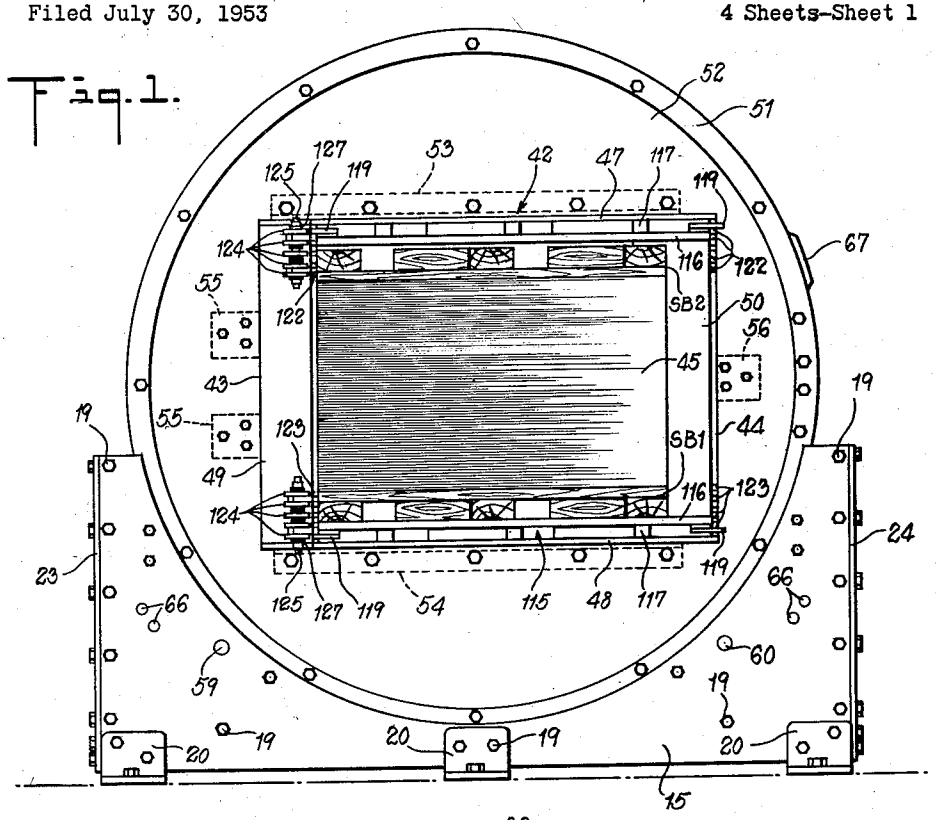
Dec. 18, 1956 C. P. ROUNSEFELL ET AL 2,774,487

PACK TURNOVER APPARATUS

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Fig. 1.



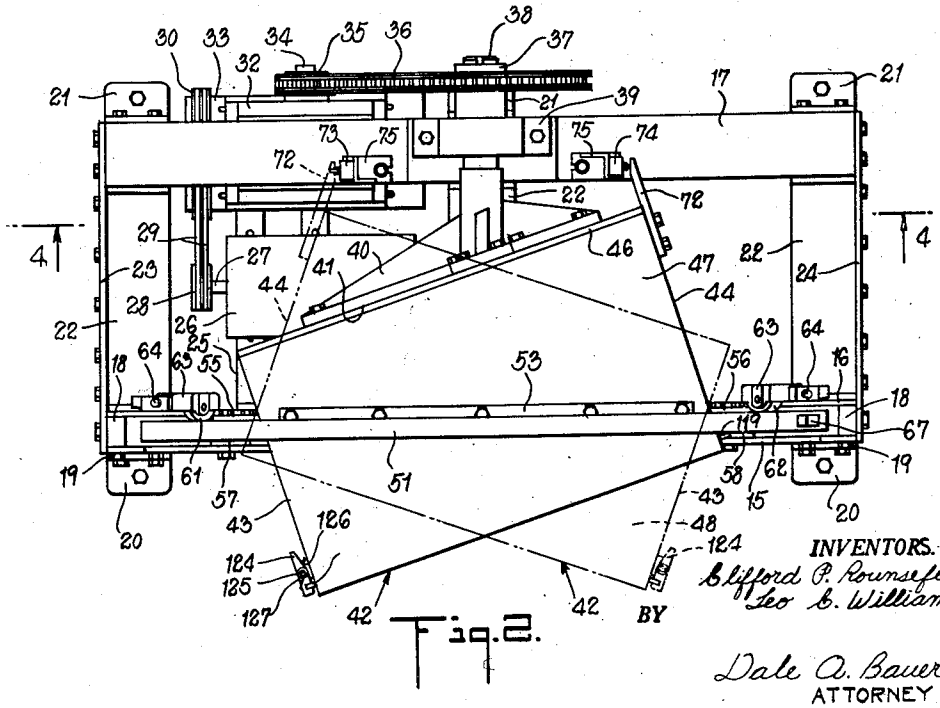


Fig. 2.

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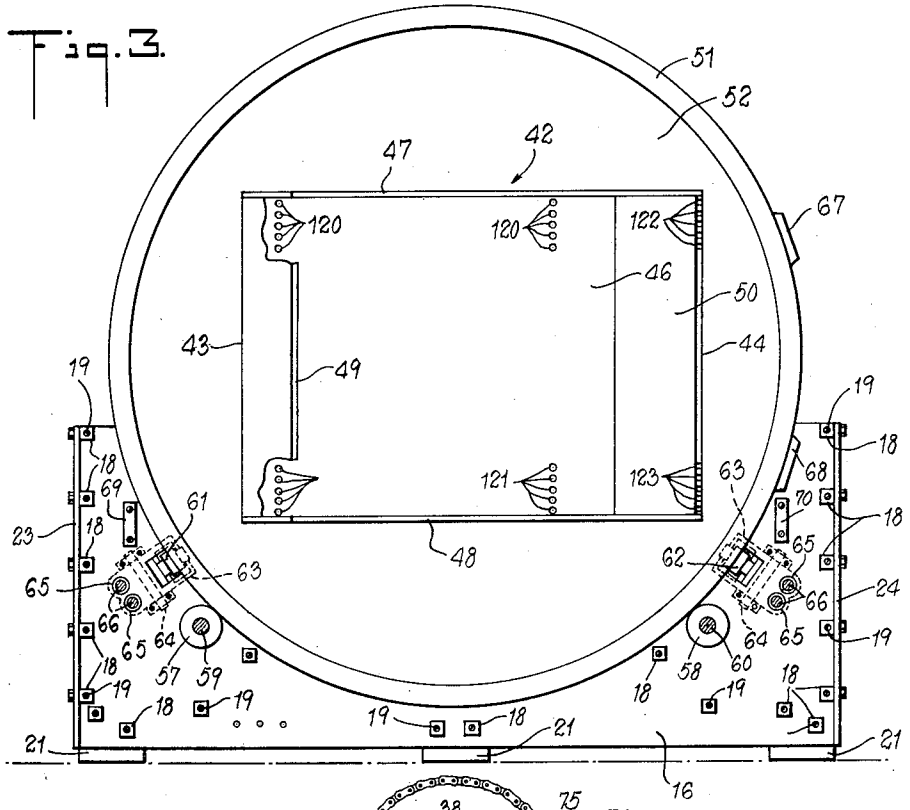
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PACK TURNOVER APPARATUS

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Fig. 3.



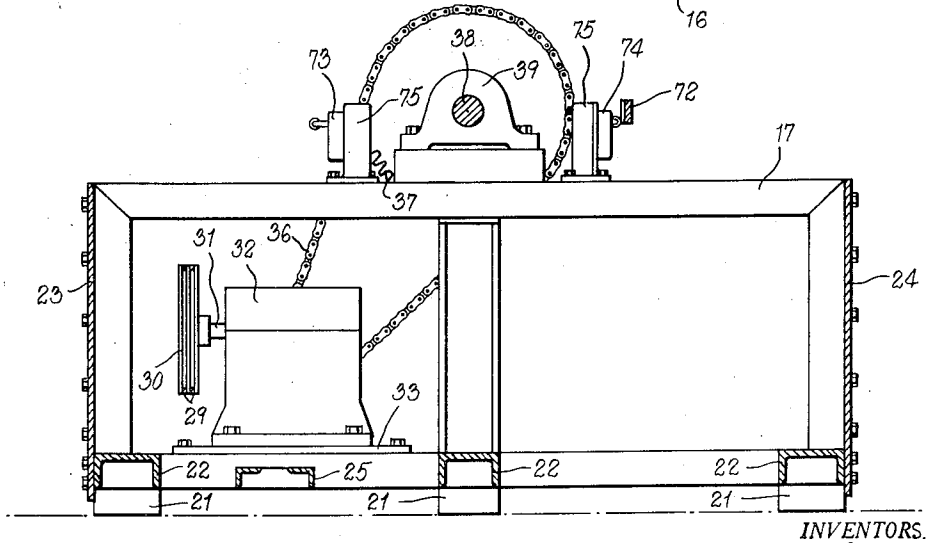


Fig. 4.

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PACK TURNOVER APPARATUS

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Fig. 5.

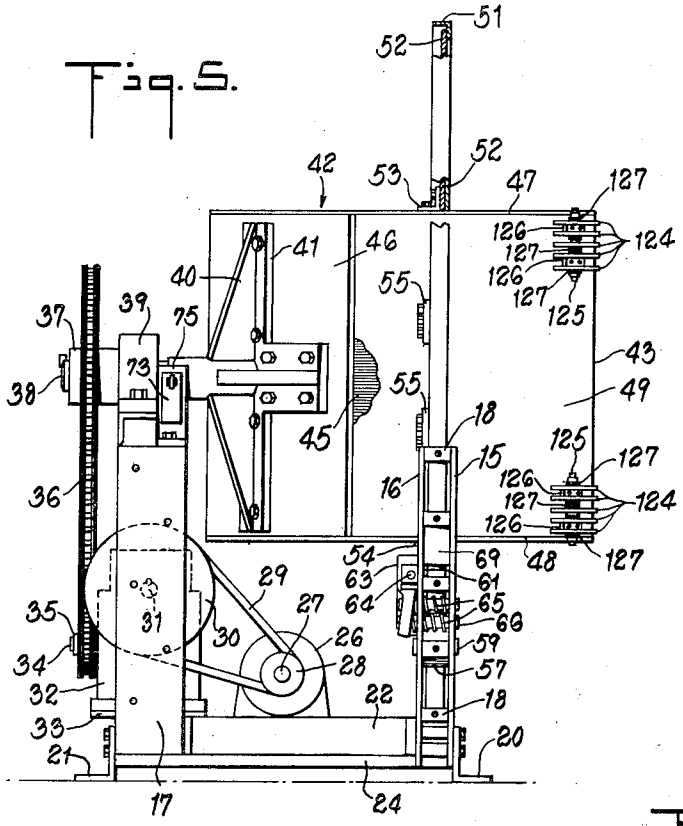


Fig. 6.

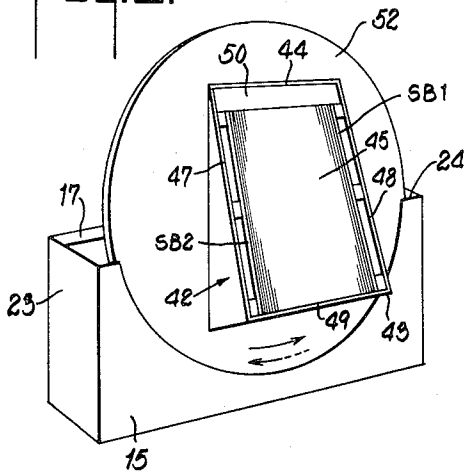
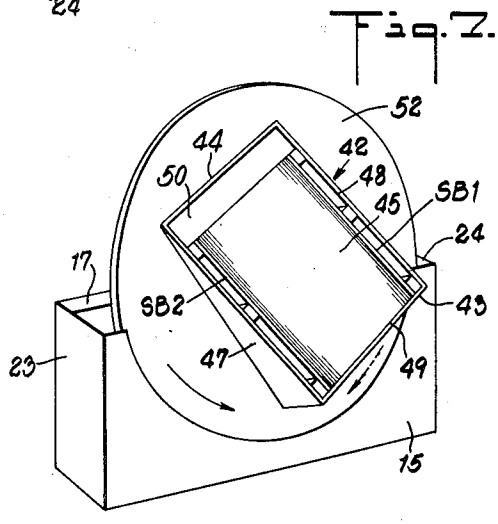


Fig. 7.



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PACK TURNOVER APPARATUS

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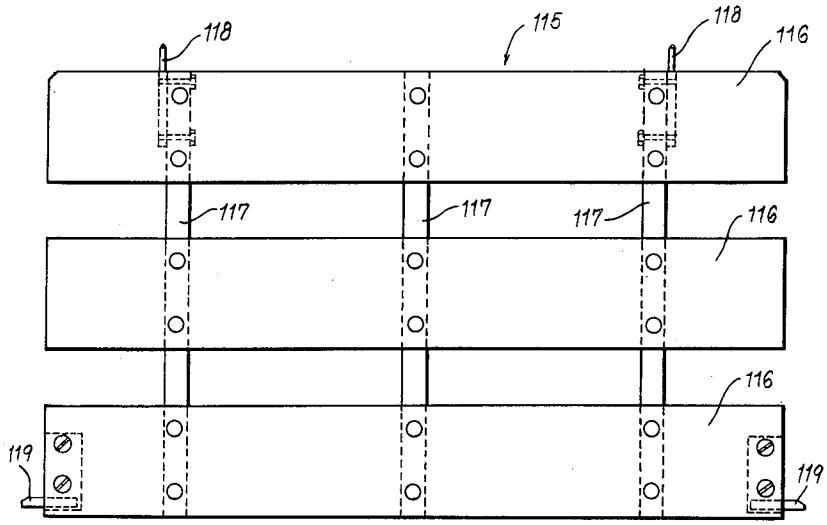


Fig. 8.

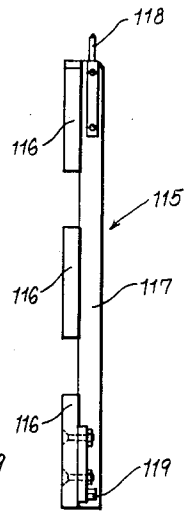


Fig. 9.

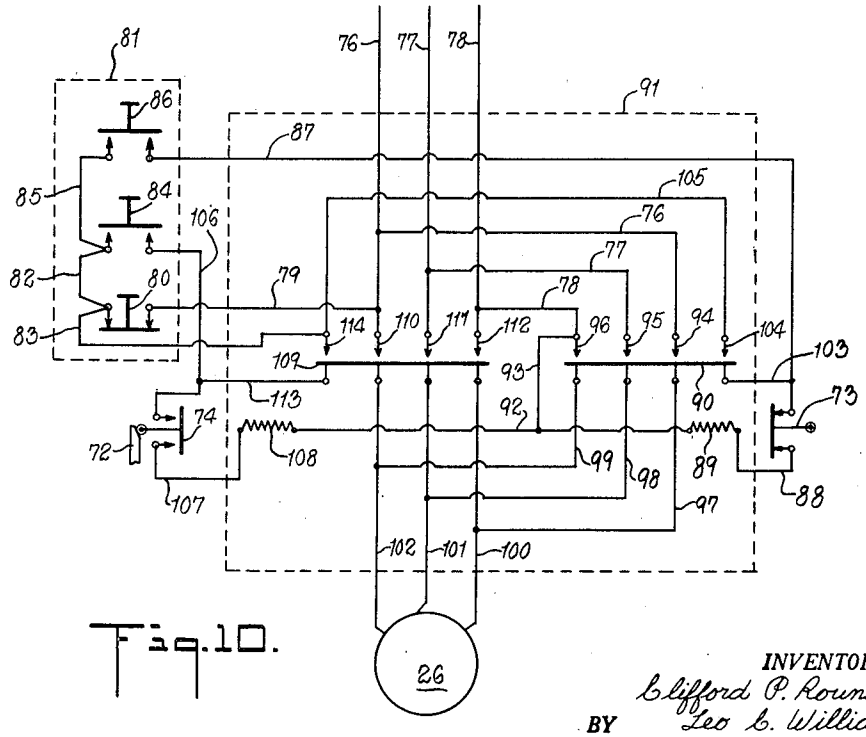


Fig. 10.

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United States Patent Office 2,774,487 Patented Dec. 18, 1956

2,774,487

PACK TURNOVER APPARATUS

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Application July 30, 1953, Serial No. 371,364

20 Claims. (Cl. 214—1)

This invention relates to turnover apparatus and while capable of general use is particularly adapted for embodiment in pack turnover apparatus for turning or reversing piles of sheets so as to bring the bottom end of each sheet pile uppermost and thereby reverse the order of the sheets for subsequent feeding and other purposes and for performance of printing, inspecting, and other desired operations on the reverse side of each sheet.

One of the objects of the present invention is to provide a pack turnover apparatus of novel, simple, and durable construction which will efficiently, safely, and accurately turn or invert piles of sheets of a variety of sheet sizes and of a variety of pile heights with a minimum amount of time and labor.

Another object of the invention is to provide a pack turnover apparatus having a relatively small number of parts novelly constructed and coordinated to insure efficiency, low manufacturing, installation and maintenance costs, and "foolproof" operation.

Another object is to provide a novel pack turnover apparatus for the purpose above described, which does not require pre-clamping of each sheet pile to be turned, and which is capable of inverting loose and unclamped piles of sheets without danger of said piles spilling therefrom and without disarranging the sheets thereof during the pile inverting operation.

Another object is to provide a pack turnover apparatus which, through novel construction thereof, will efficiently and safely turn loose and unclamped piles of sheets to invert the same, and through turning of each sheet pile will effect a jogging action thereon so as to align the sheets thereof or maintain said sheets in aligned condition.

A further object is to provide a pack turnover apparatus of novel construction for turning loose and unclamped piles of sheets to invert the same, wherein each unclamped sheet pile through turning thereof is caused to list from one side to the opposite side which tends to loosen said pile and advantageously break the adhesion between the sheets.

A still further object is to provide a novel pack turnover apparatus for turning piles of sheets to invert the same, wherein all operations incident to the inverting of each sheet pile, including the loading and unloading thereof, may be conveniently performed from one side of said apparatus.

Still another object is to provide for the purpose above described, a pack turnover apparatus which is novelly constructed so as to advantageously enable the loading of each sheet pile on and unloading of the same from said apparatus by a standard industrial lift truck which is customarily employed to transport the piles of sheets.

The above and further objects and novel features of the present invention will more fully appear from the following detail description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only, and are not intended

as a definition of the limits of the invention, reference for this latter purpose being had primarily to the appended claims.

In the drawings, wherein like reference characters refer to like parts throughout the several views,

Fig. 1 is a front elevational view of a pack turnover apparatus constructed in accordance with the present invention;

Fig. 2 is a top plan view of said pack turnover apparatus;

Fig. 3 is a view similar to Fig. 1 but with the near front plate of the base frame and the pile of sheets removed for purposes of clearer illustration, certain of the parts being shown in section, and the pile carrier having portions thereof broken away for purposes of clearer illustration;

Fig. 4 is a vertical longitudinal sectional view substantially on the line 4—4 of Fig. 2;

Fig. 5 is an end elevational view looking from the left of Fig. 1 with the near side plate of the base frame removed for purposes of clearer illustration, certain of the parts being shown in section, and portions of other parts being broken away for purposes of clearer illustration;

Figs. 6 and 7 are perspective views illustrating diagrammatically the pile carrier in the positions which it occupies when a pile of sheets is being inverted;

Fig. 8 is a face view of a board-spacer used in conjunction with the pack turnover apparatus;

Fig. 9 is an end elevational view of said board-spacer looking from the right of Fig. 8; and

Fig. 10 is a schematic diagrammatic representation of an electric wiring circuit for the operation and control of the pack turnover apparatus.

Referring to the drawings, there is shown, by way of example, one form of pack turnover apparatus embodying the present invention, which is especially constructed to safely support and effectively invert relatively heavy piles of tin plate and other metallic sheets of a variety of sheet sizes and of a variety of pile heights. Obviously, the same structure or apparatus of the same but lighter design may be employed to invert piles of paper, cardboard and other non-metallic sheets. As will hereinafter appear, the present invention advantageously provides the use of a box-like pile carrier novelly arranged whereby the necessity of clamping each pile of sheets to be inverted is completely eliminated, and each pile of sheets because it is loose and unclamped may be jogged at two angularly related sides during the inverting operation to align the sheets or to maintain the same in alignment. Additionally, the piles of sheets to be inverted, and the inverted sheet piles, may be respectively loaded into and unloaded from the carrier at the same side of the pack turnover apparatus and by the same industrial lift truck which is customarily employed to transport the piles of sheets to and from said apparatus. Moreover, the carrier in the inverted position of a first pile of sheets effected through rotation of said carrier in one direction may be loaded at said position with another pile of sheets whereby the return movement of the carrier in the opposite direction is also efficiently utilized to invert a pile of sheets. The loading of the piles of sheets into the apparatus and the unloading of the inverted sheet piles from said apparatus, as well as the operation of the carrier to invert successive piles of sheets, may be easily and conveniently handled by the operator of the industrial lift truck without leaving the vehicle, and successive piles of sheets may be safely, effectively, and efficiently inverted with a minimum amount of time and labor and a minimum number of operations.

As herein shown, the various movable parts of the pack turnover apparatus, as well as certain stationary parts thereof, are supported on a base frame comprising

two upright outer and inner front plates 15 and 16, respectively, and a parallel upright rear member 17 which is composed of several sections of channel iron welded together (Figs. 1 to 5). The front plates 15, 16 are secured together in spaced parallel relation by spacers 18 and bolts 19 (Figs. 1, 2, 3 and 5) which are distributed along opposite side edges of said plates and along the bottom edges thereof and at other suitable intermediate points. The front frame member comprising the plates 15, 16 is supported on the machine foundation as by three angle brackets 20 (Figs. 1, 2 and 5) which are bolted or otherwise suitably secured to the plate 15. The rear frame member 17 is also supported on the machine foundation as by three similar angle brackets 21 (Figs. 2, 4 and 5) bolted or otherwise suitably secured thereto. The front frame member 15, 16 and the rear frame member 17 are rigidly connected together by channel cross beams 22 (Figs. 2, 4 and 5) disposed near the bottom and at opposite sides and centrally of said members and bolted or otherwise suitably secured to said rear frame member and the plate 16 of said front member. The front frame member 15,16 and the rear frame member 17 are further rigidly connected together at the sides thereof by vertical side plates 23 and 24 (Figs. 1 to 5) which are bolted or otherwise suitably secured to said rear frame member, the adjacent spacers 18, and the adjacent cross beams 22. The members 15, 16, 17, 22, 23 and 24 thus form a relatively strong and rigid base frame which may be said to be in the form of a rectangular box opened at the top thereof.

Disposed between the front frame member 15, 16 and the rear frame member 17 and near the bottom and to one side thereof nearest the side plate 23 is a motor base 25 (Figs. 2 and 4) which is bolted or otherwise suitably secured at its opposite ends to said rear frame member and the plate 16 of said front frame member. Mounted on the upper surface of the base 25 and releasably clamped to said base in a suitable manner for adjustment therealong is a motor 26 (Figs. 2 and 5). This motor 26 is of a well-known reversible type having incorporated therein a magnetic brake which is so controlled, as is well understood in the motor art, that when electrical current is supplied to the motor the brake is released and when said current is interrupted said brake is applied to immediately stop rotation of the armature shaft 27 of said motor.

Keyed to and driven by the armature shaft 27 of motor 26 is a pulley 28 (Figs. 2 and 5) suitably grooved to receive a twin V-belt 29 which passes around said pulley and also passes around a larger diameter pulley 30 (Figs. 2, 4 and 5) suitably grooved to receive said belt. This pulley 30 is keyed to and drives the input shaft 31 of a well-known speed reduction drive unit 32 which is releasably clamped in a suitable manner to a mounting plate 33 for longitudinal adjustment along said plate. The plate 33 extends longitudinally of the rear frame member 17 and is bolted or otherwise suitably secured to said frame member at the bottom thereof. Keyed to the driven output shaft 34 of the speed reduction unit 32 is a sprocket 35 around which passes a chain 36 which also passes around and drives a larger diameter sprocket 37. This sprocket 37 is keyed to the rear end of a horizontally disposed shaft 38 (Figs. 2, 3, 4 and 5) which extends at right angles to the rear frame member 17 and is journalled in a suitable anti-friction bearing provided in a bracket 39 which is bolted or otherwise suitably secured to the upper surface of said frame member. The shaft 38 is preferably of a large diameter for strength purposes and it extends forwardly beyond the bearing bracket 39 and the rear frame member 17. The shaft 38 will thus be driven in opposite directions at a comparatively slow speed by the reversible motor 26 through the speed reduction unit 32 and the described driving connections therefor with said unit.

Welded or otherwise firmly secured to the front end of the shaft 38 is a relatively strong spider-like bracket 40 (Figs. 2 and 5) which extends vertically above and below said shaft and transversely of said shaft beyond opposite sides thereof. This bracket 40 is so formed that the front flat face 41 thereof is perpendicular to the shaft 38 in a vertical plane, as clearly shown in Fig. 5, and in a horizontal plane said face is slanted or inclined at an oblique angle with respect to said shaft, as clearly shown in Fig. 2. In the illustrated embodiment, for tin plate and the like sheets, the angle of inclination of the bracket 40 is preferably 19° to the horizontal, but this angle may be increased or decreased as desired depending on the kind of sheet material to be handled and the coefficient of friction of said material in a pile thereof. A box-like pile receiving and inverting carrier indicated generally at 42 (Figs. 1, 2, 3 and 5) is bolted or otherwise firmly secured to the face 41 of the bracket 40. The carrier 42 projects forwardly from the bracket 40 and extends symmetrically above and below the axis of the shaft 38 and transversely of said shaft axis. By virtue of its mounting on the bracket 40, the carrier 42 is likewise disposed perpendicular to the axis of the shaft 38 in a vertical plane as clearly shown in Fig. 5, and is slanted or inclined at an oblique angle to the horizontal and with respect to said shaft axis, as clearly shown in Fig. 2, thereby disposing one closed side 43 of the carrier farther outwardly from the shaft 38 than the opposite closed side 44 of said carrier. In order to obtain a more balanced condition when handling piles of sheets of the average sheet length, the carrier 42 is horizontally located on the bracket 40 with respect to the axis of rotation of the shaft 38 so that said axis intersects the horizontal center line of said carrier at a point to one side of the vertical center line thereof remote from the side 43 of said carrier.

The carrier 42 is opened at the front thereof to receive therein a pile of sheets 45 in the full line position of said carrier shown in Figs. 1 and 2, and is rotated in a counter-clockwise direction from said position to the broken line position shown in Fig. 2 to invert said pile of sheets. In the broken line position of the carrier 42 (Fig. 2) the inverted pile of sheets 45 is removed from said carrier and a second pile of sheets is loaded therein at said position, whereupon the carrier is rotated in the opposite or clockwise direction from the broken line position and returned to the full line position shown in Figs. 1 and 2 to invert said second pile of sheets. The inverted second pile of sheets is then removed from the carrier 42 and a third and succeeding piles of sheets are loaded in said carrier at each end position thereof and inverted through rotation of the carrier in opposite directions from one end position to the other end position. In the aforesaid end positions of the carrier 42, said carrier comprises a vertical pile supporting and aligning rear wall 46 extending transversely of and at an oblique angle with respect to the shaft 38, a pair of vertically spaced pile supporting horizontal walls 47 and 48 disposed in parallel relation and extending forwardly from the rear wall 46 at right angles thereto, a vertical pile supporting and aligning side wall 49 at the side 43 of the carrier and extending forwardly from the rear wall 46 at right angles thereto, and a vertical side wall 50 at the side 44 of the carrier and extending forwardly from the rear wall 46 at right angles thereto, said walls being formed of heavy gauge steel plate and being welded together to provide a strong and rigid box-like pile carrier. The carrier 42 projects beyond the front frame member 15, 16 and is conveniently located a short distance from the machine foundation to facilitate loading and unloading of the piles of sheets. To enable rotation of the carrier 42 the frame plates 15 and 16 have arcuate sections thereof removed.

Surrounding the carrier 42 is an annular supporting member in the form of a flanged outer ring 51 and an inner disc 52 bolted or otherwise suitably secured to the flange of said ring and having an appropriate opening or

window therein to receive said carrier (Figs. 1, 2, 3 and 5). This annular supporting member is rigidly secured to the carrier **42** in concentric relation to the horizontal axis of rotation of the shaft **38** by means of angle bars **53** and **54** and blocks **55** and **56** bolted or otherwise suitably secured to said carrier and to the disc **52** of said member. The lower portion of the annular member extends between the frame plates **15**, **16** and is rotatably supported and guided by means of anti-friction rollers **57** and **58** to prevent downward deflection of the carrier **42** under the weight of the pile load of sheets therein. The rollers **57** and **58** are engaged by the ring **51** of the annular member and are journalled on short shafts **59** and **60**, respectively, which are carried by the frame plates **15** and **16**. The ring **51** of the annular member is also yieldingly engaged at the rear edge thereof by anti-friction thrust rollers **61** and **62** (Figs. 2, 3 and 5) to resist rearward displacement of the carrier **42**. Each roller **61** and **62** projects through a suitable opening formed in the frame plate **16** into engagement with the ring **51** and is journalled on a bracket **63** which is pivotally mounted intermediate its ends as at **64** on said frame plate. Each bracket **63** has engaged therewith corresponding ends of two heavy coil compression springs **65** for biasing the roller thereon toward the ring **51** and for yieldingly holding said roller under heavy pressure in engagement with said ring. The springs **65** are seated in suitable recesses in each bracket **63** and extend from the latter into abutting engagement with the outer frame plate **15** through suitable openings formed in the inner frame plate **16**, said springs being retained in position by guide pins **66** loosely carried at corresponding ends thereof by the bracket **63** and at the opposite ends by the frame plate **15**.

The ring **51** of the annular supporting member has bolted or otherwise suitably secured to the peripheral surface thereof two elongated stop engaging elements or blocks **67** and **68** (Figs. 1, 2 and 3) which are so located on said ring that one end of the element **67** is adapted to engage a stop-block **69** when the carrier **42** has been rotated through an angle of approximately 180° in a counter-clockwise direction from the position thereof shown in Figs. 1 and 3, and that one end of the element **68** is adapted to engage a stop-block **70**, as shown in Fig. 3, when said carrier has been rotated through an angle of approximately 180° in a clockwise direction from the broken line position shown in Fig. 2. The stop engaging elements **67**, **68** and the stop-blocks **69** and **70** thus cooperate to limit the rotation of the carrier **42** to approximately 180° in opposite directions, and to prevent accidental rotation of the carrier in wrong directions which would result in spilling of the pile of sheets from said carrier as will be hereinafter explained. The stop-blocks **69** and **70** are disposed between the frame plates **15**, **16** and are bolted or otherwise suitably secured to said plates.

Mounted on and rotatable with the carrier **42** is a switch engaging and actuating element **72** which is disposed at the side **44** of said carrier and is bolted or otherwise suitably secured to the side wall **50** to project rearwardly therefrom. This element **72** is arranged to engage and actuate an electrical limit switch **73** when the carrier **42** is rotated in a counter-clockwise direction from the position thereof shown in Fig. 1 and substantially reaches the broken line position shown in Fig. 2, and to engage and actuate a second electrical limit switch **74** when the carrier is rotated in a clockwise direction from said broken line position and substantially reaches the position shown in Fig. 1. The switches **73** and **74** are of the normally closed well-known roller-plunger actuator type and are connected in the electrical control circuit for the motor **26**, as illustrated in Fig. 10 and to be hereinafter described in detail. The switches **73** and **74** are adjustably secured in a suitable manner to identical brackets **75** such that their respective rollers are disposed in the path of rotation of the element **72**. The brackets **75** are adjustably secured to the upper surface of the rear frame member **17**. When the switches **73** and **74** are actuated or opened by the element **72**, the electrical circuit for the motor **26** is automatically broken, whereupon the magnetic brake immediately functions to stop said motor and further rotation of the carrier **42** thereby. This automatic stopping of the motor **26** upon rotation thereof in either direction occurs when the carrier **42** has been rotated thereby through an angle of approximately 180°, and provides for subsequent reverse rotation of said motor through closing of the motor circuit to be presently described.

Referring now to the electrical control circuit illustrated in Fig. 10, the motor **26** is of the three-phase type supplied with electrical current from any suitable source through lead wires **76**, **77** and **78**. Lead wire **76** is connected by a wire **79** with one terminal of a normally closed motor stopping switch **80**. This switch **80** is of the push-button type and is arranged in a switch box **81** indicated in broken lines (Fig. 10) and which is mounted at a convenient point within the reach of the operator on an industrial lift truck when the latter is in pile loading and unloading positions with respect to the carrier **42**. If desired, the switch box **81** may be conveniently located for actuation either by the lift truck operator or by a machine attendant. The other terminal of switch **80** has connected therewith two wires **82** and **83**. The wire **82** is connected with one terminal of a normally open motor starting switch **84**, and said terminal has also connected therewith a wire **85** which, in turn, is connected with one terminal of another normally open motor starting switch **86**. The switches **84** and **86** which are of the push-button type are arranged in the switch box **81** and are actuated or closed by the lift truck operator or by a machine attendant, as the case may be, to start the motor **26**. The other terminal of switch **86** is connected by a wire **87** with one terminal of the limit switch **73**. The other terminal of switch **73** is connected by a wire **88** with a coil **89** of a magnetic switch **90** which forms part of a conventional reversing controller arranged within a control box **91** indicated in broken lines (Fig. 10) and secured by suitable means at any convenient point on the machine frame. The coil **89** is connected by a wire **92** with a wire **93** which, in turn, is connected with the lead wire **78**. When the carrier **42** is disposed in the position thereof shown in Fig. 1, the limit switch **73** is closed as shown in Fig. 10.

It will thus appear that when the switch **86** is closed by the lift truck operator, or by a machine attendant, with the carrier **42** in the position thereof shown in Fig. 1, the coil **89** will be energized and actuate the magnetic switch **90** to close it in contact with terminals **94**, **95** and **96** of lead wires **76**, **77** and **78**, respectively. Closing of the switch **90** starts the motor **26** in the proper direction to rotate the carrier **42** in a counter-clockwise direction from the position shown in Fig. 1, said motor receiving current from the lead wires **76**, **77** and **78** through wires **97**, **98** and **99** connected with switch **90** and with wires **100**, **101**, **102** which, in turn, are connected with the motor **26**.

The switch **86** having been closed by the lift truck operator, or by a machine attendant, is opened as soon as it is released, thus disconnecting the wires **85** and **87**. The wire **87**, however, connected with the switch **86** and switch **73** is also connected with the magnetic switch **90** by a wire **103**, and when said magnetic switch is closed, it contacts the terminal **104** of a wire **105** which has connected therewith the wire **83** which, as previously described, is connected with the lead wire **76** through the switch **80** and wire **79**. Accordingly, when the switch **86** is opened, current flows from lead wire **76** through wire **79**, switch **80**, wires **83** and **105**, terminal **104**, magnetic switch **90**, wire **103**, limit switch **73**, and wire **88** to the coil **89**, thus maintaining current in said coil and

holding the magnetic switch 90 closed, regardless of the opening of switch 86. The motor 26 will thus continue to run until the limit switch 73 is opened by the element 72 on the carrier 42, or the switch 80 is opened, for some reason, by the operator of the lift truck, or by a machine attendant. Opening of the limit switch 73, or the switch 80, breaks the circuit to the coil 89, whereby said coil is deenergized, the magnetic switch 90 is opened, the motor 26 is stopped and the magnetic brake is applied. Opening of the limit switch 73 by the element 72 on the carrier 42 occurs when said carrier has been rotated through an angle of approximately 180° in a counterclockwise direction from the position shown in Fig. 1, and the pile of sheets therein is inverted.

The motor 26 having been stopped through actuation or opening of limit switch 73, the inverted pile of sheets in the carrier 42 having been unloaded therefrom by the lift truck, and another pile of sheets having been loaded into said carrier by said lift truck in the broken line position of said carrier shown in Fig. 2, the motor 26 is again started through closing of the switch 84 by the operator of the lift truck, or by a machine attendant. Closing of the switch 84 starts the motor 26 so that it rotates in a direction reverse to that in which it was first rotated to turn the carrier 42 from the position shown in Fig. 1 to the broken line position shown in Fig. 2 in a counterclockwise direction. In this case, the carrier 42 with another pile of sheets therein is rotated in a clockwise direction from the broken line position shown in Fig. 2 by the motor 26 which is supplied wiith electrical current from the lead wire 76 through wire 79, switch 80, wire 82, switch 84, a wire 106, limit switch 74, and a wire 107 to the coil 108 of a magnetic switch 109 arranged within the control box 91, said coil, in turn, being connected to the lead wire 78 by the wires 92 and 93. When the carrier 42 is in the position shown in Fig. 1, the limit switch 74 is held in opened condition by the element 72 on the carrier 42 as shown in Fig. 10, but said switch is released by said element and permitted to close immediately upon rotation of said carrier from said position.

It will thus appear that, with the limit switch 74 previously closed, when the switch 84 is closed, the coil 108 will be energized, thus actuating the magnetic switch 109 and closing it in contact with other terminals 110, 111 and 112 of lead wires 76, 77 and 78, respectively. When the magnetic switch 109 is closed, current flows to the motor 26 from lead wires, 76, 77 and 78 through the wires 102, 101 and 100, respectively. The switch 84 opens as soon as it is released, thus disconnecting the wires 82 and 106. The wire 106, however, connected with switch 84 and limit switch 74, is also connected by a wire 113 with the magnetic switch 109, and when said magnetic switch is closed, it contacts the terminal 114 of wire 105 which, as previously described, is connected with the lead wire 76 through wire 83, switch 80 and wire 79. Accordingly, when the switch 84 is opened, current flows from lead wire 76 through wire 79, switch 80, wire 83, terminal 114, magnetic switch 109, wire 113, closed limit switch 74 and wire 107 to the coil 108, thus maintaining current in said coil and holding the magnetic switch 109 closed, regardless of the opening of switch 84. The motor 26 will thus continue to run in the reverse direction until the limit switch 74 is opened by the element 72 on the carrier 42, as shown in Fig. 10, or the switch 80 is opened, for some reason, by the operator of the lift truck, or by a machine attendant.

Opening of the limit switch 74, or the switch 80, breaks the circuit to the coil 108, whereby said coil is deenergized, the magnetic switch 109 is opened, the motor 26 is stopped and the magnetic brake is applied. Opening of the limit switch 74 by the element 72 on the carrier 42 occurs when said carrier has been rotated from the broken line position shown in Fig. 2 to the position shown in Fig. 1 in a clockwise direction, and the second pile of sheets therein is inverted. The motor 26 then remains stopped until the inverted second pile of sheets is unloaded from the carrier 42 by the lift truck and a new or succeeding pile of sheets is loaded into said carrier in the position shown in Fig. 1 by said lift truck, at which time the motor may again be started in its original direction through closing of the switch 86 by the operator of the lift truck, or by a machine attendant, as previously described, the limit switch 73 being previously closed through disengagement of the element 72 on the carrier 42 therefrom upon rotation of said carrier from the broken line position shown in Fig. 2. It is to be noted that because of the fact that the limit switch 74 is open when the carrier 42 is in the position shown in Fig. 1, accidental closing of the switch 84 by the operator and starting of the motor 26 which will effect rotation of said carrier in a clockwise direction from said position is positively prevented. Likewise, when the carrier 42 is in the broken line position shown in Fig. 2, the limit switch 73 is open and, hence, accidental closing of switch 86 by the operator and starting of the motor 26 which will effect rotation of said carrier in a counterclockwise direction from said position is also positively prevented. Accordingly, the motor 26 can only be operated in the proper directions and utmost safety in the operation of the pack turnover apparatus is thereby assured.

In the operation of the hereinbefore described pack turnover apparatus, assuming now that the motor 26 is stopped, and that the box-like pile carrier 42 occupies the position shown in Figs. 1 and 3. An unclamped pile of sheets 45 carried upon a skid-board SB1 and having a second identical skid-board SB2 placed in inverted position on top thereof is transported together with said skid-boards to the pack turnover apparatus by an industrial lift truck and loaded by said lift truck into the carrier 42 such that one side of the pile of sheets and skid-boards contact or substantially contact the side wall 49 of the carrier, as shown in Fig. 1, and that the rear side of said sheet pile and skid-boards contact or substantially contact the rear wall 46 of said carrier, as shown in Fig. 5. With the lift truck retracted sufficiently to clear the carrier 42, the operator of said truck without leaving the same, or an assistant machine attendant if desired, now closes the switch 86 which starts the motor 26 in the proper direction to rotate the carrier 42 and pile of sheets 45 therein counterclockwise from the position shown in Fig. 1 so that the side 43 of said carrier travels downwardly and then upwardly, as indicated by the full line arrow shown in Figs. 6 and 7. As the carrier 42 with the pile of sheets 45 therein thus rotates through the first 90° of its movement and reaches the central position diagrammatically shown in Fig. 6, it is important to note that the carrier gradually assumes a rearward inclination, as shown in Fig. 6, because of the described angular mounting of said carrier obliquely with respect to the horizontal axis of rotation thereof.

In the rotated central position of the carrier 42 shown in Fig. 6, it will be seen that the side wall 49 of said carrier is at the bottom and is tilted downwardly and rearwardly and the rear wall 46 of the carrier stands vertically and is correspondingly tilted rearwardly and downwardly. Under these conditions, the pile of sheets 45 and skid-boards SB1 and SB2 are safely retained in the carrier 42 during rotation thereof, and at the same time the pile of sheets and skid-boards are biased by the weight thereof toward and into engagement with the carrier walls 46 and 49 which effectively imparts a jogging action to the loose and unclamped sheet pile such that the sheets thereof are evenly aligned at two angularly related sides if said sheets are not already so aligned.

Upon continued rotation of the carrier 42 through the last 90° of its movement in the direction of the full line arrow shown in Fig. 7, said carrier is turned over, as diagrammatically shown in Fig. 7, so that the wall 47 thereof is now at the bottom, the wall 48 is now at the top, and the wall 49 is now at the right-hand side (Fig. 7) of

the carrier, whereupon the pile of sheets 45 rocks about its lower edge on the wall 49 from the wall 48 to the wall 47 and is likewise turned over so that the skid-board SB2 is now at the bottom of said pile and the skid-board SB1 is now at the top thereof, said rocking motion of the sheet pile tending to advantageously break the adhesion between the sheets for subsequent individual handling thereof. When the carrier 42 reaches the limit of its 180° movement and is disposed in the broken line position shown in Fig. 2, at which position said carrier and the pile of sheets therein are fully inverted, the switch actuating element 72 on the carrier engages and actuates the limit switch 73 to open the same. Opening of the switch 73 breaks the electrical circuit for the motor 26 thus stopping said motor and rotation of the carrier thereby. The inverted pile of sheets 45 together with the skid-board SB2 now at the bottom thereof and the skid-board SB1 now at the top thereof is now unloaded from the carrier 42 by the lift truck and transported to a desired destination. The carrier 42 in the actuated broken line position shown in Fig. 2 is now ready to receive therein a second pile of sheets with upper and lower skid-boards.

When a second pile of sheets and skid-boards have been loaded by the lift truck, as in the case of the first pile or load, into the carrier 42 and said lift truck has been moved clear of the carrier, the truck operator, or machine attendant, closes the switch 84 which starts the motor 26 so that it rotates in the reverse direction to rotate the carrier clockwise, as indicated by the broken line arrow shown in Figs. 6 and 7, from the broken line position shown in Fig. 2. As the carrier 42 with the second pile of sheets therein thus rotates in the clockwise direction, the side 43 of said carrier travels downwardly and then upwardly as will clearly be seen from an inspection of Fig. 7, and hence the carrier, as in the previous case, assumes a rearward inclination during rotation thereof in this direction. Accordingly, the second pile of sheets is safely retained in the carrier 42 during rotation thereof and is effectively jogged against the carrier walls 46 and 49. When the carrier 42, upon continued rotation thereof in the clockwise direction, reaches the limit of its 180° movement and is again disposed in its first described position shown in Fig. 1, at which position the second pile of sheets therein is inverted, the switch actuating element 72 on the carrier engages and actuates the limit switch 74 to open the same. Opening of the switch 74 breaks the electrical circuit for the motor 26, thereby stopping said motor with the carrier 42 in the first described position shown in Fig. 1. The second inverted pile of sheets together with the skid-boards is now unloaded from the carrier 42 by the lift truck and transported to a desired destination. A third pile of sheets with upper and lower skid-boards may now be truck loaded into the carrier 42 in the position of the latter shown in Fig. 1, and the above described operations repeated to invert said third pile and subsequent piles of sheets through rotation of the carrier 42 in opposite directions.

It will be apparent that rotation of the carrier 42 in a clockwise direction from the position thereof shown in Fig. 1, and rotation of said carrier in a counter-clockwise direction from the broken line position thereof shown in Fig. 2, will cause the carrier to assume a forward inclination with the result that the pile of sheets and skid-boards therein would be spilled from said carrier onto the machine foundation. Such rotation of the carrier 42 in the wrong directions is, however, avoided by the limit switches 73 and 74, as hereinbefore described, as well as by the cooperating stop engaging elements 67 and 68 and the stop-blocks 69 and 70.

For maximum efficiency and to obtain the full benefit of the described pack turnover apparatus, the carrier 42 is usually loaded with piles of sheets having an overall height, including the top and bottom skid-boards, which is substantially equal to the inside dimension of said carrier between the walls 47 and 48 thereof. When, however, piles of sheets of less height are to be inverted, the inside dimension of the carrier 42 is preferably, but not necessarily, reduced to substantially the height of said sheet pile, including the skid-boards, through the provision of board-spacers, indicated generally at 115 (Figs. 8 and 9), so that the gravity fall of the sheet pile in the turning thereof is reduced to a minimum. In order to illustrate the board-spacers 115 in operative position, the carrier 42 is shown in Fig. 1 as including two of said board-spacers, it being understood that the board-spacers are normally removed from the carrier as shown in Figs. 6 and 7, and are inserted therein only when necessary or required, and that they do not form a permanent part of said carrier.

The board-spacers 115 may be of any suitable construction, but as herein shown, are preferably constructed of a plurality of wood bars 116 (Figs. 8 and 9) extending lengthwise and disposed in spaced parallel relation, and a plurality of wood runners 117 extending crosswise of said bars and disposed centrally of the latter and inwardly of the opposite ends thereof, said bars and runners being firmly secured together as by gluing and riveting. Secured in any suitable manner to the outer runners 117 are two retaining pins 118 which project rearwardly beyond the rear ends of said runners, and secured in any suitable manner to the underside of the front bar 116 are two retaining lugs 119 which project outwardly beyond the opposite ends of said front bar.

The number of board-spacers 115 to be used when piles of sheets of less than maximum height are to be inverted depends upon the overall height of the sheet pile, and in the illustrated embodiment the carrier 42 is constructed to accommodate ten of such board-spacers, five above the pile of sheets and five below said pile. This symmetric arrangement of the board-spacers 115 above and below the pile of sheets serves to maintain a substantially balanced condition. For this purpose, the rear wall 46 of the carrier 42 is provided adjacent the wall 47 with two longitudinally spaced and aligned sets of vertically spaced and aligned holes or openings 120 (Fig. 3), and adjacent the wall 48 with two longitudinally aligned sets of vertically spaced and aligned holes or openings 121 which are in vertical alignment with the holes 120, there being five holes in each of said sets and said holes serving to receive therein the pins 118 on the board-spacers 115 and thereby support said spacers individually at the rear thereof in positions on the carrier 42. The side walls 49 and 50 of the carrier 42 are each provided along the front edge thereof with five open-ended slots 122 which are aligned with the holes 120, and five additional open-ended slots 123 which are aligned with the holes 121, said slots serving to receive therein the lugs 119 on the board-spacers 115 and thereby support said spacers individually at the front thereof in positions on the carrier 42. The holes 120, 121 and slots 122, 123 are slightly oversize so as to enable the board-spacers 115 to contact each other and the walls 47 and 48 of the carrier 42, whereby the weight of the pile load of sheets and skid-boards is taken by said carrier walls and not by the pins 118 and lugs 119.

It will thus be apparent that when piles of sheets of less than maximum height are to be inverted, board-spacers 115 of an appropriate even number are inserted edgewise into the carrier 42 at the top and bottom thereof beginning at the walls 47 and 48 and such that said board-spacers will be symmetrically disposed above and below the sheet pile and that their respective pins 118 and lugs 119 are engaged in the holes 120, 121 and slots 122, 123, respectively, registering therewith. The pile of sheets, together with top and bottom skid-boards, is then truck loaded into the carrier 42 between the upper and lower board-spacers 115 for turning thereof by said carrier in the manner previously described. As the pile of sheets is being turned, it is confined by

the board-spacers **115** and, hence, the gravity fall of said pile is reduced to a minimum.

The carrier **42** is provided exteriorly thereof with a plurality of spring-pressed latches **124** (Figs. 1, 2, 3 and 5) for retaining the board-spacers **115** in said carrier and thereby prevent outward displacement thereof by the lift truck when the inverted piles of sheets are unloaded from said carrier by said lift truck. These latches **124** are arranged in superposed relation at one side of the carrier **42**, preferably at the side 43 thereof, and are engageable with the lugs **119** at the corresponding sides of the board-spacers **115**, there being one latch **124** for each slot **122** and **123** in the carrier side wall **49**. The latches **124** are pivotally mounted intermediate the ends thereof in groups on pins **125**, each pin being carried in blocks **126** which are bolted or otherwise suitably secured to the carrier side wall **49**. The springs **127** for the latches **124** are of the torsion type and surround the pins **125**, each spring having one end thereof engaged with one end of its respective latch **124** and the other end engaged with the other end of said latch. When the board-spacers **115** are inserted into the carrier **42**, the latches **124** therefor are cammed out of operative positions by the lugs **119** on said board-spacers and snap over said lugs when the board-spacers are fully inserted. When the board-spacers **115** are no longer required, the latches **124** engaged therewith are manually released to permit removal of said board-spacers from the carrier **42**.

The foregoing description and accompanying drawings set forth with more or less particularity one embodiment of the present invention, but it is to be expressly understood that said invention is not limited to said embodiment. Various changes may be made therein, particularly in the design and arrangement of the parts illustrated, as well as in the mode of operation and manner of use, without departing from the spirit and scope of the invention, as it will now be clear to those skilled in the art. For example, the box-like pile carrier may be driven through the annular supporting member therefor by providing the latter with suitable gear teeth on the periphery thereof and connecting the driving means through suitable gearing with said annular member. Additionally, for relatively small and/or light piles of sheets, the annular supporting member for the pile carrier may be eliminated. For a definition of the limits of the invention reference is had primarily to the appended claims.

What is claimed is:

1. In apparatus for inverting piles of sheets, a box-like carrier opened at one side thereof and arranged for rotary movement about a horizontal axis passing axially through said side, said carrier being disposed transversely of and at an oblique angle with respect to said axis and in normal position presenting opposed parallel wall portions thereof in horizontal position to receive therein a pile of sheets, and means for rotating said carrier about said axis from said normal position through an angle of approximately 180° in a direction such that said carrier will assume a rearward inclination as it rotates whereby the pile of sheets is retained therein and inverted.

2. In apparatus of the class described, a box-like carrier opened at one side thereof and arranged for rotary movement about a horizontal axis passing axially through said side, said carrier being disposed transversely of and at an oblique angle with respect to said axis and in normal position presenting opposed parallel wall portions thereof in horizontal position to receive therein a pile of sheets, means for rotating said carrier about said axis from said normal position, means for limiting said rotation of the carrier to a direction such that said carrier will assume a rearward inclination as it rotates, and means for limiting said rotation of said carrier in said direction through an angle of approximately 180 degrees.

3. In apparatus for inverting piles of sheets, a box-like carrier opened at one side thereof and arranged for rotary movement about a horizontal axis passing axially through said side, said carrier being disposed transversely of and at an oblique angle with respect to said axis and in normal position presenting opposed parallel wall portions thereof in horizontal position to receive therein a pile of sheets, power means for rotating the carrier about said axis from said normal position in a direction such that said carrier is tilted rearwardly as it rotates whereby the pile of sheets is retained therein, and means for automatically throwing said power means out of operation when said carrier and the pile of sheets have been rotated in said direction through an angle of approximately 180 degrees.

4. In apparatus of the class described, a box-like carrier opened at the front thereof and mounted for rotary movement in opposite directions about a horizontal axis between two positions spaced approximately 180° apart, said carrier being disposed transversely of and at an oblique angle with respect to said axis and at said positions presenting opposed parallel wall portions thereof in horizontal position to receive at each of said positions a pile of sheets, said wall portions serving alternately as top and bottom supports for each sheet pile depending on the position of said carrier, power means for rotating the carrier about said axis in said directions from one position to the other position and such that said carrier assumes a rearward inclination during such rotation whereby each pile of sheets is retained therein, and means automatically actuated when the carrier and the sheet pile therein reach the said other position for throwing said power means out of operation and stopping rotation of said carrier thereby.

5. In apparatus for inverting piles of sheets, a box-like carrier opened at one side thereof and mounted for rotary movement about a horizontal axis passing axially through said side, said carrier being disposed transversely of and at an oblique angle with respect to said axis and in normal position presenting opposed parallel wall portions thereof in horizontal position to receive therein a pile of sheets, mechanism including an electric motor for rotating the carrier about said axis from said normal position in a direction such that said carrier is rearwardly inclined during such rotation whereby the pile of sheets is retained therein, means for supplying current to said motor and comprising a circuit therefor, a switch in said circuit for breaking it to thereby stop said motor and rotation of said carrier, and means rotatable in unison with said carrier for actuating said switch and breaking said circuit when said carrier and the pile of sheets have been rotated through an angle of approximately 180 degrees.

6. In apparatus of the class described, a box-like carrier opened at the front thereof and mounted for rotary movement in opposite directions about a horizontal axis between two end positions spaced approximately 180° apart, said carrier being disposed transversely of and at an oblique angle with respect to said axis and at said positions presenting opposed parallel wall portions thereof in horizontal position to receive at each of said positions a pile of sheets, said wall portions serving alternately as top and bottom supports for each pile depending on the position of said carrier, mechanism including a reversible electric motor for rotating the carrier about said axis in said directions and such that said carrier is rearwardly inclined during such rotation whereby each pile of sheets is retained in said carrier, means for supplying current to said motor and comprising a circuit therefor, two independent manually actuated switches in said circuit for controlling said motor and rotation thereof in opposite directions, and two independent switch means in said circuit and controlled by said carrier, one of said

switch means being arranged to break said circuit and stop said motor when the carrier is rotated in one direction and has reached the corresponding end position in inverted position, and the other of said switch means being arranged to break said circuit and stop said motor when the carrier is rotated in the other direction and has reached the corresponding end position in inverted position.

7. Apparatus as defined in claim 6, comprising stop engaging means rotatable in unison with the carrier, and stop elements arranged to be engaged by said stop engaging means for confining the movement of said carrier in opposite directions to said end positions, said stop elements and stop engaging means cooperating to prevent accidental rotation of the carrier in directions which would effect a forward inclination of said carrier.

8. In apparatus for inverting piles of sheets, a vertically disposed annular member, means supporting and guiding said annular member for rotation concentrically about a horizontal axis, a box-like carrier disposed transversely of and at an oblique angle with respect to said axis and secured in such relation to said annular member, said carrier being opened at the front thereof and in normal position presenting opposed parallel wall portions thereof in horizontal position to receive therein a pile of sheets, and means for rotating said annular member, said carrier and the pile of sheets about said axis through an angle of approximately 180° in a direction such that said carrier is rearwardly inclined as it rotates whereby the pile of sheets is retained therein and inverted.

9. In apparatus of the class described, a box-like carrier mounted for rotary movement about a horizontal axis and opened at the front thereof to receive therein a pile of sheets, said carrier when in pile receiving position comprising a vertical rear wall extending transversely of said axis and turned in the plane of said axis at an oblique angle relative to said axis, a pair of vertically spaced horizontal walls extending forwardly from said rear wall at right angles thereto, and a pair of vertical side walls extending forwardly from said rear wall at right angles thereto, said horizontal walls serving alternately as top and bottom supports for the sheet pile depending on the position of said carrier, and means for rotating said carrier about said axis from said normal position through an angle of approximately 180° in a direction such that said carrier will assume a rearward inclination as it rotates whereby the pile of sheets is gravity biased toward said rear wall and one of said side walls and thereby is retained in said carrier and evenly jogged against said rear wall and the said one of said side walls during rotation thereof to inverted position.

10. Apparatus as defined in claim 9, comprising spacer-board means normally removed from the carrier and insertable therein to accommodate a variety of pile heights, and releasable latch means on said carrier for holding said spacer board means against outward displacement from said carrier.

11. In apparatus of the class described, a base frame, a horizontally disposed shaft rotatably mounted on said frame, a box-like carrier secured to one end of said shaft and opened at the front thereof to receive therein a pile of sheets, said carrier when in pile receiving position comprising a vertical pile supporting and aligning rear wall extending transversely of the shaft and turned in the plane of said shaft at an oblique angle relative to said shaft thereby disposing one side edge of said wall farther outwardly from said shaft than the opposite side edge of said wall, a pair of vertically spaced pile supporting horizontal walls projecting outwardly from said rear wall at right angles thereto, and a vertical pile supporting and aligning side wall projecting outwardly from the said one side edge of said rear wall at right angles thereto, and means drivably connected to said shaft for rotating the latter and said carrier through an angle of approximately 180° from pile receiving position in a direction such that said carrier side wall travels downwardly and then upwardly, whereby said side wall and said rear wall are tilted downwardly and rearwardly during such rotation of said carrier so that the pile of sheets during rotation thereof to inverted position is retained in said carrier and is gravity biased toward said side and rear walls and evenly jogged against the same.

12. Apparatus as defined in claim 11 wherein said carrier in pile receiving position is so disposed in angular relation to said shaft that the horizontal axis of rotation of the shaft is located on the horizontal center line of the carrier and to the side of the vertical center line of said carrier remote from said side wall of the carrier.

13. Apparatus as defined in claim 11 wherein the means for rotating the shaft and the carrier comprises an electric motor, means for supplying current to said motor and comprising a circuit therefor, and manually operable switch means in said circuit for starting said motor, and comprising other switch means in said circuit and controlled by said carrier for breaking said circuit and stopping said motor and rotation of said carrier thereby when the latter has been rotated through an angle of approximately 180° and the pile of sheets carried thereby is substantially disposed in upright inverted position.

14. Apparatus as defined in claim 11, comprising a vertically disposed annular member surrounding said carrier and secured thereto in concentric relation to said shaft, and means on said base frame and engageable with said annular member for rotatably supporting said annular member.

15. In apparatus of the class described, a base frame, a horizontally disposed shaft rotatably mounted on said frame, a box-like carrier secured to one end of said shaft for rotation thereby in opposite directions between two end positions spaced 180° apart, said carrier being opened at the front thereof to receive therein at either of said positions a pile of sheets, said carrier in pile receiving position comprising a vertical pile supporting and aligning rear wall extending transversely of the shaft and turned in the plane of said shaft at an oblique angle relative to said shaft thereby disposing one side edge of said wall farther outwardly from said shaft than the opposite side edge of said wall, a pair of vertically spaced pile supporting horizontal walls projecting outwardly from said rear wall at right angles thereto, and a vertical pile supporting and aligning side wall projecting outwardly from the said one side edge of said rear wall at right angles thereto, mechanism including a reversible electric motor drivably connected to said shaft for rotating the latter and said carrier in said directions from one end position to the other end position and such that said carrier side wall travels downwardly and then upwardly, whereby said side wall and said rear wall are tilted downwardly and rearwardly during rotation of said carrier in either direction so that each pile of sheets during rotation thereof is retained in said carrier and is gravity biased toward said side and rear walls and evenly jogged against the same, means for supplying current to said motor and comprising a circuit therefor, and two independent manually actuated switches in said circuit for controlling said motor and rotation thereof in opposite directions.

16. Apparatus as defined in claim 15, comprising switch actuating means carried by and rotatable with said carrier, and two other independent switches connected in said motor circuit and mounted on said base frame, one of said last-named switches being arranged to be engaged and actuated by said switch actuating means to break said circuit and stop the motor when the carrier is rotated in one direction and has reached the corresponding end position in inverted position, and the other of said last-named switches being arranged to be engaged and actuated by said switch actuating means to break said circuit and stop said motor when the carrier is rotated in

the other direction and has reached the corresponding end position in inverted position.

17. Apparatus as defined in claim 15, comprising spacer-board means normally removed from the carrier and insertable therein above and below the pile of sheets to accommodate a variety of pile heights, and a plurality of releasable spring-pressed latches disposed in superposed relation and carried by the side wall of said carrier adjacent the upper and lower and front edges thereof for holding a corresponding number of said spacer-board means against outward displacement from said carrier.

18. Apparatus as defined in claim 15, comprising a vertically disposed annular member surrounding said carrier and secured thereto in concentric relation to said shaft, and means on said base frame and engageable with said annular member for rotatably supporting and guiding said annular member.

19. Apparatus as defined in claim 18, comprising stop engaging means carried by and rotatable with said annular member, and stop elements carried by the base frame and arranged to be engaged by said stop engaging means for confining the rotation of the carrier in opposite directions to the pile receiving and pile inverting positions.

20. In apparatus for inverting piles of sheets, a base frame, a horizontally disposed shaft rotatably mounted on said frame, a box-like carrier extending transversely of and at an oblique angle with respect to said shaft and secured substantially centrally to one end of said shaft, said carrier being opened at the front thereof to receive therein a pile of sheets, an annular member surrounding said carrier and secured thereto in concentric relation to said shaft, means on said frame and engaged by said annular member for rotatably supporting said annular member, and means for rotating said shaft, said carrier and said annular member through an angle of approximately 180° in a direction such that said carrier together with the pile of sheets disposed therein and carried thereby will assume a rearward inclination during rotation thereof.

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