

Aug. 2, 1960

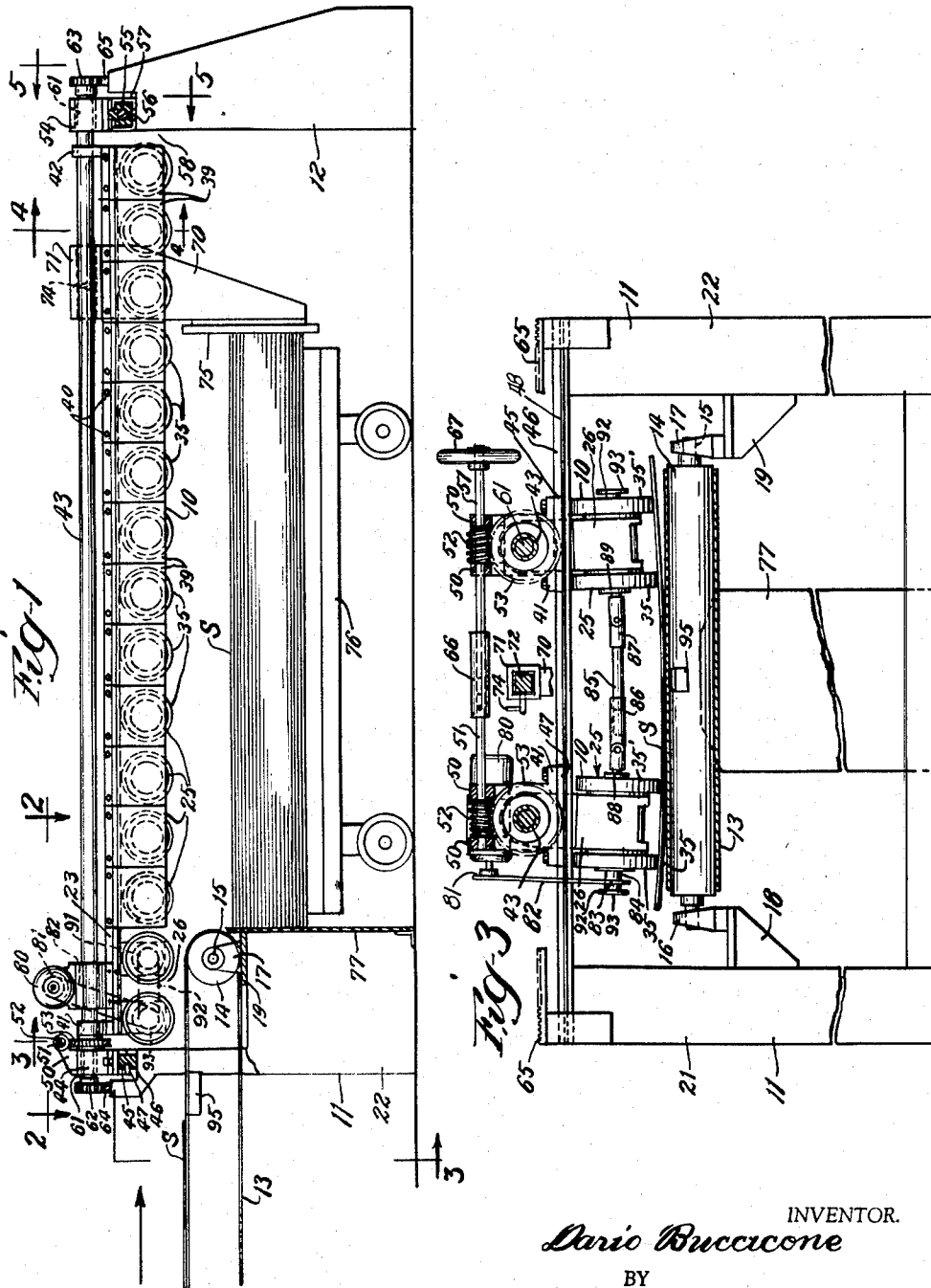
D. BUCCICONE

2,947,429

SHEET HANDLING APPARATUS

Filed May 25, 1959

3 Sheets-Sheet 1



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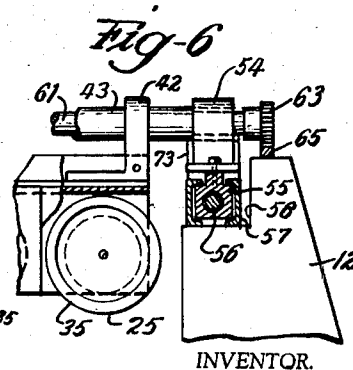
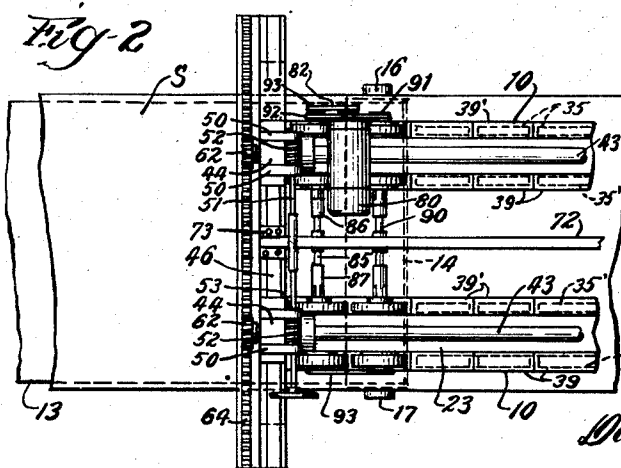
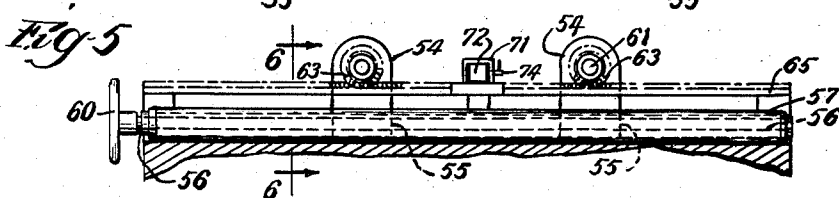
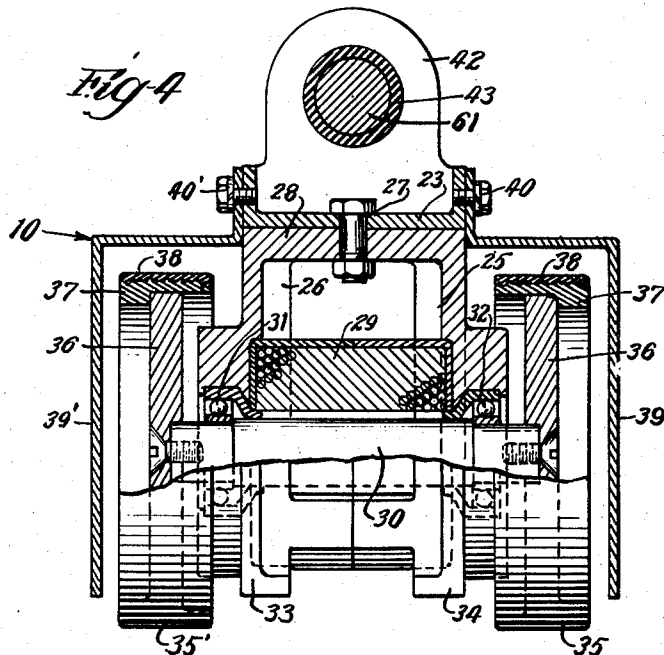
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D. BUCCICONE
SHEET HANDLING APPARATUS

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3 Sheets-Sheet 2



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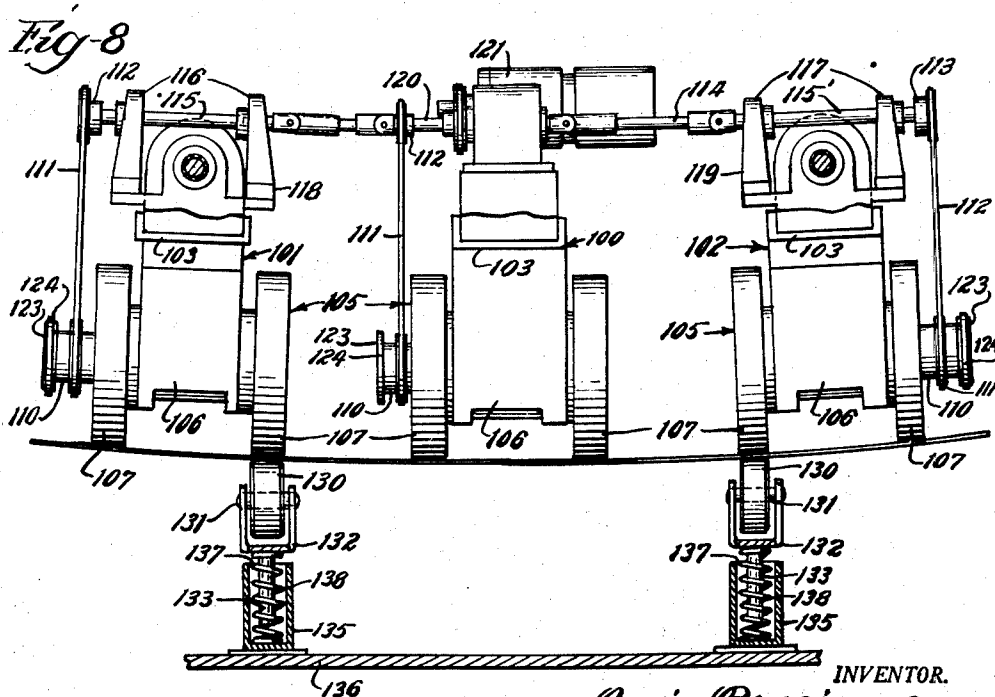
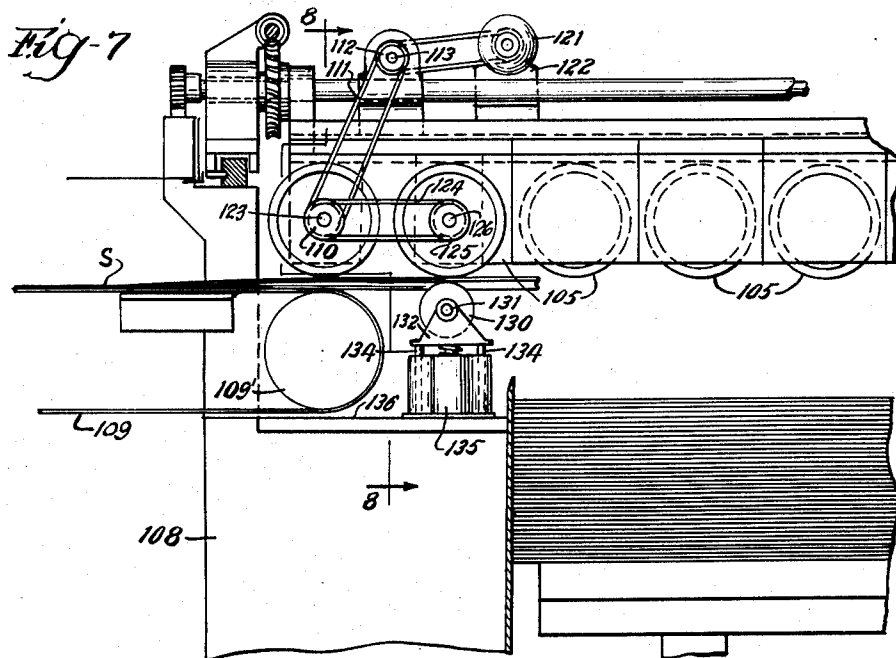
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SHEET HANDLING APPARATUS

Filed May 25, 1959

3 Sheets-Sheet 3



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2,947,429

SHEET HANDLING APPARATUS

Dario Buccicone, Gary, Ind., assignor to Bucciconi Engineering Co., Inc., Gary, Ind., a corporation of Indiana

Filed May 25, 1959, Ser. No. 815,552

17 Claims. (Cl. 214—6)

This invention relates to sheet handling apparatus and is more particularly concerned with improvements in a sheet piler which is particularly adapted for handling sheets of relatively thin metal.

In handling very thin sheets of steel or similar material as it is delivered from a shear or other processing apparatus, piling at high speeds becomes difficult because there is not enough body to the material to withstand the stopping by usual bumper materials or the sheet does not have sufficient stiffness in the lengthwise direction to prevent it from folding up when it falls into the packing box. Sheets of thicker material may be handled satisfactorily with overhead magnetic conveyors of the type which are disclosed in my Patent No. 2,600,475, dated June 17, 1952. Such conveyors are so constructed that they give to the sheet a curvature or bowing in the direction of the length of the sheet or about a transverse axis as they are advanced by the conveyor and satisfactory piling can be accomplished without damage to the leading edges of the sheet. However, thin sheets which do not have sufficient rigidity cannot be satisfactorily handled in this manner. It is a general object, therefore, of the present invention to provide an apparatus for handling relatively thin sheets of metal which employs overhead magnetic conveyors arranged so as to overcome the tendency of the sheet to bow on a transverse axis and which will impart to the sheet a curvature along a longitudinal axis so as to stiffen the sheet while it is being carried by the conveyor and thereby reduce the likelihood of damage to the leading edge of the sheet when it strikes the end stop and is released by the conveyor for deposit in the piler box.

It is another object of the invention to provide a piling apparatus for metal sheets of the type which employs an overhead magnetic conveyor wherein the apparatus is constructed to receive sheets of relatively thin metal from a shear or other processing line and to bow the sheets in the transverse direction while advancing the same to the piler box so as to give the sheets considerably more stiffness in the direction of their length and greater resistance to buckling on a transverse axis whereby to facilitate the stopping and piling of the sheets.

It is a more specific object of the invention to provide a sheet handling apparatus which comprises an upright supporting frame having mounted thereon in laterally spaced relation conveyor rail type units which are pivoted at opposite ends for tilting movement on the frame structure and which carry traveling sheet engaging means on the bottom thereof which has associated therewith a series of longitudinally spaced electromagnets mounted in depending relation thereon and arranged to hold successive sheets against the sheet engaging means together with means for swinging the conveyor rails in opposite directions so as to impart to each successive sheet a curvature in the transverse direction or about a longitudinally extending axis thereby to stiffen the sheet and eliminate the tendency to buckle on a transverse axis and the

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liability of damage to the leading edge when it strikes the end stop.

These and other objects and advantages of the invention will be apparent from a consideration of the sheet handling apparatus which is shown by way of illustration in the accompanying drawings wherein:

Figure 1 is a side elevation, with portions broken away, of a sheet piling apparatus having the principal features of the invention embodied therein;

Figure 2 is a partial plan view of the machine taken on the lines indicated at 2—2 in Figure 1;

Figure 3 is a cross section taken on the line 3—3 of Figure 1, to an enlarged scale, and with portions broken away;

Figure 4 is a fragmentary cross section taken on the line 4—4 of Figure 1, to an enlarged scale;

Figure 5 is a cross section taken on the line 5—5 of Figure 1, to an enlarged scale;

Figure 6 is a section taken on line 6—6 of Figure 5, to an enlarged scale;

Figure 7 is a partial side elevation of a modified form of machine;

Figure 8 is a cross section taken on the line 8—8 of Figure 7, to an enlarged scale and with portions broken away.

Referring to Figure 1 of the drawings, the piler apparatus comprises two rail type conveyor units 10 which are supported in parallel, laterally spaced, longitudinally extending relation on upright end frame structures 11 and 12. The end frame structure 11 at the receiving end of the apparatus also supports the discharge end of a feed conveyor 13 which is carried on a transversely extending roll 14, having the ends of its support shaft 15 journaled in upright bearing brackets 16 and 17 which are mounted on inwardly extending angle support brackets 18 and 19, respectively, the latter being carried on upright side members 21 and 22 of the end frame structure 11. The conveyor 13 delivers successive sheets S from a shear (not shown) or other processing apparatus to the receiving end of the piler.

Each of the conveyor rail units 10 comprises a longitudinally extending top or base in the form of an upwardly opening channel 23 (Figure 4) on the bottom face of which a plurality of longitudinally spaced electromagnetic assemblies 25 are supported in depending relation. Each of the magnetic assemblies 25 comprises a downwardly opening housing or support bracket 26 of generally U-shaped cross section which is of non-magnetic material, such as aluminum, and which is secured to the base member 23 by a bolt 27 extending through a suitable aperture in the top wall 28 of the housing 26. An electromagnetic coil 29 is seated in pocket forming recesses provided in the inner walls of the housing 26 with its longitudinal axis extending transversely of the rail unit so as to receive the pole piece 30 which is supported at opposite ends in bearings 31 and 32, with the latter being mounted in suitable apertures in the side walls 33 and 34 of the housing 26. The pole piece 30 has its ends projecting beyond the outer faces of the side walls 33 and 34 of the housing 26 and a pair of wheel-like pole extensions 35 and 35' of identical construction are mounted thereon. Each of the wheel formations 35 and 35' comprises a wheel plate 36 and a rim member 37 secured on the periphery of the wheel plate which rim member is provided with a cover 38 of rubber or other cushioning material of a character which will not scratch the sheets S when engaged with the surface thereof. A pair of bent guard plates or cover members 39 and 39' are secured in depending relation on the side forming flanges of the base channel 23 by means of bolts 40 and 40' or other suitable fastening means.

The supporting channel 23 of each of the conveyor

units 10 is provided at its opposite ends with upstanding mounting brackets 41 and 42 (Figure 1). The brackets 41 and 42 secure the unit in fixed relation on a longitudinally extending supporting tube member 43 which extends between the two end frame structures 11 and 12 and is supported thereon.

At the sheet receiving end of the apparatus, the supporting tube 43 is journaled in a bearing bracket 44 (Figures 1 and 2) which is mounted in upstanding relation on a slide or carriage 45, with the latter being supported on a cross bar or rail 46 extending between the side members 21 and 22 of the end frame structure 11. The carriage 45 is keyed to the rail 46 by a plate-like key 47 which extends into a longitudinal slot 48 in the support rail 46. The supporting bearing bracket 44 has on its top a pair of transversely spaced upstanding bearing arms or ears 50 in which a tilt adjusting shaft 51 is journaled. The shaft 51 has a worm 52 mounted thereon between the bearing arms or ears 50 which engages with a cooperating gear 53 mounted on the rail support member 43. At its opposite end the rail support member 43 is journaled in an upstanding bearing bracket 54 (Figures 1, 5 and 6) which is secured on a nut 55 mounted on a cross shaft 56. The cross shaft 56 is supported at opposite ends of a transversely extending guideway forming housing 57 which is formed by two oppositely facing spaced channel members mounted in a recessed portion 58 of the end support frame 12. The cross shaft is mounted in the housing 57 so that the nut 55 will travel in a direction transversely of the conveyor rail unit upon rotation of the position adjusting cross shaft 56. The shaft 56 is provided at one end with a hand wheel 60 to facilitate rotation of the same for adjusting the lateral position of the nut 55 and the conveyor rail support member 43 to which it is connected. The shaft 56 is, of course, provided with right and left hand threads extending from the center towards opposite ends so that rotation of the shaft moves the rail units 10 toward and from each other.

The tubular support member 43 of each rail unit 10 has a cylindrical movement equalizing rod 61 which is rotatably mounted in the tubular member 43 and supported at opposite ends thereof. The rod 61 extends the length of the tubular member 43 and has its ends projecting beyond the end support bearings 44 and 54. Pinions 62 and 63 are secured on the projecting ends of the equalizing rod 61 and engage with transversely extending racks 64 and 65. The rack 64, which is engaged by the pinion 62, is mounted on the side frame members 21 and 22 at the sheet receiving end of the apparatus and the rack 65, which is engaged by the pinion 63, is mounted on the top of the end support frame 12 at the opposite end of the machine. With this arrangement, rotation of the position adjusting shaft 56 moves the rail units 10 toward and from each other while they are held in parallel relation so as to vary the spacing and provide the most appropriate positioning of the two units for carrying the sheets S.

The tilt adjusting shaft 51 is formed in sections with telescopic connections 66 between the sections. Each shaft section is connected with an end support bracket 44, of a conveyor rail unit 10 and each shaft section carries a worm 52 in engagement with a gear 53 on the rail support member 43, with the respective worms 52 having right and left hand threads so that upon rotation of the tilt adjusting shaft 51, by the hand wheel 67, which is provided at one end thereof, the two rail units 10 are tilted in opposite directions and when the magnets are energized a sheet S moving beneath the receiving end of the conveyor is picked up at opposite sides allowing the center portion of the sheet S to sag or buckle downwardly or upwardly, depending upon the direction in which the rail units are tilted, thereby imparting a bend in the sheet about a longitudinal axis.

An end stop device 70 (Figures 1 and 2) is mounted

in depending relation on a carriage 71 which is slidably mounted on a longitudinally extending center bar 72. The center bar 72 is supported at opposite ends by bracket members 73 (Figure 2) upstanding from the cross bar 46 and the housing 57 at opposite ends of the machine. The carriage 71 is provided with a locking mechanism indicated at 74 for securing the end stop 70 in adjusted position along the longitudinally extending center support bar 72. The end stop 70 may be of the type shown in my Patent No. 2,761,682, dated September 4, 1956, or any other suitable type having a bumper 75 of rubber or similar resilient material against which the leading end of the sheet S is adapted to strike when released by the conveyor for deposit beneath the latter. A dolly 76 or any other suitable platform may be provided with the apparatus for receiving a stack of the sheets S as they are advanced by the conveyor units 10 and released for deposit beneath the same. A back stop 77 is provided on the end frame structure 11 adjacent the end support roll 14 for the feed conveyor 13.

Preferably, the wheel members 35 and 35' of the first two electromagnetic assemblies 25 at the entrance end of the apparatus are power driven by a motor drive unit 80 (Figures 1 to 3) which is mounted on the top of one of the conveyor rails 10. The motor unit 80 has a power sprocket 81 connected by a chain 82 to a sprocket 83 on an axle extension member 84 provided on the outer face of the outermost wheel member 35 of the endmost magnet assembly 25. The innermost wheel member 35' is connected to the corresponding wheel member 35' on the endmost magnet assembly 25 on the other one of the two conveyor rails 10 by an extensible shaft 85 which is connected by universal joints 86 and 87 with axle extension members 88 and 89 on the oppositely disposed wheels of the two transversely aligned magnet assemblies 25. The wheel members on the next two adjacent magnet assemblies 25 on the two rail units 10 may be connected in driving relation in a similar manner. A center extensible shaft 90 connects the two inside wheel members of these assemblies and the outside wheel member of each assembly has a sprocket 91 which is connected by a drive chain 92 with a sprocket 93 on the corresponding wheel member of the first magnet assembly 25.

The electromagnetic coils 29 are connected to a suitable current source in a conventional manner and an inducto switch 95 is positioned at the entrance end of the machine to control the energizing and de-energizing of the coils 29 so as to hold each successive sheet S against the wheels 35 and 35' until the trailing end of the sheet passes the switch 95 when the momentum given to the sheet by the driven wheels 35 and 35' of the endmost magnet assemblies 25 at the entrance end of the conveyor will carry the sheet forward until it strikes the end stop bumper member 75 after the sheet is released from the conveyor units by de-energizing of the coils under the control of switch 95.

The apparatus may be provided with any suitable side guide mechanism to insure even stacking of the sheets on the dolly 76. Also, the dolly 76 may be replaced by any other suitable stack or pile supporting mechanism such as an hydraulic lift.

In using the apparatus, the two conveyor rail units 10 are first adjusted laterally by rotation of the position adjusting shaft 56 to the proper position for the width of the sheet S being handled. The rail units 10 are then tilted by rotation of the tilt adjusting shaft 51 to give the desired curve or bow to the sheet S as it is picked up by magnetic attraction and held against the wheels 35 and 35'. The driven wheels on the two endmost magnet assemblies 25 at the entrance or receiving end of the conveyor advances the sheet S along on the bottom of the conveyor while current is supplied to the magnets to hold the sheet in engagement with the wheels 35 and 35'. As the trailing end of the sheet passes the inducto switch 95, the current is cut off and the magnets de-energized, which

allows the sheet to drop as the leading end approaches the bumper pad 75, the momentum imparted to the sheet by the driven wheels being sufficient to carry the sheet forward against the bumper pad 75. The bowed condition of the sheet stiffens the same sufficiently to avoid damage to the leading edge by impact with the bumper pad 75 and also to avoid buckling in the lengthwise direction as the sheet is released from the magnets so that the sheet will settle on the pile without damage to the same.

A modified arrangement of the apparatus is illustrated in Figures 7 and 8. As illustrated, this form of the apparatus comprises three rail type conveyor units 100, 101 and 102. All of these units may be constructed in the same manner as the rail units 10 with a top forming channel-like support member 103 and a series of depending longitudinally spaced magnetic assemblies 105, the latter comprising a housing 106 in which a rotatable pole piece is horizontally mounted with wheel extensions 107 at opposite ends thereof.

The rail units 100, 101 and 102 are supported on upright end frame structures, only one end being shown in Figure 7, with end frame 108 providing the support. The sheets S are delivered to the receiving end of the apparatus on the conveyor 109 having its end support roll 109' rotatably mounted on the end frame structure 108. The center rail unit 100 is supported between the upright end frames in fixed, permanent, non-tilting position on the longitudinal center line of the machine in any convenient manner, as by extending the top support channel 103 at its ends to a fixed position of the end frames. The two side rail units 101 and 102 are mounted for adjustment toward and away from the center unit 100 and also for tilting movement on a longitudinal axis in the same manner as in the form of the apparatus shown in Figures 1 and 2.

One or more of the magnetic assemblies 105 of each of the conveyor rails 100, 101 and 102 at the entrance end of the piler conveyor may be driven, as illustrated in Figures 7 and 8. The first assembly 105 of each of the rails 100, 101 and 102 at the entrance end of the conveyor is transversely aligned with the corresponding assembly of the adjoining rail unit so that the wheel carrying pole piece of each one is axially aligned with the pole piece of the corresponding assembly in the adjoining rail unit when the rails are in their normal non-tilted position. Each of the pole pieces has an axial extension 110 at one end thereof outside of the wheel member 107 on which a sprocket 111 is mounted. The sprockets 111 on the end-most assemblies are each connected by a drive chain 112 to a sprocket 113 on a sectional, transversely extending drive shaft 114. The drive shaft 114 comprises end sections 115 and 115' which are mounted in spaced bearing blocks 116 and 117 supported by the bracket formations 118 and 119 on the tops of the outside rail units 101 and 102, respectively. The center section 120 of the drive shaft 114 is suitably connected to a drive motor and gear reduction unit 121, the latter being mounted by bracket 122 on the top of the center rail unit 100. The shaft sections 115, 115', 120, are suitably connected in driving relation as by extensible and universal connections so as to permit the tilting of the side wall units 101 and 102 and also the lateral adjustment of the same when required for handling sheets of different widths.

One or more of the magnet assemblies 105 at the entrance end of each of the rail units 100, 101 and 102 may be connected in driving relation. As illustrated, a sprocket 123 may be provided on the axial extension 103 of the first assembly 105 which is connected by a drive chain 124 with a sprocket 125 provided on an extension member 126 on the pole piece of the next adjacent assembly 105. The number of driven wheels will be determined by the character of the sheets being handled.

The apparatus may be provided with means for insuring that the leading edge of each sheet will be held in engagement with the driven wheels on the conveyor rail units. In the form illustrated, this comprises a pair of

laterally spaced spring pressed rollers 130. Each roller 130 is mounted for rolling engagement with a driven wheel 107 on one of the conveyor rail units. Each roller 130 is carried on a horizontal shaft 131 which is journaled in the side walls of an upwardly facing U-shaped bracket 132. The bracket 132 is provided on its bottom face with a depending center pin 133 and a pair of parallel spaced guide pins 134. A base forming bracket 135 is adjustably mounted on a shelf 136 provided on the end frame 108 which has an upwardly opening center recess 137 and a compression spring 138 housed therein so as to receive the center pin 133 on the bracket 132 with parallel guide recesses being provided for the guide pins 134.

The modified form of the apparatus shown in Figures 7 and 8 is used in the same manner as the apparatus illustrated in Figures 1 to 6 and is better adapted to handling of extra wide sheets.

While specific materials and particular details of construction have been referred to in describing the illustrated forms of the apparatus, it will be understood that other materials and different structural details may be resorted to within the spirit of the invention.

I claim:

1. An apparatus for handling relatively thin metal sheets comprising an upright supporting frame providing longitudinally spaced end supports, a pair of rail type electromagnetic conveyors arranged in laterally spaced, parallel relation between said end supports, means for pivotally mounting the opposite ends of each of said rail conveyors on said end supports for rotation about a longitudinal axis, means for rotating said conveyors in opposite directions, and means for feeding successive sheets to the lower surfaces of said conveyors whereby said rail conveyors may be adjusted to position the lower surfaces at an angle to a horizontal plane so as to impart a curvature about a longitudinal axis to each successive sheet delivered to said conveyors thereby to stiffen the sheets and eliminate transverse buckling thereof.

2. A sheet handling apparatus comprising an upright supporting frame providing longitudinally spaced end supports, a pair of rail type overhead electromagnetic conveyors arranged in laterally spaced, parallel relation above said frame, means mounting the opposite ends of said rail conveyors on said end supports for rotation about a longitudinal axis, and means connected to said mounting means for rotating said conveyors in opposite directions whereby said rail conveyors may be tilted so as to impart a curvature about a longitudinal axis to each successive sheet which is delivered to the bottom surface of said rail conveyors thereby to stiffen the sheets and eliminate buckling thereof on a transverse axis.

3. A sheet handling apparatus comprising an upright frame structure providing longitudinally spaced supports, rail-like overhead electromagnetic conveyors arranged in laterally spaced, parallel relation between said spaced supports, means mounting said conveyors on said supports for tilting movement about a longitudinal axis and means for tilting said conveyors about their axis and in opposite directions so as to impart a curvature about a longitudinal axis to each successive sheet delivered to the bottom surfaces of said conveyors and thereby to stiffen the sheets and eliminate transverse buckling thereof.

4. A handling apparatus for relatively thin, flexible metal sheets comprising an upright supporting structure providing longitudinally spaced support members, rail type overhead electromagnetic conveyors arranged in laterally spaced, parallel relation above said spaced support members, means for mounting said conveyors on said spaced supports for rotation about a longitudinal axis whereby said conveyors may be tilted in opposite directions so as to position the sheet receiving bottom surfaces in laterally diverging planes whereby to impart a curvature about a longitudinal axis to each successive sheet delivered to the bottom surfaces of said conveyors

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and to stiffen the sheets so as to eliminate buckling thereof on a transverse axis.

5. An apparatus for piling relatively wide and thin metal sheets comprising a supporting frame, relatively narrow elongate rail-like electromagnetic conveyor units disposed in longitudinally extending, laterally spaced, parallel relation above said frame, longitudinally aligned pivots connecting opposite ends of each conveyor unit to said supporting frame, a cross shaft rotatably mounted on said frame, worm and gear connections between said cross shaft and each of said conveyor units which are operative to rotate each of said conveyor units about a longitudinal axis so as to position the bottom surface of each unit at an angle to a common cross plane, means for advancing successive sheets in a longitudinal direction to the bottom surfaces of said conveyor units, means for actuating said conveyor units to hold the sheets on the bottom surfaces thereof whereby the sheets are bowed about a longitudinal axis, and means to advance the sheets beneath the conveyor units while held thereby.

6. An apparatus for piling relatively wide and thin metal sheets comprising a supporting frame, relatively narrow elongate rail-like electromagnetic conveyor units disposed in longitudinally extending, laterally spaced, parallel relation above said frame, longitudinally aligned pivots connecting opposite ends of each conveyor unit to said supporting frame, a cross shaft rotatably mounted on said frame, worm and gear connections between said cross shaft and each of said conveyor units which are operative to rotate each of said conveyor units about a longitudinal axis so as to position the bottom surface of each unit at an angle to a common cross plane, means for advancing successive sheets in a longitudinal direction to the bottom surfaces of said conveyor units, means for actuating said conveyor units to hold the sheets on the bottom surfaces thereof whereby the sheets are bowed about a longitudinal axis, and means for operating the conveyor units to advance the sheets beneath the conveyor units while held against the bottom surfaces thereof.

7. An apparatus for piling relatively wide and thin metal sheets comprising a supporting frame, relatively narrow elongate rail-like electromagnetic conveyor units disposed in longitudinally extending, laterally spaced, parallel relation above said frame, longitudinally aligned pivots connecting opposite ends of each conveyor unit to said supporting frame, a cross shaft rotatably mounted on said frame, worm and gear connections between said cross shaft and each of said conveyor units which are operative to rotate each of said conveyor units about a longitudinal axis so as to position the bottom surface of each unit at an angle to a common cross plane, means for advancing successive sheets in a longitudinal direction to the bottom surfaces of said conveyor units, means for actuating the magnets of said conveyor units to hold the sheets on the bottom surfaces thereof whereby the sheets are bowed about a longitudinal axis, and means to drive at least one of said conveyor units so as to advance the sheets beneath the conveyor units while held thereby.

8. An apparatus for piling relatively wide and thin metal sheets comprising a supporting frame, relatively narrow elongate rail-like electromagnetic conveyor units disposed in longitudinally extending, laterally spaced, parallel relation above said frame, longitudinally aligned pivots connecting opposite ends of at least one of said conveyor units to said supporting frame, a cross shaft rotatably mounted on said frame, worm and gear connections between said cross shaft and said one conveyor unit which are operative to rotate said conveyor unit about a longitudinal axis so as to position the bottom surface thereof at an angle to the bottom surface of the adjoining unit, means for advancing successive sheets in a longitudinal direction to the bottom surfaces of said conveyor units, means for actuating said conveyor units

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to hold the sheets on the bottom surfaces thereof whereby the sheets are bowed about a longitudinal axis, and means to advance the sheets while held beneath the conveyor units.

9. A piler for relatively wide and thin metal sheets comprising a pair of longitudinally spaced, upright end supports, a pair of relatively narrow elongate electromagnetic conveyors disposed in longitudinally extending, parallel relation between said end supports, each of said conveyors comprising a base member and a series of longitudinally spaced electromagnets mounted in depending relation on said base member, each of said magnets having a rotatably mounted, transversely extending pole piece with wheel forming extensions of substantially greater diameter than the pole piece on opposite ends thereof, the lowermost periphery of each of the wheel formations being in a common plane which forms the bottom of the conveyor against which a sheet is held when the magnets are activated, longitudinally spaced, upstanding bracket members on the base member, a longitudinally extending shaft connected to said bracket members, carriage forming members at opposite ends of said longitudinal shaft, said longitudinal shaft being journaled at its ends in said carriage forming members, transversely extending members on said end supports forming tracks for said carriage members, means for varying the transverse position of the conveyors relative to each other, an extensible cross shaft journaled in the carriage members at one end of the conveyors and a worm and gear connection between the cross shafts and each longitudinal shaft whereby each of the conveyor units may be tilted about a longitudinal axis to bring the bottoms thereof into angular relation, means for advancing successive sheets to one end of the conveyors, and means for driving the wheel formations at the sheet receiving end of the conveyors to advance the sheets beneath the conveyors.

10. A piler for relatively wide and thin metal sheets comprising a pair of longitudinally spaced, upright end supports, a pair of relatively narrow elongate electromagnetic conveyors disposed in longitudinally extending, parallel relation between said end supports, each of said conveyors comprising a base member and a series of longitudinally spaced electromagnets mounted in depending relation on said base member, each of said magnets having a rotatably mounted, transversely extending pole piece with wheel forming extensions on opposite ends thereof, the lowermost periphery of each of the wheels being in a common plane which forms the bottom of the conveyor against which a sheet is held when the magnets are activated, longitudinally spaced, upstanding bracket members on the base member, a hollow longitudinally extending shaft connected to said bracket members, carriage forming members at opposite ends of said longitudinal shaft, said longitudinal shaft being journaled in said carriage forming members, transversely extending track forming members on said end supports for receiving said carriage forming members, a movement equalizing shaft journaled in each of said hollow shafts, pinions on the ends of the equalizing shafts, racks mounted on the end supports with which said pinions engage, means for moving the carriage members at one end of the conveyors on the track member so as to adjust the lateral position of the conveyors relative to each other, an extensible cross shaft journaled in the carriage members at one end of the conveyors and driving connections between the cross shaft and each longitudinal shaft whereby the conveyor units may be rotated to tilt the same about a longitudinal axis and bring the bottoms thereof into angular relation, means for advancing successive sheets to the conveyors, and means for driving the wheel extensions of the magnets at the sheet receiving end of the conveyors to advance each sheet beneath the conveyors.

11. A piler for relatively wide and thin metal sheets comprising a pair of longitudinally spaced, upright end supports, a pair of relatively narrow, elongate electromagnetic conveyors disposed in longitudinally extending parallel relation between said end supports, each of said conveyors comprising a base member and a series of longitudinally spaced electromagnets mounted in depending relation on said base member, each of said magnets having a rotatably mounted, transversely extending pole piece with wheel forming extensions having relatively narrow runs and of substantially greater diameter than the pole piece on opposite ends thereof, the lowermost periphery of each of the wheels being in a common plane which forms the bottom of the conveyor against which a sheet is held when the magnets are activated, longitudinally spaced, upstanding bracket members on the base member, a longitudinally extending hollow shaft connected to said bracket members, carriage forming member at opposite ends of said longitudinal shaft, said longitudinal shaft being journaled in said carriage forming members, transversely extending track forming members on said end supports for receiving said carriage forming members, the carriage members at one end of each conveyor shaft being in the form of a nut and the cooperating track member being a threaded rotatably mounted screw, said screw being rotatable to vary the transverse position of the carriage members so as to adjust the lateral position of the conveyors relative to each other, an extensible cross shaft journaled in the carriage members at one end of the piler and a worm and gear connection between the cross shaft and at least one of said longitudinal shafts whereby one conveyor may be tilted about a longitudinal axis to bring the bottom thereof into angular relation with the bottom of the adjoining conveyor, means for advancing successive sheets to the conveyors, and means for driving the wheel extensions of the magnets at the sheet receiving end of the conveyors to advance the sheets beneath the conveyors.

12. A handling apparatus for relatively thin flexible metal sheets comprising an upright frame structure providing longitudinally spaced support members, rail type overhead electromagnetic conveyors arranged in laterally spaced, parallel relation above said spaced support members, means for mounting one of said conveyors on said spaced supports for rotation about a longitudinal axis whereby said one conveyor may be tilted relative to the adjacent conveyor so as to position the sheet receiving bottom surfaces thereof in planes which extend in angular relation in the direction transversely of the conveyors whereby to impart a curvature about a longitudinal axis to each successive sheet delivered to the bottom surfaces of said conveyors and to stiffen the sheets so as to eliminate buckling thereof on a transverse axis.

13. An apparatus for piling relatively wide and thin metal sheets comprising a supporting frame, a plurality of relatively narrow elongate rail-like electromagnetic conveyor units disposed in longitudinally extending, laterally spaced, parallel relation above said frame, means including longitudinally aligned pivot formations mounting one of said conveyor units on said supporting frame, a cross shaft rotatably mounted on said frame, driving connections between said cross shaft and said pivotally mounted conveyor unit which are operative to rotate said pivotally mounted conveyor unit about a longitudinal axis so as to position the bottom surface of said pivotally mounted conveyor unit at an angle to the bottom surface of an adjacent conveyor unit, means for advancing successive sheets in a longitudinal direction to the bottom surfaces of said conveyor units, means for actuating the magnets in said conveyor units to hold the sheets on the bottom surfaces thereof whereby the sheets are bowed about a longitudinal axis, and means for operating the conveyor units to advance the sheets beneath the conveyor units while held against the bottom surfaces thereof.

14. A piler for relatively wide and thin metal sheets comprising a pair of longitudinally spaced, upright end supports, a plurality of relatively narrow elongate electromagnetic conveyors disposed in longitudinally extending, parallel, transversely spaced relation between said end supports, each of said conveyors comprising a base member and a series of longitudinally spaced electromagnets mounted in depending relation on said base member, each of said magnets having a rotatably mounted, transversely extending pole piece with wheel forming extensions of substantially greater diameter than the pole piece on opposite ends thereof, the lowermost periphery of each of the wheel formations being in a common plane which forms the bottom of the conveyor against which a sheet is held when the magnets are activated, one of said conveyors being mounted at its ends in fixed relation on said end supports, longitudinally spaced, upstanding bracket members on the base member of an adjoining conveyor, a longitudinally extending shaft connected to said bracket members, carriage forming members at opposite ends of said longitudinal shaft, said longitudinal shaft being journaled at its ends in said carriage forming members, transversely extending members on said end supports forming tracks for said carriage members, means for varying the transverse position of the carriage members so as to adjust the lateral position of the conveyor relative to the adjoining fixed conveyor, an extensible cross shaft journaled in the carriage members at one end of the conveyors and a driving connection between the cross shaft and said longitudinal shaft whereby said conveyor unit may be tilted about a longitudinal axis to bring the bottom thereof into angular relation with the bottom of the adjoining fixed conveyor, means for advancing successive sheets to one end of the conveyors, and means for driving the wheel formations at the sheet receiving end of the conveyors to advance the sheets beneath the conveyors.

15. A piler for relatively wide and thin metal sheets comprising a pair of longitudinally spaced, upright end supports, a plurality of relatively narrow elongate electromagnetic conveyors disposed in longitudinally extending, parallel relation between said end supports, each of said conveyors comprising a base member and a series of longitudinally spaced electromagnets mounted in depending relation on said base member, each of said magnets having a rotatably mounted, transversely extending pole piece with wheel forming extensions of substantially greater diameter than the pole piece on opposite ends thereof, the lowermost periphery of each of the wheel formations of each conveyor being in a common plane which forms the bottom of the conveyor against which a sheet is held when the magnets are activated, the base member of one of said conveyors being secured in fixed relation on said end supports, longitudinally spaced, upstanding bracket members on the base member of the adjoining conveyors, a longitudinally extending shaft connected to the bracket members of each of said conveyors, carriage forming members at opposite ends of said longitudinal shaft, said longitudinal shaft being journaled in said carriage forming members, transversely extending track forming members on said end supports on which said carriage members are slidably positioned, means for varying the transverse position of the carriage members so as to adjust the lateral position of the movable conveyors relative to said fixed conveyor, an extensible cross shaft journaled in the carriage members at one end of the conveyors and a driving connection between the cross shaft and each longitudinal shaft whereby the movable conveyors may be tilted about a longitudinal axis to bring the bottoms thereof into angular relation relative to the bottom of the fixed conveyor, means for advancing successive sheets to one end of the conveyors, and means for driving the wheel extensions of the magnets at the sheet receiving

end of the conveyors to advance the sheets beneath the conveyors.

16. An apparatus for piling relatively wide and thin metal sheets comprising a supporting frame, relatively narrow elongate rail-like electromagnetic conveyor units disposed in longitudinally extending, laterally spaced, parallel relation above said frame, longitudinally aligned pivots connecting opposite ends of each conveyor unit to said supporting frame, a cross shaft rotatably mounted on said frame, worm and gear connections between said cross shaft and each of said conveyor units which are operative to rotate each of said conveyor units about a longitudinal axis so as to position the bottom surface of each unit at an angle to a common cross plane, means for advancing successive sheets in a longitudinal direction to the bottom surfaces of said conveyor units, means for actuating the magnets of said conveyor units to hold the sheets on the bottom surfaces thereof whereby the sheets are bowed about a longitudinal axis, and means to drive at least one of said conveyor units so as to advance the sheets beneath the conveyor units while held thereby.

17. A piler for relatively wide and thin metal sheets comprising a pair of longitudinally spaced, upright end supports, a pair of relatively narrow elongate electromagnetic conveyors disposed in longitudinally extending parallel relation between said end supports, each of said conveyors comprising a base member and a series of longitudinally spaced electromagnets mounted in depending relation on said base member, each of said magnets having a rotatably mounted, transversely extending

pole piece with wheel forming extensions on opposite ends thereof, the lowermost periphery of each of the wheel extensions being in a common plane which forms the bottom of the conveyor against which a sheet is held when the magnets are activated, longitudinally spaced, upstanding bracket members on the base member, a longitudinally extending shaft connected to said bracket members, carriage forming members at opposite ends of said longitudinal shaft, said longitudinal shaft being journaled in said carriage forming members, transversely extending track forming members on said end supports for receiving said carriage forming members, means for varying the transverse position of the carriage members so as to adjust the lateral position of the conveyors relative to each other, means connected with each longitudinal shaft for pivoting the same whereby the conveyor units may be tilted about a longitudinal axis to bring the bottoms into angular relation, means for advancing successive sheets to the bottom surfaces of the conveyors, means for driving the wheel extensions of the magnets at the sheet receiving end of the piler to advance the sheets beneath the conveyors, and resiliently mounted rollers for urging the sheet upwardly into engagement with the wheel extensions at the sheet receiving end of the piler as the sheets are advanced into the piler.

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