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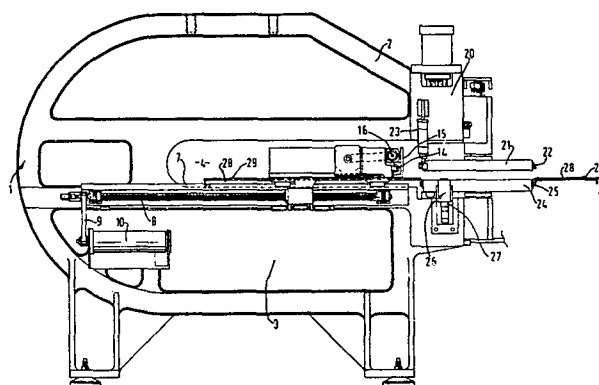
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⑤④ **Workpiece positioning.**

⑤⑦ A workpiece positioning assembly for a punch press of C-shape has a first traverse (5) comprising two rails (7) one secured to each side of the lower limb (3) of the frame, and a second traverse (6) mounted upon the first traverse for horizontal movement in a direction perpendicular to the axis of the second traverse. The second traverse includes only a single rail (14) along which a workpiece support (15) is movable.

The punch press may be a turret punch press and include a lower turret (24) the circumference of which has a scalloped configuration so as to receive a die assembly (30) against an arcuate datum surface (41).



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"WORKPIECE POSITIONING"FIELD OF THE INVENTION

This invention relates to an improved workpiece positioning assembly and to a punch press incorporating such an assembly.

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BACKGROUND OF THE INVENTION

Existing punch presses usually include a frame having an upper and lower limb defining a throat therebetween. The punch assembly for punching a hole in a sheet of metal is carried by the upper limb and an aligned die assembly is carried by the lower limb. In order to move a sheet of metal relative to the punch assembly so that more than one hole may be punched without lifting the sheet from the press the sheet of metal is clamped to a movable traverse in the form of a beam which extends at right angles to the axis of the throat of the press. The beam is movable in the axial direction of the throat and is supported at each of its ends by a bearing bar which extends parallel to the axis of the throat. Such an arrangement allows movement in the one direction; movement in a right-angled direction being provided by a movable carriage supported on horizontally or vertically spaced bearing bars and to which the sheet is clamped: for example such an arrangement is disclosed in British Patent Specifications 1096284, and 1378487.

As an improvement over the disclosures in 1096284 and 1378487 there is disclosed in our prior British Patent No. 1563921 a workpiece positioning assembly for a machine tool comprising a first traverse, a second elongate traverse unsupported at its ends and mounted intermediate its ends upon the first traverse for horizontal movement in a direction perpendicular to the axis of the second traverse, each traverse including two parallel vertically spaced tracks, and a workpiece support movable in a direction parallel to the axis of the second traverse. Whilst this arrangement enabled the punch press to be much more compact since no lateral horizontal support was required at the ends of the beam and the beam required a minimum throat depth we have now found that, although the vertically-spaced tracks of the first traverse made the punch press more compact, the second traverse had to have a large bearing area in order to counter any unbalance created by mounting the first traverse one side of the lower limb only.

Therefore, since the development of the arrangement disclosed in our British Patent No. 1563921 we have been concentrating on trying to devise an arrangement which will be both compact and reduce the size of the second traverse.

In the past it has always been accepted that, in order to achieve the required stability for support and movement of a workpiece carriage along the X axis and to prevent twisting two parallel spaced tracks are required. In some instances this has meant two separate horizontally spaced

rails, e.g.: as in British Patent 1378487, where space at the back of the throat has been sacrificed so that the point of support can be positioned down low in line with the sheet. In other cases, such as in British Patent 1096284 and in U.S. Patent No. 3058380, the tracks have been positioned vertically to save space at the back of the throat, but this arrangement necessarily means that some form of bearing has to be provided below the lower track. In Figure 3 of 3058380 for example it will be seen that the vertically-spaced tracks are provided by rollers on V-shaped members cooperating with the opposed faces of a dove-tail strip carriage. However, although the workpiece sheet has been positioned in line with the strip carriage, it will be seen that the sheet has to be positioned some distance above the lower limb of the frame in order to accommodate transverse movement of the lower rollers.

Thus prior arrangements for the X-axis have been a compromise between saving space at the rear of the throat and positioning the point of support down low in line with the sheet and as close to the lower limb as possible. Also, in punch presses incorporating turrets, such as in our British Patent No. 1420594, it has always been the practice for the lower turret forming a die holder for the dies to be formed with a plurality of holes of different size which receive the dies. This arrangement means that the turret is not able to accept different types of die.

SUMMARY OF THE PRESENT INVENTION

Surprisingly, we have now found that by providing a bearing which is capable of accepting a greater load and which resists rotational load about the axis, there is no longer a need for two rails on the X-axis. Consequently, the X-axis traverse can be made compact and lightweight with the advantages of both the vertically and horizontally spaced arrangement of the prior art.

Moreover in a preferred arrangement we may include a lower turret which is more versatile in its acceptance of dies of different types.

Therefore, according to the present invention a workpiece positioning assembly for a machine tool comprises a first traverse, a second traverse mounted upon the first traverse for horizontal movement in a direction perpendicular to the axis of the second traverse, and a workpiece support movable in a direction perpendicular to the axis of the first traverse, the second traverse comprising a single rail.

Preferably, in order to reduce the load on the single rail the second traverse is mounted on a first traverse consisting of two horizontally spaced tracks symmetrically disposed with relation to the centre point of the second traverse thereby balancing the second traverse on the first traverse.

Suitably, the single track constituting the second traverse may be a bearing capable of accepting load from all directions for example a bearing as disclosed in U.S. patent specification 3,897,982.

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The invention also includes a punch press comprising a frame having an upper member and a lower member defining a throat therebetween, a first traverse on the frame and extending in a direction parallel to the throat, a second traverse mounted upon the first traverse for horizontal movement in a direction perpendicular to the axis of the second traverse, and a workpiece support movable along the second traverse, the second traverse comprising a single rail.

Preferably the punch press is a turret punch press having an upper turret for punches and a lower turret for dies, the lower turret having its circumference rebated to provide a plurality of datum surfaces against which a die assembly may be received.

The lower turret suitably has a scalloped configuration so as to receive a die assembly against an arcuate datum surface.

The die assembly may comprise a die holder, means for releasably securing the die holder on the lower turret, and a die releasably received within the die holder.

Preferably the means for releasably securing the die holder on a punch press comprises a groove on the die holder which is cooperable with an angularly movable, eccentric locking head of a retainer on the turret.

The die holder may include an O-ring for engaging the die and retaining it by a friction fit.

Suitably the die holder has two protruding location pins set at 90° to one another and four equally-spaced location slots offset by 45° from said pins, and the die has one location pin for cooperation with the location
5 slots in the holder, adjustment of the location pins enabling the die to be set angularly at intervals of 45° .

Preferably the movement of the second traverse and the workpiece support is numerically controlled the movement being transmitted by means of orthogonally arranged driven
10 lead-screws. However, if desired, rack and pinion drive may be used as an alternative.

The arrangement of the present invention enables the rail supporting the workpiece carriage to be positioned down low in line with the sheet that is being moved and just above
15 the lower limb.

In our British Patent No. 1563921 the construction of the beam forming the second traverse was a closed box section for strength. However, we have now found that a beam of U-shaped cross-section open to the top and having 45°
20 angular cross-ties is lighter in weight and more suitable. Such a beam structure makes assembly much easier, and resists angular movement about a vertical axis.

According to another aspect of the invention there is provided a punch press comprising a C-shaped frame having an
25 upper limb and a lower limb defining a throat therebetween, a first traverse on the frame and extending in a direction parallel to the throat, said first traverse including two

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parallel spaced rails one secured to each side of the lower limb of the frame, said rails extending forwardly and rearwardly from the back of the throat to enable a maximum throat depth to be employed during punching, a second
5 elongate traverse including a single bearing rail and supported on the first traverse intermediate the ends of the second elongate traverse for movement in a direction perpendicular to the axis of the second traverse, support means extending rearwardly of the second elongate traverse
10 so as to engage with the rearwardly extending portions of the rails of the first traverse to enable the second elongate traverse to be withdrawn to the back of the throat, a workpiece support mounted on the single rail of the second elongate traverse, a first driven means in driving connection
15 with the second traverse for moving the second traverse along the two horizontally-spaced rails of the first traverse in a direction perpendicular to the axis of the second traverse, and a second driven means in driving connection with the workpiece support for moving the workpiece support along
20 the second traverse.

Preferably the first driven means is a leadscrew positioned alongside one of the two rails of the first traverse. The second driven means may be a leadscrew suitably positioned above the single track of the second
25 traverse.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a side elevation of a punch press having a
5 C-shaped frame;

Figure 2 is a plan view of the lower limb of the punch press shown in Figure 1 with the lower turret shown diagrammatically and partially broken away;

Figure 3 is a section through the second traverse (X-axis);

10 Figure 4 is a section through that half of the first traverse shown to the left in Figure 2;

Figure 5 is a side elevation of a preferred die assembly,

Figure 6 is a plan view of a preferred lower turret; and

Figure 7 is a section on A-A of figure 6.

15 In Figures 1 to 4 of the drawings a workpiece positioning assembly is shown in position on a punch press frame 1 of C-shape, having upper and lower limbs 2 and 3 defining a throat 4. The workpiece positioning assembly comprises a first traverse 5 forming the Y-axis fixed to the frame 1 and
20 a second traverse 6 forming the X-axis supported for movement along the Y-axis traverse 5.

The Y-axis traverse 5 (see Figures 2 and 4 particularly) comprises two horizontally-spaced rails 7, one secured to each side of the lower limb 3 of the punch press frame 1.

25 Extending parallel to the rails 7, and secured on one side only of the lower limb, is a leadscrew 8 driven, via a belt connection 9, by a DC servo motor 10. The rails 7 are

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not secured directly to the frame 1 but, as shown, are disposed on an intermediate mounting member 11 and these extend forwardly and rearwardly from the back of the throat 4 as clearly seen from Figure 1.

5 The X-axis traverse 6 comprises an elongate beam 12 of U-shaped cross-section and having a lattice of cross-ties 13 for strength. Secured along the lower front edge of the beam 12 (see Figure 3), as low as possible, is a single bearing rail 14 for supporting a workpiece carriage 15. The
10 workpiece carriage 15 includes two workpiece clamps (not shown) and is movable along the second traverse by means of a driving connection with a driven leadscrew 16.

As seen from Figure 2 the driven leadscrew 16 is also driven by a DC servo motor 17 via a belt connection 18. The
15 belt connections 9 and 18 enable the respective motors 10 and 17 to be positioned alongside the respective leadscrews rather than at one end thereby producing a more compact arrangement.

Extending rearwardly from the main beam 12 of the X-axis traverse are two support extensions 19 which engage with the
20 rearward extensions of rails 7 and enable the traverse to be withdrawn right to the back of the throat whilst maintaining rigidity.

As explained above the single bearing rail 14 is arranged to take load in all directions and preferably is a
25 bearing as disclosed in the above-mentioned U.S. Patent Specification. Also, in view of the superior stiffness and load capacity of these bearings, it is preferable that

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the bearing rails 7 are also of this type.

Referring once again to Figure 1 it will be seen that the free end of the upper limb 2 supports a hydraulic ram assembly 20 and an upper turret 21. Around its peripheral
5 edge the turret 21 is provided with roller chain drive 22 for rotating the turret into a desired angular position to bring a desired punch below the operative position of the hydraulic ram assembly 20. The workpiece may be locked in position for clamp repositioning by means of retractable clamping mechanism 23.

10 Disposed below the upper turret 21, on the lower limb 3, is the lower turret 24 shown in detail in Figures 6 and 7. The lower turret 24 also has a roller chain drive 25 around its periphery and the two chains are driven by a single drive motor (not shown) so that the movement of the two turrets
15 are synchronised. The lower limb 3 also carries at the front of the machine a datum arm 26 including a datum plunger 27 for ensuring accurate

positioning. Table surfaces 28 with protruding ball bearings 29 are also shown for support of a workpiece during punching.

20 The construction of the preferred die assembly is shown in Figure 5. The assembly 30 comprises a die holder 31 having two laterally projecting location pins 32 set at 90° (only one shown) and a locking groove 33. The holder 31 receives a die 34 having a location pin 35 locating in one
25 of four location slots 36 and retained in position by frictional engagement with an O-ring 37 in the die holder 31.

The location pins 32 are offset from the location slots 36 by 45^0 so that adjustment at 45^0 intervals is possible with only four slots.

In order to prevent upward lifting of the die holder 31
5 a retainer 38 is provided which has an eccentric locking head 39 for engagement with locking groove 33. The die holder 31 is designed to be received in the scalloped lower turret 24 (see Figure 6), the die holder being located by one of pins 32 being positioned in a slot 40 in the turret
10 station datum face 41. In use the slot 40 is closed vertically by means of a permanently set grub screw (not shown). The retainer 38 is loosely received in an aperture 42 in the turret and has a vertical slot (not shown) joining peripheral groove 43. The vertical slot and groove 43
15 cooperate with a locking screw 44 in the aperture 42 to allow removal of the retainer only when the locking head is released i.e. angular movement of the retainer 38 to release the locking head 39 from the groove 33 enables the locking screw for the retainer 38 to be aligned with the vertical
20 slot.

As seen from figures 6 and 7 the lower turret, in addition, includes holes 45 for pinched slugs to drop through and holes 46 for pin locators (not shown) to accurately orientate the turret - equivalent pin locators being provided on the upper turret also. The locking screws 44 pass through holes 47.

25 Although the invention has been particularly described with reference to a punch press (single hole or multiple hole) it will be understood that it may be used with other machine tools.

CLAIMS:

1. A workpiece positioning assembly for a machine tool comprising a first traverse (5), a second traverse (6) mounted upon the first traverse for horizontal movement in a direction perpendicular to the axis of the second traverse, and a workpiece support (15) movable in a direction perpendicular to the axis of the first traverse, characterised in that the second traverse comprises a single rail (14).
5
2. A workpiece positioning assembly according to Claim 1 characterised in that the first traverse (5) comprises two horizontally spaced tracks (7) symetrically disposed with relation to the centre point of the second traverse.
10
3. A punch press comprising a frame (1) having an upper member (2) and a lower member (3) defining a throat (4) therebetween, a first traverse (5) on the frame and extending in a direction parallel to the throat, a second traverse (6) mounted upon the first traverse for horizontal movement in a direction perpendicular to the axis of the second traverse, and a workpiece support (15) movable along the second traverse, characterised in that the second traverse comprises a single rail (14).
15
20
4. A punch press according to Claim 3 including an upper turret (21) for punches and a lower turret (24) for dies,

characterised in that the lower turret has its circumference rebated to provide a plurality of datum surfaces (41) against which a die assembly (30) may be received.

5. A punch press according to Claim 4 characterised in that the circumference of the lower turret (24) has a scalloped configuration so as to receive a die assembly against an arcuate datum surface.

6. A punch press according to Claim 4 or 5 characterised in that the die assembly (30) comprises a die holder (31), means (33, 38) for releasably securing the die holder on the lower turret, and a die (34) releasably received within the die holder.

7. A punch press according to Claim 6 characterised in that the means for releasably securing the die holder on the lower turret comprises a groove (33) on the die holder which is cooperable with an angularly movable, eccentric locking head (39) of a retainer (38) on the turret.

8. A punch press according to Claim 6 or 7 wherein the die holder (31) is circular has two protruding location pins (32) set at 90° to one another for cooperation with a datum face of the lower turret, and four equally-spaced location slots (36) offset by 45° from said pins, and the die (34) has one location pin (35) for cooperation with the location

slots in the holder, adjustment of the location pins enabling the die to be set angularly at intervals of 45° .

9. A punch press comprising a C-shaped frame (1) having an upper limb (2) and a lower limb (3) defining a throat (4) therebetween, a first traverse (5) on the frame and extending in a direction parallel to the throat, said first traverse (5) including two parallel spaced rails (7) one secured to each side of the lower limb of the frame, and a second traverse (6) supported on the first traverse intermediate the ends of the second traverse for movement in a direction perpendicular to the axis of the second traverse, a workpiece support (15) mounted on the second traverse, and drive means for effecting two dimensional coplanar movement of the workpiece support, characterised in that the rails (7) of the first traverse extend forwardly and rearwardly from the back of the throat to enable maximum throat depth to be used during punching, the second traverse includes a single rail (14), and the second traverse includes support means (19) extending rearwardly therefrom so as to engage with the rearwardly extending portions of the rails of the first traverse to enable the second elongate traverse to be withdrawn to the back of the throat.

10. A punch press according to Claim 9 wherein the structural frame of the second traverse is U-shaped in cross-section open to the top and has 45° angular cross-ties.

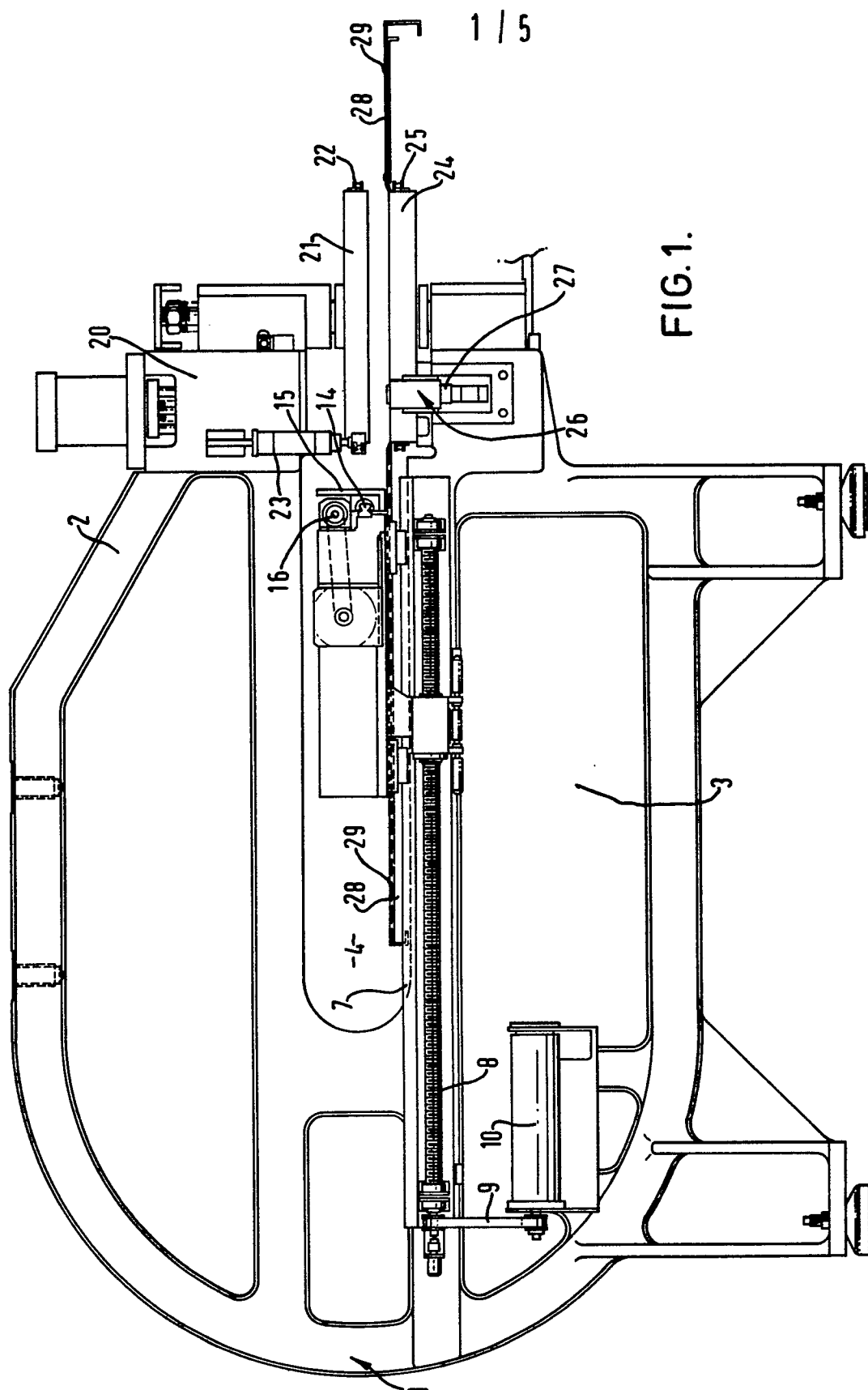
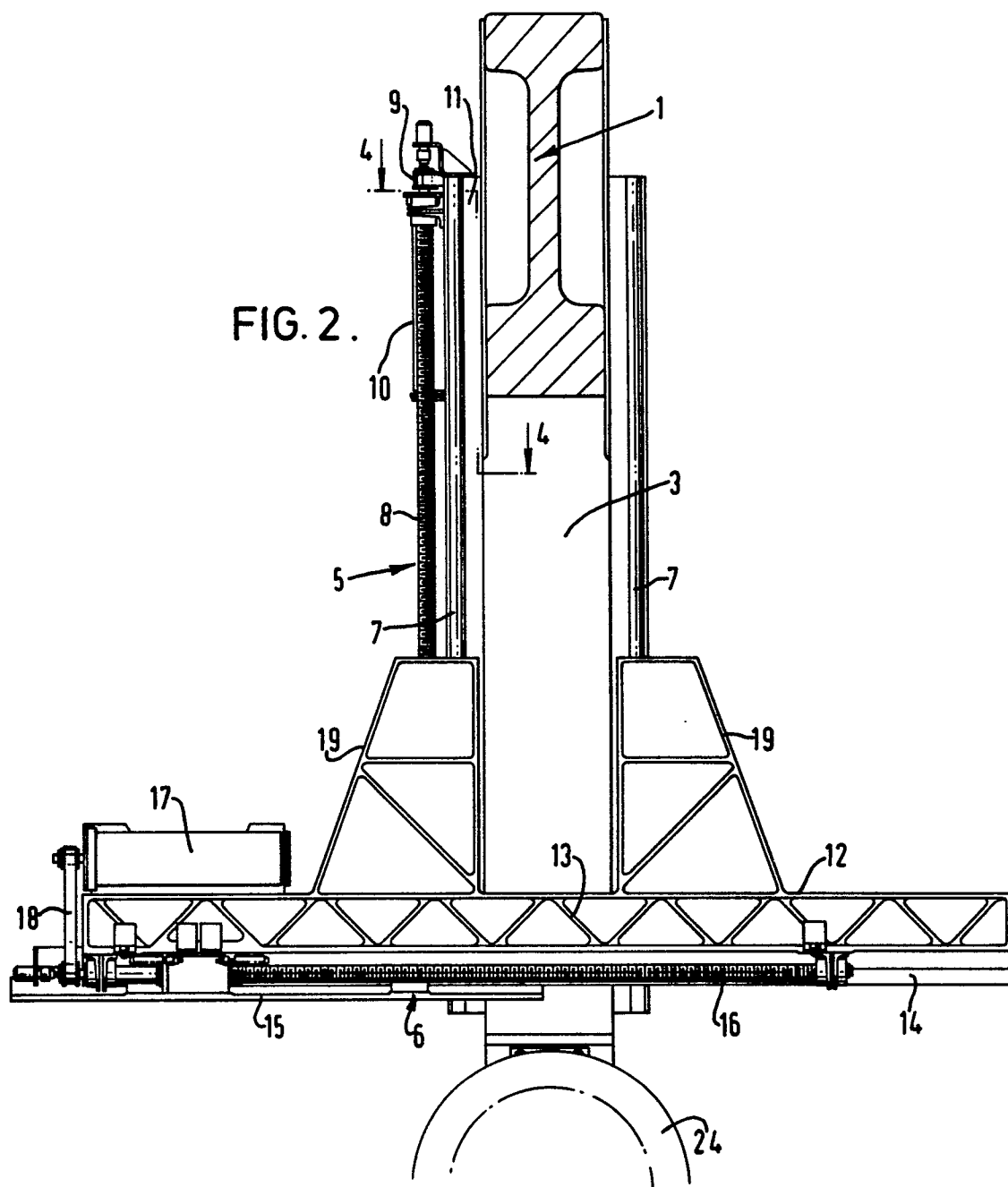


FIG. 1.

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FIG. 2.



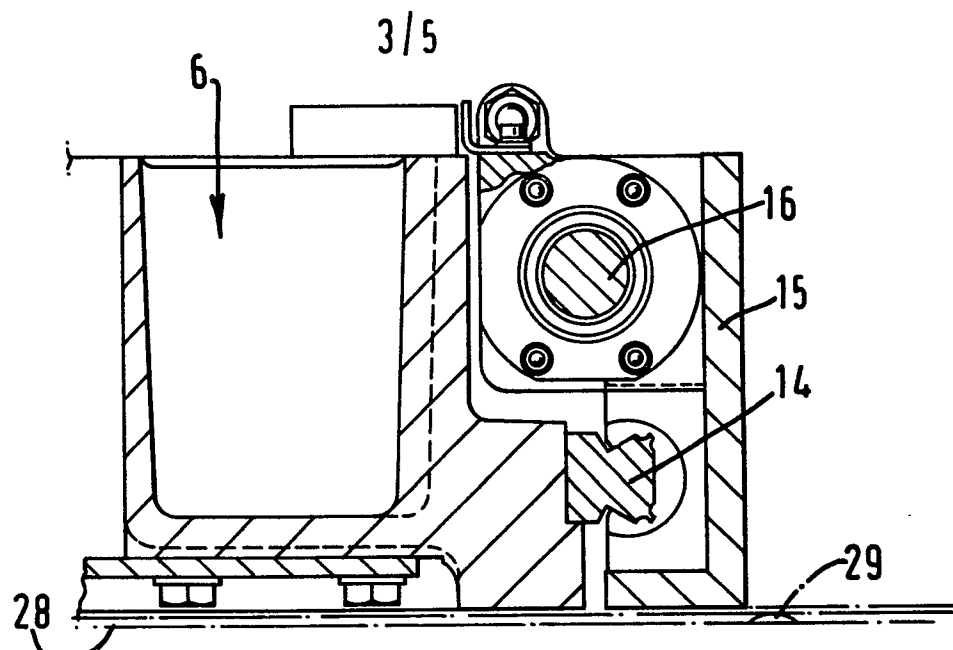


FIG. 3.

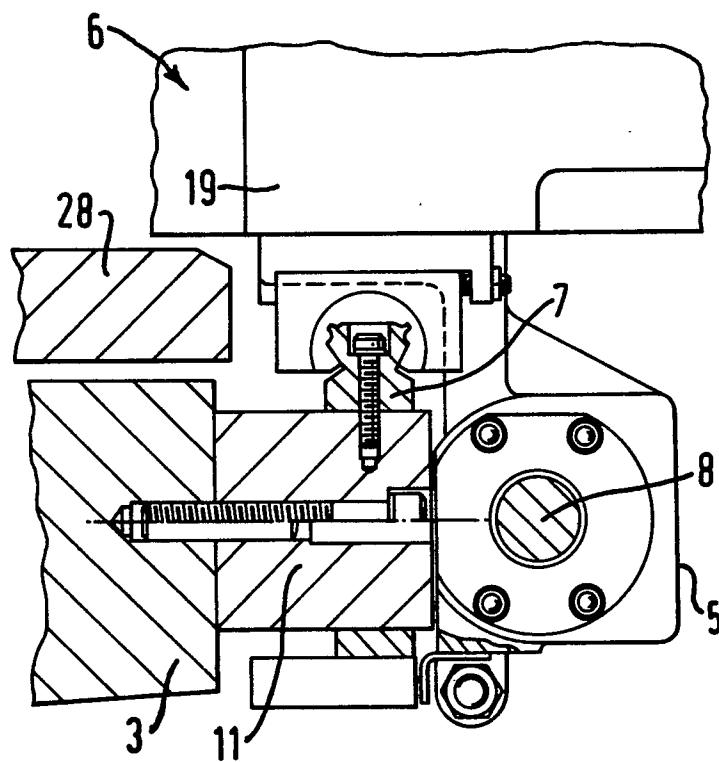


FIG. 4.

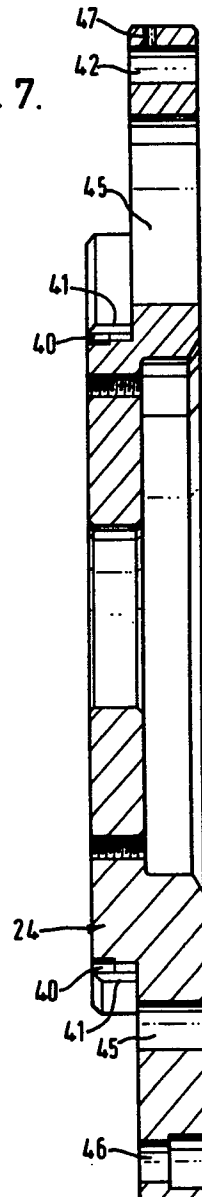


FIG. 6.

