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(54) **Apparatus for creasing fold lines in a sheet of cardboard.**

(57) Apparatus for creasing fold-lines in a sheet of cardboard, especially for a lid e.g. for a tin-plate stack is designed to provide quick and accurate operation, with a variety of sizes of cardboard and of the lid. The apparatus has an upright support surface for the cardboard sheet, a conveyor for bringing the sheet in an upright position against the support surface. Adjacent the support surface is a resilient track 22, and a pressing wheel 24 having a tapered periphery 25 forming a creasing edge is arranged to move along said track so as to form a creased fold line in a front side of the sheet when the sheet is interposed between the wheel 24 and the track 22. A section pad 60 engages and picks up the sheet on the support surface and is movable horizontally and vertically so as to bring the sheet into the desired position for creasing on the said track and rotatable so as to rotate the sheet in its plane in order that fold lines at angles to each other can be creased in the sheet. Creasing tongs 86 arranged to engage the rear side of the sheet to form creases therein.

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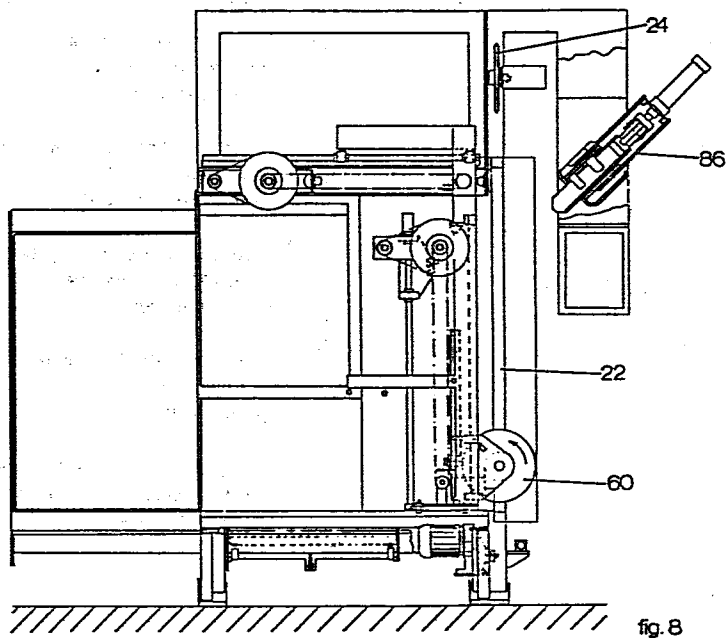


fig. 8

1.

APPARATUS FOR CREASING FOLD LINES IN A SHEET
OF CARDBOARD

The invention relates to apparatus for creasing fold lines in a sheet of cardboard, and particularly but not
5 exclusively to apparatus for making the creased fold lines in a cardboard sheet which is to form a rectangular lid or cover having top and downwardly extending sides, for which fold lines must be made in both sides of the sheet.

10 In the packing of steel industry products, in particular stacks of tin-plate destined for export, it is desirable to make the packing as secure and compact as possible in order to assist in minimizing damage. Netherlands patent application No. 8102950 shows a folded
15 cardboard component in the form of a lid which covers the top of a stack of tinplate and has preformed creases. For convenience, this lid is illustrated in Fig. 1 of the drawings accompanying the present application. Part of a sheet, unfolded but creased, is shown for this lid in
20 Fig. 1a. After it has been folded by hand by an operative, it has the shape shown in perspective in Fig. 1b; the edges of the cardboard sheet are thus bent downward from the top of the lid to form the sides. The complete lid is shown (upside down) in Fig. 1c. It can
25 be seen that the four long fold lines parallel to the

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edges are formed in one side of the sheet while the short diagonal fold lines at each corner are formed in the other side.

The object of the invention is to provide apparatus
5 which can quickly and accurately make the required creases in a sheet of cardboard, e.g. for a lid as described above. Preferably the apparatus can within certain limits make a large number of sizes of lids out of cardboard sheets of varying dimensions.

10 The apparatus according to the invention has an upright support surface for the sheet a conveyor, preferably horizontally working, which transports the sheet of cardboard in upright condition to the support surface, a track or underlayer of resilient material
15 adjacent the support surface and a pressure wheel with sharp (but preferably rounded) creasing periphery which is movable along the track. Preferably the apparatus has a contact-sensing mechanism to determine the dimensions of the cardboard sheet on the support surface. A further
20 feature is a suction pad which can be moved vertically and horizontally over the support surface in order to pick up the cardboard sheet and displace it to bring it to the desired position where it overlaps the resilient track, this suction pad being also rotatable, preferably
25 stepwise through 90° steps in order to permit the sheet

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to be creased along four edges. Another feature is a creasing tongs arranged to operate on the other side of the sheet from the creasing wheel.

Preferably, there are control means which, from the
5 output of the contact sensing means, determine the position of the centre of the sheet and move the suction pad to that position to pick up the sheet.

The dimensions of the surface of a stack of tin-plate can vary from 500 to 1000 mm, in steps of 1 mm.
10 Efforts have been made to standardise the tin-plate dimensions, but even so the dimensions of the sheet of cardboard from which the lid, which is later to be placed on the stack of plate, is folded, are much easier to standardise. For example, it may be possible to achieve
15 a limited number of fixed formats for the sheet, e.g. 10; the apparatus of the invention can be capable of rapid adjustment for all formats which occur, both of cardboard sheets and the lids formed from them.

The pre-creasing of the fold lines in the cardboard
20 sheet is achieved in the apparatus without removal of material; thus a lid can be folded from the cardboard sheet without making notches at the corners and the creasing may be performed without significantly breaking or bruising the fibres of the cardboard.

25 A preferred embodiment of the invention, displaying

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further optional characteristics and advantages of the invention will be described below by way of non-limitative example with reference to the accompanying drawings.

5 In the drawings;-

Figs. 1a, 1b and 1c show a creased sheet and the lid which is to be made from it, and have been described above.

Fig. 2 shows the principle of the creasing wheel of
10 the apparatus embodying the invention.

Fig. 3 shows schematically the creasing step and the result achieved.

Fig. 4 shows the principle of the horizontal transport of the cardboard sheet being carried into the
15 apparatus by the conveyor.

Fig. 5 shows the principle of displacement of the sheet on the support surface.

Fig. 6 shows schematically the cross-section of the suction pad of the apparatus.

20 Fig. 7 is a general side elevation of the apparatus embodying the invention.

Fig. 8 is a front elevation of the apparatus embodying the invention.

Fig. 9 is a schematic drawing of the creasing tongs
25 of the apparatus.

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The apparatus of the drawings is particularly adapted for the production of the fold lines for the lid shown in Fig. 1, already described. In the apparatus, the production of each crease in one side of the sheet of cardboard is achieved by means of the creasing wheel 24 shown in Fig. 2. The sheet 20 shown in this figure has a rectangular shape, and a crease 21 is made parallel to each of the sides. For this purpose a resilient track of elastomeric material 22 is used as a backing for the cardboard, e.g. hard rubber with a hardness of 60° to 70° shore, at 22. The creasing wheel 24 is mounted on a spindle 23, and has at its periphery a sharp edge 25 with a taper angle of about 30°. The creasing wheel is preferably made of a suitable plastics material, and, for example, has a diameter of 32 cm. The edge 25 has a rounding radius of 1mm. The pressure exerted between the wheel 24 and the cardboard is preferably at least 100 kg, in the embodiment being about 200 kg, or even 250 kg.

In Fig. 3 the rubber track of underlayer 22 is again shown with the creasing wheel 24 having its rounded edge 25. Fig. 3b shows how deeply the creasing wheel presses into the track 22 taking the cardboard sheet with it and deforming it into a creased fold line (Fig. 3c). In this way the cardboard can be easily and tightly applied later to a stack of tin-plate sheets, the bent cardboard being

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shown by Fig. 3d.

A diagonal corner crease line has to be made at each of the four corners of the cardboard sheet on the other side from the lines 21, to enable the cardboard sheet to
5 be folded into a lid, as discussed above in connection with Fig. 1b. This is done by the creasing tongs, described below.

After thus describing the principles of the creasing of a cardboard sheet, the apparatus will now be described
10 in more detail with reference to Figures 4 to 9. Fig. 4 shows the horizontal conveyor which brings the sheet into position on the support surface or panel described below, and shows how a vertical sheet 20 of cardboard is propelled between the continuously driven toothed belt 40
15 and a set of rollers 41 and 42 which hold the cardboard sheet 20 against the toothed belt 40, until the sheet comes against a fixed stop 43; at this point, either mechanically or using a photo-electric cell, it is arranged that the rollers 41 and 42 stop their pressing
20 action, so that the sheet comes to rest. The rollers 41 and 42 retract to the position shown by the broken lines.

The dimensions of the sheet of cardboard so inserted must now be determined, before the crease lines can be formed. The dimensions of the cardboard sheet may lie
25 between 750 and 1260 mm and typically come in a total of

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10 standardized formats. The cardboard typically also has a thickness of 2 mm or less and a weight of 800 to 1000 g/m². When the dimensions of the cardboard sheet are determined and the dimensions of the plate to be
5 packaged are known, the positions of the fold-lines and the width of the downwardly extending sides of the lid to be made are fixed. The apparatus has contact sensors which move to engage the sheet edges, to determine its size.

10 Before the fold-lines are creased in the cardboard as shown in Fig. 2 and Fig. 3, the position of its centre is calculated by control means (not shown) from the output of the contact sensors. It must be assumed that this centre coincides with the centre-of-gravity of the
15 sheet.

The principle of operation of the apparatus is to displace the cardboard sheet in its own plane by picking it up at its centre-of-gravity using a suction pad such as a vacuum disc. Such a disc is shown in Fig. 6, which
20 illustrates how the sheet of cardboard 20 can be picked up by a flat vacuum disc 60 having an annular seal 61 of soft rubber and a central recess connected via a duct 62 to a vacuum source. This vacuum disc can, as shown schematically in Fig. 5, be moved over the cardboard
25 sheet until it reaches the centre-of-gravity of this

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sheet, and can then be engaged with the cardboard sheet
20. These movements are controlled by the control means.
The vacuum disc is therefore movable in a horizontal
direction and also vertically, and can also be rotated
5 around its axis, as shown in Fig. 5, in order to rotate
the sheet which has been picked up by it.

The illustrated apparatus thus requires only one
creasing wheel for making four creases in a sheet of
cardboard, and in operation the sheet is rotated by the
10 suction pad in its own plane relative to this wheel so
that the creases are formed in the correct places on the
cardboard sheet. The sheet is thus creased in four steps
by successive stepwise rotations through 90° .

As discussed previously, a short diagonal fold line
15 is also made in each corner of the sheet as far as the
nearby intersection of the two long crease lines in the
rear face of the sheet. This is done using a creasing
tongs, which makes a fold at about 10° out of the plane
of the sheet. The principle of operation of the creasing
20 tongs is shown in Fig. 9. The creasing tongs has two jaws
90 and 91, which receive the cardboard sheet 20 and are
hinged at the fixed pivot 92. The jaws are pulled
together by a lever system 93, 94, 95, 96 which is
operated by a piston-and-cylinder unit 97. The force
25 applied to the sheet is preferably at least 1000 kg and

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may be about 2500 kg.

Since the crease line formed by the creasing tongs does not always have to extend at 45° to the sheet edges, the creasing tongs are preferably adjustable in this
5 respect. The corner crease is in each case formed before the cardboard sheet is rotated to the next position, as described above.

The apparatus is shown in full in Figs. 7 and 8, respectively in side and front elevation. In these
10 figures the sheet of cardboard which is being creased is omitted for clarity.

The support panel is slightly tilted back from the vertical as appears from Fig. 7, in order to allow the inserted cardboard to lie easily. The cardboard is moved
15 by the horizontal conveyor as described above to a stop and then comes to rest. A plotting frame (not shown) forms the dimension determining means described above and is mounted over the support panel having two mutually orthogonal operational co-ordinates, as shown in Fig. 5.

20 The rotatable vacuum disc 60 is shown and this can be moved both horizontally and vertically, and can also rotate about its own axis. All movements are controlled by the control means which takes the form of a microprocessor, not shown. The rotation of the vacuum
25 disc 60 is always anticlockwise at a rate of 90° per

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second. Its vertical displacement occurs at a speed of 0.25 m/sec.

The resilient track 22 is located at one edge of the somewhat tilted support panel. The creasing wheel 24 is
5 mounted on a holder 80 which can be moved up and down by a carriage 81. The extremities of the track 22 are bevelled, as may be seen at 26, 27, so that the creasing wheel 24 effects a crease in the cardboard sheet with more certainty (see Fig. 2 and Fig. 3b). The creasing
10 tongs is indicated in Fig. 8 schematically by reference number 86.

By the term "cardboard", we mean also similar board materials, such as pasteboard.

11.

CLAIMS:

1. Apparatus for creasing fold-lines in a sheet of cardboard,
characterised by an upright support surface for the
5 cardboard sheet, a conveyor (40,41,42) for bringing the
sheet in an upright position against the support surface,
a resilient track (22) adjacent the support surface, a
pressing wheel (24) having a tapered periphery (25)
forming a creasing edge arranged to move along said track
10 so as to form a creased fold line in a front side of the
sheet when the sheet is interposed between the wheel (24)
and the track (22), a suction pad (60) for engaging and
picking up the sheet on the support surface and movable
horizontally and vertically so as to bring the sheet into
15 the desired position for creasing on the said track and
rotatable so as to rotate the sheet in its plane in order
that fold lines at angles to each other can be creased in
the sheet, and creasing tongs (86) arranged to engage the
rear side of the sheet to form creases therein.
- 20 2. Apparatus according to claim 1 having measuring
means including at least one contact sensor for
determining the dimensions of the sheet and control means
adapted to bring said suction pad (60) to the centre of
the sheet as determined from the dimensions thereof, in
25 order to pick up the sheet.

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3. Apparatus according to claim 1 or claim 2 wherein the creasing tongs (86) is adjustable so as to vary the direction of the crease formed by the tongs in the sheet.

4. Apparatus according to any one of claims 1 to 3
5 wherein the said conveyor comprises a toothed belt (40) arranged to engage the sheet.

5. Apparatus according to any one of claims 1 to 4 wherein the suction pad (60) is in the form of a disc having a surface region to which a vacuum source is
10 connected.

6. Apparatus according to any one of claims 1 to 5 wherein the creasing wheel (24) is arranged to apply a force of at least 100 kg to the sheet where supported by the said track (22).

15 7. Apparatus according to any one of claims 1 to 6 wherein the creasing tongs (86) is adapted to bend a portion of the sheet by about 10° out of the general plane of the sheet and is adapted to apply a gripping force of at least 1000 kg to the sheet.

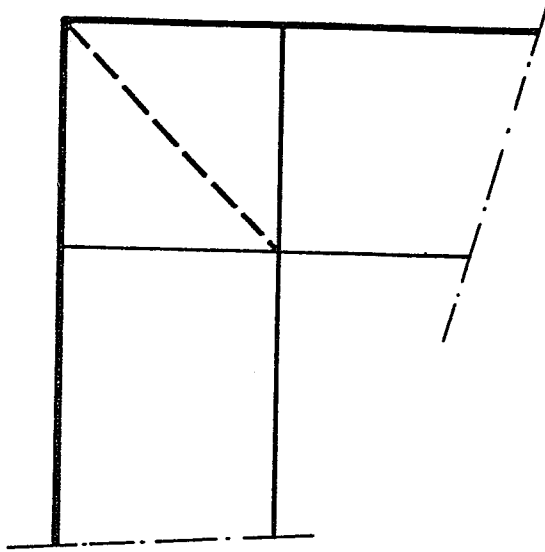


fig. 1a

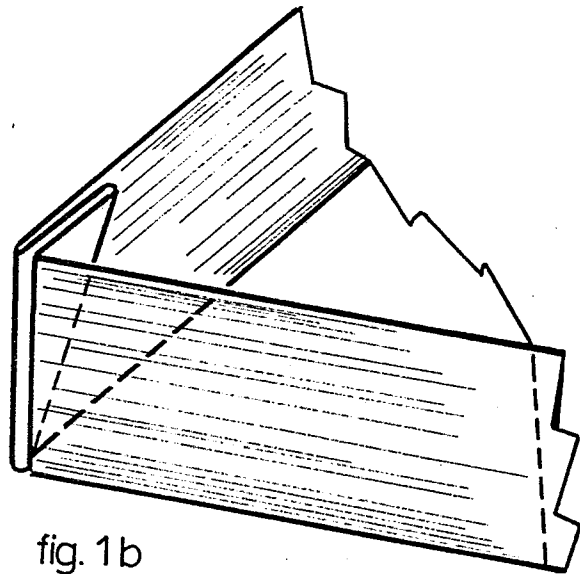


fig. 1b

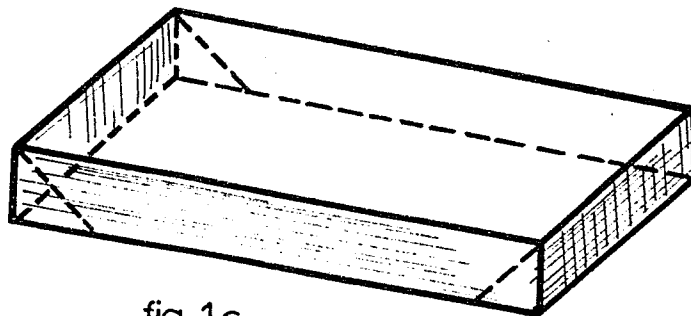
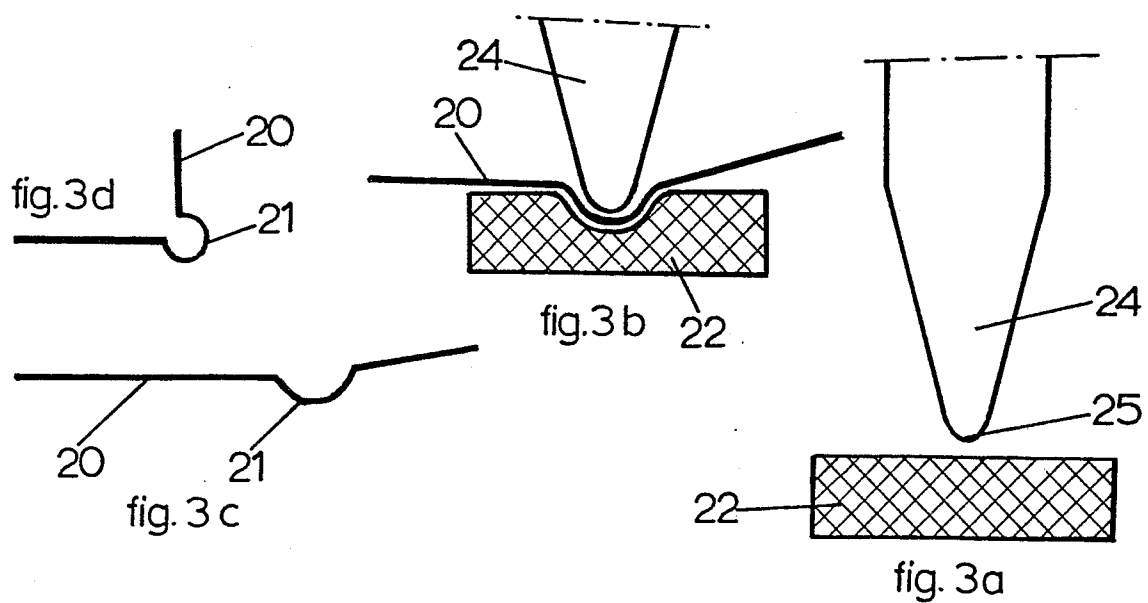
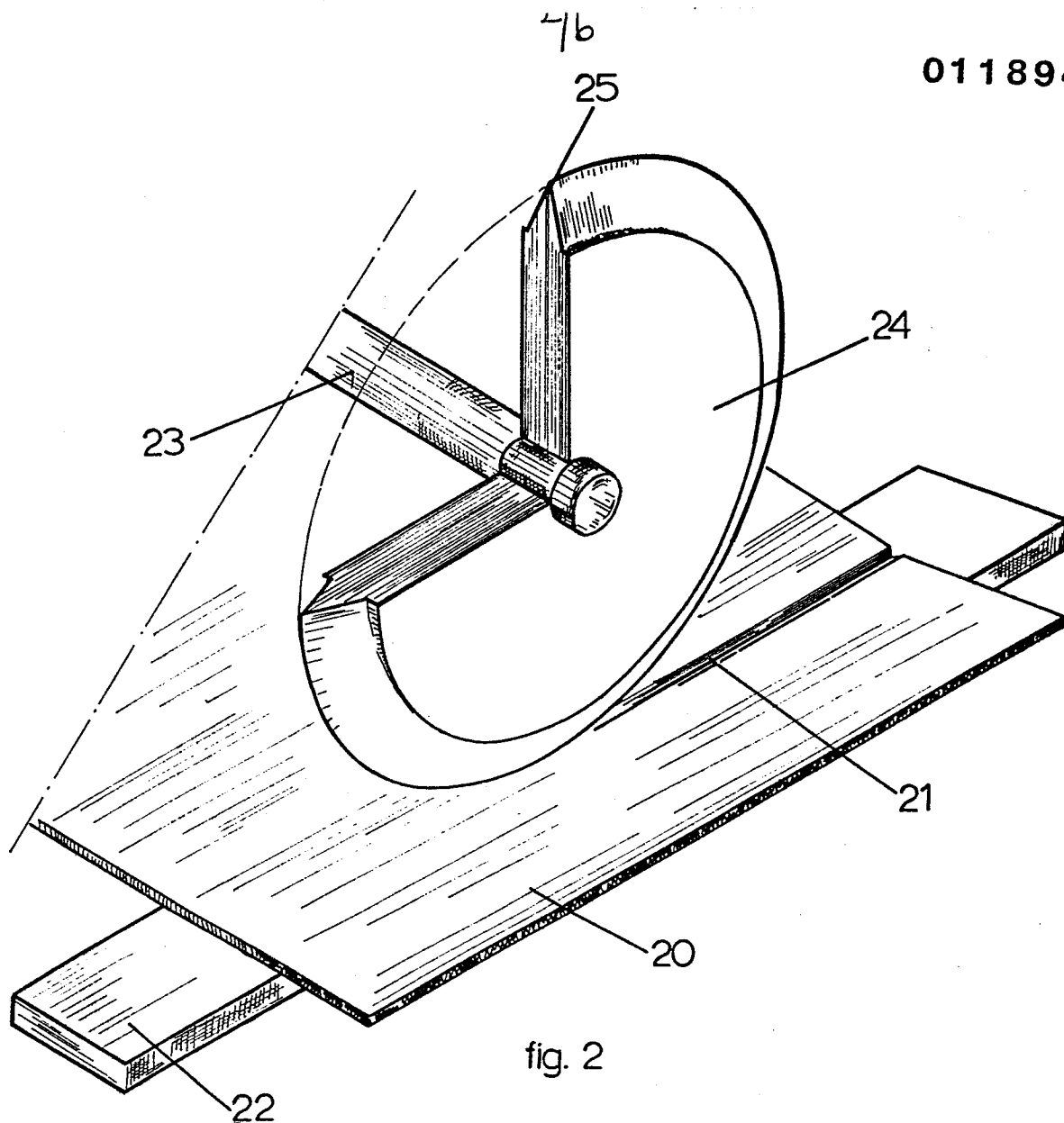


fig. 1c



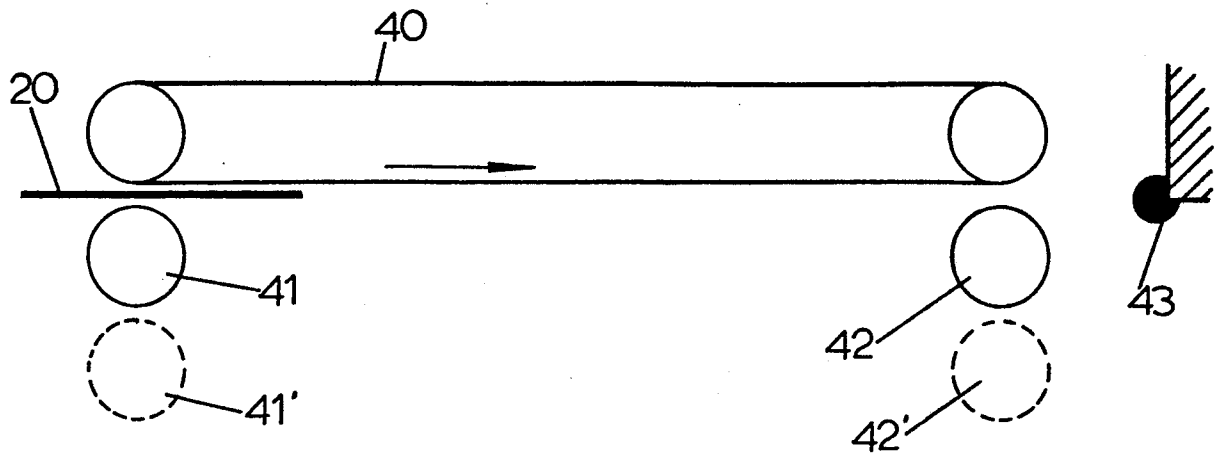


fig. 4

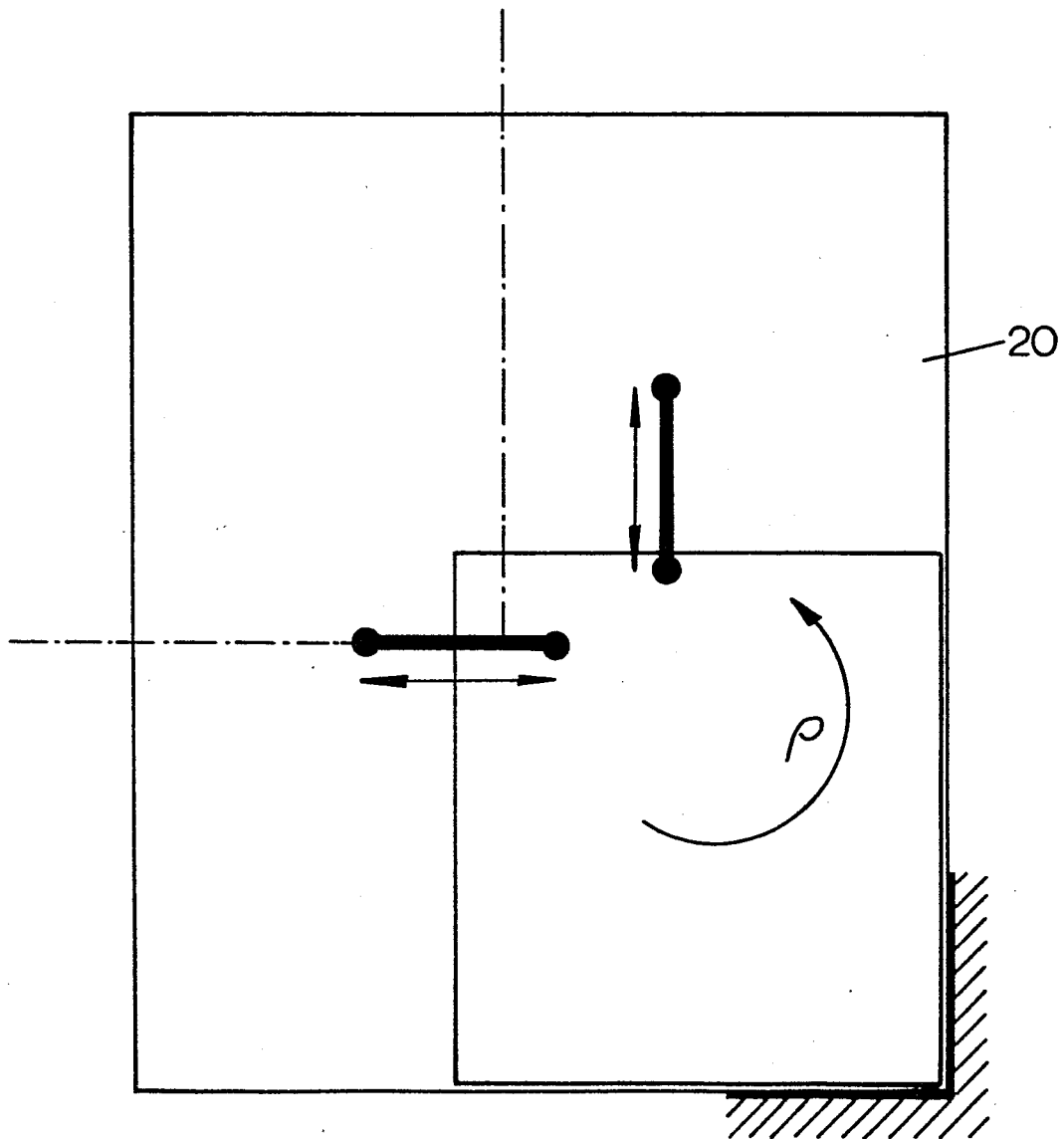


fig. 5

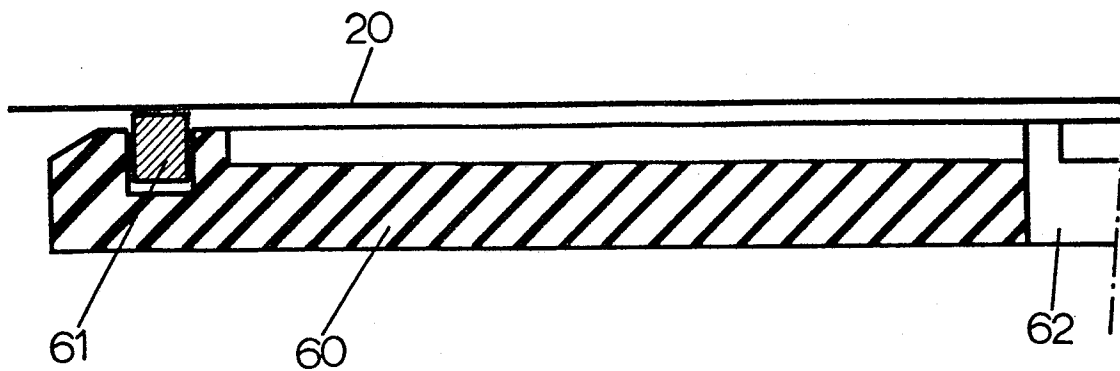


fig. 6

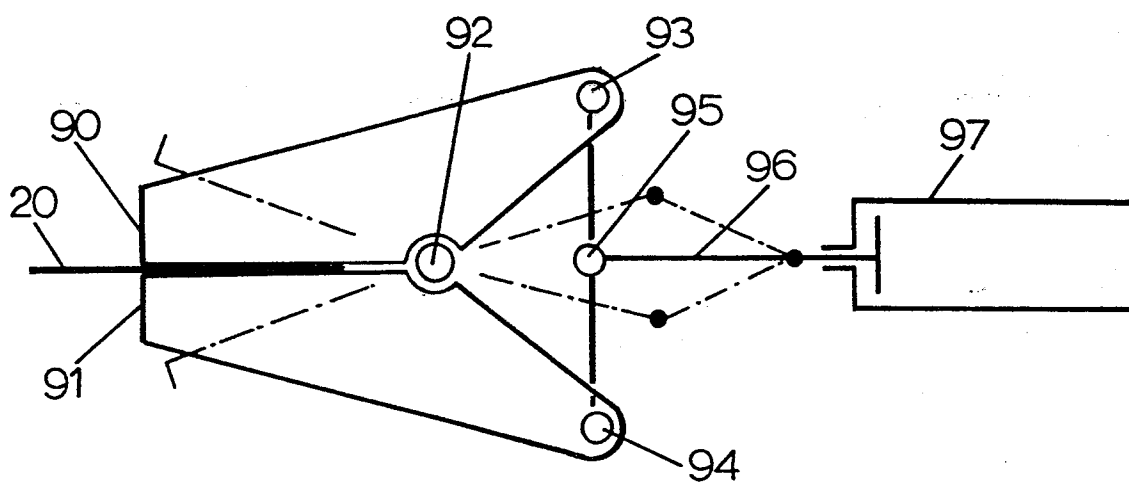
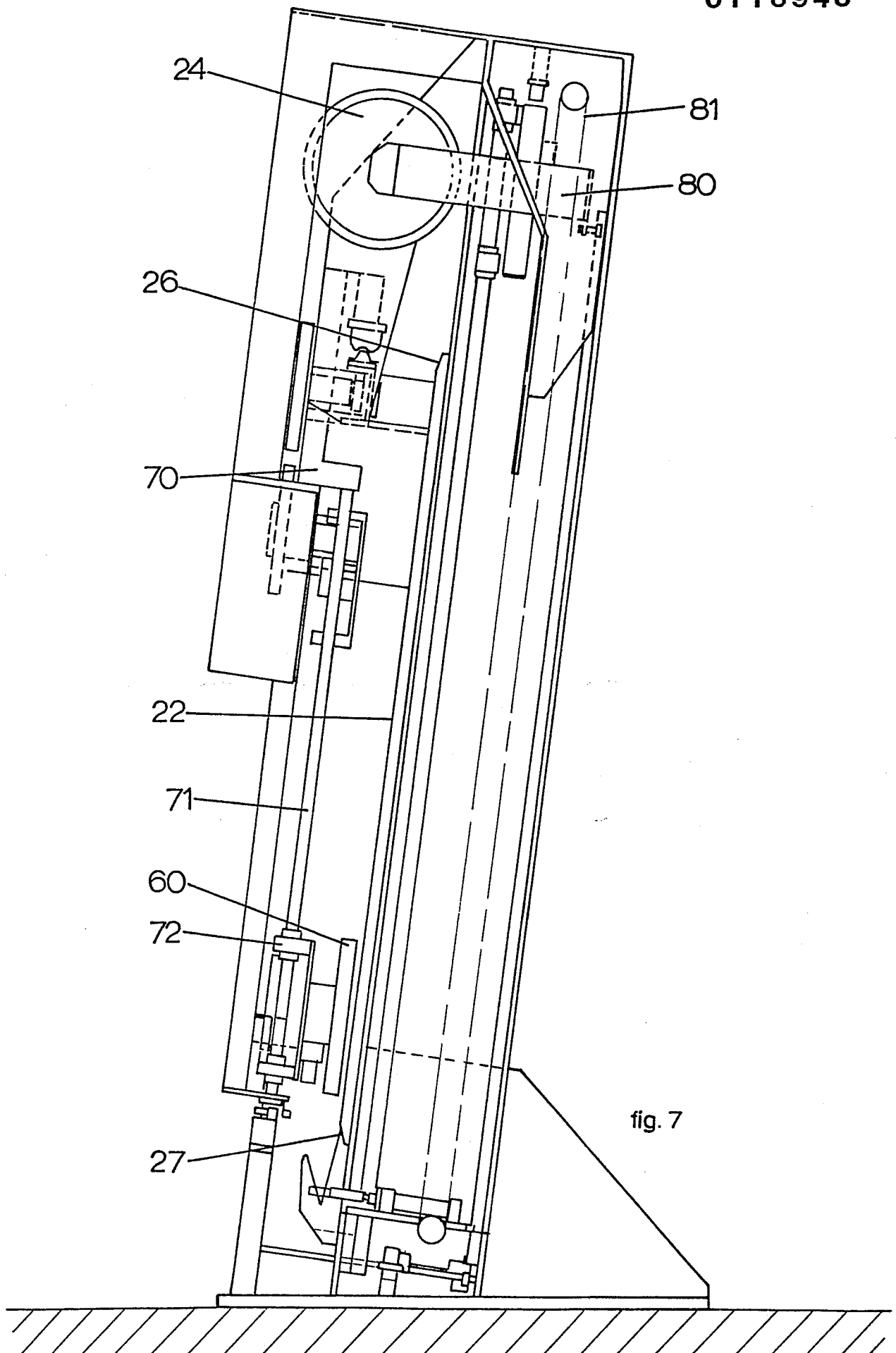
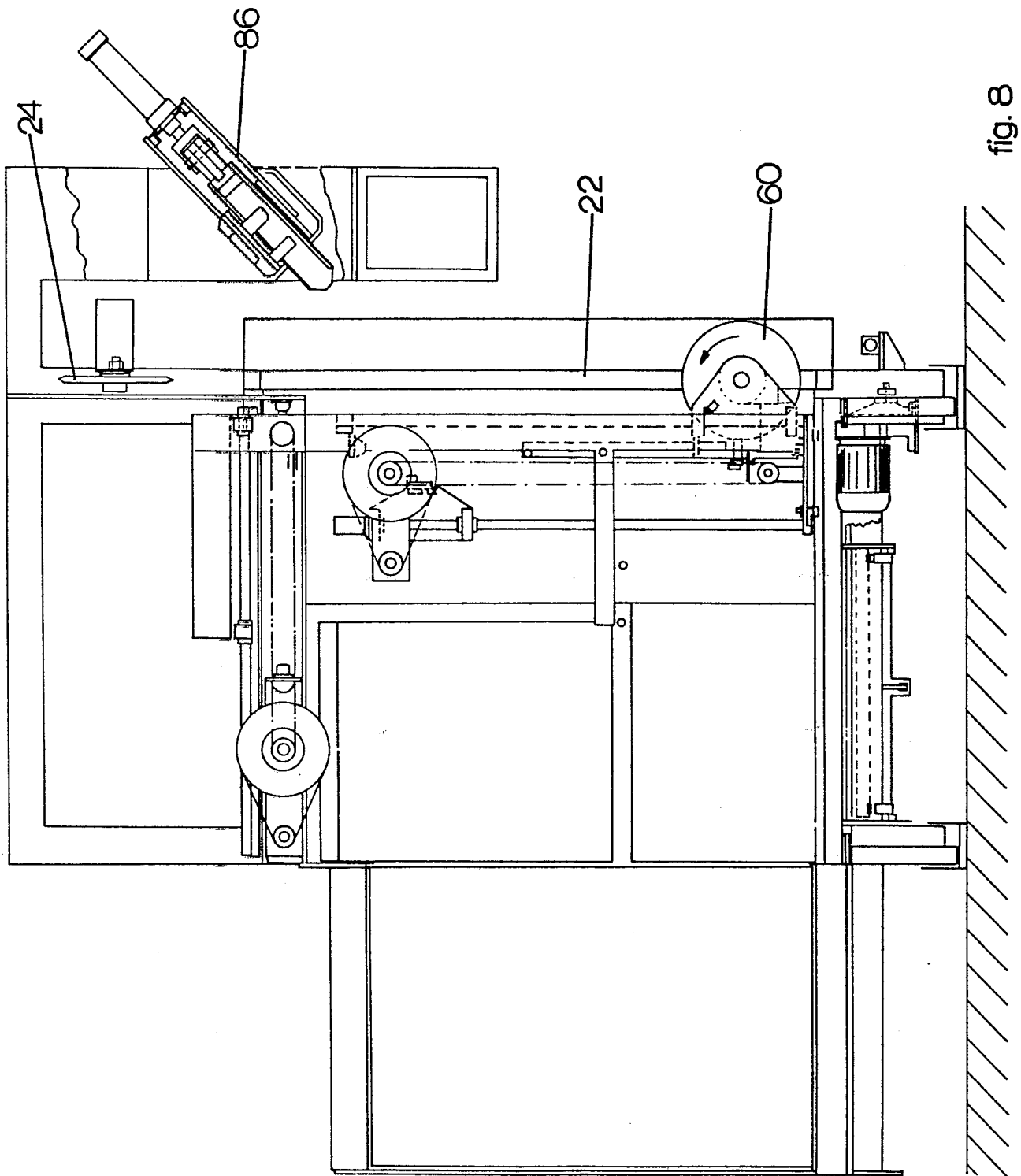


fig. 9







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. ³)
A	FR-A-1 246 239 (VICKERS-ARMSTRONGS)	1	B 31 B 1/25
A	GB-A-1 267 155 (SHEA-SIMONDS) -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
			B 31 B B 26 D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 06-06-1984	Examiner PEETERS S.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			