(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 389 289 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **90303112.8**

(51) Int. Cl.[5]: **E21B 19/20**

(22) Date of filing: **22.03.90**

(30) Priority: **23.03.89 FI 891419**

(43) Date of publication of application:
26.09.90 Bulletin 90/39

(84) Designated Contracting States:
AT CH DE FR GB IT LI SE

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(54) Apparatus for breaking a threaded connection.

(57) A coupling arrangement for breaking threaded joints of drill rods or the like (5), in which arrangement a drill rod or tube (5) is clamped by means of jaws fastened to hydraulic cylinders (8a, 8b; 108a, 108b) on both sides of a threaded joint to retain the tube (5) portion on one side unrotatable with respect to a carrier (2) of a drilling unit (1) and to rotate the tube (5) portion on the other side about its axis. To increase the clamping force, pressure raising cylinders (15; 115) are connected to the pressure channel (12; 112) of the pressure cylinders (8a, 8b; 108a, 108b), into which pressure raising cylinders is led pressure fluid under the normal pressure of the hydraulic net at the moment of breaking the thread, under the influence of which pressure fluid the hydraulic pressure of the pressure raising elements (15; 115) rises to be considerably higher than the normal pressure and thus intensifies the pressure effect created by the cylinders (8a, 8b; 108a, 108b).

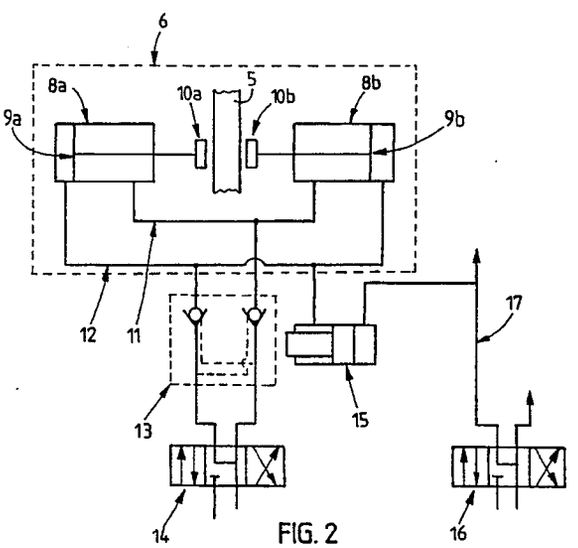

FIG. 2

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APPARATUS FOR BREAKING A THREADED CONNECTION

The invention relates to apparatus for breaking a threaded connection between drill rods, drill tubes or the like, the apparatus comprising a retaining device and a breaking device each device having means including at least one hydraulic fluid operated pressure cylinder to retain the drill rod or the like non-rotatable with respect to a feed beam and the rotating breaking device, respectively; and respective pressure fluid channels along which pressure fluid can be led into the pressure cylinders.

In retaining and breaking devices of drilling equipment, ie. drill tubes and drill rods, clamping jaws provided with hydraulic cylinders are generally used, by means of which jaws the drill tube or the like is clamped to prevent it from rotating with respect to the retaining devices or the rotating breaking device, respectively. In known solutions, these pressure cylinders are connected with the normal hydraulic pressure system of the drilling unit in such a way that they have the same pressure as the rest of the hydraulic net. Because very big forces are required for breaking threads stuck fast tightly, the tubes or the like slide easily with respect to the jaws in spite of full clamping pressure. Efforts have been made to avoid this by mounting lever mechanisms of various kinds on the pressure cylinders, which mechanisms function as converters and increase the force acting on the tube in comparison with the cylinder force. This leads, however, to the fact that the lengths of movement to the cylinders increase correspondingly, and thus, the need of space required by the cylinders increases. A further suggestion to solve the problem has been to increase the surface area of the pressure cylinders, which increases the space required by the cylinders and makes the retaining and breaking devices unnecessarily big and heavy, respectively. One more attempt to solve the problem and to avoid big pressure cylinders has been to raise the pressure of the whole hydraulic net high, in which case the retaining capacity has naturally been improved. However, a drawback of this solution is that the whole hydraulic pressure net must be dimensioned by using a high pressure component, which increases both the costs and the tendency to be damaged.

The object of this invention is to provide a solution, by means of which the above drawbacks are avoided, and nevertheless, a sufficient pressing force is achieved for breaking joints. This is achieved according to the invention in that the apparatus further comprises at least one pressure raising element with an inlet channel to be connected to a pressure fluid source and an outlet channel in which a pressure higher than that of the pressure fluid source is created when pressure fluid is fed to the element through its inlet channel, wherein the pressure fluid channel of each pressure cylinder can be connected to at least one of the output channels of the pressure raising element.

The substantial idea of the invention is that at least at the moment of breaking a joint the pressure level of the pressure cylinders is raised so much higher than the pressure level of the rest of the hydraulic net that a sufficient pressing force is created by means of small cylinders, in which case components resistant to high hydraulic pressure are only needed in that part of the hydraulic net being in immediate connection with the pressure cylinders and after the joint has been released a conventional hydraulic net pressure can be used for unscrewing the thread. The substantial idea of the invention starts from the fact that a high pressing force is needed at the very moment of breaking joints only, and then the force needed is great, but at the other stages it is not necessary. By means of the solution of the invention the advantage is achieved that it is possible to choose very small hydraulic cylinders to fit into the space being at disposal and to use high pressure components only in those parts required expressly during the breaking phase, and then the rest of the net system can be built entirely according to low hydraulic pressure, through which unnecessary costs are saved. Because the solution of the invention can be realized by using a plain pressure raising component, which shall act at the very breaking moment only, the solution is simply and easily realizable and thus advantageous in use.

An example of the invention is described more closely in the attached drawings, in which

Figure 1 shows schematically a drilling equipment, to which, for instance, the apparatus according to the invention can be applied,

Figure 2 shows schematically an embodiment of the apparatus : of the invention in principle and

Figure 3 shows schematically an arrangement applied to the whole breaking mechanism.

Figure 1 shows a drilling unit 1, on a carrier 2 of which is mounted a drill boom 3 with a boom por tion 3a and a feed beam 3b. Along the feed beam 3b, in its longitudinal direction, moves a drilling machine or the like 4, to which is fastened a drill tube, rod or the like 5 consisting of two or more pieces joined together by means of a thread. At the front end of the feed beam 3b there is a retaining device 6 provided with jaws on both sides

of the drill tube or the like 5, by means of which retainer the drill tube 5 can be clamped unrotatably with respect to the feed beam. Between the retaining device 6 and the drilling machine 4 is mounted a breaking device 7 provided with jaws mounted rotatably about the axis of the drill tube and to be clamped to the drill tube 5, whereby when breaking the joint of the drill tube both the jaws of the retaining device 6 and those of the breaking device 7 are clamped to the drill tube 5 on both sides of its joint and the jaws of the breaking device 7 are turned to the opening direction of the thread.

Figure 2 shows in principle an example of a coupling arrangement for carrying out the invention applied to one retaining device provided with clamping jaws. The retaining device 6, shown schematically in broken line, has on both sides of the drill rod 5 pressure cylinders 8a and 8b with pistons 9a and 9b, to which are connected clamping jaws 10a and 10b. The cylinders 8a and 8b are connected to each other by means of pressure fluid channels 11 and 12 in such way that the spaces on respective side of their pistons 9a and 9b are connected to each other, so that the pistons 9a and 9b tend to move in opposite directions with respect to each other when pressure medium is fed into one of the channels. The channels 11 and 12 are connected in a manner generally known per se through a sequence of non-return valves 13 to a regulating valve 14, by means of which the cylinders are normally used. To the channel 12 leading to a compression space behind the pistons of the cylinders 8a and 8b is further connected a pressure raising element 15, which in the case of the figure is a pressure raising cylinder. The pressure raising cylinder 15 again is connected to a channel 17 of a thread breaking valve 16, in which channel there is the normal pressure of the pressure source of the hydraulic net system when the thread is broken. The channel 17 is further connected to the breaking device 7 in a manner to be described more closely in Figure 3.

When clamping the jaws 10a and 10b to the drill rod 5 to retain it in place, pressure fluid is fed through the regulating valve 14 into the channel 12. Then the drill rod 5 is clamped between the jaws 10a and 10b with a force created by the normal hydraulic pressure, which is more than enough to retain the drill rod 5 in place when unscrewing the joint already broken or when screwing it up at the extension of the drill rod, respectively. When disengaging the drill rod 5, the force created by using small pressure cylinders 8a and 8b is, however, not sufficient for breaking a joint tightened during drilling, but the clamping pressure is raised by means of the pressure raising cylinder 15. This takes place in such a way that pressure fluid under normal pressure is led by means of the thread breaking valve 16 into the channel 17 and at the same time into the pressure raising cylinder 15, and then due to the different piston cross-sections of the pressure raising cylinder 15 a considerably higher pressure, inversely proportional to the surface areas of the piston, is created on the other side of the pressure raising cylinder, and thus in the channel 12, respectively, than the normal pressure of the hydraulic system. The result of this is that there is a high pressure in the cylinders 8a and 8b, which provides the jaws 10a and 10b with a high clamping force, respectively. After the thread has been broken, the final unscrewing can be carried out under normal pressure, if desired.

Figure 3 again gives a schematic example of the hydraulic coupling of the whole apparatus for breaking a thread, in which the breaking device 7 comprises parts corresponding to those of the retaining device 6, i.e. pressure cylinders 108a and 108b, pistons 109a and 109b, clamping jaws 110a and 110b, channels 111 and 112, sequence non-return valves 113 known per se, a regulating valve 114 and a pressure raising cylinder 115. The use and operation of these parts correspond to the operation of the retaining device of Figure 2. Further, the breaking pressure channel 17 is connected through a stopper element 18 and a sequence non-return valve 19 to a rotating device 20, which can be a rotating motor or a hydraulic cylinder according to Figure 3. A pressure fluid return channel 21 leads from the rotating device through the sequence non-return valve 19 further to the breaking valve 16 and from there forward in a known manner to a hydraulic fluid receiver not shown.

When breaking a thread the drill rod or the like 5 is lifted by moving the drilling machine 4 along the feed beam 3b to such a position that the jaws of the retaining device 6 and the breaking device 7 are on different sides of the threaded joint. After this, hydraulic pressure fluid is fed by means of the regulating valves 14 and 114 into the cylinders 8a, 8b and 108a, 108b, respectively, in such a way that the jaws connected to the pistons clamp to the drill rod 5 on both sides thereof. After this, hydraulic fluid is led by means of the breaking valve 16 into the channel 17, in which case due to the different piston cross-sections of the pressure raising cylinders 15 and 115 a considerably higher pressure is created in the channels 12 and 112, respectively, than is normally created in a hydraulic system. A result from this is that there is a high pressure in the cylinders 8a, 8b and 108a, 108b, respectively, providing the jaws with a high clamping force. While the jaws clamp the tubes on different sides of the joint with great force, pressure fluid is flowing from the channel 17 through the non-return valve 19 into the rotating cylinder 20, which makes

the breaking device turn about the axis of the drill rod 5 and release the joint while the other rod portion is retained in place. After the release of the joint, the breaking valve 16 can be placed in rest position and the jaws of the breaking device can be released from the upper rod 5 portion, which can be entirely unscrewed from the joint by means of the drilling machine 4.

By means of the solution of the invention the advantage is achieved that the cylinders 8a, 8b and 108a, 108b, respectively, can be rather small in size. Moreover, only the following components resistant to high pressure are needed for the whole structure: cylinders 8a, 8b and 108a, 108b together with the channels 12, 112 between the cylinders, non-return valves 13 and 113 as well as pressure raising elements 15 and 115. In the other parts of the coupling, there is a pressure normally existing in a hydraulic pressure net, and thus, the components can be cheaper and less resistant to pressure. Further, the solution is simple and easy to realize, because a high pressure can be created just by leading hydraulic fluid under normal pressure to the pressure raising elements 15 and 115, which can be located in the close vicinity of the pressure cylinders 8 and 108, and thus, pressure fluid under normal pressure can be led to the breaking device.

The description and figures above describe only one embodiment of the hydraulic arrangement of the invention and the invention is by no means restricted thereto. The quantity and design of pressure cylinders can be chosen freely as per needed, and correspondingly, the pressure raising elements can be pressure raising cylinders or other pressure raising components or devices suitable for the purpose. It is not absolutely necessary to connect the pressure raising elements to be controlled by the breaking valve, but they can be controlled also in other ways.

Claims

1. Apparatus (6,7) for breaking a threaded connection between drill rods, drill tubes or the like, the apparatus comprising a retaining device (6) and a breaking device (7) each device having means including at least one hydraulic fluid operated pressure cylinder (8a, 8b,108a, 108b) to retain the drill rod (5) or the like non-rotatable with respect to a feed beam (3b) and the rotating breaking device (7), respectively; and respective pressure fluid channels (12, 112) along which pressure fluid can be led into the pressure cylinders characterised in that the apparatus further comprises at least one pressure raising element (15, 115) with an inlet channel to be connected to a pressure fluid source and an outlet channel in which a pressure higher than that of the pressure fluid source is created when pressure fluid is fed to the element through its inlet channel, wherein the pressure fluid channel (12, 112) of each pressure cylinder (8a, 8b, 108a, 108b) can be connected to at least one of the output channels of the pressure raising element (15, 115).

2. Apparatus according to claim 1, wherein there is at least one pressure raising element (15) for the retaining device (6) and at least one pressure raising element (115) for the breaking device (7).

3. Apparatus according to claim 2, wherein the pressure raising elements (15, 115) are mounted on the retaining device (6) and the breaking device (7), respectively.

4. Apparatus according to any of claims 1 to 3, further comprising control valves (14, 114) for connecting the pressure fluid channels (12, 112) of the pressure cylinders (81, 8b, 108a, 108b) directly to the pressure fluid source, and wherein the pressure fluid channels (12, 112) are connected to the pressure raising elements (15, 115) between the control valves (14, 114) and the pressure cylinders (8a, 8b, 108a, 108b).

5. Apparatus according to claim 4, further comprising a sequence non-return valve (13, 113) mounted between each control valve (14, 114) and the pressure cylinders (8a, 8b, 108a, 108b) connected thereto, and wherein the pressure fluid channels (12, 112) are connected to the pressure raising elements (15, 115) between the non-return valves (13, 113) and the pressure cylinders (8a, 8b, 108a, 108b).

6. Apparatus according to any of the preceding claims, wherein the pressure raising elements (15, 115) are pressure raising cylinders.

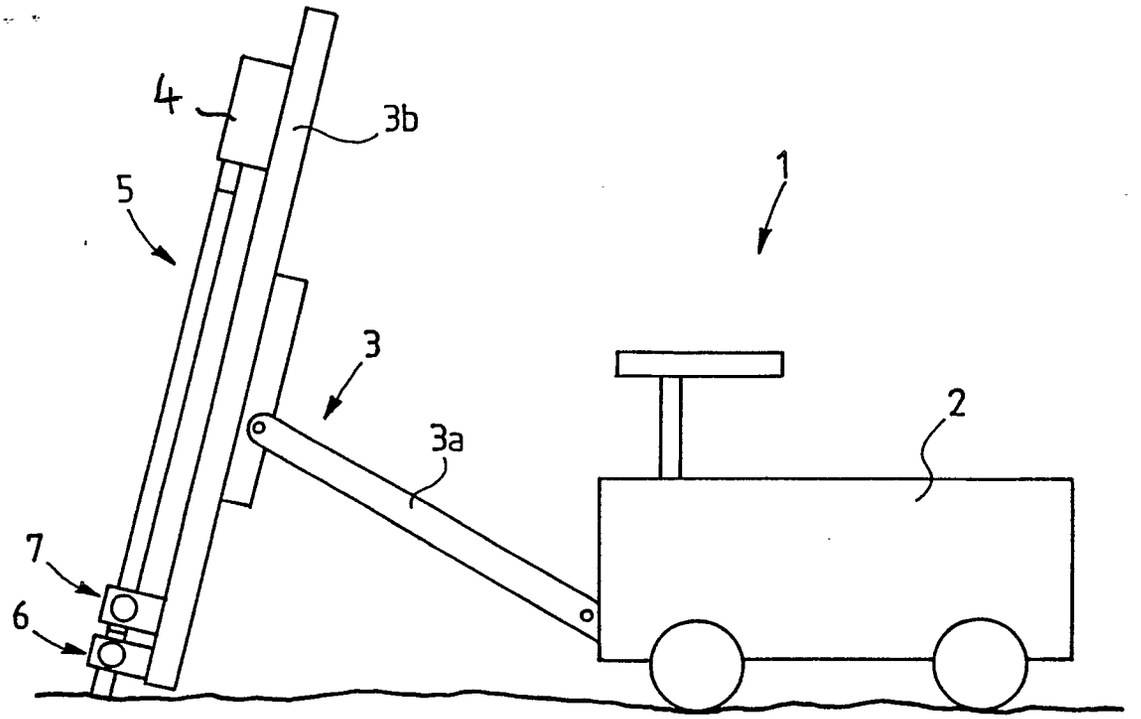

FIG. 1

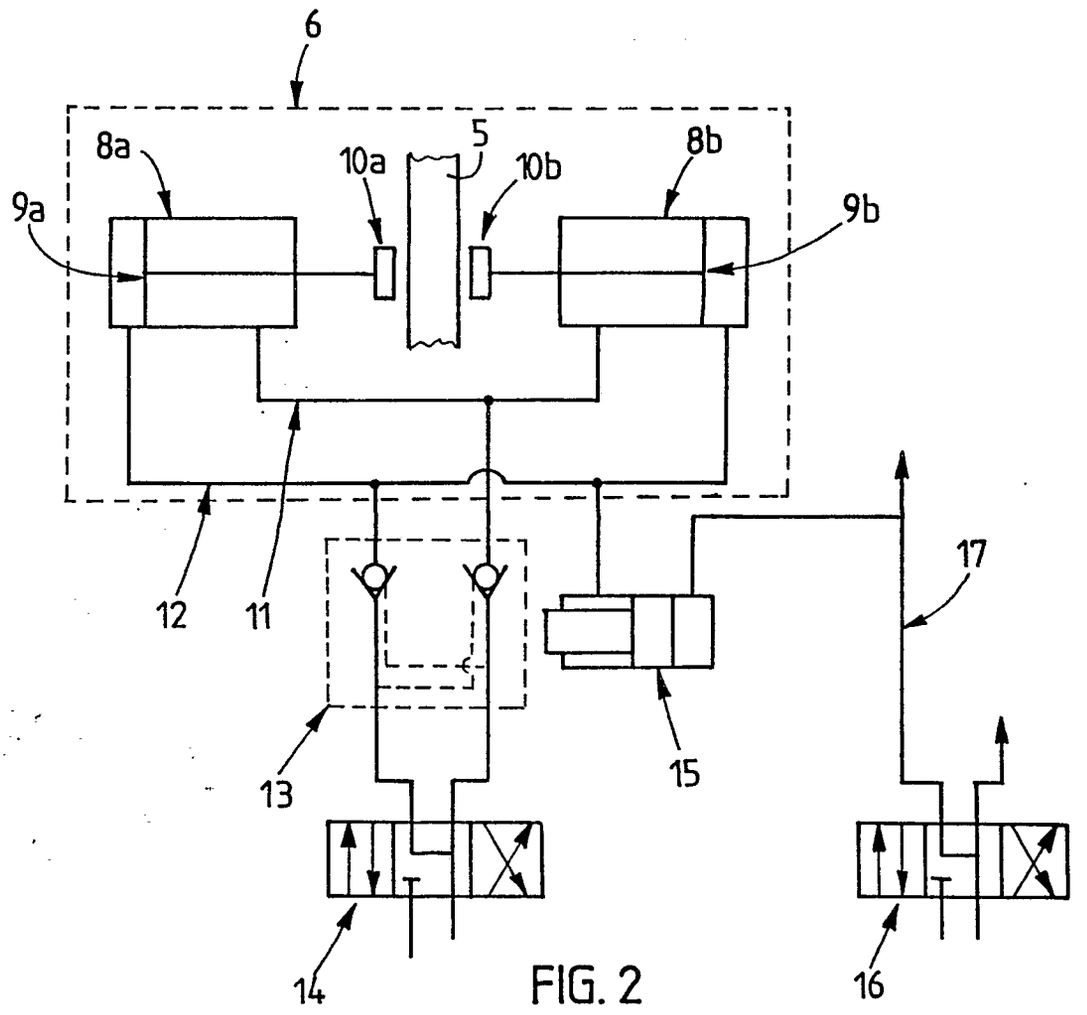

FIG. 2

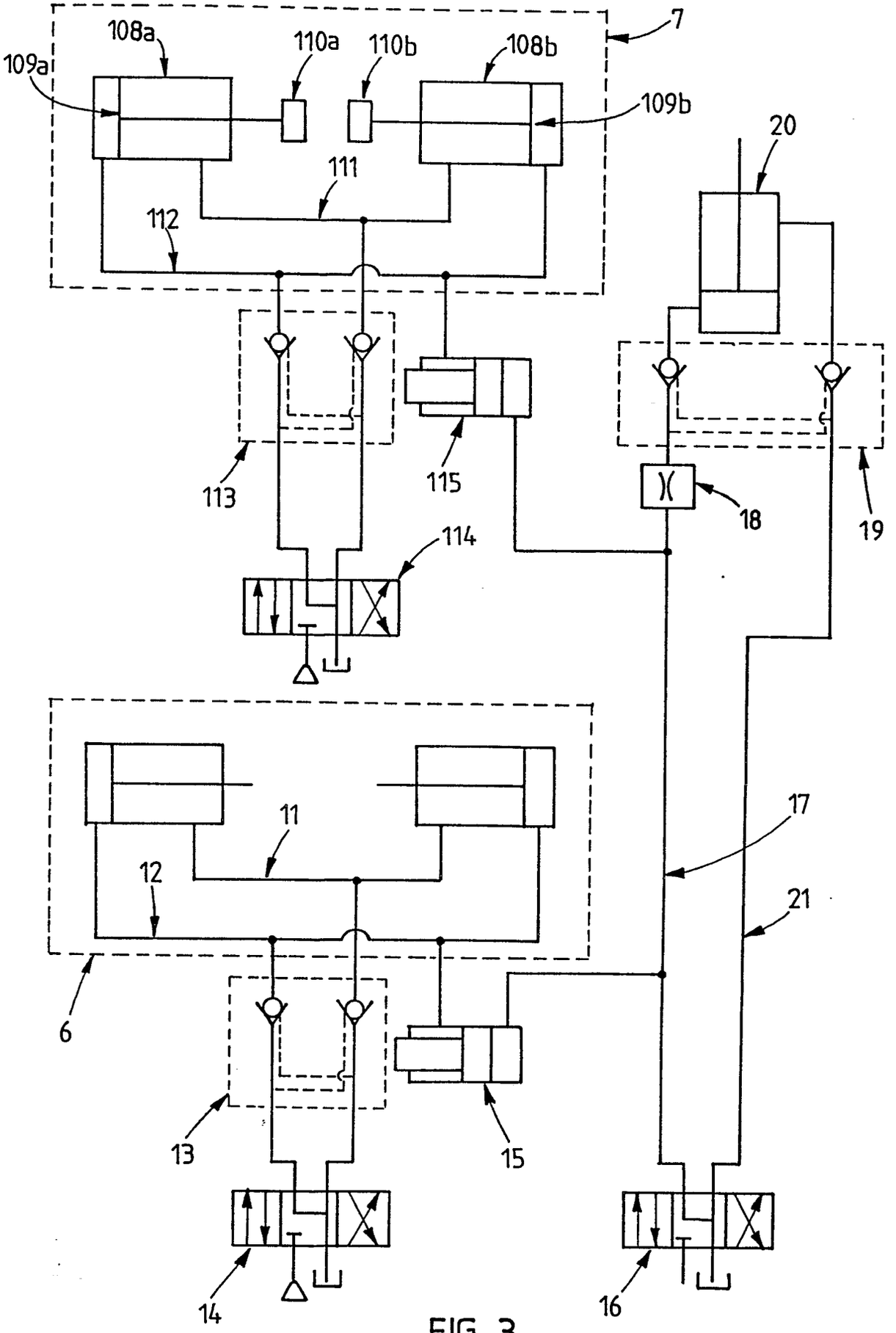
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FIG. 3

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EUROPEAN SEARCH REPORT

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT

EP 90303112.8

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US - A - 3 739 663 (WILMS) * Abstract; fig. 8; claims 1,2 *	1,2,4, 5	E 21 B 19/20
A	DE - A1 - 3 315 569 (BRISSONNEAU) * Abstract; claims 1,2 *	1,2	
A	EP - A1 - 0 130 450 (HÜTTE & CO) * Totality *	1,2	
A	EP - A2 - 0 142 477 (MARITIME HYDRAULICS A.S.) * Totality *	1	
			TECHNICAL FIELDS SEARCHED (Int Cl.5)
			E 21 B 17/00 E 21 B 19/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	28-06-1990	DRNOWITZ

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