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(54) DRIVING AND CONTROL UNIT OF A FIREWOOD SPLITTING MACHINE AND METHOD OF CONTROLLING SUCH MACHINE

ANSTEUERUNG UND STEUEREINHEIT EINER BRENNHOLZSPALTMASCHINE UND VERFAHREN ZUR STEUERUNG EINER DERARTIGEN MASCHINE

UNITE D'ENTRAINEMENT ET DE COMMANDE D'UNE FENDEUSE DE BOIS A BRULER ET PROCEDE DE COMMANDE DE LADITE MACHINE

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Description

[0001] In the field of forestry the invention relates to splitting machines, which are intended for longitudinally splitting of logs, which are prior to that cut into appropriate length sections. At the same time the invention concerns machinery, especially hydraulics, and in particular hydraulic appliances, by which the velocity is controlled during operation.

[0002] The purpose of the invention is to create an exclusively by means of hydraulic components end especially without any electric and/or electronic components operating driving and controlling unit of a firewoof splitting machines, in which a splitting or pushing tool is attached to the rod of a cylinder, which is then brought in abutment to each log when said rod is longitudinally moved towards said log, and wherein through a further movement of said rod in the same direction said log is then split, by which such unit would have to be controlled in such a manner, that driving and controlling would be adapted to varying of loading conditions during said splitting, which result from varying of toughness and splitting resistance of the firewod during said splitting, so that the splitting speed should be as hign as possible when the resistance is low, while by increasing of resistance the velocity of the rod would have to be reduced and simultaneously the pushing force would also have to be increased as much as possible.

[0003] Various splitting machines are known in the patent literature, where several of them which are quite mechanically operated, while the other ones are hydraulic or also combined and during the last time even electronically controlled. However, the invention is concentrated exclusively to hydraulic machines, which may be together with corresponding forestry machine or tractor used anywhere, in any desierd location i.e. either in the forest or in the field or also in the downtown.

[0004] An apparatus is described in CH 605 068, which comprises a plate and a wedge, which may both be attached to a classic three-point hydraulic mechanismus on the tractor in order to produce a sufficient force, which is required by splitting of logs. Such apparatus is operating cvery slowly, and also adequate positioning of logs inteneded to be split is also very time-consuming.

[0005] Furthermore, CA 1,084,814 describes a hydraulic splitting machine, a kind of guillotine, which is arranged on appropriate chassis. The cutting blade is available on a horizontal transversal beam, which is then along adequate guides movable in the vertical direction within a frame, in the adjacency of which a hydraulic cylinder is available, so that said transversal blade is moved together with said cutting blade in the vertical direction by memeans of said rod of the cylinder as well as appropriate lever arrenged therebetween. Althoug said document is silent with respect to controlling of such machine, such solution is very old and very simple, where e.g. also the logs need to be manually positioned prior to splitting and removed after being split, and wherein also the operating mode as such and economical aspects of cutting are not taken into account at all.

[0006] Still further, DE 19507197 A1 presents an attempt toowards to avoiding of manually positioning of logs. A device has been proposed, which includes a clamping unit, which is adepted to be attached to an existing hydraulic mechanismus of an excavating machine, so than manually forwarding of logs may be avoided, and in addition to that the excavator manupullating person is protected agaist denger. Also in this case operation of said device is extremely slow and inefficient from the economic point of view, where the jufgement is made, that the device is old-fashion despite to its reliable operation.

[0007] The relevant prior art in the field of actually used modem machines includes e.g. a splitting machine, which comprise a horizontal chute, into which the log is inserted, where in the one end of said chute an axially directed single or miltiple cutting blade is available, while in the opposite end portion a pushing means is foreseen, which is driven by means of the rod of a hydraulic cylinder, by which the log towards is then pressed towards said cutting blade. An alternative approach is also possible, where the cutting blade is attached on the rod and is then pushed towards the log, which is supported in the longitudinal direction by appropriate resting wall arranged in the opposite end portion of the chute. Such devices regulary operate by performing a cyclic oscilatory movement to and fro and are pretty unefficient when berating in mind the presence of both active and reverse strokes, which are succesively performed and where each stroke includes a certain time period, which is required for placing the log into said chute, a time period of moving the pushing means towards the log, then a time period of effective splitting, and upon that also a prettx long time period, in which the reverse stroke of the pushing means into its origine position takes place. Certain but actually not essential improvement of the efficiency may be achieved e.g. in such a manner, that the speed of the rod in during the reverse stroke is greater than the speed during the active opertating stroke.

[0008] In order to improve efficiency within the above described context FI 2097 U1 proposes a machine, where a tandem of two cylinders is used, where appropriate rods are mutually interconnected via appropriate pivoting rod, and are then alternatively and oscilatory moved to and fro in opposite directions. Accordingly, a tandem of two alternatively operating pushing means is used, where prior to starting a stroke of each cylinder one of both chuts is ready for receipt of a log intended for splitting. Consequently, at least two hydraulic cylinders must be present in such device, which requires essentially more complex hydraulic system and also correspondingly larger dimensions of mechanic construction as such. This means, that such machines are then pretty bulky, essentially more expensive and less confortable in respect of transporting from one to another working place.

[0009] As an alternative to the above specified ap-

proach the splitting machine according to EP 1 213 486 A2 still includes a single hydraulic cylinder, where the desired efficiency should be achieved by means of changong the operation mode like speed of the rod, when possible. Said rod is namely moved due to supplying the hydraulic media into said cylinder either in the side of the piston, where said rod and a spring are available, or alternatively in the opposite side of the piston. The rod may be moved in its opposite directions with two different speed values, where the speed during the active oparaton stroke is pretty low, while the speed during its reverse stroke is essentially increased. When the cutting blade, which is connected to the rod, starts pressing towards the log, the speed of the rod remains unchanged, until the splitting resistance is below the critical value, while by increasing of said resistance above said value the pressure of the hydraulic emdia is increased, which results in appropriate change within the hydraulic circuit, and consequently to reduction of the speed of the rod. Regardless to said decreasing of velocity the pushing force of the rod remains unchanged, since the device is operating under a pre-set value of pressure. Whenever such device is used for splitting of bulky or extremely tough logs, either the value of the pre-set operating pressure must be extremely high or the diameter of the cylinder must be quite large, which is then in contradiction with the economic benefits, which should result from such approach when compared with previously discussed tandem of cylinders.

[0010] A further example is given in FR 1439211. The present invention refers to a driving and forwarding unit of a firewood splitting machine, which comprises a hydraulic cylinder and a rod, which is connected with the pushing means or appropriate blade, which is then by means of said rod pushed towards the log, which is to be splitted. Said cylinder is by means of appropriate hydraulic connections integrated into a corresponding hydraulic circuit, which contains a hydraulic media under a desired pressure, which is supplied from a reservoir by means of a pump. According to the invention said unit comprises a hydraulic cylinder, which consists of an external tube having a larger diameter and an internal tube having a smaller diameter and moreover of a head, which forms a supplemental chamber in the axial direction of the cylinder on the side of the active stroke of the rod. Furthermore, said cylinder is equipped with three hydraulic connections, while said internal tube is equipped with a nonreturn valve, which allows the hydraulic media to flow into the tube and not outwards from it into the intermediate space between the tubes of the cylinder and the hollow rod, which is arranged within said intermediate space between said tubes surrounding thereby the internal tube and is oscillatory moved to and fro along said internal tube of the cylinder and also throughout the head of the cylinder. Said rod comprises an outlet, which in the original position of the rod coincides with the nonreturn valve on the internal wall, and further comprises a sealing portion, which has a larger diameter and is arranged between the external tube and the internal tube of the cylinder, as well as a guiding portion of a smaller diameter, which surrounds at a desired distance said internal tube of the cylinder and is moved throughout said head of the cylinder, and also a front portion, which protrudes outside of the cylinder in the direction of the active stroke of the rod. Said hydraulic connections of the cylinder are arranged in such a manner, that the first connection is available on the external tube on the end portion of the cylinder in the direction of the reverse stroke of the rod and at appropriate distance apart from the sealing portion of the rod, while the second connection is placed on the external tube on the opposite end portion of the cylinder and apart from the head, and the third connection is available in the area of said head adjacent to said second connection. Said cylinder is connected by means of these connections together with the rod into appropriate hydraulic circuit, which moreover includes a reservoir, which is intended for storing of the hydraulic media, a pump, which is intended for establishing of a desired pressure, and moreover also a differential valve, which is hydraulically connected with the first connection and the reservoir and is shifted from one to another position when a pre-defined value of the pressure is achieved, said circuit further comprising a control valve, which is shifted either by means of a lever or a similar manually controlled mechanical means or also by means of the pressure of the hydraulic media in the area of the third connection and is thereby hydraulically interconnected with the interior of the internal tube of the cylinder and/or with the pump and either directly via said pump and also with the reservoir and/or indirectly via the security valve and the pressure-regulating valve with the reservoir and/or with reservoir and the second hydraulic connection. Said hydraulic circuit also includes a security valve, which is connected parallel between the hydraulic conduit, by which the control valve is connected via the pump with the reservoir, and the hydraulic circuit, in which the third connection on the head of the cylinder is connected with the reservoir via the pressure-regulating valve.

[0011] Furthermore, the unit according to the invention in **characterized in that** the cylinder with the belonging rod is included within a hydraulic circuit, which is concieved in such a manner, that by unloaded cylinder prior to starting of the active stroke of the rod in the origin position thereof, the hydraulic media is enabled to flow from the pump throughout the control valve into said cylinder and along the interior of the internal tube towards the second connection and outwards through the control valve back to the reservoir, and that the pressure within said internal tube, within the hollow rod and also within the intermediate space between the rod and the external tube corresponds to the minimum pressure. Still further, the unit according to the invention in **characterized in that** the cylinder with the belonging rod is included within a hydraulic circuit, which is concieved in such a manner, that the control valve is shifted in its alternative position

by means of displacement of the belonging lever, upon which the hydraulic media is enabled to enter the interior of the internal tube of the cylinder, by which the rod is enabled to perform a high-speed active stroke, while the pressure equilibration in the area behind said rod is enabled through the differential valve and the reservoir, while the security valve is inactive and the pump may operate under the working pressure, which occurs within the interior of the internal tube of the rod, while the pressure in other sections still corresponds to the minimum pressure. Still further, the unit according to the invention in **characterized in that** the cylinder with the belonging rod is included within a hydraulic circuit, which is concieved in such a manner, that by operation under a regular splitting resistance and regular working pressure below the pre-set value, the rod is enabled to move with unchanged speed and to reach the end position of the active stroke, where the hydraulic media is allowed to enter into the interior of the head and then throughout the third connection to appropriate hydraulic conduit, in which the pressure-regulating valve is available in order to redirect the flow towards the control valve, which is then shifted in order to enable the hydraulic media to enter into the intermediate space between the rod on the side of the active stroke thereof and the internal tube and the external tube of the cylinder, where the speed of the rod is relatively high thanks to relatively small surface thereof. Still further, the unit according to the invention in characterized in that the cylinder with the belonging rod is included within a hydraulic circuit, which is concieved in such a manner, that by essentially increasing of the splitting resistance the working pressure of the hydraulic media within the interior of the internal tube and the rod is essentially increased, which leads to essentially descreasing of the speed of the rod and increasing of the pressure above the pre-set value thereof, upon which the differential valve is switched to its alternative position, which enables the hydraulic media to flow into the cylinder via the pump and the first connection, where the complete rear surface of the rod, which is faced in a direction of its reverse stroke, is exposed to the working pressure, by which the pushing force in the rod is then essentially increased. Still further, the unit according to the invention in **characterized in that** the cylinder with the belonging rod is included within a hydraulic circuit, which is concieved in such a manner, that by increasing of the splitting resistance the working pressure of the hydraulic media behind the rod and within the interior of the internal tube and the rod is increased above the pre-set value thereof, where the hydraulic media under said pressure is allowed to flow into the cylinder via the pump and the differential valve and the first hydraulic connection, by which the security valve is activated, while flowing of the hydraulic media throughout said security valve results in shifting of the control valve in its alternative position, while the position of the differential valve remains unchanged. Still further, the unit according to the invention in **characterized in that** the cylinder with the belonging rod is included within a hydraulic circuit, which is concieved in such a manner, that by shifting of the control valve upon achieving of critical pressure the hydraulic media is redirected from the pump towards the second hydraulic connection of the cylinder, upon which the hydraulic media is enabled to enter into the space among the side of the rod, which is faced in a derection of the operation stroke, and both tubes of the cylinder, which is followed by returning of the differential valve in its origin position and movement of the rod in the direction of the reverse stroke, while the pressure equilibration in the cylinder on the side of the reverse stroke of the rod is achieved via the control valve and the reservoir.

[0012] The invention is also characterized by method of controlling of a firewood splitting machine by means of hydraulic components, wherein by regular splitting resistance i.e by regular pressure of the hydraulic media below the pre-set value the active operation stroke of the rod is performed by normally high velocity, upon which the reverse stroke of the rod is performed with still higher velocity, while by increasing of the splitting resistance and consequently also of the pressure of the hydraulic media above the pre-set value the velocity of the rod is then immediately essentially reduced and at the same time the pushing force in the rod is essentially incresed, and wherein just before further increasing of the pressure above the critical value the pressure within the hydraulic circuit is released by switching of appropriate hydraulic components, which is then followed by performing of the reverse stroke of the rod.

[0013] Now the invention will be described in more detail on the basis if a schematic presentation of an embodiment of the driving and control unit of a firewood splitting machine, where also the method of controlling such machine is disclosed by means of sequence of separate operations. In this

Fig. 1 is a schematic presentation of an unloaded machine in its original state;

Fig. 2 is a schematic presentation of said machine in the early stage of high-speed splitting;

Fig. 3 is a schematic presentation of said machine in the final stage of high-speed splitting with;

Fig. 4 is a schematic presentation of said machine during performing a reverse stroke upon conclusion of steps according to Figs. 1 to 3;

Fig. 5 is a schematic presentation of said machine in the early stage of high-speed splitting, when the cutting edge abuts a log and the splitting resistance is essentially increased;

Fig. 6 is a schematic presentation of said machine in the stage of essentially increasing of splitting resistance, upon which splitting is continued with decreased velocity, while the force in the rod is essentially increased;

Fig. 7 is a schematic presentation of said machine in the stage immediately prior to overloading i.e. just below the top limit of the regular operation;

Fig. 8 is a schematic presentation of said machine in the stage of overloading; and
Fig. 9 is a schematic presentation of said machine upon performing steps according to Figs. 5 to 8 and in the stage of returning into the original state thereof.

[0014] Appliance according to the invention consists of a hydraulic cylinder 1 with incorporated rod 2, which is in accordance with Fig. 1 during the active stroke moved toward s the right and during the reverse stroke towards the left.

[0015] Said cylinder 1 consist of an external tube 15 as well as of internal tube 16, which extends co-axially therewith, and moreover also of a hollow cup i.e. a head 14, which actually presents a hollow extension of the active working volume of the cylinder 1 in the longitudinal direction thereof, more precisely in the direction of the active stroke of the rod 2. A single-way nonreturn valve 6 is mounted within the internal tube 16 of the cylinder 1, which enables hydraulic media to flow from the exterior towards the interior and not also from the interior of the tube 16 towards the exterior thereof into the intermediate space between the tubes 15, 16 of the cylinder 1.

[0016] A rod 2 is available within said intermediate space between said tubes 15, 16, which can be moved to and fro along said cylinder 1; said rod2 is hollow and is movable throughout said hollow head 14 of the cylinder 1 and at the same time along the internal tube 16, which is actually surrounded by said rod 2. In addition, the rod 2 comprises an outlet 21, which in the original state of the rod 2 coincides with the nonreturn valve 6 within the internal tube 16 of the cylinder 1.

[0017] Said rod 2 is furthermore equipped with a sealing portion 23, which is characterized by greater diameter and is available between the external tube 15 and the internal tube 16 of the cylinder 1 on the side i.e. in the direction of the reverse stroke thereof, as well as with a guiding portion 22, which surrounds the internal tube 16 of the cylinder 1 at appropriate distance and may be moved throughout said head 14 of the cylinder 1, and moreover also with a front portion 24, which protrudes outwards from the cylinder 1 in a direction of the active stroke of the rod 2.

[0018] Said cylinder 1 comprises three hydraulic connections 11, 12, 13, which are intended for connection of the cylinder I into appropriate hydraulic circuits. The first connection 11 is available on the external tube 15 of the end portion of the cylinder 1 in the area of reverse stroke of the rod 2, namely at a certain distance apart from the sealing portion 23 of the rod 2. The second connection 12 is also available on the external tube 15, however on the opposite end portion of the cylinder 1, while the third connection 13 is available in the area of the head 14 adjacent to said second connection 12. The interior of the internal tube 16 may also be included into appropriate hydraulic circuit.

[0019] In addition to said cylinder 1 and rod 2, said appliance also includes a reservoir 8 for storage of each desired hydraulic media, a pump 7 for establishing a required pressure of said hydraulic media, and moreover also

- a two-way differential valve 5, which is hydraulically interconnected with the first connection 11 and the reservoir 8 and is shifted from one position into another on the basis of achieving of a pre-set value of the pressure,
- a control valve 3, which is in this shown embodiment equipped and switched either by appropriate lever 31 or also by means of the pressure in the third hydraulic connection 13, and is hydraulically interconnected either with the interior of the internal tube 16 of the cylinder 1 and/or with the pump 7 and via said pump 7 with the reservoir 8 and/or directly with said reservoir 8 and/or indirectly via a security valve 4 and a pressure-regulating valve 9 with the reservoir 8; and
- s security valve 6, which is in a parallel manner interconnected between the hydraulic conduit, by means of which the control valve 3 is via said pump 7 connected with the reservoir 8, and the hydraulic conduit, by means of which the third connection 13 on the head 14 of the cylinder 1 is connected with the reservoir 8 via said pressure-regulating valve 9.

[0020] In Fig. 1 the rod 2 is shown in its original position prior to splitting. The cylinder 1 is unloaded, and the hydraulic media is fed throughout the control valve 3 into the cylinder 1 and further towards the interior of the internal tube 16 and towards the second hydraulic connection 12, through which said media is then returned back to the reservoir 8. The minimum pressure p_0 is present in the complete system i.e. inside of the internal tube 16, in the hollow area of the rod 2 and within the intermediate space between the rod 2 and the external tube 15 of the cylinder.

[0021] Upon shifting the lever 31 of the control valve 3 is displaced in its alternative position (Fig. 2), upon which the hydraulic media is directed into the interior of the internal tube 16 of the cylinder 1, upon which the rod 2 is moved with the operating speed towards the right, by which the operating stroke is performed, and by which equilibration of pressure then occurs in the area behind the rod 2 via the differential valve 5 and the reservoir 8. The security valve 4 is switched-off, while the pump 7 is operating under the working pressure p_1, while in the other sestions of the hydraulic system the pressure p_0 is still maintained.

[0022] Despite to certain resistance, which normally occurs by splitting the log, the rod 2 may continue its movement with unchanged velocity towards the end position of the operating stroke (Fig. 3), whenever said resistance and consequently also adequate increasing of pressure is not very high. In this, hydraulic media then enters into the interior of the cup 14 and flows throughout the third connection 13 into appropriate hydraulic conduit,

whereupon it is directed towards the control valve 3, which may be shifted i.e. switched, when appropriate. From that state the hydraulic media under the working pressure p_1 starts wlowing throughout the second connection 12 into the intermediate space, which is limited by the rod 2, namely its portion on the side of the active stroke, as well as the internal tube 16 and the external tube 15 of the cylinder, in which due to reduced active surface area the velocity of the rod 2 may be essentially higher. During such recerse stroke, the pressure equilibration in the front of the rod 2 is performed via the differential valve 3 into the reservoir 8.

[0023] Whenever by movement of the rod apart from its origin position the resistance is essentially increased, the pressure of the hydraulic media inside of the internal tube 16 and the rod 2 is adequately increased, and simultaneously the speed of the rod 2 is decreased (Fig. 5).

[0024] As soon as the pressure is increased above the pre-set value p_2 (Fig. 6), the differential valve 5 is shifted to alternative position, which enables hydraulic media to flow from the pump 7 throughout the first connection 11 into the cylinder 1, whereupon the complete rear surface of the rod 2, which is faced towards the reverse stroke, is exposed to the working pressure p1, through which consequently the pushing force on the rod 2 is then essentially increased.

[0025] By further increasing of the pressure within the cylinder 1 behind the rod 2 and within the rod 2 and the internal tube 16 of the cylinder 1 up to the highest still allowed value (Fig. 7), the hydraulic media under the pressure p_{max} is flowing from the pump 7 into the cylinder 1 throughout the differential valve 5 and the first connection 11.

[0026] In such state then the security valve 4 is activated (Fig. 8), upon which then the branch of the hydraulic circuit via the security valve 4 is redirected by switching the control valve 3, while the differential valve 5 is retained in its current position.

[0027] Upon switching the control valve 3 the hydraulic media from the pump 7 is redirected towards the second connection 12 of the cylinder, upon which the hydraulic media is fed into the space among the rod 2, namely the side of the active stroke thereof, and both tubes 15, 16 of the cylinder 1. Then the differential valve 5 is returned into its origin position and the reverse stroke of the rod 2 is performed, where the pressure equilibration of the cylinder 1 on the side of the reverse stroke is established via the control valve 3 and the reservoir 8.

[0028] Said steps also clearly define a method of controlling of a firewood splitting machine, which is performed by means of said unit according to the invention, wherein the active stroke of the rod 2 is performed with realtively high velocity, if the splitting resistance does not result in increasing of the pressure within the hydraulic circuit above a predetermined value, and wherein the reverse stroke of the rod 2 is performed, during which the velocity of the rod is higher than the previously mentioned velocity during athe normal active stroke; and wherein any occurance of an extreme splitting resistance results in increasing of the pressure of the hydraulic media above the predetermined value, upon which due to activation of the differential valve 5 velocity of the rod 2 is promptly decreased, where sumultaneously the pushing force in the rod 2 is promptly increased. Whenever by such slow movement of the rod 2 with enlarged pushing force the loadings should then exceed the top limits of a regular operation, then thanks to the security valve 4 the unit is prevented against damages by switching the control unit 3, which then allows releasing of unit by decreasing the pressure within the hydraulic system and simultaneously performing of the reverse stroke of the rod 2.

Claims

1. Driving and control unit of a firewood splitting machine, comprising a hydraulic cylinder (1) and a rod (2), which is connected with the pushing means or appropriate blade, which is then by means of said rod (2) pushed towards the log, which is to be splitted, wherein said cylinder (1) is via appropriate connections (11, 12) connected with a corresponding hydraulic circuit, which contains a hydraulic media under a desired pressure, which is supplied from a reservoir (8) by means of a pump (7), said unit comprising a hydraulic cylinder (1), which consists of an external tube (15) having a larger diameter and an internal tube (16) having a smaller diameter and moreover of a head (14), which forms a supplemental chamber in the axial direction of the cylinder (1) on the side of the active stroke of the rod (2), and wherein said cylinder (1) is equipped with three hydraulic connections (11, 12, 13), **characterized by,** said internal tube (16) is equipped with a nonreturn valve (6), which allows the hydraulic media to flow into the tube (16) and not outwards from it into the intermediate space between the tubes (15, 16) of the cylinder (1) and the hollow rod (2), which is arranged within said intermediate space between said tubes (15, 16) surrounding thereby the internal tube (16) and is moved oscillatory to and fro along said internal tube (16) of the cylinder (1) and also throughout the head (14) of the cylinder (1), and wherein said rod (2) comprises an outlet (21), which in the original position of the rod (2) coincides with the nonreturn valve (6) on the internal wall (16), and further comprises a sealing portion (23), which has a larger diameter and is arranged between the external tube (15) and the internal tube (16) of the cylinder (1), as well as a guiding portion (22) of a smaller diameter, which surrounds at a desired distance said internal tube (16) of the cylinder (1) and is moved throughout said head (14) of the cylinder (1), and also a front portion (24), which protrudes outside of the cylinder (1) in the direction of the active stroke of the rod (2), and wherein said

connections (11, 12, 13) of the cylinder (1) are arranged in such a manner, that the first connection (11) is available on the external tube (15) on the end portion of the cylinder (1) in the direction of the reverse stroke of the rod (2) and at appropriate distance apart from the sealing portion (23) of the rod (2), and that the second connection (12) is available on the external tube (15) on the opposite end portion of the cylinder (1) apart from the head (14), and that the third connection (13) is available in the area of said head (14) adjacent to said second connection (12), and wherein by means of these connections (11, 12, 13) said cylinder (1) is connected together with the rod (2) into appropriate hydraulic circuit, which moreover includes a reservoir (8) intended for storage of the hydraulic media, a pump (7) intended for establishing of a desired pressure, and moreover also a differential valve (5), which is hydraulically connected with the first connection (11) and the reservoir (8) and is shifted from one to another position when a pre-defined value of the pressure (p_2) is achieved, a control valve (3), which is shifted either by means of a lever (31) or a similar manually controlled mechanical means or also by means of the pressure of the hydraulic media in the area of the third connection (13) and is thereby hydraulically interconnected with the interior of the internal tube (16) of the cylinder (1) and/or with the pump (7) and either directly via said pump (7) also with the reservoir (8) and/or indirectly via the security valve (4) and the pressure-regulating valve (9) with the reservoir (8) and/or with reservoir (8) and the second connection (12), and where said hydraulic circuit also includes a security valve (4), which is connected parallel between the hydraulic conduit, by which the control valve (3) is connected via the pump (7) with the reservoir (8), and the hydraulic circuit, in which the third connection (13) on the head (14) of the cylinder (1) is connected with the reservoir (8) via the pressure-regulating valve (9).

2. Unit according to Claim 1, **characterized in that** the cylinder (1) with the belonging rod (2) is included within a hydraulic circuit, which is concieved in such a manner, that by unloaded cylinder (1) prior to starting of active stroke of the rod (2) in the origin position thereof, the hydraulic media is enabled to flow from the pump (7) throughout the control valve (3) into said cylinder (1) and along the interior of the internal tube (16) towards the second connection (12) and outwards through the control valve (3) back to the reservoir (8), and that the pressure within said internal tube (16), within the hollow rod (2) and also within the intermediate space between the rod (2) and the external tube (15) corresponds to the minimum pressure (p_o).

3. Unit according to Claim 1, **characterized in that** the cylinder (1) with the belonging rod (2) is included within a hydraulic circuit, which is concieved in such a manner, that the control valve (3) is shifted in its alternative position by means of displacement of the belonging lever (31), upon which the hydraulic media is enabled to enter the interior of the internal tube (16) of the cylinder (1), by which the rod (2) is enabled to perform a high-speed active stroke, while the pressure equilibration in the area behind said rod (2) is enabled through the differential valve (5) and the reservoir (8), the security valve (4) is inactive and the pump (7) may operate under the working pressure (p_1), which occurs within the interior of the internal tube (16) of the rod (2), while the pressure in other sections still corresponds to the minimum pressure (p_o).

4. Unit according to Claim 1, **characterized in that** the cylinder (1) with the belonging rod (2) is included within a hydraulic circuit, which is concieved in such a manner, that by operation under a regular splitting resistance and regular working pressure below the pre-set value (p_2), the rod (2) is enabled to move with unchanged speed and to reach the end position of the active stroke, where the hydraulic media is allowed to enter into the interior of the head (14) and then throughout the third connection (13) to appropriate hydraulic conduit, in which the pressure-regulating valve (9) is available in order to redirect the flow towards the control valve (3), which is then shifted in order to enable the hydraulic media to enter into the intermediate space between the rod (2) on the side of the active stroke thereof and the internal tube (16) and the external tube (15) of the cylinder, where the speed of the rod is relatively high thanks to relatively small surface thereof.

5. Unit according to Claim 1, **characterized in that** the cylinder (1) with the belonging rod (2) is included within a hydraulic circuit, which is concieved in such a manner, that by essentially increasing of the splitting resistance the working pressure of the hydraulic media within the interior of the internal tube (16) and the rod (2) is essentially increased, which leads to essentially descreasing of the speed of the rod (2) and increasing of the pressure above the pre-set value (p_2), upon which the differential valve (5) is switched to its alternative position, which enables the hydraulic media to flow into the cylinder (1) via the pump (7) and the first connection (11), where the complete rear surface of the rod (2), which is faced in a direction of its reverse stroke, is exposed to the working pressure (p_1), by which the pushing force in the rod (2) is then essentially increased.

6. Unit according to Claim 1, **characterized in that** the cylinder (1) with the belonging rod (2) is included within a hydraulic circuit, which is concieved in such

a manner, that by increasing of the splitting resistance the working pressure of the hydraulic media behind the rod (2) and within the interior of the internal tube (16) and the rod (2) is increased above the pre-set value (p_{max}), the hydraulic media under said pressure (p_{max}) is allowed to flow into the cylinder (1) via the pump (7) and the differential valve (5) and the first connection (11), by which the security valve (4) is activated, while flowing of the hydraulic media throughout said security valve (4) results in shifting of the control valve (3) in its alternative position, while the position of the differential valve (5) remains unchanged.

7. Unit according to Claim 1, **characterized in that** the cylinder (1) with the belonging rod (2) is included within a hydraulic circuit, which is concieved in such a manner, that by shifting of the control valve (3) upon achieving of critical pressure (p_{max}) the hydraulic media is redirected from the pump (7) towards the second connection (12) of the cylinder (1), upon which the hydraullic media is enabled to enter into the space among the operation stroke faced side of the rod (2) and both tubes (15, 16) of the cylinder (1), which is followed by returning of the differential valve (5) in its origin position and movement of the rod (2) in the direction of the reverse stroke, while the pressure equilibration in the cylinder (1) on the side of the reverse stroke of the rod (2) is achieved via the control valve (3) and the reservoir (8).

Patentansprüche

1. Antriebs- und Steuereinheit einer Brennholzspaltmaschine, umfassend einen Hydraulikzylinder (1) und eine Stange (2), die mit dem Vorschubmittel oder einer geeigneten Klinge verbunden ist, welche dann mittels der Stange (2) zu dem zu spaltenden Kloben hin vorgeschoben wird, wobei der Zylinder (1) über geeignete Anschlüsse (11, 12) mit einem entsprechenden Hydraulikkreis verbunden ist, der ein auf einem gewünschten Druck stehendes Hydraulikmedium enthält, das mittels einer Pumpe (7) von einem Behälter (8) zugeführt wird, wobei die Einheit einen Hydraulikzylinder (1) umfasst, der aus einem äußeren Rohr (15) mit einem größeren Durchmesser und einem inneren Rohr (16) mit einem kleineren Durchmesser und ausserdem aus einem Kopf (14) besteht, der in der axialen Richtung des Zylinders (1) auf der Seite des aktiven Hubs der Stange (2) eine zusätzliche Kammer bildet, und wobei der Zylinder (1) mit drei Hydraulikanschlüssen (11, 12, 13) ausgestattet ist, **dadurch gekennzeichnet, dass** das innere Rohr (16) mit einem Rückschlagventil (6) ausgestattet ist, welches ermöglicht, dass das Hydraulikmedium in das Rohr (16) strömt und nicht aus diesem hinaus in den Zwischenraum zwischen den Rohren (15, 16) des Zylinders (1) und der hohlen Stange (2), die in dem Zwischenraum zwischen den Rohren (15, 16) angeordnet ist und **dadurch** das innere Rohr (16) umgibt und entlang dem inneren Rohr (16) des Zylinders (1) und auch durch den Kopf (14) des Zylinders (1) hindurch schwingend hin und her bewegt wird, und wobei die Stange (2) einen Auslass (21) umfasst, der in der Ausgangsposition der Stange (2) mit dem Rückschlagventil (6) an der inneren Wand (16) übereinstimmend angeordnet ist, und ferner einen Dichtungsabschnitt (23) umfasst, der einen größeren Durchmesser aufweist und zwischen dem äußeren Rohr (15) und dem inneren Rohr (16) des Zylinders (1) angeordnet ist, sowie einen Führungsabschnitt (22) mit einem kleineren Durchmesser, der in einem gewünschten Abstand das innere Rohr (16) des Zylinders (1) umgibt und durch den Kopf (14) des Zylinders (1) hindurch bewegt wird, und auch einen vorderen Abschnitt (24), der außerhalb des Zylinders (1) in Richtung des aktiven Hubs der Stange (2) vorragt, und wobei die Anschlüsse (11, 12, 13) des Zylinders (1) auf derartige Weise angeordnet sind, dass der erste Anschluss (11) an dem äußeren Rohr (15) an dem Endabschnitt des Zylinders (1) in Richtung des Rückwärtshubs der Stange (2) und in einem geeigneten Abstand von dem Dichtungsabschnitt (23) der Stange (2) zur Verfügung steht, und dass der zweite Anschluss (12) an dem äußeren Rohr (15) an dem entgegengesetzten Endabschnitt des Zylinders (1) von dem Kopf (14) entfernt zur Verfügung steht, und dass der dritte Anschluss (13) im Bereich des Kopfes (14) dem zweiten Anschluss (12) benachbart zur Verfügung steht, und wobei mittels dieser Anschlüsse (11, 12, 13) der Zylinder (1) gemeinsam mit der Stange (2) zu einem geeigneten Hydraulikkreis verbunden sind, der darüber hinaus einen Behälter (8) umfasst, der zur Speicherung des Hydraulikmediums bestimmt ist, eine Pumpe (7), die zum Herstellen eines gewünschten Drucks bestimmt ist, und darüber hinaus auch ein Differenzialventil (5), das mit dem ersten Anschluss (11) und dem Behälter (8) hydraulisch verbunden ist und von einer zu einer anderen Stellung bewegt wird, wenn ein vorbestimmter Wert des Drucks (p_2) erreicht wird, ein Steuerventil (3), das entweder mittels eines Hebels (31) oder eines ähnlichen von Hand bedienten mechanischen Mittels oder auch mittels des Drucks des Hydraulikmediums im Bereich des dritten Anschlusses (13) bewegt wird und **dadurch** mit dem Inneren des inneren Rohres (16) des Zylinders (1) und/oder mit der Pumpe (7) und entweder direkt über die Pumpe (7) auch mit dem Behälter (8) und/oder indirekt über das Sicherheitsventil (4) und das Druckregelventil (9) mit dem Behälter (8) und/oder mit dem Behälter (8) und dem zweiten Anschluss (12) hydraulisch verbunden ist, und wobei der Hydraulikkreis auch ein Sicherheitsventil (4) umfasst, welches zwischen der Hy-

draulikleitung, durch welche das Steuerventil (3) über die Pumpe (7) mit dem Behälter (8) verbunden ist, und dem Hydraulikkreis, in welchem der dritte Anschluss (13) an dem Kopf (14) des Zylinders (1) über das Druckregelventil (9) mit dem Behälter (8) verbunden ist, parallel geschaltet ist.

2. Einheit nach Anspruch 1, **dadurch gekennzeichnet, dass** der Zylinder (1) mit der zugehörigen Stange (2) in einen Hydraulikkreis eingebunden ist, der auf derartige Weise ausgebildet ist, dass durch den entlasteten Zylinder (1) vor dem Beginn des aktiven Hubs der Stange (2) in deren Ausgangsposition ermöglicht wird, dass das Hydraulikmedium von der Pumpe (7) durch das Steuerventil (3) in den Zylinder (1) und das Innere des inneren Rohres (16) entlang zu dem zweiten Anschluss (12) und nach außen durch das Steuerventil (3) zu dem Behälter (8) zurück strömt, und dass der Druck in dem inneren Rohr (16), innerhalb der hohlen Stange (2) und auch innerhalb des Zwischenraums zwischen der Stange (2) und dem äußeren Rohr (15) dem Minimaldruck (p_0) entspricht.

3. Einheit nach Anspruch 1, **dadurch gekennzeichnet, dass** der Zylinder (1) mit der zugehörigen Stange (2) in einen Hydraulikkreis eingebunden ist, der auf derartige Weise ausgebildet ist, dass das Steuerventil (3) mittels Verlagerung des zugehörigen Hebels (31) in seine alternative Stellung bewegt wird, woraufhin ermöglicht wird, dass das Hydraulikmedium in das Innere des inneren Rohres (16) des Zylinders (1) eintritt, wodurch die Stange (2) einen aktiven Hochgeschwindigkeitshub ausführen kann, während der Druckausgleich in dem Bereich hinter der Stange (2) durch das Differenzialventil (5) und den Behälter (8) ermöglicht wird, wobei das Sicherheitsventil (4) inaktiv ist und die Pumpe (7) mit dem Arbeitsdruck (p_1) betrieben werden kann, der im Inneren des inneren Rohres (16) der Stange (2) herrscht, während der Druck in anderen Abschnitten noch dem Minimaldruck (p_0) entspricht.

4. Einheit nach Anspruch 1, **dadurch gekennzeichnet, dass** der Zylinder (1) mit der zugehörigen Stange (2) in einen Hydraulikkreis eingebunden ist, der auf derartige Weise ausgebildet ist, dass sich bei Betrieb mit einem normalen Spaltwiderstand und einem normalen Arbeitsdruck unter dem voreingestellten Wert (p_2) die Stange (2) mit unveränderter Geschwindigkeit bewegen und die Endlage des aktiven Hubs erreichen kann, wo das Hydraulikmedium in das Innere des Kopfes (14) und dann durch den dritten Anschluss (13) hindurch in den geeigneten Hydraulikkreis eintreten kann, in dem das Druckregelventil (9) zur Verfügung steht, um den Strom zu dem Steuerventil (3) hin umzuleiten, welches dann bewegt wird, um zu ermöglichen, dass das Hydraulikmedium in den Zwischenraum zwischen der Stange (2) auf der Seite von deren aktivem Hub und dem inneren Rohr (16) und dem äußeren Rohr (15) des Zylinders eintritt, wo die Geschwindigkeit der Stange dank ihrer relativ geringen Oberfläche relativ hoch ist.

5. Einheit nach Anspruch 1, **dadurch gekennzeichnet, dass** der Zylinder (1) mit der zugehörigen Stange (2) in einen Hydraulikkreis eingebunden ist, der auf derartige Weise ausgebildet ist, dass durch wesentliches Erhöhen des Spaltwiderstands der Arbeitsdruck des Hydraulikmediums im Inneren des inneren Rohres (16) und der Stange (2) wesentlich erhöht wird, was zu einer wesentlichen Verringerung der Geschwindigkeit der Stange (2) und einer Erhöhung des Drucks über den voreingestellten Wert (p_2) führt, woraufhin das Differenzialventil (5) in seine alternative Stellung geschaltet wird, wodurch ermöglicht wird, dass das Hydraulikmedium über die Pumpe (7) und den ersten Anschluss (11) in den Zylinder (1) strömt, wobei die gesamte hintere Oberfläche der Stange (2), welche in Richtung ihres Rückwärtshubs gewandt ist, dem Arbeitsdruck (p_1) ausgesetzt ist, wodurch die Schubkraft in der Stange (2) dann wesentlich erhöht wird.

6. Einheit nach Anspruch 1, **dadurch gekennzeichnet, dass** der Zylinder (1) mit der zugehörigen Stange (2) in einen Hydraulikkreis eingebunden ist, der auf derartige Weise ausgebildet ist, dass durch Erhöhen des Spaltwiderstands der Arbeitsdruck des Hydraulikmediums hinter der Stange (2) und im Inneren des inneren Rohres (16) und der Stange (2) über den voreingestellten Wert (p_{max}) erhöht wird, das Hydraulikmedium unter dem Druck (p_{max}) über die Pumpe (7) und das Differenzialventil (5) und den ersten Anschluss (11) in den Zylinder (1) strömen kann, wodurch das Sicherheitsventil (4) aktiviert wird, während das Strömen des Hydraulikmediums durch das Sicherheitsventil (4) zum Bewegen des Steuerventils (3) in seine alternative Stellung führt, während die Stellung des Differenzialventils (5) unverändert bleibt.

7. Einheit nach Anspruch 1, **dadurch gekennzeichnet, dass** der Zylinder (1) mit der zugehörigen Stange (2) in einen Hydraulikkreis eingebunden ist, der auf derartige Weise ausgebildet ist, dass durch Bewegen des Steuerventils (3) nach Erreichen des kritischen Drucks (p_{max}) das Hydraulikmedium von der Pumpe (7) zu dem zweiten Anschluss (12) des Zylinders (1) hin umgeleitet wird, woraufhin das Hydraulikmedium in den Raum zwischen der Arbeitshubseitigen Seite der Stange (2) und beiden Rohren (15, 16) des Zylinders (1) eintreten kann, gefolgt vom Rückstellen des Differenzialventils (5) in seine Ausgangsstellung und von der Bewegung der Stange

(2) in Richtung des Rückwärtshubs, während der Druckausgleich in dem Zylinder (1) auf der Seite des Rückwärtshubs der Stange (2) über das Steuerventil (3) und den Behälter (8) erreicht wird.

Revendications

1. Unité d'entraînement et de commande d'une fendeuse de bois à brûler, comprenant un cylindre hydraulique (1) et une tige (2), qui est connectée avec le moyen de poussée ou une lame appropriée, qui est ensuite au moyen de ladite tige (2) poussée vers la bûche, destinée à être fendue, dans laquelle ledit cylindre (1) est par l'intermédiaire de connexions appropriées (11, 12) connecté avec un circuit hydraulique correspondant, qui contient un milieu hydraulique sous une pression désirée, qui est amené d'un réservoir (8) au moyen d'une pompe (7), ladite unité comprenant un cylindre hydraulique (1), qui consiste en un tube externe (15) ayant un diamètre plus grand et un tube interne (16) ayant un diamètre plus petit et en outre en une tête (14), qui forme une chambre supplémentaire dans la direction axiale du cylindre (1) sur le côté de la course active de la tige (2), et dans laquelle ledit cylindre (1) est équipé de trois connexions hydrauliques (11, 12, 13), **caractérisée en ce que** ledit tube interne (16) est équipé d'un clapet anti-retour (6), qui permet que le milieu hydraulique afflue à l'intérieur du tube (16) et pas vers l'extérieur de celui-ci à l'intérieur de l'espace intermédiaire entre les tubes (15, 16) du cylindre (1) et la tige creuse (2), qui est agencée à l'intérieur dudit espace intermédiaire entre lesdits tubes (15, 16) entourant ainsi le tube interne (16) et est déplacée selon un mouvement d'oscillation en va-et-vient le long dudit tube interne (16) du cylindre (1) et également à travers l'intégralité de la tête (14) du cylindre (1), et dans laquelle ladite tige (2) comprend une sortie (21), qui dans la position d'origine de la tige (2) coïncide avec le clapet anti-retour (6) sur la paroi interne (16), et comprend en outre une partie d'étanchéité (23), qui a un diamètre plus grand et est agencée entre le tube externe (15) et le tube interne (16) du cylindre (1), ainsi qu'une partie de guidage (22) d'un diamètre plus petit, qui entoure à une distance désirée ledit tube interne (16) du cylindre (1) et est déplacée à travers l'intégralité de ladite tête (14) du cylindre (1), et également une partie avant (24) qui fait saillie à l'extérieur du cylindre (1) dans la direction de la course active de la tige (2), et dans laquelle lesdites connexions (11, 12, 13) du cylindre (1) sont agencées de telle façon que la première connexion (11) est disponible sur le tube externe (15) sur la partie d'extrémité du cylindre (1) dans la direction de la course inverse de la tige (2) et à une distance appropriée à l'écart de la partie d'étanchéité (23) de la tige (2) et que la deuxième connexion (12) est disponible sur le tube externe (15) sur la partie d'extrémité opposée du cylindre (1) à l'écart de la tête (14), et que la troisième connexion (13) est disponible dans la zone de ladite tête (14) adjacente à ladite deuxième connexion (12), et dans laquelle au moyen de ces connexions (11, 12, 13) ledit cylindre (1) est connecté avec la tige (2) en un circuit hydraulique approprié, qui inclut en outre un réservoir (8) destiné au stockage du milieu hydraulique, une pompe (7) destinée à l'établissement d'une pression désirée, et de plus également une soupape différentielle (5), qui est hydrauliquement connectée avec la première connexion (11) et le réservoir (8) et est passée d'une position à une autre lorsqu'une valeur prédéfinie de la pression (p_2) est atteinte, une soupape de commande (3), qui est manoeuvrée soit au moyen d'un levier (31) ou d'un moyen mécanique similaire à commande manuelle ou également au moyen de la pression du milieu hydraulique dans la zone de la troisième connexion (13) et est ainsi hydrauliquement interconnectée avec l'intérieur du tube interne (16) du cylindre (1) et/ou avec la pompe (7) et soit directement par l'intermédiaire de ladite pompe (7) également avec ledit réservoir (8) et/ou indirectement par l'intermédiaire de la soupape de sécurité (4) et de la soupape de régulation de pression (9) avec le réservoir (8) et/ou avec le réservoir (8) et la deuxième connexion (12), et dans laquelle ledit circuit hydraulique inclut également une soupape de sécurité (4), qui est connectée en parallèle entre la conduite hydraulique, par laquelle la soupape de commande (3) est connectée par l'intermédiaire de la pompe (7) avec le réservoir (8), et le circuit hydraulique, dans laquelle la troisième connexion (13) sur la tête (14) du cylindre (1) est connectée avec le réservoir (8) par l'intermédiaire de la soupape de régulation de pression (9).

2. Unité selon la revendication 1, **caractérisée en que** le cylindre (1) avec la tige (2) en faisant partie est inclus au sein d'un circuit hydraulique, qui est conçu de telle façon que, par le cylindre (1) déchargé avant le démarrage de la course active de la tige (2) dans la position d'origine de celle-ci, le milieu hydraulique est laissé affluer de la pompe (7) à travers la soupape de commande (3) jusque dans ledit cylindre (1) et le long de l'intérieur du tube interne (16) vers la deuxième connexion (12) et vers l'extérieur à travers la soupape de commande (3) en retour jusqu'au réservoir (8), et en ce que la pression à l'intérieur dudit tube interne (16), à l'intérieur de la tige creuse (2) et également à l'intérieur de l'espace intermédiaire entre la tige (2) et le tube externe (15) correspond à la pression minimum (p_0).

3. Unité selon la revendication 1, **caractérisée en que** le cylindre (1) avec la tige (2) en faisant partie est inclus au sein d'un circuit hydraulique, qui est conçu

de telle façon que la soupape de commande (3) est mise dans son autre position au moyen du déplacement du levier (31) en faisant partie, ce sur quoi le milieu hydraulique est laissé pénétrer à l'intérieur du tube interne (16) du cylindre (1), ce par quoi la tige (2) est laissée effectuer une course active à grande vitesse, tandis que l'équilibrage de pression dans la zone derrière ladite tige (2) est réalisé par l'intermédiaire de la soupape différentielle (5) et du réservoir (8), la soupape de sécurité (4) est inactive et la pompe (7) peut fonctionner sous la pression de travail (p_1), qui se trouve dans l'intérieur du tube interne (16) de la tige (2), tandis que la pression dans les autres sections correspond encore à la pression minimum (p_0).

4. Unité selon la revendication 1, **caractérisée en que** le cylindre (1) avec la tige (2) en faisant partie est inclus au sein d'un circuit hydraulique, qui est conçu de telle façon que, par un fonctionnement sous une résistance au fendage normale et une pression de travail normale en dessous de la valeur prédéfinie (p_2), la tige (2) est laissée se déplacer avec une vitesse inchangée et atteindre la position d'extrémité de la course active, où le milieu hydraulique est laissé pénétrer dans l'intérieur de la tête (14) et ensuite à travers la troisième connexion (13) jusqu'à une conduite hydraulique appropriée, dans laquelle la soupape de régulation de pression (9) est disponible afin de rediriger le flux vers la soupape de commande (3), qui est ensuite manoeuvrée afin de permettre au milieu hydraulique de pénétrer dans l'espace intermédiaire entre la tige (2) sur le côté de la course active de celle-ci et le tube interne (16) et le tube externe (15) du cylindre, où la vitesse de la tige est relativement élevée grâce à la surface relativement petite de celle-ci.

5. Unité selon la revendication 1, **caractérisée en que** le cylindre (1) avec la tige (2) en faisant partie est inclus au sein d'un circuit hydraulique, qui est conçu de telle façon que, en augmentant essentiellement la résistance au fendage, la pression de travail du milieu hydraulique à l'intérieur du tube interne (16) et de la tige (2) est essentiellement augmentée, ce qui conduit à diminuer essentiellement la vitesse de la tige (2) et à augmenter la pression au dessus de la valeur prédéfinie (p_2), ce sur quoi la soupape différentielle (5) est mise sur son autre position, ce qui permet au milieu hydraulique d'affluer dans le cylindre (1) par l'intermédiaire de la pompe (7) et de la première connexion (11), où la surface arrière complète de la tige (2), qui fait face dans une direction de sa course inverse, est exposée à la pression de travail (p_1), ce par quoi la force de poussée dans la tige (2) est alors essentiellement augmentée.

6. Unité selon la revendication 1, **caractérisée en que** le cylindre (1) avec la tige (2) en faisant partie est inclus au sein d'un circuit hydraulique, qui est conçu de telle façon que, en augmentant la résistance au fendage, la pression de travail du milieu hydraulique derrière la tige (2) et à l'intérieur du tube interne (16) et de la tige (2) est augmentée au dessus de la valeur prédéfinie (p_{max}), le milieu hydraulique sous ladite pression (p_{max}) est laissé affluer dans le cylindre (1) par l'intermédiaire de la pompe (7) et de la soupape différentielle (5) et de la première connexion (11), ce par quoi la soupape de sécurité (4) est activée, tandis que le flux du milieu hydraulique à travers ladite soupape de sécurité (4) résulte en la mise de la soupape de commande (3) dans son autre position, tandis que la position de la soupape différentielle (5) reste inchangée.

7. Unité selon la revendication 1, **caractérisée en que** le cylindre (1) avec la tige (2) en faisant partie est inclus au sein d'un circuit hydraulique, qui est conçu de telle façon que, par la manoeuvre de la soupape de commande (3) à l'atteinte de la pression critique (p_{max}), le milieu hydraulique est redirigé de la pompe (7) vers la deuxième connexion (12) du cylindre (1), ce sur quoi le milieu hydraulique est laissé pénétrer dans l'espace entre le côté faisant face à la course opérationnelle de la tige (2) et les deux tubes (15, 16) du cylindre (1), ce qui est suivi du retour de la soupape différentielle (5) à sa position d'origine et du mouvement de la tige (2) dans la direction de la course inverse, tandis que l'équilibrage de pression dans le cylindre (1) sur le côté de la course inverse de la tige (2) est réalisé par l'intermédiaire de la soupape de commande (3) et du réservoir (8).

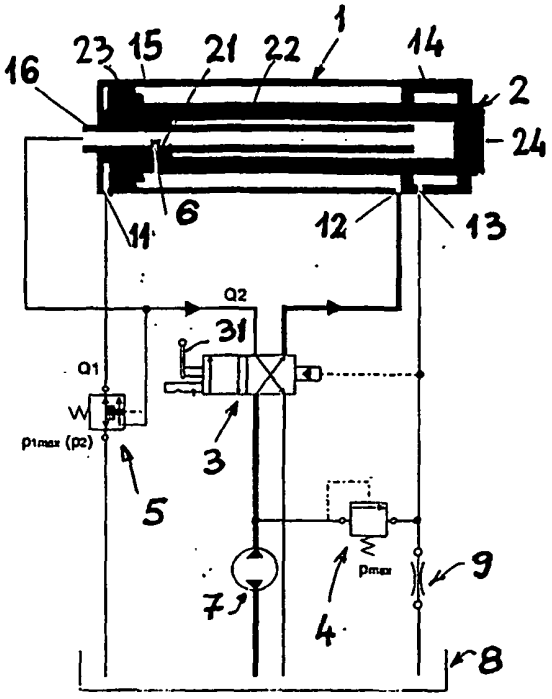

Fig. 1

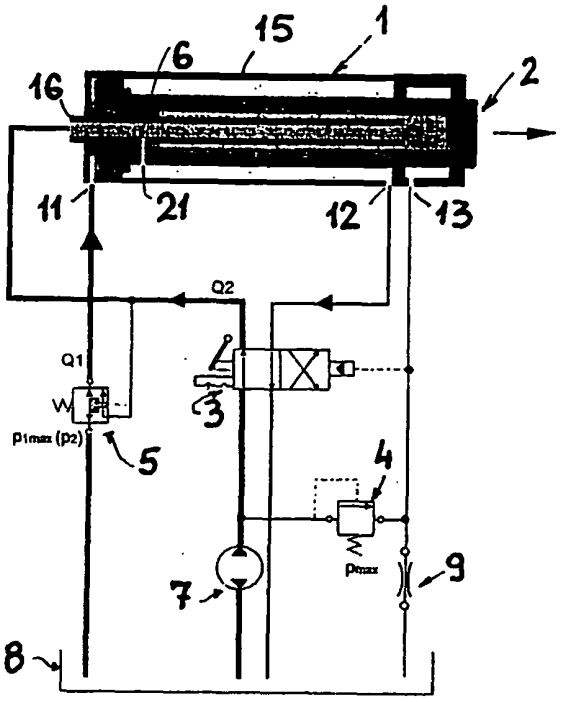

Fig. 2

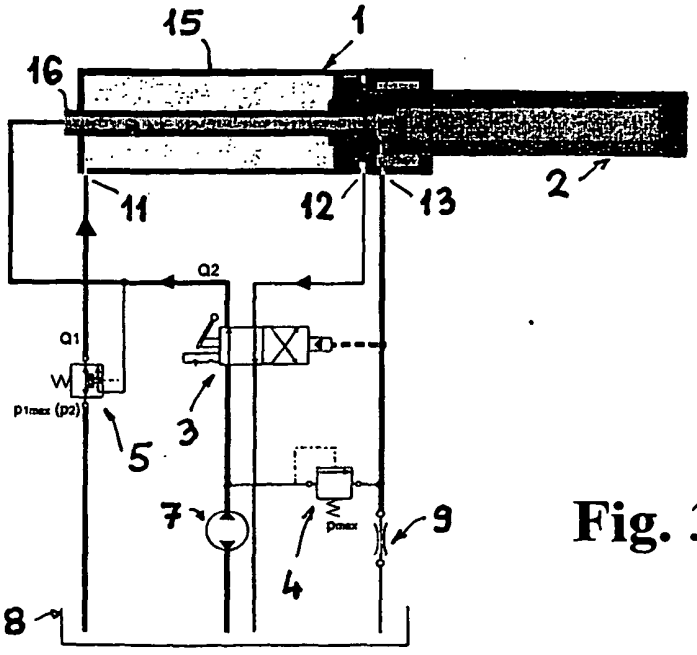

Fig. 3

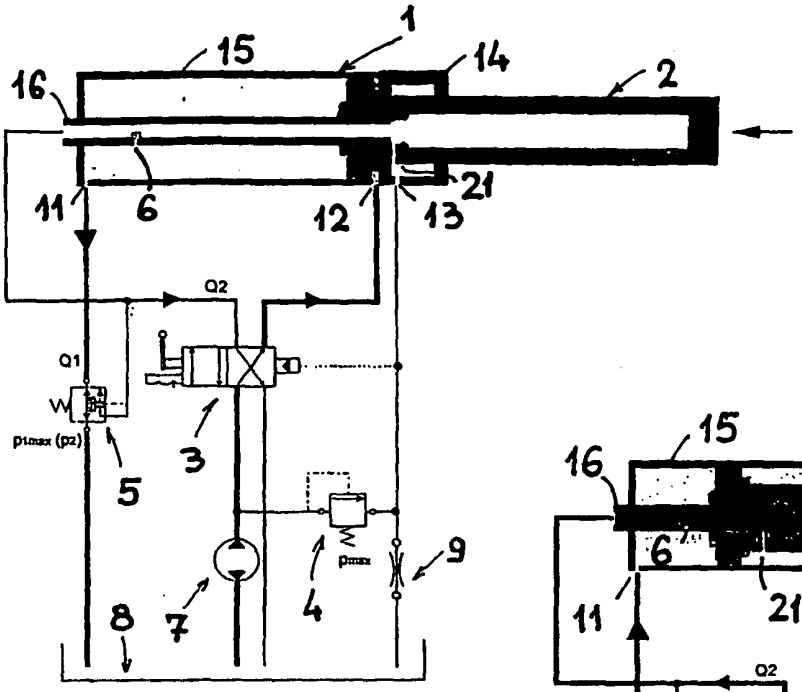

Fig. 4

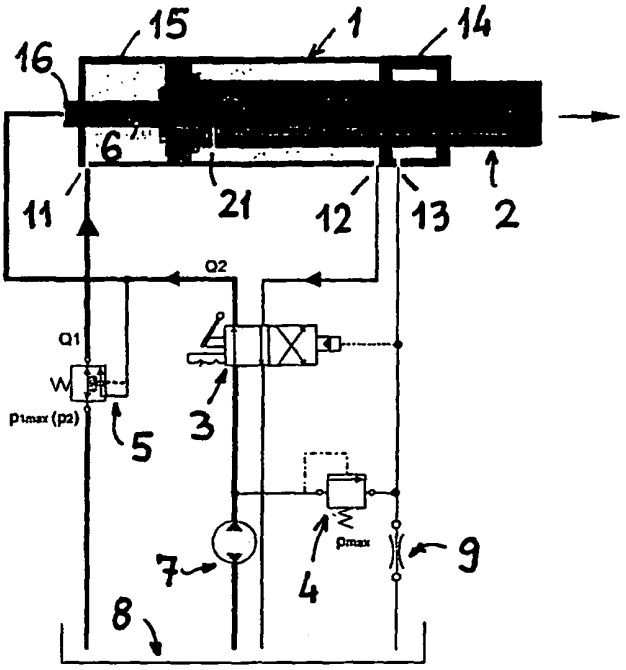

Fig. 5

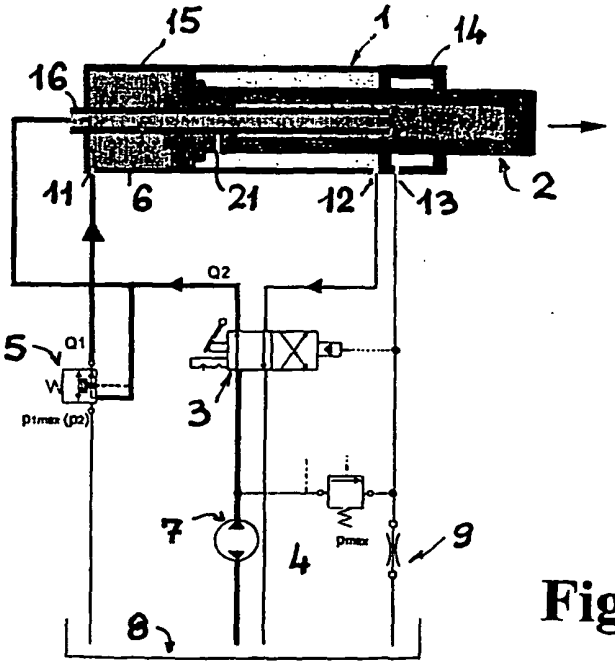

Fig. 6

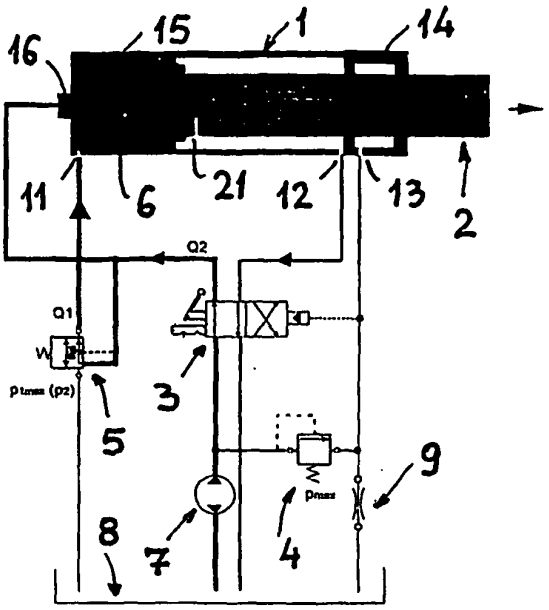

Fig. 7

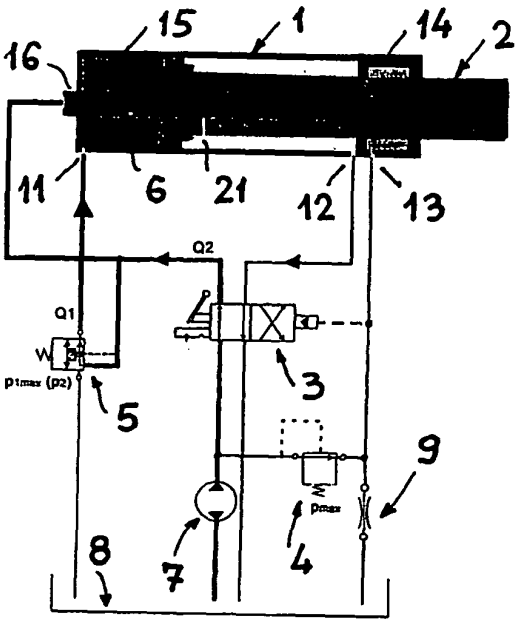

Fig. 8

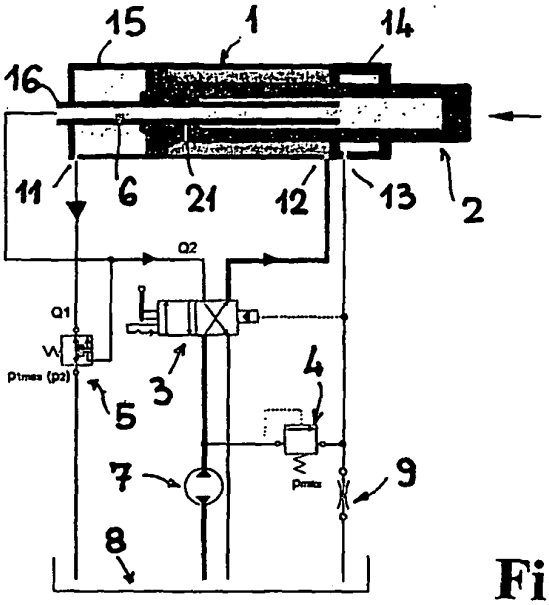

Fig. 9

REFERENCES CITED IN THE DESCRIPTION

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