(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 377 255 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **89203297.0**

(51) Int. Cl.[5]: **E21B 33/05, E21B 33/16**

(22) Date of filing: **22.12.89**

(30) Priority: **02.01.89 FR 8900062**

(43) Date of publication of application:
11.07.90 Bulletin 90/28

(84) Designated Contracting States:
DE FR GB IT NL

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(54) Cementing head for oil wells.

(57) The invention relates to a cementing head for oil wells or the like, comprising a body (11) adaptable by a connecting means (2) on the upper end of a casing (II) placed inside the well, and means (I) for connecting the head with a supply station supplying at least one fluid under pressure, this cementing head comprising a tubular magazine or container (11), open at its lower (δ) end, extending downwardly from the body in order to be placed at least partly inside the casing (II) with which it creates an annular space (e), at least one plug (A,B,C) mounted in the container with radial elastic deformation prestressing and capable of sealingly occupying the casing after expelling of the container, and an expelling jack (V) for expelling the plug from the container.

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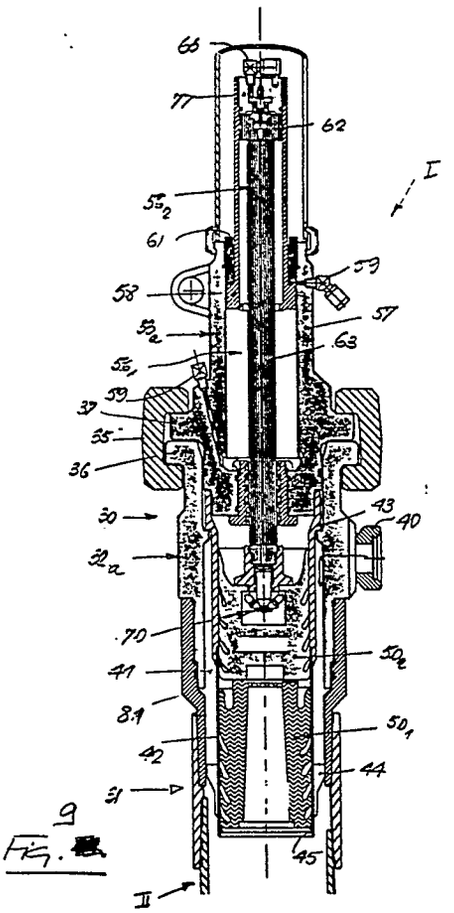
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II

Fig. 9

Cementing head for oil wells.

BACKGROUND OF THE INVENTION

1. Field of the invention

The invention relates to the technical sector of the cementing of the annulus in oil, gas, water, geothermal or other wells.

2. Prior art

A principle which is well known is that of the technique consisting in injecting in suitable sequence, inside the casing lowered into the drilling well, fluids such as slurry, cement slags, separated by a mechanical plug and/or by a spacer fluid. It is also necessary to throw, in the appropriate manner, one or more mechanical plugs in order to isolate certain parts of the well.

All of these operations are performed at high pressure (pumping pressure for the fluids in the well).

All of them are, in their principle and in their operating procedure, routine work for the field engineer.

At present, and for several decades already, the cementing heads used are as illustrated in accompanying Figure 1, on which the following references designate the constituent elements as stated :

- I, a cementing head,
- II, a casing disposed inside a well P,
- 2, a connecting collar between the head I and the upper overground part of the casing II,
- 3 and 4, two plugs immobilized in the head by two stops R_3 and R_4,
- T, a passage sensor or tell-tale,
- V_1, V_2, V_3, valves placed upstream of the head.

The cementing heads according to the prior art work as follows (the fluid arrives under high pressure in "F"):

- firstly, valve V_1 is opened while valves V_2 and V_3 being closed) for circulating a first fluid into the well P without throwing any plug; this first fluid may be a slurry;
- then V_2 is opened after closing V_1, V_3 remaining closed, and a cement slag is admitted under high pressure.

The element R_3 has to be retracted beforehand either manually or hydraulically or otherwise, and the first plug 3 is released and lowered into the well. It is followed by the cement slag which is pumped in. The element T, or telltale, which is spring-loaded, is supposed to detect the passage of the plug;

- when the above phase is completed, V_1 and V_2 are closed and V_3 is opened, and a displacing fluid (slurry, brine, etc...) is pumped in. By the same process, the plug 4 is released by retraction of element R_4. Element T then should detect the passage of the second plug;
- V_3 is then closed.

The operation of V_1, V_2 and V_3 is generally controlled by hand as a remote-control would be too complex. Also, the cementing head which must be able to withstand very high pressures, is extremely heavy. This is an additional and serious disadvantage inasmuch as, firstly, the head has to be lifted above the "table" of the derrick and, secondly, the handling of such a weight involves a very high risk of damaging the fine-pitch threading of the collar 2, as well as a risk of accident.

Another serious disadvantage, is the well known "U-tube" phenomenon, namely the free dropping of the cement slag in the well, which occurs during cementing, and causes a transient although noticeable depression. When the first plug has been thrown, but not the second, said depression is exerted on the plug 4 and can deform element R_4. Such deformation may have a damaging effect on the throwing of the second plug, such as premature throwing/blocking/aslant jamming inside the well, etc..., and/or geometry or resistance of the plug, which is liable to impair the cementing operation.

SUMMARY OF THE INVENTION

It is the aim of the invention to propose a cementing head integrated to the casing, which will solve the aforementioned problems.

One object of the invention is to provide a cementing head designed to allow the throwing of one, two and even more successive plugs, not only to be carried out in precise, efficient and simple operations by any operator, but also with a throwing accuracy for each plug, according to the sequence of phases required by the implemented process.

Another object of the invention relates to the storage of the plugs inside the head in conditions which eliminate all risks of incorrect positioning which could result, particularly in the course of the operation, in damages or slantings which will interfere with the good development of the operation.

Yet another object of the invention is to provide

means permitting the accurate and selective control, firstly, of the throwing of the plugs and also of the transfer of each one inside the head until the correct position for throwing the plug into the casing is reached.

These objects are attained according to the invention by producing a cementing head for oil wells or the like, of the type comprising a body adaptable by any connecting means on the upper end of a casing placed inside the well, and means for connecting the head with a supply station supplying at least one fluid under pressure, characterized in that it comprises:

- a tubular magazine or container, open at its lower end, extending downwardly from the body in order to be placed at least partly inside the casing with which it creates an annular space,
- at least one plug mounted in the container with radial elastic deformation prestressing, and capable of sealingly occupying the casing after expelling of the container,
- and an expelling jack for expelling said plug from said container.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more readily understood on reading the following description with reference to figures 2 to 9 of the accompanying drawings, in which :

- Figure 1 is a diagrammatical view corresponding to the prior art.
- Figure 2 is a diagrammatical elevational section of a first embodiment of the cementing head.
- Figure 3 is a partial elevational section of Figure 2.
- Figure 4 is an elevational section showing, on an enlarged scale, one detail of embodiment.
- Figure 5 is an elevational section of one industrial embodiment of the cementing head according to the invention.
- Figure 6 is an elevational section, showing on an enlarged scale, one detail of embodiment.
- Figures 7 and 8 are two elevational sections, similar to Figure 5, illustrating two phases of operation.
- Figure 9 is an elevational section illustrating a preferred embodiment of the cementing head according to the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

The cementing head according to the invention essentially comprises, as shown in Figure 2, a container 11, open at its lower part f and in which are placed a number of plugs. Three plugs 3, 4 and 5 are shown in Figure 2, but a higher number of plugs may be used. The plugs are mechanically joined together by releasing members 15, 14, 13. The plugs, which as is known, are constituted at least on their periphery of an elastic material such as rubber, are held in position inside the container by being compressed by the wall 11.

The releasing elements 15, 14, 13 are joined to each plug via conventional mechanical means, not shown. Preferably, these mechanical means will be anchored in the mass of the plug. The upper releasing element, 13 in the illustrated example, is connected to a vertical displacement jack V, controlled by any conventional means. As illustrated in Figure 2, the plugs, the container, the jack and the lower face of the head I which is secured to the collar 2, the latter being itself mounted in conventional fashion on the casing II lowered into the well P, define zones A, B, C and D. The wall of the container 11 is perforated in facing relationship to each zone A, B, C and D, the holes 8, 9, 10, 17 allowing a ready flow of the fluid F pumped under high pressure into the well.

The working principle of the head according to the invention is as follows:

- a differential pressure ΔP as low as possible (preferably lower than 50 psi/3.5 kg/cm^2, and more preferably around 10 psi/0.7 kg/cm2) is created between zones A and D;
- elements 15, 14 and 13 are calibrated so that, as indicated hereinafter, they break under a tensile force corresponding to the difference of pressure ΔP exerted by the fluid on the upper face Ps of one plug and on the lower face Pi of the same plug, such that :

$\Delta P = P_1 - P_2$ and

in the non-restrictive example illustrated in Figure 2,

ΔP (element 15)$< \Delta P$ (element 14)$< \Delta P$ (element 13);

- the first fluid, normally a slurry, is pumped in through F; the fluid under pressure spreads through all the zones A, B, C, D and E defined in the container 11 by the plugs, and into space e, as shown in Figure 2, defined by container 11 and casing II, due to the communications created by holes 8, 9, 10 and 17, in the illustrated example. The plugs are then in a non-stressed condition due to the equalization of pressures, and the first fluid can be circulated into the well for the required time;
- then, the jack V is moved downwards over a sufficient distance for the bottom plug 3 to pass over the safety boss 12, which boss is not absolutely necessary, and to reach zone E. It is

understood, as will be seen hereinafter, that the releasing elements 15, 14 and 13 are capable of transmitting without deformation the thrust of the jack. In zone E, the fins of the plug expand as far as the wall of the casing II where they take on their final wellknown shape, thus ensuring tightness between zone the bottom of the well, as illustrated in Figure 3;

- if a second fluid F, which may be for example a cement slag, a sludge, an inert fluid or spacer, a brine, etc... is admitted, at that particular time, under pressure, the pumping pressure P_1, illustrated in Figure 3, becomes higher than pressure P_2 and element 15 is subjected to a differential pressure ΔP sufficient to cause the release of the plug 3. Said plug is then "thrown" correctly into the well under the action of P_1;
- the same procedure is used successively with plugs 4, 5... simply by moving the jack V downwards, thus allowing the plugs 4, 5, etc... to reach zone E while successively admitting the appropriate fluids.

An embodiment of the releasing elements is illustrated in Figure 4 which describes the situation wherein plug 3 has already been thrown and the jack V has brought plug 4, to which part of element 15 is still attached as explained hereinafter, in zone E. Figure 4 therefore describes the operation of element 14, but understandably, the operation of elements 15 or 13 is identical.

In the described embodiment, element 14 is composed of two parts : a which is mechanically fixed to the plug situated above plug 4, namely in this case, plug 5, and b which is mechanically fixed to plug 4. The "mechanical fixing means" used is not shown. Preferably, a and b are pieces in metal, in composite material or in plastic material, said pieces going through the plug and being either anchored in the rubber of the plug by means of grooves, or fixed by a threading or other means to an element in metal or other, which element is itself anchored to the plug or forms part thereof. Such fixing means are obvious. Piece a is housed in an adapted recess of piece b and rests on the bottom 23 of said recess. The side walls of the recess comprise one or more grooves 22 situated in facing relationship to recesses 24 provided through the whole thickness of piece a, grooves 22 and recesses 24 being so dimensioned as to receive at least one movable element S, which is preferably a ball, occupying substantially all the space defined by 22 and 24, and thus firmly fixing the relative position of a and b. A piston 21 locks the element or elements S in position and is itself held in position by mechanical means such as a readily compressible spring R, namely a spring exerting on the lower face 25 of the piston just enough pressure to hold said piston in abutment on the shoulder 27 of piece a.

When, as explained hereinabove, pressure P_1 increases, the piston naturally undergoes a vertical force directed downwardly, via communications d and 28 : P_1 x surface 20, and a vertical force directed upwardly, via communications g and 26: P_2 x surface 25.

When the downward resultant of said two forces reaches the calibration threshold predetermined for element 14, the piston 21 is lowered into the recess 26, the effect of the pressure P_1 which is higher than P_2 urges the plug 4 downward, thus driving the elements S towards the inside of recess 24. This movement may be helped by giving the appropriate shape to the upper surface 29 of the groove or grooves 22.

When, in this movement, the elements S are no longer engaged in the groove or grooves 22, piece b is disconnected from part a and plug 4 is "thrown" down by the pumping pressure P_1. Piece a remains attached to the upper plug 5, which is not important.

Tightness is of course ensured by joints j as illustrated in Figures 2 and 4, and the spring R may be replaced by equivalent means, such as friction means provided at the level of the walls, small breaking element joining lightly piston 21 and piece b and being quite unable to oppose the movement of the piston under the action of $P_1 - P_2$, etc... .

The invention therefore proposes a cementing head which is :

- light , the container 11 being optionally made of metal or alloy of small thickness or of composite material;
- reliable, due to equalization of the pressure which limits the dangerous stresses, particularly at the level of the plugs;
- simple to use, the only operation to perform being the lowering of the jack;
- automatizable and remotely-controllable;

The last two advantages being important also from the point of view of staff safety and from the point of view of reliability of the operation.

- capable of throwing 2, 3, 4, 5, etc... plugs, which makes it possible, for the first time, to perform more complex, hence more accurate operations than in the prior art.

Figure 5 illustrates an industrial example of embodiment of the cementing head according to the invention. Head I comprises a body 30 provided, at its lower part, with means 31 of connection with casing II. Said means 31 can be constituted by the fine-threaded collar 2, of the normally used type, with which the body 30 cooperates either directly or via an adapter.

Body 30 is constituted by a lower half-body 32 of tubular type, and by an upper half-body 33, said half-bodies being joined together, with interposition

of sealing means 34, by a clamp 35 or similar device designed to fasten, one against the other, flanges 36 and 37 respectively provided in facing relationship on the half-bodies 32 and 33.

The body 30 is provided with means 40 for connecting the head I with a supply station, supplying fluid under high pressure, such as slurries, cleaning fluids or spacers, and of course, fluids capable of ensuring the cementing of the annulus in a well P. In the present case, the means 40 are constituted by fittings carried by the upper half-body 33 and opening into the inner periphery of a cavity 41 defined on the outside by the body 30 so as to be substantially in line with the inner section of the casing II when the head I is fitted on the latter.

Said head I comprises, internally in cavity 41, a tubular container 42 of general cylindrical shape, open at its lower end and extending coaxially to the half-body 32. Said container 42 is constituted by an independent, removable element which is held in position by clamping or squeezing, between the two half-bodies 32 and 33, of an outer edge 43 formed by said element. Tubular element 42 is preferably perforated over its whole height, in such a way as to place the annular space which it defines inside cavity 41, in communication with its own defined volume. Tubular element 42 has, close to its lower open end, a centering flange 44, adapted to cooperate with the half-body 32 and, preferably, a thin annular inner edge 45 formed in offset fashion with respect to its lower open end.

Container 42 is designed to constitute a magazine for the temporary storage of plugs 50 which can be provided in variable number. Said container 42 can be so constituted as to contain only one plug, and even two, as illustrated in the drawings, or a higher number of plugs, this constitutinga considerable advantage over the prior art. In consequence, the axial length of the container 42 is preferably determined in relation to the expected number of plugs as well as to the overall height occupied by said plugs.

According to this embodiment, the plugs 50 are placed inside the container 42 in such a way as to be superposed and in contact one with the other, to form a column resting by the bottom plug 50_1 on the edge 45. The plugs 50 have a very conventional general structure and are constituted by generally axi-symmetrical bodies comprising, on their outer periphery, annular fins 51, which are elastically deformable and confer to each plug, when in rest position, a diameter greater than the internal passage section of container 42 and also slightly greater than the internal diameter of casing II, this latter point being quite conventionally known. The loading of container 42 therefore necessarily implies a radial elastic deformation prestressing of the fins 51 to obtain their radial elastic deformation, this ensuring, by reaction, the stacking of the different plugs in stable superimposition. Preferably, the container 42 is loaded by its open upper end, before being mounted inside cavity 41 by assembly of the two half-bodies 32 and 33.

In the illustrated example, the bottom plug designated by the reference 50_1 is of perforatable type and comprises, to this effect, an axial passage 52 which is closed at its upper end by a cap 53 which can be perforated by the known pressure means which are normally generated during drilling or treatment of the well P.

The second plug, or top plug, as illustrated in Figure 5 has the reference 50_2 and occupies a superposed position to perform an obturating function, as described hereinafter. To this end, top plug 50_2 is compact and has no part or zone which cannot withstand the pressures generated inside the well. Other combinations of plugs could also be used.

The head I is completed with means 55 for successively expelling the different plugs from the container 42. Said means 55 are in the form of a jack formed by or adapted on the upper half-body 33. The jack 55 can be a single-rod jack or, on the contrary, it can be of the type with multiple working-stages, in which case, preferred according to the invention, the number of working stages is directly related to the number of plugs 50 filling the container 42. In the illustrated case, the jack 55 is of telescopic type with two double-acting working stages 56_1 and 56_2. Stage 56_1 is constituted by a primary cylinder 57 containing a piston 58 of double-acting type. Fittings 66 are provided to this end, to ensure the supply of either one of the variable volume chambers defined by piston 58 inside cylinder 57. Piston 58 is of tubular type and comprises a cylinder 60 extending through a sealing ring 61 closing off cylinder 57. Cylinder 60 contains a piston 62 extended by a rod 63 and forming with cylinder 60 the second stage 56_2. Said rod 63 extends through cylinder 57 as well as body 33 via a lining 64, so as to penetrate by its end part 65 inside the volume of container 42. Preferably, rod 63 extends coaxially to the container 42. Piston 62 defines, inside cylinder 60, two chambers of variable volume which can be respectively fed with fluid under pressure through fittings 66, fitting 59 which belongs to cylinder 57 ensuring the return of the fluid. As more clearly illustrated in Figure 6, the end part 65 of rod 63 is designed to constitute, via a flanged part 67, a means of acting and exerting pressure on the column of superposed plugs during the extending stroke of the rod of jack 55. According to the invention, it is proposed to join the end part 65 to the top plug 50_2 by automatic assembling and releasing means 70

controlled releasably by the fluid supplying the last stage 56_2 of the jack 55. Such means comprise, first, inside a chamber 71 defined by end part 65, a piston 72 servo-controlled by a retraction member using spring return means. The piston is designed to control pivotable fingers 73 provided inside a housing 74 formed in the upper part of the top plug 50_2. The chamber defined between the upper part of the piston 72 and the lower part of the rod 63, communicates via an axial passage 75 extending through the whole piston rod 63, with a recess 76 provided in piston 62 to allow its opening towards the end 77 of the cylinder 60. Said recess 76 contains a valve 78 working in combination with an elastic member 79 urging it in closing position, as soon as it stops cooperating with an opening piece 80 carried by the end 77.

The cementing head works as follows :
In the position illustrated in Figure 5, the plugs 50_1 and 50_2 fill the container 42 which is immobilized by the assembling of the two half-bodies 32 and 33 forming the head I adapted on the casing II. The system 70 create an axial link between the end part 65 of the rod 63 and the top plug 50_2. Jack 55 occupies a position in which the rod or rods which constitute it are retracted. It is indicated in the foregoing that stages 56_1 and 56_2 are of double-acting type, but it is understood that a single-acting jack with multiple stages is also suitable.

To throw the bottom plug 50_1 into the casing II, the first stage 56_1 of jack 55 is supplied through lower fitting 66, so as to control the sliding movement of the piston 58 in the direction of arrow f_1. This stroke brings the piston 58 in abutment against the half-body 33. During this displacement, the end 77 pushes the piston 62 subjecting the rod 63 to an extending stroke. The end part 65 pushes the top plug 50_2 which, in turn, expels the bottom plug 50_1 urging it to pass over the edge 45.

At end-of-stroke of the piston 58, such as illustrated in Figure 7, the top plug 50_2 is brought substantially to rest against the edge 45, whereas the plug 50_1 is engaged in casing II in which it is centered via the fins 51 urged in radial elastic deformation of expansion. Said plug 50_1 can then be thrown by the admission into the cavity 41 of a fluid under pressure which is either a spacer, or a cement slag, brought through one of the fittings 40. It is important to recall that the container 42 is defined by a perforated wall, so that the pressure of the fluid pumped into the casing II has no influence on the stable position occupied by the top plug 50_2.

After the throwing of the bottom plug 50_1 and correct performance of the operational sequence or phase concerned, including optionally the perforation of plug 50_1, the top plug 50_2 is thrown by controlling the supply of stage 56_2 through upper fitting 66. In this step, as illustrated in Figures 6 and 7, the fluid under pressure, fed into the upper chamber of cylinder 60 through upper connector 66, is introduced into the recess 76 because of the open position of valve 78. This fluid follows passage 75 in order to penetrate into the chamber situated above piston 72 and to control the extending stroke of piston 72. The pivoting fingers 73 are actuated in retracted position when piston 72 occupies its abutting position while in extending stroke. Then, the fluid under pressure actuates piston 62, urging the rod 63 back, thereby simultaneously controlling the closure of valve 78 to isolate the system 70 from any variation of pressure and to keep the fingers 73 in retracted position. The extending stroke of rod 63 causes, as illustrated in Figure 8, the expelling of plug 50_2 from the container 42 in a similar way as described with respect to bottom plug 50_1. Once expelled from the container 42, the top plug 50_2 is propelled by the admission of a propellant fluid through the fittings 40. This occurs automatically due to the retraction of the system 70 following the retraction of the fingers 73.

It is clear from the foregoing that it is possible with the cementing head according to this example, to store temporarily in a stable ready-for-throwing position, a variable number of plugs without any successive physical link, which plugs are protected against all risks of degradation, of misorientation or inadvertent slipping. Said plugs can be thrown with accuracy by successive expelling from the container by means of the expelling jack 55, and they can be propelled by introduction into the cementing head of a fluid under pressure acting upstream of the plug as driving energy.

The aforesaid advantages are due to the structure of the head, and also to the conformation of the plugs which is chosen to ensure a secure and stable immobilization inside the container and to allow the plugs to suitably cooperate with the inner wall of the casing on emerging from the storage container.

In preferred manner, said special conformation will reside in fins that are more developed than the fins of the conventional plugs.

The aforesaid advantages are also obtained by preferably using a jack 55 with successive strokes and more particularly, with as many working stages as there are plugs inside the container. In this way, the jack 55 is controlled every time to perform an extending stroke corresponding exactly to the transfer amplitude required to be imposed on a plug inside the container in order to expel it.

Figure 9 illustrates a preferred variant, in which the body 30 is constituted of a lower half-body 32a and of an upper half-body 33a. The lower half-body 32a is adapted on the collar 31 via an adapter 81

and comprises fittings 40 which are thus situated under the clamp 35.

The upper half-body 33a directly constitutes, on its own, the cylinder 57 forming the first working stage 56_1 associated, as indicated hereinabove, to the elements constituting the second stage 56_2.

The invention is not in any way limited to the examples described and illustrated herein, but on the contrary covers any modifications that can be brought thereto without departing from its scope.

Claims

1. Cementing head for oil wells or similar of the type comprising a body adaptable by a connecting means on the upper end of a casing placed inside the well, and means for connecting the head with a supply station supplying at least one fluid under pressure, wherein said head comprises :
- a tubular magazine or container open at its lower end, extending downwardly from the body in order to be placed at least partly inside the casing with which it creates an annular space,
- at least one plug mounted in the container with radial elastic deformation pre-stressing, and capable of sealingly occupying the casing after expelling of the container,
- and an expelling jack for expelling said plug from said container.

2. Cementing head as claimed in claim 1, wherein the container has an open lower end, preferably slightly narrowing, and contains a plurality of plugs and in that the jack is placed coaxially to the head and has a rod extending through the latter and which is joined to the top plug by a releasing system.

3. Cementing head as claimed in claim 2, wherein the container contains a plurality of plugs joined successively one to the other by releasing elements having limited tensile strength, said strengths being staged from the bottom plug to the top plug.

4. Cementing head as claimed in claim 3, wherein the different plugs define inside the container free volumes, at the level of each one of which the wall of the container is provided with holes creating a communication with the connection means between the head and the supply station.

5. Cementing head as claimed in claim 3, wherein each element and releasing system with limited tensile strength comprises :
- one male part joined to the lower part of the upper element, defining a chamber connected with the corresponding volume and issuing in at least one recess opening out on the outside and containing a movable element retractable inside said recess,
- and a female part rising from the upper face of the lower element, provided with a recess for receiving the male part, having on the inside at least one groove corresponding with the recess and defining a bore which communicates with the corresponding volume and contains a piston, urged by a spring to enter the recess and the chamber and to drive the movable element into displacement outward of the male part, in order to penetrate into the groove when the latter is in facing relationship to the recess.

7. Cementing head as claimed in claim 1, wherein the plugs are mounted to contact one with the other inside the container into which penetrates the piston rod of the expelling jack.

8. Cementing head as claimed in claim 7, wherein the expelling jack is of telescopic type with as many working stages as there plugs inside the container.

9. Cementing head as claimed in claim 8, wherein the releasing system is of retractable assembly type and is releasably controlled from the supply fluid of the last working stage of the jack.

10. Cementing head as claimed in claim 9, wherein the retractable assembly system comprises :
- at the end part of the jack rod, a piston controlling, against the action of an elastic return member and during its extraction stroke, the retraction of pivoting fingers, disposed inside a housing of the top plug,
- at the top part of the jack rod, an automatically closing valve, which opens into the corresponding chamber admitting the fluid under pressure controlling the jack, and cooperates, in the retracted position of the rod, with an opening stop piece projecting into the chamber,
- and between the valve and the piston, an axial passage extending through the rod.

11. Cementing head as claimed in claim 1, wherein the head body is constituted :
- by a lower half-body provided with an adapter on the connection means,
- by an upper half-body carrying the jack,
- and by a clamp for assembling the half-bodies.

12. Cementing head as claimed in claim 11, wherein the connecting means between the head and the supply station are carried by the lower half-body.

13. Cementing head as claimed in claim 11, wherein the container is constituted by a removable tubular element held axially in position by an upper shoulder provided between the half-bodies.

14. Cementing head as claimed in claim 11, wherein the upper half-body forms a first working stage of the jack by defining a primary cylinder containing a tubular piston forming a second work-

ing stage by defining a secondary cylinder with which cooperates the jack rod which penetrates into the container.

15. Method for cementing oil, gas, water, geothermal and other wells, characterized in that it uses a cementing head as claimed in any one of the preceding claims.

FIG. 1.

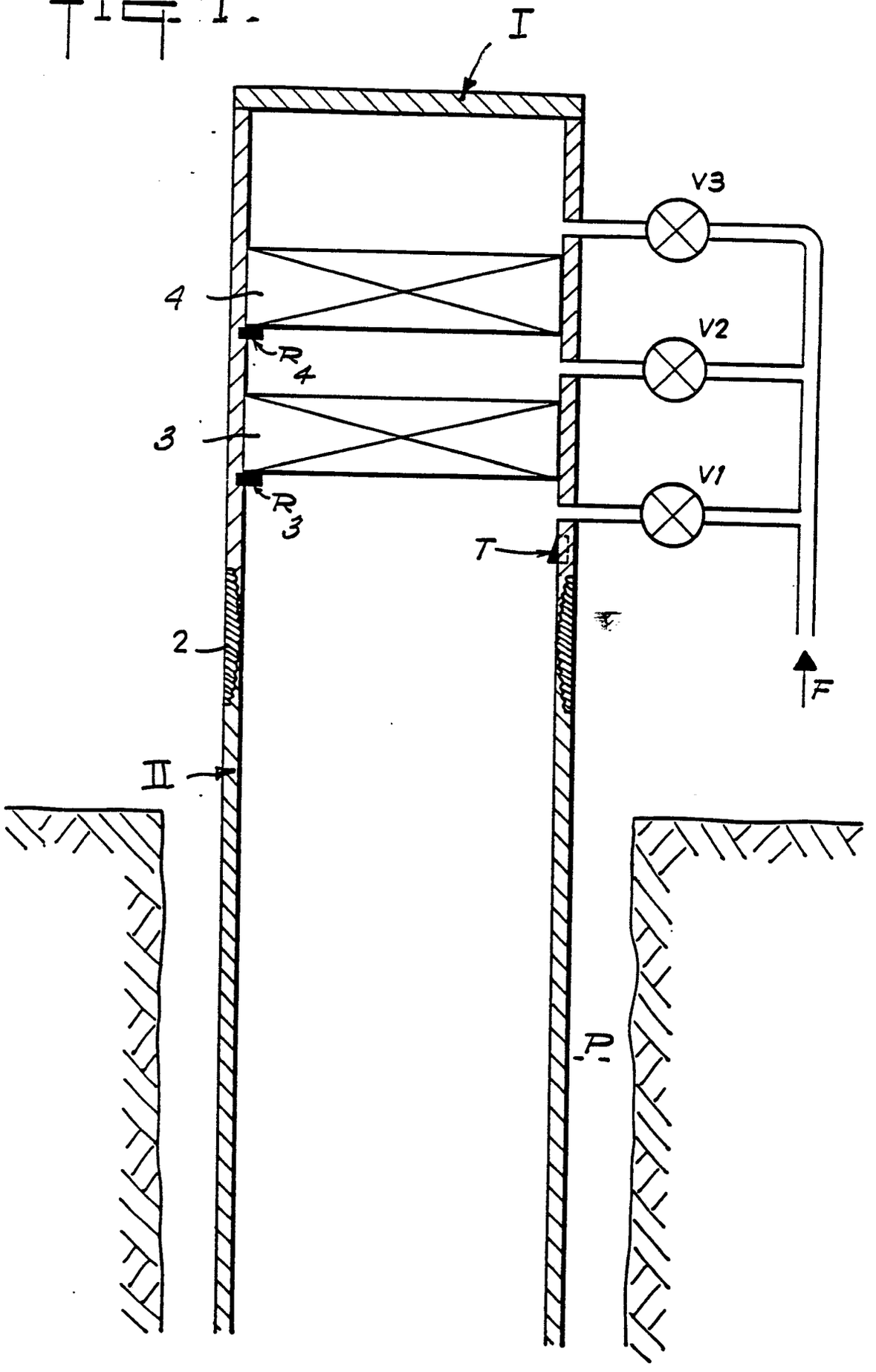


Fig-2

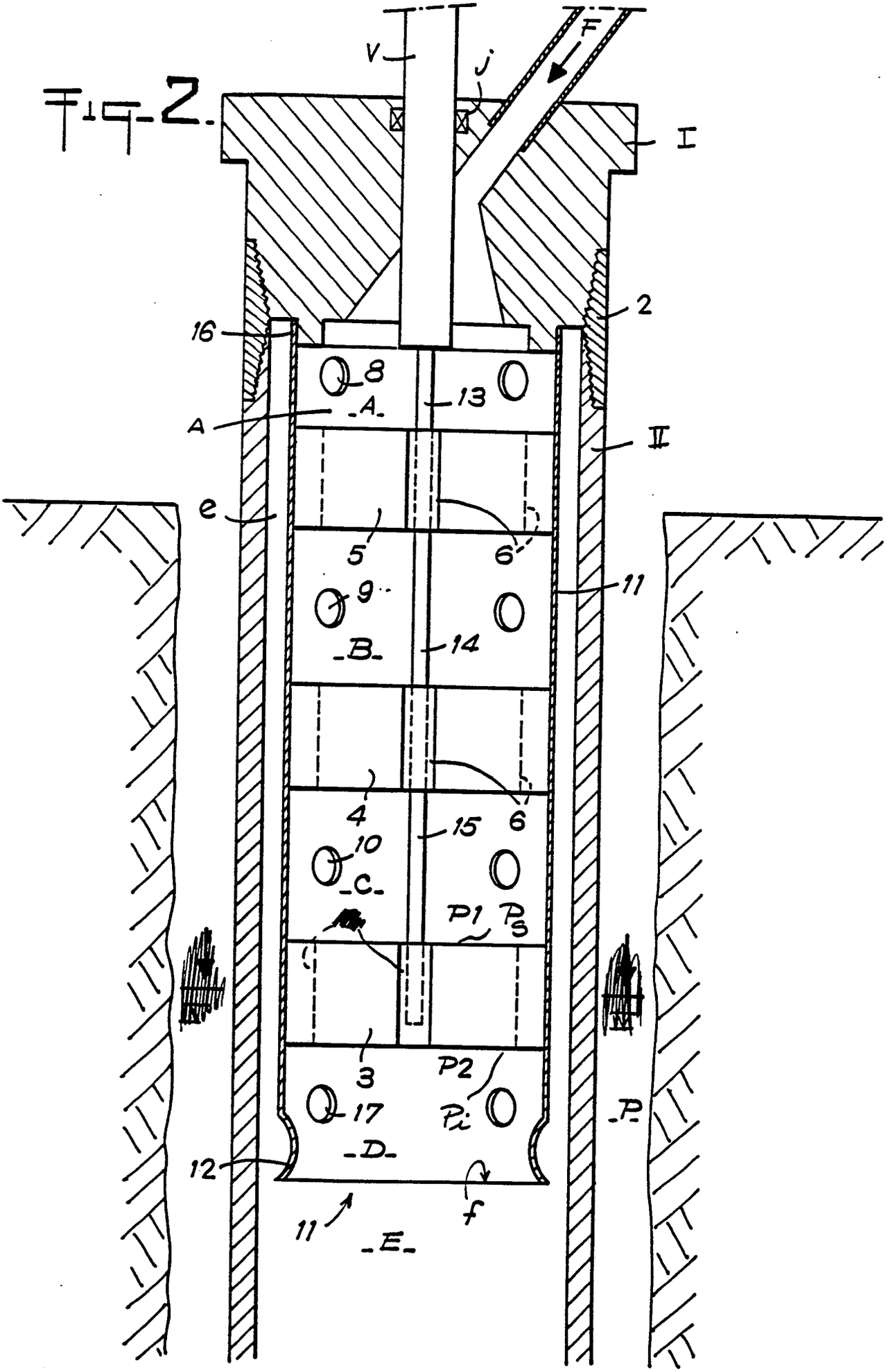


Fig. 3

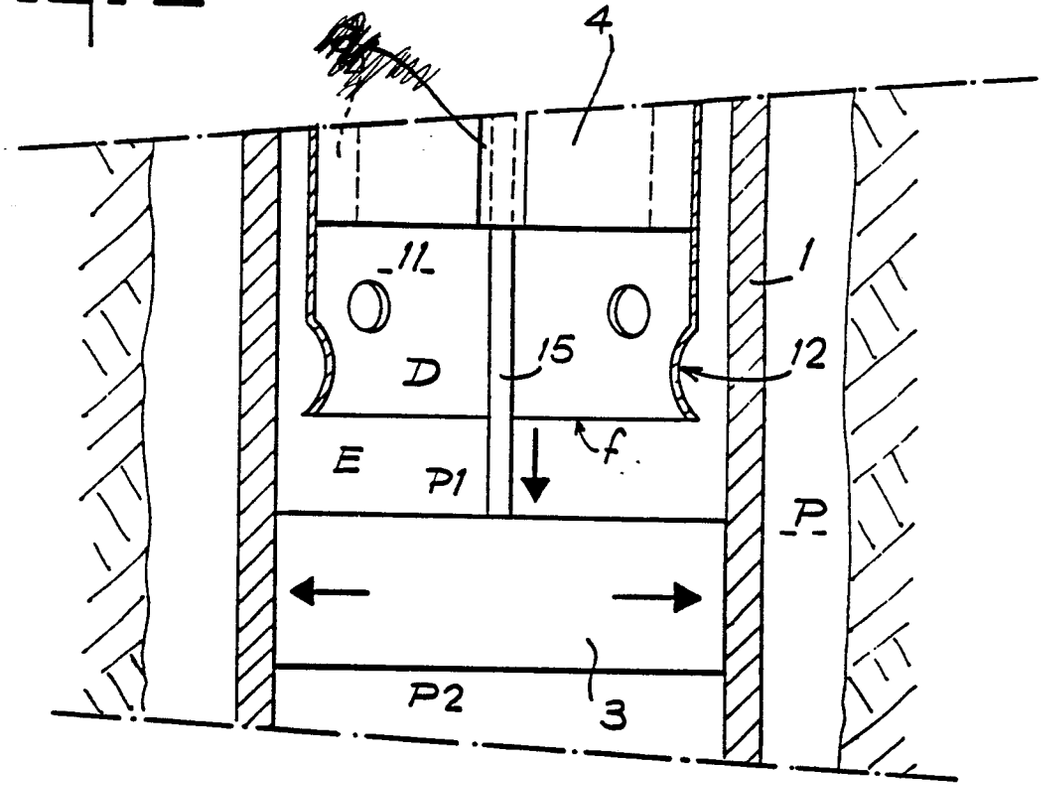


Fig. 4

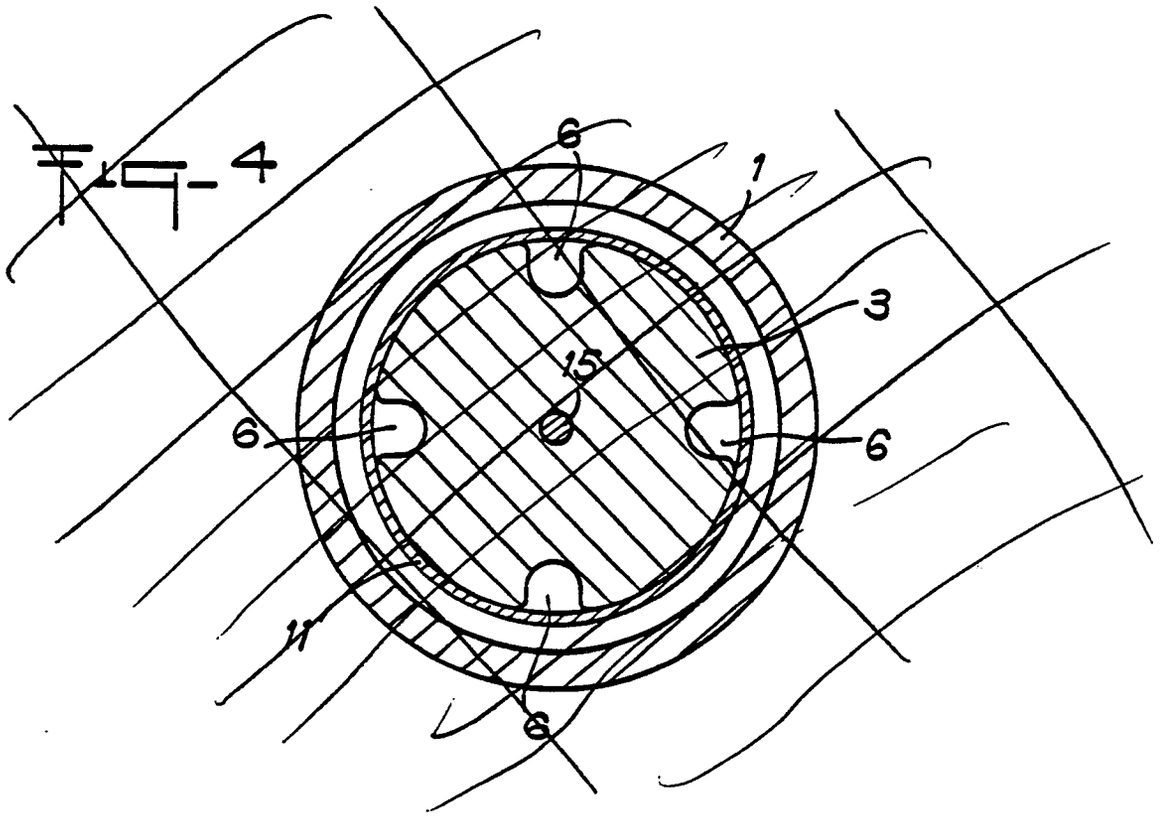
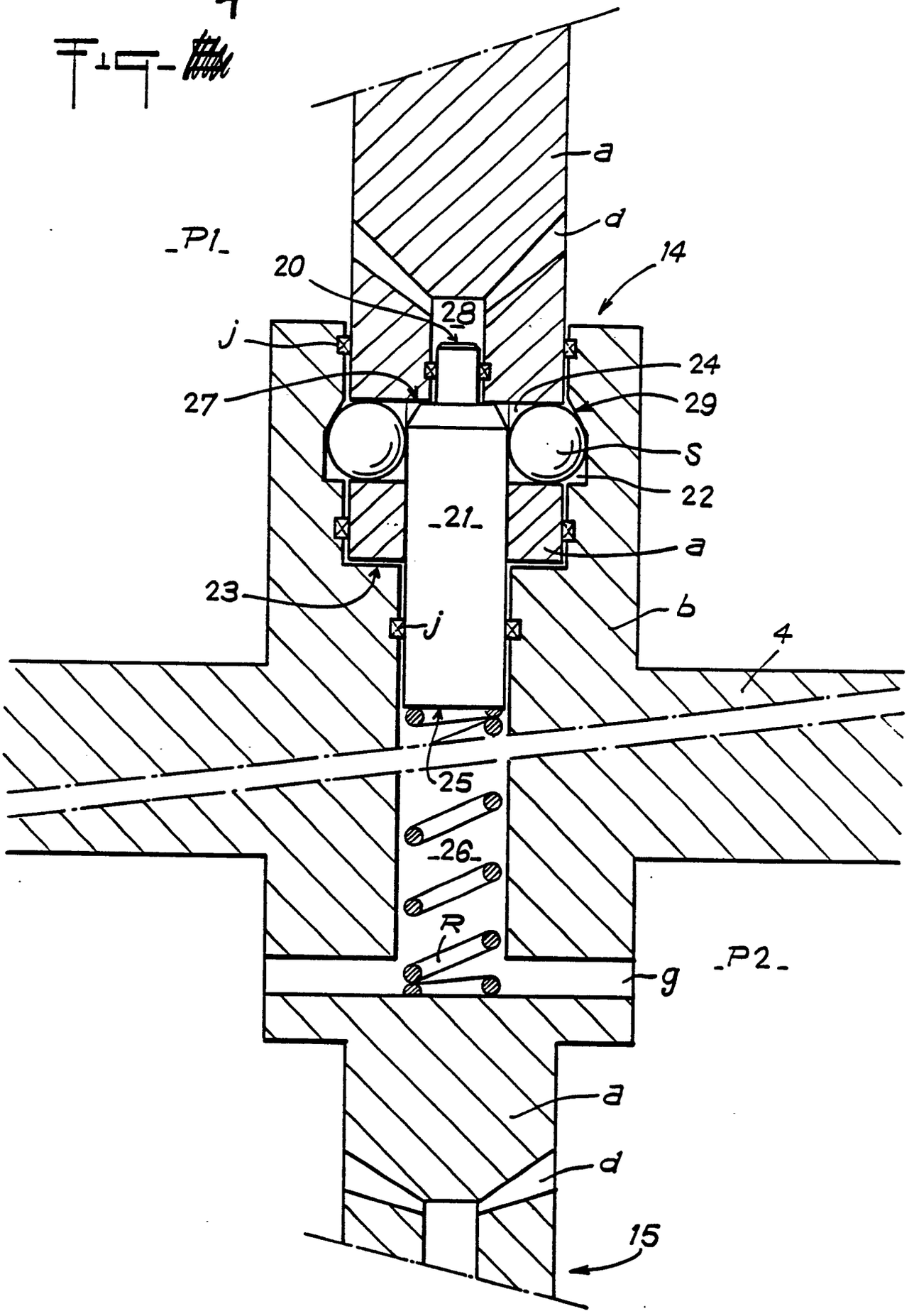


FIG 4



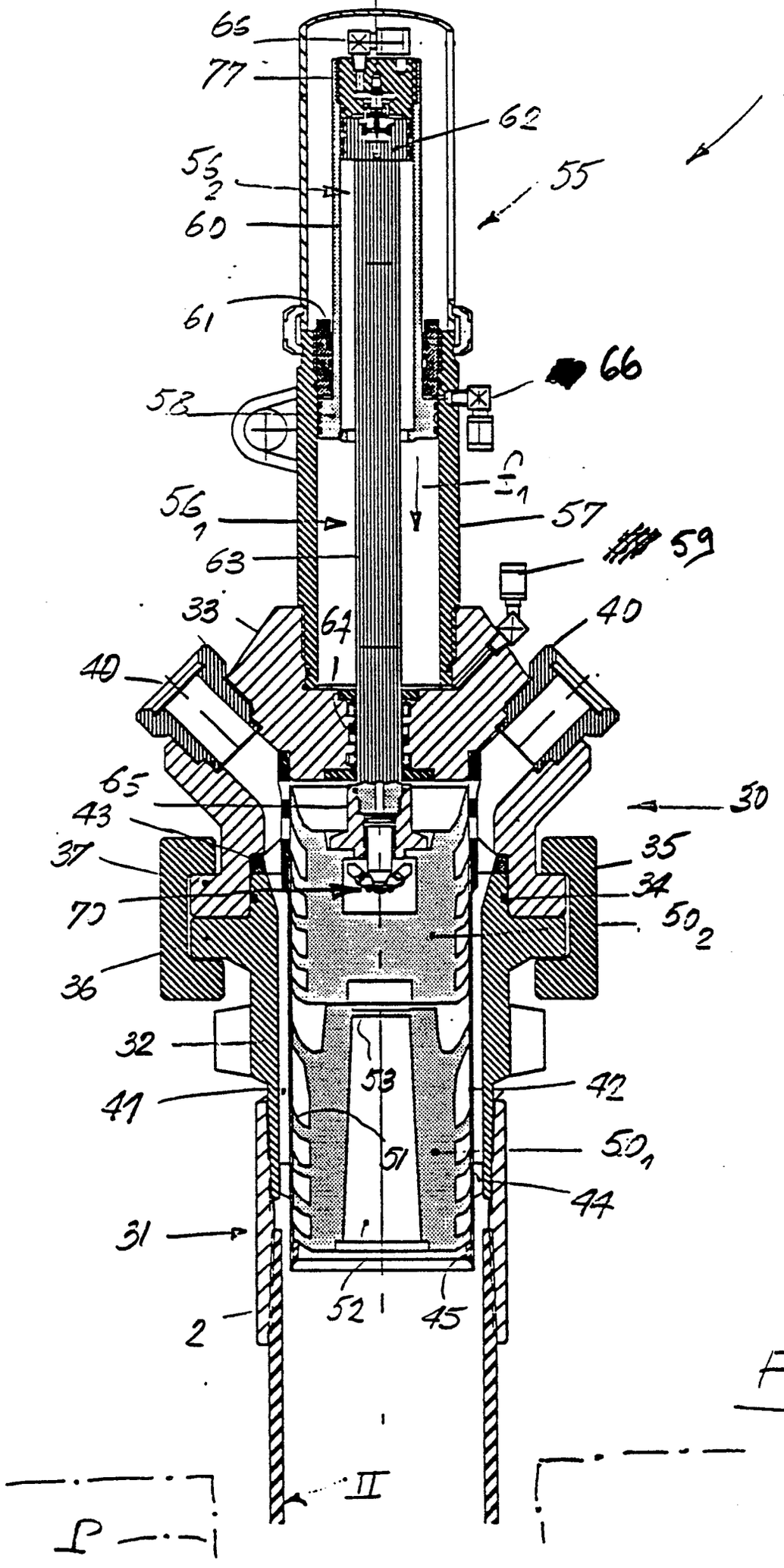

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FIG. 5

Fig. 6

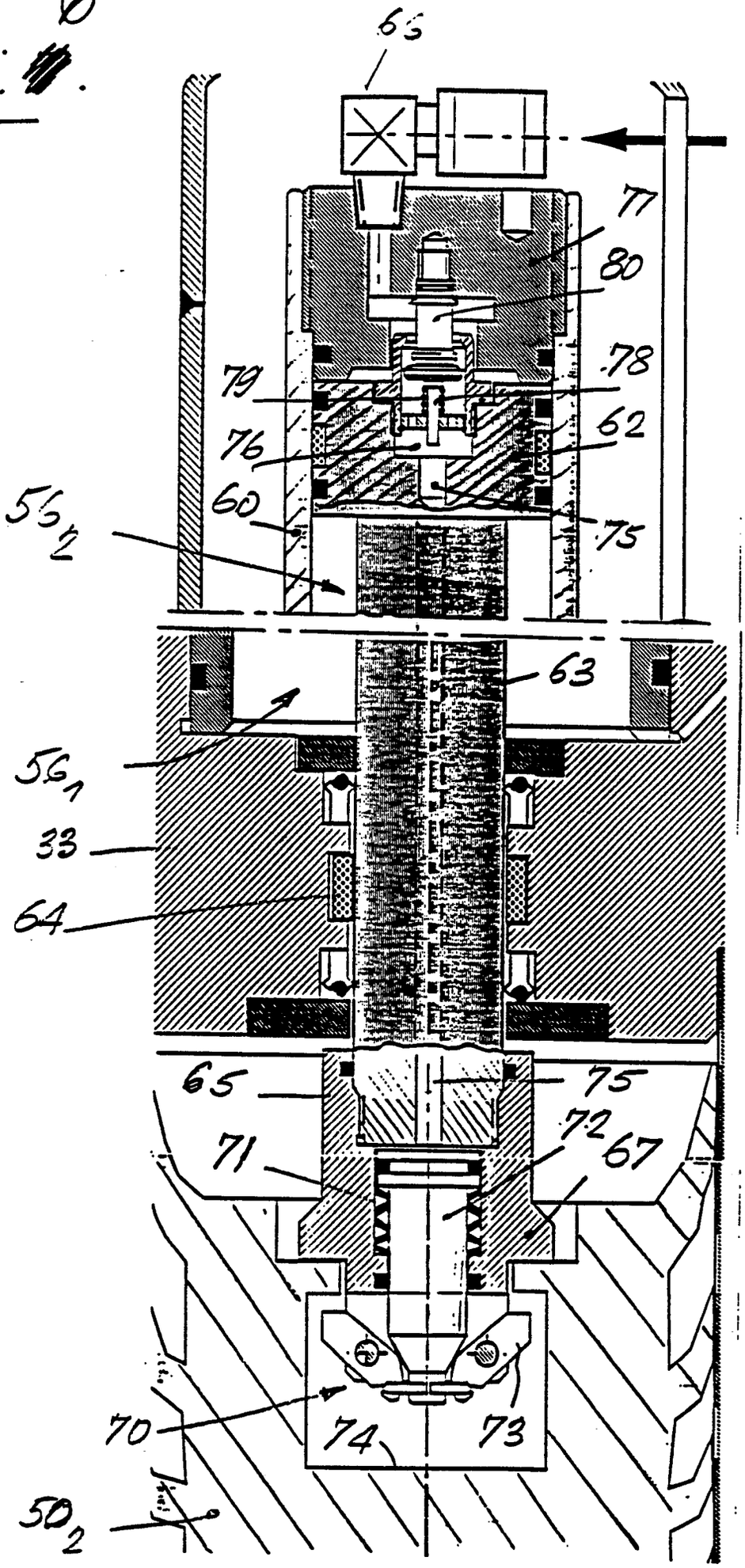

Fig. 7.

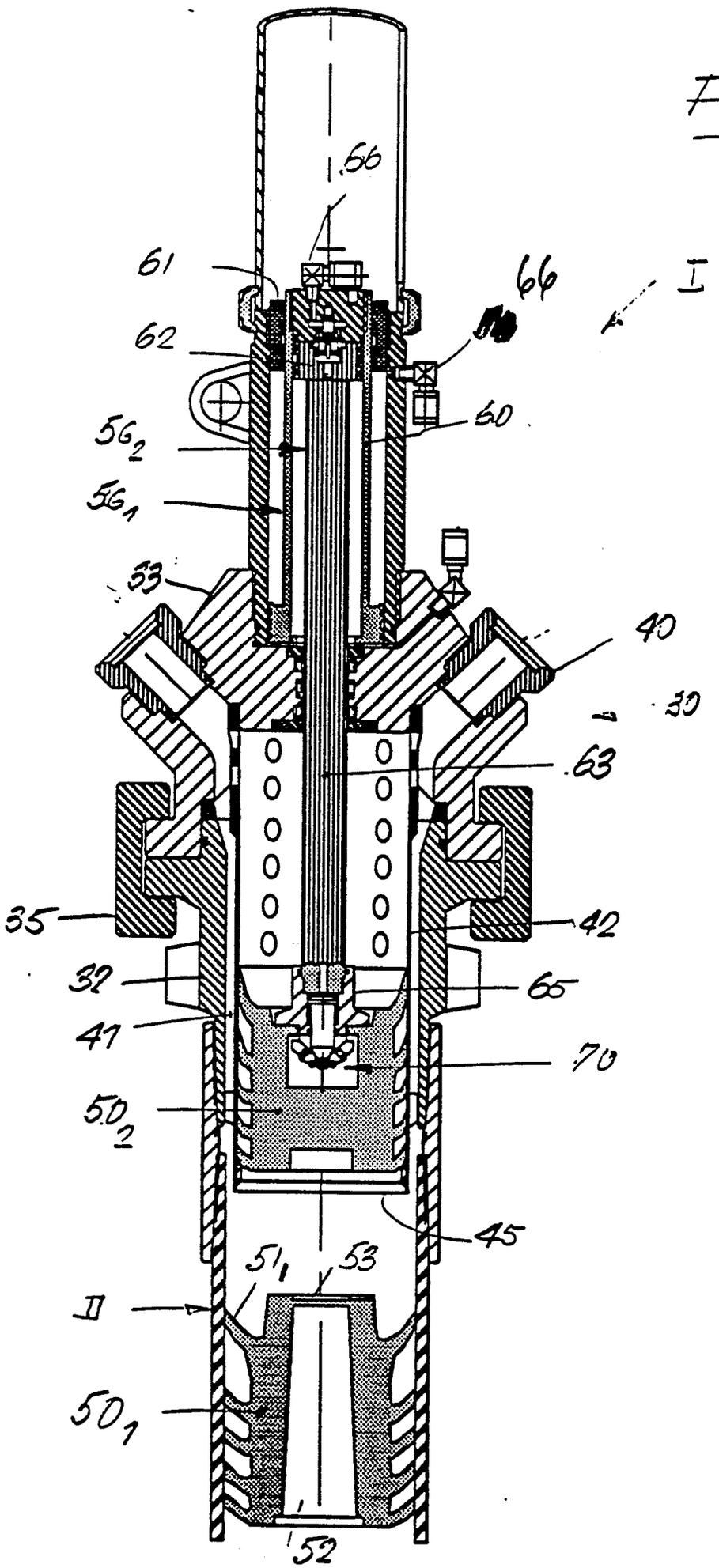
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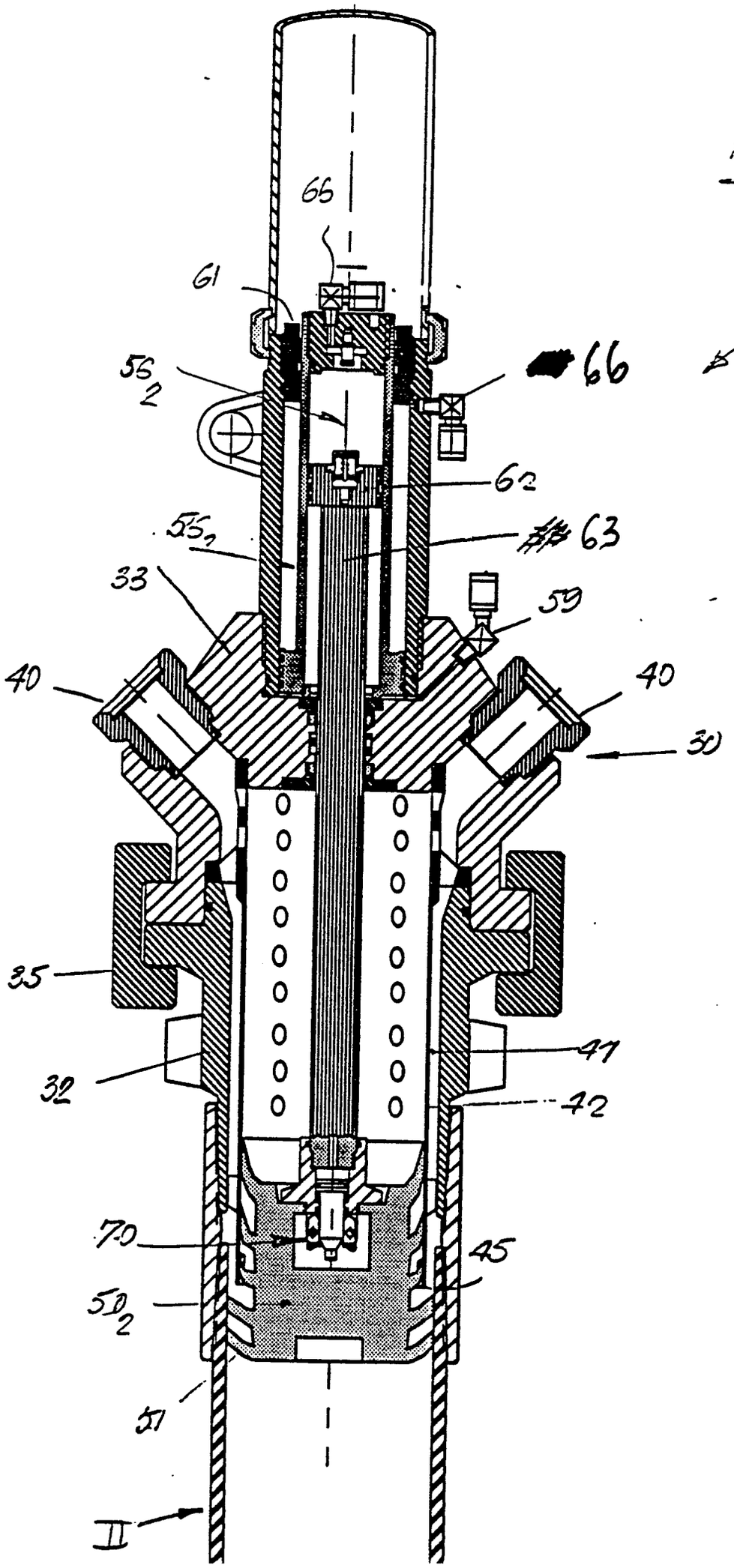
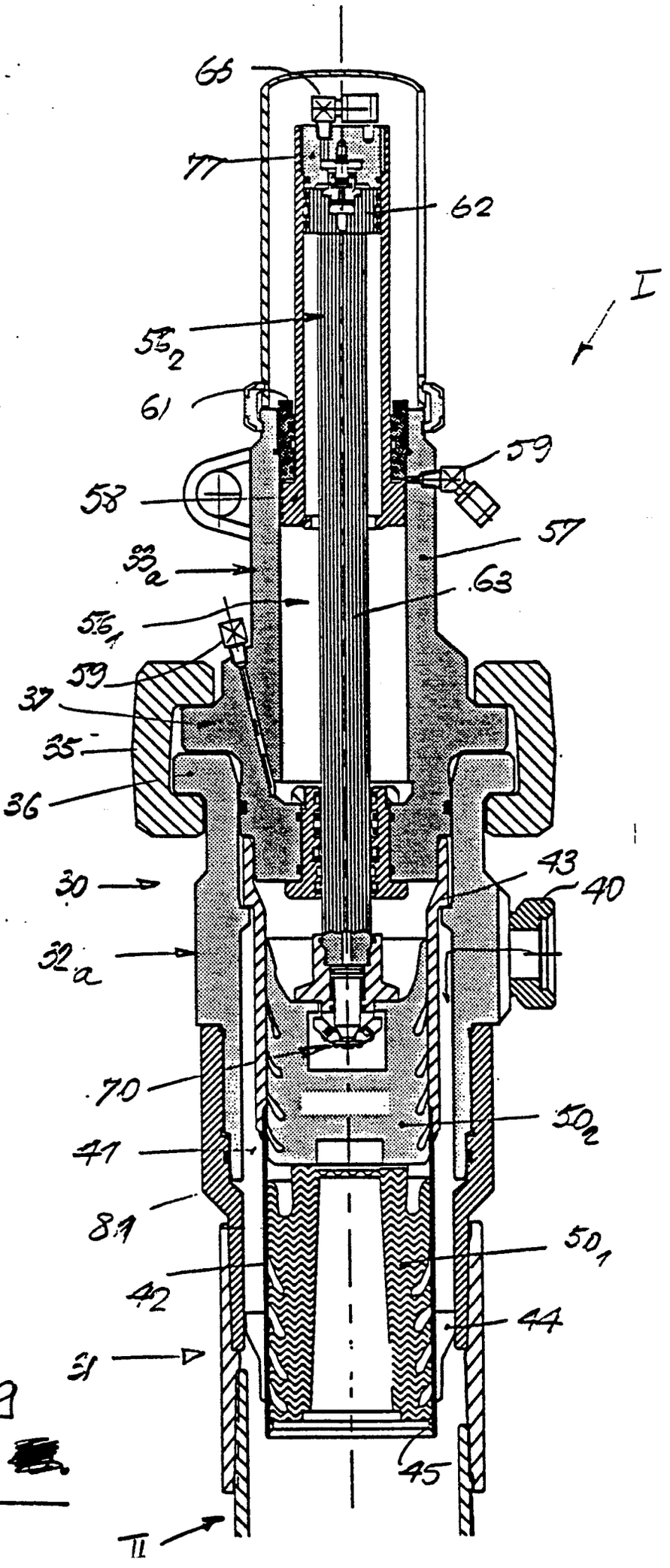
Fig. 8.

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81
50_1
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Fig. 9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 20 3297

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	US-A-4 164 980 (DUKE) * Figures; abstract *	1	E 21 B 33/05 E 21 B 33/16
A	US-A-2 615 519 (CARR) * Figure 1 *	1	
A	DE-B-1 117 520 (WEATHERFORD) * Claim 1; figures *	1	
A	US-A-4 317 486 (HARRIS) * Abstract; figures *	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E 21 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28-03-1990	WEIAND T.

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