



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) Publication number:

0 457 251 A1

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: **91107738.6**

(51) Int. Cl.⁵: **B25D 9/14, B25D 9/20**

(22) Date of filing: **13.05.91**

(30) Priority: **14.05.90 ES 9001334**

(43) Date of publication of application:
21.11.91 Bulletin 91/47

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

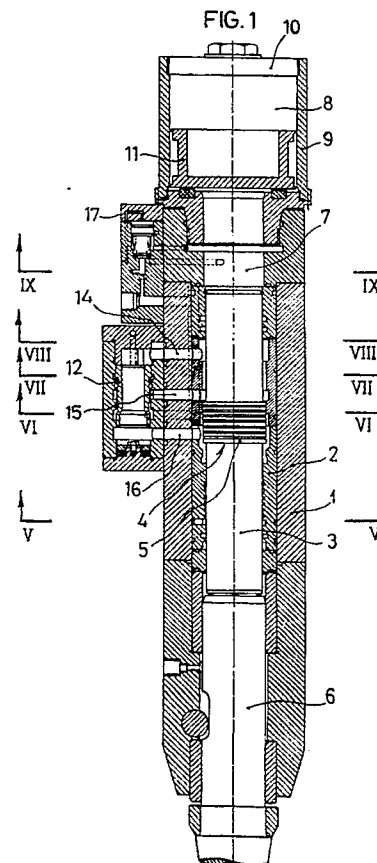
(71) Applicant: **Tapias Puig, Marcelino**
Santa Rita, 42
E-08775 Castellbisbal (Barcelona)(ES)

(72) Inventor: **Tapias Puig, Marcelino**
Santa Rita, 42
E-08775 Castellbisbal (Barcelona)(ES)

(74) Representative: **Klunker . Schmitt-Nilson .**
Hirsch
Winzererstrasse 106
W-8000 München 40(DE)

(54) **Improvements to the manufacture of hydraulic hammers.**

(57) Characterized by there being an assembly comprising a cylinder (1) in which there is a mobile group (3) of components and having replaceable sleeves and carrying at the extremity opposed to the operating or hammer end a chamber of hydraulic fluid (7) capable of receiving and transmitting the force with respect to a gas pressure accumulator (8) coupled to the extremity of the hammer body which latter has attached thereto two valve manifolds (17,12) the first (12) of which contains a hollow slide valve controlling a system of three passages (14,15,16) for conducting hydraulic fluid to the main cylinder and the second (17) holding a system of valves for pressure regulation and safety for the hydraulic fluid chamber (7) which comes between the mobile group of the hammer and the gas pressure accumulator chamber.



EP 0 457 251 A1

This present invention Patent discloses improvements to the manufacture of hydraulic hammers of the type used in Public Works or similar uses where the object is to break up rocks or hard areas of terrain with a view to subsequent Civil construction.

Hydraulic hammers comprise mechanisms which fundamentally consist of a cylinder and piston assembly fed by an hydraulic fluid under high pressure communicating alternately by means of a system of slide valves with one or other side of the piston, causing a percussion movement, or in other words an active impulse on the piston crown and its return movement. The kinetic energy of the reciprocal return movement in each cycle is absorbed by springs.

Improvements in efficiency of hydraulic hammers can be obtained by increasing the rate of percussion in a unit time of operation in working on the terrain in question and also by maintaining a high value of the kinetic energy in the hammer blow on the target spot being worked.

The improvements object of this Patent are designed precisely to achieve a much higher rate of operation of the hydraulic hammer and at the same time to provide characteristics yielding an accumulation of pressure which is obtained by means of a gaseous device of considerable effectiveness and novelty.

Essentially, the improvements object of this patent are based on a design of hydraulic hammer using a cylinder and piston system where the piston stroke is controlled by a slide valve having specific characteristics and such that the entire mobile assembly is acting against a gaseous buffer through an intermediate mass of hydraulic fluid which itself provides refrigeration of the cylinder of the pressure accumulator. This permits operation at high pressures, the high level of heat being evacuated in the cooling hydraulic fluid.

A control and non-return system of valves completes the functional cycle of the hydraulic hammer.

Briefly, these improvements are based on the provision of the high pressure accumulator and hollow piston with a compensated and cooled pressure chamber, with inlet fluid control and pressure valve without membranes but having a high degree of sealing, energy recovery from the piston rebound effect or that of the mobile assembly in the hammer from its striking the breaker tool, this being obtained by the retention of a minimum constant pressure in the interior of the pressure chamber, limiting the rebound and increasing the contact time between the piston and the breaker tool, considerably increasing the impact and the paving breakage effect.

The above results in a higher speed and safety

in the displacement of the mobile masses in the operation of the hydraulic hammer and prevents the missing or stalling which is frequently associated with conventional hydraulic hammers. Also it provides the arrest of operation automatically by means of hydraulic absorption in the event of a hammer operation in free air, as well as an operation without rebound and vibration free, this without springs or mechanical means, and hence absence of breakages in the mechanism.

To assist understanding of this patent explanatory drawings are attached hereto.

Figure 1 shows in longitudinal section an hydraulic hammer embodying the improvements disclosed in this patent.

Figure 2 is a detail in section of the part corresponding to the valve system and the gas pressure accumulator.

Figure 3 is a section in detail of the lower part of the hammer in which the mobile piston makes contact with the mobile punch of the hammer.

Figure 4 is a view of the control valve systems incorporating the improvements.

Figures 5,6,7,8 and 9 are details in section on the planes so indicated.

As is shown in the drawings the improvements object of this patent comprise the construction of the hydraulic hammer consisting of a monoblock -1- with internal replaceable sleeves -2- within which the mobile assembly or piston -3- moves, this latter having a sealing zone or head -4- of a slightly larger diameter with a multiplicity of sealing ring grooves -5-. This mobile assembly makes contact at its lower end with the extremity of the striker punch -6- and at the other end, through a mass of hydraulic fluid filling the chamber -7-, transmits its kinetic energy, receiving the opposed force of a gas pressure accumulator, consisting of the chamber -8- enclosed by the high strength external cylinder -9- and the welded upper capping -10- within which can move a hollow piston -11- which is able to transmit and receive the compressive action of the gas held in the said chamber -8-.

A slide valve -12- housed in the lateral manifold -13- determines the charge and discharge cycle to one or other of the two faces of the mobile assembly -3- and this permits, jointly with the operation of the pressure accumulator the repeated high speed work cycle of the hammer. The manifold communicates with the cylinder -3- through passages -14-, -15 and -16-.

Another lateral body -17- contains the inlet and outlet control valves governing also the maintenance of pressure in the chamber -7-, intermediate between the mobile assembly and the pressure accumulator.

As can be seen in figure 2, the slide valve -12- is hollow having an axial bore -18- with a widening

of the diameter at the lower end -19-, another at the upper end -20- and a third, less wide -21- at an intermediate level. An hydraulic damper or buffer zone -22- is shown schematically by dotted lines and is designed to act on the mobile body of the slide valve at the extremity corresponding to the widening -20-.

The upper chamber -22- communicates directly with the channel -14- and the body -13- in the interior of which valve -12- can move, the valve body periphery having recesses -24-, -25-, -26-, intercommunicating, and which in conjunction with the external profiles on the valve and the said communicating passages provide the means of inlet and discharge of fluid to the main cylinder through the intermediate channelling presented by the peripheral recesses -27-, communicating with the lower passage -16-; -28-, communicating with the intermediate passage -15-, and -29- which communicates with the upper passage -14-, with the recess -30-, which is in communication with the recessed zone -28-.

The series of recesses and passages shown above provide for the successive charge and discharge of the hydraulic fluid under pressure to one or other of the two faces, determined by the widened section or piston -4-, giving the cyclic action of the hydraulic hammer.

To obtain a correct operation of the system, given the high pressures in the pressure chamber and in the accumulator and the high number of cycles per minute, a constant and adequate circulation of hydraulic fluid is required in the interior of the pressure chamber in order to provide sufficient cooling. To satisfy this requirement the improvements in this patent include a valve block -17- containing three valves -31-, -32-, and -33-, interconnected as can be seen in the drawings - the valve -31- regulating the pressure in both directions to a value of approximately 20 bars, with valve -32- being a high precision controlled non - return valve with valve -33- being a discharge control and relief valve.

Valve -31- receives the pressure directly of the fluid at entry to the hammer from the hydraulic pump feeding the hammer and regulates the pressure to a predetermined level, normally some 20 bars as well as the flow required to the pressure chamber, this, without altering the pressure or the flow in the main circuit.

Valve -32- closes off the pressure to the valve -31- when the accumulated pressure discharges to the pressure accumulator in the interior of the chamber and there is an excess of pressure above the set level of the feed valve -31-.

The pre-set valve -33- controls the pressure required at the pressure chamber during discharge of the pressure built up in the pressure accumula-

tor, thus ensuring the precise and constant pressure differential between maximum and minimum levels in the interior of the chamber and controlling the circulation of the hydraulic fluid which cools the pressure chamber. It acts as a relief safety valve in the case of an excess pressure.

As can be seen in the drawings a main channel -34- feeds through passage -35- to the cylinder -36- in which the valve -31- operates, this valve communicating with the inclined passage -37- through to an axial passage or collector -38- which is in communication with the hammer body through another longitudinal passage -39-. Valves -31- and -32- are interconnected by the passage -40-.

The longitudinal channel or collector -39- is in communication radially on different planes, as may be seen, through the radial channels -41-, -42-, -43- and -44-.

The hammer incorporating the improvements herein described is put into operation by exerting a slight pressure on the breaker tool or bit, thus causing the opening of access of fluid to the control valve when the mobile assembly referred to above is in a position open to the lower part of the piston, forcing it to the top of its stroke where the pressure chamber is situated and which maintains a controlled constant pressure in which the hammer piston is inserted and which on being under the pressure of the hydraulic fluid advances to within the chamber forcing the fluid therein to the upper part where the piston pressure accumulator is located, this causing a multiplying effect on the pressure due to the ratio of the areas of the pressure surfaces of the hammer piston and the accumulator. This differential being approximately 1:5 resulting in that between the pressure chamber and the piston accumulator some 500 cm³ of hydraulic fluid are retained. The pressure can be easily regulated by means of controlling the pressure of nitrogen in the accumulator chamber over a wide range of operating requirements depending on the type of surface that the hammer has to cope with.

The application of these improvements offers many advantages including the increased speed and safety on the movement of the mobile assembly, the low flow and pressure required for its operation, being between 40 and 60 l/min. and 80 bars pressure. Also an operation without rebound and vibration free and no requirement for springs or similar components. Wear and tear is less, time and man-hours decreased, maintenance is lower and repairs can be carried out simply by replacing the sleeves and block units. Equally advantageous is the forced cooling of the fluid in the chamber between the blocks and the sleeves of the hammer.

Anything not altering, modifying or changing the essence of these improvements is a variable

for purposes of this Invention Patent.

Claims

1. Improvements to the manufacture of hydraulic hammers characterized in there being an assembly comprising a cylinder in which is a mobile group of components, and having replaceable sleeves and carrying at the extremity opposed to the hammer operating end a chamber of hydraulic fluid capable of receiving and transmitting the force with respect to a gas pressure accumulator coupled to the extremity of the hammer body, which latter has attached thereto two valve manifolds the first of which contains a hollow slide valve controlling a system of three passages for conducting hydraulic fluid to the main cylinder, the second holding a system of valves for pressure regulation and safety for the hydraulic fluid chamber which is between the rear part of the mobile group of the hammer and the pressure accumulator chamber. 5 10 15 20
2. Improvements to the manufacture of hydraulic hammers as in claim 1, characterized in that the hollow slide valve has diametric expansions at each extremity and another of lesser expanded diameter at an intermediate position, having movement within its containing body which body is provided with three lateral passages communicating with the hammer cylinder located respectively at the part corresponding to the lower zone of the main piston for the return movement with the two other passages in communication with recesses in the cylinder, these being intercommunicating. 25 30 35
3. Improvements to the manufacture of hydraulic hammers as in claim 2, characterized in that the upper passage of the distribution valve body opens into a chamber at the end into which due to a mechanical stop the slide valve body does not have access and in which are located hydraulic dampers which act on the slide valve itself. 40 45
4. Improvements to the manufacture of hydraulic hammers as in claim 2, characterized by the provision of recesses in the cylinder in which the slide valve operates and which are mutually in communication through recesses of lesser diameter and which correspond generally with the three zones of greater diameter in this valve. 50 55
5. Improvements to the manufacture of hydraulic hammers as in claim 1, characterized by it comprising a gas pressure accumulator in the form of a cylinder in the end of the hammer body with a hollow piston which can move within it with one of its faces subject to the action of compressed nitrogen and the other the hydraulic fluid from the intermediate chamber between the mobile assembly and the accumulator, the oil fluid acting as a means of refrigeration for the pressure accumulator.
6. Improvements to the manufacture of hydraulic hammers as in claim 1, characterized in that the set of control and safety valves for the refrigerant hydraulic oil includes a first pressure regulation valve, a controlled non return valve and a third valve for discharge and safety interconnected with the pressure supply to the hammer and also interconnected across the controlled safety relief valve with the discharge.
7. Improvements to the manufacture of hydraulic hammers as in claim 6 characterized in that the valve which regulates the pressure control takes its pressure directly from the supply line to the hammer and is set at a predetermined value of pressure.
8. Improvements to the manufacture of hydraulic hammers as in claim 6, characterized in that the non-return valve is designed to actuate the closure of the entry to the pressure regulation valve when the pressure accumulator discharges.

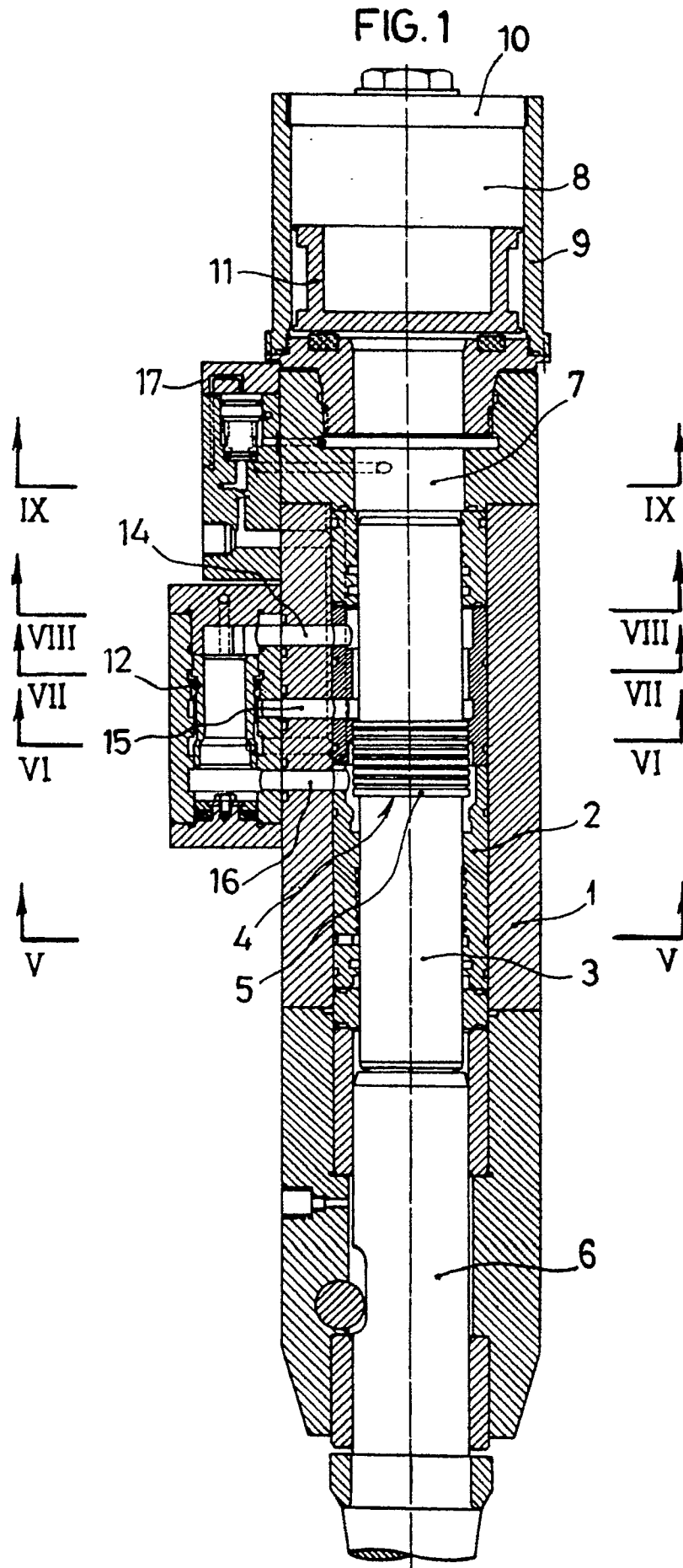


FIG.2

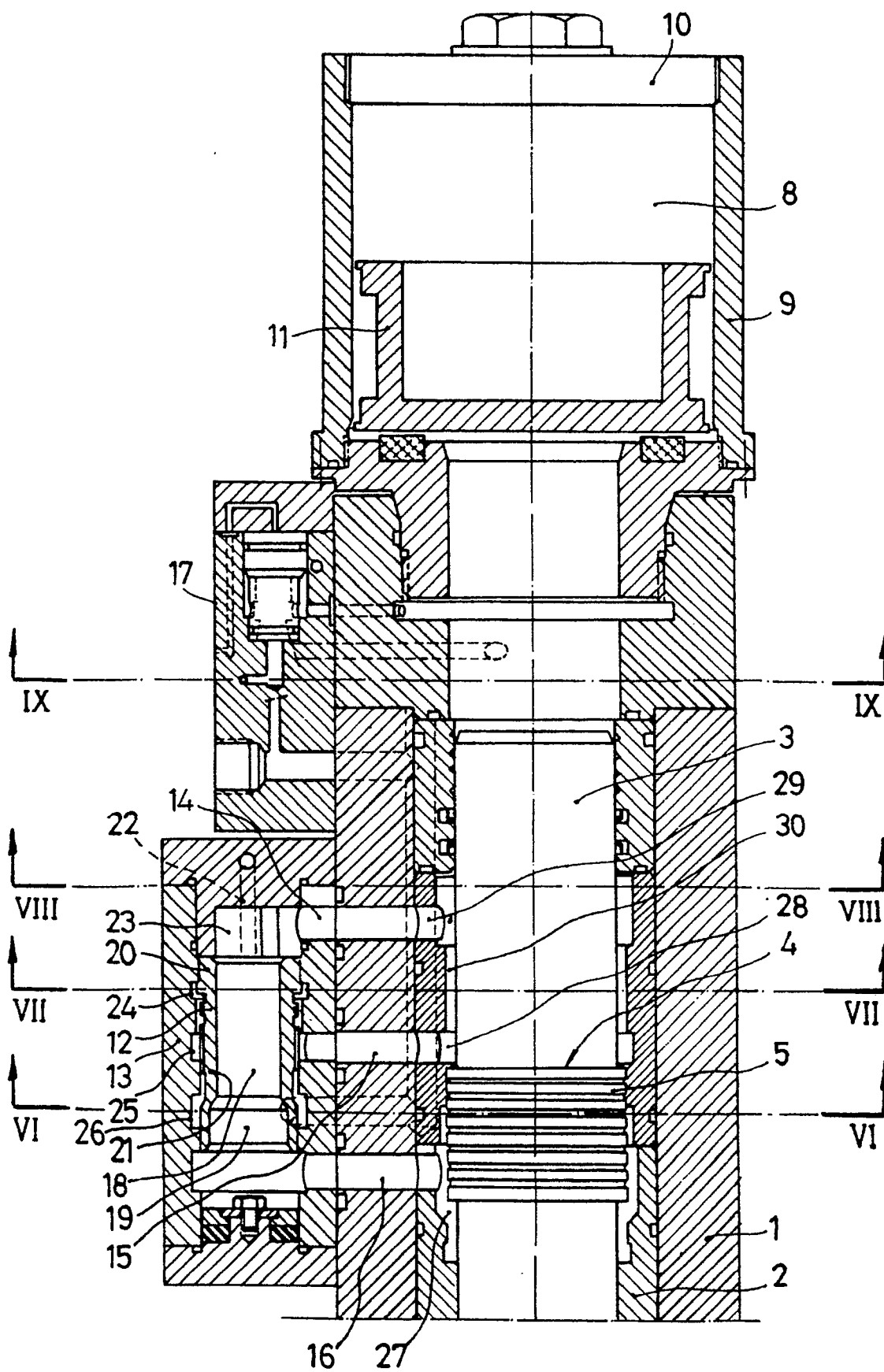


FIG.3

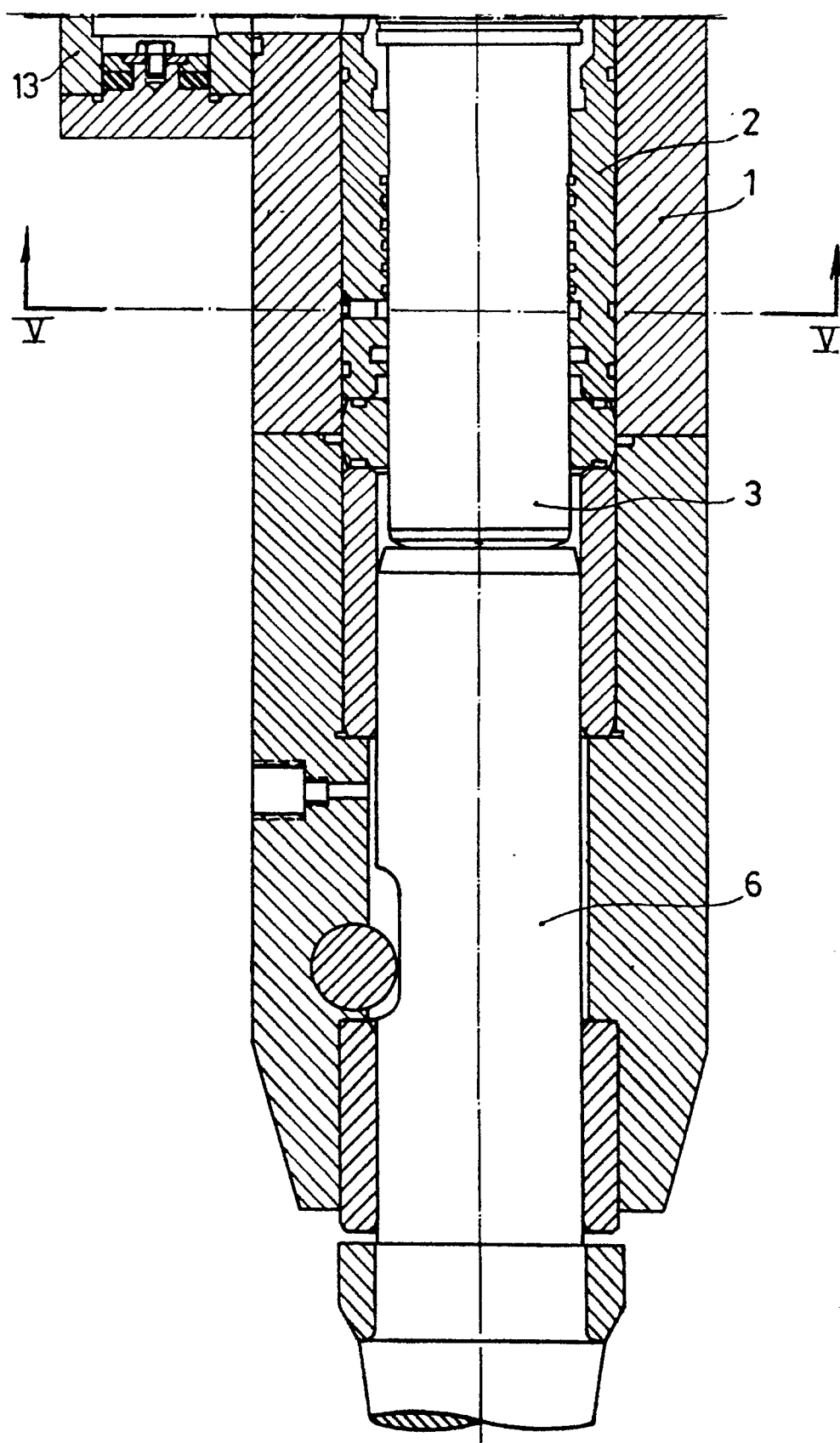


FIG. 4

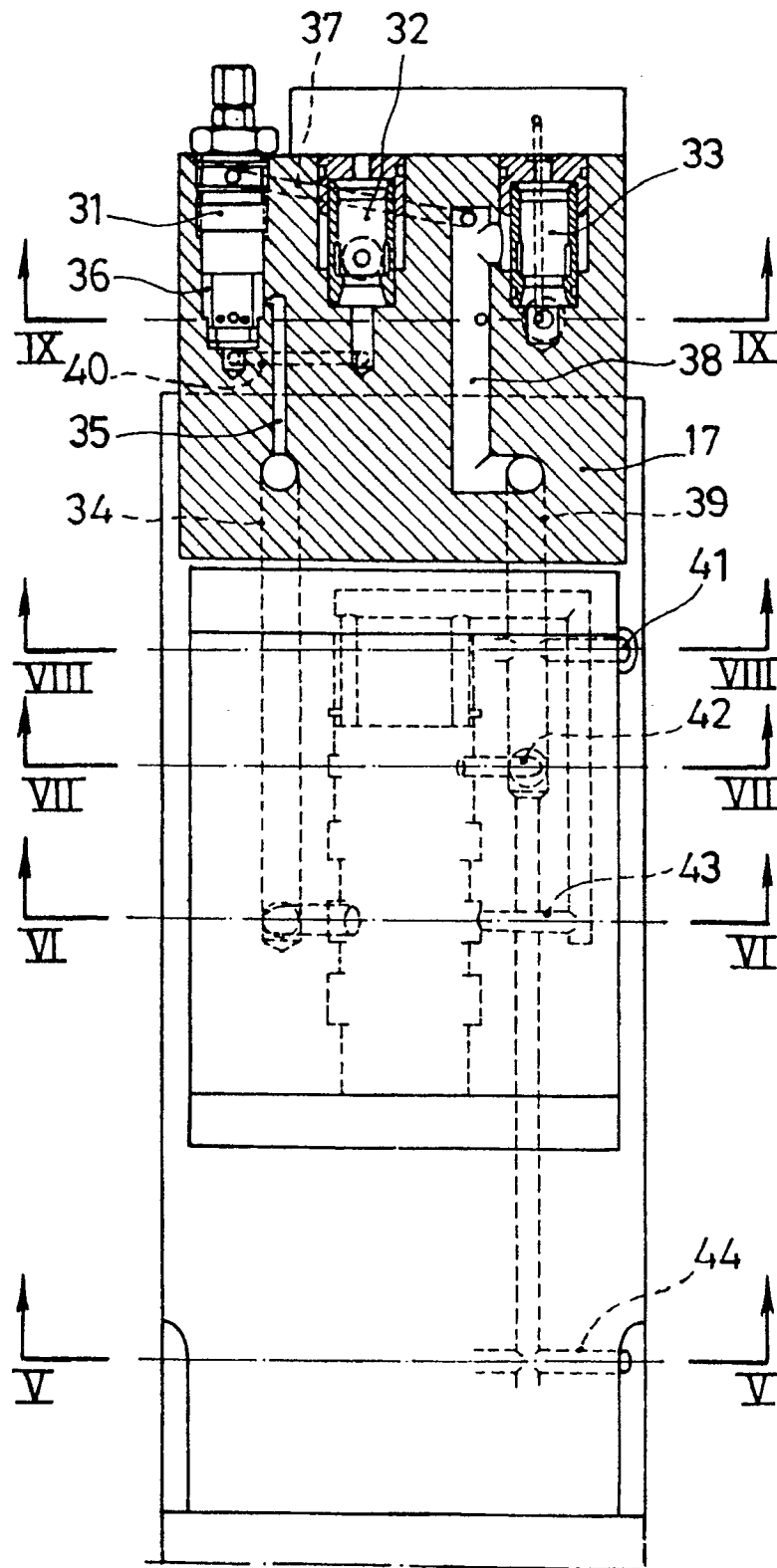


FIG. 5

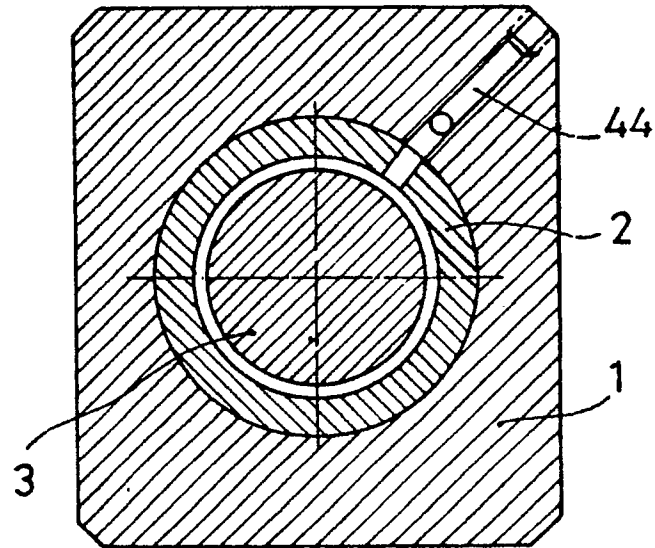


FIG. 6

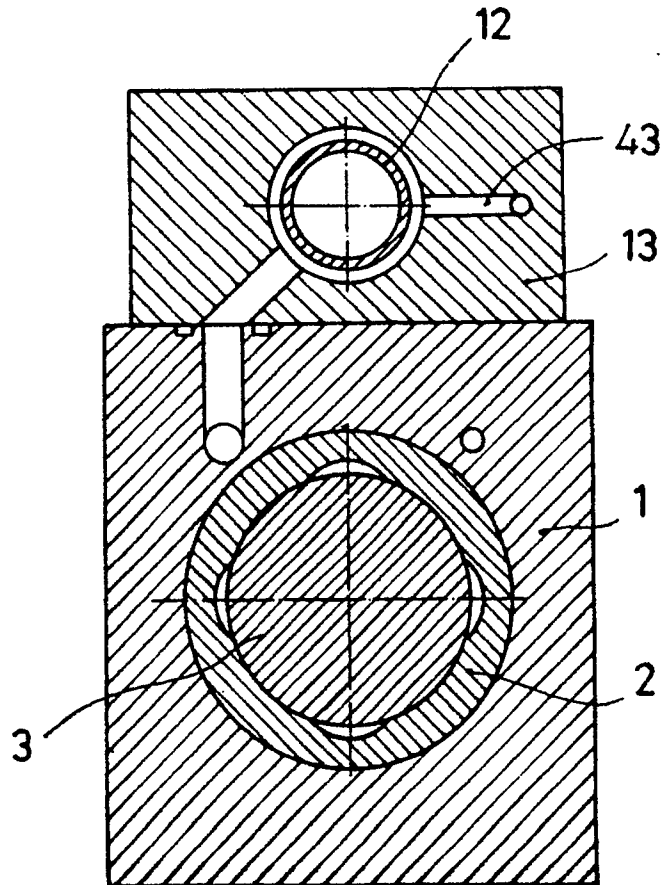


FIG.7

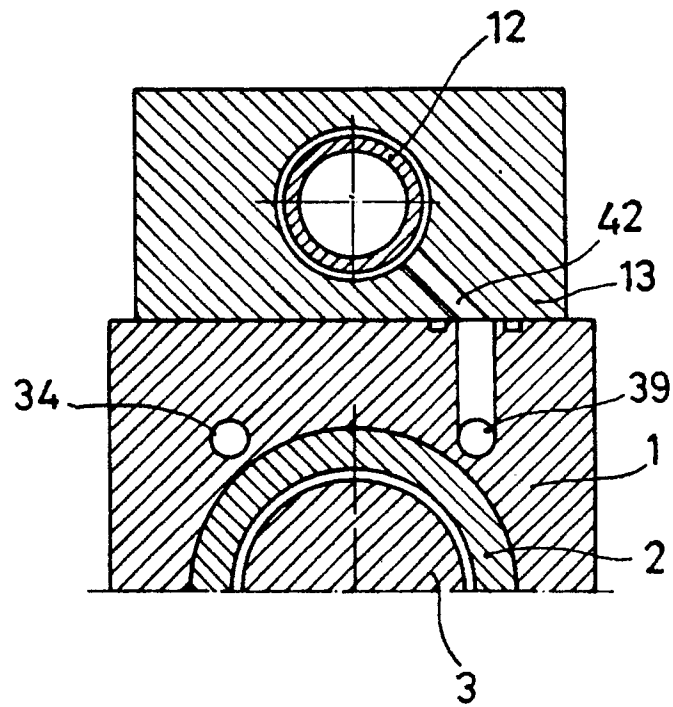
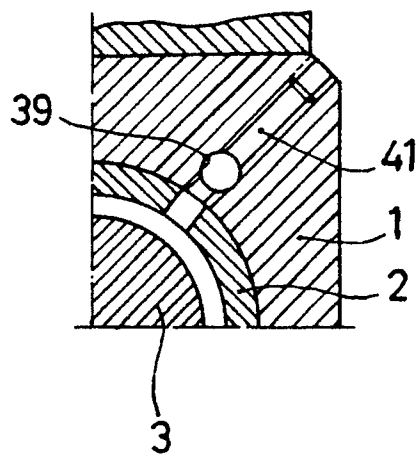
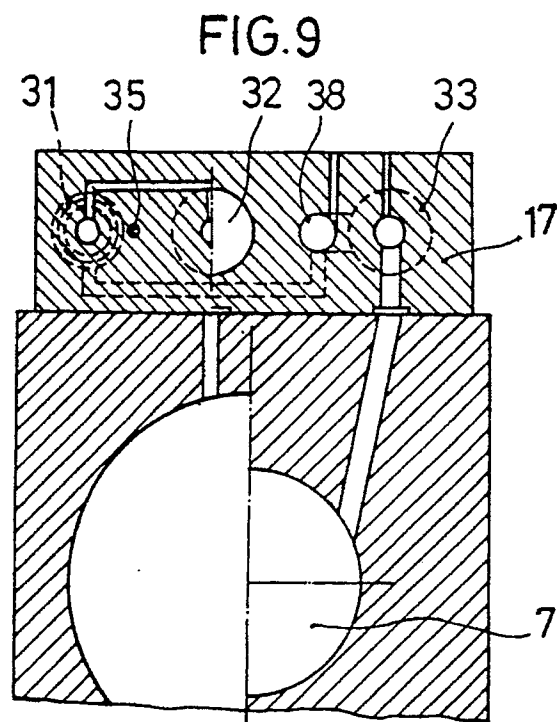


FIG.8







European
Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 10 7738

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.5)
A	EP-A-0 256 955 (MONTABERT) * Abstract; figures * - - -	1	B 25 D 9/14 B 25 D 9/20
A	US-A-3 741 316 (ALAJOUANINE) * Abstract; figures * - - -	1	
A	FR-A-2 248 122 (SVENSKA HYMAS) * Claims; figures * - - -	1	
A	US-A-3 774 502 (ARNDT) * Abstract; figures * - - - - -	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E 21 C B 25 D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of search 14 August 91	Examiner WEIAND T.
CATEGORY OF CITED DOCUMENTS 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 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			