March 30, 1937. C. A. ADAMS 2,075,416

CONVEYING MECHANISM

Filed Jan. 22, 1934 3 Sheets-Sheet 1

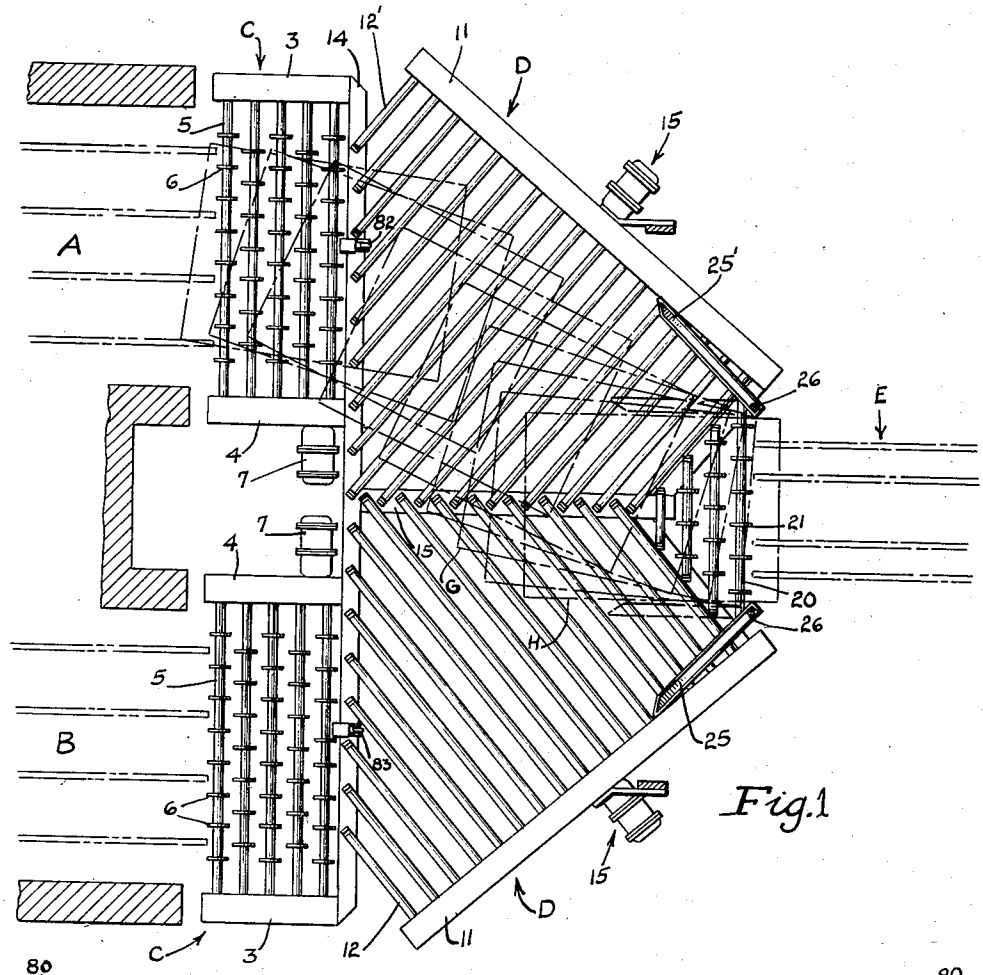


Fig. 1

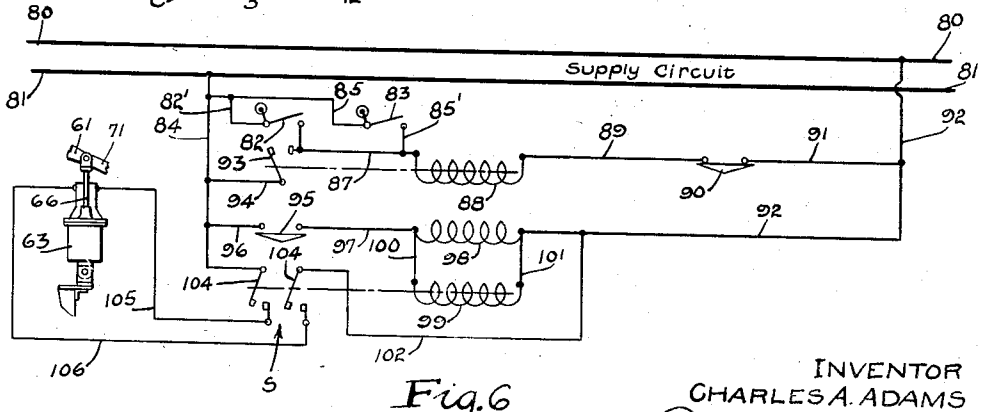


Fig. 6

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CONVEYING MECHANISM

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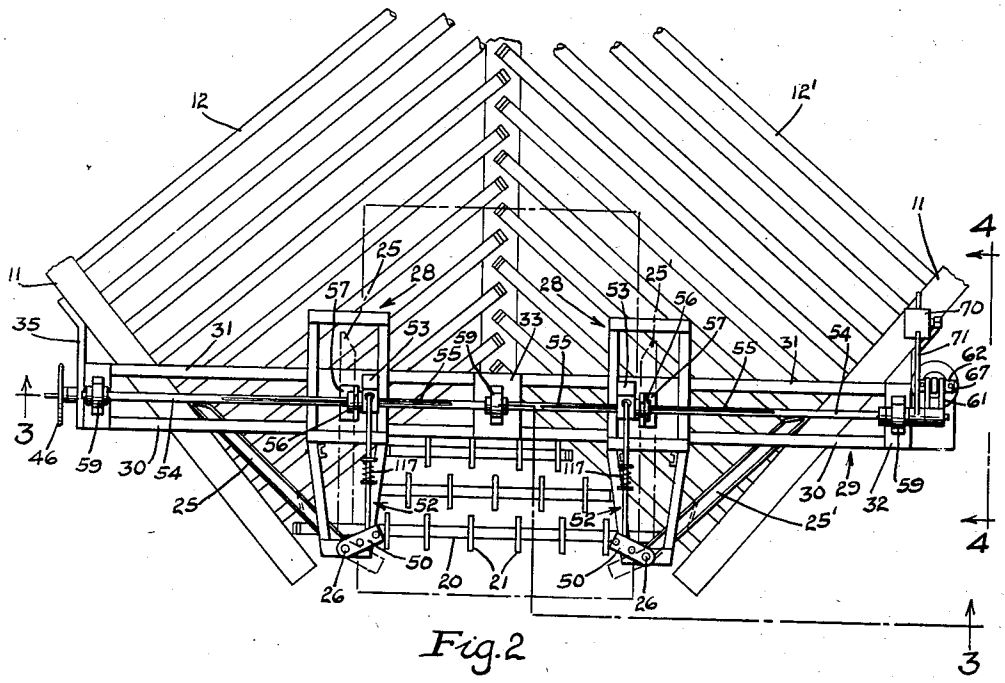


Fig. 2

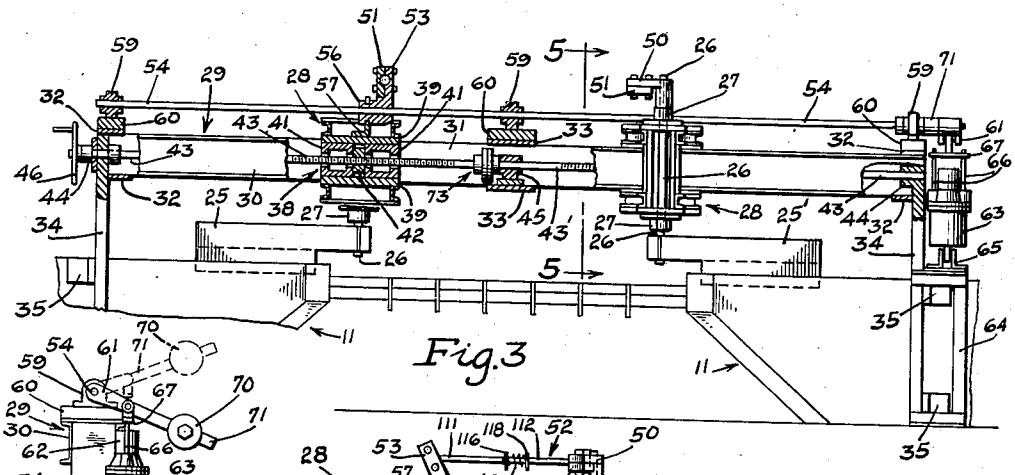


Fig. 3

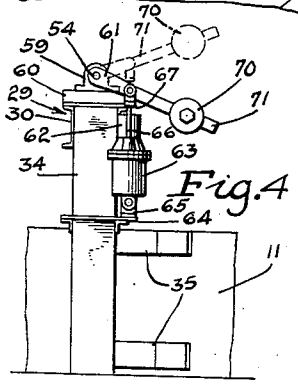


Fig. 4

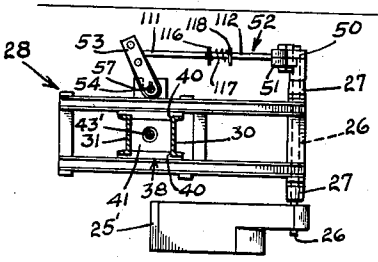


Fig. 5

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CONVEYING MECHANISM

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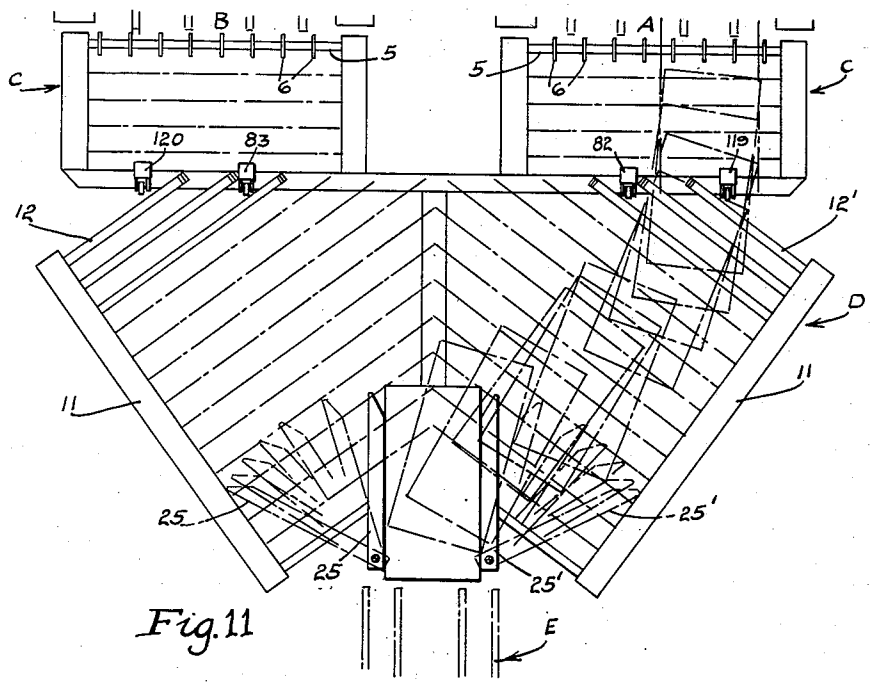


Fig. 11

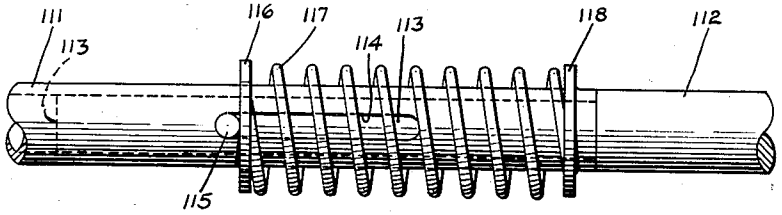


Fig. 7

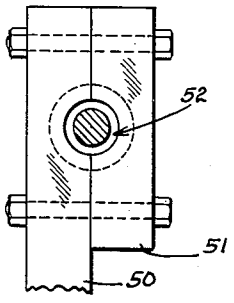


Fig. 9

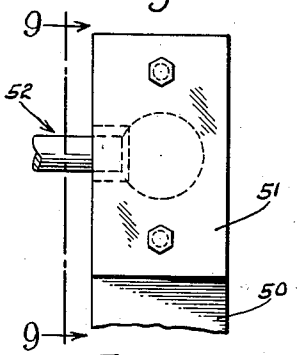


Fig. 8

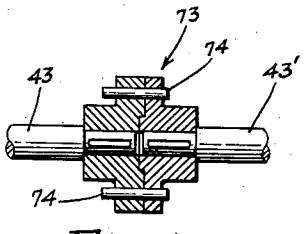


Fig. 10

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Patented Mar. 30, 1937

2,075,416

UNITED STATES PATENT OFFICE

2,075,416

CONVEYING MECHANISM

Charles A. Adams, Ellwood City, Pa., assignor to Mathews Conveyer Company, Ellwood City, Pa., a corporation of Pennsylvania

Application January 22, 1934, Serial No. 707,777

11 Claims. (Cl. 198—32)

This invention relates to new and useful improvements in runout tables of the herringbone type, such as disclosed in Patents No. 1,931,453 to C. A. Adams, No. 1,931,454 to M. J. Anderson, issued October 17, 1933, and in Patent No. 1,946,453 to J. R. Brodbeck.

Tables of the herringbone type are particularly well adapted for transferring hot metal bars, sheets, and packs of sheets, from the discharge ends of a plurality of heating furnaces to a single point of operation, or a suitable feeding means leading thereto. Tables of this type may, however, be used equally well for transferring other articles such, for example, as composition boards and sheets, boxes, crates, and various other articles, from a plurality of sources of supply to a single receiving means. For instance, articles may be delivered onto the herringbone table herein disclosed, from a plurality of conveyers, or furnaces, or other separate sources of supply, and be transferred thereby to a single conveyer having its receiving end positioned adjacent to the discharge end of the herringbone table.

In the manufacture of sheet metal, it frequently happens that a single installation comprises two furnaces and a rolling mill designed to handle both wide and narrow sheets, with the result that the longitudinal centerlines of the two furnaces may be widely separated from each other, which results primarily because of the fact that each furnace compartment is made sufficiently wide to accommodate the widest sheets to be handled. In such an installation, the receiving end of the herringbone table is made sufficiently wide to embrace the discharge ends of the two furnaces, which usually are arranged side by side, and from which the sheets are discharged onto the herringbone table.

In many cases the herringbone tables are installed in steel mills which have been in existence for years. In such steel mills, the rolling mills are usually permanently located, and the heating furnaces, even when newly constructed, must be placed in positions determined by mill dimensions, location of other equipment, etc. In some such installations, the furnaces and the rolling mill may not be spaced very far apart, with the result that when a herringbone table and a feeder catcher unit are subsequently interposed between the furnaces and the rolling mill, the sides of the herringbone table must converge rapidly towards the discharge end thereof because of said table being rather short in length, and further, because the receiving end of said table must embrace both furnaces.

The axes of the load carrying rollers at each side of the herringbone table are usually disposed at right angles to their respective side frame members. Obviously, when a sheet is delivered onto one of the rows of rollers of the herringbone table, from a furnace or furnace compartment, the sheet is first turned out of its longitudinally alined position occupied while being transferred through the furnace, to a skewed position upon the herringbone table. The sheet is then carried forwardly, and at the same time inwardly toward the center of the table, and in a line substantially at right angles to the axes of the rollers of the table, over which the sheet is traveling, as it moves toward the discharge end of the table. As the sheet approaches the discharge end of the table, it engages the rollers at the opposite side thereof, whereby it is squared upon the table in a position wherein its sides are substantially parallel to the longitudinal centerline of the two furnaces, and the longitudinal centerline of the herringbone table. While being transported through the furnaces, the sides of the sheets are substantially parallel to the longitudinal centerlines thereof, but when delivered onto the herringbone table, this position is altered to a skewed position. It is therefore necessary that the sheet be returned to a squared longitudinally alined position before, or at the time it is discharged from the herringbone table onto the feeder table leading to the rolling mill.

In the accompanying drawings, there is disclosed a herringbone type table particularly adapted for transferring wide or narrow sheets from two heating furnaces or furnace compartments to a rolling mill feeder table, and it is also capable of handling sheets of considerable length. It has been found that when very wide sheets are heated in the furnaces, they are frequently warped, in which condition they are delivered onto the herringbone table. The sheets are often so warped that a large portion of the sheets' surface does not come in direct contact with the rollers of the herringbone table, whereby the influence of these rollers upon the sheet to square it is minimized. The inherent principle of operation of a herringbone table, as clearly set forth in the above mentioned patent to C. A. Adams, No. 1,931,453, is based upon the influence the oppositely disposed rollers of the two sides thereof have upon the sheet to square it, when it approaches the center of the table, particularly at the discharge end thereof, where the sheets are to be squared with the feeder table or other receiving means. When the sheets are warped as above described, the rollers of the herringbone table may not exert their full influence thereon. Another difficulty sometimes encountered when handling wide, hot sheets is that frequently the corners thereof may droop, or sag between the rollers, with the result that it is difficult to squarely position the sheets upon the table when they reach the discharge end thereof.

In a furnace and rolling mill installation designed for rolling sheets which do not vary too

greatly in size, both as to width and length, run-out tables such as disclosed in the above mentioned patents operate satisfactorily. Difficulty, however, is sometimes experienced, when handling in the same installation, sheets which vary considerably in width, and particularly in length, as, for example, some installations are now called upon to handle sheets varying from eight to twelve feet in length. It will therefore be readily understood that when transferring a long sheet over the runout table, if some means were not provided at the discharge end of the table to assist the inclined rollers thereof to aline or square each sheet with the feeder table, the sheets might not always be squared with the longitudinal centerline of the feeder table or rolling mill, when delivered thereto from the runout table.

To overcome the above mentioned difficulties, I have provided a novel squaring mechanism adapted for use in connection with herringbone tables of the general character herein disclosed, whereby each sheet, when it reaches a position adjacent the discharge end of the table, will be positively squared or longitudinally alined therewith, before it is discharged from the table, and also whereby the sheet may be discharged from the table in a position offset from the longitudinal centerline thereof, whereby the sheets may be squarely delivered onto a feeder table or other receiving means, whose centerline may be disposed in offset relation to the centerline of the herringbone table.

It frequently happens that an installation comprising the usual heating furnaces of a double furnace, a herringbone runout table, a feeder catcher unit, and the usual rolling mill, must be adapted for handling sheets varying greatly in size. To meet this condition, each furnace or heating compartment may be provided with a plurality of conveying means as, for example, the furnace compartment may be equipped with four conveyer chains disposed lengthwise of the heating compartment and arranged in spaced parallel relation with respect to each other and to the furnace walls. When maximum width sheets are being manufactured, the sheets, while being transported through the furnace, are supported on the four conveyer chains therein, and are substantially symmetrically positioned thereon with respect to the longitudinal axis of the furnace or furnace compartment. Herringbone tables are designed to receive sheets symmetrically positioned in the furnace, transfer them toward the discharge end of the table, turn them to a substantially squared position, and discharge them therefrom in a position substantially symmetrical about the longitudinal centerline of the herringbone table. Tables such as those disclosed in the two patents hereinbefore mentioned, are well adapted for handling sheets in the matter above outlined.

It is now becoming more or less common practice with some sheet rolling mills to use the same furnace or furnaces for rolling both narrow and wide sheets. In such cases, the heating compartments of the furnaces must be made sufficiently wide to accommodate the widest sheets which, as hereinbefore stated, necessitates that the receiving end of the herringbone table be correspondingly widened, whereby it may embrace the discharge ends of the two furnaces, it being understood that two furnaces are usually employed, placed side by side, as disclosed in the accompanying drawings.

In these wide heating furnaces, it sometimes happens that one side of the heating compartment of the furnace will become overheated or will be heated to a higher temperature than the opposite side thereof. When this condition arises, and narrow sheets are to be rolled, it has been found advisable to convey the narrow sheets through the furnace compartment on the high temperature side thereof, whereby the excess heat at that side of the furnace may be utilized and consumed to advantage, and with the result that the temperature within the furnace or heating compartment may be substantially equalized, whereby when wider sheets are subsequently rolled, they will be subjected to a temperature which is substantially uniform throughout the width of the furnace compartment.

It is obvious that when narrow sheets are conveyed through a wide furnace compartment along one side thereof, as above described, said narrow sheets will be discharged onto the herringbone table to one side of the longitudinal centerline of the furnace compartment. Should the sheets be discharged from the furnace adjacent its outer wall, they will be delivered onto the rollers at one side of the herringbone table in a position adjacent the outer ends of said rollers, whereby they may not be carried inwardly toward the longitudinal centerline of the herringbone table sufficiently far to contact with and become influenced by the rollers at the opposite side of the table, to thereby cause them to be discharged from the table in a position symmetrical about the longitudinal centerline thereof. On the other hand, when narrow sheets are conveyed through the furnace along its inner wall, they will be delivered onto the herringbone table at a point nearer the center thereof, and consequently when being transferred to the discharge end of the table, they may be carried past the center thereof and are likely to be discharged from the table in a position in which the sheet is out of longitudinal alinement with the centerline of the table. The above difficulties are positively eliminated by the use of the novel squaring mechanism herein disclosed.

An important object of the present invention therefore is to provide a mechanism operable in connection with a herringbone runout table to accurately position warped or distorted sheets upon the discharge end of said table, whereby each sheet may be alined with the feeder table or other means positioned to receive the sheets from said herringbone table.

A further object of the invention is to provide a herringbone runout table having means for accurately positioning sheets of any width received from a furnace, in order that they may be discharged therefrom in a position symmetrical with the longitudinal centerline of the herringbone table, or with the receiving means.

A further object is to provide in connection with a herringbone runout table, a power operated mechanism for squaring the sheets thereon before they are discharged therefrom onto a suitable receiving means, said mechanism being automatically controlled by the movement of the sheets delivered onto either side of the receiving end of the table, and whereby the sheets, when approaching the discharge end of the table, will cause said mechanism to become operative and square each sheet upon the table before it is discharged therefrom, said mechanism normally being retained in inoperative position.

A further and more specific object of the invention is to provide a squaring mechanism

adapted for use in connection with a runout table of the class herein disclosed, comprising a pair of pivoted guide members or arms disposed adjacent the discharge end of the table and adapted to be swung inwardly into engagement with each sheet traveling over the table to thereby square or aline the sheet therewith before it is discharged from the table, said mechanism also being adapted to aline each sheet with a receiving means whose centerline may be laterally offset from the longitudinal centerline of the runout table, whereby the discharge end of the runout table need not be mounted for swinging or lateral movement, as disclosed in the Patent No. 1,946,453 hereinbefore referred to.

Other objects of the invention will appear from the following description and accompanying drawings and will be pointed out in the annexed claims.

In the accompanying drawings, there has been disclosed an improved structure designed to carry out the various objects of the invention, but it is to be understood that the invention is not to be confined to the exact features shown, as various changes may be made within the scope of the claims which follow.

In the drawings:

Figure 1 is a plan view of a power driven runout table embodying my invention;

Figure 2 is an enlarged plan view of the discharge end of the table showing my improved squaring mechanism mounted thereon;

Figure 3 is a cross-sectional view substantially on the line 3—3 of Figure 2, showing the means for varying the spacing between the two guide members;

Figure 4 is a view taken along the line 4—4 of Figure 2, to show the operating mechanism;

Figure 5 is a detail sectional view on the line 5—5 of Figure 3, with some of the parts omitted;

Figure 6 is a wiring diagram;

Figure 7 is an enlarged detail view showing a portion of one of the connecting rods for actuating the guide members;

Figure 8 is an enlarged detail view showing one of the universal connections provided at the ends of the connecting rods;

Figure 9 is a detail sectional view on the line 9—9 of Figure 8;

Figure 10 is a detail sectional view showing the construction of the coupling for connecting together the adjusting screws of the guide members; and

Figure 11 is a diagrammatic view illustrating substantially the path traveled by a narrow sheet over the table, when discharged from the furnace adjacent its outer wall.

In the selected embodiment of the invention herein disclosed, there is illustrated in Figure 1, for purposes of disclosure, a live roller runout table of the general character disclosed in the two patents and the pending application hereinbefore mentioned, but as this invention does not concern itself with the specific construction of the table, but to an improved squaring mechanism adapted for use in connection with such herringbone type tables, it is thought unnecessary to describe the table in detail, and it will therefore be but briefly described.

The table, as illustrated in Figure 1, comprises a pair of stationary live roller receiving sections C onto which the sheets are delivered from the furnaces, designated by the letters A and B. From the sections C, the sheets are discharged onto the main carrying bed of the runout table, designated generally by the letter D. The table D is composed of angularly disposed live rollers over which the sheets are transferred to a single receiving means E, which may be the usual feeder table of a feeder catcher unit, such as are commonly used in steel mills, and which is directly associated with the rolling mill and the feeder table E, disposed between the discharge end of the herringbone table and the rolling mill.

Each stationary receiving section C, as shown in Figure 1, comprises outer and inner side frame members 3 and 4, which frame members are preferably box-shaped in cross-section, and extend downwardly and are supported upon the mill floor, or upon suitable foundations, not shown. The receiving sections C are provided with suitable rollers 5, rotatably supported on stationary axles, not shown, the ends of which are supported in the side frame members 3 and 4. The rollers 5 are shown provided with suitable spaced discs 6, welded or otherwise secured thereto. The discs 6 form the supporting means for the sheets being transferred over the sections C. The discs 6 function to prevent the hot plates from contacting directly with the peripheries of the rollers 5, and to dissipate heat emanating from the furnaces. Suitable drives, not shown, are provided within the box-shaped side members 4—4 for driving the rollers 5. These drives may be driven from suitable motors 7, located between the inner frame members 4—4, as shown in Figure 1.

The converging table D is shown comprising inclined side frame members 11—11, preferably similar in cross section to the frame members 3 and 4 of the receiving section C. A plurality of load carrying rollers 12 and 12' are arranged in separate rows disposed with their axes at substantially right angles to their respective side members 11. The two sets or rows of rollers 12 and 12' constitute the bed of the table and are angularly disposed with relation to each other. The rollers 12 and 12' are preferably rotatably supported upon stationary through type axles, having their ends suitably supported in the outer frame members 11. The inner ends of the said axles may be supported by suitable angle clips secured to a transverse beam 14, and a center beam 15, which members form part of the supporting structure of the table D.

The outer ends of the rollers of each row of rollers of the table D are operatively connected to suitable drives, not shown, which may be driven from motor-reducer units 15, of ordinary construction. The motors 7 and 16 are operated simultaneously and continuously so that the rollers 5, 12, and 12' are always alive to receive sheets from either of the furnaces A or B, and transfer them to the feeder table E.

The V-shaped opening at the discharge end of the table, resulting from the angular disposition of the rollers 12 and 12' of the table D, is provided with a plurality of rollers 20, each of which is rotatably supported on a stationary axle, the ends of which are non-rotatably supported upon the table supporting structure. Each roller may be provided with a plurality of discs 21, which cooperate to form the carrying surface for the sheets at the discharge end of the table. The rollers 20 are power driven by suitable means, not shown. The drives for the rollers 5, 12, 12' and 20, as hereinbefore stated, are not shown, as these are shown in detail in the hereinbefore mentioned patent to Adams, No. 1,931,453, and it is therefore deemed unnecessary to herein disclose

the same. The rollers **20** are operated simultaneously with the rollers **12** and **12'**.

An important feature of the present invention resides in the novel means provided at the discharge end of the herringbone table D, adapted to cooperate with the load carrying rollers **12** and **12'**, and the rollers **20**, to square or aline each sheet with the feeder table E, just prior to being delivered thereto. The means for thus squaring the sheets before they are delivered onto the feeder table E, is best shown in Figures 1, 2, 3, 4, and 5, and comprises guide members **25** and **25'**, secured to vertically mounted shafts **26**, journaled in bearings **27**. The bearings **27** may be secured to the upper and lower portions of a movable head, designated generally by the numerals **28**, in Figures 1 and 2.

The two heads **28** are here shown as comprising structural members welded or otherwise secured together to form suitable supporting structures. The heads **28** are movably supported upon a transverse beam, designated generally by the numeral **29**, and disposed above the herringbone table D near its discharge end, as best shown in Figure 2. The supporting beam **29** is shown comprising opposed channel members **30** and **31**, secured together in spaced relation by top and bottom plates **32**, welded to the flanges of said channels at the ends thereof, and by top and bottom plates **33**, welded to said channels intermediate their ends. The supporting beam or structure **29**, above described, is supported at each end by vertical members **34**, the lower ends of which may be secured to the floor or suitable foundations. The upright members **34** are braced by being tied to the side frame members **11** of the herringbone table by suitable strap-like brackets **35**. The heads **28** are substantially alike in construction.

Each movable head **28** is secured to a slide, designated generally by the numeral **38**, and adapted to be moved laterally with respect to the table D, between the channel members **30** and **31** of the transverse beam **29**. Each slide **38** comprises top and bottom plate members **39** secured together in spaced relation, vertically, by suitable spacing blocks **41**, as best shown in Figure 5. The edges of the plates **39** are reduced in thickness at opposite sides to form shoulders **40** which cooperate with the inside edges of the channel members **30** and **31** to keep the slide **38** longitudinally alined with the transverse supporting beam **29**. The spacing blocks **41** of each slide are spaced apart lengthwise of the beam **29**, sufficiently to receive therebetween a nut **42**, which nut is held stationary between the two complemental blocks **41**. The nuts **42** are threaded to receive a pair of correspondingly threaded alined adjusting screws **43** and **43'** which extend the full length of the beam **29**.

The adjusting screws **43** and **43'** are supported at the ends of the beams **29** by suitable bearings **44** and are supported at the center of the table D by a bearing **45**, as best shown in Figure 3, the latter bearing being secured to the plate member **33** which is secured to the bottoms of the channel members **30** and **31** at the center of the apparatus. The adjusting screw **43** is provided at the end of the beam **29** with an operating wheel **46** whereby the screws may be conveniently rotated. The adjusting screws **43** and **43'** are threaded in opposite directions, as will be noted by reference to Figure 3, and are suitably secured together adjacent the bearing **45** by suitable means which will subsequently be described. Rotation of the screws **43** and **43'** will effect adjustment of the heads **28** with respect to each other, rotation of the screws in one direction, causing said heads to move away from each other, and rotation of the screws in the opposite direction, causing said heads to move towards each other, the movement thereof being symmetrical about the longitudinal centerline of the herringbone table.

To the upper end of each vertically disposed shaft **26**, there is secured a crank arm **50**. Each crank arm **50** has one end of a connecting rod **52** connected thereto, the opposite ends of which are connected to similar crank arms **53** operatively mounted upon a rock shaft **54** supported in suitable bearings **59** secured to the transverse beam **29**, as best shown in Figures 2 and 3. Because of each pair of crank arms **50** and **53** swinging in different planes, the connections between the connecting rods **52** and said crank arms are adapted for universal movement.

To thus connect the connecting rods to the crank arms, each crank arm is provided with a cap **51** removably secured to its respective crank arm by suitable bolts, as shown in Figures 8 and 9. Each crank arm and its cap **51** is provided with a semi-spherical recess. These recesses cooperate to provide a spherical socket adapted to receive a ball provided at each end of the connecting rod **52**, as clearly illustrated in Figure 8. The ends of the connecting rods extend through openings provided between the crank arms and their respective caps **51**, as shown in Figure 9, which openings are relatively larger in diameter than the connecting rods, thereby to permit swinging movement of the latter with respect to the crank arms.

The crank arms **53** are mounted for sliding movement upon the rock shaft **54**, but are prevented from relatively rotating thereon by means of keyways **55**, provided in the shaft **54**, and suitable keys secured in the bores of said arms **53** and slidably received in said keyways **55**. The crank arms **53** are shown provided with hubs **56**, each of which has an annular groove machined in its periphery, each adapted to receive a forked angle bracket **57**, secured to the plates **39** of the slides **38** of the heads **28**. The brackets **57** prevent lateral movement of the crank arms **53** relative to the heads **28**.

The means provided for operating the rock shaft **54** is best shown in Figures 2, 3, and 4, and comprises a crank **61** preferably bifurcated as shown in Figure 2, and having pivotally connected thereto, the cross head **67** of an electrically controlled hydraulic thruster **63**. The lower end of the thruster **63** is shown pivotally mounted upon a suitable supporting structure **64** by angle brackets **65** secured to the top of the structure **64**. Hydraulic thrusters of the type herein disclosed are manufactured by the General Electric Company and are well-known to the trade. These thrusters comprise a hydraulic cylinder having a plunger operable therein adapted to be actuated by fluid pressure, circulated by means of a suitable fluid pump provided within the plunger of the thruster. This pump is operated by a small electric motor, not shown, mounted in the upper portion **62** of the thruster.

The rotary motion of the motor in the upper portion of the thruster, is converted into straight-line movement in one direction by the action of a suitable fluid-circulating means within the cylinder of the thruster, whereby a smooth reciprocal movement is imparted to the cross

head 67 of the thruster by the action of the plunger thereof. The crows head 67 is connected to the plunger of the thruster by spaced rods 66, operating in suitable guides provided in the cylinder head of the thruster. By thus connecting the thruster to the crank 61, each time the thruster is operated, the crank 61 will be swung upwardly to the dotted line position, indicated in Figure 4, whereby a rocking movement is imparted to the shaft 54 with the resultant actuation of the crank arms 50 and 53, and therefore the guide members 25 and 25'. Such movement of the rock shaft by the thruster will cause the guide members to be moved into operative positions, as indicated by the dotted lines in Figure 2, to square the sheets upon the runout table D before they are discharged therefrom.

The mechanism is so constructed that when the guide members 25 and 25' are in their closed or operative positions, they will be disposed in substantially parallel relation to each other and to the longitudinal centerline of the herringbone table, and when thus positioned, the thruster 63 will be in its full raised position. The cross head of the thruster is retained in such full raised position as long as its motor remains energized. When the supply of current to the thruster motor is cut off, the cross head 67 of the thruster is returned to its lower position, as shown in Figures 3 and 4. This return movement of the cross head 67 is aided by a counterweight 70 adjustably secured to a lever 71 keyed to the rock shaft 54 adjacent to the crank 61. From the foregoing, it will readily be understood that when the thruster motor is deenergized, the thruster cross head returns to its normal lowered position, thereby causing the rock shaft 54 to be rotated in a direction to cause the guide members 25 and 25' to be returned to their normal inoperative positions, shown in full lines in Figures 1 and 2, and in which positions the outer ends of the guide members 25 and 25' will be engaged with the side frame members 11—11.

In Figures 1 and 2, the guide members 25 and 25' are shown spaced apart for handling the maximum width sheets which may be conveyed over the herringbone table D. It will be noted in these figures that the guide members are shown symmetrically disposed with respect to the longitudinal centerline of the table; that is, the distance from the said centerline to each guide member, when in operative position, is the same. The guide members 25 and 25' may be simultaneously moved toward or away from the centerline of the table by operation of the crank wheel 46, because of adjusting screws 43 and 43' being provided with right and left hand threads. Thus, rotation of the screws 43 and 43' in one direction, will cause the heads 28 to be simultaneously moved inwardly, and rotation thereof in the opposite direction, will cause them to move outwardly, away from the centerline of the table.

It is common practice in the manufacture of metal sheets to use the same rolling mill for rolling sheets of different widths, this being accomplished by changing the rolls of the mill; using long rolls for wide sheets, and relatively shorter rolls for narrow sheets. It is also well known in the rolling mill art that the mill rolls are supported between two housings which are bolted to guide rails set in the mill foundation. The mill housings are spaced apart a distance corresponding to the length of the mill rolls. In some mills, both of the housings are laterally movable and, in changing from one length roll to another, both mill housings are moved towards or away from each other equal distances. In such cases, the longitudinal centerline of the rolling mill is retained in alinement with the longitudinal centerline of the herringbone table D, and the feeder table E, interposed between the rolling mill and the table D.

It frequently happens, however, that only one of the mill housings is movable, the other one being permanently bolted or otherwise secured to its supporting means. With this arrangement, the centerline of the rolling mill may be shifted laterally out of alinement with the longitudinal centerline of the table D, depending upon the length of the rolls to be used. Obviously, if the permanently located housing is so positioned that when medium length rolls are used, the centerline midway between the ends of said rolls will be alined with the longitudinal centerline of the table D, then it naturally follows that when narrow sheets are to be rolled, necessitating the substitution of relatively shorter rolls for the medium length rolls, the movable mill housing will be moved towards the stationary mill housing, whereby the centerline of the mill is shifted laterally to one side of the longitudinal centerline of the herringbone table. Conversely, when wider sheets are to be rolled, the movable housing is moved in a direction away from the fixed housing, which, obviously, causes the centerline of the rolling mill to shift to the opposite side of the longitudinal centerline of the table D.

The feeder table leading to the rolling mill is usually adapted for lateral adjustment, whereby it may always be positioned in longitudinal alinement with the centerline of the rolling mill. Such lateral adjustment of the feeder table may cause it to become disalined with the discharge end of the herringbone table D, necessitating that means be provided whereby the sheets may be discharged from the herringbone table, squarely onto the feeder table.

In the herringbone table disclosed in the Patent No. 1,946,453, above mentioned, the discharge end of the table is mounted for swinging movement in an arcuate path, whereby it may readily be moved laterally into registration with the receiving end of the feeder table E. It has been found entirely satisfactory in some installations to thus laterally move or swing the discharge end of the herringbone table to aline it with the feeder table E, but there are installations where the herringbone table cannot be thus mounted for lateral movement. The squaring mechanism herein disclosed is particularly well adapted for use in connection with herringbone tables of the type which are not mounted for lateral movement, and whereby the sheets discharged therefrom may always be squared or longitudinally alined with the receiving end of the feeder table E, before they are delivered thereonto, regardless of whether or not the feeder table is longitudinally alined with the herringbone table D.

To thus discharge the sheets from the herringbone table D, whereby they will always be alined with the feeder table E, or other receiving means, the guide members 25 and 25' are mounted for independent adjustment whereby, when necessary, they may be symmetrically disposed with respect to the feeder table E, in which case they may be unsymmetrically disposed with respect to the longitudinal centerline of the runout table D. To thus adjust the guide members, the adjusting screws 43 and 43' are coupled together by a suitable coupling, designated generally by

the numeral 73, as shown in Figures 3 and 10. This coupling comprises two members suitably secured to the adjacent ends of the two adjusting screws, as best shown in Figure 10. Suitable pins or bolts 74 provide means for securing the two coupling members together for simultaneous operation. One of the coupling members is preferably counterbored, as shown, to receive a correspondingly shaped projection upon the other coupling member, whereby said members are maintained in axial alinement. The adjusting screws 43 and 43' are secured against longitudinal movement.

To thus move one of the guide members independently of the other, whereby said members may be positioned unsymmetrically with respect to the longitudinal centerline of the table D, the pins 74 are moved out of engagement with one of the coupling members of the coupling 73, whereby when the adjusting screw 43 is rotated by the hand wheel 46, the supporting head 28 of the guide member 25 is moved independently of the other supporting head 28. The two heads 28 are then positioned whereby they are symmetrically disposed with respect to the longitudinal centerline of the feeder table E, or the receiving means, after which the members of the coupling 73 are operatively connected together by the pins 74, as shown in Figure 10, whereby when the crank wheel 46 is rotated, both adjusting screws 43 and 43' will be operated to thereby simultaneously move the two supporting heads 28 towards or away from each other, depending upon the direction of rotation of the crank wheel 46. It will thus be seen that by independently adjusting the supporting heads 28, the two guide members 25 and 25' may readily be positioned in offset relation to the longitudinal centerline of the runout table D, whereby sheets delivered onto said table may be squarely discharged therefrom onto a receiving means whose longitudinal centerline may be offset from the longitudinal centerline of the runout table D.

The guide members 25 and 25', as herein disclosed, are adapted for automatic operation. That is, they are provided with suitable control elements positioned to be actuated by the delivery of sheets onto the runout table from the furnaces for controlling the operation of the thruster 63, whereby each time a sheet is delivered onto the runout table, the guide members will automatically move into operative positions, indicated by the dotted lines in Figures 1 and 2.

To thus automatically control the operation of the guide members 25 and 25', suitable limit switches 82 and 83 are positioned at the receiving end of the runout table in the paths of the sheets, whereby the latter will actuate said switches. These limit switches are diagrammatically illustrated in Figure 6, and are electrically connected to a suitable supply circuit comprising conductors 80 and 81. The limit switch 83 is connected to the conductor 81 of the supply circuit by wires 84 and 85, and to the conductor 80 of the supply circuit by wire 85', the coil of a time delay relay 88, wire 89, contact 90, and wires 91 and 92. The other limit switch 82 is connected in parallel with the limit switch 83 by wires 82', 87, and 85', and the time delay relay 88 is of well-known construction, and comprises a normally open contact 93, having a wire 94 electrically connecting it to the wire 84. The movable contact 93 is adapted to engage a fixed contact connected to the wire 87. The normally open contact member 93 of the relay 88 is automatically closed upon energization of the coil 88 of said relay, and remains closed until said coil is deenergized. The purpose of the contact 93 in the circuit of the limit switches 82 and 83, is to provide a shunt path around said limit switches whereby the circuit will be maintained after the sheet has passed over one of the limit switches.

The time delay relay 88 also has a normally open contact member, indicated in Figure 6, by the numeral 95. This contact remains open a predetermined length of time after the coil 88 is energized, before closing. The time delay relay 88 is so adjusted that a sheet discharged from the furnace will reach the position, indicated at G in Figure 1, after it has actuated the limit switch 82, before the thruster 63 is rendered operable to move the guide members 25 and 25' into their operative or closed positions, indicated in dotted lines in Figure 1. About the time the sheet reaches the position G in Figure 1, the circuit to the thruster is completed, whereby the guide members are moved into their operative positions to thereby square or longitudinally aline the sheet with the longitudinal centerline of the runout table D, as indicated by the broken lines H in Figure 1, which represent the position of a sheet about to be discharged from the runout table. The contact 95 is interposed in a circuit comprising a wire 96, having one end connected to the wire 84, and a wire 97 connected to a second time delay relay coil 98, which also is connected to the wire 92. Closing of the contact 95 completes a circuit through the wire 84, wire 96, contact 95, wire 97, coil 98, and wire 92, which is connected to the conductor 80 of the supply circuit. Closing of the above described circuit causes energization of the time relay 98. Simultaneously with the energization of the relay 98, a coil 99 is energized by reason of the latter being connected in parallel with the relay 98 by wires 100 and 101.

The relay coil 99 is operatively associated with a magnetic starting switch, generally indicated by the letter S, and comprising movable contacts 104 adapted to engage a pair of fixed contacts, having wires 105 and 106 electrically connecting them to the motor of the thruster 63, as clearly indicated in Figure 6. One of the movable contacts 104 of the magnetic starting switch S is electrically connected to the wire 84, leading to the main line conductor 81, and the other movable contact 104 of said switch is connected by a wire 102 to the wire 92 which leads to the other conductor 80 of the supply circuit. When the coil 99 is energized, the contacts 104—104 are moved into electrical connection with their complemental fixed contacts, thereby closing the circuit to the motor of the thruster, as will readily be understood by reference to Figure 6. Thus, it will be seen that closing of the magnetic starting switch S connects the motor of the thruster directly across the conductors 80 and 81 of the supply circuit.

As previously stated, at the end of approximately two seconds, the time relay contact 95 is closed. The closing of this contact will cause the coils 98 and 99 to become energized simultaneously, whereby the circuit to the thruster motor is completed. Subsequent to the closing of the contact 95, at the end of the two-second period, said contact remains closed as long as the coil 88 is energized. It requires approximately one second for the thruster and the mechanism connected therewith to move the guide members 25 and 25' from their inoperative to their operative

or closed positions, indicated in full and dotted lines in Figures 1 and 2, and it has been found advisable to retain the guide members in their operative positions for a period of about one second to assure that the sheet will be accurately squared with the table D before being discharged therefrom onto the receiving means. It will be apparent from an inspection of Figure 6, that after the circuits are closed to the coils 88, 98, and 99, they will be maintained closed through the normally closed period of contact 90 of the time delay relay 98. The opening of the contact 90 causes deenergization of the relay coil 88 which results in the opening of the contacts 93 and 95. Opening of the contact 95 causes the coils 98 and 99 to become deenergized whereby the movable contacts 104 of the starting switch S are moved into open or inoperative positions by suitable means such as gravity or a spring. Such opening of the starting switch S will cause interruption of the thruster motor, whereby the counter weight 70 on the arm 71 will restore the guide members 25 and 25' to their normal open positions, shown in full lines in Figures 1 and 2.

From the description of the control mechanism herein disclosed, it will be obvious that at the time the sheet reaches the position G in Figure 1, the guide members 25 and 25' begin to move from their normally open positions, shown by the full lines in Figure 1, to their closed or operative positions, indicated by the dotted lines in the above figure. When the guide members are in their operative positions, they are substantially parallel to the centerline of the table. As the sheet continues its forward movement from the position G to that indicated by the letter H, it is moved inwardly by the action of the guide members 25 and 25' and, at the same time, it is influenced by the action of the power driven conveyer rollers 12 and 12', and 20 of the runout table, whereby it will be accurately squared or longitudinally alined with the herringbone table D before it is discharged therefrom, as clearly indicated in Figure 1. As soon as the guide members have performed their function, they are returned to their normal open positions with their outer ends in engagement with the side rails 11 of the runout table, whereby other sheets may be received from either furnace without interference from the guide members, until said sheets reach a location on the table substantially as indicated by the dotted line position G. When narrow sheets are to be rolled the distance between the heads 28 which support the vertical sheets to which the guide members are secured are moved closer together by rotation of the hand wheel 46, whereby the guide members 25 and 25' may be properly spaced apart to receive therebetween the narrower sheets. It is to be understood that the spacing between the guide members is varied only when the rolling mill and feeder table are adjusted for rolling sheets of different widths.

Provision is made in the operating mechanism of the guide members 25 and 25' whereby the outer ends thereof will always substantially engage the side rails 11 of the runout table, when said guide members are returned to their normal inoperative or open positions. In other words, when the guide members are moved towards the center of the table for handling narrow sheets, they will be rotated a greater number of degrees than when positioned for handling relatively wider sheets.

To thus cause the outer ends of the guide members to always substantially engage the side rails 11 of the runout table, when not in operative positions, the connection between the thruster 63 and the rock shaft 54 is such that when the guide members are positioned for handling narrow sheets, as shown in Figure 11, the plunger within the thruster will travel a greater distance than when the guide members are positioned for handling wider sheets, as shown in Figures 1 and 2. In other words, the connection between the plunger of the thruster and the rock shaft 54 is such that when the guide members 25 and 25' are moved inwardly to their operative positions, as shown in dotted lines in Figures 1 and 2, the plunger will be at the limit of its upward movement. The extent of travel of the thruster plunger in a downward direction will be limited by the swinging movement of the guide members 25 and 25'. In other words, when the guide members are positioned as shown in Figure 11, the thruster plunger will have a longer travel than when the guide members are positioned for handling wider sheets, as shown in Figures 1 and 2.

As hereinbefore stated, it frequently happens that the longitudinal centerline of the rolling mill is shifted laterally with respect to the longitudinal centerline of the table D, which results when only one of the mill housings is adjusted relatively to its complemental fixed housing to adapt the mill frame for relatively longer or shorter rolls. When the longitudinal centerline of the feeder table E, or the rolling mill, is thus laterally offset from the longitudinal centerline of the table D, means must be provided for compensating for the differential in movement of the two guide members 25 and 25', it being understood that the outer ends of these members always contact with the side frame members 11, when in inoperative positions, as shown in full lines in Figures 1 and 2. If the outer ends of the guide members thus engage the side frame members 11 of the table, then when the guide members are laterally offset from the longitudinal centerline of the table D, to aline them with the feeder table E, one of said guide members will have a greater travel or swinging movement than the other, and as both guide members are actuated simultaneously by the rocking movement of the rock shaft 54, it will be seen that means must be provided for taking care of this differential in movement of the two guide members.

To take care of the differential in movement of the two guide members, each connecting rod 52 is shown comprising two sections 111 and 112. The section 112 is shown provided with a reduced extension 113 adapted to be slidably received in the adjacent end of the section 111. Elongated openings or slots 114 are provided in the walls of the section 111 adapted to receive a pin 115 suitably secured in the reduced extension 113 of the section 112. The terminals of the pin 115 extend beyond the periphery of the extension 111 to provide an abutment for a washer 116 against which one end of a suitable compression spring 117 is seated. The opposite end of the spring 117 is seated against a collar 118 suitably secured to the section 111 adjacent the end thereof. The spring 117 normally holds the sections 111 and 112 in their retracted positions, as shown in Figure 7, and the two connecting rod sections do not relatively move with respect to each other, when the guide members

25 and 25' are positioned symmetrically about the longitudinal centerline of the table.

When, however, the guide members are laterally offset with respect to the longitudinal centerline of the table D, to aline them with the longitudinal centerline of the feeder table E, or the rolling mill, then one of the springs 117 will become operative each time the guide members are returned to their normal inoperative positions, as shown in Figures 1 and 2. When the guide members are in their operative positions, as indicated by the dotted lines in Figures 1 and 2, the connecting rods 52 will be retracted, and the springs 117 will be in their normal expanded positions, as shown in Figure 7. When, however, the guide members are moved outwardly to their inoperative positions with their outer ends in engagement with the side frame members 11 of the table D, one of the guide members will contact with its respective side frame members before the other of said guide members, whereby it will come to rest while the other guide member continues its outward swinging movement until it contacts with its respective side frame member 11 at the opposite side of the table D. During such continued swinging movement of the second guide member, the connecting rod of the guide member which first engaged its side frame member 11, will elongate, caused by the action of the counterweight 70 continuing the rocking movement of the rock shaft 54 until the second guide member engages its limit stop or side frame member 11, whereby the rock shaft 54 comes to rest. The tension of the springs 117 is such as to cause the weight 70 to operate as above described, whereby it will be clearly understood that the outer ends of the guide members 25 and 25' will always be brought into contact with the side frame members 11, when in inoperative positions.

Figure 11 diagrammatically illustrates a herringbone runout table of slightly different dimensions than those of the table disclosed in Figures 1 and 2. In Figure 11, the guide members 25 and 25' are shown positioned for handling narrow sheets. This figure also shows substantially the path traveled by the sheets when discharged from the furnace adjacent its outer wall. When the same apparatus is to be used for handling both wide and narrow sheets, additional limit switches 119 and 120 may be provided at the receiving end of the table D so that regardless of whether the sheets are discharged from the furnaces adjacent their outer or their inner walls, said sheets will always engage and actuated one or more of the limit switches provided at the receiving end of the table D. These additional limit switches 120 and 119 are connected in parallel with their respective limit switches 82 and 83 whereby, regardless of which switch at the discharge end of the furnace is actuated by a sheet discharging therefrom, the mechanism for operating the guide members 25 and 25' will be automatically set into motion when the sheet reaches substantially a predetermined position upon the runout table D.

When the guide members are laterally offset from the longitudinal centerline of the runout table D, as hereinbefore described, the action of said members upon the sheets traveling over the runout table will be substantially the same as when positioned symmetrically with respect to the longitudinal centerline of the table D, the only difference being that one of the guide members, in moving into its operative position, will have the extra burden of sliding the sheet laterally across the table into position between the two guide members from which position it will be discharged from the table D in a position symmetrically to or longitudinally alined with the corresponding centerline of the feeder table E, and the rolling mill. In most cases, the distance through which the sheet will be pushed laterally by one of the guide members will be a matter of only a few inches.

In the drawings and in the foregoing description, I have disclosed a squaring mechanism adapted for use in connection with runout tables of the herringbone type, comprising a pair of guide members adapted to be operated by a hydraulic thruster provided with an automatic electrical control mechanism. It is to be understood, however, that other types of operating mechanisms may be used for actuating the guide members 25 and 25'. For example, the guide members may be operated by a motor through a speed reduction unit and a suitable crank mechanism, in lieu of the thruster operated mechanism herein disclosed. It will therefore be seen that various changes may be made in the constructional details of the apparatus, and the means for operating the same, without departing from the scope of the invention.

I claim as my invention:

1. In a runout table, rows of load-carrying rollers arranged to convey articles inwardly towards the center of the table as they pass thereover, means movably mounted over said table and cooperating with said rollers to square each article with the longitudinal centerline of the table before it is discharged therefrom, and an operating mechanism for said movable means controlled by movement of the articles.

2. In a runout table, rows of load-carrying rollers arranged to convey articles inwardly towards the center of the table as they pass thereover, means mounted for swinging movement over said table and cooperating with said rollers to square each article with the table before it is discharged therefrom, and an operating mechanism for said swinging means controlled by movement of the articles.

3. In a converging runout table, rows of load-carrying rollers, the rollers of one row being angularly disposed with respect to the rollers of an adjacent row, whereby articles passing over the table will be conveyed inwardly towards the center thereof, as they approach the discharge end of the table, oppositely movable guide members at the discharge end of the table adapted to engage and square each article with the table before being discharged therefrom, and means responsive to the traveling movement of articles over the table to control the operation of said guide members.

4. In a converging runout table adapted to receive articles from separate sources of supply, said table comprising two rows of load-carrying rollers, the rollers of one row being arranged obliquely to the rollers of the other row, whereby articles conveyed over the table will move inwardly towards the center thereof, as they approach the discharge end of the table, a pair of guide members mounted for swinging movement over a portion of said table and adapted to engage and square each article with the table before it is discharged therefrom, an operating mechanism for said guide members, and means made operable by movement of the articles for automatically

controlling the operation of said operating mechanism.

5. In a converging runout table adapted to receive hot metal sheets from a plurality of furnaces and convey them to a single receiving means such as a rolling mill, said table comprising a plurality of angularly disposed load carrying rollers, forming the bed thereof, and whereby sheets conveyed over the table will move inwardly towards the center thereon, as they approach the discharge end of the table, and means responsive to the travel of the sheets over said table to aline each sheet with said receiving means, before it is discharged thereonto from the runout table.

6. In a converging runout table adapted to receive hot metal sheets from a plurality of furnaces and deliver them to a single receiving means, such as the feeder table of a rolling mill, said runout table comprising a plurality of angularly disposed load-carrying rollers whereby sheets conveyed over said table will move inwardly towards the center thereof, as they approach the discharge end of the table, a pair of pivoted guide members at the discharge end of the table, an operating mechanism for said guide members, and a control mechanism for said operating mechanism, comprising a plurality of control elements positioned to be actuated by sheets delivered onto the runout table whereby said guide members will be operated to square each sheet with the longitudinal centerline of the receiving means, before it is discharged thereonto from the runout table.

7. In a converging runout table adapted to receive hot metal sheets from a plurality of furnaces and deliver them to a single receiving means, such as the feeder table of a rolling mill, said runout table comprising a plurality of angularly disposed load-carrying rollers whereby sheets conveyed over said table will move inwardly towards the center thereof, as they approach the discharge end of the table, a pair of pivoted guide members at the discharge end of the table, an operating mechanism for said guide members, and an electric control mechanism for said operating mechanism, comprising a plurality of independently operable control elements positioned to be actuated by sheets delivered onto the runout table from the furnaces, whereby said guide members will be automatically operated to square each sheet with the longitudinal centerline of the receiving means, before it is discharged thereonto from the runout table.

8. In a converging runout table adapted to receive hot metal sheets from a plurality of furnaces and deliver them to a single receiving means such as a rolling mill, said table comprising a plurality of angularly disposed load carrying rollers whereby sheets conveyed over the table will move inwardly towards the center thereof, as they approach the discharge end of the table, a pair of guide members at the discharge end of the table adapted to engage and square each sheet with respect to said receiving means, before it is discharged thereonto from the runout table, an operating mechanism for automatically actuating said guide members, said operating mechanism including a motor, and a plurality of limit switches positioned to be influenced by traveling movement of the sheets over said table, and means whereby said guide members may be relatively adjusted towards or away from each other, thereby to adapt the apparatus for handling sheets of different widths.

9. In a converging runout table adapted to receive hot metal sheets from a plurality of furnaces and deliver them to a single receiving means such as a rolling mill, a squaring mechanism at the discharge end of said table comprising a pair of guide members mounted for swinging movement over the table to thereby engage and square each sheet with said receiving means, before it is delivered thereonto from said table, a supporting head for each guide member, means whereby said heads may be adjusted independently of each other to aline or square said guide members with the longitudinal centerline of the receiving means, and also whereby the spacing between said guide members may be varied to adapt them for sheets of different widths, an operating mechanism for simultaneously actuating said guide members, and a control means for said operating mechanism, including a plurality of limit switches positioned to be actuated by sheets delivered onto the runout table from said furnaces, whereby said guide members will be automatically operated each time a sheet approaches the discharge end of the table.

10. In a converging runout table adapted to receive hot metal sheets from a plurality of furnaces and deliver them to a single receiving means such as a rolling mill, said table comprising a plurality of angularly disposed load-carrying rollers whereby sheets conveyed over said table will be moved inwardly towards the center thereof as they approach the discharge end of the table, a squaring mechanism comprising a pair of guide members mounted for swinging movement over the table to thereby engage and square each sheet with said receiving means, before it is delivered thereonto from said table, a supporting structure mounted over the table adjacent its discharge end, a supporting head for each guide member, mounted for independent adjustment on said supporting structure, whereby they may be moved towards or away from each other for different width sheets, and whereby they also may be alined with said receiving means, should the longitudinal centerline of said securing means be laterally offset from the longitudinal centerline of the runout table, an operating mechanism for simultaneously actuating said guide members, and a control means for said operating mechanism, including a plurality of limit switches positioned to be actuated by sheets delivered onto the runout table from said furnaces, whereby said guide members will be automatically operated each time a sheet approaches the discharge end of the table.

11. In a conveying apparatus, guide elements, operating means for simultaneously moving said guide elements inwardly to center the articles on the apparatus, and a plurality of electric switches responsive to traveling movement of articles over the apparatus thereby to automatically control the operation of said guide elements.

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