



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
11.08.2004 Bulletin 2004/33

(51) Int Cl.7: **B21D 28/00**, B21D 28/24,
B21D 28/26

(21) Application number: **04075318.8**

(22) Date of filing: **03.02.2004**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT RO SE SI SK TR**
Designated Extension States:
AL LT LV MK

(72) Inventor: **Battaglia, Ruggero**
36045 Lonigo (VI) (IT)

(74) Representative: **Mittler, Enrico et al**
Mittler & C. s.r.l.,
Viale Lombardia, 20
20131 Milano (IT)

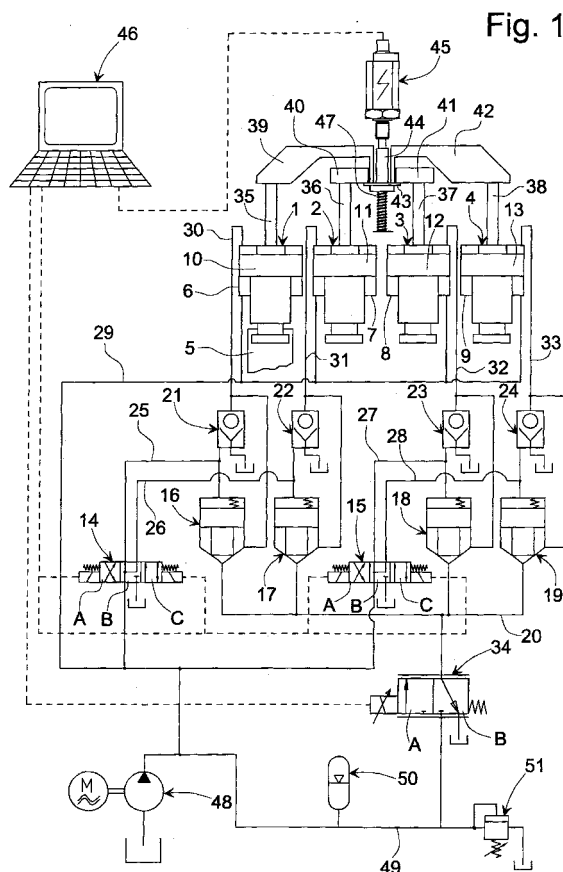
(30) Priority: **07.02.2003 IT MI20030217**

(71) Applicant: **SALVAGNINI ITALIA S.p.A.**
I-36040 Sarego (Vicenza) (IT)

(54) **Device for the detection of the position of punches in a sheet metal punching machine with several punches**

(57) A device for the detection of the position of punches (5) in a sheet metal punching machine with a plurality of punches is described. The device comprises a single position transducer (45) which is operatively

coupled to all the aforesaid pistons (10-13) in unidirectional way so as to follow the punching movement of any piston (10-13), while the other pistons (10-13) remain in rest position.



Description

[0001] The present invention concerns a device for the detection of the position of the punches in a sheet metal punching machine with several punches.

[0002] In the field of sheet metal working the use of punching machines that provide to the execution of holes with opportune shape and position is known.

[0003] In particular punching machines with multipress head are known, that are made up of a plurality of hydraulic presses, one near the other, each one of which controls the vertical motion of a single punch.

[0004] The main advantage of this constructive system resides in that all the different punches that must be used in sequence in order to complete the punching working of a piece are available and ready to operate, without need to carry out any tool change operations during the production cycle; an improved productivity of the machine is therefore obtained, because the operations of substitution of the tools are avoided during the cycle and the total length of the distance that the piece, displaced by a manipulator along two directions perpendicular to each other, must cover in order to allow the execution of all the workings required on its surface is reduced.

[0005] In modern punching machines of this type, operating by numerical control, it is important to carry out the detection of the position of the punch each time being used. In the case of multipunch machines this would imply to use a position transducer for each punch. Such solution would involve great complexity and high cost of the machine.

[0006] In view of this state of the art, the object of the present invention is to provide a device for the detection of the position of the punch, that is usable for a plurality of punches of a machine with a number of punches of the aforesaid type.

[0007] According to the invention such object is attained with a device for the detection of the position of punches in a sheet metal punching machine comprising a plurality of punches controlled by respective pistons, characterised in that it comprises a single position transducer that is operatively coupled to all the aforesaid pistons in unidirectional way so as to follow the punching movement of any piston, while the other pistons remain in rest position.

[0008] These and other characteristics of the present invention will be made more evident by the following detailed description of an embodiment thereof that is illustrated as a non limiting example in the enclosed drawings, in which:

Figure 1 shows the embodiment of principle of a control device for multipunch punching machine provided with a detection device according to the present invention;

Figure 2 shows the same device in the stage of pre-setting of the pistons for the descent;

Figure 3 shows the same device in the stage of execution of the descent of one of the pistons;

Figure 4 shows the same device in the stage of regulated ascent of the same piston.

[0009] In figure 1 a set of presses 1-4 for the control of respective punches 5 (only one shown) of a punching machine with several punches is shown.

[0010] Each press 1-4 is made up of a hydraulic cylinder 6-9 and of a piston 10-13 to which a respective punch 5 is fastened.

[0011] From the piston 10-13 a stem 35-38 extends upward onto which an arm 39-42 that projects laterally is fastened. The arms 39-42 of all the pistons 10-13 rest on a same plate 43 which is fastened in the mobile part 44 of a position transducer 45 connected with an electronic control unit 46. The plate 43 is thrust upward by a spring 47.

[0012] In addition in figure 1 a hydraulic control circuit is shown which comprises a servovalve 34 with outlet connected with the lower chambers of logical elements 16-19 by a duct 20 and pre-setting valves 14-15 connected, downstream, with the upper chambers of the logical elements 16-19 and with control inlets of nonreturn valves 21-24 by ducts 25-28 and, upstream, with the bottom chambers of the hydraulic cylinders 6-9 by a duct 29.

[0013] The upper chambers of the hydraulic cylinders 6-9 are connected with the nonreturn valves 21-24 and with lateral chambers of logical elements 16-19 by ducts 30-33.

[0014] The duct 29 of the hydraulic circuit is supplied by a pump 48 which is connected by a duct 49 with the inlet of the servovalve 34, with a pressure accumulator 50 and with a safety valve 51.

[0015] The servovalve 34 and the pre-setting valves 14-15 are controlled by the control unit 46.

[0016] The hydraulic circuit in Figure 1 is shown in the stand-by condition in which it is found when the servovalve 34 is in position B and the pre-setting valves 14-15 are in the stand-by position B. In such situation, the connection between the lower chambers and the lateral chambers of the logical elements 16-19 is closed; the nonreturn valves 21-24 are in the opening position, therefore the upper chambers of the cylinders 6-9 are connected to discharge. The pistons 10-13 are kept raised in the position of upper stroke end by the pressure of the pump 48, supplied to the lower chambers of the cylinders 6-9.

[0017] In figure 2 the hydraulic circuit is shown in the condition in which the position B 34 of the servovalve and the position A of the pre-setting valve 14 cause the pre-setting of the piston 10 and the relative punch 5 to the descent. Such pre-setting is generated by the closing of the nonreturn valve 21, whose control inlet is connected to discharge. The piston 10 is ready to receive pressure on the upper face. In this situation the nonreturn valves 22-24, the pre-setting valve 15 and the pis-

tons 11-13 are in the condition of Figure 1.

[0018] In Figure 3 the hydraulic circuit is shown in the condition in which the operating position A of the servovalve 34 and the operating position A of the pre-setting valve 14 cause the descent of the piston 10. Such movement is generated by the increase in pressure of the upper chamber of the hydraulic cylinder 6, due to the lifting movement of the logical element 16, caused by the discharge of the upper chamber of the same logical element 16. The lower chamber of piston 10 remains in pressure, but its thrust area is smaller than the one of the upper chamber so that the net force on the piston 10 is as a result directed downward. In this operating condition the non-return valve 21 is closed; the non-return valves 21, 23 and 24, the pre-setting valve 15 and the pistons 10, 12 and 13 are in the condition of Figure 1.

[0019] In Figure 4 the hydraulic circuit is shown in the condition in which the servovalve 34 is in a position comprised between A and B. By adjusting the opening of the servovalve 34 the pressure of the upper chamber of the piston 10 gets adjusted, thus obtaining the possibility to arrest the same piston 10 in any mid position and also to make it go back upward, thus adjusting its speed both in descent as well as in ascent. The regulation is always meant as being carried out by the control unit 46, that receives in input the value of the position of the transducer 45, it calculates the speed and it consequently adjusts the extent of opening of the servovalve 34.

[0020] The descent of the piston 11 is controlled in similar way by switching the valve 14 in position C from the situation in Figure 1 to the one in Figure 2.

[0021] The descents of the pistons 12 and 13 are thus controlled in turn by switching the valve 15 in the positions A and C, respectively.

[0022] It must be noticed that, whereas in the example shown in the figures the pistons are rendered with punching movement from the top to the bottom, the invention is applicable in the same way to pistons with inverse movement.

[0023] Similarly, instead of the punches, a similar movement of the dies and relative detection of the same can be provided. Where it is said punches dies must therefore also be meant.

said transducer (45) is unidirectionally coupled to all of said pistons (10-13) by means of arms (39-42) projecting from said pistons (10-13) that rest on a common mobile part (44) of said transducer (45).

3. Device according to claim 2, **characterised in that** said common mobile part (44) is made up of a plate (43) which is elastically biased into rest position.
4. Device according to claim 1, **characterised in that** it comprises a hydraulic control circuit provided with pre-setting valves (14-15) for the selection of the piston (10-13) being controlled each time.
5. Device according to claim 4, **characterised in that** it comprises the logical elements (16-19) for the control of the operation of the pistons (10-13), selectable by means of said pre-setting valves (14-15).
6. Device according to claim 4, **characterised in that** it comprises one servovalve (34) which is suitable to adjust the pressure of operation of the controlled piston (10-13), thus obtaining the possibility to arrest the piston (10-13) in any mid position and also to make it go back to rest position, thus adjusting its speed.
7. Device according to claims 1 and 4, **characterised in that** said transducer (45) is connected with an electronic control unit (46), that regulates the operation of said hydraulic circuit.

Claims

1. Device for the detection of the position of punches (5) in a sheet metal punching machine comprising a plurality of punches controlled by respective pistons (10-13), **characterised in that** it comprises a single position transducer (45) operatingly coupled to all the aforesaid pistons (10-13) in unidirectional way so as to follow the punching movement of any piston (10-13), while the other pistons (10-13) remain in rest position.
2. Device according to claim 1, **characterised in that**

Fig. 2

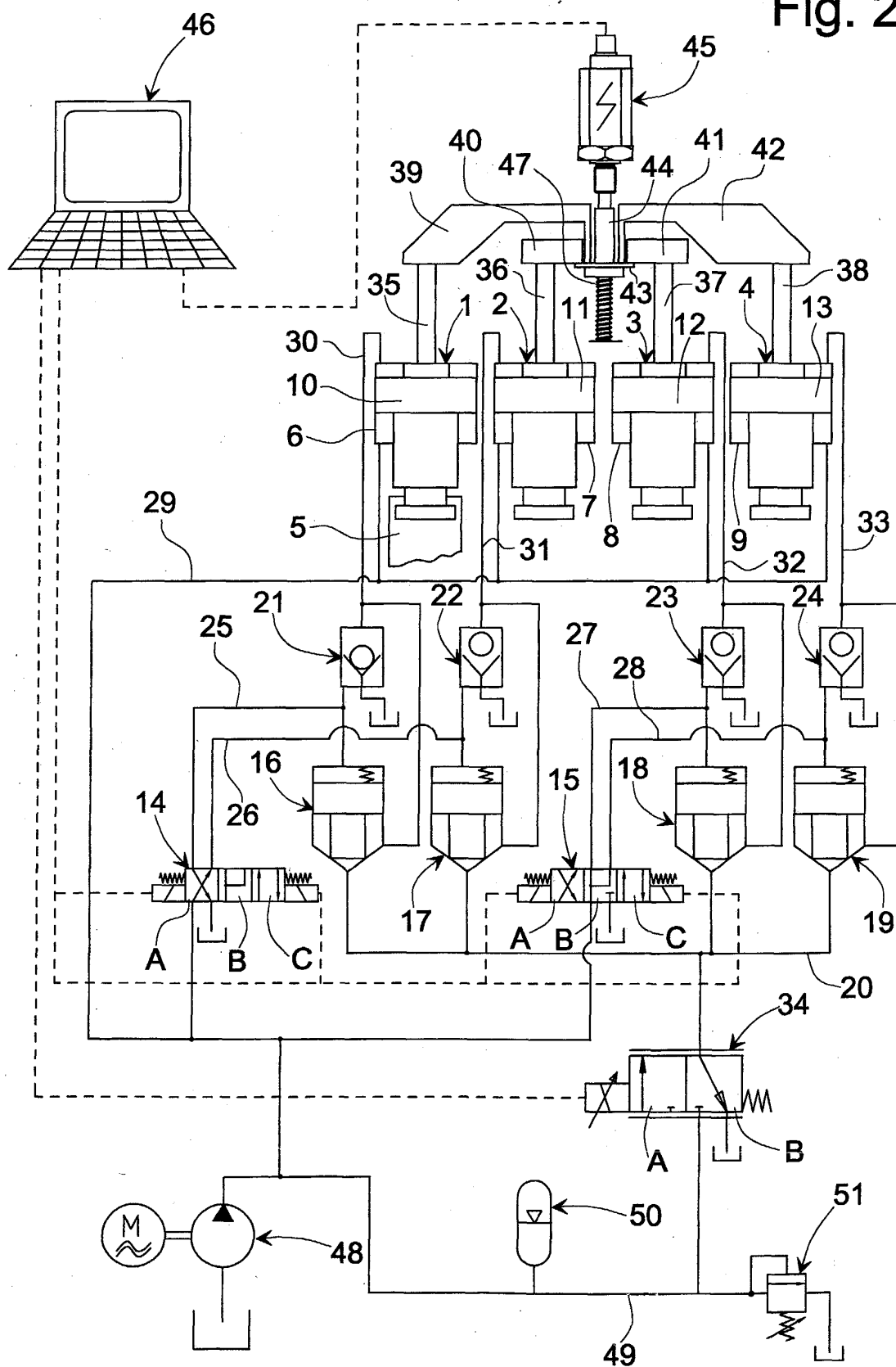


Fig. 3

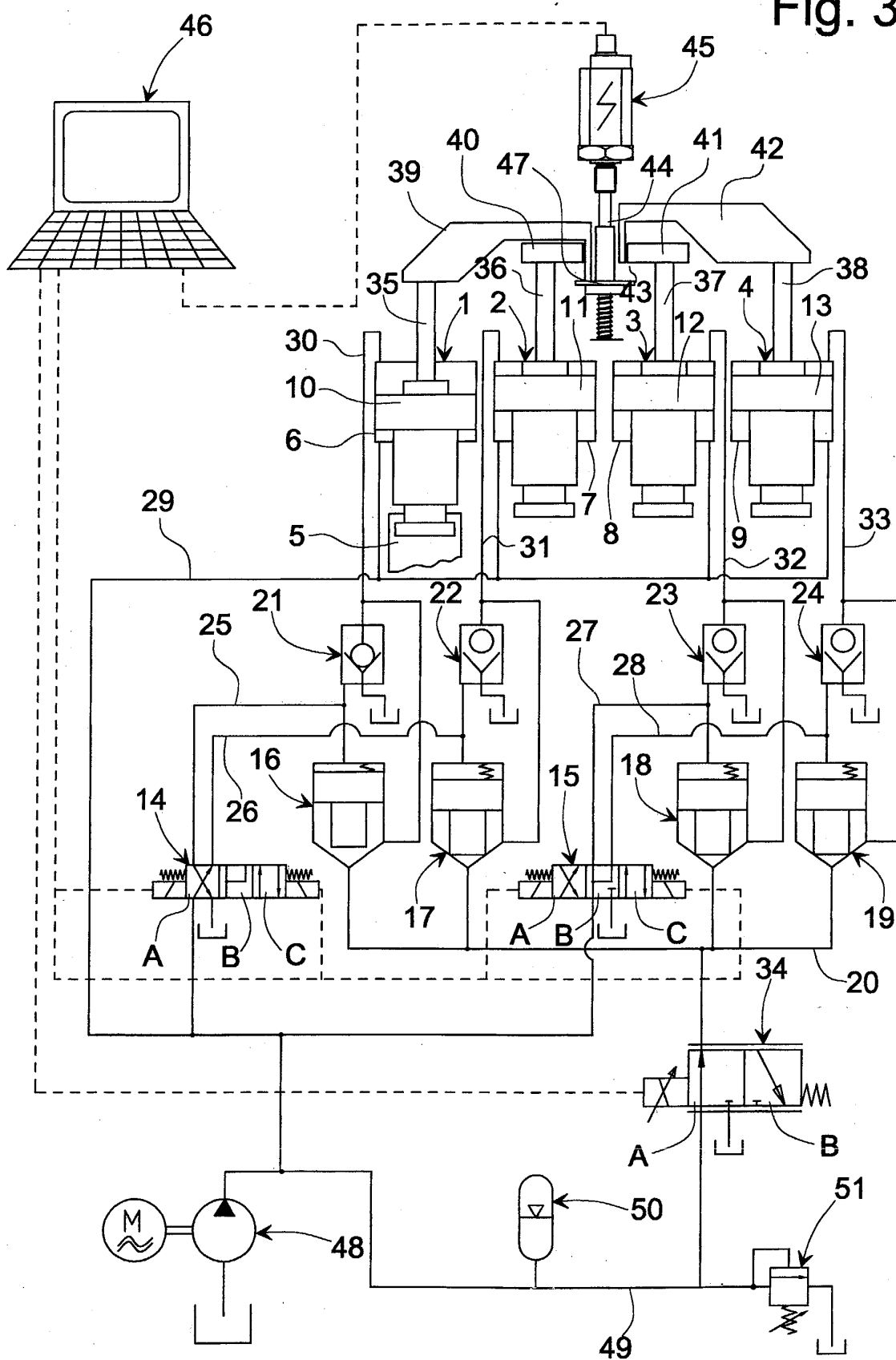
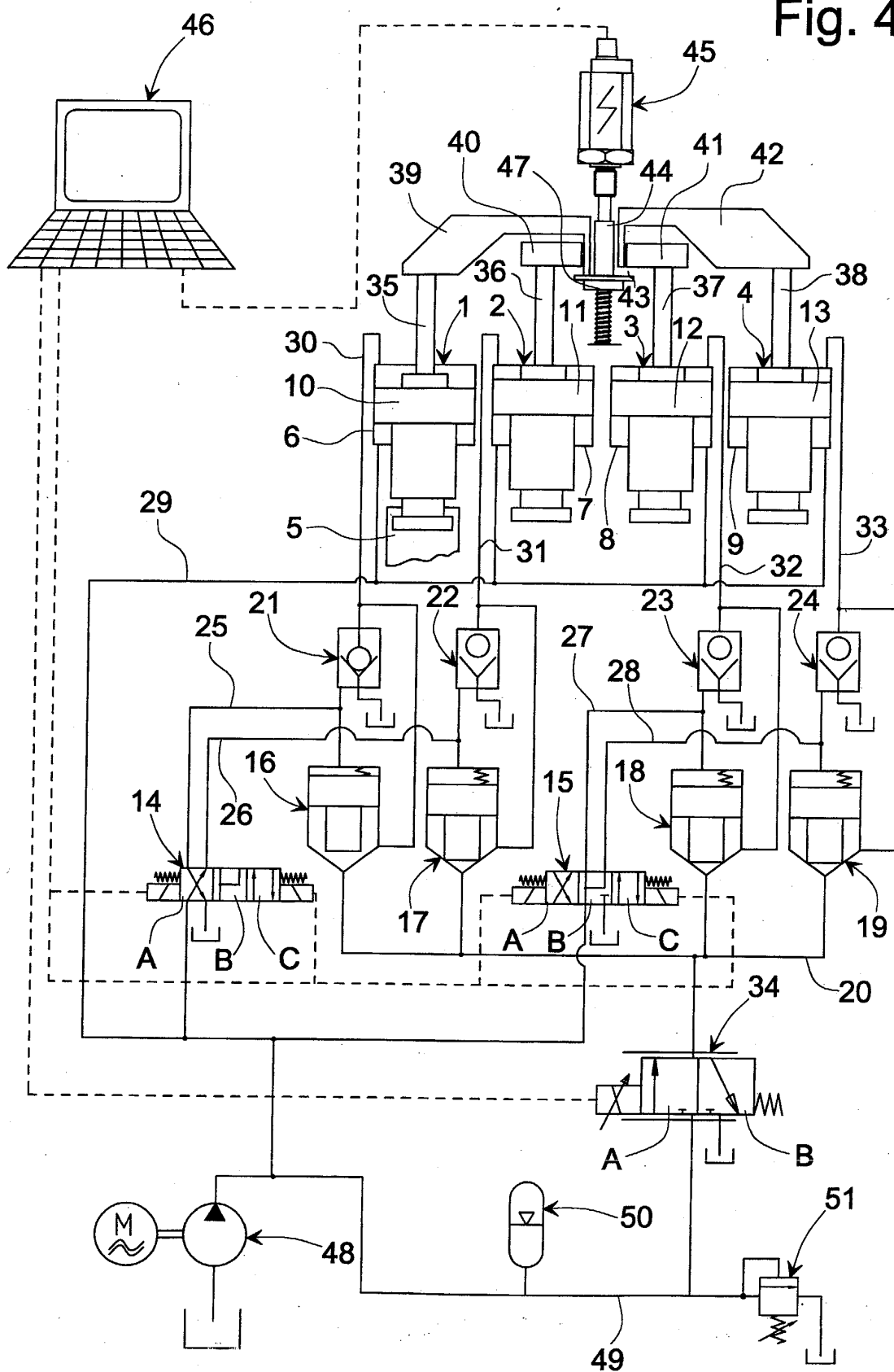


Fig. 4





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 07 5318

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 5 301 585 A (HOSAKA MAKOTO) 12 April 1994 (1994-04-12) * column 2, line 61 - column 3, line 30; figures 1-4 *	1	B21D28/00 B21D28/24 B21D28/26
A	WO 96/26023 A (SAPIM AMADA SPA ;CODATTO ANTONIO (IT)) 29 August 1996 (1996-08-29) * page 6, line 24-26; figure 1 * * page 9, line 10-27 *	1	
A	EP 0 538 725 A (INST TECH PRECISION EL D W) 28 April 1993 (1993-04-28) * column 7, line 56-58; figures 1-4 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B21D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
MUNICH		13 May 2004	Meritano, L
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 07 5318

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

13-05-2004

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
US 5301585	A	12-04-1994	JP	3295105 B2	24-06-2002
			JP	5031597 A	09-02-1993

WO 9626023	A	29-08-1996	IT	T0950136 A1	26-08-1996
			WO	9626023 A1	29-08-1996
			JP	11501870 T	16-02-1999

EP 0538725	A	28-04-1993	JP	3217444 B2	09-10-2001
			JP	5317986 A	03-12-1993
			JP	3285901 B2	27-05-2002
			JP	5104294 A	27-04-1993
			JP	3285904 B2	27-05-2002
			JP	5104297 A	27-04-1993
			CA	2080611 A1	19-04-1993
			DE	69213156 D1	02-10-1996
			DE	69213156 T2	23-01-1997
			DE	69228770 D1	29-04-1999
			DE	69228770 T2	12-08-1999
			EP	0538725 A1	28-04-1993
			EP	0700736 A2	13-03-1996
			KR	9512389 B1	17-10-1995
			KR	9512808 B1	21-10-1995
			US	5526668 A	18-06-1996
			US	5678446 A	21-10-1997
