Feb. 13, 1940. W. W. DAVIDSON 2,190,413

FOLDING MACHINE

Filed May 2, 1938 4 Sheets-Sheet 1

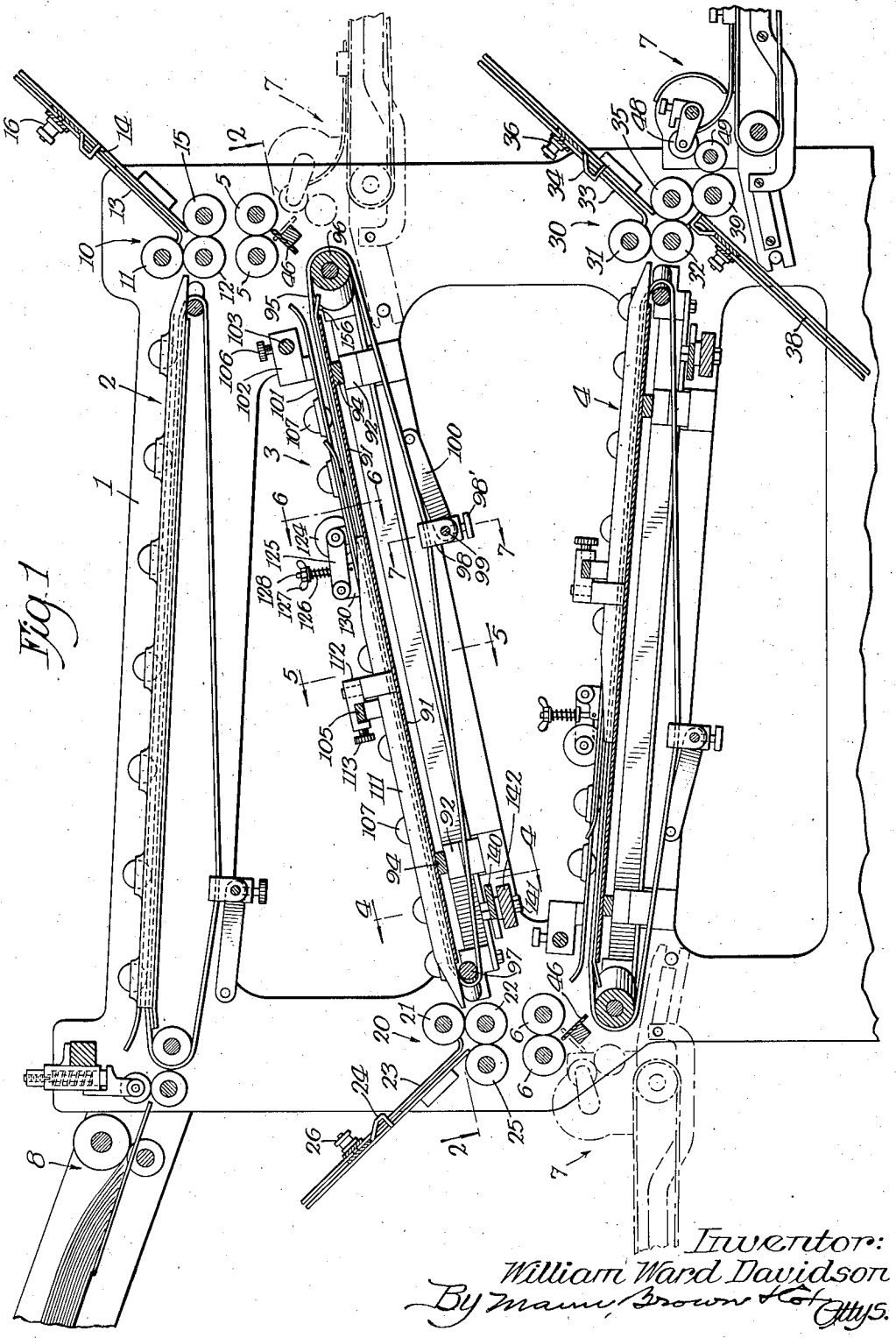


Fig. 1

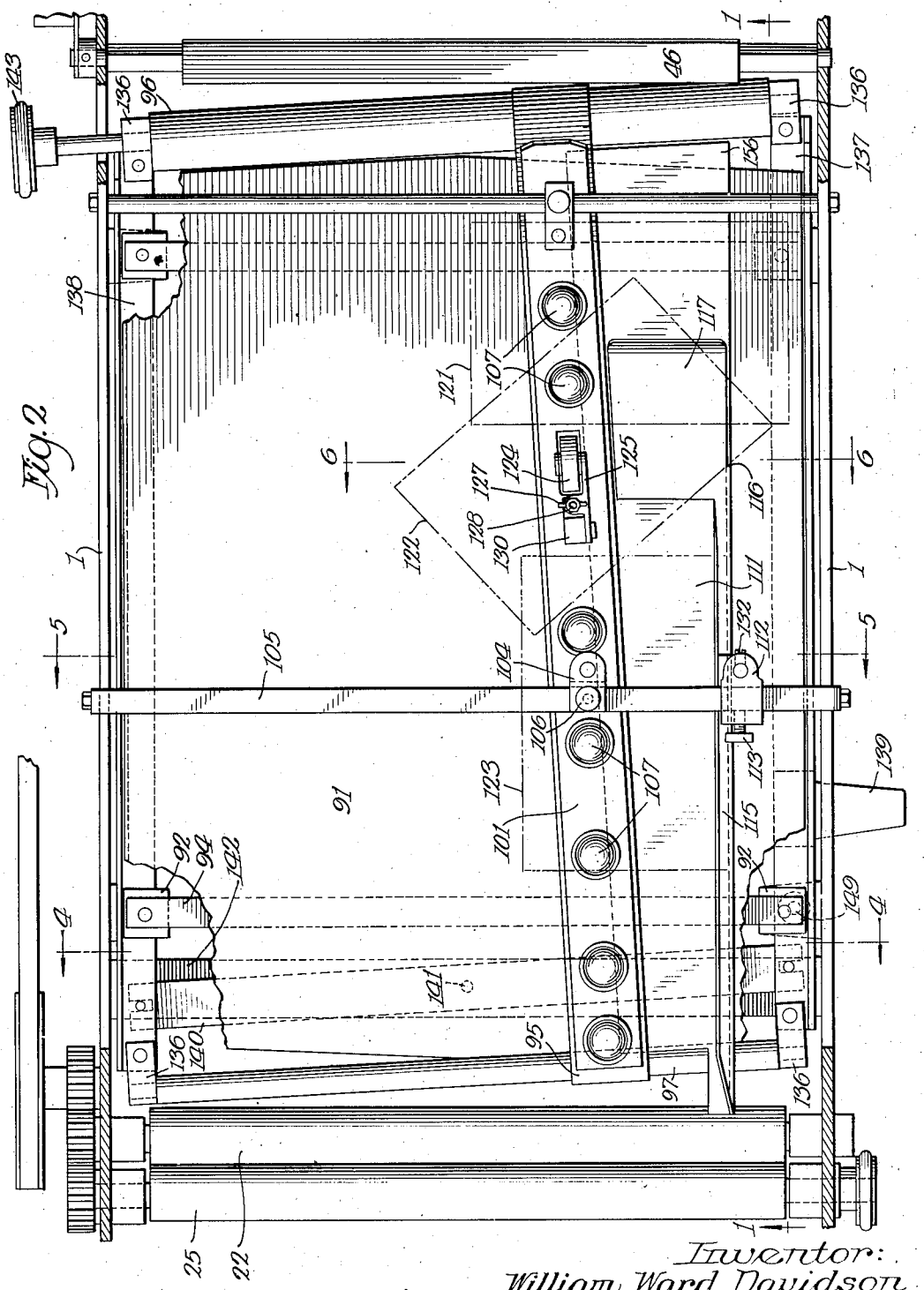
Inventor:
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FOLDING MACHINE

Filed May 2, 1938 4 Sheets-Sheet 2

Fig. 2



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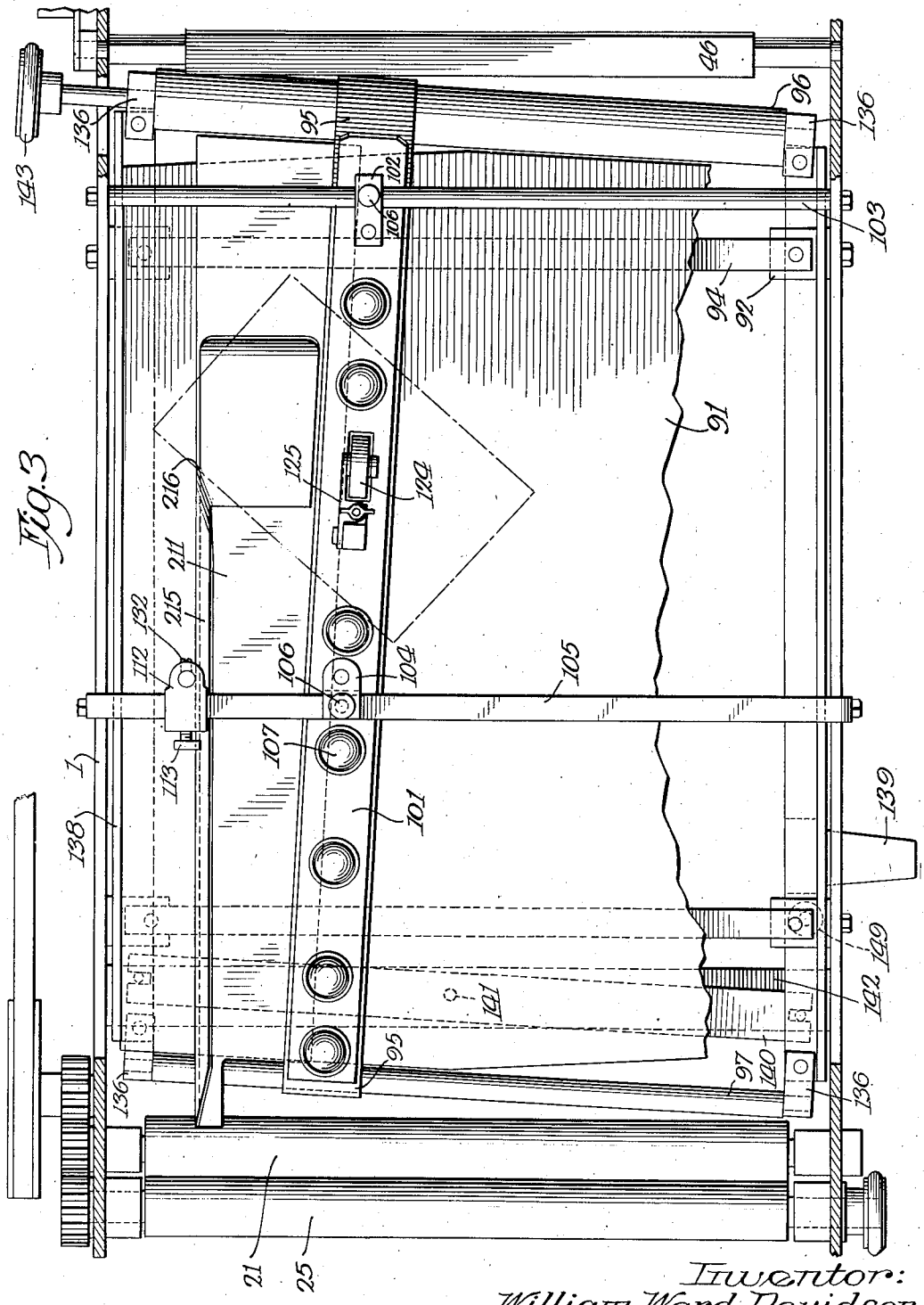


Fig. 3

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FOLDING MACHINE

Filed May 2, 1938 4 Sheets-Sheet 4

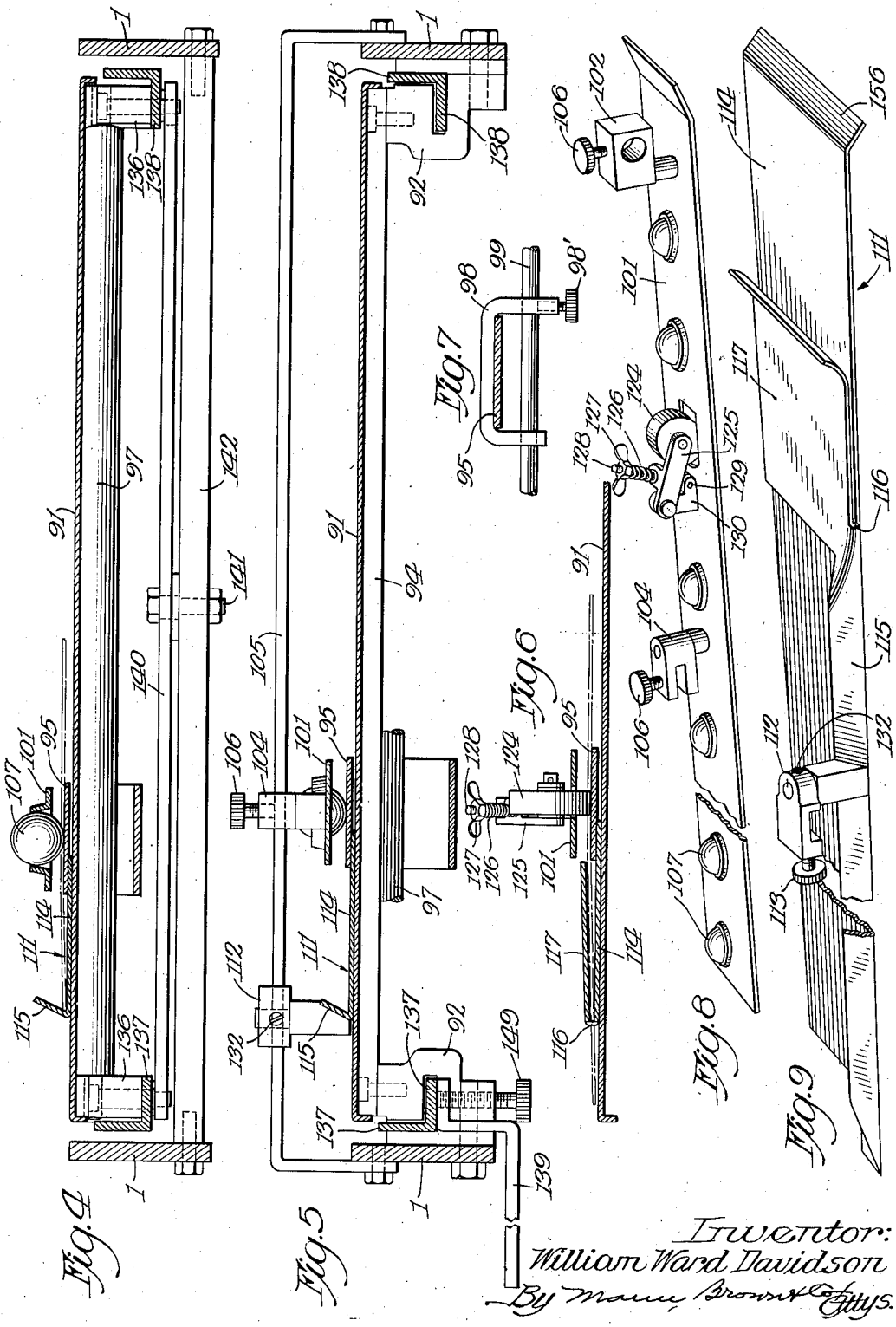


Fig. 4

Fig. 5

Fig. 7

Fig. 6

Fig. 8

Fig. 9

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Patented Feb. 13, 1940 2,190,413

UNITED STATES PATENT OFFICE

2,190,413

FOLDING MACHINE

William Ward Davidson, Evanston, Ill., assignor to Davidson Manufacturing Corporation, a corporation of Illinois

Application May 2, 1938, Serial No. 205,571

24 Claims. (Cl. 271—49)

In printing plants handling a variety of types of work the provision of folding machines which will meet all of the requirements has been a severe problem. The folding to be accomplished may vary all the way from a single fold, as in letters, pamphlets and the like, to a complicated series of folds some in one direction and some in another, such as may be used in folding forms of many pages for books. The folding of book sections varies widely depending on the number of pages and the manner of binding.

In the past a single machine capable of performing various series of folds including folds in different directions has been extremely complicated and has necessarily included many folding units which would lie idle most of the time, when running simpler folds. To have the equipment available for a wide variety of folds requires large and bulky machines. The costs of such machines have been so high and their space requirements so great that only large concerns have been able to buy them. In general, the size and cost of the machines have been necessitated largely by lack of flexibility. In my prior Patent No. 1,620,444 I disclosed one manner of obtaining flexibility, consisting in the provision between two folding units of a conveyor for carrying the sheet from one unit to the other, together with means for turning the sheet 90° or not turning it at all at will. In its illustrated form the present invention uses this combination in improved form, preferably with a second conveyor capable of turning the sheet and with a delivery table or stacking unit which may be attached adjacent to any folding unit so that the sheet may be ejected from the machine at the earliest possible moment, thus reducing the number of idle folding units which the completely folded sheet must pass and the number of adjustments which must be made to cause the sheet to pass all the way through the machine without being further folded. Further simplification is secured by providing a simplified form of conveyor table capable of turning the sheet in either direction.

It is very important that the conveyor table be capable of turning the sheet in either direction since this will multiply the variety of folds that can be accomplished by the complete machine. Of course, it is not only necessary that the sheet be turned in either direction but in each instance it must be accurately registered as to its angular position so that the succeeding fold will be at exactly 90° to the preceding fold. From the commercial standpoint it is of course desirable that the conveying table be convertible to turn the sheet in either direction with great ease, and that its cost shall not be greatly increased to this end.

From the foregoing it is evident that an object of the present invention is to provide a conveyor table which in carrying the sheet from one folding unit to another can turn the sheet in either direction and accurately register it for the succeeding fold, and which is easily changed over from one function to another, although designed to be relatively inexpensive in cost.

Further objects and advantages of the invention will appear as the description is read in connection with the accompanying drawings, in which:

Fig. 1 is a vertical longitudinal sectional view taken through the machine approximately on the line 1—1 of Fig. 2, the stacking unit being fragmentarily shown in one position in full lines and in two alternative positions in dotted lines.

Fig. 2 is a fragmentary sectional view taken approximately on the line 2—2 of Fig. 1, showing the top of the turning table with a sheet of paper shown in dotted lines in three positions.

Fig. 3 is a view similar to Fig. 2 but showing the machine arranged for turning the paper in the opposite direction.

Fig. 4 is a transverse sectional view taken approximately on the line 4—4 of Figs. 1 and 2.

Fig. 5 is a similar view taken approximately on the line 5—5 of Figs. 1 and 2.

Fig. 6 is a fragmentary sectional view taken approximately on the line 6—6 of Figs. 1 and 2.

Fig. 7 is a fragmentary view showing the adjustable belt guide and tightener taken on line 7—7 of Fig. 1.

Fig. 8 is a perspective view of the pressure strip for pressing the paper against the conveyor belt to insure proper movement of the paper.

Fig. 9 is a similar view of the paper guide which the paper strikes and along which it slides.

A preferred embodiment of the invention has been shown in the drawings and will hereinafter be described, all as required by Sec. 4888 of the Revised Statutes, but the appended claims are not to be limited by the specific disclosure unless required by the prior art.

As seen in Fig. 1, the entire folding machine may be supported by a frame 1 and, briefly stated, includes a feed table indicated more or less diagrammatically at 2, a conveying and turning table indicated as a whole by the numeral 3, a second conveying and turning table indicated as

a whole by the numeral 4, with folding units 10, 20 and 30 positioned at the end of each table, scoring rolls 5 and 6 adjacent to the folding units 10 and 20, and with an ejecting and stacking unit 7 optionally positioned adjacent any folding unit to receive the folded sheet therefrom.

Folding units

Although the folding units may be of any type, that illustrated is the buckle type and it is similar at all positions. The reference numerals begin with 11 in unit 10, 21 in unit 20, and 31 in unit 30, the last digits being the same for like parts. The paper is fed to the folding unit 10 from the table 2 on which it is placed either by hand or more commonly by an automatic feeding device 8. The construction of the folding units is seen best in Fig. 1, the feeding and folding rolls being numbered 11, 12 and 15. The rolls 11 and 12 first receive the paper and feed it into the buckle chute 13, which it enters freely until it strikes the paper stop 14 which stops the forward edge of the paper. Since the feeding action of rolls 11 and 12 continues, the paper necessarily buckles into the space between rolls 12 and 15. The buckled sheet is thus caught by these two rolls and drawn in between them to crease the buckled sheet and thus complete the fold. The position of the fold is determined by the position of the paper stop 14 which may be adjusted by loosening the clamping nut 16. The two rolls 12 and 15 continue to draw the paper down between them, drawing it out of the buckle chute 13 and feeding it to the next unit of the machine, or an adjacent buckle chute if one is provided. Thus, in the case of a double folding unit such as the unit 30 the rolls 32 and 35 may feed the sheet into a second buckle chute 38. This second buckle chute, together with rolls 35 and 39, makes a fold parallel to that made by the associated buckle chute 34.

After the first fold the sheet passes from the rolls 12 and 15 to the scoring rolls 5, one of which may be grooved or formed of rubber to receive a blade-like member on the other. It may be observed that the scoring is not necessary before the first fold but is usually desirable for subsequent right-angle folds to insure a smooth fold of the already folded paper. If there is to be no subsequent right-angle fold, the scoring rolls may be separated or moved to one side so as not to score.

Deflectors

Below the scoring rolls 5 and below each but the last folding unit is a deflector 46 for directing the paper in the desired direction away from the folding unit. These deflectors 46 are shiftable between the position shown in full lines and that shown in dotted line. In the full-line position the deflector guides the folded sheet toward the next folding unit or, more specifically, onto the conveyor and turning table 3 or 4. When a deflector 46 is in the dotted line position it guides the folded sheet directly to the ejector rolls 48 and 49 which will then have been moved with the stacking unit 7 to the position shown in dotted lines adjacent the deflector 46 in question. It is evident therefore that the machine may be adjusted to eject the folded sheets immediately after they leave any one of the three folding units. In other words, if the sheet is to be folded only once, it may pass through the folder 10 and then immediately to the stacking unit 7. If it is to be folded twice, it may pass through the first two folders 10 and 20 and then immediately to the stacking unit 7.

Conveying and turning tables

If more than one fold is desired in the sheet the deflector 46 below scoring rolls 5 will be set as shown in full lines in Fig. 1 to guide the folded sheet onto the conveying and turning table 3 which will feed the sheet to the second folding unit or, more specifically, to the rolls 21 and 22 thereof. If it is desired that the fold formed by this second folding unit be at right angles to the first fold, this can be accomplished by turning the sheet through 90°. According to the present invention the turning of the sheet is accomplished by an improved form of table. The table includes a table top 91 which may be supported from the frame 1 in any suitable manner as by brackets 92 and bar 94, seen best in Fig. 4. A feed belt 95 slides over table top 91, being driven by roll 96. The belt passes around an idler roll 97 at its lower end and may be tightened and positioned laterally of the table by tightener and guide 98, which, upon loosening screw 98', may be slid along rod 99 carried by pivoted links 100.

The folded sheet is passed onto the belt 95 from the deflector 46 and is carried under a traction plate 101 which is positioned by bracket 102 sliding on bar 103 and bracket 104 (Fig. 7) sliding on bar 105. The traction plate is positioned directly over the belt 95 wherever the belt may be positioned by belt guide 98 and is secured in this position by set screws 106. The traction plate 101 may be provided with any means such as the marbles 107 for pressing the sheet against the belt 95 with relatively little friction, so as to insure the proper movement of the sheet by the belt.

Resting on the table top 91 and preferably extending under the belt 95 is a paper guide 111 seen in Fig. 9. This paper guide is positioned properly with respect to the belt 95 and traction plate 101 by a clamp 112 secured at any position on the bar 105 by a set screw 113. The paper guide 111 includes a bottom plate portion 114 on which the sheet slides and an edge guiding flange 115 along the inside of which the edge of the sheet slides after the sheet is turned. The edge guide 115 terminates in its upper end with a shoulder 116 forming a turning stop beyond which is an extension 117 which forms a guide over the sheet to insure that the sheet properly engages the shoulder 116. Of course, a separately mounted spring finger could serve in place of the extension 117.

In Fig. 2 three positions of the paper sheet being turned are shown in dotted lines. At 121 the sheet has been dropped onto the belt 95 and is being moved forwardly by it toward the shoulder 116. At 122 the sheet has struck the shoulder 116 which stops one end of the sheet and the belt 95 has carried the other end of the sheet forwardly, thus turning the sheet. At 123 the belt has turned the sheet through 90° and has carried it beyond the shoulder 116. The lateral inclination of the belt 95 is now pressing the sheet against the edge guiding flange 115, thus insuring the accurate lateral position of the sheet and also insuring that it is turned to exactly 90°. To be sure that the sheet does not jam or slide off of its proper course, a pressure roller 124 supported from the traction plate 101 by spring urged arm 125 may be provided to press the paper firmly against the belt 95.

The position of the roller 124 is quite important. It operates best when positioned as shown with its axis extending approximately through the shoulder 116, which forms the pivotal axis for the turning of the sheet. It will be observed that if the sheet rotates freely about the point 116 that portion under the roller 124 is always moving in a direction perpendicular to a line extending between the shoulder 116 and the roller 124. If the roller rotates in this same direction there will not need to be any lateral slippage either between it and the sheet or between the sheet and the shoulder 116. From this standpoint the theoretical ideal position for the roller 124 would be slightly lower (to the left in Fig. 2) than the position shown so that its axis would exactly pass through the shoulder 116, the inclination of the roller being the same as the inclination of the belt. However, at the present time it appears to be desirable that the paper be engaged in the bite between the roller 124 and the belt 95 at the time that it strikes the shoulder 116 so as to insure the continued proper movement of the paper after it strikes the shoulder 116. For this reason the roller 124 is positioned slightly in advance of the theoretical position mentioned. Nevertheless, it is so close to that position that the slippage between the sheet and the shoulder 116 during the turning of the sheet may be negligible.

Another important consideration with respect to the roller 124 is that its pressure on the sheet be exactly regulated. It will be evident that the sheet must twist under the roller 124 and hence the tension should be low enough to permit this twisting action without buckling the sheet. On the other hand, there is appreciable friction between the sheet and the other parts of the table, and the pressure of the roller 124 should be sufficient to overcome this friction safely in turning the sheet. Furthermore, the pressure necessary and safe varies according to the nature and thickness of the sheet. For this reason the pressure of the roll should be adjustable minutely or with infinitesimal variations. This is accomplished by the construction seen best in Fig. 8, in which the pressure is applied to arm 125 by spring 126, the tension of which may be adjusted by a thumb screw 127 threaded on a bar 128 which is pivoted at 129 to the post 130 to which the arm 125 is pivoted.

The roller 124 could be made of conical shape with its axis intersecting the bottom of the stop shoulder. This would eliminate the necessity of slippage between the roller and the turning sheet and hence would decrease the necessity for fine adjustment of the pressure of roller 124.

After the sheet is turned, the inclination of the conveyor belt 95 thrusts it against edge guide 115 so that it is accurately alined for feeding to the folding unit 20. The angular position of the edge guide 115 (and of the entire paper guide 111) may be adjusted upon loosening the set screw 132. Ordinarily the edge guide will be set to extend exactly perpendicularly to the rollers 21 and 22 as indicated by suitable markings on the clamp 112 and the pin 133 extending therethrough.

Reversed turn

For some folding effects it is desirable to turn the sheet in the opposite direction from that illustrated in Fig. 2. This may be accomplished as seen in Fig. 3 by providing a paper guide 211 similar to the paper guide 111 but positioned on the opposite side of the machine and by changing the belt 95 and traction plate 101 to position them near and incline them toward the paper guide 211. The guide strip 101 may be shifted for this purpose by loosening the set screws 106. The belt 95 may be positioned laterally by sliding the belt guide 98 along on its supporting shaft 99 after loosening screw 98'.

In order to incline the belt 95 in the opposite direction, as shown in Fig. 3, it is necessary to reverse the angular position of the rolls 96 and 97 carrying this belt. To this end the rolls 96 and 97 are journaled in bearing blocks 136 which are pivoted to slide bars 137 and 138 and hence may be called swivel bearings. As seen best in Fig. 5, the slide bars are supported by and slide with respect to bracket 92. A handle 139 may be rigidly secured to the slide bar 137 and extend outwardly from the frame 1 to facilitate shifting the slide bar 137. The slide bar 138 is operated in synchronism with the slide bar 137 by means of a lever 140 pivoted by a pin 141 to the cross bar 142 of the frame 1 so that when the slide bar 137 is moved in one direction the slide bar 138 is automatically moved in the opposite direction. Any suitable means may be provided for securing the slide bars 137 and 138 in the adjusted position as, for example, the set screw 149 which is threaded through the bracket 92 adjacent to the handle 139, and which, when advanced upwardly, bears against the slide bar 137. The belt 95 is driven by a drive belt 143. The belt 143 should, of course, be driven from a position equidistant from the two positions of the pulley on roll 96 to permit the reversing of the angularity of the rolls 96 and 97 as already described, and so that the belt will be tight in both positions.

The lower feeding table 4 may be substantially the same as the feeding table 3 already described, although for some purposes it need not be reversible to turn the sheet in either direction at will.

Additional folding units

Although the folding units 10 and 20 have each been illustrated as only a single folding unit, it should be understood that additional folding units may be provided at each position if desired. For example, at either or both of units 10 and 20 there may be two or more folders. Such multiple folding units are well known and therefore need not be specifically described. The arrangement of such multiple folding units should be such as to cause the sheet to pass through all sections thereof to form two or more parallel folds in the sheet or to skip all but one of the sections so as to form only one fold in the sheet at this position.

Operation

When a flat sheet is fed along the table 2 to rolls 11 and 12, these rolls feed the sheet into buckle chute 13 until it strikes the paper stop 14, after which the sheet buckles and is caught between folding rolls 12 and 15 which feed the folded sheet between the scoring rolls 5 unless intervening folders are provided in connection with folding unit 10. If the sheet is to be further folded, the deflector 46 below folding unit 10 is set in the position shown in full lines and the sheet passes onto the belt 95 which carries it along under the guide strip 101 and the guide extension 117.

If the next fold is to be at right angles to the

preceding fold, one end portion of the paper strikes shoulder 116 which stops this end of the paper, causing the paper to be rotated through 90° as it is carried on by the belt 95, against which the paper is pressed firmly by the roller 124. After the sheet has been turned it is properly lined up for the next operation by being pressed against the edge guiding flange 115 due to the lateral inclination of the belt 95 in that direction. If the second fold is to be parallel to the first fold, the sheet is not turned on the table 3. Turning may be avoided by replacing the sheet guide 111 with a plain sheet guide which does not have a roller 128 or stop 116, but instead has the edge guide 115 extending the length of the table 3. If the sheet guide 111 is retained, the machine may be adjusted to cause the paper to strike the edge guide 115 after it has passed the stop 116. It will be understood of course that the feed table 2 will have an edge guide or jogger for determining the lateral position at which the sheet starts through folding unit 10 and hence its initial lateral position on the table 3.

If it is desired, on account of subsequent folding operations, that the sheet be turned 90° but in the opposite direction from that illustrated in Fig. 2, this can easily be accomplished. The thumb screw 149 is released, and the handle 139 is shifted to the left from the position seen in Fig. 2 to the position seen in Fig. 3 thereby reversing the inclination of the rolls 96 and 97 so that the belt 95 will be inclined toward the right of the direction of the sheet movement instead of toward the left. The sheet guide 211 will then be placed on the right-hand side of the machine and the corresponding guide 111 removed from the left-hand side of the machine. Next, the belt 95 will be shifted to the proper position as seen in Fig. 3 with respect to the sheet guide 211. This is accomplished by loosening the thumb screw 98' and sliding the belt guide 98 along the rod 99. Finally, the traction plate 101 is shifted from the position seen in Fig. 2 to the position seen in Fig. 3 directly over belt 95 in its new position. The various thumb screws will of course be tightened to hold the parts in their new positions. Now when a sheet is delivered onto the belt 95 is will be carried without turning until its end strikes stop shoulder 216, at which time the belt 95 in cooperation with the roller 124 will rotate it as illustrated in Fig. 3 about the stop shoulder 216 until it has been turned 90°, at which time it will strike the edge guide 215 and be accurately alined by said edge guide and held in the desired lateral position until it is delivered to the rolls 21 and 22.

One important feature of the invention is its simplicity, which is especially important in view of the necessity for adjusting the machine to turn the sheet in either direction or carry it without turning it. The use of a single belt 95 contributes to this simplicity. When a single belt is used, however, it is necessary that the traction exerted by the belt on the sheet be enough to drag the sheet along the stationary table top 91 and the sheet guide 111 or 211. To obtain this traction the marbles 107 are provided at frequent intervals along the traction plate 101 to press the sheet against the belt, and at the point where the greatest traction is needed the roller 124 is provided. The use of a single belt is advantageous inherently in that it eliminates the possibility of the corners of the sheet catching on other belts as the sheet is turned. To prevent the leading edge of the sheet from catching on table top 91, roll 95, or roll 22, the sheet guides 111 and 211 are constructed to extend close to the rolls 96 and 22 and the table top 91 is made V-shaped at its ends so that the rolls 95 and 96 can fit closely thereto. There is no possibility of the sheet's catching on the flat portion 114 of the sheet guide 111 (or 211) since its longitudinal edge lies under the belt 95 and its end is depressed at 156 adjacent the roll 96. Because of serving as an extension of the table this flat portion 114 may be called a supplemental table top.

These folding machines are sometimes operated at very high speed. The result is that the sheets will strike the edge guide 115 with considerable speed and hence with appreciable momentum. This momentum tends to make the sheets bounce away from the edge guide and such bouncing would of course be disastrous to perfect registry of the sheet for subsequent folds if the effects of the bouncing were not overcome. However, the marbles 107 in the lower part of the traction plate 101 which press the sheet onto the belt 95 are effective to substantially eliminate this bouncing of the sheets, by which is meant that if any bouncing occurs it is so slight that the belt returns the sheet to the edge guide 115 immediately and before it reaches the bite of the rolls 21 and 22. It is of course very important in a high speed folding machine that the sheets be turned and fed to the next folding unit with absolute dependability. There is no chance to make corrections for errors on individual sheets, and, if one sheet jams, a large number of sheets may be spoiled. The combination of the various features described produces this highly desirable dependability.

The belt 95 now feeds the paper to the folder rolls 21 and 22 of folding unit 20 by which the sheet is fed into chute 23 until it strikes paper stop 24, at which time it buckles and is caught between rolls 22 and 25. Subsequent conveying or conveying and turning operations and subsequent folding operations are similar to those already described and therefore need not be described in detail. The various features described in connection with table 3 are embodied in the table 4 illustrated so that it will turn the sheets with equal dependability when such turning is desired.

The statement in the appended claims to the effect that portions of the diagonally-moving sheet engaging means are spaced a substantial distance away from the side guide in order that sheets initially widely spaced from the side guide will be urged throughout substantially their entire length by said diagonally-moving means toward said guide and into registry therewith, is intended to mean that said portions of the diagonally moving sheet engaging means are spaced from the side guide a sufficient distance so that taking into consideration the range of error within which sheets may be fed to the conveyor, or the range of error within which a 90° turn may be made, the diagonally-moving sheet engaging means will dependably move the sheets laterally into engagement and registry with the side guide.

This application is a continuation in part of an application filed by Alfred Anderson and myself on February 24, 1936, Serial No. 65,372.

I claim:

1. In a machine of the kind described, a conveyor comprising two parallel spaced conveyor rolls, a conveyor belt trained around the rolls and

shiftable along said rolls, means mounting the rolls whereby they can be inclined relatively to the normal line of travel of articles on the conveyor to cause the belt to urge articles either toward the right or toward the left as they progress along the conveyor, guides adapted to be arranged at the side of the conveyor toward which the articles are urged, a stationary plate extending between the rolls for supporting the belt, the guide having a flat extension at its lower edge extending out over the stationary plate.

2. In a machine of the kind described, a conveyor comprising two parallel spaced conveyor rolls, a conveyor belt trained around the rolls and shiftable along the rolls, longitudinally movable side bars, swivel bearings mounting the rolls on the side bars, means for moving the side bars longitudinally in opposite directions whereby the rolls are inclined relatively to the normal line of travel of articles on the conveyor for causing the belt to urge articles optionally either toward the right or toward the left as they progress along the conveyor, guides adapted to be arranged at the side of the conveyor toward which the articles are urged, and a stationary plate extending between the rolls for supporting the belt.

3. In a machine of the kind described, a conveyor comprising two parallel spaced conveyor rolls, a conveyor belt trained around the rolls and shiftable along the rolls, longitudinally movable side bars, swivel bearings mounting the rolls on the side bars, a transversely arranged lever pivotally mounted between its ends on the conveyor frame to swing horizontally, means loosely connecting the lever with said side bar, the arrangement being such that, as the lever pivots, the side bars move longitudinally in opposite directions whereby the rolls are inclined relatively to the normal line of travel of articles on the conveyor for causing the belt to urge articles optionally either toward the right or toward the left as they progress along the conveyor, guides adapted to be arranged at the side of the conveyor toward which the articles are urged, and a stationary plate extending between the rolls for supporting the belt.

4. In a conveyor having conveyor rolls on which a conveyor belt is mounted, side bars, swivel bearings on the side bars in which the rolls are mounted, the side bars being shiftable longitudinally to change the inclination of said rolls, a transversely arranged lever pivotally mounted between its ends to swing horizontally, means connecting the ends of the lever with the side bars, the arrangement being such that as the lever is swung the side bars are moved longitudinally in opposite directions, and means for retaining the lever and side bars at both limits of their movement.

5. In a folding machine, a conveyor including parallel rollers for moving a sheet toward a folding unit, sheet turning mechanism adapted to turn the sheet selectively in a clockwise or counterclockwise direction through an angle of 90° while moving toward said unit, and means for pivotally supporting said rollers with each roller pivotal about an axis approximately perpendicular to the conveyor and approximately passing through the middle of said roller, and means for securing the rollers in parallel relationship and inclined toward either side with respect to the longitudinal axis of the conveyor whereby the conveyor is biased toward either side optionally without changing the axis of the conveyor and stationary support means for supporting the sheet between the rollers having an edge thereof adjacent one roller V-shaped in the plane of the conveyor with each leg of the V lying closely adjacent to the adjacent roller when the roller is in one or the other of its inclined positions.

6. The invention as defined in claim 1, and sheet manipulating means adapted to deliver sheets to one end of the conveyor, and sheet manipulating means adapted to receive the sheets from the conveyor, the guide being adjustable to cause the delivered sheets to properly register with said last named sheet manipulating means.

7. In a machine of the kind described, a conveyor comprising two parallel spaced conveyor rolls, a conveyor belt trained around the rolls, means mounting the rolls whereby they can be inclined relatively to the normal line of travel of articles on the conveyor to cause the belt to urge the articles toward one side of the machine, a guide positioned on the side of the machine toward which the articles are urged, a stationary plate extending between the rolls for supporting the belt, the guide having a flat extension at its lower edge arranged between the belt and said plate as and for the purpose specified.

8. A sheet conveying and turning mechanism including an upwardly facing table, a pair of rolls at opposite ends of the table, a single conveyor belt trained around the rolls and along the table, means for shifting the rolls substantially in the plane of the table whereby the belt is inclined optionally toward one side of the table or the other to urge the sheets to the right or to the left as they are progressed along the table, means adapted to be arranged at the side of the table toward which the sheets are urged, optionally effective to turn the sheets and including edge guide means against which the edge of the sheet is thrust by the conveyor belt, a plurality of traction devices distributed along the length of the belt for dependably dragging the sheets along the table top and urging them against the edge guide with sufficient firmness to substantially eliminate rebound at high speed operation, said belt being relatively narrow with respect to the width of the table but being wide enough to allow said traction devices to have ample contact therewith, and means for shifting said belt laterally of the table to position it close to the edge guide means toward which it urges the sheets.

9. A sheet conveying and turning mechanism including an upwardly facing table, a pair of diagonally disposed rolls at opposite ends of the table, a conveyor belt trained around the rolls and extending diagonally along the table to urge the sheets toward one side of the table as they are progressed along the table, a stop intermediate the ends of the table and at the side of the table toward which the sheets are urged engaged by the sheet in its forward movement for stopping one end of the sheet, edge guide means against which the side edge of the turned sheet is thrust by the conveyor belt, and a plurality of traction devices distributed along the length of the belt and pressing the sheets thereagainst for dependably dragging the sheets along the table top, turning them, and urging them against the edge guide with sufficient firmness to substantially eliminate rebound at high speed operation, one of said traction devices comprising a roller having its axis located approximately in the plane that is normal to the edge guide and includes the stop, and others of the traction devices being rotatable in any direction.

10. In a folding machine, a conveyor including

parallel rollers for moving a sheet toward a folding unit, sheet turning mechanism adapted to turn the sheet selectively in a clockwise or counter-clockwise direction through an angle of 90° while moving toward said unit, and means for pivotally supporting said rollers with each roller pivotal about an axis approximately perpendicular to the conveyor and approximately passing through said roller, and means for securing the rollers in parallel relationship and inclined toward either side with respect to the longitudinal axis of the conveyor whereby the conveyor is biased toward either side optionally without changing the longitudinal axis of the conveyor, and side guide means cooperating with the conveyor to guide the sheet accurately to the folding unit and including a bottom flange which extends below the sheet on the conveyor and has an extension extending close to the folding unit to support the sheet between the roller adjacent thereto and the folding unit.

11. A sheet conveying and turning mechanism including an upwardly facing table, a pair of diagonally disposed rolls at opposite ends of the table, a conveyor belt trained around the rolls and extending diagonally along the table to urge the sheets toward one side of the table as they are progressed along the table, a stop intermediate the ends of the table and at the side of the table toward which the sheets are urged engaged by the sheet in its forward movement for stopping one end of the sheet, edge guide means against which the side edge of the turned sheet is thrust by the conveyor belt, a plurality of traction devices distributed along the length of the belt and pressing the sheets thereagainst for dependably dragging the sheets along the table top, turning them, and urging them against the edge guide with sufficient firmness to substantially eliminate rebound at high speed operation, one of said traction devices comprising a roller having its axis located approximately in the plane that is normal to the edge guide and includes the stop, and others of the traction devices being rotatable in any direction, and means for minutely adjusting the pressure of said roller toward the belt.

12. A sheet conveying and turning mechanism including an upwardly facing table, a pair of rolls at opposite ends of the table, a single conveyor belt trained around the rolls and along the table and inclined toward one side of the table to urge the sheets toward that side as they are progressed along the table, means intermediate the ends of the table and arranged at the side of the table toward which the sheets are urged to turn the sheets and including edge guide means against which the edge of the sheet is thrust by the conveyor belt, and traction means effective along the length of the belt for dependably dragging the sheets along the table top and urging them against the edge guide with sufficient firmness to substantially eliminate rebound at high speed operation, said table being characterized by the absence of any shoulder that is capable of catching or fouling the corner of the sheet that is diagonally opposite the stop while said corner is moving laterally away from the stop during the turning movement of the sheet.

13. A sheet conveying and turning mechanism including an upwardly facing table, a pair of diagonally disposed rolls at opposite ends of the table, a single conveyor belt trained around the rolls and extending diagonally along the table to urge the sheets toward one side of the table as they are progressed along the table, means intermediate the ends of the table for turning the sheets as they progress along the table, edge guide means against which the side edge of the turned sheet is thrust by the conveyor belt, and a plurality of traction devices distributed along the length of the belt for dependably dragging the sheets along the table top and urging them against the edge guide with sufficient firmness to substantially eliminate rebound at high speed operation, said belt being relatively narrow with respect to the width of the table but being considerably wider than the area of direct pressure between said traction devices and the belt to obtain maximum gripping of the sheets.

14. A sheet conveying and turning mechanism including biased conveyor means urging the sheets mainly forwardly and only slightly toward one side of the conveyor means as they are progressed along the conveyor means, optionally effective means for turning the sheets substantially without buckling them as they progress along the conveyor means, edge guide means against which the side edge of the sheet is thrust by the biased conveyor means even though the sheet is unturned and is initially a substantial distance laterally from the edge guide, and a plurality of traction devices distributed along the length of the conveyor means for dependably moving the sheets along the conveyor means and urging them against the edge guide with sufficient firmness to substantially eliminate rebound at high speed operation.

15. A substantially horizontal sheet conveyor for carrying sheets along a contemplated direct line of travel from its entrance end to its delivery end, sheet turning mechanism adapted to be arranged for turning the sheets through substantially ninety degrees either to the right or to the left as desired, an associated guide toward which the turning mechanism is arranged to turn the sheets and arranged at an angle to the direction in which the conveyor is urging the sheets as they are received from the turning mechanism so that the conveyor will carry the sheets into contact with the guide, and the guide being movable to positions where the line of travel of the sheets as defined by the guide will be the contemplated line of travel, the arrangement being such that the conveyor and the turning mechanism cooperate with each other in moving the sheet in the general direction in which it travels both in turning and in movement towards the sheet guide, said conveyor comprising a pair of cross bars pivotally mounted at their transverse center points to swing in a horizontal plane, parallel longitudinal side bars pivotally mounted on the opposite ends of the cross bars and a plurality of substantially parallel conveyor rollers pivotally mounted at their ends on the side bars, the arrangement being such that the rollers can be changed in inclination so as to set them at such an angle to an aligning member arranged at either side that the conveyed sheets shall be carried toward the aligning member toward which the sheets are being turned by shifting said side bars longitudinally.

16. A substantially horizontal, biased, sheet conveyor for carrying sheets along a contemplated direct line of travel from its entrance end to its delivery end, sheet turning mechanism adapted to be arranged for turning the sheets through substantially ninety degrees either to the right or to the left as desired, or to be rendered ineffective, an associated guide toward which the turning mechanism is arranged to turn the sheets

and arranged at an angle to the direction in which the conveyor is urging the sheets as they are received from the turning mechanism so that the conveyor will carry the sheets into contact with the guide, and the guide being movable to positions where the line of travel of the sheets as defined by the guide will be the contemplated line of travel, the arrangement being such that the conveyor and the turning mechanism cooperate with each other in moving the sheet in the general direction in which it travels both in turning and in movement towards the sheet guide, said sheet turning means including an abutment associated with the guide and in the path of one end of the advancing sheet, said guide being provided with an open ended slot through which the sheet advances to the abutment, the wall of the slot being positioned so as not to impede a sheet positioned to pass inwardly of the abutment without being turned, and means for pressing the sheet upon the conveyor means to cause the sheet to turn upon the abutment as a pivot, said conveyor means including a diagonally-moving sheet engaging portion substantially spaced laterally from the guide whereby an unturned sheet will be dependably registered with the side guide even through the sheet is initially widely spaced laterally from the guide.

17. In a sheet conveyor, substantially horizontally disposed conveyor means, sheet aligning means adapted to be arranged selectively either at one side or at the other side of the conveyor means, the conveyor means being adjustable to cause a conveyed sheet to be selectively carried toward an aligning means at one side or toward an aligning means at the other side of the conveyor as the sheet is carried forward by the conveyor, said conveyor means comprising a plurality of substantially parallel conveyor rollers, the rollers being rotatably carried at their ends in bearings pivotally mounted on longitudinally movable side bars, the arrangement being such that the rollers can be set at an advancing inclination to an aligning device at either side of the conveyor as and for the purpose specified.

18. In a device of the kind described, sheet conveying means which define a substantially flat horizontal conveying surface, arranged and adapted to receive sheets at one end and discharge them at the opposite end, means for operating said conveyor means to advance a sheet in a predetermined direction from the entrance end to the discharge end of the conveyor, means associated with the conveyor means for causing the sheets to be turned in a horizontal plane through substantially ninety degrees selectively clockwise or counterclockwise, a guide adapted to be arranged in the path of the sheets as they are turned, and provided with a groove opening towards the conveyor means, the bottom of the groove serving as a sheet guide and arranged with its lower wall below the flat conveying surface defined by the conveyor means and projecting into close proximity with the adjacent edge thereof, said conveyor means being capable of being selectively arranged to urge the conveyed sheets towards the sheet guide (that is in the direction in which the sheets are selectively turned).

19. In a folding machine, a conveyor including parallel rollers for moving a sheet toward a folding unit, sheet turning mechanism adapted to turn the sheet selectively in a clockwise or counterclockwise direction through an angle of 90° while moving toward said unit, and means for pivotally supporting said rollers with each roller pivotal about an axis approximately perpendicular to the conveyor and approximately passing through said roller, and means for securing the rollers in parallel relationship and inclined toward either side with respect to the longitudinal axis of the conveyor whereby the conveyor is biased toward either side optionally without changing the axis of the conveyor.

20. In a folding machine, a conveyor including parallel rollers for moving the sheet toward a folding unit, sheet turning mechanism adapted to turn the sheets selectively in a clockwise or counterclockwise direction through an angle of ninety degrees while moving toward said unit, a frame for supporting said rollers including parallel side members which fix the spacing between corresponding ends of the rollers, and means for longitudinally shifting one of the side members relative to the other without disturbing their parallel relationship.

21. In a device of the class described, a conveyor table comprising side guide means positionable on either side of the table and a biased conveyor adjustable to convey sheets optionally to one side or the other of the table, said conveyor including diagonally-moving sheet engaging means having portions thereof disposed longitudinally of the conveyor a substantial distance away from the side guide means, turning means adapted to be arranged in the path of the advancing sheets to cause them to be turned either to the left or to the right in accordance with the setting of the conveyor and guide means, said turning means being capable of being rendered inoperative whereby sheets being moved along the table by the conveyor will be urged throughout substantially their entire length by said diagonally-moving means of the conveyor toward said guide means and into registry therewith, even though the sheets, or portions of the edge to be registered against the guide means are a substantial distance laterally from the guide means after the sheet passes the position of the turning means.

22. A sheet conveying and turning mechanism comprising conveyor means including a biased conveyor belt urging the sheets mainly forwardly and only slightly toward one side of the conveyor means as they are progressed along the conveyor means, optionally effective turning means for turning the sheets substantially without buckling as they progress along the conveyor means, edge guide means against which the side edge of each sheet is thrust by the biased conveyor belt, and a plurality of traction devices distributed along the length of the conveyor belt for dependably moving the sheets along the conveyor means and urging them against the edge guide with sufficient firmness to substantially eliminate rebound at high speed operation.

23. In a device of the class described, a conveyor table comprising side guide means positionable on either side of the table and a biased conveyor adjustable to convey sheets optionally to one side or the other of the table, said conveyor including diagonally-moving sheet engaging means having portions thereof disposed longitudinally of the conveyor a substantial distance away from the side guide means, turning means adapted to be arranged in the path of the advancing sheets to cause them to be turned either to the left or to the right in accordance with the setting of the conveyor and guide means, said turning means being capable of being ren-

dered inoperative whereby sheets being moved along the table by the conveyor will be urged throughout substantially their entire length by said diagonally-moving means of the conveyor toward said guide means and into registry therewith, even though the sheets, or portions of the edge to be registered against the guide means are a substantial distance laterally from the guide means after the sheet passes the position of the turning means, and means for preventing substantially any rebound of the sheets away from the guide means including pressure devices adapted to be rotated by the conveyor and to be separated from the conveyor by the sheet being conveyed.

24. In a device of the class described, a conveyor table comprising side guide means positionable on either side of the table and a biased conveyor adjustable to convey sheets optionally to one side or the other of the table, said conveyor including diagonally-moving sheet engaging means having portions thereof disposed longitudinally of the conveyor a substantial distance away from the side guide means, turning means adapted to be arranged in the path of the advancing sheets to cause them to be turned either to the left or to the right in accordance with the setting of the conveyor and guide means, said turning means being capable of being rendered inoperative whereby sheets being moved along the table by the conveyor will be urged throughout substantially their entire length by said diagonally-moving means of the conveyor toward said guide means and into registry therewith, even though the sheets, or portions of the edge to be registered against the guide means are a substantial distance laterally from the guide means after the sheet passes the position of the turning means, and means for preventing substantially any rebound of the sheets away from the guide means including a row of pressure balls arranged above the belt and adapted to be separated from the belt by a sheet being conveyed, and said biased conveyor including a belt looped about parallel rollers positioned on opposite sides of the sheet turning means.

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