Sept. 18, 1945. J. ADRIAN 2,385,047

PAPER HANDLING MACHINE

Filed March 31, 1943 4 Sheets-Sheet 1

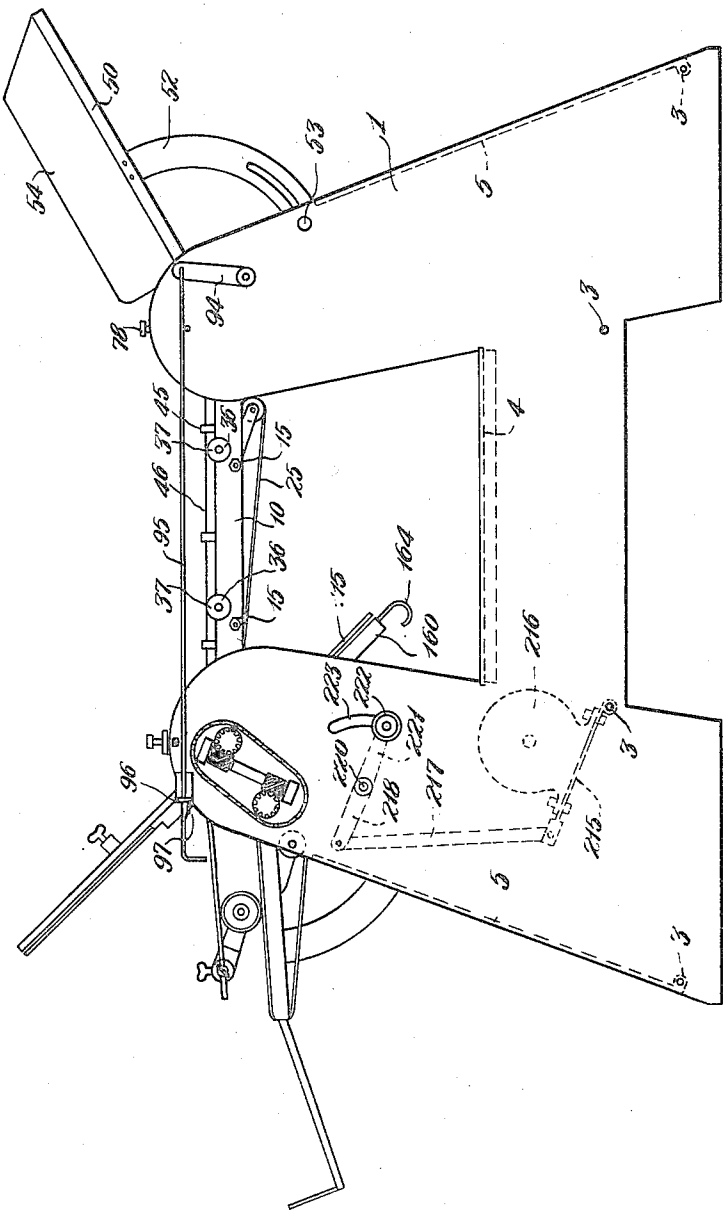

FIG. 1

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PAPER HANDLING MACHINE

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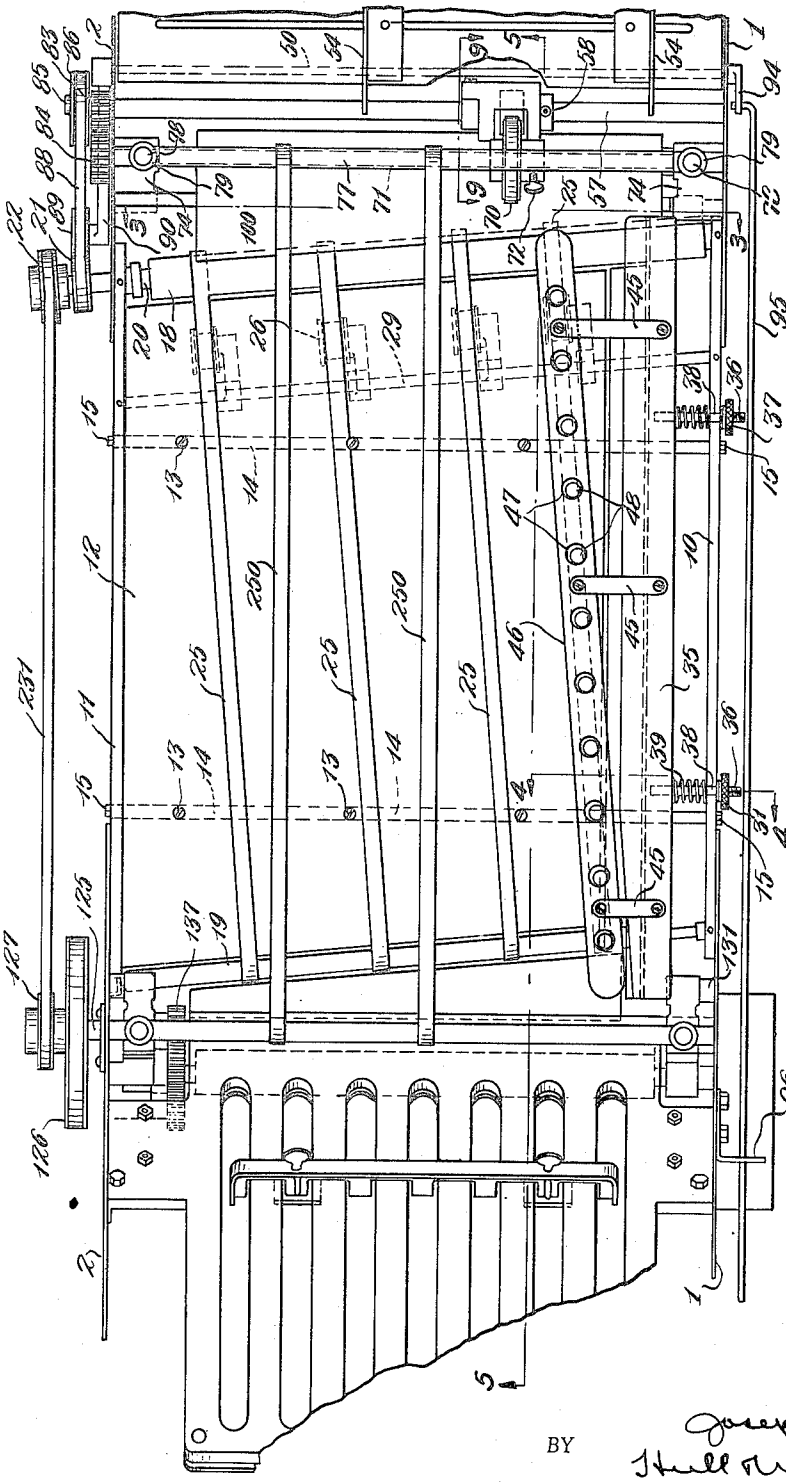

FIG. 2

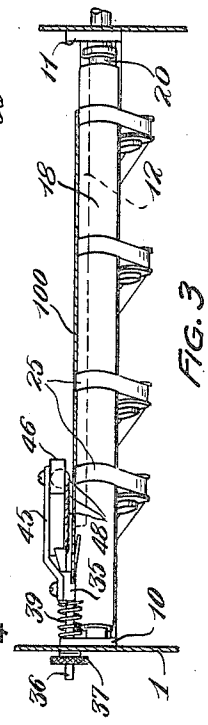

FIG. 3

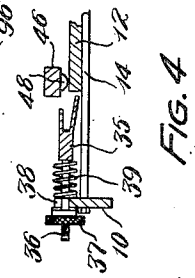

FIG. 4

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PAPER HANDLING MACHINE

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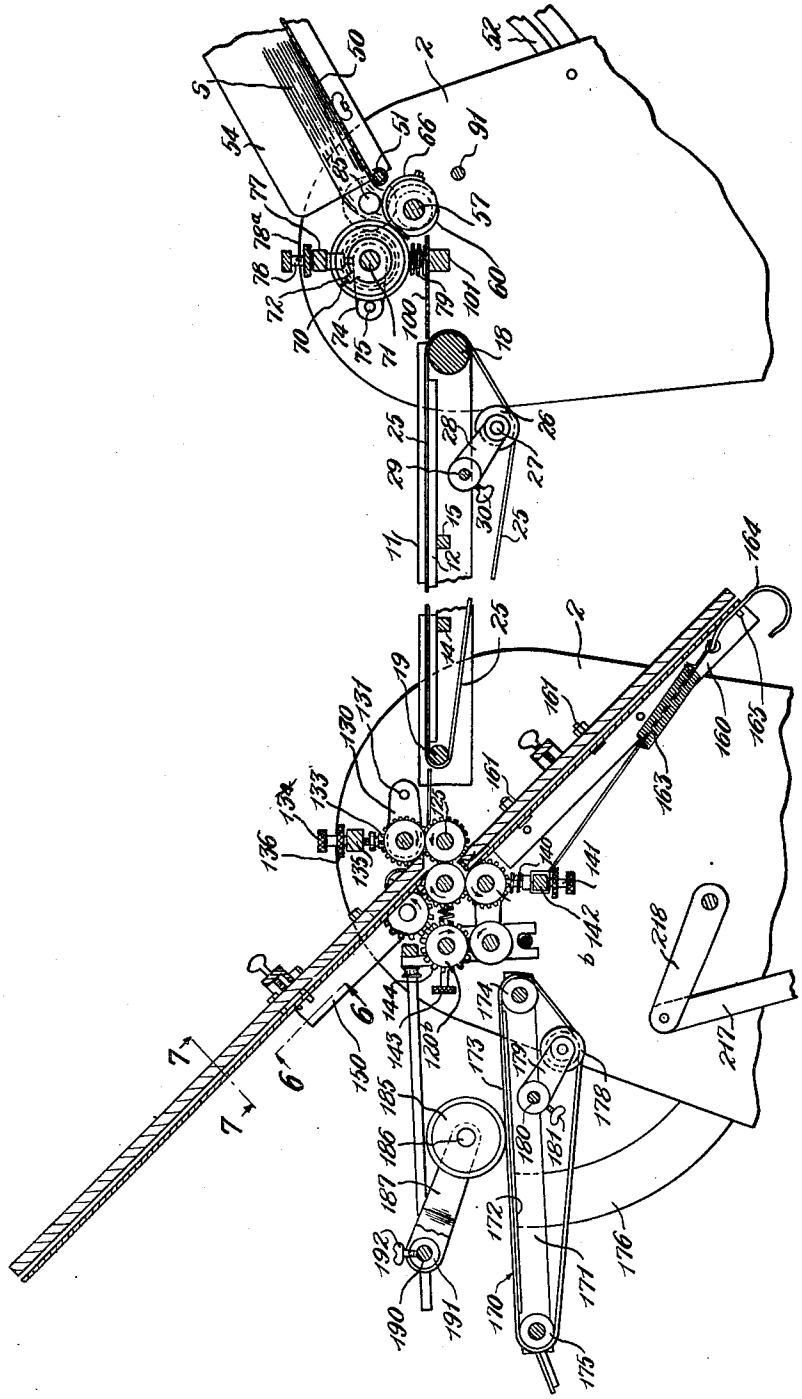

FIG. 5

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Filed March 31, 1943 4 Sheets-Sheet 4

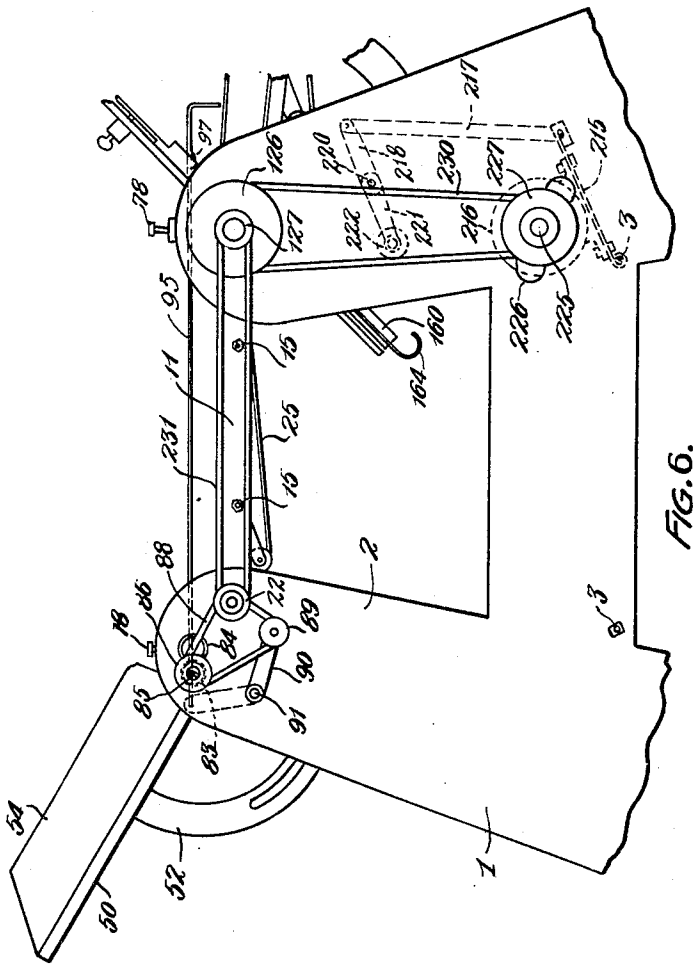

FIG. 6.

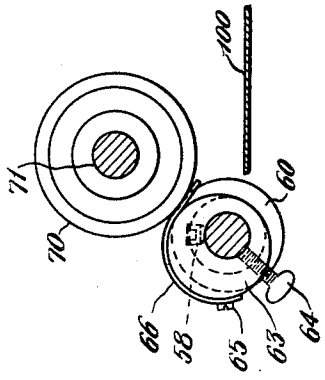

FIG. 7.

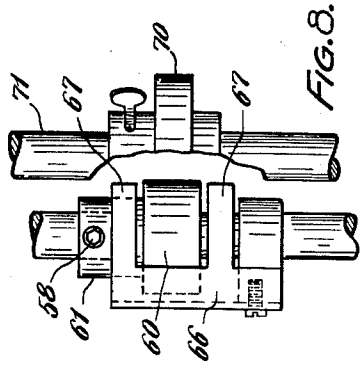

FIG. 8.

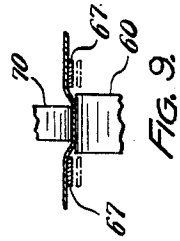

FIG. 9.

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Patented Sept. 18, 1945 2,385,047

UNITED STATES PATENT OFFICE

2,385,047

PAPER HANDLING MACHINE

Joseph Adrian, Cleveland, Ohio, assignor to The Turner Type Founders Company, Cleveland, Ohio, a corporation of Ohio

Application March 31, 1943, Serial No. 481,201

4 Claims. (Cl. 271—12)

This invention relates to improvements in machines for handling, folding, or otherwise treating sheets of paper or the like, and it has to do more particularly with sheet folding machines of the buckle fold type.

The principal purpose of the invention is to simplify the construction and materially lower the production cost of sheet handling or folding machines while attaining or surpassing in some respects the efficiency and high standard of performance of the more complicated and expensive machines that are now in use, whereby a thoroughly satisfactory machine of the class in question may be made available to offices and small printing shops operating on limited budgets.

Another object of the invention is to improve the sheet feeding mechanism of machines of the kind referred to so that, by a simple adjustment, it may be made to satisfactorily handle sheets of a very wide range of thickness, stiffness, and surface smoothness—in fact, to handle all kinds and qualities of paper likely to be encountered in the use of such a machine.

Another object is to provide sheet conveying means or a so-called feed table that is quick and simple of adjustment in the matter of adapting it to sheets of different sizes and for the purpose of properly relating it to the sheet treating or folding mechanism.

A further object of the invention is to provide a simple and economical power transmission involving a control by which any desired speed within a wide range may be easily and quickly and very accurately attained, said transmission incorporating, also, means by which the sheet feeding mechanism may be instantly thrown into and out of operation and which is conveniently accessible to the attendant from various positions about the machine. A further object is to provide means, for the purpose just mentioned, which is of such nature that, while acting promptly to throw the feeding mechanism into operation, it does so without imposing undue shock thereon.

The objects and advantages above enumerated, with others hereinafter appearing, are attained in the embodiment of the invention illustrated in the accompanying drawings that form a part hereof and wherein Fig. 1 is a front elevation of a folding machine constructed in accordance with the invention; Fig. 2 is a fragmentary plan view of the machine on a scale considerably enlarged over that of Fig. 1; Figs. 3 and 4 are transverse sections on the respective lines 3—3 and 4—4 of Fig. 2; Fig. 5 represents a fragmentary vertical longitudinal section through the machine, on the line 5—5 of Fig. 2, with the middle portion of the feed table broken away; Fig. 6 is a fragmentary rear elevation of the machine on the same scale as Fig. 1; Fig. 7 is a sectional detail of the sheet feeding mechanism, the same being taken on the line 9—9 of Fig. 2 and being on a considerably enlarged scale; Fig. 8 is a plan view of what is shown in Fig. 7, with parts of the feed roller and shaft broken away, and Fig. 9 is a sectional view in the nature of a diagram and in rather exaggerated style through the feeding mechanism showing the manner in which a sheet is acted upon as it is advanced by the feed roll and is sustained on opposite sides thereof by the branches of the bifurcated sheet support.

The frame of the machine includes front and rear housings 1 and 2, respectively. These are desirably fabricated from relatively heavy metal plates and are connected at suitable points adjacent the bottoms by tie rods or the like, such as represented at 3 in Figs. 1 and 6, and by a shelf 4 and end panels 5, shown in dotted lines in Fig. 1.

Supported by and between the upper separated end portions of the respective housings 1 and 2 are side rails 10 and 11 of sheet conveying means or a so-called feed table. A flat bed 12 of wood or other suitable material is attached, by screws 13, to cross bars 14 that are fastened at their ends, as by screws 15, to the aforesaid rails 10 and 11. As will be observed from Fig. 2, the ends of the bed 12 are at other than right angles to the lateral edges thereof, and supported adjacent and parallel to the ends of the bed 12 are rollers 18 and 19, the top surfaces of which are approximately in the plane of the corresponding surface of the bed 12. The shafts that support the rollers 18 and 19 are journaled in the machine frame, and the rear end of the shaft 20 of roller 18 extends a considerable distance beyond the housing 2 where it has fastened to it grooved pulleys 21 and 22.

Engaged about the rollers 18 and 19, with their top flights supported by the bed 12, are endless belts 25 of suitable material, such as webbing, and engaged with the lower flights of said belts are flanged pulleys 26 mounted on spindles 27 that are carried by arms 28 (Fig. 5). Said arms are mounted on a cross rod 29 that is rigidly supported by and between the rails 10 and 11, and the arms are adapted to be shifted along said rod and locked in the position to which they are shifted and in any desired angular relation to the rod by set screws 30. By such an adjustment

of the arms 28, and consequently of the pulleys 26, the belts 25 are shifted laterally of the bed 12 to any desired position with respect thereto and with the required degree of tautness to insure their proper action. The lateral adjustment of the belts is for the obvious purpose of adapting them to sheets of different widths.

Supported adjacent and substantially parallel to the front edge of the bed 12 is a side guide 35 wherewith the edges of the sheets are engaged as the sheets are advanced by the conveying means or feed table. This guide has the cross sectional shape best shown in Fig. 4, and is supported by studs 36 that extend laterally from the guide, and to the threaded outer ends of which are applied knurled nuts 37, the studs occupying notches 38 in the rail 10. The guide 35 is urged toward the sheet conveying means or table by springs 39 that surround the studs and are compressed between the guide and the inner side of the rail 10. By reason of this construction, the guide 35 may be adjusted relative to the sheet conveying means or table by simply turning the knurled nuts 37.

Supported through arms 45 from the guide 35 above and in parallel relation to the front belt 25 is a bar 46 having apertures 47 in which are loosely contained spherical weights or balls 48 between which and said belt the sheets are adapted to be fed.

Situated beyond the receiving end of the sheet conveying means or table—that is, beyond the right hand end thereof as the machine is viewed in Figs. 1, 2 and 5—are the stack support, and the sheet feeding mechanism. The stack support consists of a shelf 50, that is pivotally supported at 51 (Fig. 5) between the front and rear housings 1 and 2, and it may be held at any desired inclination by suitable means, such as slotted arcuate braces 52 adjustably secured to the housings by screw means thereon engaged through the slots of said braces. Adjustable laterally of the stack support 50 are side plates 54 which, with said support, form a chute in which a stack of sheets may be placed. The nature of the adjustable connections between the side plates and support 50 may be of any approved character, such connections being common in the class of machines to which the invention pertains. Forwardly and below the plane of the pivoted end of the support 50 is a rod 57 that is fixedly supported by and between the housings 1 and 2, and adapted to be locked to the rod 57 in any desired position therealong, as by a set screw 58 (Fig. 7), is a resiliently faced cylindrical support 60. This support may consist of a rubber faced roller, the extended hub 61 of which is locked, by the beforementioned set screw 58, to the stationary rod 57. Also mounted on the rod 57, for adjustment therealong and angularly thereof, is an eccentric mounting 63. This mounting is adapted to be locked to the rod by a thumb screw 64 (Fig. 7). Fastened to the eccentric mounting, as by means of a screw 65, is a curved bifurcated plate 66, the branches 67 of which are arranged on opposite sides of the cylindrical support 60. The fanned out front edges of the sheets of a stack S are adapted to contact the plate 66, as indicated in Fig. 5, as the stack tends to descend along the inclined support 50, and the front edge of the top sheet may be caused to bear with the desired degree of pressure against the support 60 by the adjustment of the plate 66 through the eccentric mounting 63. This adjustment is an exceedingly important one and varies minutely with papers of different weights or thickness, stiffness and smoothness of finish and has to be determined by actual test. The invention provides a very convenient way of making the adjustment while the machine is in operation.

Arranged for contact with the stationary cylindrical support 60 is a resiliently faced feeding roller 70. This roller is adapted to be adjusted along and locked to a shaft 71, by a set screw 72 that is threaded through the hub of the roller. The shaft 71 is journaled at its ends in hangers 74 that are pivoted at 75 (Fig. 5) to the adjacent parts of the housings 1 and 2. A bar 77 is supported a substantial distance above and in parallel relation to the shaft 71 by and between the front and rear housings, and threaded through the bar adjacent each of its ends is a screw 78 that bears at its lower end on the adjacent hanger 74. By means of the screws 78 the hangers 74 may be depressed against the action of springs 79 so as to effect the desired pressure of the roller 70 upon the stationary cylindrical support 60. The screws 78 may be locked in any adjusted position by means of the knurled nuts 78a. The rear end of the shaft 71 extends through an enlarged opening (not shown) in the rear housing 2 and beyond said housing has fastened to it a gear 83 that meshes with a gear 84 on a stub shaft 85 that is secured to and projects rearwardly from the housing 2. Also mounted on the stub shaft 85, and locked to the gear 84 so as to rotate therewith, is a pulley 86 that is substantially in the plane of the previously mentioned pulley 21. A belt 88 is engaged about the pulleys 21 and 86 and about a belt tightener pulley 89 (Figs. 2 and 6) carried by the free end of an arm 90 that is fastened to a shaft 91. This shaft extends through the machine from front to rear and is journaled in bearings of the front and rear housings 1 and 2. Fastened to the front end of the shaft 91 (Figs. 1 and 2), where it projects beyond the front housing 1, is an arm 94 to the free end of which is connected a rod 95 that extends along the front side of the machine and is guided through an opening in a bracket 96, fastened to the housing 1 adjacent the end of the machine remote from the sheet feeding means.

Assuming that the pulley 21 is being driven in a manner hereinafter to be described, it will be seen that upon exerting a pull upon the rod 95, the shaft 91 will be rocked in a direction to depress the pulley 89 and tighten the belt 88, causing it to drive the pulley 86 and, through the gears 84 and 83, the shaft 71 to which the feed roller 70 is fastened. The parts may be locked in this position by engaging an abutment 97 on the rod 95 with the bracket 96, the opening in said bracket through which the rod 95 operates being enough larger than the rod to permit the latter to be lifted so as to disengage said abutment from the plate 96.

A plate 100 (Figs. 2 and 5) is supported, as by a cross bar 101, in substantially the plane of the belts 25 with its edge adjacent the sheet conveying means parallel to the roller 18 and its opposite edge parallel to the rod 57 on which the cylindrical support 60 and bifurcated plate 66 are mounted. The sheets, as they are fed by the roller 70, glide across the plate 100 onto the belts 25.

Pivotally supported in the lower portion of the end of the machine frame below the folding apparatus, as upon one of the tie rods 3, is a support 215 on which an electric motor 216 is mounted. The free end of the support 215 is con-

nected, by a link 217 to an arm 218, fastened to a shaft 220 that is journaled in bearings carried by the front and rear housings 1 and 2, said shaft, adjacent the front housing, having attached to it an operating lever 221 that carries a knob 222. This knob is in the nature of a nut that is threaded on a stud projecting laterally from lever 221 through a slot 223 in the housing 1. By means of the knob 222, when loosened, the lever 221 may be raised and lowered, thereby to similarly move the support 215 of the motor through the beforementioned connections, and it may be locked in any position to which it is adjusted by means of the knob 222, the knob, when tightened, clamping the lever 221 to the housing. The shaft 225 of the motor 216 (Fig. 6), extends through an arcuate slot 226 in the rear housing 2, and beyond said housing the shaft has mounted upon it a variable pitch pulley 227. This pulley is of a well known type comprising opposed conical plates between which the belt 230 operates, said belt being engaged over a pulley 126 that is mounted on a shaft 125. The conical plates of the pulley 227 are urged toward each other by a relatively heavy spring whose tension may be varied by an adjustment incorporated in the pulley, in accordance with the standard construction of pulleys of the type in question. It will be seen, therefore, that by an adjustment of the motor support, through means of the knob 222, the speed at which the machine is driven may be changed and very accurately regulated to suit it to the type of paper that is being handled. A belt 231 is engaged over a pulley 127 on the rear end of the shaft 125 and the previously mentioned pulley 22 on the rear end of the shaft 20 that operates the sheet conveying means or table.

In considering the operation of the machine, it will be assumed that a stack of sheets S is sustained by the support 50 in the position shown in Fig. 5 with their lower edges fanned out over the curved plate 66 and with the edge of the first sheet projecting into the bight between the feed roll 70 and the stationary roll or element 60. With the motor 216 energized by the closing of a suitable switch (not shown) and adjusted by means of the knob 222 to approximately the desired speed, the operator, standing in front of the machine, shifts the rod 95 to the left and engages its shoulder 97 with the plate 96 thereby to hold depressed the idler 89 (Fig. 6) on the rear side of the machine and tighten the belt 88 so as to cause it to drive, through the gears 83 and 84 (Fig. 2) the shaft 71 on which the feed roll 70 is mounted. As a consequence of the rotation of the roll 70, sheets will be drawn successively from the stack S and projected across the plate 100 onto the belts 25 of the sheet feeding means or table, and as they are carried along the table they are shifted to the front of the machine by reason of the inclination of said belts until their edges adjacent the front of the machine contact the side guide 35 by which the sheets are lined up squarely in the machine for proper presentation to buckle fold apparatus that is located beyond the end of the sheet conveying means or table opposite the sheet feeding mechanism. During their travel along the conveying means or table, the sheets are held down against the belt 25 that is nearest the front of the machine by the spherical weights 48.

Immediately after the machine is started, the speed of the motor may be regulated by adjusting the knob 222 so as to effect the proper speed of the feeding mechanism and the conveying means or table, and during operation of the feeding means, the relation of the roll 70 to the support or element 60 may be adjusted by means of the screws 78 so as to obtain the best results from the feeding mechanism. Papers of different weight, thickness and surface character handle so differently that the only practical way of obtaining satisfactory action of the feeding mechanism is to regulate it while the machine is actually operating upon the particular kind of paper that is to be fed, and a highly important feature of adjustment in the paper feeding mechanism is that of the curved plate 66. This adjustment may also be made in the testing of said mechanism to insure the feeding of one sheet at a time, notwithstanding speed.

For sheets of different widths, the sides 54 are adjusted with respect to the support 50, and also the feed roll 70 and the parts associated therewith are adjusted laterally on their respective shafts so as to operate at approximately the transverse center of the sheet. For the same reason, the belts 25 may be adjusted laterally of the bed 12 by means of the arms 28 that carry the tightener pulleys 26, and said arms may then be locked in any position of adjustment along and about the rod 29 by the thumb screws 30.

To maintain the sheets perfectly flat and to prevent their edges from rising as they are carried forward in rapid succession by the belts 25 of the conveying means or table, metal strips 250 may be employed which are shown in Fig. 2, the same being omitted from Fig. 5 to avoid confusion. The body portions of the strips lie immediately above and parallel with the plane of the belts 25 and are formed at their ends for slidable engagement with the cross bar 77 and a similar bar adjacent the opposite end of the conveying means or table. The strips may be shifted laterally of the conveying means or table along said bars to best adapt them to the width of the sheets that are being fed.

The feed of the sheets may be stopped at any moment by releasing the rod 95 from the bracket 96 and, in the case of an emergency, as when a sheet jams in the buckle fold apparatus, the rod may be reached for the purpose of unlatching it from the bracket 96 from anywhere along the machine or from either end thereof.

It is exceedingly important that the front edges of the sheets be in parallel relation to the rolls of the buckle fold apparatus, and this may be accomplished by adjusting the side guide 35 through the medium of the knurled nuts 37 on the studs 36. This adjustment is made especially simple by employing the springs 39 for urging the side guide inward.

Having thus described my invention, what I claim is:

1. In a sheet handling and treating machine, a support for a stack of sheets, mechanism for performing operations upon said sheets, sheet feeding means for withdrawing sheets successively from the stack and feeding them toward said mechanism, a prime mover, constantly effective driving connections between the prime mover and said mechanism, a pulley situated on the rear side of the machine and operated by and in unison with said connections, a second pulley located on said rear side for driving the sheet feeding means, a belt engaged over said pulleys and normally sufficiently loose not to transmit motion to the second pulley, a belt tightener arranged to operate upon said belt for rendering it effective to drive the second pulley from the first, a shaft

extending from the rear to the front of the machine, operative connections between the rear end of the shaft and said belt tightener, an arm on the forward end of the shaft, and an actuator extending lengthwise of the machine along the front thereof and having connection with said arm whereby the shaft may be rocked through the medium of said actuator to operate the belt tightener.

2. In a sheet handling and treating machine, a support for a stack of sheets, mechanism for performing operations upon said sheets, sheet feeding means for withdrawing sheets successively from the stack and feeding them toward said mechanism, a prime mover, constantly effective driving connections between the prime mover and said mechanism, a pulley situated on the rear side of the machine and operated by and in unison with said connections, a second pulley located on said rear side for driving the sheet feeding means, a belt engaged over said pulleys and normally sufficiently loose not to transmit motion to the second pulley, a belt tightener arranged to operate upon said belt for effecting driving of the second pulley from the first, a shaft extending from the rear to the front of the machine, operative connections between the rear end of the shaft and said belt tightener for rendering the belt tightener effective when the shaft is rocked in a given direction, an arm on the forward end of the shaft, an elongated element connected to said arm and extending lengthwise of the front of the machine for rocking the shaft in the aforesaid direction, and latch means associated with said element for holding it in the position it occupies when the shaft is rocked in said direction.

3. In a sheet handling and treating machine, a support for a stack of sheets, mechanism for performing operations upon said sheets, sheet feeding means for withdrawing sheets successively from the stack and feeding them toward said mechanism, a prime mover, constantly effective driving connections between the prime mover and said mechanism, a pulley situated on the rear side of the machine and operated by and in unison with said connections, a second pulley located on said rear side for driving the sheet feeding means, a belt engaged over said pulleys and normally sufficiently loose not to transmit motion to the second pulley, a shaft extending through the machine from front to rear and supported for oscillation, an arm secured to the rear end of the shaft, an idler pulley rotatably supported by the free end of said arm and engaging said belt for tightening the belt when the arm is swung in a given direction, a second arm on the front end of said shaft, a rod connected to the free end of the second arm and extending lengthwise of the front of the machine, and latch means for retaining said rod in the position it occupies when the parts are in belt-tightening condition.

4. In a sheet handling and treating machine, mechanism for feeding sheets and for performing operations thereon, an electric motor, a hinged support therefor, driving connections between said motor and the aforesaid mechanism, the same including a pulley that is driven by and movable bodily with the motor, a second pulley through which the mechanism is driven, and a belt that is engaged tightly about said pulleys, one of said pulleys being of the yieldable variable pitch variety, a rock shaft supported in substantially parallel relation to the hinge axis of said support and with its forward end beyond the front of the machine, an arm on said shaft, a link connecting a part on said arm spaced from the shaft with a part on the motor support remote from said axis, an operating handle on the front end of the shaft for oscillating the same, and means on the handle cooperating with a part of the machine for holding the handle in any position to which it is adjusted.

JOSEPH ADRIAN.