

[54] APPARATUS AND METHOD FOR FOLDING OF TABS IN A RIGHT ANGLE TRANSFER ZONE

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[58] Field of Search. .... 93/49 R, 49 AC, 49 M; 271/35

[56]

### References Cited

#### UNITED STATES PATENTS

3,604,316	9/1971	Labombarde .....	93/49 R
3,111,885	11/1963	Perrelli .....	93/49 M
2,879,699	3/1959	Labombarde .....	93/49 R

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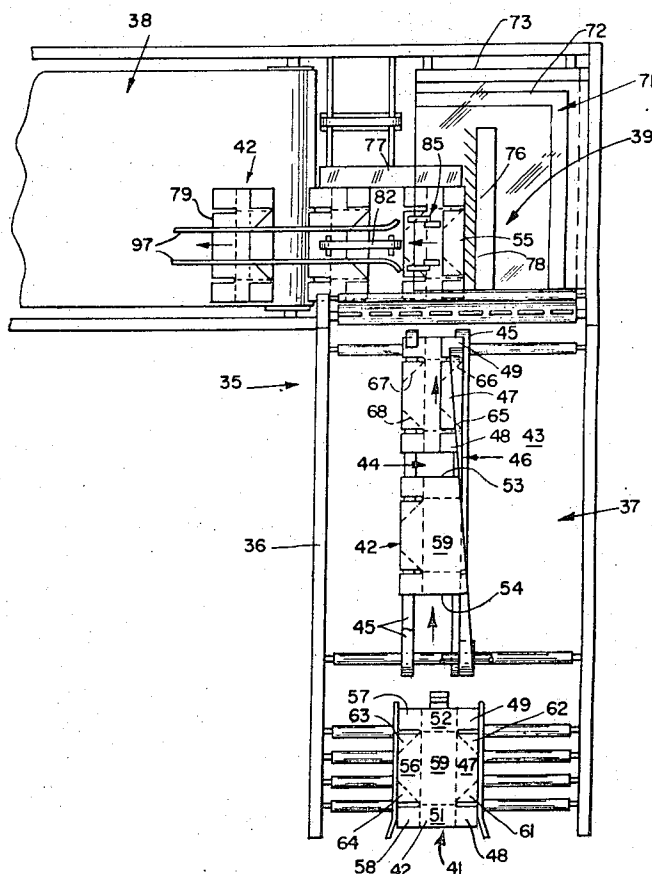
Attorney, Agent, or Firm—Pearson & Pearson

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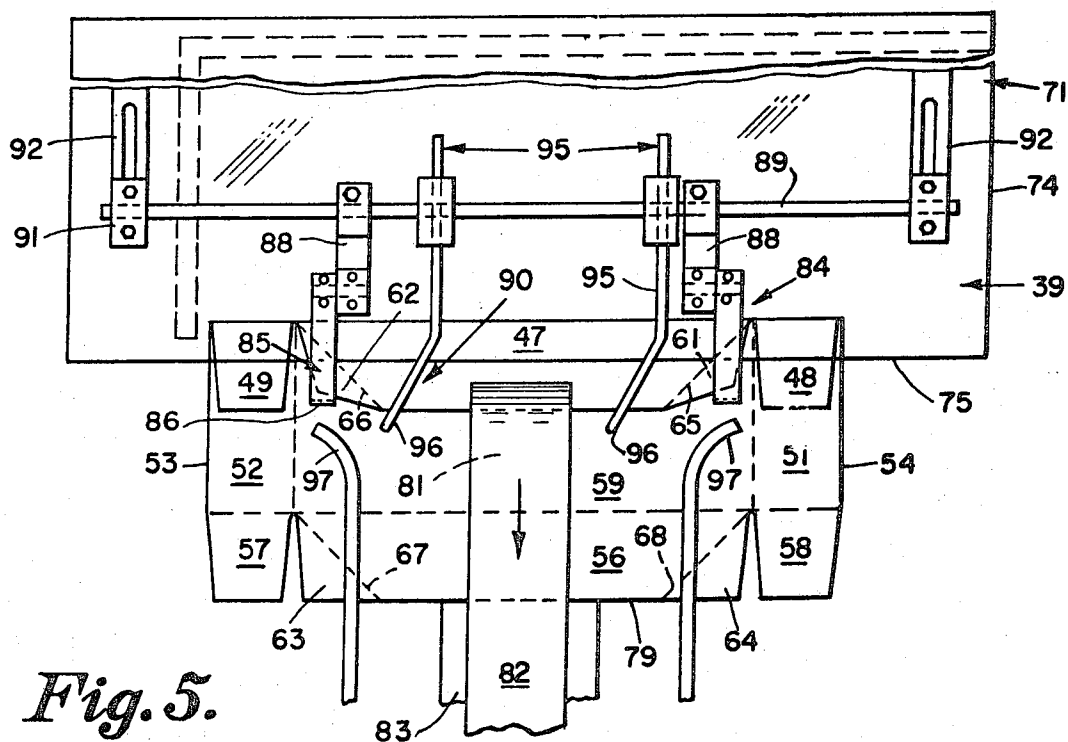
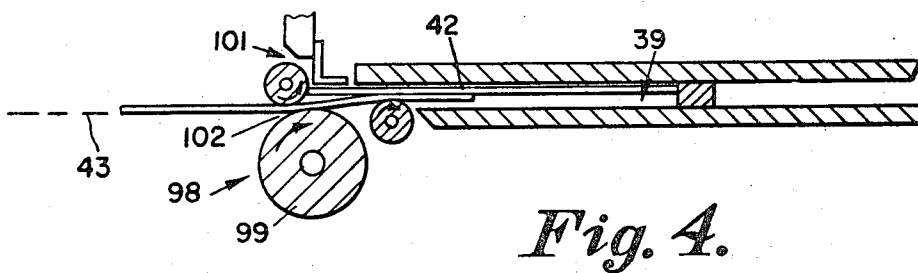
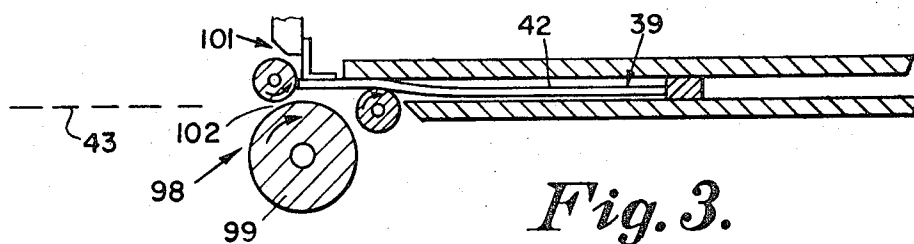
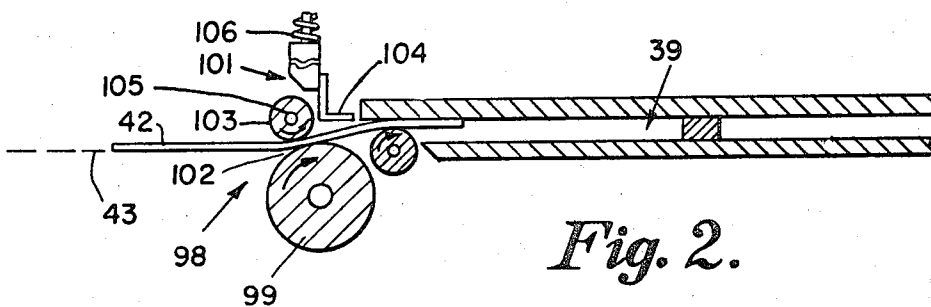
### ABSTRACT

In a right angle paper box blank folding machine the diagonal tabs on the trailing overfolded flaps of successive blanks advanced across the transfer zone into the second flap folding section are backfolded while still in the transfer zone and before they enter the carrier belt nips of the second section. Tapered edge tips of resilient folding hooks are cammed upwardly by blanks entering the zone to ride on each blank until it leaves the zone. Upon exiting from under the transfer zone cover the tips hook on the diagonal tabs and backfold them.

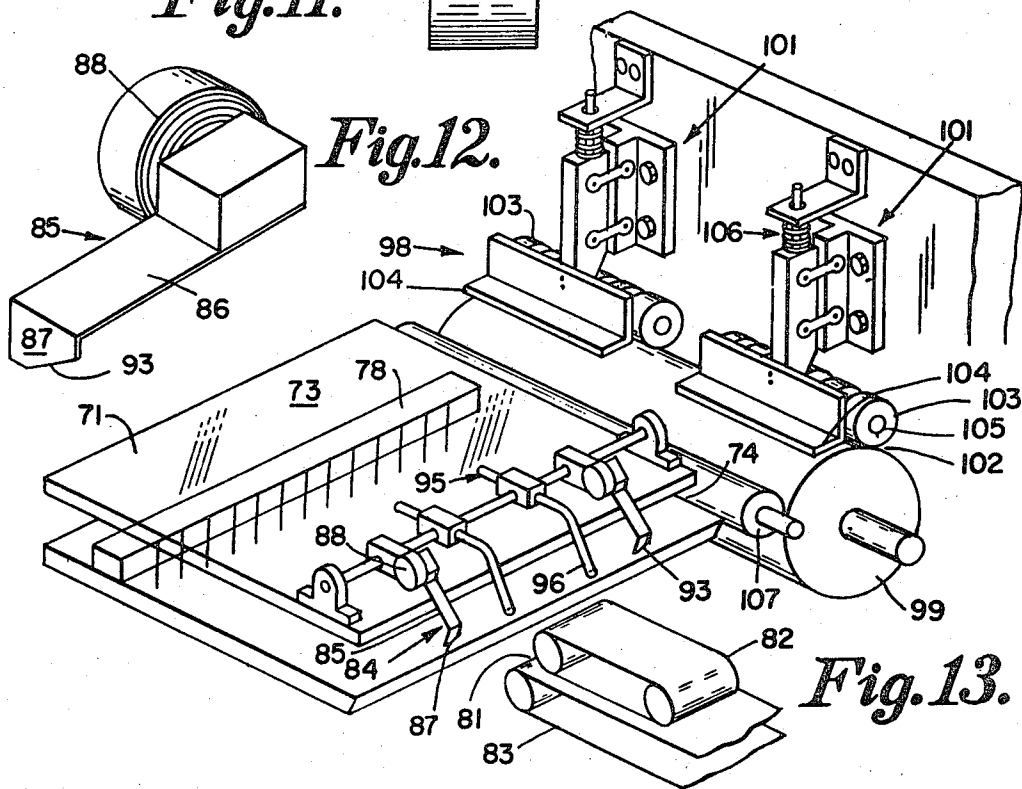
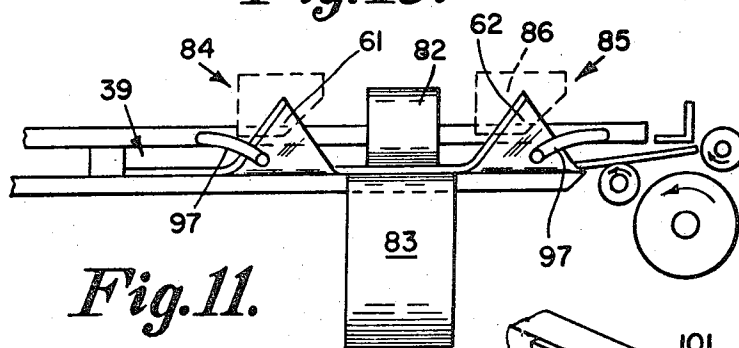
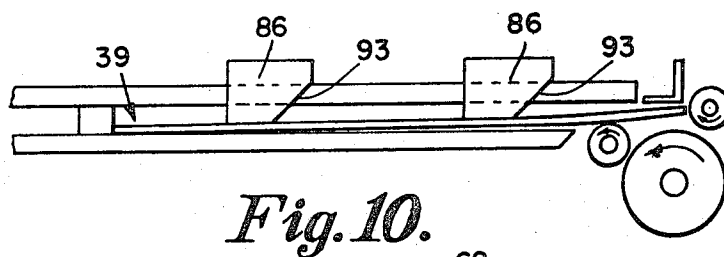
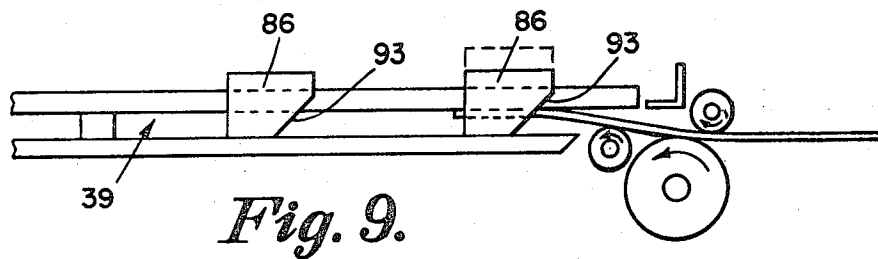
10 Claims, 13 Drawing Figures











# APPARATUS AND METHOD FOR FOLDING OF TABS IN A RIGHT ANGLE TRANSFER ZONE

## BACKGROUND OF THE INVENTION

In U.S. Pat. No. 3,111,885 to Perrelli of Nov. 26, 1963, a right angular folding machine is disclosed in which flat folding paper box blanks are fed individually and successively from a magazine along the paper line of a first flap folding section and into a right angle transfer zone. The diagonal tab carrying flaps along one side of the blanks are overfolded in the first section. The blanks are then engaged along the overfold line by a kicker in the transfer zone and advanced at right angles to the first section, into the nip of carrier belts in the second flap folding section. As the blanks advance along the second section the diagonal tabs of the trailing overfolded flaps are backfolded by angle rods and the leading flaps are overfolded rearwardly.

In my U.S. Pat. No. 3,604,316 of Sept. 14, 1971 a similar right angle machine is disclosed in which a series of flexible springs are used to flip the blanks transversely into the second section and rotating nip roll means is disclosed for advancing the blanks to the end stop of the transfer zone.

## SUMMARY OF THE INVENTION

This invention relates to a similar right angle folding machine in which the blanks are delivered into the transfer zone with the trailing diagonal tab carrying flaps overfolded, the trailing fold line being engaged by the leaf springs, or other transfer means and the blanks flipped at right angles to the first section into the second section.

In the Perrelli apparatus, the stationary abutments, or angle rods, used to backfold the diagonal tabs are critical as to adjustment in that they must be sufficiently above the paper line to miss the leading unfolded edge of the blanks, but low enough to engage the edge of the overfolded diagonal tabs. Hence the speed of operation is limited and the apparatus is subject to skips and jams.

Such skips and jams are avoided in this invention by accomplishing the back folding of the diagonal tabs of the trailing flaps in the transfer zone, and in advance of the second flap folding section, rather than accomplishing the diagonal tab fold in the second section. The tips of the resiliently mounted folding hooks are located in the transfer zone, just beyond the exit edge of the transfer zone cover and in the path of the forward edge of oncoming blanks being delivered into the zone by the first flap folding section. The side edge of the hook tip facing the oncoming blanks is tapered, or cammed, to cause the tips to be lifted onto the upper face of each blank, without damage to blank or hook. The tapered tips are aligned to intercept the overfolded diagonal tabs of the blanks, as the blanks advance thereunder and to hook on and backfold the same in cooperation with holddown means including holddown rods and the exit edge of the cover.

To increase the speed of the machine, without jam ups, the oncoming blanks entering the transfer zone, slide under the preceding blank being urged upwardly against sectional stop and guide means. The sectional stop and guide means includes a plurality of sets of small diameter, smooth faced nip rolls each having a section of a stop plate at the level of the centre thereof

so that the section over the overfolded flaps of the blanks may rise accordingly to conform therewith while the other parts of the section serve as a side guide for the adjacent edge of the blank.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of the transfer zone portion of a right angular paper box blank folding machine,

FIG. 2 is a diagrammatic fragmentary side elevation in section on line 2—2 of FIG. 6 of the combined stop and side guide means of the invention, showing a blank entering the transfer zone,

FIG. 3 is a view similar to FIG. 2 in section on line 3—3 of FIG. 7, showing the blank fully in the transfer zone and starting in the right angular direction,

FIG. 4 is a view similar to FIG. 3 in section on line 4—4 of FIG. 8, showing the next succeeding blank sliding under the preceding blank in shingle formation, while the rearward edge of the preceding blank is guided by the stop plate,

FIG. 5 is an enlarged fragmentary plan view showing the diagonal tabs of the trailing overfolded flaps of a blank being backfolded while exiting from the transfer zone,

FIG. 6 is a fragmentary plan view corresponding to FIG. 2 and showing a blank entering the transfer zone with one hook lifted up and riding on the blank;

FIG. 7 is a fragmentary plan view corresponding to FIG. 3 and showing the blank fully in the transfer zone, with both hooks lifted up and riding thereon and the blank moving transversely toward the second section,

FIG. 8 is a plan view corresponding with FIG. 4 and showing a succeeding blank sliding under the transversely moving preceding blank, showing the hooks backfolding the tabs and showing the sectional nip rolls and guide plates lifting to accommodate the folded flaps;

FIGS. 9, 10 and 11 are fragmentary, side elevations from the exit end of the transfer zone showing the tapered tips of the folding hooks being cammed upwardly by the oncoming blanks in FIG. 9 riding thereon in FIG. 10 and backfolding the tabs thereof in FIG. 11,

FIG. 12 is a perspective view showing the tapered tip end of a folding finger of the invention, and

FIG. 13 is a diagrammatic perspective view of the transfer zone of the machine illustrating the plurality of individual sections of nip roll, stop plate elements.

## DESCRIPTION OF PREFERRED EMBODIMENT

As shown in the drawings, 35 is a known type of right angular, untimed, paper box blank folding machine having a frame 36, a first flap folding section 37, a second flap folding section 38 at right angles to the first section and a transfer zone 39 at the junction of the first and second section. The first flap folding section 37 includes a conventional untimed blank magazine 41 for feeding flat paper box blanks 42 from a stack thereof, individually and successively along the paper line 43 of the first section 37, the blanks being spaced apart by a gap 44.

Suitable upper and lower belt carriers, indicated generally at 45, are provided in the first section 37 for advancing the blanks 42 along the paper line 43, and suitable blank folding mechanism 46, such as fold belts, is provided in the first section to overfold the side flaps 47 and the tabs 48 and 49 on the end flaps 51 and 52,

all in a manner well known and shown in both of the above mentioned patents. Each blank 42 also includes a forward edge 53, a rearward edge 54, an overfolded side edge 55, side flap 56, tabs 57 and 58 on end flaps 51 and 52 and a bottom panel 59.

The great advantage of a box folding machine 35, of the right angular untimed type, is that blanks 42 with diagonal tabs 61, 62, 63 and 64, foldable on diagonal fold lines 65, 66, 67 or 68 on the side flaps 47 or 56, can be formed into collapsed, completed, glued trays or the like thereon. It will be understood that hooks, plows, fold belts and the like can easily overfold most flaps and tabs of flat box blanks but to fold both side flaps 47 and 46 inwardly and fold the tabs 61, 62, 63 and 64 thereon outwardly, while the blanks are advancing through the machine has always been a difficult folding accomplishment in the art. It has been especially difficult to accomplish with a simple apparatus occupying minimum floor space, most solutions to the problem involving travelling carriages with movable folding arms or unduly elongated folding zones and being somewhat clumsy, cumbersome and inaccurate while not being easily adjustable to accommodate new runs of blanks of different dimensions.

In this invention, the right angular blank transfer zone 39, at the junction of the first flap folding section 37 and the second flap folding section 38, includes the cover means 71, having a frame 72 pivoted to frame 36 so that it can be raised when necessary and preferably having a transparent plastic cover 73 with an entrance edge 74 and an exit edge 75 (FIG. 5). An adjustable side guide 76 and a movable stop bar 77 are provided in transfer zone 39, and the transfer mechanism 78 is preferably the leaf springs disclosed in my Pat. No. 3,604,316.

In the transfer zone, for convenience of description the overfolded side edge 55 of the blanks is termed the trailing edge, the overfolded flaps 47, 48 and 49 are termed the trailing flaps, the unfolded flat flaps 56, 57 and 58 are termed the leading flaps and the edge 79 is termed the leading edge, because the transfer mechanism 78 automatically flips each successive blank 42 transversely at right angles to the first section 37, when released thereby, so that the leading edge portion 79 is gripped in the entrance nip, or throat, 81 of the upper and lower belt carriers 82 and 83 of the second flap folding section 38 (FIG. 5).

The diagonal tab, back-folding means 84 of the invention is located in the transfer zone 39, rather than in the second flap folding section 38, thereby reducing the floor space required by the second section to complete the folding of the blanks. Means 84 includes folding hook means 85, which preferably comprise a plurality of flexible resilient, yieldable folding hook such as 86, each having a downturned tip 87 and having a spring biased base end structure 88, rotatably and slidably mounted by set screw brackets on the support rod 89 (FIG. 5). The support rod 89 is mounted in slide elements 91 which in turn are slidably adjustable in tracks 92 so that the hook tips 87 may be aligned in the path of the forward edges 53 of the oncoming blanks 42 within zone 39, just beyond the exit edge 75 of cover 73 and just in advance of the entrance throat 81 of the second section 38.

Since the hooks 86 are in the transfer zone, they would be struck by the incoming blanks for the damage of both blank and hook, except for the novel feature

that at least one side edge 93 of each tip 87 is tapered, beveled, curved or otherwise provided with an inclined surface whereby the oncoming forward edges 53 cam, or lift the tips 87 upwardly out of the path to ride on the upper face 94 of the blank as it enters the transfer zone. This permits the tips 87 to always be in rear of the leading edge 79, when the blanks are advanced transversely, so that they will not undesirably hook onto the leading diagonal tabs 63 and 64 and overfold the same, but will intercept and hook onto the diagonal tabs 61 and 62 of the trailing flap 47 and backfold the same.

Holddown means 90 is provided including the exit edge 75 of cover 73 and a plurality of holddown rods 95, the rods 95 being mounted on support rod 89 for set screw adjustment rotatably and slidably thereon and having tips 96, at the level of paper line 43, for holding down the body of the flap 47 while the tabs 61 and 62 emerge from under the cover edge 75 and are back folded. The holddown means 90 assures that the tabs 61 and 62 will first bow, and then fold exactly on the diagonal fold lines such as 65 and 66 thereby assuring a commercially acceptable folded carton.

Suitable adjustable folding bars, or plows 97 are mounted in the path of the upfolded diagonal tabs 61 and 62 to complete the back folding thereof and to retain the tabs in overfolded condition in the second flap folding section.

The combined stop and edge guide means 98 of the invention includes a single, elongated, driven lower nip roll 99 opposed by a plurality of individual sets of combined rolls and stop plates such as 101, each set forming a pressure nip 102 with the lower roll, but being resiliently yieldable to conform to the overfolded flaps 47, 48, 49 of blanks 42 as the blanks pass therethrough. Each set 101 includes a plurality of small diameter smooth faced bearings, discs or rolls 103 having a generally horizontal stop plate 104 at the level of the centre 105 of the rolls and mounted by suitable spring means 106 to yield upwardly to pass an overfolded flap.

A roll 107 is positioned to raise the trailing portion of each successive blank 42, discharged from nip 102, upwardly until it is stopped by the set of plates 104 with its rearward edge 54 at the level of the centre of the smooth faced rolls 103. Thus as the blank 42 is then moved transversely by the transfer mechanism 78, its then side edges are guided by the face of the rolls and the stop bar 77 for accurate control until the blank is gripped by the second flap folding section. Because the trailing portion of each blank has been lifted up against the stop plates 104, the next succeeding blank can be slid under it and can be entering the transfer zone while the preceding blank is leaving transversely and having the diagonal tabs thereon backfolded while still in the transfer zone.

It should be noted that the tips 96 of the holddown rods 95 are bent at 108 so that the forward edges 53 of the oncoming blanks 42 will not crumple against a barrier, but will be deflected harmlessly under the tips as they are advanced into the transfer zone.

I claim:

1. In a right angular paper box blank folding machine of the type having a first flap folding section, a second flap folding section at right angles to said first section, a blank transfer zone at the junction of said sections, a holddown cover and blank transfer mechanism in said transfer zone and folding mechanism in said first sec-

tion delivering each successive blank into said transfer zone with the diagonal tab carrying flaps thereof overfolded on a fold line engaged by said transfer mechanism and held down by said cover the combination of:

diagonal tab back folding means at the exit of said transfer zone, and at the entrance nip of the carrier belts of said second flap folding section, including hook means permitting the passage thereunder of each successive blank delivered into said zone by said first section; for permitting the passage of the unfolded leading edge thereof into said second flap folding section and for intercepting and backfolding the diagonal tabs on the overfolded trailing flaps of said blanks while the remainder of the said trailing flaps are held down.

2. A combination as specified in claim 1, wherein: the hook means of said diagonal tab back folding means comprises a plurality of spring biased hooks mounted above the path of said blanks in said transfer zone with the tips thereof extending downwardly to engage said blanks at a spaced distance inside the leading unfolded edge thereof and just beyond the adjacent exit edge of said cover; whereby the overfolded trailing flaps on said blanks are still partially under said cover edge while said hooks are backfolding the diagonal tabs thereon, to thereby bow and break said tabs exactly on the diagonal fold line thereof.

3. A combination as specified in claim 1, wherein: the hook means of said diagonal tab backfolding means comprises a plurality of spring pressed folding hooks each in the path of a diagonal tab on a trailing overfolded flap of said blanks, and each having a tip with at least one side edge thereof tapered to permit each blank approaching from that sidewise direction to pass thereunder without breakage while lifting the hook to ride on the blank.

4. A combination as specified in claim 1; wherein the hook means of said diagonal tab backfolding means comprises a plurality of spring biased flexible folding hooks, each with a tapered tip in the path of each oncoming blank delivered into said zone and adapted to ride thereon ready to intercept and backfold said diagonal tabs, each hook having a base end rotatably and slidably mounted on a support rod carried by said cover, and said support rod being movably mounted on said cover;

whereby the tapered tips of said hooks may be aligned along the edge of said cover in the path of the diagonal tabs of blanks of various dimensions.

5. A combination as specified in claim 1, plus: combined stop and edge guide means extending transversely of said first section, just in advance of said transfer zone, said means comprising a plurality of individually yieldable, resiliently mounted sections each including a set of upper, small diameter, smooth faced rolls for forming a nip with an elongated driven lower roll and each including a generally horizontal stop plate at the level of the centre of the smooth face of said small diameter rolls, whereby the trailing edge of each successive blank delivered through said nip may be lifted up to the

level of said stop plates by the next successive blank being shingled thereunder, said plate and rolls may serve as an edge guide as said blanks are moved transversely in said transfer zone, and said individual roll and plate sections may accommodate themselves to the thickness of the overfolded blanks passing thereunder.

6. An untimed, right angular, paper box blank, folding machine having a first, flap folding section, a second, flap folding section at right angles to said first section and a blank transfer zone at the junction of said sections, said machine characterized by:

holddown means extending over said transfer zone for holding down the trailing, overfolded, diagonal, tab flaps of each successive blank received in said zone while said blanks are advanced with leading flaps unfolded out of said zone into said second section;

and diagonal tab backfolding hook means within said transfer zone in advance of said second section, co-operable with said holddown means for permitting the passage of the leading flaps of each successive blank advancing thereunder, but intercepting and hooking on the diagonal tabs on the trailing flaps of each said blank to backfold said tabs, whereby said blanks enter said second flap folding section with the diagonal tabs on the trailing flaps thereof already backfolded.

7. A machine as specified in claim 6 wherein: said diagonal tab backfolding hook means comprises a plurality of resilient, yieldable hooks each having a tip in the path of a diagonal tab and each tip having at least one side edge tapered to permit a sidewise approaching blank to lift the same without damage to ride on the upper face of the blank.

8. A machine as specified in claim 6 wherein: said holddown means includes a cover having an exit edge spaced from the entrance of the carrier belt nips of said second section and in parallelism therewith,

and said hook means includes a plurality of folding hooks each having a tapered tip in the path of a diagonal tab of said trailing flaps and operably located just beyond said exit edge of said cover;

whereby said cover edge holds down the trailing flaps emerging from thereunder as said tapered tips backfold said diagonal tabs to cause said tabs to fold on the diagonal fold lines thereof.

9. A machine as specified in claim 6; wherein said holddown means includes a cover extending over said transfer zone having an exit edge, said hook means comprises a plurality of resilient folding hooks mounted on said cover, each having a tapered tip operable on said blanks just beyond said exit edge, and said holddown means includes holddown rods mounted on said cover to extend beyond said exit edge alongside the tapered tips of said hook means.

10. A machine as specified in claim 6: wherein said diagonal tab back folding means includes a plurality of yieldable, resiliently mounted folding hooks each having a hooked tip with a tapered side edge for permitting sidewise passage of blanks thereunder and includes a plurality of folding bars, mounted in said second section and co-operable with said tapered hook tips to complete the overfolding of diagonal tabs advancing thereunder.

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