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(54) A method for damping oscillations and a crane provided with an oscillation damper

(57) In a method and a device for providing operator-independent oscillation damping in a hydraulically operated crane having a loading tool attached to a swingable jib, the swinging of the jib is driven by means of a hydraulic swing device (6) for the adjustment thereof into different working positions. The loading tool is joined to a hydraulically actuated brake mechanism (16, 18), the regulation of which is operator-independently pressure sensed from the swing device (6) for the activation of the brake mechanism (16, 18) that counteracts undesired oscillations of the loading tool.

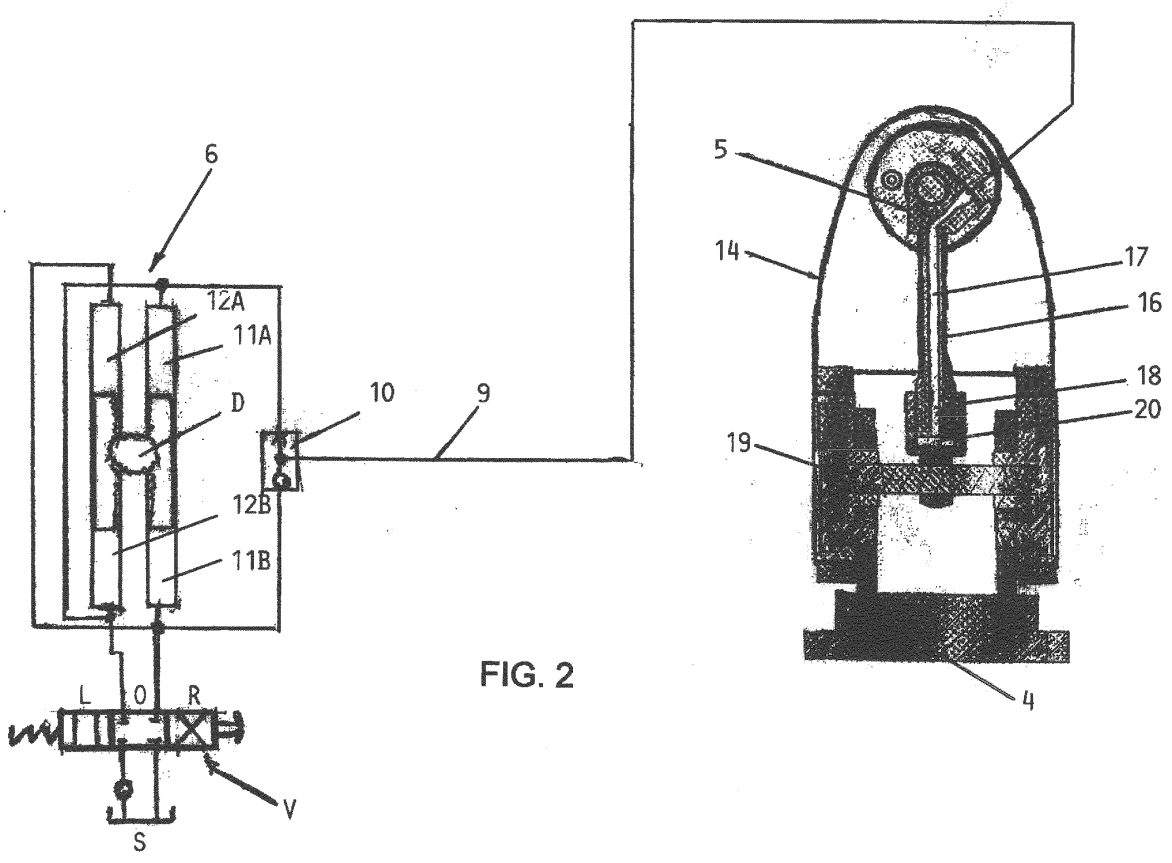

FIG. 2

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Description

[0001] The present invention relates to a method and a device for providing oscillation damping in a hydraulically operated crane. In particular, the invention relates to a crane having a loading tool attached to a swingable jib.

[0002] Such cranes are generally occurring, for example, in the forestry business for the loading of timber. It is in that connection, a generally familiar fact that it is difficult for the operator to bring the loading tool quickly and securely into an exact position for engagement with the cargo to be lifted.

[0003] This problem is obviated or at least brought down to a minimum by means of the present invention.

[0004] In the method according to the invention, the hydraulic regulation of the jib embraces an operator-independent pressure detection provided for a rotator link belonging to the working tool and intended for the counteraction of undesired oscillations of the loading tool.

[0005] The pressure detection is advantageously effected on a hydraulic swing device arranged for the swingable jib and produces pressure information that is fed into a break means that, in the rotator link between the loading tool and the outer end of the jib, damps the oscillatory motion of the loading tool.

[0006] Preferably, the oscillation damping is effected by the break means acting against at least one joint of the rotator link.

[0007] By a device according to the invention, a rotator link belonging to the loading tool has a hydraulically actuated brake mechanism, the regulation of which is operator-independently pressure sensed for the counteraction of undesired oscillations of the loading tool.

[0008] Preferably, the brake mechanism is formed with a hydraulically actuated brake, which, via a line, is coupled to a hydraulic swing device arranged for the swingable jib for the receipt of pressure information.

[0009] The rotator link is preferably double jointed and at least one of the joints thereof is formed with the hydraulically actuated brake mechanism.

[0010] The brake mechanism advantageously embraces a piston/cylinder device where the cylinder is coupled to one joint of the rotator link, the one joined to the loading tool. The piston rod projecting into the cylinder is coupled to the other joint of the rotator link, the one joined to the jib of the crane.

[0011] The pressure detection is preferably effected on a hydraulic swing device - arranged for the turning of the swingable jib - for the receipt of pressure information from the same.

[0012] This pressure information from the hydraulic swing device arranged for the swinging of the jib is conveyed to the chamber in the cylinder of the break means via an axially extending channel in the piston rod projecting into the cylinder.

[0013] The pressure information is extracted from the hydraulic swing device, drive motor, of the jib in the hydraulic chamber of which pressure variations are produced upon the swinging of the jib. A pressure detecting system is coupled to the hydraulic chamber of the drive motor for the transfer of the pressure information to the piston/cylinder device of the break means in the rotator link of the loading tool.

[0014] Advantageously, the pressure-sensing system embraces a reverse valve connected to the hydraulic chamber of the drive motor in order to, via a pressure-indicating line, forward the occurring pressure present during the swinging of the jib to the cylinder in the break means of the loading tool. The reverse valve allows braking upon both acceleration and retardation of the swing motion of the jib.

[0015] The invention furthermore relates to a crane that comprises a device for damping oscillations in accordance with what has been mentioned above.

[0016] The invention will be explained more in detail below in connection with an embodiment that shown in the appended drawings and depicted in connection with a known crane for forestry use, wherein

Fig. 1 shows a view from the side of the crane and
Fig. 2 shows the principle for the oscillation damping according to the invention.

[0017] The oscillation damping according to the present invention, which is operator-independent, automatic and self-locking, will be exemplified in an application of a crane 1 known *per se*, as shown in Fig. 1. This crane 1 has a jib 2 that comprises different, hydraulically driven regulating parts irrelevant to the present invention. The jib 2 is fixedly anchored on a support, for example on a lorry/truck chassis (not shown), by means of a hydraulically driven swing device 6. At the free end 5 of the jib 2, there is suspended a loading tool in the form of a grip 3. The jib 2 is swingable in the horizontal plane around the vertical axis 7 of the swing device 6. This swinging is operated by means of the hydraulically driven swing device 6.

[0018] In the operation of the jib 2, the swing device 6 is thus brought to swing the same for adjustment into a position where the cargo to be lifted is placed. A certain technique is required of the operator conducting the crane in order to get the grip 3 into the correct position. Even if it is known to form the rotator 4 with a brake mechanism having oscillation dampers, the grip 3 will still obtain an undesired oscillation.

[0019] In order to obviate or at least quickly bring down this undesired oscillation to a minimum, the present invention embraces an operator-independent pressure detection in the hydraulically driven swing device 6. In that connection, a pressure indication or pressure information is obtained that is fed to an oscillation damping rotator link 14 belonging to the rotator 4.

[0020] The principle for the invention will be described in more detail in the following, reference being made to Fig. 2. This figure illustrates the invention in connection

with a swing device 6 known *per se* and a rotator link 14 known *per se*. Therefore, it should be entirely clear to the reader that the invention is applicable also in other embodiments of swing devices and oscillation dampers for cranes.

[0021] Thus, the crane is equipped with a hydraulic swing device 6 that can swing the crane jib both clockwise and counter clockwise. The hydraulics of the swing device 6 may be made as any hydraulic drive motor having hydraulic pressure chambers, but in the embodiment described herein, it embraces four actuator cylinders 11A, 11 B, 12A, 12B, the pistons of which drive a gearwheel D for the swinging of the jib to the right or the left depending on the position of an operator-actuated actuator valve V. The actuator valve V has three positions: L, 0 and R for the connection of the swing device 6 to a hydraulic source S. In the intermediate position 0, the swing device 6 is locked while the positions L and R feed the cylinders 11A, 11 B, 12A, 12B of the swing device 6 from the hydraulic source S for the swinging of the jib to the left and to the right, respectively.

[0022] The rotator link 14 known *per se* embraces a brake mechanism 16, 18. Furthermore, in this embodiment, the rotator link 14 is double jointed 5, 19, where at least one of the joints is actuatable by a brake function. In the embodiment shown here, the brake mechanism 16, 18 of the rotator link 14 embraces a piston/cylinder device interconnected between the two joints 5, 19. The piston rod 16 is then joined to the joint 5 directed perpendicular to the plane of the drawing while the cylinder 18 is coupled to the joint 19 extending in the plane of the drawing.

[0023] For the provision of the operator-independent function counteracting undesired oscillations, the piston rod 16 according to the invention is provided with a channel 17, which mouths in a chamber 20 formed by the cylinder 18. The channel 17 is connected to a reverse valve 10 via the line 9. By the two entrances thereof, the reverse valve 10 is joined to the swing device 6 for the output of the pressure that prevails in the hydraulics thereof in the swinging of the jib of the crane. The reverse valve 10 supplies said hydraulic pressure to the rotator link 14 and the piston/cylinder device 16, 18 arranged therein. The reverse valve 10 allows braking upon both acceleration and retardation of the swing motion of the jib.

[0024] When swinging of the jib of the crane is desired, the actuator valve V, which is spring-loaded so as to normally assume the middle position 0, is brought into one of the outer positions, for example into L, for the swinging of the jib to the left. In that connection, the cylinder 11 B is pressurized from the hydraulic source S, while the cylinder 12B is pressure-relieved. On the cylinder 11 B as well as on the cylinder 12A, a pressure is then obtained (a pressure change, pressure increase, pressure pulse) that, via the reverse valve 10 and the line 9, is supplied to the piston/cylinder device 16, 18 of the rotator link 14. By the pressure change arisen thereby in the chamber 20 of the cylinder 18, in the embodiment shown herein, the piston/cylinder device 16, 18 is pressed apart against the respective joint 5 and 19, so that brake action is provided on these joints and thereby the desired oscillation damping. The same conditions occur when operating the swing device 6 in the right direction.

[0025] By the fact that the pressure detection is carried out automatically in the swing device 6 and is forwarded to the rotator link 14 via the reverse valve 10, there is obtained an operator-independent damping oscillation function for the jib of the crane and the working tools thereof.

[0026] Even if the invention and the function thereof here has been exemplified in connection with a known embodiment of the swing device 6 and a known embodiment of the rotator link 14, a person skilled in the art appreciates that the invention also is applicable in other embodiments. Accordingly, the swing device may equally well be hydraulic components of another embodiment where pressure detection may take place, and the rotator link may be designed differently with pressure action by, for example, drum brakes or disc brakes.

[0027] Therefore, the present invention must not be considered limited to the above-mentioned designs, but its principle, as defined in the subsequent claims, is applicable in different embodiments.

Claims

1. Method for damping oscillations in a hydraulically operated crane (1) having a loading tool (3) attached to a swingable jib (2), where the jib (2), by means of hydraulic regulation and a hydraulic motor, is swung into different working positions, and where the loading tool (3) is fastened to a rotator link (14) attached to the outer end of the jib (2), which rotator link (14) is provided with a brake mechanism (16, 18), **characterized in that** the hydraulic regulation embraces an operator-independent pressure detection upon the swinging of the jib (2) for the counteraction of undesired oscillations of the loading tool (3), by the hydraulic motor being hydraulically coupled to the brake mechanism (16, 18) via a reverse valve (10).

2. Method according to claim 1, **characterized in that** the pressure detection is effected on a hydraulic swing device (6) arranged for the swingable jib (2) and produces pressure information that is fed to a brake mechanism (16, 18) that, in the rotator link (14) between the loading tool (3) and the outer end (5) of the jib (2), damps the oscillatory motion of the loading tool (3).

3. Method according to claim 2, **characterized in that** the oscillation damping is effected by the brake mechanism (16, 18) acting against at least one joint (5, 19) of the rotator link (14).

4. Device for damping oscillations in a hydraulically operated crane (1) embracing a rotator link (14) attached to a swingable jib (2) and arranged for attaching a loading tool (3), which rotator link (14) is provided with a brake mechanism (16, 18), and where the swinging of the jib (2) is driven by means of a hydraulic swing device (6) comprising a hydraulic motor for the adjustment thereof into different working positions, **characterized in that** the brake mechanism is hydraulically actuated (16, 18), and that the regulation thereof is operator-independently pressure sensed for the counteraction of undesired oscillations of the loading tool (3), by the hydraulic motor being hydraulically coupled to the brake mechanism (16, 18) via a reverse valve (10).

5. Device according to claim 4, **characterized in that** the rotator link (14) is double jointed, where at least one of the joints (5, 19) is equipped with the hydraulically actuated brake mechanism (16, 18).

6. Device according to any one of claims 4-5, **characterized in that** the brake mechanism (16, 18) embraces a piston/cylinder device where the cylinder (18) is coupled to one joint (19) of the rotator link (14), the one joined to the loading tool (3), and the piston rod (16) projecting into the cylinder (18) is coupled to the other joint (5) of the rotator link (14), the one joined to the jib (2) of the crane.

7. Device according to claim 6, **characterized in that** the chamber (20) of the cylinder (18) is in hydraulic pressure communication with the hydraulic swing device (6) arranged for the swinging of the swingable jib (2) for the receipt of pressure information from the same.

8. Device according to claim 6, **characterized in that** the piston rod (16) projecting into the cylinder (18) has an axially extending channel (17), which mouths in the chamber (20) of the cylinder (18) and the free end of which is coupled to the hydraulic swing device (6) of the swingable jib (2) for the receipt of pressure information from the same.

9. Device according to any one of claims 4-8, **characterized in that** the hydraulic swing device (6) for the swingable jib (2) is a hydraulic drive motor, from the chambers (11A, 11B, 12A, 12B) of which a pressure-sensing system (9, 10) is arranged to feed the pressure information to the piston/cylinder device of the brake mechanism (16, 18).

10. Device according to claim 9, **characterized in that** the pressure-sensing system (9, 10) embraces a reverse valve (10) arranged to connect the side of the chambers (11A, 11B, 12A, 12B) of the drive motor that has the pressure occurring during the swinging of the jib (2) to a pressure-indicating line (9) connected to the chamber (20) of the cylinder (18) in the brake mechanism (16, 18) of the rotator link (14).

11. Crane comprising a device for damping oscillations according to any one of claims 4-10.

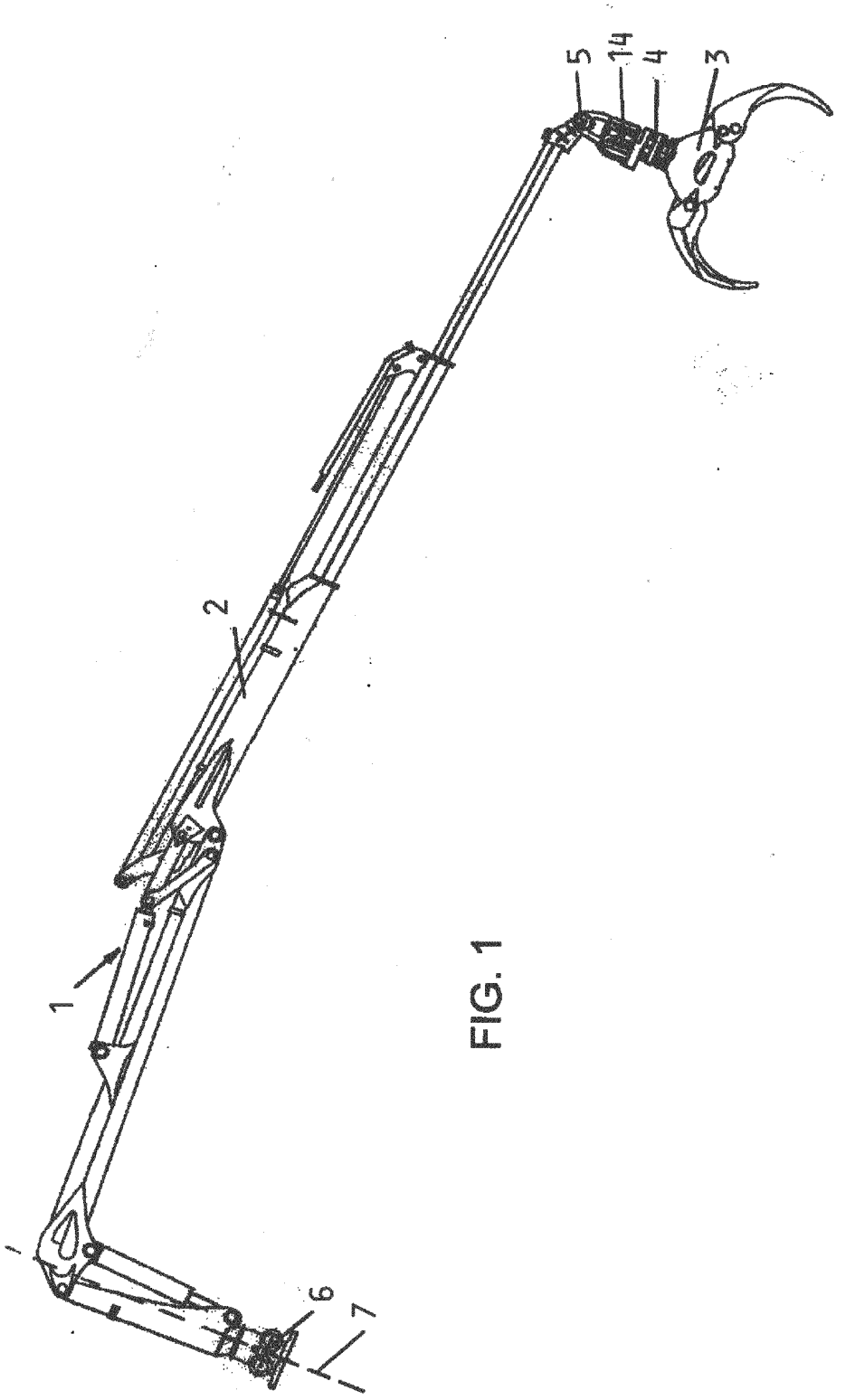

FIG. 1

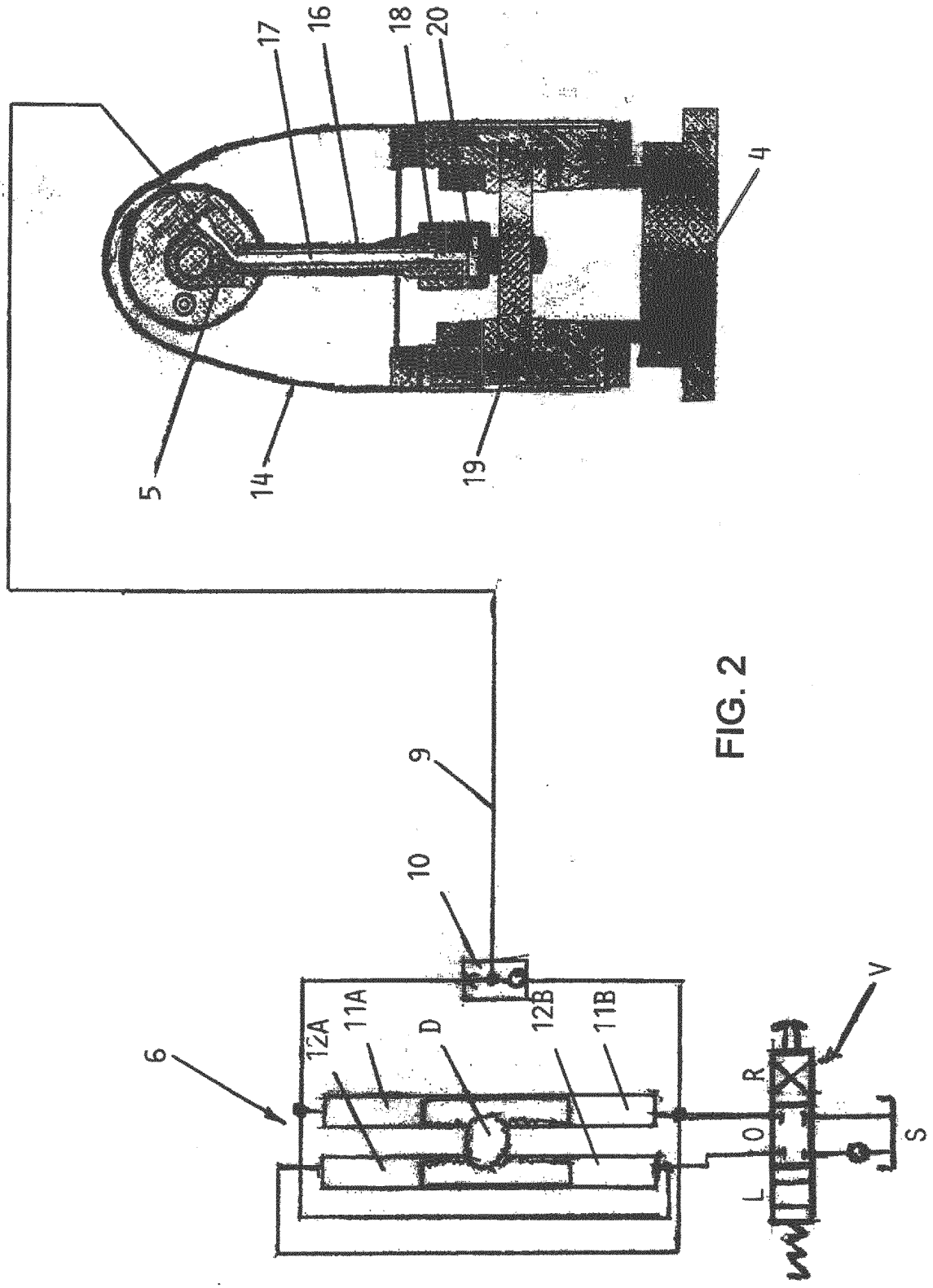

FIG. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 11 18 7807

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B66C
E02F
B60P

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	7 February 2012	Guthmuller, Jacques

CATEGORY OF CITED DOCUMENTS

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