March 31, 1959 R. A. LABOMBARDE 2,879,699

FOLDING APPARATUS FOR LEADING FLAPS

Filed Feb. 26, 1957 2 Sheets-Sheet 1

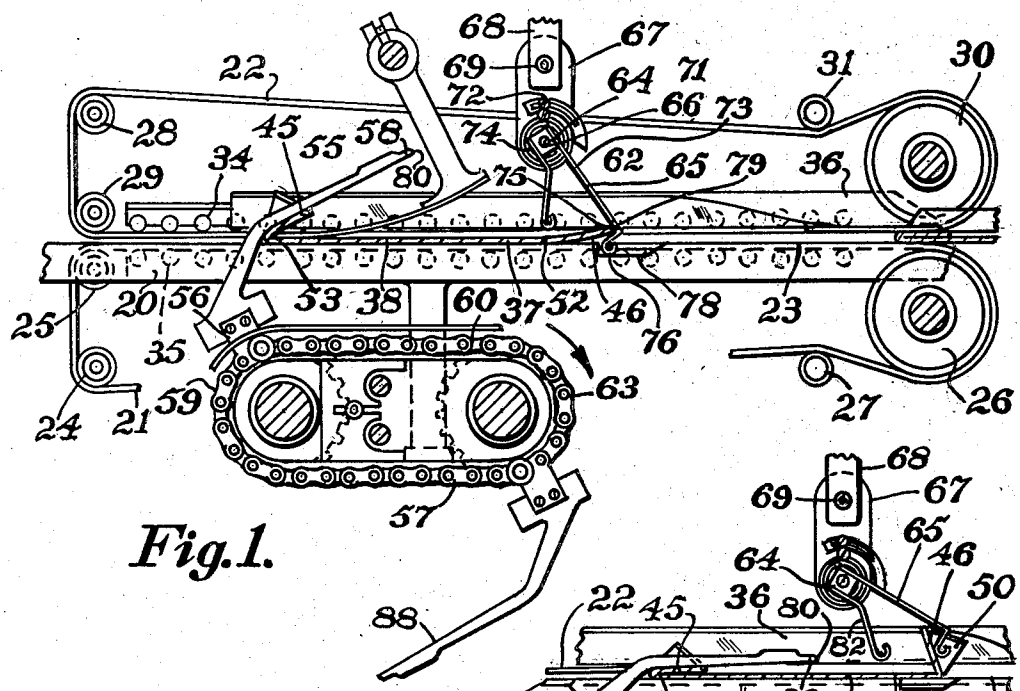


Fig. 1.

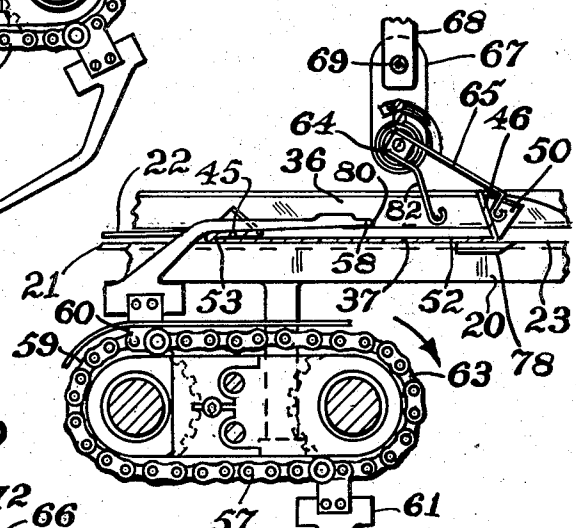


Fig. 2.

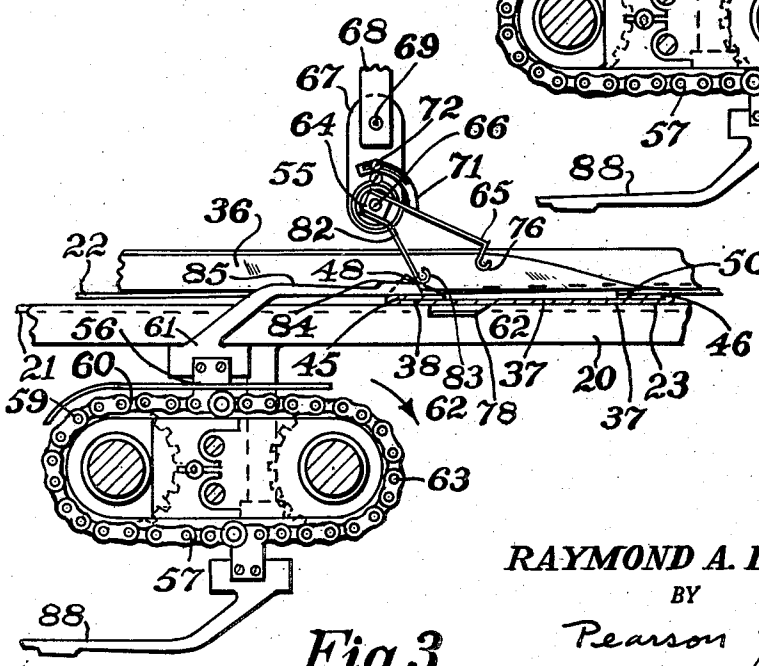


Fig. 3.

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March 31, 1959 R. A. LABOMBARDE 2,879,699

FOLDING APPARATUS FOR LEADING FLAPS

Filed Feb. 26, 1957 2 Sheets-Sheet 2

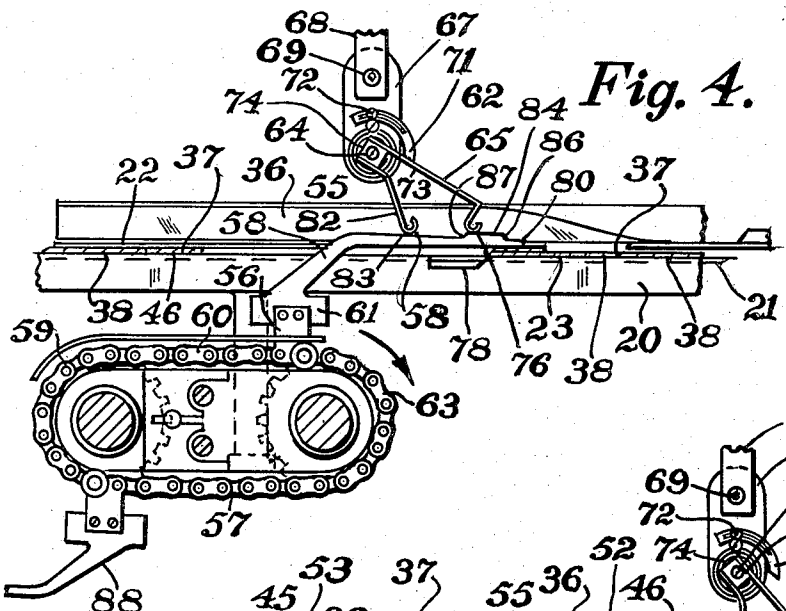


Fig. 4.

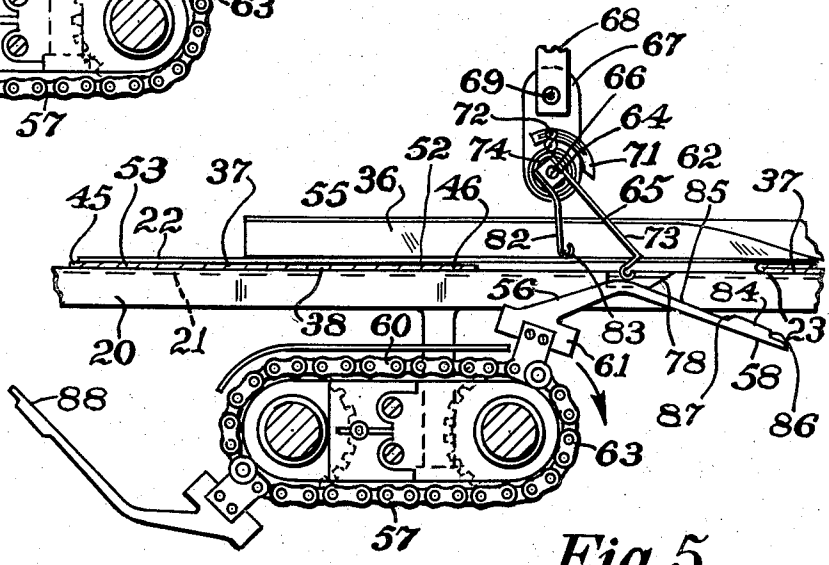


Fig. 5.

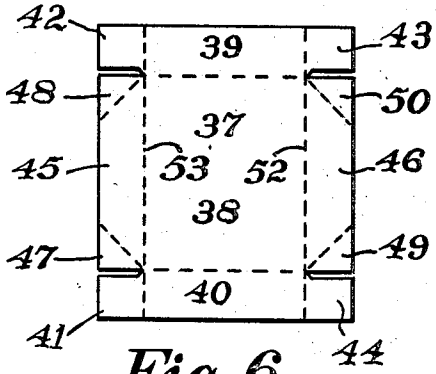


Fig. 6.

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2,879,699

FOLDING APPARATUS FOR LEADING FLAPS

Raymond A. Labombarde, Nashua, N.H.

Application February 26, 1957, Serial No. 642,606

9 Claims. (Cl. 93—49)

This invention relates to machines for folding the leading and trailing flaps of flat articles advancing along a path through the machine.

In such flat articles, for example paper box blanks, a particular difficulty arises when the trailing flaps are directly behind the leading flaps so that both follow the same longitudinal path through the machine. This is for the reason that there must be space above the path in which the leading flap may be overfolded rearwardly and an overfolded trailing flap will rise up into such space and unfold as it passes through the leading flap folding zone. A holddown bar or similar stationary holddown element extending along the leading flap folding zone to hold down the trailing flaps would, of course, prevent the overfolding of the leading flaps.

In U.S. Patent 2,764,918 to Leon E. La Bombard of October 2, 1956, a rod rotating in a vertical plane above the path of the articles engages the trailing flaps and holds them down as the flaps pass through the leading flap folding zone. In my copending applications Serial No. 448,616, filed August 9, 1954, Serial No. 448,720, filed August 9, 1954, now patent No. 2,839,972, June 24, 1958, and Serial No. 459,114, filed September 29, 1954, a forwardly hooked folding finger overfolds the trailing flaps, then advances therewith through the leading flap folding zone while holding the flaps down and then drops below the path of the articles. In my copending application Serial No. 583,494, filed May 8, 1956, an untimed hooked folding arm, or member, is provided to engage each leading flap and overfold the same rearwardly.

This principal object of this invention is to provide an untimed hooked folding arm arranged to overfold rearwardly each successive leading flap passing thereby and arranged to pass already overfolded trailing flaps, without hooking onto the same, by untimed, article actuated means.

Another object of the invention is to provide a hooked folding arm arranged to overfold rearwardly each leading flap of each article passing thereby, without timing mechanism but cooperative with timed trailing flap holddown means to move out of the path of said means and the flaps held down thereby.

A further object of the invention is to provide a hooked folding arm in a leading flap folding zone and a forwardly hooked folding finger advancing through said zone to hold down folded trailing flaps, the finger lifting the arm out of the way of the trailing flaps and then lowering the arm with greatly diminished rebound effect.

Another object of the invention is to provide longitudinally aligned leading and trailing flap folding mechanism, both operable in a leading flap folding zone, wherein even an upwardly curled leading flap will be overfolded rearwardly and wherein no jams occur if the machine skips a blank or is operated without blanks.

Still another object of the invention is to provide a novel mechanism for the untimed overfolding of leading flaps of flat articles advancing along a path, which mechanism

includes a pivoted arm having a flap engaging hook and an actuating arm having an actuatable portion in advance of the hook and above the path of said flat articles. The hooked finger thus falls into flap engaging position in the space between flat articles but is supported out of the way of any overfolded portion of an article engaging said actuatable portion.

Other objects and advantages of the invention will be apparent from the claims, the description of the drawing and from the drawing in which:

Fig. 1 is a fragmentary side elevation, partly in section, of the trailing flap folding zone and the leading flap folding zone of a paper box blank folding machine. The leading and trailing flaps of a typical blank are shown being overfolded in their respective folding zones.

Fig. 2 is a view similar to Fig. 1 showing the overfolding at a later stage.

Fig. 3 is a similar view showing the leading flap completely overfolded and the trailing flap finger entering the leading flap folding zone.

Fig. 4 is a similar view showing the trailing flap finger supporting the hooked folding arm out of the way as it holds down the trailing flaps through the leading flap folding zone.

Fig. 5 is a similar view showing the gentle disengagement of the trailing flap finger from the hooked folding arm without rebound of the latter.

Fig. 6 is a plan view of a flat article having leading and trailing flaps adapted to be folded by the invention.

As shown in the drawing, **20** represents the frame of a paper box folding machine, of a well known type, the machine having one or more lower carrier belts such as **21** and one or more upper carrier belts such as **22** for advancing flat articles individually and successively along a path through the machine such as the paper line **23**. Lower carrier belt **21** is trained around pulleys **24** and **25**, a drive pulley **26** and is tensioned by a tension pulley **27**. Upper carrier belt **22** is trained around pulleys **28** and **29**, a drive pulley **30** and is tensioned by a tension pulley **31**. Suitable upper and lower presser roll cages **34** and **35** are provided as well as suitable longitudinally extending twisted folder bars such as **36**.

As shown in Fig. 6 a typical flat article adapted to be folded by the apparatus of this invention comprises the flat blank **37** which forms a collapsed tray when folded and glued. Blank **37** includes a bottom panel **38**, side wall panels **39** and **40** having glue tabs **41**, **42**, **43** and **44** thereon and side wall panels **45** and **46** having triangular glue tabs **47**, **48**, **49** and **50** formed therein. The blanks **37** are fed to the machine by any well known type of feeding device and are continuously advanced along the paper line **23** by upper and lower carrier belts such as **21** and **22** with the flaps **43**, **44** and **46** in the lead and the flaps **41**, **42** and **45** trailing. The device of this invention is for the purpose of overfolding the leading flaps **43**, **44** and **46** rearwardly on the transverse fold line **52** and overfolding the trailing flaps **41**, **42** and **45** forwardly on the transverse fold line **53**. The triangular tabs **47**, **48**, **49** and **50** are folded in the opposite direction from that of the flap of which they form a part on their respective diagonal fold lines. The remaining operations on the blank to form a completed collapsed tray are well known and form no part of this invention and therefore are not described herein.

55 represents a trailing flap folding zone and a trailing flap such as **45** is overfolded forwardly in zone **55** by trailing flap folding means **56**. Each flap folding means **56** includes an endless carrier **57** mounted on frame **20** below paper line **23** and driven in synchronization with the drive pulleys **26** and **30**. One or more forwardly hooked folding fingers **58** are mounted on each carrier **57** and arranged to overfold the trailing flap such as

45, aligned therewith, as the finger rounds the rearward end stretch 59 of the carrier 57.

Each finger then advances along the upper stretch 60 of its carrier 57 at a less rate of speed than the carrier belts 21 and 22 so that it holds the folded trailing flap down through the leading flap folding zone 62 while the article gradually draws away from thereunder. Near the forward end stretch 63 of each carrier 57 the overfolded trailing flaps have drawn ahead of the finger completely and passed under a holddown bar thus permitting the finger to drop below the paper line 23 on its return path. The operation of the flap folding means 56 is explained in detail in my copending application Serial No. 448,720, filed August 9, 1954, but in combination with timed, rotating means for folding the leading flaps.

As explained in said application, each finger 58 comprises a base 61 adapted to be mounted in fixed upstanding relationship on an endless carrier such as 57 and the forwardly turned terminal hooked portion in extension of the base 61 is preferably at least equal in length to the depth of the trailing flap it is designed to overfold.

In this invention instead of timed folding means in the leading flap folding zone 62 an untimed hooked folding arm 65 is provided. The arm, or finger, 65 includes a block 64 mounted on a transverse pivot pin 66 above the path of the flat articles, the pivot pin 66 being carried by a support 67 which in turn is angularly adjustable in a vertical longitudinal plane on a frame piece 68 by a set screw 69. An arcuate stop member 71 is adjustable by set screw 72 to stop the shank 73 of arm 65 at the desired height and cause it to rebound downwardly. A coil spring 74 is also provided on support 67 to resiliently urge the arm 65 downwardly. Arm 65 is bent rearwardly at an angle of 90° to form a right angular notch 75 and its terminal tip 76 is rounded forwardly to enable the arm to ride along the upper face of objects advancing therebelow.

A recess 78 is provided below the path of the articles and in the path of the tip 76 to accommodate the tip when the arm 65 is in its normal downward position. The leading edge 79 of each successive article such as blank 37 is thus guided directly into the notch 75 and further advance of the blank causes a leading flap such as flap 46 to fold upwardly while pivoting the arm 65 upwardly. When shank 73 strikes stop 71 the leading flap is forced to fold on its line of fold 52 and further advance causes the leading flap to move out from under the arm while being overfolded downwardly by the spring pressed arm.

It will be apparent that the terminal tip 80 of a forwardly hooked finger 58 traveling in alignment with an untimed hooked arm 65 through the zone 62 would catch in the notch 75 and destroy the arm 65. It will also be apparent that if the finger 58 were not aligned with the arm 65 but any portion of an overfolded trailing flap or tab were so aligned, the arm 65 would catch on such portion and fracture the same.

An untimed actuating arm 82 is therefore fixed to block 64 of the folding arm 65 and pivotable therewith on the transverse pivot 66. Actuating arm 82 includes an actuating portion 83 normally positioned in longitudinal alignment in advance of the notch 75 and above the path of a flat article advancing along paper line 23. Preferably actuating portion 83 is normally at about the level of an overfolded trailing flap and tab which level is proximate the level of the tip 76 of finger 58 when advancing along the paper line 23. The leading edge 79 of a flat leading flap such as 45 will thus pass below the actuating portion 83 without engaging the same and will enter the notch 75 of folding arm 65 for overfolding rearwardly by the arm 65. The overfolded trailing flap of each article is, however, advancing in a higher plane, or at a higher level, than the main body of the article and, regardless of how it is held down through the leading flap folding zone 62, can be arranged to slidably engage the actuating portion 83 and lift the arms 82 and 65 out of the path of the overfolded trailing flap.

When a forwardly hooked folding finger such as 58 is used it is preferred that the actuating portion 83 be engaged by the finger rather than the trailing flap as shown in the drawing. In addition it is preferred that an elongated, protruberance or abutment 84 be provided on the outer face 85 of each finger 58, the protruberance or abutment 84 upstanding therefrom at a substantially uniform height and having inclined forward and rearward ends 86 and 87 respectively.

In operation as shown in Fig. 1 each successive flat article such as the blank 37 is advanced continuously along the path formed by paper line 23 at a predetermined speed. In the trailing flap folding zone 55 a trailing flap such as 45 is overfolded forwardly by the finger 58 in its rapid sweep around the rearward stretch 59 of carrier 57. Any diagonal tabs such as 47 and 48 on the flap 45 engage a downfold bar such as 36 and are simultaneously overfolded to 45° on their diagonal fold lines in a direction opposite to the fold direction of flap 45. Preferably, during the forward folding operation of finger 58 the leading edge 79 of each leading flap such as 46 engages in notch 75 of untimed folding arm 65 and pivots the arm upwardly to overfold the leading flap 46 rearwardly. Any diagonal tabs such as 44 and 50 on a flap such as 46 are overfolded to 45° in the opposite direction by a twisted folding bar such as 36.

In Fig. 2 the finger 58 is shown advancing along paper line 23 and entering the leading flap folding zone while holding down the overfolded trailing flap 45. Since finger 58 is advancing along the straight upper stretch 60 of carrier 57 it is traveling at less speed than the blank 37 and the blank is gradually moving out from under the finger. Hooked folding arm 65 is completing the downfold of the leading flap 46.

In Fig. 3 the overfolded leading flap 46 has been downfolded and released by folding arm 65 and the terminal tip 76 of the arm 65 is spaced above the upper face of the main body of the blank 37. The actuating portion 83 of actuating arm 82 is directly in the path of the finger 58 and the trailing flap 45 is nearly out from under finger 58 but still being held down through the leading flap folding zone 62.

In Fig. 4 the actuating portion 83 of actuating arm 82 is riding along the upper face of finger 58 and the terminal tip 76 of folding arm 62 is riding along the flat, elongated, straight, upper, or outer, face of the protuberance 84 so that both arms are supported, any vibration is deadened and neither arm can be engaged by the overfolded trailing flap.

In Fig. 5 both the overfolded leading and trailing flaps have passed under the control of holddown bars or presser cages, the trailing flap 45 is no longer held down by the finger 58 and the finger 58 is dropping below the paper line 23 on its return movement. It should be noted that while dropping below the paper line the finger 58 is still supporting the terminal tip 76 of arm 65 and gently deposits the same in the recess 78 to reduce the possibility of rebound of the arm 65. As shown in Fig. 5 the next successive blank is now ready to be folded in a similar manner by a second folding finger 88 similar to finger 58 and mounted on carrier 57.

The diagonal glue tabs 47, 48, 49 and 50 travel through the leading zone in engagement with the 45° face of twister bars such as 36 and are completely downfolded by bar 36 beyond the leading flap zone. The leading and trailing flaps 41, 42, 43 and 44 are overfolded by similar mechanism but in another zone not shown, this being a well known expedient to permit one portion of the flat article to be held down while another portion is being folded.

I claim:

1. In a machine for folding the leading and trailing

flaps of flat articles, said machine being of the type having means for continuously advancing said flat articles individually and successively along a path through a trailing flap folding zone and a leading flap folding zone and having trailing flap folding means in said trailing flap folding zone, the combination of an untimed, hooked, folding arm pivotally mounted on a transverse axis above the path of said articles in said leading flap folding zone, said arm having its hooked portion normally below the path of said flat articles and adapted to intercept the leading edge of, and overfold rearwardly, each leading flap of an article passing thereunder and an untimed actuating arm pivotable on said axis with said folding arm and having an actuating portion normally above the path of said flat articles and in longitudinal alignment in advance of the hooked portion of said folding arm, said actuating portion being in the path of, and slidably engageable by the overfolded trailing flaps of each successive article to lift said folding arm out of the path of said overfolded trailing flaps.

2. A combination as specified in claim 1 wherein said trailing flap folding means includes a forwardly hooked folding finger advancing in timed relation through said leading flap folding zone while holding down said trailing flaps, the path of said finger being aligned with said actuating portion of said actuating arm and said finger being adapted to engage and lift said portion during passage thereby.

3. A combination as specified in claim 2 wherein said hooked folding arm and said actuating arm are each curved forwardly at the respective terminal tips thereof for riding on the upper face of said hooked folding finger.

4. A combination as specified in claim 1 wherein said actuating arm and said folding arm are both mounted on a block rotatable on said transverse axis, and said transverse axis is formed by a transverse pin carried on a support movable angularly in a vertical longitudinal plane whereby the relative heights of said arms may be varied.

5. A device for overfolding the leading flaps of flat articles advancing individually and successively along a path, said device comprising an untimed, hooked, folding arm adapted to pivot on an axis transverse to, and above the path of said articles for hooking onto the leading edge portion of a leading flap and overfolding said flap rearwardly and an untimed actuating arm, in longitudinal alignment therewith fixed to said folding arm, said actuating arm having an actuating portion in the path of, and adapted to be lifted by, any overfolded trailing flaps on said articles to thereby pivot said hooked folding arm out of the path of said trailing flaps.

6. As an article of manufacture a hooked folding finger for use in overfolding and holding down the trailing flaps on paper box blanks advancing through a paper box folding machine, said finger comprising a base adapted to be mounted in fixed upstanding relationship on an endless carrier; a forwardly turned terminal hooked portion in extension of said base at least equal in length to the depth of a trailing flap and an upstanding protuberance extending along the top of the terminal end of said hooked portion, said protuberance being adapted to engage and displace an actuating arm in its path and having a flat, straight, elongated, upper face for supporting said arm in displaced position while advancing thereunder.

7. A combination as specified in claim 1 wherein said trailing flap folding means includes a forwardly hooked folding finger advancing in timed relation through said leading flap folding zone while holding down said trailing flaps, an elongated abutment upstanding along the outer face of said folding finger and a flat, straight, elongated, upper face on said abutment adapted to engage and support the actuating portion of said actuating arm, to deaden the vibration of said folding finger as said trailing flaps pass thereunder.

8. In a machine for folding the leading and trailing flaps of flat articles, said machine being of the type having means for continuously advancing said flat articles individually and successively along a path through a trailing flap folding zone and a leading flap folding zone and having trailing flap folding means including a forwardly hooked folding finger advancing through said leading flap folding zone while holding down overfolded trailing flaps and then dropping below the path of said articles, the combination of a hooked folding arm pivoted on a transverse axis above the path of said articles in said leading flap folding zone and adapted to hook onto and overfold rearwardly each successive leading flap; an actuating arm pivotable in longitudinal alignment with said folding arm and having a portion above the path of said articles and in advance of the hook of said folding arm, and an elongated abutment upstanding from the outer face of said forwardly hooked folding finger, said abutment being in longitudinal alignment with and adapted to engage said portion of said actuating arm, lift said actuating arm and said folding arm out of the path of said overfolded trailing flaps, deaden the vibration thereof and then engage and lower said folding arm to its flap engaging position without rebound.

9. In a machine for overfolding longitudinally aligned leading and trailing flaps of flat articles the combination of means for continuously advancing said flat articles individually and successively along a path with at least one trailing flap of each article following the path of a leading flap of said article; a hooked folding arm pivoted on a transverse axis above the path of each said leading flap and adapted to hook on to the leading edge thereof to fold each said flap rearwardly; an actuating arm, longitudinally aligned with, and pivotable with, said folding arm; trailing flap folding means along said path adapted to fold each said longitudinally aligned trailing flap forwardly; mechanism advancing with said articles past said hooked folding arm for holding down said overfolded longitudinally aligned trailing flaps; and means, advancing with said mechanism, adapted to engage said actuating arm and thereby pivot said folding arm out of the path of each said trailing flap during its passage by said arm.

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