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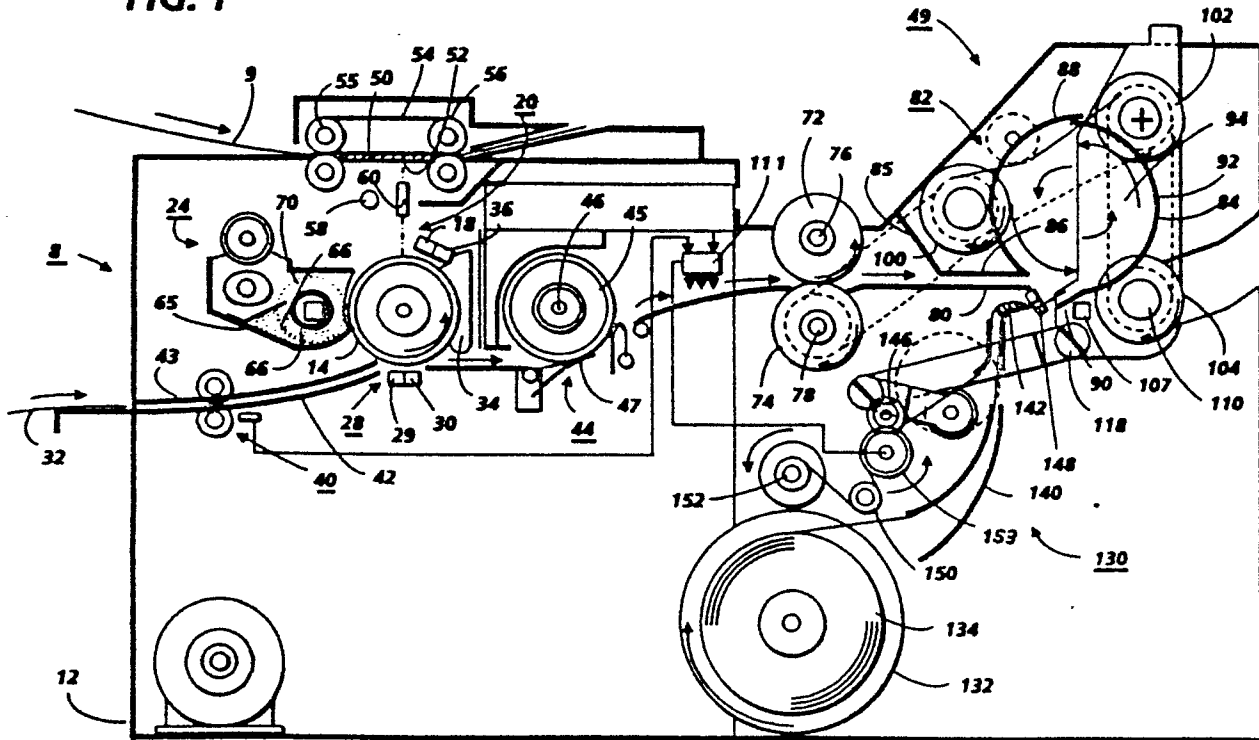
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⑤④ **Apparatus for automatically rolling up and taping output sheets from a document reproduction system.**

⑤⑦ A copying/printing machine is adapted for rolling up copies of large size documents such as engineering drawings and the like and for automatically applying tape to the rolled-up copy sheets so as to maintain a tubular form. An output copy from the machine is fed by feed rollers (72, 74) to a cylindrical space (94) formed by a combination of curved baffles (92, 88). The copy sheet is fed around the inside of the baffles by rollers (104, 102, 100) which propel the sheet into a spiral path and form it into a roll. The apparatus includes a tape dispenser (130) which is activated in timed relation with the completion of the sheet rolling process to apply a tape segment so as to overlap the trailing edge of the rolled-up sheet and an underlying portion of the roll.

EP 0 300 742 A2

FIG. 1



APPARATUS FOR AUTOMATICALLY ROLLING UP AND TAPING OUTPUT SHEETS FROM A DOCUMENT REPRODUCTION SYSTEM

The present invention relates to an apparatus for automatically rolling up sheets, for example copy sheets from the output station of a document reproduction system.

There are a number of prior art applications wherein the configuration of a flat article, following a manufacturing or production step, is required to be transformed into a tubular form for convenient removal from a work station. For example, US-A-2,849,191 discloses an apparatus for winding paper material into rolls. The apparatus includes two input rollers and two roll-up stations where the sheets are rolled within a central aperture formed between rolled sets. Upon completing the roll-up operation, the paper rolls automatically fall into a container. US-A-3,052,073 shows a cluster of rollers which form a space therebetween in which sheets are wound. As the rolled sheet diameter expands, bottom rollers are moved away to allow rolled-up sheets to be removed.

These prior art systems do not disclose any mechanism for maintaining the rolled-up output sheets in tubular form. There are various prior art devices for attaching tapes to rolled-up articles as exemplified by the following references:

US-A-4,381,211 to Nechay discloses a label carrying web transport wherein labels 110 are optically registered by a scanner assembly 50 which emits a signal, thereby setting into motion an apparatus which regulates intermittent web motion and controls the advance of the labels.

US-A-4,248,655 to Kerwin discloses a control system for a moving web wherein a series of indicia on the web are sensed and a first signal indicative of an indicium is generated. A series of moving articles is sensed and a second signal indicative of a moving article is generated. The disparity between the sensed indicium and moving article is then calculated, and a speed adjustment of the web and moving articles is made to obtain a corrected relative position of indicium and moving article.

EP-A-106,167 discloses an apparatus for securing the tail portion of a rolled product with labels 30a and 30b and comprising sensors 70 and 72, and feed rollers 12 and 14.

US-A-4,397,710 to Gaylord discloses a machine for applying labels to a cylindrical article. The machine comprises a sensor assembly 34 which responds to dark sensor mark 22 associated with each label to activate both web advancement and placement of the labels onto the cylindrical articles.

None of the references discloses a system whereby copy output is automatically rolled into a

tubular configuration and automatically taped so as to be secured into the rolled-up configuration.

The present invention is therefore directed to an apparatus for automatically rolling up and taping output sheets including, in combination:

means for accepting sheets and feeding them into a roll-up assembly, the roll-up assembly incorporating a plurality of roller members which cooperate to wind the sheets into a spiral form; and

means for securing the sheets in a final rolled-up configuration, said means including a tape dispensing mechanism periodically actuated to dispense a tape segment across the trailing edge of the rolled-up sheet.

An apparatus in accordance with the invention, for rolling up copy sheets from a document reproduction machine, will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a side view of a document reproduction machine including a roll-up assembly and a taping assembly.

Figure 2 is an enlarged view of the apparatus of the taping assembly.

Figure 3 shows the output sheet in the initial phase of the roll-up process.

Figure 4 shows the tape section being fed into initial contact with the trailing edge of the rolled-up document.

Figure 5 shows the tape securing the rolled-up sheet seam and extending around the entire circumference of the rolled up sheet.

Figure 6 shows the rolled-up, sealed document being ejected from the rolled-up assembly.

Referring to Figure 1 of the drawings, there is shown a xerographic type reproduction machine 8 incorporating the present invention. Machine 8 has a suitable frame 12 on which the machine xerographic components are operatively supported. Briefly, and as will be familiar to those skilled in the art, the machine xerographic components include a recording member, shown here in the form of a rotatable drum 14 having a photoconductive surface. Other photoreceptor types such as a belt or web may instead be contemplated. Operatively disposed about the periphery of photoreceptor 14 is charge corotron 18 for placing a uniform charge on the photoconductive surface of photoreceptor 14, an exposure station 20 where the previously charged photoconductive surface is exposed to image rays of the document 9 being copied or reproduced, development station 24 where the latent electrostatic image created on the photoconductive surface is developed by toner, transfer station 28

with transfer corotrons 29, 30 for transferring the developed image to a suitable copy substrate material such as a copy sheet 32 brought forward in timed relation with the developed image on photoconductive surface and cleaning station 34 for removing leftover developer from the photoconductive surface.

Copy sheets 32 are brought forward to transfer station 28 by feed roll pair 40 and sheet guides 42, 43. Following transfer, the sheet 32 is carried forward to a fusing station 44 where the toner image is fixed by fusing roll 45 in cooperation with a biased flexible web 47. Fusing roll 45 is heated by a suitable heater such as lamp 46 disposed within the interior of roll 45. After fixing, the copy sheet 32 enters the document roll-up apparatus 49 whose operation is described in detail below.

Continuing with the description of machine 8, transparent platen 50 supports the document 9 as the document is moved past a scan point 52 by a constant velocity type transport 54. As will be understood, scan point 52 is, in effect, a scan line extending across the width of platen 50 at a desired point where the document is scanned line-by-line. Transport 54 has input and output document feed roll pairs 55, 56 respectively on each side of scan point 52 for moving document 9 across platen 50 at a predetermined speed. Exposure lamp 58 is provided to illuminate a strip-like area of platen 50 at scan point 52. The image rays from the document line scanned are transmitted by a gradient index fiber lens array 60 to exposure station 20 to expose the photoconductive surface of the moving photoreceptor 14.

Developing station 24 includes a developer housing 65, the lower part of which forms a sump 66 for holding a quantity of developer. As will be understood by those skilled in the art, developer comprises a mixture of larger carrier particles and smaller toner or ink particles. A rotatable magnetic brush developer roll 70 is disposed in predetermined operative relation to the photoconductive surface. In developer housing 65, roll 70 serving to bring developer from sump 66 into developing relation with photoreceptor 14 to develop the latent electrostatic images formed on the photoconductive surface thereof.

In the preferred embodiments, documents 9 represent large (up to about 92 cm) engineering drawings. The width of the photoreceptor, and the dimension of the developing transfer cleaning and fusing stations are of like dimension.

Turning now to the roll-up apparatus 49, shown in side view in the right hand portion of Figure 1, there is shown two sets of feed rollers 72, 74 which engage the leading edge of sheet 32 as it emerges from the fusing station 44. Feed roller sets 72 and 74 comprise a plurality of rollers, a preferred num-

ber being two, which are driven in the indicated direction. The rollers are mounted on shafts 76, 78 which are driven by drive motors (not shown). The sheet is guided by baffle members 80, 82, 84 and 86 all of which present relatively smooth surfaces to the sheets thereacross. Baffle member 82 has an upward inclination 85 at the left end with a straight section 86 from left of center position to the right end (viewed from Fig. 1 perspective) and a curved section 88, forming a portion of a circular roll-up area. Baffle member 80 comprises a flat section which forms a parallel guideway with section 86. Baffle member 84 has a straight left section 90 and a curved right section 92. Curved sections 88 and 92 enclose a central, roll-up area 94 therebetween. Baffle members 88 and 92 are further characterized as having a plurality of apertures formed at intervals along their length. These apertures are of sufficient width and length to accommodate a portion of roller sets 100, 102 and 104 seated therein. As shown, a small chord of each roller protrudes a short distance into the interior of central roll-up area 94. Roller sets 100, 102, 104 are mounted on shafts and driven in the indicated direction by motor means (not shown). Baffle member 92 and roller sets 102, 104 are further characterized as forming an assembly 156 which is pivotable downward in a clockwise direction, about point 105 to the position shown in Figure 6.

As copy sheet 32 emerges from the fusing station 44, its leading edge is engaged by rollers 72, 74 and the sheet is fed into the relatively wide space formed by the diverging left ends of baffle members 80, 82. As the sheet progresses from left to right, it is guided into the narrow guideway formed between the flat sections, 80, 86 of the baffles. As the leading edge of the sheet emerges from the guideway, it is guided in an upward counterclockwise arc by the curved right end 92 of baffle member 84 and by the action of roller set 104. The sheet is urged to continue its upward curved path by the action of roller set 102. The sheet, now being propelled by feed roll set 72, 74 and roller sets 102, 104 continues to slide along the surface of baffle members 92 and 88, until it encounters roller set 100. These rollers contribute to the continued motion of the sheet which has now assumed a spiraling motion. The leading edge of the sheet completes a complete spiral revolution as the leading edge contacts an intermediate portion of the still advancing copy sheet. At this point, the first "ring" of the rolled up document has been established. The roll-up, spiraling action will continue in the same manner with the roll being slightly compressed inward with the addition of each new "ring" following a complete revolution. In a preferred embodiment, the roller sets are of soft

foam construction to allow for expanded diameter of additional "rings".

Turning now to the tape-dispensing assembly 130, the assembly is seen to consist of tape-dispensing supply roll 132 containing a supply of wound-up adhesive tape 134. Tape 134 consists of a roll of continuous 25 mm wide release liner 136 upon which are adhered individual strips of tape 138. In a preferred embodiment, the tape segments are 210 mm in length and completely encircle the circumferential outer surface of the rolled up sheet. Other suitable lengths of tape segment may be used, for example shorter lengths such as about 76 mm which secure the trailing edge of the rolled up sheet to the roll, or longer lengths for rolled up sheets having a roll of greater diameter. The top surface of the tape presents an adhesive surface to the rolled-up copy sheet, as will be seen below. The tape incorporates peelable adhesive with a non-glued edge to facilitate subsequent removal from the copy. At initial installation, the tape is withdrawn from supply roll 132, advanced through guideway 140 and bent around the edge of strip plate 142. Strip plate 142, shown enlarged in Figure 2 incorporates an edge 144. Edge 144 functions to cause a clean stripping of liner from the top segments but is not sharp enough to cause tape or liner tearing. In a preferred embodiment, the edge has a radius of 0.76 mm. Liner 136 is then threaded between pinch roll 146, drive roll 153, tension roll 150 and liner take-up roll 152. The tape segments are discarded corresponding to the threaded liner.

In operation, the trailing edge of a copy sheet 32 is sensed by photosensor 111 (Fig. 1) and a timed signal is sent by appropriate control circuitry to a motor (not shown) which drives roll 153 in the indicated direction. Figure 3 shows the output sheet being rolled-up prior to tape dispensing. Rollers 146, 150 serve to pull the tape 134 taut around edge 144 of strip plate 142. This causes the leading edge of a relatively rigid tape segment 138 to continue forward guided by baffle 148 until it engages the surface of rolled-up sheet 32 (fig. 4) adjacent the trailing edge. Approximately 38 mm of the tape segment 138 will adhere to the rolled-up sheet surface before encountering the training edge seam (Fig. 5). As the roll-up action continues, the tape, advancing in the same rotational direction as the copy sheet, overlaps the trailing edge (Fig. 5). During continuing sheet rotation, the tape is continually pressed into secure contact with the rolled-up sheet through combined action of the roller sets and frictional movement along the baffle walls. The remaining portion of the tape continues to adhere to the surface of the rotating, scrolled sheet until it overlaps that portion of the tape initially adhering to the sheet side. This complete

wrap-around of the tape constitutes an effective sealing strip which is not affected by contaminants, such as fuser oil, which may have been deposited on the sheet surface. Baffle 148 incorporates a sensor 154 adjacent the tape edge. The sensor detects the trailing edge of the tape segment 138 and sends an appropriate, delayed signal to the driver motor of drive roll 153, stopping further tape movement. The rolled-up, sealed sheet can now be removed by pivoting baffle/roller assembly 156 counterclockwise to the position shown in Figure 6, allowing the rolled-up copy to drop downward into a receptacle or be removed manually.

Claims

1. An apparatus for automatically rolling up and taping output sheets including, in combination:

means (72,74) for accepting sheets (32) and feeding them into a roll-up assembly (49), the roll-up assembly incorporating a plurality of roller members (104, 102, 100) which cooperate to wind the sheets into a spiral form; and

means (130) for securing the sheets in a final rolled-up configuration, said means including a tape dispensing mechanism (132, 142, 152) periodically actuated to dispense a tape segment (138) across the trailing edge of the rolled-up sheet.

2. The apparatus of claim 1 wherein said tape dispensing mechanism includes:

a supply (132) of adhesive tape (134) consisting of a liner substrate (136) comprising individual tape segments (138) with an adhesive surface in pressure adhesive contact with said substrate,

a stripping plate (142) to separate the individual tape segments from the liner substrate,

means (145, 153, 150) to tension the substrate about the stripping plate to effect separation, and

means (152, 148) to advance the adhesive side of the tape segment (138) into pressure contact with the rolled-up sheet (32) so that the tape segment overlaps the trailing edge of the rolled-up sheet.

3. The apparatus of claim 2 wherein the means to advance a tape segment into pressure contact with a rolled up sheet includes control means (154) to sense the position of the sheet trail edge, and drive means (153) to advance the adhesive tape from the supply and to apply the tape in timed sequence with the rolling-up action to effect tape adhesion over the trailing edge of the sheet.

4. The apparatus of claim 3 including control means to inactivate said tape drive means after an appropriate delay.

5. The apparatus of any one of claims 2 to 4 wherein said stripping plate (142) has a separation-edge (144) having a sharply curved configuration of radius 0.76 mm.

6. The apparatus of any one of claims 1 to 5 wherein said tape dispensing mechanism dispenses a tape segment which completely encircles the rolled up sheet.

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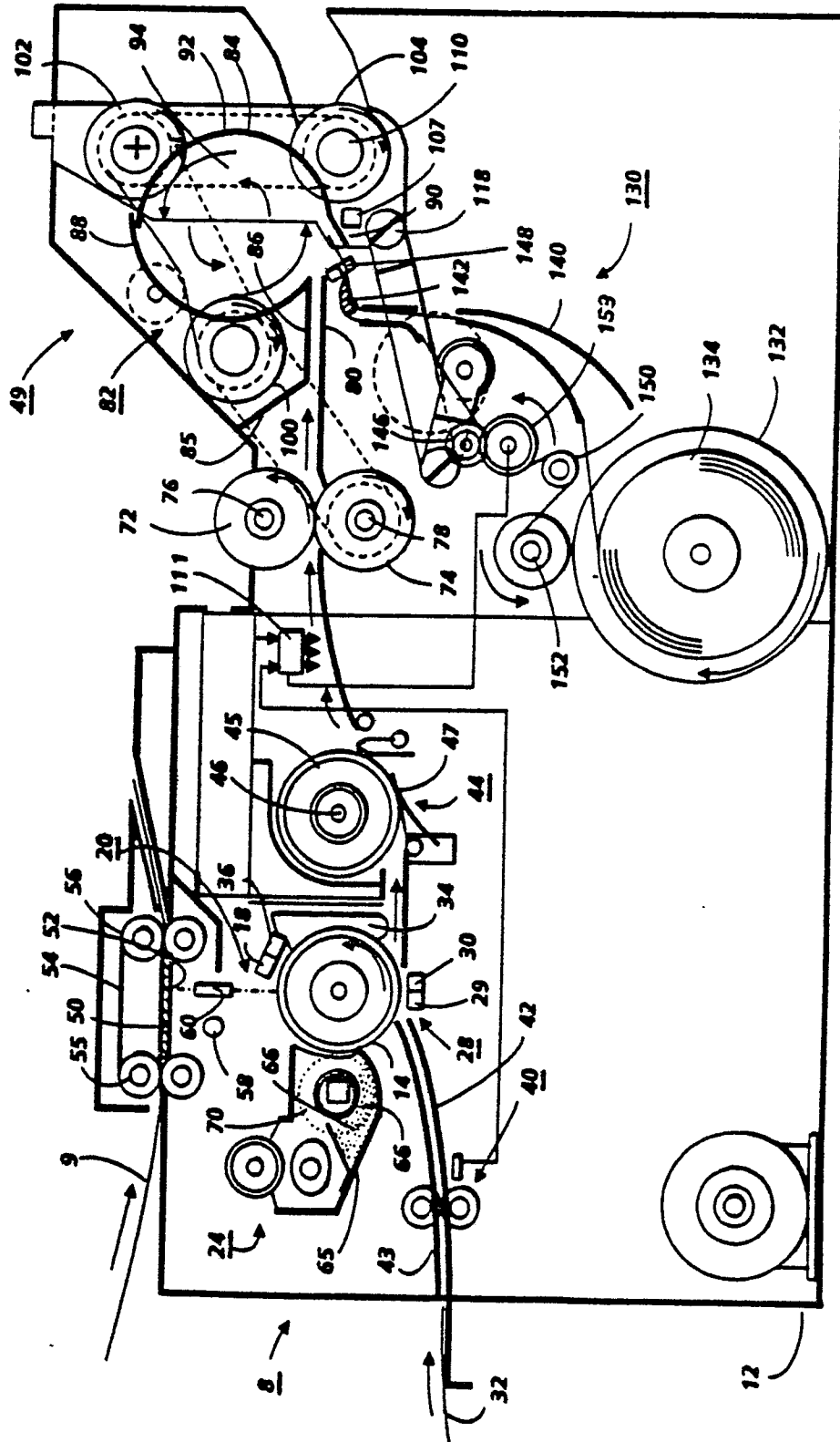
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FIG. 1



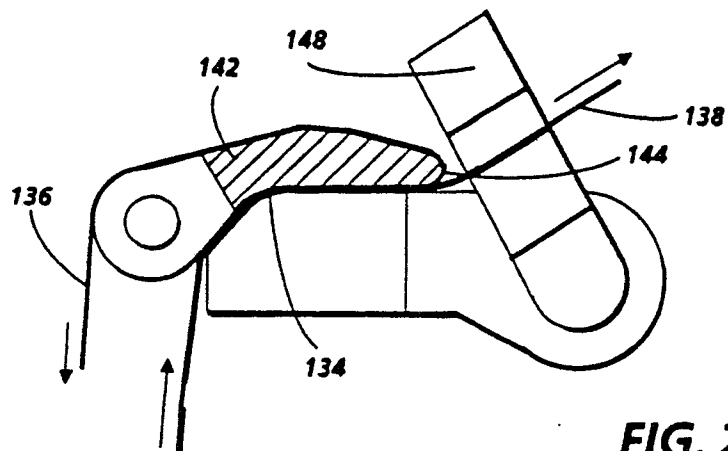


FIG. 2

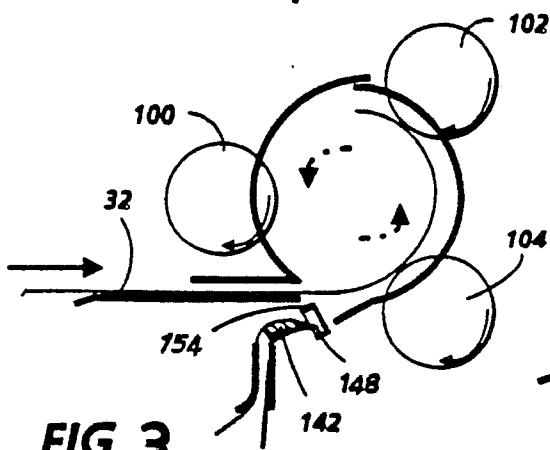


FIG. 3

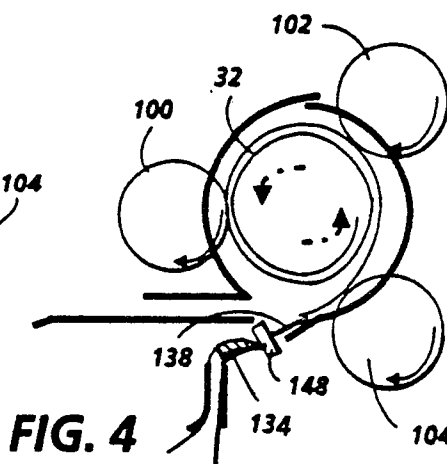


FIG. 4

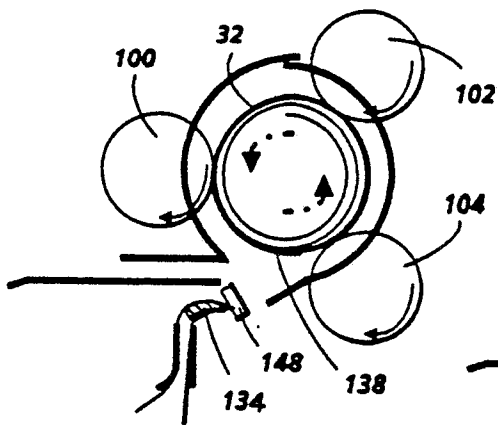


FIG. 5

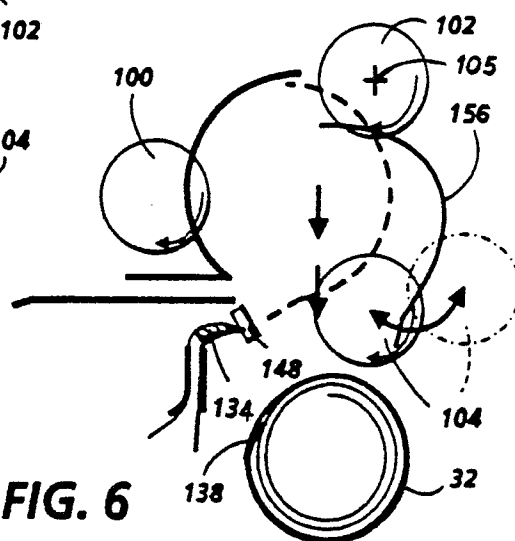


FIG. 6