Jan. 27, 1953 G. A. MARTIN 2,626,800

SHEET DELIVERING APPARATUS

Filed July 20, 1948 3 Sheets-Sheet 1

Fig. 1

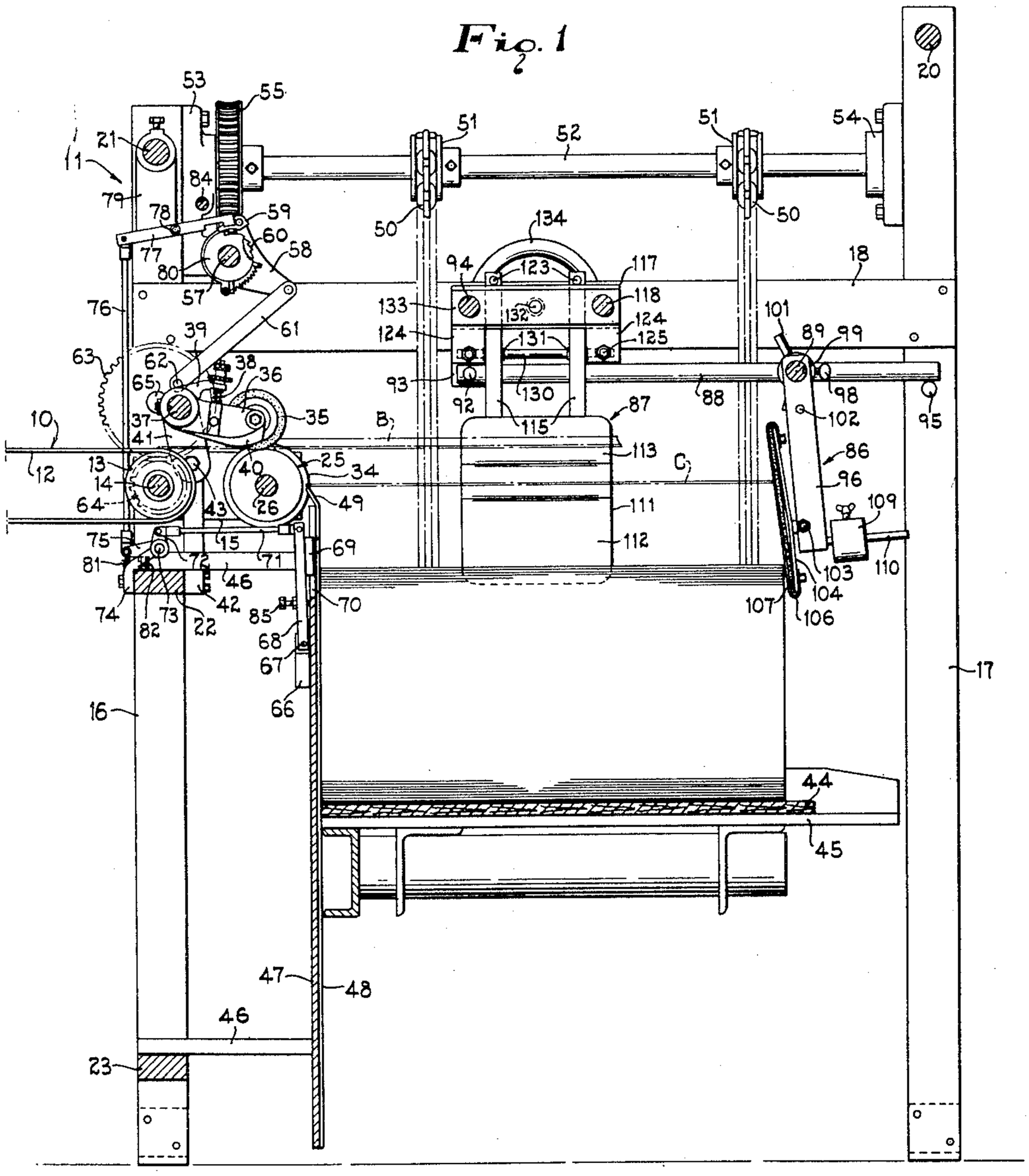
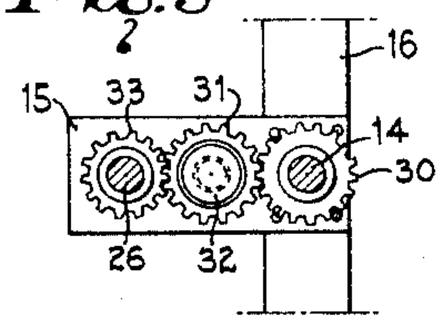


Fig. 3



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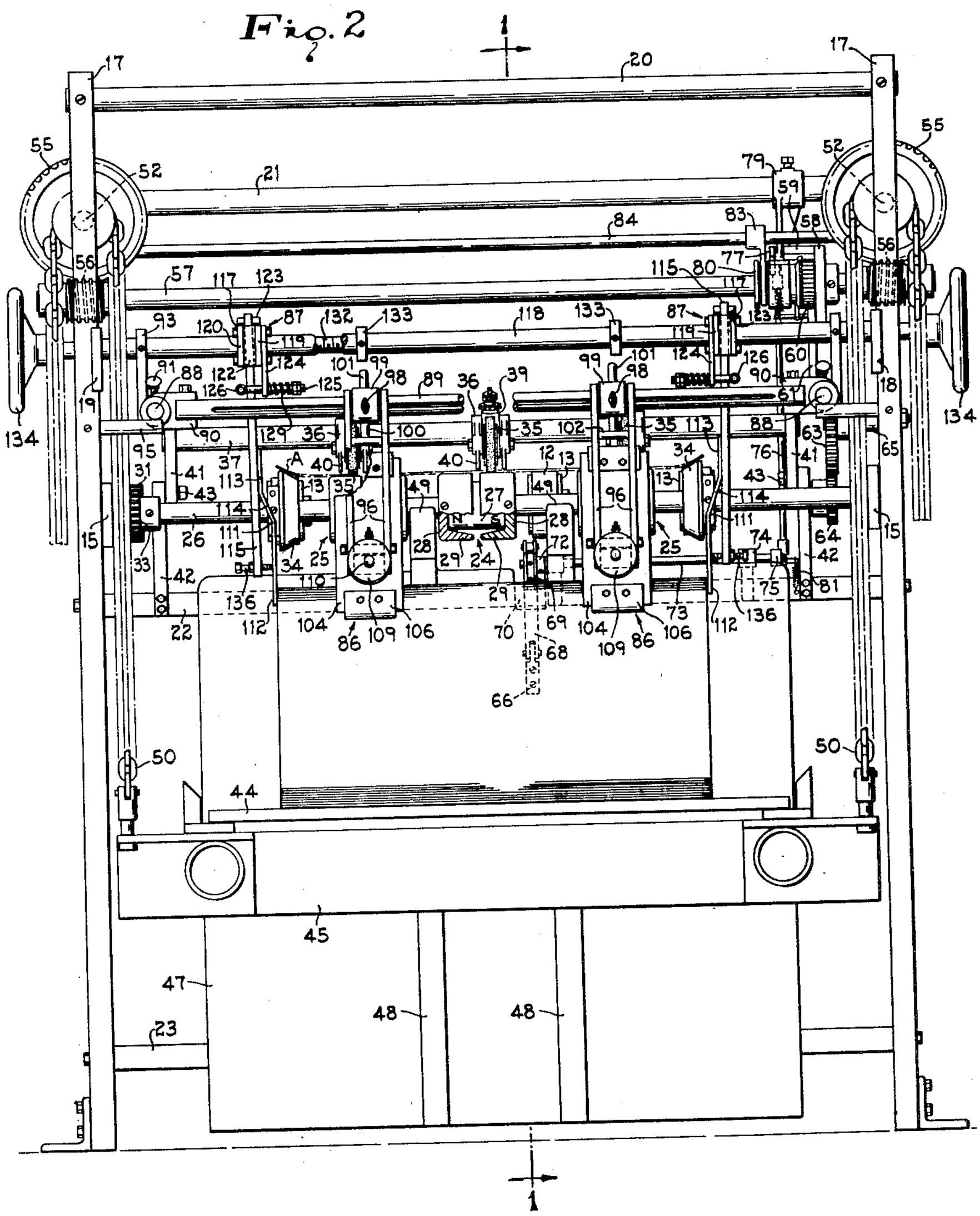
SHEET DELIVERING APPARATUS

Filed July 20, 1948 3 Sheets-Sheet 2

Fig. 2



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SHEET DELIVERING APPARATUS

Filed July 20, 1948 3 Sheets-Sheet 3

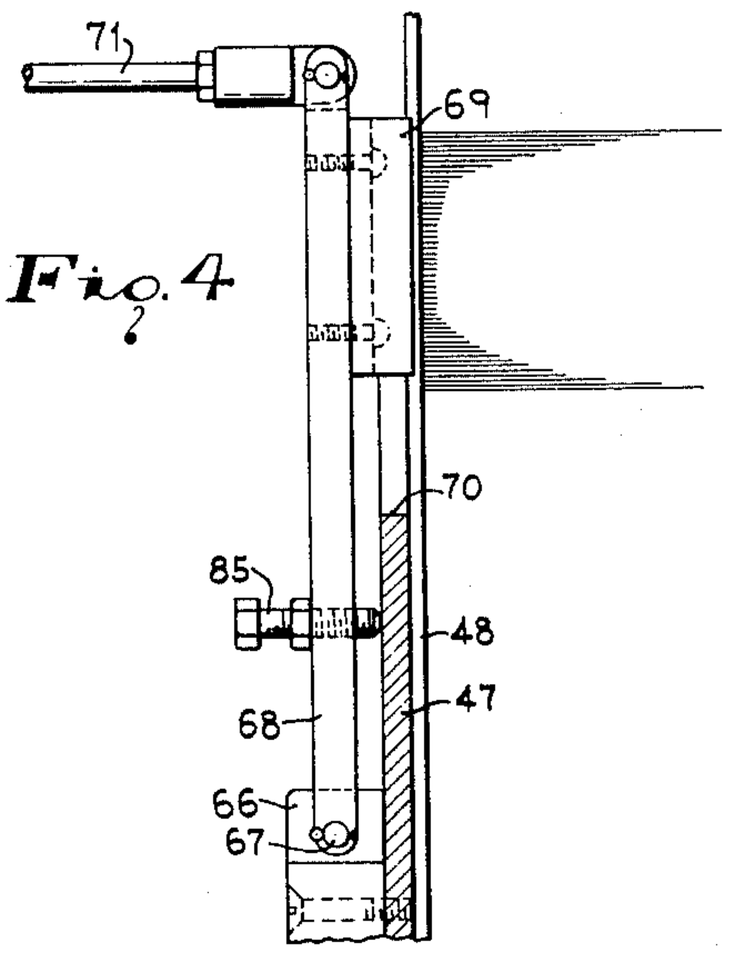

Fig. 4

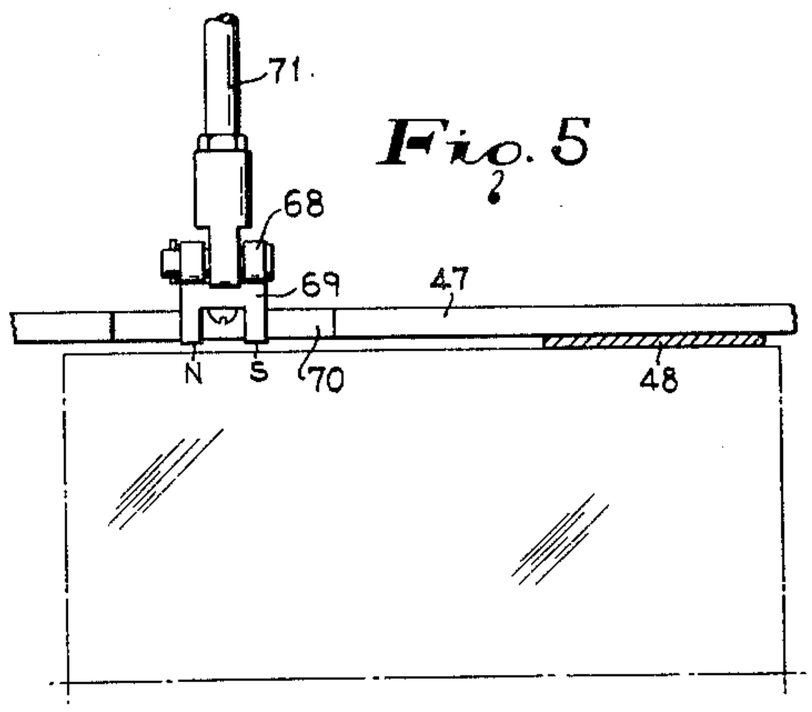

Fig. 5

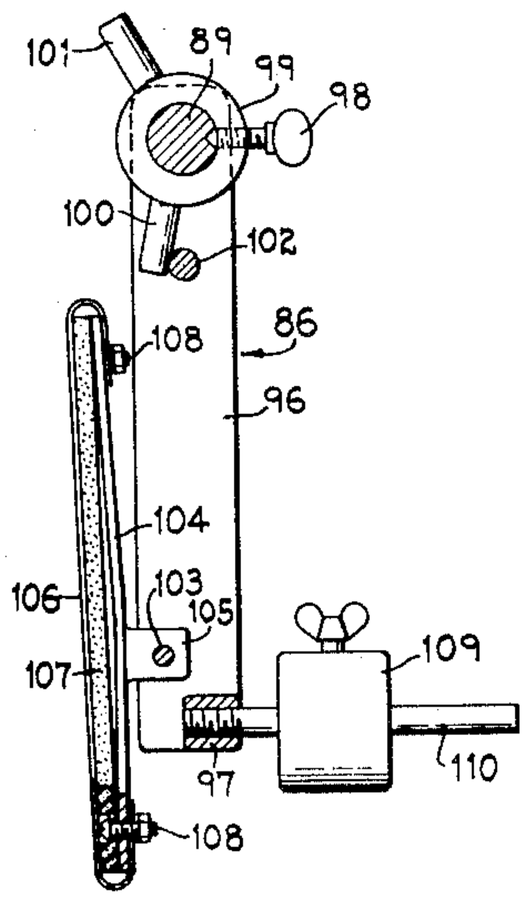

Fig. 6

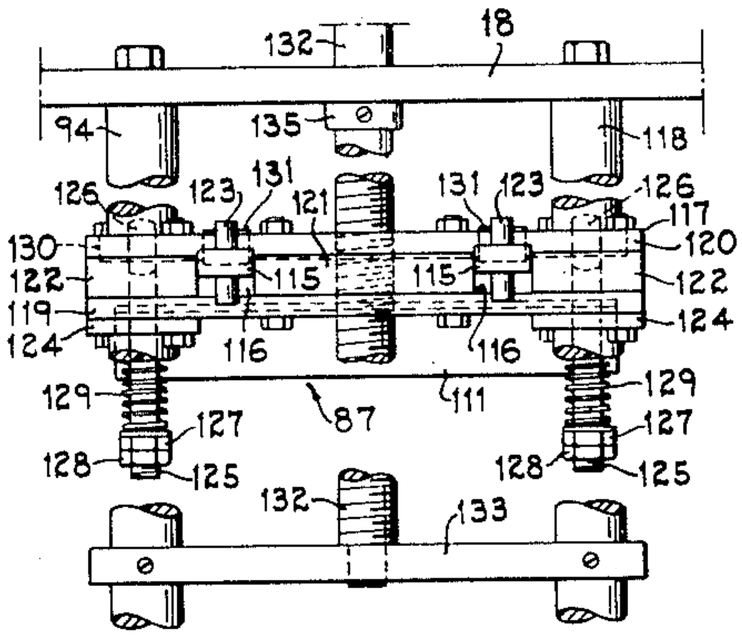

Fig. 7

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UNITED STATES PATENT OFFICE

2,626,800

SHEET DELIVERING APPARATUS

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Application July 20, 1948, Serial No. 39,764

8 Claims. (Cl. 271—68)

1

This invention relates to sheet handling apparatus, and more particularly to sheet delivering apparatus for delivering and piling sheets of tin plate and other metallic or relatively heavy sheets as the same are discharged from a printing press, coating machine, buffing and cleaning machine, drying or baking oven, rolling mill, inspecting machine, trimming machine, and various other processing machines.

One object of the present invention is to provide an improved sheet delivery of novel, simple, and durable construction that will rapidly deliver and evenly pile sheets of tin plate or other metallic material without scratching their surfaces or otherwise injuring the same.

Another object of the invention is to provide an improved pile delivery for metal or other relatively heavy sheets wherein the successive sheets are caused to move on a substantially horizontal plane until they are completely over piling position, whereupon said sheets will bodily fall flatwise one on top of the other without relative sliding movement and form an even pile thereof, and each succeeding sheet will be prevented from dragging along the upper surface of a preceding delivered and piled sheet.

Another object is to provide an improved pile delivery for sheets of tin plate or the like magnetic material having novelly arranged rotary magnetic and non-magnetic means for advancing the successive sheets under positive control and causing the same to move on a substantially horizontal plane into space over piling position.

Another object is to provide novel rotary means for advancing and transversely bowing sheets of tin plate or the like flexible magnetic material through magnetic gripping action applied thereon.

Another object is to provide a pile delivery for sheets of a magnetic character having pile lowering mechanism and novel control means therefor so constructed and arranged that magnetic forces may be utilized in the operation of said means and control thereby of said pile lowering mechanism.

A further object is to provide a pile delivery for sheets of magnetic material having a pile supporting elevator which is machanically lowered step by step and controlled by novel magnetic means disposed in magnetic relation to and under the influence of the pile of such sheets.

A still further object is to provide in a pile delivery for metal or other relatively heavy sheets novel self-acting sheet jogging means for accurately aligning the successive sheets as they are piled so as to form an even pile thereof.

2

Still another object is to provide in a pile delivery for metal or other relatively heavy sheets a novel sheet actuated sheet jogging device which is actuated by each succeeding sheet in process of delivery to effectively jog or align each preceding sheet delivered to and resting on the pile.

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 a fragmentary side elevation, partly in section, showing the drive for the rotary sheet advancing means;

Fig. 4 is an enlarged side elevation, partly in section, of magnetic control means for the pile elevator lowering mechanism, said means being shown in the position it occupies when lowering of the pile elevator and pile of sheets thereon by said mechanism is effected;

Fig. 5 is a top plan view, partly in section, of the magnetic control means shown in Fig. 4;

Fig. 6 is an enlarged vertical longitudinal section of one of the front sheet jogging devices shown in Figs. 1 and 2, certain of the parts having portions broken away for purposes of clearer illustration; and

Fig. 7 is an enlarged top plan view of one of the side sheet jogging devices shown in Figs. 1 and 2.

Referring to the drawings, there is shown one form of sheet delivery embodying the present invention which is particularly adapted for delivering and piling sheets of tin plate as the same are received 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 sheet delivery disclosed herein may be advantageously and effectively employed in connection with other machines for delivering and piling sheets of tin plate or other metal sheets of a magnetic or non-magnetic character, as well as cardboard

or other relatively heavy non-metallic sheets as the same are discharged from said machines.

In the illustrated embodiment, the sheets of tin plate pass in succession from the baking oven and turnover unit with their treated surfaces uppermost onto a horizontally disposed endless conveyor 10 which advances said sheets away from said unit to a pile delivery 11 to be hereinafter described wherein the 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 14 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, and 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 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.

In accordance with one aspect of the present invention, novel rotary means are provided adjacent the forward end of conveyor 10 for further advancing and progressively bowing and stiffening the successive sheets of tin plate in a longitudinal direction through application of magnetic forces applied to the lower surfaces of the sheets at spaced points across the same, and for causing each sheet to move straight forward on a substantially horizontal plane into space until approximately the entire sheet is disposed over piling position. In this manner the successive sheets are advanced under positive control to piling position, each succeeding sheet is made self-supporting and prevented from dragging along and marring the upper surface 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 and 2 of the drawings, said rotary sheet advancing and bowing means comprise a plurality of permanently magnetized rollers, there being an intermediate roller 24, and outer rollers 25, 25. Rollers 24, 25 are adjustably secured on a shaft 26 in spaced relation and such that the north and south poles of the intermediate roller 24 are reversed with respect to the north and south poles of the outer rollers, 25, 25 whereby the magnetic forces between the intermediate and the outer rollers are repelling instead of attracting in order to insure magnetic sheet gripping effect of said rollers. Shaft 26

which is made of bronze, brass or other non-magnetic material extends transversely of the pile delivery adjacent the belt roller shaft 14 and is journalled at its opposite ends in suitable bearings provided in the side plates 15. The upper portions of the permanent magnet rollers 24, 25 lie in substantially the same plane as the upper reaches of belts 12, and the diameter of said rollers is substantially the same as the diameter of the belt rollers 13 including said belts. It will be understood that the number and size of permanent magnet rollers may be varied as desired.

The permanent magnet rollers 24, 25 are of the general type disclosed in my United States Patent No. 2,228,913, granted January 14, 1941, and each of said rollers includes a hollow permanent magnet 27 (Fig. 2) loosely engaged over the non-magnetic shaft 26 and having a north and south pole as indicated at N and S, respectively. Associated with and contacting the opposite ends of permanent magnet 27 is a pair of circular shells 28 formed of soft iron or other suitable magnetizable material and having horizontal sheet engaging rims 29 which project toward each other and are spaced at their inner ends. Shells 28 are secured to shaft 26 and clamp the permanent magnet 27 therebetween for rotation by said shaft as a unit, said shells, due to their engagement with opposite ends of said magnet, also having north and south poles which produce magnetic fluxes across the rims 29 and cause the sheets of tin plate to adhere thereto when moved into engagement therewith by belts 12. The inner surfaces of rims 29 are bevelled to prevent contact of said rims with magnet 27 and thus insure proper distribution of the magnetic forces to shells 28.

Permanent magnet rollers 24, 25 are driven continuously and at a surface speed slightly faster than the surface speed of belts 12 so that the successive sheets will be withdrawn more rapidly from said belts, thereby increasing the relative spacing between each leading sheet and the next following sheet and providing more time for accurate piling thereof as hereinafter described. For this purpose, the driven belt roller shaft 14 has fixed thereon adjacent one end thereof a spur gear 30 (Fig. 3) which meshes with and drives an idler gear 31 that is journalled on a stud 32 secured in any suitable manner in the adjacent side plate 15. Idler gear 31 meshes with a spur pinion 33 which is smaller than gear 30 and is fixed on and drives shaft 26. Permanent magnet rollers 24, 25 are thus driven continuously by shaft 14 in the same direction as belts 12 and at a faster surface speed than the surface speed of said belts through gears 30, 31 and pinion 33.

Disposed outwardly of the outer permanent magnet rollers 25, 25 and adjustably secured to shaft 26 for rotation therewith and adjustment therealong are two truncated cone-shaped rollers 34 (Fig. 2) which are non-magnetic and of a size such that the inner smaller diameter thereof is substantially the same as the diameter of rollers 24, 25. It will thus appear that as each advancing sheet of tin plate leaves the belts 12 and passes over the continuously rotating, transversely spaced rollers 24, 25, and 34, the opposite side edge portions of the sheet will engage the cone-shaped rollers 34 and the intermediate portion of said sheet will be magnetically attracted and drawn downwardly into engagement with the permanent magnet rollers 24, 25, thus bowing up opposite sides of the sheet as indicated in broken lines at A in Fig. 2. Under these con-

ditions and upon continued rotation of rollers 24, 25, and 34, each sheet magnetically adhering to rollers 24, 25 is further advanced thereby under positive control into space over piling position, and is progressively bowed as it is advanced so that the extended or leading portion thereof is stiffened in a longitudinal direction. In this manner the extended or leading portion of each advancing sheet is made self-supporting and prevented from bending or curving downwardly under its own weight toward the pile support, thereby providing for accurate flatwise piling of the sheets.

Cooperating in a novel manner with the permanent magnet rollers 24, 25 are upper spring-pressed pressure rollers 35 (Figs. 1 and 2) which are so located with respect to said magnet rollers that the axes thereof are not directly above and in the same vertical plane as the axis of the magnet rollers but are somewhat rearward of said latter axis as clearly shown in Fig. 1. By virtue of the pressure rollers 35 and the described location thereof, the trailing portion of each advancing and stiffened sheet is engaged by said rollers at a point rearwardly of the magnet rollers 24, 25. In this manner the trailing portion of the advancing and stiffened sheet is held down by pressure rollers 35 and said sheet is prevented from swinging or pivoting bodily about the magnet rollers 24, 25 in a downward direction, thus causing the sheet to move straight forward on a substantially horizontal plane as indicated in broken lines at B in Fig. 1 which further provides for accurate flatwise piling of the sheets without scratching or marring the surfaces thereof. Pressure rollers 35 also aid in effectively bowing the sheets through engagement of the same with said sheets at the outer magnet rollers 25, 25 and adjacent the cone-shaped rollers 34.

As herein shown, the pressure rollers 35 are of the rubber tire type to prevent scratching or marking of the sheets, and are journalled at the free ends of forwardly extending bifurcated arms 36 which are loosely mounted on a shaft 37. Arms 36 are yieldingly urged downwardly by adjustable compression springs 38 which are disposed between the furcations of said arms and other arms 39 associated therewith and adjustably secured to shaft 37 for movement therealong with arms 36 to various positions. Arms 36 are provided on the lower surfaces thereof with forwardly and downwardly inclined thin webs 40 which guide the leading edge of each advancing sheet beneath the pressure rollers 35 and between the latter and the magnet rollers 24, 25.

Shaft 37 extends transversely of the pile delivery above the path of travel of the sheets and is fixed at its opposite ends in the upper free ends of vertically extending arms 41. These arms 41 are adjustably clamped at their lower ends to vertically extending bars 42 by bolts 43 which pass through suitable openings in said arms and are threaded into suitable threaded openings in the upper ends of said bars. Bars 42 are secured at their lower ends to the cross member 22. By loosening bolts 43, arms 41, shaft 37, arms 36 and 39, and pressure rollers 35 may be rocked forwardly and rearwardly as a unit about said bolts to locate said pressure rollers in the proper rearward position with respect to the magnet rollers 24, 25.

When the trailing portion of each sheet advanced by the magnet rollers 24, 25 moves out of engagement with the pressure rollers 35, said

sheet begins to swing downwardly, said trailing portion of the sheet, however, still being under the magnetic influence of the magnet rollers will continue to adhere to said rollers and, hence, the sheet will simultaneously be moved forwardly and downwardly at the trailing edge thereof around a portion of the periphery of the magnet rollers, thus maintaining the sheet substantially horizontal, as shown in broken lines at C in Fig. 1, and removing the trailing portion thereof from the path of the next or oncoming sheet to prevent interference therewith. When the delivered downwardly moving sheet reaches a position substantially coplanar with the axis of rotation of the magnet rollers 24, 25, said sheet is stripped from said rollers by strippers hereinafter referred to, whereupon it falls flatwise by gravity a relatively short distance onto a piling platform or skid 44 upon which the successive sheets are piled one upon the other in an orderly pile.

As shown in Figs. 1 and 2, the platform or skid 44 is removably supported on a pile elevator which is preferably but not necessarily of the general type disclosed in my United States Patent No. 2,218,401, granted October 15, 1940. This elevator includes a U-shaped frame or support 45 which carries the platform 44 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 45 reference may be had to my above-mentioned Patent No. 2,218,401.

Disposed slightly forward of the rollers 24, 25 and supported on the cross member 22, 23 of the delivery frame by means of forwardly extending bars 46 is a metal plate or apron 47 provided on the front surface thereof with two transversely spaced, vertically extending pile guides 48 against which the successively delivered sheets are jogged as hereinafter described, and against which the rear side of the pile of delivered sheets bears during lowering of said pile and the elevator by mechanism to be presently described. Secured to the upper end of apron 47 and serving as a continuation of the pile guides 48 are strippers 49 which are made of brass or other non-magnetic material and have portions extending upwardly and rearwardly at an angle tangent with the periphery of the magnet rollers 24, 25 and to a point substantially in line with the axis of shaft 26, said strippers acting to strip the delivered sheets from said rollers as hereinbefore described.

Connected with the U-shaped support 45 at opposite sides thereof are corresponding extremities of four double-end chains 50 the links of which engage in the teeth of sheaves 51 that are fixed on and rotated by shafts 52 at opposite sides of the delivery frame. These shafts 52 are journalled in suitable bearings in brackets 53 and 54 which are secured to the uprights 16 and 17, respectively. Fixed on shafts 52 adjacent brackets 53 are right and left hand worm gears 55 which mesh with right and left hand worms 56 that are fixed on a shaft 57 extending transversely of the delivery frame and journalled in suitable bearings in the brackets 53.

Shaft 57 is intermittently rotated in the proper direction to impart step by step downward movement to the support 45 and pile of delivered sheets thereon, and this 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, 1941, to Leo C. Williams. This pawl and ratchet mechanism includes a pawl carrier **58** loosely mounted on shaft **57** and which has a pawl **59** pivoted thereon and adapted, under certain conditions, to engage a ratchet **60** that is fixed on said shaft. Pivotally connected with pawl carrier **58** is one end of a link **61** the opposite end of which is pivotally connected with a crank pin **62** secured in an idler spur gear **63** which meshes with and is continuously driven by a smaller spur gear **64** that is fixed on the opposite end of the driven belt roller shaft **14**. Idler spur gear **63** is journalled on a stud **65** which is secured in the adjacent rear upright **16**. It will thus appear that through oscillation of pawl carrier **58** by the described driving connections therefor with gear **63**, and through engagement of the oscillating pawl **59** with ratchet **60**, the shaft **57** and worms **56** thereon will be intermittently rotated as pointed out above. Under these conditions worm gears **55**, shafts **52** and sheaves **51** at opposite sides of the delivery will likewise be rotated inwardly toward each other, thus lowering chains **50** and the support **45** and pile of sheets thereon.

In order to maintain the top of the pile of delivered sheets at a selected minimum distance below the magnet rollers **24** and **25**, the elevator and its operating mechanism are, in accordance with another aspect of the present invention, magnetically controlled by magnetic means preferably constructed, mounted, and operated as follows.

Bolted or otherwise suitably secured to the rear surface of apron **47** is a bracket **66** (Figs. 1, 2, and 4) which has pivotally mounted thereon at **67** an arm **68** that extends upwardly from said bracket along and in close proximity to said apron. Arm **68** is formed of brass, bronze or other non-magnetic material. Secured to the front side of arm **68** adjacent the upper end thereof is a vertically extending permanent magnet **69** which is U-shaped in top plan view or horizontal cross section (Fig. 4), thereby forming north and south poles, indicated at N and S, respectively, which are transversely spaced with respect to the vertical movement of the pile of sheets and are of an appreciable length in a vertical direction. Magnet **69** is exposed to the sheets of tin plate delivered to and piled on support **45** through a suitable opening **70** provided in apron **47**, and said magnet is so positioned on arm **68** that the lower end thereof is located substantially at the desired normal level of the top of the pile of sheets on support **45**. It will be noted that by virtue of the vertically disposed magnet **69** with transversely spaced poles the magnetic circuit through said poles flows in a horizontal plane and substantially parallel with the surface of the piled sheets, thus providing for a more accurate and sensitive control of the elevator operating mechanism.

Pivotally connected to the upper end of arm **68** is the front end of a rearwardly extending connecting rod **71** (Figs. 1 and 4) the rear end of which is pivotally connected to the free end of a vertically extending arm **72**. This arm **72** is secured to the inner end of a short cross shaft **73** which is journalled adjacent its opposite ends in suitable bearings in brackets **74** secured to the cross member **22** of the delivery frame (Figs. 1 and 2). Secured to shaft **73** at its outer end is a rearwardly extending arm **75** to the free end of which is pivotally connected the lower end of a vertically extending connecting rod **76**. The upper end of rod **76** is pivotally connected to the rear

end of a forwardly extending latch **77** which is pivoted as at **78** on a bracket **79** secured to and depending from the stay shaft **21**. The front end of latch **77** projects over a pawl mask **80** which is loosely mounted on shaft **57** adjacent ratchet **60** and is yieldably connected with the pawl carrier **58**. Pawl **59** extends across ratchet **60** and normally rests on pawl mask **80** out of engagement with said ratchet. A light extension spring **81** having one end connected to arm **75** and the opposite end connected to cross member **22** is provided to yieldingly urge said arm downwardly, whereby latch **77** is normally held out of engagement with pawl mask **80** and magnet **69** is normally held a short distance away from the rear vertical projection of the pile of delivered sheets on support **45**, as shown in Fig. 1. An adjustable stop **82** secured in cross member **22** and engaged by arm **75** limits the downward movement of said arm and provides for proper setting of latch **77** and magnet **69** in their normal inoperative positions, as described.

At the beginning of the operation, the pile support **45** and empty platform **44** thereon are rapidly raised by suitable mechanism (not shown) connected with worm shaft **57** until the upper surface of said platform is slightly below the lower end of magnet **69**. Prior to this raising of support **45** and platform **44**, the pawl mask **80** is shifted to the left, as viewed in Fig. 2, by a fork **83** so that a bevelled annular flange on said mask will lift the pawl **59** out of engagement with ratchet **60** if said pawl is not already disengaged therefrom. Fork **83** is engaged in an annular groove in pawl mask **80** and is fixed on a transversely extending shift rod **84** which is slidably mounted in suitable openings in the brackets **53** and is operated in any suitable manner.

When the support **45** has been initially positioned as above described, and with no sheets of tin plate on platform **44**, the magnetic circuit through the laterally spaced vertical legs of magnet **69** will flow through the air. Under these conditions, magnet **69** will remain in the position shown in Fig. 1, and latch **77** will be held up above the path of movement of mask **80** so that the latter, pawl carrier **58** and pawl **59** will oscillate idly and no downward movement will be imparted to the support **45**. As the sheets of tin plate drop one after another onto platform **44** and the pile thus formed progressively increases until the top thereof is adjacent the upper end of magnet **69**, said magnet, because of the presence of this pile of magnetic material, is magnetically attracted and swung about its pivot **67** toward said pile of tin plate sheets, as shown in Fig. 4. Thereupon, latch **77**, through the described connections therefor with magnet **69**, is swung downwardly into engagement with pawl mask **80** to stop rotation of the same and enable pawl **59** to engage and drive ratchet **60** and shaft **57** to lower the support **45** and the pile of tin plate sheets thereon through continued oscillation of pawl carrier **58**.

Lowering of the support **45** and pile of tin plate sheets thereon continues until the top of said pile has reached a point adjacent the lower end of magnet **69** at which time the magnetic circuit will again flow through the air and said magnet will no longer be under the magnetic influence of the pile of tin plate sheets. Springs **81** then acts to return magnet **69** to its original inoperative position, whereupon latch **77** is raised out of engagement with pawl mask **80**. The pawl carrier **58**, pawl **59** and mask **80** will then oscillate idly until it is again necessary to lower the

support 45 and pile of sheets thereon, whereupon the above described operations of the pawl and ratchet control means are repeated. An adjustable stop 85 carried by magnet arm 68 and engageable with apron 47 limits the movement of magnet 69 toward the pile of sheets and prevents direct contact of said magnet with said pile in operative position.

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 45 to pile evenly thereon and without relative sliding movement. In the illustrated embodiment two sheet jogging devices indicated generally at 86, 86 are employed at the front of the delivery, and a single sheet jogging device indicated generally at 87 is employed at each side of said delivery. The front sheet jogging devices 86, 86 are identical in construction, mounting and operation, and the side sheet jogging devices 87, 87 are identical in construction, mounting and operation, therefore, a description of one of said front jogging devices and of one of said side jogging devices will suffice for both of the same.

As herein shown, the front sheet jogging devices 86, 86 are supported on an auxiliary frame comprising side members 88 and a front cross member 89. This cross member 89 is secured to brackets 90 slidably mounted on the side members 88. The cross member 89 and sheet jogging devices 86, 86 carried thereby and hereinafter described in detail are therefore adjustable rearwardly and forwardly along the side members 88 and may be secured in any desired position of adjustment thereon by thumb screws 91 or the like. The auxiliary frame is pivotally mounted at the rear thereof, as indicated at 92, on hangars 93 secured to and depending from a shaft 94 which extends transversely of the delivery frame and is secured at its opposite ends to the side members 18, 19 of said delivery frame. The auxiliary frame is supported at the front thereof by laterally projecting pins 95 secured in the front uprights 17. It will be noted that the pivotal mounting of the auxiliary frame enables said frame and the sheet jogging devices 86, 86 carried thereby to yield upwardly in the event the elevator is accidentally raised too high, thus preventing damage to said sheet jogging devices through engagement of the pile supporting platform 44 therewith.

As shown in Figs. 1, 2, and 6 of the drawings, each front sheet jogging device 86 comprises a pair of spaced vertically extending arms 96 which are loosely mounted for pivotal movement on the cross member 89 of the auxiliary frame and connected together at their lower extremities by a block 97 welded or otherwise suitably secured thereto. Arms 96 are adjustable along cross member 89 and may be secured in any desired position of adjustment thereon by a thumb screw 98 which is threaded into a collar 99 engaged over said cross member and disposed between said arms. Collar 99 is provided with two angularly related pins 100 and 101 which are adapted to be engaged by a cross pin 102 secured in and extending between the arms 96. Pin 100 is utilized to limit the swinging movement of the sheet jogging device in a rearward or clockwise direction, as viewed in Fig. 1, and pin 101 is utilized to support said sheet jogging device when the latter is swung forwardly and upwardly out of operative position to permit unloading of the

pile of delivered sheets from the elevator through the front of the delivery.

Pivotally mounted on a pin 103 secured in and extending between the arms 96 adjacent the lower ends thereof is a vertically extending plate 104 provided on the front side thereof with a bearing block 105 to receive the pivot pin 103, said block being located below the center of said plate so that the latter is overbalanced and will tend to swing downwardly by gravity relative to the arms 96. The vertical dimensions of plate 104 is such that it extends a short distance below the normal level of the top of the pile of sheets on support 45 and above the horizontal plane of the magnet rollers 24, 25. Extending along the rear side of plate 104 and around the upper and lower ends of said plate is a thin metallic band 106 formed of a suitable wear resisting resilient material such as, spring steel, and disposed between said band and said plate is a cushion pad 107 of a suitable material, such as, for example, sponge rubber. Pad 107 extends the full length of plate 104 and said pad and band 106 are secured to said plate by machine screws 108. The portion of plate 104 disposed above bearing block 105 is slightly offset rearwardly, as clearly shown in Fig. 6, so that pad 107 is spaced from said plate for a major portion of the length thereof, thus enabling said pad to also yield bodily relative to plate 104 and thereby increase the effective cushioning action thereof. Arms 96 are further weighted by a weight 109 which is adjustably secured to a forwardly projecting pin 110 that is, in turn, secured in the tie block 97.

In the initial operation of the pile delivery, the described sheet jogging devices 86, 86 are moved along the side members 88 and cross member 89 to positions approximate the length and width of the sheet when the same is resting on the platform 44 and engaged with the rear pile guides 48. A few sheets are then delivered to the platform 44 and evenly piled thereon by manually moving the same rearwardly into engagement with the pile guides 48 and laterally to bring the front, rear, and side edges thereof into vertical alignment. Thereupon, the sheet jogging devices 86, 86 are reset, if necessary, on cross member 89 to desired lateral positions with respect to the pile, and moved farther rearwardly on side members 88 until the bands 106 contact the top front edge of the pile, the plate, cushion pad and band units 104, 107, 106 are inclined rearwardly toward the magnet rollers 24, 25, and the arms 96 are swung forwardly beyond their natural vertical positions, as shown in Fig. 1.

Under these conditions, the upper end portions of the inclined plate, cushion pad and band units 104, 107, 106 will be spaced from the magnet rollers a distance equal to the length of the sheet, the lower end portions of said units at the point of contact with the pile will be spaced from the rear pile guides 48 a distance equal to the length of the sheet, and the arms 96 in tending to return to their natural vertical positions by gravity and the action of the weights 109 will press said units against the pile and hold the same in their intended inclined poistions. The pressure of the plate, cushion pad and band units 104, 107, 106 may be increased as desired by moving the weights 109 forwardly along pins 110.

Accordingly, as each sheet is moved forwardly and downwardly by magnet rollers 24, 25 as hereinbefore described, the front edge of said sheet contacts the bands 106, thus checking the sheet against any further forward movement, said

bands yielding under this impact and thereby preventing damage to said edge. As the sheet is stripped from the magnet rollers 24, 25 and drops flatwise toward the pile, it moves in a forwardly and downwardly inclined direction along the inclined strippers 49 and band 106 and along the pile guides 48 onto the pile and to a final position thereon with the rear edge thereof engaged with the pile guides 48 and the front edge in line 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 the sheets is automatically obtained. It will be noted that each forwardly and downwardly moving sheet, upon initial contact thereof with the bands 106, tends to swing the plate, cushion pad and band units 104, 107, 106 in a clockwise direction, as viewed in Fig. 1, thus causing the lower end portions of said units to tap or impart a rearward thrust to the preceding delivered topmost sheet or sheets on the pile, whereby engagement of the same with the pile guides 48 and even piling thereof is further assured.

Referring now to Figs. 1, 2, and 7, each of the side sheet jogging devices 87 comprises a thin metallic plate 111 formed to provide a vertically extending pile engaging portion 112, an outwardly offset vertically extending attaching portion 113, and a downwardly and inwardly inclined portion 114 connecting the portions 112 and 113. Plate 111 is suitably secured by the attaching portion 113 thereof to two longitudinally spaced vertically extending bars 115 which are supported and guided at their upper ends for floating movement in vertical and horizontal directions in suitable enlarged openings 116 formed in a bracket 117. This bracket 117 is slidably mounted on shaft 94 and on a similar shaft 118 which extends transversely of the delivery in spaced parallel relation with shaft 94 and is secured at its opposite ends to the side members 18, 19 of the delivery frame.

Bracket 117 may be of any suitable construction and as herein shown is formed of two outer plates 119 and 120, a centrally disposed inner spacer block 121, and two end spacer blocks 122, said plates and blocks being bolted together as a unit, and said spacer blocks forming between them the openings 116. Plates 119, 120 and end blocks 122 are provided with suitable axially aligned openings to receive shafts 94 and 118. Downward movement of bars 115 relative to bracket 117 is limited by short pins 123 which are suitably secured in the upper ends of said bars and normally engage the upper side of said bracket to properly position the plate 111 vertically so that the portion 112 thereof extends a short distance below the normal level of the top of the pile of sheets on support 45. The portion 112 of plate 111 extends substantially to the same level as the axis of rotation of magnet rollers 24, 25, at which level is located the inclined connecting portion 114 of said plate.

Bolted or otherwise suitably secured to the plate 119 of bracket 117 at opposite ends thereof and depending from said plate are two narrow plates 124 which are provided adjacent their lower ends with suitable openings to slidably receive therein short rods 125. These rods 125 are formed at their outer ends with enlarged heads 126 and are externally threaded at their inner ends to receive adjusting and lock nuts 127 and 128, respectively. Surrounding rods 125 between plates

124 and adjusting nuts 127 are compression coil springs 129 for yieldingly urging said rods axially inwardly toward the center of the delivery.

Secured in the heads 126 of rods 125 and extending longitudinally across the outer sides of bars 115 is a rod 130 having journalled thereon two anti-friction needle bearings 131 which are held in engagement with said bars by the action of springs 129. It will thus appear that the floating mounting of bars 115 and the anti-friction bearings 131 enables said bars to freely yield upwardly in the event the elevator is accidentally raised too high, thus preventing damage to the sheet jogging device 87 through engagement of the pile supporting platform 44 with the plate 111 of said device. It will also appear that the floating mounting of bars 115 enables pivoting or canting of said bars relative to bracket 117 under the action of springs 129.

Journalled in suitable bearings in the side members 18, 19 of the delivery frame and extending inwardly and outwardly of said side members are externally threaded shafts 132 which are threadedly engaged in suitable threaded openings provided in the plates 119, 120 and spacer blocks 121 of the brackets 117 of the sheet jogging devices 87, 87. Shafts 132 have their inner ends reduced and journalled in suitable bearings in plates 133 secured to the shafts 94, 118, and the outer ends of shafts 132 have fixed thereon handwheels 134. Axial movement of shafts 132 is prevented in one direction by plates 133 and in the opposite direction by collars 135 fixed on said shafts adjacent the inner sides of the side members 18, 19.

In operation, the side sheet jogging devices 87, 87 are adjusted inwardly toward each other by rotating the handwheels 134 and threaded shafts 132 in the proper direction until the portions 112 of plates 111 engage opposite sides of the pile of tin plate sheets on platform 44 and springs 129 are somewhat compressed. Under these conditions, the plate portions 112 will engage the uppermost sheets of the pile under a yielding pressure, and will be spaced apart a distance equal to the width of the sheets being handled. The pressure of the plate portions 112 on the pile may be varied, as desired, by adjusting the tension of springs 129 by means of the adjusting nuts 127. In order to hold the plates 111 against outward yielding movement relative to bars 115 adjustable stops 136 are provided in the lower ends of said bars, said stops being also utilized to adjust the portions 112 of said plates so that they are parallel with the vertical projection of the pile.

As each stiffened sheet of tin plate is advanced by magnet rollers 24, 25 in a horizontal plane over piling position, as hereinbefore described, said sheet passes between the attaching portions 113 of the plates 111. When the advanced sheet is moved downwardly by magnet rollers 24, 25 and is stripped from said rollers by strippers 49, said sheet falls flatwise toward the pile between the portions 112 of plates 111 and, hence, drops onto the pile without sliding relative to the next preceding or underlying sheet on the pile and into position such that the side edges thereof are in accurate alignment with the side edges of the previously delivered and piled sheets.

The magnetic control means for the pile elevator operating mechanism disclosed herein is not claimed in the present application for the reason that it forms the subject matter of a divisional application Serial No. 278,444, filed

March 25, 1952. The sheet jogging devices are not claimed in the present application for the reason that they also form the subject matter of a divisional application Serial No. 278,445, filed March 25, 1952.

While the present invention is herein illustrated and described in connection with the delivering and piling of sheets of tin plate as the same are discharged from a combined drying oven and sheet turnover unit, it is equally adapted for the delivering and piling of tin plate, as well as, other relatively stiff sheets of a magnetic character as the same are discharged from various other instrumentalities acting on such sheets. Additionally, by merely substituting one of many known mechanical pile elevator control mechanisms for the magnetic control means herein illustrated and described, the present invention, without further modifications, may also be employed for the delivering and piling of metal sheets of a non-magnetic character, as well as, cardboard and other sheets of similar relatively stiff non-metallic material.

Further, 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.

What is claimed is:

1. In a sheet delivery, a pile support, driven rotatable magnetic means disposed above said support at one side thereof for receiving and conveying sheets of magnetic material in succession forwardly over said support and then downwardly toward said support through application of magnetic forces applied first to the underside of said sheets and then to the trailing edges of said sheets, and stripper means for stripping the successive sheets from said magnetic means during downward movement thereof, said stripping means being effective to strip the downwardly moving sheets from the magnetic means when the trailing edges of said sheets reach a position substantially coplanar with the axis of rotation of said magnetic means.

2. In apparatus of the character described, a sheet support, driven rotatable magnetic means disposed at one side of said support for receiving and advancing sheets of magnetic material in succession to said support through magnetic gripping action on the underside thereof, and means cooperating with said magnetic means and acting only on the underside of the sheets for causing the opposite side edge portions of each sheet to curve upwardly when said sheet is magnetically attracted to and gripped by said magnetic means.

3. In a sheet delivery, a sheet support, driven rotatable magnetic means disposed at one side of said support for receiving and advancing sheets of magnetic material one after another to said support through magnetic gripping action on the underside thereof, and rotatable non-magnetic means associated with said magnetic means and acting only on the underside of the sheets for holding the opposite side edge portions of the successive sheets above the plane of said magnetic means, whereby said sheets are caused to bow transversely when magnetically attracted to and gripped by said magnetic means.

4. In apparatus of the character described, a sheet support, a plurality of driven permanent magnet rollers arranged at one side of said support for receiving and advancing sheets of magnetic material in succession to said support through magnetic gripping action on the underside thereof, and other non-magnetic rollers arranged coaxially with said magnet rollers outwardly of the same, said other rollers being of a diameter larger than the diameter of said magnet rollers and engaged by the opposite side edge portions of the successive sheets, whereby said sheets are caused to bow transversely when magnetically attracted to and gripped by said magnet rollers.

5. In a sheet delivery, a pile support, a driven shaft disposed above said support at one side thereof, a plurality of permanent magnet rollers fixed on and rotated by said shaft for receiving and advancing sheets of magnetic material one after another to said support through magnetic gripping action on the underside thereof, and truncated cone-shaped rollers of non-magnetic material fixed on said shaft outwardly of said magnet rollers for holding the opposite side edge portions of the successive sheets above the plane of the magnet rollers, whereby said sheets are transversely bowed when magnetically attracted to and gripped by said magnet rollers to stiffen the same in a longitudinal direction.

6. In apparatus of the character described, a pile support, driven rotatable magnetic means disposed above said support at one side thereof for receiving and conveying sheets of magnetic material in succession forwardly over said support and then downwardly toward said support through application of magnetic forces applied first to the underside of said sheets and then to the trailing edges of said sheets, means wholly disposed beneath the sheets and cooperating with said magnetic means for transversely bowing the successive sheets to stiffen the same in a longitudinal direction during forward movement thereof, and stripper means for stripping the successive sheets from said magnetic means during downward movement thereof, said stripper means being effective to strip the downwardly moving sheets from the magnetic means when the trailing edges of said sheets reach a position substantially coplanar with the axis of rotation of said magnetic means.

7. In apparatus of the character described, a horizontally disposed pile support, driven rotatable means disposed above said support at one side thereof for receiving and advancing sheets one after another into space over said support, said means comprising axially spaced lower feed rollers and cooperating axially spaced upper pressure rollers normally disposed with their axes rearwardly of the axes of said feed rollers, means mounting said pressure rollers for movement forwardly and rearwardly to various selected positions with respect to said feed rollers, and means cooperating with said rotatable means for transversely bowing the successive sheets to stiffen the same from the front rearwardly as they are advanced.

8. In a sheet delivery, a horizontally disposed pile support, a plurality of driven axially spaced permanent magnet rollers disposed above said support at one side thereof for receiving and conveying sheets of magnetic material in succession forwardly over said support and then downwardly toward said support through application of magnetic forces applied first to the underside of said sheets and then to the trailing edges of said sheets, means cooperating with said magnet rollers for transversely bowing the successive sheets

to stiffen the same from the front rearwardly as they are moved forwardly by said magnet rollers and for holding each advancing and stiffened sheet against pivotal downward movement about the peripheral surfaces of said magnet rollers, said means comprising non-magnetic truncated cone-shaped sheet-bowing rollers arranged coaxially with said magnet rollers outwardly of the latter and a plurality of upper spring-pressed non-magnetic sheet-holding rollers normally engaged with said magnet rollers and disposed with their axes rearwardly of the axes of said magnet rollers, and stripper means for stripping the successive sheets from said magnet rollers during downward movement thereof toward said support, said stripper means being effective to strip the downwardly moving sheets from the magnet rollers when the trailing edges of said sheets reach a position substantially coplanar with the axis of rotation of said magnet rollers.

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