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⑤④ **Sheet sorters.**

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⑧④ Designated Contracting States:
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⑤⑥ References cited:
DE-A- 2 808 700
FR-A- 2 529 183
GB-A- 2 066 217

EP 0 210 045 B1

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Description

This invention relates to sheet sorters, by which is meant a device for inserting a series of identical copy sheets, such as issue from a xerographic copier, into individual bins or like receptacles. The number of bins is always equal to or greater than the number of copies, and the sorting operation is repeated as many times as is necessary to complete each set of copies, so that each bin holds a complete set.

In order to reduce the volume of the sorter, it is desirable to make the area of each bin less than the area of the sheets it is intended to house. One way of accommodating this is to arrange for each of the bins to be inclined at an acute angle to the vertical, so that the "excess" area of sheet projects beyond the respective bin. This then raises the problem of how to ensure that the projecting area of the sheet does not just flop over and interfere with sheets being fed into adjacent bins.

FR-A 2 529 183 discloses a "tower" sheet sorter having a plurality of vertically - movable substantially - horizontal trays having slight wings which cooperate with gravity to induce a shallow curve in the outer ends of sheets lying on the trays. Unlike the present invention, the sheets do not project beyond the tray ends, and are not self-supporting.

Accordingly, the present invention aims at providing a shape of bin which automatically curves each sheet as it is being fed in, so as to give the sheet sufficient beam strength for the projecting part of each sheet to be self-supporting.

The present invention therefore provides a sheet sorter which is as claimed in the appended claims.

The present invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic side view of two adjacent bins in a sorter of the present invention;

Figure 2 is a view similar to Figure 1, showing the extent to which different-sized copy sheets project beyond the top of the bin;

Figure 3 is a front elevation of the tray acting as one surface of a bin;

Figure 4 is a plan view of the tray shown in figure 3, when in its position in the sorter, and

Figure 5 is a side elevation of the tray shown in Figures 3 and 4.

The sorter of the present invention includes a horizontally-aligned series of individual tray 2, of which each has its major support surface 4 inclined at an acute angle to the vertical. At its bottom edge, each tray 2 is provided with a horizontal flanged lip 6. As shown more clearly in Figure 3, the tray is formed with two asymmetrical wings 8 and 10. Also as shown in Figure 3, the flanged lip 6 can be interrupted with a series of "cuts-out" 12, but these are not essential: both the flange 14 and the contiguous portion 16 of the lip could be continuous.

The lines 18 along which the wings 8 and 10 are folded lie at such an angle to the horizontal that the outer edges of the wings are vertical when the ma-

ior surface 4 of the tray is at its working angle to the vertical.

As shown more clearly in Figures 1 and 2, the horizontal spacing-apart between adjacent and parallel trays 2, in order to define the intermediate sheet-receiving bins 20 is such as to ensure that both wings 8 and 10 overlap the inclined wall of the opposing bin, for purposes which will be discussed below.

The sorter of this invention is intended to be of the bottom-fed type, in which aligned with the respective bin 20 is a pair of feed rolls 22 designed to expel a sheet 24 fed into the interior of bin 20, along the direction indicated by arrow 26. The output from a xerographic or other copier is normally supplied along a horizontal output path (not shown) but at one end of which is a pair of feed rolls 28. These rolls grip each sheet being fed and pass it through a pair of curved guide surfaces 30 which act to deflect the sheet 24 from the horizontal path on which it enters feed rolls 28 to a path extending in parallel with the major axis of the bin 20.

By means which are not shown, after a sheet has been fed into the respective bin, either the sheet-feed device 32 shown in Figure 1 is indexed along to the next bin, or the aligned series of trays is indexed relatively in the appropriate direction to the same effect. This process is repeated as many times as there are sheets to be sorted or bins to receive them.

In all the drawings, parts already referred to have retained their original references.

Figure 2 illustrates the mode of operation of the present invention, from which Figure some parts have been omitted for clarity. The sheet 24 being fed into bin 20 is originally planar. When its lead edge is spaced sufficiently from the feed rolls 22, the weight of the paper causes the lead edge to start to droop towards the tray 2. In so doing, one or both of its sides or corners with the lead edge come into contact with one or both of the wings 8 and 10. If the sheet being fed is of sufficiently-stiff material, it will resist assuming a more-curved shape across the width of the paper transverse to the feed direction 26 until after the lead edge has contacted the rear surface of the opposing tray. When this has happened, each sheet has the opposing tray pushing down on the centre of the lead edge, and the side edges pushed upwardly by contact with the respective wings 8 and 10, so that a curvature is induced in the sheet which increases with distance from the trail edge. The speed with which each sheet is fed into the bin 20 is such that the sheet has its trail edge completely enter the bin 20 before the force of gravity stops the upward movement of the sheet and causes it to fall down so that its trail edge comes to rest on lip 6, which tends to cause each trail edge to remain straight, whereas the lead edge has by now assumed the shape of a relatively-uniform curve. It is this change of shape of the sheet with distance from the trail edge which imparts sufficient beam strength to the sheet for those portions 34 of each sheet which project beyond the upper ends of the trays 2 to be self-supporting. In practice, it has been found that a tray of which the height is only about 150 mm will support a

sheet 425 mm in height. The relatively-small height of each bin thus renders the total volume of the sorter small, while permitting it to handle reliably the sorting of a wide range of sheet sizes, e.g. from B5 to B4 in a long-edge, first-fed, orientation, and 425 mm and A3 in a short-edge, first-fed, orientation.

It will be appreciated from the above that the relatively-simple tray shape offers the significant advantages that the larger the sheets which are fed into the bins, then the greater is the amount of curvature induced, and therefore the necessary increased beam strength. In addition, for large sheets fed short-edge first, the amount of curvature increases with distance from the trail edge, which is itself directly supported so as to locate its position and ensure that the differentially-curved sheet is not displaced by gravity from the bin by virtue of the fact that its centre of gravity is above the top surface of the bin.

Thus it will be seen that the present invention provides a sheet sorter of the bottom-fed type, in which a series of trays of identical and simple design induce curvature in sheets being fed into the bin so formed that the portions of the fed sheets which project beyond the top of the bins are self-supporting.

Claims

1. A bottom-fed upright sheet sorter, comprising a plurality of horizontally-aligned like trays (2) each having a bottom lip (16); each tray also comprising a flat sheet-contact surface (4) adjacent the lip and inclined at a relatively-small acute angle to the vertical, and wings (8, 10) extending upwardly out of the plane of the sheet-contact surface, with the lines of intersection (18) of the wings and the said surface converging with distance from the lip so that two adjacent and parallel trays define between them a sheet-receiving bin which is substantially-uniform in thickness and of which the cross-section varies from straight at the bottom lip to angled at the top thereof, the horizontal spacing between adjacent trays, and the heights of the wing tips from the sheet-contact surface, being such that each tray is partially nested within the wings of the underlying tray whereby two adjacent trays cooperate to form the lead edge of each sheet into a curve as the sheet is being fed into the bin, so that the edges, parallel to the direction of feed, of a sheet (34) fed into, and coming to rest in, a bin form an acute angle with the said surface in order to increase the beam strength of the sheet so that a significant proportion of its length may project beyond the top of its tray in a self-supporting manner.

2. A sorter as claimed in Claim 1, in which the wings of each tray are of differing area.

3. A sorter as Claim 1 or 2, in which the lines of intersection of the wings and the said surface meet the outer edges of each tray at different distances from the bottom lip, and in which the angle between each wing and the sheet-contact surface is such that the upright edge of each wing lies in a substantially-vertical plane.

4. A sorter as claimed in any preceding claim, in

which the sheet-contact surface of each tray has in it a substantially-rectangular recess in the form of an indent (4) in its upper edge.

5 Patentansprüche

1. Ein an der Unterseite zugeführter, aufrechter Blattsortierer mit einer Mehrzahl horizontal angeordneter, gleicher Körbe (2), die jeweils eine untere Lippe (16) besitzen; wobei jeder Korb eine flache Blattkontaktoberfläche (4) umfaßt, die an die Lippe anliegt und unter einem relativ kleinen, spitzen Winkel zur Vertikalen geneigt ist, und wobei sich Flügel (8, 10) nach oben aus der Ebene der Blattkontaktoberfläche erstrecken, wobei die Schnittlinien (18) der Flügel mit der Oberfläche mit dem Abstand von der Lippe konvergieren, so daß zwei aneinander liegende und parallele Körbe zwischen sich einen Blattempfangsbehälter bilden, der im wesentlichen von gleichmäßiger Dicke ist und dessen Querschnitt von gerade an der unteren Lippe bis gewinkelt an seiner Oberseite variiert, wobei die horizontalen Abstände zwischen aneinander liegenden Körben und die Höhen der Flügelspitzen von der Blattkontaktoberfläche derart sind, daß jeder Korb teilweise zwischen den Flügeln des darunterliegenden Korbs verschachtelt ist, wodurch zwei aneinanderliegende Körbe zusammenwirken, um eine Führungskante für jedes Blatt in einer Kurve zu bilden, während das Blatt in den Behälter zugeführt wird, so daß die zu der Zufuhrichtung parallelen Kanten eines eingeführten und im Behälter zur Ruhe gekommen Blatts (34) einen spitzen Winkel mit der Oberfläche bilden, um die Tragstärke des Blatts zu erhöhen, so daß ein beträchtlicher Teil seiner Länge über die Oberseite seines Korbes selbsttragend herausragen kann.

2. Ein Sortierer nach Anspruch 1, bei dem die Flügel jedes Korbs von verschiedener Fläche sind.

3. Ein Sortierer nach Anspruch 1 oder 2, bei dem die Schnittlinien der Flügel und dieser Oberfläche die äußeren Kanten jedes Korbs an verschiedenen Abständen von der unteren Lippe treffen und bei dem der Winkel zwischen jedem Flügel und der Blattkontaktoberfläche derart ist, daß die aufrechte Kante jedes Flügels in einer im wesentlichen vertikalen Ebene liegt.

4. Ein Sortierer nach einem der vorhergehenden Ansprüche, bei dem die Blattkontaktoberfläche jedes Korbs in sich eine im wesentlichen rechtwinklige Vertiefung in der Form einer Kerbe (4) in ihrer oberen Kante aufweist.

55 Revendications

1. Trieuse verticale de feuilles à introduction par le bas, comprenant une multitude de plateaux (2) identiques, en alignement horizontal, chacun ayant une lèvre inférieure (16); chaque plateau comprenant aussi une surface plate (4) de contact avec les feuilles qui est contiguë à la lèvre et inclinée suivant un angle aigu relativement petit par rapport à la verticale, et des ailes (8, 10) s'étendant vers le haut du plan de la surface de contact avec les feuilles, les lignes d'intersection (18) des ailes et la-

dite surface convergeant avec la distance par rapport à la lèvre de sorte que deux plateaux adjacents et parallèles définissent entre eux un casier de réception de feuilles dont l'épaisseur est sensiblement uniforme et dont la section transversale varie pour passer d'une forme rectiligne à la lèvre inférieure à une position inclinée à sa partie supérieure, l'espacement horizontal entre plateaux adjacents, et les hauteurs des extrémités des ailes par rapport à la surface de contact avec les feuilles, étant tels que chaque plateau repose partiellement à l'intérieur des ailes du plateau sousjacent, d'où il résulte que deux plateaux contigus coopèrent pour conférer au bord avant de chaque feuille une courbe alors que la feuille est introduite dans le plateau, de sorte que les bords, parallèles au sens d'introduction, d'une feuille (34) introduite dans un plateau, et amenée à reposer dedans, forment un angle aigu avec la surface dans le but d'augmenter la rigidité de la feuille de façon qu'une partie importante de sa longueur puisse être en saillie au-delà du sommet de son plateau d'une façon auto-porteuse.

2. Trieuse selon la revendication 1, dans laquelle les ailes de chaque plateau ont une surface différente.

3. Trieuse selon la revendication 1 ou 2, dans laquelle les lignes d'intersection des ailes et la surface rencontrent les bords extérieurs de chaque plateau à des distances différentes par rapport à la lèvre inférieure, et dans laquelle l'angle entre chaque aile et la surface en contact avec les feuilles est tel que le bord vertical de chaque aile se trouve dans un plan sensiblement vertical.

4. Trieuse selon l'une quelconque des revendications précédentes, dans laquelle la surface en contact avec les feuilles de chaque plateau comporte un évidement sensiblement rectangulaire ayant la forme d'une échancrure (4) ménagée dans son bord supérieur.

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Fig. 1.

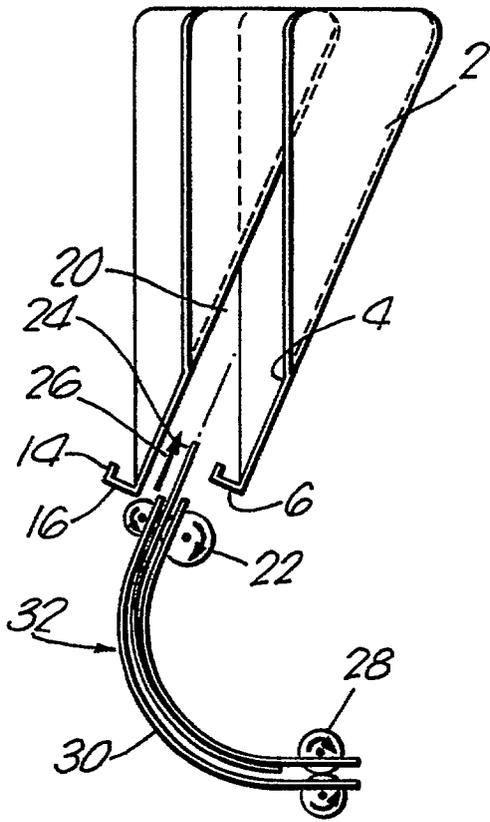


Fig. 2.

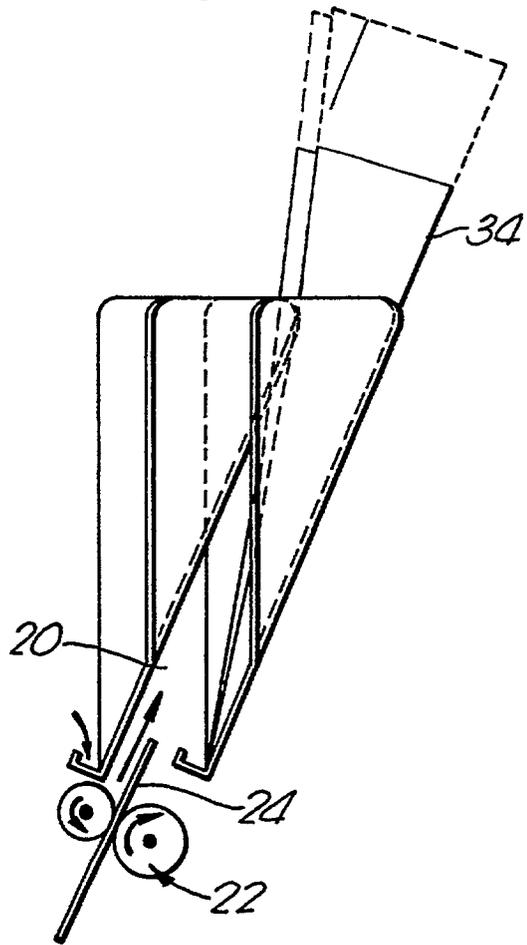
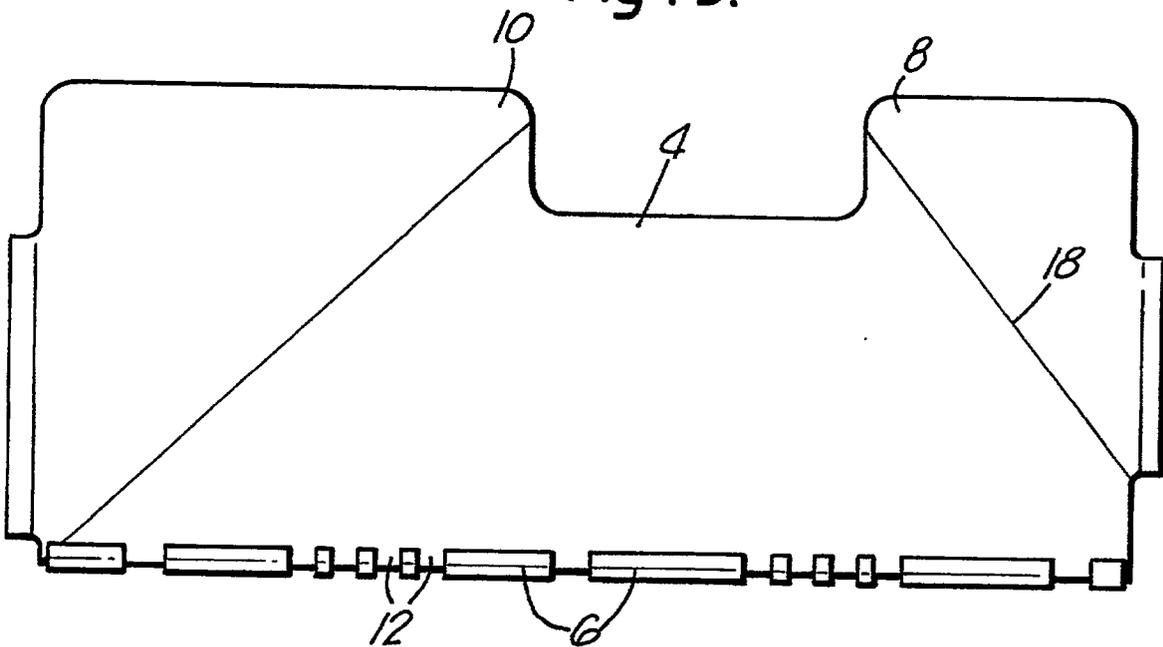


Fig. 3.



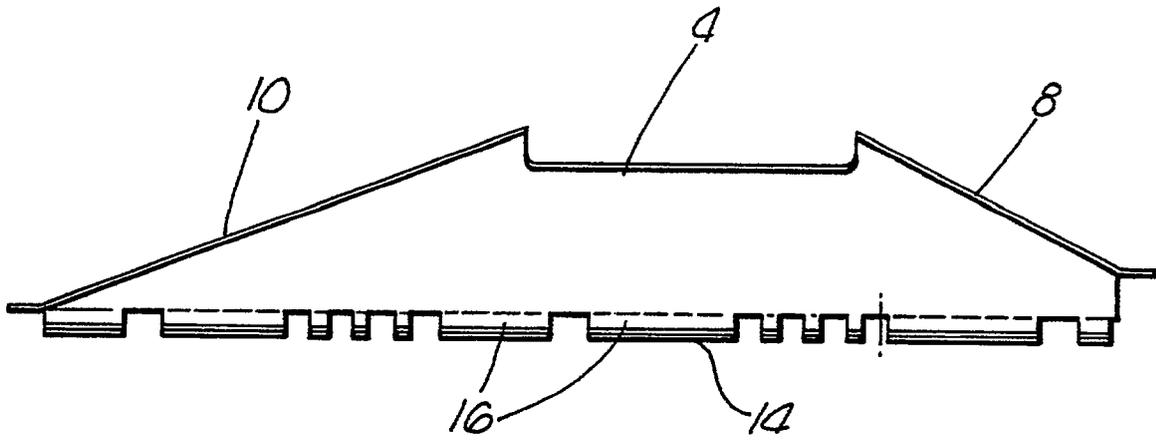


Fig . 4.

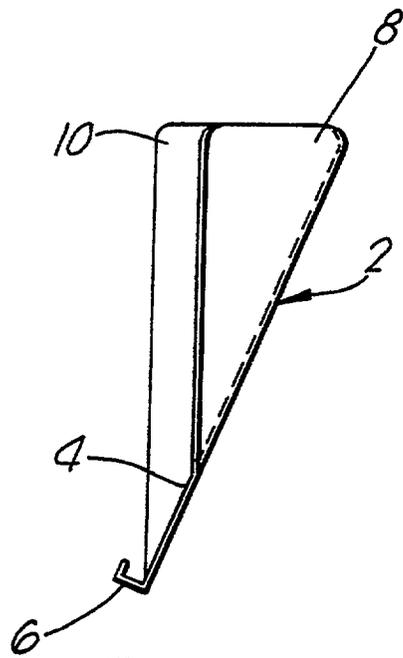


Fig . 5.