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(54) **Machine for cleaving slate pieces.**

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FR-A- 2 432 375
FR-A- 2 527 505
FR-A- 2 611 573
US-A- 2 626 597
US-A- 4 934 616

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EP 0 498 755 B1

Description

This invention relates to a machine for cleaving slate pieces, said pieces determining an orientation for planes of cleavage and having at least one generally flat lateral edge perpendicular to said cleavage planes, the machine comprising: a fixed structure having a frame for holding the piece of slate to be cloven and at least one vertical guide-way; a head member which is slidable along said guideway and is provided with: a cylinder holder housing cylinders with through rod; an approach mechanism sliding on the through rods and which is movable relative to the cylinder holder; and at least one blade, having a straight line cutting edge adapted to open a crack in said flat lateral edge.

The cleavage is traditionally carried out by hand, on the basis of using a sharp chisel and striking with a hammer. This leads to irregularities in the thickness of the pieces and to a high rejection rate for breakages, since the process depends on the manual skill of the worker.

More or less extensive mechanization processes have been developed, always on mechanical processes. The difficulty lies in the different nature of the materials being cloven and on the irregularity of the forms of the cleavage planes. The advantages obtained have been slender, and in the majority of cases, there has been a return to the manual processes.

The document FR-A-397 899 discloses a machine for cleaving slate pieces, in which the piece is held laterally by means of jaws; nevertheless, this document does not contemplate any type of holding of said piece by the upper edge thereof, in the proximity of the area where the penetration of the blade in the piece produce a crack in the material. The document does not contemplate either the injection of pressurized water in said crack.

The document FR-A-2 527 505 relates to a process and a plant for the cleaving of schistose material according to first part of claim 1. The block is held by the four side faces, but no firm holding of the block by the upper edge thereof is contemplated either in this case. The use of pressurized air is disclosed, which requires a sealed chamber, obliging costly sealing measures.

It is an object of the invention to provide a machine overcoming the said drawbacks. This object is achieved with a machine for cleaving slate pieces characterised in that said approach mechanism has two arms with end feelers arranged to engage said flat lateral edge; and in that comprises: a blade holder attached to the through rods and capable of moving relative to the cylinder holder; and nozzles adapted to inject pressurized water in said crack.

In a preferred development of the invention, the head member may rock, so that when a portion of the end feelers of said arms engages said lateral edge of the piece of slate, the head member is caused to rock until said cutting edge becomes parallel to said lateral edge.

According to a further preferred feature of the invention, the arms may rock between a closed position in which the end feelers thereof are juxtaposed and a spaced apart position of said end feelers.

Also according to the invention, the machine is provided with a positioning mechanism comprising two opposed jaws, adapted to engage respectively the opposite faces of the piece of slate while moving it to centre said lateral edge with the vertical plane containing said cutting edge.

The jaws may be provided with respective sloping surfaces which converge upwardly, and preferably at least one of said jaws rocks.

Further advantages and features of the invention will be appreciated from the following description in which, without any limiting nature, there is described one preferred embodiment of the invention, with reference to the accompanying drawings. In the drawings:

Figure 1 is a top plan view of the machine of the invention.

Figure 2 is a cross sectional view on the line II-II of Figure 1.

Figure 3 is a partial side elevation view of a module comprising head member, guideways and frame.

Figure 4 is a detail on a larger scale of Figure 3.

Figure 5 is a part side elevation view, partly in cross section, of the approach mechanism.

Figure 6 is a view on line VI-VI of Figure 1.

The machine of the invention has a fixed structure formed by a frame 2 (Figure 3) having a space for containing the piece 3 of slate to be cloven. This piece or block is approximately a regular parallelepiped, the larger surfaces of which are surfaces parallel to the plane of cleavage of the piece. In any case, between the smaller sides of the block there is at least one generally flat lateral edge orientated perpendicularly to the cleavage planes. The piece 3 of slate is placed in the frame in such a way that said edge is upwards. The structure is also provided with vertical guideways 4.

The machine also comprises a head member 6 which may slide along the guideways 4. Sliding is oleohydraulically operated and the guideways form a portal (as in the illustrated embodiment) or are gooseneck shaped, the most appropriate possibility for the final arrangement in the workshop, available space or use of available supply facilities and, above all, the desired level of automation being chosen in each case.

The plant may comprise one or several modules depending on the production rate it is desired to attain. Each module comprises a head member 6, the corresponding vertical guideways 4 and frame 2. In the case of several modules with their corresponding

structure, the first one checks the size of the block or piece of slate and provides a coarse cleavage to obtain slabs of a thickness equivalent to four final slates, which thickness is predetermined depending on the market and quality of the slate, ranging normally from 3 to 6 mm.

The slabs obtained move to a second module which splits them exactly down the middle and each of the slabs obtained is moved to further modules which split them down the middle, thereby obtaining the four final slates. Reference is made herein to this second and subsequent modules.

A head member 6 comprises a cylinder holder 8 having preferably hydraulic cylinders 12 (Figure 2) which are connected to a blade holder 20 by way of their rods 13. The blade holder 20 is thus provided with the possibility of movement relative to the cylinder holder 8.

The blade holder 20 has attached thereto a blade 22 which may be continuous or sectional, although it is preferably sectional for reasons to be described hereinafter. These blades are removably mounted, i.e. they may be removed for replacement or repair. The series of blades 22 has a cutting edge 24 defining a single straight line which, as said above, must be generally parallel to the upper edge of the piece 3 of slate.

The rods 13 of the cylinders 12 act as sliding ways for the frame 5 which supports the approach mechanisms, with the feelers therefor and the positioning or self centering mechanism.

The frame 5 is supported on the cylinder holder block 8 through the rods 11 of special, preferably pneumatic cylinders 10 which relieve the load which, due to the weight thereof, the unit exerts on the piece of slate, by air pressure on the surface of the upper portion of the rod 11. Furthermore the piece 3 of slate is released once the blade has penetrated therein to allow separation of the pieces and handling thereof.

The approach mechanism (Figure 5) consists of arms 16 fixedly attached to respective feelers 14 and capable of being oscillated by a preferably pneumatic cylinder 7 between a normal closed position as shown in Figure 5 and a further position in which the ends are spaced apart. Said feelers 14 are provided at the lower end thereof with flat surfaces 18 which at the end of the downward stroke thereof are pressed against the upper lateral edge of the piece of slate. The cylinder 7 urges the feelers 14 to the closed position thereof and the blade 22, on penetrating in the piece 3, separates the feelers 14 which continue to exert pressure.

At times the said upper lateral edge is not horizontally disposed. In such cases, only a portion of the flat surfaces 18 of the ends of the arms 16 of the feelers 14 engage the said upper lateral edge. Then the head member 6 is rocked slightly until the feelers 14 are fully engaged against the upper lateral edge, which implies substantial parallelism of said edge and the blade cutting edge (to be referred to hereinafter). Said rocking is possible because the head member 6 is associated with the guideways 4 with bearings 19 to be seen in Figure 3.

After the feelers 14 have engaged the piece of slate, the feelers 14 obviously remain fixed, although the cylinder holder 8 continues to move downwards and this movement continues until the micro switch is activated, the relative movement between the cylinder holder 8 and the feeler 14 being regulated by way of a screw 23 (Figure 3). In this way, the blade 22 will be at a variable distance from the piece 3, allowing for different depths of penetration according to the quality of the material, since the blade stroke is fixed. The said depth of penetration will produce a particular crack in the material in each case. Logically for the access of the blade 22 to the piece , as stated hereinbefore, the arms 16 are slightly forced apart by the blade when the latter penetrates in the piece.

The machine also comprises nozzles 26 (Figure 2) which are preferably inserted in the spaces between the blades 22 and which are also preferably attached to the blade holder 20. These nozzles 26 are adapted to inject pressurized water in the crack, until the piece 3 is completely cloven along a plane of cleavage. The nozzles are duly connected to a not shown reservoir and the water is injected with a laminar jet. The water pressure causes the pieces to move sideways and they are picked up by an ejection mechanism.

The machine also preferably comprises a positioning mechanism 28 which is particularly useful for modules not for producing the coarse cleavage referred to above. The said mechanism 28 comprises opposed jaws 30, at least one of which may be caused to rock by connecting rods 32 (Figure 6) attached forks 34, fixedly attached to stems 36 of preferably pneumatic cylinders 38 (Figure 6).

Before cleaving the piece 3 of slate, the jaws 30 are opened and the mechanism 28 is lowered so that each jaw is disposed at a different side of the piece 3. When the jaws close, the piece is caused to move as necessary to centre the upper edge with the vertical plane containing the cutting edge 24 of the blade 22. In other words, the piece 3 and the cutting edge 24 are caused to become aligned in parallel, and the median line of the upper lateral edge and the cutting edge are situated in the same vertical plane, such that when the blade 22 is lowered, a centered crack is formed and thus the piece is split into two substantially equal halves.

Each jaw 30 is provided with replaceable contact pads 40 and with sloping surfaces 42 which converge upwardly.

Claims

1. A machine for cleaving slate pieces, said pieces (3) determining an orientation for planes of cleavage and having at least one generally flat lateral edge perpendicular to said cleavage planes, the machine comprising:

   a fixed structure having a frame (2) for holding the piece (3) of slate to be cloven and at least one vertical guideway (4);

   a head member (6) which is slidable along said guideway (4) and is provided with a cylinder holder (8) housing cylinders (12) with through rod (13);

   an approach mechanism sliding on the through rods (13) and which is movable relative to the cylinder holder (8); and

   at least one blade (22), having a straight line cutting edge (24) adapted to open a crack in said flat lateral edge, characterised in that said approach mechanism has two arms (16) with end feelers (14) arranged to engage said flat lateral edge; and in that comprises: a blade holder (20) attached to the through rods (13) and capable of moving relative to the cylinder holder (8); and nozzles (26) adapted to inject pressurized water in said crack.

2. The machine of claim 1, characterized in that said head member (6) may rock, so that when a portion of the end feelers (14) of said arms (16) engages said lateral edge of the piece (3) of slate, the head member (6) is caused to rock until said cutting edge (24) becomes parallel to said lateral edge.

3. The machine of claim 1 or 2, characterized in that said arms (16) may rock between a closed position in which the end feelers (14) thereof are juxtaposed and a spaced apart position of said end feelers (14).

4. The machine of any one of claims 1 to 3, characterized in that it is provided with a positioning mechanism (28) comprising two opposed jaws (30), adapted to engage respectively the opposite faces of the piece (3) of slate while moving it to centre said lateral edge with the vertical plane containing said cutting edge (24).

5. The machine of claim 4, characterized in that the jaws (30) are provided with respective sloping surfaces (42) which converge upwardly.

6. The machine of claim 4, characterized in that at least one of said jaws (30) rocks.

Patentansprüche

1. Maschine zum Spalten von Schieferstücken, wobei die Schieferstücke (3) eine Richtung für Spaltungsebenen vorgeben und wenigstens eine, im allgemeinen ebene Seitenkante aufweisen, die zu den Spaltungsebenen senkrecht steht, wobei die Maschine folgende Teile umfaßt:
   einen feststehenden Aufbau mit einem Rahmen (2) zum Halten des Schieferstückes (3), das gespalten werden soll und mit wenigstens einer vertikalen Führung (4);
   ein Kopfteil (6), das längs der Führung (4) gleitend verschiebbar und mit einem Zylinder-Halteteil (8) versehen ist, das seinerseits Zylinder (12) mit durchgehenden Kolbenstangen (13) beherbergt,
   eine Annäherungsvorrichtung, die an den durchgehenden Kolbenstangen (13) gelagert ist und die relativ zum Zylinder-Halteteil (8) bewegbar ist, und
   wenigstens eine Klinge (22), die eine gerade Schneidkante (24) hat, die so ausgelegt ist, daß sie in der genannten, ebenen Seitenkante einen Spalt öffnen kann,
   dadurch **gekennzeichnet,**
   daß die Annäherungsvorrichtung zwei Arme (16) mit Endfühlern (14) hat, die so angeordnet sind, daß sie mit der ebenen Seitenkante in Eingriff kommen können, und
   daß sie einen Klingenhalter (20) umfaßt, der an den durchgehenden Kolbenstangen (13) angebracht und in der Lage ist, sich relativ zum Zylinder-Halteteil (8) zu bewegen sowie Düsen (26), die dazu bestimmt sind, Druckwasser in den Spalt einzuspritzen.

2. Maschine nach Anspruch 1, dadurch gekennzeichnet, daß das Kopfteil (6) sich so verschwenken kann, daß dann, wenn nur ein Abschnitt der Endfühler (14) der Arme (16) mit der Seitenkante des Schieferstückes (3) in Eingriff kommt, das Kopfteil (6) sich solange verschwenkt, bis die Schneidkante (24) zu dieser Seitenkante parallel verläuft.

3. Maschine nach einem der Ansprüche 1 oder 2, dadurch gekennzeichnet, daß die Arme (16) zwischen einer geschlossenen Stellung, in der ihre Endfühler (14) nebeneinanderliegen und einer voneinander entfernten Stellung der Endfühler (14) verschwenkt werden können.

4. Maschine nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß sie mit einer Ausrichtvorrichtung (28) versehen ist, die ihrerseits zwei einander gegenüberliegende Backen (30) aufweist, die dazu bestimmt sind, jeweils einander

gegenüberliegende Flächen des Schieferstückes (3) zu erfassen, während sie das Schieferstück so bewegen, daß die Seitenkante mit der vertikalen Ebene ausgerichtet wird, in der die Schneidkante (24) liegt.

5. Maschine nach Anspruch 4, dadurch gekennzeichnet, daß die Backen (30) jeweils mit schräg verlaufenden Flächen (42) versehen sind, die nach oben zusammenlaufen.

6. Maschine nach Anspruch 4, dadurch gekennzeichnet, daß wenigstens eine der Backen (30) verschwenkbar ist.

Revendications

1. Machine pour cliver des pièces schisteuses, lesdites pièces (3) déterminant l'orientation de plans de clivage et ayant au moins un bord latéral de manière générale plat perpendiculaire auxdits plans de clivage, la machine comportant:

une structure fixe comportant un châssis (2) destiné à supporter la pièce (3) de schiste à cliver et au moins un guide vertical (4),

un élément (6) formant tête qui peut coulisser le long dudit guide (4) et comportant un support (8) de vérins recevant des vérins (12) munis d'une tige traversante (13),

un mécanisme d'approche coulissant sur les tiges traversantes (13) et qui est mobile par rapport au support (8) de vérins, et

au moins une lame (22) ayant un bord (24) de coupe en ligne droite adapté pour ouvrir une fente dans ledit bord latéral plat, caractérisée en ce que ledit mécanisme d'approche comporte deux bras (16) munis de palpeurs (14) d'extrémité agencés pour venir en contact avec ledit bord latéral plat, et en ce qu'il comporte un support (20) de lame fixé sur les tiges traversantes (13) et capable de se déplacer par rapport au support (8) de vérins, et des buses (26) adaptées pour injecter de l'eau sous pression dans ladite fente.

2. Machine selon la revendication 1, caractérisée en ce que ledit élément (6) formant tête peut basculer, de sorte que lorsqu'une partie des palpeurs d'extrémité (14) desdits bras (16) vient en contact avec ledit bord latéral de la pièce (3) de schiste, l'élément (6) formant tête est amené à basculer jusqu'à ce que ledit bord de coupe (24) devienne parallèle audit bord latéral.

3. Machine selon la revendication 1 ou 2, caractérisée en ce que lesdits bras (16) peuvent basculer entre une position fermée dans laquelle les palpeurs d'extrémité (14) de ceux-ci sont juxtaposés et une position écartée, écartant lesdits palpeurs d'extrémité (14).

4. Machine selon l'une quelconque des revendications 1 à 3, caractérisée en ce qu'elle comporte un mécanisme de positionnement (28) comportant deux mâchoires opposées (30), adaptées pour venir en contact respectivement avec des faces opposées de la pièce (3) de schiste tout en la déplaçant pour centrer ledit bord latéral dans le plan vertical contenant ledit bord de coupe (24).

5. Machine selon la revendication 4, caractérisée en ce que les mâchoires (30) sont munies de surfaces inclinées (42) respectives qui convergent vers le haut.

6. Machine selon la revendication 4, caractérisée en ce qu'au moins une desdites mâchoires (30) bascule.

FIG.1

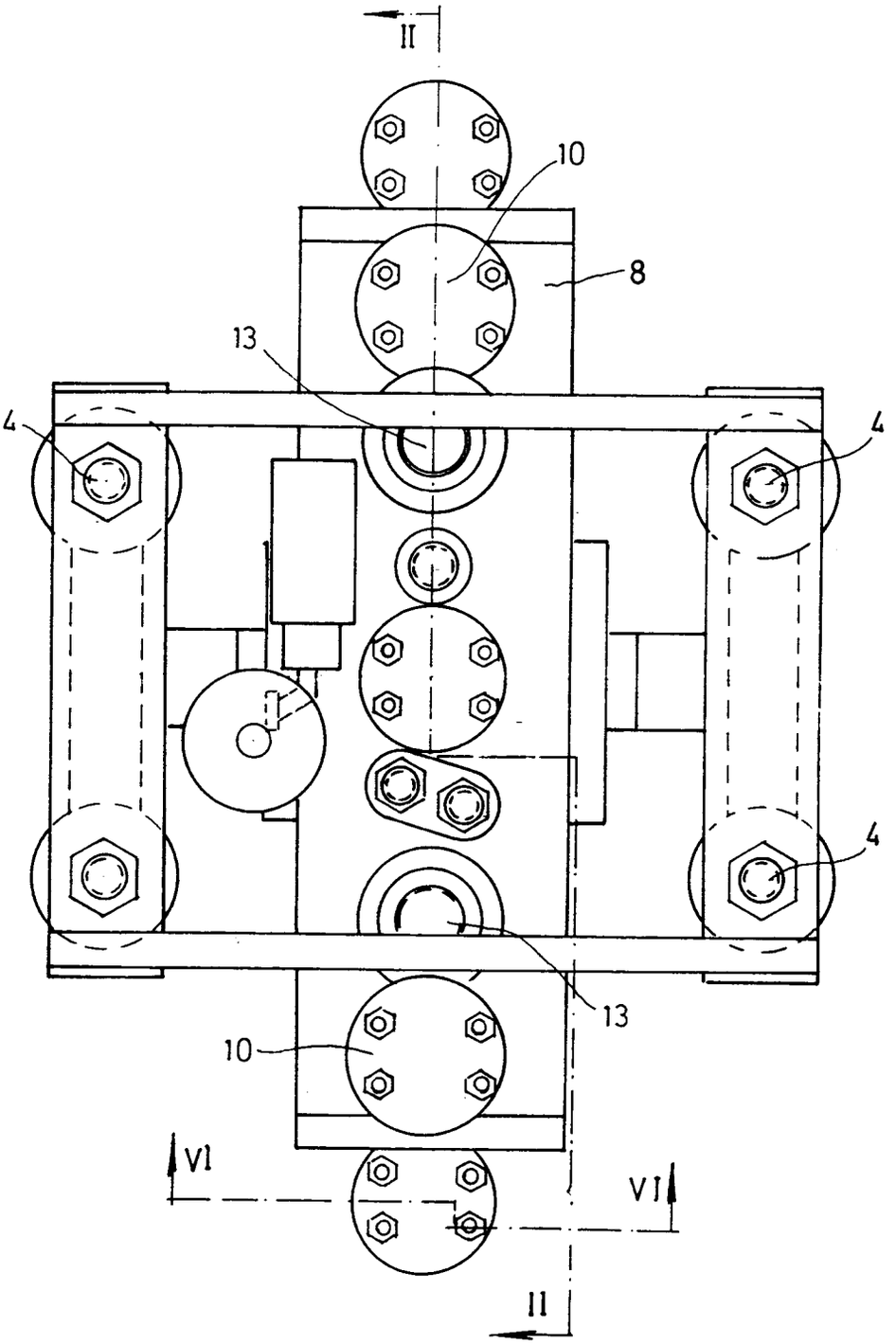

FIG.2

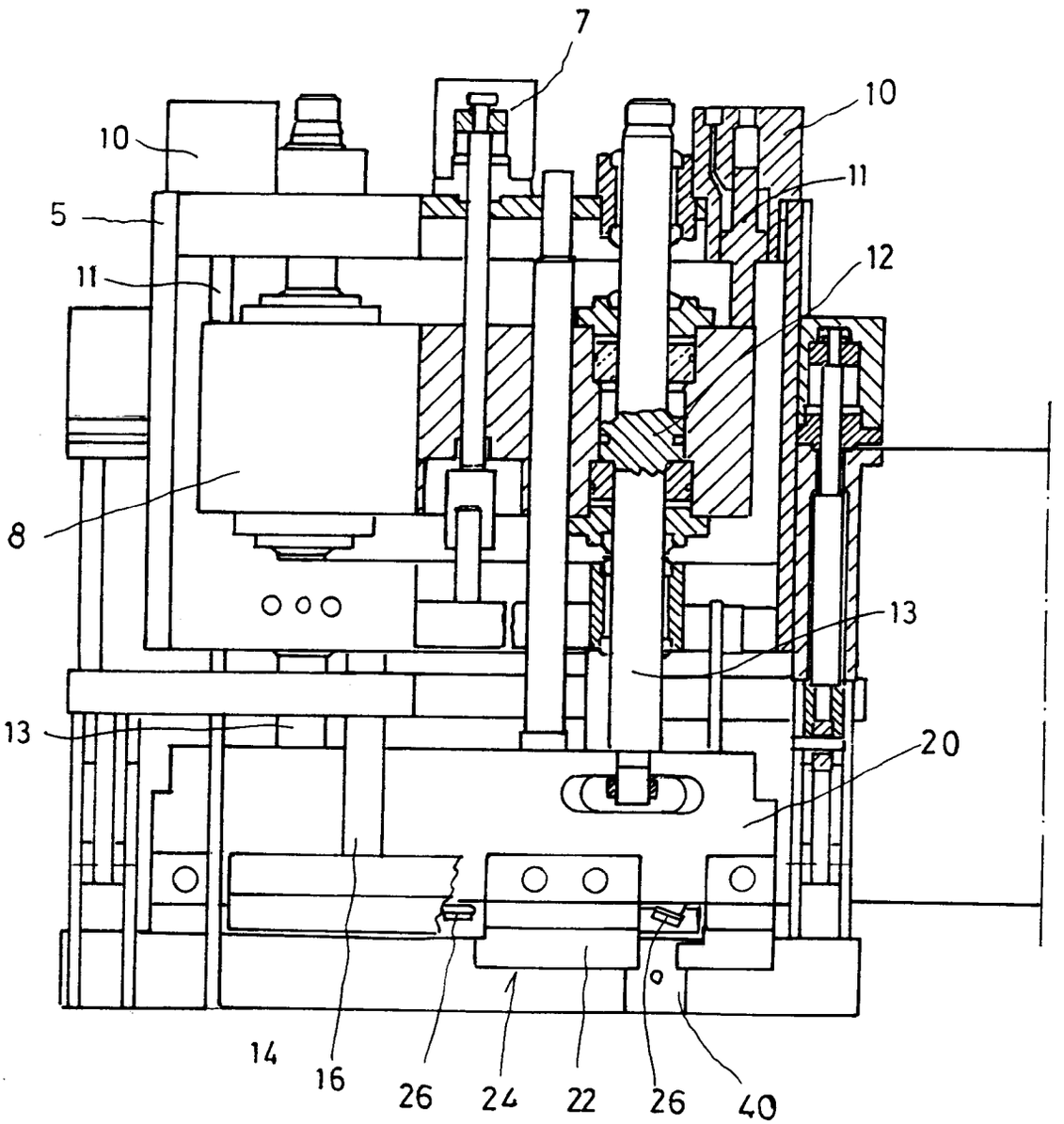

FIG.3

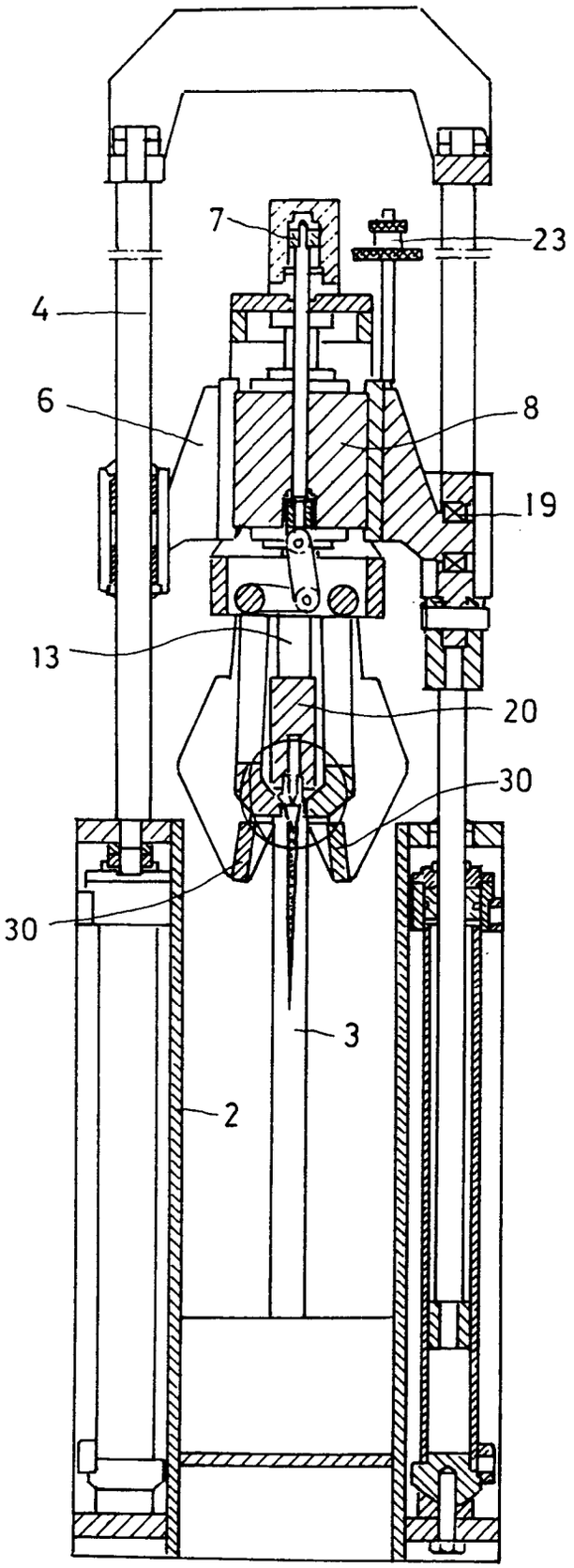

FIG 5

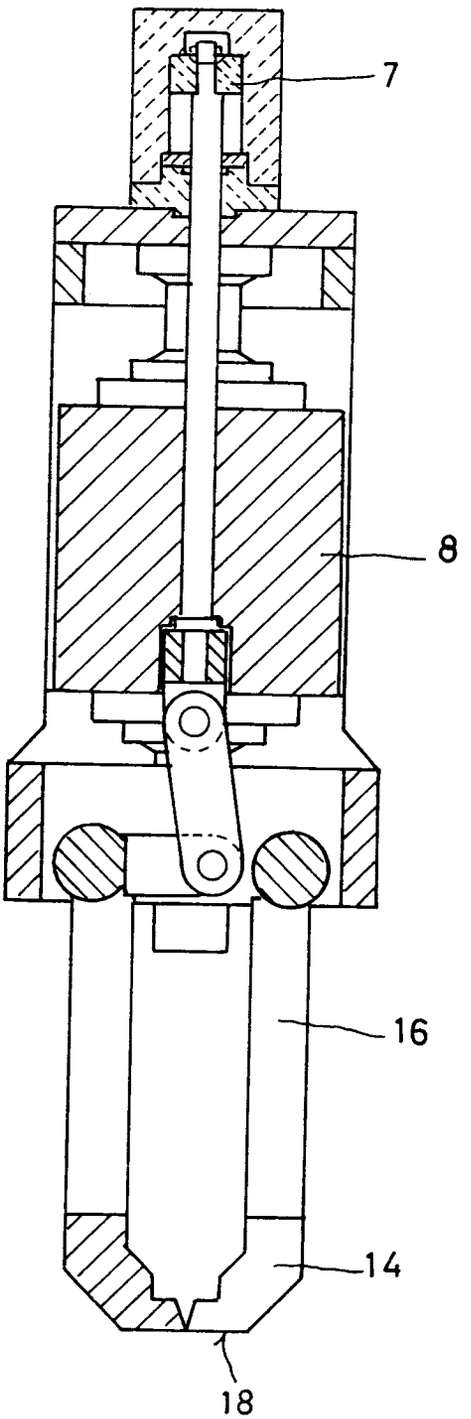

FIG 4

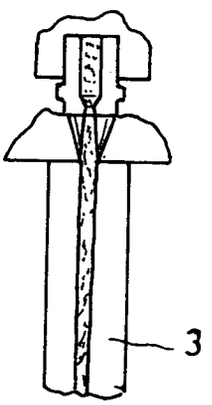

FIG. 6