This invention relates to turn-in fingers for box wrapping machinery.

In the art of applying a paper wrap to a cardboard box or the like it is conventional to superimpose a box upon a previously pasted wrapper and to cause the assembly to follow a downward movement during which successively the side flaps of the wrap are caused to adhere to the side walls of the box, the marginal edges of such side flaps are caused to be turned and lapped about the ends of the box, the end flaps are caused to be superimposed upon the lapped marginal edges of the side flaps and the end walls of the box, the upper margins of the side flaps and of the joint end flaps and lapped side margins are caused to be turned over the upper edges of the box walls, and finally the turned upper margins are bent downwardly on the inner upper surfaces of the side and end walls of the box, Mechanism for the effective and proper turn-in of the upper margins of the side and end flaps and the lapped margins of the side flaps, is the subject of the invention herein.

In the use of turn-in fingers according to past practices the box body was provided with a forming-block comprised of upper and lower relatively movable portions which were both initially within the box during the brushing or rolling of the side and end flaps and the lapping of the side flap margins into contact with the box walls, and the upper forming block was elevated perpendicularly and out of the box a distance sufficient to permit the free reciprocation of turn-in fingers between the blocks. Such separation of the blocks allowed side turn-in fingers to advance transversely against the upstanding marginal portions above the upper edge of the box to initiate the turning-in of the side flaps in advance of the end flaps and in close synchronized relation thereto the end turn-in fingers advanced across the end walls of the box to bend the compound end flap over the upper edges thereof and at the corners upon the previously inturned side flap margins, and then pursuant to withdrawal of the turn-in fingers the upper forming block moved downwardly into the box brushing all of the inturned marginal edges downwardly into adhesive relation to the inner wall surfaces. As provided heretofore the side turn-in fingers have been thin, substantially planar horizontally guided reciprocating members and the end turn-in fingers have been similar and have had similar guided horizontal reciprocation differing from the side fingers only in having elevated or embossed ends raised out of the plane of the main body of the end turn-in fingers to afford clearance to permit the end turn-in fingers to pass over the previously inwardly positioned side turn-in fingers. It will be appreciated that the embossing referred to is necessary when the boxes are of uniform depth as the fingers must then reciprocate in the same plane.

In order to minimize tearing at the corners it has been conventional to have the side turn-in fingers terminate inwardly of the interior end surfaces of the box, and in many cases the ends of end inturning fingers were exaggeratedly bent upwardly to afford extra clearance for the mass of wrap at the corners but with a consequent failure to effect sharp definition of the corners. As provided heretofore it has been conventional to provide the turn-in fingers as substantially rigid members having substantially fixed planes of horizontal movement, or have been otherwise so provided that the resultant wiping action across the upper edge of the walls of the box has been as a shearing action to exert a wiping motion across the upper surfaces of the walls of the box.

When it is realized that the corner of the assembled wrap elements comprises as many as four thicknesses of the material of the wrap and that the side turn-in finger itself constitutes a fifth lamination, it will be understood that the shearing motion of the end turn-in finger of the past frequently causes tearing of the material at the corner. It will also be understood that variations in thickness in the wrapper exert further variations in the responsiveness of the whole to bending distortion. It will be seen that the shearing motion of the turn-in fingers results in improperly turned corners and involves considerable waste.

It is among the objects of this invention; to provide improvements in turn-in fingers; to provide floating turn-in fingers enabling automatic adjustment to compensate for thickness or stiffness of a wrap; to provide improvements in box wrapping machinery; to provide improved methods of wrapping paper boxes whereby inturned flaps are accurately folded to form smooth unbroken corners; to provide a novel turn-in finger assembly for wrapper flaps wherein the turn-in action is automatically varied as the thickness of the material varies; to provide means for increasing the output of wrapped paper boxes in a given time as compared to means heretofore in use; and many other objects and advantages
will become more apparent as the description proceeds.

In the accompanying drawing forming part of this description:

Fig. 1 represents a fragmentary side elevation of a form of the improved turn-in fingers showing in dotted lines the position of adjustment to which the finger has been moved.

Fig. 2 represents a fragmentary front elevation of the same.

Fig. 3 represents a perspective of a box and wrap and the associated turn-in fingers just before the end turn-in fingers have been moved inwardly to complete the turning-in of the upper margins of the end flaps, with the actuating and supporting elements fragmentarily shown but with the forming block elements removed from the box, for clarity.

Fig. 4 represents a fragmentary corner of a box and wrap on an enlarged scale showing the plurality of thicknesses at the corner.

Fig. 5 represents a fragmentary plan of a box and wrap prior to the inward folding motion of the fragmentary turn-in fingers, again with forming block elements removed for clarity.

Fig. 6 represents a fragmentary vertical section of the box and wrap 27 with the forming block elements separated just prior to the advance of the turn-in fingers.

Fig. 7 represents a similar fragmentary section with the end turn-in plate according to this invention contacting the end margins and showing in full lines the position to which they float.

Fig. 8 represents a similar fragmentary section marking the conclusion of the end turn-in finger movement, and its concluding mashing down movement as the upper forming block impulses thereto as it returns to the box.

Fig. 9 represents a fragmentary transverse section through a completed assembly.

Figs. 10 and 11 represent respectively diagrammatic side elevations of modified forms of fingers, showing in dotted lines their positions of adjustments.

Referring to the drawing, a box, illustratively but not necessarily a cardboard box, is disclosed, comprising a bottom 10, side walls 11 and 12 and end walls 13 and 14. The side and end walls illustratively have upper edges or surfaces 15 in a common plane. It is contemplated also that the walls may have different heights if desired.

A wrap is provided which comprises a bottom panel 16 arranged for adhesive mounting on the bottom 10 of the box, side panels or flaps 17 and 18 and end panels or flaps 20 and 21. By operation of a part of the machine (not shown) or by hand operation, the side panels 17 and 18 have been swung into contact with the side walls of the box, leaving upper edges or margins 22 extending above the upper edges 15 of the box side walls, the vertical end margins 23 of the side panels having been swung about or lapped into adhesive engagement with the end walls respectively, and the end panels have been swung up into overlying adhesive relation to the end margins 23 and the end walls of the box, leaving upper margins 24 and the turned or lapped vertical margins extending above the respective upper edges of the adjacent end walls of the box.

The association of box and wrap to this point may be in accordance with the disclosure of my application on a non-stop box wrapping machine Serial No. 510,479, filed Dec. 22, 1939.

It will be recognized by those skilled in the art that an upper forming block comprising upper 75 wiping block 25 and lower box unit 26 has been associated with the box in the development of the engagement of the box and wrap and that the final turn-in operation for all of the noted upper edges or margins of the side end flaps or panels, is accomplished by withdrawing the wiping block 25 as shown in Fig. 6, leaving block 26 in the box, in order to permit said margins to be bent inwardly about the upper edges of the box walls as is conventional. After such bending the wiping block 25 is again moved axially into the box to force the bent margins down about the inner upper edges of the box walls as shown in Fig. 9.

Referring to Fig. 4, a corner is portrayed on an enlarged scale showing that the side wall margins 22 have been bent inwardly first by the more or less conventional side turn-in fingers in their guided horizontal reciprocations, a substantial fold line 28 is formed about which the upper side wall margin 22 is bent to form a reentrant lap 29 upon which the vertical margin upper edge 23 and the end flap margin 24 are subsequently superimposed. This involves four thicknesses at the cornes, and when either of the advancing side turn-in fingers 18 and 20 in position it in effect creates an extra thickness at the corner. It will be evident that when conventional end turn-in fingers advance to force the end flap marginal assembly to in-bent relation over the end wall, and it advances as is customary with a horizontally positively guided advance it exerts a shearing stress on the paper wrap which frequently causes tearing of the covers and spoilage of the box.

It will be evident that in the case of heavy paper it is necessary to raise the plane of travel of the end turn-in finger if the shearing stress imparted to the upstanding margins is to be able to bend the margins about the end wall of the box without rupture of the paper. Obviously this causes loose corner constructions and unsatisfactory wrapping of the box.

I have found that all of the disadvantages of the prior art of turn-in fingers can be obviated and uniformly successful, neat, tight and efficient wrapping can be effected by providing a floating end turn-in finger which adjusts itself to resistance to convert shear into a turning moment regardless of the weight of wraps used.

A preferred embodiment of the invention is shown in Figs. 1, 2 and 3 in which the turn-in finger proper, comprising the paper contacting portion, consists of the median blade 30 having the raised or offset ends 31, normally in a plane parallel to the body of the median blade 30, such plane being spaced from the plane of the blade body a distance slightly greater than the thickness of the side turn-in fingers 27. The blade 30 is preferably mounted rigidly on a pivoted weighted frame 32, including a clamp 33 having a reduced upper surface 34 lying in a plane substantially common to the upper surface of the embossed ends 31. Weighted element 32 includes the end offsets 35 having laterally disposed trunnions 36 journaled respectively in ears 37. These ears 37 project from a head 38 carried by rods 40 having guided reciprocation in the supports 41 (not shown) and controlled by the pivoted operating link 41 as is conventional for turn-in fingers of the prior art.

As shown in Fig. 6, the upper facing or wiping block 25 has been withdrawn from the box, and the pivoted or floating end turn-in blade 30 starts forward in slightly spaced (vertically) re-
to this upper edge of the end wall of the box. At this juncture the turn-in blade 30 is substantially at right angles to the wall 14 of the box. Since the action of one blade 30 is a duplicate of the other, and, as shown, both operate in synchronism, this description will be directed to what happens as one blade 30 operates. Thus as a blade 30 moves inwardly into contact with a flap 24, it has to overcome the resistance of the material to bending, which resistance varies in accordance with the thickness of the material. Therefore as the inward movement of the blade 30 continues the pivotal action of the trunnions 38 allows the blade 30 to ride upwardly along the face of the flap 24 thereby gaining leverage on the flap for a uniform and accurate turn-in of the flap above the top faces of the side fingers 27. In this connection it will be seen that the relation of the offsets 31 to the body of the blade 30 permits the inward movement of the blade 30 without interference with the fingers 27.

In place of swinging on the short radius shown in Figs. 1, 3 and 7, it will be appreciated that as shown in Fig. 10 the entire assembly can swing on a long radius to the same general effect, if the finger supporting device is so pivoted as to obtain the result.

As shown in Fig. 11 similar results can be obtained when the entire finger assembly is arranged for vertical floating as a resultant of resistance of the corners to bending.

In any case the shearing motion of the finger is converted into rolling or turning motion of the finger because of its floating relation and the end composite flap is bent about and either completely folded, or the descending block 25 forces it downwardly into contact with the upper surfaces of the flaps against the upper wall to mash the assembly into tight turned corners and ends.

I claim as my invention:

1. In turn-in fingers for box wrapping machines, a horizontally reciprocable supporting assembly, a supporting frame journalied in the assembly and having angularly divergent surfaces arranged to abut the supporting assembly in extreme oscillative position of the frame and assembly, and a turn-in finger mounted on the frame.

2. In turn-in fingers for box wrapping machines, a two part forming block for the box, a vertically floating horizontally reciprocating turn-in finger arranged to adjust itself in accordance with the resistance encountered from the wrap, the upper of said two part forming block being arranged to contact with and to force the floating turn-in finger downwardly toward a predetermined position relative to the edge of the box.

3. A method of turning-in the upper edges of a wrap about the edge of an end wall of a box without tearing the corners which comprises advancing a floating turn-in finger laterally against the upstanding margin of the wrap as it exists after the advancement of the side turn-in finger, and in permitting it to float upwardly as a function of the resistance of the wrap to turning about the end of the box while advancing across the end of the box, then in forcing an upper forming block downwardly upon the floating turn-in finger to compress the turned wrap against the upper surface of the end wall.

4. A method of turning-in the upper edges of a wrap about the edge of an end wall of a box without tearing the corners which comprises advancing a floating turn-in finger laterally against the upstanding margin of the wrap as it exists after the advancement of the side turn-in finger, and in permitting it to float upwardly as a function of the resistance of the wrap to turning about the end of the box while advancing across the end of the box, then in forcing an upper forming block downwardly upon the floating turn-in finger to compress the turned wrap against the upper surface of the end wall, then withdrawing the end turn-in finger and dropping the upper forming block downwardly against the in turned flattened marginal surfaces and then into the box to wipe the marginal edge about the inner surface of the end wall of the box.

ERNST G. RIDER.