(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

CORRECTED VERSION

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
3 May 2012 (03.05.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/055579 A9

(51) **International Patent Classification**:
B30B 15/16 (2006.01) *B30B 15/24* (2006.01)

(21) **International Application Number**:
PCT/EP2011/057395

(22) **International Filing Date**:
9 May 2011 (09.05.2011)

(25) **Filing Language**: English

(26) **Publication Language**: English

(30) **Priority Data**:
2010/08886 27 October 2010 (27.10.2010) TR

(71) **Applicant** *(for all designated States except US)*: **COSKUNÖZ METAL FORM MAKINA ENDÜSTRI VE TIC. A.S.** [TR/TR]; Osb Mavi Cad. No: 5, Bursa (TR).

(72) **Inventors; and**
(75) **Inventors/Applicants** *(for US only)*: **DEMIR, Hakan** [TR/TR]; Osb Mavi Cad. No: 5, Bursa (TR). **YORUKOGLU, Sancar** [TR/TR]; Osb Mavi Cad. No: 5, Bursa (TR).

(74) **Agent**: **BILEN PATENT INC.**; Hudavendigar Mh. Biltekin Cd., Akkonak Villalari No.31/A, Osmangazi, 16090 Bursa (TR).

(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*

(48) **Date of publication of this corrected version**:
19 December 2013

[Continued on next page]

(54) **Title**: A SERVO HYDRAULIC PRESS

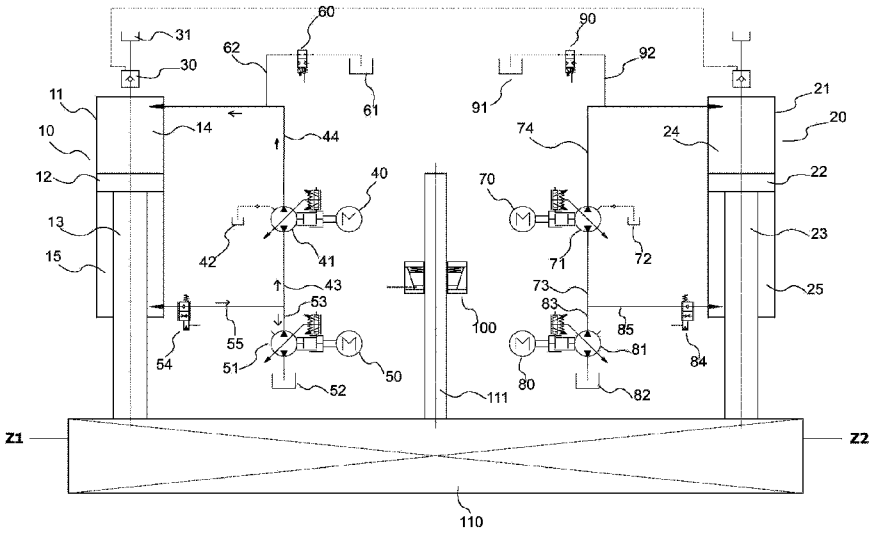

Figure 1

(57) **Abstract**: A press comprising at least one cylinder (10); a main servo motor (40) and a first hydraulic pump (41) which is driven by said main servo motor (40), whose one output is connected through hydraulic lines (43, 44, 54) to said upper chamber (14) and whose other output is connected hydraulically through hydraulic lines (43, 44, 54) to said lower chamber (15); one auxiliary servo motor (50) and a second hydraulic pump (51) which is driven by the auxiliary servo motor (50) and whose one output is connected to the lower chamber (15) through a hydraulic line (53, 55) and to the input of said first hydraulic pump (41) through another hydraulic line (53, 43); and an electronic control unit which adjusts the velocities and directions of the main and auxiliary servo motors (40, 50) according to the requirements in the free fall, pressing and return steps.

WO 2012/055579 A9

(15) **Information about Correction**:
see Notice of 19 December 2013

A SERVO HYDRAULIC PRESS

The present invention relates to servo-hydraulic presses and particularly relates to presses comprising a cylinder body; a piston arm whose one end is connected to the ram; at least one cylinder with a piston head separating the cylinder body into two parts called upper and lower chambers; a main servo motor; and a hydraulic pump which is driven by said main servo motor, whose one output is connected hydraulically through the hydraulic lines related to said upper chamber and whose other output is hydraulically connected through hydraulic lines related to said lower chamber.

PRIOR ART

In conventional hydraulic presses, in order to produce the pressure force, AC standard motor and pump with variable displacement are used. For rotation speed and power adjustment, servo proportional throttling valves are used. Accordingly, the pump applies oil onto the cylinder, the output under the cylinder is connected to the servo proportional valve. Thus, the amount of oil which is pressed through the valve is controlled by means of the servo proportional valve and rotation speed and power adjustment is realized in the presses. However, there are some disadvantages of this embodiment resulting from servo valve usage. First of all, while the hydraulic oil is passing through servo proportional throttling valves, there becomes pressure loss in the system. Moreover, the oil heats up which is applied through the gap throttled by the valve and as a result of this heating and cooling cycle, the viscosity of the oil changes and the performance thereof decreases, and the oil has to be changed periodically. On the other hand, since the AC motors used have high inertias and since they are relatively inefficient, the electric consumption of the system is at a high level. The systems with servo valves have other disadvantages which are not mentioned here.

As a result, when servo valve is not used, all of the abovementioned problems are eliminated. In order to realize this, the hydraulic pumps are driven by a servo motor and the hydraulic oil is supplied to the cylinders. By means of this, since the hydraulic oil does not pass through the throttling valves, it is not heated up to the critical temperature, therefore, there is no need for cooling. The oil which does not enter into the heating-cooling cycle can be used 2 times more.

In the present art, there are solutions regarding this. For instance, in the patent application US6240758, a hydraulic press is disclosed which has a cylinder unit comprising two types of

cylinder chambers with different cross sections. In the embodiment here, the hydraulic oil sent from the hydraulic pump driven by the servo motor is fed to the cylinder unit through a hydraulic circuit. In the embodiment disclosed in the patent application US200770101711, a servo motor connected to the pump drives the pump, referring to a signal controlling the drive element.

In the patent application EP1387090, a servo motor transfers the drive to the hydraulic cylinder by driving two pumps with different volumes. By means of a direction valve, the output of the pumps is controlled and again, thanks to the direction valve, when desired, the output of the two pumps can be jointed. Accordingly, the servo motor provides pressure-position control on the cylinder according to the data it receives from the position information means.

In the patent application US2010/0212521, a press brake is disclosed which functions without an oil tank and which thus has a compact construction, thanks to the close cycle functioning capability. In said press brake, the drive is provided to the system by a hydraulic pump driven by a servo motor.

Besides the advantages the abovementioned solutions bring, there is a common disadvantage. Since, particularly in cases which require high power; servo motors, pumps and drivers are required which will provide this power. These elements which are out of the standards and which are particularly manufactured increase the cost of the system seriously. Moreover, during the control of big motors, there may be sensitivity problems. Thus, during the free fall, return and pressing processes; rotation speed, flow and power controls can not be realized with the desired sensitivity.

As a result, because of the abovementioned drawbacks, an improvement is required in the related technical field.

BRIEF DESCRIPTION OF THE INVENTION

The present invention relates to a novel servo-hydraulic press, in order to eliminate the abovementioned problems and to bring new advantages to the related technical field.

An object of the present invention is to provide a servo hydraulic press which can function at the desired power using servo motors with lower power and using hydraulic pump and drivers suitable to these motors.

Another object of the present invention is to provide a servo hydraulic press where rotation speed, flow and power controls in free fall, pressing and return stages can be realized in a sensitive manner.

In order to realize all of the abovementioned objects and the objects which are to be obtained from the detailed description below, the present invention is a press comprising at least one cylinder with a cylinder body, a piston arm whose one end is connected to the ram, a piston head separating the cylinder body into two parts called upper and lower chambers; a main servo motor; and a hydraulic pump which is driven by said main servo motor, whose one output is connected hydraulically through said hydraulic lines related to said upper chamber and whose other output is connected hydraulically through hydraulic lines related to said lower chamber; characterized by comprising at least one auxiliary servo motor; a hydraulic pump which is driven by at least one said auxiliary servo motor and whose one output is connected to the lower chamber through a hydraulic line and whose other output is connected hydraulically to the input of said hydraulic pump through another hydraulic line; and an electronic control unit which adjusts the velocities and directions of the main and auxiliary servo motors according to the requirements in the free fall, pressing and return steps.

In a preferred embodiment of the subject matter invention, there is an oil tank connected hydraulically to the related output of the hydraulic pump which is driven by the auxiliary servo motor.

In another preferred embodiment of the subject matter invention, said electronic control unit does not energize the main and the auxiliary servo motor in the free fall step.

In another preferred embodiment of the subject matter invention, in the pressing step, said electronic control unit operates the main servo motor so that the oil in the lower chamber is suctioned by the related hydraulic pump and so that said oil is applied to the upper chamber; and said electronic control unit operates the auxiliary servo motor so that the oil in said oil tank is suctioned by the related hydraulic pump and so that said oil is applied to the suctioning of the hydraulic pump driven by the main servo motor through the related hydraulic line.

In another preferred embodiment of the subject matter invention, in the return step, the electronic control unit operates the main servo motor so that the oil in the upper chamber is

suctioned by the related hydraulic pump and so that said oil is applied to the lower chamber; and said electronic control unit operates the auxiliary servo motor so that the oil in said oil tank is suctioned by the related hydraulic pump and so that said oil is applied to the lower chamber through the related hydraulic line.

In another preferred embodiment of the subject matter invention, there is a second cylinder which is connected to the other end of the ram; an additional main servo motor; an additional hydraulic pump which is driven by said additional main servo motor and whose one output is connected to the upper chamber of the second cylinder through a hydraulic line and whose other output is connected to the lower chamber of the second cylinder through another hydraulic line and in relation to these, there is an additional auxiliary servo motor; an additional hydraulic pump which is driven by said additional auxiliary servo motor and whose one output is connected to the lower chamber through a hydraulic line and whose other output is connected to the input of the related hydraulic pump through another hydraulic line.

In another preferred embodiment of the subject matter invention, said electronic control unit does not energize the main and the auxiliary servo motor in the free fall step.

In another preferred embodiment of the subject matter invention, there is an oil tank which is related to the hydraulic pump driven by said auxiliary servo motor.

In another preferred embodiment of the subject matter invention, in the pressing step, said electronic control unit operates the main servo motor so that the oil in the lower chamber is suctioned by the related hydraulic pump and so that said oil is applied to the upper chamber and said electronic control unit operates the auxiliary servo motor so that oil in said oil tank is suctioned by the related hydraulic pump and so that said oil is suctioned by the hydraulic pump driven by the main servo motor through the related hydraulic line.

In another preferred embodiment of the subject matter invention, in the return step, the electronic control unit operates the main servo motor so that the oil in the upper chamber is suctioned by the related hydraulic pump and so that said oil is applied to the lower chamber and said electronic control unit operates the auxiliary servo motor so that oil in said oil tank is suctioned by the related hydraulic pump and so that said oil is applied to the lower chamber through the related hydraulic line.

In another preferred embodiment of the subject matter invention, the electronic control unit operates the main servo motor related to the first cylinder according to the position data

received from a related end of the ram and the auxiliary servo motor is synchronized with the main servo motor.

In another preferred embodiment of the subject matter invention, the electronic control unit operates the main servo motor related to the second cylinder so that the position data received from the opposite end of the ram will be equal to the position data received from the other end, and the electronic control unit synchronizes the auxiliary servo motor regarding the second cylinder with the main servo motor.

In another preferred embodiment of the subject matter invention, there are motor drivers which drive each servo motor and which provide communication with the electronic control unit.

In order for the embodiment of the subject matter invention and the advantages thereof together with the additional members to be understood in the best manner, it has to be evaluated with the annexed figures whose description is given below.

BRIEF DESCRIPTION OF THE FIGURES

In Figure 1, the representative block schema of the subject matter servo-hydraulic press is given.

In Figure 2a, 2b and 2c, the representative views of the different operating steps of the subject matter servo-hydraulic press are given.

REFERENCE NUMBERS

10 First cylinder
11 Cylinder body
12 Piston head
13 Piston arm
14 Upper chamber
15 Lower chamber
20 Second cylinder
21 Cylinder body
22 Piston head
23 Piston arm
60 Safety valve
61 Oil tank
62 Hydraulic line
70 Main servo motor
71 Hydraulic pump
72 Oil tank
73 Hydraulic line
74 Hydraulic line
80 Auxiliary servo motor
81 Hydraulic pump

24 Upper chamber
25 Lower chamber
30 Pre filling valve
31 Filling tank
40 Main servo motor
41 Hydraulic pump
42 Oil tank
43 Hydraulic line
44 Hydraulic line
50 Auxiliary servo motor
51 Hydraulic pump
52 Oil tank
53 Hydraulic line
54 Safety valve
55 Hydraulic line
82 Oil tank
83 Hydraulic line
84 Safety valve
85 Hydraulic line
90 Safety valve
91 Oil tank
92 Hydraulic line
100 Safety lock
110 Ram
111 Locking extension

Z1: Position data
Z2: Position data

THE DETAILED DESCRIPTION OF THE INVENTION

In this detailed explanation, the subject matter servo-hydraulic press is explained with references to examples without forming any restrictive effect in order to make the subject more understandable.

With reference to Figure 1, in the subject matter invention, the drive to the ram (110) is preferably supplied by the two cylinders (10, 20). The piston arm (13, 23) of each cylinder (10, 20) is connected to one end of the ram (110). Since the system is symmetric, the details regarding only one cylinder (10) will be given below. The cylinder (10) which is used as the drive element has a cylinder body (11); a piston arm (13) whose one end is connected to the ram (110); and a piston head (12) which is connected to a piston arm (13) moving downwardly and upwardly inside the cylinder body (11). Said piston head (12) separates the cylinder body (11) into two compartments called upper and lower chambers (14, 15). The upper chamber (14) is hydraulically connected to a filling tank (31) through a pre filling valve (30).

In the system, as a drive source, there is a main servo motor (40); a hydraulic pump (41) driven by said main servo motor (40); and an auxiliary servo motor (50); and a hydraulic pump (51) driven by said auxiliary servo motor (50). One output of the hydraulic pump (41) which is driven by the main servo motor (40) is hydraulically connected to the cylinder upper

chamber (14) through a hydraulic line (44) and the other output thereof is connected hydraulically to the lower chamber (15) through another hydraulic line (43, 53). One output of the hydraulic pump (51) driven by the auxiliary servo motor (50) is hydraulically connected to the lower chamber (15) through the related hydraulic lines (53, 55) and the other output thereof is hydraulically connected to an oil tank (42). On the other hand, there is a safety valve (54) in the system which is connected in a serial manner to the hydraulic line opened to the lower chamber (15); there is another safety valve (60) which is connected in a parallel manner to the hydraulic line (44) which is opened to an upper chamber; and there is an oil tank (61) at the output of said safety valve (61).

As in the first cylinder (10), the second cylinder (20) also has a cylinder body (21); a piston arm (23) whose one end is in connection with the other end of the ram; and a piston head (22) which separates the cylinder inner volume into upper and lower chambers (24, 25). Again, the upper chamber (24) of the second cylinder (20) is hydraulically connected to a filling tank (31) through a pre filling valve (30). So as to be a symmetric of the system regarding the first cylinder (10), a main servo motor (70) is used which drives a hydraulic pump (71) as the drive source of the second cylinder (20) and another auxiliary servo motor (80) is used which drives another hydraulic pump (81). The hydraulic lines (73, 74, 83, 85) hydraulically connect the second cylinder (20) and said hydraulic pumps (71, 81) in the same manner as the mechanism in the first cylinder (10). On the other hand, there is a safety valve (84) which is connected to the hydraulic line (85) in a serial manner, and there is another safety valve (90) which is connected to the other hydraulic line (74) in a parallel manner, and there is an oil tank (91) at the output of said safety valve (90).

In addition to the abovementioned details, as a safety precaution known in the art, there is a locking extension (111) which extends upwardly from the middle part of the press ram (110), and there is a safety lock (100) which interacts with said locking extension (111).

Under the light of the structural details mentioned above and under the light of Figure 2a, 2b and 2c, the operation of the subject matter invention is as follows. Since the operation manner is the same, first of all, the explanation below is realized so as to cover the members regarding the first cylinder (10). As known, the pressing process essentially is completed in 3 steps including the free fall process, pressing process and return process and all of these processes are realized by an electronic control unit (not illustrated in the figure) integrated to the system controlling all of the valves and servo motors in the system in a suitable manner.

Accordingly, during free fall, first of all, the pre filling valve (30) is opened by a pilot pressure and the oil in the filling tank (31) begins discharging to the upper chamber (14) of the cylinder in a free manner. While oil is filling the upper chamber (14), the oil which exists in the lower chamber (15) reaches the hydraulic pump, which is related to the auxiliary servo motor (50), through the hydraulic line (55) and through the hydraulic line (53) extending at the continuation of this line respectively and afterwards, said oil discharges to the oil tank (52), on the other hand, it reaches the hydraulic pump (41) related to the main servo motor (40) through another hydraulic line (43) and afterwards, it reaches the upper chamber (24) through the hydraulic line (44) opened to the upper chamber (24). Thus, at a certain speed, the ram of the press begins downward movement. On the other hand, with the rotation of the hydraulic pumps (41, 51), the main and the auxiliary servo motors (40, 50) begin rotating without consuming power. Thanks to the braking power formed, the free fall of the ram (110) becomes controllable, and it becomes possible to produce power from this movement of the servo motors by means of the methods known in the art. The produced power is stored by means of a capacitor when desired or it can be transferred to the present system or to another system through the frequency converter unit.

The free fall of the ram continues up to a point determined in the position sensor (not illustrated in the figure) and afterwards, the pressing process begins by closing the pre filling valve (30). Accordingly, the hydraulic pump (51) which is began to be driven by the auxiliary servo motor (50) suctions the oil in the oil tank (52) back and the hydraulic pump (51) begins pumping the oil to the suctioning port of the hydraulic pump related to the main servo motor (40) through the related hydraulic line (43). Meanwhile, the hydraulic pump (41) which is rotated in the suitable direction by the main servo motor (40) also begins suctioning the oil in the lower chamber (15) through the related hydraulic lines (55, 43). Thus, the oil coming from the lower chamber (15) and the oil tank (52) joins with the related hydraulic line (43) and it enters into the suctioning of the related hydraulic pump (41). This hydraulic pump (41) pressurizes the arriving oil more, and it applies this oil to the upper chamber (14) of the cylinder through the related hydraulic line (44). Thus, the desired pressing power is obtained.

After the pressing process ends, the rotation direction of the main and the auxiliary servo motor (40, 50) is changed and thus, the return process is started. Accordingly, during return, the hydraulic pump driven by the main servo motor (40) starts applying the oil in the upper chamber (14) of the cylinder to the lower chamber (15) through the related hydraulic line (44, 43, 55). At the same time, the hydraulic pump (51) driven by the auxiliary servo motor (50) applies the oil in the oil tank (52) to the lower chamber (15) through the related hydraulic lines (53, 55) and the other hydraulic pump (41) applies the oil in the upper chamber (14) or

in the tank (52) to the lower chamber (15), thus, the ram (110) can return back in a rapid manner. During return, the pre filling valve (30) is open, thus, the oil remaining in the upper chamber (14) is transferred to the filling tank (31). Since the operation manner of the second cylinder (20) is the same as the operation manner of the first cylinder, it will not be given in detail here.

The synchronization of the servo motors related to the first and the second cylinders (10, 20) is preferably as follows. The electronic control unit operates the main servo motor (40) regarding the first cylinder (10) according to the position data (Z1) obtained from one related end of the ram (110) and the auxiliary servo motor (50) is synchronized with the main servo motor (40). On the other hand, the electronic control unit operates the main servo motor (40) regarding the second cylinder (20) so that the position data (Z2) obtained from the opposite end of the ram (110) will be equal to the other position data (Z1); the auxiliary servo motor (80) regarding the second cylinder is controlled by being synchronized with the main servo motor (70) here. The revolution proportions between all of the servo motors (40, 50, 70, 80) in the system are adjusted according to the selected motor types and application requirements and they drive the servo motors (40, 50, 70, 80) according to these values predefined in the electronic control memory. On the other hand, as known in the art, the electronic control unit controls each servo motor (40, 50, 70, 80) through the motor driver (not illustrated in the figure) of that servo motor.

As a result, thanks to the subject matter system, particularly the pressing and the return processes can be realized with the same efficiency by using two small standard servo motors and hydraulic pumps related to these motors instead of using a big servo motor which has a high cost, which requires particular production and instead of using a hydraulic pump accordingly. Moreover, all of the pressing steps can be controlled in a sensitive manner by adjusting the rotation speed and direction of the servo motors in a suitable manner. In more details, in free fall, the servo motors can be operated with maximum revolution and maximum speed; in pressing process, it can be operated with maximum pressure and thus maximum torque; and in return process, the servo motors can be operated as in the free fall process but with the opposite direction in a controllable and sensitive manner.

CLAIMS

1. A press comprising at least one cylinder (10) with a cylinder body (11), a piston arm (13) whose one end is connected to the ram (110), a piston head (12) separating the cylinder body (11) into upper and lower chambers (14, 15); a main servo motor (40); and a hydraulic pump (41) which is driven by said main servo motor (40), whose one output is connected hydraulically through hydraulic lines (43, 44, 54) related to said upper chamber (14) and whose other output is connected hydraulically through hydraulic lines (43, 44, 54) related to said lower chamber (15); characterized by comprising at least one auxiliary servo motor (50); a hydraulic pump (51) which is driven by at least one said auxiliary servo motor (50) and whose one output is connected to the lower chamber (15) through a hydraulic line (53, 55) and whose other output is connected hydraulically to the input of said hydraulic pump (41) through another hydraulic line (53, 43); and an electronic control unit which adjusts the speed and directions of the main and auxiliary servo motors (40, 50) according to the requirements in the free fall, pressing and return steps.

2. A press according to Claim 1, characterized by comprising an oil tank (52) connected hydraulically to the related output of the hydraulic pump (51) which is driven by the auxiliary servo motor (50).

3. A press according to Claim 1, characterized in that said electronic control unit does not energize the main and the auxiliary servo motor (40, 50) in the free fall step.

4. A press according to any of the preceding claims, characterized in that, in the pressing step, said electronic control unit operates the main servo motor (40) so that the oil in the lower chamber (15) is suctioned by the related hydraulic pump (41) and so that said oil is applied to the upper chamber (14); and said electronic control unit operates the auxiliary servo motor (50) so that the oil in said oil tank (52) is suctioned by the related hydraulic pump (41) and so that said oil is applied to the suctioning of the hydraulic pump (41) driven by the main servo motor (40) through the related hydraulic line (53, 43).

5. A press according to any of the preceding claims, characterized in that, in the return step, the electronic control unit operates the main servo motor (40) so that the oil in the upper chamber (14) is suctioned by the related hydraulic pump (41) and so that said oil is applied to the lower chamber (15); and said electronic control unit operates the auxiliary servo motor (50) so that the oil in said oil tank (52) is suctioned by the

related hydraulic pump (51) and so that said oil is applied to the lower chamber (15) through the related hydraulic line (53, 55).

6. A press according to Claim 1, characterized by comprising a second cylinder (20) which is connected to the other end of the ram (110); an additional main servo motor (70); an additional hydraulic pump (81) which is driven by said additional main servo motor (70) and whose one output is connected to the upper chamber (24) of the second cylinder (20) through a hydraulic line (74) and whose other output is connected to the lower chamber (25) of the second cylinder through another hydraulic line (73, 85) and in relation to these, there is an additional auxiliary servo motor (80); an additional hydraulic pump (81) which is driven by said additional auxiliary servo motor (80) and whose one output is connected to the lower chamber (25) through a hydraulic line (83, 85) and whose other output is connected to the input of the related hydraulic pump (71) through another hydraulic line (73).

7. A press according to Claim 6, characterized in that said electronic control unit does not energize the main and the auxiliary servo motor (70, 80) in the free fall step.

8. A press according to Claim 6, characterized by comprising an oil tank (82) which is related to the hydraulic pump (81) driven by said auxiliary servo motor (80).

9. A press according to any of the claims between Claim 6 and 8, characterized in that in the pressing step, said electronic control unit operates the main servo motor (70) so that the oil in the lower chamber (23) is suctioned by the related hydraulic pump (71) and so that said oil is applied to the upper chamber (24); and said electronic control unit operates the auxiliary servo motor (80) so that the oil in said oil tank (82) is suctioned by the related hydraulic pump (81) and so that said oil is applied to the suctioning of the hydraulic pump (71) driven by the main servo motor (70) through the related hydraulic line (83, 73).

10. A press according to any of the claims between Claim 6 and 9, characterized in that in the return step, the electronic control unit operates the main servo motor (70) so that the oil in the upper chamber (24) is suctioned by the related hydraulic pump (71) and so that said oil is applied to the lower chamber (23) and said electronic control unit operates the auxiliary servo motor (80) so that oil in said oil tank (82) is suctioned by the related hydraulic pump (81) and so that said oil is applied to the lower chamber (25) through the related hydraulic line (83, 85).

11. A press according to any of the preceding claims, characterized in that, the electronic control unit operates the main servo motor (40) related to the first cylinder (10) according to the position data (Z1) received from a related end of the ram (110) and the auxiliary servo motor (50) is synchronized with the main servo motor (40).

12. A press according to any of the preceding claims, characterized in that the electronic control unit operates the main servo motor (70) related to the second cylinder (20) so that the position data (Z2) received from the opposite end of the ram will be equal to the position data (Z1) received from the other end, and the electronic control unit synchronizes the auxiliary servo motor (80) regarding the second cylinder with the main servo motor (70).

13. A press according to any of the preceding claims, characterized by comprising motor drivers which drive each servo motor (40, 50, 70, 80) and which provide communication with the electronic control unit.

1/2

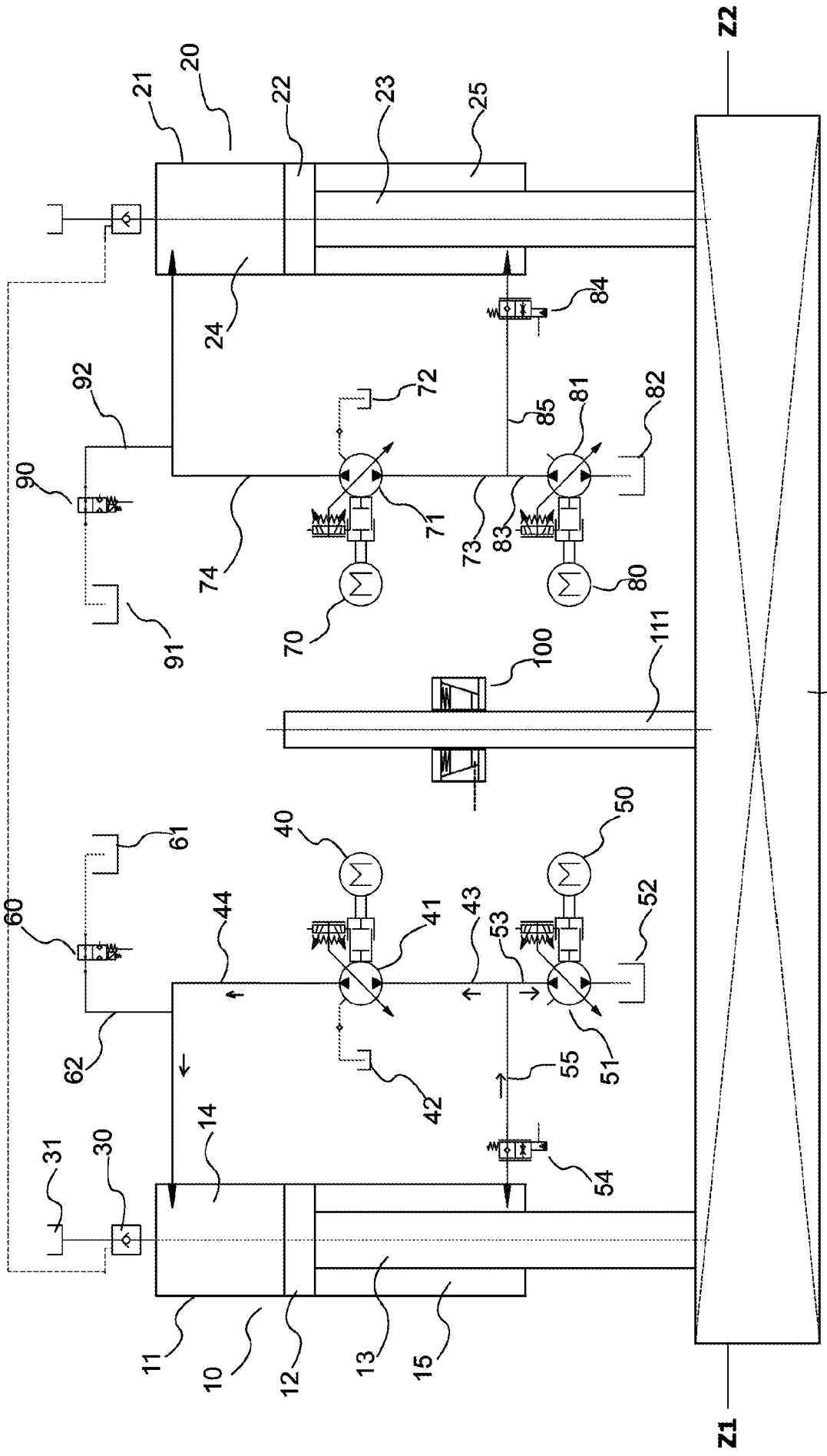
Z2
Z1
21
20
22
23
25
24
84
92
72
85
81
82
90
74
71
73
83
80
70
91
100
111
110
61
40
50
60
44
41
43
53
52
62
42
55
51
14
31
30
54
11
10
12
13
15

Figure 1

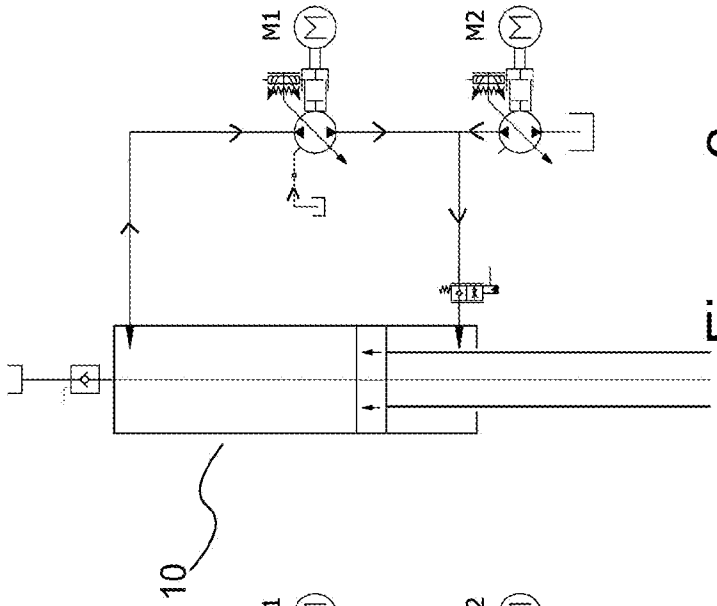

Figure 2c

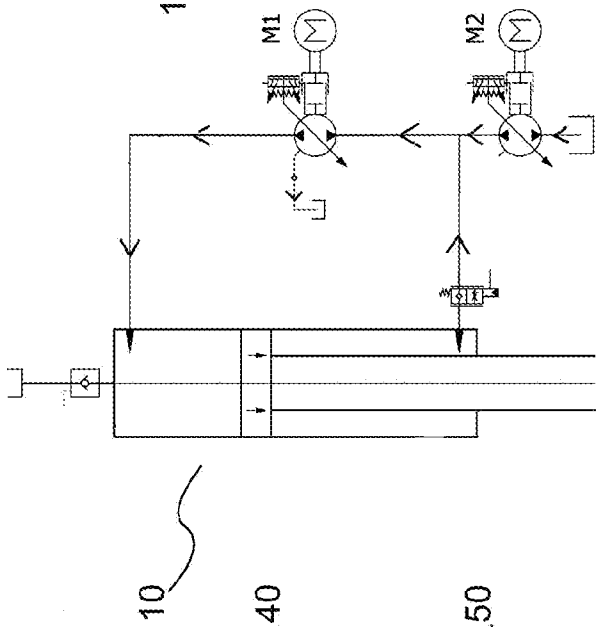

Figure 2b

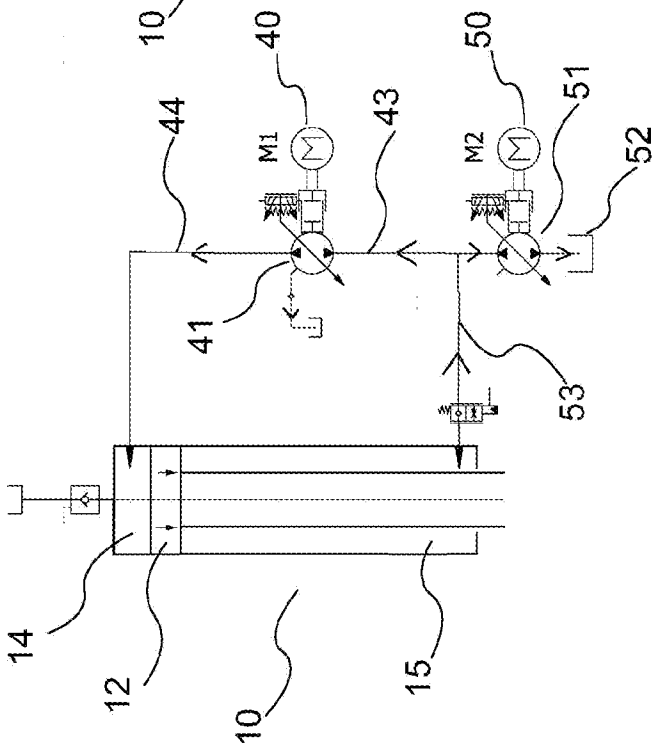

Figure 2a

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/057395

A. CLASSIFICATION OF SUBJECT MATTER
INV. B30B15/16 B30B15/24
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B30B B21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 641 644 A1 (MUELLER WEINGARTEN MASCHF [DE]) 8 March 1995 (1995-03-08) column 4, line 26 - column 10, line 43; figure 1	1-3,6-8, 11-13
X	DATABASE WPI Section PQ, Week 7937 Thomson Scientific, London, GB; Class P71, AN 1979-H8941B XP002659940, -& SU 637 282 A1 (SHAKHTINSKI TEKH INST [SU]) 15 December 1978 (1978-12-15) abstract; figure 1	1

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 September 2011	06/10/2011

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Petrucci, Luigi

1

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/057395

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2009/102740 A2 (PARKER HANNIFIN CORP [US]; PERSSON BENGT-GORAN [SE]; VANDERLAAN DALE [) 20 August 2009 (2009-08-20) page 18, line 10 - page 21, line 11; figure 8 page 21, lines 23-32 page 22, lines 5-19	1-4,6-9
A	SCHMIDT S: "ENERGIESPARENDE PRIMAER- UND SEKUNDAERREGELUNG FUER PRESSEN", O + P OLHYDRAULIK UND PNEUMATIK, VEREINIGTE FACHVERLAGE, MAINZ, DE, vol. 41, no. 10, 1 October 1997 (1997-10-01), pages 747-751, XP000720332, ISSN: 0341-2660 page 749, paragraph 8-17; figures 5-6f	1
A	EP 1 232 810 A1 (AMADA CO LTD [JP]) 21 August 2002 (2002-08-21) figure 6	1,11
T	EP 0 116 024 A1 (PALMERS GORAN) 15 August 1984 (1984-08-15) the whole document	

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2011/057395

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0641644 A1	08-03-1995	CA 2131228 A1	03-03-1995
		DE 4429782 A1	09-03-1995
		JP 7155999 A	20-06-1995
		US 5568766 A	29-10-1996
SU 637282 A1	15-12-1978	NONE	
WO 2009102740 A2	20-08-2009	EP 2252799 A2	24-11-2010
		KR 20100116664 A	01-11-2010
		US 2011030364 A1	10-02-2011
EP 1232810 A1	21-08-2002	CN 1402656 A	12-03-2003
		DE 60022383 D1	06-10-2005
		DE 60022383 T2	09-03-2006
		WO 0134317 A1	17-05-2001
		TW 491738 B	21-06-2002
		US 6874343 B1	05-04-2005
EP 0116024 A1	15-08-1984	BR 8407206 A	05-11-1985
		DE 3466157 D1	15-10-1987
		EP 0164345 A1	18-12-1985
		JP 60500727 T	16-05-1985
		SE 437861 B	18-03-1985
		SE 8300567 A	04-08-1984
		WO 8403127 A1	16-08-1984
		US 4707988 A	24-11-1987