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(54) **Buckle plate for sheet manipulating apparatus.**

(57) A buckle plate (8 or 9), for use in a machine which manipulates i.e. folds or deflects sheets of paper, cardboard or the like, comprises a rectangular frame (81) having a multiplicity of pairs of transversely extending guide members (84) between which a sheet slides. A carrier (88) extending transversely of the guide members supports a plurality of sheet control members (89) in spaces between the guide members so that the control members can be moved between a first position in which they form deflecting surfaces for deflecting a sheet and a second position in which they act as stop members for locating a sheet to be folded. The second position is adjustable in accordance with the size of the sheet and the position of the fold. The carrier is slidably mounted in the frame so that the control members can be moved in unison between the first and second positions.

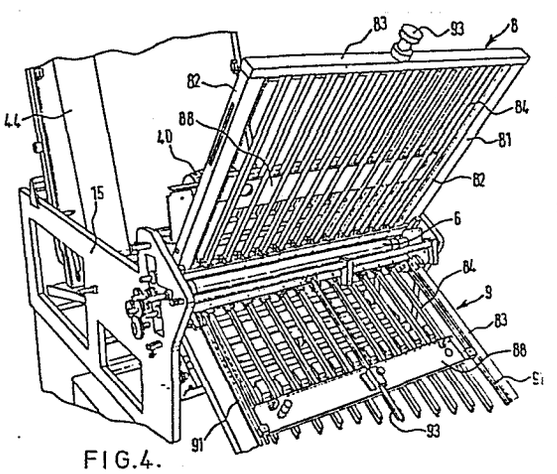

FIG.4.

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Buckle Plate For Sheet Manipulating Apparatus

Technical Field Of The Invention

This invention relates to a buckle plate for apparatus which folds, scores, perforates and slits sheets of paper, cardboard, plastics material, metal foil or other metallic material. Such apparatus is utilized in the production of leaflets and other printed publicity material, in the production of packaging material and in other similar fields.

Background Art

Hitherto the somewhat different functions of deflecting sheet material and folding sheet material have been regarded as incompatible and separate buckle and deflector plates have had to be provided for the two functions. This need to provide two different types of buckle and deflector plates has not only increased the capital cost of sheet manipulating apparatus but has also increased the operating costs, since when changing over from one function to the other the apparatus has to cease production while the different type of plate is substituted for the one being used.

An object of the invention is to provide a buckle plate which alleviates this disadvantage.

Disclosure Of The Invention

According to the present invention a buckle plate for sheet manipulating apparatus comprises a plurality of sheet control members mounted in a frame so that the control members can be moved between a first position in which they provide deflecting surfaces for deflecting a sheet and a second position in which the control members act as stop members for locating a sheet which is to be folded, the second position being adjustable in accordance with the size of the sheet and the position of the fold on the sheet.

Preferably the control members are slidably mounted in the frame so that they can be moved in unison between the first position and the

second position.

The positions of the sheet control members may be adjustable so as to vary the angle of a line of deflecting surfaces or stop members relative to the leading edge of a sheet.

The buckle plate may include a position adjusting mechanism at each side of the frame arranged to be adjusted separately so as to vary the angle of a line of deflecting surfaces or stop members relative to the leading edge of a sheet. Conveniently each position adjusting mechanism comprises a toothed belt drive coupled to a carrier on which the control members are mounted.

The positions of the sheet control members may be adjustable by an arrangement of cams so as to vary the angle of a line of deflecting surfaces or stop members relative to the leading edge of a sheet.

The buckle plate may also include an auxiliary position adjusting mechanism located substantially centrally of the frame to provide fine adjustment of the positions of the control members independently of the position adjusting mechanisms at each side of the frame or the arrangement of cams.

The auxiliary position adjusting mechanism may comprise a screw-threaded rod arranged to vary the position of a carrier on which the control members are mounted.

The buckle plate may be provided with guide members arranged to direct a sheet towards the second position of the control members. The guide members may comprise pairs of fingers between which a sheet passes when travelling towards the second position of the control members.

The pairs of fingers may be mounted on the ends of pairs of guide rods which extend along the frame.

The invention also resides in a paper manipulating machine

incorporating a buckle plate as defined in the nine preceding paragraphs.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings.

Brief Description Of The Drawings

Figure 1 is a perspective view of a paper manipulating machineincorporating a buckle plate embodying the invention;

Figure 2 is a perspective view of the paper manipulating machine shown in Figure 1 but from the opposite end;

Figure 3 is a further perspective view of the machine showing details of a loading table;

Figure 4 is a perspective view of two buckle plates of the machine;

Figure 5 is a perspective view of a sheet conveyor, a roller assembly and part of a buckle plate;

Figure 6 is a perspective view of a sidelay of the machine;

Figure 7 is a perspective view showing further details of the sidelay;

Figure 8 is a perspective view of a stacker conveyor;

Figure 9 is a further perspective view of the roller assembly and the sheet conveyor;

Figure 10 is a fragmentary side elevation of an end portion of a buckle plate with the sheet control members in a first position for use as deflectors;

Figure 11 is a fragmentary side elevation of an intermediate portion of a buckle plate with the sheet control members in a second position

for use as stop members;

Figure 12 is a fragmentary side elevation of the calipers which control the nips of the roller assembly;

Figure 13 is a fragmentary end elevation of the calipers shown in Figure 12;

Figure 14 is a sectional side elevation of the control arrangements of the loading table;

Figure 15 is a fragmentary side elevation of the roller assembly with an arrangement for slitting, scoring and perforating sheets in an operative position; and

Figure 16 is a fragmentary side elevation similar to Figure 15 but with the arrangement for slitting, scoring and perforating sheets in an inoperative position.

Best Mode For Carrying Out The Invention

Referring to the drawings, the paper manipulating machine comprises a base 1 on which is mounted a loading table 2 of a bottom feed conveyor 3, a sidelay 5, a roller assembly 6, an upper buckle plate 8 and a lower buckle plate 9. Under the lower buckle plate 9 is mounted a pivotable slitting, perforating and scoring arrangement 10 best seen in Figure 2 from which the lower buckle plate 9 has been removed. Also mounted on the base 1 are a sheet conveyor 12 and a stacker conveyor 13 which delivers the processed sheets to the output end 14 of the machine. The base 1 comprises a metal framework 15 clad with metal covers 16 and metal panels 17 some of which have been removed in several Figures to show parts which would otherwise be concealed.

The bottom feed conveyor 3, see in particular Figures 3 and 8, has a loading table 19 having a flat, substantially horizontal surface 20 onto which a stack 22 of sheets to be processed is placed. Two elongate ducts 23 extend along the loading table 19 substantially

parallel to one another on either side of the stack 22. The two ducts 23 are substantially rectangular in cross-section and are each provided with four, relatively widely spaced air outlet slots 25 (see Figure 14) in the vertically disposed side 26 of the duct which faces inwards towards the stack 22 of sheets. Typically the air outlet slots 25 are spaced some twelve centimetres apart along the length of the surface 20. The two ducts 23 are each provided with five relatively closely spaced air outlet slots 28, also in the vertically disposed side 26 but located towards the end of the duct which is adjacent the sidelay 5. Typically the air outlet slots 28 are spaced some six centimetres apart.

The supply of air under pressure to the air outlet slots 25 of each duct 23 is controlled by respective first control arrangements 29 each comprising a rectangular block 30 slidably mounted within the duct 23 and provided with a pattern of holes 31 which can be moved into register with different combinations of air outlet slots 25. As will be seen from Figure 14 the block 30 is provided with a single hole 31 towards its left hand end, two holes 31 at the next location, three holes 31 at the next location and four holes 31 towards the right hand end. When the block 30 is in the position shown in full line in Figure 14 a hole 31 is in register with each of the air outlet slots 25. As the block 30 is moved to the left towards the position seen in dotted line in Figure 14 the number of holes 31 in register with the air outlet slots 25 is progressively decreased by one until only the last hole of the group of four holes 31 is in register with the air outlet slot 25 which is towards the right hand end of the block 30 in Figure 14. The block 30 is moved by a control knob 32 which projects through an elongate aperture 33 in the outwardly facing wall of the duct 23.

The supply of air under pressure to the air outlet slots 28 of each duct 23 is controlled by respective second control arrangements 34 each of which comprises five pressure control valves 35 each associated with one of the air outlet slots 28. Each pressure control valve is operable by a control knob 36 which projects from

the side of the duct 23. The number of air outlet slots to which air under pressure is supplied may be increased (or decreased) in steps of one by operating the control knobs 36. The air outlet slots 25 and 28 may be suitably located and spaced to cater for sheets varying in size from SRA2 down to sheets one hundred millimetres square and the control knobs 32 and 36 may be calibrated to correspond to the size of the sheets being loaded.

It will be appreciated that the air issuing from the air outlet slots 25 and 28 raises the stack 22 of sheets above the surface 20 of the loading table 19 so that the bottom sheet can be removed from the stack by a suction roller 37 located between the loading table 19 and the feed table 42. A third control arrangement 38 controls the pressure of the air supplied in accordance with the height of the stack of sheets on the loading table 19. The suction roller 37 is arranged to rotate so that it carries the bottom sheet of the stack 22 through a gate 39 and onto the sidelay 5. A compressor/vacuum pump (not shown) mounted in the base 1 provides a supply of air under pressure to the two ducts 23 and also provides a vacuum to operate the suction roller 37. The supply of air under pressure may also be controlled in accordance with the quality and weight of the sheets being moved by the suction roller 37. The suction roller 37 is rotated by an electric motor 40.

The sidelay 5 is located above a flat, substantially horizontal, surface 41 of a feed table 42 along which a sheet 43 is to be transported from the suction roller 37 to the roller assembly 6. The sidelay 5 comprises an endless belt 44 of polyurethane or other suitable flexible material the upper reach of which extends the full length of the feed table 42 to form a sheet conveyor 46. The endless belt 44, which is approximately ten centimetres in width, extends at an angle of two degrees to a side rail 47 which also extends along the surface 41 of the feed table 42. The two degree angle between the endless belt 44 and the side rail 47 ensures that the edge of the sheet 43 is maintained in contact with the side rail 47 as the sheet 43 is moved along the surface 41. The sheet 43 is held in contact

with the surface of the sheet conveyor 46 by an assembly 48 of sixteen steel balls 49 held captive in co-operating sockets 51 and which press on the sheet 43 and the sheet conveyor 46 by gravity. The balls 49 may also be formed from a suitable material such as glass, plastics material or nylon and are retained in the sockets 51 by a retaining bar (not shown) which extends above the balls 49.

The sidelay 5 including the endless belt 44, the side rail 47 and the assembly 48 of balls is movable across the surface 41 of the feed table as a unitary whole in a single movement to cater for the size of the sheets 43 being conveyed. Coarse adjustment of the position of the sidelay 5 is provided by downwardly extending abutments on the lower surface of the side rail 47 which fit into correspondingly shaped holes 53 in the surface 41 of the feed table 42 best seen in Figure 7 in which various parts have been removed. Two rows of the holes 53 at opposite ends of the feed table 42 provided a variety of different positions of the sidelay 5 depending on the size of the sheets being conveyed. The sidelay 5 is simply moved so that the abutments fit into the particular holes 53 which are suitable for the size of the sheets 43 being conveyed.

Fine adjustment of the position of the sidelay 5 is provided by a screw-threaded member 54 which engages the side rail 47 and can be tightened or slackened by a control knob 55 to effect the adjustment. In an alternative arrangement (not shown) two screw threaded members which engage the side rail at opposite ends are arranged to be adjustable independently to vary the angle of the sidelay 5 relative to the direction of travel of the sheets.

The roller assembly 6 to which the sheets 43 are moved by the sheet conveyor 46 of the sidelay 5 comprises a central or fixed roller 57 which co-operates with two fold rollers 58 and 59 and with a feed roller 60. The central roller 57, the two fold rollers 58 and 59 and the feed roller 60 are steel rollers each having ten hard rubber meshing portions 61 provided with splines at spaced positions along their lengths. The rollers of the roller assembly 6 are driven by an

electric motor 62 through helical gears 63. The nips between the central roller 57 and each of the two fold rollers 58 and 59 are adjustable by respective calipers 64 and 65 having gaps 66 which vary in accordance with the dimensions of the nips so that inserting a specimen of a sheet to be folded into the gaps 66 automatically sets the nips to suit the specimen. Similarly the nip between the central roller 57 and the feed roller 60 is adjustable by a caliper 68 having a gap 69 which varies in accordance with the dimension of the nip so that inserting a specimen of a sheet to be fed into the gap automatically sets the nip to suit the specimen.

As can be seen in Figure 12 the movable arms 72 of the calipers 64 and 65 are formed by blocks in which the spindles 73 of the fold rollers 58 and 59 are journalled so that opening the gaps moves the fold rollers 58 and 59 away from the central roller 57. Similarly the movable arm 74 of the caliper 68 (see Figure 13) is formed by a block in which the spindle of the feed roller 60 is journalled so that opening the gap moves the feed roller 60 away from the central roller 57. The gaps in the calipers 64, 65 and 68 are arranged to be opened by a cam 77 which engages the blocks forming the movable arms, the cam being operated by a handle 78 acting through a Bowden cable 79. The handle 78 and the ends of the calipers 64, 65 and 68 project outside the metal covers 16 so that the handle can be operated and the specimens inserted in the calipers without the need to uncover or touch the rollers 57, 58, 59 and 60.

The upper buckle plate 8 and the lower buckle plate 9, which are substantially identical, each comprise a substantially rectangular metal frame 81 formed by two parallel sides 82 and two parallel ends 83. Twelve pairs of guide members 84 each formed by two cylindrical metal rods extend from one end 83 of the frame 81 to the other, the space between the rods allowing a sheet 43 to slide between them. As can be seen in Figure 10 the end 83 of the frame 81 which is adjacent the roller assembly 6 is provided with twelve pairs of guide fingers 86, each pair of guide fingers being located at the end of a pair of guide members 84. The guide fingers 86 direct a sheet emerging from

the roller assembly 6 into the space between the rods forming the guide members 84. Mounted on the frame 81 so that it extends transversely of the guide members 84 is a carrier 88 to which are secured eleven sheet control members 89, each sheet control member being accommodated in a space between two adjacent guide members 84.

The carrier 88, and with it the control members 89 can be moved along the frame 81 so that the control members can move from a first position at the end 83 adjacent the roller assembly 6 to any intermediate position between the two ends 83. A position adjusting mechanism 91 at each side 82 of the frame is arranged so that each end of the carrier can be moved separately so as to vary the angle of a line of sheet control members 89 relative to the direction of travel of a sheet 43. Each position adjusting mechanism 91 comprises a toothed belt drive 92 coupled to the carrier 88. An auxiliary position adjusting mechanism 93, located substantially centrally of the frame is arranged to provide fine adjustment of the positions of the sheet control members 89 independently of the position adjusting mechanisms 82 at each side of the frame 81. The auxiliary position adjusting mechanism 93 comprises a screw-threaded rod arranged to vary the position of the carrier 88.

The sheet control members 89 have an arcuate end 94 of substantially the same curvature as the rollers 57, 58, 59 and 60, although other suitably shaped ends may be provided. When the control members 89 are in a first position as illustrated in Figure 10 the ends 94 provide deflecting surfaces for deflecting a sheet 43, but if the control members 89 are moved to a second position as illustrated in Figure 11 the ends 94 act as stop members for locating a sheet 43 which is to be folded, this second position being adjustable in accordance with the size of the sheet 43 and the position of the fold on the sheet.

A sheet 43 leaving the sheet conveyor 46 of the sidelay 5 enters the nip between the feed roller 60 and the fixed roller 57. If the sheet 43 is to be folded by upper buckle plate 8 the sheet control members

89 of upper buckle plate 8 will have been set to a second position and the leading edge of the sheet moves between the guide fingers 86 until it encounters the ends 94 of the control members 89 which act as stop members. The movement of the leading edge of the sheet 43 is halted, but the portion of the sheet emerging from the nip between the rollers 57 and 60 continues to move, producing a fold, the doubled end of which enters the nip between the fixed roller 57 and the fold roller 58. If folding in this way is not required then the control members 89 of the upper buckle plate 8 will have been set to the first position so that the ends 89 act as deflectors which deflect the leading edges of a sheet 43 emerging from the nip between the rollers 57 and 60 into the nip between rollers 57 and 58.

After leaving the nip between the rollers 57 and 58 a sheet 43 may be folded by the lower buckle plate 9, deflected by the lower buckle plate 9 or guided into the slitting, scoring and perforating arrangement 10 for delivery out of the rear end of the machine. If the sheet is to be folded by the lower buckle plate 9 the sheet control members 89 will have been set to a second position and the leading edge of the sheet moves between the guide fingers 86 until it encounters the ends 94 of the control members 89 which act as stop members. The movement of the leading edge of the sheet 43 is halted, but the portion of the sheet emerging from the nip between the rollers 57 and 58 continues to move, producing a fold, the doubled end of which enters the nip between the fixed roller 57 and the fold roller 59. The folded sheet emerging from the nip between rollers 57 and 59 then enters a nip between two main perforator rollers 97 and 98 and then passes under a plurality of bale arms 99 onto the sheet conveyor 12 which is formed by a cord conveyor arrangement. The sheet conveyor 12 is arranged to feed a stacker conveyor 13 which is driven at a speed one fifteenth that of the sheet conveyor 12 so that the delivered sheets form a stepped stack at the output end 14 of the machine.

If folding by the lower buckle plate 9 is not required then the control members 89 of the lower buckle plate 9 will have been set to

the first position so that the ends 89 act as deflectors which deflect the leading edge of a sheet 43 emerging from the nip between the rollers 57 and 58 into the nip between rollers 57 and 59. The sheet 43 emerging from the nip between rollers 57 and 59 enters the nip between main perforator rollers 97 and 98 which may be provided with slitting, scoring or perforating cutters (not shown) to slit, score or perforate the sheet. The sheet then passes to the sheet conveyor 12 and is fed to the stacker conveyor 13 for delivery to the output end 14 of the machine. When slitting, scoring or perforating are not required the slitting, scoring or perforating cutters are removed from the rollers 97 and 98.

After leaving the nip between the rollers 57 and 58 the sheets 43 may by-pass the main perforator rollers 97 and 98, the sheet conveyor 12 and the stacker conveyor 13 and be slit, scored or perforated by the slitting, scoring and perforating arrangement 10 and delivered to the rear of the machine. To this end the lower buckle plate 9 is removed and the arrangement 10, which is mounted for pivotal movement about a pivot 95, is swung from the inoperative position shown in Figure 16 to the operative position shown in Figure 15.

The arrangement 10 comprises a rotatable blade 100 which co-operates with a rotatable channel 101 to slit, score or perforate a sheet 43, the particular blades 100 which perform each of these functions being interchangeable. The blades 100 may also be adjustable to cater for sheets 43 of paper and cardboard of different grades of thickness. When the arrangement 10 is in the operative position the pinion 104 driving the blade 100 and the channel 101 through pinion 105 is arranged to mesh with the roller 98. Guide members 106 are automatically located to direct a sheet 43 emerging from the nip between the rollers 57 and 58 towards the blade 100 and the co-operating channel 101 when the arrangement 10 is in the operative position. An outlet 108, aligned with the guide members 106 is arranged so that sheets emerging from between the blade 100 and channel 101 are ejected from the rear of the machine. A sheet passing from the blade 100 and channel 101 to the outlet 108 travels

in a substantially straight line path and does not have the curl usually associated with slitting, scoring and perforating arrangements.

Although in the buckle plate described above the control members 89 are moved in unison, in other arrangements the control members 89 may be moved singly or in groups, for example when manipulating polygonal sheets instead of the rectangular sheets shown in the drawings. Moreover, although the sheet conveyor 46 is formed by a single endless belt 44, in other arrangements the sheet conveyor may be formed by a plurality of endless belts or cards arranged parallel to one another.

CLAIMS

1. A buckle plate for sheet manipulating apparatus comprising a plurality of sheet control members mounted in a frame so that the control members can be moved between a first position in which they provide deflecting surfaces for deflecting a sheet and a second position in which the control members act as stop members for locating a sheet which is to be folded, the second position being adjustable in accordance with the size of the sheet and the position of the fold on the sheet.

2. A buckle plate as claimed in Claim 1, wherein the control members are slidably mounted in the frame so that they can be moved in unison between the first position and the second position.

3. A buckle plate as claimed in Claim 1 or Claim 2, wherein positions of the sheet control members are adjustable so as to vary the angle of a line of deflecting surfaces or stop members relative to the leading edge of a sheet.

4. A buckle plate as claimed in any preceding claim, including a position adjusting mechanism at each side of the frame arranged to be adjusted separately so as to vary the angle of a line of deflecting surfaces or stop members relative to the leading edge of a sheet.

5. A buckle plate as claimed in Claim 4, wherein each position adjusting mechanism comprises a toothed belt drive coupled to a carrier on which the control members are mounted.

6. A buckle plate as claimed in any one of Claims 1 to 3, wherein the positions of the sheet control members are adjustable by an arrangement of cams so as to vary the angle of a line of deflecting surfaces or stop members relative to the leading edge of a sheet.

7. A buckle plate as claimed in any one of Claims 4 to 6, including an auxiliary position adjusting mechanism located

substantially centrally of the frame to provide fine adjustment of the positions control members independently of the position adjusting mechanisms at each side of the frame or the arrangement of cams.

8. A buckle plate as claimed in Claim 7, wherein the auxiliary position adjusting mechanism comprises a screw-threaded rod arranged to vary the position of a carrier on which the control members are mounted.

9. A buckle plate as claimed in any preceding claim, wherein the frame is provided with guide members arranged to direct a sheet towards the second position of the control members.

10. A buckle plate as claimed in Claim 9, wherein the guide members comprise pairs of fingers between which a sheet passes when travelling towards the second position of the control members.

11. A buckle plate as claimed in Claim 10, wherein the pairs of fingers are mounted on the ends of pairs of guide rods which extend along the frame.

12. A buckle plate constructed and arranged to operate substantially as hereinbefore described with reference to the accompanying drawings.

13. A sheet manipulating machine incorporating a buckle plate as claimed in any preceding claim.

14. A sheet manipulating machine constructed and arranged to operate substantially as hereinbefore described with reference to the accompanying drawings.

FIG.1.

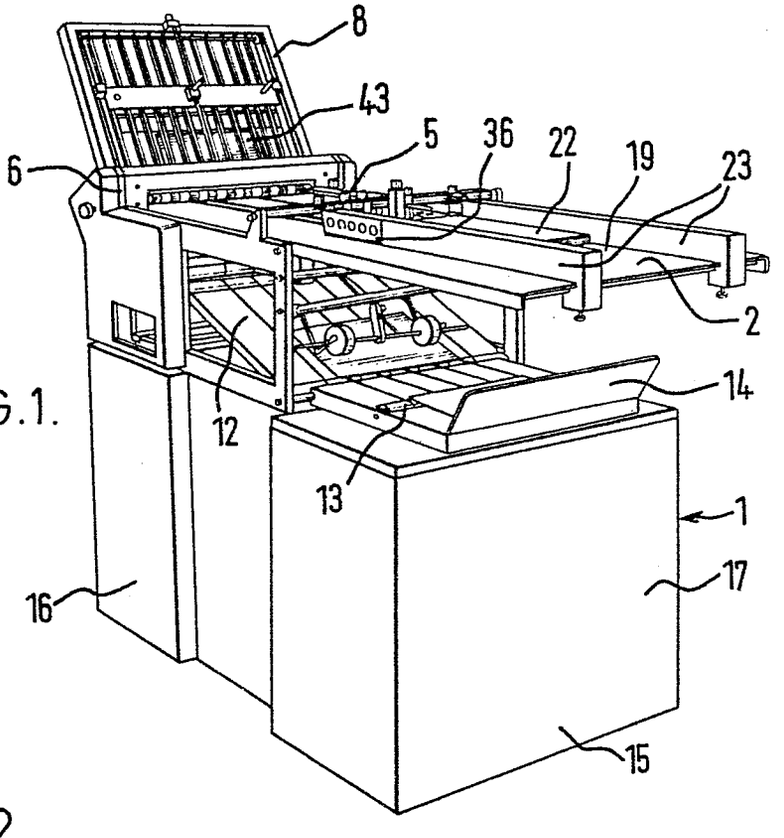


FIG.2.

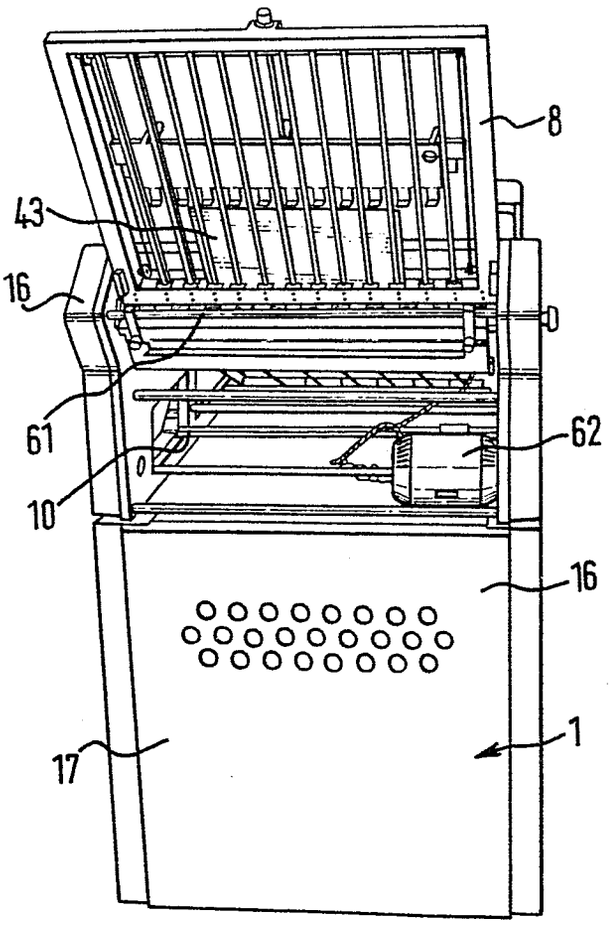
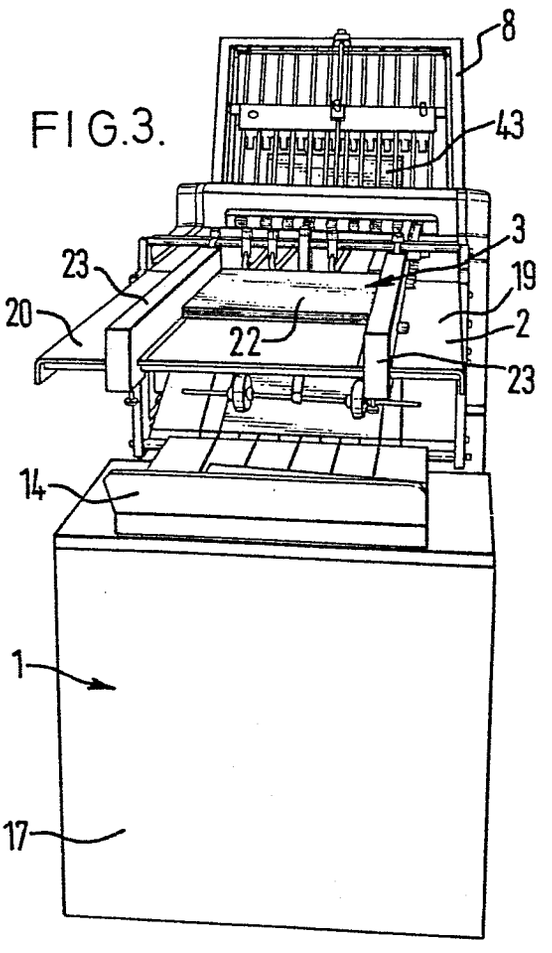


FIG.3.



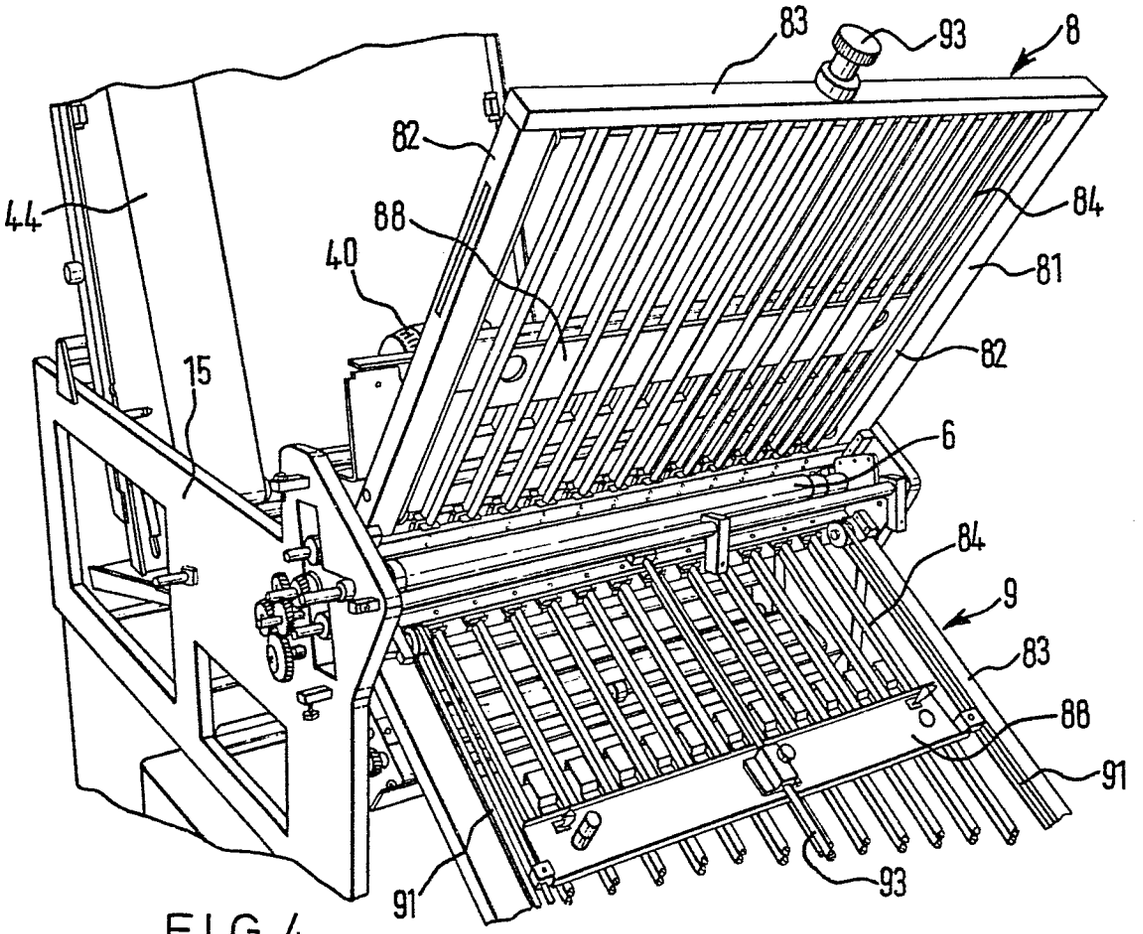


FIG.4.

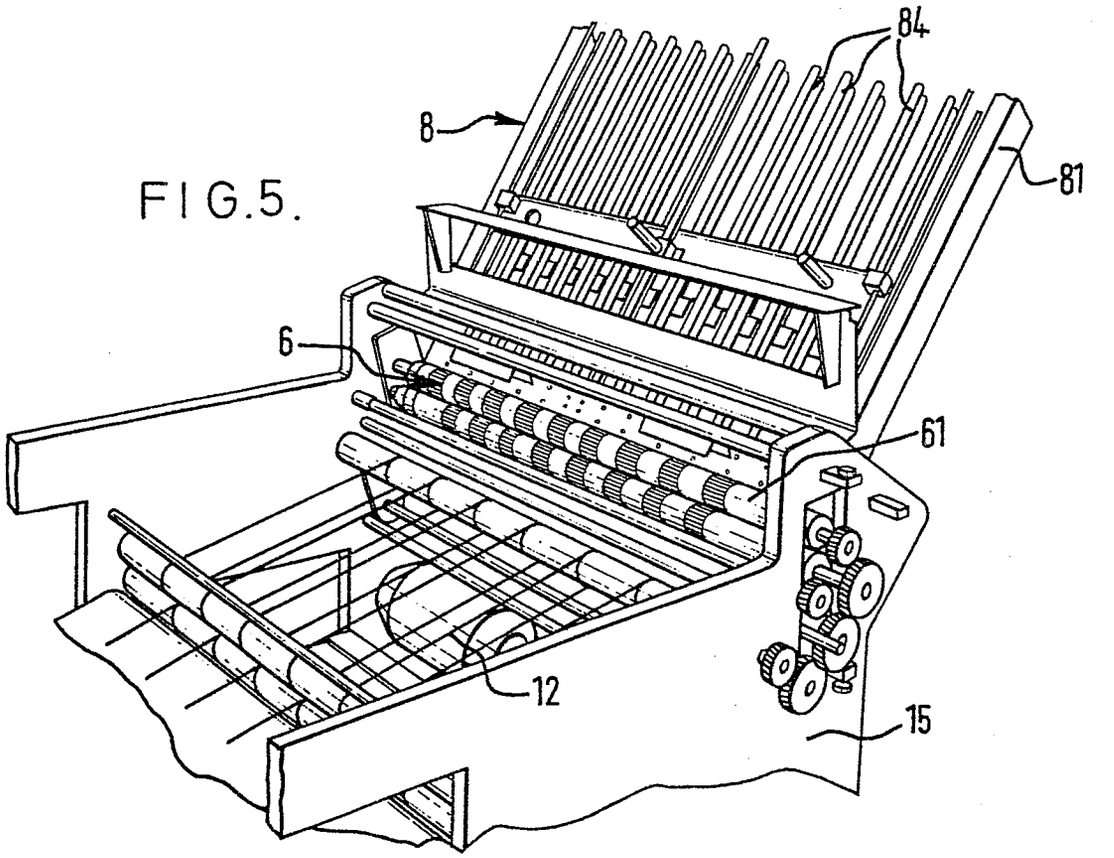


FIG.5.

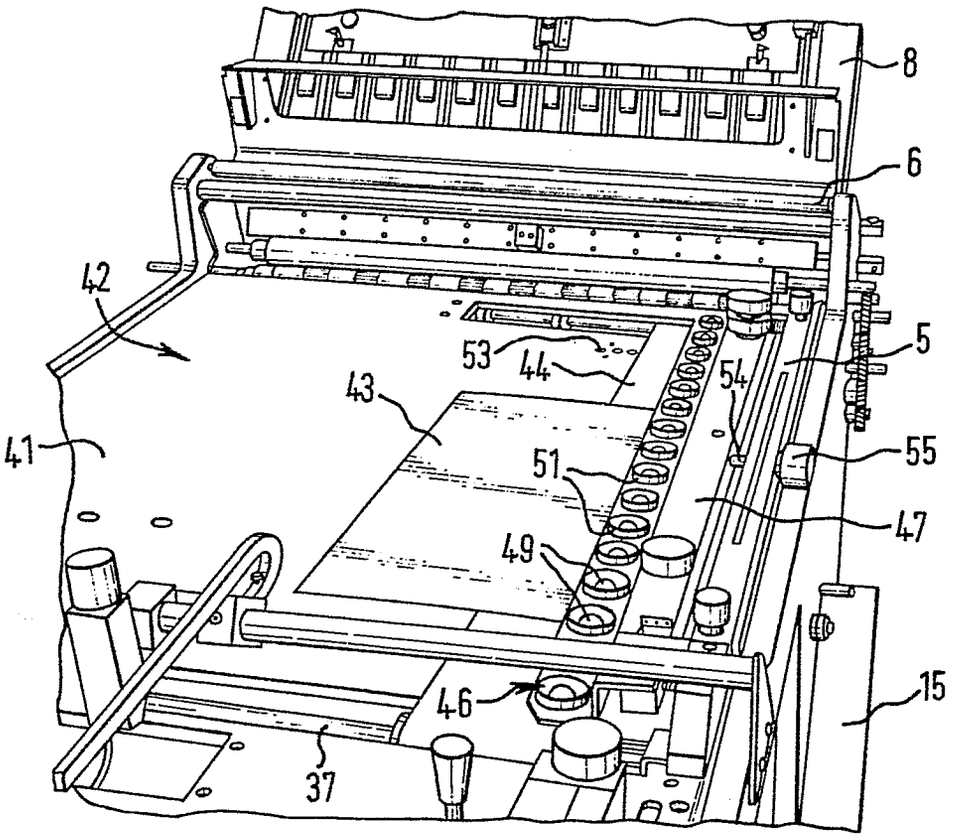

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FIG.6.

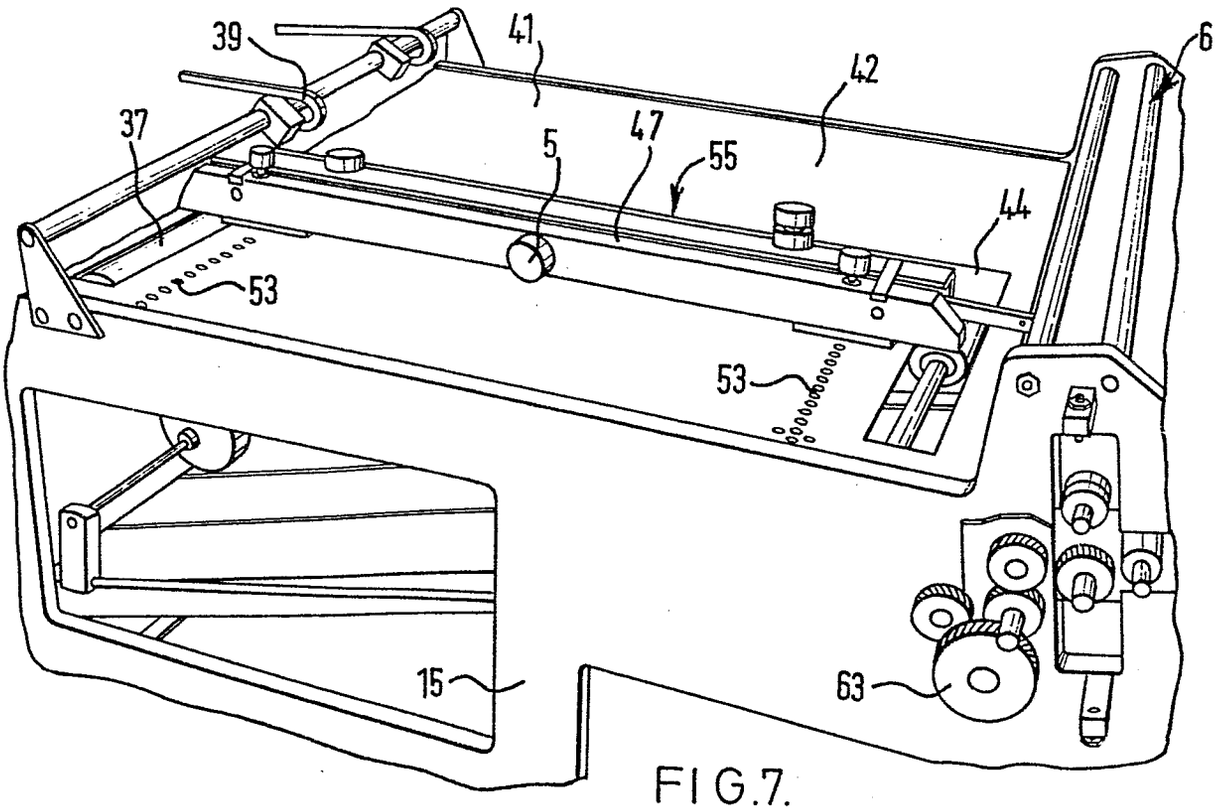
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FIG.7.

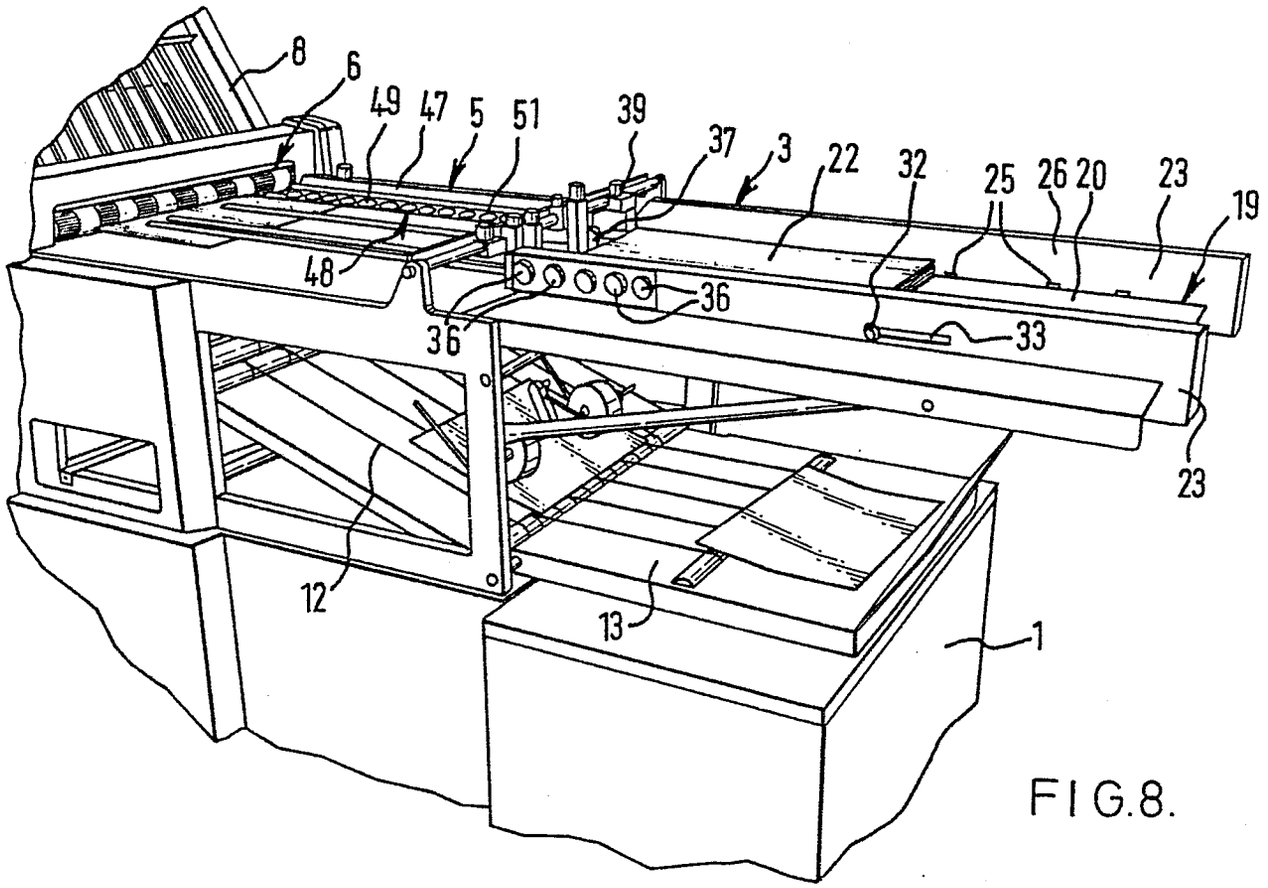
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FIG.8.

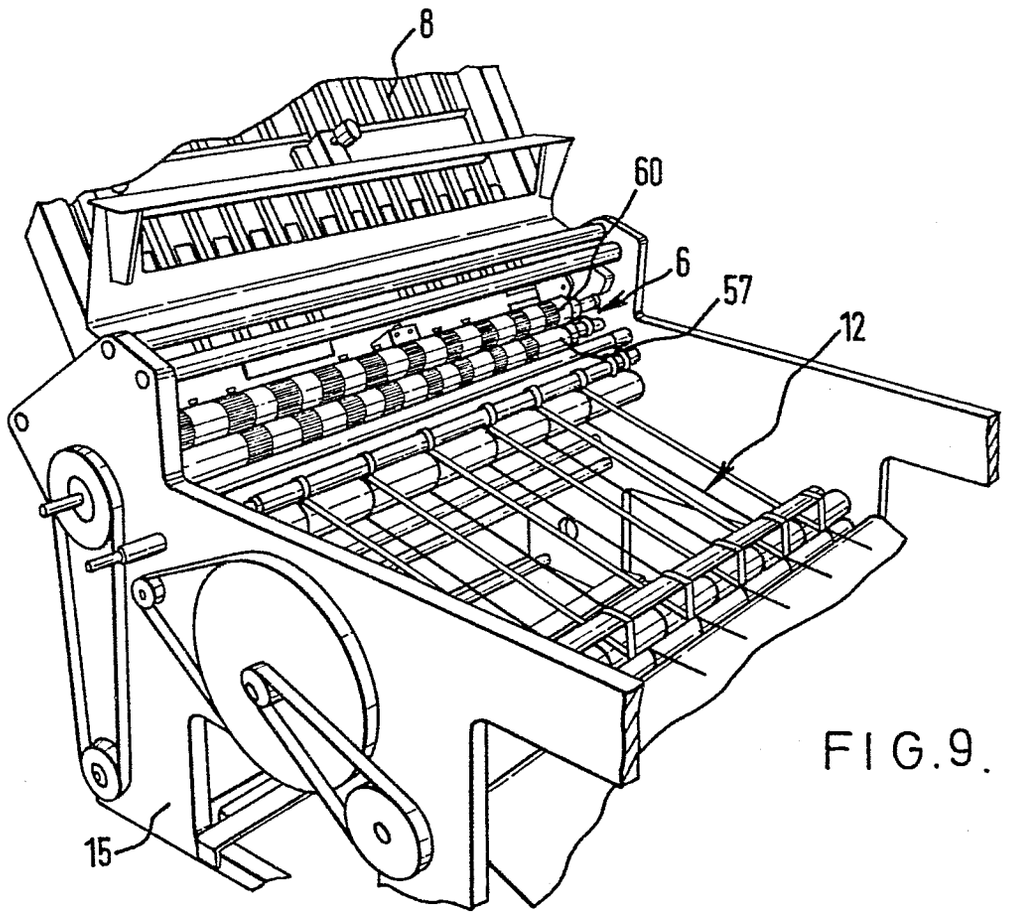
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FIG.9.

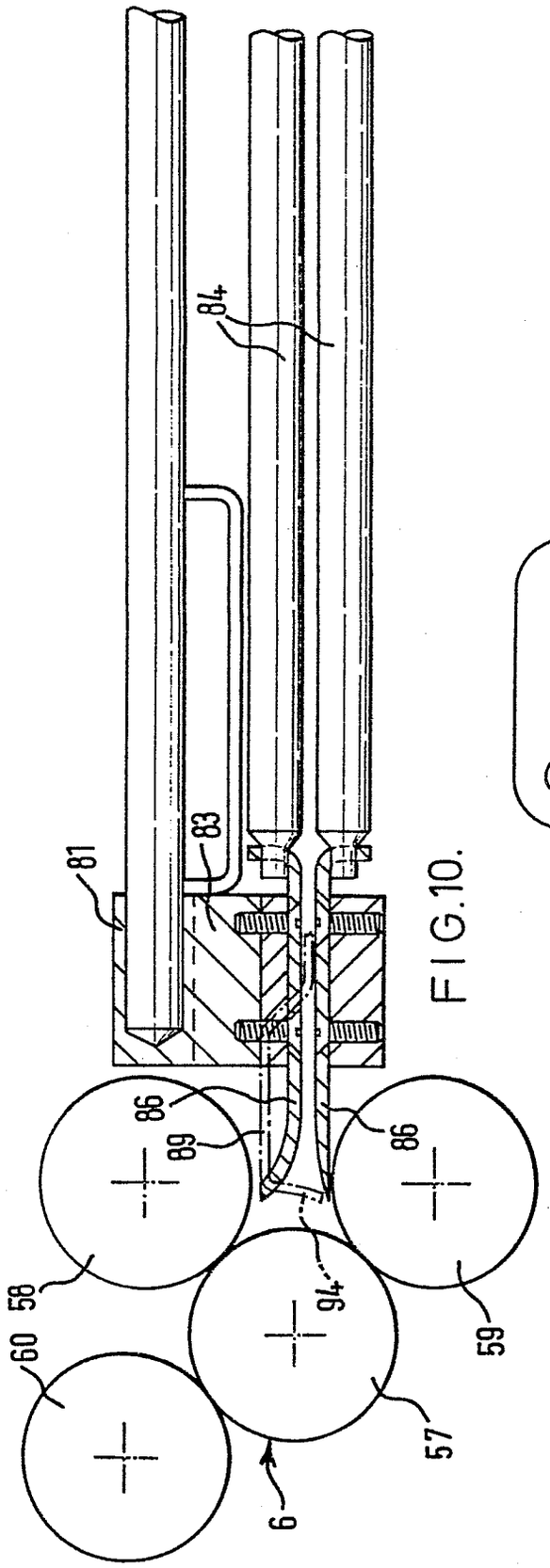

FIG.10.

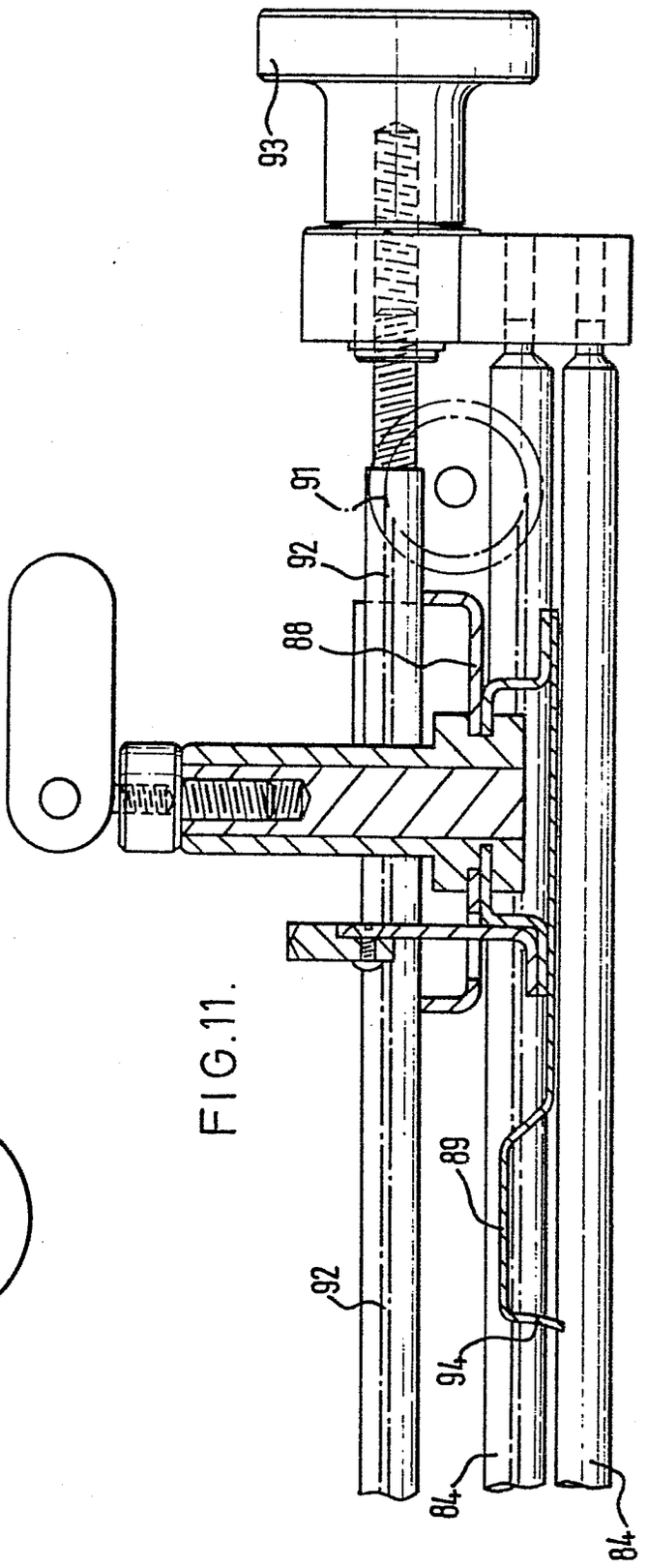

FIG.11.

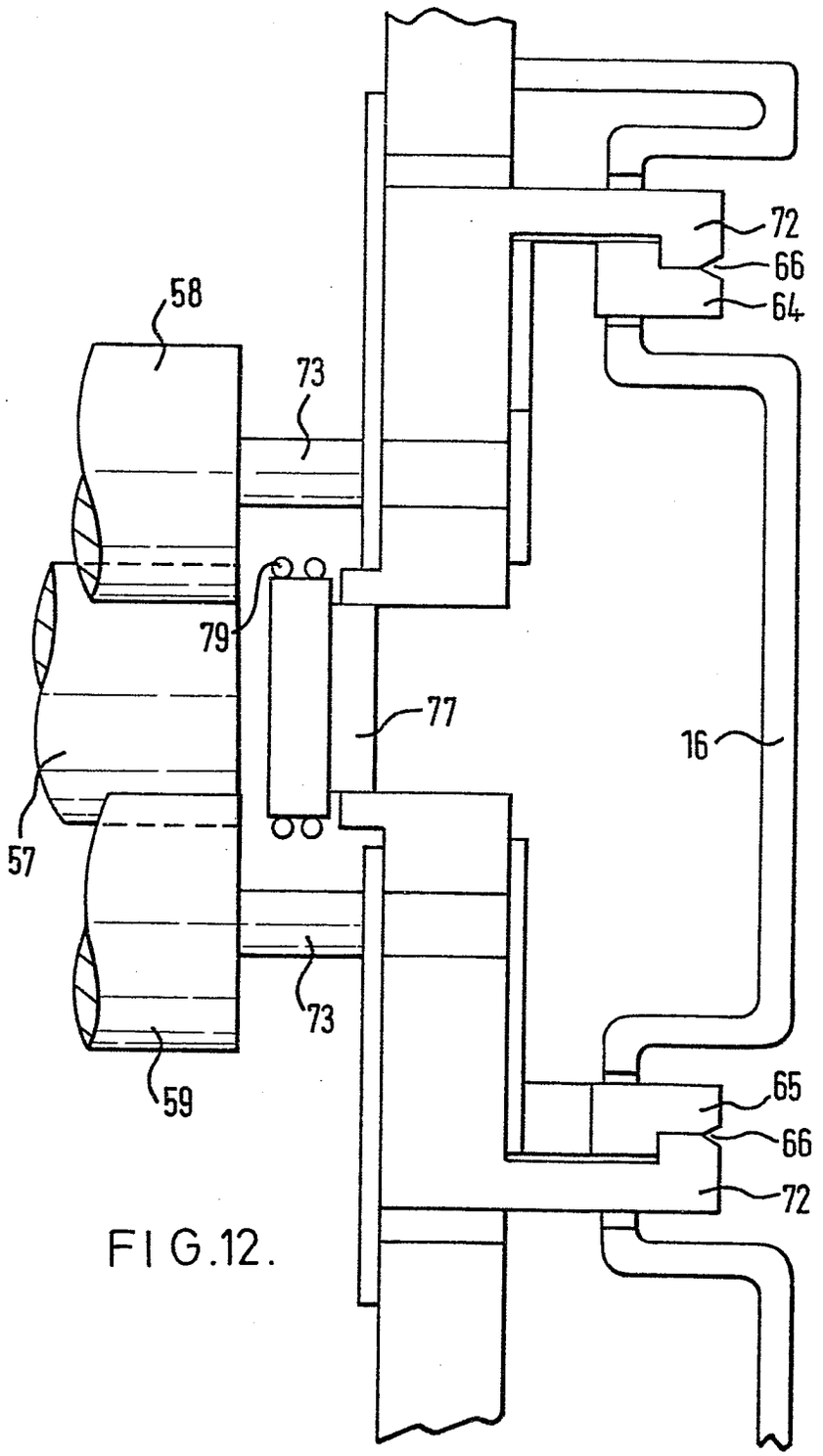

FIG.12.

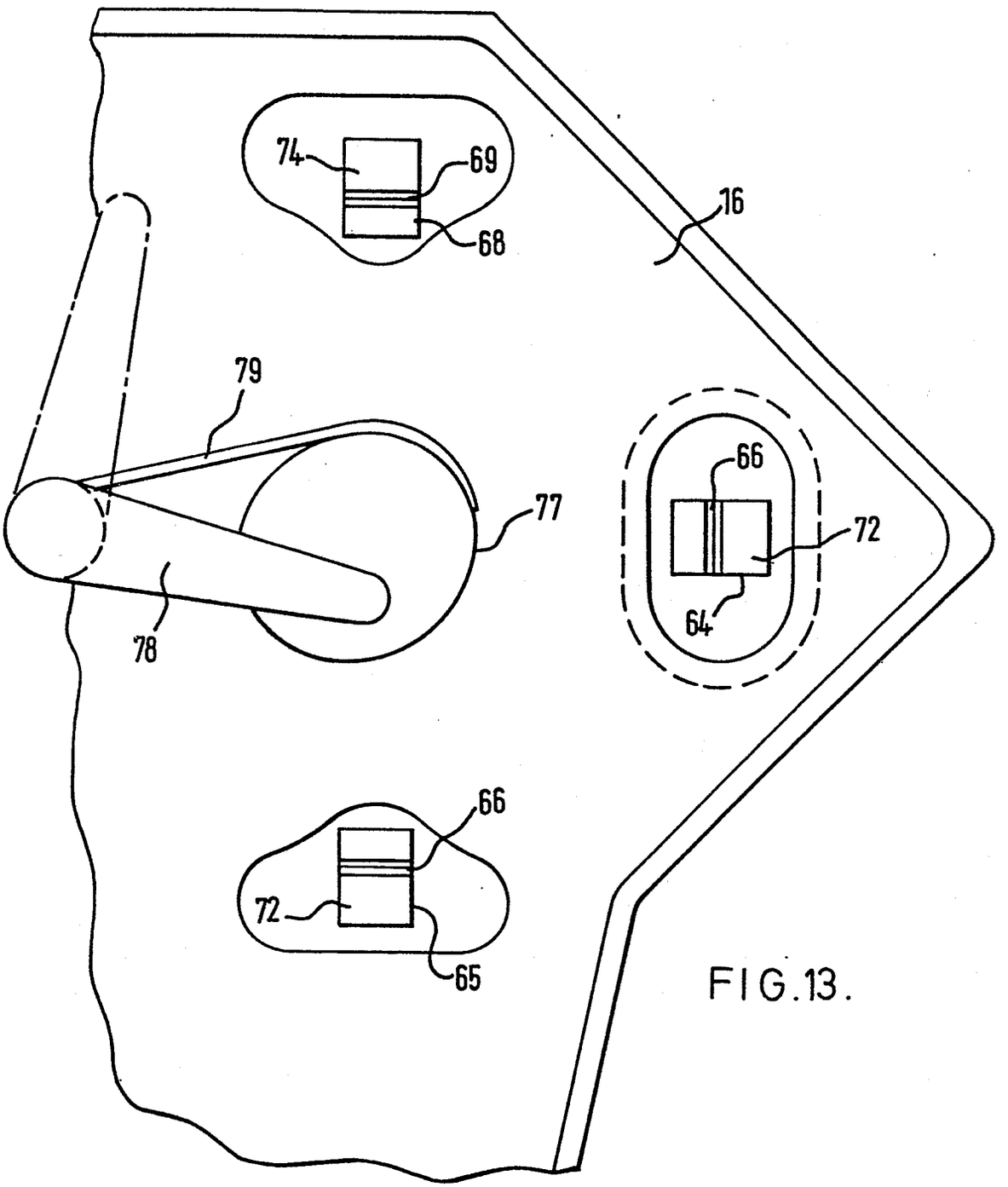

FIG.13.

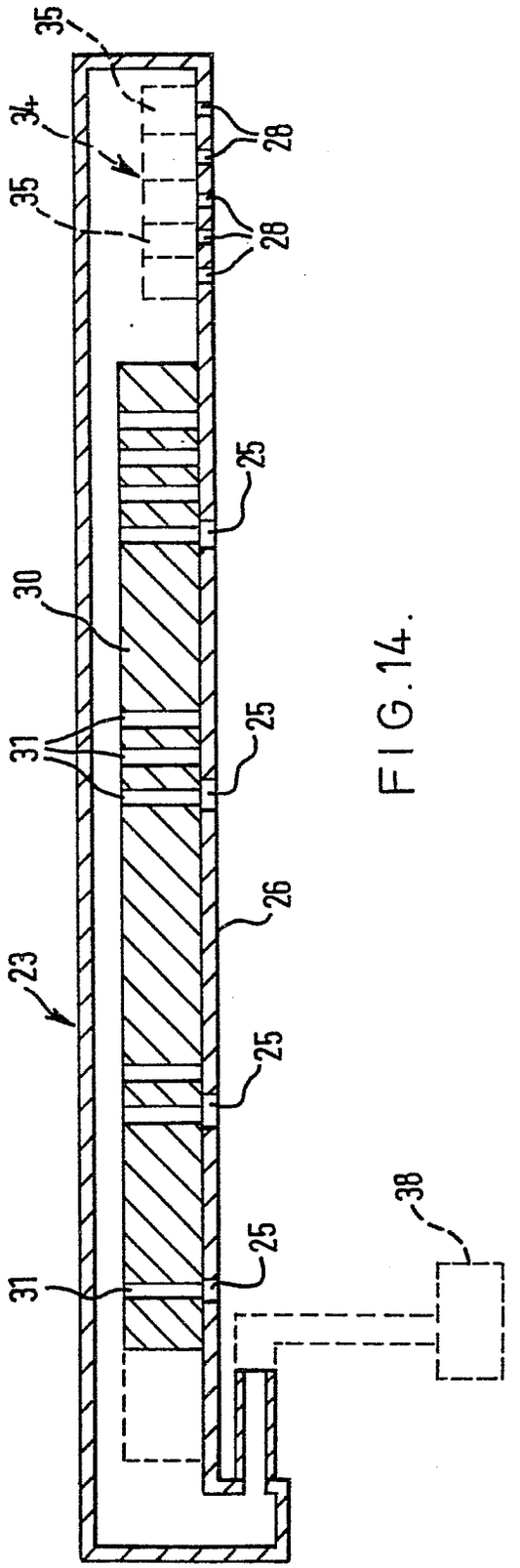

FIG.14.

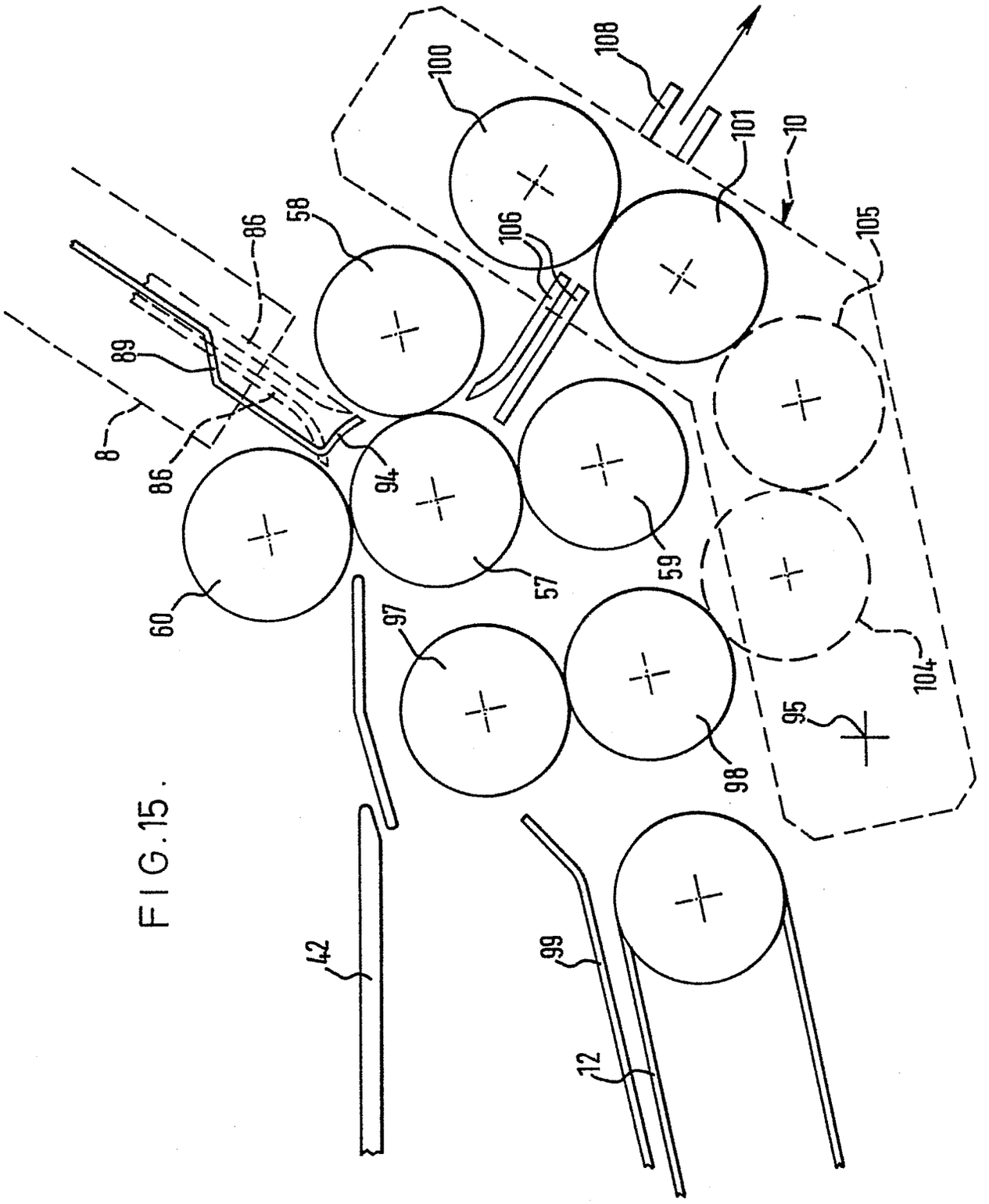

FIG.15.

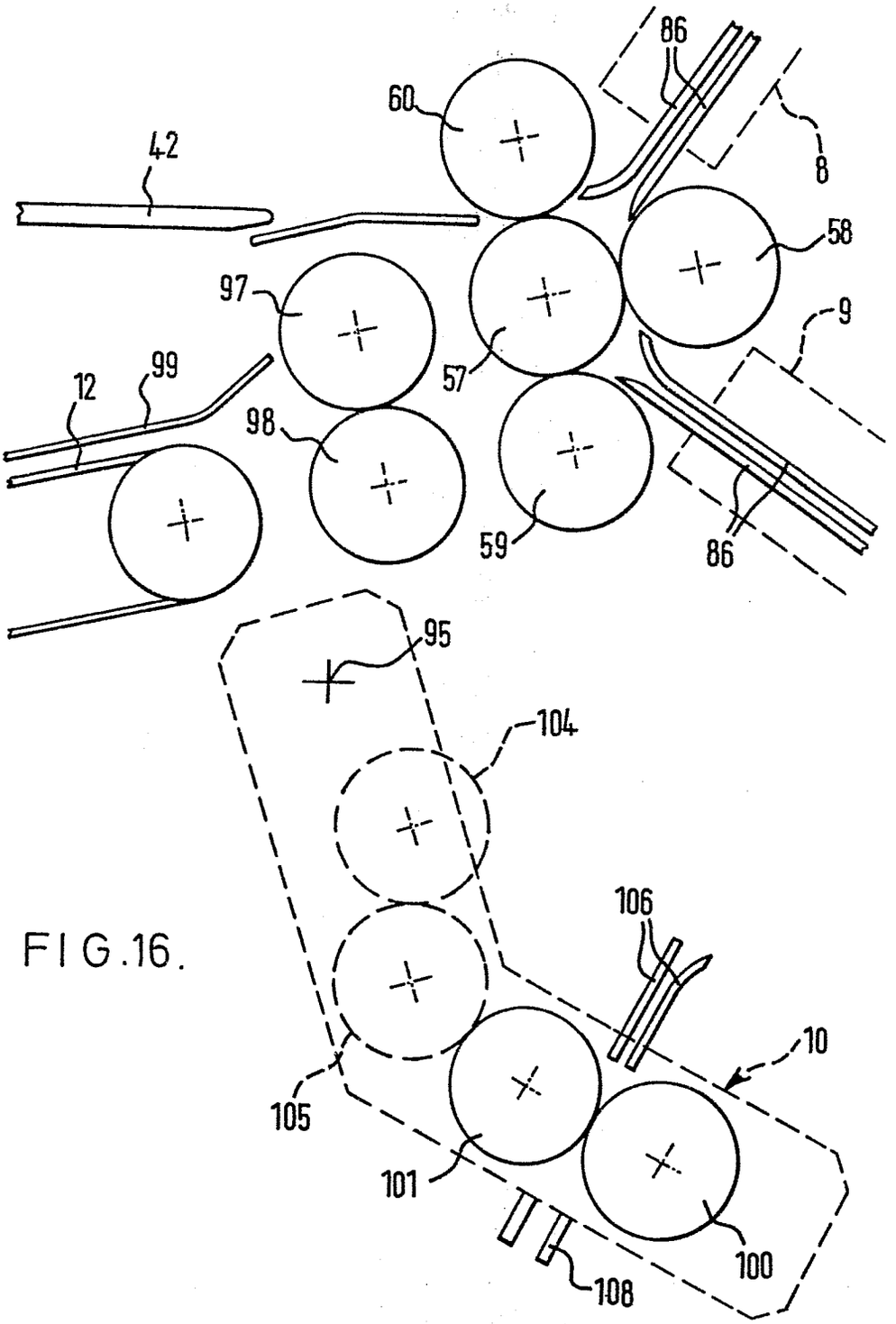

FIG.16.

European Patent Office

EUROPEAN SEARCH REPORT

0118228
Application number

EP 84300773.3

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	DE - A1 - 2 417 750 (MASCHINEN-BAU OPPENWEILER GMBH) * Fig.; claim 1 *	1	B 65 H 45/16
A	DE - A1 - 2 949 387 (MASCHINEN-BAU OPPENWEILER BINDER & CO) * Fig. 1-3; claims 1-6 *	1	
A	GB - A - 1 177 857 (MATHIAS BAUERLE GMBH) * Totality *	1-4	
A	GB - A - 2 069 981 (HADEWE B.V.) * Fig. 2; abstract *	1	TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
A	DE - C - 548 947 (ROTO- UND DEBEGO-WERKE A.G.)		B 65 H

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
VIENNA	09-05-1984	PANGRATZ

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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X CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.

☒ Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid,

namely claims: 11.

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions.

namely:

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid,

namely claims:

☐ None of the further search fees has been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims,

namely claims: