Aug. 28, 1928. 1,682,237

H. C. OSBORN

FOLDING MACHINE

Filed Dec. 14, 1923 3 Sheets-Sheet 1

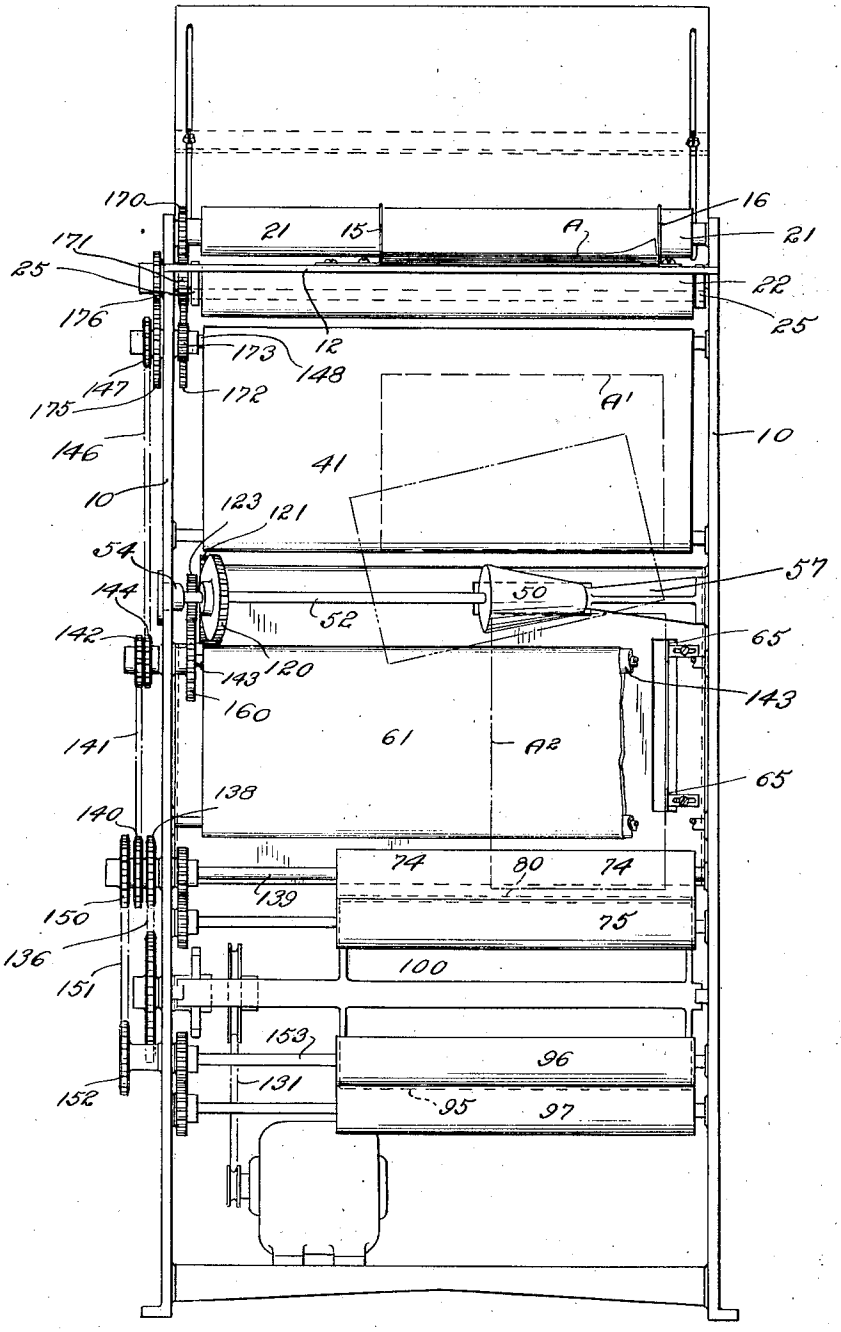


Fig.-1

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FOLDING MACHINE

Filed Dec. 14, 1923 3 Sheets-Sheet 2

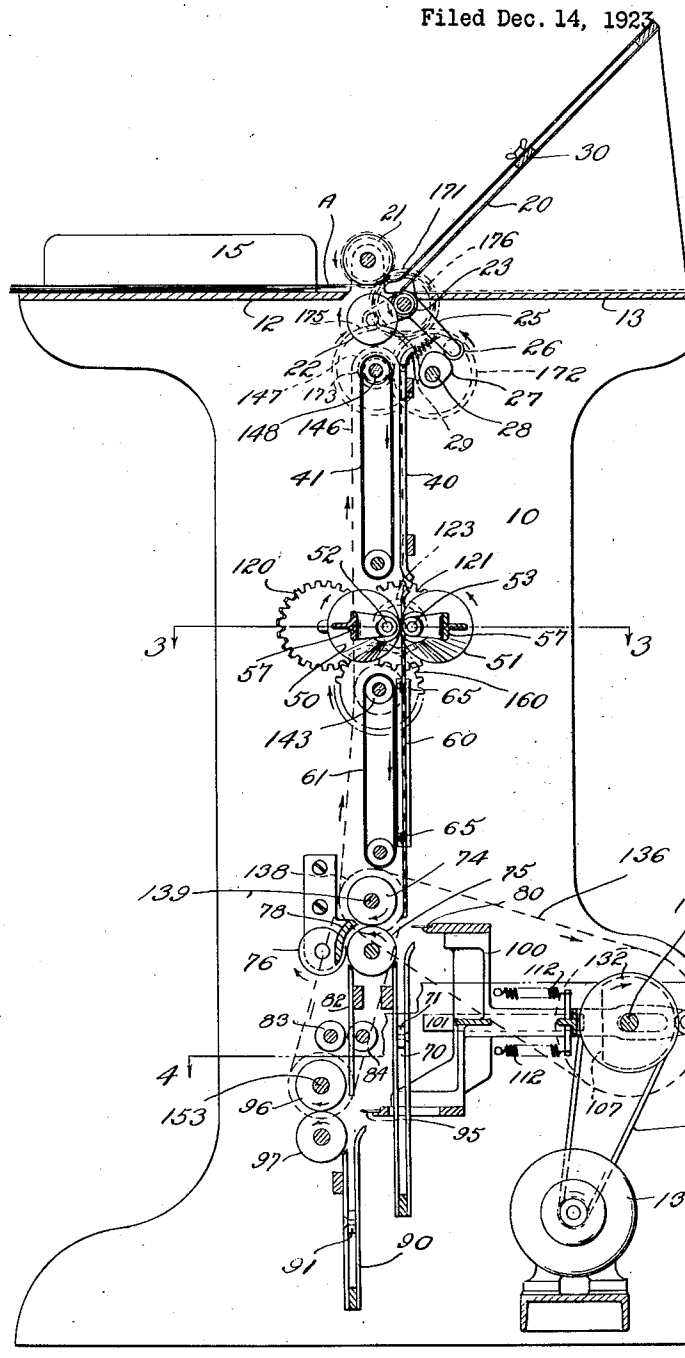


FIG.-2

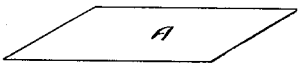


FIG.-5

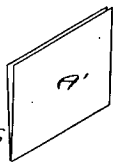


FIG.-6

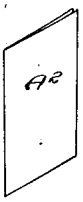


FIG.-7

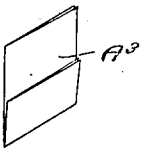


FIG.-8



FIG.-9

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FOLDING MACHINE

Filed Dec. 14, 1923 3 Sheets-Sheet 3

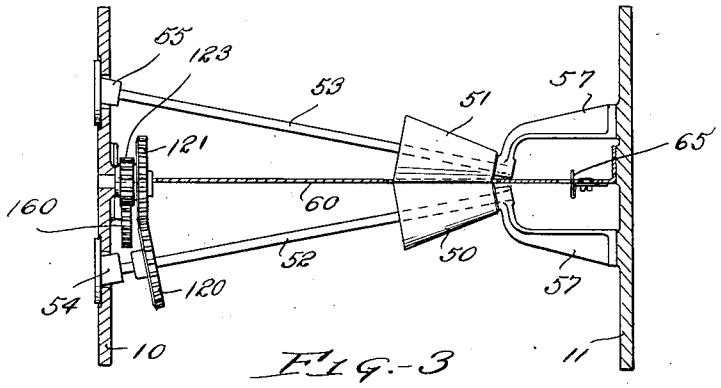


FIG.-3

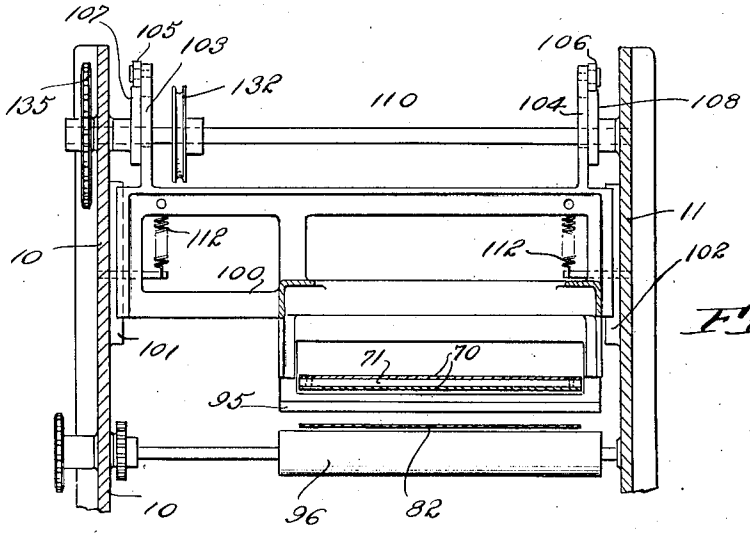


FIG.-4

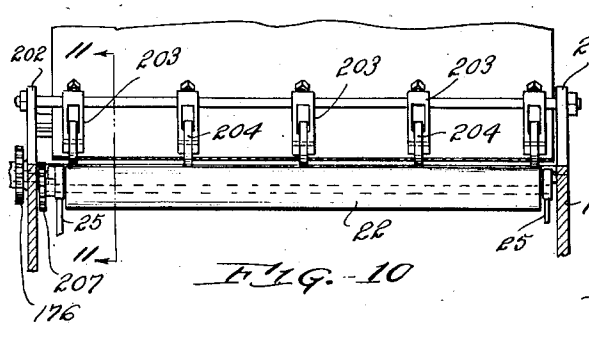


FIG.-10

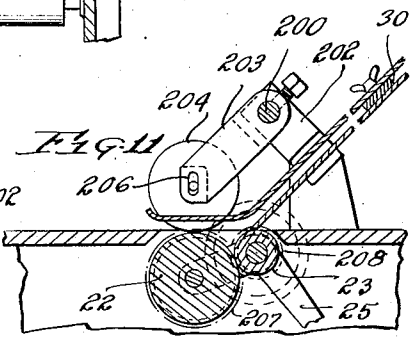


FIG.11

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Patented Aug. 28, 1928. 1,682,237

UNITED STATES PATENT OFFICE.

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FOLDING MACHINE.

Application filed December 14, 1923. Serial No. 680,759.

The object of this invention is to provide a simple and efficient machine for folding sheets of paper. My invention is well adapted, for instance, for embodiment in a machine for folding sheets of letter paper for insertion in ordinary size envelopes. There have been a number of prior machines adapted to give the so-called six-panel fold to letter sheets, but those with which I am familiar have provided knives or buckle chutes at right angles to the primary folding device to produce the two parallel folds and this has requred a cumbersome system of bevel gearing or other mechanism to drive the various parts.

I have discovered that the machine may be much simplified by giving the sheet a quarter turn between the first and second foldings. This allows all three folds to be made by parallel folding devices, enabling a material simplification of the driving mechanism as well as providing for embodiment in a very compact machine.

I find that the paper can be turned about one corner thereof very simply and efficiently by means of a coacting pair of conical rollers having their apices (real or theoretical) at the corner of the sheet. Such rolls operate to move the sheet about such corner as a center, the sheet clearing the rolls when the quarter turn has been made.

A machine embodying the above mentioned features is illustrated in the drawings hereof, and is hereinafter more fully described, but it is to be understood that I do not intend to limit myself to the particular construction there shown, as I believe I am entitled to broad protection on the feature referred to of turning the paper between foldings.

In the drawings, Fig. 1 is a front elevation of an embodiment of my machine; Fig. 2 is a vertical transverse section thereof; Fig. 3 is a horizontal section adjacent the conical turning rolls as indicated by the line 3—3 in Fig. 2; Fig. 4 is a horizontal section through the mechanism shown for imparting the two parallel folds to the sheet, the section being taken on an offset plane indicated by the line 4—4 on Fig. 2; Figs. 5 to 9, inclusive, indicate the condition of a sheet from its unfolded form to the final or six-panel fold; Fig. 10 is a sectional front elevation of a modified form of paper feed; Fig. 11 is a section taken along the line 11—11 on Fig. 10.

In the embodiment shown in the drawings, 10 and 11 indicate a pair of upright frame plates carrying at their tops a horizontal table 12 adapted to support the sheets to be folded. A small pile of sheets is indicated at A in Figs. 1 and 2 resting on the table 12 between suitable laterally adjustable guides 15 and 16. At the rear of the table I have shown suitable mechanism for transversely folding a sheet fed by hand toward the rear from the top of the pile.

The primary folding mechanism comprises an inclined buckle chute 20 and three rotatable rolls 21, 22 and 23. The roll 21 is constantly driven in the direction to carry its lower portion toward the rear, that is, toward the buckle chute. The roll 23 is constantly driven in the same rotative direction. The roll 22 bears against the roll 23 and is free to rotate and hence is driven by the roll 23 in the opposite direction to the roll 21, thus causing its upper portion to move toward the buckle chute. The roll 22 is journaled in the arms of a pair of bell cranks 25 which are pivoted axially to the roll 23 and carry at their free ends rollers 26 bearing against cams 27 on a shaft 28, which is also constantly rotated. A suitable spring 29 maintains the rollers 26 in contact with the cams.

It follows from the above described construction, that the roll 22 rises periodically from the idle position shown in Fig. 2 into coaction with the roller 21, and a short time thereafter drops to idle position. If, therefore, a sheet of paper A is shoved rearwardly by hand or otherwise past the rolls 21 and 22 while they are separated the pinch of these rolls when brought together will advance the sheet up the buckle chute until it is stopped by engaging the adjustably positioned abutment bar 30 therein. This buckles the sheet at its free portion between the lower end of the chute and the bite of the rolls 21 and 22, causing the sheet to double and pass downwardly, doubled edge foremost, between the rolls 22 and 23. The sheet is thus transformed from the condition indicated at A Fig. 5 to that indicated at A^1 in Fig. 6.

Beneath the primary folding mechanism described is shown a suitable vertical guide

for receiving the transversely folded sheet A^1. As shown, this guide comprises a series of vertical guide bars 40 and an endless belt 41 in front thereof, the belt being driven so that its reach adjacent the guide bars travels downwardly. The transversely folded sheet is thus fed downwardly, doubled edge foremost, into the grip of the turning mechanism, which will now be described.

50 and 51 in Figs. 1, 2 and 3 indicate a pair of coacting conical rollers having their meeting line in the plane of the advanced doubled sheet and so formed and positioned that their theoretical apices meet at the edge of the sheet as fed to these rollers. For convenience in supporting these conical rollers, I omit their extreme portions. Both rolls may be driven, but I find it sufficient to drive one of them and allow the other to rotate by frictional engagement therewith. As shown, these two rolls are mounted on shafts 52 and 53 which are journalled at their outer ends in suitable skewed bearings 54 and 55 carried by the frame plate 10. Their inner ends are shown as mounted in bearings in suitable bearing brackets 57 secured to the frame plate 11. Beneath the conical rolls is a vertical guide plate 60, and in front of this is an endless belt 61 which is constantly driven in the direction to carry its reach adjacent the plate downwardly.

The transversely folded sheet A^1 descends, doubled edge foremost, into the bite of the rolls 50 and 51 with one doubled corner of that sheet at the theoretic apex of the conical rolls. Now the revolution of these rolls is in the direction to cause their adjacent portions to travel downwardly so that the sheet is turned about one corner thereof until the doubled edge which was horizontal becomes vertical, the sheet thus having the position indicated at A^2 in Fig. 7.

A suitable guide is provided to align the turned sheet. This guide is shown as comprising an upright bar 65 laterally adjustable on the plate 60 and extending transversely through an opening in that plate. This bar is theoretically located directly in alignment with the common apex of the cones. The turning of the sheet by the cones continues until it has been turned just ninety degrees, which frees it from the cones and brings its doubled edge into engagement with the guide, and then passes downwardly for the subsequent folds.

In practice, a slight adjustment of the guides 15 and 16 for the original sheets may cause the paper to turn about a point which varies slightly from the exact corner, and then the guide 65 will be adjusted correspondingly, so that the turned sheet will pass downwardly with its doubled edge substantially in contact with the guide 65, and in accurate registration for the subsequent folding.

The mechanism for giving the two parallel folds may be varied materially from that illustrated. I find a very simple arrangement is to employ two buckle chutes, knife and roller folders. As shown in Figs. 2 and 4, the transversely folded sheet descends vertically into the buckle chute 70 against an adjustable stop bar 71 therein. This bar is ordinarily so positioned that about one-third of the sheet passes into the chute. In front of the open space between the guide plate 60 and buckle chute 70 are a pair of contacting rotating rolls 74 and 75 moving with their adjacent portions forwardly, while coacting with the roll 75 is a roll 76 which travels in the opposite direction of rotation to that roll, so that their adjacent surfaces travel downwardly. A suitable curved guide 78 leads from the pass of the rolls 74 and 75 to the pass of the rolls 75 and 76.

When the once folded sheet drops into the buckle chute 70 a suitable knife 80 moves forwardly and tucks the sheet into the bite of the rolls 74 and 75 whereby it is given its first longitudinal fold. These rolls advance the sheet forwardly and thence downwardly, so that it is delivered vertically downward by the rolls 75 and 76 in the condition shown in A^3, Fig. 8. The sheet in this condition travels downwardly along the guide plate 82 (by gravity assisted by the separated rolls 83 and 84) and is discharged into the buckle chute 90. This chute has an adjustable stop bar 91, which is positioned so that the sheet having a once folded panel stands about equally in the chute and above the chute, thus bringing its region where the final fold is to be made between the chute and the plate 82. Behind this open space is a knife 95 which operates to tuck the sheet into the bite of the folding rolls 96 and 97, which thus deliver the sheet forwardly in its final folded condition, as illustrated in A^4 in Fig. 9.

I find it very simple to mount the two knives 80 and 95 on a single reciprocating cross head and position the parts so that when the knife 95 is acting on one sheet to give it its final fold the knife 80 is acting on the succeeding sheet to give it its first parallel fold. Figs. 2 and 4 illustrate such crosshead at 100. It is slideably guided in ways 101 and 102 in the frame plates 10 and 11 respectively, and has a pair of arms 103 and 104 which carry rollers 105 and 106 bearing on cams 107 and 108 on a rotating shaft 110. Suitable springs 112 (four being shown) maintain the rollers 105 and 106 in contact with their respective cams.

The adjustment of the stop bar 71 about midway of the chute 70, as shown in Fig. 2, and the arrangement of the conical rolls

as shown, gives the ordinary six-panel letter sheet fold, when the sheets lie face-up on the table 12 with their bottom edges toward the buckle chute. Various other folds may be obtained, however, if desired. For instance, by setting the stop bar 71 near the bottom of the chute 70, the two parallel folds will be in opposite directions, giving the sheet a fan fold. Or, should it be desired to give the sheet one transverse and one longitudinal fold, to produce the four-panel fold sometimes desired for letter sheets, it is only necessary to set the abutment bar 71, so that the sheet is folded in the middle, and remove the guide member 78, it being understood that suitable receiving or conveying mechanism might be attached to the machine at either pair of folding rolls.

Furthermore, either the six-panel or four-panel fold may be in other directions, to cause other panels to be exposed (sometimes desired for printed circular work) by interchanging the positions of the knives and parallel folders, or by reversing the conical rolls so that they turn the sheet about the other doubled corner.

It will be noted that all of the rollers and shafts shown and described with the exception of the conical rolls and their shafts are parallel with each other and may thus be driven with very simple mechanism. Moreover, the simple expedient of a pair of bevel gears enables the conical rolls to be driven from a gear axially parallel with said shafts. Thus, I have shown a bevel gear 120 on the shaft 52 meshing with a bevel gear 121 which is rigid with a pinion 123, the gear 121 and its pinion being axially parallel with all of the other rolls.

The folding machine described adapts itself for being driven by spur gearing and sprocket chains, for instance as follows:

As shown the shaft 110 may be considered the main shaft. It is shown as driven by a motor 130 from which a belt 131 runs over a pulley 132 on the shaft 110. On this shaft is shown a sprocket wheel 135. A sprocket chain 136 runs from this wheel over the sprocket wheel 138 on the shaft 139 of the roller 74. From another sprocket wheel 140 on this shaft, Fig. 1, a sprocket chain 141 runs to a sprocket wheel 142 on the upper roller 143 carrying the belt 61. From a companion sprocket wheel 144 on this roller another chain 146 leads over a sprocket wheel 147 on the shaft of the upper roller 148 for the belt 41. On the shaft 139 of the roller 74 is shown a third sprocket wheel 150 connected by a sprocket chain 151 with a sprocket wheel 152 on the shaft 153 of the roller 96. The sprocket chains described accordingly drive each of the parallel folding sets as well as the two feeding belts.

As shown, the pinion 123 which drives the conical rolls meshes with a gear 160 on the shaft of the belt roller 143. The roller 21 of the primary folder is shown as provided with a gear 170 meshing with a gear 171 loose on the shaft carrying the roll 23 and this gear 171 meshes with a gear 172 on the cam shaft 28. This same gear 172 meshes with a pinion 173 on the shaft of the upper belt roller 148. On this same belt roller shaft is a gear 175 meshing with a gear 176 on the roller 23 for driving the latter.

It will thus be seen that the primary folding mechanism and the turning mechanism are all driven by spur gears from parts driven by the sprocket chain mechanism described. The entire driving mechanism is accordingly simple and direct and not liable to get out of order and may conveniently be mounted all on one side of the machine. It is to be understood, of course, that driving mechanism other than sprocket chains may be employed. For instance, the arrangement of parallel shafts shown adapts itself for driving by trains of spur gearing, if desired.

Beneath the buckle chute 20 in Fig. 2 is shown a table 13 aligning with the table 12. By removing the buckle chute and the roller 21, a pile of sheets may be placed on the tables 12 and 13 and the bottommost sheet fed automatically therefrom by the coacting rollers 22 and 23, which, by feeding inwardly the intermediate region of such sheet, may both fold and feed it.

The paper feeding mechanism shown in Figs. 10 and 11 may be used in place of that shown in Figs. 1 and 2 in connection with the initial buckle chute. The primary purpose of this form of feed is to more accurately align the paper to be folded.

I have rigidly secured a bar 200 in brackets 202 rising from the side plates 10 and at intervals along this bar I have adjustably mounted bifurcated bearing brackets 203 for light individual rollers 204. These brackets are slotted at 206 to receive the axle shafts of the rollers, which construction allows them to rest lightly on the feed roll 22 at all times. Thus, the paper may be urged upwardly along the inclined buckle chute with sufficient force to align the foremost edge against the stop bar 30 and so hold it until the feed roll 22 is rocked upwardly by the cams as hereinbefore explained. This upward rocking is sufficient to bring the axle shafts of the individual rollers 204 against the upper end of the slots 206 which positively pinches the paper and buckles it into the bite of the folding rolls 22 and 23. I have shown the roll 23 preferably driven by the gear 176 as before while spur gears 207 and 208 indentical in pitch to the rolls 23 and 24 serve to positively connect these rolls. It results that the fed sheet

stops against the bar 30 thus stopping the rolls 204 while the roll 22 slides on the paper until it is rocked upward to pinch the paper and forcibly drive it forward.

Having thus described my invention, I claim:

1. In a folding machine, the combination of mechanism for folding a sheet and propelling it in a plane along a guideway without binding it, and mechanism for then giving the sheet a quarter turn in the same plane.

2. In a folding machine, the combination with folding mechanism, of a pair of conical rolls adapted to engage and turn a sheet, an open chute between the folding mechanism and rolls and occupied by said sheet during the first portion of the turning, said chute comprising a stationary guiding member and an adjacent traveling member unopposed on the face adjacent the guiding member.

3. In a folding machine, the combination with a pair of folding mechanisms, one adapted to act on the product of the other, a conveyor between the mechanisms including a belt lightly engaging the product and urging it forwardly and a pair of conical rolls adapted to engage the sheet from the first folder while acted on by the conveyor and turn it in its own plane for delivery to the second folder.

4. In a folding machine, the combination with a paper guide, of means for lightly urging paper along said guide, a pair of coacting conical rolls adapted to turn a folded sheet in its own plane into parallelism with said guide while still in contact with the urging means.

5. In a folding machine, the combination with paper propelling means and a plate adjacent thereto, the propelling means being free from opposition on the face adjacent the plate, of a pair of coacting conical rolls adapted to engage a sheet of paper and turn it while engaged by said propelling means.

6. The combination of a folding mechanism adapted to give a sheet one fold, a folding mechanism located parallel with the first mechanism and adapted to give the sheet another fold, a pair of coacting conical rolls acting between said mechanism and serving to give the sheet a quarter turn in its own plane after leaving the first folder and before engaging the second folder, and means including a belt lightly engaging the paper between the conical rolls and said first folding mechanism for maintaining the alignment of the paper.

7. In a folding machine, the combination of two folding mechanisms each comprising a pair of folding rolls, and means for causing the same to act on an intermediate region of a sheet and fold it, all of said rolls being mounted on parallel axes, and means additional to said folding mechanisms to turn the folded sheet delivered by the first folder about a center and deliver it without folding it to the second folder, and means operating between the folders and turning means to guide and convey the paper toward and away from the turning means.

8. In a folding machine, the combination of a primary folder comprising a buckle chute and a pair of coacting rolls, means controlled by the engagement of the paper with the stop of the buckle chute for aligning the paper with the roll, a pair of coacting conical rolls adapted to act on the sheet delivered by the primary folder and give such sheet a quarter turn, and a secondary folder acting on the turned sheet.

9. In a folding machine, the combination with a primary folding device, of a belt unopposed on its active face and adjacent a guide for advancing the once folded sheet, a pair of conical rolls for giving such sheet a quarter turn, and means for thereafter giving the sheet a secondary fold.

10. In a folding machine, the combination of a table for paper, an adjacent buckle chute, folding rolls coacting with the buckle chute to fold a sheet transversely, means for advancing such folded sheet, a pair of conical rolls adapted to give the sheet a quarter turn in its own plane, means for advancing such turned sheet, and an adjustable stop for limiting the advance of the sheet, and rolls and a tucking knife for giving the sheet a secondary fold.

11. In a folding machine, the combination with two parallel folders, of a pair of coacting rotatable cones adapted to act on a sheet after its discharge from the first folder and before it enters the second folder, an open chute between the first folder and the cones comprising a stationary plate, and a belt having a reach parallel with the plate and adjacent to it and unopposed on its paper engaging face, and means including a side guide for engaging an edge of the sheet to align it after leaving said cones.

12. The combination of a pair of folding mechanisms parallel with each other, a pair of coacting cones located intermediately of the folders and adapted to turn the folded sheet delivered from the first folder to present it to the second folder, an open chute between the first folder and the cones comprising a stationary plate, and a belt having a reach parallel with the plate and adjacent to it and unopposed on its paper engaging face, and an edge guide substantially at right angles to the plane in which the cone axes lie, said guide being adapted to position the sheet discharged by the conical rolls.

13. In a folding machine, the combination of a pair of coacting rotatable cones having a common theoretic apex, means for delivering to the cones a folded sheet with one edge thereof substantially in line with said apex,

said means comprising an open chute, one member of which travels and is unopposed on its paper engaging face, and a guide substantially in line wtih said apex adapted to act on the sheet delivered by the cones.

14. In a folding machine, the combination of folding rolls adapted to fold a sheet intermediately and deliver it along an open chute comprising a guiding member and an unopposed belt parallel therewith, a pair of coacting cones having their meeting lines substantially in the plane of said guide, whereby the folded sheet discharged from the primary folder may be given a quarter turn in its own plane, a guide leading from the cones in substantially the same plane as the first mentioned guide, a receiving chute aligned with said plane for receiving the folded and turned sheet, and a blade adapted to act on the sheet in said chute and tuck it into the bite of a pair of folding rolls.

15. In a folding machine, the combination of a buckle chute and a group of rolls adapted to form a primary fold in a sheet, an endless belt and a guide for delivering such folded sheet, a pair of coacting cones having their pass registering with the passageway between the belt and guide and having their common theoretic apex substantially in the line of one edge of the sheet, a belt and guide providing a passageway on the other side of said conical rollers substantially in the plane of the pass between them, and one or more groups of rollers for giving one or more subsequent folds to the sheet after delivery by said second belt.

16. In a folding machine, the combination of a paper table, laterally adjustable edge guides thereon, a primary folding device comprising a buckle chute and a group of rolls, a pair of coacting cones adapted to engage the folded edge of the once folded sheet delivered from the primary folder and give such sheet a quarter turn in its own plane, an adjustable edge guide adapted to position the sheet delivered by the cones, and a secondary folding device adapted to act on such delivered sheet.

17. In a folding machine, the combination of a paper table, a primary folder comprising a buckle chute and a group of rolls adapted to fold a sheet intermediately, a belt for advancing the sheet, a pair of coacting cones to act on the advanced sheet, said cones having their common theoretic apex substantially in line with one edge of the sheet, a guide substantially in the same line for positioning the sheet turned by the rolls, means for advancing such turned sheet, a chute for receiving it, a group of folding rolls adjacent the mouth of the chute on one side thereof, a knife on the other side, two groups of folding rolls being parallel with each other, power mechanism geared with the folding rolls of both groups, the rolls carrying the belts and the conical rolls, whereby all of such parts are simultaneously rotated, and the mechanism connecting the knife with said mechanism whereby the knife is reciprocated.

18. In a folding machine, the combination of a buckle chute, a pair of folding rolls into the bite of which the sheet may be buckled, and means for positioning the sheet in the chute without causing it to buckle.

19. In a folding machine, the combination of a buckle chute, a pair of folding rolls, means for advancing the sheet into the chute with sufficient force to cause it to buckle into the bite of such rolls, and means for advancing the sheet in the chute to position it but without sufficient force to buckle it.

20. The combination of a buckle chute, a pair of folding rolls, a third roll with which one of the pair may coact to buckle the sheet in the chute into the bite of the pair and means for shoving the sheet into the chute with sufficient force to position it without buckling it.

21. The combination with a buckle chute and folding rolls, of positioning rolls adapted to act on the sheet to feed it against a stop without buckling it, and means for thereafter buckling the sheet.

22. The combination with a buckle chute, of a pair of rolls adapted to force a sheet lightly against a stop in the chute to true it without buckling it, and means for causing said rolls to thereafter pinch the sheet to buckle it.

23. The combination with a buckle chute, of a feeding roll and a set of individual truing rolls resting lightly thereon adapted to coact therewith to feed the sheet against the stop to true it, and means for thereafter causing said rolls to pinch the sheet to push it against the stop to buckle it.

24. In a folding machine, the combination with a buckle chute, of a rotatable and bodily shiftable feeding roll and a positioning roll coacting therewith and resting lightly thereon when the feeding roll is in one position, said positioning roll being adapted to oppose the bodily movement of the feeding roll when it is shifted and thus coact with it to positively feed a sheet into the chute and buckle it.

25. In a folding machine, the combination of a primary folder adapted to fold a sheet transversely, mechanism adapted to act then on a sheet to give it a quarter turn in its own plane, two subsequent folders each parallel with the first folder and adapted to act on the once folded sheet to give it two parallel folds one after the other, said subsequent folders being so related that while the last folder is acting on one sheet the preceding folder is acting on the succeeding sheet.

26. In a folding machine, the combination with a primary folder, of mechanism

acting on the once folded sheet and serving to turn it in its own plane about a center adjacent the corner of the sheet, two secondary folders each comprising a pair of rolls and a blade adapted to give two parallel folds to the transversely folded sheet, said secondary folders being so mutually positioned that when one blade is giving the final fold to the foremost sheet the other blade is giving the first parallel fold to the succeeding sheet.

27. In a folding machine, the combination of two folders acting simultaneously on different sheets and successively on the same sheet, each folder comprising two rolls and a blade, and a reciprocating cross head carrying both blades.

28. In a folding machine the combination of a primary folder adapted to give one fold to a sheet and two secondary folders adapted to give the once folded sheet two additional folds parallel to each other and at right angles to the first fold, said secondary folders each comprising a pair of rolls and a blade and means including a movable member carrying both blades for simultaneously operating the two blades, said means being so correlated with the control of the periodic action of the primary folder that the blades will operate simultaneously on successive sheets delivered from the primary folder.

29. In a folding machine, the combination of a periodically acting primary folder adapted to give one fold to the sheet and two secondary folders adapted to give the once folded sheet two additional folds parallel to each other and at right angles to the first fold, said secondary folders being parallel with each other and facing in the same direction and each comprising a pair of rolls and a blade, a cross-head carrying both blades, and means for reciprocating the cross-head, said secondary folders being so set and so related to the control of the periodic action of the primary folder that the blades will operate simultaneously in different regions on successive sheets folded and delivered from the primary folder.

30. In a folding machine the combination with a periodically acting primary folder of two secondary folders acting simultaneously on different sheets and successively on the same sheet, each folder comprising two rolls and a blade, and a single member carrying and reciprocating both blades.

31. In a folding machine, the combination of mechanism for giving the sheet a fold in one direction, mechanism for giving the sheet a quarter turn in its own plane after it has left the first folder, and while maintaining it in the plane in which it is delivered from the first folder, and mechamism for giving the sheet another fold at right angles to the first fold after it has left the turning mechanism.

32. In a folding machine, the combination of mechanism for giving a transverse fold to an unfolded sheet, mechanism acting on the sheet after it has cleared the first folder for giving the sheet a quarter turn in its own plane about a center adjacent one corner of the sheet, and without folding it, and mechanism acting after the sheet has been given such quarter turn for again folding the sheet.

33. In a folding machine, two folding mechanisms, one acting on a sheet previously folded by the other, means to deliver such sheet from one to the other and cause it to travel along a substantially true plane, means to turn said sheet substantially 90° in said plane while being delivered, each folding mechanism acting to fold and deliver the paper while moving all parts of the sheet along respective planes normal to said first mentioned plane.

34. In a folding machine, two folding mechanisms each arranged to fold and deliver a sheet while moving it in a path parallel to the side edges of the sheet, and means intermediate of said mechanisms for turning the folded sheet while maintaining all portions thereof substantially in one plane during such turning.

35. In a folding machine, two sets of cylindrical folding rolls in axially parallel relation, means for delivering a once folded sheet from one to the other, and means operating on such folded sheet as it is being delivered for turning it substantially 90° in its own plane.

36. In a folding machine, a folding device comprising cylindrical folding rolls, another folding device comprising cylindrical folding rolls with their axes substantially parallel to the axis of the first named rolls, means for guiding a folded sheet from one device to the other while maintaining it in one plane, and means acting on the folded sheet while it is so delivered for turning it substantially 90°.

37. In a folding machine, the combination of two folding mechanisms each comprising a pair of folding rolls, and means for causing the same to act on an intermediate region of a sheet and fold it, all of said rolls being mounted on parallel axes, and means additional to said folding mechanisms to turn the folded sheet delivered by the first folder 90° about a center and swing its fold against an adjustably positioned edge guide, and means for advancing it parallel with the guide into the second folder.

In testimony whereof, I hereunto affix my signature.

HENRY C. OSBORN.