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**54** An arrangement for setting the nips of the rollers of sheet manipulating apparatus.

**57** An arrangement for the remote control of the setting of the nip between a fixed roller (57) and an adjustable roller (58) of apparatus which manipulates i.e. folds, slits, scores, perforates or deflects of paper, cardboard or the like, comprises a caliper (64) coupled to the adjustable roller and having a gap (66) the dimension of which varies in accordance with the dimension of the nip. By opening the caliper

and inserting a specimen of a sheet in the gap the nip between the rollers is adjusted automatically to suit the specimen. The movable arm (72) of the caliper is formed by a block in which a spindle (73) of the movable roller is journaled and which is moved by a cam (77) operated by a handle acting through a Bowden cable (79).

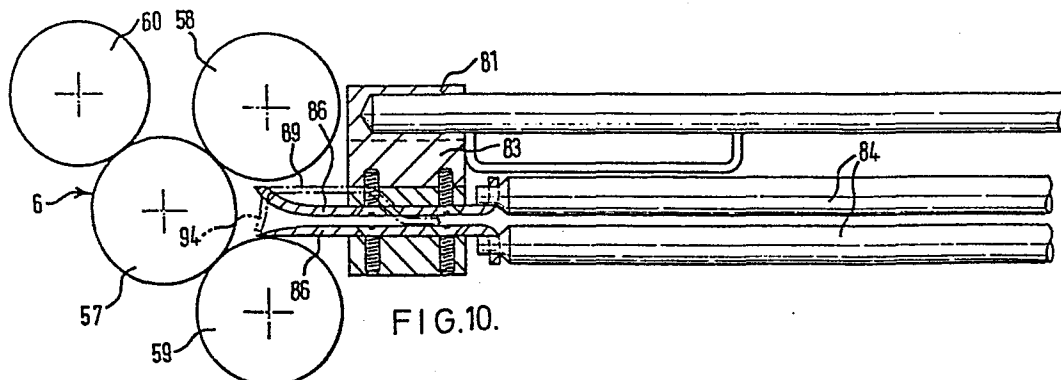


FIG. 10.

An Arrangement For Setting the Nips of the  
Rollers of Sheet Manipulating Apparatus

Technical Field Of The Invention

This invention relates to an arrangement for setting the nips of the  
5 rollers of sheet manipulating apparatus which folds, scores,  
perforates and slits sheets of paper, cardboard or plastics material,  
metal foil or other metallic material. Such apparatus is utilized in  
the production of leaflets and other printed material, in the  
production of packaging material and in other similar fields.

10 Background Art

Hitherto the nips of the rollers of sheet manipulating apparatus have  
been set by inserting a specimen of the sheet material in the nip  
between the rollers and then securing the co-operating rollers in this  
position. This procedure has the disadvantage that the rollers need  
15 to be made accessible for the insertion of a specimen by removing  
protective covers.

An object of this invention is to alleviate this disadvantage.

Disclosure Of The Invention

According to the present invention an arrangement for setting the nip  
20 between a fixed roller and an adjustable roller of sheet manipulating  
apparatus comprises a caliper coupled to the adjustable roller and  
having a gap which varies in accordance with the dimension of said nip  
so that inserting a specimen of a sheet into said gap automatically  
adjusts the nip between the fixed roller and the adjustable roller.

25 The arrangement may include further calipers coupled to respective  
further adjustable rollers of the sheet manipulating apparatus each  
having a gap which varies in accordance with the dimensions of the nip  
between the further adjustable roller and the fixed roller so that  
inserting a specimen of a sheet into said gap automatically adjusts  
30 the nip between the feed roller and the further adjustable roller.

The calipers and the further calipers if provided are operable to adjust the nips between the rollers by a cam arrangement.

The cam arrangement may be coupled to the rollers through a Bowden cable. The cam arrangement may be actuated by a handle. The cam  
5 arrangement may also move a block in which a roller is rotationally mounted.

The invention also resides in a paper manipulating machine incorporating an arrangement for setting the nips between the rollers as defined in the four preceding paragraphs.

- 10 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 machine incorporating an arrangement for setting the nips of a roller assembly  
15 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;

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

Figure 5 is a perspective view of the roller assembly, a sheet conveyor 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;

- 25 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  
5 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  
10 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;

15 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  
20 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  
25 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  
5 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  
10 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  
15 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  
20 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  
25 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  
30 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.

5 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  
10 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  
15 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  
20 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  
25 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  
30 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 92 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  
5 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  
10 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  
15 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  
20 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  
25 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  
30 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  
5 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  
10 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  
15 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  
20 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  
25 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  
30 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 5 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 10 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 15 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 20 formed by a plurality of endless belts or cards arranged parallel to one another.

CLAIMS

1. An arrangement for setting the nip between a fixed roller and an adjustable roller of sheet manipulating apparatus comprises a caliper coupled to the adjustable roller and having a gap which varies  
5 in accordance with the dimension of said nip so that inserting a specimen of a sheet into said gap automatically adjusts the nip between the fixed roller and the adjustable roller.
2. An arrangement as claimed in Claim 1, wherein further calipers coupled to respective further adjustable rollers of the sheet  
10 manipulating apparatus each have a gap which varies in accordance with the dimension of the nip between the further adjustable roller and the fixed roller so that inserting a specimen of a sheet into said gap automatically adjusts the nip between the feed roller and the further adjustable roller.
- 15 3. An arrangement as claimed in Claim 1 or Claim 2, wherein the calipers and the further calipers if provided are operable to adjust the nips between the rollers by a cam arrangement.
4. An arrangement as claimed in Claim 3, wherein the cam arrangement is arranged to adjust all the nips between the rollers  
20 simultaneously.
5. An arrangement as claimed in Claim 3 or Claim 4, wherein the cam arrangement is coupled to the rollers through a Bowden cable.
6. An arrangement as claimed in any one of Claims 3 to 5, wherein the cam arrangement is actuated by a handle.
- 25 7. An arrangement as claimed in any one of Claims 3 to 6, wherein the cam arrangement moves a block in which a roller is rotationally mounted.
8. An arrangement for setting the nips between the rollers of a

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

9. A sheet manipulating machine incorporating an arrangement for  
5 setting the nips between rollers as claimed in any preceding claim.

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

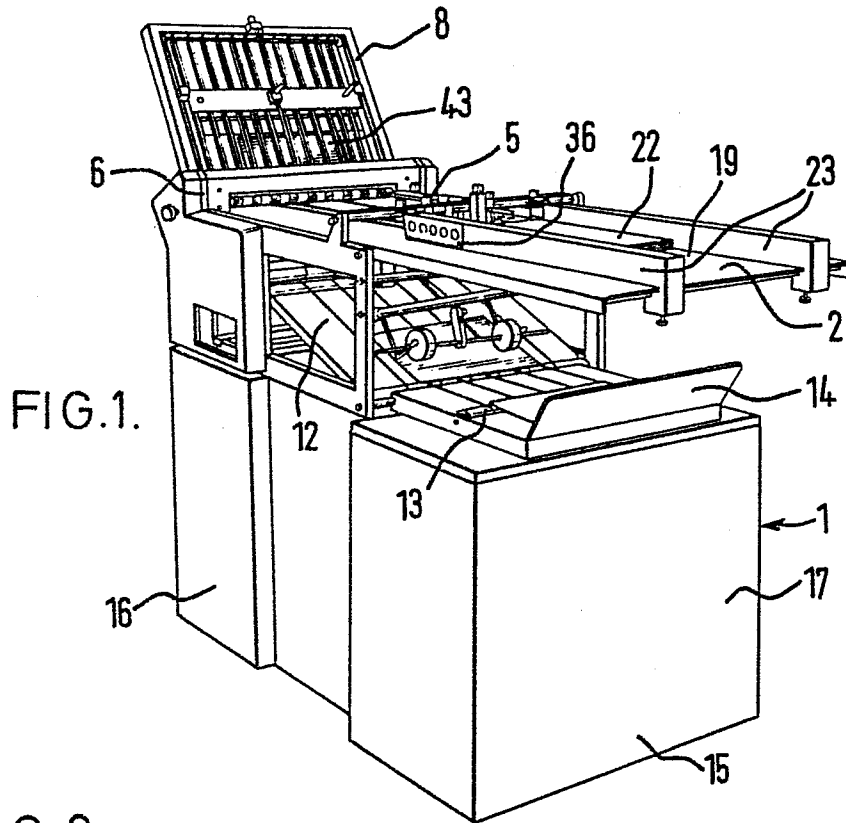


FIG. 2.

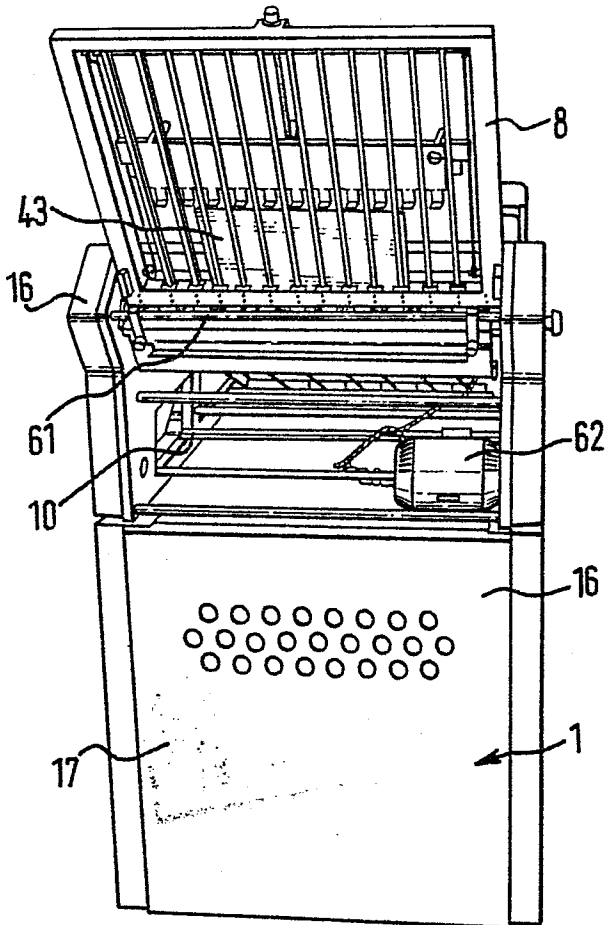
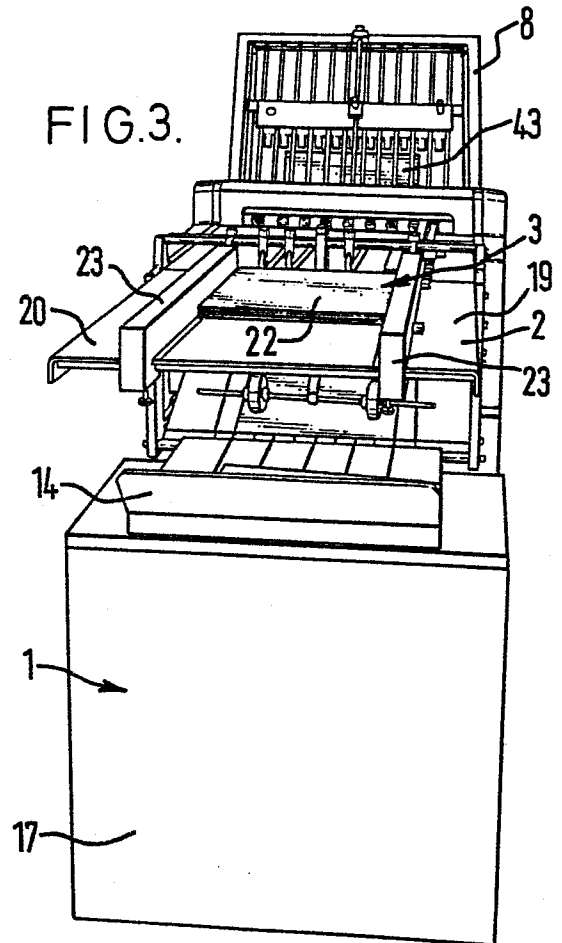


FIG. 3.



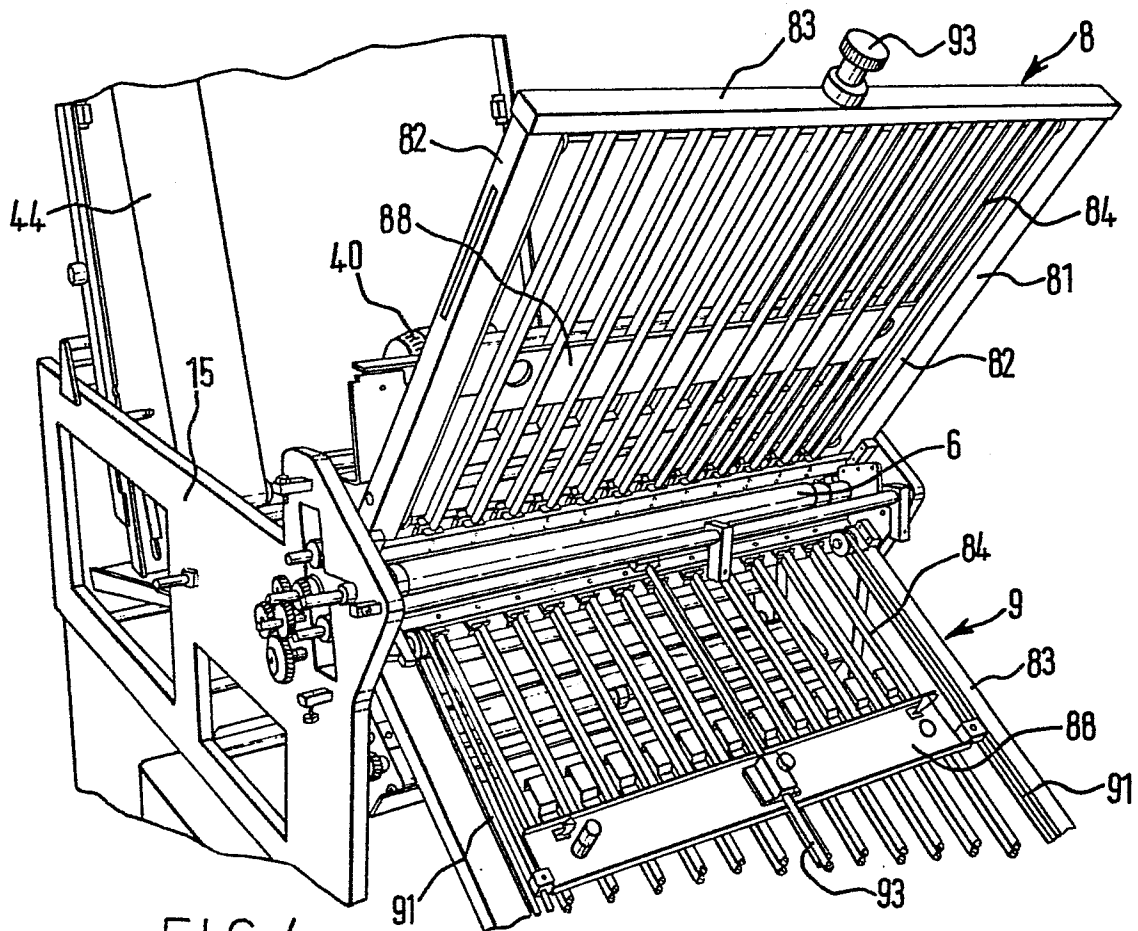


FIG. 4.

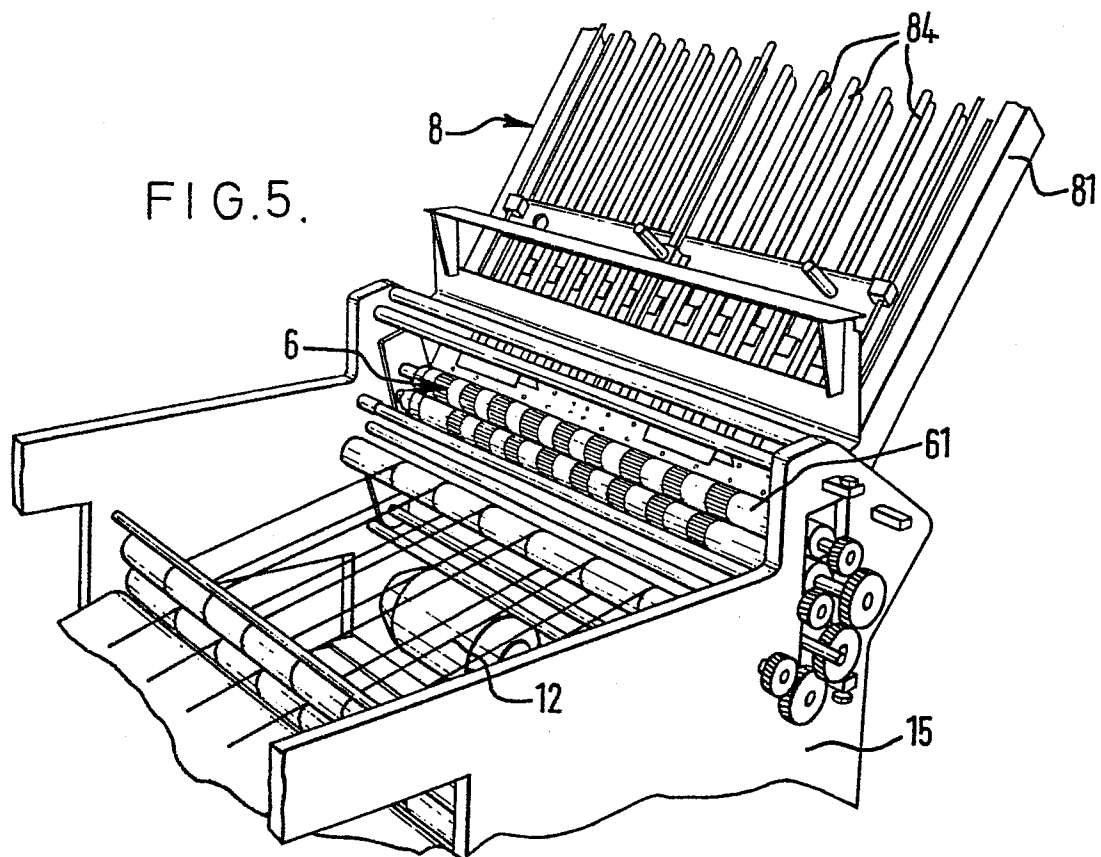


FIG. 5.

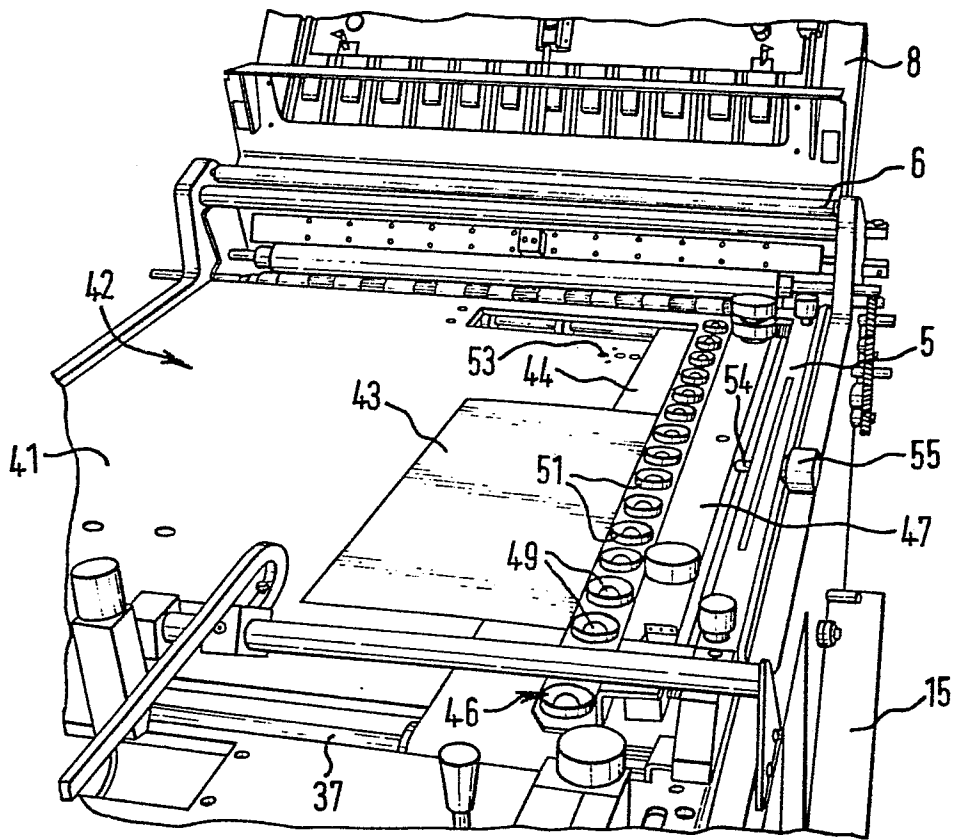


FIG. 6.

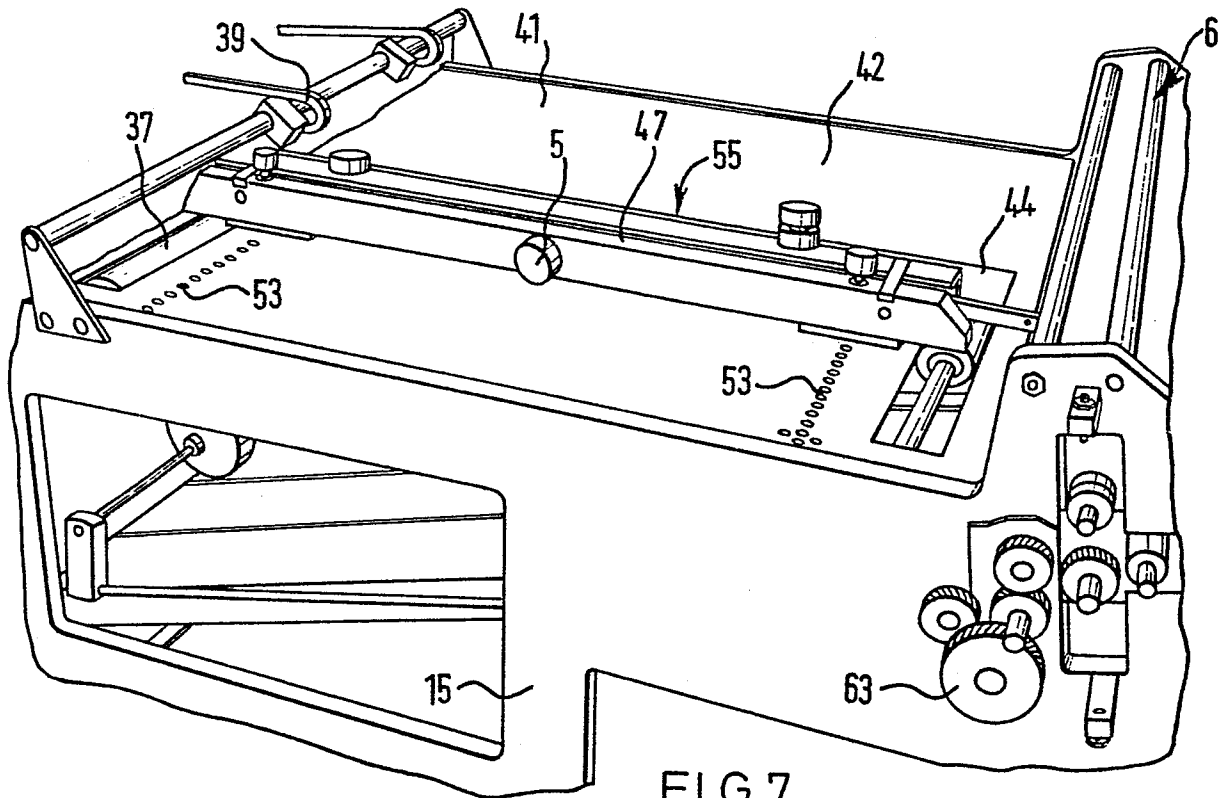


FIG. 7.

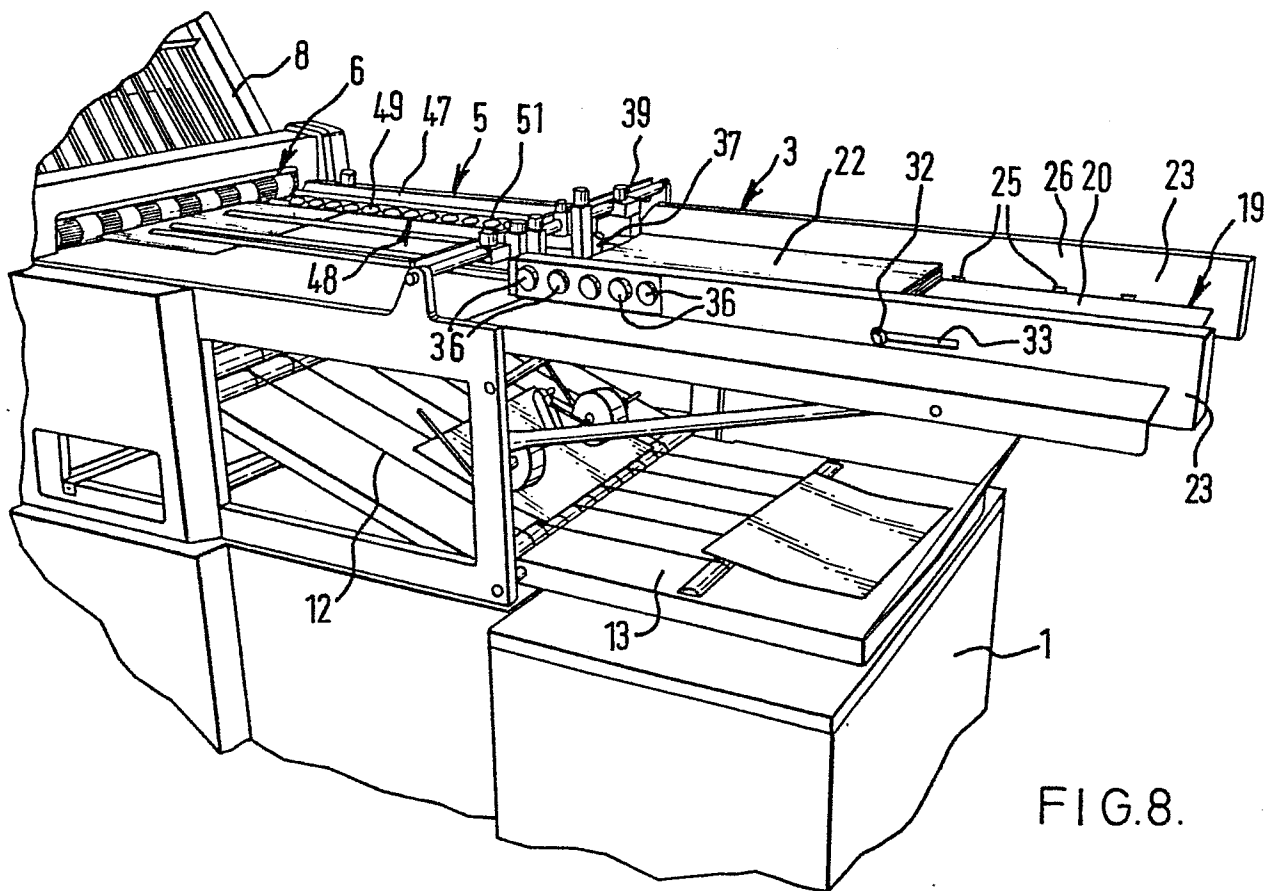


FIG. 8.

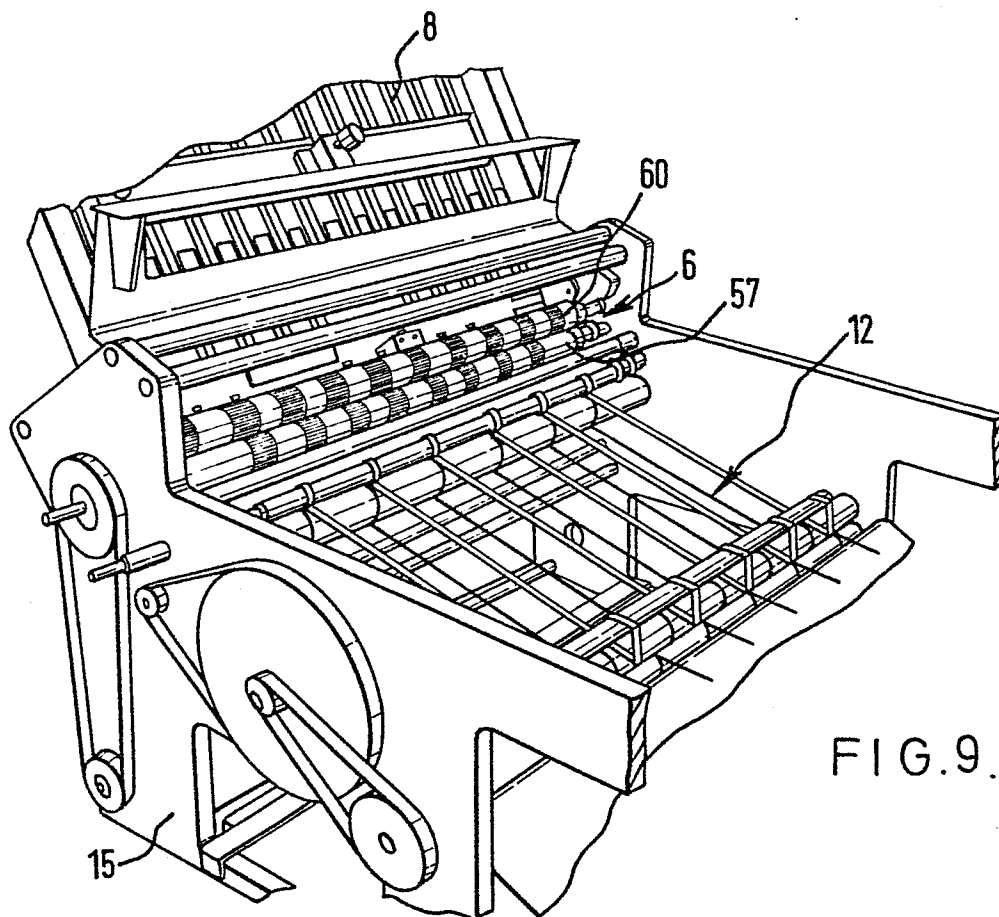


FIG. 9.

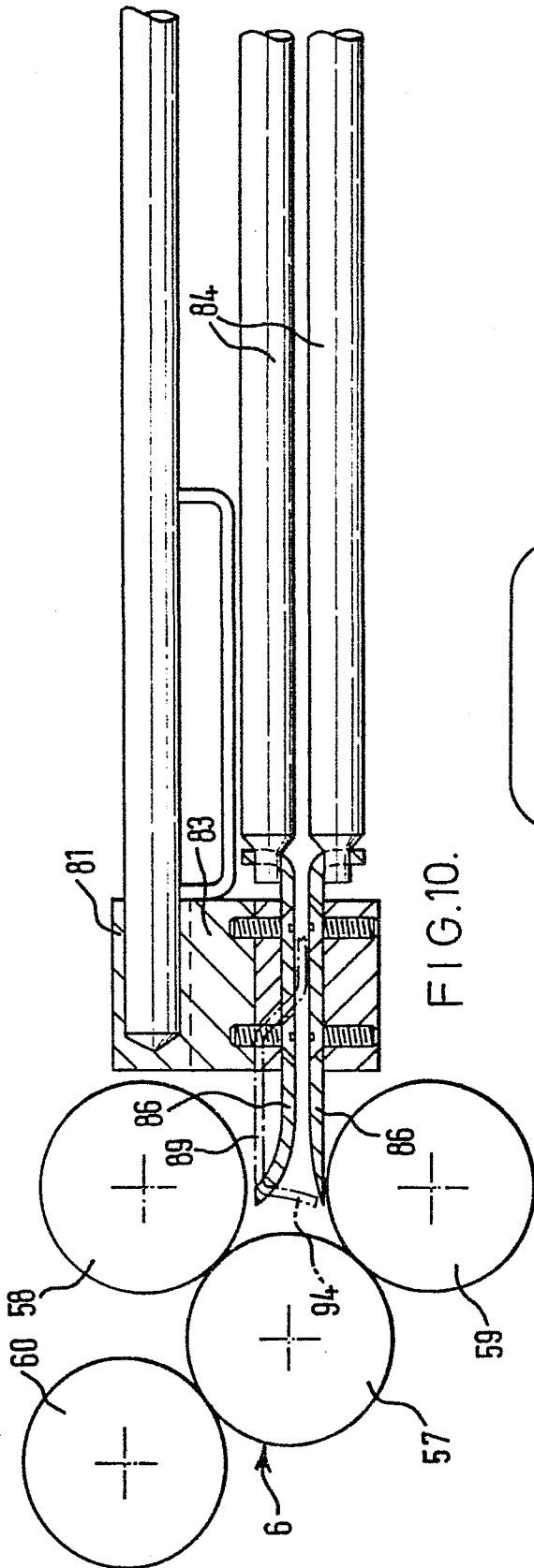


FIG. 10.

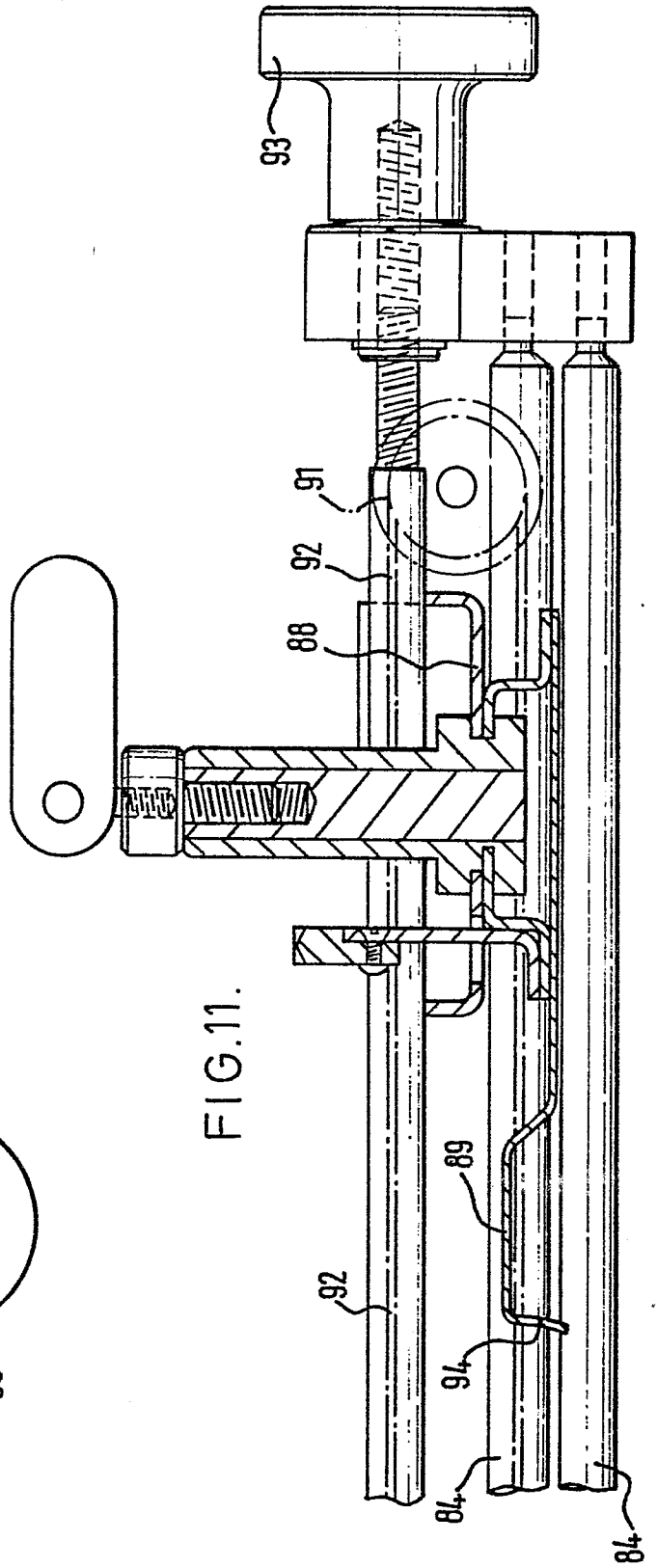


FIG. 11.

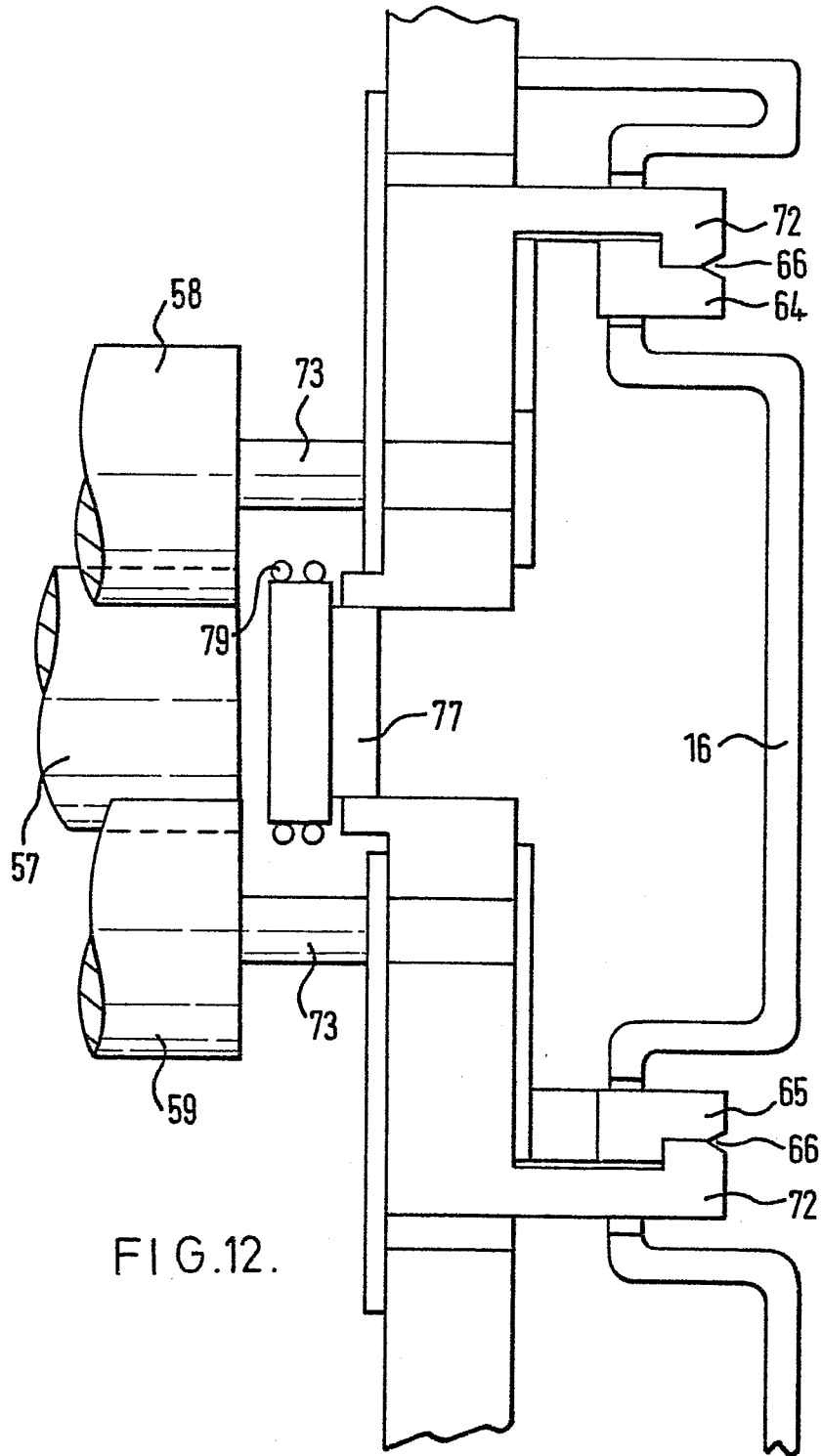


FIG.12.

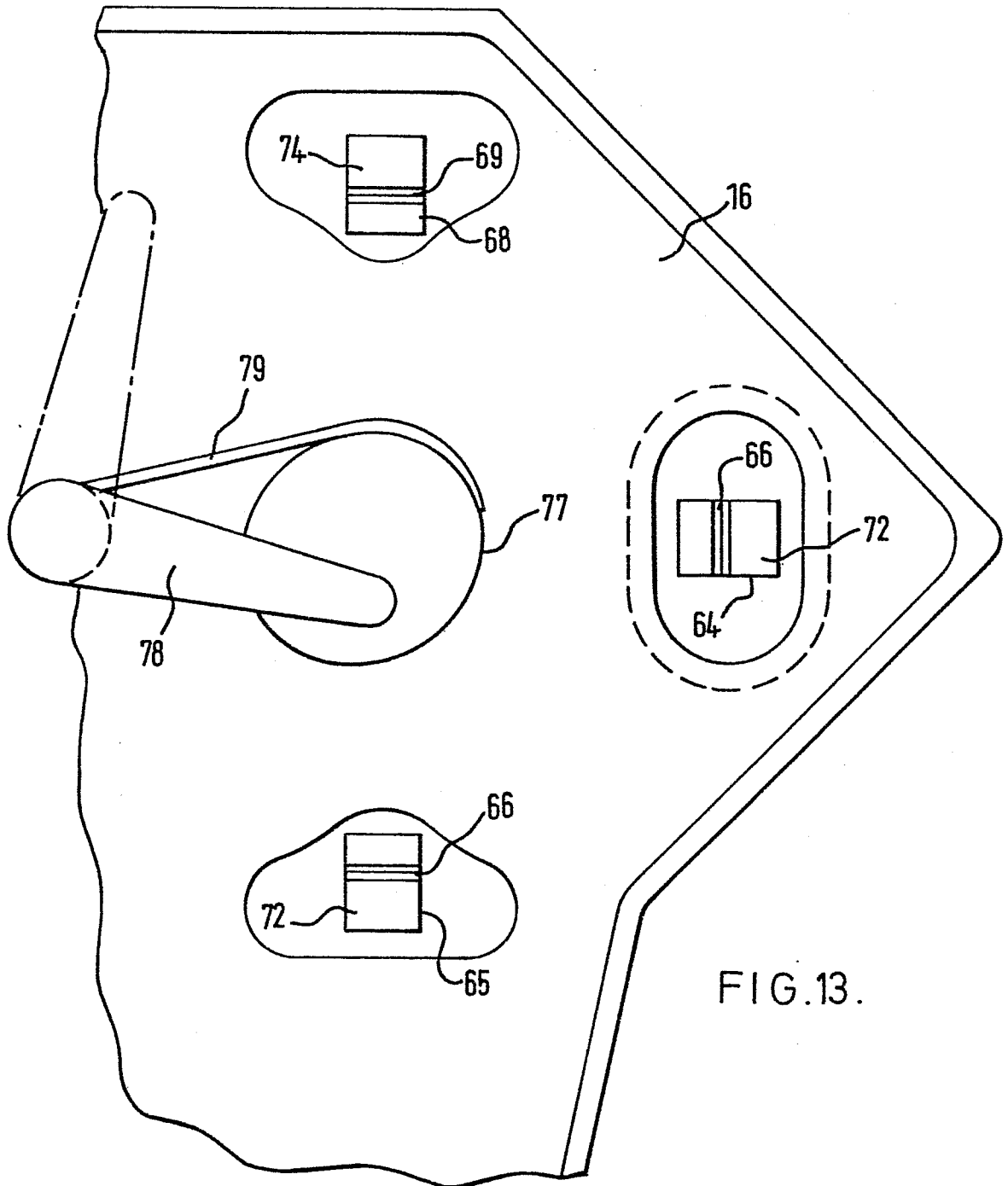


FIG.13.

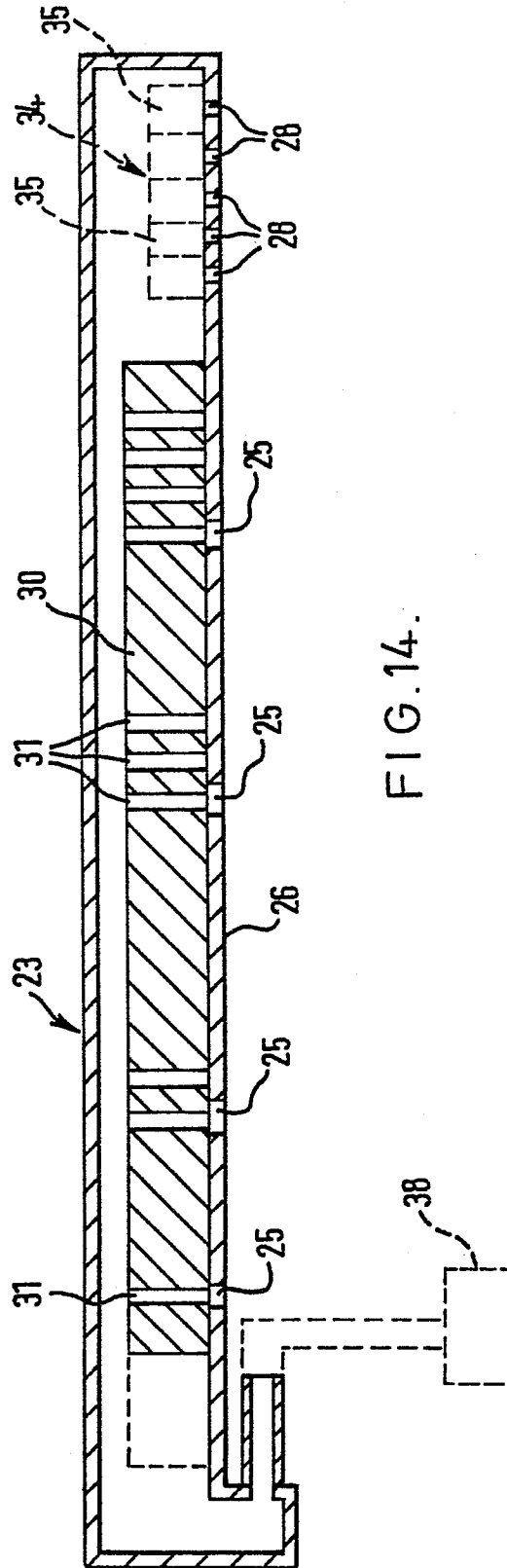


FIG.14.

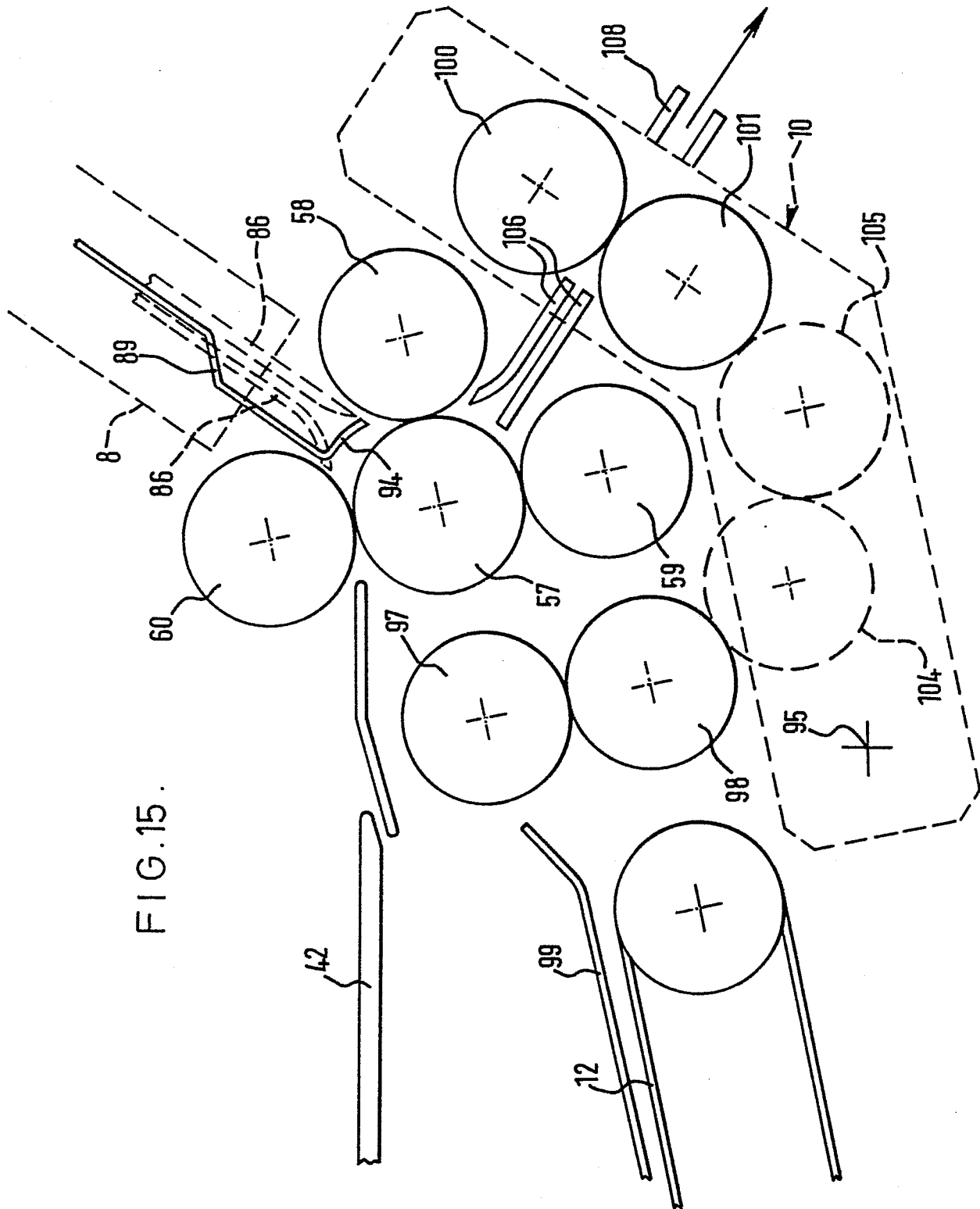


FIG.15.

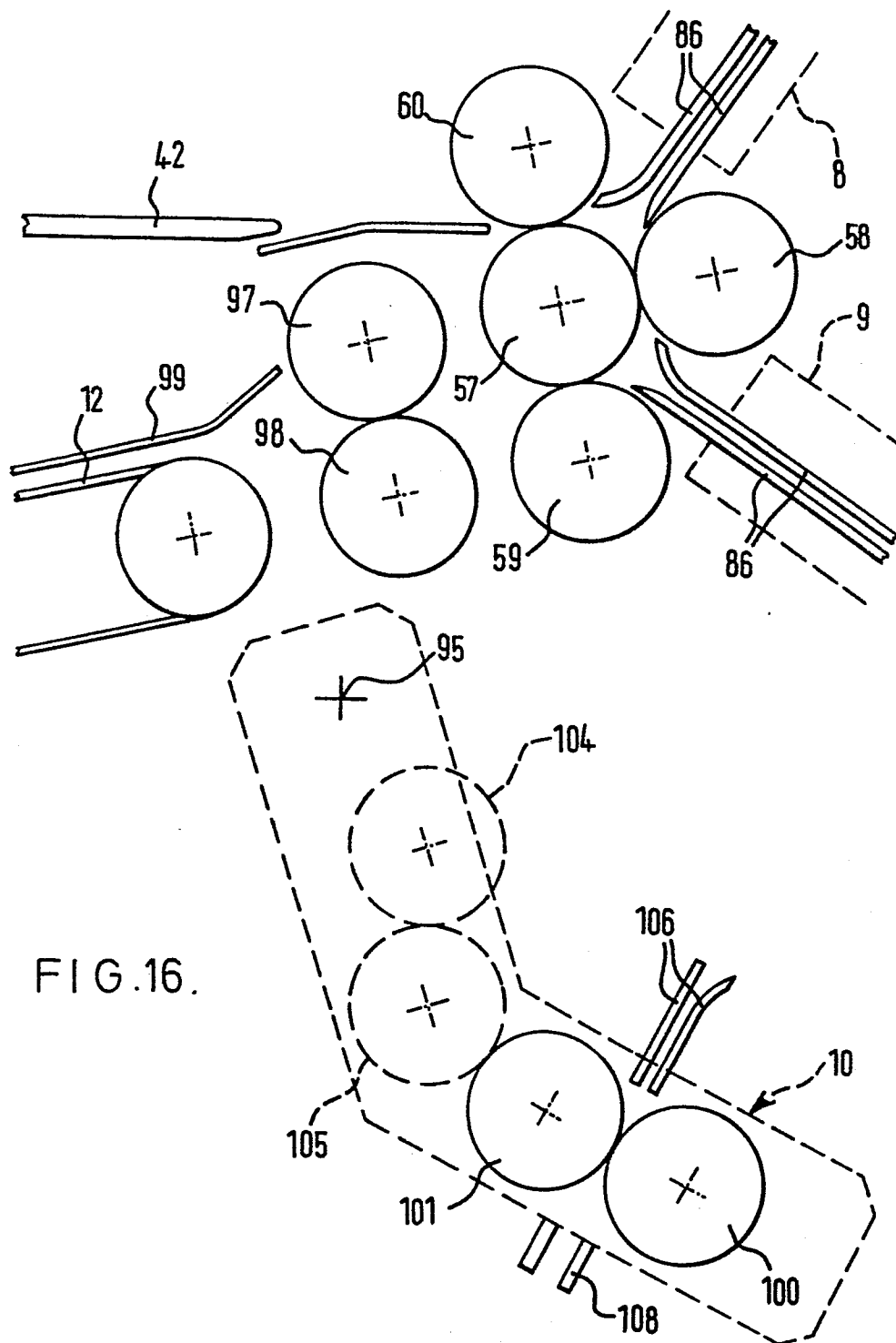


FIG. 16.



DOCUMENTS CONSIDERED TO BE RELEVANT			EP 84300772.5
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 7)
X	DE - B - 1 561 153 (HERZOG & HEYMANN) * Column 4, lines 4-11 *	1, 8, 9, 10	B 65 H 45/16
A	GB - A - 2 069 981 (HADEWE B.V.)		
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 10-05-1984	Examiner PANGRATZ
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>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</p> <p>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  &amp; : member of the same patent family, corresponding document</p>			