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Benbenek et al.

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[54] **ELECTROSTATIC LAYBOY WITH UNDERLAP SYSTEM**

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[21] Appl. No.: **208,187**

[52] **U.S. Cl.** **271/46,** 271/76

[51] **Int. Cl.** **B65h 5/24,** B65h 29/12

[58] **Field of Search** ..... 271/46, 63 A, DIG. 3, 271/76, DIG. 8

[56] **References Cited**

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3,612,270	10/1971	Benbenek et al.	209/74
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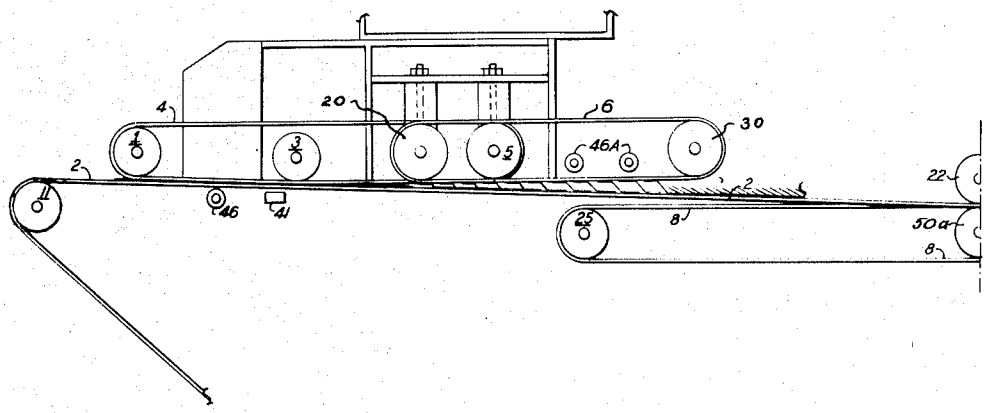
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[57] **ABSTRACT**

A layboy assembly moves paper sheets and underlaps the sheets by guiding the sheets between opposing conveyors along a course, charging the edges of the paper sheets with an electrostatic charge as the sheets are moved first rapidly, then more slowly through a series of conveyors. An upper conveyor attracts the charged edges of the sheets as the sheets are slowed down. The charged edges are raised before and during slowdown to reduce the distance between moving sheets. The opposing conveyors diverge at the slowdown zone to leave a gap, thus permitting sheet under lapping when a static eliminator neutralizes the charges on the paper sheets releasing the raised edges of the sheets downstream of the charging elements.

7 Claims, 3 Drawing Figures



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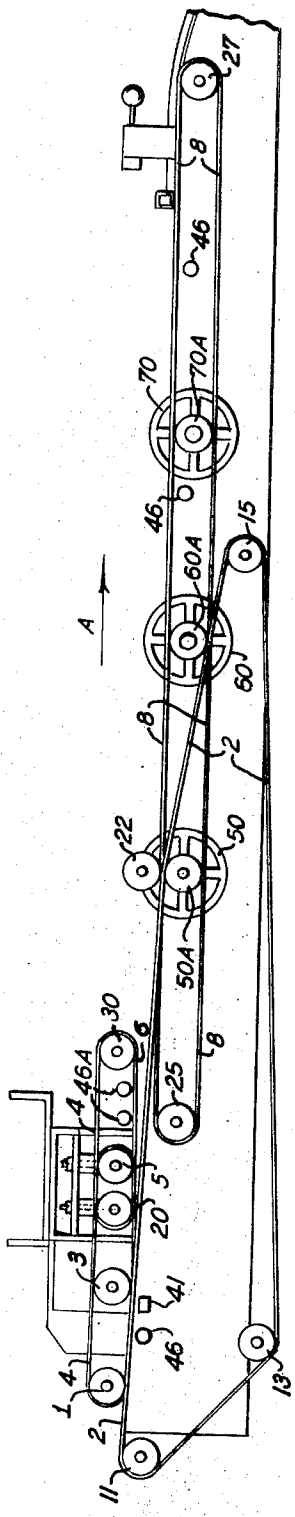


FIG. 1

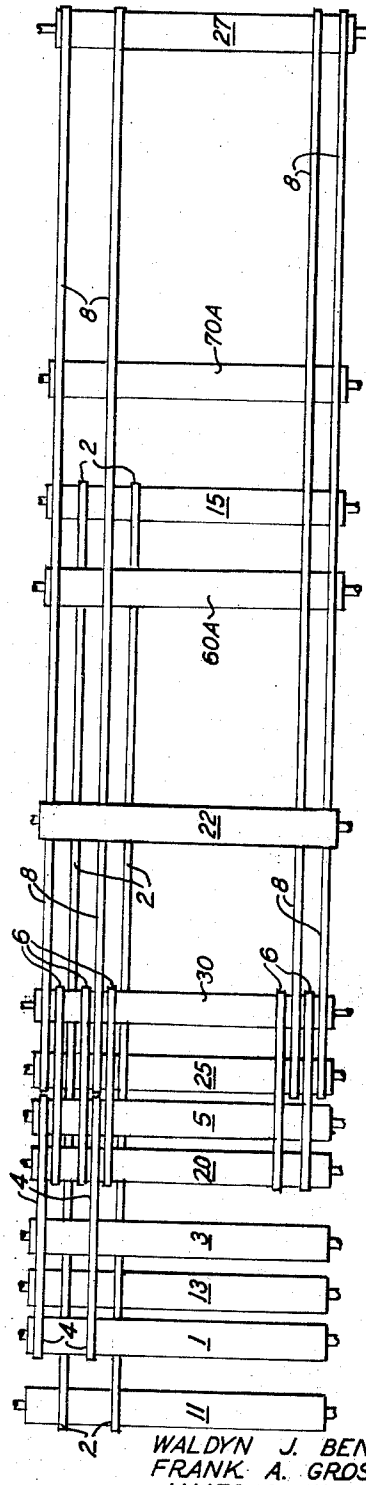


FIG. 2

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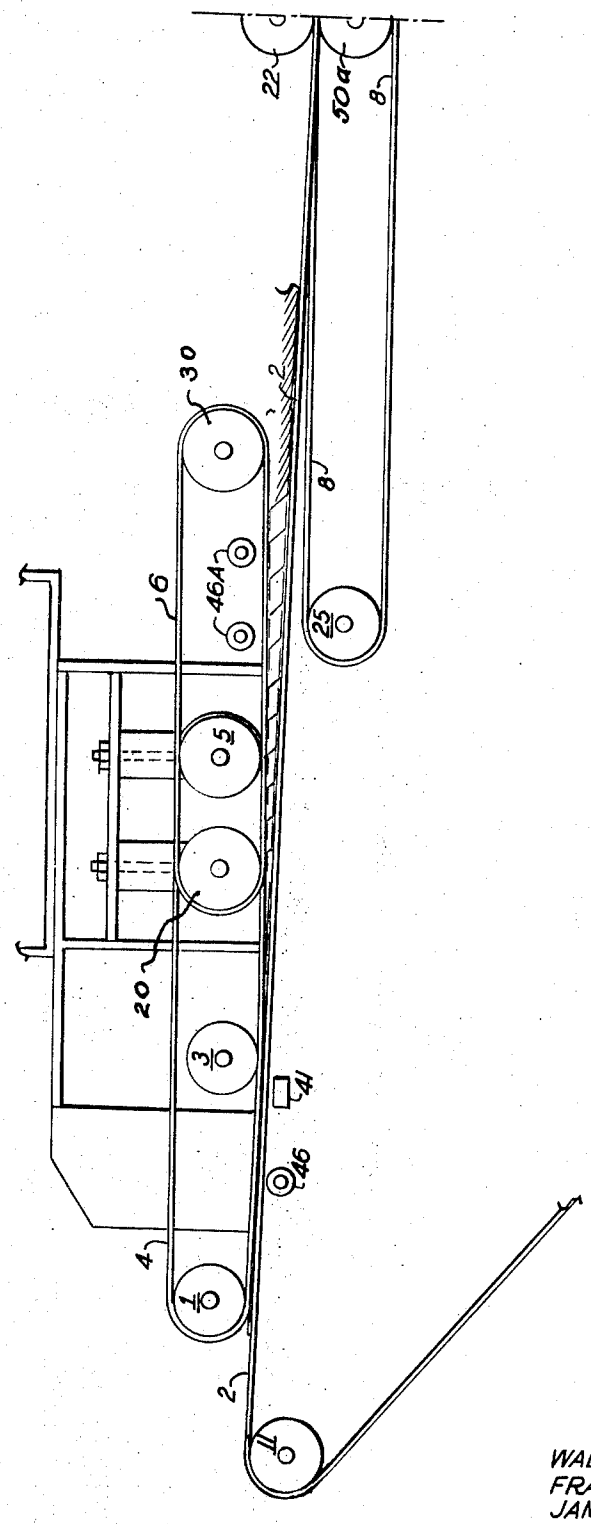


FIG. 3

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ELECTROSTATIC LAYBOY WITH UNDERLAP SYSTEM

FIG. 1 is a side elevation of the underlap system with parts broken away;

FIG. 2 is a top plan view of the FIG. 1 arrangement with parts omitted; and

FIG. 3 is an enlarged view of the underlap segment of the FIG. 1 arrangement.

In the drawings, the first conveyor system includes rolls 1, 3 and 5 arranged in tandem to move and/or support endless tapes 4 which comprises the upper part of the first system. The lower part of the first system includes foremost roll 11, a lower roll 13 and a rearmost roll 15 which move lower tapes 2 adjacent upper tapes 4 so that paper sheets are "pinched" between the tapes 2 and 4 and conveyed in the direction of arrow A to a collection area. The tapes 2 and 4 are staggered relative to one another and spaced apart so that the tapes 2 of the lower part pass closely adjacent the rolls 1, 3 and 5, between tapes 4. Roll 3 is positioned slightly below rolls 1 and 5 to position the lower run of tapes 4 and the upper run of tapes 2 adjacent one another. Beyond roll 3, the tapes 2 and 4 separate from one another to leave a small gap as shown in FIG. 3.

The second conveyor system includes upper tapes 6 mounted on rolls 20 and 30 which are spaced from one another with roll 5 of the upper part of the first conveyor system intervening between rolls 20 and 30. The intervening rolls 5, 20, 30 and others can be grooved or have varying diameters so that the tapes from other conveyors can pass at higher or lower speeds over and under the rolls, along the grooves with a minimum of friction. The tapes 6 are located slightly above lower tapes 2 of the first conveyor system as a continuation of tapes 4 beyond roll 5. Tapes 4 terminate at roll 5 being directed slightly upwardly beyond roll 3 to leave a small gap between tapes 2 and 4. Thus, tapes 6 of the second conveyor system afford the only upper moving force for conveying paper sheets being processed beyond roll 5. Tapes 4 and then tapes 6 hold the charged edges of the paper sheets so that the uncharged lower portions of the sheets can slide along tapes 2 which are being moved faster than tapes 6.

The lower tape means of the second conveyor system includes lower tapes 8 on rolls 25 and 27 so that the lower tapes extend beyond roll 15 at which point the lower conveyor part of the first conveyor system terminates. Beyond roll 27, a cascade feed (figuratively shown in part) for a printing press or other conventional feed can be located to collect the lapped sheets carried by tapes 8.

It will be noted that the tapes 2 extend slightly downwardly from roll 11 to first pass closely adjacent to tapes 4 for a short distance and then to intersect the paths of lower tapes 8 of the second conveyor system. Guide roller assemblies 50, 60 and 70 with supporting rollers 50A, 60A and 70A respectively, are located downstream to support tapes of the second system which extend to the feed or assembly area beyond roll 27. Guide roller assemblies 50, 60 and 70 are shown figuratively and can be the same as roller assembly 14(A–E) shown in U. S. Pat. No. 3,612,270, FIG. 8 with the same adjustment features. The slow down roller 22 of assemnly 50 can be smooth or grooved as roller 14 in the abovementioned patent, but the other rollers preferably have smooth surfaces.

Also, tapes 2 can be guided to extend further downwardly beyond roller 22 to pass under tapes 8 before assuming generally horizontal positions. The slow down roller 22 is located approximately at the intersection of tapes 2 and 8 to slow down paper sheet travel as same are moved by slower tapes 8 rather than tapes 2 beyond this point.

Electrostatic charge means in the form of one or more charge bars 41 are located within the first conveyor system below tapes 2 and immediately ahead of the entrance to the second conveyor system defined by rolls 20 and 25. The charge bars 41 and upper tapes 4 and 6 are the same as those disclosed in patent 3,613,270 and cooperate with upper tapes 4 and 6 of the second conveyor system in the same way as referenced in FIGS. 2–5 of the drawings of that patent.

Preferably, the charge bars 41 are signalled to impart a charge to the rear edges only of paper sheets being processed so that only the rear edges are raised upwardly to be carried by tapes 4 and then tapes 6 of the second conveyor system. The tapes of the second conveyor system are moved substantially slower than the tapes of the first system, say about 40 percent slower. At the intersection of the two tape systems (between rolls 20 and 25), the paper sheets are lapped, to the extent of about 10–12 inches, to form an underlap stream. The amount of underlap can be varied, but 20 to 40% of a sheet length underlap is generally the desired amount.

A series of static elimination bars 46 are positioned below tapes 8 along the course to be followed by the paper sheets. The static elimination bars 46 are the same as those disclosed in the above-identified patent and shown in FIG. 6. These bars serve to eliminate static electricity from the moving paper sheets except in the area of intersection of the two conveyor systems.

Upper static elimination bars 46A are located above the course of moving paper sheets downstream of the intersection of the two conveyor systems, and downstream of roll 5 within the upper tapes 6 of the second system so that once underlapping has taken place at the intersection of the high speed and low speed tapes, the static charges are dispelled from the paper sheets and their trailing edges drop to overlap the forward edges of succeeding sheets. Thus, slower speed tapes 6 carry the trailing edges of the moving sheets for a short distance whereupon the static elimination bars 46A neutralize the charges. Between the intersection of the two systems and slow down roller 22, is a distance of at least one paper sheet length.

The tapes 2, 4, 6 and 8 are shown only in part in FIG. 2, and as many tapes as necessary can be used in each of the conveyors. Only the upper tapes 4 and 6 need have the nonconductive and conductive lamination structure referred to in FIG. 4 of patent 3,612,270 to attract the charged portions of the paper sheets.

What is claimed is:

1. A layboy assembly for processing paper sheets having a first conveyor system for moving the paper sheets through a layboy course at relatively high speed, comprising opposing end-less conveyors including an upper part and a lower part; a second relatively slower conveyor system with an entrance positioned downstream within the course of said first conveyor system to intersect same, said second system comprising an upper tape means and an opposing lower tape means which intersect the course of said first conveyor sys-

tem, electrostatic charging means positioned upstream of at least part of said second conveyor system to charge a trailing portion of the paper sheets being processed in said layboy whereby the charged portions of the sheets are attracted to the upper tape means of said second conveyor system and the sheets are under lapped adjacent the intersection of the two conveyor systems, a slowdown roller located downstream of said upper tape means to level said paper sheets, said slowdown roller being located at least one paper length downstream of said intersection.

2. The assembly of claim **1** wherein the upper tape means of said second system is located upstream of the lower tape means and the electrostatic charge means is positioned upstream of said upper tape means and below said first conveyor system whereby only the trailing ends of the sheets being processed are attracted upwardly to said upper tape means.

3. The assembly of claim **2** wherein the upper part of said first conveyor system terminates intermediate the ends of said upper tape means.

4. The assembly of claim **2** wherein the upper part of said first conveyor system has tapes which extend upwardly to intersect said upper tape means of said second conveyor system.

5. The assembly of claim **4** wherein said lower tape means extends beyond said first conveyor system.

6. The assembly of claim **2** wherein static elimination means is positioned above said upper tape means to neutralize the charges on the moving paper sheets being underlapped.

7. The assembly of claim **1** wherein said second conveyor system is moved at a lineal speed up to about 40 percent slower than that of said first conveyor system.

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