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(54) **A HYDRAULIC ARRANGEMENT FOR TURNING THE ACTUATOR OF A ROCK DRILLING
MACHINE**

HYDRAULISCHE ANORDNUNG ZUR BETÄTIGUNG DES ANTRIEBS EINER
GESTEINBOHRMASCHINE

DISPOSITIF HYDRAULIQUE POUR ACTIVER L'ORGANE DE COMMANDE D'UNE MACHINE DE
FORAGE DE ROCHES

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Description

[0001] The invention relates to a hydraulic arrangement for turning the actuator of a rock drilling machine about its turning axis to at least three different positions, the arrangement comprising a pressure medium cylinder provided with two cylinder spaces and two pistons, the cylinder being arranged to affect and turn the actuator, and at least one control valve with which pressure fluid can be fed into the cylinder spaces of the cylinder such that the two pistons can be simultaneously fully ejected or fully retracted, or one can be ejected while the other is retracted.

[0002] In rock drilling machines and especially in rock bolting machines, it is often necessary to turn the actuator, such as a bolting head, which comprises one or more devices, about an axis parallel to a drill rod. In rock bolting, first a drill rod, then a feed apparatus for feeding soldering material, and finally a bolt feeding apparatus can be turned, in succession, such that they align with the same axis, whereby the soldering material and then the bolt can be fed into the drill hole. Normally, this is effected by moving different apparatuses either along transverse rails by a linear movement or by turning the apparatuses about an axis parallel to the axis of the drill rod by means of hydraulic cylinders.

[0003] The problem with known solutions is that accurate alignment requires either a separate cylinder for each movement or mechanic stoppers to effect sufficiently accurate alignment. Another problem is that to control different movements, a separate control lever is often needed for each movement, or a plural number of control levers will have to be used simultaneously, which makes positioning difficult, subjecting the process to errors.

[0004] The object of the present invention is to provide a hydraulic arrangement by which control can be implemented in a simple and reliable manner. The hydraulic arrangement according to the invention is characterized in that the control valve can be placed in at least three control positions but in only one at a time; that in each control position the pressure fluid is arranged to affect both cylinder spaces of the cylinder so that in the control position concerned, the pistons always settle in a certain predefined position.

[0005] The essential idea of the invention is that each control valve is arranged to control both hydraulic cylinders at the same time such that when a control valve is in a certain position, the cylinders settle in a certain predefined position, thereby turning the drill machine to a certain predefined position.

[0006] The arrangement according to the invention makes it possible to always turn the actuator of the rock drilling machine to a correct predefined position.

[0007] In the following, the invention will be described in greater detail with reference to the attached drawings, in which

fig. 1 shows a schematic view of a hydraulic arrangement according to the invention,

figs. 2a to 2c show a schematic view of positioning of a bolting head with the arrangement according to fig. 1,

fig. 3 shows a schematic view of another embodiment of a hydraulic arrangement according to the invention, and

fig. 4a to 4c show a schematic view of positioning of a bolting head with the arrangement according to fig. 3.

[0008] Fig. 1 shows a schematic view of an embodiment implementing a hydraulic arrangement according to the invention. In the figure, reference number 1 indicates a bolting head functioning as an actuator of a rock drilling machine. A cylinder 2 turning the bolting head is a double cylinder with cylinder spaces 2a and 2b, both of which comprise an independently moving piston 3a and 3b, respectively. Both cylinder spaces 2a and 2b are connected to pressure-controlled pilot-operated check valves 6, 7, 8 and 9 through pressure channels 4a, 4b and 5a, 5b, respectively, such that channels 4a and 5a are connected to pilot-operated check valves 6 and 8, and channels 4b and 5b are connected in parallel to pilot-operated check valves 7 and 9. Normally, when no pressure is fed to the pilot-operated check valves on their supply side, the valves close and stop the flow of the pressure medium to and from cylinder 2.

[0009] Pilot-operated check valves 6 and 9 are connected to control valves 11 and 12 through pressure fluid channels 10a to 10c. Further, one pressure fluid channel 10d coming from pilot-operated check valves 8 and 9 is connected directly to a pressure fluid container 13. Control valves 11 and 12 receive pressure fluid along pressure fluid channel 14, and, correspondingly, pressure fluid channel 15 leads from valve 11 directly to the pressure fluid container 13.

[0010] Figs. 2a to 2c show how valves 11 and 12 together with cylinder 2 control the bolting head. All the figures show the positions of valves 11 and 12, cylinder 2 and the bolting head after a control movement. In a situation illustrated by fig. 1, cylinder 2 is at its shortest, i.e. in one extreme position. When control valve 11 is moved to a position according to fig. 2a, the pressure fluid can flow through channel 10a to pilot-operated check valves 6 and 7. Valve 12 is then in free position as shown in fig. 2a, and so it does not affect the operation in any way. The pressure fluid then penetrates into the cylinder spaces 2a and 2b through pilot-operated check valves 6 and 7, behind the pistons 3a and 3b, whereby pistons 3a and 3b project as shown in fig. 2a. Since there is a partition wall between the cylinder spaces 2a and 2b in the double cylinder 2, the pressures prevailing in the cylinder spaces have no effect whatsoever on each other. The visible bolting head, which is arranged to pivot about an axis 17 in relation to a frame 16, is here in its extreme left-hand-side position, and the

drilling axis of a drill machine 18 is in a predefined position. A bolt feeding apparatus 19 and a concrete feeding apparatus 20 are then off-set from line L.

[0011] When valve 11 is in free position, i.e. in the middle position, no pressure fluid flows from channel 14, and cylinder 2 remains in its current position. When valve 12 is pushed to the position shown in fig. 2b, the pressure fluid flows from channel 14 through valve 12 to channel 10c and further through pressure-controlled pilot-operated check valves 8 and 9 to channels 4a and 5b. The piston 3a of cylinder 2a remains ejected, but the piston 3b of cylinder 2b slides inside until it is fully retracted. Here the distance between the positions to which the piston rods of the cylinder 2 are fixed is between the extreme positions of the piston rods, but is always exactly of a certain size. The bolting head 1 is here turned such that the concrete feeding apparatus 20 is at line L, in alignment with the above drilling axis.

[0012] When valve 11 is moved to the position shown in fig. 2c, the pressure fluid channel 14 is connected to channel 10b, while channel 10a is connected through channel 15 to the pressure fluid container. Valve 12 is here in free position and does not affect the operation in any way. The pressure fluid here flows from channel 10b through pilot-operated check valves 6 and 7 to both cylinder spaces 2a and 2b so that the pressure pushes the pistons 3a and 3b inside the cylinder. Since piston 3a is already inside the cylinder, pressure fluid flows only through pilot-operated check valve 7, also pushing piston 3b inside the cylinder so that the cylinder 2 is at its shortest, in the position shown in fig. 1. The axis of the bolt feeding apparatus 19 and thereby the bolt thereon align with the drilling axis at line L. In accordance with figs. 2a to 2c, hydraulic control is hereby effected: the pistons 3a and 3b of the double cylinder 2 can be moved to three predefined positions in order to pivot the bolting head about its axis. In practice, valves 11 and 12 are preferably cross-connected valves in one and the same valve unit: when the control rod is moved forward or backward, the cylinder 2 moves to the extreme positions, and movement of the control lever from the middle position in the transverse direction produces the intermediate positions as shown in fig. 2b.

[0013] Fig. 3 shows an arrangement corresponding to the one shown in fig. 1, with the exception that it comprises a separate change-over switch, which is needed since the cylinders of the double cylinder 2 are designed to differ in length such that control of the cylinder in different ways gives four predefined positions. The operation and arrangement according to fig. 3 are otherwise exactly the same as in fig. 1, but the figure shows a separate directional control valve 22 that is arranged to change channels 10d and 10c with each other such that it is possible to make a choice between two middle positions. In this embodiment, the operation of valve 11 is exactly the same as and corresponds to the positions shown in figs. 2a and 2c. Likewise, the control of the middle position, i.e. the operation and connections of

valve 12, completely correspond to fig. 2b, but the position of the double cylinder 2 depends on the position of valve 22.

[0014] Figs. 4a to 4c, in turn, show the control of the arrangement according to fig. 3 with the different positions of directional control valve 22. Fig. 4a shows the position of valves 11 and 12 when the operation of the arrangement is to be controlled with directional control valve 22. The position of directional control valve 22 can be selected either before using valve 12 or during its use. Fig. 4b shows a situation where by the use of valve 12, one of the pistons of the double cylinder 2, i.e. here piston 3a, is retracted, while piston 3b is ejected. The change of the position of directional control valve 22 in accordance with fig. 4c produces a situation where the positions of pistons 3a and 3b are reversed, i.e. piston 3a is ejected and piston 3b is retracted. Because of the different impact lengths of pistons 3a and 3b, there are two different distances between the heads of the piston rods of the cylinder 2, and so there are two accurately defined positions between the extreme positions of the ends of the piston rods of the cylinder 2, whereby, e.g. when the bolting head is turned, four permanent turning positions are provided for different actuators. This embodiment is useful when there are four actuators and when it must be possible to use each one of them in exactly the same position in the axial direction. An example for this is a bolting head comprising a drill machine for drilling a hole, a solder resin feeding apparatus, a concrete feeding apparatus, and a bolt feeding apparatus. In a situation like this, a valve can be used for choosing whether to use the resin feeding apparatus or the concrete feeding apparatus, since both are not necessarily needed simultaneously. When resin is to be fed into a drill hole, the shorter piston rod 3a is retracted into its cylinder space, whereby the bolting head 1 turns about axis 17, and a tube 21 of the resin feeding apparatus aligns with the drilling axis of the above drill machine 18 in accordance with fig. 4b. If concrete is to be used instead of resin, piston 3a remains ejected from its cylinder space, whereas piston 3b is retracted into its cylinder space, whereby a concrete delivery hose 20 aligns with the drill hole as shown in fig. 4c.

[0015] Sometimes all four alternative positions are needed in succession. Valve 12 can be connected in the same way as valve 11: channel 10d is connected to one channel of valve 12, and so a change-over can be conducted between channels 10c and 10d by controlling the valve so as to achieve the desired intermediate position. On the basis of the above, this solution as such is obvious to a person skilled in the art.

[0016] The invention is described in the above specification and the accompanying drawings only by way of an example, and it is not in any way limited thereto. The essential feature is that the control valves are arranged to control both cylinders by forced control so that a certain control movement always makes the cylinders settle in a certain predefined position. Valves 11 and 12 are

preferably cross-connected valves controlled by a single control lever. The second position of valve 12 shown in the figures is not needed in the control when only three control positions are used. Valve 12 can then have a simpler structure, or the second position can be used for controlling some other actuator. When the same lever is to be placed in four control positions, valve 12 must be implemented as depicted in the figure.

Claims

1. A hydraulic arrangement for turning the actuator of a rock drilling machine about its turning axis to at least three different positions, the arrangement comprising a pressure medium cylinder (2) provided with two cylinder spaces (2a, 2b) and two pistons (3a, 3b), the cylinder being arranged to affect and turn the actuator, and at least one control valve (12) with which pressure fluid can be fed into the cylinder spaces (2a, 2b) of the cylinder such that the two pistons (3a, 3b) can be simultaneously fully ejected or fully retracted, or one can be ejected while the other is retracted, whereby the control valve (12) can be placed in at least three control positions but in only one at a time; **characterized in that** in each control position the pressure fluid is arranged to affect both cylinder spaces (2a, 2b) of the cylinder (2) so that in the control position concerned, the pistons (3a, 3b) always settle in a certain predefined position.
2. A hydraulic arrangement according to claim 1, **characterized in that** the pressure fluid channels of the valves are connected to the cylinder spaces (2a, 2b) of the cylinder (2) through pressure-controlled pilot-operated check valves (6 - 8); that in the first control position, the pressure fluid channel (10a) coming from the control valve (11) is connected behind the pistons (3a, 3b) of both cylinder spaces (2a, 2b) of the pilot-operated check valves (6, 7) so that both pistons (3a, 3b) are ejected from the cylinder (2); that in the second control position, the pressure fluid channel (10b) coming from the control valve (11) is connected through pilot-operated check valves (6, 7) to the cylinder spaces (2a, 2b) of the cylinder (2) so that the pistons (3a, 3b) are retracted into the cylinder (2); and in the third control position, the pressure fluid channel (10c) coming from the control valve (12) is connected through pilot-operated check valves (8, 9) to the cylinder spaces (2a, 2b) of the cylinder (2) so that one piston (3a; 3b) is ejected from the cylinder (2) while the other piston (3b; 3a) is retracted into the cylinder (2).
3. A hydraulic arrangement according to claim 2, **characterized in that** the cylinder spaces (2a, 2b) of the cylinder (2) and, correspondingly, the pistons (3a, 3b) are of different length, and that the valve can

also be placed in a fourth control position, in which the piston (3a) that was ejected in the third position is retracted into the cylinder (2) and, correspondingly, the other piston (3b) that was retracted in the third position is ejected from the cylinder (2).

4. A hydraulic arrangement according to any one of the preceding claims, **characterized in that** the cylinder (2) is arranged to turn the bolting head of the rock drilling machine so that the drilling axis of the drill machine (18), the soldering material delivery tube (20, 21), and the bolt feeding apparatus (19) can be turned, in succession, about the turning axis (17) such that they align with the same drilling axis.
5. A hydraulic arrangement according to any one of the preceding claims, **characterized in that** the valves (11, 12) are cross-connected valves controlled with a single lever in such a way that only one control position of either valve can be switched on at a time.

Patentansprüche

1. Hydraulische Anordnung zum Drehen des Aktuators einer Gesteinsbohrmaschine um ihre Drehachse in zumindest drei verschiedene Stellungen, welche Anordnung einen Druckmediumzylinder (2) mit zwei Zylinderräumen (2a, 2b) und zwei Kolben (3a, 3b), welcher Zylinder angeordnet ist, den Aktuator zu beeinflussen und zu drehen, und zumindest ein Steuerventil (12) aufweist, mit dem Druckflüssigkeit in die Zylinderräume (2a, 2b) des Zylinders zugeführt werden kann, so dass die zwei Kolben (3a, 3b) gleichzeitig völlig vorgesprungen oder völlig zurückgezogen sein können oder dass der eine vorgesprungen sein kann, während der andere zurückgezogen ist, wobei das Steuerventil (12) in zumindest drei Steuerstellungen aber jeweils nur in eine Stellung gebracht werden kann, **dadurch gekennzeichnet, dass** die Druckflüssigkeit in jeder Steuerstellung angeordnet ist, beide Zylinderräume (2a, 2b) des Zylinders (2) derart zu beeinflussen, dass sich die Kolben (3a, 3b) in der betreffenden Steuerstellung immer in eine gewisse vorbestimmte Stellung stellen.
2. Hydraulische Anordnung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Druckflüssigkeitskanäle der Ventile mit den Zylinderräumen (2a, 2b) des Zylinders (2) über druckgesteuerte Rückschlagventile (6 bis 8) verbunden werden; dass in der ersten Steuerstellung der von dem Steuerventil (11) kommende Druckflüssigkeitskanal (10a) hinter den Kolben (3a, 3b) beider Zylinderräume (2a, 2b) der Rückschlagventile (6, 7) verbunden wird, so dass beide Kolben (3a, 3b) aus dem Zylinder (2)

vorspringen; dass in der zweiten Steuerstellung der von dem Steuerventil (11) kommende Druckflüssigkeitskanal (10b) über Rückschlagventile (6, 7) mit den Zylinderräumen (2a, 2b) des Zylinders (2) verbunden wird, so dass die Kolben (3a, 3b) in den Zylinder (2) zurückgezogen werden; und in der dritten Steuerstellung der von dem Steuerventil (12) kommende Druckflüssigkeitskanal (10c) über Rückschlagventile (8, 9) mit den Zylinderräumen (2a, 2b) des Zylinders (2) verbunden wird, so dass ein Kolben (3a; 3b) aus dem Zylinder (2) vorspringt, während der andere Kolben (3b; 3a) in den Zylinder (2) zurückgezogen wird.

3. Hydraulische Anordnung nach Anspruch 2, **dadurch gekennzeichnet, dass** die Zylinderräume (2a, 2b) des Zylinders (2) und dementsprechend die Kolben (3a, 3b) von unterschiedlicher Länge sind und dass das Ventil auch in eine vierte Steuerstellung gebracht werden kann, in der der Kolben (3a), der in der dritten Stellung vorgesprungen war, in den Zylinder (2) zurückgezogen wird und dementsprechend der andere Kolben (3b), der in der dritten Stellung zurückgezogen war, aus dem Zylinder (2) vorspringt.
4. Hydraulische Anordnung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Zylinder (2) angeordnet ist, den Verbolzungskopf der Gesteinsbohrmaschine derart zu drehen, dass die Bohrungsachse der Bohrmaschine (18), das Förderrohr für Lötmaterial (20, 21) und die Bolzenzuführvorrichtung (19) nacheinander um die Drehachse (17) gedreht werden können, so dass sie sich nach derselben Bohrungsachse ausrichten.
5. Hydraulische Anordnung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Ventile (11, 12) quer angeschlossene Ventile sind, die mit einem einzigen Hebel derart gesteuert werden, dass nur eine Steuerstellung von einer der Ventile jeweils eingeschaltet werden kann.

Revendications

1. Agencement hydraulique destiné à entraîner en rotation l'actionneur d'une machine de perçage de roche autour de son axe de rotation à au moins trois positions différentes, l'agencement comprenant un vérin hydraulique (2) comportant deux espaces formant cylindre (2a, 2b) et deux pistons (3a, 3b), le vérin étant agencé de manière à activer et faire tourner l'actionneur, et au moins une vanne de commande (12) avec laquelle un fluide hydraulique peut être délivré dans les espaces formant cylindre (2a,

2b) du vérin de telle sorte que les deux pistons (3a, 3b) peuvent être éjectés entièrement ou rétractés entièrement de manière simultanée, ou l'un d'eux peut être éjecté alors que l'autre est rétracté, dans lequel la vanne de commande (12) peut être placée dans au moins trois positions de commande, mais dans une seule à la fois; **caractérisé en ce que**, dans chaque position de commande, le fluide hydraulique est distribué de manière à affecter les deux espaces formant cylindre (2a, 2b) du vérin (2) de telle sorte que dans la position de commande concernée, les pistons (3a, 3b) se stabilisent toujours dans une certaine position prédéfinie.

2. Agencement hydraulique selon la revendication 1, **caractérisé en ce que** les canaux de fluide hydraulique des vannes sont raccordés aux espaces formant cylindre (2a, 2b) du vérin (2) par l'intermédiaire de clapets pilotés commandés en pression (6 à 8); **en ce que**, dans la première position de commande, le canal de fluide hydraulique (10a) provenant de la vanne de commande (11) est raccordé derrière les pistons (3a, 3b) des deux espaces formant cylindre (2a, 2b) des clapets pilotés (6, 7) de telle sorte que les deux pistons (3a, 3b) sont éjectés par rapport au vérin (2); **en ce que** dans la deuxième position de commande, le canal de fluide hydraulique (10b) provenant de la vanne de commande (11) est raccordé par l'intermédiaire des clapets pilotés (6, 7) aux espaces formant cylindre (2a, 2b) du vérin (2) de telle sorte que les pistons (3a, 3b) sont rétractés dans le vérin (2); et **en ce que** dans la troisième position de commande, le canal de fluide hydraulique (10c) provenant de la vanne de commande (12) est raccordé par l'intermédiaire des clapets pilotés (8, 9) aux espaces formant cylindre (2a, 2b) du vérin (2), de telle sorte qu'un piston (3a; 3b) est éjecté par rapport au vérin (2) alors que l'autre piston (3b; 3a) est rétracté dans le vérin (2).
3. Agencement hydraulique selon la revendication 2, **caractérisé en ce que** les espaces formant cylindre (2a, 2b) du vérin (2) et, de manière correspondante, les pistons (3a, 3b) sont de longueur différente, et **en ce que** la vanne peut aussi être placée dans une quatrième position de commande dans laquelle le piston (3a) qui a été éjecté dans la troisième position est rétracté dans le vérin (2) et, de manière correspondante, l'autre piston (3b) qui a été rétracté dans la troisième position est éjecté par rapport au vérin (2).
4. Agencement hydraulique selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le vérin (2) est agencé de manière à faire tourner la tête de vissage de la machine de perçage de roche de telle sorte que l'axe de perçage de la machine de perçage (18), le tube d'alimentation en ma-

tériau de soudage (20, 21) et le dispositif d'alimentation de vis (19) peuvent être tournés, successivement, autour de l'axe de rotation (17) de telle sorte qu'ils s'alignent avec le même axe de perçage.

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5. Agencement hydraulique selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les vannes (11, 12) sont des vannes raccordées en opposition, commandées par un seul levier d'une telle manière que seule une position de commande d'une des vannes peut être commutée à la fois.

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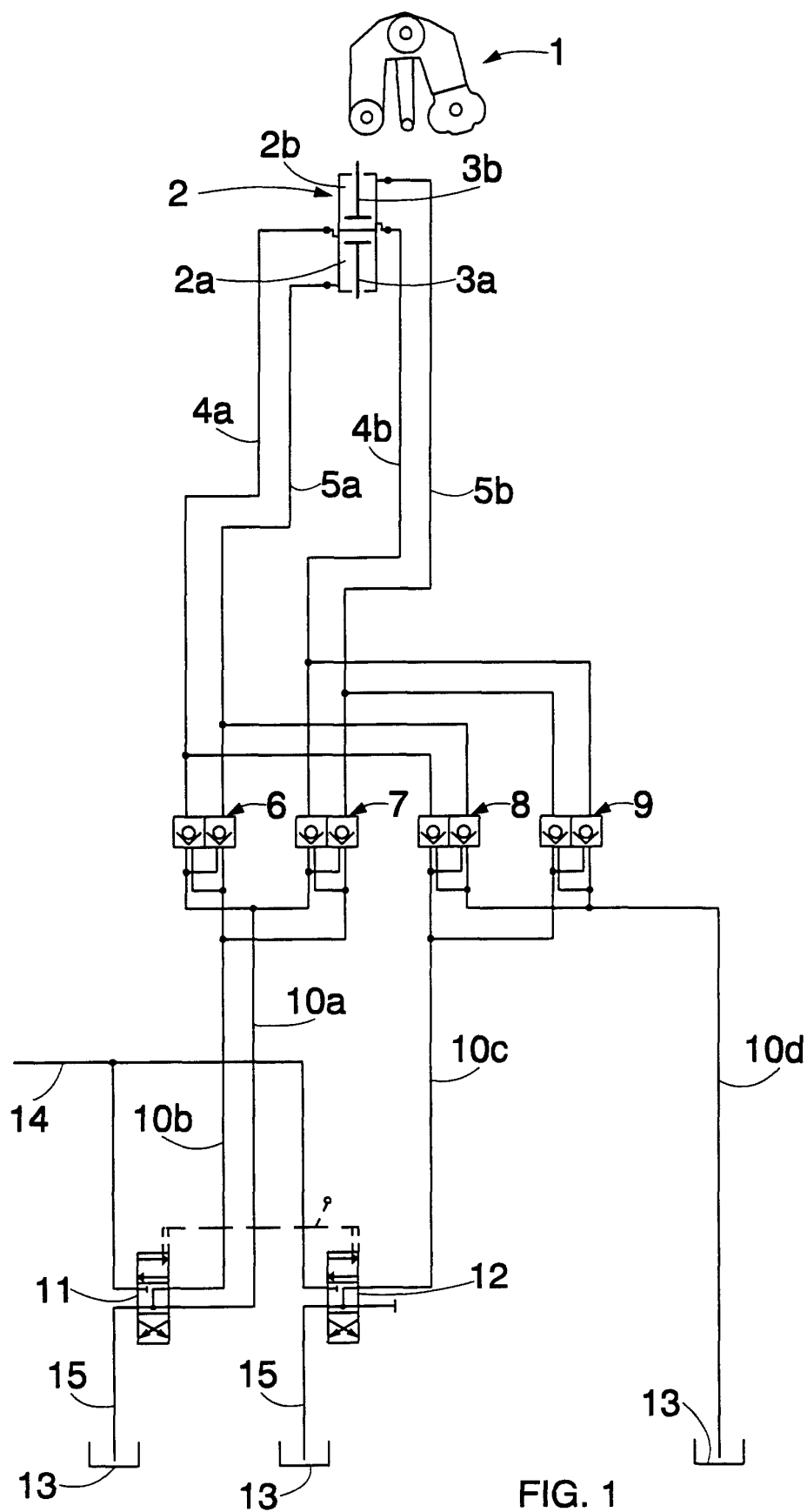
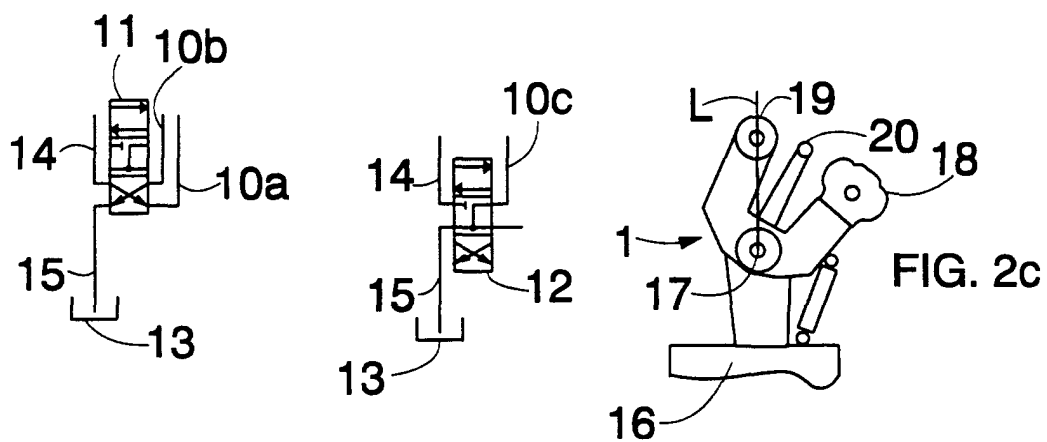
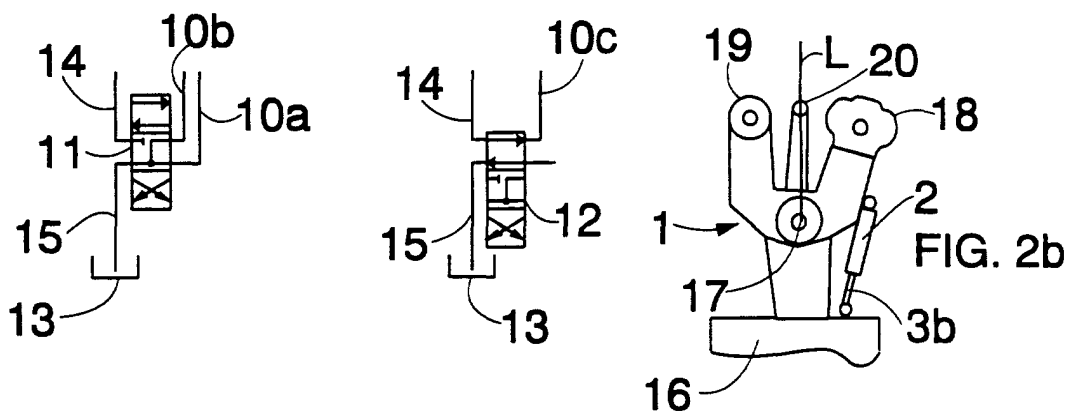
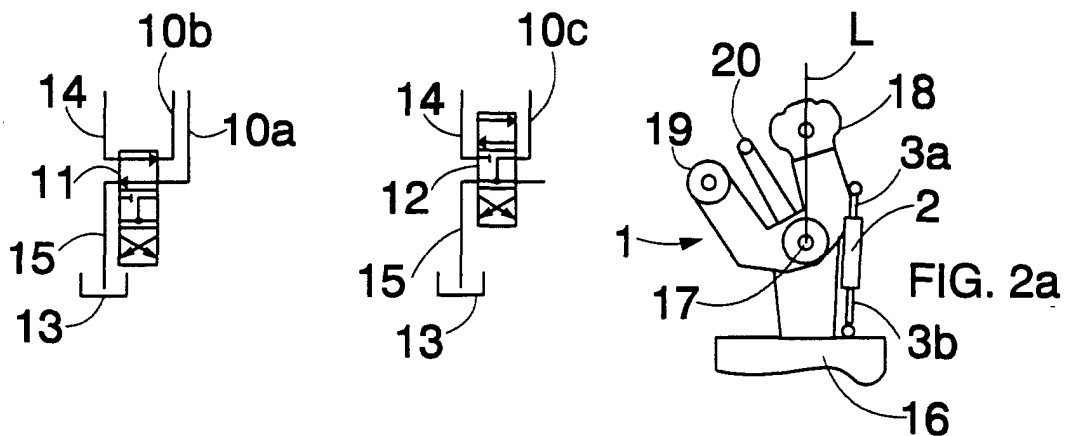


FIG. 1



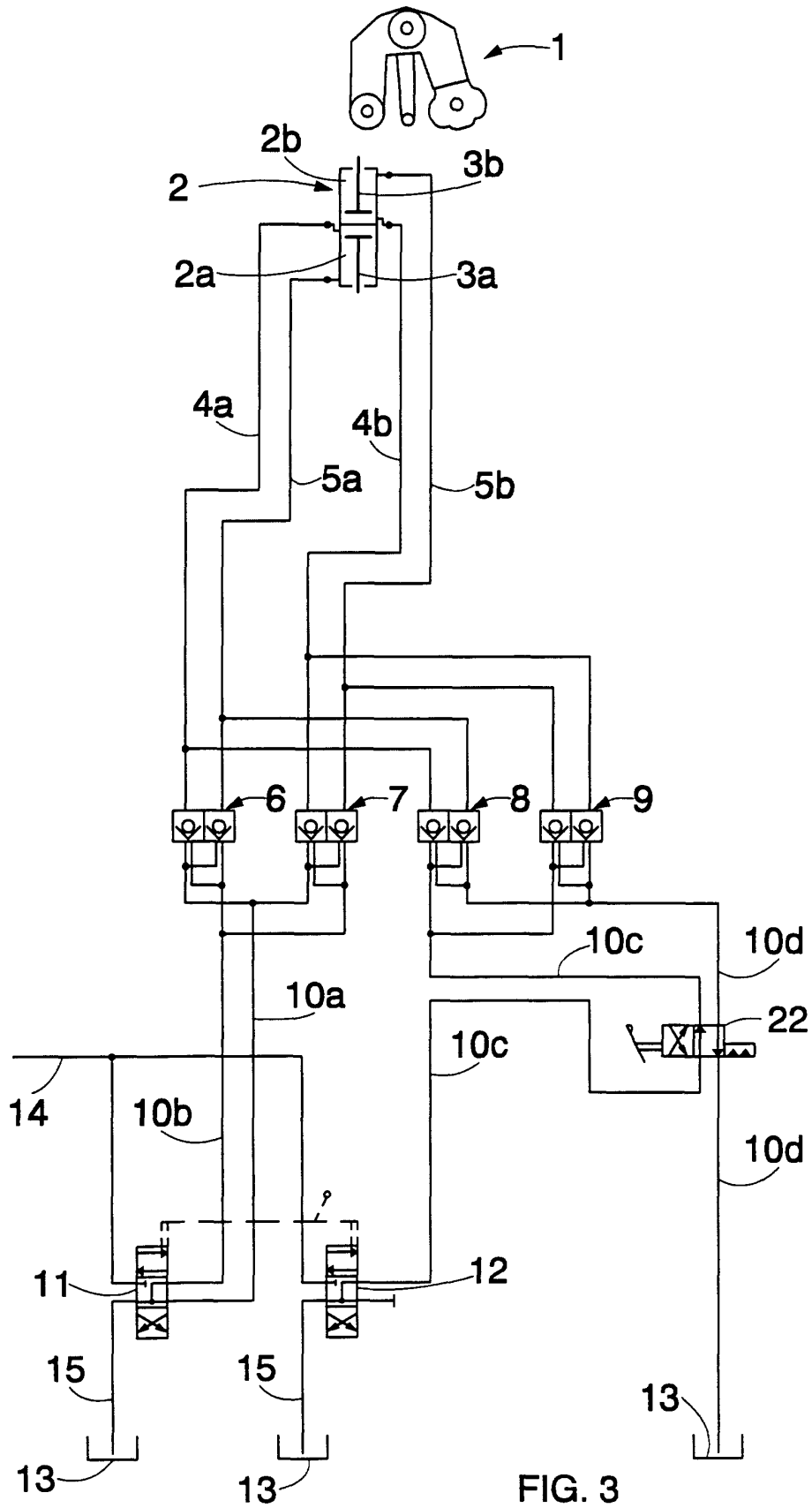


FIG. 3

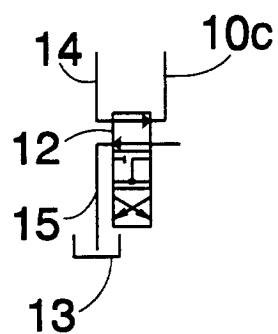
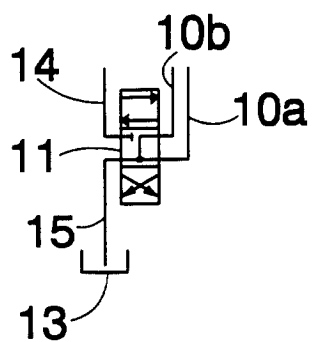


FIG. 4a

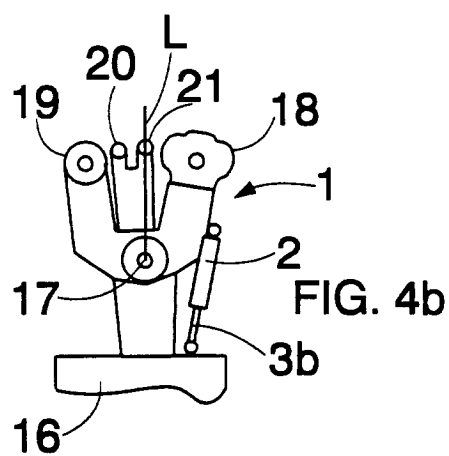
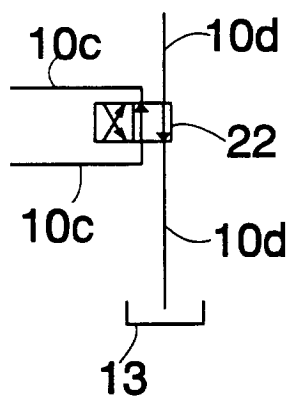


FIG. 4b

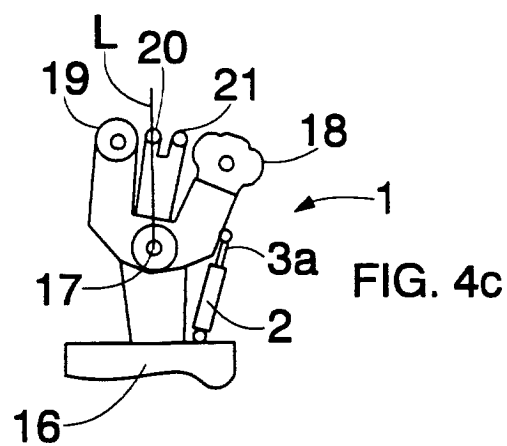
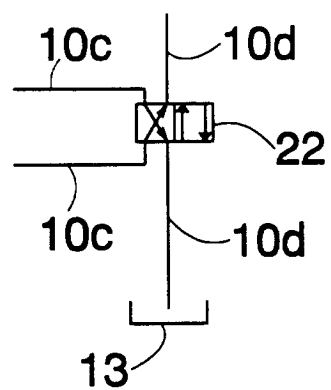


FIG. 4c