

Feb. 24, 1970

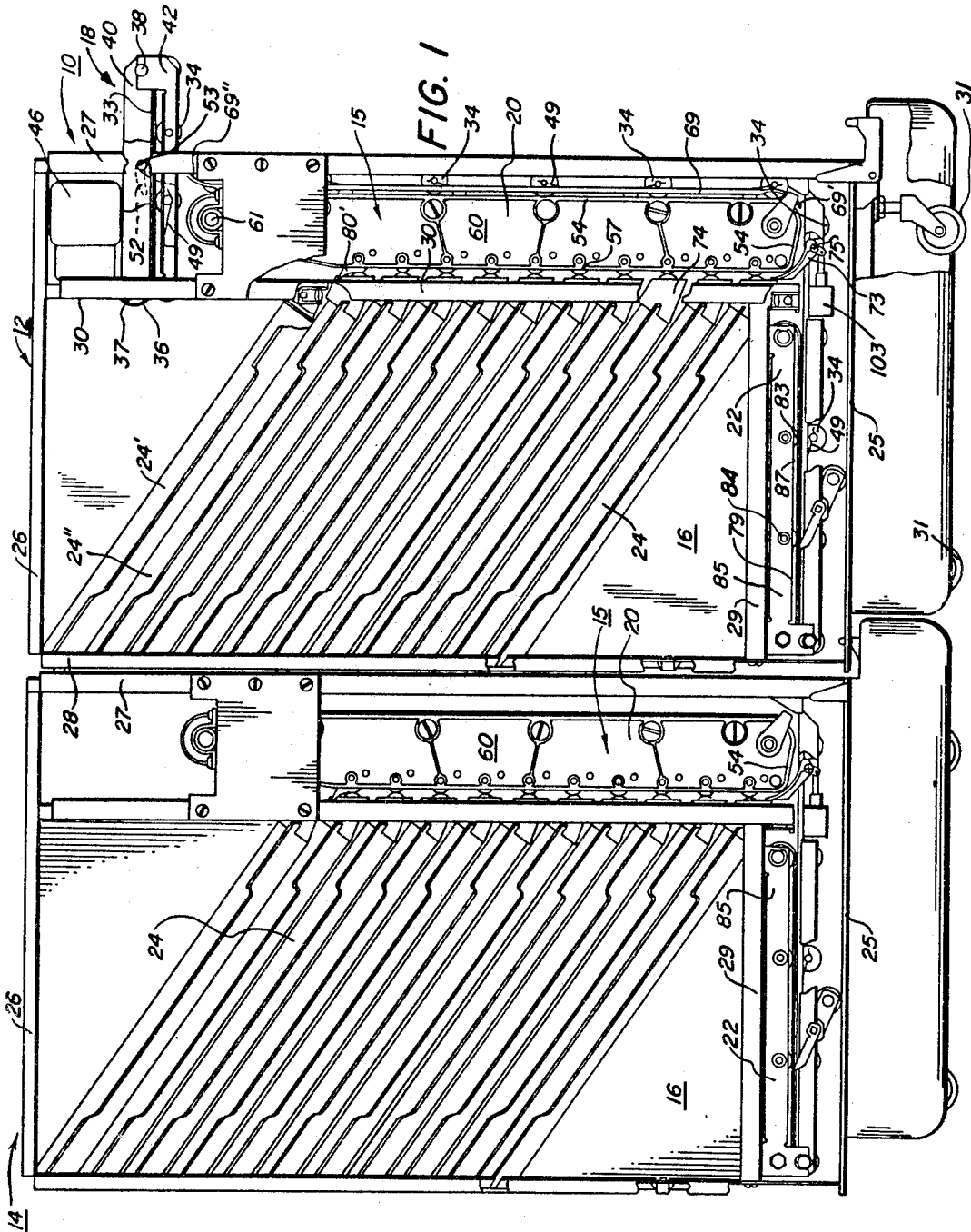
J. R. CALDWELL ET AL

3,497,207

SORTING APPARATUS FOR DOCUMENTS

Filed Jan. 24, 1968

5 Sheets-Sheet 1



INVENTORS
JOHN R. CALDWELL
JAMES R. CASSANO
BY *Frederick E. McMillen*
James M. Schneider
ATTORNEYS

Feb. 24, 1970

J. R. CALDWELL ET AL

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5 Sheets-Sheet 2

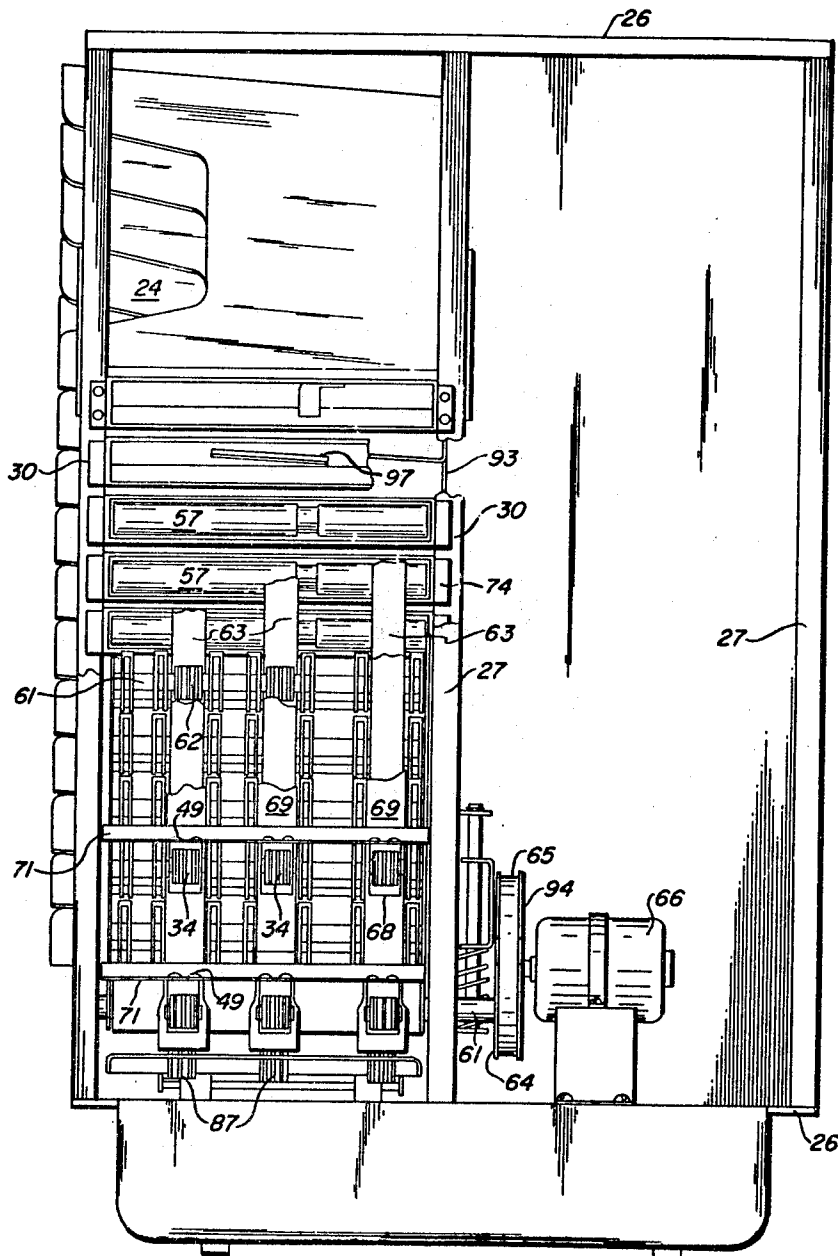


FIG. 2

INVENTORS
JOHN R. CALDWELL
JAMES R. CASSANO
BY *Frederick E. McTear*
James R. Schaefer
ATTORNEYS

Feb. 24, 1970

J. R. CALDWELL ET AL

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SORTING APPARATUS FOR DOCUMENTS

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5 Sheets-Sheet 3

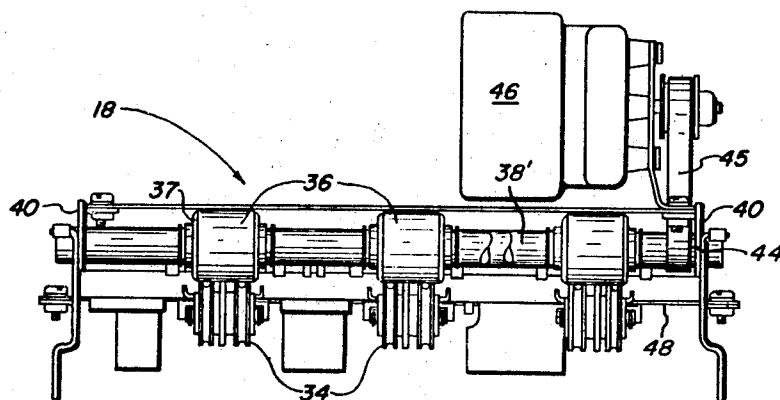


FIG. 3

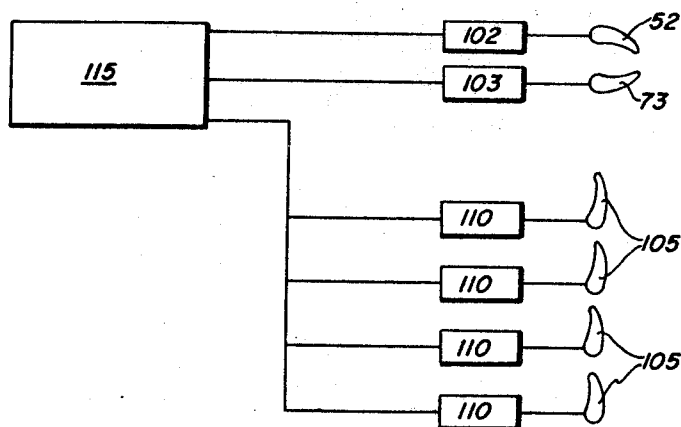


FIG. 6

INVENTORS
JOHN R. CALDWELL
JAMES R. CASSANO
BY *Frederick E. McMillan*
James P. Schneider
ATTORNEYS

Feb. 24, 1970

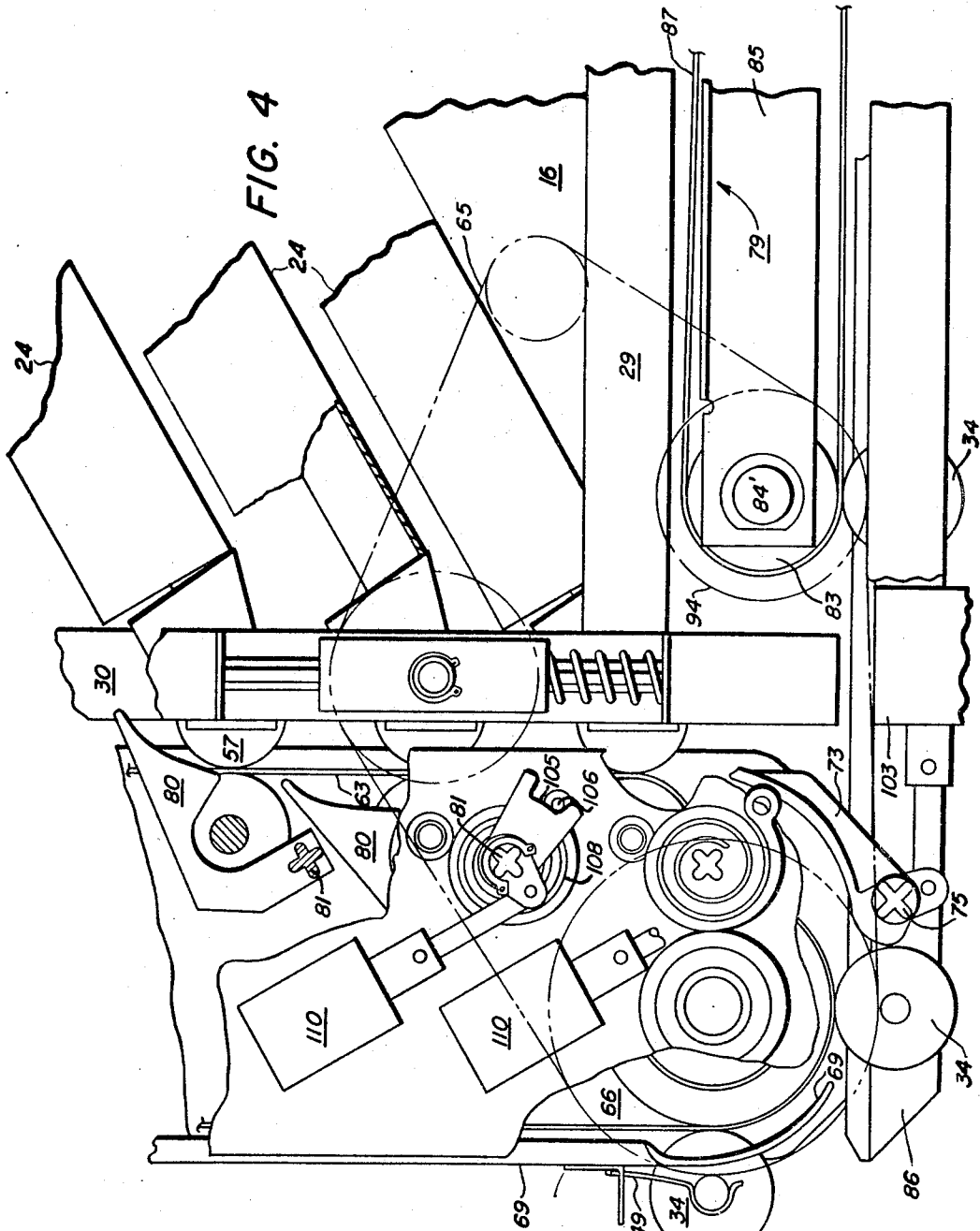
J. R. CALDWELL ET AL

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SORTING APPARATUS FOR DOCUMENTS

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5 Sheets-Sheet 4



INVENTORS
JOHN R. CALDWELL
JAMES R. CASSANO
BY *Frederick E. McMillan*
James R. Cassano
ATTORNEYS

Feb. 24, 1970

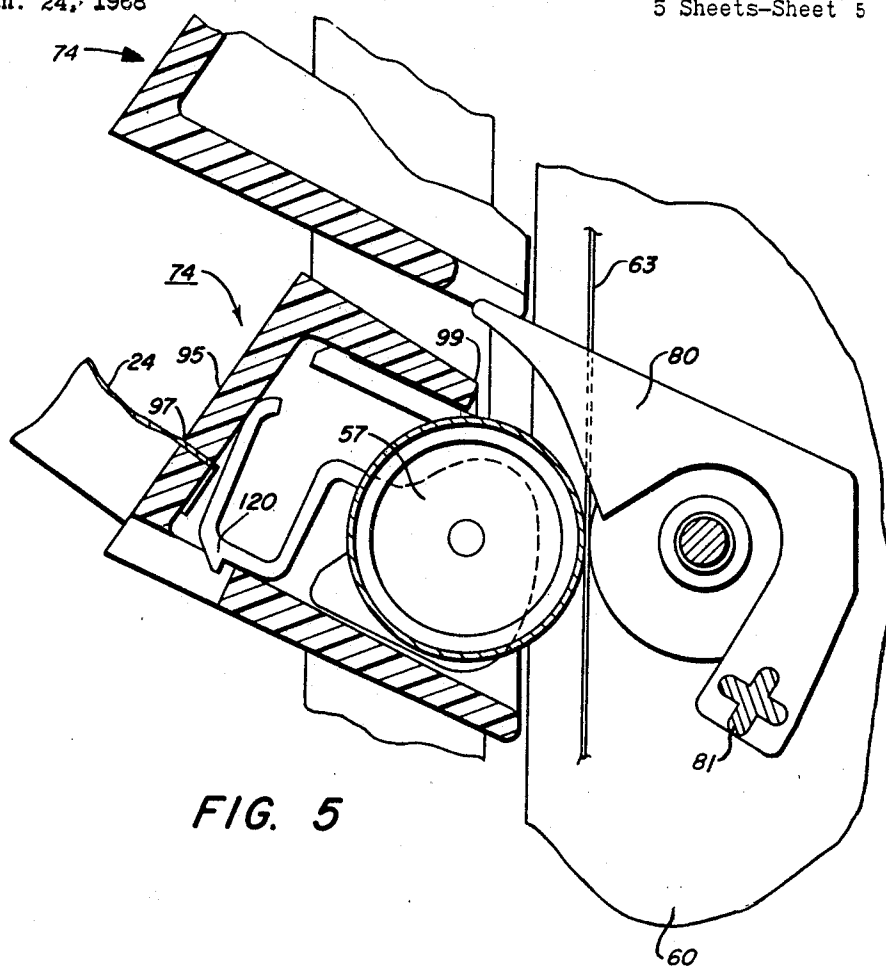
J. R. CALDWELL ET AL

3,497,207

SORTING APPARATUS FOR DOCUMENTS

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5 Sheets-Sheet 5



INVENTORS
JOHN R. CALDWELL
JAMES R. CASSANO
BY *Frederick E. McTullen*
James F. Schroeder
ATTORNEYS

1

3,497,207

SORTING APPARATUS FOR DOCUMENTS

John R. Caldwell and James R. Cassano, Rochester, N.Y.,
assignors to Xerox Corporation, Rochester, N.Y., a
corporation of New York

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5 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for sorting documents having document receiving trays that are both inclined upwardly and titled sideways; document transport means for feeding documents upwardly into selected ones of said trays, said documents being adapted to move backwardly across said trays toward the lower sides of said trays; and document registering means in the path of backward document movement and engageable with adjoining lower edges of the documents to stop document movement while placing the adjoining lower edges of the documents in each tray in common registry with one another.

This invention relates to an apparatus for sorting documents, and more particularly, to a high speed modular type apparatus for both sorting and registering documents.

Document sorters provide in effect a plurality of alternate document routes or paths to individual document receptacles or trays whereby the documents may be separated from one another in the manner desired. Inasmuch as the time required by the sorter to handle documents is directly related to the speed at which documents move through the sorter, high document speed are necessary if sorter operating time is to be minimized. Additionally, where the sorter input comprises a high speed document generating machine such as a copier, the speed of the sorter must at least match that of the input machine if the full potential of the input machine is to be realized.

Where documents such as paper sheets are to be sorted, high sorter speeds with corresponding high document velocities are difficult to maintain. As can be appreciated, these types of documents are susceptible to bending, buckling, tearing, etc. These failings, which are exaggerated by increased document velocities, have rendered development of reliable high speed document sorters difficult.

Where the documents to be sorted are of random size, it is usually desired that the sorter, in addition to separating and sorting the documents, also size or register the sorter documents with one another to facilitate subsequent handling and use thereof. The added burden in requiring the sorter to register as well as sort documents at high speed has increased the difficulty of developing a reliable high speed sorter.

It is a principal object of the present invention to provide a new and improved apparatus for sorting documents.

It is a further object of the present invention to provide a high speed apparatus to both sort and size documents.

It is an object of the present invention to provide a document sorter having an improved document receiving receptacle facilitating high speed sorter operation and in-

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corporating means to automatically register at least one edge of each document in the receptacle.

This invention relates to a high speed apparatus for sorting documents comprising in combination a plurality of spaced tray-like document receiving receptacles, the receptacles being parallel with one another and inclined upwardly; document transport means adjacent the lower side of the receptacles adapted to feed documents upwardly into the receptacles, the documents moving first in a substantially upward direction in the receptacles under the impetus of the conveyor means and thereafter moving in a substantially downward direction in the receptacles under the influence of gravity; and document registering means for the receptacles adapted to place at least one edge of the documents in each of the receptacles in common registry, the document registering means including a document stop arranged in the path of downward document movement and engageable with the one document edge to stop document movement and register the document.

Other objects and advantages will be apparent from the ensuing description and drawings in which:

FIGURE 1 is a schematic view of the document sorting apparatus of the present invention showing primary and secondary sorter modules;

FIGURE 2 is an end view with parts broken away of a sorter module;

FIGURE 3 is an end view showing the document input transport of the primary sorter module;

FIGURE 4 is an enlarged view with parts broken away showing the document deflector mechanism of the sorting apparatus shown in FIGURE 1;

FIGURE 5 is an enlarged view with parts broken away of the document guide means of the sorting apparatus shown in FIGURE 1; and

FIGURE 6 is a schematic view of the control arrangement for the sorting apparatus shown in FIGURE 1.

Referring particularly to FIGURE 1 of the drawings there is shown the document sorting apparatus 10 of the present invention. In the exemplary showing of the drawings, sorting apparatus 10 includes series connected primary and secondary sorter modules 12, 14, respectively, arranged to receive documents to be sorted from a suitable document producing apparatus such as a copying machine (not shown). The document input to sorting apparatus 10 normally comprises conventional paper sheets usually rectangular in shape and of various size, weight, and thickness. Other types of documents such as film, cards, etc. are, however, contemplated.

It will be understood that secondary sorter module 14 may be omitted or, alternately, additional secondary sorter modules 14 may be added to obtain requisite sorter capacity.

Sorter modules 12, 14 each have a document transfer section 15 and a separating or receiving section 16. In primary sorter module 12, transfer section 15 includes input transport 18 for receiving documents discharged by the document producing apparatus with which sorting discharge transport 22. In the secondary sorter module apparatus 10 is used, intermediate transport 20, and 14, input transport 18 is omitted, documents entering sorter module 14 at the bottom thereof between intermediate transport conveyor 54 and pinch rolls 34.

Separating section 16 includes a plurality of upwardly inclined trays or receptacles 24 for receiving and holding documents. As will appear more fully, trays 24 are canted slightly to enhance document registration.

Referring particularly to FIGURES 1 and 2, sorter modules 12, 14 each include a base 25, top 26, plural side frame members 27 at one end, and side wall 28 at the opposite end thereof. Cross members 29 project between frame members 30 and wall 28 parallel to and slightly above base 26. Additional frame members 30 extend parallel to frame members 27 between cross members 25 and top 26. To facilitate moving sorter modules 12, 14 wheels 31 may be attached to base 25 thereof. Referring to FIGURES 1 and 3, input transport 18 of primary sorter module 12 comprises a belt type conveyor 33 with cooperating pinch rolls 34. Conveyor 33 includes plural feed belts 36 supported on rolls 37. Rolls 37 are carried by shafts 38 journaled in sides 40 of conveyor 33. Conveyor sides 40 may be suitably secured to pinch roll side supports 42 which in turn are secured to module frame members 27, 30. Roll carrying shaft 38' is extended to carry conveyor drive pulley 44. Drive belt 45 operably connects motor 46 with pulley 44 to drive conveyor 33.

Pinch rolls 34 are releasably held in contact with conveyor feed belts 36 at spaced points along the working surfaces thereof by wire-like members 49 supported on cross legs 48.

Finger-like document deflectors 52 are supported on shaft 53 journaled for limited rotation in sides 40 of conveyor 33. Deflectors 52, when in raised position route documents downwardly to intermediate transport conveyor 54.

Intermediate transport 20 includes a belt type conveyor 54 with cooperating pinch rolls 34 spaced along the outer downwardly moving side and at the base thereof, and cooperating pinch rollers 57 spaced along the inner upwardly moving side thereof. Conveyor 54 includes roll support shafts 61 journaled in sides 60 of conveyor 54. Rolls 62 on shafts 61 support conveyor feed belts 63. Lower shaft 61 of conveyor 54 is extended and drive pulley 64 is mounted thereon. Drive belt 65 connects pulley 64 with motor 66.

Outer pinch rolls 34 for conveyor 54 are arranged in slot-like openings 68 in longitudinal channels 69. Rolls 34 are resiliently held and journaled in contact with feed belts 63 by means of support members 49 attached to frame cross legs 71. Channels 69 are curved at 69' to define, in cooperation with feed belts 63 a transition path to turn the documents carried by conveyor 54 from a vertical to a horizontal direction. The upper portions of channels 69 are curved at 69". Curved channel portions 69" cooperate with deflectors 52 when depressed to form a transition path for routing documents from input conveyor 33 to conveyor 54.

Lower pinch rolls 34, which contact belts 63 of intermediate conveyor 54 adjacent the bottom thereof are similarly journaled by members 49 attached to discharge transport frame 86.

Inner pinch rollers 57 are rotatably supported in document guides 74 adjacent the inlet to each document tray 24. As will appear more fully, rollers 57, which are biased and journaled into contact with belts 63 by spring members 120 (FIG. 5), cooperate with deflectors 80 to route documents into document trays 24.

Referring particularly to FIGURES 1 and 4, movable finger-like deflectors 73 are provided adjacent the bottom of conveyor 54 to control the routing of documents into separating section 16 or onto discharge transport 22 for transport to a subsequent sorter module. Deflectors 73 are carried by shaft 75 journaled for limited rotation in frame support 86. Deflectors 73, when raised (the solid line position shown in FIGURES 1 and 4 of the drawings), route documents carried by conveyor 54 upwardly to module separating section 16. When depressed, deflectors 73 permit documents carried by conveyor 54 to pass onto discharge conveyor 79.

Discharge transport 22 includes a belt type conveyor 79 and cooperating pinch rolls 34. Discharge transport 22 is disposed between base 25 and cross members 29. Shafts 84, journaled in sides 85 of conveyor 79, carry support rolls 83 for feed belts 87. Pinch rolls 34 are rotatably supported in contact with feed belts 87 of conveyor 79 at spaced points along the working surface thereof by supports 49 attached to frame 86.

One roll support shaft 84' of conveyor 79 is extended and drive pulley 94 is secured thereto. Drive belt 65 drives pulley 94 from motor 66.

Document trays 24, which may be formed from a suitable sheet-like material, are substantially rectangular in shape with one side 93 upturned. As will be more apparent hereinafter, side 93 serves as both a document stop and register.

Trays 24 are supported at one end in document guides 74 while the other end is attached to wall 28.

Referring particularly to FIGURES 2 and 5 of the drawings, document guides 74 comprises a trough-like part suitably secured to frame members 30 in parallel spaced relation to one another. The inside wall 95 of each guide 74 has an inclined slot-like opening 97 therethrough adjacent the lower portion thereof adapted to receive the lower end of document tray 24. As will appear more fully documents are fed between adjacent guides 74 onto trays 24, wall 95 of guides 74 serving both as a document stop to prevent documents from sliding backwardly out of trays 24 and as a document register.

Wall 95 of guides 74 has a plurality of spaced fingers 99 projecting therefrom. Document deflectors 80, mounted on shafts 81 are arranged adjacent each tray 24. Deflector support shafts 81 are journaled for limited rotation in sides 60 of conveyor 54. Deflectors 80, when moved to a document intercepting position, cooperate with fingers 99 and pinch rollers 57 to route documents through the space between adjacent guides 74 into the tray 24 associated therewith. The uppermost deflectors 80', which are fixed in a document intercepting position route any document remaining on conveyor 54 into the tray 24" associated therewith to obviate possible carryover of documents by conveyor 54.

Document trays 24, which are arranged in parallel spaced relation to one another, are inclined upwardly. Documents in trays 24 accordingly tend to slide backwardly into registering abutment with wall 95 of the guides 74.

The angle of inclination of trays 24 is critical to the successful operation of sorter apparatus 10, it being understood that where the angle of inclination is too great, the documents, which are normally sheet paper, may sag or buckle, or may not completely pass between guides 74 into the trays. Where, however, the angle of inclination is too small, documents may not slide sufficiently to contact the guide 74 and registration is not completed.

The velocity at which documents are fed into trays 24, static electric charges on the documents themselves which tend to cause the documents to stick to one another, and the weight of the documents also affect the choice of tray angle inclination.

To forestall document sag and buckling while assuring document registration at relatively high document velocities, trays 24 are inclined at an angle of substantially 35° to the horizontal. Trays 24 are additionally tilted or canted downwardly in a plane substantially perpendicular to the plane of tray inclination toward upstanding side 93. Documents fed onto trays 24 accordingly tend to move angularly across trays 24, first in a generally upward direction under the impetus of conveyor 54 and thereafter is a generally downward direction under the influence of gravity until the lower side and bottom edges of the document contact side 93 of tray 24 and guide 74, respectively. Through this arrangement, an adjacent side and bottom edge of the documents in each tray are brought into common registration with one another.

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Solenoids 102, 103 are provided to move deflectors 52, 73, respectively, solenoid 102 serving when energized to rotate shaft 53 and depress deflectors 52 while solenoid 103 serves, when energized to rotate shaft 75 and raise deflectors 73.

Referring particularly to FIGURE 4 of the drawings shafts 81 carrying deflectors 80 are each provided with a suitable rotation limiting means, as for example, slot and pin means 105, 106, respectively. Springs 108 bias shafts 81 in a counterclockwise direction as seen in FIGURE 4 to hold deflectors 80 thereof retracted. Solenoids 110 serve, when energized, to rotate the shaft 81 associated therewith in a clockwise direction against the bias of spring 108 to place deflectors 80 thereof in a document intercepting position seen in FIGURE 4. Slot and pin means 105, 106 cooperate to limit rotation of deflectors 80 to a predetermined arc.

Referring to FIGURE 6 of the drawings, document sorter apparatus 10 may be controlled by means of a suitable programmer 115 selectively adjustable by the operator to obtain desired document sorting. Programmer 115 controls, through suitable circuitry (not shown) operation of motors 46, 66 and solenoids 102, 103 and 110.

With programmer 115 preset to obtain desired document sorting, motors 46, 66 are energized to drive input transport 18, and intermediate and discharge transports 20, 22 respectively. It is understood that where one or more secondary sorter modules 14 are employed, programmer 115 energizes the intermediate and discharge transport drive motor 66 thereof.

Motor 46 preferably drives input transport 18 at a speed which is substantially equal to the velocity at which documents are discharged by the machine with which sorting apparatus 10 is used to facilitate transfer of documents to the sorting apparatus 10. Motor 66 preferably drives intermediate transport 20 and discharge transport 22 at the relatively high design speed of sorting apparatus 10, which is normally greater than the speed at which input transport 18 is driven. This arrangement facilitates coupling of sorting apparatus 10 with document producing machines of various types and speeds by requiring only that the speed of input transport 18 be changed as needed to match the operational speed of the machine with which sorting apparatus 10 is used.

With operation of transports 18, 20, 22 of sorter module 12, input transport 18 carries documents into the sorter module. Where documents are not sorted, programmer 115 holds solenoid 102 inoperative and deflectors 52 thereof retracted. Transport 18 accordingly carries the documents to unsorted document tray 24'.

To sort documents in module 12 or in secondary sorter module or modules 14, programmer 115 triggers solenoid 102 whereby deflectors 52 are moved downwardly to a document intercepting position to route documents carried by input transport 18 onto intermediate transport conveyor 54. Documents are accordingly carried by belts 63 of conveyor 54 downwardly toward base 25 of module 12.

To feed documents to secondary module 14, programmer 115 holds solenoid 103 inoperative and deflectors 73 thereof retracted. Documents carried by conveyor 54 accordingly fed onto discharge transport conveyor 79 which in turn carries the documents from module 12 to the adjoining sorter module 14.

To sort documents in module 12, programmer 115 triggers solenoid 103 to raise deflectors 73 and route documents carried by conveyor 54 upwardly trays 24 of separating section 16 thereof. Solenoids 110 are individually triggered by programmer 115 to temporarily move the deflectors 80 associated therewith into a document intercepting position whereby an individual or series of documents may be routed from conveyor 54 into a selected tray 24. It is understood that on termination of the triggering signal from programmer 115, the

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actuated deflectors are retracted by spring 108. Where solenoids 110 are inoperative, fixed deflectors 80' routes documents from conveyor 54 into tray 24'.

Where additional sorter modules are employed, the document deflectors 80 thereof are similarly regulated by programmer 115 to obtain desired sorting of the documents therewithin.

Due to the downward cant or tilt of document trays 24, documents fed upwardly onto trays 24 by conveyor 54 tend to move or skew angularly across the tray until the document side edge abuts upturned tray side 93. Because of the upward inclination of trays 24, the impetus imparted to the documents by conveyor 54 dissipates and the documents thereafter slide in a downward direction upwardly across the tray until the document trailing edge contacts document guide wall 95. The sideways component of document movement, due to the downward cant of trays 24, tends to urge the downwardly moving document toward upturned tray side 93. It is understood that following contact of the document side edge with tray side 93, the document may continue to move downwardly within the tray until the trailing edge thereof abuts wall 95 of guide 74. By this arrangement, both the lower or trailing edge and adjoining side edge of documents in each tray 24 are automatically brought into common registration with one another.

In applications where module 12 only is employed or where secondary sorter module 14 comprises the last module, programmer 115 maintains solenoid 103 thereof energized and deflectors 73 thereof raised to prevent documents from being ejected by the discharge transport 22 thereof.

While we have described and illustrated herein a preferred form of our invention, it will be apparent to those skilled in the art that changes and modifications may be made thereto without departing from the spirit and intent thereof.

What is claimed is:

1. In a high speed apparatus for sorting documents, the combination of
 - a plurality of spaced tray-like document receiving receptacles,
 - said receptacles being parallel with one another and inclined upwardly;
 - document transport means adjacent the lower side of said receptacles adapted to feed documents upwardly into said receptacles,
 - said documents moving first in a substantially upward direction in said receptacles under the impetus of said transport means and thereafter moving in a substantially downward direction in said receptacles under the influence of gravity;
 - and document registering means for said receptacles adapted to place at least one edge of the documents in each of said receptacles in common registry, said document registering means including a document stop arranged in the path of said downward document movement and engageable with said one document edge to stop document movement and register said document.
2. The apparatus according to claim 1 in which each of said receptacles is tilted downwardly along an axis substantially transverse to the axis of said receptacle inclination whereby documents fed into said receptacles are adapted to move angularly across said receptacles in said substantially upward and downward directions, said document registering means including a second document stop engageable with a second document edge to stop sideways movement of documents in said receptacles while bringing the second edge of documents in each of said receptacles into common registry, said document second edge adjoining said document first edge.
3. The apparatus according to claim 2 in which each of said receptacles include a base portion, said first mentioned document stop comprising an upstanding wall sec-

tion at the document inlet end of said receptacle base, said transport means being adapted to impel documents over and beyond said upstanding wall section onto said receptacle base whereby movement of said documents in said substantially downward direction brings the trailing edge of said documents into registering contact with said upstanding wall section.

4. The apparatus according to claim 3 in which said second document stop comprises an upstanding wall section forming the lower side edge of said receptacle base.

5. The apparatus according to claim 1 in which said

receptacles are inclined upwardly at an angle of substantially 35°.

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EDWARD A. SROKA, Primary Examiner

U.S. Cl. X.R.

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