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(54) **APPARATUS AND METHOD FOR RAISING AND LOWERING A PISTON IN A PISTON-CYLINDER ARRANGEMENT IN A DERRICK**

VORRICHTUNG UND VERFAHREN ZUM HEBEN UND SENKEN EINES KOLBENS IN EINER KOLBEN-ZYLINDER EINHEIT IN EINEM BOHRMAST

EQUIPEMENT ET PROCEDE DE HISSAGE ET DE DESCENTE D'UN JOUG A L'AIDE D'UN ENSEMBLE PISTON-CYLINDRE, DANS UN DERRICK

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Description

[0001] The present invention relates to a hoisting apparatus for a derrick, according to the pre-characterising portion of claim 1. It also relates to a derrick and a method therefor.

[0002] A derrick structure, developed by the present inventor in 1987, that has shown great promise is the RamRig™ concept. Two or more hydraulic piston/cylinder arrangements are used in the derrick for raising and lowering the drill string. The cylinders operate between the drill floor and a yoke which travels on guide rails in the derrick itself. The advantages of this concept are numerous, some of the most important being that it is possible to place the drill floor at a higher level than the platform floor, that a derrick having significantly lower air resistance can be constructed, and that the most expensive components of the derrick attain higher safety and a longer lifetime.

[0003] Since it is possible to position the drill floor higher than the platform floor, pipe handling is significantly simplified. There is no longer any need to arrange the pipe handling equipment at a high level in the derrick. All pipe handling equipment can be placed on the platform floor and the drill floor.

[0004] Other derricks and hoisting apparatuses are known from US-A-7-4 170 340 and US-A- 4 341 373.

[0005] The object of the present invention is to solve important, practical problems in the realization of the RamRig™ concept. This object is achieved by means of the features apparent from the characterizing clause of the subsequently disclosed claim 1.

[0006] The invention will now be explained in greater detail with reference to the enclosed drawings, where

Figure 1 shows a RamRig™ derrick in every essential detail;

Figure 2 shows the derrick schematically, viewed from the side;

Figure 3 shows the derrick schematically, viewed from the front, with the top drive in its lowest position;

Figure 4 shows the derrick schematically, viewed from the front, with the top drive in its highest position;

Figures 5 - 13 show the drive means of the piston/cylinder arrangements in various modes of operation.

[0007] Figure 1 shows a derrick 1 positioned on a drill floor 2. The drill floor is positioned at a higher level than the platform floor 3, so that the pipe handling equipment 4 can be placed, in the main, between the platform floor 3 and the drill floor 2. The derrick 1 is substantially gantry-shaped, with gantry legs 5, 6. Guide rails 7 for a yoke 8 and a top-drive 9 run along each gantry leg 5, 6. Hydraulic piston/cylinder arrangements 10, 11 are positioned so that they extend along each gantry leg 5, 6 and operate between the drill floor 2 and the yoke 8, for moving the yoke 8 vertically along the guide rails 7.

[0008] The yoke 8 is provided with a plurality of sheaves 12, preferably four, for running wire lines 13. The wire lines 13 run from the drill floor 2 along each gantry leg 5, 6, over the sheaves 12 and down to the top drive 9. By retracting and extending the piston/cylinder arrangement 10, 11, it is thus possible to raise and lower the top drive 9.

[0009] In Figures 2, 3 and 4, the function of the lift system is seen most clearly. In Figures 2 and 3, the piston/cylinder arrangement 10, 11 is shown in a completely retracted condition. The top drive 9 is then in its lowest position, quite close to the drill floor. The yoke 8 is at the upper end of the piston/cylinder arrangement.

[0010] When the pistons in the piston/cylinder arrangement are extended, the yoke 8 is lifted along the guide rails 7 up to the top of the derrick 1. The top drive is then lifted, as a result of the exchange created by the wire lines 13 being run over the sheaves 12, from its position adjacent to the drill floor 2 to a position directly below the yoke 8. The height to which the top drive 9 is lifted is thus the double of that to which the yoke 8 is lifted.

[0011] There may, for example, be as much as eight wire lines 13 arranged in the lift means described above, where two and two are strung in their own separate tracks over the same sheave 12. Four sheaves are arranged in pairs at each end of the yoke 8. The wire lines 13 are thus arranged in two sets 13a and 13b, extending from attachment points 14a and 14b at the drill floor 2, over the sheaves 12 and down to the top drive 9. The attachment points 14a and 14b are horizontally spaced apart by a distance approximately like the length of the yoke 8.

[0012] In Figure 5 the piston/cylinder arrangements 10, 11 are schematically illustrated. Here the yoke 8 is also shown, together with the sheaves 12 and the top drive 9. The drill floor 2 is also indicated. From the drill floor 2 each of the wire lines 13 runs over its own sheave 12 and down to the top drive 9.

[0013] Each piston/cylinder arrangement 10, 11 consists of a cylinder and a piston 21 having a piston rod 22. The cylinder 20 is at one end attached to the drill floor 2, whereas the piston rod 22 is attached to the yoke 8. The piston 21 divides the cylinder into two chambers, a lower chamber 23 and an upper chamber 24. The lower chamber 23 is circular/cylindrical and only delimited by the walls of the cylinder 20 and the lower end surface 25 of the piston 21. The upper chamber 24 is also delimited by the walls of the cylinder 20, but is in addition delimited by the piston rod 22 and the upper annular surface 26 of the piston 21. It will thus be seen that hydraulic fluid in the lower chamber 23 has a larger operating sur-

face with respect to the piston 21 than hydraulic fluid in the upper chamber 24, since the lower end surface 25 of the piston is larger than its upper annular surface 26.

[0014] The drive system which is here generally designated by reference numeral 30, consists of a reservoir 31, a feed pump 32 driven by a motor 33, one or more main pumps 34 driven by one or more motors 35, a control valve 36, an accumulator/valve plate 37, a cylinder valve 38 for each cylinder 20, one or more accumulators 39 and one or more pressure tanks 40.

[0015] From each side of the main pumps 34 lines 41, 42 respectively, lead to a port a, b in the control valve 36 respectively. A line 43 leads from the reservoir 31, via the feed pump 38 to a third port c in the control valve 36. From a fourth port e in the control valve 36 a line 44 leads to the accumulator/valve plate 37. From a fifth port d in the control valve 36 a line 45 leads via a ramification 46, where the line 45 branches so as to create one line for each cylinder 20 leading into a port f in each cylinder valve 38. The line 44 which leads into a port g in the accumulator/valve plate 37, splits here into branches which lead from a number of ports h to the control valve 38 of each cylinder 20 into a port i for each control valve 36. The accumulators 39 are connected to the accumulator valve plate 37 via ports j. It must be understood that both ports h and ports j respectively may represent a plurality of ports or optionally one port branching outside the accumulator/valve plate 37. The accumulators 39 are connected to the pressure tanks 40 via a line 47.

[0016] A line 48, connected with the upper chamber 24 of the cylinder 20, extends from a port k in each cylinder valve 38. From a port l in each cylinder valve a line 49 leads to the chamber 23 of the cylinder 20. A line 50 connects ports m in each cylinder valve 38.

[0017] Now, since the construction of the drive means 30 of the piston/cylinder arrangements 10, 11 has been explained, the mode of operation of this drive means 30 shall be explained by means of Figures 5 - 13, as follows.

[0018] In Figure 5, the piston/cylinder arrangements 10, 11 are in a locked position. The main pump 34 is set for zero displacement volume, and the connection between the ports k and the ports f and i is closed. Thus, there is no flow of hydraulic fluid in the system.

[0019] In figure 6 the piston/cylinder arrangements are extended for maximum thrust power, but at low velocity. Now the displacement volume of the main pump 34 is adjusted so that hydraulic fluid flows from the reservoir 31, via the feed pump 32 and the line 43, in through the port c in the control valve 36, out through the port b, through the line 42 via the main pump 34 and the line 41 to port a of the control valve 36, out through the port e, via the line 44 to port g of the accumulator valve plate and from this via the ports h to the ports i in the cylinder valves 38 and further out through the ports l and the lines 49 to the chamber 23 of the cylinder 20. Hydraulic fluid, displaced from the chamber 24 of the cylinder 20, flows via the lines 48, via the cylinder valves 38 and the line 45 back to the control valve 36 and main pump 34. The ports j in the accumulator valve plate 37 are closed. The connection 50 between the ports m of the cylinder valves 38 is open, however, in order to ensure that there is equal pressure on the underside 25 of the pistons 21. In this mode the piston/cylinder arrangements 10, 11 would be extended at a comparatively low velocity, but with a relatively high thrust power.

[0020] In Figure 7 another mode is shown which, with respect to hydraulic fluid circulation, is quite in accordance with the mode shown in figure 6. However, here the ports j in the accumulator valve plate 37 have been opened up so that the accumulators 39, which are influenced by pressure from pressure tanks 4 via the line 47, increase the pressure in the hydraulic fluid which flows through the line 44 to the lower chamber 23 of the cylinders 20. The velocity of the pistons 21 is then somewhat increased at the same time as the thrust power is maintained at a high level.

[0021] In Figure 8 a mode is shown where the travelling speed of the pistons 21 has been further increased. At the same time the thrust force is reduced. This mode is thus well suited for raising the unloaded top drive 9. In this mode the connection is opened between the ports i, k, l and m in the control valves 38, so that the lower chamber 23 and the upper chamber 24 of the cylinders 20 are short circuited. Hence, the hydraulic pressure acts on a differential area which is equal to the difference between the area of the underside 25 of the piston 21 and the top side 26 of the piston 21, i.e., the cross-sectional area of the piston rod 22. Thus the piston 21 obtains a greater travelling speed at the same hydraulic pressure. In this mode the ports j in the accumulator valve plate 37 are closed so that the accumulators 39 do not function.

[0022] In Figure 9 a further mode is shown, where the ports j of the accumulator valve plate 37 are opened so that the accumulators 39 supply an additional pressure into the line 44. As in Figure 8, the connection between ports i, k and l in the cylinder valves 38 is open. The ports m may also be open in this mode, although this is not shown here. In this mode, the travelling speed of the piston 21 will be further increased because of the increased pressure in the line 44. The thrust force will still be comparatively low, however.

[0023] In Figure 10 there is shown a lowering mode at maximum load and controlled speed. The main pump 34 is now readjusted so that the hydraulic fluid flows into the pump through the line 41 and out of the pump through the line 42. In this case the connection between the ports k of the lines 48 in the cylinder valves 38 and the port f of the line 45 in the cylinder valves 38 is open so that the hydraulic fluid flows into the upper chamber 24 of the cylinder. At the same time the connection between the port l and the port i in the cylinder valves 38 is open so that the hydraulic fluid in chamber 23 of the cylinder 20 flows out in the line 44. A part of the hydraulic fluid will flow back to the reservoir 31 for the very reason

that the chamber 24 of the cylinder 20 has a smaller cross sectional area than the chamber 23.

[0024] In Figure 11 a lowering mode is shown where the lowering is carried out at up to maximum load and up to maximum velocity. Here the ports f, i, k and l in the cylinder valves 38 are connected with each other. Thus hydraulic fluid can freely flow out of the chamber 23 of the cylinder 20. Some of this fluid will flow back to the cylinder and into the chamber 24, whereas the remainder will flow through the lines 44 and 45 and further, to the reservoir 31. The lowering speed can be controlled to a certain degree by means of the main pump 34, but because of the fact that the connection between the cylinder valves 38 and the reservoir 31 via the line 45 is completely open, it will be expedient to control the lowering speed by means of a throttling 51, which, as shown here, may lie in the connection between the port l and the ports f, i and k in the cylinder valves 38. This mode will be well suited for carrying out hard thrusts with the drill string, if the need should arise.

[0025] Figure 12 shows a mode of operation where constant load is maintained during the movement of the piston/cylinder arrangements 10, 11. This mode is used, for example, for the drilling itself. In this mode the fluid flow goes back and forth in the system, and the displacement volume of the main pump 34 is adjusted in both directions in accordance with signals given from a load distributor (not shown). The connection between the ports f and k in the cylinder valve 38 is open, as is the connection between the ports i and l. The hydraulic fluid thus flows between the main pump 34 and the cylinder valve 38 via the line 44 and the line 45, respectively. The directions of the flow of fluid in these two lines will at all times be opposite to each other. A certain exchange of hydraulic fluid with the reservoir 31 will also occur, since the cross-sectional areas of the lower chamber 23 of the cylinder 20 and of the upper chamber 24 are different.

[0026] Figure 13 shows a similar mode of operation, where the purpose is to maintain a constant load while the pistons 21 are moved. In this mode, however, a greater velocity is achieved with respect to the travel of the piston. The port f in the valve 38 is now closed, so that there no longer will be any fluid flow in the line 45. The ports i, k and l in the cylinder valve 38 are connected with each other, however. Thus, in the same manner as in the mode according to Figure 9, the area of piston 21 activity will be the differential area between the area of the lower surface 25 of the piston and the area of the upper annular surface 26 of the piston. This corresponds to the cross-sectional area of the piston rod 22. A faster move of the piston 21 will then be obtained even if the pressure in the system is unchanged.

[0027] Even though the use of the accumulators 39 to provide increased pressure in the system has been shown in only a few of the modes shown in Figures 5-9, it must nevertheless be understood that the accumulators may be used in any one of the modes shown, for increasing the pressure in the system and thus increase either the velocity of the piston movement, the force by which the piston 21 is moved or both. In the lowering of the pistons 21, it will be expedient to open the ports j in the accumulator valve plate 37 in order to transfer some of the pressure created hereby into the accumulators 39, which thereby charge the pressure tanks 40 via the line 47. Hence, it will be ensured that there is extra power available from the accumulators 39 when this is needed. Even in the modes for constant loads it may be expedient to use the accumulators 39.

Claims

1. A hoisting apparatus for a derrick, comprising two or more substantially vertical hydraulic piston/cylinder arrangements (10, 11) for raising and lowering a yoke (8) adapted to travel on guide rails (7), each of said hydraulic piston/cylinder arrangements (10, 11) comprising a cylinder (20), a piston (21) with a piston rod (22), said piston dividing the cylinder into a lower cylinder chamber (23) and an upper cylinder chamber (24), the surface of the piston (21) facing the lower cylinder chamber (23) being different from the surface of the piston (21) facing the upper cylinder chamber (24), said piston rod (22) being connectable to said yoke (8), a hydraulic system (30) for operation of the piston/cylinder arrangements (10, 11), where the hydraulic system comprises at least one main pump (34), having inlet and outlet ports for supplying hydraulic fluid pressure to each piston/cylinder arrangement (10, 11), valves (36, 37, 38) for control of hydraulic pressure to said lower cylinder chamber (23) and said upper cylinder chamber (24), respectively,
   characterised in that at least one of the valves is a cylinder control valve (38) which is adapted to open and close the connection between ports (f, i, k, l) in the valve (38) so as, in the following modes of operation, to establish connection between

   - each of the upper and lower cylinder chambers (23, 24) and the outlet, respectively the inlet port of the main pump (34) for normal raising and lowering of the yoke (8),

   - each of the upper and lower cylinder chambers (23, 24) and the inlet port in the main pump (34), and, optionally, directly between said chambers (23,24) and a reservoir (31), for rapid lowering of the yoke (8), or

   - each of the upper and lower cylinder chambers (23, 24) and the outlet port of the main pump for rapid raising of the yoke (8).

2. A hoisting apparatus according to claim 1, wherein the hydraulic system (30) comprises one or more

accumulators (39), which are adapted for connection with a first line (44) for hydraulic fluid leading to the lower chamber (23), during the raising of the piston (21), in order to provide extra pressure to the chamber (23), so that the piston (21) moves faster.

3. A hoisting apparatus according to claim 2, wherein the accumulators (39) are adapted for connection with said line (44) during the lowering of the piston (21), so that hydraulic pressure generated in the lower chamber will charge the accumulators (39).

4. A hoisting apparatus according to claim 2 or 3, wherein the valve (38) comprises a first port (f) for coupling to a line (45) for transport of hydraulic fluid to and from one side of the main pump (34), a second port (i) for coupling to said first line (44) for transport of hydraulic fluid to and from the other side of the main pump (34), a third port (k) for coupling to a second line (48) for transport of hydraulic fluid to and from the upper chamber (24) and a fourth port (l) for coupling to a third line (49) for transport of hydraulic fluid to and from the lower chamber (23); that during normal raising and lowering of the piston (21) the first port (f) is connected with the third port (k) and the second port (i) is connected with the fourth port (l); and that during rapid raising or lowering, the third port (k) and the fourth port (l), and the first port (f) and/or the second port (i) are connected with each other.

5. A hoisting apparatus according to claim 4, wherein the cylinder control valve (3 8) also comprises a fifth port (m) which is adapted to be connected with a corresponding port (m) in another or in a plurality of other cylinder control valve(s) (38) via a fourth line (50) and further is unrestricted in connection with the fourth port (l) so as to provide the possibility of equalizing the pressure differences between the lower chambers (23) of the various cylinders (20).

6. A hoisting apparatus according to claims 4 or 5, wherein the connection between the third line (49), extending from the lower chamber (23) and the first line (44), leading to the other side of the main pump (34) comprises a throttle (51).

7. A derrick comprising a hoisting apparatus according to anyone of the preceding claims, comprising said guide rails.

8. A method for raising and lowering a piston (21) in two or more substantially vertical piston-cylinder arrangements (10, 11) for the purpose of raising and lowering a yoke (8) which travels on guide rails (7) in a derrick,
characterised in that for normal raising or lowering of the piston (21), a lower cylinder chamber (23) of each piston/cylinder arrangement (10, 11) is connected with a first side of a main pump (34), whereas an upper cylinder chamber (24) of each of the piston/cylinder arrangements (10, 11) is connected with the other side of the pump; that for rapid raising of the piston (21) the lower chamber and the upper chamber (23, 24) are connected with each other and with the outlet side of the main pump (34); and that for rapid lowering of the piston (21) the lower chamber and the upper chamber (23, 24) are connected with each other and with the inlet side of the main pump (34) and/or directly with a reservoir (31).

9. A method according to claim 8, wherein one or more accumulators (39) are placed in connection with the lower chamber (23) for supply of extra pressure during the raising of the piston (21), and that the accumulators (39) stay connected with the lower chamber (23) during the lowering of the piston (21) for charging the accumulators.

Patentansprüche

1. Hebevorrichtung für einen Bohrturm, die zwei oder mehr im wesentlichen vertikale Hydraulikkolben/Zylinder-Anordnungen (10, 11) zum Anheben und Absenken eines Jochs (8) umfaßt, das so ausgeführt ist, daß es sich auf Führungsschienen (7) weiterbewegen kann, wobei jede der Hydraulikkolben/Zylinder-Anordnungen (10, 11) einen Zylinder (20), einen Kolben (21) mit einer Kolbenstange (22), wobei der Kolben den Zylinder in eine untere Zylinderkammer (23) und eine obere Zylinderkammer (24) unterteilt, wobei die Oberfläche des der unteren Zylinderkammer (23) zugewandten Kolbens (21) anders als die Oberfläche des der oberen Zylinderkammer (24) zugewandten Kolbens (21) ausgeführt ist, wobei die Kolbenstange (22) mit dem Joch (8) verbunden werden kann, sowie ein Hydrauliksystem (30) für den Betrieb der Kolben/Zylinder-Anordnungen (10, 11) umfaßt, wobei das Hydrauliksystem mindestens eine Hauptpumpe (34) mit Einlaß- und Auslaßöffnungen zur Zuleitung von Hydraulikfluiddruck an jede Kolben/Zylinder-Anordnung (10, 11), Ventile (36, 37, 38) zur Steuerung von Hydraulikddruck zur unteren Zylinderkammer (23) bzw. zur oberen Zylinderkammer (24) umfaßt, **dadurch gekennzeichnet, daß** mindestens eines der Ventile ein Zylindersteuerungsventil (38) ist, das so ausgeführt ist, daß es die Verbindung zwischen Öffnungen (f, i, k, l) im Ventil (38) öffnet und schließt, um in den folgenden Betriebsarten eine Verbindung herzustellen zwischen

- jeder der oberen und der unteren Zylinderkammer (23, 24) und der Auslaß- bzw. der Einlaßöffnung der Hauptpumpe (34) zum nor-

malen Anheben und Absenken des Jochs (8),

- jeder der oberen und der unteren Zylinderkammer (23, 24) und der Einlaßöffnung in der Hauptpumpe (34) sowie wahlweise direkt zwischen den Kammern (23, 24) und einem Reservoir (31) zum raschen Absenken des Jochs (8) oder
- jeder der oberen und der unteren Zylinderkammer (23, 24) und der Auslaßöffnung der Hauptpumpe zum raschen Anheben des Jochs (8).

2. Hebevorrichtung nach Anspruch 1, bei der das Hydrauliksystem (30) einen oder mehrere Sammler (39) umfaßt, die so ausgeführt sind, daß während des Anhebens des Kolbens (21) eine Verbindung mit einer ersten Leitung (44) hergestellt wird, um der unteren Kammer (23) Hydraulikfluid zuzuführen, um die Kammer (23) mit zusätzlichem Druck zu versorgen, so daß sich der Kolben (21) rascher bewegt.

3. Hebevorrichtung nach Anspruch 2, bei der die Sammler (39) so ausgeführt sind, daß während des Absenkens des Kolbens (21) eine Verbindung mit der Leitung (44) hergestellt wird, so daß in der unteren Kammer erzeugter Hydraulikdruck die Sammler (39) beaufschlagt.

4. Hebevorrichtung nach Anspruch 2 oder 3, bei der das Ventil (38) eine erste Öffnung (f) zur Verbindung mit einer Leitung (45), um Hydraulikfluid zu und von einer Seite der Hauptpumpe (34) zu befördern, eine zweite Öffnung (i) zur Verbindung mit der ersten Leitung (44), um Hydraulikfluid zu und von der anderen Seite der Hauptpumpe (34) zu befördern, eine dritte Öffnung (k) zur Verbindung mit einer zweiten Leitung (48), um Hydraulikfluid zu und von der oberen Kammer (24) zu befördern, sowie eine vierte Öffnung (l) zur Verbindung mit einer dritten Leitung (49) umfaßt, um Hydraulikfluid zu und von der unteren Kammer (23) zu befördern, **dadurch gekennzeichnet, daß** während des normalen Anhebens und Absenkens des Kolbens (21) die erste Öffnung (f) mit der dritten Öffnung (k) und die zweite Öffnung (i) mit der vierten Öffnung (l) verbunden ist, und daß während des raschen Anhebens oder Absenkens die dritte Öffnung (k) und die vierte Öffnung (l) sowie die erste Öffnung (f) und/oder die zweite Öffnung (i) miteinander verbunden sind.

5. Hebevorrichtung nach Anspruch 4, bei der das Zylindersteuerungsventil (38) auch eine fünfte Öffnung (m) umfaßt, die so ausgeführt ist, daß sie mit einer entsprechenden Öffnung (m) in einem anderen oder in mehreren anderen Zylindersteuerungsventil(en) (38) über eine vierte Leitung (50) verbunden werden kann und weiterhin in ihrer Verbindung mit der vierten Öffnung (l) nicht eingeschränkt ist, um so die Möglichkeit zu bieten, die Druckdifferenzen zwischen den unteren Kammern (23) der verschiedenen Zylinder (20) auszugleichen.

6. Hebevorrichtung nach Anspruch 4 oder 5, bei der die Verbindung zwischen der dritten Leitung (49), die sich von der unteren Kammer (23) aus erstreckt, und der ersten Leitung (44), die zur anderen Seite der Hauptpumpe (34) führt, eine Drossel (51) umfaßt.

7. Bohrturm, der eine Hebevorrichtung nach einem der vorhergehenden Ansprüche umfaßt, bei der die Hebevorrichtung die Führungsschienen umfaßt.

8. Verfahren zum Anheben und Absenken eines Kolbens (21) in zwei oder mehr im wesentlichen vertikalen Kolben/Zylinder-Anordnungen (10, 11) zum Zwecke des Anhebens und Absenkens eines Jochs (8), das sich auf Führungsschienen (7) in einem Bohrturm weiterbewegt, **dadurch gekennzeichnet, daß** zum normalen Anheben oder Absenken des Kolbens (21) eine untere Zylinderkammer (23) jeder Kolben/Zylinder-Anordnung (10, 11) mit einer ersten Seite einer Hauptpumpe (34) verbunden ist, während eine obere Zylinderkammer (24) jeder der Kolben/Zylinder-Anordnungen (10, 11) mit der anderen Seite der Pumpe verbunden ist, daß zum raschen Anheben des Kolbens (21) die untere Kammer und die obere Kammer (23, 24) miteinander und mit der Auslaßseite der Hauptpumpe (34) verbunden sind, und daß zum raschen Absenken des Kolbens (21) die untere Kammer und die obere Kammer (23, 24) miteinander und mit der Einlaßseite der Hauptpumpe (34) und/oder direkt mit einem Reservoir (31) verbunden sind.

9. Verfahren nach Anspruch 8, bei dem ein oder mehrere Sammler (39) so mit der unteren Kammer (23) verbunden ist bzw. sind, daß während des Anhebens des Kolbens (21) zusätzlicher Druck zugeführt wird, und daß die Sammler (39) während des Absenkens des Kolbens (21) zur Beaufschlagung der Sammler mit der unteren Kammer (23) verbunden bleiben.

Revendications

1. Dispositif de levage destiné à un derrick, comportant deux ou plus de deux agencements piston/cylindre hydrauliques sensiblement verticaux (10, 11) pour lever et abaisser un joug (8) adapté pour se déplacer sur des rails de guidage (7), chacun desdits agencements piston/cylindre hydrauliques (10, 11) comportant un cylindre (20), un piston (21) ayant une tige de piston (22), ledit piston divisant le cylindre en une chambre de cylindre inférieure (23)

et une chambre de cylindre supérieure (24), la surface du piston (21) dirigée vers la chambre de cylindre inférieure (23) étant différente de la surface de la surface du piston (21) dirigée vers la chambre de cylindre supérieure (24), ladite tige de piston (22) pouvant être connectée audit joug (8), un système hydraulique (30) pour un actionnement des agencements piston/cylindre (10, 11), le système hydraulique comportant au moins une pompe principale (34), ayant des orifices d'entrée et de sortie pour alimenter une pression de fluide hydraulique vers chaque agencement piston/cylindre (10, 11), des vannes (36, 37, 38) pour commander la pression hydraulique vers ladite chambre de cylindre inférieure (23) et vers ladite chambre de cylindre supérieure (24), respectivement,

caractérisé en ce qu'au moins une des vannes est une vanne de commande de cylindre (38), qui est adaptée pour ouvrir et fermer la connexion entre des orifices (f, i, k, l) situés dans la vanne (38) de manière à établir, dans les modes de fonctionnement suivants, une connexion entre

- chacune des chambres de cylindre supérieure et inférieure (23, 24) et la sortie, respectivement l'orifice d'entrée de la pompe principale (34), pour un levage normal et un abaissement normal du joug (8),
- chacune des chambres de cylindre supérieure et inférieure (23, 24) et l'orifice d'entrée situé dans la pompe principale (34) et, facultativement, directement entre lesdites chambres (23, 24) et un réservoir (31), pour un abaissement rapide du joug (8), ou
- chacune des chambres de cylindre supérieure et inférieure (23, 24) et l'orifice de sortie de la pompe principale, pour un levage rapide du joug (8).

2. Dispositif de levage selon la revendication 1, dans lequel le système hydraulique (30) comporte un ou plusieurs accumulateurs (39), qui sont adaptés pour connexion avec une première ligne (44) destinée à un fluide hydraulique menant vers la chambre inférieure (23), pendant le levage du piston (21), afin de fournir une pression supplémentaire à la chambre (23), de sorte que le piston (21) se déplace plus rapidement.

3. Dispositif de levage selon la revendication 2, dans lequel les accumulateurs (39) sont adaptés pour connexion avec ladite ligne (44) pendant l'abaissement du piston (21), de sorte qu'une pression hydraulique générée dans la chambre inférieure va charger les accumulateurs (39).

4. Dispositif de levage selon la revendication 2 ou 3, dans lequel la vanne (38) comporte un premier orifice (f) pour couplage à une ligne (45) afin de transporter un fluide hydraulique vers un premier côté de la pompe principale (34), et à partir de celui-ci, un deuxième orifice (i) pour couplage à ladite première ligne (44) afin de transporter un fluide hydraulique vers l'autre côté de la pompe principale (34), et à partir de celui-ci, un troisième orifice (k) pour couplage à une deuxième ligne (48) afin de transporter un fluide hydraulique vers la chambre supérieure (24), et à partir de celle-ci, et un quatrième orifice (l) pour couplage à une troisième ligne (49) afin de transporter un fluide hydraulique vers la chambre inférieure (23), et à partir de celle-ci, dans lequel pendant un levage normal et un abaissement normal du piston (21), le premier orifice (f) est connecté au troisième orifice (k) et le deuxième orifice (i) est connecté au quatrième orifice (l) et dans lequel, pendant un levage et un abaissement rapides, le troisième orifice (k) et le quatrième orifice (l), et le premier orifice (f) et/ou le deuxième orifice (i) sont connectés les uns aux autres.

5. Dispositif de levage selon la revendication 4, dans lequel la vanne de commande de cylindre (38) comporte également un cinquième orifice (m), qui est adapté pour être connecté à un orifice correspondant (m) situé dans une autre vanne de commande de cylindre, ou dans une pluralité d'autres vannes de commande de cylindre (38), via une quatrième ligne (50), et qui est de plus non-limité en association avec le quatrième orifice (l), de manière à fournir la possibilité d'égaliser les différences de pression entre les chambres inférieures (23) des divers cylindres (20).

6. Dispositif de levage selon la revendication 4 ou 5, dans lequel la connexion entre la troisième ligne (49), s'étendant à partir de la chambre inférieure (23), et la première ligne (44), menant à l'autre côté de la pompe principale (34), comporte une vanne papillon (51).

7. Derrick comportant un dispositif de levage selon l'une quelconque des revendications précédentes, comportant lesdits rails de guidage.

8. Procédé pour lever et abaisser un piston (21) dans deux ou plus de deux agencements piston-cylindre sensiblement verticaux (10, 11) dans le but de lever et d'abaisser un joug (8) qui se déplace sur des rails de guidage (7) dans un derrick, **caractérisé en ce que** pour un levage normal et un abaissement normal du piston (21), une chambre de cylindre inférieure (23) de chaque agencement piston/cylindre (10, 11) est connectée à un premier côté d'une pompe principale (34), tandis qu'une chambre de cylindre supérieure (24) de chacun des agencements piston/cylindre (10, 11) est connectée à l'autre côté

de la pompe, **en ce que**, pour un levage rapide du piston (21), la chambre inférieure et la chambre supérieure (23, 24) sont connectées l'une à l'autre et au côté de sortie de la pompe principale (34), et **en ce que** pour un abaissement rapide du piston (21) la chambre inférieure et la chambre supérieure (23, 24) sont connectées l'une à l'autre et au côté d'entrée de la pompe principale (34) et/ou directement à un réservoir (31).

9. Procédé selon la revendication 8, dans lequel un ou plusieurs accumulateurs (39) sont positionnés en association avec la chambre inférieure (23) afin d'alimenter une pression supplémentaire pendant le levage du piston (21), et en ce que les accumulateurs (39) restent connectés à la chambre inférieure (23) pendant l'abaissement du piston (21), pour charger les accumulateurs.

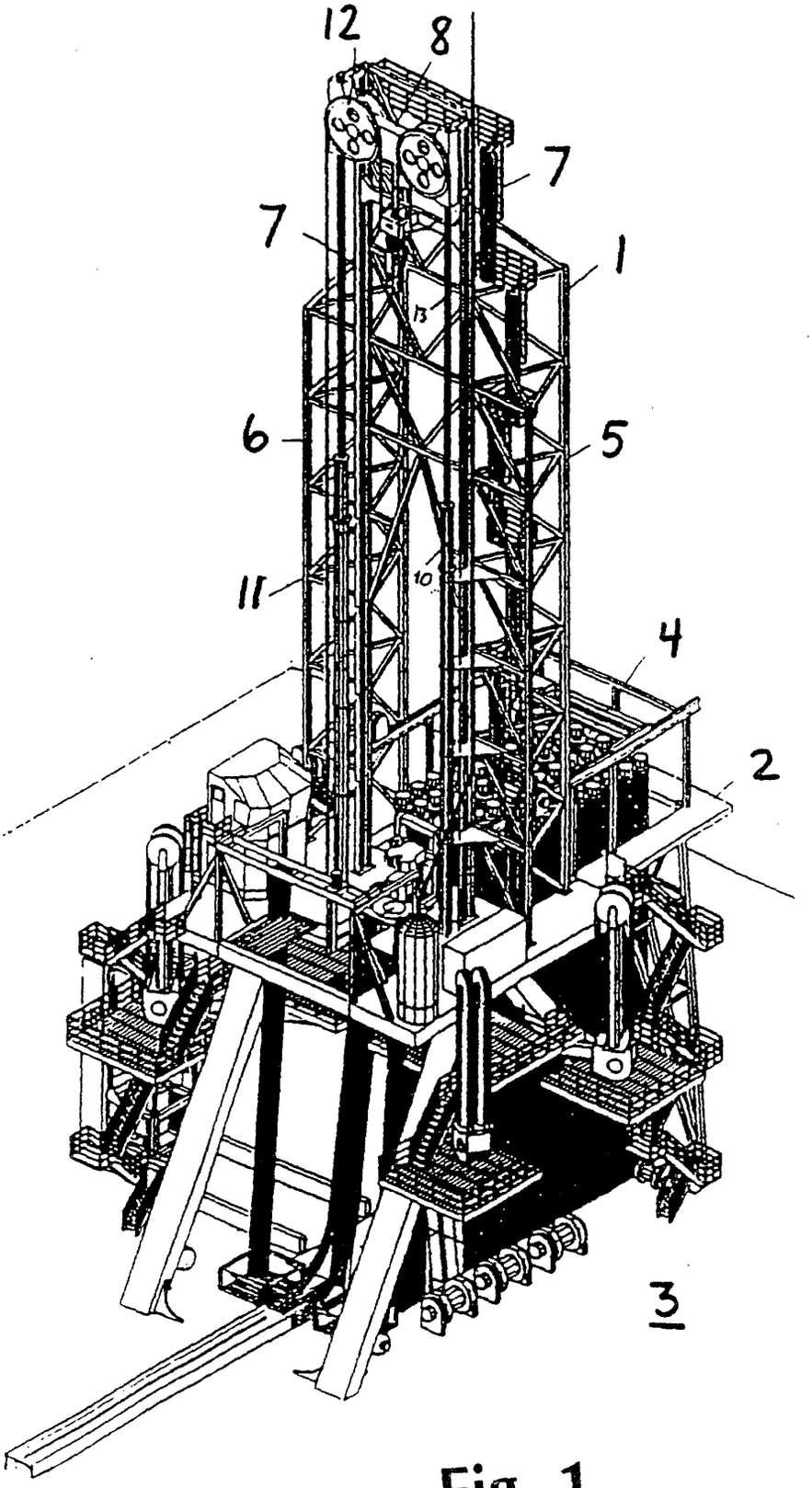

Fig. 1

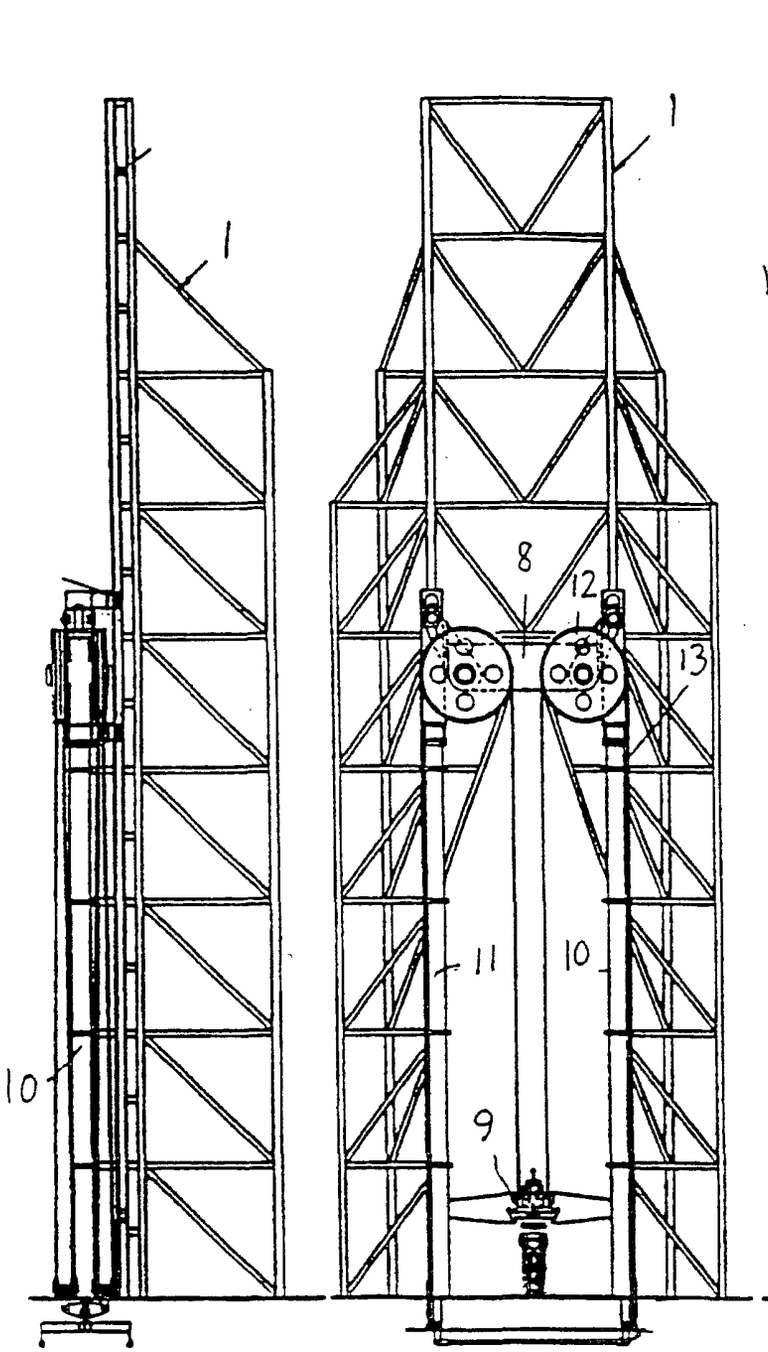

Fig. 2

Fig. 3

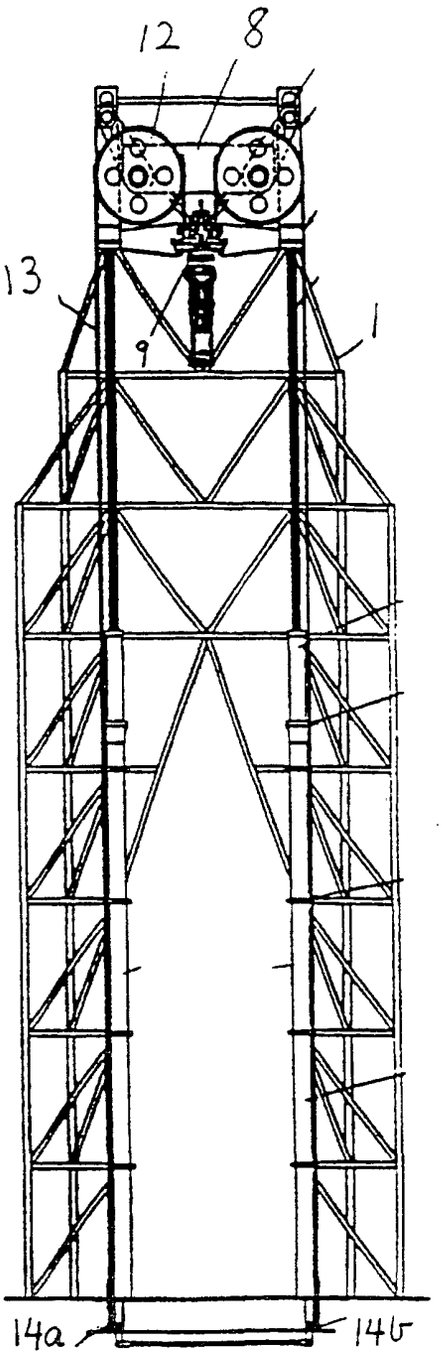

Fig. 4

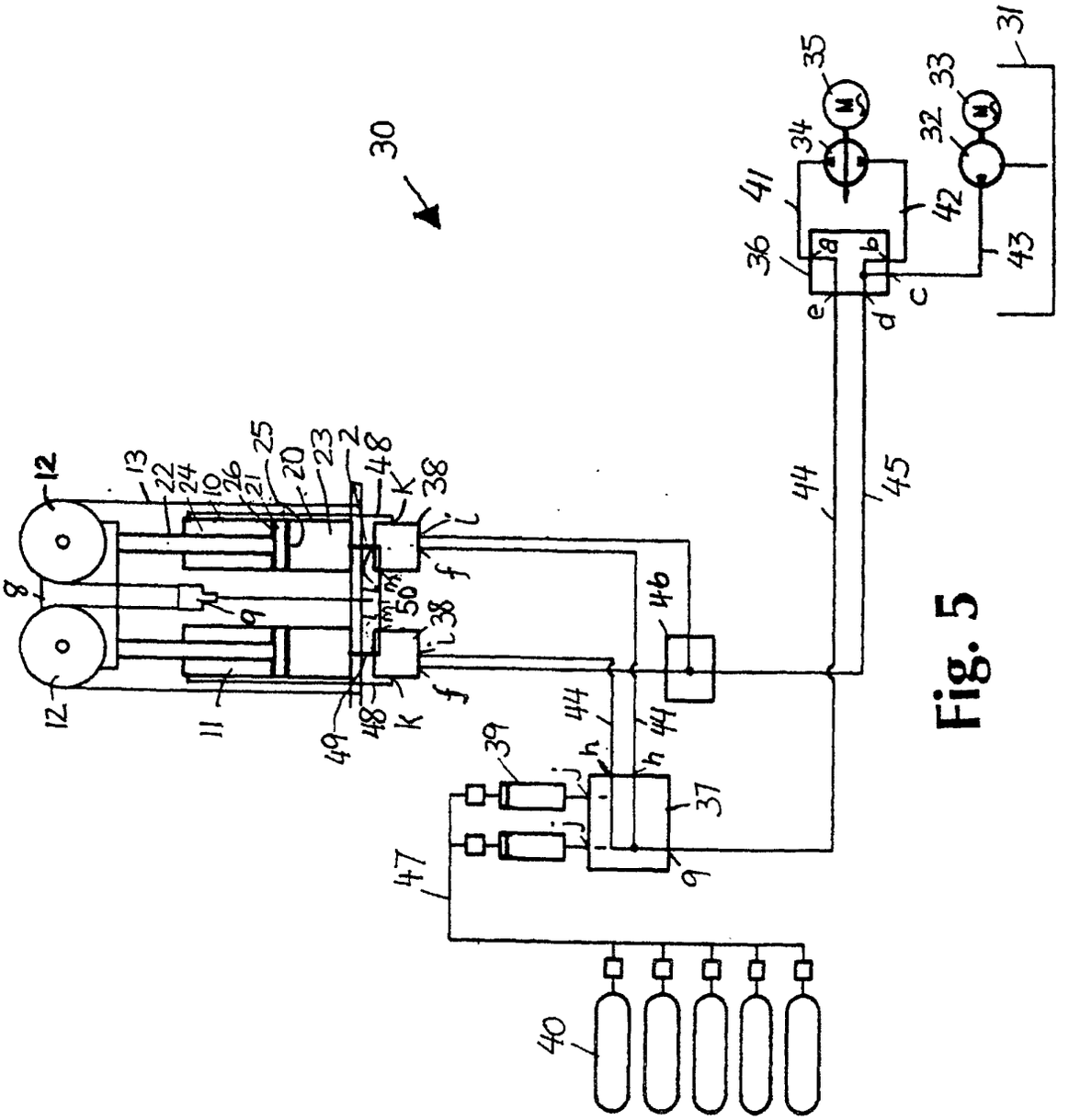
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Fig. 5

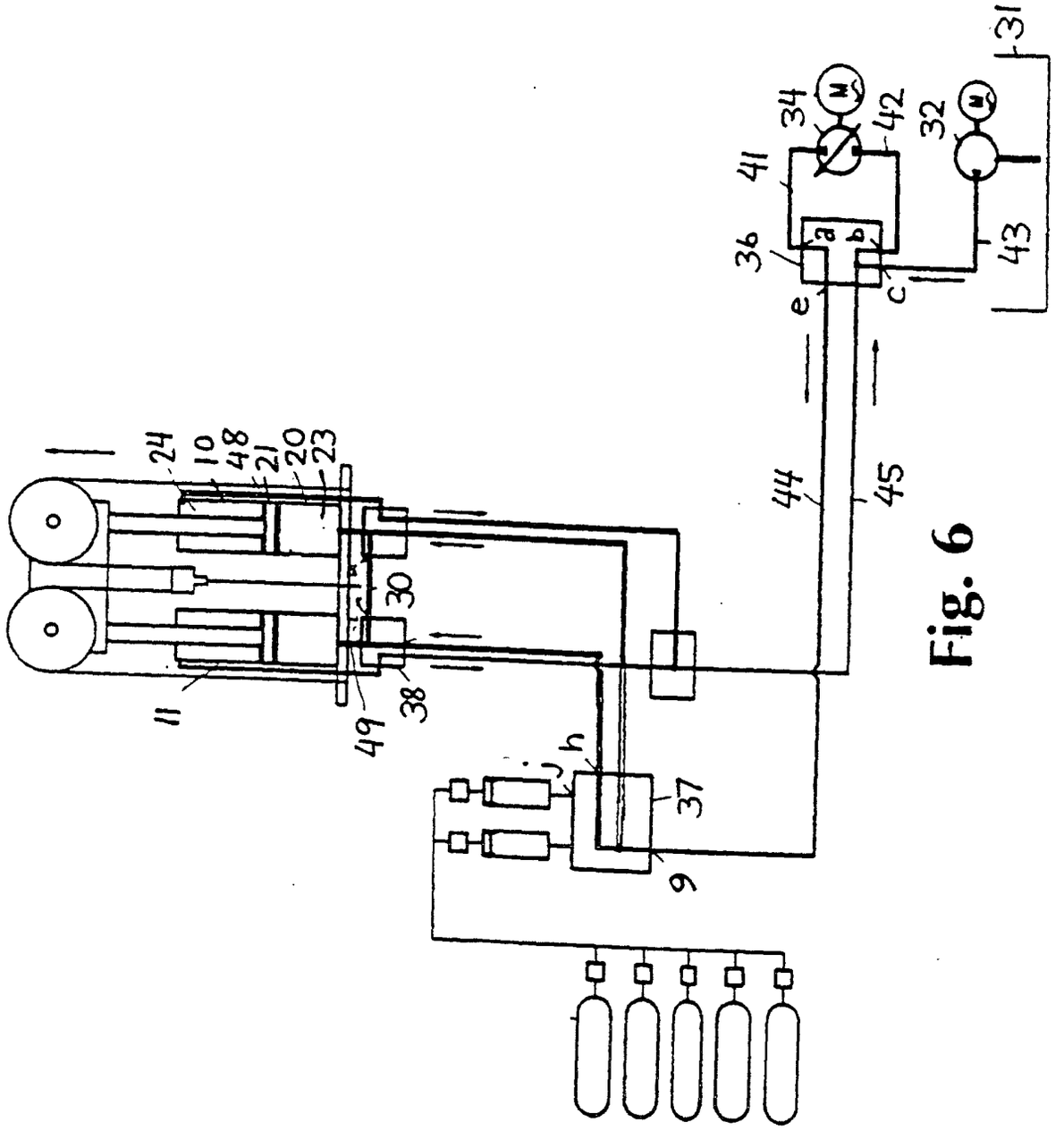

Fig. 6

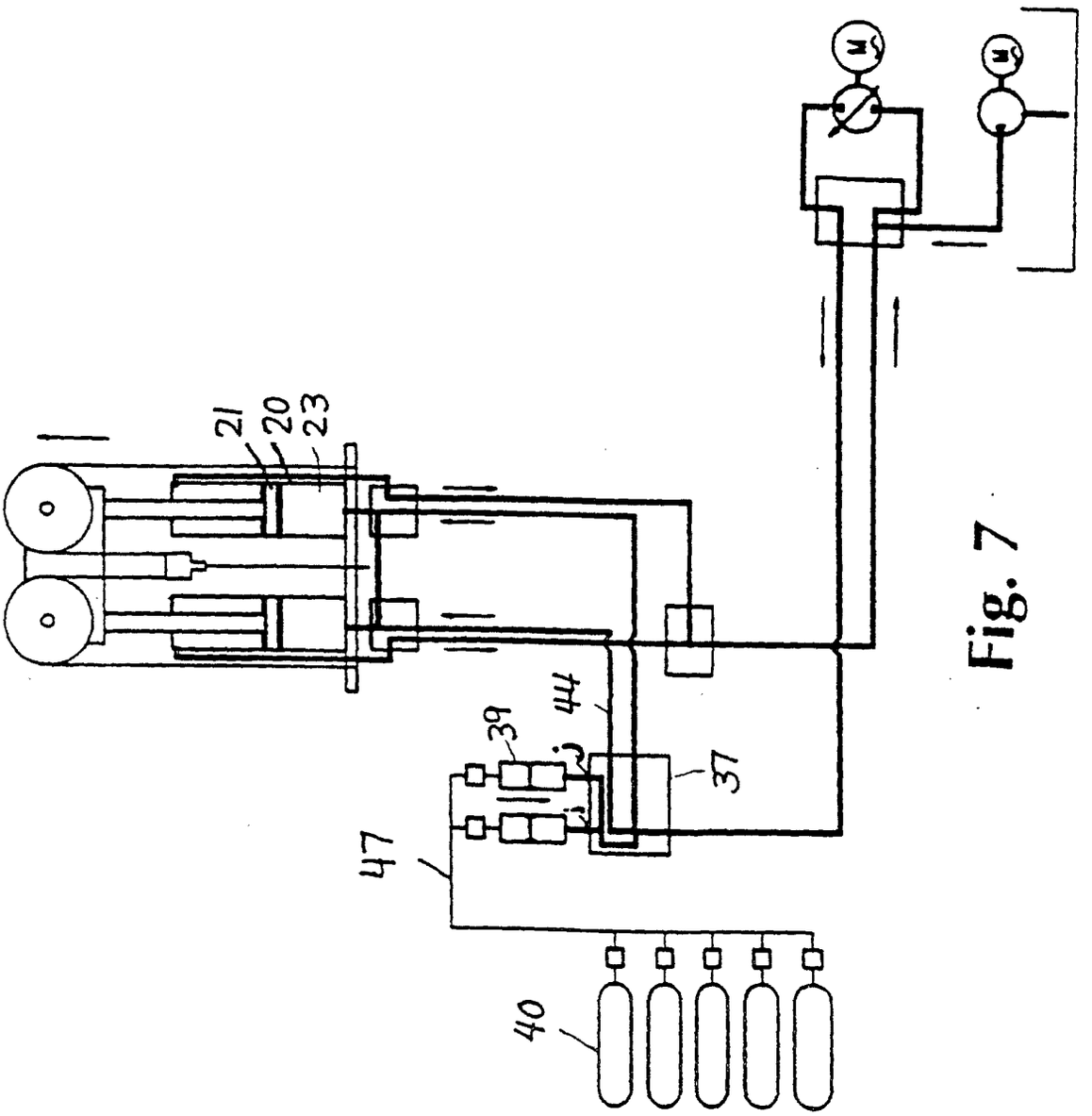

Fig. 7

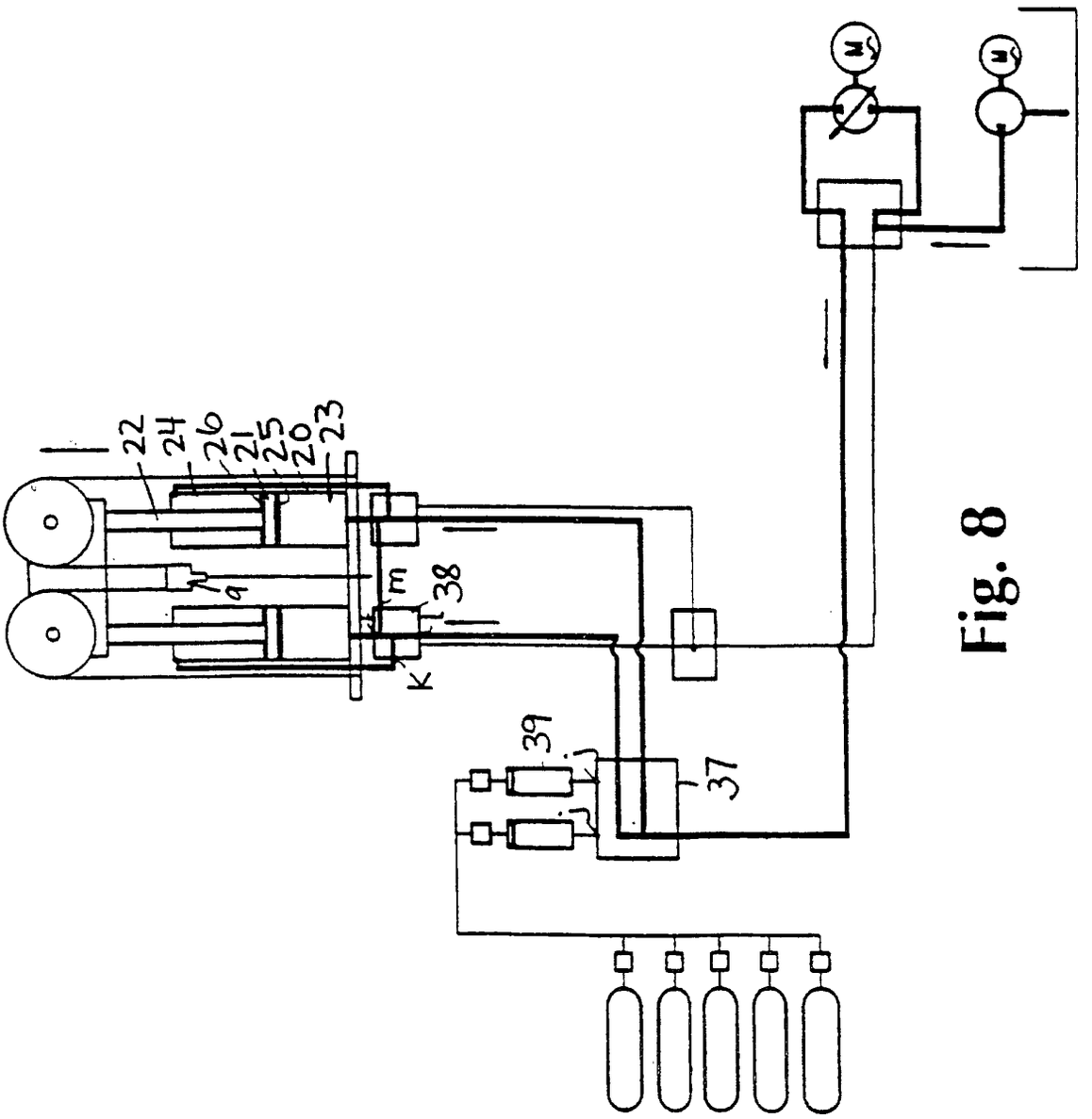

Fig. 8

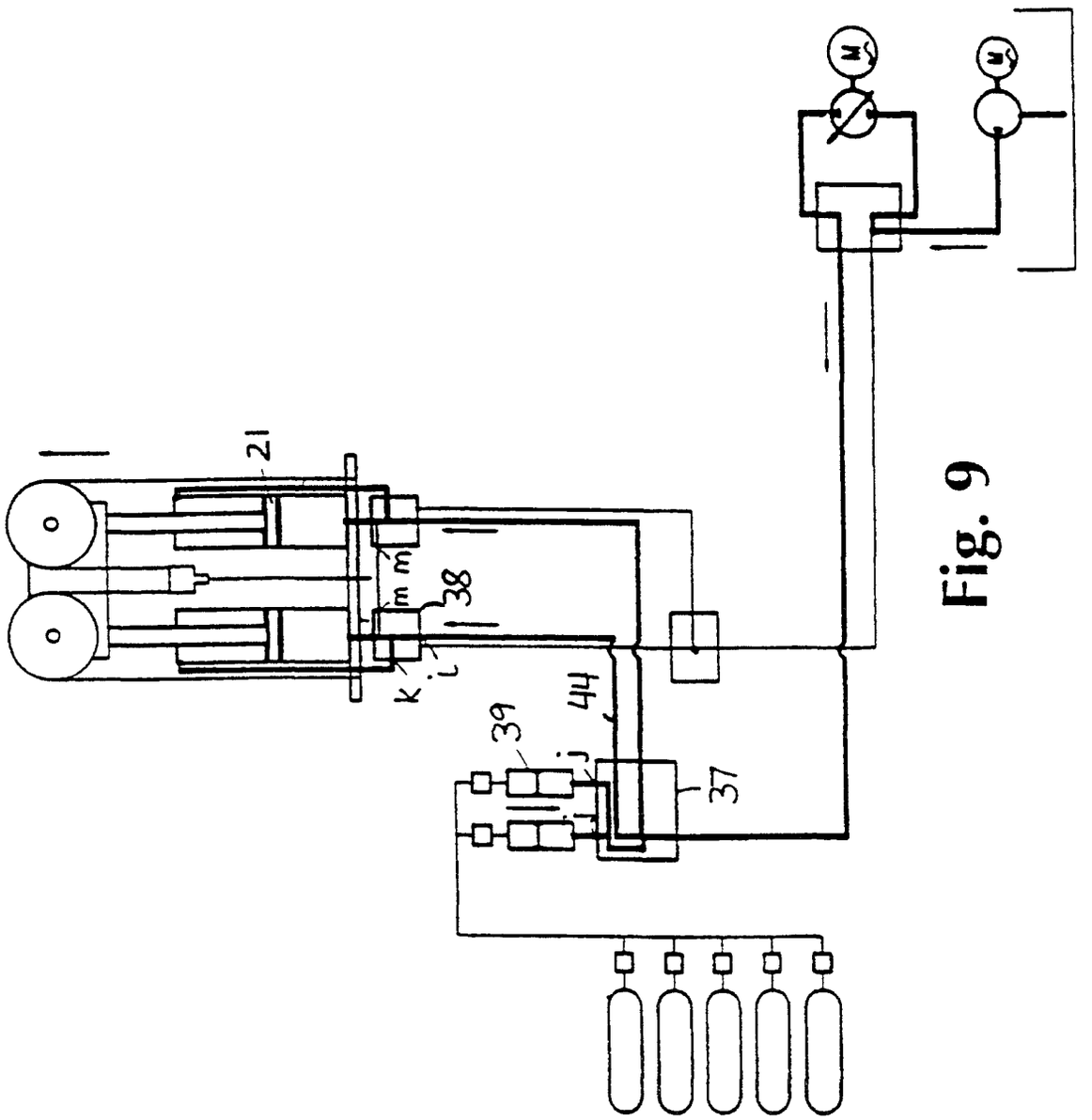

Fig. 9

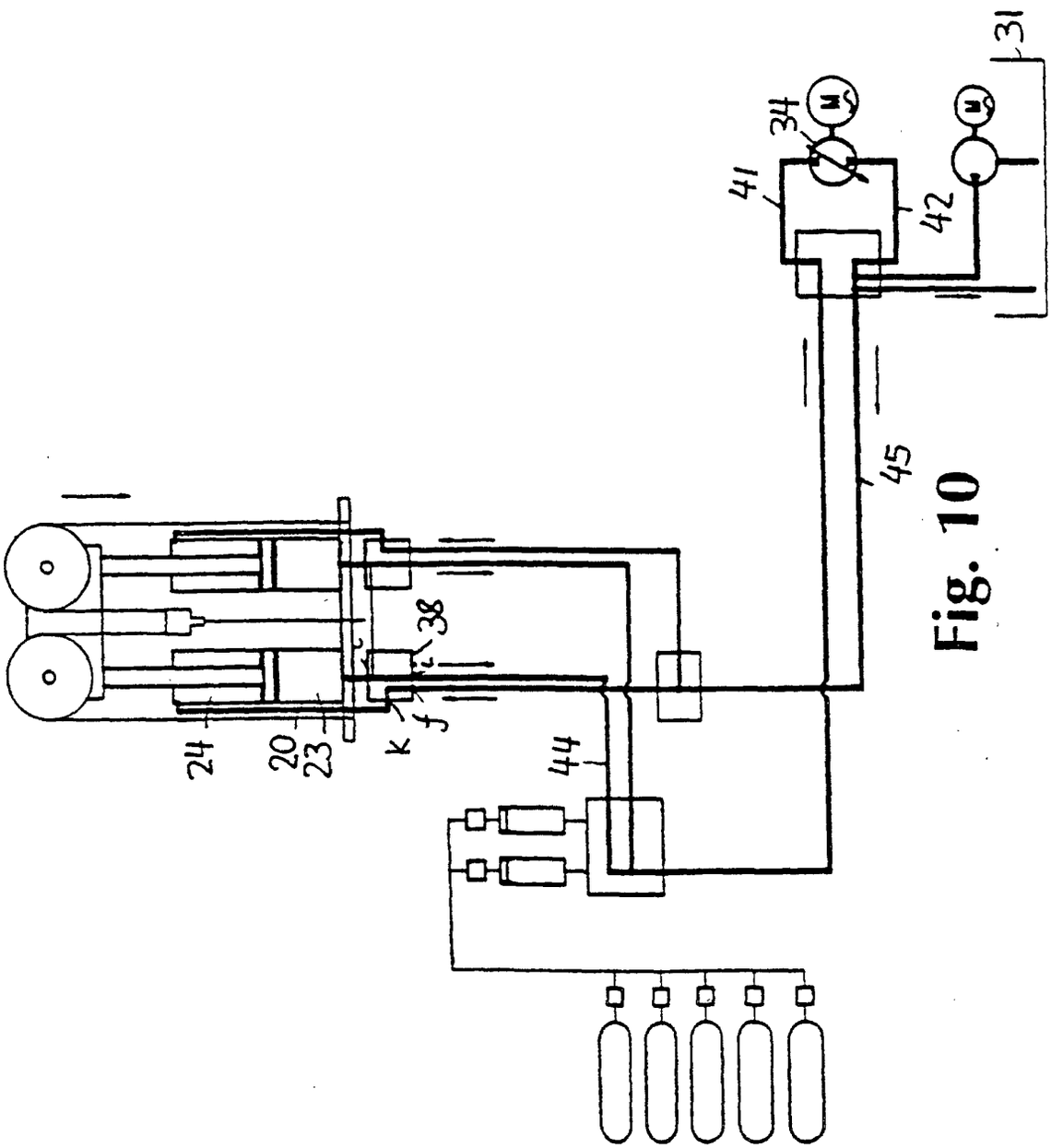

Fig. 10

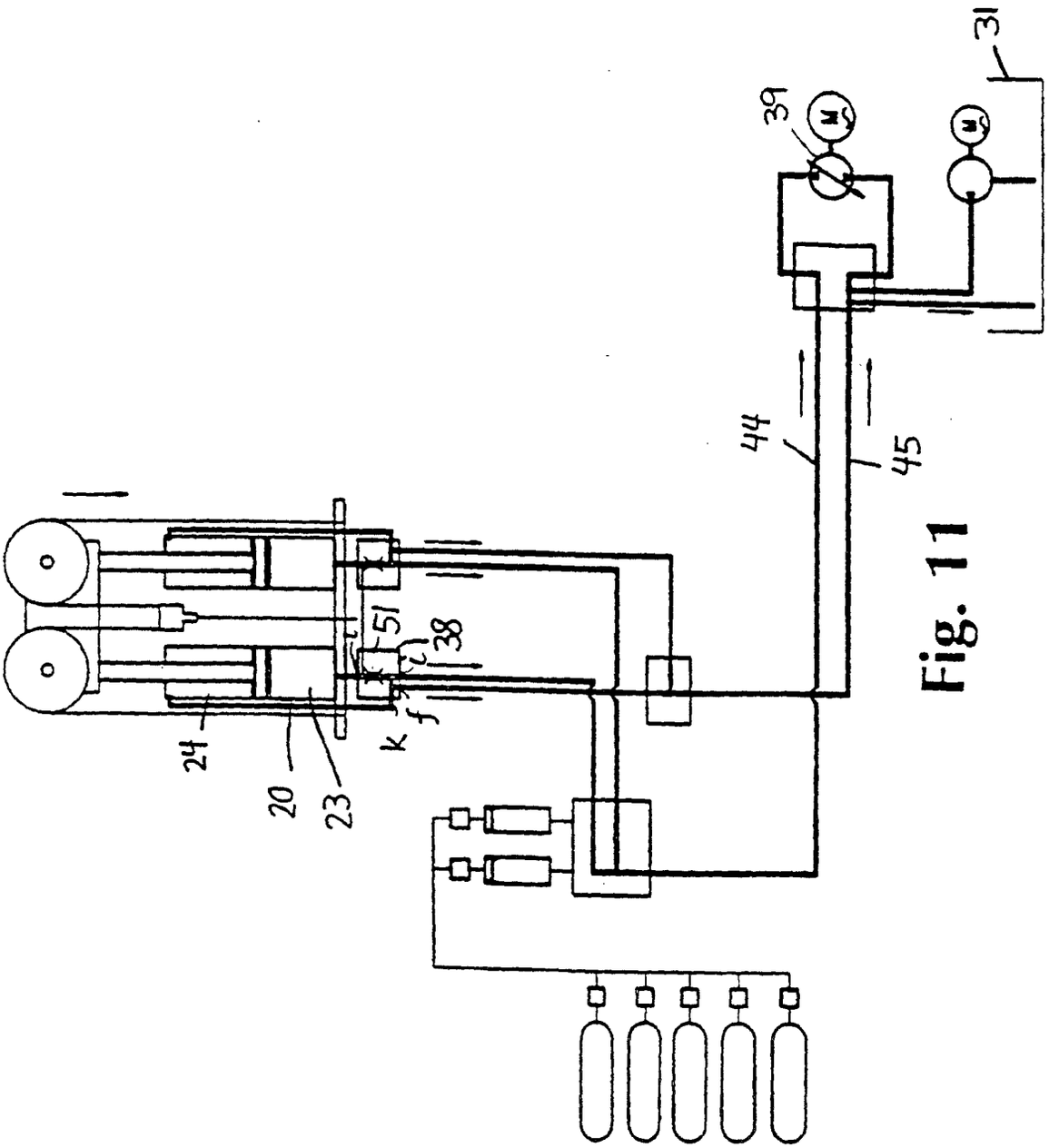

Fig. 11

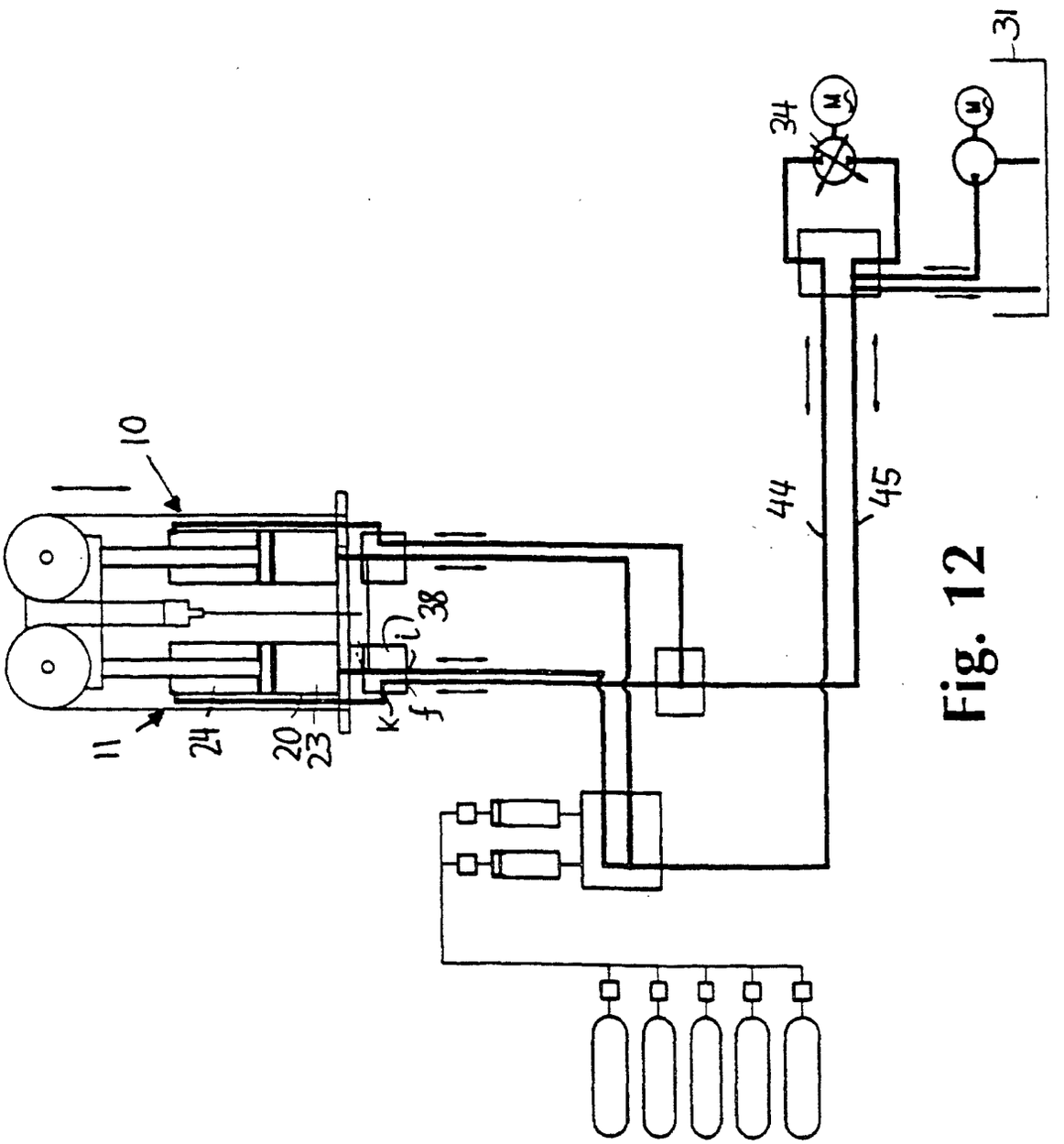

Fig. 12

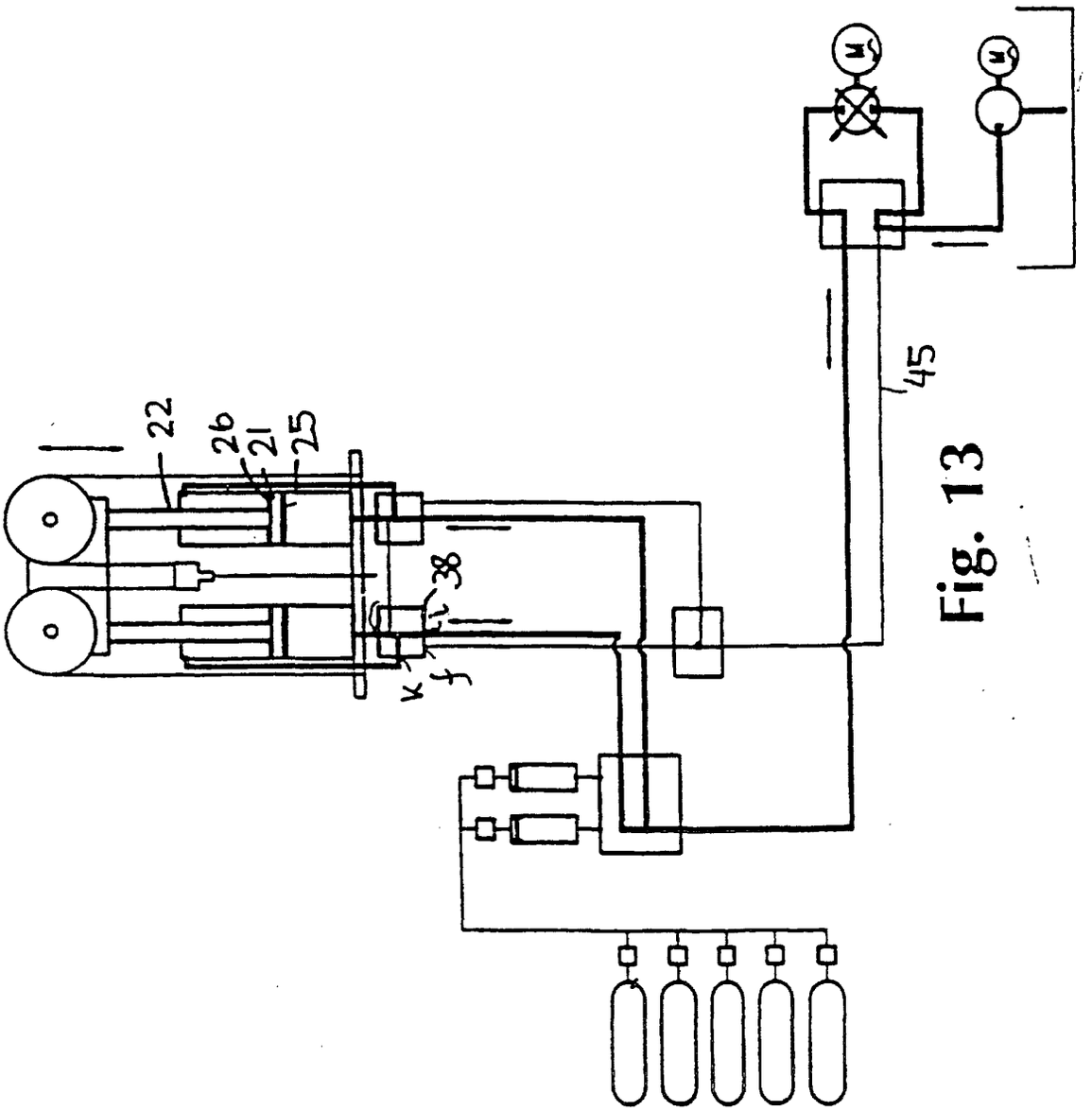

Fig. 13