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Office européen des brevets



(11) Publication number:

0 256 830 B1

(12)

EUROPEAN PATENT SPECIFICATION

- (49) Date of publication of patent specification: **22.02.95** (51) Int. Cl.⁶: **B21H 3/06, B23Q 3/06**
- (21) Application number: **87307072.6**
- (22) Date of filing: **10.08.87**

(54) **Machines for forming configurations on a rotary workpiece.**

(30) Priority: **11.08.86 GB 8619554**

(43) Date of publication of application:
24.02.88 Bulletin 88/08

(45) Publication of the grant of the patent:
22.02.95 Bulletin 95/08

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

(56) References cited:
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01-11-1986

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Description

The invention relates to machines for forming configurations on or in a rotary workpiece, and particularly relates to apparatus for holding a forming tool of such a machine.

The machines may be pressure forming machines, used for forming grooves, splines or gear teeth on a rotary shaft such as a gear or crank shaft of an internal combustion engine. Again, the machines may be broach turning or cutting machines, in which a rack-like cutter is moved over a rotary workpiece to form a desired shape therein, for example a surface channel.

In such machines metal workpieces are formed between a pair of opposed, substantially parallel reciprocating dies, tools or tool members. As the tools reciprocate (in opposite directions usually) they apply pressure to the workpiece and form or shape it. One disadvantage of these machines is that the tools (mounted on supports) have to be mounted and dismounted from the machines using a time consuming manual operation, which is also the case when the tools are required to be adjusted in position relative to one another. EPO 181132 shows apparatus for holding a tool of a machine for pressure forming surface configurations on a rotary workpiece comprising an elongate support on which a tool is mountable, first automatic means for shifting the support longitudinally for adjusting the position of the tool and second automatic means for securing the support in a shifted position. It is an object of this invention to provide improved apparatus for holding a tool of a machine for pressure forming surface configurations on a rotary workpiece.

According to the invention there is provided apparatus for releasably clamping a tool for forming configurations on a rotary workpiece, characterised in that it comprises:

an elongate member having a bed and at least two support surfaces, rising from the bed in different planes;

releasable clamping means comprising a lever device rotatably mounted on a spindle in the vicinity of a first support surface, the lever device having an engagement part shaped such that it can force a tool toward both the first support surface and a second support surface when the lever device is rotated in the clamping direction, which is the direction that moves the engagement part of the lever device towards the other support surface, the lever device also having a further part projecting away from the first-mentioned part;

a slide means engageable with the lever device for rotation thereof in the clamping direction, the slide means having a wedge profile engageable with the further part of the lever device, and a

biasing means connected to the lever device to bias said device away from the clamping direction.

The slide may have a wedge profile engaging the further part.

5 The slide means may be carried by an elongate carrier which may be reciprocable longitudinally by actuating means.

The actuating means may comprise a hydraulic piston and cylinder arrangement.

10 There may be two spaced apart clamping means driven by the hydraulic cylinder which is a double-acting piston and cylinder arrangement having two coaxial carriers extending on either side of the cylinder to actuate the two clamping devices.

15 Using the invention it is possible to provide a simple, yet efficient and effective, way in which to achieve rapid interchangeability of tools used in a machine tool.

20 Apparatus embodying the invention is hereinafter described, by way of example, with reference to the accompanying drawings.

Figure 1 is a plan view, partly in section, of the apparatus, with a tool used in the apparatus removed for clarity; and

25 Figure 2 is a front elevational view of the apparatus.

Referring to the drawings, there is shown apparatus 1 for holding a tool (not shown) of a rotary workpiece (that is one which rotates during the forming operation, though it could also rotate in use) comprising an elongate member 2 on which the tool is mountable and which member has a plurality of support surfaces 3 and 4, and means 5 to engage and urge the tool bodily against the support surfaces 3 and whereby to clamp the tool in an operative position.

30 The means 5 in the embodiment shown is a rotatable lever device 6. There are in the embodiment shown two lever devices 6 for each tool, and there are two tools in line, at 7 and 8, in upper and lower elongate members, of which the lower member 2 only is shown in the drawings. The devices 6 are identical and so only one will be described in detail. Also, the elongate member 2 in which each tool is mounted is identical in having a bed 9, which is inclined, with a heel 10 and toe plate 11 and heel/toe plate 12 which provide support surfaces 3 and 4 which rise at substantially 90° to one other from the bed 9. In the embodiment shown there are two tools 24" (60.96cm) long though there could be one tool 48" (121.92cm) long or indeed as many tools as are desired along a bed of the machine.

55 The lever device 6 is mounted in a recess 13 and has a part 14 which has a gear tooth surface profile or configuration 14a and in use engages a complementary part of the tool. The lever device 6 is mounted on a spindle or shaft 15 for rotation,

and has a further part 16 projecting away from the first-mentioned part 14 and which further part 16 is of bull-nose shape and is engageable by a slide means in the form of a wedge 17 to rotate the lever device 6. The wedge 17 is carried by an elongate carrier 18 which is reciprocable longitudinally by an actuating means in the form of a double acting piston and cylinder arrangement 19. The piston 19 is a hydraulic piston situated between the two respective lever devices 6 for each tool, the carriers 18 being carried by the piston rods 20. The devices 6 include biasing means 21 in the form of coil tension springs which bias the levers to the position shown in Figure 1.

A tool for forming a configuration such as gear profiles in the surface of a rotary workpiece, such as a metal shaft, is an elongate metal block with transverse surface grooves in it so that it is in the form of a rack, and is known as such or as a rack cassette. In use, the grooved surface would be uppermost when the rack is on the lower bed 2 shown. The rack is of generally square cross-section and in the rear (as considered in use) surface there are two channel-shaped blind slots, terminating at a position remote from the grooved surface, in other words adjacent the in use lower surface 9, in an enlarged part so that the channel is effectively of T-shape. The enlarged part has an angled and tapered surface profile which is effectively a camming surface of complementary shape to that of the gear tooth configuration 14a of the projecting part 14 of the lever device 6.

In use to mount a tool in the machine, the piston and cylinder arrangement 19 is actuated to move the wedge 17 to rotate the lever device 6 so that that device is effectively at right angles to the surface 4. The tool is then offered up to the bed, above it, with the channels aligned with a respective part 14, and is then lowered to rest on the bed 9. The piston and cylinder arrangement 19 is then actuated to move the piston to the right as viewed in Figure 1. This action results in the wedges 17 moving to the right and they in turn rotate their respective lever devices 6 clockwise, as viewed, against the bias of the springs 21 so that the parts engage in the enlarged parts of the tool channels, ride over the camming surfaces and force the tool to the left as viewed, and to the rear, to abut the support surfaces 3 and 4 firmly. The tool is thus clamped in an operative position. In this position, hydraulic female connectors (not shown) projecting from the end of piston and cylinder arrangement 19 and moving with the piston rods automatically engage in a leak proof manner with fixed male hydraulic connectors which are mounted on the frame of the machine and which are also part of the hydraulic circuit. The female parts have non-return valves which are normally closed, but which are

opened by the male parts, or drogues, to complete the hydraulic circuit so that there is thus a "solid" hydraulic connection throughout the system and it is therefore unnecessary to maintain hydraulic force and the wedges 17, which are effectively self-locking, remain in position to clamp the tool via the lever devices 6. This saves on energy as a pump for the system can be closed down, and meanwhile the lever devices 6 remain in position to maintain the tool clamped, as described. A forming operation can then be carried out, usually by reciprocating the upper tools in unison longitudinally in an opposite direction to the lower tools while a workpiece between them is rotated. As many passes as are necessary are carried out to form the desired configuration. The operation is then repeated on a succeeding workpiece, and so on. If it is necessary to change a tool, for example because a different configuration is to be formed on a workpiece, or because a tool is worn, it is merely necessary to pressurize the cylinder of the piston and cylinder arrangement 19 to move the lever devices 6 to the substantially 90° position, when the tool can simply be slid clear and replaced by another one using the sequence already described. The apparatus thus provides a simple yet efficient method of interchangeability of tools in machines of the kind described.

In a modification, it is possible to mount and dismount a tool with the lever devices in the position shown. Also, other means than hydraulic means for the piston and cylinder arrangement may be used, for example pneumatic, mechanical or electro-mechanical.

Claims

1. Apparatus (1) for releasably clamping a tool for forming configurations on a rotary workpiece, characterised in that it comprises:

an elongate member (2) having a bed (9) and at least two support surfaces (3, 4) rising from the bed (9) in different planes;

releasable clamping means (5) comprising a lever device (6) rotatably mounted on a spindle (15) in the vicinity of a first support surface (4), the lever device (6) having an engagement part (14) shaped such that it can force a tool toward both the first support surface and a second support surface (3) when the lever device is rotated in the clamping direction, which is the direction that moves the engagement part (14) of the lever device (6) towards the other support surface (3), the lever device (6) also having a further part (16) projecting away from the first-mentioned part (14);

a slide means (17) engageable with the lever device (6) for rotation thereof in the

clamping direction, the slide means (17) having a wedge profile engageable with the further part (16) of the lever device, and a biasing means (21) connected to the lever device (6) to bias said device (6) away from the clamping direction.

2. Apparatus according to Claim 1, characterised in that the part (14) has a gear-tooth surface profile.
3. Apparatus according to Claim 1 or Claim 2, characterised in that the biasing means (21) comprises a coil spring.
4. Apparatus according to any preceding claim, characterised in that the slide means (17) is carried by an elongate carrier (18) which is reciprocable longitudinally by actuating means (19).
5. Apparatus according to Claim 4, characterised in that the actuating means (19) comprises a hydraulic piston and cylinder arrangement.
6. Apparatus according to Claim 5, characterised in that there are two spaced apart clamping means (5) driven by a double-acting piston and cylinder arrangement (19) having two coaxial carriers (18) extending on either side of the cylinder to actuate the two clamping devices.

Patentansprüche

1. Vorrichtung (1) zum lösbaren Einspannen eines Werkzeuges zum Herstellen von Konfigurationen an einem rotierenden Werkstück, dadurch gekennzeichnet, daß sie folgendes umfaßt:
 ein längliches Element (2) mit einem Bett (9) und wenigstens zwei Stützflächen (3, 4), die sich in verschiedenen Ebenen von dem Bett (9) erheben;
 lösbare Einspannmittel (5) mit einer Hebeleinrichtung (6), die in der Nähe einer ersten Stützfläche (4) drehbar auf einer Spindel (15) montiert ist, wobei die Hebeleinrichtung (6) ein Eingriffsteil (14) aufweist, das so geformt ist, daß es ein Werkzeug sowohl gegen die erste Stützfläche als auch gegen eine zweite Stützfläche (3) drücken kann, wenn die Hebeleinrichtung in Einspannrichtung gedreht wird, bei der es sich um die Richtung handelt, die das Eingriffsteil (14) der Hebeleinrichtung (6) zu der anderen Stützfläche (3) hin bewegt, wobei die Hebeleinrichtung (6) noch ein weiteres Teil (16) aufweist, das von dem erstgenannten Teil (14) wegragt;

ein Schiebermittel (17), das zur Drehung mit der Hebeleinrichtung (6) in Einspannrichtung in diese eingreifen kann, wobei das Schiebermittel (17) ein Keilprofil aufweist, das in das weitere Teil (16) der Hebeleinrichtung eingreifen kann, und ein Vorspannmittel (21), das mit der Hebeleinrichtung (6) verbunden ist, um die genannte Einrichtung (6) von der Einspannrichtung weg vorzuspannen.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß das Teil (14) ein gezahntes Oberflächenprofil aufweist.
3. Vorrichtung nach Anspruch 1 oder Anspruch 2, dadurch gekennzeichnet, daß das Vorspannmittel (21) eine Schraubenfeder umfaßt.
4. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das Schiebermittel (17) von einem länglichen Träger (18) getragen wird, der von einem Betätigungsmittel (19) in Längsrichtung hin- und herbewegt werden kann.
5. Vorrichtung nach Anspruch 4, dadurch gekennzeichnet, daß das Betätigungsmittel (19) eine Anordnung aus Hydraulikkolben und Zylinder aufweist.
6. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß zwei voneinander beabstandete Einspannmittel (5) vorgesehen sind, die von einer doppelwirkenden Kolben- und Zylinderanordnung (19) mit zwei coaxialen Trägern (18) angetrieben werden, die sich zur Betätigung der beiden Einspanneinrichtungen auf beiden Seiten des Zylinders erstrecken.

Revendications

1. Appareil (1) pour serrer de manière libérable un outil servant à former des configurations sur une pièce à usiner rotative, caractérisé en ce qu'il comprend :
 un organe allongé (2) présentant un banc (9) et au moins deux surfaces d'appui (3, 4) s'élevant à partir du banc (9) dans des plans différents ;
 un moyen de serrage libérable (5) comprenant un dispositif à levier (6) monté de façon à pouvoir effectuer une rotation sur un axe (15) dans le voisinage d'une première surface d'appui (4), le dispositif à levier (6) présentant une partie à engagement (14) formée de telle sorte qu'elle puisse forcer un outil en direction à la fois de la première surface d'appui et d'une seconde surface d'appui (3) lorsque l'on fait

effectuer une rotation au dispositif à levier dans le sens de serrage, qui est le sens qui déplace la partie à engagement (14) du dispositif à levier (6) en direction de l'autre surface d'appui (3), le dispositif à levier (6) présentant également une partie supplémentaire (16) faisant saillie à partir de la partie (14) mentionnée la première ;

un moyen à coulisse (17) capable d'engagement avec le dispositif à levier (6) pour effectuer la rotation de celui-ci dans le sens de serrage, le moyen à coulisse (17) présentant un profil en coin capable d'engagement avec la partie supplémentaire (16) du dispositif à levier, et un moyen d'inclinaison (21) raccordé au dispositif à levier (6) pour incliner ledit dispositif (6) dans un sens différent du sens de serrage.

2. Appareil selon la revendication 1, caractérisé en ce que cette partie (14) présente un profil à surface en denture d'engrenage.
3. Appareil selon la revendication 1 or la revendication 2, caractérisé en ce que le moyen d'inclinaison (21) comprend un ressort à boudin.
4. Appareil selon une revendication précédente quelconque, caractérisé en ce que le moyen à coulisse (17) est porté par un support allongé (18) qui est capable de mouvement alternatif longitudinalement à l'aide d'un moyen de commande (19).
5. Appareil selon la revendication 4, caractérisé en ce que le moyen de commande (19) comprend un arrangement à piston hydraulique et cylindre.
6. Appareil selon la revendication 5, caractérisé en ce qu'il existe deux moyens de serrage espacés l'un de l'autre (5) entraînés par un arrangement (19) à piston et cylindre à double action présentant deux supports coaxiaux (18) s'étendant de chaque côté du cylindre pour actionner les deux dispositifs de serrage.

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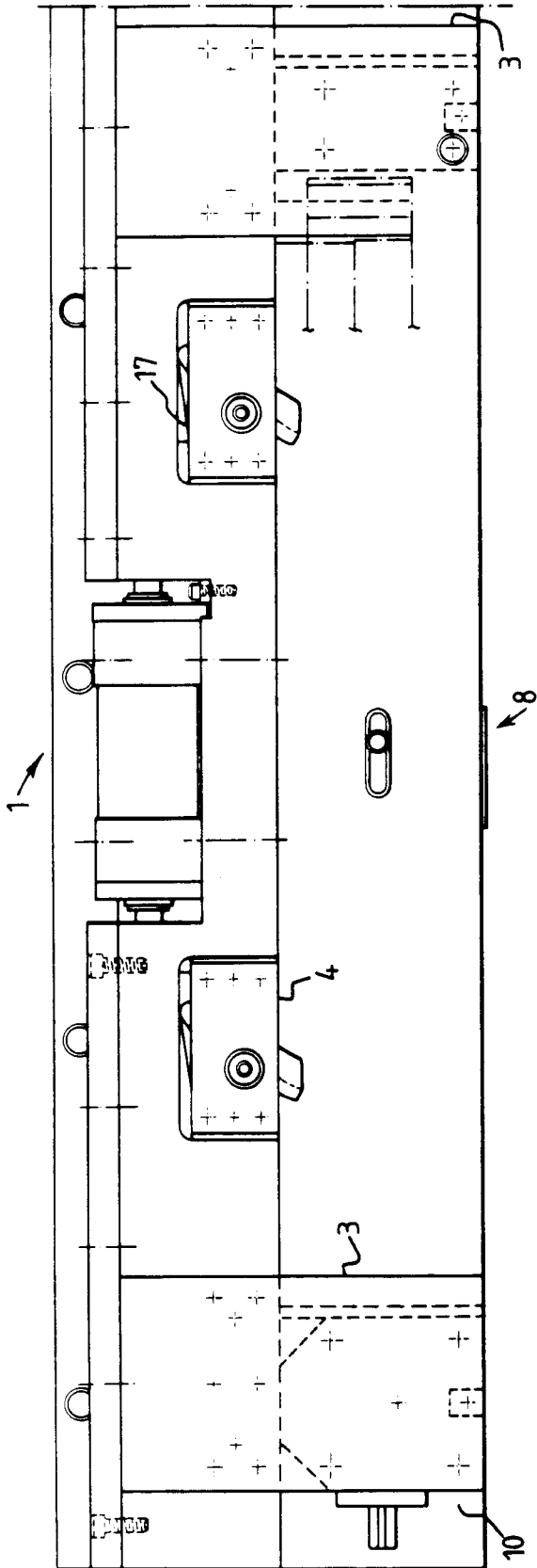
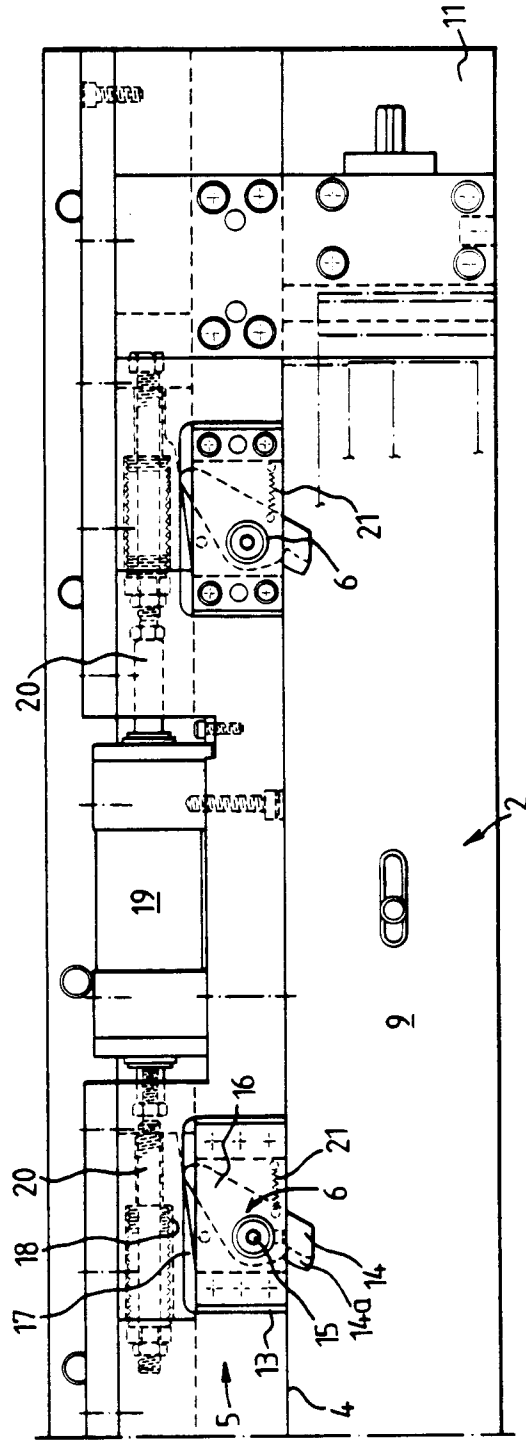


FIG. 1.



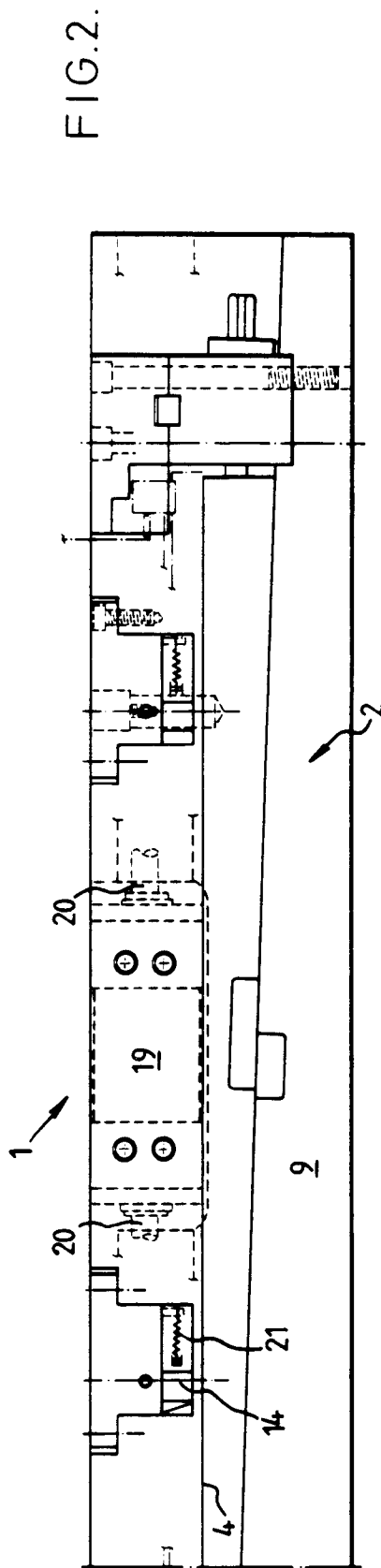
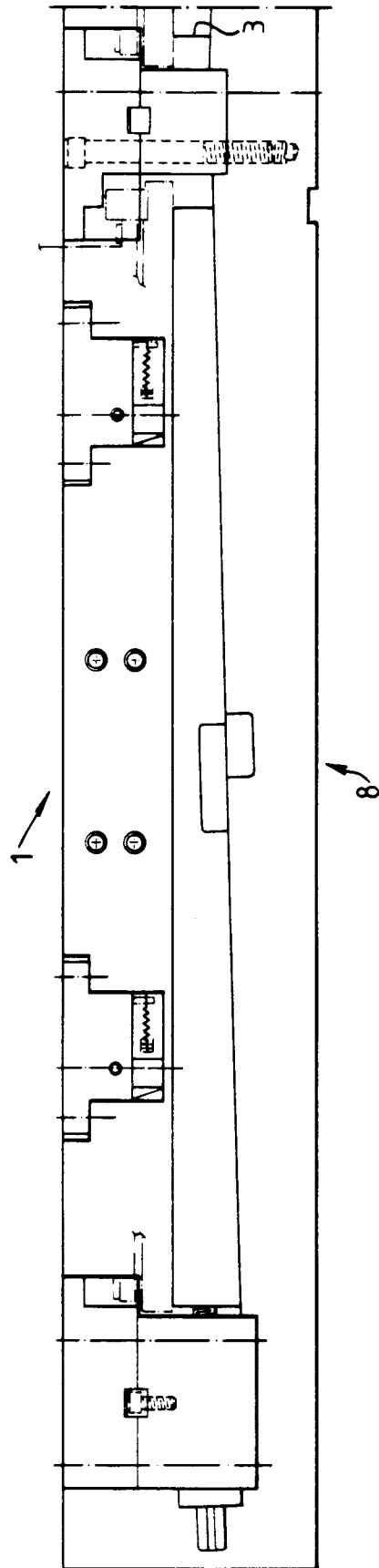


FIG.2.