This invention relates to bag making machines generally of the type disclosed in the commonly assigned Adolph Potdevin patent application entitled "Improvement in Bag Making Machines" filed on even date hereunder Serial No. 255,238 and, more particularly, to improvements in a bag bottom trailing flap folding station for such machines.

In a bag making machine to which the present invention is particularly applicable, a web of sheet material is progressively transformed into a tube which, as rapidly as it is produced, is converted into bags of predetermined configuration. Accordingly, the web which may be of paper, is suitably fed through and exposed to tube pasting and forming stations by means of which it is progressively converted into a bellows sided tube. At prescribed intervals, the tube is periodically notched, slit and then severed in a predetermined fashion for conversion into tubular bags blank preparatory to bottom-forming operations upon the successive blanks.

Thus, the tube will have its leading end formed with a projecting tongue as well as a pair of parallel slits in the upper layer of the tube on each side of the tab. Similarly, the bottom layer of the tube, separated from the top layer by a pair of correspondingly aligned and parallel slits. Since the tube is severed transversely from a location proximal the base of the tab of the top layer, the trailing end of the thusly formed bag blank will include a notch corresponding in size with tab. This notch will be located on top of the ultimately finished bag such that, when a number of bags are stacked side by side, gripping of the bag by mere thumb pressure is facilitated. Most important of all, by so grasping the bag, the self opening aspect thereof is quite evident.

The tubular bag blank is now formed with a pair of upper parallel score lines adjacent the leading end of the blank. The score lines extend into a pair of companion score lines in the bottom layer of the blank. The leading end of the blank is now subjected to a tuck spreading operation during which the leading end is fully distended. While in this fully distended position, the leading end is flattened such that the upper layer is folded back on itself along one of these score lines to thereby provide a leading flap of bottom layer extending from one of the other score lines of the upper layer. Thus, the upper layer and bottom layer will cooperate and combine to form overlying panels disposed between the outermost companion score lines, respectively, of these layers.

Shortly thereafter, adhesive or paste is applied to the surfaces of the leading flap and overlying panel portions. The trailing flap is then folded along the leading score lines of the upper layer forwardly and upon the panel portions and, consequently, part of the applied and exposed adhesive. Subsequently, the leading flap is folded rearwardly along its leading score lines so that it will not only adhere to the panels but the outer surfaces of the trailing flap as well. The bag blank is thus formed into a finished bag, which may be conveniently stacked, among others, in accordance with a predetermined arrangement whereby their number can be ascertained.

It is the principal object of this invention to provide an improved bottom wing folding mechanism for the station at which the trailing flap of the bag blank is folded forwardly along the upper and leading score line and upon the panel portions prior to folding rearwardly the leading flap in completing the bag bottom forming operation.

Another object is to provide a bottom wing folding mechanism of this nature wherein the wings are so adapted to follow relatively closely the associated circumference of the bag bottom forming drum whereby proper folding of the trailing flap is most efficiently assured.

While a single and somewhat preferred embodiment will be disclosed herein, it should be understood that other objects and advantages incident to the other embodiments embraced by this invention will become apparent. Thus, reference is now made to the detailed description of the invention which is to be taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a fragmentary elevational view of bottom wing folding mechanism of this invention illustrating the manner in which the wings initially engage and then fold rearwardly the trailing flap;

FIG. 2 is a sectional view taken along the line 2--2 of FIG. 1 illustrating the disposition of wings in plan with respect to the bag blank; and

FIG. 3 is a fragmentary sectional view taken along the line 3--3 of FIG. 2 showing schematically the tucking mechanism and forward flap folder together with bag blank.

As a bag blank approaches the trailing flap folding mechanism or station 140, it will be in the form of a notched, slit and severed blank having a top layer 46 and a bottom layer 48 connected together by a pair of opposed bellows folded sides extending from the longitudinal length of the bag. The leading end 56 of the blank is formed with a projecting tongue or tab 58 extending from the upper layer 46. The leading end is also provided with a pair of parallel slits 60 and 62 in the upper layer 46 on each side of the tab 58. Similarly, the bottom layer is formed with a pair of corresponding aligned and parallel slits 64 and 66.

The tubular bag blank 70 is also formed with a pair of upper parallel score lines 74 and 76 adjacent the leading end 56 but spaced therefrom substantially as illustrated. These score lines are accompanied by score lines in the bottom layer 48 one of which includes score line 75. The leading end 56 of the blank 70 prior to the illustrated station is subjected to a tuck spreading operation during which the leading end is fully distended. While in this fully distended position, the leading end 56 is flattened such that the upper layer 46 is folded back on its self along the score line 76 to thereby provide a leading flap 78 of bottom layer 48 from the score line. Thus, the upper layer 46 and bottom layer 48 will cooperate and combine with the bellowed sides to form the overlying panels 82 and 84 disposed between the score lines 74 and 75.

Adhesive or paste 86 is advantageously applied to the surfaces of the flap 78 and panel portions 82 and 84 substantially as illustrated. The trailing flap 80 is then folded along the score line 74 forwardly and upon the panel portions 82 and 84 and, consequently, part of the exposed adhesive 86. Subsequently, the leading flap 78 is folded rearwardly along its fold or score line 75 so that it will not only adhere to the panels 82 and 84 but rather to the outer surfaces of the trailing flap 80 as well. The bag blank 70 is thus formed into a finished bag which may be conveniently stacked among others in accordance with a predetermined arrangement whereby their number can be ascertained.

In order to assure the proper initial contact with the trailing flap 80 by the bottom wing folding mechanism 140 and trouble-free proper folding forwardly of this flap, the present invention provides for improved bottom wing folding mechanisms as shown. During transport through this station, the blank 70 is flattened and tacked along the
fold or score lines 74 and 75 to the circumferentially extending periphery of the drum 132 by a tucking mechanism. The trailing flap 80 is folded forward along its score line 74 at the trailing flap folding station 140. Substantially simultaneously therewith, the leading flap 78 is folded rearwardly by the leading flap folding mechanism 142. The finished bags are ultimately accumulated in a prearranged manner at a stacking station so that the number of finished bags can be easily counted and ascertained and be readily available in preset quantities for shipping and storage or packing.

The trailing flap folding station 140 includes a pair of flap folding assemblies 536 and 538; and since both assemblies complement one another both structurally and functionally, only one will be described in detail. Thus, referring to the wing assembly 536, it will be observed that a wing 540 extends transversely from shaft 542 rotatably mounted by a suitably supported stationary bushing 544. The upper end of the shaft 542 has a spiral gear 546 suitably keyed thereto and which meshes with spiral gear 548. This latter gear is driven in synchronization with the drum 132 by means of the shaft 550 extending from the common drive also coupled with the drum 132. The spiral gear 548 is suitably affixed to this shaft 550 for purposes of driving the gear 546. Under the circumstances, the drive imparted to the wing 540 should be sufficiently rapid for the wing to engage the flap 80 from behind as the bag blank is carried by the drum 132 and force the encountered flap forwardly about the score line 74 that is engendered to pass pattern 86 present on the panel portions 82 and 84. The leading flap folding station 142 is sequentially presented to the carried bag blank 70. The leading flap 78 is somewhat upstanding with respect to the normal tangential line at such location thereby facilitating the folding of this flap rearwardly upon the wing 556 with respect to the rear wing end 558 encountered this station. It should be understood that the wing 540 manages to execute the desired folding of the trailing flap 80 at such time as the leading flap 78 is in the process of being bent rearwardly along the score line 75 at the station 142. The flaps 78 and 80 are then securely adhered to the associated surfaces of the now finished bag.

In assuring the proper engagement of the trailing flap 80 by the cooperating pair of wings 540 while the blank 70 is being carried on the drum 132, the leading edge 552 of each wing should contact the trailing flap at a sufficient distance from its terminal end to prevent the wing from merely overriding the flap while traveling at a somewhat higher speed. In view of this higher rate of travel, the trailing flap 80 should also be engaged sufficiently close to score line 74 throughout the folding step to prevent this overriding following initial contact. The trailing edge 554 of the wings should then pass over the outer face of the trailing flap to complete the folding operation. The flap inner face will, accordingly, be shifted into firm contact with the adjacent sectors of the paste pattern 86. Under such circumstances, the trajectory of each of the flaps should approach or approximate the circumference or adjacent periphery of the drum 132.

In order to approach, as close as possible, this desired path of travel of each of the wings 540, the axis of the shaft 542 is tilted in an inward direction towards the drum substantially as shown by the angle a. With this tilting, the terminal end portion 556 is somewhat divergent with respect to the rear end 558 to dispose the forward terminal wing 156 closer to the periphery of the drum 132 over as much of its flap as possible. The angle a as well as the extent of divergence of the forward terminal wing end 556 with respect to the rear wing end 558 are variable; and the selection of these individual parameters will depend upon the particular application including the diameter of drum 132. In any event, these parameters are calculable for purposes of permitting the sweep of the wings 540 to substantially accumulate the curvature of the drum 132 and, consequently, the mounted bag blank 70 during the trailing flap folding operation.

This invention further contemplates pulsating trailing flap folding mechanism by which the wings 540 engage the trailing flap while traveling at a slower rate of speed; and then their speed increases during the remaining portion of the folding cycle. Driving apparatus of this nature is disclosed in the above referenced companion patent application. For details of an exemplary mechanism of this nature, reference should be made to that application.

Thus, the aforesaid objects and advantages are most effectively attained. It should be understood, however, that this invention is in no sense limited by the preferred embodiment illustrated and described herein, but its scope is to be taken and determined by that of the appended claim. In this connection, this invention is not only applicable to the manufacture of self-opening bags, but other bags as well, including "sacks" or satchel bottom bags.

I claim:

In a bag-making machine for forming a bag blank of predetermined length from a tube formed in turn from a web of sheet material, the improvement in means for forming a bag bottom having a trailing flap on said bag blank to thereby provide a finished bag, said means including a rotatable cylindrical drum on which the bag blank is adapted to travel and a folding means in operative association with said drum to form a flap upon itself, said trailing flap folding means including at least one wing and actuating means for rotating said wing in a timed relationship with respect to the movement of the bag blank such that, when rotated, the wing is adapted to engage the outer face of the trailing flap to fold the trailing flap upon itself, said actuating means including a rotatably driven shaft coupled with said wing, directing means for directing the sweep of the wing during the folding of the trailing flap such that the sweep approximates the cylindrical path of travel of the bag blank through the trailing flap folding means, said direct ing means journaling said shaft at an acute angle with respect to the curved plane of the blank and away from the drum, and said wing including a base section extending substantially normally from said shaft and a flap engaging end diverging from said base section at an acute angle therewith and adapted to travel in a conical path and in a path substantially concentric with the curved plane of the bag blank, said flap engaging end gradually increasing in width from its associated base section to its outer periphery, and the flap engaging end adapted to initially engage said trailing flap at sectors thereof of shorter radius located adjacent the associated base section upon operation of said actuating means whereby rupturing of the trailing flap by the wing is prevented.

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