher densification in the passage, it is as though the refuse is highly plastically deformed and compacted into a smaller volume so that the load of refuse, once it is inside the container, shows less tendency to expand again elastically and will hence exert relatively less pressure and friction resistance against the container walls and floor than would less compacted refuse. Moreover, this higher degree of densification in the container offers the additional advantage that the load

is more uniformly distributed in the container. As for refuse trucks, this involves that the point of gravity of the load is shifted towards the front end of the container, leading to a better weight distribution over the wheel axles of the vehicle.

Further features and advantages of the invention will be clarified with reference to the embodiment of the mechanism according to the invention, namely a loading mechanism for a refuse vehicle, whereby reference is made to the annexed drawings.

Figure 1 is a schematic view of the loading mechanism ;
Figure 2 is a diagram of a control circuit for connecting the movements of the packing mechanism and the ejector panel ;
Figure 3 is a diagram of an alternative control circuit.

The refuse vehicle according to Figure 1 comprises a refuse container 1 with floor 2, walls 3, front end 4, and loading opening 5. This refuse container comprises an ejector panel 6 which can slide in guideways in the floor of the container and which is controlled by a hydraulic ram mechanism 7. A known loading mechanism is pivotally fixed to the loading opening 5 by means of hinges 9 at the top of the loading opening of the container. During the loading operation the loading mechanism 8 is also locked with the container 1 near the underside of the loading opening, and, for unloading the refuse from the filled container, this locking is released in a known manner, and the loading mechanism is tilted upwards about hinges 9.

The loading mechanism 8 essentially comprises a loa-

ding hopper 10 and a packing arrangement 11 comprising a known slide member 12 which can move up and down and whose movement is hydraulically controlled by a cylinder-piston combination 13. A packer blade 14 is pivotably fixed to the underside of the slide member, pushing the refuse fed into the loading hopper along floor 15 into the supply passage 16 of the loading mechanism towards the loading opening 5 under the impact of hydraulic cylinder assembly 17 which is also fixed to the slide member. The passage 16 preferably converges between its bottom surface 18, the underside 19 of the slide member and the underside 20 of the partition wall 21 with the container.

The operation of the loading mechanism is as follows. While the slide member 12 is in its uppermost position and the packer blade 14 is in open position (piston rod 22 retracted), the refuse (for example household waste) to be loaded is thrown into the loading hopper 10. The slide member 12 descends with open packer blade to its lowest position and subsequently the blade pivots about pin 23 into its compacting position under the impact of the hydraulic extension of the piston rod 22 (see figure), hereby pushing the refuse along the floor 15 of the loading hopper into the supply passage 16. Then the cylinder-piston combination 13 pushes the slide member with the packer blade 14 upwards and the refuse is thrust upwards in the passage 16 and compacted between the converging walls 18, 19 and 20 in the narrowed exit 24 from the passage to the loading opening 5, where it is plastically compacted, on the one hand, between these walls, and on the other hand, against the refuse loaded before (not suggested in the figure) which has already been compacted in the container body between

the ejector panel 6 and the exit 24. The packer blade 14 opens again following the retraction of the piston rod 22. In this process, part of the compacted refuse may fall back on floor 15 and the packing cycle starts again with slightly shorter stroke of the slide member 12 while more refuse is thrown into the hopper 10. In this way, the amount of refuse accumulated in the passage 16 continues to grow when the packing cycle, which becomes shorter each time, is repeated successive times. As a result of the repeated falling back of the refuse into the hopper 10 and the repacking, the refuse undergoes a very favourable grinding process (cutting of refuse bags, etc.). This stimulates the densification and facilitates the ulterior sorting of different refuse materials. This is an important additional advantage of the invention.

The admissible volume of accumulated refuse in passage 16, however, must stay below a given value - hereafter called the critical degree of filling - because, on the one hand, the packing arrangement would no longer exert an effective loading effect (too short packing strokes and hence obstruction of hopper 10), and because, on the other hand, the packing pressure of the plate 14 would no longer be able to overcome the friction resistance of the refuse against walls 18, 19 and 20. Therefore, this resistance may not exceed a given critical value. This value can be experimentally determined and corresponds to a maximum admissible volume of compacted refuse in the passage 16.

Right before this critical filling degree is reached, the ejector panel is released so that it can slide towards the front end of the container. As a result the pressure of the refuse in the loading opening

decreases and during the next packing cycle the packer blade 14 pushes the refuse from passage 16 through the narrowed exit 24 into the container. As soon as the passage 16 is empty, the panel is secured again and both operations of connecting, respectively disconnecting the movements of panel 6 and packing arrangement 11 are steered by suitably positioned detector switches 25, and 26 for controlling respectively the critical filling degree and the empty state of passage 16. As long as, in its upward movement, the upper edge 27 of the slide member passes beyond switch 25 during the successive compacting cycles, the panel will stay secured. As soon as this upper side does no longer reach switch 25 during its upper movement, it switches on the control member for lowering the oil pressure in ram cylinder 7 so releasing panel 6. During the next upward stroke of the slide member, the panel stays released until the upper edge 27 again reaches its highest position, i.e. when the packer blade has emptied passage 16. In this position, it actuates switch 26 which on its turn holds the hydraulic ram mechanism 7 at a pressure substantially equal to the packing pressure, so securing panel 6.

The types and connecting possibilities of detectors and control members (oil distributors) for ram 7 are multiple and comprise only the control means and measures normally used by those skilled in the art. It is also clear that the detectors must not per se respond to the position of the upper edge of the slide member. The following kinds of detectors may be considered : photocells, electromechanical limit switches (responding to course limits) or electromagnetic approach contacts, etc. An embodiment of such a control means is schematically illustrated in Figure 2.

The four successive stages of a packing cycle are indicated by arrows A, B, C and D in Figure 2. As known, the eletrohydraulic control circuits for these loading mechanisms are always made in such a way that

5 when a phase reaches its limit position a signal is given for starting the next phase. We assume that the slide member 12 is in its uppermost position with the packer blade swung into its foreward position. At this moment, the switch 26 is interrupted so that re-

10 lay 40 is not energised and switch 41 is open. As a consequence, the electromagnet 42 of the pressure distributor of the ejector panel 6 connected thereto via electric connection 55, is not energised either, so that the cylinder ram 7 in 43 comes under the pres-

15 sure of oil pump 44 and the panel 6 becomes secured. Upon starting phase A, the electromagnet 37 is energised so that the oil distributor 28 connects the supply line 29 of the oil under pressure with the pressure space 30 under piston 31, as well as the

20 space 32 with the discharge line 33 to the oil reservoir 48. As a result of the pressure difference between supply and discharge lines, the piston rod 22 is lifted and the packer blade 14 is swung open.

25 However, together with the energising of the electromagnet 37 also the contact point 35 in detector switch 25 is put under electric tension via the electric connection 34. As soon as the signal is given (at the end of phase A) to start phase B through the ener-

30 gising of the electromagnet 36, the slide member 12 will come down. The detector switch 26 is closed so that relay 40 is earthed again. The slide member moves beyond the contact sensor 38 so closing swicth 39.

At the end of phase B, the electromagnet 45 is energised so that the oil pressure in the cylinder space 32 will rise through the action of the oil distributor 46 in the circuit : the packer blade 14 is swung forward and phase C starts. The next phase D is started following the energising of electromagnet 47 so that the slide member is lifted and the refuse is pushed towards the loading opening against the pressure of refuse load in exit 24 and of the refuse accumulated between exit 24 and the panel 6 which is subjected to counterpressure.

Presently two situations may occur. The upward course of the slide member may reach such a high level that its upperedge pushes open switch 25, but does not reach switch 26. In this event, the cycle will be repeated as described before : in other words the counterpressure panel stays under pressure since the electromagnet 42 is not energised. However, when the slide member cannot slide upwards to a level at which its upperedge reaches the contact sensor 38 (because of excessive pressure buildup in the refuse in passage 16), then, when the packer blade 14 swings open (phase A'), the contact will remain closed. Since the contact point 35 is brought under electric tension by electromagnet energised 37 (through the opening of packer blade 14), the relay 40 will be energised and close switch 41. Since switch 41 is connected to a voltage source in 49 the electromagnet 42 is energised so that the cylinder space 43 is again brought in connection with the oil reservoir 48, whereby the pressure in 43 is released and the panel 6 can slide backward towards the front end 4 of the container. This shortened cycle with phases A', B, C and D can be repeated a few times whereby the slide member each



time reaches a slightly higher level during its upward stroke. As soon as it reaches the contact sensor 38 again, the contact 39 is opened. When packer blade 14 is opened the tension in 35 (via electromagnet 37) will no longer be able to energise relay 40. But this is not necessary since this relay stays energised (or in other words energises itself) via the closing of switch 41. As a result, also the electromagnet 42 stays energised so that the panel 6 stays released.

10 This process continues until during one of the following cycles the slide member succeeds in pulling the packer blade into its highest position (phase D) (owing to the continuing low counterpressures on panel 6) so as to empty the passage 16 into the container.

15 The upperside of slide member then opens switch 26 so that the energising of relay 40 is interrupted again and switch 41 is opened. This means that the energising of electromagnet 42 is stopped and the cylinder space 43 is again connected to the oil

20 pump 44 under the influence of spring 50. The panel is again brought under pressure (secured). The cycle ABCD for pushing new refuse into the passage 16 may start again.

25 In summary it can be said that at least a part of the refuse is always pushed to and fro and slightly shifted between the panel 6 and the packer plate 14, until the critical filling degree is reached in passage 16. This moving to and fro results in a favourable

30 crushing effect on the refuse and stimulates the densification of the refuse.

Instead of connecting the cylinder space 43 alternately with the oil pump 44 and the oil reservoir 48

35 via the oil distributor 51, also a distributor 52



with two positions can be used. It is here shown in Figure 3 in closed position, whereby the cylinder space 43 is closed so that the panel 6 is secured. In the other position, the passage in distributor 52 is open and the cylinder space 43 is connected pressureless with the oil reservoir 48 so that the panel is released.

Finally, it must also be mentioned that the loaded container is emptied (after that the loading mechanism is swung upwards in hinges 9) by connecting the oil pump to the cylinder space 43 by means of the manually controlled oil distributor 54.

It may also be advantageous to provide additional means near the exit 24 of the passage 16 to narrow this exit, for example temporarily at the start of the loading operation of the container as long as the ejector panel cannot exert effective counterpressure. The supply passage 16 must not necessarily have the shape of a channel as suggested in the drawing. The invention is in principle also applicable to other types of loading mechanisms, as for example described in the Netherlands Patent Application No. 70,11689. These and other variants of the invention are considered to be covered by the following claims.

Claims :

1. A process for loading a refuse container (1) by means of a packing arrangement (11) for depositing and compacting the refuse in a supply passage (16) towards the loading opening (5) of the container, whereby the refuse container comprises a counterpressure ejector panel (6) and whereby means are provided for periodically connecting resp. disconnecting the movement of the ejector panel to resp. from the movement of the packing arrangement, characterized in that, during the loading process, the panel (6) is moved a certain distance towards the front end (4) of the container each time a predetermined volume of refuse has been accumulated in the supply passage (16) under the action of the packing arrangement.
2. A process according to Claim 1 characterized in that the movement of the panel (6) towards the front end (4) of the container is stopped and that the panel is secured again each time the packing arrangement (11) has emptied the supply passage into the container.
3. An apparatus for carrying out the process according to Claim 2 comprising a refuse container (1) with slidable ejector panel (6) and a supply passage (16) connecting to loading opening (5) in which refuse is deposited and compacted by means of a packing arrangement (11), as well as periodically functioning means for coupling the movement of the panel (6) to that of the packing arrangement (11), characterized in that these coupling means comprise a first detector switch (25) for the critical degree of filling of the supply passage and an actioning member (7), controlled by means of this detector switch for releasing the ejec-



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tor panel, and a second detector switch (26) for the emptied condition of said supply passage and for steering said member (7) for the purpose of securing the panel.

5

4. Apparatus according to Claim 3 whereby the packing mechanism (11) comprises an up-and-down-movable slide member (12) carrying at its underside a rotatable packer blade (14) and which forms a supply passage (16) with the floor (15, 18) of the loading mechanism, characterized in that the first detector switch (25) responds to the position of the slide member (12) which corresponds with the critical degree of filling of the passage (16) and the second detector switch (26) for the emptied condition of this passage.
- 10
- 15

BAD ORIGINAL



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FIG.1

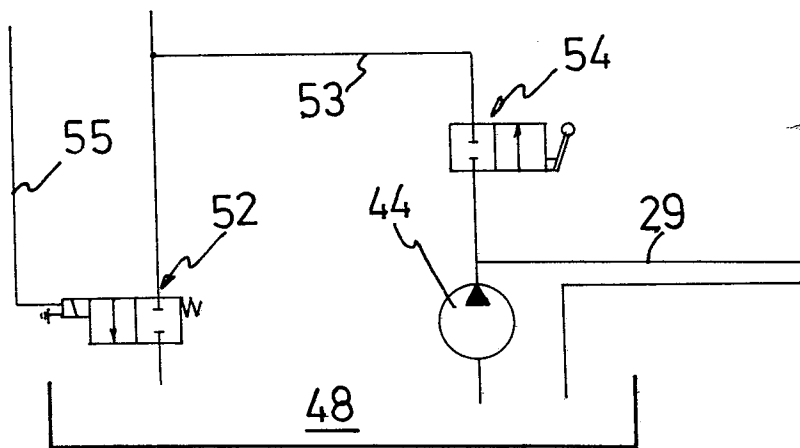
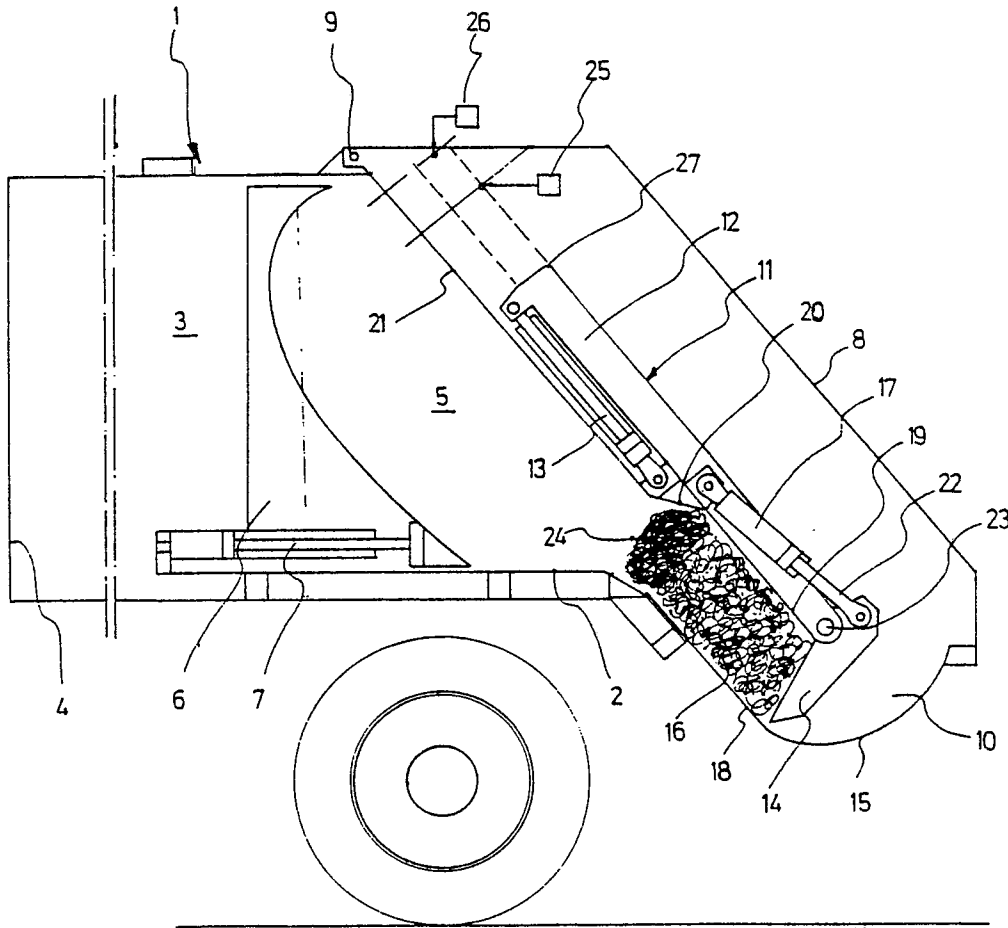
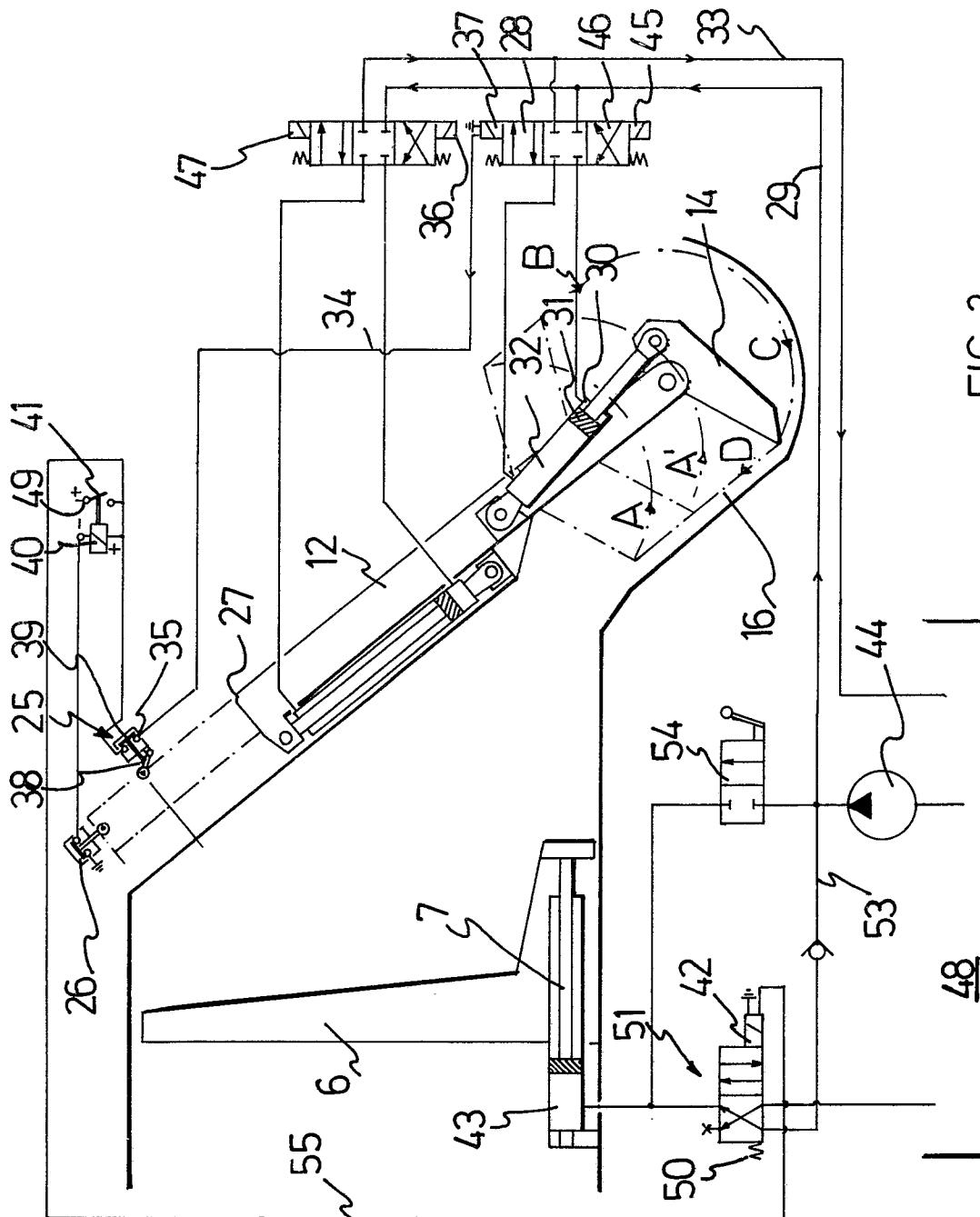


FIG.3

FIG. 2



DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<u>US - A - 3 049 256</u> (G.E. URBAN) * column 2, line 23 to column 3, line 6; column 5, lines 8-36; figures 1-5 * --	1	B 65 F 3/28 3/20
A	<u>US - A - 4 180 365</u> (W.A. HERPICH) * column 2, line 38 to column 6, line 40; figures 1-5 * --	1, 3	
A	<u>FR - A - 2 261 207</u> (S.E.M.A.T.) * page 3, lines 9-33; page 4, lines 16-31; figures 1, 2 ^A * --	1	TECHNICAL FIELDS SEARCHED (Int. Cl.) B 65 F
	<u>US - A - 3 410 427</u> (J. McCARTHY) * column 4, lines 9-49; column 5, line 57 to column 6, line 70; figures 1-7 * -----	1	
			CATEGORY OF CITED DOCUMENTS X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
			&: member of the same patent family, corresponding document
☒ The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
The Hague	01-09-1981	MARTENS	