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(54) A bending machine.

(57) A bending machine for bending thin-walled tube profiles (16) such as spacer profiles or edge rails for sealed insulating glass units comprising two separate bending pins (22) situated opposite one another at mutually displaceably arranged lateral guides (18, 20). Profiles of different widths can hereby be bent. The bending pins (22) have a rivet-like shape with a head on a stem or neck, where the side edge of the profile is guided in the slot between the rear side of the head of the pin and the lateral guide during the bending process. By bending the side edges across the stems or the necks, which have a small bending radius compared with that of the head, the side edges appear in almost full height upon the bending, thus presenting a larger contact face for the glass than is otherwise the case.

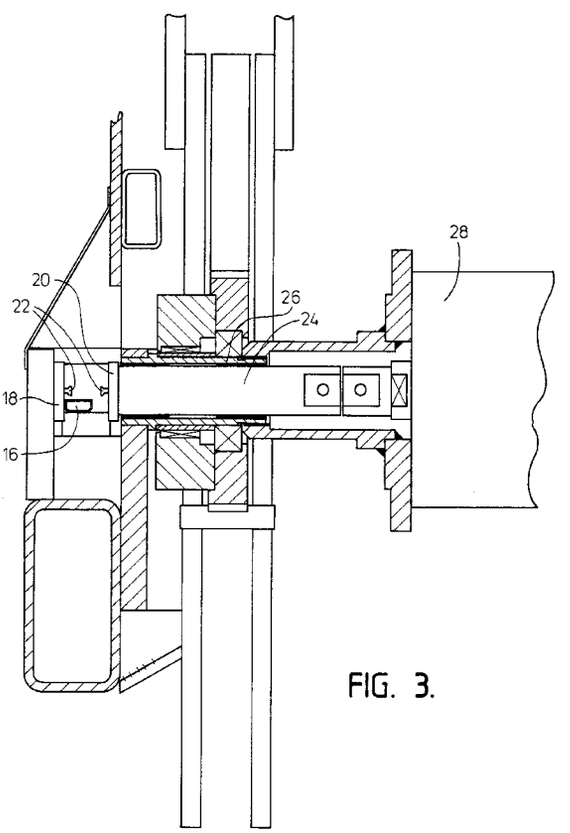

FIG. 3.

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The present invention relates to a bending machine for bending of thin-walled tube profiles, especially spacer profiles or edge profiles for sealed insulating glass units having a virtually rectangular cross-section and where the bending is effected across a bending pin.

In sealed insulating glass units the glass is assembled around thin-walled tube profiles of aluminium or sheet steel. Previously the profiles were cut up in lengths corresponding to the edge lengths of the glass panes and the profile portions were assembled to a frame by angle units. Because angle units are comparatively expensive and the method is time-consuming, at the same time causing a comparatively large waste, bending of the profiles has been attempted instead for quite some time, and bending machines are now on the market especially for this purpose. An example of such a bending machine is known from EP-A2- 0 318 748. The bend to be made is primarily a sharp 90° bend, as the predominant number of windows are rectangular having right-angled corners. Mildly rounded bends are not allowed, but at the same time the bend at the inner side facing inwardly towards the glass pane and being visible, must possess an aesthetically attractive look. Furthermore it is a requirement that the side edges upon bending are flat and lying at the same level as the side edges outside the bent area. As the glass is stuck to the side edges of the profiles it is furthermore a requirement that the proportion of the side edges of the bend is as large as absolutely possible in order to achieve as good an adhesion to the glass as to the straight lengths of the profile. A possible deformation caused by the stretching of the outer side of the profile can be tolerated, i.e. of the side facing outwardly from the glass pane. This side being concealed after mounting of the glass pane, and it is, moreover, sealed just like the entire surrouting edge of the plane.

A completely different problem with the bending machines is that they are only immediately capable of bending spacer profiles having the same cross-sectional dimension. Essentially spacer profiles have the same height given by the depth of the groove of the window, whereas the width varies considerably depending on the distance provided between the glass sheets and whether it is a matter of double or triple pane units. The known bending machines cannot be instantly readjusted to the various widths of spacer profiles. From EP-A2- 0 241 174, however, is known one single example of a bending apparatus, which immediately can bend spacer profiles of different widths. The apparatus comprises two wringing heads being provided with a through-going cylindrical bending pin in the center line of the wringing heads, and where one wringing head is laterally displaceable relatively the other via a compressed air cylinder. However, this apparatus suffers from the same drawback as the apparatus according to EP-A2- 0 318 748, viz. that the profile collapses at the corner at the bending.

The object of the invention is to provide a bending machine meeting with above-mentioned requirements for performing the bending and which may without adjustment bend spacer profiles having different widths.

This is achieved by a bending machine according to the invention, which is characteristic in comprising two separate, situated opposite one another, bending pins on lateral guides and reaching across the upper side of the profile and where the outer ends of the bending pins comprise a portion, which during the bending process initially deforms the upper side of the profile locally at the sides, and where the bending pins furthermore are designed such that the side walls of the profile during the further bending can be accommodated in a groove at the base of the bending pins at the lateral guide for stabilizing the side walls. During the bending, the side walls of the profile are guided up into the grooves at the base at the lateral guides and are stabilized. Upon the bending the side edges almost appear as of full height, as the bending radius in the groove is significantly smaller than the bending radius of the outer portion of the bending pins. Consequently a larger contact face for the glass in the bend is provided. The bending pins are preferably designed having a rivet-like shape with a head on a stem or neck, where the head constitutes the outer portion of the pin, and the groove being formed at the stem between the lateral guide and the face of the head facing towards the lateral guide, this groove guiding the side wall of the profile during bending. The side edges are then bent across the stems. The pins may of course also be designed in the actual guides and only show the faces required for the bending.

Due to the fact that the lateral guides with bending pins are mutually displaceable, the machine may instantly be applied to bending of profiles having different widths. One lateral guide is usually stationary at the side of the profile infeed in the machine and the other is displaceable relative thereto.

The invention is described in more detail in the following with reference to the attached drawing, in which:-

Fig. 1 is a bending machine according to the invention shown from one side,

Fig. 2 is an end view of the bending machine,

Fig. 3 is an enlarged cross-section of the machine at the bending pins,

Fig. 4 is an enlarged side view at the bending pins,

Fig. 5 is an enlargement of a bending pin, and

Fig. 6 is a bending principle of a spacer profile.

The bending machine consists in principle of a frame 2 with a plate-shaped top 4 supporting the bent portion of the profile during the bending process. The machine has an automatic infeed for the profiles but

is otherwise computer controlled for automatic bending of the profiles. The position of the bends is determined by a counter 8 in the feeding path of the profiles. The reference numbers 10, 12 designate a bending head and a bending actuator, respectively, while 14 designates a sawing arrangement for shortening of the profiles.

In Fig. 3 of the drawing reference number 16 is a spacer profile between a stationary lateral guide 18 and relative thereto displaceable other lateral guide 20, each carrying bending pins 22 positioned opposite one another. The displaceable lateral guide is fastened at the end of a spindle 24 slidably embedded in a sliding bush 26. The lateral guide 20 is via the spindle connected to an air cylinder 28, which via the automatic control is activated and brings the lateral guide into contact with the side edge of the profile is the bending position. A bending rail 30 lifts the profile up against the bending pins 22 for bending around them. The automatic control likewise determines the displacement for effecting the required bend, upon which the bending rail returns to its initial position and the same applies to the lateral guide. The profile is then fed on for effecting the next bend.

An enlarged bending pin is shown in Fig. 5, where the side edge of the profile is guided in the groove 32 between the head 34 and the side wall of the lateral guide for stabilizing this during the bending process.

As will be realized, the machine is immediately capable of bending profiles of varying widths, just like it can bend profiles of limited height vaiation due to a certain latitude between the pins and the upper side of the bending rail.

Despite the fact that the machine here is described especially in connection with edge profiles for sealed insulating glass units, it can of course be applied to bending of other thin-walled profiles.

Claims

1. A bending machine for bending thin-walled tube profiles, especially spacer profiles or edge profiles (16) for sealed insulating glass units having a virtually rectangular cross-section and where the bending is effected across a bending pin, characterized in that the machine comprises two opposite, separate bending pins (22) on lateral guides (18, 20) projecting across the upper side of the profile and where the outer end of the bending pins is provided with a portion (34), which during the bending process initially deforms the upper side of the profile locally at the sides, and where the bending pins furthermore are designed such that the side walls of the profile during further bending can be accommodated in a groove (32) at the base of the bending pins at the lateral guide for stabilizing the side walls.

2. A bending machine according to claim 1, characterized in that the bending pins are provided rivet-like having a head (34) on a stem or neck.

3. A bending machine according to claim 2, characterized in that the bending pins are provided as separate, replaceable parts of the lateral guides.

4. A bending machine according to claim 1, characterized in that the lateral guides (18, 20) are arranged mutually displaceable towards and away from one another for interengagement with the sides of the profile.

5. A bending machine according to claim 1, characterized in that one lateral guide (18) is stationary while the other (24) is arranged displaceably relative thereto.

6. A bending machine according to claim 4, characterized in that the lateral guide is displaceable by means of a compressed air cylinder (28).

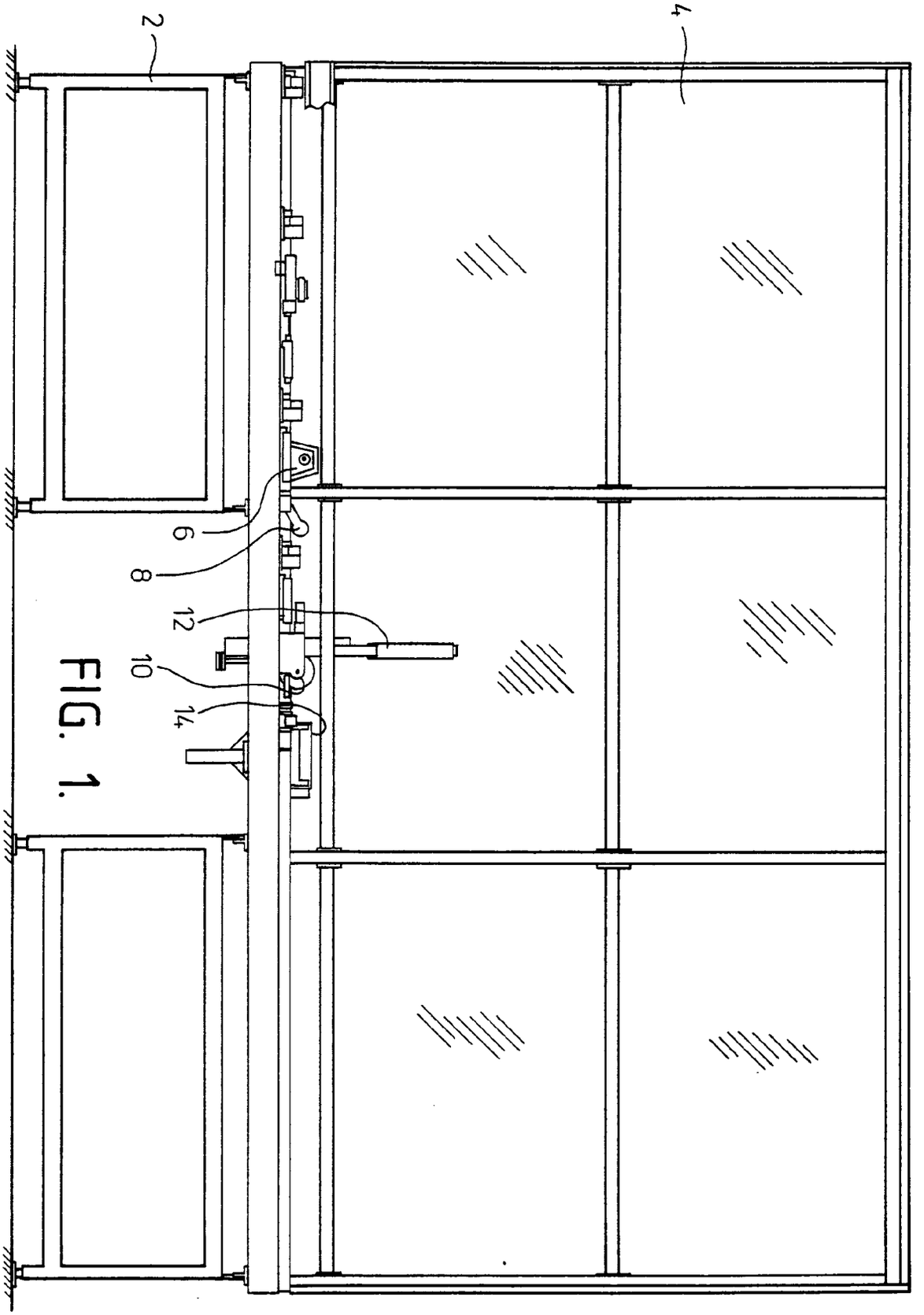

FIG. 1.

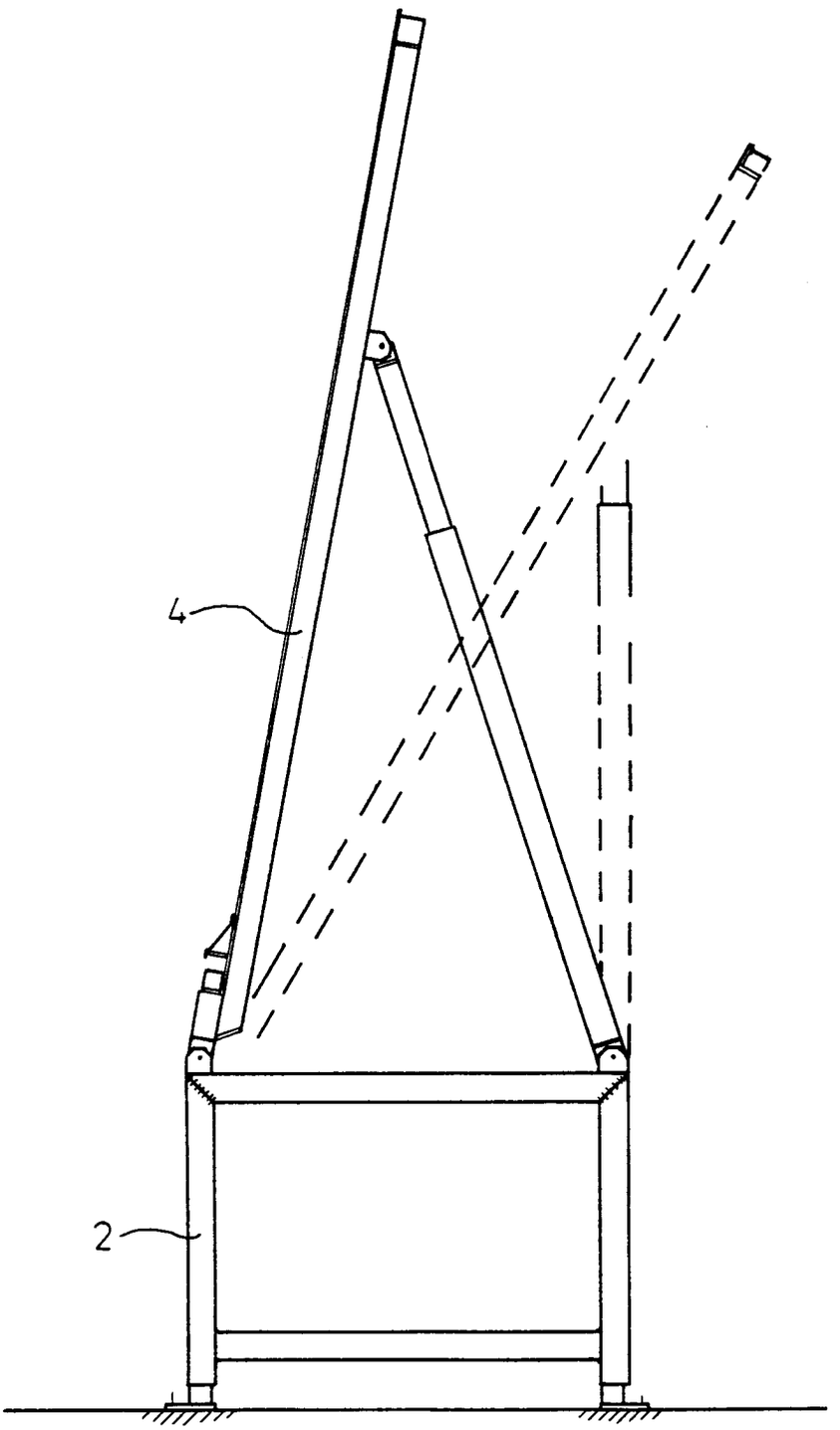

FIG. 2.

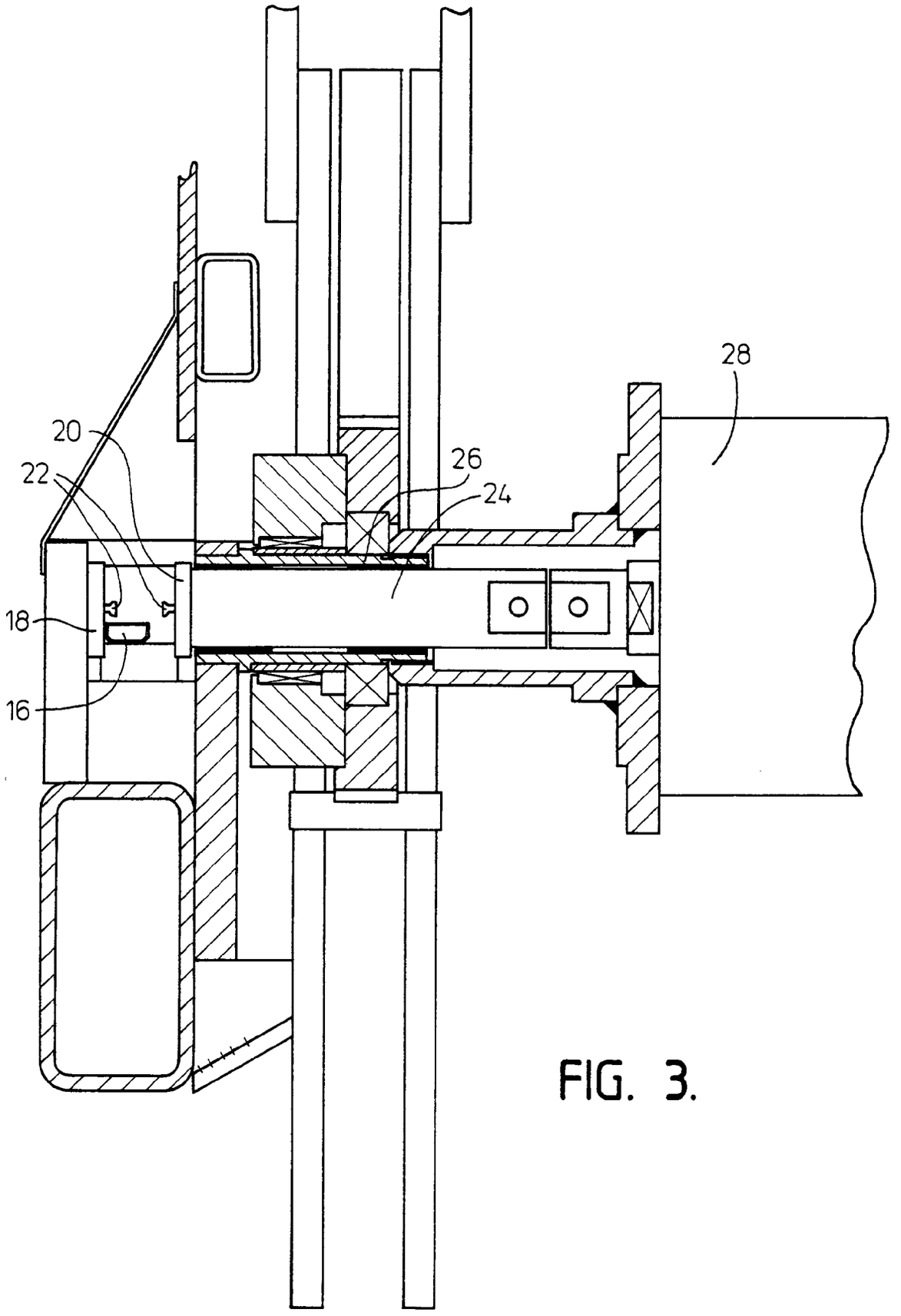

FIG. 3.

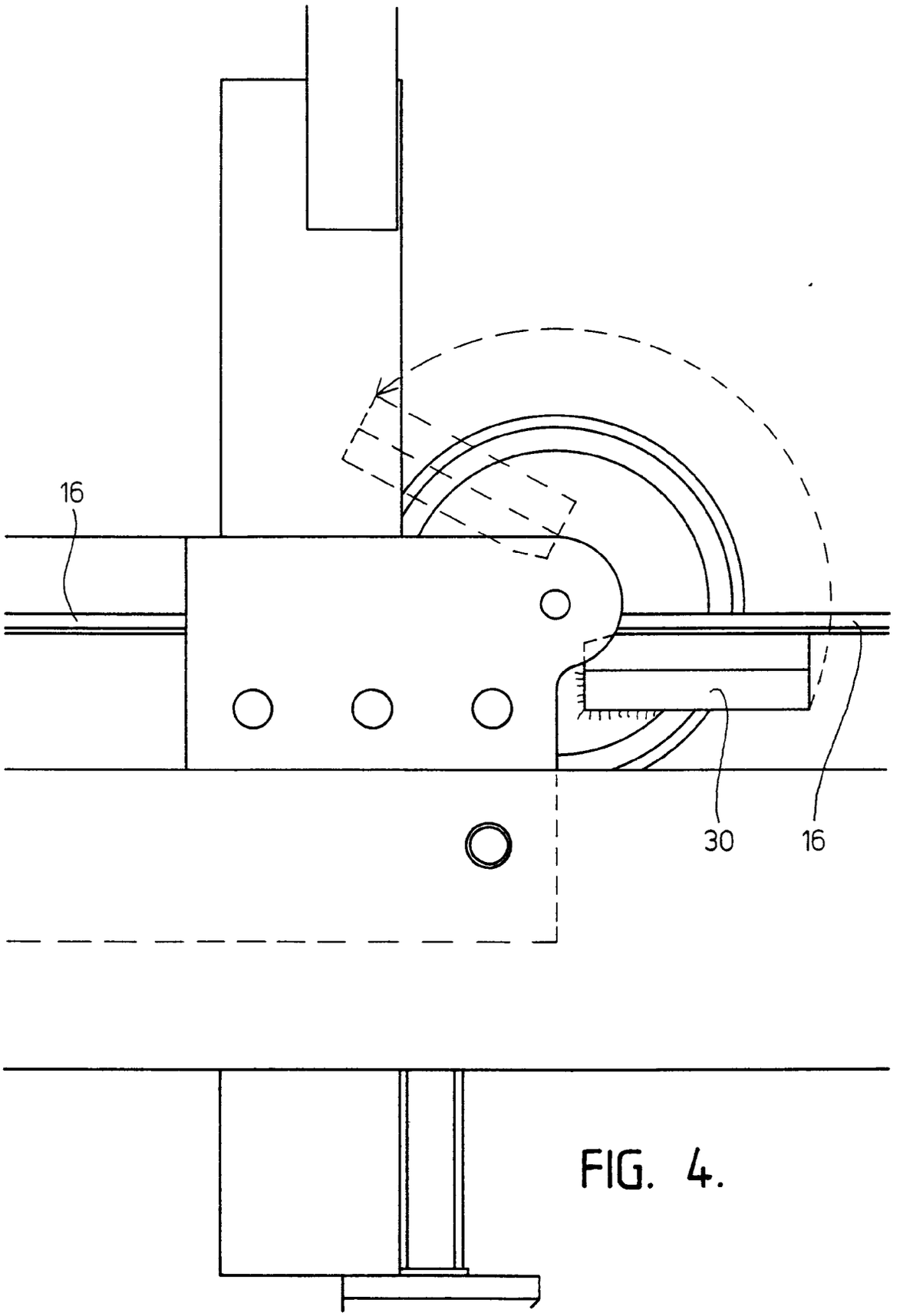

FIG. 4.

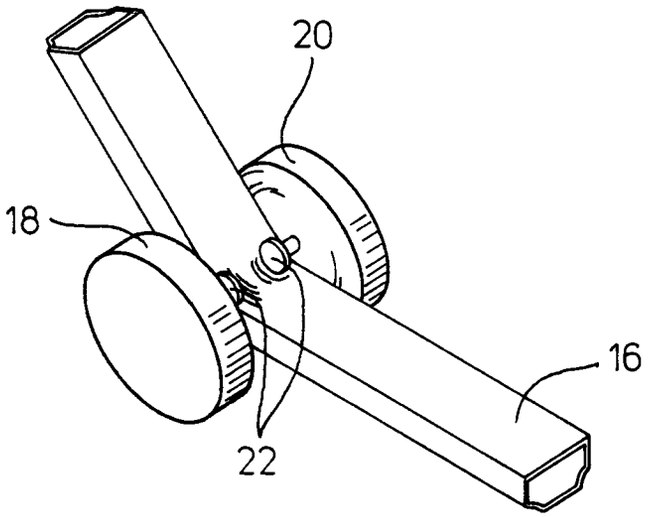

FIG. 6.

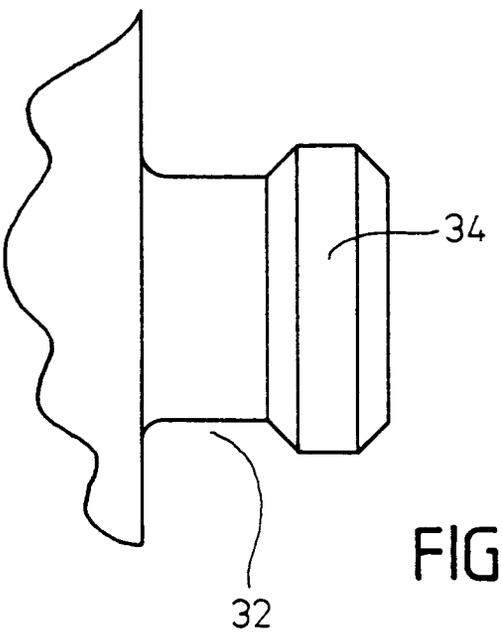

FIG. 5.