Oct. 25, 1960 L. C. WILLIAMS 2,957,691

SHEET HANDLING APPARATUS

Filed May 23, 1958 3 Sheets-Sheet 1

Fig. 1

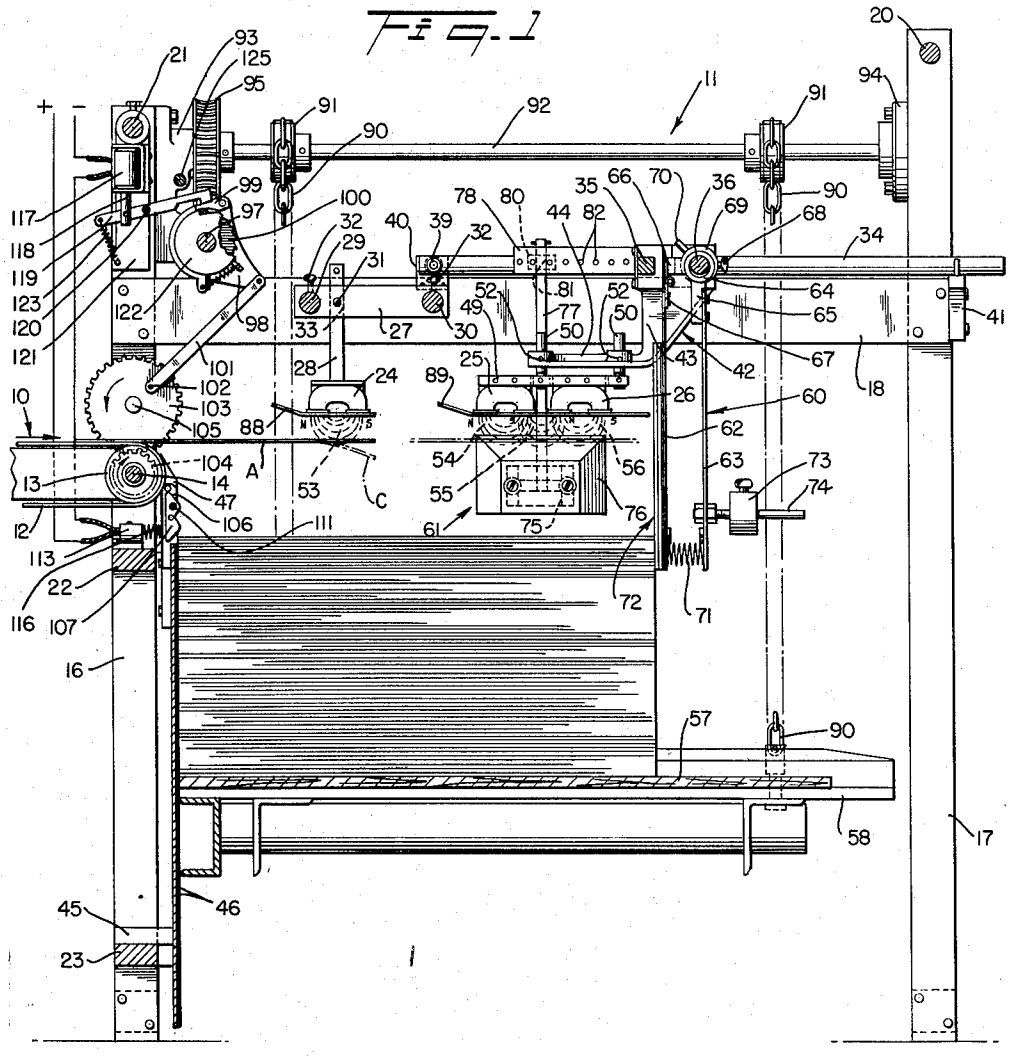
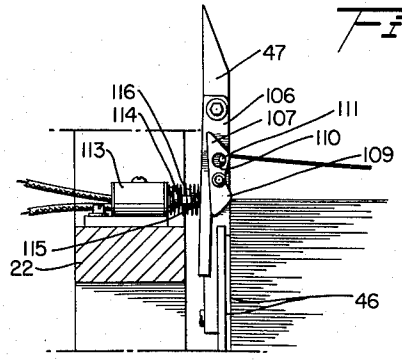


Fig. 6



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SHEET HANDLING APPARATUS

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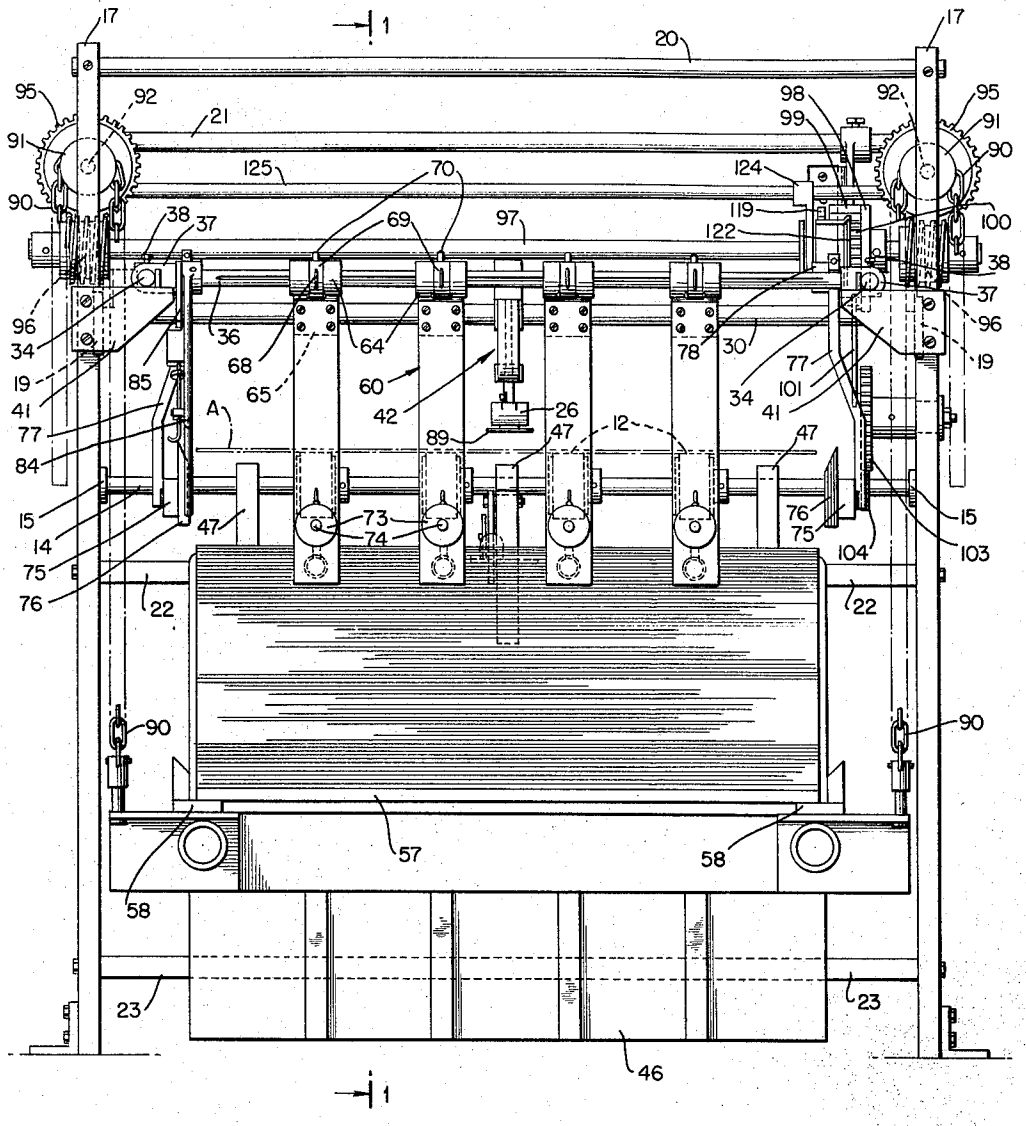

Fig. 2

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SHEET HANDLING APPARATUS

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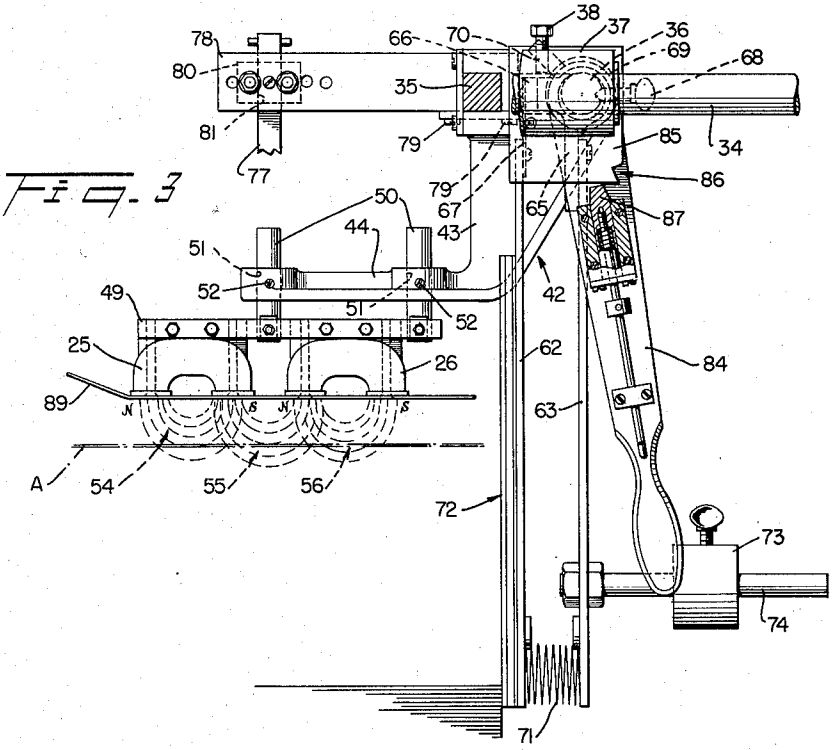
Fig. 3



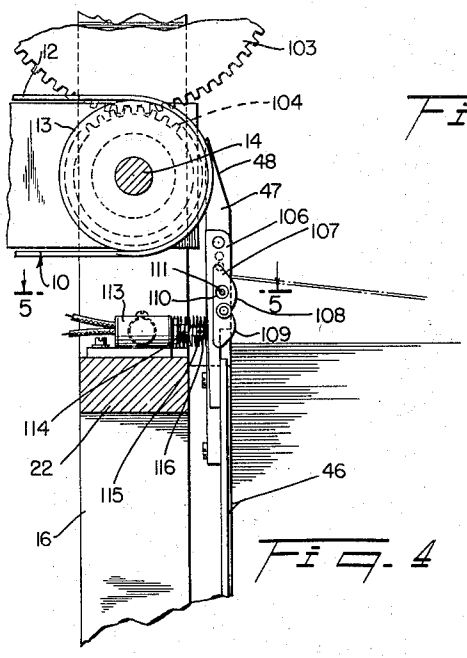
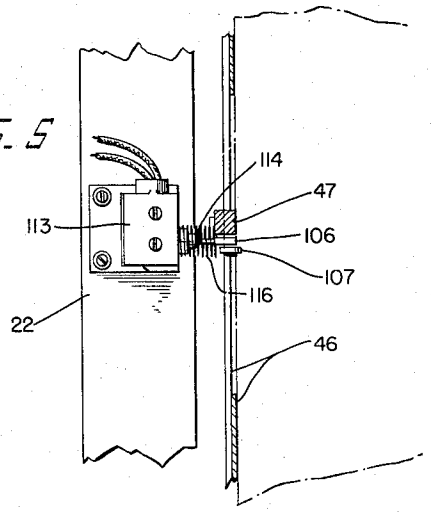


Fig. 4

Fig. 5



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United States Patent Office

2,957,691

Patented Oct. 25, 1960

2,957,691

SHEET HANDLING APPARATUS

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Filed May 23, 1958, Ser. No. 737,367

14 Claims. (Cl. 271—88)

This invention relates to sheet handling apparatus having a pile elevator and more particularly to novel means to control the downward movement of the elevator.

An object of the present invention is to provide an improved control means for a pile lowering mechanism which is of novel, simple and durable construction.

Another object is to provide a pile delivery for sheets of metal, cardboard or other relatively stiff non-metallic material having a pile lowering mechanism and novel control means therefor which is responsive to the rising level of sheets delivered to said pile.

A further object is to provide a pile delivery for sheets of metal and other relatively stiff non-metallic material having a pile lowering mechanism and novel control means therefor which is actuated by the sheets being delivered to a pile.

A still further object is to provide a pile delivery for sheets of metal and other relatively stiff non-metallic material having a pile lowering mechanism and novel control means therefor actuated by the engagement of said means and the edges of said sheets moving downwardly past said means when the top of the pile of delivered sheets reaches a predetermined level.

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.

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

Fig. 1 is a vertical longitudinal sectional view of a sheet delivery embodying the present invention and including a pile elevator, said view being taken on the line 1—1 of Fig. 2;

Fig. 2 is an end elevation of the sheet delivery shown in Fig. 1 looking from the right thereof, certain of the parts having portions broken away for purposes of clearer illustration;

Fig. 3 is an enlarged vertical longitudinal section of one of the front sheet jogging devices, the lifting device for said front sheet jogging devices, and the slow-down magnets as shown in Figs. 1 and 2, certain of the parts having portions broken away for purposes of clearer illustration;

Fig. 4 is an enlarged vertical longitudinal section of the pile elevator control means, said means being shown in the position it occupies when the pile lowering mechanism is not actuated;

Fig. 5 is a top plan view taken on line 5—5 of Fig. 4 and partly in section, of the control means; and

Fig. 6 is an enlarged vertical longitudinal section of the pile elevator control means, said means being shown in the position it occupies when the pile lowering mechanism is actuated and the lowering of the pile elevator and the pile of sheets thereon is effected.

Referring to the drawings, there is shown one form

of a high speed sheet delivery apparatus embodying the present invention which is particularly adapted for slowing down and piling sheets of tin plate as the same are delivered to said apparatus at a speed of approximately 120–150 sheets per minute from a combined drying or baking oven and sheet turnover unit employed in the processing or making of metal articles or containers. It will be understood, however, that the high speed sheet delivery apparatus disclosed herein may be advantageously and effectively employed in connection with other machines for slowing down and piling sheets of tin plate or other metal sheets of a magnetic character as the same are discharged from said machines.

In the illustrated embodiment, the sheets of tin plate pass in rapid succession from the baking oven and turnover unit with their treated surfaces uppermost onto a horizontally disposed endless conveyor **10** which advances said sheets at a high speed away from said unit to a pile delivery **11** wherein sheets are piled one on top of the other in an orderly pile for further handling thereof. Conveyor **10** comprises a plurality of transversely spaced and parallel endless belts **12** the rear ends of which pass around a suitable roller or rollers (not shown) located adjacent the discharge end of the sheet turnover mechanism. The front ends of belts **12** pass around a plurality of rollers **13** which are fixed in spaced relation on a transversely extending shaft **14**. This shaft is journalled at its opposite ends in suitable bearings provided in side plates **15** that are secured to the inner surfaces of two transversely spaced rear uprights **16** and project forwardly therefrom. Uprights **16** form part of the pile delivery frame which includes two transversely spaced similar front uprights **17**, said uprights being bolted to the machine foundation and connected together by side members **18** and **19**. The front uprights **17** are connected together at the tops thereof by a stay shaft **20**, the rear uprights **16** are connected together at the tops thereof by a stay shaft **21**, and at vertically spaced points below the belt roller shaft **14** by cross members **22** and **23**.

The belts **12** are continuously driven to advance the sheets of tin plate at a high rate of speed in a continuously moving procession from the baking oven and turnover unit to the pile delivery **11**, and said operation may be effected, as desired, directly from said unit or from a separate source of power, such as an electric motor carried by the pile delivery frame and connected by suitable known means with the belt roller shaft **14**.

If desired advancing rollers and cooperating pressure rollers may be located at the discharge end of conveyor **10** in the same manner as disclosed in United States Patent No. 2,626,800, granted Jan. 27, 1953, to George A. Martin, to further advance and guide the sheet as it leaves the endless conveyor.

In accordance with one aspect of the present invention, magnetic slowdown and supporting devices of novel construction are provided in the space over the piling position for the creating of magnetic fields to cause the sheet as it leaves the endless conveyor at a high rate of speed to be decelerated and at the same time to move forward in a substantially horizontal plane into space until approximately the entire sheet is disposed over the piling position. In this manner, the successive sheets are advanced under positive control to piling position, each succeeding sheet is decelerated, supported and suspended in space and is prevented from dragging along and marring the upper surfaces of a preceding delivered and piled sheet, and upon reaching piling position the successive sheets will bodily fall flatwise one on top of the other in an accumulated pile thereof.

As shown in Figs. 1, 2 and 3 of the drawings, the magnetic slowdown and supporting means comprises a

plurality of permanently magnetized horeshoe shaped magnets 24, 25 and 26. A lead-in magnet 24 is mounted adjacent the discharge end of conveyor 10 and slowdown magnets 25, 26 are mounted forwardly thereof. Magnet 24 with its open ends pointing downwardly is suitably secured to a vertically extending bracket 28 which is mounted at its upper end for vertical adjustment in slot 33 of block 27 and secured in adjusted position by a set screw 31. Block 27 is slidably mounted on parallel shafts 29 and 30 which are secured at their opposite ends to the side members 18, 19 of the delivery frame. The block 27 and the magnet 24 carried thereby are therefore adjustable horizontally from side to side along the shafts 29, 30 and may be secured in any desired position of adjustment thereon by set screws 32.

As herein shown, the slow-down magnets 25, 26 are supported on an auxiliary frame comprising side members 34 and front parallel cross members 35, 36. Cross members 35, 36 are secured to brackets 37 slidably mounted on the side members 34. Cross member 36 also supports sheet jogging devices hereinafter to be described in detail. The cross members 35, 36 and the magnets 25, 26 together with the sheet jogging devices carried thereby are therefore adjustable rearwardly and forwardly along the side members 34 and may be secured in any desired position of adjustament thereon by set screws 38 which are threadedly secured in brackets 37. The auxiliary frame is pivotally mounted at the rear thereof, as indicated at 39, on upright supports 40 secured to and supported by shaft 30. The auxiliary frame is supported at the front thereof by laterally projecting brackets 41 secured in the front uprights 17. It will be noted that the pivotal mounting of the auxiliary frame enables said frame with the front magnets and the sheet jogging devices carried thereby to yield upwardly in the event the elevator of the pile support mechanism to be hereinafter described in accidently raised too high, thus preventing damage to the sheet jogging devices through engagement of the pile supporting platform therewith. The front magnets 25, 26 are supported by a bracket 42 comprising a vertically extending portion 43 and a horizontally extending portion 44. Bracket 42 is movably supported on parallel cross members 35, 36 and said bracket together with the magnets 25, 26 carried thereby are therefore adjustable horizontally from side to side along the cross members 35, 36 and may be secured in any desired position of adjustment thereon by the use of suitable set screws threadedly engaged through the upper portion of said bracket and into cross member 35. Magnets 25, 26 with their open ends pointed downwardly are secured at their top portions to a plate 49 which is suitably secured, for example by bolts, to two longitudinally spaced vertically extending bars 50 the upper ends of which are adapted to fit into apertures 51 in horizontal portion 44 of bracket 42. Plate 49 has a series of apertures to permit bars 50 to be bolted thereto at several positions on said plate. Bars 50 are vertically adjustably secured in apertures 51 by set screws 52.

Suitable shields 88, 89 are placed over the open ends of magnets 24, 25 and 26 to redirect a sheet into the machine should it accidently be misdirected out of its normal horizontal path of movement.

As the sheet leaves the conveyor 10, it travels forward into space and its leading edge would normally tend to dip downwardly as shown in C in Fig. 1. Lead-in magnet 24 is mounted adjacent the end of the conveyor 10 and slightly above the horizontal path of movement of the sheet and has a magnet field 53 which extends downwardly and through said path. As the leading edge of the sheet enters into said magnetic field the lead-in magnet will attract said sheet and lift it sufficiently against the pull of gravity to keep it in a substantially horizontal and suspended path of movement. However, the magnet is so spaced that its magnetic field 53 is not strong enough to lift the sheet any more than to keep it in a straight horizontal path. Each of slowdown magnets 25, 26 like magnet 24 are horseshoe or U-shaped in cross-section (Fig. 3) and each has a north and south pole, indicated at N and S, with magnetic fields 54, 56, respectively, extending between said unlike poles. Said magnets are mounted on plate 49 in a spaced apart position to each other with the adjacent poles of each magnet being unlike poles so that a further magnetic field 55 is created between said magnets. Magnetic fields 54, 55 and 56, extend downwardly into and through the horizontal path of movement of the sheet and present a magnetic field of a greater intensity than magnetic field 53. Magnetic fields 54, 55 and 56, however, are not of sufficient intensity to pull the sheet into physical contact with said magnets or to hold the entire weight of the sheet against the downward pull of gravity. As the trailing edge of the sheet leaves the conveyor the leading edge thereof enters into the magnetic fields 54, 55 and 56 and is lifted upward toward and suspended by magnets 25, 26 and at the same time the intensity of these magnetic fields will cause its forward horizontal speed to be decreased. As the leading portion of the sheet enters the magnetic fields 54, 55 and 56, the weight thereof will overcome the magnetic influence of lead-in magnet 24 at the trailing edge thereof causing said trailing edge to be pulled downwardly by gravity. Since magnetic fields 54, 55 and 56 will not support the entire weight of the sheet it will be peeled downwardly away from said magnetic fields as the trailing edge thereof falls. As the trailing edge of the sheet falls downwardly and out of the magnetic field 53, the leading edge of the succeeding sheet enters into said magnetic field and the above described cycle is repeated giving in effect a shingling of successive sheets in space. The entire forward speed of the sheet is not absorbed by the magnetic fields 54, 55 and 56 with the result that each sheet continues to travel forward for a relatively short distance at the same time that it is being peeled away from said magnetic fields until the leading edge thereof strikes the front sheet joggers 60. As each sheet is fed into the space over the piled sheets at a high rate of speed it is directed by and subjected to the following composite forces. First, the leading edge of the sheet is pulled upwardly by the magnetic force of lead-in magnet 24 which redirects the sheet into a substantially horizontal and suspended path of movement. As the leading edge of the sheet horizontally moves into the magnetic fields of magnets 25, 26 the sheet is temporarily supported and suspended in space and is decelerated by said magnetic fields. Simultaneously with the action of magnets 25, 26 on the leading portion of the sheet, its trailing edge has started to drop downward away from magnet 24 so that the sheet moves forward for a relatively short distance at an inclined angle which further tends to decelerate the sheet by air friction on the underside of said sheet and a slight compression of air beneath said sheet. The forward movement of said sheet is not completely decelerated as the leading edge of the sheet strikes the front sheet joggers 60 which causes the forward movement to stop whereby the sheet falls flatwise by gravity a short distance onto a piling platform or skid 57.

As shown in Figs. 1 and 2, the platform or skid 57 is removably supported on a pile elevator which is preferably but not necessarily of the general type disclosed in the United States Patent No. 2,218,401, granted October 15, 1940, to George A. Martin. This elevator includes a U-shaped frame or support 58 which carries the platform 57 and which is open at the front thereof to receive a portable truck for unloading of said platform and the pile of sheets thereon from said elevator through the front of the delivery. For a more detailed description of the construction of the U-shaped support 58 reference may be had to the above-mentioned Patent No. 2,218,401. Disposed slightly forward of rollers 13 and supported on cross members 22, 23 of the delivery frame

by means of forwardly extending bars 45 is a vertically extending metal plate 46 against which the successively delivered sheets are jogged as hereinafter described, and against which the rear edge of the pile of delivered sheets bears during lowering of said pile and the elevator, the operation and control of which will be described hereinafter. Suitably secured to the upper end of plate 46 are three vertically extending guides 47 having inner edges thereof aligned with the inner surface of said plate and constituting an extension thereof. The upper ends of guides 47 have inwardly inclined surfaces 48 whereby as the sheets fall downwardly the rear edge thereof is guided into alignment with the inner surface of plate 46 against which they are jogged into an evenly stacked pile of sheets.

In accordance with another aspect of the invention, sheet jogging devices of novel construction and operation are provided to cause the successive sheets upon delivery thereof to the support 58 to pile evenly thereon and without relative sliding movement. In the illustrated embodiment four sheet jogging devices indicated generally at 60 are employed at the front of the delivery, and a single sheet jogging device indicated generally at 61 is employed at each side of said delivery. The front sheet jogging devices 60 are identical in construction, mounting and operation, and the side sheet jogging devices 61 are identical in construction, mounting and operation, therefore a description of one of said front jogging devices and one of said side jogging devices will be sufficient for an understanding of the operation and function of all.

As herein shown, the front sheet jobbing devices 60 are supported on the auxiliary frame described above in connection with the support for the slow-down magnets 25, 26. In Figs. 1, 2 and 3 of the drawings each front sheet jogging device 60 comprises a front plate 62 and a rear plate 63 both of which are supported by and depend downwardly from a bifurcated collar 64 which is loosely mounted for pivotal movement on the cross member 36. Bifurcated collar 64 has a downwardly projecting leg 65 and a horizontally projecting leg 66 positioned at right angles to leg 65. The upper end of plate 63 is suitably secured to leg 65. The upper end of plate 62 is secured to the end of leg 66 by a hinge 67, said hinge permitting plate 62 to pivotally swing from its normally vertical position toward plate 63 but preventing it from swinging from its normally vertical position away from plate 63. Plates 62, 63 are thus pivotally mounted from their upper ends from the same support and depend vertically downward and parallel to each other. Loosely mounted bifurcated collar 64 and plates 62, 63 are adjustable along cross member 36 and may be secured in any desired position of adjustment thereon by a thumb screw 68 which is threaded into a collar 69 engaged over said cross member and disposed between the forked arms of collar 64. Collar 64 is provided with a pin 70 adapted to engage leg 66 of collar 64 as and for a purpose to be hereinafter described. The lower ends of plates 62 and 63 are resiliently connected by a spring 71. The vertical dimensions of plates 62, 63 are such that they extend a short distance below the normal level of the top of the pile of sheets on support 58. Extending along the front surface of plate 62 from the lower end to a point substantially above the horizontal path of movement of a sheet from the conveyor is an energy absorbing cushion 72 comprising, for example, of a pad of ensolite, type 22226, manufactured by U.S. Rubber Co. and covered with a sheet of neoprene "Monarch" to protect the ensolite from being cut. Plate 63 is weighted by a weight 73 which is adjustably secured to a pin 74 that is, in turn, secured to the end of plate 63.

In the initial operation of the pile delivery, the described front sheet joggers 60 are moved along the side members 34 until the front surface of cushion 72 touches the edges of a previously manually stacked and aligned pile of sheets resting on platform 57 as front joggers 60 loosely extend vertically downward. Joggers 60 are adjusted, along cross member 34, for the width of the sheet being fed and the desired spacing of the joggers along that width.

Accordingly as each sheet is fed into the space over the pile support it is directed, supported and slowed down by the magnets 24, 25 and 26 as hereinbefore described, and the front edge of said sheet strikes the cushion 72, thus checking the sheet against further forward movement. Cushion 72 prevents damage to the front edge of the sheet as it strikes said joggers. The force of the sheet striking against cushion 72 will force the lower end of plate 62 to pivotally move forward against the resilient force of spring 71 which will become compressed and transmit the force to the lower end of plate 63 which in turn will pivotally move forward as it absorbs the force transmitted to it. The shock absorbing force of plate 63 can be increased as desired by moving weight 73 outwardly along pin 74 away from said plate. The force of the sheet striking jogger 60 is thus absorbed by plates 62, 63 with a minimum of movement of said plates and the compressed spring 71 will instantly return plate 62 to its vertical position where it will receive the impact of the succeeding sheet of a series being rapidly fed from conveyor 10. As the sheet is peeled away from the magnetic fields of slow-down magnets 25, 26 it will drop flatwise toward the pile along the pile guide 46 onto the pile and to a final position thereon with its rear edge engaged with the pile guide 46 and its front edge aligned with the front edges of the previously delivered and piled sheets. Thus, each sheet is deposited on the pile without sliding forwardly or rearwardly relative to the previously delivered underlying sheet and an even piling of sheets is obtained.

It is to be noted that as plate 62 returns to its vertical position the lower end of cushion 72 thereon strikes the top portion of the previously piled sheets to impart a rearward tap or thrust to said sheets whereby engagement of the same with the guide 46 and an even piling thereof is further assured. This novel construction of front sheet joggers prevents said joggers from swinging excessively when struck by a forward moving sheet and assures that they will be returned to the vertical position in time to absorb the impact of the succeeding sheet.

When it is desired to remove the pile of sheets from frame 58, it is necessary to move front sheet joggers 60 forwardly and upwardly so that the pile may be moved forwardly from frame 58. To enable all of sheet joggers 60 to be moved simultaneously a lever arm 84 is fixedly secured to cross member 36. As the lever arm is lifted upwardly the cross member 36 and adjustably secured collar 69 are rotated causing pins 70 to engage and move leg 66 of bifurcated collars 64 thus causing all of the joggers 60 to be simultaneously moved forwardly and upwardly. A plate 85 having a notch 86 at its lower front surface is fixedly mounted adjacent the upper end of lever arm 84. A spring biased pin 87 is suitably mounted on the same side of arm 84 as plate 85 with said pin resiliently urged against the lower surface of the plate. Thus, as lever arm 84 is pivoted upwardly pin 87 will be forced into engagement with notch 86 thereby locking arm 84 and joggers 60 in said upward position. Pin 87 may be manually retracted from notch 86, thus allowing joggers 60 to return to the operative position.

Referring now to Figs. 1 and 2 of the drawings, each of the side sheet jogging devices 62 comprises a vertically extending permanent magnet 75 which is U-shaped in top plan view or horizontal cross section, thereby forming north and south poles, indicated at N and S, which are transversely spaced with respect to the vertical

movement of the pile of sheets whereby a magnetic field horizontally extends into the downward path of the sheets being delivered to said pile. A vertically extending cover plate **76** of magnetizable material and having an inwardly inclined surface at the upper end thereof to guide the side edges of the sheets is suitably secured across the open end of said magnet. A vertically extending support bar **77** is suitably secured at its lower end to the rear of magnet **75** and supported and guided at its upper end for floating movement in vertical and horizontal directions on horizontally disposed bracket **78**. Bracket **78** is adjustably secured to cross member **35** by bolts **79** whereby each side jogger may be adjusted for the width of the sheet being piled. A U-shaped plate **80** is bolted to the side of bracket **78** to provide a suitable slot **81** to slidably receive the upper end of magnet support bar **77**. A series of apertures **82** in bracket **78** permits plate **80** to be bolted thereto at various places whereby forward and rearward adjustment of the support bar **77** on said bracket is possible. A pin **83** at the upper end of bar **77** limits its downward movement in slot **81**. It will thus be noted that the floating mounting of bars **77** enables the magnet **75** to freely yield upwardly in the event the elevator is accidently raised too high. In addition to guiding the side edges of the sheets and assuring an even piling thereof on platform **57**, side joggers **61** magnetically attract the outer corners of the leading edge of the sheet as it falls downwardly past said magnets. In a flexible sheet, the outer corners of the leading edge thereof will tend to bend slightly downward in which case these bent down corners will strike the surface of the preceding piled sheet and mar it. Side joggers **61**, however, will magnetically attract these outer corners and as the sheet falls downwardly said outer corners will be straightened out thus preventing said corners from striking and marring the upper surface of the precedingly piled sheet.

The pile delivery **11** is constructed and operated in accordance with the following description. Connected with the U-shaped support **58** at opposite sides thereof are corresponding extremities of four double-end chains **90**, the links of which engage in the teeth of sheaves **91** that are fixed on and rotated by shafts **92** at opposite sides of the delivery frame. Shafts **92** are journalled in suitable bearings in brackets **93**, **94** which are secured to the uprights **16** and **17**, respectively. Fixed on shafts **92** adjacent brackets **93** are right and left hand worm gears **96** that are fixed on a shaft **97** extending transversely of the delivery frame and journalled in suitable bearings in the brackets **93**.

Shaft **97** is intermittently rotated in the proper direction to impart step-by-step downward movement to the support **58** and the pile of delivered sheets thereon, and thus intermittent rotation of shaft **57** is preferably effected by pawl and ratchet mechanism of the general type disclosed in the United States Patent No. 2,230,633 granted February 4, 1951, to Leo C. Williams. This pawl and ratchet mechanism includes a pawl carrier **98** loosely mounted on shaft **97** and which has a pawl **99** pivoted thereon and adapted, under certain conditions, to engage a ratchet **100** that is fixed on said shaft. Pivotally connected to pawl carrier **98** is one end of a link **101**, the opposite end of which is pivotally connected with a crank pin **102** secured in an idler spur gear **103** which meshes with and is continuously driven by a smaller spur gear **104** that is fixed on the opposite end of the driven belt roller shaft **14**. Idler spur gear **103** is journalled on a stud **105** which is secured in the adjacent rear upright **16**. It will thus appear that through oscillation of pawl carrier **98** by the described driving connections therefor with gear **103**, and through engagement of the oscillating pawl **99** with ratchet **100**, the shaft **97** and worms **96** thereon will be intermittently rotated as pointed out above. Worm gears **95**, shafts **92** and sheaves **91** at opposite sides of the delivery will likewise be rotated inwardly toward each other, thus lowering chains **90** and the support **58** together with the pile of sheets thereon.

In order to maintain the top of the pile of delivered sheets at a selected minimum distance below the magnetic slowdown and supporting devices, the elevator and its operating mechanism are, in accordance with another aspect of the present invention, controlled by a novel movably mounted oscillating lever mechanism preferably constructed, mounted and operated as follows.

Pivotally mounted on the side of extension plate **47** is an arm **106** that extends downwardly. The lower end of arm **106** is cut away as shown in Fig. 4 to permit said end to abut the upper end of plate **46**. Pivotally mounted on the upper portion of arm **106** is a lever **107** having a first enlarged portion **108** located above the pivot point and a second enlarged portion **109** located below the pivot point. Lever **107** is pivotally positioned on arm **106** in such a manner that enlarged portions **108**, **109** project into the path of movement of downwardly falling sheets when said lever is vertically positioned as shown in Fig. 4. An aperture **110** is located in the lever above the pivot point and receives therein a pin **111** having a diameter substantially smaller than the diameter of said aperture and which is secured to and projects horizontally outwardly from arm **106**. Lever **107** is thus limited in its forward and backward movement to an oscillating motion within the confines of aperture **110**. An electrical switch **113** is mounted on cross member **22** and adjacent arm **106** and has an actuator rod **114** having a contact roller **115** at its outer end. Said rod is resiliently held in an extended position from said switch with roller **115** in contact with the rear surface of arm **106**. A spring **116** is mounted over rod **114** between switch **113** and arm **106** and resiliently urges the lower end of arm **106** into contact with the upper end of plate **46**.

Switch **113** is electrically connected to solenoid **117** having an arm **118** pivotally connected to the rear end of a forwardly extending latch **119**. Latch **119** is pivoted as at **120** on a bracket **121** secured to and depending from the stay shaft **21**. The front end of latch **119** projects over a pawl mask **122** which is loosely mounted on shaft **97** adjacent ratchet **100** and is yieldably connected with the pawl carrier **98**. Pawl **49** extends across ratchet **100** and normally rests on pawl mask **122** out of engagement with said ratchet. A light extension spring **123** having one end connected to the rear of latch **119** and at the opposite end connected to bracket **121** is provided to yieldingly urge said rear portion of the latch downward, whereby the forward end of said latch is normally held out of engagement with pawl mask **122**.

The beginning of the operation, the pile support **58** and empty platform **57** thereon are raised by a suitable mechanism (not shown) connected with worm shaft **97** until the upper surface of said platform is slightly below the lower end of lever **107**. Prior to this raising of support **58** and platform **57**, the pawl mask **122** is shifted to the left, as viewed in Fig. 2, by a fork **124** so that a bevelled annular flange on said mask will lift the pawl **99** out of engagement with ratchet **100** if said pawl is not already disengaged therefrom. Fork **124** is engaged in an annular groove in pawl mask **122** and is fixed on a transversely extending shift rod **125** which is slidably mounted in suitable openings in the brackets **93** and is operated in any suitable manner.

When the support **58** has been initially positioned as above described, the sheets will fall downwardly with the rear edge thereof first striking portion **108** of lever **107** and pushing the upper end of lever **107** to the left, as viewed in Fig. 4, and allowing the sheet to continue its downward movement. The sheet will continue to fall downward until its rear edge strikes protruding portion **109** whereupon the weight of the falling sheet will then push the lower end of lever **107** to the left and allow

said sheet to pass downward and come to rest on the support 58. Each succeeding sheet will repeat the above cycle of movement of lever 107 and said lever will oscillate on arm 106 without causing said arm to move. Under these conditions switch 113 will not actuate solenoid 117 and latch 119 will be held above the path of movement of mask 122 so that the latter, pawl carrier 98 and pawl 99 will oscillate idly and no downward movement will be imparted to the support 58. As the sheets drop one after another onto platform 57 the pile progressively increases until the top thereof is in the path of movement of the lower end of lever 107. When this occurs and as the rear portions of successively falling sheets strike portion 108 of lever 107 the lower end of said lever will about the edges of the piled sheets and prevent said lever from pivoting on arm 106. Consequently, the continued pressure of falling sheets on portion 108 will cause arm 106 to move outwardly and away from plate 46. As plate 46 moves outwardly it will actuate solenoid 117 through switch 113. Upon actuation of solenoid 117, latch 119 is swung downwardly into engagement with pawl mask 122 to stop rotation of the same and enable pawl 99 to engage and drive ratchet 100 and shaft 97 to lower the support 58 and the pile of sheets thereon through continued oscillation of pawl carrier 98.

Lowering of support 58 and the pile of sheets thereon continues until the top of said pile has reached a point adjacent the lower end of lever 107 at which time the lever 107 will freely oscillate on arm 106 and will not urge the movable arm outwardly and away from plate 46. Spring 114 resiliently urges the arm 106 into contact with the upper end of plate 46 at which position the switch is in an off position which in turn deactivates solenoid 117 and spring 123 will raise latch 119 out of engagement with pawl mask 122. Pawl carrier 98, pawl 99 and mask 122 will then oscillate idly until it is again necessary to lower the support 58 and pile of sheets thereon, whereupon the above described operations are repeated.

While the present invention is herein illustrated and described in connection with the delivering and piling of tin plate and metallic sheets as the same are discharged from a combined drying oven and turnover unit, it is equally adapted for the delivery and piling of cardboard and other relatively stiff metallic and non-metallic sheets as the same are discharged from various other instrumentalities acting on such sheets.

Various changes may be made in the design and arrangement of the parts of the illustrated embodiment without departing from the spirit and scope of the invention as will now be clear to those skilled in the art. It is therefore to be expressly understood that the present invention is not limited to the particular embodiment thereof herein illustrated and described.

I claim:

1. In a mechanism for controlling the movement of a pile of sheets having a support to hold the pile, means to move the support vertically downward as the number of sheets thereon increases, means to actuate said support moving means, a movable arm positioned adjacent said actuating means, a swingable lever having end portions and being pivotally mounted on said arm intermediate said end portions, one of said end portions being adapted to be engaged and acted upon by edges of sheets being delivered to said platform to swing said lever, and the other end portion adapted to be held from swingable movement by the edge of the piled sheets when said pile reaches a predetermined level whereby when said one end portion is swung said arm will move outwardly and operate said actuating means to move the support vertically downward.

2. In a sheet handling mechanism the combination of a support for a pile of sheets, means for moving said support downwardly, means to actuate said support moving means, a detector comprising a movable arm operatively associated with said actuating means, a swingable lever having first and second end portions adapted to be engaged and acted upon by edges of sheets moving downwardly past said end portions as the same are being delivered to said platform, said lever being pivotally mounted on the movable arm intermediate said end portions and oscillatable about the pivot point as a sheet edge engages and swings the first end portion and successively engages and swings the second end portion, said lever adapted to prevent oscillation on said arm as the pile of delivered sheets reaches the level of the lower end of the second end portion whereby the engagement of the edges of successive sheets with the first end portion will move said arm to operate said actuating means whereby said platform and the pile of sheets thereon is lowered.

3. In a mechanism according to claim 2, wherein the swingable lever has an aperture adapted to receive a pin fixedly attached to the movable arm, the diameter of said aperture being substantially greater than the diameter of said pin whereby the oscillating movement of said lever is restricted.

4. In a mechanism for controlling the movement of a pile of sheets having a support to hold the pile, a mechanism to move the support vertically downward as the number of sheets thereon increases, and means to control the actuation of said mechanism, for the improvement in said last mentioned means comprising a movable arm operatively associated with said control means, a swingable lever having end portions and being pivotally mounted on said arm intermediate said end portions, both end portions being adapted to be engaged and acted upon by edges of sheets being delivered to said support to successively pivotally swing each of said end portions out of the downward path of movement of the sheets as said sheets move downwardly past each lever end portion, means to hold said lever being mounted as to be held from pivotal movement on said arm when the pile reaches a predetermined level whereby the lever and the movable arm will be moved by the downwardly falling sheets to the control means to actuate said support moving mechanism.

5. In a mechanism according to claim 4 wherein said lever is mounted for pivotal movement on a horizontal axis and is so located that the edge of the piled sheets engages the lower end of the lever when said pile reaches its highest level.

6. In a mechanism according to claim 4 wherein said lever has an aperture adapted to receive a pin fixedly attached to the movable arm, said aperture having a diameter substantially greater than the diameter of said pin whereby the pivotal movement of said lever is limited to an oscillating motion defined by said aperture.

7. In apparatus of the type having a vertically movable support to which sheets of material are successively delivered and pile thereon having means to move said support and means to actuate said last mentioned means, the improvement which comprises a detector means for operating said actuating means comprising a vertically extending swingable lever having end portions adapted to be engaged and acted upon by edges of sheets being delivered to said support, said lever being pivotally mounted on a movable arm intermediate said end portions and adapted to permit each end portion to be successively swung out of the path of movement of the sheets as said sheet edges engage each end portion, said lever being so mounted as to be held from pivotal movement on said arm when the delivered pile of sheets reaches a predetermined level, said movable arm being positioned in operative relationship to said actuating means and being mounted for pivotal movement toward and away from said pile of sheets to inoperative and operative positions respectively, said arm having the movement into operative position with said actuating means when the lever is held from pivotal movement thereon, whereby said mechanism

is rendered effective to lower said support and the pile of sheets thereon.

8. In apparatus of the type having a vertically movable support to which sheets of material are successively delivered and piled thereon, mechanism for imparting downward movement to said support, and means to actuate said last mentioned means, the improvement which comprises a detector means comprising actuating means, a vertically extending swingable lever having end portions adapted to be engaged and acted upon by edges of sheets delivered to said support, said lever being pivotally mounted on a movable arm intermediate said end portions and adapted to permit each end portion to be successively swung out of the path of movement of the sheets as said sheet edges engage each end portion, said lever being so mounted as to be held from pivotal movement on said arm when the delivered pile of sheets on said support reaches a predetermined level, said movable arm being positioned in operative relation with said actuating means and being mounted at one end for pivotal movement toward and away from said pile of sheets to inoperative and operative positions, respectively, said arm having the movement into operative position with said actuating means when the lever is held from pivotal movement thereon, whereby said support and the pile of sheets thereon are lowered, and means for effecting return movement of said arm to said inoperative position when the pile of sheets has been lowered below said predetermined level and said swingable lever is released for free pivotal movement on said arm, whereby said pile lowering mechanism is stopped.

9. In a pile delivery of the type having a vertically movable support to which sheets of material are successively delivered and piled thereon, and mechanism for imparting downward movement to said support, the improvement which comprises the combination of a switch for actuating said support moving mechanism, a vertically extending movable arm, a vertically extending swingable lever having end portions and pivotally mounted on said arm intermediate said end portions, one of said end portions being adapted to be engaged and acted upon by edges of sheets delivered to said support to swing said lever and the other end portion adapted to engage the edge of the sheets piled on said support when said pile reaches a level adjacent said other end portion thereby preventing pivotal movement of the lever on said arm, said movable arm mounted adjacent an edge of said support for pivotal movement about a horizontal axis away from said support to actuate said switch and, said arm having the movement into switch actuating position when the level of the piled sheets prevents pivotal movement of the lever on said arm, whereby said mechanism is rendered effective to lower said support and the pile of sheets thereon.

10. In an apparatus having a vertically movable sheet receiving platform to which sheets of material are successively delivered and piled thereon, means for moving said platform downwardly, and means to actuate said platform moving means, the improvement which comprises a sheet slow-down and detector means for said actuating means comprising a support positioned adjacent the rear edge of said platform and in operative relationship to said actuating means, an oscillatable lever pivotally mounted to said support, integrally formed protrusions at each end of said lever, said lever being retained in oscillatable and generally vertical position whereby the protrusions extend into the path of the downwardly moving sheets and whereby each protrusion will be moved out of the sheet path as each falling sheet successively strikes said protrusions, said lever being so mounted as to be held from oscillatable movement on said support when the delivered pile reaches a predetermined level, said support being movably mounted toward and away from said platform and the sheets piled thereon to inoperative and operative positions in relation to said actuating means, said support being moved into operative position by said downwardly falling sheets when said lever is held from oscillatable movement on said support.

11. An apparatus for slowing down sheets being delivered downwardly onto a horizontal platform comprising a support positioned adjacent the rear edge of said platform and the sheets piled thereon, an oscillatable lever pivotally mounted at its center to said support, integrally formed protrusions at each end of said lever, said lever being vertically positioned so that the protrusions extend into the path of the downwardly moving sheets, means to movably hold said lever in the generally vertical position whereby said lever is oscillatable in an arc to permit each protrusion to be moved out of the sheet path as each sheet falls downwardly past each of said protrusions.

12. An apparatus as set forth in claim 11 wherein said support is movably mounted whereby when the level of sheets delivered to the horizontal platform reaches a point adjacent the lowermost protrusion on said lever said support and said protrusions will be moved outwardly from said platform by downwardly falling sheets.

13. A mechanism to detect the level of sheets piled upon a support comprising an arm member pivotally mounted adjacent one edge of said pile of sheets, means to resiliently retain said arm spaced from and parallel to one edge of said pile of sheets, a lever pivotally mounted on said arm and having end portions adapted to be engaged by the edges of sheets passing the same whereby each end portion is successively moved out of the path of each sheet as it moves past said lever, said lever being so mounted as to be held from pivotal movement on said arm when said pile reaches a predetermined level whereby the arm and the lever will be pivotally moved outwardly away from said one edge of the pile when a sheet passes an end portion of said lever.

14. A mechanism as defined in claim 13 wherein said lever has an aperture to receive a pin fixedly secured to said arm, said aperture having a diameter substantially greater than the diameter of said pin whereby the pivotal movement of said lever is limited to an oscillating motion defined by said aperture.

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