United States Patent [19]

Stemmle

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[45] **Feb. 25, 1975**

[54] **TRAY APPARATUS**

[75] Inventor: **Denis J. Stemmle,** Williamson, N.Y.

[73] Assignee: **Xerox Corporation,** Stamford, Conn.

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[52] **U.S. Cl.** **211/126**

[51] **Int. Cl.** **B65h 31/24**

[58] **Field of Search** 211/126, 128, 49, 175, 211/176, 55; 198/213; 271/64, 173, 207, 217

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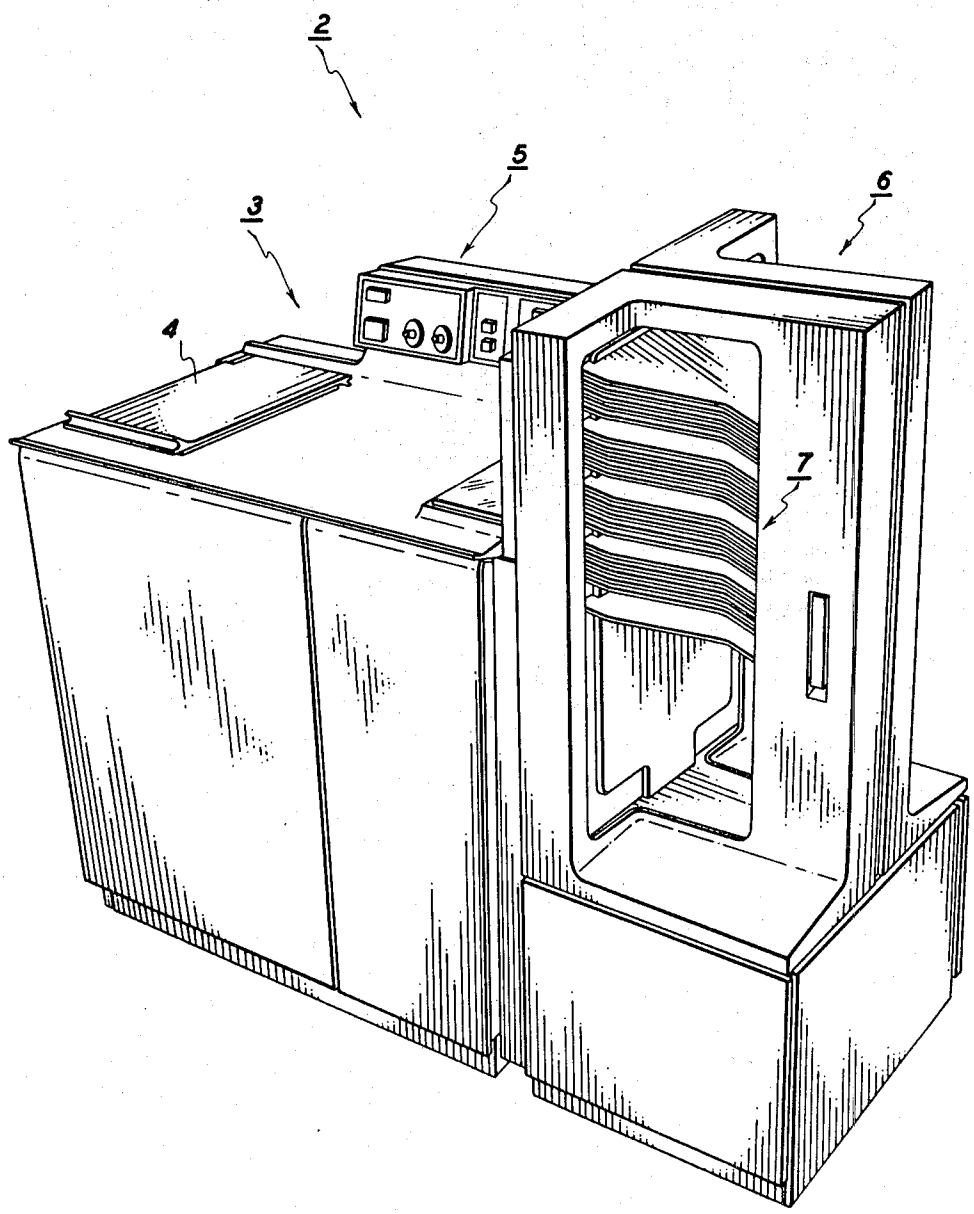
Primary Examiner—Roy D. Frazier

Assistant Examiner—Robert W. Gibson, Jr.

[57] **ABSTRACT**

This invention relates to a tray apparatus for receiving sheets from a copying machine. The tray apparatus includes a vertically extending array of tray members in a nested configuration to enable rapid unloading of sheets in collated sets.

2 Claims, 9 Drawing Figures



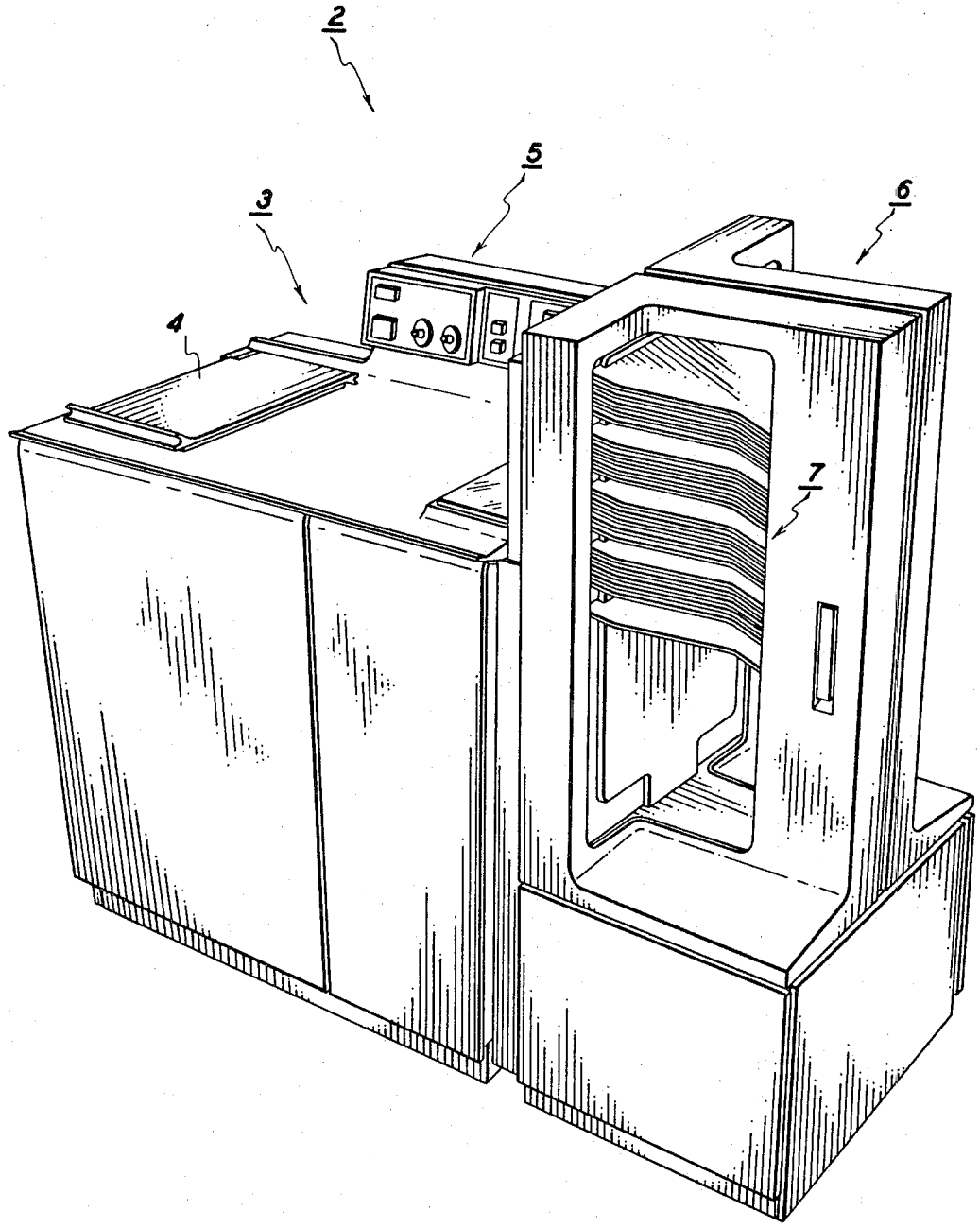


FIG. 1

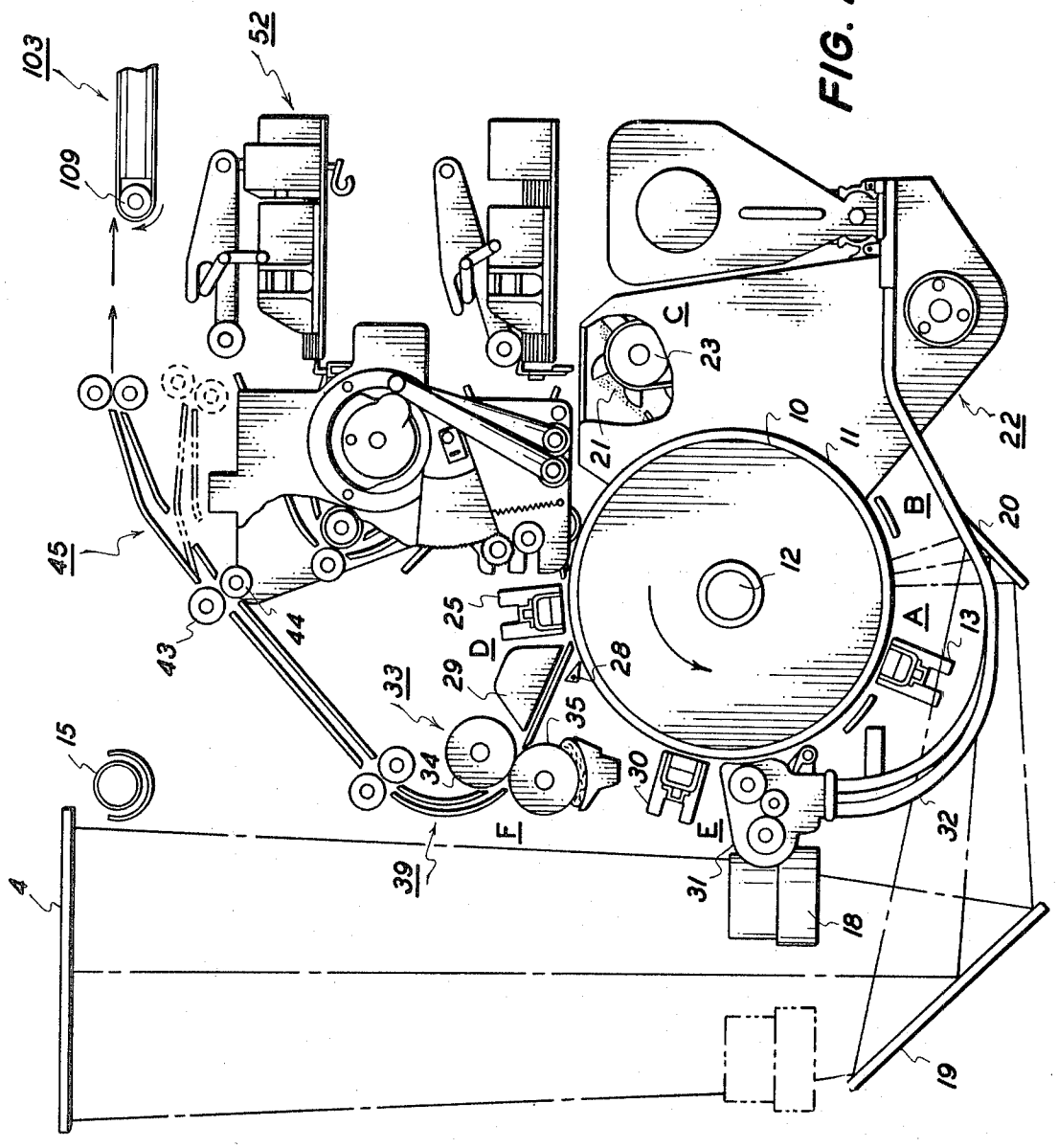

103
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43
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29
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4
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F
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13
28
30
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FIG. 2

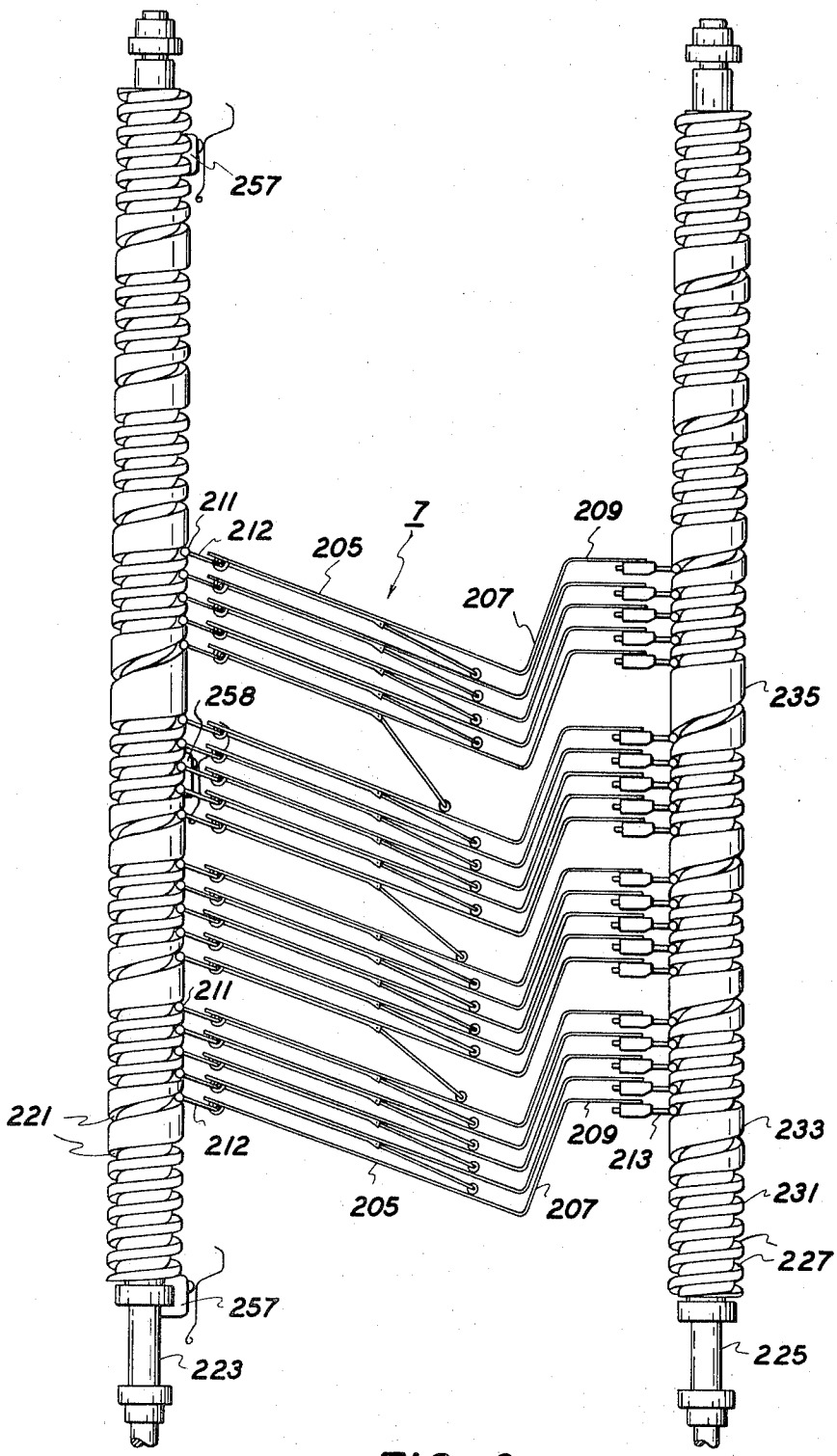

257
211
212
205
7
209
207
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258
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221
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233
231
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257
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225

FIG. 3

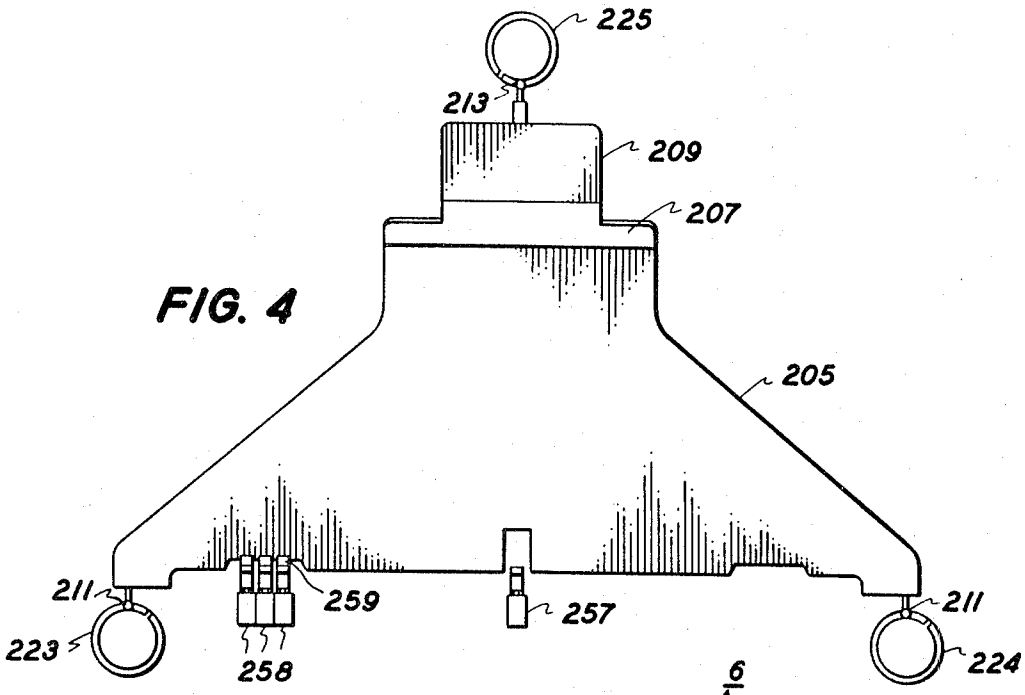


FIG. 4

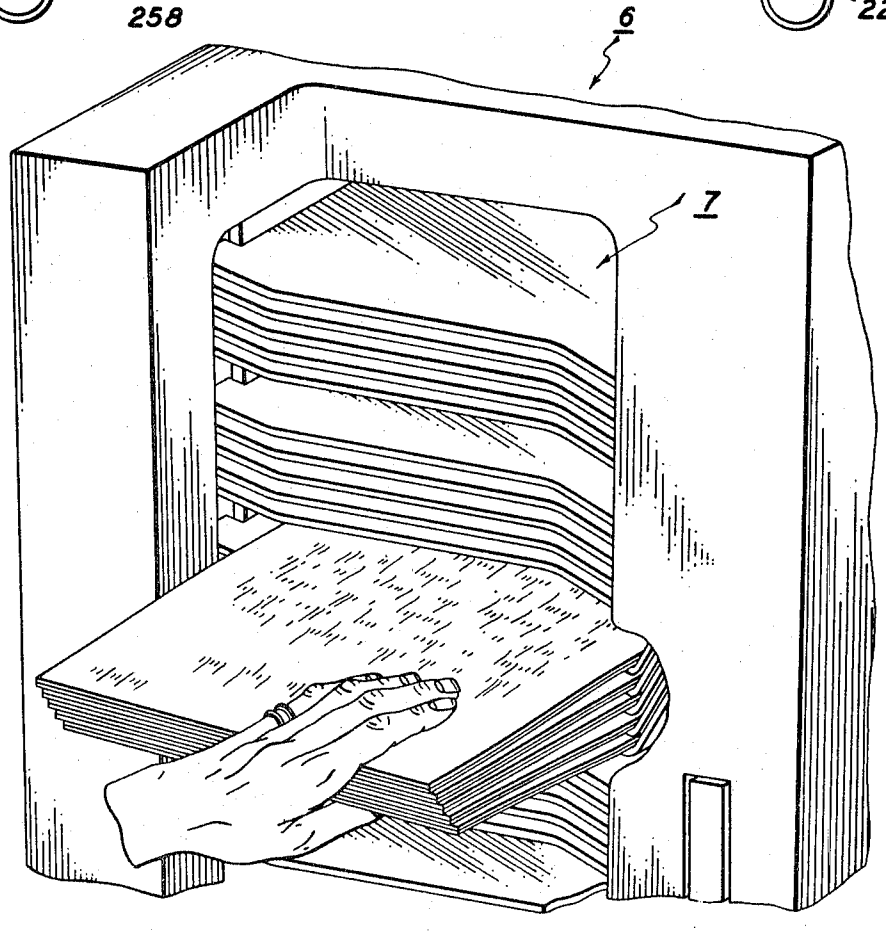


FIG. 7

FIG. 5a

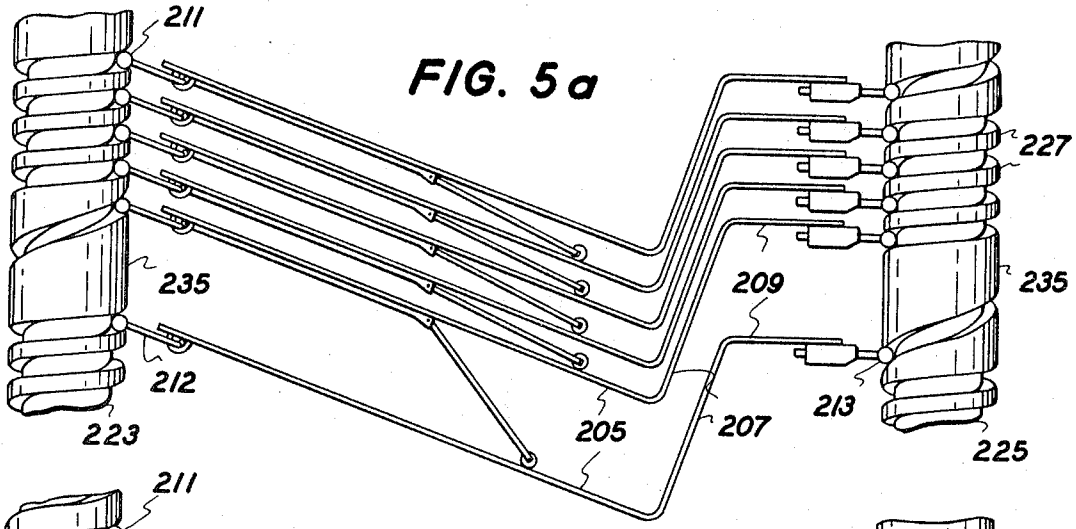


FIG. 5b

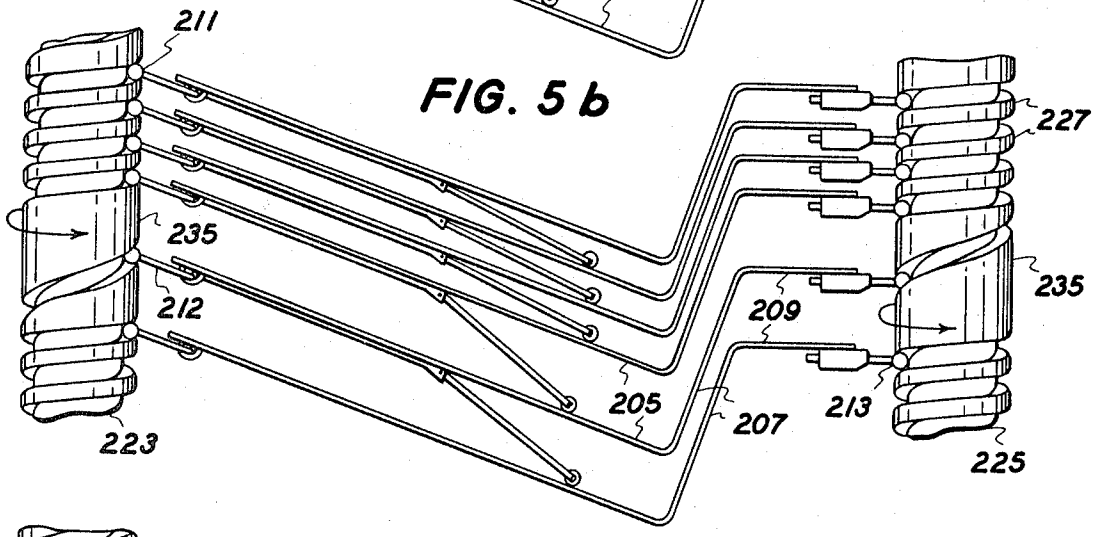
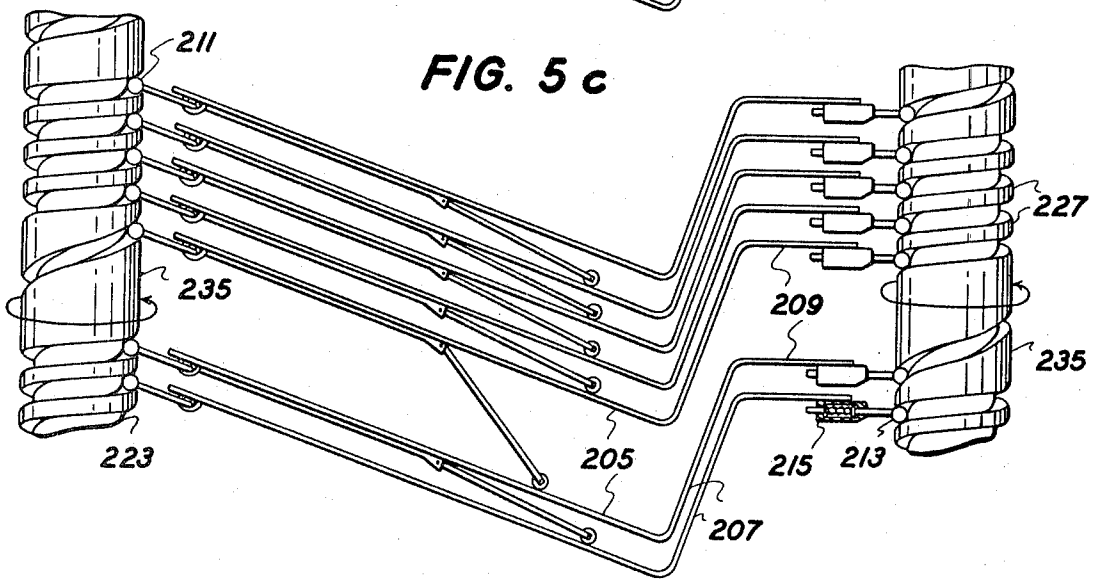


FIG. 5c



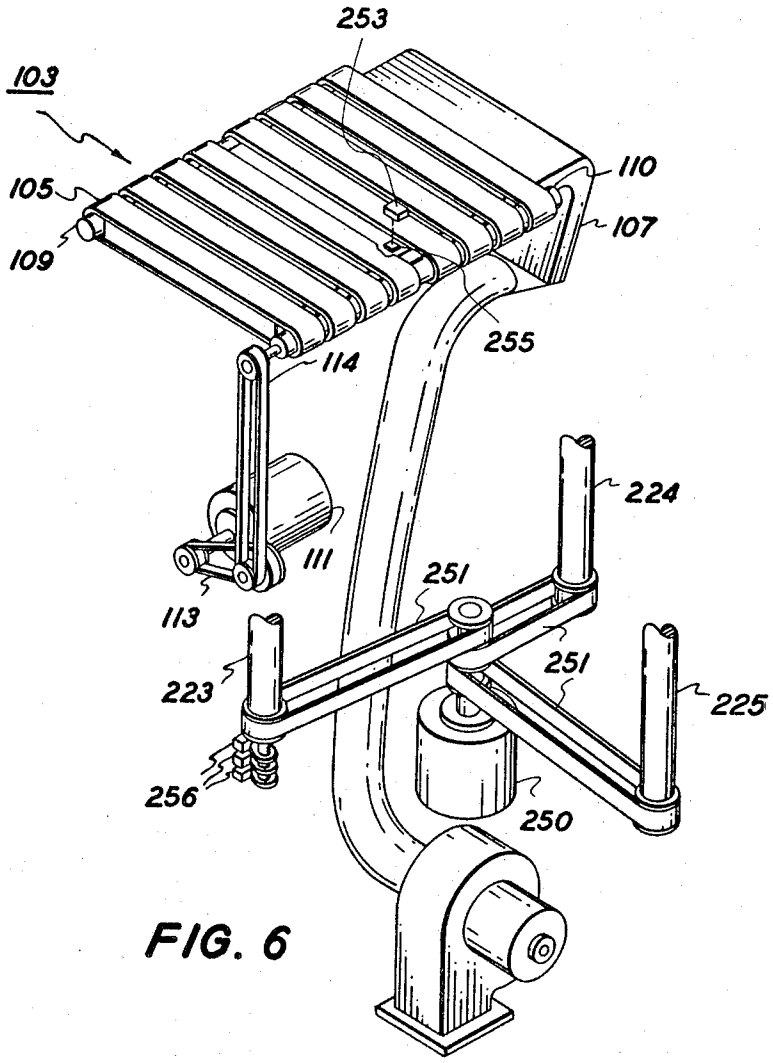

253
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107
255
114
224
111
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113
223
251
225
256
250

FIG. 6

TRAY APPARATUS

This invention relates to a tray apparatus for received copies advanced from a copier/duplicator into collated sets.

With advent of high speed copier/duplicator systems there has been a growing concern for the distribution and handling of the copy sheets in a collated fashion. In the past, sheet handling systems included large and bulky sorting bin modular units with a multitude of trays arranged for movement relative to the sheet path for increased storage as described in U.S. Pat. No. 3,356,362. Another approach has been a rotating housing carrying bins or trays past a copy sheet path as described in U.S. Pat. No. 2,876,008, 2,951,697, and 3,076,647. While this construction is satisfactory in one sense, there are certain disadvantages such as the number of trays that can be accommodated as well as the number of sheets in each tray. Still another approach is a vertically moving distributor in the form of trays moved up and down together as described in U.S. Pat. No. 3,561,754. While this type of construction is suitable for some applications, it is not entirely satisfactory for many copier/duplicators in commercial use.

The present invention is, generally speaking, an arrangement of the bins or trays for rapid distribution and unloading of copy sheets in collated sets.

It is therefore a general object of this invention to improve the distribution and unloading of copy sheets.

It is another object of this invention to enable the distribution and unloading of copy sheets in collated sets in a reliable manner.

It is still a further object of the invention to enhance the delivery of copy sheets to a moving bin sorting apparatus.

It is still a further object of the invention to achieve sorting of copy sheets into a moving tray configuration which is simple and compact in construction.

The above and added advantages of the present invention will be more apparent after reading the following detailed description which refers to accompanying drawings in which:

FIG. 1 is a perspective view of a high speed copier/duplicator system including a sorter/collator apparatus according to the present invention;

FIG. 2 is a schematic illustrating the xerographic components of the copier/duplicator system;

FIG. 3 is an elevation view of tray assemblies according to the present invention;

FIG. 4 is a plan view of the tray assembly;

FIG. 5*a* – *c* are exploded views of the tray assemblies illustrating details of the opening tray operation;

FIG. 6 is an isometric view of the drive assembly for the sorter/collator apparatus; and

FIG. 7 is an exploded view of the tray illustrating set separation upon unloading.

GENERAL (FIGS. 1–2)

FIG. 1 shows a copier/duplicator system generally designated 2 including a copier machine 3, which is a high speed copier/duplicator capable of producing simplex or duplex copies at the option of a machine operator. The copier machine 3 has a platen 4 for receiving documents to be reproduced, and a control panel 5 which includes various control knobs, buttons, and switches for selecting various modes of operation such as simplex and duplex copies and the number of copies to be reproduced. In accordance with the invention, the copier/duplicator system includes a sorting apparatus 6 having tray assemblies 7.

As best shown in FIG. 2, the copier/duplicator system includes an automatic xerographic apparatus which includes a photosensitive plate including a photoconductive layer 10 that is placed over a conductive backing. The plate is formed in the shape of a drum 11 and the drum mounted upon a shaft 12 that is journaled for rotation in the machine frame. Basically, the xerographic drum is rotated in the direction indicated so as to pass sequentially through a series of xerographic processing stations. The photosensitive drum and the xerographic processing apparatus are driven at predetermined speeds relative to each other from a drive system (not shown) and the operations thereof coordinated in order to produce proper cooperation of the various processing mechanisms.

The original, to be reproduced, is placed upon a transparent horizontally supported platen 4 and the original scanned by means of a moving optical scanning system and to produce a flowing light image of the original. The scanning system includes an elongated horizontal extended aperture lamp 15 and a movable lens element 18. The lamp and lens element moves in coordination across the object supported upon the platen to focus successive incremental bans of illumination reflected from the object onto the moving drum surface at synchronous speeds therewith. The optical path is folded by means of a pair of image mirrors 19 and 20 interposed between the lens and the drum surface, the drum is first uniformly charged by means of a corona generator 13 positioned in charging station A. Under the influence of the flowing light image, the uniformly charged photoconductive surface is selectively dissipated in the non-image areas to form what is commonly known as a "latent electrostatic image."

The latent electrostatic image is carried on the drum surface from the exposure station into the developing station C. The developing station primarily is comprised of a developer housing 22 adapted to support a supply of two-conponent developer material 21 therein. The developer material is transported by means of a bucket system 23 from the bottom of the developer housing to an elevated position where the material is delivered into the active development zone. The developer material is caused to flow downwardly in contact with the upwardly moving drum surface under closely controlled conditions wherein charged toner particles are attracted from the developer mix into the image areas on the plate surface thus making the image visible.

The moving drum surface next transports the developed xerographic image to a transfer station D. Cut sheets of final support material are also moved into the transfer station, the backside of the copy sheet is sprayed with an ion discharge from a transfer corotron 25 inducing on the sheet a charge having a polarity and magnitude sufficient to attract the toner material from the drum surface to the final support material. This induced charge also electrostatically tacks the final support material to the drum surface. In order to remove the copy sheet from the drum surface, a stripper finger 28 is positioned downstream from the transfer corotron. The finger is arranged to move between the drum surface and the copy sheet and lifts the sheet from the drum surface and the copy sheet is directed along a

predetermined path of travel into contact with a stationary vacuum transport **29.**

Although a preponderance of the toner material is transferred from the drum surface to the copy sheet during the transfer process, invariably some residual toner remains behind on the drum surface after transfer. This residual toner is transported on the drum surface into a cleaning station E where it is brought under the influence of cleaning corotron **30** adapted to neutralize the electrostatic charge tending to hold the residual toner to the drum surface. The neutralized toner is mechanically cleaned from the drum surface by means of a brush or the like and the toner collected within a housing **31.** A conveyor moving in an endless loop through tubes **32** transport the collected residual toner back to the developer housing where it is deposited within the developer mix so that it can be once again reused in the xerographic developing process.

The copy sheet, which has been removed from the drum surface after the transfer operation, is moved along stationary transport **29** into fusing station F. The fuser **33** is basically made up of an upper fuser roll **34** and a lower fuser roll **35** mounted in operative relation to each other and arranged to coact so as to support a sheet of material in pressure driving contact therebetween. The lower roll is heated. As the heated roll is rotated in the direction indicated, the heated surface of the lower roll is pressed into intimate contact with the image face of the support sheet. Mechanical and heat energy transported from the roll surface to the support sheet to permanently bond the toner particles to the support material.

Upon leaving the fuser, the fixed copy sheet is passed through a curvalinear sheet guide system, generally referred to as **39,** into cooperating advancing rolls **43** and **44.** At this point, depending on the mode of operation selected, the copy sheet is either forwarded directly to the sorter or into the upper supply tray **52** by means of a movable sheet guide **45** before entering the sorter.

It is believed that the foregoing description is sufficient for purposes of the present application to show the general operation of a xerographic reproducing machine. For a more detailed explanation of the copier/duplicator xerographic components reference is made to U.S. Pat. No. 3,645,615, entitled Copying Apparatus.

SORTING APPARATUS

Sorter apparatus **6** comprises a horizontal vacuum transport assembly **103** which receives copy sheets from the copier/duplicator and advances them to a plurality of tray assemblies **7.** A drive apparatus moves the tray assemblies vertically intermittently for receiving copy sheets advanced along the transport path as will be explained hereinafter. A drive motor **111** serves to drive transport assembly **103** which uses vacuum generated by a pump **108.**

The tray assemblies **7** are arranged in groups of approximately five trays each for the purpose of multiple bin unloading as will become more apparent. Each of the tray assemblies has a tray portion **205** which is inclined to the horizontal plane for receiving the sides of the copy sheets. The angle of inclination may range from about 5° to about 50° and preferably is about 20° to minimize sheet scatter and still accomplish multiple bin unloading. An end portion **207** is substantially perpendicular to the tray portion **205.** The tray assembly extends in a horizontal direction at tail portion **209.** Tray portion **205** and tail portion **209** are mounted on cam followers which engage the spiral slot formed in the cylindrical surface of cam members to be described.

Tail portion **209** has a cam follower mounted **213** which includes a spring member **215** for enabling movement of the cam follower **213** relative to the tray assembly **203.** Tray portion **205** has a pair of cam followers **211** pivotally mounted on link members **212** adjacent the leading corners of the tray assembly. Cam followers **211** are received in spiral grooves **221** of camming members **223** and **224** positioned at opposite sides of the entrance to the tray assembly. A third cam member **225** which has spiral portions **227** for receiving cam follower **213.** By this arrangement, a three point suspension is provided by the tray assemblies.

Each of the cam members **223** and **224** at the entrance of the tray assemblies and cam member **225** at the rear of the tray assemblies have the same path. The path has a series of fine closely spaced or low pitch surfaces **231** separated by a high pitch surface **233** providing separation of the tray assemblies into groups to enable multiple bin unloading. It will be noted that by this arrangement that multiple bin unloading results in copy sets adjacent tray assemblies being offset about one-fourth inch such that set separations of sets or books is effected upon simultaneous unloading of a groups of the tray assemblies. Also by the above arrangement, the drive motor **250,** is energized intermittently by electrical signals supplied by machine control when sheets on transport assembly **105** are detected by a lamp and photocell sensing unit **253** with the aid of a reflector **255** (FIG. **6**).

In operation, a plurality of switches **258** serve to determine the location of the tray assemblies relative to the sheet discharge zone by contacting tray tab portions **259** (FIG. **4**) which serve as a tray coding device. Switches **258** supply a signal to machine control to indicate tray assemblies are in a ready condition to receive sheets and also to indicate when drive motor **250** should reverse. Another function of the switches is to prevent the tray assemblies from over indexing beyond the normal range by supplying a signal to machine control.

One or more switches **256** are mounted near cam member **223** to control deenergization of motor **250** upon a single revolution of the cam member. In this manner the tray assemblies advance together with each tray assembly receiving a sheet in the discharge zones. Limit switches **257** are provided as a backup to detect the upper and lower limits of the path of the tray assemblies to deenergize the motor **250** to prevent damage in the event of component failure.

By the above described moving tray apparatus, the distribution of copy sheets from a reproduction machine is greatly enhanced. Thus the reliability of stacking the sheets in collated identifiable fashion is most apparent. It will be appreciated that this improved sorting apparatus greatly facilitates the sorting and stacking of sheets distributed by copier/duplicator systems into collated sets.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illus-

trated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. Tray apparatus comprising

a frame

an array of closely spaced tray members supported by said frame in vertical alignment,

each of said tray members having a first wall portion extending in a direction inclined to the horizontal plane, and a second wall portion extending in a direction inclined to the vertical plane from said first wall portion at right angles thereto, said wall portions in vertical alignment defining a nested relationship,

wherein each of said tray members includes a third wall portion extending in the horizontal plane,

wherein each of said tray members has mounting means connected thereto, said mounting means including a resilient member to enable movement of said tray members relative to said frame,

wherein said mounting means includes cam follower means which guide said tray members in a generally vertical path.

2. Tray apparatus comprising

a frame

an array of closely spaced tray members supported by said frame in vertical alignment,

each of said tray members having a first wall portion extending in a direction inclined to the horizontal plane, and a second wall portion extending in a direction inclined to the vertical plane from said first wall portion at right angles thereto, said wall portions in vertical alignment defining a nested relationship,

wherein said first wall portions are inclined to the horizontal plane at an angle ranging from about 5° to about 35°,

wherein said tray members are mounted on said frame in groupings, means on said frame mounting each grouping so that the groups are separated from each other by a space larger than the space between individual tray members to enable multiple unloading of tray members.

* * * * *