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APPARATUS FOR FOLDING PAPER SHEETS

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1

This invention relates to improvements in paper art principally, and more especially where it is required that paper or other flexible sheets be folded for various reasons, as for making the sheets more compact, for instance.

One of the principal objects of this invention is to construct an apparatus for performing said folding, that will be extremely inexpensive, yet positive in its action.

The invention has an added object, of so constructing an apparatus of the kind described, that the folding operation will be performed as rapidly as desired, and without danger of damaging the paper sheets during the folding of the same.

A further object of my invention is to so construct an apparatus of the kind described, that a stack of said sheets may be placed in place, and from whence the sheets will be withdrawn in sequence as the apparatus is operated, and properly folded as desired, smoothly and evenly and with a minimum of attention during such operation.

Another object of this invention is to so construct a folding mechanism of the kind described, that the sheets may be withdrawn one at a time in sequence, from a stack of sheets that are held deflected along substantially their predetermined line of fold, and fed into creasing means.

A still further object of my invention is to provide a folding means whereby the lowermost sheet of the stack will be withdrawn, in sequence, by frictionally engaging the same along a pair of spaced intervals and sliding the sheet thus engaged, relatively of the remainder of the stack, bringing the engaged portions together so as to substantially double the sheet upon itself, and thence feed the sheet so doubled, into the fold-creasing means.

Still another object of this invention is to so construct apparatus of the kind set forth, that the fold creasing means will normally engage the under sheet of the stack and move therepast in sliding relationship to be ineffective to actuate the sheet so engaged, but that a highly frictional material shall be incorporated into each of said creasing means substantially as part of the periphery thereof in a narrow longitudinally extending strip, so that as said frictional strips, driven toward one another in unison, engage said lowermost sheet at the pair of spaced intervals, they will actuate the two ends of the sheet toward one another to withdraw said sheet from the stack, and feed said withdrawn sheet into the crease forming part of said creasing means.

Other objects of this invention include the pro-

2

duction of sheet-folding means, and the method of folding, that will be extremely simple and inexpensive, rapid, and otherwise satisfactory and efficient for use wherever deemed applicable.

Many other objects and advantages of the construction, method and operation, and apparatus herein shown and described, and the uses mentioned, will be obvious to those skilled in the art to which this invention appertains, as will be apparent from the disclosures herein given.

To this end, my invention consists in the novel construction, arrangement and combination of parts of the apparatus shown and described, and the method employed, as will be more clearly pointed out in the claims hereunto appended.

In the drawings, wherein like reference characters indicate like or corresponding parts throughout the views,

Figure 1 is a vertical cross-sectional view through the apparatus for folding the sheets; and

Figures 2 through 6 illustrate progressive stages in the withdrawing and folding of a sheet from the stack, and the sheet finally about to be discharged from the fold creasing means.

With further reference to the drawings, wherein I have illustrated a preferred embodiment of my invention, an apparatus is shown for automatically taking a sheet of flexible material, such as of paper or the like, either imprinted or plain as desired, from a supply of such sheets and folding the sheet at a predetermined interval between its ends. This folding is done for any one or more reasons, as for example, in folding a broadside or other printed sheet into proper size for use in a predetermined mailing envelope.

It has been my intention to so construct the folding mechanism hereinafter described, with as few parts as possible, and yet enable it to be used with efficiency and on a factory-production basis, and it is believed that such simplicity and resultant economy in construction and operation will enable it to be used in substantially all instances where folding of flexible sheets is required, or deemed advisable.

To this end, I have shown the apparatus as employing a platform 1, or other suitable support having a plane surface for receiving and retaining a supply of the sheets to be folded, as by superimposing these sheets 2, one upon the other in a substantially vertical formation or stack. If desired, side or end stops 3 may be used as needed to abut the edges of the stack and prevent any accidental shifting of the sheets on the platform.

An elongated weight or bar 4 may be interposed across the platform, extending along sub-

stantially the predetermined line of fold 5 of the sheets, and exerting sufficient pressure to deflect the sheets so that those lowermost will be depressed to below the plane of the supporting platform, for a purpose to be more clearly hereinafter set forth.

A pair of drivingly interconnected rolls 6—6 are positioned transversely across said platform, below the same so that their peripheral surfaces are substantially flush with the supporting plane of said platform, the rolls being of such diameter and so positioned that they will exert pressure on a sheet fed therebetween, and that the rolls substantially engage each other in a line in registry with the predetermined line of fold of the sheets in the stack, and with the median line through the deflector element.

If the rolls 6—6 were left without further additions or cooperating elements, then even with the deflector element in operative position to deflect the stacked sheets as shown, and the rolls driven in the directions indicated by the arrows thereon, the rolls would simply slip or slide in engagement with the lowermost sheet of the stack, and would not withdraw such sheet. The coefficient of friction between the sheet and the peripheral surface of the rolls would be too ineffectual to actuate the sheets or withdraw the same.

In order to perform such withdrawal of the sheets in sequence from the under side of the stack, in order to feed the withdrawn sheets into position to be creased between the folding rolls, I have interposed means at a narrow portion of the peripheral surface of each roll 6, that will grip the sheet with sufficient force to actuate the latter and pull or push it relatively of the other sheets superimposed thereon in the stack.

Although various means might be employed to perform this movement of the sheets, yet I have devised means that are sufficiently effective for the purpose and yet will accomplish it in such a manner so as not to damage any of the sheets, and which may be operated rapidly and with positiveness. A narrow strip of adherent material, such as rubber or rubber-treated element 7, is interposed to extend longitudinally in each of the rolls 6—6, preferably slightly below their main peripheral surfaces.

This strip, as set forth, or of any other suitably highly frictional material, as compared to the sheets, will operate to carry the sheet in the direction in which the strip is moved, but will release easily therefrom when desired. placed on the rolls 6—6 so that they meet at each revolution of the latter, so that when the rolls are driven at equal speeds the strips will similarly travel at equal speeds.

Bearing in mind that the deflector means 4 keeps the lowermost sheets in the stack depressed below the supporting plane of the platform, the strips will engage the underside of the lowermost sheet at or immediately past the topmost point of travel of the strips, because said sheets are bent or curved downwardly at and adjacent said deflector means. Thus, although the main peripheral surface of the rolls are at a slightly greater distance radially than is the exterior surface of said strips, so that the rolls normally simply slide relatively of the sheets with which they contact, yet as soon as the strips reach the topmost point of their travel, and especially at slightly therepast, and aided by the

downward curvature given to the sheets by said deflector, the strips more firmly engage and adhere to the underside of the said sheet, the two strips together shifting the sheet relatively of the stack, to bring the ends of the sheet inwardly toward one another, and to bend the intermediate portion of said sheet to a U-shape or doubled relation. Continued travel of both strips in unison carries the doubled portion of the sheet into the main or creaser portion of the rolls to thereby sharply fold the same along the predetermined fold line, the greater diameter of the rolls thereat aiding in permitting release of the sheets from the strips as the sheets pass through the rolls.

Each time that the strips come uppermost they will engage the sheet then lowermost in the stack, and actuate the same and fold it in the manner just described, one sheet after the other until all sheets in the stack have been used.

Having thus described my invention, it is obvious that various immaterial modifications may be made in the same without departing from the spirit of my invention; hence I do not wish to be understood as limiting myself to the exact form, arrangement, construction and combination of parts herein shown and described, nor the method employed, except as limited by the state of the art to which this invention appertains, and the claims hereunto appended.

What I claim as new and desire to secure by Letters Patent is:

1. In an apparatus for folding sheets one at a time from a stack of superimposed sheets, a supporting platform for said stacked sheets, a pair of creaser rolls slidably supporting said sheets, and frictionally adherent strips longitudinally extending on both rolls at a single interval of their periphery but below the latter to together intermittently grip the lowermost sheet of the stack to pull the sheet toward the said rolls to bend the sheet double between said creaser rolls.

2. In an apparatus for folding sheets in sequence along a predetermined fold line, a platform for holding the sheets stacked, a pair of creaser rolls drivingly interconnected to rotate in unison below said platform and having their peripheral surfaces substantially flush with the supporting plane of said supporting platform to slidably engage the under side of the stacked sheets to either side of said fold line, and a longitudinally extending strip of relatively highly frictional material in and slightly below the periphery of each roll to simultaneously engage the undermost sheets in sequence along intervals substantially equidistant from said fold line and actuate the ends of the engaged sheet downwardly to draw said sheets radially inwardly of the rolls and feed the same folded into and through said creaser rolls.

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