This invention relates to improvements in wrapping and sealing machines and methods.

One of the important objects of the present invention is to provide a multiple lane wrapping machine adapted to wrap a number of articles simultaneously in each of a plurality of lanes, using wrapper strips cut from a single web and suitably separated to provide clearance between the lanes.

It is another object of the invention to provide a novel arrangement whereby the machine may be adjusted to wrap articles differing somewhat as to size.

Another object of the invention has reference to improvements in the specific folding mechanism for conveniently and simply pleating the wrapper at each end of the wrapped article to facilitate the folding of the wrapper upon the article to be sealed.

Another object of the invention relates to improvements in the cut-off knives to enable them to operate with adequate strength in limited quarters. It is also my purpose to provide novel and improved sealing methods and means whereby the wrapper ends are sealed, preferably thermo-plastically, at the time the tube wrapping strip is cut.

Still other objects of the invention relate to improvements in the means for synchronizing the movement of the articles in the several lanes and to improvements in the apparatus for feeding such articles. Other objects will be apparent to those skilled in the art from the following disclosure of the invention.

In the drawings:

Fig. 1 is a plan view of the entire apparatus.
Fig. 2 is a view of the machine in side elevation.
Fig. 3 is an enlarged detail view in longitudinal section of that portion of the machine in which the articles and wrapping web are fed into the machine and the wrapping accomplished.
Fig. 4 is an enlarged detail view in plan of that portion of the machine in which wrapping is accomplished.
Fig. 5 is a further enlarged fragmentary detail in longitudinal section through the cut-off knives.
Fig. 6 is a fragmentary detail partially in end elevation and partially in section, showing portions of the cut-off knives and their mountings on an enlarged scale.
Fig. 7 is a fragmentary detail view in cross-section showing the infeed conveyor mechanism.
Fig. 8 is a view taken on line 3—3 of Fig. 4.
Fig. 9 is a detail view taken in section on line 9—9 of Fig. 4.
Fig. 10 is a view taken in transverse section on the line 10—10 of Fig. 1.
Fig. 11 is a view taken in section on the line 11—11 of Fig. 10.
The transfer belt 38 may be guided at its input end over a stationary block 41 which provides a curve of less radius than any ordinary pulley, thereby enabling the transfer belt 38 to be brought into immediate proximity to the feeding belt. 24.

The several troughs 39 may have converging side walls as best illustrated in Figs. 1 and 17. They are also preferably downwardly inclined as best shown in Fig. 3. Their pitch, however, is not sufficient to feed the articles by gravity and the articles are propelled in unison along the several troughs by the depending arms 43 of an overhead conveyor belt 44 operating over pulleys 45 and 46 and contributing importantly to the timing of the apparatus, as will hereinafter be explained. The several cross arms 43 are pivotally supported upon sleeves 47 mounted on cross shafts 48 of the conveyor 44, as best shown in Fig. 7. A torsion spring 49 acts on the sleeve to urge it toward a position where the bar 50, connecting the several arms 43, will engage the stop 51 carried by the cross shaft 48. The torsion spring provides sufficient tension to enable the arms 43 normally to propel the work down the several troughs 39 but enables the connecting bar 50 and the arms 43 to yield rearwardly with respect to the direction of conveyor travel whenever an obstruction is encountered.

Projecting inwardly from the machine frame is a fixed stop pin 52 engaged by the finger 53 of sleeve 47 at the point where the cross pin 48 and the arms carried thereby begin to change direction to pass around the pulley 45 at the discharge end of the conveyor. But for this arrangement, the change of direction would result in advancing the arms suddenly (due to the change in angle) thereby abruptly increasing the velocity of movement of the work pieces. Because of the presence of the stop 52 (Fig. 3 and Fig. 7) the movement of the fingers 43 is momentarily arrested while the conveyor continues its movement until the finger 53 clears the stop pin 52. Meanwhile the several arms 43 will have been deflected backwardly with respect to the conveyor so that they will be virtually tangent to the pulley 45 instead of radial thereto. In the interim the work will have cleared the arms, so that when the arms are released and spring back to their original positions they will not affect the movement of the work.

At the ends of the respective troughs 39 the work pieces will be fed onto the individual strips of wrapping material in which they are ultimately to be wrapped. The wrapping material is initially supplied from a large parent roll 55 which may be printed with the wrapper designs for a number of series of wrappers corresponding to the number of feed troughs 39 (four in this instance). The several wrapper designs may be aligned transversely as shown in Fig. 17 and repeated from end to end of the web comprising the roll 55.

From the parent roll the web passes over an idler pulley 56 past a light source 57 and a photoelectric cell 58 used for synchronizing the movement of the web and the material to be wrapped in a manner hereinafter to be explained. Thence the web passes over a matrix roll 59 with which cooperate a sufficient number of slitting knives 60 to divide the web longitudinally into a number of strips corresponding to the number of troughs 39 through which the articles 40 are fed to the wrapping station. Since there are shown, the particular machine employs three of the slitting knives 60 to cut the web into four strips or ribbons.

The individual strips or ribbons each of which contains a succession of wrapper designs placed end to end, passes beneath the guide roll 61 to a pair of spreader bars 62 and 63 which are shown in detail in Figs. 14 and 15. These spreader bars are interchangeable with others for varying the spacing of the individual wrapper strips according to the width desired for wrapping any particular set of objects. To facilitate interchangeability of the bars 62 and 63, these are preferably detachably mounted in brackets 64 such as the one shown in Fig. 16.

Referring back to Figs. 14 and Fig. 15, it will be noted that the folding bar 62 is provided at each side of the longitudinal center line of the machine with rounded stationary web guiding surfaces 65 and 66 which are slightly oblique at an obtuse angle to each other and something less than 90 degrees with respect to the center line of the machine.

Immediately outside of these surfaces are the rounded guide surfaces 67 and 68 which deviate at greater angles from a line normal to the longitudinal machine axis. Despite the difference in angularity of the several surfaces 65 and 67 on the one hand and 68 and 66 on the other, the mid points of the several surfaces are substantially equi-distant from the roll 59 about which the several strips of web material have passed. Thus, in passing about the several surfaces, the different webs all change direction at the same time, although each takes a slightly different direction in leaving the folding bar 62.

Immediately above the folding bar 62 is the bar 63 which has surfaces parallel to the several turning surfaces of bar 62 but slightly offset therefrom toward the sides of the machine. Thus, surfaces 75 and 76 of bar 63 are parallel to their general direction with the surfaces 65 and 66 of bar 62, but whereas surfaces 65 and 66 meet at the center line of the machine, surfaces 75 and 76 are offset from the center at 74.

Surfaces 75 and 76 are also somewhat longer transversely of the machine than surfaces 65 and 66, so that the outer turning surfaces 77 and 78 of bar 63 (which correspond to surfaces 67 and 68 of bar 62 in direction) are still further offset toward the sides of the machine.

The several strips or ribbons of wrapping material which are designated by reference characters 70, 71, 72, and 73 of Fig. 15, initially have their edges in juxta-position where they were formed by the slitting knives. In passing over the spreader bar 62, these strips will be caused to move angularly outwardly away from each other, but in passing over the second spreader bar 63 these strips will be returned to parallelism and will be somewhat spaced from each other due to the period of movement from one bar to the other during which the margins of the several strips are mutually divergent. This spreading moves the individual wrapping bands or strips far enough apart to permit them to be manipulated individually with respect to the work pieces. If the dimensions of the individual work pieces are varied, a different spacing between the strips 70, 71, 72, 73, may be required, and for this purpose other spreading bar sets may be substituted to provide exactly the desired spacing, while still delivering the strips ultimately to the work in perfect parallelism as shown at the right in Fig. 15.
The several strips of wrapping material, after being spread in passing the bars 62 and 63, pass over a roll 79 upon which glue rolls 80 apply glue to the margins of the strips. Thereupon the several strips pass back over the upper surface roll 61 into contact with the under surfaces of the several troughs 39 which are centered with respect to the several strips and consequently do not touch the glued side margins thereof.

Because the roll 61 is at a higher level than the lower ends of the several troughs 39 over which the several wrapping strips are drawn, the wrapping strips are channeled about the delivery ends of the respective troughs, the glued sides of the strips being folded upwardly as indicated at 82 in Fig. 17. Thus, as the several work pieces 40 are propelled by the arms 43 down the troughs, they are ultimately delivered from the ends of their respective troughs into the channeled wrapping strips 70, 71, 72 and 73, and are propelled by the wrapping strips when the fingers 43 are arrested and ultimately moved upwardly away from the troughs in the manner already described.

Immediately beyond the ends of the troughs are individual wrapping tables 63 having side pressure conveyors 84 and 85 guided at their respective ends about upright pulleys 86 and 87, these conveyors serving to hold the channeled portions of the wrappers tightly to the sides of the work as the work and the wrappers progress through the folding mechanism. Additional lateral pressure is provided by the spring supported shoes 88 (Fig. 4).

Supported upon each of the tables 83 by suitable brackets 85 shown in Figs. 4 and 9, are the folding blades 90 and 91 which operate in a manner well known to those skilled in the art to fold the sides of the web strip over each other upon the work. As viewed in Fig. 9, the side of the web strip which is at the left is folded against the work by the blade 90, while the side of the web which is at the right intervenes between blades 90 and 91, being thereby folded on top of the inwardly folded margin from the left. This brings the glue surface along the right hand margin of the web strip into contact with the material of the left hand margin of the web strip as the web strip leaves the folding blades 90 and 91. Pressure plates, preferably made of resilient material, are provided at 93, and in order that their pressure may be regulated these may be pivoted to a cross bar 94 of the machine frame and subject to the action of weights 95 to exert a determinable pressure on the adhesively joined wrapper margins to hold these together as the work passes beneath the pressure plates until the adhesive sets.

As the work leaves the pressure plate 93, the work pieces are encased in a continuous tube of wrapping material closed above the work pieces by the gluing of the margins of the web strips as just described.

After the end tube work pieces leave the wrapping table 83, the tube wrapper and the end tube work pieces pass a device which sever the tube wrapper between work pieces and simultaneously seals its severed ends. Details of this device are best shown in Figs. 3, 5 and 6.

At the same time that the wrapper designs are printed upon the wrapping web 55 (or at any other time) the web 55 is provided with a series of longitudinally spaced transversely extending bands 57 of thermo-plastic adhesive. The material used is preferably non-adhesive at ordinary atmospheric temperature but may be rendered adhesive by the application of heat. Shellac is one of the simple, well known forms of such an adhesive. Even paraffin is usable, and numerous others are employed in mending tissues, mounting tissues, and the like. The same band, colored, may be used to energize the photoelectric registering mechanism which includes the light source 57 and the color already described, together with other mechanism not yet described.

In any event, the machine is so synchronized that the bands 57 come midway between the articles entubed in their respective wrapping strips and at the precise point at which the tube is to be severed.

Upper and lower cutter rolls 98 and 99 are provided. In order to reduce to a minimum the gap through which the work must span in its longitudinal travel through the machine, the diameters of rolls 88 and 89 are very small in proportion to the load that they must sustain. Roll 98 carries a pinch knife 100 having a wedge-like point which engages an anvil blade 101 carried by roll 99. Both blades are replaceable and the knife 100 is adjustable diametrically of its roll.

Flanking the pinch knife on each side is a heating iron 102 internally heated by resistance coils 103. These coils are supplied with current by a commutator arrangement 104 shown in Fig. 6.

When the pinch knife 100 and the anvil blade 101 are out of registry with each other in the course of rotation of their respective rolls 98 and 99, the portion of the tubular wrapper in which a candy bar is engaged will readily feed between rolls 98 and 99 out of contact therewith, the portion of the wrapper between the entubed candy bars remaining in the form of an open and uncompromised tube. Immediately before this intervening tubular portion of the wrapper is compressed by the pinch off and sealing mechanism, it is plaited from the sides to the form clearly appearing in Figs. 5 and 17. This is done by the pleating disks 120 which are carried by levers 121 pivoted at 122 to the frame member 123 upon which the pressure plates 93 are also carried. The levers 121 are curved to pass about the pulleys 87 over which the belts 86 and 85 operate. Tension springs 128 bias the levers 121 toward each other in pairs and thereby regulate the extent of the pleating pressure exerted by the disks 120 upon the work. The levers 121 are retracted against the bias of their springs 125 by reciprocable actuating rods 129 and 127 which have pins projecting upwardly into engagement with the respective levers 121 as shown in Fig. 4. These rods are reciprocable by means of links 126 and 128 which connect them to cranks 130 and 131 on a crank disk 132 on rock shaft 133 (see Figs. 4 and 8). The rock shaft is controlled by a rocker arm 135 actuated in one direction of oscillation by a tension spring 138 and in the other direction by a follower roller 137 and a cam 136 on shaft 139. As shown in Fig. 8, the cam has a low point of limited extent. Throughout most of the cam periphery the cam follower roller rides at a uniform radius from the center of shaft 139, thereby holding the levers 121 and the pleating disks 120 retracted from the position in which they are illustrated in Fig. 4. When the cam follower roller 137 drops into the pocket on the periphery of cam 138, the tension of spring 135 sharply oscillates the rock shaft 133 and this motion, communicated to the slide rods 125 and 127 by links 129 and 120, allows the levers 121 to spring inwardly so that the pleating disks 120 form longi-
tudinal pleats in the sides of the tube wrapper between the work members and tube therein. This happens immediately prior to the engagement of the wrapper by the pinch knife 100 and its complementary blade 101, so that when such engagement occurs the wrapper pleats are creased neatly as indicated at 140 in Fig. 17.

As the pinch knife 100 contacts the complementary blade 101 to pinch off the tube wrappers (internally flattening the wrapper and setting the crease) the sealing irons 102 heat the thermo-plastic band sufficiently to set the thermo-plastic adhesive, thereby sealing the ends of the short lengths of tube resulting from the pinch-off operation.

While a pinch-off knife set is preferred to shearing or cutting knives because it facilitates the thermo-plastic sealing of the ends of the short tube lengths in which the candy bars are disposed, the use of pinch-off knife sets is not essential to the invention.

Because of the small diameter of the rolls 98 and 99 for the purposes aforesaid, and because of the very heavy pressure to which such rolls are subject due to the use of pinch knives, it is preferred to provide support or backing for the rolls and knives to keep the rolls from springing during the pinch-off operation. Accordingly I operate upper and lower rolls 105 and 106 in synchronism with rolls 98 and 99, and I provide on rolls 105 and 106 immediately above the paths of the several tube wrappers which are to be cut, cams 107 and 108 respectively, these being so positioned that as the pinch knife 100 approaches registry with the anvil plate 101 for the pinching operation, the cam 107 engages the upper surface of roll 98 while the cam 108 engages the lower surface of roll 99, thereby providing support and backing in the diametrical plane in which the reaction thrust becomes effective.

The broad belt 110 receives the individual work pieces from all of the several channels after the tubular wrapper is severed and the ends sealed about the candy therein contained. Belt 110 operates over pulleys on shafts 111 and 112. Rotary brushes 113 on shaft 116 operate immediately over the receiving end of belt 110 to assist in drawing the wrapped work pieces onto belt 110 and across the gap in which the severing and sealing mechanism operates. The flexible bristles of the brushes 115 do not damage the relatively soft candy bars and yet exert enough pressure to keep the bars from tilting or becoming displaced and to hold their leading ends to the belt 110 until the work pieces are firmly positioned upon the belt.

To complete the folding of the ends of the creased and flattened and sealed wrappers, the partially wrapped work pieces now change direction, being fed laterally from the belt 110. The mechanism about to be described is best shown in Figs. 1, 2, 10 to 13, and 17.

As the several partially wrapped work pieces 141 move longitudinally of the machine upon the lines which they have followed thus far, they are uniformly spaced on the belt 110 as shown in Fig. 10. They are now engaged by the propelling lug 142 of cross feed conveyors 143, the arrangement being such that half of each row of articles is moved to the right and half to the left for subsequent operations. The two mechanisms for completing the folding are identical and a description of one will serve for both.

The chains of cross conveyors 143 operate over suitable sprockets on shafts 145 and 146. Wherever necessary the chains are rigidly backed, as by shoes 147, the guides thus provided constraining flights of the conveyor chains to move recumbent without yielding.

The partially wrapped work pieces from the belt 110 onto a narrow table or guideway 148, the wrapper ends 149, previously flattened and sealed, project beyond the table. With the parts in this position the portion of the tubular wrapper which is supported on the wrapped candy is lightly engaged near each end by a gluing disk 150 (see Figs. 10 and 17). Almost immediately thereafter the projecting ends 149 of the flattened and sealed wrapper are turned upwardly by the mechanism shown in Fig. 11.

Disposed crosswise over the guide table 146 is a shaft 152 carrying pinions 153 which are elongated axially of the shaft and at opposite sides of the path of travel of the work. Between such pinions is a rocker arm 154 which depends to a position for engagement by lug 155 carried by the conveyor 143, so that as the conveyor moves the work along the guide table 148 the shaft 152 will be oscillated in synchronism with the progress of the work pieces.

Meshing with the respective pinions 153 are a pair of racks 157 and a pair of racks 158. The racks 157 are normally elevated while the racks 158 are normally depressed, tension springs 159 connected to the racks 157 tending to maintain the normal positions of the parts.

Racks 157 carry downwardly moving tucking blades 160, while racks 158 are provided with arms 161 which support upwardly movable tucking blades 162. The tucking blades 160 move downwardly to the ends of the wrapped candy bar, while the tucking blades 162 move upwardly to points slightly spaced outwardly from the paths upon which the blades 160 move. As the respective blades move downwardly and upwardly sufficiently to lap each other, the flattened and sealed ends 149 become turned directly upwardly as shown at 145 in Fig. 17. As soon as the lug 155 clears the rocker arm 154 on the rock shaft 152, the tension springs 159 restore the folding blades to their original retracted positions in readiness for another operation upon a subsequent work piece.

The partially wrapped work piece now continues its movement with its pleated, flattened and sealed ends folded upwardly as indicated at 169 in Fig. 13. As it progresses over the guide table 148 it passes over a point where rock shafts 165 and 166 below the table support arms 167 and 168 upon which sealing fingers 169 and 170 project at right angles. Shafts 166 carry pinions engaged by gears actuated by rocker arm 171 and link 172, as shown in Fig. 13, this link being operated in synchronism with the advance of the work so that as the upturned ends 159 move into transverse registry with the fingers 169 and 170, the arms 167 and 168 are oscillated from their full line positions in Fig. 13 to the dotted line positions in Fig. 13, thereby folding the upturned ends 159 onto the upper surface of the wrapped bar 144, upon which glue has previously been deposited by the gluing disks 150. This completes the wrapping operation, and the completely wrapped article is indicated at 175 in Fig. 17.

It is still necessary, however, that the ends 169 be maintained in contact with the adhesively treated surface of the article for a sufficient period to enable the adhesive to set. Accordingly, immediately after the ends have been pressed
2,462,254 into position by the mechanism shown in Fig. 13, the wrapped article 175 runs onto an inverting table 176 beneath the semi-circular guide bars 177. The inverting table is mounted on a shaft 178 which turns the article 175 upside down, the guide bars 177 meantime keeping the ends securely folded onto the face of the article.

As inversion is completed, the table 176 and the guide bars 177 discharge the article 175 onto the turntable 180 with the glazed ends 185' underneath, so that the weight of the candy bar maintains the fold until the glue sets. The turntable 180 rotates the bars about 90 degrees so that their length is no longer parallel to the major axis of the machine but is transverse thereto. In this position, side by side, the completed products are delivered from the turntable onto the discharge conveyor 182.

All of this mechanism which completes the folding and sealing of the article, is duplicated at the other side of the machine and consequently there are two delivery conveyor belts 182 running parallel to the axis of the machine at each side thereto on which the finished products are discharged.

The operating connections may, of course, be arranged as desired. In practice, the following organization has been found satisfactory.

A main motor 183 is belted to a shaft 184 carrying a pinion 185 which meshes with a large gear 186 on a shaft 187 (Fig. 2). A cam 188 on this shaft actuates a lever 189 from which the link 172 drives the lever 171 for the final folding and sealing mechanism just described and illustrated in Fig. 13.

The shaft 187 likewise carries a sprocket which drives chain 190 to operate shaft 191 from which numerous driving chains receive motion.

Shaf 191 is connected by a chain to shaft 192 which is connected to shaft 193 by which the output conveyor 182 is driven. Shaft 192 is also connected by bevel gearing to a shaft 194 from which a chain 195 drives conveyor shaft 145 and shaft 177 for the inverting table, this drive being duplicated at the opposite side of the machine.

Likewise driven by spiral gearing 196 (Fig. 10), from shaft 195 is the shaft 198, this mechanism also being duplicated at the other side of the machine.

The shaft 112 carrying the pulley for the conveyor belt 116 is chain operated from shaft 192 as shown in Fig. 10.

The various shafts for the pinch-off and sealing mechanism are connected by gearing as shown in Fig. 2, the lowest shaft 166 in the series being driven by chains from shaft 191.

A gear on shaft 191 meshes with a gear on shaft 187 which is connected by a chain with shaft 198 which carries the pulley for the infeed conveyor 44, thereby driving the infeed conveyor. A cam on shaft 188 operates switch 193 (Fig. 1) for energizing solenoid 37 to release the endless chain to release a row of work pieces for advance to position of compound engagement by the lugs of conveyor 44.

Shaft 198 is also connected by a gear train shown in Figs. 1 and 2, with shaft 199 for the matrix roll 59 on which the broad wrapping web is slit. This shaft in turn is geared to shaft 202 which drives the slit web guide for. Conveyor 44 transmits motion from its drive shaft 199 to the shaft 202 upon which the sprockets 45 are mounted at its input end. Shaft 202 is geared to shaft 203 over which conveyor belt 205 operates. Shaft 203 is also chain connected to drive shaft 23 over which conveyor belt 24 operates.

The gear train from shaft 188 is not directly connected to shaft 199 but is connected therewith through a differential gear box 233 to which a motor 206 provides a separate power input through shaft 207. The arrangement is more particularly described in the companion application above identified, and is used to synchronize the movement of the web over matrix roll 59 (shaft 199) to the movement of the outer candy bar end fed into the wrapper by the propelling fingers 43 of conveyor 44.

As explained in the above companion application, the web movement may either be synchronized as closely as possible with the rate of candy bar input feed, or it may be set either to under-run or over-run the rate of candy bar input feed by a very slight amount. If synchronization is attempted it may be necessary to make the motor reversible. It is much easier to achieve accurate synchronization in practice if one feed normally differs from the other in a predetermined amount and a predetermined direction.

In a suitable relay mechanism not shown here but described more particularly in my companion application aforesaid, the impulses generated in the photo-electric cell 58 by the passage of the marking strips 87 impressed on the wrapping paper will, after a given interval, act out of time with the impulses generated electrically by the engagement of successive web propelling lugs on conveyor 44 with a switch 208 having an arm 209 in the path of such lugs. As long as the impulses from the photo-electric cell and the switches are in synchronism the motor 206 will remain unenergized, but as soon as such impulses are out of synchronism the motor 206 will be energized in such a direction as to deliver motion through the differential 233 into the matrix roll 59 which feeds the web and the motion will be in such a direction as to restore the electrical impulses of the switch and photo-electric cell to synchronism, whereupon the motor 206 will again remain at rest until lack of synchronism re-establishes itself due to the predetermined slight degree of over-run or under-run, as the case may be.

Reference has been made to the fact that the wrapping device as herein disclosed, is adjustable to handle different sizes of work pieces. Assuming that the device is used for the wrapping of candy bars, this being the exemplification specifically discussed, it will be apparent that a great deal of change of size will be required.

The dimensions 27, 28, 29 and 30 which guide the work along the infeed belt 24 may therefore be set sufficiently far apart to receive the largest work piece upon which the particular machine will be designed to operate. Likewise, the trowels 39 which deliver the work pieces into the channeling wrapping strips may have a cross section adapted to handle the maximum of work piece sizes which the machine will be called upon to wrap.

The only actual adjustments required will ordinarily be adjustments of the wrapping mechanism itself, with particular reference to the belts 24 and 25 and the pulleys 45 and 46 over which these belts operate. It is essential, or at least very desirable to a satisfactory wrapping job, that the wrapping strip of web material be held tightly to the sides of the work piece, and accordingly any variation in work piece dimensions will
ordinarily involve an adjustment of the spacing between the belts 84 and 85. The machine frame is provided with transverse supports at 210 and 211 upon which the supporting blocks 212 and 213 respectively are slidably transversely of the machine (see Figs. 3 and 4). There is one such block at each end of each belt and, as clearly indicated in Figs. 3 and 4, the blocks provide support for the respective pulleys 84 and 85 beyond the ends of the associated tables 83, the tables, however, having tongue-like extensions 214 and 215 along the path of the work between the respective belts. Adjustable blocks 212 and 213 not only carry the spindle upon which the pulleys 87 are fed, but blocks 213 also carry the driving connections for the pulleys 87. The driving cross shaft 220 is provided at suitable intervals with driving spiral gears 221 splined thereto and connected for movement with the respective blocks 213. Each driving spiral gear 221 meshes with a driven spiral pinion 222 on the spindle which operates a pulley 87 for one of the belts.

A manually operable adjusting screw 223 has a hand wheel 224 for its operation and is provided with right and left hand threads engaged by nut elements 225 connected with the respective blocks 212. A chain 226 connects the screw shaft 223 with a similar screw shaft 227 having like right and left hand threads engaged by nut elements 228 connected to the respective blocks 212 at the other ends of the respective belts. Thus, any hand wheel operation in either direction will move the pairs of belts 84 and 85 respectively, toward or from each other at both ends corresponding amounts, simultaneously shifting along the drive shaft 220 the spiral gear pairs which provide power for each belt.

No other part of the machine will ordinarily require adjustment. If, however, the size of the work piece is changed extensively, it may be necessary to provide a different width of web in the wrapping roll 55 to vary the width of the strip into which such web is divided. To accomplish this, it is only necessary to adjust axially of the cross shaft 230 the supports for the sitting rolls 60. Since the resulting wrapping strips slit from the web should accurately fit the surfaces of the spreader bars 62 and 63 about which they move, the spreader bars are made readily interchangeable in their end brackets 64, as already described. It will be apparent to those skilled in the art, however, that within substantial limits of variation such as are normally encountered in candy bar wrapping, no change in the width of the individual wrapping strips will be necessary. It is likewise assumed that no change in length between the points of cut-off will be required, and it will be found that quite substantial changes in the length of the bar will make no difference in the point at which the web is severed between bars by the pinch knife 100.

In a broad sense, the thermo-plastic means for sealing the ends of the wrapper at the time of cut-off are only an exemplification of other means of connecting the wrapper ends. Specifically, however, the thermo-plastic seal is greatly preferred to other end fastening expedients. It will likewise be apparent to those skilled in the art that it is not necessary that the means to which the photo-electric cell responds for synchronizing the movement of the web and the articles should constitute the thermo-plastic strip imprinted on the web for later use in sealing the wrapping strips at the points of severance. Special specifically, however, the machine and its operation are simplified by using a single imprint on the web for both functions.

From the standpoint of method there are substantial advantages in the operations above described. It is advantageous to print a single wrapper web of a sufficient width to provide wrappers for several articles to be wrapped concurrently, later dividing the web into individual strips and entubing the articles in such strips before cutting the strips into individual wrappers. It is also desirable to provide for the spacing of the individual wrapper strips to provide ample room for the wrapping function. It is also very desirable to seal, or at least to connect, the ends of the individual wrappers at the points and at the time of severance from the respective wrapping strips, even though such ends are additionally held closed by the final operation in which they are folded onto the upper surface of the work and glued in place.

1. In a multiple lane wrapping machine having means for feeding a plurality of articles along adjacent paths, means for feeding a broad wrapping web upon which individual wrapper designs are printed, and means for slicing said web into separate strips each containing a series of wrapper designs, the cooperation with means for laterally spacing the strips in the course of their advance, of means for tubing the respective strips about the successive articles fed upon the respective paths, means for cutting the respective strips between wrapper designs and for completing the packaging of the respective articles in the wrappers cut from the respective strips.

2. In a multiple lane wrapping machine, the combination with a set of adjacent troughs and overhead conveyor means provided with work propelling fingers individual to the respective troughs for advancing through said troughs work pieces supplied thereto, a web parent roll support adapted to carry a broad web of wrapping material, guide means for said web including a matrix roll, at least one sitting roll coacting with the matrix roll for dividing said web into strips, guide means for the respective strips including means for spreading the strips laterally in the course of their advance, propelling belt means laterally positioned in the path of article advance beyond said troughs and adapted to divide the individual wrapping strips across the ends of the respective troughs in channeled form, means for folding the edges of the respective strips over articles delivered therein from said troughs to entube such articles, and means for severing the strips intermediate the articles entubed therein, together with means for closing the severed ends of the portions of said strips in which articles are entubed.

3. In a multiple lane wrapping machine, the combination with a set of adjacent troughs and overhead conveyor means provided with work propelling fingers individual to the respective troughs for advancing through said troughs work pieces supplied thereto, a web parent roll support adapted to carry a broad web of wrapping material, guide means for said web including a matrix roll, at least one sitting roll coacting with the matrix roll for dividing said web into strips, guide means for the respective strips including means for spreading the strips laterally in the course of
their advance, propelling belt means laterally positioned in the path of article advance beyond said troughs and adapted to draw the individual wrapping strips across the ends of the respective troughs in channeled form, means for folding the edges of the workpiece intermediate the respective troughs, from said troughs to entube such articles, and means for severing the strips intermediate the articles entubed therein, together with means for closing the severed ends of the portions of said strips in which articles are entubed, said connecting means comprising a heater associated with the severing means, said strips being provided with thermo-plastic adapted for sealing engagement by said heater.

4. In a multiple lane wrapping machine, the combination with a plurality of pairs of laterally spaced pressure belts and work supports between said pressure belts to which said belts are approxi- mately normal, of article delivering troughs inclined toward the respective supports, common conveyor means for propelling articles along the respective troughs toward said supports, means for delivering strips of wrapping material across the ends of the respective troughs toward said supports, said wrapping material being drawn by the opposed belts in channeled form across said troughs to receive articles propelled along the troughs toward the supports, folding plates above the supports with which the margins of the wrapping strips are engaged for the folding thereof above the articles deposited therein, means for sealing the margins of the strips to entube such articles, and common means for severing the tubed wrapping strips intermediate the articles entubed therein.

5. In a wrapping machine having a wrapping table, troughs inclined with respect to the wrapping table, means for drawing a plurality of wrapping strips over the ends of the respective troughs whereby to tube such strips to receive work pieces delivered through said troughs, the combination of an overhead conveyor including lugs individual to the respective troughs for propelling work therethrough in timed relation to the movement of said strips, mechanism for synchronizing the operation of said conveyor and the feeding of said strips, and means for delivering separate work pieces to the several troughs for concurrent propulsion along said troughs, said last named means comprising a conveyor belt having a surface adapted for frictional propulsion of work pieces resting thereon, guides establishing paths of work piece movement along said belt in substantial parallelism toward the respective troughs, starting gate means for arresting the movement of work pieces with said belt toward said troughs, and mechanism for retracting said starting gate means for the substantially simultaneous release of work pieces in sufficient synchronism with the movement of the lugs of the conveyor first mentioned so that the work pieces will be engaged properly by the respective lugs for concurrent propulsion along said troughs and in synchronism with their respective troughs in synchronism with the strip advance toward the point of work piece delivery thereto.

6. In a wrapping machine having a wrapping table, side belts movable in pairs along said table, work pieces channeled with respect to said table, means for delivering wrapping strips across the ends of said troughs and between said belts, whereby to be channeled on said table, the combination with an overhead conveyor having lugs associated with the respective troughs for the positive propulsion of work pieces into the channeled wrapping strips, an infeed conveyor belt having a surface adapted frictionally to propel work pieces placed thereon, an overhead support across said belt, a set of partition strips defining guide channels longitudinally of said belt for delivering successive work pieces toward said troughs.

7. The combination recited in claim 6 in further combination with gate means normally positioned to intercept work pieces intermediate the respective guide partitions for the transverse alignment of such work pieces upon said belt, and mechanism for retracting said gate means in synchronism with the operation of said conveyor lugs whereby to assure the movement of respective work pieces concurrently into the respective troughs for positive propulsion by said conveyor lugs.

8. The combination with spaced work feeding conveyor means and an intervening cut-off device, of means comprising a rotary brush located immediately beyond the cut-off device in the direction of work advance and cooperating with one of said conveyor means for holding work thereto.

9. In a wrapping machine having means for entubing successive work pieces in a continuous wrapper, a work receiving conveyor spaced from said entubing means, and a cut-off device intervening in the space between the conveyor and the entubing means and synchronized to cut the wrapper intermediate successive work pieces entubed therein, the combination with said conveyor, of a rotary brush disposed immediately above said conveyor and adjacent said cut-off device and provided with means rotating it in a direction to hold successive work pieces and their entubing wrapper sections to said conveyor as such wrapper sections are severed.

10. The combination with a pair of laterally spaced propelling belts and a conveyor surface along which said belts are movable, of a feed means inclined respecting said table, means for delivering a wrapper strip across the end of said feed means to be channeled thereby, the channeled wrapping strip being adapted to receive work pieces from said feed means, a conveyor for propelling work pieces along said feed means and delivering such work pieces at spaced intervals upon the channeled wrapper, the side portions of the wrapper being supported by said belts against the work pieces, folding plates engaging with the margins of the wrapper for entubing the spaced work pieces in the wrapper, supports adjacent the belts movable to and from each other laterally, pleating fingers carried by the supports, means for actuating the fingers in synchronism with the advance of the wrapper for pleating engagement with the sides of the wrapper intermediate the work pieces entubed therein, cut-off means for flattening the pleated wrapper portions and for severing such portions intermediate successive work pieces, and a conveyor adapted to receive the severed wrapper sections and entubed work pieces, together with a rotary brush beyond the cut-off device and adjacent the path of work piece movement toward the conveyor, and means for operating said brush in a direction to assist movement of work pieces entubed in several wrapper sections toward said conveyor.

11. In a machine of the character described, the combination with a conveyor for lateral pro-
propping a work piece entubed in a wrapper having flattened and projecting ends, means in the path of work piece movement for folding upwardly the projecting wrapper ends, means in the path of work piece movement for folding over the work piece the wrapper ends previously folded upwardly, means for rendering such ends adhesive to the portion of the wrapper in which the work piece is entubed when said ends are folded thereon, an inverting table to which said conveyor delivers the work piece with its ends adhesively folded over, means for rotating the table to invert the wrapper work piece, accurate guide means for holding the ends tightly upon the work piece during such inversion, and conveyor means for receiving the inverted work piece, the inverted work piece holding the ends in position pending the setting of the adhesive.

12. In a machine of the character described, the combination with a table and means for propelling a work piece over a work piece and rendering them adhesive, of an inverting table, means for propelling the work piece onto the said table, arcuate guide means for holding the ends in place pending inversion of said table and work piece, said table and guide means being adapted for maintaining said table in a position in which its weight rests upon said ends to maintain them in position pending the setting of the adhesive.

13. In a device of the character described, the combination with a table and means for propelling a work piece, moreover, of means for folding wrapper ends over the work piece in the course of its propulsion across the table, an inverting table having a work piece receiving surface adapted to receive the work piece from the table first mentioned, means for rotating the inverting table on its axis whereby to invert the work piece, guide means for holding the ends upon the work piece during the inversion of the inverting table, said inverting table and guide means being adapted to deliver the work piece upside down with its weight resting upon the said ends to maintain them in position.

14. The device of claim 13 in further combination with a turntable upon which the inverted work piece is received, and means for delivering the inverted work piece from the turntable.

15. A wrapping method which comprises printing a web of wrapping material with a plurality of lengthwise series of wrapper designs, slitting said web between the designs of the respective series whereby to provide separate wrapping strips each containing a series of wrapper designs, delivering work pieces at spaced intervals to design-bearing portions of the respective strips, tubing the respective strips concurrently about the respective work pieces, severing the entubed strips intermediate the designs and work pieces, delivering the several work pieces concurrently in their severed sections of entubed wrapper strips, each of said strips bearing a wrapper design, laterally propelling delivered work pieces and wrapper sections, and completing the folding and sealing of the wrapper sections upon the work pieces in the course of such lateral delivery.

16. In a multiple lane wrapping machine, having a plurality of substantially parallel devices for entubing articles in wrapper strips, each of said devices including laterally spaced feeding and folding conveyors, the combination of means for supplying a broad web of wrapping material, means for slitting said web into wrapper strips during the continuous movement of said web and strips, and means operative upon the strips during continuous movement thereof for laterally spacing the several strips and delivering the spaced strips to the respective devices, the spacing between said strips accommodating the conveyors of said devices.

17. In a multiple lane wrapping machine, the combination with a plurality of elongated wrapping devices, each comprising means for the continuous advance of a wrapping strip and the enfolding of successive articles in spaced positions in said strip, means for slitting a broad web into said wrapper strips and laterally spacing the respective strips for delivery simultaneously to the respective devices provided with intermittent strips adjacent in said web will maintain their relative longitudinal positions while advancing in laterally spaced positions through said devices, together with a wrapper strip severing means common to the several devices, and means synchronizing with the wrapper strip severing means for delivering articles to be wrapped simultaneously onto the said strips of the several devices in such timed relationship that the web severing means will sever said strips intermediate successive articles in all of the several devices.

18. In a wrapping machine which includes a wrapping device, and means for propelling a wrapper strip thereover and enfolding said strip about an article to be wrapped in the course of wrapper strip movement through said device, the combination with said last mentioned conveyor means, of a rotary brush located immediately beyond the cutoff means in the direction of work advance and power operated to cooperate with said last mentioned conveyor means for holding work thereto.

19. In a wrapping machine which includes a wrapping device, and means for propelling a wrapper strip thereover and enfolding said strip about an article to be wrapped in the course of wrapper strip movement through said device, the combination with delivery means leading to said device for discharging successive articles on the wrapper strip to be wrapped therein, and including an accumulative fester having a guide-way for successive articles, of means for frictionally urging said articles toward said device, a gate controlling the movement of successive articles toward said device, said gate being normally disposed to block the passage of articles to said device and being provided with means for its momentary retraction to permit the passing of a single article, cutoff means for severing the wrapper strip between successive articles, and interconnected operating connections for said cutoff means and said gate retraction means whereby to synchronize the entry of articles into said device with the operation of said cutoff means in order that said cutoff means may operate on said wrapper strip intermediate successive articles enfolded therein.

20. In a multiple lane wrapping machine comprising a plurality of wrapping devices having a common cutoff knife, the combination of a web feed common to said devices, means for slitting the web into wrapping strips individual to the respective devices, and means for laterally spacing the respective strips en route to said devices while maintaining their relative positions in the direction of strip movement, whereby labels printed on said web may be properly synchronized with the cutoff means common to the several devices, together with means for feeding work pieces to the several wrapping devices simultaneously as predetermined intervals, and means for synchronizing said feeding means to
the operation of the common cutoff means whereby said devices will sever the respective wrapping strips, wherein the work pieces are folded therein in the several devices, said feeding means comprising cumulating guideways for rows of work pieces for delivery to the respective devices, means urging the work pieces in the respective guideways toward the respective devices, gate means retaining the foremost work piece in each guideway, and means for simultaneously releasing the gate means of the several guideways for the simultaneous delivery of a work piece from each guideway to a respective folding device.

21. The device of claim 20 in which the means for laterally spacing the respective strips comprises a first guide for each strip, the respective guides having surfaces slightly oblique at obtuse angles to each other at something less than 90 degrees with respect to the original paths of travel of the respective strips, whereby the strips, in passing about such surfaces, deviate angularly from each other, and second guides for each strip, the respective second guides having guiding surfaces substantially parallel to the guiding surfaces of the guide first mentioned but about which the respective strips pass in opposite directions, whereby such strips are restored to substantial parallelism in mutually spaced relation.

22. In a wrapping machine having a plurality of lines of wrapping apparatus, a feeder of the character described comprising a conveyor belt approximately equal to the combined width of the several lines of wrapping apparatus, said belt, having a delivery end extending toward said apparatus, guide means adjacent to the delivery end of the belt defining a plurality of paths of work piece travel in substantial alignment with the several lines of wrapping apparatus, a preceding portion of said belt being open for the deposit of work pieces therein, gate means adjacent to the delivery end of the belt defining the plurality of paths of work piece travel in substantial alignment with the several lines of wrapping apparatus, a preceding portion of said belt being open for the deposit of work pieces therein, gate means adjacent to the delivery end of the belt, means beyond the gate means providing guide channels leading to the respective lines of wrapping apparatus, synchronized conveyor means including propelling fingers operating along the respective channels for propelling individually toward the respective lines of wrapping apparatus work pieces spaced in said channels, and means for intermittently opening said gate means for the delivery of individual work pieces urged toward said gate means by the friction of the belt travelling therebetween, whereby to discharge from said belt individual work pieces at intervals spaced for the propulsion of such individual work pieces by the arms of the conveyor.

23. In a wrapping machine having a plurality of parallel wrapping devices, means for feeding separate wrapping strips to the said devices, and a cutter common to said devices for severing said strips at corresponding points, a feeder comprising the combination with guide means providing parallel lines aligned with respective wrapping devices, of a work piece advancing conveyor having lugs on the respective lines for delivering successive work pieces concurrently through the several lines to the respective devices for wrapping, a feeding conveyor common to the several lines and upon which work pieces are deposited at random for delivery through said lines, guides above the feeding conveyor leading to said lines, and means for transferring work pieces in synchronism from the feeding conveyor to the conveyor first mentioned, said means including start-

24. In a multiple lane wrapping machine having means for feeding a plurality of articles along adjacent paths, means for feeding a broad wrapping web upon which individual wrapper designs are printed in adjacent series, and means for setting said web into separate strips each containing a series of wrapper designs, the combination with means for laterally spacing the strips in the course of their advance, of means for wrapping portions of the respective strips about the successive articles fed upon respective paths, and means for cutting the respective strips between articles wrapped thereon, the lateral spacing means comprising pairs of guides defining paths of travel of substantially uniform length for the respective strips, the guides of each pair being complementary as to angle to leave the strips parallel, and the angles of guides of a particular pair being diverse from the angles of the guides of another pair for laterally spacing the several strips to accommodate the wrapping means respectively active on portions thereof.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>102,563</td>
<td>Maxwell</td>
<td>Mar. 3, 1870</td>
</tr>
<tr>
<td>109,645</td>
<td>Heeren</td>
<td>Jan. 29, 1878</td>
</tr>
<tr>
<td>1,036,399</td>
<td>Witt</td>
<td>Aug. 20, 1912</td>
</tr>
<tr>
<td>1,150,180</td>
<td>Cohen</td>
<td>Oct. 26, 1915</td>
</tr>
<tr>
<td>1,341,408</td>
<td>Armstrong</td>
<td>May 25, 1920</td>
</tr>
<tr>
<td>1,352,629</td>
<td>Remington</td>
<td>Sept. 14, 1920</td>
</tr>
<tr>
<td>1,586,020</td>
<td>Buren</td>
<td>Dec. 13, 1928</td>
</tr>
<tr>
<td>1,912,696</td>
<td>Everett et al.</td>
<td>Apr. 23, 1931</td>
</tr>
<tr>
<td>1,946,457</td>
<td>Ferguson</td>
<td>June, 1933</td>
</tr>
<tr>
<td>1,953,098</td>
<td>Donnelly et al.</td>
<td>Feb. 6, 1934</td>
</tr>
<tr>
<td>1,954,393</td>
<td>Becker</td>
<td>Apr. 3, 1934</td>
</tr>
<tr>
<td>1,954,476</td>
<td>Richard</td>
<td>Apr. 24, 1934</td>
</tr>
<tr>
<td>1,957,471</td>
<td>Belcher</td>
<td>Jan. 26, 1935</td>
</tr>
<tr>
<td>2,082,317</td>
<td>Saltsberg</td>
<td>June 15, 1937</td>
</tr>
<tr>
<td>2,103,813</td>
<td>Saltsberg</td>
<td>June 15, 1937</td>
</tr>
<tr>
<td>2,090,448</td>
<td>Jahne et al.</td>
<td>Aug. 17, 1937</td>
</tr>
<tr>
<td>2,103,390</td>
<td>Saltsberg</td>
<td>Dec. 28, 1937</td>
</tr>
<tr>
<td>2,105,159</td>
<td>Peksky</td>
<td>Jan. 11, 1938</td>
</tr>
<tr>
<td>2,117,847</td>
<td>Molin</td>
<td>May 17, 1938</td>
</tr>
<tr>
<td>2,156,466</td>
<td>Vogt</td>
<td>May 2, 1938</td>
</tr>
<tr>
<td>2,162,230</td>
<td>Saltsberg</td>
<td>Dec. 13, 1938</td>
</tr>
<tr>
<td>2,163,318</td>
<td>Scusa</td>
<td>June 20, 1939</td>
</tr>
<tr>
<td>2,213,602</td>
<td>Yates</td>
<td>Sept. 3, 1940</td>
</tr>
<tr>
<td>2,213,957</td>
<td>Freud</td>
<td>Sept. 10, 1940</td>
</tr>
<tr>
<td>2,257,119</td>
<td>Smith</td>
<td>Apr. 1, 1941</td>
</tr>
<tr>
<td>2,297,346</td>
<td>Griffen</td>
<td>Apr. 8, 1941</td>
</tr>
<tr>
<td>2,298,542</td>
<td>Talbot</td>
<td>May 5, 1941</td>
</tr>
<tr>
<td>2,248,471</td>
<td>Stroop</td>
<td>July 8, 1941</td>
</tr>
<tr>
<td>2,260,064</td>
<td>Stokes</td>
<td>Oct. 21, 1941</td>
</tr>
<tr>
<td>2,280,405</td>
<td>Frostad</td>
<td>Apr. 21, 1942</td>
</tr>
<tr>
<td>2,296,142</td>
<td>Campbell</td>
<td>Sept. 15, 1942</td>
</tr>
</tbody>
</table>

FOREIGN PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Country</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>472,874</td>
<td>Great Britain</td>
<td>Oct. 1, 1937</td>
</tr>
</tbody>
</table>