

March 23, 1965

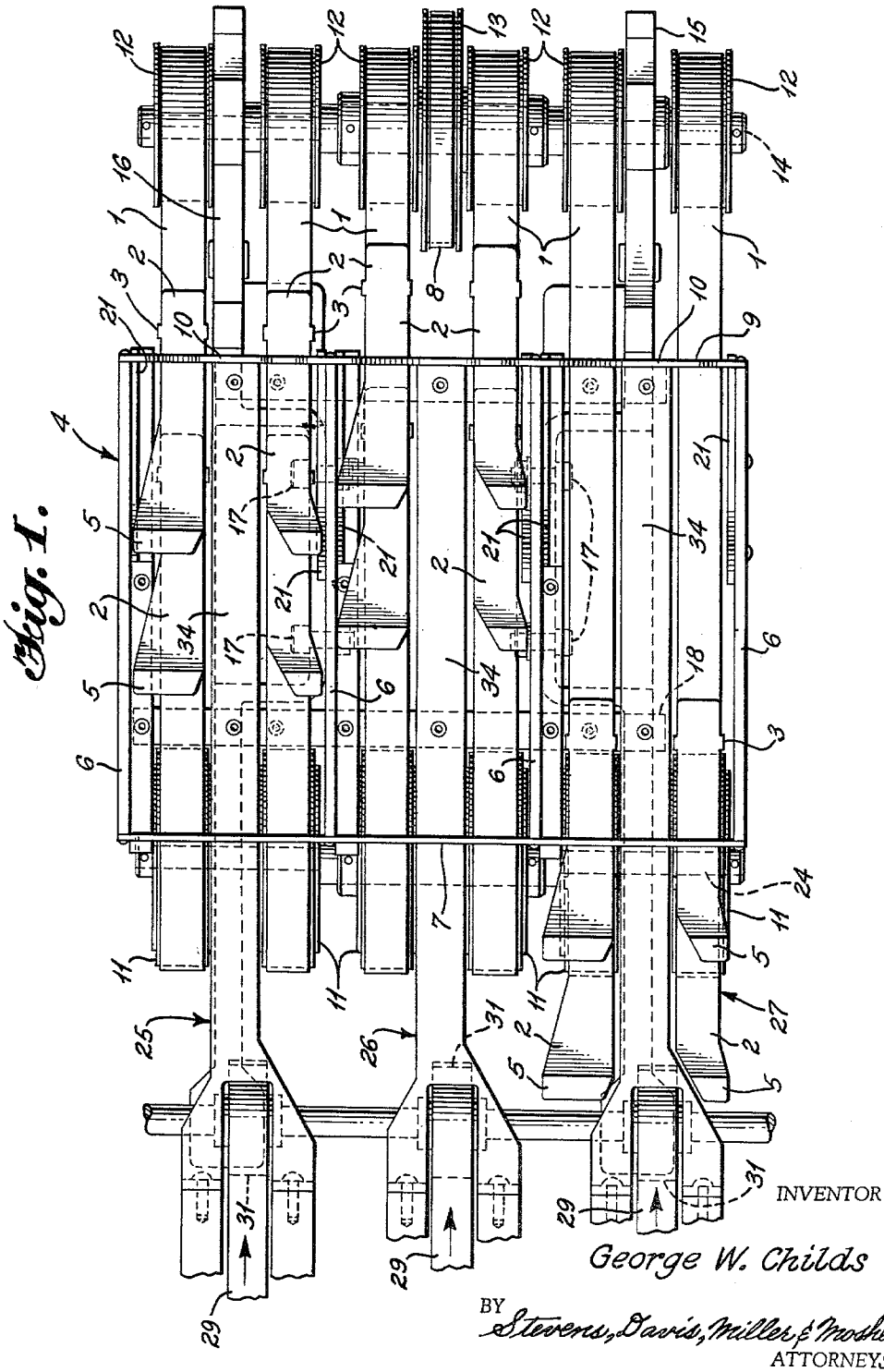
G. W. CHILDS

3,174,749

SHEET STACKING DEVICE

Filed March 16, 1961

4 Sheets-Sheet 1



March 23, 1965

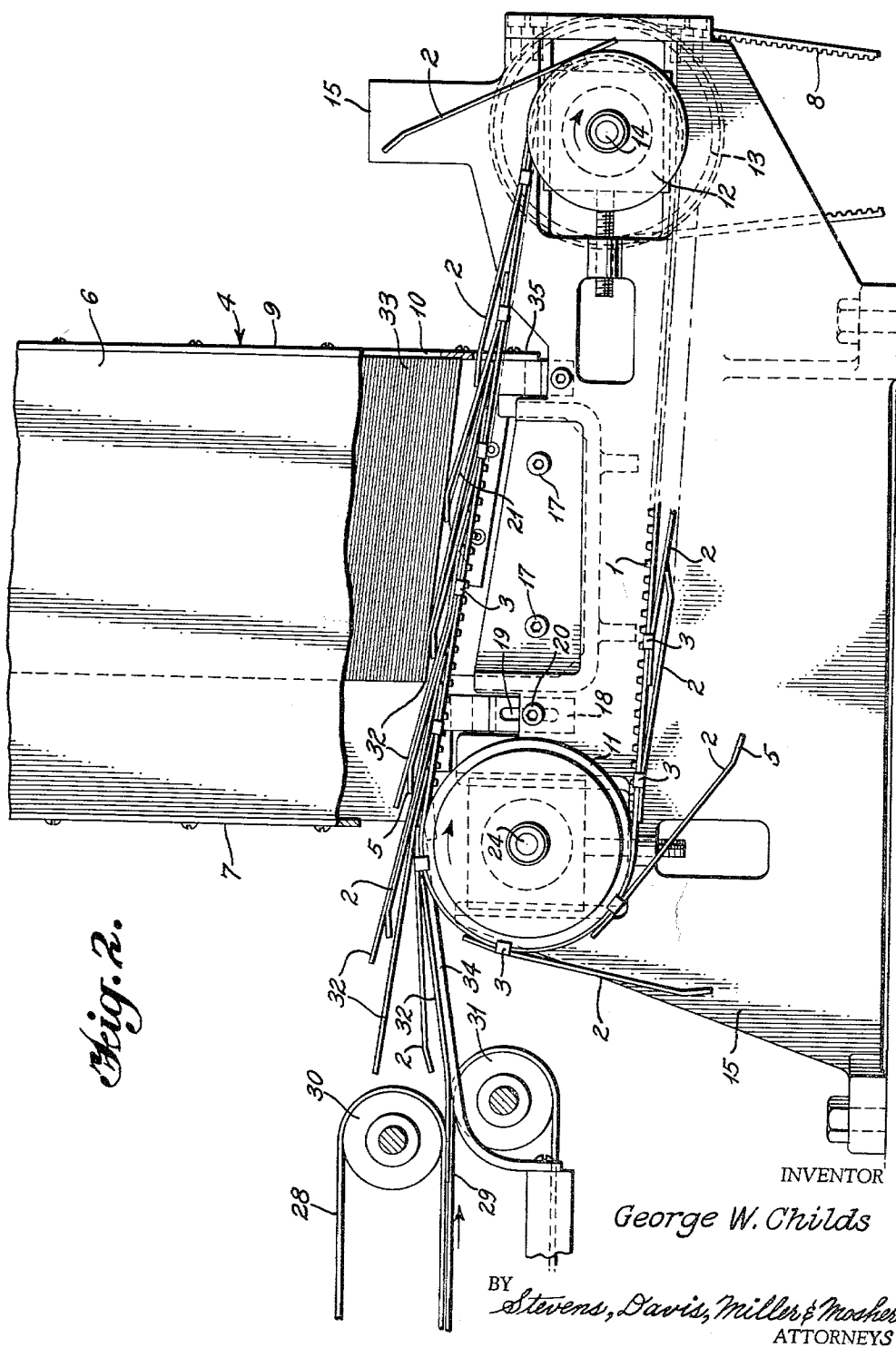
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3,174,749

SHEET STACKING DEVICE

Filed March 16, 1961

4 Sheets-Sheet 2



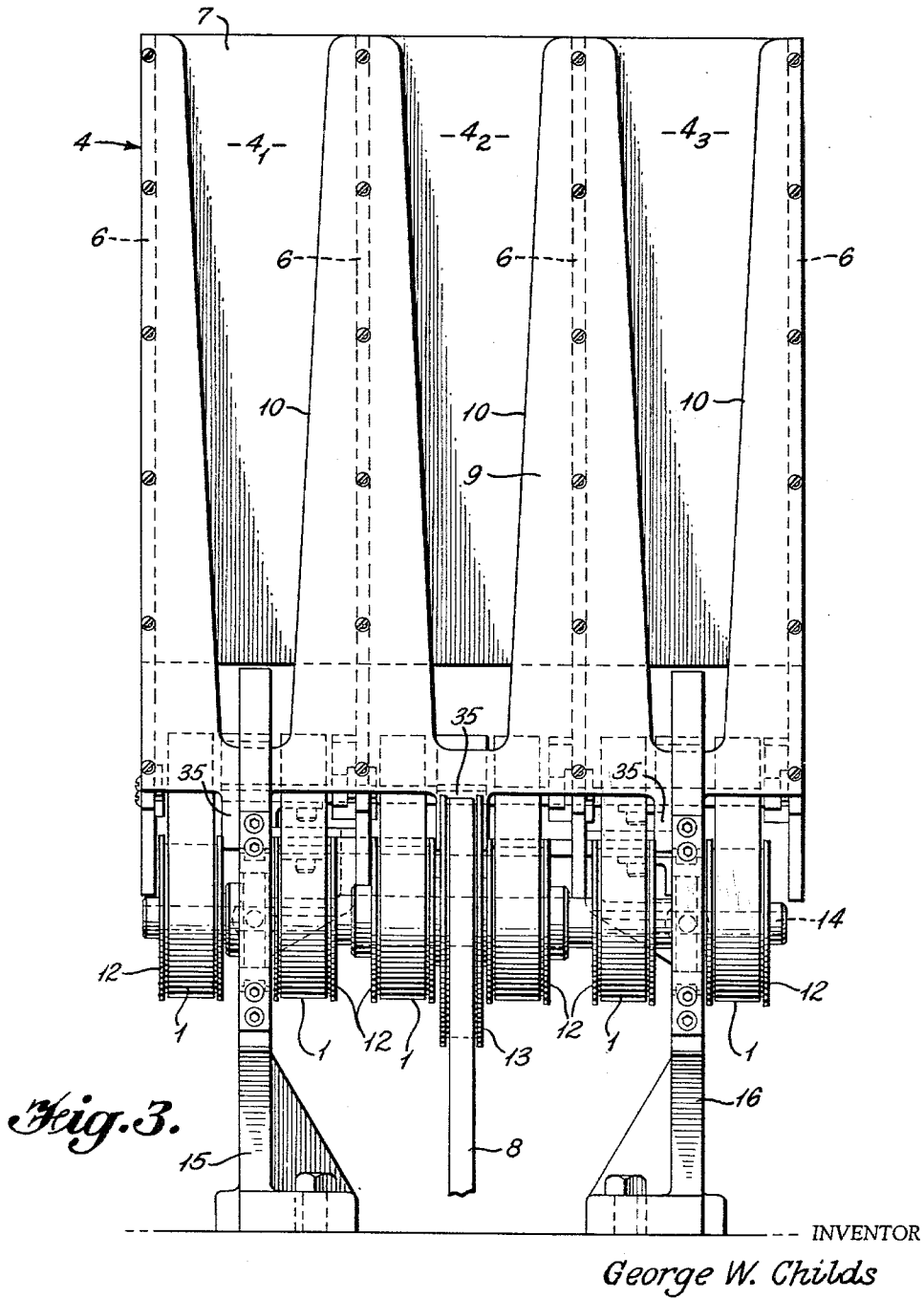
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SHEET STACKING DEVICE

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4 Sheets-Sheet 3



BY
Stevens, Davis, Miller & Mosher
ATTORNEYS

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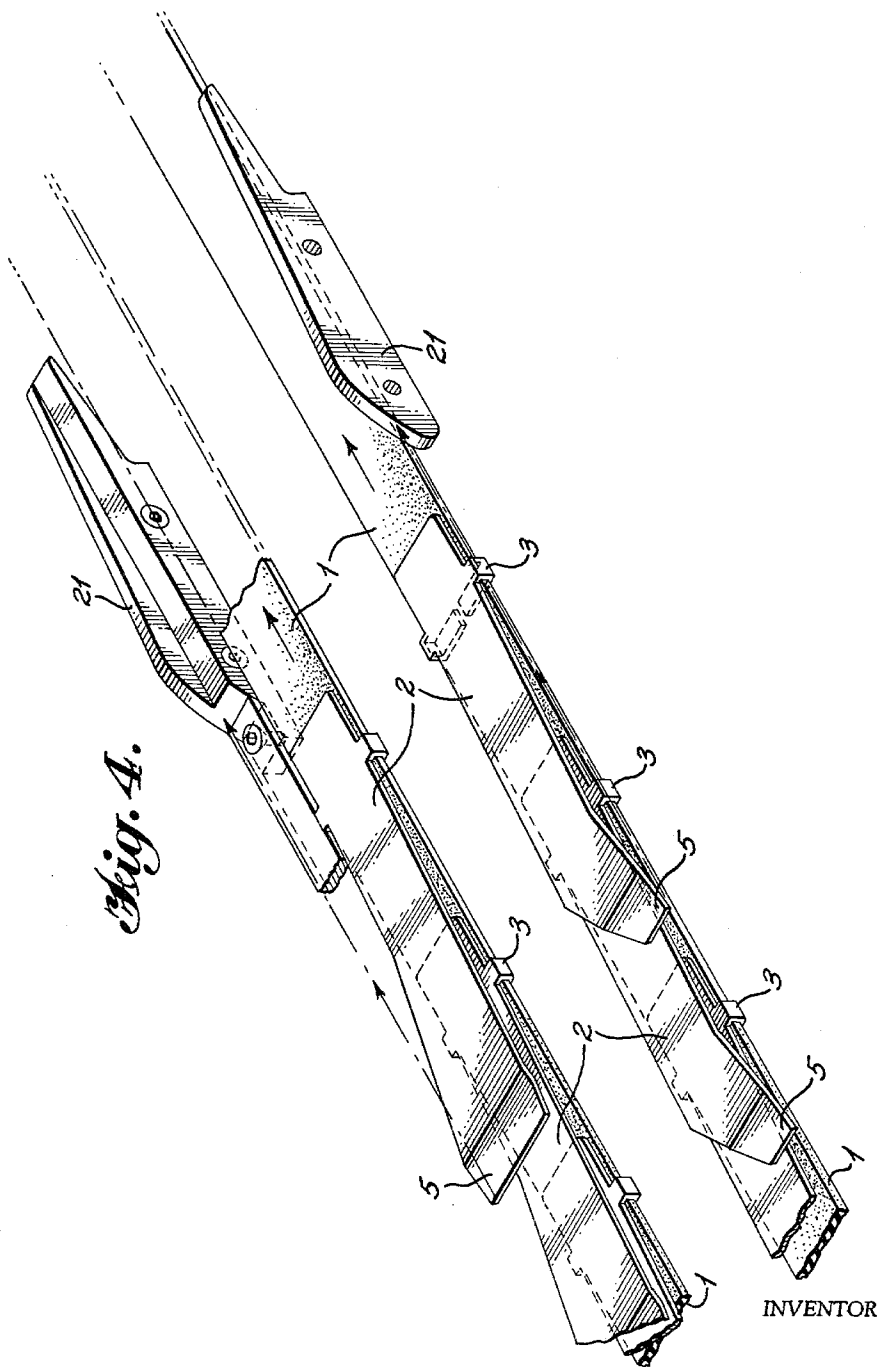
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SHEET STACKING DEVICE

Filed March 16, 1961

4 Sheets-Sheet 4



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3,174,749

SHEET STACKING DEVICE

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5 Claims. (Cl. 271—68)

The present invention relates to material handling assemblies and more particularly to a sheet stacking assembly for stacking sheets received from an associated apparatus. Although the sheet stacking device of the present invention may be employed with a wide variety of sheet-type materials, it is particularly applicable to paper sheet materials, such as checks or invoices.

There are many instances where flexible sheets, such as checks, invoices, telegrams, etc., must be stacked at a high rate of speed, yet remain in order and be easily accessible during the stacking operation. For example, in the field of character reading, documents in the form of flexible sheets, which contain information printed in magnetic ink, can be passed through a character reading station to obtain a "reading" of the information thereon. The "read" information may then be used as the basis for mechanically directing the individual sheets selectively into a plurality of depositories to effect a sorting of the sheets into various groups. These depositories must be capable of accepting and storing said sheets at a rate of speed which at least equals the speed of the prior operations, such as, for example, "reading" and sorting. The depository must also be capable of stacking the sheets in the order in which they are received with easy accessibility for removal of the sheets during the operation of the stacker, for use, for example, in a second sorting apparatus. The present invention is designed to perform these functions.

It is an object of this invention to provide a sheet stacking apparatus capable of entering individual sheets of material, such as paper, at the bottom of a stack of sheets.

It is a further object of this invention to provide a sheet stacking apparatus capable of performing a stacking operation at very high speed.

It is a still further object of this invention to provide a sheet stacking device in which an operator may safely remove accumulations of the stacked sheets while the stacking operation is in progress.

In accordance with the present invention there is provided a plurality of belts, each of which includes a plurality of clip plates having an outwardly extending lip. The clip plates are arranged along each belt so that they lie flat against the belt, one clip plate overlapping the next in a clamping position when the portion of the belt to which each clip plate is attached has a substantially infinite radius of curvature. As the belts curve about the perimeter of a set of pulleys and assume a finite radius of curvature, the clip plates remain tangent to the belt at their points of attachment, the remaining portion of the clip plate projecting out away from the belt and in a non-clamping position with the following clip plate. The amount of opening between the clip plates will depend upon the radius of curvature of the pulleys.

Incoming sheets are positioned between two adjacent clip plates as they assume the non-clamping position while traveling around the pulley. As the belt straightens out, the sheets become clamped between two successive clip plates which then assume their clamping position and travel along in the clamped position beneath the front wall of a pocket or bin for storing the sheets and beneath the stack of sheets already in the pocket. When the leading edge of the sheet is positioned at the rear end of the pocket, the outwardly extending lip on the forward or top clip plate rides over a cam, thereby lifting the top

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plate out of a clamping engagement with the sheet. The forward movement of the sheet is then stopped by a downwardly extending projection on the rear wall of the pocket, thereby allowing the sheet to be positioned at the bottom of the stack within the pocket.

The above and still further objects of the invention will become apparent upon consideration of the following detailed description of a specific embodiment thereof, especially when taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a top view of the invention;

FIGURE 2 is a side view of the invention;

FIGURE 3 is an end view of the invention; and

FIGURE 4 is an enlarged view of a portion of the belt, the clip plates and the cam.

Referring to FIGURES 1 to 4, there is shown a plurality of flexible belts 1 each being provided with a plurality of clip plates 2. The clip plates 2 are fastened to the belt 1 by a fastener 3 by bending the arms of the fastener 3 down and around the belt 1 to maintain the clip plates 2 in a fixed relationship with the portion of the belt 1 to which they are fastened, the clip plates 2 being positioned at predetermined distances from each other so that each clip plate 2 is capable of overlapping a portion of the clip plate 2 immediately behind it. The clip plates 2 are tightly secured to the belt 1 so that each clip plate 2 will always lie in a plane tangent to the belt 1 at the fasteners 3. A particular clip plate 2 can be made to extend outwardly from the belt 1 by introducing a finite radius of curvature into that portion of the belt at which the clip plate 2 is fastened by its fastener 3. In this manner two successive clip plates 2 will act as a clamp and be capable of holding materials, such as sheets, between them when a substantially infinite radius of curvature is introduced into the portion of the belt 1 wherein the said two successive clip plates 2 lie, since the plane tangent to the belt 1 would be parallel to the belt 1. When, on the other hand, the portion of the belt 1 on which the forward one of said two successive clip plates 2 lies has a finite radius of curvature introduced thereto, the plane in which said forward clip plate 2 lies will be along the belt 1 only at the fasteners 3, the forward clip plate 2 thereby ceasing to be in clamping relation with the following clip plate 2. Each clip plate 2 is provided with an outwardly extending lip portion 5 for reasons to be set forth later.

Supports 34 (FIGURE 1) are positioned between the two belts 1 in each channel 25, 26 and 27 to prevent excessive slack in the belts 1 from the downward force exerted by the stack 33 of sheets in the bin 4. The supports 34 may also be curved downwardly at their forwardmost points to aid in the positioning of the sheets 32 between two clip plates 2.

The belt 1 is positioned about and in frictional engagement with the pulleys 11 and 12. An external source (not shown) imparts motion to the timing belt 8 which in turn rotates a pulley 13 secured to the shaft 14. The shaft 14 supplies the power for the rotational movement of the pulleys 12, said pulleys 12 thereby imparting movement to the belt 1. The power source may be designed to operate at predetermined speeds which will cause the belt 1 to move at the speeds required to open the clip plates 2 for insertion of the sheets 32 in synchronism with the rate at which the incoming sheets are being delivered.

Two such belt and pulley devices are provided in each channel 25, 26 and 27 and bins 4₁, 4₂ and 4₃, all of said pulley devices 11 and 12 operating on the same shafts 14 and 24 and thereby being powered by the same source.

The bins 4 are positioned above a portion of the belts 1, each bin 4 comprising two side walls 6, some of said side walls 6 being common to two bins 4 and a front wall

7 raised a slight distance above the belts 1 at its lowermost portion to permit passage of the belts and the sheets 32 clamped thereto by the clip plates 2. Each of the bins 4 further includes a rear wall 9 provided with a vertical tapered slot 10 for facilitating manual removal of the sheets 32 accumulated therein. The bins 4 are secured to the panels 15 and 16 by the bolts 17.

A downwardly extending projection 35 is provided in the rear wall 9 of each channel 25, 26 and 27 between and below the two belts 1 positioned in each said channel to halt the forward movement of the sheets 32 as they pass into the bottom portion of the bin 4.

A plurality of cam surfaces 21, one for each belt 1, are positioned on the stacker frame within the rear wall 9 of the bin 4 and on the side of each belt whereon the projecting lip 5 extends, the top surface of each of said cams lying a predetermined distance above the top surface of the belt 1. The cam 21 is positioned so that the projecting lip 5 of each clip plate 2 will ride up over the cam once during each revolution of the belt 1, thereby causing the forward clip plate 2 to be raised out of clamping engagement with the following clip plate.

An angle support 18 is also provided which is secured to the frame of the stacker and is vertically adjustable within the slot 19 by means of the bolt 20 to adjust the angle of supports 34 at the bottom of the bin 4.

In operation, flexible sheets 32 are conveyed to the feed point of the stacker by a dual belt 28, 29 and pulley 30, 31 arrangement shown in FIGURE 2. The sheets 32 are fed between two clip plates 2 which are in the non-clamping position due to their excursion around the pulley 11. The sheets entering the clip plates are carried by their own inertia to the base of the clip plate resting above the sheet at which point it is halted by contact with the clip plate base. As the belt 1 ceases to be in contact with the pulley 11, the radius of curvature of the belt 1 becomes substantially infinite. Accordingly, the clip plates 2 which are fastened to the belt 1 in advance of the pulley 11 will lie tangent to the belt and clamp the sheet 32 between itself and the clip plate 2 immediately behind.

It should be noted that two such belt mechanisms are provided in each channel. These mechanisms work together as one, a clip plate on one belt corresponding to a clip plate on the second belt, each of the corresponding clip plates being in the same horizontal plane. Thereby, an incoming sheet may be clamped by the clip plates on one belt or on both belts simultaneously without danger of mutilating the sheet.

As the belts 1 continue their movement in the clockwise direction, the clamped sheets 32 are carried within the bin 4 under the stack 33 of sheets already accumulated therein. A support 34 is provided to prevent excessive slack in the belt 1 due to the downward force of the stack 33 of sheets in the bin 4. As the forward clip plate 2 approaches the rear wall 9 of the bin 4 the lip 5 thereon rides over a cam 21 forcing the clip plate to ride upward on the cam and thereby causing said clip plate to cease to be in clamping relationship with the clip plate immediately beneath it. The sheet 32 is then impinged against a downwardly extending projection 35 on the rear wall 9 which forces the sheet to end its forward movement and come to rest at the bottom of the stack 33.

The belt 1 then continues on its journey around the pulley 12. The stacked sheets may be manually removed from the bins at any time with the aid of the slots 10 cut in the rear wall 9 thereof.

The clamping action described supra can also be carried out by positioning the clip plates at predetermined positions about the belt. However, the clip plates are sufficiently distant from each other so that the clamping of the incoming sheets will take place between a clip plate and the belt rather than between two clip plates.

It should be noted that this system could also operate efficiently with only one belt in each channel rather

than two. The system can also operate under unsynchronized conditions with but minor changes in the above system.

Although the invention has been described with respect to a specific embodiment, many variations will be obvious to those skilled in the art. Accordingly, it is the intention to be limited only as indicated by the scope of the following claims which are to be interpreted as broadly as possible in view of the prior art.

What is claimed is:

1. A device for stacking flexible sheets comprising a flexible belt, a plurality of clip plates, each of said clip plates being positioned at predetermined positions on said flexible belt to lie in overlapping clamping relationship with one of its adjacent clip plates when a portion of said flexible belt is in a first predetermined position, said clip plates being in a non-clamping relationship when said flexible belt is in a second predetermined position, each of said clip plates including an outwardly extending lip portion, means to continuously drive said flexible belt so that each portion thereof is continuously transported between said first and second predetermined positions, means to insert between the clip plates said flexible sheets as the clip plates pass said second predetermined position, cam means for momentarily removing said clip plates from a clamping relation by contacting the lip portion thereof as they pass a point on a path adjacent a bin for storing stacked flexible sheets, said bin including a downwardly extending projection on a wall thereof which forces the flexible sheet, carried by said clip plates, to end its forward movement and come to rest in the bin, as the cam means momentarily removes said clip plates from a clamping relation.

2. A device for stacking flexible sheets comprising a flexible belt, a plurality of clip plates, each of said clip plates being positioned at predetermined positions on said flexible belt to lie in overlapping clamping relationship with one of its adjacent clip plates when a portion of said flexible belt is in a first predetermined position, said clip plates being in a nonclamping relationship when said flexible belt is in a second predetermined position, each of said clip plates including an outwardly extending lip portion, means to continuously drive said flexible belt so that each portion thereof is continuously transported between said first and second predetermined positions, means to insert between the clip plates said flexible sheets as the clip plates pass said second predetermined position, cam means for momentarily removing said clip plates from a clamping relation by contacting the lip portion thereof as they pass a point on a path adjacent a bin for storing stacked flexible sheets, said bin including an extending projection on a wall thereof which forces the flexible sheet, carried by said clip plates, to end its forward movement and come to rest in the bin, as the cam means momentarily removes said clip plates from a clamping relation.

3. A device for stacking flexible sheets comprising a flexible belt, a plurality of clip plates, each of said clip plates being positioned at predetermined positions on said flexible belt to lie in overlapping clamping relationship with one of its adjacent clip plates when a portion of said flexible belt is in a first predetermined position, said clip plates being in a nonclamping relationship when said flexible belt is in a second predetermined position, each of said clip plates including an outwardly extending lip portion, means to continuously drive said flexible belt so that each portion thereof is continuously transported between said first and second predetermined positions, means to insert between the clip plates said flexible sheets as the clip plates pass said second predetermined position, cam means for momentarily removing said clip plates from a clamping relation by contacting the lip portion thereof as they pass a point on a path adjacent a bin positioned above said flexible belt, for storing stacked flexible sheets, said bin including a downwardly extending projection on a wall thereof which forces the flexible sheet, carried by

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said clip plates, to end is forward movement and come to rest in the bin, as the cam means momentarily removes said clip plates from a clamping relation.

4. A device comprising a flexible member, a plurality of clip plates, each of said clip plates being positioned at predetermined positions on said flexible member to lie in overlapping clamping relationship with one of its adjacent clip plates when a portion of said flexible member is in a first predetermined position, said clip plates being in non-clamping relationship when a portion of said flexible member is in a second predetermined position, each of said clip plates including an outwardly extending lip portion and cam means for contacting said lip portion to remove said clip plates from clamping relationship as they pass a point on a path adjacent a bin for storing stacked flexible sheets, said bin including a projection extending from a wall thereof which forces the flexible sheet, carried by said clip plates, to end its forward movement and come to a rest in the bin, as the cam means momentarily removes said clip plates from a clamping relation.

5. A device comprising a flexible member, a plurality of clip plates, each of said clip plates being positioned at predetermined positions on said flexible member to lie in overlapping clamping relationship with one of its adjacent clip plates when a portion of said flexible member is in a first predetermined position, said clip plates being in non-

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clamping relationship when a portion of said flexible member is in a second predetermined position, each of said clip plates including an outwardly extending lip portion and cam means for contacting said lip portion to remove said clip plates from clamping relationship as they pass a point on a path adjacent a bin positioned above said flexible member for storing stacked flexible sheets, said bin including a downwardly extending projection from a wall thereof which forces the flexible sheet, carried by said clip plates, to end its forward movement and come to a rest in the bin, as the cam means momentarily removes said clip plates from a clamping relation.

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