May 15, 1962 D. M. WAMPLER 3,034,632

SHEET HANDLING APPARATUS

Filed Dec. 22, 1960 3 Sheets-Sheet 1

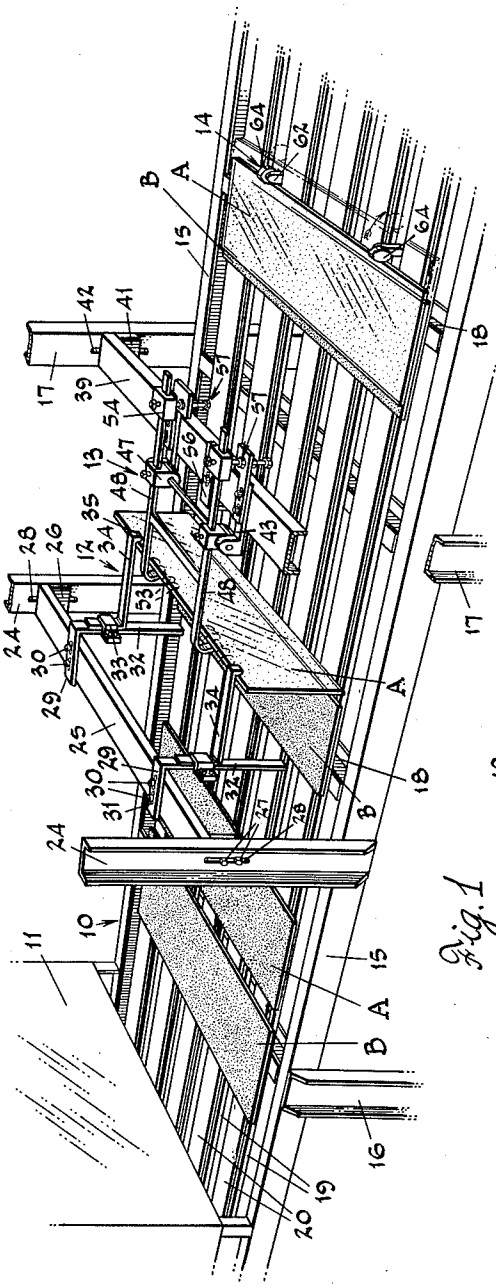


Fig. 1

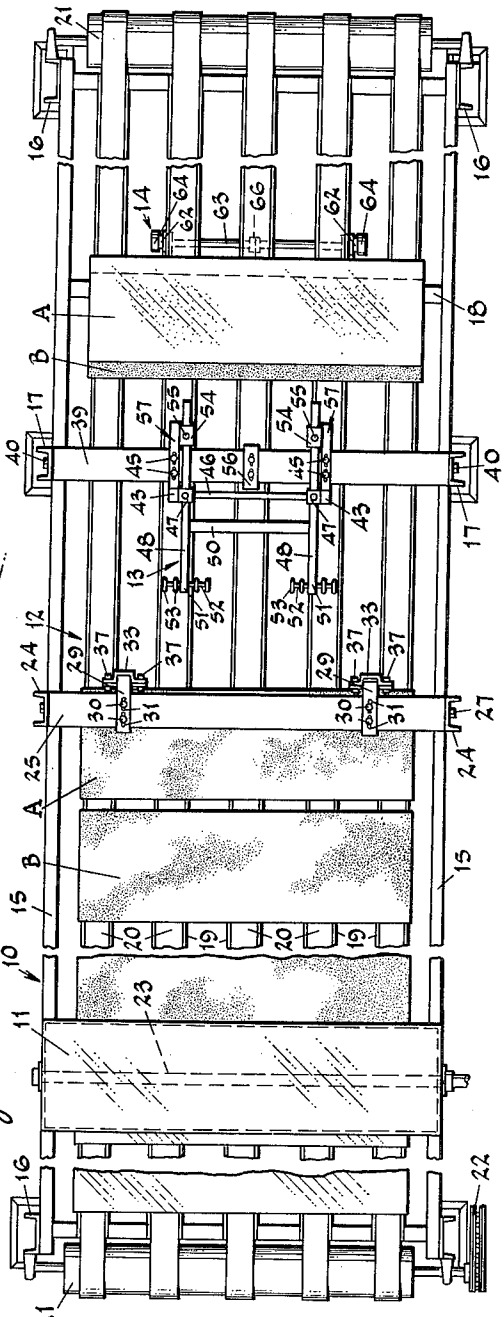


Fig. 2

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SHEET HANDLING APPARATUS

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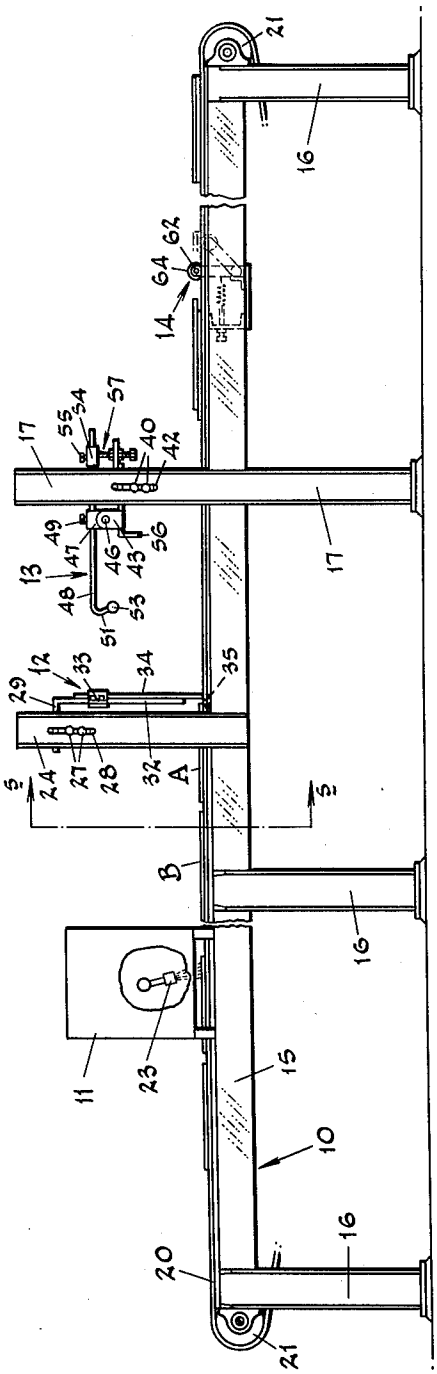


Fig. 3

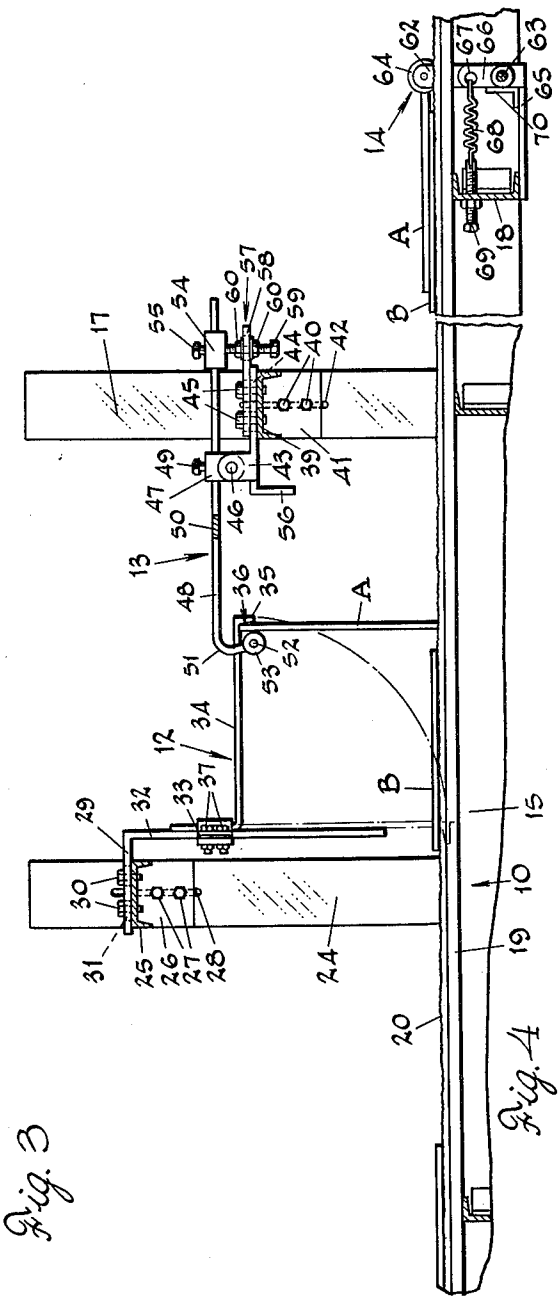


Fig. 4

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SHEET HANDLING APPARATUS

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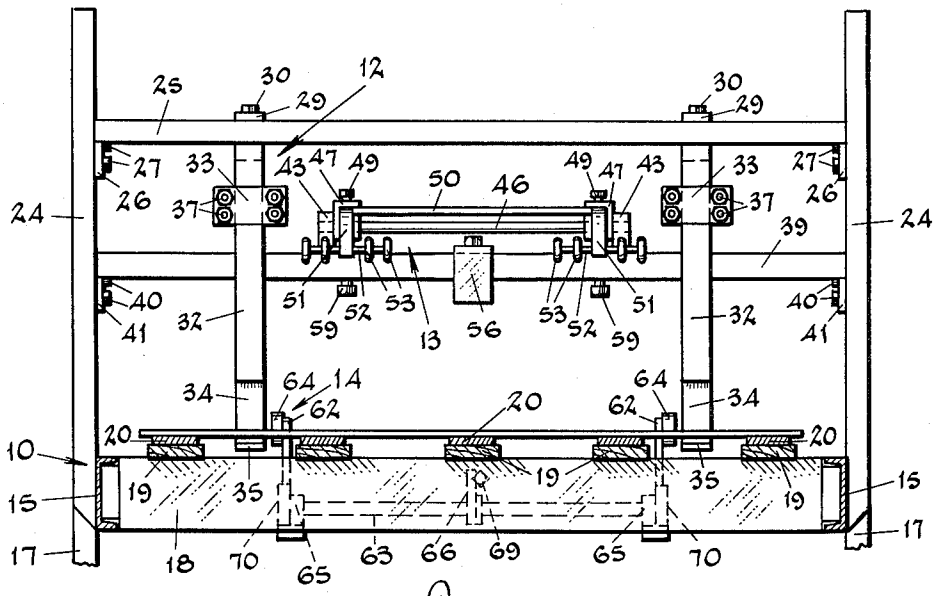


Fig. 5

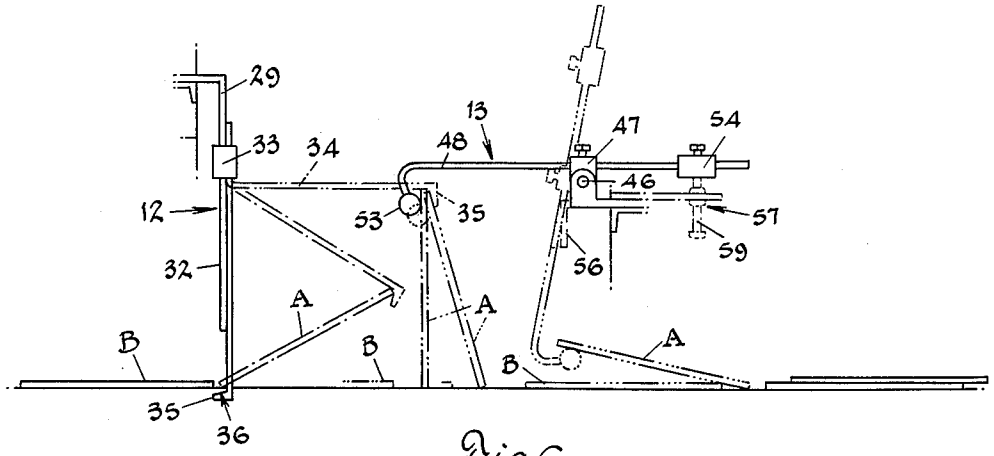


Fig. 6

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3,034,632

SHEET HANDLING APPARATUS

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This invention relates broadly to improvements in apparatus for handling sheet material and more particularly to the turning over of glass sheets.

In the production of bent laminated glass products, such as present day automobile windshields, it is common practice to achieve the desired configuration by bending flat sheets of glass in pairs to the contour of a mold. Prior to the actual bending, the sheets are thoroughly cleaned and dried and a surface of at least one and preferably both of the sheets has applied thereto a coating of a water soluble parting material to prevent the sheets from fusing to one another when heated during the bending process. The sheets are then placed one upon the other with the parting material therebetween, and their edges aligned in preparation for bending.

As disclosed in copending application, Serial No. 592,210 filed June 18, 1956, and over which this invention is an improvement, pairs of glass sheets were carried horizontally, or in the flat position, on a conveyor through the various steps of the process which included inverting the first sheet of each pair and laying it upon the second sheet.

In the apparatus disclosed in said copending application, when the sheet reaches the vertical position in the turnover process, it is allowed to fall freely for a distance until the upper edge of the sheet encounters a vertically oriented, endless belt which supports the sheet during its movement downwardly into the inverted horizontal position. With the introduction of the so-called "cap" or "wrap-around" windshields which extend back into the roof of the vehicle, much larger sheets were required and it was found desirable to support them during the entire turnover procedure instead of allowing them to fall freely for a distance and be subjected to a sudden impact as the edge was caught by the vertical belt.

An important object of this invention therefore is to provide an improved, yet simple apparatus for handling large sheets of glass or other fragile material.

Another object of the invention is to provide an improved apparatus for inverting one sheet and placing it horizontally upon a second sheet as said sheets are carried along a horizontal path.

Still another object of the invention is to provide an improved apparatus for coating a surface of at least one sheet of each pair and subsequently stacking the sheets one upon the other in aligned pairs, separated by the coated surface or surfaces in such a manner that breakage of the sheets or chipping of the edges thereof is effectively overcome.

Other objects and advantages of the invention will become more apparent during the course of the following description when taken in connection with the accompanying drawings.

In the drawings wherein like numerals are employed to designate like parts throughout the same:

FIG. 1 is a perspective view of sheet handling apparatus embodying the invention;

FIG. 2 is a plan view of the apparatus shown in FIG. 1;

FIG. 3 is a side elevation of the same;

FIG. 4 is an enlarged longitudinal section of the sheet turnover and aligning apparatus;

FIG. 5 is a transverse section taken on line 5—5 of FIG. 3 and showing the sheet turnover and aligning apparatus; and

FIG. 6 is a side elevation of the turnover apparatus, with the various positions taken by the apparatus in operation being shown in broken lines.

Referring now to the drawings, the numeral 10 indicates generally a horizontal conveyor along which are mounted a spray booth 11 of any conventional type, the details of which do not form a part of this invention, a sheet turnover apparatus comprising generally a lifting portion 12 and a lowering portion 13, and a sheet aligning device indicated generally at 14.

The conveyor 10 comprises longitudinally extending side rails 15 supported on legs 16 and standards 17, the opposite side rails 15 being connected by a series of cross rails 18. Mounted upon the cross rails 18 are spaced, parallel, longitudinally extending slats 19 which serve as runways for the upper flights of endless belts 20 as best seen in FIG. 5. The endless belts 20 pass over and are driven by rolls 21 mounted at the opposite ends of conveyor 10. One of the rolls 21 is connected to a suitable power source by a driving mechanism 22 as shown in FIG. 2. The rolls 21 are rotated in a manner to cause the upper flights of the endless belts 20 to move in a generally left-to-right direction as viewed in FIGS. 1, 2, 3 and 4.

Identical sheets of glass or other material to be treated are placed upon the conveyor 10 in pairs, the leading sheet of each pair being identified by the letter A and the trailing sheet by the letter B. As endless belts 20 move to the right, the sheets A and B are carried first through the spray cabinet 11 in which a conventional spray unit 23 applies a coat of parting material to the upper surface of one or both sheets.

The lifting portion 12 of the turnover apparatus comprises a pair of uprights 24 mounted upon side rails 15. Extending between and secured to the uprights 24 is cross member 25 having end portions 26 through which bolts 27 pass to enter vertically elongated slots 28 in uprights 24 so that the cross member 25 can be adjusted vertically as desired. A pair of spaced, right angle brackets 29 are attached to cross member 25, each by means of bolts 30 passing through longitudinally aligned slots 31, in such a manner that the depending leg 32 of each bracket 29 projects downwardly toward one of the openings between spaced, parallel endless belts 20. Slidably mounted upon the depending legs 32 of brackets 29 are two-piece clamps 33 as best seen in FIG. 4. Attached to the depending legs 32 by the clamps 33 are flexible straps 34 provided at their lower, free ends with lateral fingers 35. The upwardly directed surfaces 36 of the fingers 35 are bevelled toward their outer ends (FIG. 4). The fingers 35 face toward the oncoming sheets A and B, and in their at rest or inoperative position lie in the spaces between adjacent longitudinally extending endless belts 20 and just below the lower surfaces of the oncoming sheets. The straps 34 may be made of any flexible material such as rubber or rubberized canvas.

The separate portions of clamps 33 are held in clamping relation by bolts 37. As will be seen in FIGS. 3 and 4, as the oncoming sheets reach lifting portion 12, the leading edge of sheet A encounters the straps 34, and the fingers 35 thereon engage the lower surface of said sheet. As the sheet continues to advance, straps 34 pivot about the lower edge of clamps 33, whereby the fingers 35 will raise the leading edge of sheet A which pivots about its trailing edge on endless belts 20.

The sheet lowering portion 13 is supported by a horizontal cross member 39 extending between and connected to the upper extensions of standards 17. It will, of course, be understood that lowering portion 13 could be

supported by short uprights 24 as is lifting portion 12, and conversely, lifting portion 12 could be supported by the upper extensions of standards 17 if desired. The cross member 39 is connected to standards 17 by bolts 40 passing through end portions 41 of the cross member and vertically elongated slots 42 in said standards. Mounted upon the top of cross member 39 are a pair of spaced hinge arms 43 having longitudinally aligned slots 44, through which pass bolts 45. A horizontal pintle 46 passes through and is rotatably mounted in openings in the outer end of each hinge arm 43. Mounted on the pintle 46 are blocks 47, each having an opening through which is received an arm 48. The arms 48 may be longitudinally adjusted by sliding through blocks 47 and held in any desired position by setscrews 49 which threadedly engage blocks 47 and press against arms 48. The arms 48 are also mounted so as to pivot about pintle 46 in planes which are perpendicular to its axis. A cross brace 50 connects arms 48 so that they pivot as a unit.

The outer forward ends of the arms 48 are bent to provide elbow portions 51 through which pass horizontal shafts 52 carrying rollers 53 for a purpose to be hereinafter described. At the opposite ends of arms 48, remote from rollers 53, counterweights 54 are adjustably secured by setscrews 55. In order to limit the pivotal movement of arms 48 at their fully lowered position, as shown in broken lines in FIG. 6, there is provided a stop member 56 secured to the cross member 39 of the lowering apparatus 13. Also mounted on the cross member 39, as by the bolts 45 at the hinge arms 43, are a pair of adjustable limiting members 57 against which counterweights 54 rest when the arms 48 are in their upper, substantially horizontal position. The limiting members 57 comprise support arms 58 secured to the cross member 39, said support arms carrying at their outer ends screws 59 threaded in the support arms 58 for vertical adjustment, and lock nuts 60 on screws 59. The lock nuts 60 are turned up tightly against the surfaces of the support arms 58 to maintain the screws 59 at the desired adjusted position.

In operation, as the leading edge of sheet A engages and is lifted upwardly by straps 34 as above described, it swings in behind and is engaged by rollers 53 on arms 48 as best seen in FIG. 6. As sheet A passes the vertical position, the former leading edge starts downward to become the trailing edge when the sheet is in the inverted position. Also as sheet A passes the vertical position, the portion of its weight carried by the straps 34 during lifting is transferred to the lowering apparatus through the elbow portions 51 and rollers 53. This weight being sufficient to overcome that of the counterweights 54, the arms 48, carrying rollers 53 upon which the edge of the sheet now rests, are caused to pivot about pintle 46 and thereby to carry the trailing edge of the inverted sheet A downwardly with them. As rollers 53 reach the bottom of their arc, cross brace 50 engages stop member 56. The sheet continues to advance on the endless belts 20 and its rear edge slides off rollers 53 to fall freely the relatively short distance onto sheet B. Air trapped between sheets A and B cushions the fall to prevent breakage. Counterweights 54 are so adjusted as to return arms 48 to their horizontal position after the sheet has dropped off rollers 53.

At some intermediate point during the lowering of the sheet, the fingers 35 are disengaged from the sheet and straps 34 swing to their at rest position to await the next oncoming sheet A. However, by the time the straps 34 swing free, the trailing sheet B of the first pair will have advanced sufficiently so that it will not be hit by the swinging straps. The straps do hit depending legs 32 of brackets 29, which prevent them from oscillating and insure that fingers 35 will be in position to engage the leading edge of the next sheet A.

After sheet A has been inverted and placed upon sheet B, it will be noted that the longitudinal edges of the sheets are not aligned as is necessary for further handling of the sheets. To bring the longitudinal edges of the sheets into alignment with one another, the edge aligning apparatus 14 is provided. This apparatus includes spaced levers 62 pivotally mounted upon a transverse shaft 63 and carrying at their upper ends aligning rollers 64. The shaft 63 is mounted at its ends in brackets 65 secured to an adjacent cross rail 18. Secured to the shaft 63 between the levers 62 is a lever arm 66 having in its end an opening 67 which receives one end of a tension spring 68. The other end of the spring 68 is attached to a tension adjusting device 69 threadedly carried by the aforementioned cross rail 18. Adjacent the levers 52 and secured to brackets 65 are abutment members 70 against which the levers 62 are normally held by the spring 68. Levers 62 are positioned in the spaces between parallel slats 19 of the conveyor so as to pivot generally clockwise about the axis of shaft 63. The aligning rollers 64 are mounted on levers 62 so that their axes are aligned with a plane between the upper and lower surfaces of top sheet A. In operation, the stacked sheets A and B approach the aligning mechanism 14 with sheet A usually slightly ahead of sheet B. The leading edge of sheet A contacts aligning rollers 64 causing sheet A to slide across sheet B until sheet B also contacts the aligning rollers, at which time the combined force exerted upon the aligning device by sheets A and B is sufficient to overcome the resistance of spring 68. The levers 62 and aligning rollers 64 then pivot clockwise about the axis of shaft 63, down into the space between the longitudinally extending slats 19, and allow the aligned sheets to pass thereover. After the sheets pass beyond the rollers 64, the spring 68 returns the levers 62 to their normal position against the abutment members 70, and the rollers 64 are in position to receive the next pair of sheets.

In briefly reviewing the operation of the turnover apparatus, the sheets arrive at the loading point for conveyor 10 from previous operations. The sheets are placed, either manually or mechanically, on conveyor 10 in matched pairs, leading sheet A being closely followed by trailing sheet B, with a suitable interval being provided between trailing sheet B of one pair and leading sheet A of the succeeding pair. The sheets pass through the spray cabinet 11 where parting material is applied to the upper surface of one or both sheets of each pair.

After the parting material is applied, the paired sheets proceed to the area of the turnover apparatus where the leading edge of leading sheet A is engaged by fingers 35 of flexible straps 34. As the sheet A continues to move forwardly, the leading edge thereof is swung upwardly in an arc while at the same time it pivots about its trailing edge which continues to travel horizontally on endless belts 20. Near the top of its upward swing, the leading edge of sheet A moves in behind the elbow portions 51 of arms 48, and the rollers 53 thereon engage the surface of the sheet opposite to that engaged by fingers 35 so that during a portion of the turnover operation, the sheet A is held by and between the fingers 35 and rollers 53.

As sheet A passes the vertical position, the former leading edge thereof begins to swing downwardly in an arc while also pivoting about the former trailing edge which continues to move horizontally on endless belts 20 and which now becomes the leading edge. Also as sheet A passes the vertical position, the portion of its weight carried by the fingers 35 and straps 34 during the upward movement is transferred to the rollers 53 and arms 48. During the lowering of the sheet, fingers 35 disengage from the sheet and allow straps 34 to drop back to their position abutting depending legs 32 where they await the next pair of sheets. When cross brace 50 contacts stop member 56, arms 48 stop while inverted sheet A continues to move forwardly and thereby drops from rollers 53 upon sheet B, its fall being cushioned by the air between the sheets. The arms 48 are then returned to their substantially horizontal rest position by counterweights 54.

The stacked sheets A and B advance to the aligning mechanism 14 where overhanging sheet A first encounters aligning rollers 14. Sheet A slides on sheet B until sheet B also contacts the aligning mechanism, whereupon aligning rollers 64 and levers 62 are depressed. The aligned, stacked sheets can then pass over the aligning mechanism and be removed from the conveyor by any suitable means.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred embodiment of the same, and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention.

I claim:

1. In a sheet turnover apparatus, a conveyor for supporting the sheets in a substantially horizontal position and for moving them along a definite path, sheet lifting means comprising flexible straps, means for mounting said straps above said conveyor so that they hang vertically, fingers carried at the lower ends of said straps positioned to engage the leading edge of a sheet moving along said conveyor and to lift it upwardly about the trailing edge of the sheet as said sheet continues to move with said conveyor, and means for receiving the lifted edge of said sheet from said lifting means and for lowering it upon the conveyor in an inverted position, said lowering means comprising arms pivotally mounted above said conveyor and operable to engage the sheet when it reaches a substantially vertical position and while still engaged by said fingers and to then lower said sheet upon said conveyor.

2. In a sheet turnover apparatus as defined in claim 1, including means for mounting said arms intermediate their ends for pivotal movement about a horizontal axis, and means carried at one end of said arms for engaging said sheet.

3. In a sheet turnover apparatus as defined in claim 1, including means for mounting said arms intermediate their ends for pivotal movement about a horizontal axis, said arms being provided at one end thereof with depending elbow portions, and sheet engaging rollers carried by said elbow portions.

4. In a sheet turnover apparatus as defined in claim 3, including counterweights carried at the opposite ends of said pivotally mounted arms operable to return the said arms to sheet receiving position when the sheet being lowered is disengaged from said rollers.

5. In a sheet turnover apparatus as defined in claim 4, including means for limiting the pivotal movement of said arms in one direction when the sheet being lowered reaches a predetermined position, and means for limiting the pivotal movement of the arms in the opposite direction when they return to sheet engaging position.

6. In a sheet turnover apparatus as defined in claim 1, in which the means for mounting the flexible straps comprises brackets having vertically depending legs and means for securing the straps at their upper ends to said legs, with said straps being in parallel abutting relation with the legs at a point above the lower extremities of said legs so that movement of said straps is restricted in one direction.

7. In a sheet turnover apparatus, a conveyor for supporting the sheets in a substantially horizontal position and for moving them along a definite path, sheet lifting means comprising flexible straps, means for mounting said straps above said conveyor in a vertically suspended position, said mounting means comprising brackets having vertically depending legs and means for attaching the straps at their upper ends to said legs so that the straps are in abutting parallel relation with said legs at a point above the lower extremities thereof, fingers carried at the lower ends of said straps positioned to engage the leading edge of an advancing sheet and to lift it upwardly about the trailing edge of the sheet as said sheet continues to move with said conveyor, and means for receiving the lifted edge of said sheet from said lifting means and for lowering it upon the conveyor in an inverted position, said lowering means comprising pivotally mounted arms, means for mounting said arms intermediate their ends above said conveyor for pivotal movement about a horizontal axis, said arms being provided at one end with depending elbow portions, sheet engaging rollers carried by said elbow portions, and counterweights carried at the opposite ends of said arms, said rollers being operable to engage the sheet when it reaches a substantially vertical position and while still engaged by said fingers and to then lower said sheet upon said conveyor and said counterweights being operable to return the arms to sheet receiving position when they are disengaged from the sheet being lowered.

8. In a sheet turnover apparatus as defined in claim 7, including means for limiting the pivotal movement of said arms in one direction when the sheet being lowered reaches a predetermined position, and means for limiting the pivotal movement of the arms in the opposite direction when they return to sheet engaging position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,851,147 Hageline ---------- Sept. 9, 1958