Oct. 5, 1965 H. T. HAWKES 3,209,931

SHEET TRANSFER METHOD

Original Filed July 2, 1957 2 Sheets-Sheet 1

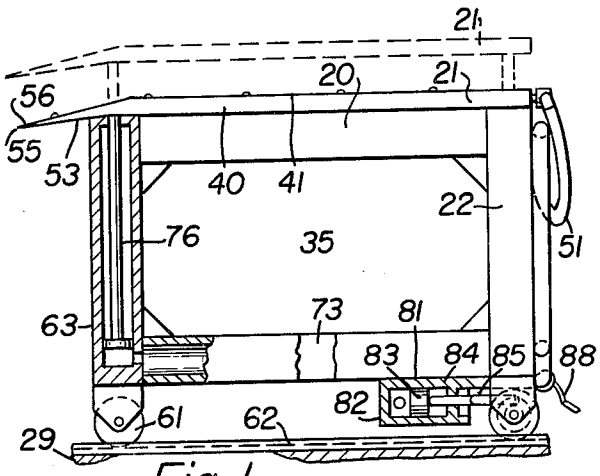


Fig. 1.

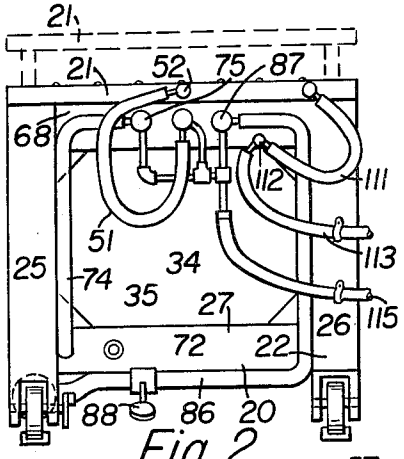


Fig. 2.

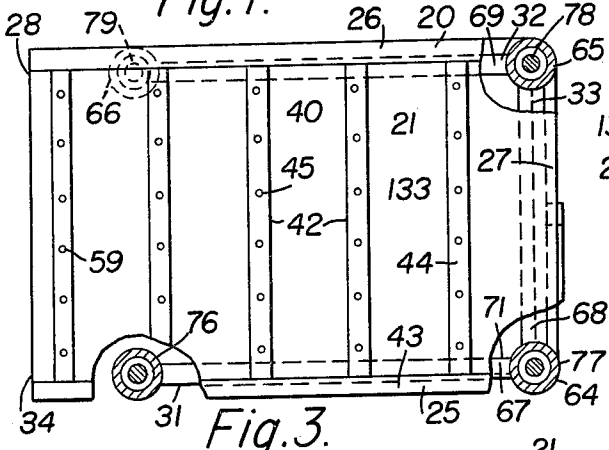


Fig. 3.

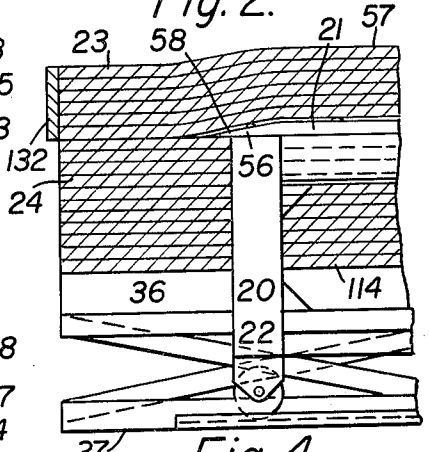


Fig. 4.

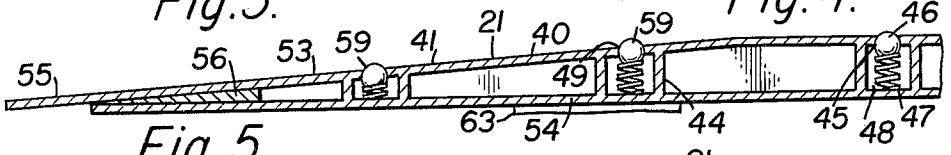


Fig. 5.

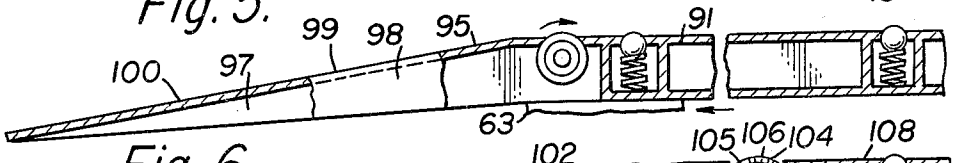


Fig. 6

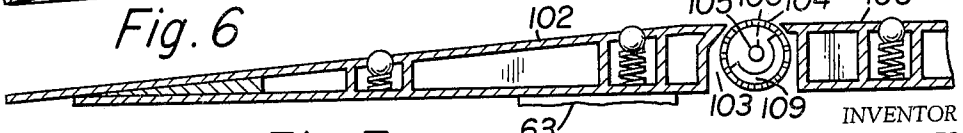


Fig. 7.

INVENTOR
HOWARD THEODORE HAWKES

BY Pearson + Pearson

ATTORNEYS

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SHEET TRANSFER METHOD

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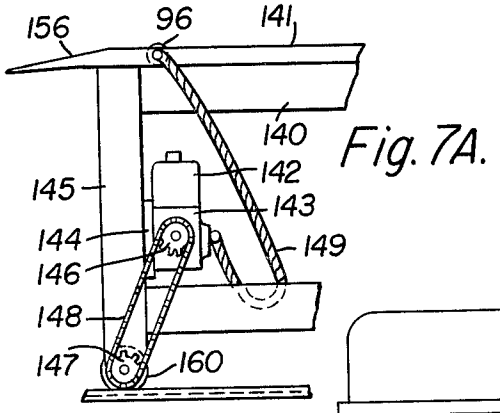


Fig. 7A.

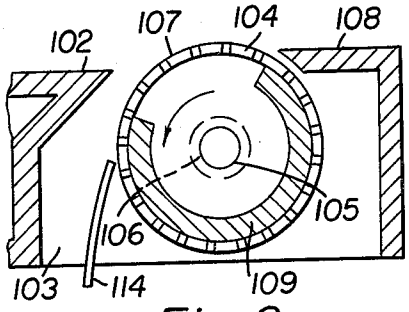


Fig. 8.

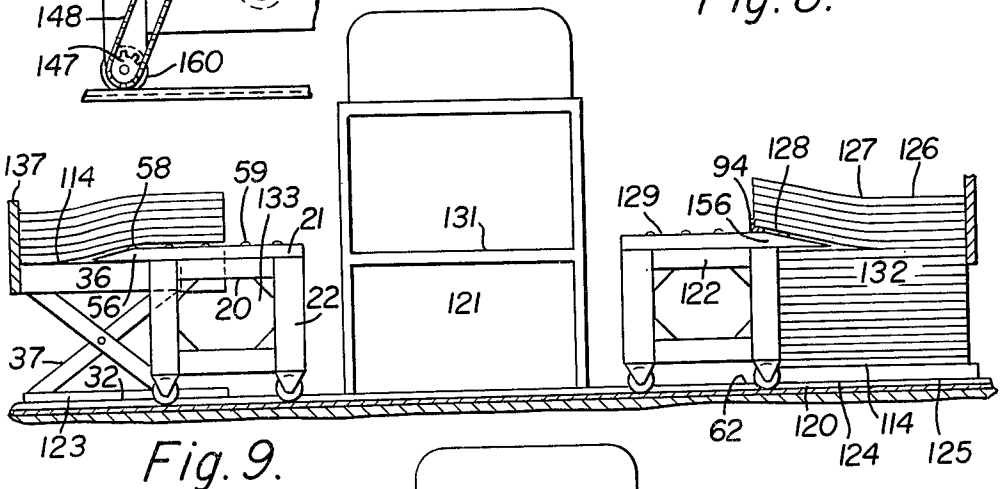


Fig. 9.

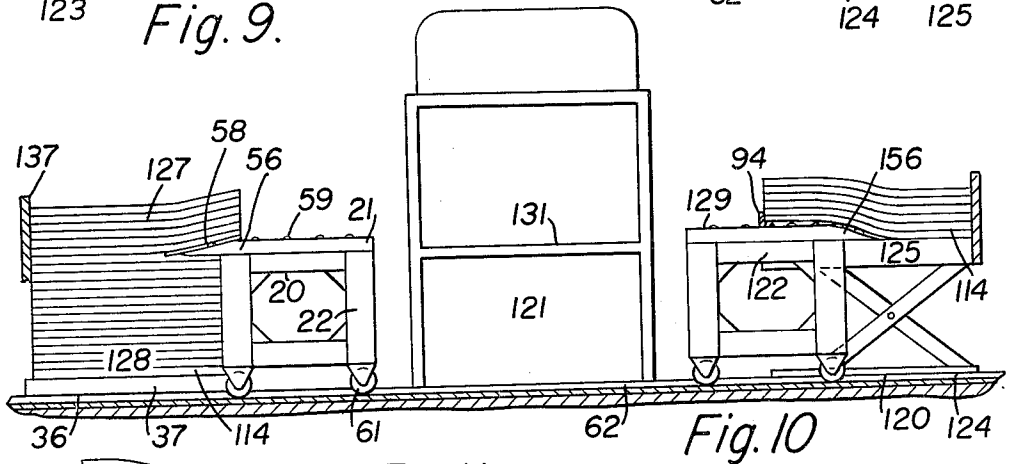
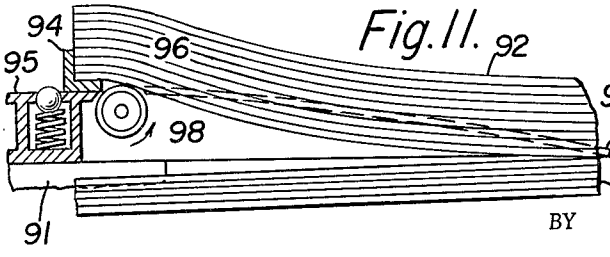


Fig. 10

Fig. 11.



INVENTOR
HOWARD THEODORE HAWKES

BY Pearson & Pearson

ATTORNEYS

United States Patent Office

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SHEET TRANSFER METHOD

Howard Theodore Hawkes, Cape Elizabeth, Maine, assignor to Southworth Machine Company, Portland, Maine, a corporation of Maine

Original application July 2, 1957, Ser. No. 669,555. Divided and this application June 24, 1959, Ser. No. 827,672

3 Claims. (Cl. 214—152)

This invention relates to an improved method for unstacking and restacking piles of flexible sheets, whereby each pile may be individually treated. It is particularly directed to an improved transfer method for use in feeding piles of paper sheets to a guillotine type trimmer and delivering the trimmed piles to a restacking location. This application is a division of my copending application, Serial No. 669,555, filed July 2, 1957 and entitled "Sheet Transfer Apparatus."

It has heretofore been proposed to use a pair of horizontally movable tables, each having a plurality of pressure sensitive air nozzles in the upper face thereof, one table for unstacking and feeding a paper trimmer, the other table for unloading the trimmer and restacking. Such tables have had downwardly foldable extensions with blunt ends for increasing the area of the table top but there have been no air nozzles in such extensions. Such tables have had leg members or supports under all four sides of a rectangular table top and the table top has been of opaque material.

It has also been proposed in U.S. Patent No. 2,089,890 to Graf, issued August 10, 1937 to provide a sheet piler buggy, or transfer table, of inverted U-shaped construction arranged to straddle a separate propelling unit and having a rotatable top for supporting a removable pallet or platform.

It has been the custom in the paper industry to locate a stack of sheets on a pallet near a paper trimmer with the pallet resting on a lift table and the lift table in a low position. An empty pallet has been mounted on another lift table near the trimmer with the lift table in a high position. The feed transfer table has then been rolled on tracks from the trimmer up to the stack and at least two operators have had to manually segregate the topmost pile of sheets from the stack and slide the same manually onto the air cushion top of the transfer table. The feed transfer table has then been rolled up to the trimmer where the trimmer operator can slide the pile into the trimmer. Meantime the lift table supporting the stack has been raised to position the next successive top pile at the height of the top of the transfer table.

After trimming, the trimmed pile has been slid from the trimmer onto the air cushion of a delivery transfer table and the delivery transfer table has been rolled on tracks up to the empty pallet and its lift table. At least two operators have then had to manually slide the trimmed pile off the air cushion table top onto the pallet and up against a jogging board. It has been most difficult to secure a neat stack on the empty pallet in view of the drop off the blunt end of the table and the lateral forces exerted on the pile to move it off the table. Usually there is a single sheet of less valuable paper under each stack or pile for receiving any slide marks or for receiving wax marks from the bed of the trimmer and it has been difficult to strip this sheet after trimming without disturbing the integrity of the pile carried thereon. The lift table supporting the originally empty pallet is lowered after the deposit thereon of each successive trimmed pile to the level required for receiving the next successive trimmed pile.

The principal object of this invention is to provide an improved method for unstacking, trimming and restacking piles of flexible sheets which reduces the number of operators required and enables sheets of large area to be transferred by a single unstacking operator and a single restacking operator.

Another object of the invention is to provide a method for unstacking a stack of untrimmed sheets, pile by pile, on a portable, pile-transfer table, the method including the step of straddling the stack with the table while the topmost pile is segregated onto the table top and then unstraddling the table from the stack while the segregated pile is carried thereby to the trimmer.

A further object of the invention is to provide a method of transferring a pile from the top of a stack wherein the topmost pile is rotatably and frictionally drawn onto a support as the support advances underneath the pile to segregate the same.

Still another object of the invention is to provide a method for unstacking an untrimmed stack, pile by pile, and restacking the trimmed piles in a trimmed stack which includes the steps of straddling each stack with a pile transfer table while a topmost pile is segregated therefrom or deposited thereon and vertically moving the tops of the transfer tables to any desired level between the waist and head of the operator to accommodate head high stacks.

Other objects and advantages of the invention will be apparent from the claims, the description of the drawings and from the drawings in which a preferred embodiment thereof is illustrated.

In the drawings:

FIG. 1 is a side view of a transfer table according to the invention with parts broken away and a raised position of the table top shown in dotted lines.

FIG. 2 is a rearward end view of the device shown in FIG. 1.

FIG. 3 is a plan view of the device shown in FIG. 1 with portions of the table top broken away.

FIG. 4 is a fragmentary side view of the forward, or leading, end of the transfer table shown depositing a pile during restacking.

FIG. 5 is an enlarged side view, in section, of the table top shown in FIGS. 1 to 4.

FIG. 6 is a view similar to FIG. 5 showing a modified form of table top.

FIG. 7 is a view similar to FIG. 5 showing a driven rotatable suction roll in the table top of FIG. 5.

FIG. 7A is a view similar to FIG. 1 of a table in accordance with the invention driven electrically rather than pneumatically and having flexible means for driving the suction stripping roll or the friction feed roll.

FIG. 8 is an enlarged end view, in section, of the suction stripper roll shown in FIG. 7.

FIG. 9 is a side elevation of a typical paper trimmer layout showing the method of stacking, trimming and restacking of the invention.

FIG. 10 is a view similar to FIG. 9 showing another stage of the method.

FIG. 11 is a fragmentary, enlarged side elevation of the leading end of a feed transfer table having the table top shown in FIG. 6 and about to wedge or pry its way under the topmost pile of a stack.

As shown in the drawings, **20** is a transfer table in accordance with the invention, the table **20** having a table top **21** and a table top supporting member **22**.

Table top **20** is preferably rectangular in outline, horizontal and of greater area than the area of the rectangular flexible sheets such as **23** in the stack **24**. Table top **20** includes two longer sides **25** and **26** and two shorter sides **27** and **28** and is supported at about waist level, at a fixed height above the floor **29** by the member **22**.

The table top supporting member **22** is of recumbent U shape, rather than of inverted U shape and includes

spaced apart vertical side supports 31 and 32 each under a longer side 25 or 26 of the table top and a similar vertical support 33 under one shorter side such as 27 of the table top. There is no vertical support or obstruction of any kind under the short side 28 of table top 21, this being the open end of the recumbent U shaped support and forming an entrance opening 34 for receiving a stack. The table top 20 and supporting member 22 jointly define a straddle space 35 large enough to accomodate a waist high stack such as 24, together with a pallet such as 36 and a lift table such as 37 thereunder. The straddle space 35 is also unobstructed laterally from the opening 34 to the rearward end support at 33 and it is of a uniform horizontal area greater than the area of the sheets 23, stack 24, pallet 36 and lift table 37.

Table top 20 is preferably skeletonized and transparent in order that the straddle space 35 and straddle opening 34 may be viewed by an operator in performing the unstacking and restacking operation. A transparent sheet 40 having a flat, smooth upper face 41 is supported on a grid 42 formed of hollow metal air conduits such as the longitudinal conduits 43 and the spaced lateral conduits 44. A plurality of pressure sensitive air nozzles such as 45 are distributed about the sheet 40, each fed by a conduit and supported therein. Each nozzle 45 includes a ball 46 and coil spring 47 mounted in a socket 48, the upper portion of each ball extending through a hole such as 49 pierced in sheet 40. The conduits of grid 41 are connected by a flexible air conduit 51 to an air control valve 52 mounted at the rear of the support member 22. The forward or leading edge portion 53 of the table top 21, extending along the short side 28 above the straddle opening 34, is inclined downwardly from the level of the upper sheet 40 to the level of the lower transparent sheet 54, and terminates in a relatively sharp pointed leading edge 55. Preferably the inclined forward edge portion or ramp, as shown, is formed on a fixed projection 56 of table top 21, the projection 56 extending beyond the forward ends of side support members 31 and 32 and overhanging the opening 34.

The area of the table top 21 is unobstructed and large enough to support the maximum area of sheet to be carried on table 20 and projection 56 is not intended to increase that area as in prior devices. Instead, projection 56 supports a pile 57 of sheets only when the pile is being wedged onto the table top or slid off the table top. Because of the antifriction air cushion created under the pile by the air nozzles 45, it is only necessary to gently nudge the pile down the inclined upper face 58 of projection 56 whereupon gravity tends to urge the pile completely off the table top. Similarly in sliding a pile up the inclined face 58 of projection 56, the line of air nozzles 59 in the projection 56 tends to overcome friction and enable the pile to be slid onto the table top with negliglible force.

The table top supporting member 22 is horizontally movable preferably by means of the wheels 61 travelling on tracks such as 62. Instead of solid vertical supports the side supports 31, 32 and 33 are skeletonized as shown in order to give the operator a clear view of the straddle space 35. The side supports 31, 32 and 33 include lifting means in the form of upstanding, hollow fluid cylinders 63, 64, 65 and 66 connected at the top by horizontal frame members 67, 68 and 69 and connected at the bottom by horizontal hollow members 71, 72 and 73 forming fluid conduits. Conduits 71, 72 and 73 connect with the bottom of the cylinders and are in turn connected by the conduit 74 to a valve 75 on the rearward frame member 68. Guide mechanism in the form of vertical pistons 76, 77, 78 and 79 extend downwardly from table top 21 and are slideable in cylinders 63, 64, 65 and 66 whereby a fluid such as air supplied through valve 75 raises the table top 21 to various desired heights up to shoulder height. It is thus possible for the transfer table

of this invention to straddle a shoulder high stack, remove the topmost pile therefrom, lower the pile to waist height for trimming and restacking and continue to remove the next successive topmost piles from such a stack.

Transfer table 20 is self propelled preferably by an air motor 81 carried by the support member 22 and aligned with a side support such as 31. The motor 81 comprises a double acting cylinder 82, piston 83, valve 84 and crank arm 85, the crank arm 85 being operably connected by a counterweighted wheel 61. Air under pressure is supplied to valve 84 by a conduit 86 leading to a control valve 87 mounted on the frame member 68. Valve 84 interchanges the supply and exhaust ports to cause reversal of direction of the table and is operable by the foot pedal 88.

As shown in FIGS. 6 and 11 a modified form of table top such as 91 is preferably provided for use in unstacking piles of sheets such as 92 from a stack 93. The operator first inserts a cross bar such as the angle iron 94 under the edge of the lower sheet of the topmost pile 92 so that the opposite ends of the iron 94 protrude from the stack. The projection 95 of the table 91 includes a driven roller 96 and a pair of parallel, forwardly projecting spars 97 and 98 laterally spaced apart a distance greater than the width of stack 93. The upper faces 99 and 100 of the spars 97 and 98 constitute ramps and incline downwardly from the plane of the flap upper face of table top 91 to a forward terminus located in a plane below the plane of the flat lower face of the top 91. Roller 96 is friction faced and rotated in the direction of the arrow at a greater surface speed than the speed of advance of the table. The advance of table top 91, as the table straddles stack 93, causes the spars 97 and 98 to lift the opposite protruding ends of angle iron 94, with a wedging or prying action, until the iron 94 moves over roller 96 onto table top 91. The lowermost sheet of pile 92 is thus lifted away from the stack to create an opening for roller 96 and is then deposited on the friction face of the roller. As the roller 96 rotates at greater speed than the table is advancing, it not only pulls the pile 92 onto the table top 91 but maintains tension on the undersheets of the pile to prevent sagging thereof. This in turn keeps the leading and trailing edges of the pile 92 in plumb condition.

Continued advance of the straddle table causes the topmost pile 92 to become progressively more supported on the air cushion of the table top with the angle iron 94 either remaining in place or being removed by an operator. When, as is sometimes the case, the trimmer includes a slot in its bed, it is desirable to leave the angle iron 94 in place so that it may bridge such a slot to prevent the leading edges of the pile from entering the same.

As best shown in FIGS. 7 and 8 a modified form of table top 102 includes a slot 103 at least co-extensive in length with the corresponding dimension of the sheets in the stack. A driven rotatable suction roll 104 is journalled by means of stub shafts such as 105 and 106 at the opposite ends of slot 103 with the upper curved face 107 of the roll substantially coplanar with the upper face 108 of the table top 102. Roll 104 is hollow and the curved face thereof is perforated, there being a fixed wiper 109 within the roll. One stub shaft such as 105 is hollow and connects the interior of roll 104 to a flexible conduit 111, the conduit 111 leading to a valve 112 on frame member 68. Valve 112 is connected by a flexible conduit 113 to a source of air suction of any well known type such as a tank, not shown, whereby suction may be created in the perforated roll 104 when desired. It will be understood that each pile 92 or stack such as 93 is usually placed on a disposable paper sheet 114 in order to protect the lowermost sheets of the stack from pallet marks and the like. The suction stripper roll 104 adheres to such a disposable sheet when the lowermost pile of the stack is slid onto or off table top 102 after trimming. The roll 104 guides the sheet 114 down into the slot 103 and

the wiper **109** masks the suction well below the slot to release the sheet **114** to fall onto the floor below the table.

In addition to the flexible suction conduit **113**, each table is connected by a flexible air conduit **115** leading to valves **52**, **75** and **87** from a suitable source of air pressure such as a tank, not shown.

As shown in FIG. 7A, instead of pneumatic means at the rear of the table for advancing the same, electrical drive means at the side of the table may be provided. The table **140** is similar to table **20** but the table top **141** may include the driven friction roll **96** or the driven suction roll **104**. A reversible electric motor **142** and gear reducer **143** are carried on a bracket **144** fixed to the table support **145** to occupy space outside the straddle opening and the straddle space of the table near the front thereof. Sprockets **146** and **147** and chain **148** connect the adjacent wheel **160** of table **140** to the reducer **143** and suitable switch means well known in the art and not shown are provided to cause the motor to advance or retract the table at a predetermined speed.

A flexible power shaft **149** connects the reducer **143** to the friction roller **96** and is arranged to rotate the roll at greater surface speed than the speed of advance of the table. If a suction roll **104** is desired, instead of the roller **96**, the flexible shaft **149** is used to drive the same in a similar manner.

In operation a table **122** is placed on a track leading from a stack location **120** to the feed portion of a trimmer **121** and a similar table **20** is placed on a track leading from the delivery position of the trimmer **121** to a restacking location **123**. In the illustration, the feed and delivery portion of the trimmer **121** is identical so that the tables are back to back on a single straight track **62** extending along the front of trimmer **121**. It will be obvious that any suitable treatment operation can be performed on the piles of sheets at the trimmer location. A lift table **37**, of any suitable type, carrying an empty pallet **36** at about waist level is provided at the restacking location **123** and a similar lift table **124** carrying a similar pallet **125** at floor level supports a waist high stack **126** of flexible sheets **127** at the stack location **120**.

A single operator handles trimmer **121** and each transfer table **20** and **122** is handled by a single operator. Table **122** with its downwardly inclined, ramp-like projection **156** is advanced over the stack **126** by straddling the same while the projection **156** wedges its way under pile **128** and through the stack from one end to the other.

Preferably the flat underface of the table top is spaced above the level of the top sheet of the stack under pile **128** in order not to crumple the same, the leading portion of pile **128** being manually lifted up onto the inclined projection **156** by means of an angle iron such as **94**. A modified form of table top such as shown at **91** may also be used if desired. The topmost pile **128** of sheets is thus lifted onto the air cushion table top **129** of table **122**. The table **122** is then moved to the trimmer **121** where the pile **128** is slid onto the deck **131** thereof for trimming. Table **20** is positioned in front of trimmer **121** to slideably receive the trimmed pile **128** on its air cushion table top **21**. Table **20** is then moved to a position straddling restacking location **123**, lift table **37** and pallet **36**.

The lift table **37** is then raised, or the table top **21** lowered, to cause the flat underface of the table top to clamp any sheets already on pallet **36** in place. This prevents crumpling of the top sheets during the addition thereto of the pile **128**. Pile **128** is then urged off table top **21**, down the inclined upper face **58** of projection **56** into contact with the jogging board **137**, with the leading edges of the sheets still plumb. The lift table **37** may then be lowered or the table top **21** may be raised slightly to unclamp from the stack whereupon the table **20** is withdrawn from under pile **128** to complete the restacking thereof.

Lift table **124** is then raised and lift table **36** is lowered a distance equal to the depth of the pile **128** to bring the next successive topmost pile **132** to the level of table top **129** and to lower pile **128** for receiving the pile **132**. The unstacking, trimming and restacking steps outlined above are repeated until the entire stack **126** has been trimmed and restacked at location **123**. Because of the means for raising the table tops **21** and **129** incorporated into the tables **20** and **122**, a stack such as **126** may be shoulder, or head high, and still be unstacked and restacked without requiring an operator on each side of the stack. In such case the table top **129** after pneumatically and mechanically wedging the topmost pile from the stack, is lowered to the level of the deck **131** for the trimming operation and after the trimming operation, the table top **21** can be raised to shoulder or head height for restacking purposes.

During the entire operation the stacks straddled by the tables may be viewed by the operator through the transparent skeletonized table tops and through the openings such as at **133** in the skeletonized table top supporting members. The guide mechanism and lifting means of the tables are aligned with each opposite longer side of the table top and supporting member or outside the same and do not reduce the inside width of space **35** or increase the outside width of the table **20**.

I claim:

1. A method of unstacking a stack of flat sheets, pile by pile, wherein the stack is vertically movable and each successive topmost pile is unstacked by a portable, pile-transfer, table having a table top supported at waist level on an integral, movable frame, said method comprising the steps of:

vertically positioning said stack with the bottom of the topmost pile substantially at the level of said table top;

then lifting upwardly the edge portion of said topmost pile, opposite the front edge of said table top, to create an opening in said stack;

then advancing said table to completely straddle the portion of said stack below said topmost pile while first exerting an upward force, beyond the lateral edges of the stack, to increase the size of said opening; then inserting the front edge of said table top into said opening and advancing said table top entirely underneath said topmost pile to thereby vertically lift said pile up onto said table top progressively from end to end until said pile is supported horizontally thereon at a spaced distance above said stack;

then retracting said transfer table to unstraddle said stack, while supporting said topmost pile horizontally on said table top until said table top and frame are entirely clear of said stack;

then removing said topmost pile from said table top; and

then repeating said steps until each successive topmost pile has been transferred from said stack.

2. A method as specified in claim **1** plus the step of:

rotatably and frictionally urging each successive topmost pile onto said table top, by engagement only with the bottom sheet of each said pile, at a speed greater than the speed of advance of said table and table top.

3. A method as specified in claim **1** wherein:

the step of lifting the edge portion of each successive topmost pile in said stack for creating an opening therein includes the step of:

inserting a rigid separator into said opening to extend beyond the lateral edges of said stack and wherein:

the step of exerting an upward force to increase the size of said opening is accomplished by wedging said separator upwardly beyond the lateral edges of the stack.

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GERALD M. FORLENZA, *Primary Examiner.*

ERNEST A. FALLER, HUGO O. SCHULZ, *Examiners.*