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(54) Folding device for folded paper formats

(57) The invention discloses a folding device for folded paper formats, formed by a sheet of paper, the folded end portions (7A) of which are folded down over the center portion (7B) of the sheet of paper, occupying the surface thereof and determining a contiguity gap (7b) between these folded end portions (7A). The device comprises: a first positionable abutment (8), a first roller (1A) and a second roller (1B), these being rotatable, having mutually parallel shafts located on one same horizontal plane and being spaced apart by a variable width gap (2). It comprises: a vertically moveable rigid folding knife (3) capable of passing through the gap (2), two deflectors (4) abutting said rigid folding knife (3), and capable of limited entrainment thereby and having a curved working face (4A) for engaging the folded end portions (7A) and in this way keeping them applied against the rollers (1A, 1B). The knife (3) is capable of engaging said contiguity space (7b), inserting the folded paper format (7) in the gap (2) disposed between the pair of rollers (1A, 1B).

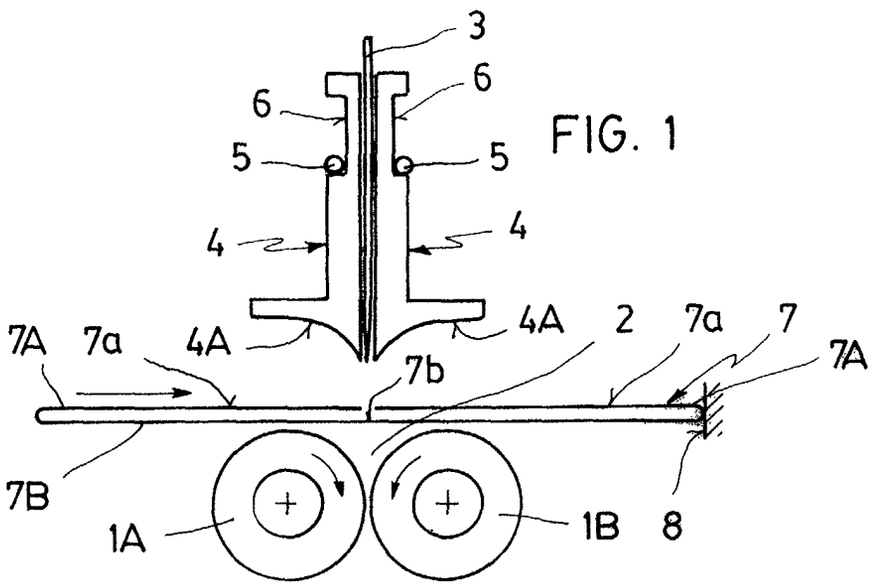

FIG. 1

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Description

[0001] The invention relates to a folding device for folded paper formats, each of said folded paper formats being formed by a sheet of paper defining a front side, and the folded end portions of which are folded down over the center portion of the sheet of paper, occupying the surface thereof and determining a contiguity gap between opposite edges of said folded end portions, said device being of the type that comprises: a first positioning abutment, a first roller and a second roller, which: [i] have mutually parallel shafts located on one same horizontal plane; [ii] are spaced apart, determining a variable width gap; [iii] are rotatable in opposite directions; [iv] the respective upper generating lines of which, in any position of rotation of said rollers, define one same support plane for said folded paper format.

[0002] Mechanical folding devices comprising a pair of downwardly rotatable parallel rollers which, being located on one same horizontal plane, define therebetween a variable width gap and constitute a support plane for the paper format in the initial folding thereof, which in engagement with a positioning abutment, remains with the center portion thereof centrally positioned relative to the gap defined between the two rollers, which use a special bag provided with a sheet acting as a folding knife, are known. Folding with a special bag for one or two folds works well, but when the bag for the gate-folded format is added, it causes many problems, slowing down the operating speed and substantially deteriorating the quality of the fold.

[0003] Normal folding with rollers is perfect for all formats except the gate-folded format, since the tips of the end portions folded over the center portion separate from this center portion, forming undesirable creases.

[0004] With a view to overcoming the present drawback and being able to use a mechanical roller folding device providing excellent results, the solution has been adopted of accompanying said tips of the end portions so that they do not separate from their abutment against the center portion.

[0005] The folding device for folded paper format according to the invention is characterized in that it comprises: a rigid folding knife for performing vertical reciprocating movements and for passing through said gap, said movements determining a first stroke; two deflectors abutting oppositely and symmetrically said rigid folding knife, capable of being entrained by said rigid folding knife, determining a second stroke shorter than said first stroke, each of said deflectors having a curved working face for engaging the front side of said folded end portions and in this way keeping said folded end portions applied against said pair of rollers; and in that said rigid folding knife is capable of engaging said contiguity space between said opposite edges of said folded end portions and inserting said folded paper format in said gap disposed between said pair of rollers.

[0006] One feature of the invention is that said rigid folding knife is slidingly mounted in vertical guides and that said vertical reciprocating movements are caused by first ends of two lever arms, which pivot about the second ends thereof; said lever arms being mounted at the second ends thereof on a common pivot shaft and being driven by at least one cam, which is associated with said lever arms via a first rod.

[0007] A further feature of the invention is that said deflectors are capable of sliding along vertical guides parallel to said vertical guides of said rigid folding knife.

[0008] Also according to the invention, said second rotary roller is mounted on pivoting supports which are associated with said common pivot shaft of said lever arms via a second rod pivotally attached to a connecting rod attached to said common pivot shaft, allowing the spacing between said second rotary roller and said first rotary roller to be varied, with the subsequent variation of the width of the gap.

[0009] The invention also contemplates that said sliding movements of said deflectors are limited by second limiting abutments.

[0010] Finally, it is contemplated in the invention that said second rod be of adjustable length its adjustment allowing the width of said gap to be regulated.

[0011] To facilitate the understanding of the foregoing ideas, there is described hereinafter the object of the invention, with reference to the accompanying illustrative drawings, in which:

Figure 1 is a schematic cross section view of the pair of rotary rollers, the first folded paper format, the rigid folding knife and the two symmetrical deflectors, all corresponding to the mechanical folding device of the invention, in a step of supplying the first folded paper format.

Figure 2 is a similar view to Figure 1, in which the deflectors have moved together with the rigid folding knife and are in engagement with the first folded paper format, forcing it under a light pressure against the pair of rotary rollers.

Figure 3 is a similar view to the previous Figure, wherein the deflectors are in the same position, while the rigid folding knife has moved clearly engaging the center portion of the first folded paper format, placing it in the gap between the pair of rollers.

Figure 4 is a similar view to the previous Figure, in which the rigid folding knife has moved upwards, entraining therewith the deflectors.

Figure 5 is a schematic elevation view of the folding device, showing the drive mechanisms of the rigid folding knife.

Figure 6 is a schematic elevation view of the folding device, showing the variator mechanism for the width of the gap between the pair of rotary rollers.

Figure 7 is a schematic fragmentary plan view of the folding device. In Figure 1 there are to be seen the first roller 1A and the second roller 1B, which is

movable relative to the first roller, and between both there is a gap 2 of variable width; both rollers can rotate in opposite directions and the respective axes thereof are parallel and located in one same horizontal plane. The generating lines of both rollers which in any position of rotation thereof are located at the top, always define one same horizontal support plane, to be referred to later. Figure 1 also shows a rigid folding knife 3, two symmetrical deflectors 4, two abutments 5 for limiting the stroke of the two symmetrical deflectors 4 in cooperation with notches 6 in the deflectors 4, a first format 7 of folded paper and a positioning abutment 8 for said first format 7.

[0012] This folded paper format 7 is constituted by a sheet of paper, the folded end portions 7A of which are folded down over the center portion 7B of the folded paper format 7, in such a way that on occupying the surface thereof they form a contiguity space 7b.

[0013] The rigid folding knife 3 is capable of reciprocating on a vertical plane which is perpendicular to the afore-mentioned plane of support and which is comprised in the variable width gap 2. The amount of the said movement, which hereinafter is also called the first stroke, is evidenced by comparing the positions of the rigid folding knife 3 in Figures 1 through 3, in which it is shown in the limit positions of the reciprocating movement.

[0014] This rigid folding knife 3 frictionally entrains the two symmetrical deflectors 4 and the amount of entrainment, hereinafter also called the second stroke, is shorter than said first stroke, as may be appreciated by comparing Figures 1 through 4. Each of the symmetrical deflectors 4 is provided with a curved working face 4A, having a larger radius than the rotary rollers 1A and 1B. This difference is related to the thickness of the first folded paper format 7, which they engage by the front surface 7a of the folded end portions 7A of the first format 7 in the initial folding thereof. Thereby, the parts 7A are held applied, with gentle sliding on the front face 7a thereof, against the surface of the rotary rollers 1A and 1B, as shown in Figures 2 and 3.

[0015] These symmetrical deflectors 4 are entrained by the rigid folding knife 3 to move from the position of Figure 1 to the position of Figure 2, at which time the deflectors are immobilized at the end of the stroke thereof determined by the notches 6 and the limiting abutments 5, at the same time as the rigid folding knife 3, continuing its forward movement in reciprocation, engages said contiguity space 7b of the center portion 7B of the first folded paper format 7 in the initial folding thereof and inserts it in the gap 2 defined between the first roller 1A and the second roller 1B, as shown in Figure 3, after which these rotary rollers 1A and 1B entrain the first folded paper format 7, as shown in Figure 4, folding it into a new quadruple format 9 or gate-folded format. The rigid folding knife 3 reverses and entrains the symmetrical deflectors 4 until reaching the initial position prior to a new folding operation, shown in Figure 1.

[0016] The rigid folding knife 3 is mounted at the ends thereof in vertical guides 10 (Figures 5 to 7) and is driven in its vertical reciprocating movement by two pivoting lever arms 11, which pass through the rigid folding knife 3 with one end 11a thereof through an aperture 12 and are provided with an elongate hole 13 in which there slides a block 14 pierced by a bolt 15, as shown in Figure 5.

[0017] The lever arms 11, of which only one is shown, pivot at the other end 11B thereof on planes perpendicular to the rigid folding knife 3 and close to the vertical guides 10, both lever arms being mounted at the pivoting end 11B thereof, on a common pivot shaft 16 and driven, at least, by one cam 17 that, via a first rod 18, acts on an intermediate point of the lever arms 11.

[0018] The second roller 1B is mounted on pivoting supports 19 (Figure 6) which are associated with the common pivot shaft 16b of the lever arms 11, by a second rod 20 pivotally attached to a connecting rod 21 attached to the pivot shaft 16. These supports 19 allow the separation between the two rotary rollers 1A and 1B and thereby to modify the width of the gap 2 therebetween depending on the work stage. The distance between the pivoting supports 19 and the connecting rod 21 is adjusted threading of the second rod 20 at the ends thereof and the width of the gap 2 is also adjusted by the third abutment 22 so as to prevent the rollers 1A and 1B from unfolding the first folded paper format 7.

[0019] The folding device additionally comprises a supply belt 23 (Figure 5), a deflector 24 for collecting the gate-folded formats 9 and placement thereof on a conveyor belt 25.

[0020] To be highlighted in the invention there is the location of the deflectors 4, and opening and closing of the gap 2 between the rollers 1A and 1B and also the direction of the rigid folding knife 3 and the provision of a photocell and clutch timing mechanism not shown in the drawing. A higher speed is obtained with the described folding device than with the conventional folding machines and a greater perfection and regularity of the format, without having to anticipate the folding of the tips, as is done at present.

[0021] The gate-folded format 9 folding device is adaptable to any of the currently operating folding machines, independently of the width and height thereof.

Claims

1. A folding device for folded paper formats, each of said folded paper formats (7) being formed by a sheet of paper defining a front side (7a), and the folded end portions (7A) of which are folded down over the center portion (7B) of the sheet of paper, occupying the surface thereof and determining a contiguity gap (7b) between opposite edges of said

folded end portions (7A), said device being of the type that comprises: a first positioning abutment (8), a first roller (1A) and a second roller (1B), which: [i] have mutually parallel shafts located on one same horizontal plane; [ii] are spaced apart, determining a variable width gap (2); [iii] are rotatable in opposite directions; [iv] the respective upper generating lines of which, in any position of rotation of said rollers (1A, 1B), define one same support plane for said folded paper format (7), the folding device comprising: a rigid folding knife (3) for performing vertical reciprocating movements and for passing through said gap (2), said movements determining a first stroke; two deflectors (4) abutting oppositely and symmetrically said rigid folding knife (3), capable of being entrained by said rigid folding knife (3), determining a second stroke shorter than said first stroke, each of said deflectors (4) having a curved working face (4A) for engaging the front side (7a) of said folded end portions (7A) and in this way keeping said folded end portions (7A) applied against said pair of rollers (1A, 1B); and wherein said rigid folding knife (3) is capable of engaging said contiguity space (7b) between said opposite edges of said folded end portions (7A) and inserting said folded paper format (7) in said gap (2) disposed between said pair of rollers (1A, 1B).

2. The folding device of claim 1, wherein said rigid folding knife (3) is slidingly mounted in vertical guides (10) and that said vertical reciprocating movements are caused by first ends (11A) of two lever arms (11), which pivot about the second ends (11B) thereof; said lever arms (11) being mounted at the second ends (11B) thereof on a common pivot shaft (16) and being driven by at least one cam (17), which is associated with said lever arms (11) via a first rod (18).

3. The folding device of at least one of claims 1 or 2, wherein said deflectors (4) are capable of sliding along vertical guides parallel to said vertical guides (10) of said rigid folding knife (3).

4. The folding device of at least one of claims 1 to 3, wherein said second rotary roller (1B) is mounted on pivoting supports (19) which are associated with said common pivot shaft (16) of said lever arms (11) via a second rod (20) pivotally attached to a connecting rod (21) attached to said common pivot shaft (16), allowing the spacing between said second rotary roller (1B) and said first rotary roller (1A) to be varied, with the subsequent variation of the width of the gap (2).

5. The folding device of claim 3, wherein said sliding movements of said deflectors (4) are limited by second limiting abutments (5).

6. The folding device of at least one of claims 1 to 5, wherein said second rod (20) be of adjustable length and its adjustment allows the width of said gap (2) to be regulated.

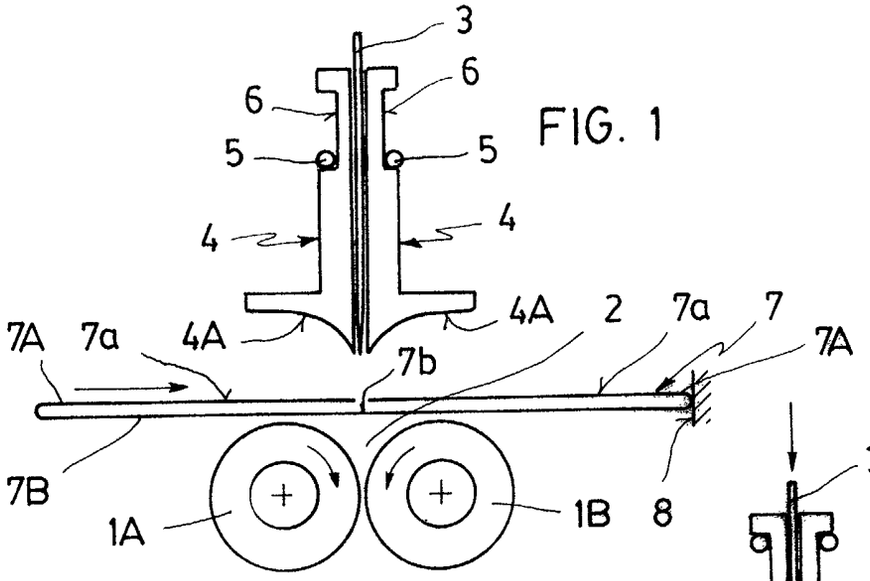


FIG. 1

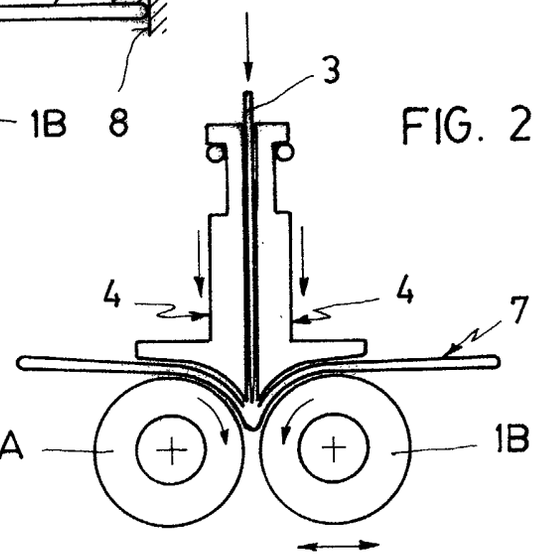


FIG. 2

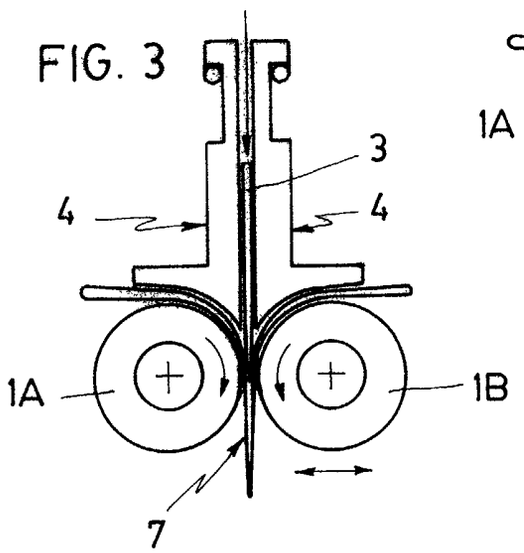


FIG. 3

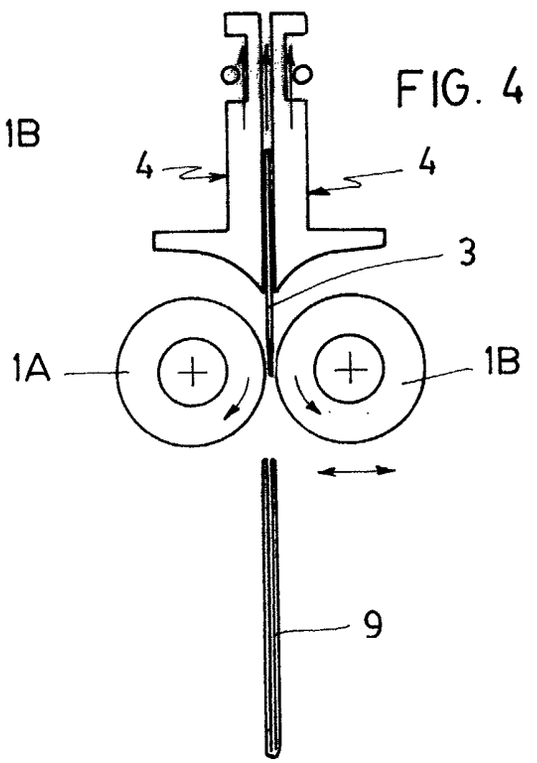
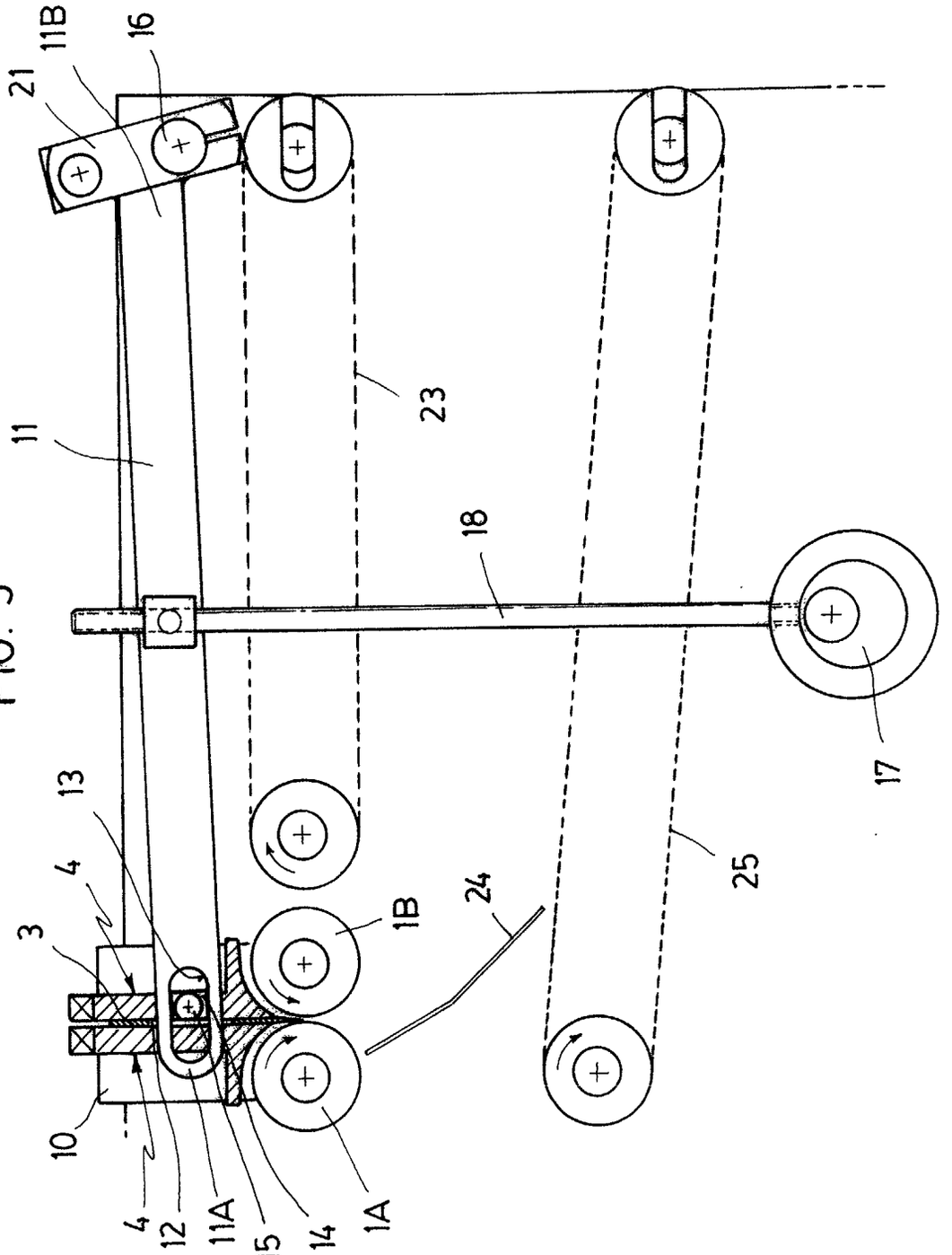


FIG. 4

FIG. 5



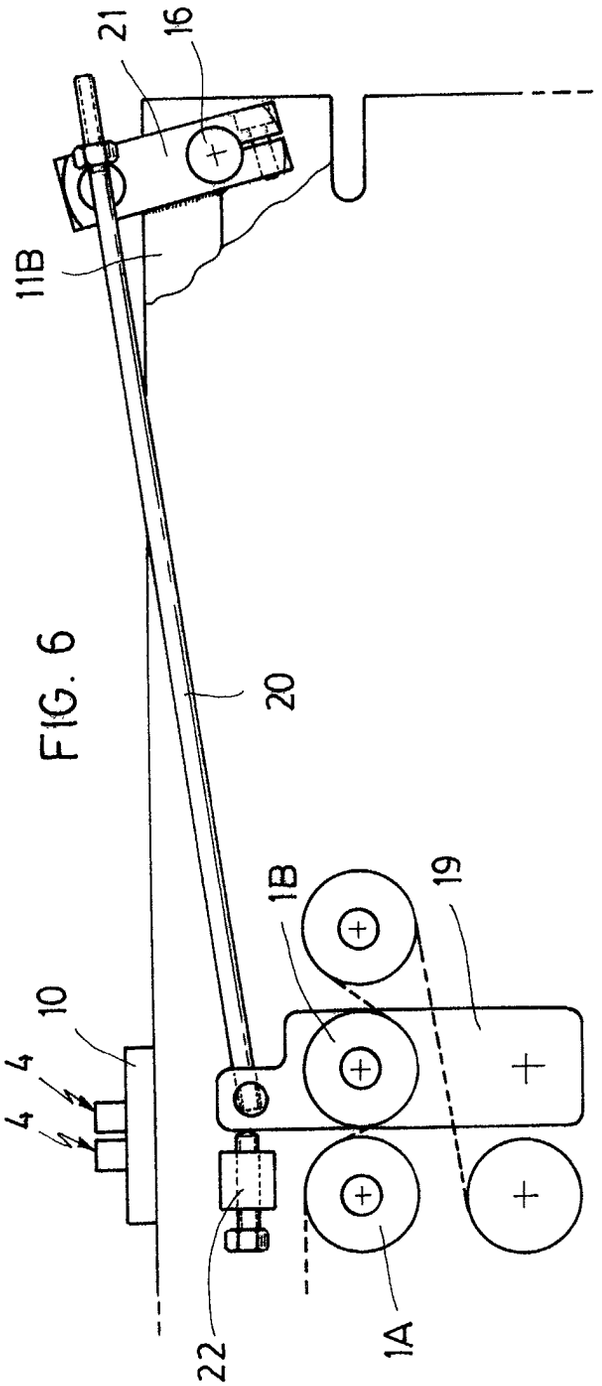


FIG. 6

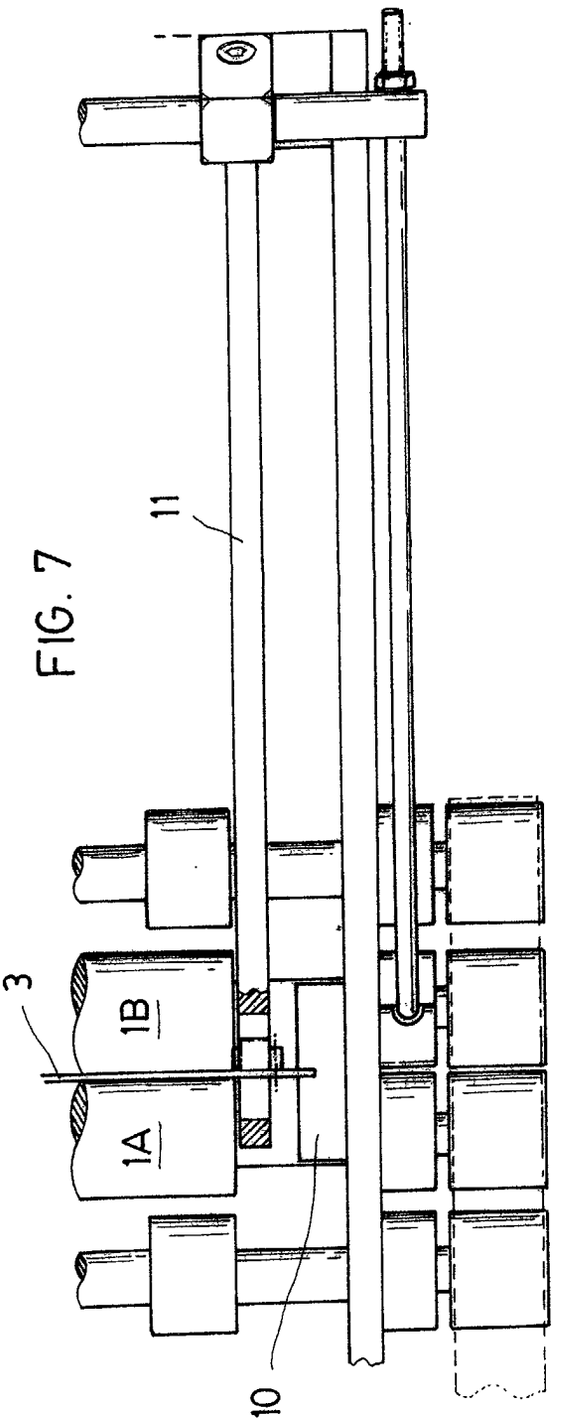


FIG. 7