

June 12, 1951

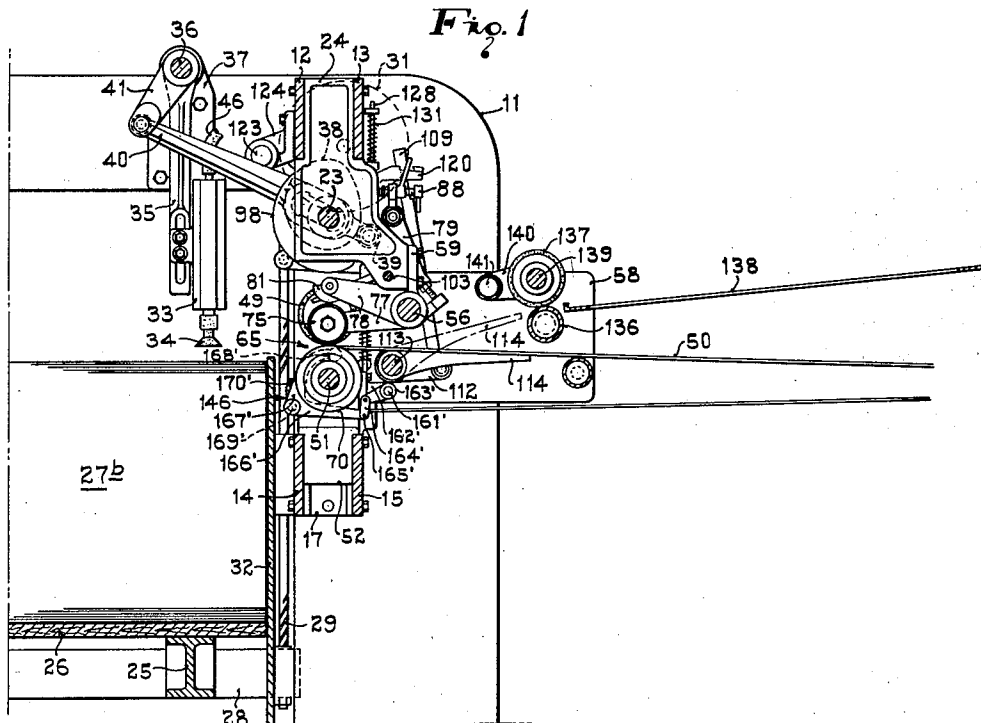
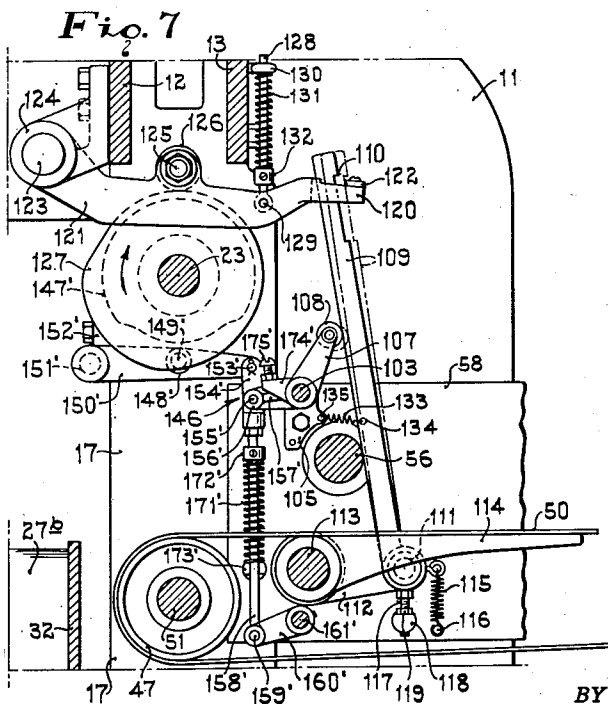
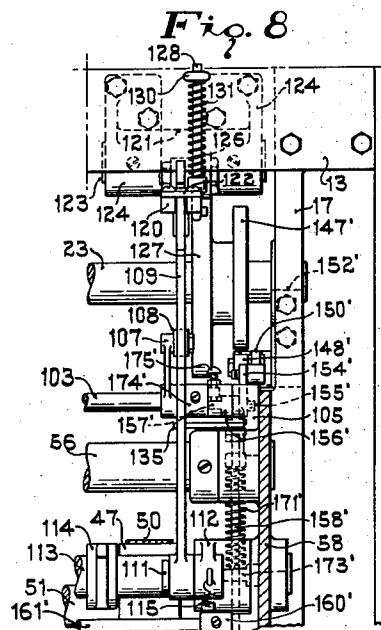
L. BAKER

2,556,895

SHEET FEEDING APPARATUS

Filed March 4, 1946

3 Sheets-Sheet 1



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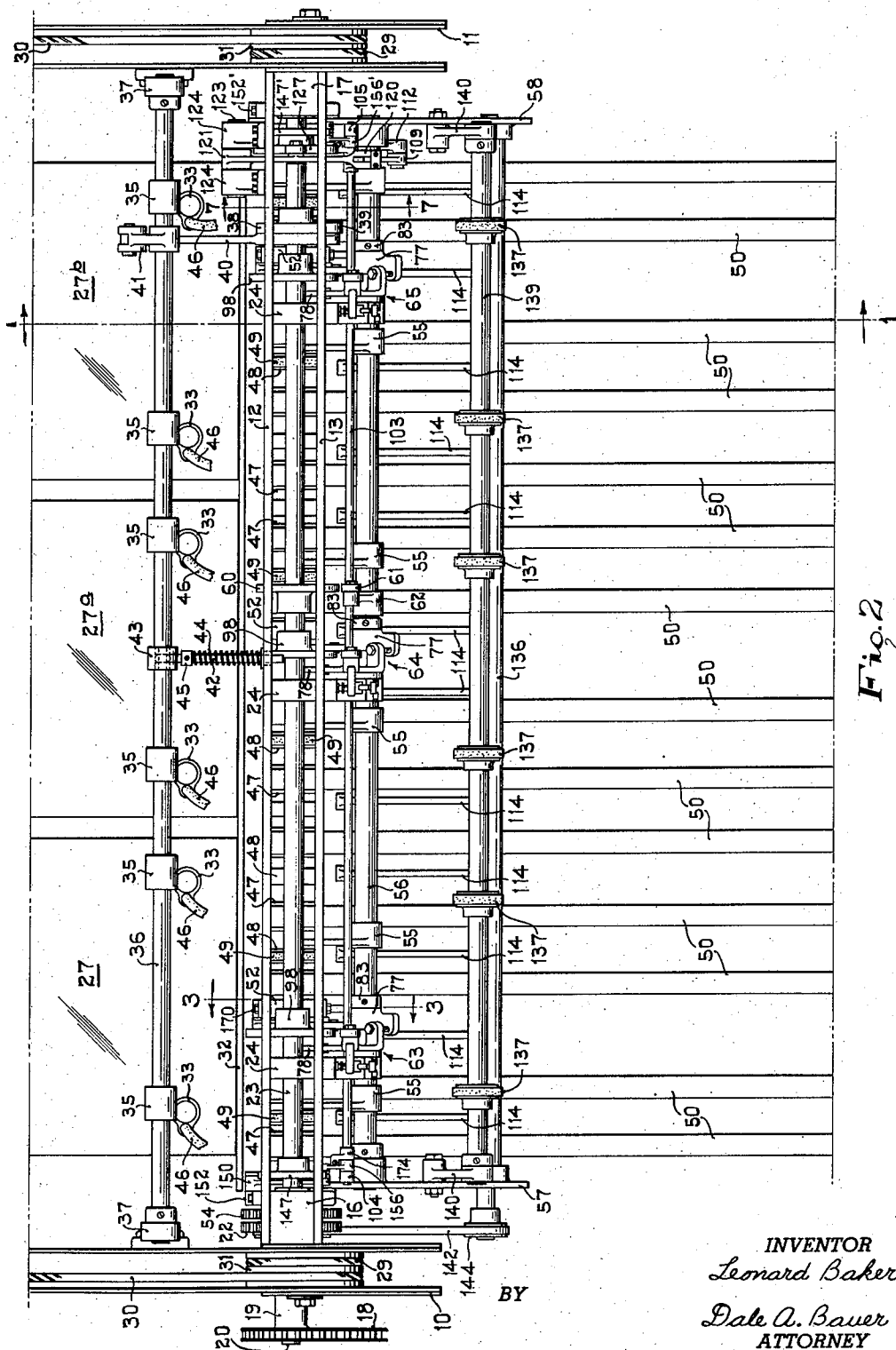
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3 Sheets-Sheet 2



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SHEET FEEDING APPARATUS

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3 Sheets-Sheet 3

Fig. 3

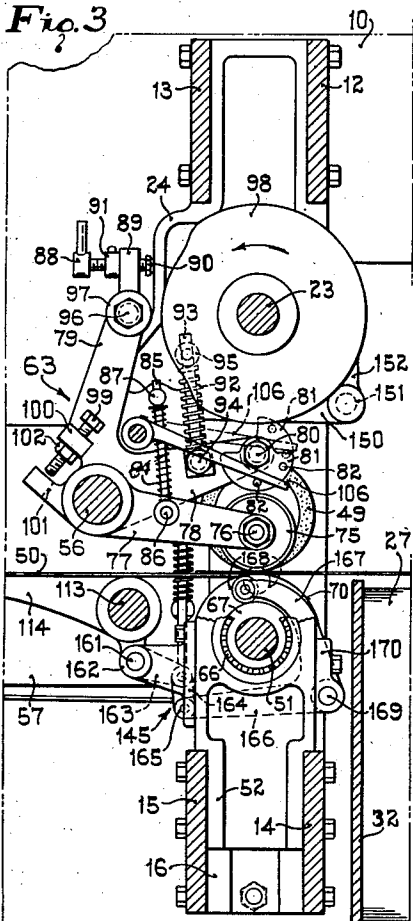


Fig. 4

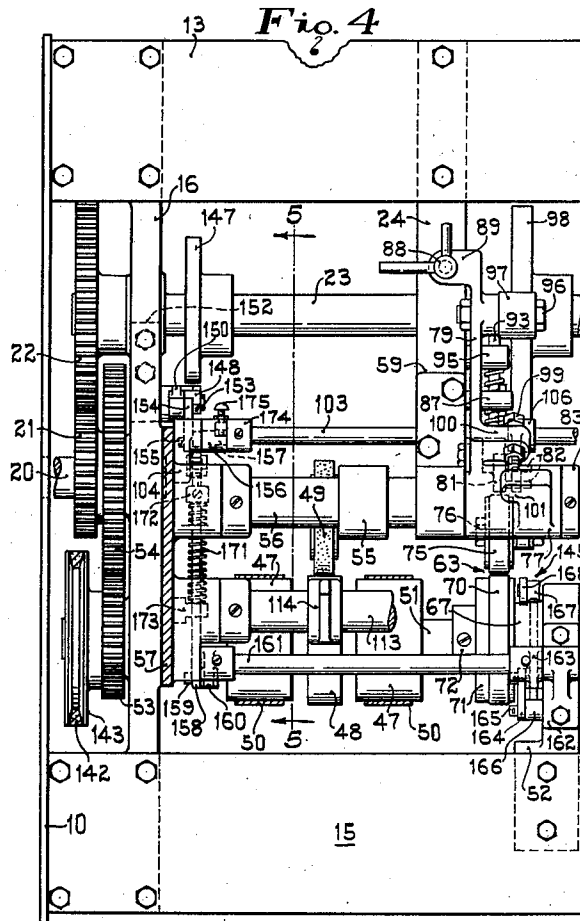


Fig. 5

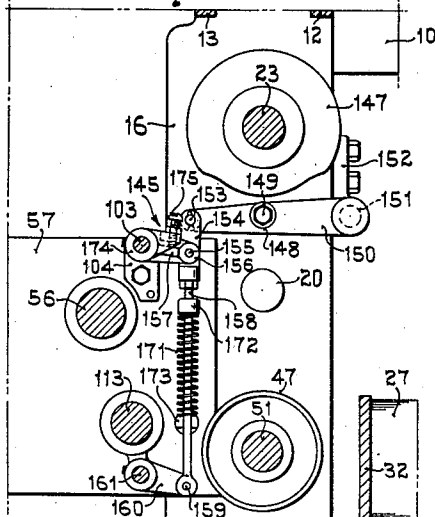
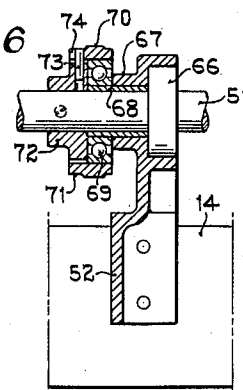


Fig. 6



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UNITED STATES PATENT OFFICE

2,556,895

SHEET FEEDING APPARATUS

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Application March 4, 1946, Serial No. 651,727

11 Claims. (Cl. 271—57)

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This invention relates to sheet feeders and more particularly to sheet detecting mechanisms thereof employed to detect an abnormal condition in the feed of sheets and transmit the result or effect of the detecting operation to control means.

One of the objects of the present invention is to provide in a sheet feeder novel sheet detecting mechanism for detecting the failure of said feeder to feed a sheet during normal operation thereof and feeding of sheets thereby, or the absence of a sheet at a time when and at a place where a sheet should normally be present.

Another object of the invention is to provide in a sheet feeder novel absence sheet detecting mechanism wherein the result or effect of the absent sheet detecting operation is controlled by a member movable periodically across the sheet path.

Another object is to provide in a sheet feeder novel absence sheet detecting mechanism associated with sheet calipering or excess sheet detecting mechanism in a novel manner, whereby the absent sheet detecting operation and the sheet calipering or excess sheet detecting operation may be performed simultaneously and at a time in each cycle of operation of the feeder when a sheet should normally be present for said detecting operations.

A further object is to provide in a sheet feeder adapted to feed a group or plurality of sheets in side by side relation to a machine or instrumentality acting on said sheets in like manner, novel means for preventing presentation to said machine or instrumentality of a group of sheets which would cause an unbalanced condition in the machine or instrumentality.

A still further object is to provide in a sheet feeder of the above character, a novel arrangement of sheet calipering or excess sheet detecting mechanisms for preventing presentation of the group of sheets to the machine or instrumentality in the event any one of said sheets contains an excess sheet or is of a thickness greater than the thickness of a normal single sheet.

Another object is to provide in a plural-sheet feeder of the above character novel absence sheet detecting means for preventing presentation of a group of sheets to a machine or instrumentality in the event one of the sheets of said group is not present at the time of the sheet detecting operation.

Still another object is to provide in a sheet feeder adapted to feed a group or plurality of

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sheets in side by side relation to a machine or instrumentality acting on said sheets in like manner, novel absence sheet detecting mechanisms associated with sheet calipering or excess sheet detecting mechanisms in a novel manner for rendering sheet reject or throw-out means effective upon failure of said feeder to feed one or more of said sheets, or in the event any one of the fed sheets contains an excess sheet or is of a thickness greater than the thickness of a normal single sheet.

The above and further objects and novel features of the present invention will more fully appear from the following detailed description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only, and are not intended as a definition of the limits of the invention, reference for this latter purpose being had primarily to the appended claims.

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

Fig. 1 is a vertical longitudinal sectional view of a sheet feeder employing sheet detecting mechanisms constructed, arranged and operated in accordance with the present invention, said view being taken substantially on the line 1—1 of Fig. 2;

Fig. 2 is a top plan view of said feeder, with parts omitted for purposes of clearer illustration;

Fig. 3 is an enlarged vertical longitudinal section on the line 3—3 of Fig. 2;

Fig. 4 is a front elevation, partly in section, of the portion of the feeder shown in Fig. 3;

Fig. 5 is a vertical longitudinal section on the line 5—5 of Fig. 4;

Fig. 6 is an enlarged detail front elevation, partly in section, of a sheet calipering roller, and mounting and driving means therefor;

Fig. 7 is an enlarged vertical longitudinal section on the line 7—7 of Fig. 2; and

Fig. 8 is a front elevation, partly in section, of the portion of the feeder shown in Fig. 7.

Referring to the drawings, there is shown a sheet feeder of the general type disclosed in the United States Patent No. 2,247,466, granted July 1, 1941, to Leonard Baker and Leo C. Williams, but adapted to feed a group of metallic sheets from a plurality of piles of said sheets arranged in side by side relation and deliver the fed sheets in like manner to a tinning pot or machine for applying a coating of tin on both surfaces thereof. It will be understood that the feeder may

be employed for feeding a group or plurality of metallic sheets in side by side relation to machines other than tinning machines, such as, for example, lithographing presses, varnishing machines, buffing and cleaning machines, and slitters, and may also be employed for feeding a plurality of cardboard or other relatively stiff sheets in side by side relation to printing presses, cutting and creasing machines, and various other machines which are devised to operate on one or both surfaces of said sheets.

As shown, 10 and 11 indicate portions of the side frames of the feeder on which are mounted the various movable parts as well as certain stationary parts of said feeder. Side frames 10, 11 are connected together at the tops thereof by two longitudinally spaced, transversely extending tie bars 12 and 13, and at a point intermediate the upper and lower ends thereof by two similar tie bars 14 and 15. Tie bars 12, 13 and 14, 15 are secured at their opposite ends to the upper and lower ends, respectively, of vertically extending side brackets 16 and 17 which, in turn, are secured to the side frames 10, 11, respectively.

The various movable parts of the feeder are driven from any suitable source of power (not shown) by a chain 18 (Fig. 2) which passes around a sprocket 19 that is secured to the outwardly projecting end of a short drive shaft 20. The latter extends through a suitable opening in the side frame 10 and is journaled in a suitable bearing in the side bracket 16. Fixed on shaft 20 and disposed between side frame 10 and bracket 16 is a spur pinion 21 (Fig. 4) which meshes with a spur gear 22 that is fixed on and drives a cam shaft 23. The latter extends transversely of the feeder and is journaled in suitable bearings in the side brackets 16, 17, and in a plurality of transversely spaced intermediate or center brackets 24 (Figs. 1 to 4) which are secured to the tie bars 12, 13 and extend downwardly therefrom, there being three of said center brackets shown for reasons to appear hereafter. Shaft 23 makes one revolution for each cycle of operation of the feeder and is utilized to operate various parts of said feeder to be hereinafter described.

The feeder includes a pile elevator comprising cross beams 25 (Fig. 1), one only being shown, adapted to support a pile board 26 and a plurality of piles of metal or other sheets arranged in side by side relation on said pile board. As shown in Fig. 2, the feeder is designed to operate on a maximum of three piles of sheets which are indicated at 27, 27a, and 27b, and arranged side by side in slightly spaced relation. The cross beams 25 have their opposite ends engaged over longitudinally extending side bars 28, each one of which is connected at its front and rear ends with flexible cables 29 and 30, respectively, (Figs. 1 and 2). The cables 29, 30 at opposite sides of the feeder extend upwardly from the side bars 28 and pass around suitably grooved sheaves journaled on the side frames 10, 11 adjacent the front and rear thereof, the front sheaves only being shown and indicated at 31. From the sheaves 31 the cables 29, 30 extend to a suitable elevator operating mechanism (not shown) for raising the elevator step by step in the usual manner in order to maintain the tops of the piles 27, 27a, and 27b at the proper level as the sheets are fed therefrom in succession by means for this purpose hereinafter described. For a more detailed description of the pile elevator, its operating mechanism and control means, reference may be had to the above-mentioned United States Patent No.

2,247,466. During step by step upward movement of the elevator, the front sides of the piles of sheets 27, 27a, and 27b bear against and are guided by a metal apron or plate 32 which is secured to the lower tie bar 14.

The upper rear opposite corner portions of the piles of sheets 27, 27a, and 27b are first winded by suitably winding devices (not shown) to preliminarily separate the opposite rear corner portions of the uppermost sheets of said piles, whereupon the topmost sheets of the piles 27, 27a, and 27b are simultaneously engaged at their opposite rear corner portions by suitable suction devices (not shown) and lifted to further separate the same from the next or underlying sheets. The pile winding devices and the suction sheet lifting devices may be of the general type disclosed in the above-mentioned United States Patent No. 2,247,466 which may be referred to for a more detailed description as to the construction, mounting, and operation thereof.

After the top sheets of piles 27, 27a, and 27b have been simultaneously lifted at the rear thereof by the suction devices as described, and have been further winded by winding devices (not shown) to completely separate the same from the next sheets therebelow, said top sheets are simultaneously forwarded from said piles by suction sheet forwarding devices located at the front of the feeder. These suction sheet forwarding devices comprise cylinders 33 (Figs. 1 and 2) and suction cups 34 that are moved up and down relative to said cylinders through the making and breaking of vacuum therein to engage each sheet at transversely spaced points and lift said sheet from its respective pile prior to forwarding of the same therefrom. The sheet forwarding devices are constructed and operated in the same manner as the sheet forwarding devices disclosed in the United States Patent No. 2,247,466 above referred to and need no detail description herein.

The sheet forward devices have swinging movement imparted thereto to forward the sheets from the piles 27, 27a, and 27b. For this purpose, the cylinders 33 are secured to arms 35 which, in turn, are adjustably fixed on a transversely extending rock shaft 36 that is journaled in suitable bearings in brackets 37 secured to side frames 10, 11. The sheet forwarding devices are rocked forwardly by a cam 38 that is fixed on and rotated by cam shaft 23 and engages a roller 39 journaled on a cam strap 40 extending over said cam shaft and pivotally connected with an arm 41 which, in turn, is fixed on rock shaft 36. The sheet forwarding devices are rocked rearwardly by a spring pressed rod 42 (Fig. 2) having one end thereof pivotally connected with an arm 43 fixed on rock shaft 36 and the opposite end guided in a suitable opening in the upper tie bar 12. The spring for rod 42 is indicated at 44 and encircles said rod between tie bar 12 and a collar 45 adjustably secured to said rod.

Vacuum is created and broken in the cylinders 33 and suction cups 34 at predetermined intervals to cause said cups to simultaneously engage, grip, and lift the top sheets from the piles 27, 27a, and 27b when the sheet forwarding devices have been swung rearwardly, and to release said sheets when the sheet forwarding devices have completed their forward movement and delivered the sheets engaged thereby in side by side relation onto conveying means to be hereinafter described. For this purpose, the cylinders 33 have connected therewith corresponding ends of flexible conduits 46 the opposite ends of which are connected with

a suitable valve mechanism (not shown) which is supported by the upper tie bars 12, 13 and is connected with a vacuum pump (not shown) or any other suitable source of vacuum. The valve mechanism may be of the general type disclosed in the United States Patent No. 2,247,466 above referred to and needs no detail description herein.

The top sheets separated at the rear thereof by the sheet separating devices are simultaneously engaged and lifted at the front thereof by the sheet forwarding devices and delivered thereby in spaced side by side relation to conveying means that advance said sheets in like manner to the tinning pot or other instrumentality with which the feeder is associated. As shown, the conveying means comprise wide and narrow feed rollers 47 and 48, respectively, drop rollers 49 cooperating with the narrow feed rollers 48, and conveyor tapes 50 passing around the wide feed rollers 47 (Figs. 2, 3, and 4). The feed rollers 47, 48 are fixed in spaced relation on a shaft 51 and are alternately arranged on said shaft in a manner such that each sheet delivered thereon from the piles 27, 27a, and 27b by the sheet forwarding devices will be properly supported and prevented from sagging by a plurality of said alternately arranged feed rollers and by a plurality of the tapes 50 during forward movement thereof toward the tinning pot or other instrumentality. Shaft 51 extends transversely of the feeder and is journaled in suitable bearings in the side brackets 16, 17 and in a plurality of transversely spaced intermediate or center brackets 52 (Figs. 2, 3, 4, and 6) which are secured to the lower tie bars 14, 15 and project upwardly therefrom, there being three of said center brackets shown corresponding to the number of piles of sheets 27, 27a, and 27b for reasons to appear hereafter. The shaft 51, feed rollers 47, 48 and conveyor tapes 50 passing around the feed rollers 47 are driven continuously by suitable gearing including a spur pinion 53 (Fig. 4) fixed on said shaft and which meshes with a spur gear 54 that is secured to or formed integrally with spur pinion 21 on drive shaft 20.

The drop rollers 49 are journaled on arms 55 (Figs. 2 and 4) which are fixed in spaced relation on a rock shaft 56 and in a manner so that each sheet delivered between said drop rollers and the feed rollers 47, 48 from the separate piles 27, 27a, and 27b by the sheet forwarding devices will be engaged at transversely spaced points by at least two drop rollers, thereby assuring forward movement of the sheets in a straight line and in spaced parallel paths toward the tinning pot or other instrumentality. The rock shaft 56 extends transversely of the feeder and is journaled in suitable bearings in side plates 57 and 58 projecting forwardly of the feeder and secured to the side brackets 16, 17. Additional supports and bearings for rock shaft 56 are provided by brackets 59 (Figs. 1 and 4) which are secured to the center brackets 24 and project downwardly therefrom to receive said shaft. The drop rollers 49 are raised and lowered at predetermined intervals, and the operation thereof is so timed that they are raised when the sheet forwarding devices deliver the sheets from the piles 27, 27a, and 27b onto the feed rollers 47, 48 and tapes 50, and are lowered after such delivery and breaking of vacuum in the sheet forwarding devices to engage said sheets until they have been substantially entirely advanced from said piles by the cooperating feed rollers 48 and the tapes 50, whereupon said drop rollers are again raised

and forward movement of the sheets in side by side relation toward the tinning pot or other instrumentality is continued by the tapes 50. The drop rollers 49 are lowered by a spring (not shown) and are raised by a cam 60 (Fig. 2) which is secured to cam shaft 23 and engages a roller 61 journaled on an arm 62 that is fixed on rock shaft 56. If desired, the drop rollers 49 may be arranged to continuously engage the feed rollers 48 by disconnecting the arm 62 from shaft 56, or by moving said arm and therewith roller 61 out of the path of action of cam 60.

It will appear that with the construction thus far described, in the normal operation of the feeder and during successive cycles of operation thereof, the sheets are forwarded simultaneously from the top of piles 27, 27a, and 27b by the sheet forwarding devices 33, 34 and delivered thereby in side by side relation to the feed rollers 47, 48, drop rollers 49, and conveyor tapes 50 which advance said sheets in like manner to the tinning pot or other instrumentality for further action thereon.

In the feeding of sheets and particularly a group or plurality of sheets in side by side relation to a tinning pot or other machine which acts on one or both surfaces of said sheets, it is desirable that only single sheets and sheets of a uniform thickness should be presented to said tinning pot or machine. If, for example, in the illustrated embodiment, the sheet fed from either the pile 27 or pile 27b is accompanied by or contains an additional sheet adhering thereto, or is of a thickness greater than the normal thickness of the remaining two sheets fed simultaneously therewith, the excess sheet or excess thickness sheet will, on the one hand, cause possible injury to the tinning pot or other machine, and on the other hand will create an unbalanced condition in the tinning pot or machine with the result that all the sheets will not be properly coated or acted upon and, hence, must be scrapped. If the sheet fed from pile 27a is accompanied by or contains an additional sheet adhering thereto, or is of a thickness greater than the normal thickness of the sheets fed simultaneously therewith from the piles 27 and 27b, the excess sheet or excess thickness sheet, while it might not cause an unbalanced condition in the tinning pot or other machine, it will cause possible injury to the tinning pot or machine, and prevent proper coating of or action on all the sheets with the result that said sheets would also have to be scrapped.

In accordance with the present invention, sheet caliper or excess sheet detecting mechanisms are provided which are arranged in a novel manner and associated with the conveying means to caliper the sheets during forward movement thereof in side by side relation and prevent presentation of all the sheets of the group to the tinning pot or other machine in the event one or more of the sheets is accompanied by or contains an additional sheet or sheets or is of a thickness greater than the predetermined normal thickness of a single sheet. In the illustrated embodiment there are shown three sheet caliper mechanisms corresponding to the number of piles of sheets 27, 27a, and 27b. The sheet caliper mechanisms are so controlled that the sheet caliper operations thereof are performed simultaneously on all the sheets of the group, and effect operation of a common control member in the event one or more of the calipered sheets contain an additional or excess sheet or

sheets or is of an abnormal thickness. The control member may be utilized to interrupt the feed of sheets by the feeder and to stop the conveyor in the usual well-known manner, but, as herein illustrated, it is utilized to operate a common sheet reject or throwout mechanism for diverting all the sheets of the group out of their normal path of travel into a reject sheet supporting tray. In this manner, the abnormal group of sheets is automatically removed from the conveyor, and feeding of successive groups of sheets by the feeder may continue without interruption, resulting in an increased output of fed sheets. The rejected double or plural sheets of normal thickness may then be individualized and placed back on the piles 27, 27a, and 27b together with the rejected single sheets of normal thickness and re-fed.

The sheet calipering mechanisms indicated generally at 63, 64, and 65 (Fig. 2), except for their location in the feeder to act on the separate sheets fed from the piles 27, 27a, and 27b in side by side relation, are identical in construction, mounting, and operation and a description of one of said mechanisms will therefore suffice for all of the same. Before proceeding with the description of the construction, mounting, and operation of one of the sheet calipering mechanisms, it might be mentioned that the center brackets 24 and 52 are so arranged that one bracket 52 is located intermediate the side edges of each pile of sheets 27, 27a, and 27b, and that one bracket 24 is located above and to one side of each bracket 52. It might also be mentioned that the center brackets 52 each contains an anti-friction bearing 66 (Figs. 3 and 6) for supporting and providing frictionless rotation of the feed roller shaft 51. For purposes of description, each sheet calipering mechanism 63, 64, and 65 will thus consist of the following parts including one bracket 24 and one bracket 52, which brackets, as hereinabove described, also serve to support and provide additional bearings for the cam shaft 23, drop roller shaft 56 and feed roller shaft 51. Each sheet calipering mechanism 63, 64, and 65 is preferably constructed, mounted, and operated as follows.

Secured in any suitable manner in the hub 67 of center bracket 52 and projecting laterally therefrom in the direction of side frame 10 is a sleeve 68 through which feed roller shaft 51 extends (Fig. 6). Secured by a press fit on the outwardly projecting end of sleeve 68 is the inner race of a ball bearing 69 having its outer race secured by a press fit in the bore of a lower sheet calipering roller 70 which is substantially of the same diameter as the diameter of the feed rollers 48, and of the feed rollers 47 including the tapes 50 which pass around the latter (Figs. 3, 4, and 6). Calipering roller 70 is formed at one side thereof with a slightly reduced hub portion 71, and disposed within said hub portion is a disc 72 which is engaged over and secured to shaft 51. Disc 72 is provided in its periphery with a pin 73 that projects into a slot 74 formed in the hub portion 71 of calipering roller 70. The calipering rollers 70 of the sheet calipering mechanism 63, 64, and 65 are thus supported independently of shaft 51 for free and true concentric rotation by sleeves 68 and bearings 69, and are driven continuously from shaft 51 in unison with and at substantially the same surface speed of the feed rollers 48 and tapes 50 by the discs 72 and pins 73. The bore of each sleeve 68 is preferably slightly greater in diameter than the diameter of shaft

51 so that any vibration of said shaft and any variation in the concentricity thereof will not be transmitted to calipering roller 70 and affect the sheet calipering operation.

Cooperating with the calipering roller 70 and disposed above the path of sheet travel is an upper sheet calipering roller 75 (Figs. 3 and 4) which is journaled at 76 on a rearwardly extending arm 77 that is loosely mounted adjacent the center bracket 24 on the drop roller shaft 56 for pivotal movement relative thereto. Disposed between bracket 24 and arm 77 and loosely mounted on shaft 56 for pivotal movement relative thereto is a bell crank lever having a rearwardly extending arm 78 and an upwardly extending arm 79. Pivotaly mounted at 80 on bell crank arm 78 and disposed above calipering roller 75 for cooperation with said roller is a caliper element 81 which is preferably in the form of a segment and provided with two radially spaced laterally projecting pins 82, 82 for purposes to be hereinafter described. Axial displacement of arm 77 and bell crank lever 78, 79 is prevented in one direction by the center bracket 24 and in the opposite direction by a collar 83 secured to shaft 56.

Arm 77 is yieldingly urged downwardly by a comparatively light compression spring 84 so that the upper calipering roller 75 thereon will engage and press the forwardly moving sheet against the calipering roller 70 with sufficient pressure to insure positive rotation of said upper calipering roller by the sheet engaged thereby and accurate calipering of said sheet. Spring 84 is mounted on a spring rod 85 having one end pivotally connected at 86 to arm 77 and the opposite end guided in a post 87 secured to bracket 24 and projecting inwardly therefrom to receive said rod. One end of spring 84 engages an abutment on rod 85 and the opposite end bears against post 87.

The segment 81 of each sheet calipering mechanism 63, 64, and 65 is normally disposed in the full-line position shown in Fig. 3 and such that it is spaced from the cooperating upper calipering roller 75 a distance less than the normal thickness of a single sheet when said roller is engaged with a single sheet of normal thickness, as shown in Fig. 3. This and other desired settings of segment 81 with respect to calipering roller 75 for sheets of different thicknesses that may be handled in the feeder is effected by an adjusting screw 88 (Figs. 3 and 4) which is threaded through a suitable opening in a vertical extension 89 of bell crank arm 79 and adapted to engage a hardened steel plug 90 threaded in the adjacent end of bracket 24. Rotation of screw 88 in opposite directions will result in clockwise and counterclockwise movement (Fig. 3) of bell crank lever 78, 79 about shaft 56 and, hence, lowering and raising movement of segment 81 toward and away from calipering roller 75. Screw 88 is held in adjusted position by a lock nut 91.

Bell crank lever 78, 79 is yieldingly urged in a clockwise direction (Fig. 3) by a comparatively heavy compression spring 92, whereby screw 88 will be firmly pressed against plug 90 to accurately locate segment 81 with respect to calipering roller 75, and segment 81 will be firmly held in proper position to insure positive rotation thereof by roller 75 when the latter engages an excess sheet or a sheet of abnormal thickness. Spring 92 is mounted on a spring rod 93 having one end pivotally connected at 94 to bell crank arm 78 and the opposite end guided in a post

95 secured to center bracket 24 and projecting inwardly therefrom to receive said rod. One end of spring 92 engages an abutment on rod 93 and the opposite end bears against post 95.

The upper calipering rollers 75 and cooperating segments 81 of the sheet calipering mechanisms 63, 64, and 65 are raised and lowered at predetermined intervals, and the operation thereof is so timed that all the rollers 75 and segments 81 are raised until the sheets delivered in side by side relation onto the feed rollers 48 and tapes 50 by the sheet forwarding devices have been advanced by the drop rollers 49 a short distance relative to piles 27, 27a, and 27b so that their front or leading edges extend a few inches beyond said drop rollers, at which time the rollers 75 and segments 81 are simultaneously lowered and the upper surfaces of the forwardly moving sheets are simultaneously engaged by said rollers for performance of the calipering operations thereon. For this purpose, the bell crank arm 79 of each sheet calipering mechanism has journaled thereon at 96 a cam roller 97 which is engaged by a cam 98 secured to and rotated by cam shaft 23. Roller 97 is biased toward cam 98 by the spring pressed rod 93 connected with the bell crank arm 78. The bell crank levers 78, 79 of the sheet calipering mechanisms 63, 64, and 65 are thus simultaneously rocked in a counter-clockwise direction (Fig. 3) by separate cams 98 to raise the segments 81 carried thereby, and are simultaneously rocked in a clockwise direction by the separate spring pressed rods 93 to lower said segments until the adjusting screws 88 on the respective bell cranks engage the respective plugs 90, at which time all the segments 81 will be disposed in like definite positions for the sheet calipering operations.

Counter-clockwise or segment raising movement of each bell crank 78, 79 is transmitted to the arm 77 associated therewith by a screw 99 which is threaded through a suitable opening in a laterally projecting ear or lug 100 formed integrally with bell crank arm 79 and is adapted to engage a similar lug 101 formed integrally with and projecting laterally from arm 77. Clockwise or downward movement of each arm 77 with the bell crank 78, 79 associated therewith is effected by the spring pressed rod 85 connected with said arm, said rod also acting to yieldingly engage the lug 101 on arm 77 with screw 99 and take up any lost motion between said arm and the bell crank when the latter is rocked to raise segment 81 and roller 75 as hereinbefore described. Screw 99 is so adjusted with respect to lug 101 on arm 77 that when segment 81 and roller 75 are lowered to sheet calipering position and the adjusting screw 88 is engaged with plug 90, a slight upward movement will be imparted to roller 75 against the tension of spring 84 by a single sheet of normal thickness upon engagement of said roller therewith. In this manner, roller 75 will engage the forwardly moving sheet under spring tension whereby positive rotation thereof by said sheet and accurate calipering of the latter will be assured. It will be understood that this slight upward movement of roller 75 by a single sheet of normal thickness is not sufficient to cause said roller to engage and rock segment 81, said movement being compensated for in the initial setting of said segment with respect to roller 75. It would also be understood that when effecting initial adjustment of segment 81 and any further ad-

justments thereof with respect to roller 75, the screw 99 is backed off several turns to permit making of said adjustments, and then returned to its proper adjusted position. Screw 99 is held in adjusted position by a lock nut 102.

Extending transversely of the feeder and past each of the sheet calipering mechanisms 63, 64, and 65 is a shaft 103 which is common to all said calipering mechanisms and may, for the sake of description, be termed the main control shaft or member. This shaft 103 is journaled intermediate its ends in suitable bearings in the center brackets 24, and at its opposite ends in suitable bearings in brackets 104 and 105 which are secured to the side brackets 57 and 58, respectively (Figs. 2, 4, 5, 7 and 8). Shaft 103 has secured thereon a plurality of pendulums 106 (Figs. 3 and 4) which extend rearwardly and downwardly from said shaft and project between the laterally projecting pins 82, 82 on the caliper segments 81, there being one pendulum associated with each segment. Pendulums 106 normally rest by gravity on one of the pins 82 of the segments 81, as shown in full lines in Fig. 3. It will thus appear that when the segment 81 of any one of the sheet calipering mechanisms 63, 64, and 65 is rotated in a counter-clockwise direction as viewed in Fig. 3, to the broken line position, the pendulum 106 associated with the rotated segment will be raised thereby to the broken line position shown in Fig. 3 and, hence, rock shaft 103 in a counter-clockwise direction as viewed in Fig. 3, or in a clockwise direction as viewed in Fig. 7, since said views are right and lefthand views, respectively.

Shaft 103 may be utilized to control the operation of well-known mechanism for stopping or tripping the feeder and for stopping the conveying means in the event an abnormal condition in the feeding of the sheets from the separate piles 27, 27a, and 27b is detected by any one of the sheet calipering mechanisms 63, 64, and 65, thereby preventing feeding of successive groups of sheets from said piles and presentation of an abnormal group of sheets on the conveying means to the tinning pot or other machine being fed. In the illustrated embodiment, however, shaft 103 is utilized to control the operation of a sheet reject or throwout mechanism for diverting all the sheets of an abnormal forwardly moving group out of their normal path of travel into a suitable receiver. In this manner, the abnormal group of sheets is automatically removed from the conveying means and the feeding of successive normal groups of sheets from piles 27, 27a, and 27b may continue without interruption. As shown, particularly in Figs. 1, 2, 7, and 8, the sheet reject or throw out mechanism and the operating and control means therefor are preferably constructed, mounted, and operated as follows.

Secured to control shaft 103 adjacent its end supporting bracket 105 is an arm 107 (Figs. 7 and 8) which extends upwardly and forwardly from said shaft and have journaled thereon a roller 108. The latter engages the rear longitudinal edge of a vertically extending bar or link 109 which is formed with an abutment 110 on its front longitudinal edge and adjacent the upper end thereof. The lower end of bar 109 is pivotally connected at 111 with a forwardly extending arm 112 which is secured to a shaft 113 that extends transversely of the feeder in front of the feed rollers 47, 48 and beneath the upper reaches of all of the tapes 50. Shaft 113 is journaled at its opposite ends in suitable bearings in the side

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plates 57 and 58, and has secured thereon a plurality of sheet reject fingers 114 which extend forwardly from said shaft between the tapes 50 and normally lie beneath the plane in which the upper reaches of said tapes and the sheets travel. As shown in Fig. 2, the fingers 114 are spaced along shaft 113 and across the entire width of the conveyor so that all the sheets moving along said conveyor in side by side relation will be rejected when said fingers are raised as hereinafter described, thus providing a common reject mechanism for the group of sheets.

Reject fingers 114 are lowered out of the sheet path and to their normal inoperative position, as shown in full lines in Figs. 1 and 7, by gravity assisted by a pull spring 115 having one end connected with the free end of arm 112 and the opposite end connected with a pin 116 secured to and projecting inwardly from the side plate 58 (Figs. 7 and 8). Downward movement of the fingers 114 beyond their normal inoperative position is prevented through engagement of arm 112 with a suitable stop member, such as, a bolt 117 located beneath the free end of said arm and adjustably threaded in a post 118 which is secured to and projects inwardly from the side plate 58. Bolt 117 is locked in adjusted position by a lock nut 119.

The upper free end of bar 109 extends through the bifurcated end 120 of a forwardly extending arm 121 having a hardened steel block 122 secured thereto at said end so as to extend across the front longitudinal edge of said bar (Figs. 1, 2, 7, and 8). Arm 121 is loosely mounted for pivotal movement on a short shaft 123 which is fixed in a pair of brackets 124 disposed on opposite sides of said arm and secured to the tie bar 12. Journalled at 125 on arm 121 is a roller 126 which engages a cam 127 secured to and rotated by cam shaft 23. Roller 126 is held in engagement with cam 127 by a vertically extending spring pressed rod 128 having one end pivotally connected at 129 to arm 121 and the opposite end guided in an eye-bolt 130 secured to and projecting forwardly from tie bar 13. The spring 131 for rod 128 is mounted thereon between the eye-bolt 130 and a collar 132 adjustably secured to said rod.

Arm 121 will thus be raised by cam 127 and lowered by spring 131 once during each cycle of operation of the feeder, and the operation of said arm is so timed that it is lowered prior to engagement of the upper caliper rollers 75 with the forwardly moving sheets on the conveyor, and raised when said rollers are engaged with said sheets and performing the caliper operations thereon. The low part of cam 127 is so proportioned that when roller 126 on arm 121 is engaged therewith during each cycle of operation, the block 122 on said arm will be disposed slightly below the level of the abutment 110 on bar 109 to permit said abutment to extend over said block when bar 109 is swung to the broken line position shown in Fig. 7 in a manner hereinafter described. Bar 109 is normally disposed in the full line position shown in Fig. 7 so that the abutment 110 thereon will normally be disposed to the rear of block 122 on arm 121 and out of the path of upward movement of said block, said bar being urged to said position and into engagement with roller 108 on arm 107 by a very light pull spring 133 having one end connected therewith at 134 and the opposite end connected with a pin 135 secured to and projecting inwardly from bracket 105 (Figs. 7 and 8).

The operation of the feeder, the sheet caliper-

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ing mechanisms and the sheet reject or throw-out mechanism may be briefly summarized as follows. Assuming that the various mechanisms of the feeder, and the sheet caliper and reject mechanisms have been properly timed with relation to each other, and that the caliper segments 81 have been adjusted to provide the proper clearance between the same and the caliper rollers 75 for the free passage of single sheets of a normal predetermined thickness only, the uppermost sheets of piles 27, 27a, and 27b are simultaneously engaged and lifted near the front thereof by the suction cups 34 of the sheet forwarding devices which have been previously swung rearwardly by the described means for this purpose. The sheet forwarding devices are then swung forwardly in unison and carry the lifted sheets in the same direction therewith until the front edges of said sheets extend between the raised drop rollers 49 and the driven feed rollers 48 and tapes 50. The sheet forwarding devices then simultaneously release the three sheets whereupon the drop rollers 49 are lowered into engagement with said sheets and the latter are advanced in side by side relation from the piles 27, 27a, and 27b to the tinning pot or other machine by the cooperating feed rollers 48 and the tapes 50, the sheet forwarding devices in the meantime moving rearwardly in readiness to engage, lift, and forward the next sheets from piles 27, 27a, and 27b.

As the sheets are being advanced in side by side relation from the piles 27, 27a, and 27b by the sheet forwarding devices, the roller 126 on reject arm 121 is engaged with the low part of cam 127 and consequently said arm will at this time be lowered by spring 131 to its lowermost position, as shown in Fig. 7. When the three sheets have been advanced by the feed rollers 48 and drop rollers 49 so that their front edges extend a few inches beyond the bite of said rollers, the high parts of caliper cams 98 upon continued rotation thereof move out of engagement with rollers 97 whereupon the caliper bell cranks 78, 79 and the caliper arms 77 are simultaneously rocked in a clockwise direction (Fig. 3) by springs 92 and 84, thus lowering the rollers 75 and segments 81 carried thereby until said rollers engage the upper surfaces of the forwardly moving sheets and the adjusting screws 88 on said bell cranks engage the stop plugs 90. The rollers 75, upon engagement thereof with the forwardly moving sheets, will be rotated in a clockwise direction, as viewed in Fig. 3, by said sheets, and will remain in contact with the sheets until they have been advanced by the feed rollers 48 and drop rollers 49 so that their front or leading edges extend partly over the lowered reject fingers 114. Thereupon the high parts of cams 98 upon continued rotation thereof will again engage the rollers 97 and simultaneously rock the bell cranks 78, 79 and arms 77 in a counter-clockwise direction, as viewed in Fig. 3, thus raising the segments 81 and the rollers 75 out of engagement with the forwardly moving caliper sheets and holding said segments and rollers in raised positions in readiness for performance of the caliper operations on the next group of sheets fed from the piles 27, 27a, and 27b during the next cycle of operation of the feeder. While the three sheets are being calipered by the rollers 75, the high part of reject cam 127 upon continued rotation thereof will move into engagement with the roller 126 and raise arm 121 and the block 122 carried thereby. The high part of cam 127 is so proportioned that arm 121 will be held in

raised position until the caliper rollers 75 have been raised out of engagement with the forwardly moving sheets and the latter have been advanced by the feed rollers 48 and drop rollers 49 so that their front edges extend beyond the front ends of the lowered reject fingers 114.

If, during caliperling of the three sheets by the rollers 75, there is no additional sheet or sheets adhering to or accompanying any one of said sheets and all three sheets are of the same predetermined normal thickness, the caliper segments 81 will remain stationary in the position shown in full lines in Fig. 3. In such event, the control shaft 103 will not be actuated, the bar 109 will remain in the full line position shown in Fig. 7, and the block 122 on arm 121, upon raising of said arm by cam 127, will merely idle past the abutment 110 on said bar. Accordingly, the reject fingers 114 will remain in their lowered inoperative position shown in Figs. 1 and 7, and the three sheets which are of a uniform predetermined thickness will then be advanced thereover in side by side relation toward the tinning pot or other machine by the feed rollers 48, drop rollers 49, and tapes 50, and presented to said tinning pot or machine for coating the same or performing other operations thereon. These operations are performed in the order named on successive groups of sheets as long as all the sheets of each group are of a uniform predetermined thickness, and normal feeding of successive groups of sheets thus proceeds without interruption.

Assuming now that one of the three sheets forwarded simultaneously from the piles 27, 27a, and 27b by the sheet forwarding devices is accompanied by or contains an excess sheet adhering thereto or is of a thickness greater than the normal predetermined thickness of a single sheet. In this event, when the caliper rollers 75 are lowered into engagement with the forwardly moving sheets and rotated by said sheets, as hereinbefore described, the roller 75 engaged with and rotated by the double or excess thickness sheet will be raised by said sheet into contact with the segment in a counter-clockwise direction as viewed in Fig. 3, to substantially the broken line position shown in said figure. Such rotation of segment 81 causes the pin 82 thereon which is normally engaged by the pendulum 106 associated therewith to raise said pendulum to the broken line position shown in Fig. 3 and thus rock control shaft 103 and arm 107 in a clockwise direction, as viewed in Fig. 7, whereupon bar 109 is swung by arm 107 in the same direction about its pivot 111 to the broken line position shown in Fig. 7, to dispose the abutment 110 on said bar in the path of upward movement of the block 122 on arm 121. Block 122, upon subsequent upward movement of arm 121 by cam 127, will then engage the abutment 110 on bar 109 and raise the latter and the arm 112 whereupon shaft 113 will be rocked in a counter-clockwise direction, as viewed in Figs. 1 and 7, and the fingers 114 will be raised and projected at an angle across the plane of movement of the upper reaches of the tapes 50, as shown in broken lines in Fig. 1. All the sheets of the abnormal group will then be diverted out of their normal path of travel by the raised and angularly disposed fingers 114 and advanced upwardly along said fingers in side by side relation by the feed rollers 48 and drop rollers 49 between opposed delivery rollers 136 and 137 which direct all the rejected sheets into a reject sheet receiving tray

138 or other form of receiver, thus preventing presentation of the abnormal group of sheets to the tinning pot or other machine and without having to stop the conveyor and interrupt the feeding of successive groups of sheets by the feeder. It will be understood that shaft 113 may also be employed to effect operation of suitable well-known means for stopping or tripping the feeder and for stopping the conveyor. Hence, shaft 113 may be termed an auxiliary or second control shaft or member.

As the rejected sheets are advanced along the reject fingers 114 by the feed rollers 48 and drop rollers 49, the caliper rollers 75 are raised out of engagement with said sheets as hereinbefore described, whereupon the rotated segment 81 is automatically reset by its own weight and the weight of the pendulums 106, at which time the control shaft 103 is also rocked thereby in a counter-clockwise direction, as viewed in Fig. 7, and the arm 107 thereon is returned to its normal full-line position shown in said figure. When major portions of the rejected sheets have been advanced by the rollers 136, 137 into the tray 138, the arm 121 is lowered by spring 131 upon continued rotation of cam 127, whereupon bar 109 and reject fingers 114 are lowered by gravity aided by the spring 115 until the arm 112 engages the stop member 117, at which time bar 109 is returned to its normal full-line position shown in Fig. 7 by the action of spring 133, and the abutment 110 on said bar is removed from the path of upward movement of block 122, thus restoring said members to their original positions for subsequent operation during the next or succeeding cycles of operation of the feeder.

The delivery roller 136 extends transversely of the feeder above the tapes 50 and is journaled at its opposite ends in the side plates 57 and 58 (Figs. 1 and 2). The delivery rollers 137 which are pressure rollers are adjustably fixed in spaced relation on a shaft 139 which extends transversely of the feeder and is journaled at its opposite ends in suitable bearings in arms 140 that are pivotally mounted at 141 on the side plates 57 and 58. The reject tray 138 may be supported in any suitable manner and by any suitable means (not shown) on the feeder frame or on the frame of the tinning pot or other machine with which the feeder is associated. The delivery roller 136 is continuously driven from the feed roller shaft 51 and at substantially the same surface speed as the feed rollers 48 and tapes 50 by a belt 142, preferably a V-belt, which passes around suitably grooved pulleys 143 and 144 that are fixed on the outwardly projecting ends of the feed roller shaft 51 and delivery roller 136, respectively (Figs. 2 and 4).

Thus far the description has related mostly to the construction and operation of the feeder and the sheet caliperling and reject mechanisms for feeding a group or plurality of sheets in side by side relation to a tinning pot or other machine during successive cycles of operation of the feeder, and caliperling all the sheets of each group during advancing movement thereof, whereby presentation of any one group of sheets to said tinning pot or machine is prevented in the event one or more of the sheets of the advancing group is accompanied by or contains an excess sheet or sheets adhering thereto or is of an abnormal thickness. In feeding a group or plurality of sheets in side by side relation to a tinning pot or other machine acting on said

sheets in like manner, it is also desirable that the outside sheets of each group should always be present when the group of sheets in side by side relation is presented to the tinning pot or other machine, whereby a balanced condition will be maintained in said tinning pot or machine and proper coating of or action on all the sheets of the group will be assured. In the illustrated embodiment, for example, should the feeder during a feeding cycle fail to feed a sheet from either the pile 27 and pile 27b for any reason, the two sheets fed simultaneously from the other piles would be offside and if they are presented in this manner to the tinning pot or other machine, they would cause an unbalanced condition therein with the result that said sheets would not be properly coated or acted upon and, hence, must be scrapped. However, if the feeder during a feeding cycle fails to feed a sheet from the center pile 27a for some reason, the absence of the center or intermediate sheet in the group of sheets when presented to the tinning pot or other machine will have no effect on the proper coating of or action on the remaining sheets of the group since the presence of the outside sheets in the group will maintain a balanced condition in said tinning pot or machine.

Accordingly, novel absent sheet detecting mechanisms are provided and associated with the conveying means and with the outside sheet calipering mechanisms 63 and 65 for detecting the presence and absence of the outside sheets in each group of sheets delivered in side by side relation to said conveying means, and effecting operation of the control shafts 103 and 113 and, in turn, the reject fingers 114 in the event either one of the outside sheets is not present in the group at the time of the detecting operations when they should normally be present, whereby the remaining offside sheets of the group will be rejected and thus prevented from passing on toward the tinning pot or other machine. These absent sheet detecting mechanisms indicated generally at 145 (Figs. 3, 4, and 5) and 145' (Figs. 1, 7, and 8) except for their location adjacent opposite sides of the feeder to act in the feed roller positions normally occupied by the sheets forwarded from the piles 27 and 27b, are identical in construction, mounting, and operation and a description of one of said mechanisms will therefore suffice for both of the same.

Referring to Figs. 3, 4, and 5 which illustrate the absent sheet detecting mechanism 145, it will be noted that said mechanism comprises the following parts constructed, mounted, and operated as follows, the corresponding parts of the mechanism 145' at the opposite side of the feeder and illustrated in Figs. 1, 7, and 8 having applied thereto the same reference characters except that they are primed. Secured to cam shaft 23 adjacent the inner side of side bracket 16 and rotated by said shaft is a cam 147 which engages a roller 148 journaled at 149 on a forwardly extending arm 150. The latter is pivotally mounted at 151 on a bracket 152 which is secured to the rear side of side bracket 16. Pivotaly connected at 153 with arm 150 is the upper end of a vertical link 154 the lower end of which is pivotally connected at 155 with a rearwardly extending arm 156 that is loosely mounted on the control shaft 103 adjacent the bracket 104. Arm 156 is provided with an inwardly projecting shelf 157 for a purpose to appear hereafter.

Arm 156 also has pivotally connected there-

with at 155 the upper end of a vertical connecting rod 158 the lower end of which is pivotally connected at 159 with a rearwardly extending arm 160 that is fixed on a short transversely extending shaft 161. This shaft 161 extends from the side plate 57 to the center bracket 52 of the sheet calipering mechanism 63 and is journaled at its opposite ends in suitable bearings in said side plate and in a bracket 162 that is secured to the front side of said center bracket. Fixed on shaft 161 adjacent center bracket 162 is a rearwardly extending arm 163 which is similar to the aforesaid arm 160 on the opposite end of said shaft. Pivotaly connected with the free end of arm 163 is the upper end of a vertical link 164 the lower end of which is pivotally connected at 165 with a sheet detector member or feeler in the form of a bell crank lever having a straight arm 166 and a curved arm 167. The straight arm 166 extends forwardly beneath the hub 67 of center bracket 52 and between the latter and the lower sheet calipering roller 70 and has the link 164 connected therewith, and the curved arm 167 extends upwardly and forwardly over said hub and between said bracket and calipering roller and has journaled on the free end thereof a roller 168. Detector member or bell crank 166, 167 is pivotally mounted at 169 on a bracket 170 which is secured to the rear side of center bracket 52.

Cam arm 150 is yieldingly urged toward cam 147 by a compression spring 171 to cause the roller 149 on said arm to follow into the lower part of said cam upon continued rotation thereof, said spring being mounted on the connecting rod 158 between a collar 172 adjustably secured to said rod and a bifurcated post 173 secured to and projecting inwardly from the side plate 57. It will thus appear that once during each cycle of operation of the feeder, the detector members or bell cranks 166, 167 and 166', 167' of the mechanisms 145, 145', respectively, through the described connections therefor with the cam arms 150 and 150' will be independently rocked in one direction about their pivots 169 and 169' by the cams 147 and 147' to raise the detector arms 167 and 167' and rollers 168, 168' thereon across the sheet path normally occupied by the outside sheets of the group on the conveyor, and in the opposite direction by the springs 171, 171' to lower said arms and rollers out of the sheet path to their normal positions, as shown in full lines in Figs. 1 and 3. The absent sheet detecting operations are so timed that the detector arms 167, 167' and rollers 168, 168' thereon are in their lowered positions while the sheets are being forwarded in side by side relation from the piles 27, 27a, and 27b by the sheet forwarding devices and delivered to the feed rollers 48 and tapes 50, at which time the caliper rollers 75 are also in their raised positions as hereinbefore described, and are then raised in unison after said sheets have been advanced a short distance relative to said piles by the feed rollers 48 and drop rollers 49, at which time caliper rollers 75 are lowered to engage and caliper the sheets as hereinbefore described.

It is to be noted that when detector arms 167, 167' are raised as aforesaid, the arms 156 and 156' associated therewith are also raised, but no movement will be imparted to the control shaft 103 by arms 156 and 156' since the latter are loosely mounted thereon as hereinbefore described. However, this raising movement of arms 156 and 156' is utilized to rock the control shaft

103 and effect operation of the reject fingers 114 as hereinbefore described. For this purpose, the arms 156 and 156' have associated therewith other arms 174 and 174' which are secured to the control shaft 103 and provided with adjustable abutment screws 175 and 175' that are adapted to be engaged by the shelves 157 and 157' on the arms 156 and 156'. Hence, by reason of the separable connections between the arms 156, 156' and 174, 174' afforded by the shelves 157, 157' and abutment screws 175, 175', the arms 174, 174' and control shaft 103 will not be actuated when the arms 156, 156' are lowered by cams 147, 147' and only actuated when the arms 156, 156' are raised by springs 171, 171' and the shelves 157, 157' engage the abutment screws 175, 175'. It is to be noted that by reason of the loose and fixed arms 156, 156' and 174, 174', respectively, the operation of the control shaft 103 by the sheet caliper mechanisms 63, 64, and 65, as hereinbefore described, is not affected by the absent sheet detecting mechanisms 145 and 146.

Assuming that both outside sheets are present in the group of sheets delivered in side by side relation onto the feed rollers 48 and tapes 50, and that the leading edges of the sheets are disposed in proper position longitudinally of the conveyor for performance of the sheet detecting and sheet caliper operations thereon. In this event, and with the outside sheets of the group disposed over the lowered detector arms 167, 167' and rollers 168, 168' thereon, and engaged by the upper caliper rollers 75 and the drop rollers 49, the outside sheets will form an obstruction and, upon engagement of the rollers 168 and 168' with the undersurfaces thereof, will thus prevent the detector arms 167, 167' from moving upwardly the full extent. Accordingly, the rollers 149, 149' cannot follow the low parts of cams 147, 147' a distance sufficient to enable arms 157, 157' to rock arms 156, 156' through an arc sufficient to engage the arms 174, 174' and rock control shaft 103. The reject fingers 114 will then remain in their lowered inoperative position and forward movement of the group of sheets on the conveyor toward the tinning pot or other machine will proceed as usual provided, of course, that none of the sheets contains an excess sheet or is of an abnormal thickness to cause operation of the control shaft 103 and reject fingers 114 by the sheet caliper mechanisms as hereinbefore described. Thereupon the detector arms 167, 167' are lowered to their original positions and the rollers 168, 168' thereon are moved out of engagement with the advancing sheets upon continued rotation of cams 147, 147' and engagement of the high parts thereof with the rollers 149, 149', at which time the caliper rollers 75 are also raised to their original positions as hereinbefore described so that said detector arms and rollers and said caliper rollers are in readiness for performance of the detecting and caliper operations during the next cycle of operation of the feeder. It is important to note that when the detector rollers 168, 168' are moved into engagement with the undersurface of the outside sheets as described, the upper surface of said sheets are engaged by the caliper rollers 75 and the drop rollers 49 at transversely spaced points, thus stiffening the sheets and preventing upward movement or bowing of the same by the detector rollers 168 and 168'.

Assuming now that during a feeding cycle, the feeder fails for some reason to feed a sheet from

the pile 27 at a time when said sheet should have been fed from said pile along with the sheets fed from the piles 27a and 27b. In this event, and with no sheet present at the feed roller position normally occupied by the sheet fed from pile 27, the upward movement of the detector arm 167' and roller 168' will be obstructed as hereinbefore described by the sheet disposed thereover and fed from the pile 27b, but the upward movement of detector arm 167 will not be obstructed and, hence, said arm and roller 168 thereon may move upwardly the full extent and to substantially the broken line position shown in Fig. 3. Accordingly, the roller 149 may then follow into the low part of cam 147 whereupon arm 150 will be raised by spring 171 a distance sufficient to raise arm 156 into engagement with abutment screw 175 and rock arm 174 and control shaft 103. Upon rocking of control shaft 103, the reject fingers 114 will be raised as hereinbefore described and the forwardly moving offside sheets on the conveyor and represented by the sheets fed from piles 27a and 27b will be diverted out of their normal path of travel and directed into the tray 138, thus preventing presentation of said offside sheets to the tinning pot or other machine.

After the reject fingers 114 have been raised, the detector arm 167 is lowered to its original position through engagement of the high part of cam 147 with the roller 149 on arm 150, at which time the control shaft 103 and arms 174, 174' are returned to their original positions by the weight of the caliper pendulums 106 on said shaft which were raised when shaft 103 was rocked under the control of the absent sheet detecting mechanism 145, said raising movement of pendulums 106 at this time merely being an idle movement. After the offside sheets have been directed into the reject tray 138, the reject fingers 114 are again lowered out of the sheet path and to their original positions, as hereinbefore described, and normal feeding of successive groups of sheets from the piles 27, 27a, and 27b proceeds without interruption.

The above-described operations of the absent sheet detecting mechanism 145 are performed in the order described by the absent sheet detecting mechanism 146 in the event the feeder, during a feeding cycle, fails for some reason to feed a sheet from the pile 27b at a time when said sheet should normally be fed from said pile along with the sheets fed from the piles 27 and 27a, therefore, a detailed description of the operation of mechanism 146 is believed to be unnecessary. It is to be noted that the absent sheet detecting mechanisms 145 and 146 will also effect operation of control shaft 103 and reject fingers 114 if, when the sheets are forwarded by the sheet forwarding devices from piles 27, 27a, and 27b, one of the outside sheets fails for some reason to reach the bite of the feed and drop rollers and is not in normal position on the conveying means at the prescribed time.

While the sheet feeder is herein illustrated and described as a three-sheet feeder for feeding three sheets in side by side relation to a tinning pot or other machine from three piles of sheets arranged in like manner, it is to be understood that said feeder may also be employed to feed only two sheets in side by side relation from two piles only, in which case the two piles of sheets are located in the feeder in the positions occupied by the piles 27 and 27b, and the presentation of the sheets fed simultaneously from said piles

to the tinning pot or other machine is controlled by the sheet caliper mechanisms 63 and 65 and the absent sheet detecting mechanisms 145 and 146. It will also be understood that the feeder may, if desired, be employed to feed sheets successively from a single pile of sheets thereof, in which case the single pile of sheets is located centrally in the feeder, i. e. in the position occupied by the pile 27a, and the presentation of the successively fed sheets to the tinning pot or other machine is controlled by the sheet caliper mechanism 64 only.

There is thus provided in a sheet feeder particularly adapted for feeding a group or plurality of sheets in side by side relation to a tinning pot or other machine, means, as in the sheet caliper mechanism 63, 64, and 65 and the absent sheet detecting mechanisms 145 and 146 for preventing presentation to said tinning pot or machine of a group of sheets in the event any one of the sheets thereof contains an excess sheet or is of an abnormal thickness or in the event one or the other of the outside sheets thereof is not present therein or is not present in normal position on the conveying means. There is also provided in a sheet feeder adapted for feeding two sheets in side by side relation to a tinning pot or other machine, means, as in the sheet caliper mechanisms 63 and 65 and the absent sheet detecting mechanisms 145 and 146, for preventing presentation to said tinning pot or other machine of the two sheets in the event either one of said sheets is not present in normal position on the conveying means or contains an excess sheet or is of an abnormal thickness, or of one sheet only upon failure of the feeder to feed one or the other of said sheets. The sheet caliper mechanisms and the absent sheet detecting mechanisms are so arranged that the sheet caliper operations and the absent sheet detecting operations are performed simultaneously on the sheets, and that a single control member common to all said mechanisms is controlled thereby. There is also provided an absent sheet detecting mechanism which is simple in construction and reliable in operation for determining whether or not a sheet is present at a time when and at a place where a sheet should normally be present.

Although only a single embodiment of the invention has been illustrated in the accompanying drawings and described in the foregoing specification, it is to be expressly understood that the invention is not limited to said embodiment or to a three-sheet feeder. Various changes may be made, particularly in the design, arrangement, and mode of operation of the parts illustrated, without departing from the spirit and scope of the invention, as will now be apparent to those skilled in the art. For example, the control shaft 103 or the control shaft 113 may be employed to actuate a clutch, a valve, or any other suitable means for stopping or tripping the feeder and stopping the conveyor or the forward movement of the sheets thereon when an abnormal condition arises in the feed of the sheets. For a definition of the limits of the invention, reference is had primarily to the appended claims.

What is claimed is:

1. In apparatus of the character described, conveying means for receiving and advancing a plurality of sheets in spaced parallel paths toward a machine, a plurality of detecting devices for detecting the thickness of said sheets, nor-

mally inoperative reject means extending transversely of said conveying means and wholly disposed below said paths forwardly of said detecting devices, a common control member actuated by any one of said detecting devices in response to the presence of double sheets in any of said paths, and means responsive to the actuation of said control member for effecting operation of said reject means and upward movement of the latter to a position angularly across said paths whereby all the sheets will be diverted out of said paths.

2. In a sheet feeder, a conveyor comprising a plurality of transversely spaced tapes for receiving and advancing a plurality of sheets in spaced parallel paths toward a machine, a plurality of sheet caliper devices for caliper ing said sheets, a plurality of reject fingers pivotally mounted below the upper reaches of the tapes and extending between and along said tapes forwardly of said caliper ing devices and normally disposed out of said paths, a common control member actuated by any one of said caliper ing devices in response to a sheet of abnormal thickness in any of said paths, and means responsive to the actuation of said control member for swinging said reject fingers upwardly to a position angularly across said paths whereby all the sheets will be diverted out of said paths.

3. In apparatus of the character described, a continuously driven conveyor including a plurality of transversely spaced tapes for advancing a group of sheets of a predetermined number presented thereto in side by side relation along a predetermined path of travel, detector means for detecting the absence of a sheet from said group, reject means arranged at a predetermined point along said tapes beyond said detector means and movable from a normal inactive position out of the path of travel of the sheets to an active position angularly across said path to cause the sheets of said group to travel in another path diverging from their normal path of travel, and means controlled by said detector means for moving said reject means to said active position when the absence of a sheet from said group is detected by said detector means.

4. Apparatus as defined in claim 3, including sheet caliper ing means arranged in advance of the reject means for detecting the presence of a sheet of excess thickness in the presented group of sheets, and which also control the reject moving means to move the reject means to active position when a sheet of excess thickness in said group is detected by said caliper ing means.

5. In apparatus of the character described, a continuously driven conveyor including a plurality of transversely spaced tapes for advancing a group of at least three sheets presented thereto in side by side relation along a predetermined path of travel, detector means for detecting the absence of one of the outside sheets from said group, a plurality of transversely spaced reject fingers pivotally mounted at a predetermined point along said tapes beyond said detector means and movable collectively from a normal inactive position out of the path of travel of the sheets to an active position angularly across said path to cause the sheets of said group to travel in another path diverging from their normal path of travel, and means controlled by said detector means for moving said reject fingers to said active position when the absence of an outside sheet from said group is detected by said detector means.

6. In apparatus of the character described, a continuously driven conveyor including a plurality of transversely spaced tapes for advancing a group of sheets of a predetermined number presented thereto in side by side relation along a predetermined path of travel, a plurality of detector devices for detecting the absence of a sheet from said group, a plurality of transversely spaced reject fingers arranged at a predetermined point along said tapes beyond said detector devices and movable collectively from a normal inactive position out of the path of travel of the sheets to an active position angularly across said path to cause the sheets of said group to travel in another path diverging from their normal path of travel, means normally ineffective for moving said reject fingers to said active position, and a common control element operatively associated with said detector devices for rendering said last-named means effective to move said reject fingers to said active position when the absence of a sheet from said group is detected by said detector devices.

7. Apparatus as defined in claim 6, including a plurality of sheet caliper devices arranged in advance of the reject fingers for detecting the presence of a sheet of excess thickness in the presented groups of sheets, and which are also operatively associated with the common control element to render the reject finger operating means effective to move the reject fingers to active position when a sheet of excess thickness in said group is detected by said caliper devices.

8. Apparatus as defined in claim 6, wherein the means for moving the reject fingers to active position comprises a cam operated lever and a connecting member which is pivotally connected to the reject fingers and moved into operative engagement with said lever in response to the actuation of the control element by the detector devices.

9. Apparatus as defined in claim 7, wherein the means for moving the reject fingers to active position comprises a cam operated lever and a connecting member which is pivotally connected to the reject fingers and moved into operative engagement with said lever in response to the actuation of the control element by the detector devices and by the sheet caliper devices.

10. In sheet handling apparatus, a conveyor comprising coaxially spaced feed rollers and opposed coaxially spaced pressure rollers for advancing sheets one after another along a predetermined path of travel, absence sheet detecting mechanism operatively associated with said conveyor for detecting the absence of a sheet in normal position thereon, said detecting mechanism comprising a feeler member arranged be-

tween two of said feed rollers and normally disposed inside the periphery of the said two feed rollers substantially in line with the point of contact of said feed and pressure rollers, means mounting said feeler member for upward movement across said sheet path at said point, and operating means for moving said feeler member periodically across said sheet path, said feeler member being held against upward movement by a sheet in normal position on said conveyor and between said feed and pressure rollers, control means, and means responsive to said upward movement of said feeler member across said sheet path in response to the absence of a sheet in normal position on said conveyor for actuating said control means.

11. In apparatus of the character described, a conveyor comprising coaxially spaced feed rollers and opposed coaxially spaced pressure rollers for advancing successive sheets along a predetermined path of travel, absence sheet detecting mechanism operatively associated with said conveyor for detecting the absence of a sheet in normal position thereon, said detecting mechanism comprising a lever arranged between two of said feed rollers with its free end normally disposed inside the periphery of the said two feed rollers and substantially in line with the point of contact of said feed and pressure rollers, a sheet engaging roller journaled on said lever at said end, means mounting said lever for pivotal movement upwardly across said sheet path at said point, and operating means for periodically moving said lever across said sheet path, said lever being held against said upward movement by a sheet in normal position on said conveyor and between said feed and pressure rollers, control means, and means responsive to said upward movement of said lever across said sheet path in response to the absence of a sheet in normal position on said conveyor for actuating said control means.

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