

Nov. 29, 1955

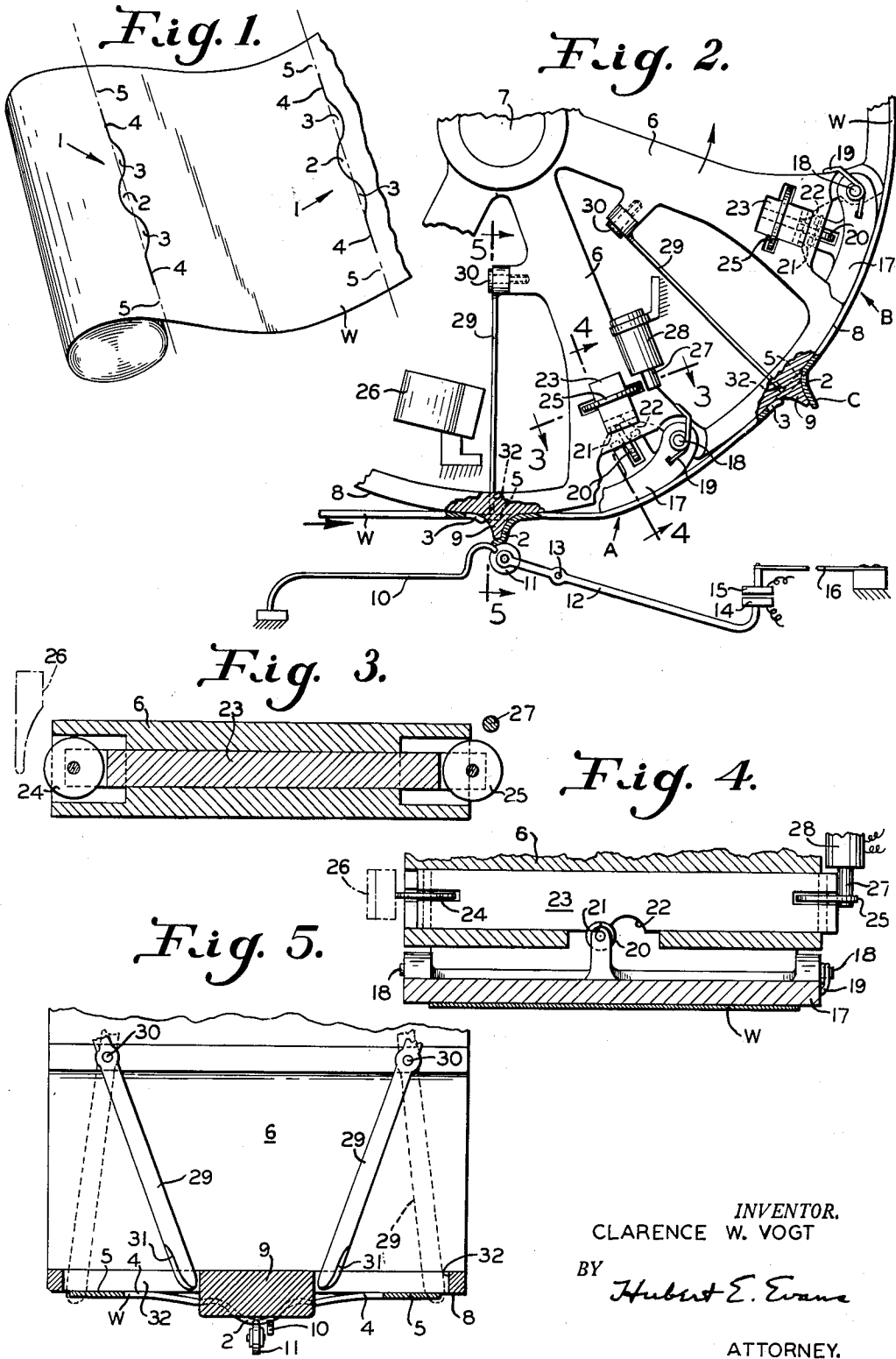
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2,724,939

METHOD OF AND APPARATUS FOR CONTROLLING REGISTRY

Filed Aug. 14, 1950

2 Sheets-Sheet 1



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METHOD OF AND APPARATUS FOR CONTROLLING REGISTRY

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2 Sheets-Sheet 2

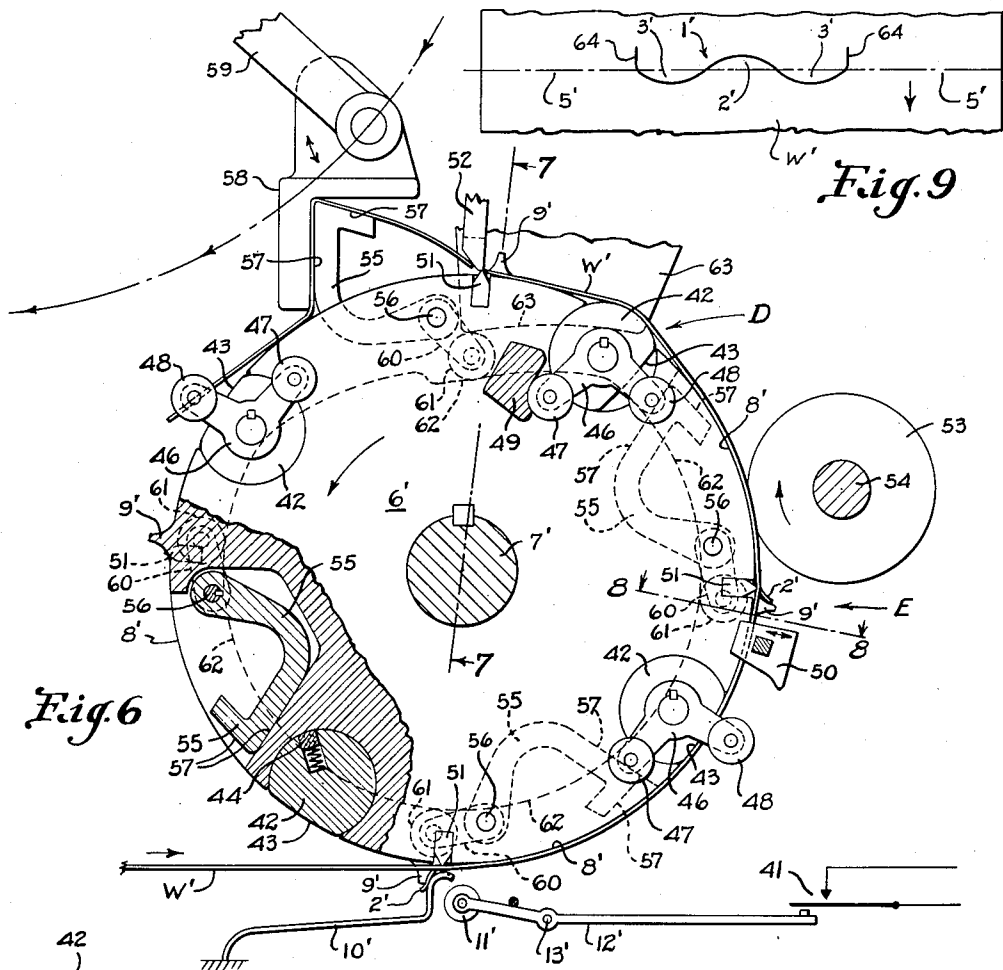


Fig. 6

Fig. 9

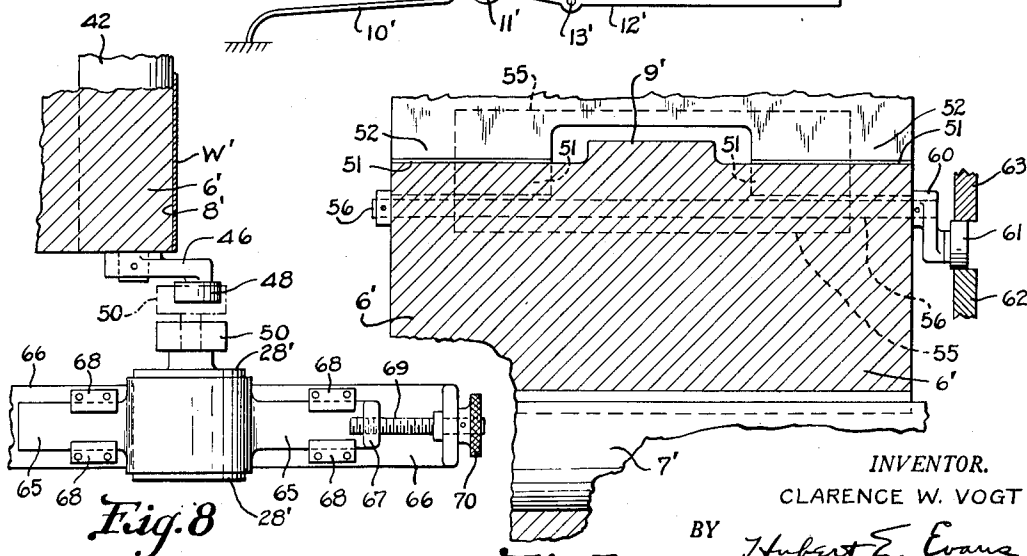


Fig. 8

Fig. 7

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METHOD OF AND APPARATUS FOR CONTROLLING REGISTRY

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13 Claims. (Cl. 53—155)

This invention relates to the registry control or positioning of a plurality of sheet material articles adapted to be fed in sequence for use, and is especially adaptable for successively separating sheet material articles, such as, for example, wrappers, labels, bands, overwraps, etc., from a web and positioning them in sequential registration.

The present invention is a continuation-in-part of my co-pending application Serial No. 174,261, filed July 17, 1950, now Patent No. 2,620,205, and entitled Sheet Material Articles in Sequence.

In many packaging operations such as wrapping or labeling it is often times desirable to feed the sheet material articles as a web or strip withdrawn from a source of supply such as a roll. However, it has long been a problem to obtain positive or proper registry of the strip or web so that the individual wrappers or labels will be of uniform length and will contain the same pattern of printed matter at substantially the same location on each individual article. To illustrate, in present day commercial practice, fractional pound units of butter and margarine are enclosed in wrappers which are fed from a roll or web on which the printed matter has been placed in a so-called repetitive or hit-or-miss pattern, so that regardless of the length of wrappers severed from the web, the printed matter will completely appear at least once on each wrapper, but not necessarily at the same location on the wrapper. This practice is followed because in the feeding and severing methods employed, it has not been found practicable to sever and apply individual wrapper lengths which are uniform and which are so controlled that they may be uniformly applied to the objects to be wrapped. Registry control mechanisms involving the use of photoelectric cells and differential gear correction mechanisms have been found useful in other fields, such as in the printing of the webs. Thus the webs may be printed in exact registry with the desired article lengths and suitable registry indicia may be disposed at desired intervals in registry with the printed matter. However, when feeding the web, it is difficult to reproduce the conditions encountered at the time the web was fabricated, imprinted and wound into supply rolls, and as a result, the individual article lengths may lengthen or shrink depending upon such factors as, the tension applied to the web, changes in the moisture content of the sheet material, or the humidity of the surrounding atmosphere. It is therefore essential, as a practical matter, to position or control the registry of the web at the time it is being fed for use. In such applications as wrapping fractional pound units of butter, margarine, etc., it has not been found practicable to utilize a photoelectric cell registry control mechanism for positioning the web conjointly with its being advanced and severed into individual articles for use. It is believed that this inability to utilize photoelectric cell registry control units is due to the fact that dairy sanitation requirements prescribe the regular use of hot water or steam to insure maintenance of sanitation and sterile conditions, and

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under the humid conditions encountered, it has been difficult to maintain photoelectric cell units in regular trouble-free operation. Another factor is that many dairy installations do not have available the highly skilled craftsmen for maintaining such units, and if available the maintenance costs are disproportionate. It is, therefore, an object of the present invention to provide a method of and apparatus for positioning sheet material articles during feeding to facilitate their being accurately separated into uniform article lengths in registry with the printed matter thereon and accurately positioned with the objects to be packaged, without requiring the use of a registry control mechanism as expensive, delicate and complicated as those which include a photoelectric cell or the like.

Another object is to provide a method of and apparatus for positioning a web of sheet material articles in joined end-to-end relation so that they may be separated into individual articles of substantially uniform length and properly associated with the objects for which they are intended. This permits the production of accurately labeled objects, as well as wrapped packages in which the wrappers are registered with respect to the objects which they enclose and thus the imprinting of the wrappers will appear at the same location on each package. From a merchandising standpoint, this results in labeled objects and wrapped packages having enhanced appearance and greatly increased sales appeal.

A further object is to provide a method of and apparatus for positioning sheet material articles conjointly with the feeding thereof in such a manner that a positive sequence of uniform sheet material articles may be supplied, without errors or gaps. The importance of this feature may be illustrated in the packaging of plastic material such as butter and margarine. The accuracy of measurement of such materials and the preservation of their components and physical characteristics are facilitated by continuous flow of the materials to and through the apparatus which meters, forms and delivers measured amounts of the commodity for packaging. If the sequence of wrappers is not positive, it may be necessary to stop the equipment to prevent depositing the commodity onto the mechanism. Obviously, a positive sequence of individual wrappers will speed up the packaging rate and obviate wastage or spoilage of the commodity, thus increasing efficiency and lowering cost.

A still further object is to provide a method and apparatus for conjointly feeding, successively positioning and severing a plurality of individual sheet material articles from a web on which they appear in joined relationship adapted for operation in a continuously moving cycle to facilitate smoother operation and obviate the adverse effects on control of the articles which may be encountered if the operation is interrupted.

Another object of the present invention is to provide a simple and efficient method and apparatus for feeding and successively positioning a sheet material web which has been partially severed at desired predetermined intervals therealong to permit completion of the severance of the web at substantially the location of the previously made partial severances, within acceptably close tolerances.

Other objects and advantages of the present invention will become apparent from the following detail description, accompanied by the drawings, in which:

Figure 1 is a perspective view of a portion of a web suitable for use in connection with the present invention;

Figure 2 is a fragmentary elevational view, with parts broken away, of a schematic form of mechanism embodying the present invention;

Figure 3 is a fragmentary sectional view taken substan-

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tially on line 3—3 of Fig. 2 to illustrate the operation of the mechanism shown in Fig. 2;

Fig. 4 is a similar fragmentary sectional view taken substantially on line 4—4 of Fig. 2;

Fig. 5 is a further fragmentary sectional view taken substantially on line 5—5 of Fig. 2;

Fig. 6 is an elevational view with parts broken away of a modified form of apparatus embodying the present invention to illustrate a method of feeding, positioning, applying and severing sheet material articles from a web;

Fig. 7 is an enlarged fragmentary sectional view taken substantially on line 7—7 of Fig. 6;

Fig. 8 is a fragmentary sectional view taken in the direction of line 8—8 of Fig. 6; and

Fig. 9 is an enlarged fragmentary plan view of a portion of a modified form of web for use in the present invention.

For purposes of illustration, the present invention will be described in connection with the feeding and positioning of wrappers for packaging objects, such as, for example, quarter-pound units of butter and margarine. However, it will be understood that the present invention is much broader in scope and application. Many other objects or commodities having a wide variety of shapes and sizes may be packed in wrappers fed and positioned in accordance with the present invention. Furthermore, the present invention may be advantageously utilized for the feeding and positioning of a large number of sheet material articles other than wrappers. It may be advantageously applied to the feeding and positioning of labels, bands, partial or complete overraps or other similar items which it is desired to supply in a succession of uniform articles for utilization.

Articles suitable for use in accordance with the present invention are disclosed in my previously identified co-pending application, Serial No. 174,261, filed July 17, 1950. Such articles are designed and arranged to be fed in a succession or sequence as a web. The web is defined or sub-divided into individual articles or wrappers by a readily detachable connection or partial separation. This partial separation extends generally in a direction transversely of the web and partially thereacross, intermediate of the side edges of the web. Further, the partial separation is preferably in the form of a slit, shaped to define a tongue or tongues deflectible from the plane of the web and disposed in the region of the common boundary between adjacent articles.

Sheet material for use with the present invention may comprise any of a variety of substances, such as many types of paper, or plastic film, or metallic foil, etc. The sheet material may be of a desired thickness, having sufficient flexibility and strength to be advanced and handled in accordance with the present invention. Also, the material may be provided with reinforcement in desired areas or may be reinforced throughout. For many applications it may be advantageous to utilize composite or laminated sheet materials having two or more plies each of which may provide some desired characteristics for the end use to which the article is intended. Also, it may be desirable to provide a sheet material with appropriate coating or surface covering to increase its imperviousness, provide better folding characteristics, add rigidity to the sheet, provide adhesive areas, improve the printability of the sheet material, or the like. The selection of an appropriate material will be dependent on the use of the individual articles, and it may be seen that a wide variety of materials may be used to advantage.

The exterior surface of the web may be imprinted with any desired pattern of printed matter, such as, trademarks, advertising, manufacturer's name and address, instructions for use, designs, art work and the like. The web may also be provided with crease lines, cut-score

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lines, slits, adhesive spots, stripes or areas, or other means which will increase the utility of the article.

Figure 1 illustrates a preferred form of web W. As described, the web is preferably sub-divided into individual article lengths or wrappers by a shaped slit indicated generally by the numeral 1. These slits are disposed at suitable intervals so that each wrapper is dimensioned to correspond to the object or commodity to be enclosed thereby. Further, each wrapper has imprinted thereon the desired pattern of printed matter accurately registered with respect to the edges of the wrapper, and accurately registered with respect to the shaped slits so that each completed wrapped package will have its pattern of printed matter properly located with respect to each panel or face of the package.

The configuration of the shaped slit 1 shown in the drawings is a particularly desirable form of partial separation and includes a central flap or tongue 2 struck from the web and extending rearwardly relative to the normal direction of feeding of the web. Outwardly of, or adjacent to the central tongue 2 are a pair of side tongues or flaps 3 which are struck from the surface of the web and extend in an opposite direction from the tongue 2. The shaped slit 1 terminates in straight line portions 4 which are aligned with and coincide with the common boundary between adjacent articles. The various portions of the shaped slit merge with one another to provide a smooth sinuous slit, as shown. The length of the slit and the dimensions of the tongues are such that the intermediate portion of the web will have the desired flexibility for the purposes to be described without affecting the tension with which the web is fed. However, the slit must be sufficiently short that the remaining integral connecting portions 5 of the web between adjacent articles are sufficiently strong to permit feeding the web under suitable tension without breakage.

To provide a source of supply of the web W, the web may be rolled into suitably sized rolls which may be supported for withdrawal of the web therefrom. Web withdrawal may be accomplished by driving the supply roll so that desired amounts of the sheet material web are fed under controlled tension, or one or more pairs of driven feed rolls may pull the web from the supply roll. Also, the web may be withdrawn from the supply roll by a feed member on which the positioning operation may also be accomplished. The source of supply of the web may also comprise a zig-zag or ticket folded stack of sheets from which desired amounts of the web may be withdrawn. This form of source of supply may be advantageous, particularly for reinforced or composite sheet materials which are not adapted to be readily rolled due to their uneven thicknesses. For continuous operation, it may be desirable to arrange the source of supply so that a continuous web may be withdrawn. When the web is zig-zag or ticket-folded, the leading edge of one stack may be suitably connected to the trailing edge of a previous stack. When the web is rolled, continuous operation may be obtained by providing for a flying splice so that the leading edge of a fresh roll may be connected to a portion of the web from the roll which is about to be exhausted.

It is believed preferable to provide relatively uniform tension during feeding of the web to compensate for any variations in the lineal speed of advancement of the web which might detract from the accuracy of positioning of the articles. A number of mechanisms for controlling the tension of a web within desired limits are available and known in the art, and consequently the drawings do not disclose a particular apparatus for tension control. By way of example, some control mechanisms apply an appropriate braking force to the source of supply or utilize a slack loop with a movable slack roller moving with the loop to actuate the speed of withdrawal of the web from its source of supply.

The drawings show in schematic form, a feed member

having a surface to which the web may be applied for successively positioning the individual articles prior to their being applied for use and separated from the web. To obtain substantially uniform lengths of individual articles, such as for providing wrapped packages on which the printed matter appears in the same location on each package, positioning of the wrapper will generally be required. Although the wrappers may have been fabricated to satisfactory specifications, variations will arise due to stretching or shrinking of the web under the feeding conditions, which may vary appreciably from the conditions at the time the web is fabricated and imprinted. For example, changes in the moisture content of the sheet material or the humidity of the surrounding atmosphere or the tension of the sheet material may cause appreciable variations in its dimensions, which adversely affect registry of the wrappers when they are separated and used. If the wrappers are in multiple length web form, the dimensional changes may cause cumulative errors which prevent the obtaining of individual wrapped packages having registered imprinting thereon. Since it is not practicable to duplicate all of the exact conditions at the time of fabrication, some means of positioning or registry control is necessary. The present invention provides a method of and apparatus for successively positioning individual wrappers without the use of expensive or complicated mechanisms such as photoelectric cell mechanisms, differential gear corrective units and the like.

Looking at Fig. 2 the web W is withdrawn from a source of supply and advanced preferably under controlled tension to the surface of a member which in the form illustrated is a rotary member 6 mounted for rotation on a shaft 7 driven by a suitable source of power (not shown). The member 6 is shown as having a cylindrical or drum-like shape and may comprise a web feeding member driven in timed relation with other portions of a machine for completely packaging commodity units. Since a member having a round or flat surface onto which the web is fed for positioning, will permit advancement of the web with a minimum of variation in lineal speed, both of these arrangements are considered beneficial for providing a surface on which adjustment or positioning of the web may be accomplished. However, many other forms of feed members having cross sections, such as square, hexagonal, octagonal, or even some irregular shape may be desirable for other adaptations of the present invention.

Disposed at spaced intervals along the peripheral surface 8 of the members 6 are ribs or finder elements 9 which extend transversely along the peripheral surface 8 for a distance less than the length of the slit 1 and project radially out from the peripheral surface. The elements 9 are spaced apart a distance substantially equal to the desired wrapper lengths and thus as the web is fed to and applied to the member 6, the elements 9 are successively inserted into the slits 1. As shown in Fig. 2, the finder elements 9 have curved side faces which merge into the peripheral surface 8 of the member 6, so that the central tongue 2 may lie against such curved sides.

At approximately the point where the web W is applied to the elements 9, one or more resilient smoothing members 10 may be mounted in a stationary position adjacent the peripheral surface of the member 6. The members 10 are shown as leaf springs terminating in rounded contact portions which engage and ride along the central portions of the web to smooth it into engagement with the peripheral surface 8 and the surface of the finder elements 9 as may be seen in Fig. 2. It may be noted that due to the presence of the slit 1, the tension of the web will be transmitted through the integral portions 5 at the side edges of the web and since the intermediate portions of the web are more flexible there may be a tendency of the central portion of the web not to conform smoothly with the surface of the member 6, particularly in the re-

gion where the finder element 9 is inserted through the flexed web. Obviously, the members 10 may terminate in rollers or have other suitable shape to conform the web, and particularly the tongue 2.

Located adjacent the free end portion of the member or members 10 and disposed centrally of the web in the path of the central portion of the tongue 2, is provided a roller 11, carried by a lever arm 12 which is mounted to oscillate about the pivotal axis indicated by the numeral 13 in Fig. 2. One end of the lever arm 12 carries the roller 11 while its opposite end has mounted thereon a switch contact 14. An opposed contact 15 may be carried on a leaf spring member 16, mounted in a stationary position so that the contacts 14 and 15 are adjacent each other. These parts schematically illustrate a precision switch, which may preferably be a snap acting type so that a relatively small movement of the roller 11 will create engagement of the contacts 14 and 15 to energize a suitable electrical circuit. This switch, in effect comprises a thickness gauge, useful for measuring the presence of sheet material of the web at the location of the roller 11. To accommodate different web thicknesses which may be applied to the member 6, the switch and its roller 11 may be mounted for adjustable movement toward and away from the member 6. Precision switches, having adequate sensitivity for even the thinner sheet materials, are commercially available in types which are protectively enclosed and have great durability and long life.

The roller 11 is disposed so that its periphery is tangent to or slightly spaced from the path of the top edges of the finder elements 9. As a finder moves past the roller, the clearance between these two parts is less than the thickness of the sheet material of the web being fed and therefore, if the web is applied to the member 6, in such a manner that a portion of the central tongue 2 extends onto or overlaps the top edge of the finder element 9, the thickness of the sheet material will depress the roller 11, oscillating the arm 12 about its pivotal axis 13 to close the contacts 14 and 15 and energize an electrical circuit. The top edges of the finder elements extend radially outward farther than other portions of the member 6 in the region of the roller 11 so that the switch will only be actuated in the manner described.

Between each adjacent finder element 9 a suitable means is provided for varying the distance between adjacent finders along the peripheral surface of the member 6. In the form of the invention shown, this comprises a flap or gate 17 pivotally mounted on a shaft 18 journaled in the member 6. To urge the flap or gate 17 into its closed position, where its outer surface is flush with the peripheral surface 8 of the member 6, a suitable torsion spring 19 may be disposed about the shaft 18. One end of the spring 19 is inserted into and bears against a portion of the flap 17 and its other end bears against a portion of the member 6. Each of the flaps 17 is arranged so that it may be located in a position where it is pivoted outwardly a suitable distance, but radially inward of the top edges of the finder elements 9. In its outer position, the flap 17 acts to increase the peripheral distance of the member 6 between adjacent finders. This outward position of the flap 17 is indicated at A in the lower central portion of Fig. 2, while the inner position of the flap 17 is indicated by the numeral B at the right hand side of Fig. 2.

To illustrate a form of mechanism for changing the position of the flaps 17 from their inner position, as at B, to their outer position, as at A, and vice versa, each of the flaps 17 is shown as provided on its inner surface with a roller 20 (see Figs. 2 and 4). These rollers 20 are adapted to be positioned either in a shallow recess 21 or a deeper recess 22 formed in a bar 23 which is mounted in the member 6 for sliding movement axially of the shaft 7. When the roller 20 is disposed in its shallower recess 21, the flap 17 is held in its outer position and when the roller 20 is in its recess 22 the flap 17 is retained in its inner posi-

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tion. A small ridge between the recesses, and the torsion spring 19 serve to retain the flap 17 in one of its two positions. To shift the position of the flaps 17, each of the slidably mounted bars 23 carries a pair of rollers 24 and 25, one at each end of the bar (Figs. 3 and 4). As the member 6 rotates in a counterclockwise direction when viewing Fig. 2, and prior to the time that a finder reaches the measuring station adjacent the roller 11 and its associated switch, a stationary wedge or cam member 26 is mounted at an appropriate fixed position adjacent an end of the member 6. The wedge 26 is disposed so that it will engage each roller 24 to cause it to move its bar 23 toward the right, when viewing Figs. 3 and 4, positioning each roller 20 of the flap 17 in the recess 21 of the bar so that each flap is in its outer position, unless the flap is already in this outer position.

The flaps 17 may be caused to move to their inner position by a pin or rod 27 mounted at the right hand side of Figs. 3 and 4 adjacent the member 6, in position to engage the periphery of each of the rollers 25 of the bars 23 successively. The pin 27 is actuated for movement by a solenoid 28 mounted in a fixed position adjacent the end face of the member 6 opposite to the end face at which the wedge or cam 26 is mounted. Further, the pin 27 is mounted in the path of the appropriate roller 25 a slight distance ahead of the position of such roller when the finder at the trailing edge of each individual wrapper is to pass adjacent the switch roller 11. Such slight distance will be dependent on the time required to actuate the solenoid 28 and pin 27, and on the peripheral speed of the member 6.

Looking at Fig. 2, the trailing edge of a wrapper has just been applied to the member 6 with the finder at the bottom of Fig. 2 inserted through the slit at the trailing edge of the wrapper. The tongue 2 of that particular slit has been conformed by the member 10 and overlaps the top edge of the finder. The finder is about to pass adjacent the periphery of the roller 11 and with the tongue 2 disposed on the top edge of the finder the roller 11 will be depressed, closing the switch contacts 14 and 15, energizing a suitable electrical circuit which will energize the solenoid 28, causing the pin 27 to be retracted or withdrawn from the path of the roller 25 which is about to contact the pin. With the pin 27 retracted, the bar 23 will not be moved to the left when viewing Figs. 3 and 4, and the flap 17 for the particular wrapper will not be moved to its flush position but will remain at its outer position. After actuation of the solenoid to retract the pin 27, the pin may be suitably returned to its position intersecting the path of the rollers 25 prior to the time that the trailing edge of the next succeeding wrapper reaches the measuring station. The pin 27 may be returned after sufficient delay to allow the roller 25 to pass or may be returned by gravity or a spring as soon as the leading edge of the roller 25 has passed and in this event the end of the pin may lightly contact and slide over the top surface of the roller without moving it or its associated bar 23.

In the case of the preceding wrapper applied to the periphery of the member 6 and shown at the right in Fig. 2, when the finder was inserted through the shaped slit 1 at the trailing edge of the wrapper, the tongue 2 did not extend over or overlap the top edge of such finder. Accordingly, the switch was not energized to cause the solenoid 28 to withdraw the pin 27, and therefore, the pin 27 contacted the roller 25 of the bar 23 and moved the bar so that roller 25 was positioned in recess 22 freeing the flap 17 from its outer position. The torsion spring 19 plus the tension of the web caused the flap 17 to move to its position flush with the peripheral surface 8 of the member 6, shortening the distance along the peripheral surface of the member 6 between the finders at the leading and trailing edge of the wrapper. The tension of the web caused a slight backward relative movement of the web with respect to the finder at

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the trailing edge of the wrapper for a length corresponding to the shortening of the peripheral distance between the adjacent finders. This backward movement of the web caused the tongue 2 at the trailing edge of the wrapper to extend further toward the top edge of the finder, as indicated at C in Fig. 2.

It may be seen that the common boundary between each adjacent wrapper bears a definite relationship to the end of the tongue 2 and accordingly the finder may be used to determine whether the end of the tongue 2 is properly positioned with respect to the finder. That is, measuring at the top edge of the finder gives an indication of the position of the tongue 2 with respect thereto, and therefore measures the location of the common boundary between adjacent wrappers. If an adjustment in the position of the wrapper is indicated at the measuring station, it may be obtained by leaving the pin 27 in position where it will vary the peripheral distance between the finders at the leading and trailing edges of the wrapper.

If the peripheral distance between adjacent finders when the flap 17 is in its outer position is slightly greater than the maximum length of the individual wrappers under the conditions actually encountered at the time of feeding, and the peripheral distance between adjacent finders when the flap 17 is flush with the surface 8 in slightly less than the minimum length of the individual wrappers actually encountered, the common boundary between adjacent wrappers may be successively positioned with respect to the member 6, within satisfactory close tolerances. It should be noted that if a wrapper is applied so that the tongues 3 at the trailing edge extend over or overlap a portion of the top edge of the finder, they are disposed at each side of the roller 11 and will not actuate the switch or affect the peripheral distance of the member 6 between adjacent finders.

Under the system of positioning or registry control which has been described, each wrapper is applied along a slightly elongated peripheral distance between adjacent finders, and if the tongue 2 of a particular wrapper reaches onto or overlaps the top edge of the finder, this peripheral distance is maintained and the wrapper advanced for gripping, application for use and separation from the web. If the tongue 2 does not extend onto or overlap the top edge of the finder at the measuring station, the peripheral distance between the adjacent finders for that wrapper is shortened and the web tension correspondingly retracts the web to adjust the trailing edge of the wrapper with respect to its finder in a direction tending to cause the tongue 2 to reach or overlap the top edge of the finder. Accordingly, the trailing edge of each wrapper is successively positioned, when conditions at the time of application call for positioning, with respect to its associated finder at the trailing edge of the wrapper within acceptable tolerances.

After the wrappers have been successively positioned, they may be fed or advanced by movement of the member 6, and may be suitably gripped to retain their positioned location to facilitate carrying out the operations of severing or completing the separation of the individual wraps and applying them for use. These operations may be accomplished while the wrappers are retained on the surface of the member 6, or the wrappers may be transferred to other suitable mechanism for completing the severance and application for use. To aid in preserving their positioned relationship, it is believed preferable to accomplish these operations while the wrappers are retained or gripped to the member 6.

In the form of the invention shown in Figs. 2 through 5, means for completing the severance of the individual articles is illustrated as a pair of pivotally mounted knives 29 disposed adjacent and in predetermined relation with respect to each of the finder elements 9. The knives 29, best seen in Figs. 2 and 5, are pivotally mounted to the member 6 by pivot pins 30. The free ends of the knives

may be guided during movement by being disposed in slots 32 formed in the member 6 and opening to the surface 8. Any suitable mechanism (not shown) may actuate the knives in timed relation with the movement of the member 6, so that each pair of knives is moved, preferably simultaneously, outwardly in opposite directions, causing cutting portions 31 of the knives to sever the connecting portions 5 at a common boundary between adjacent wrappers of the web. This method of successively separating the individual articles from the web is advantageous in that the force of the knives is applied to the web in equal and opposite directions and will tend to cause a minimum of disturbance to the web.

I have found that the shape of the slits 1 may assist in obtaining substantially even edges of the individual articles, when the cutting is accomplished as described. Fig. 1 shows center lines, indicating the common boundaries between adjacent wrappers, which are aligned with the straight line portions 4 of the slits. The provision of intermediate flexible portions of the web and the insertion of the finder element through the slit to spread the marginal edges of the slit, permits a substantially aligned, continuation of the cut portions 4 along the common boundary between adjacent wrappers even though the adjacent wrappers may be slightly misaligned with respect to the cutting edges of the knives at the time of cut. Since the positioning operation places the trailing edge of each wrapper in a predetermined relationship with respect to the corresponding finder element, within acceptable tolerances, it is contemplated that other separating means, such as, rotary, reciprocating or other cutters, mounted exteriorly of the member 6 and acting in appropriate timed relation therewith, may be employed to separate individual articles from the web.

It is believed preferable that the web of wrappers be gripped or held to the surface 8 of the member 6 after each wrapper has been positioned with respect thereto, so that the positioning may be preserved for cutting and applying the articles. Any suitable form of gripping means (not shown) may be utilized, it being considered that web gripping mechanisms are well known in the art. For purposes of illustration, a plurality of pins suitably arranged to impale edge portions of the wrappers, may be disposed at suitable locations. Where it is not desired to pierce the sheet material, the gripping may be accomplished by a plurality of vacuum ports opening to the surface 8 of the member 6 at appropriate positions and communicating with a suitable exhaust pump. It is also contemplated that the grippers may take the form of members which oscillate from the ends of the member 6 to pinch edge portions of the web against the surface 8, or may comprise a roller or rollers, preferably having a flexible or resilient surface, engaging a portion or portions of the surface 8. Two rolls contacting spaced locations of the surface 8 may be used so that one is gripping while a recessed portion of the other passes over projections on the surface 8. Obviously, it is desirable to retain control of the individual articles as long as possible, and accordingly, it may be desirable to successively apply the leading wrapper to a receiving member prior to the completion of its separation from the web. The pivotally mounted flaps or gates 17 might, for example, comprise applying members movable outwardly to apply predetermined portions of the wrappers onto suitable receiving surfaces, as they are separated from the web.

Figs. 6 through 8 illustrate a modified form of method and apparatus embodying the present invention, for conjointly feeding, positioning, applying and separating a sequence of wrappers in the form of a web. Similar to the form of the invention shown in Figs. 2 through 5, a feed member 6', comprising a cylindrical block is mounted for rotation on a shaft 7' and provides a peripheral surface 8' to which a web W' may be applied, preferably with a substantially uniform, controlled ten-

sion. Finder elements 9' are disposed at intervals along the surface of the feed member, the distance between adjacent finders along the peripheral surface 8' being substantially equal to an individual wrapper length.

As in the previously described form of the invention, one or more leaf spring members 10' are disposed adjacent the point where the web W' is applied to the finder elements 9', and each member 10' has rounded contact portions to smooth the central portion of the web, and particularly the central tongue or flap 2' of the shaped slit, against the rounded side face of the finder element 9' at the time of measuring. A roller 11', carried by lever arm 12', pivotally mounted at 13', is also disposed adjacent the free end of the member 10', and as previously described in connection with Figs. 2 and 5 is disposed to act as a thickness gauge to successively measure or discern whether the ends of the tongues 2' extend onto or overlie the top edges of the finder elements 9'. When the roller 11' is depressed by the thickness of the web, it closes the contacts of a switch, indicated by numeral 41, to energize a suitable electric circuit, activating a solenoid 28' (Fig. 8).

The adjustment of the peripheral distance between adjacent finder elements 9' is obtained by mounting adjusting members 42 in the member 6' at a suitable location between adjacent finders. These members 42 are preferably cylindrical with a flattened surface 43 which may either be planar or be rounded to conform to the curvature of the peripheral surface 8'. The adjusting members are mounted for oscillating movement in suitably shaped recesses of the member 6', opening to the peripheral surface so that the members 42 may present either the surface 43 flush with the surface 8', or a projecting surface at the periphery of the member 6'. Each adjusting member 42 is retained in position by one or more spring pressed plungers 44, made of a suitable material to frictionally engage the walls of the recess in the member 6' in which the member 42 is disposed. To change the position of the adjusting members, they may be each provided at an end of the member 6', with a bell crank member 46, the free ends of which carry rollers 47 and 48. At a suitable point in the rotation of the member 6', a stationary cam bump or projection 49 is mounted from a fixed part of the apparatus to project into the path of each of the rollers 47 to cause it to oscillate its adjusting member 42 so that it presents the surface 43 to the periphery of the member 6', unless the member 42 is already in this position. In the upper right hand portion of Fig. 6, it may be seen that the roller 47 has just come into contact with the projection 49, and the member 42 will be oscillated so that it will not project from the surface 8'. The adjusting member 42 retains this flush position until it contacts a cam bump or projection 50, which is normally mounted adjacent to, but out of, the path of the rollers 48, when the trailing edge of the corresponding wrapper has just been applied to the finder element 9' and passes over the roller 11'. The projection 50 is movably mounted and adapted to be actuated by the solenoid 28', best seen in Fig. 8.

If the tongue 2' at the trailing edge of a wrapper when applied, reaches onto or overlaps the top edge of the finder element 9', it depresses the roller 11', closing the contacts of the switch 41, energizing the solenoid 28', causing it to move the projection 50, from its full line position to its dash-dot line position in Fig. 8 where it is disposed in the path of the roller 48. When the roller 48 strikes the projection 50, it causes oscillation of the adjusting member 42 so that at least a portion of the surface 43 disappears from the periphery of the member 6' and the cylindrical surface of the member 42 is projected from the periphery of the member 6'. The peripheral distance between adjacent finders 9' is thereby increased, and an additional amount of the web is caused to be fed, which amount corresponds to the vari-

ation of the peripheral surface of the member 6' due to the change in the position of the member 42. This condition is indicated at D in the upper portion of Fig. 6 where it may be seen that the web is lifted from the surface 8' of the feed member by the adjusting member 42. This additional feeding of the web will cause the trailing edge of the tongue 2' to be moved forwardly with respect to the finder to a position where it will not reach onto or overlap the top edge of the finder, as indicated at E at the right hand side of Fig. 6.

If the tongue 2' of the trailing edge of any wrapper does not extend onto or overlap the top edge of the finder element 9', the roller 11' is not depressed to cause the solenoid 28' to be energized and the projection 50 is not moved into the path of the roller 48. The position of the member 42 is not changed and the surface 43 remains presented to the surface 8'. Thus, the peripheral distance between adjacent finders is not changed. In this form of positioning of the web, it may be seen that if the tongue 2' extends onto or overlaps the top edge of the finder an additional amount of the web is fed, tending to move the tongue forward with respect to the finder so that the edge of the tongue does not quite reach onto or overlap the top edge of the finder.

To provide for variation in the amount of correction or adjustment accomplished by the members 42, the movable projection 50 may be mounted to move in a direction radially of the member 6'. This is indicated in Fig. 8, where it will be seen that the solenoid 28' is enclosed in a casing having extensions or ears 65 mounted for sliding movement along a fixed supporting bracket or base 66. The ears 65 are held and guided by retaining plates 68 secured to the bracket 66 to provide a fixed path for the solenoid. One of the ears 65 is also provided with an upstanding lug 67 which has a threaded aperture for threaded engagement with an adjusting screw 69. The adjusting screw extends through and is journaled in an extension of the support bracket 66. The free end of the adjusting screw has secured thereto an adjusting knob 70.

It may be seen that by rotating the knob 70, solenoid 28' and the projection 50 are moved radially inwardly or radially outwardly with respect to the member 6'. Since the location of the radially inward edge of the projection 50 determines the amount of oscillation of each of the adjusting members 42 as imparted by the roller 48 and member 46, the amount of projection of the member 42 from the peripheral surface 8' of the member 6' may be controlled. It may be noted that this adjustment is afforded while the member 42 is being moved so that the surface 43 is not presented to the periphery of the member 6', because after the normal cylindrical surface of the member 42 has reached a radial line of the member 6' passing through the axis of rotation of the member 42, no further projection from the periphery of the member 6' is caused by further movement of the member 42. The above described means for varying the projection of the adjusting members 42 from the surface 8', controls the amount of change in the peripheral distance along the surface of the member 6' between adjacent finders, and thereby varies the amount of correction or positioning of the web. It is especially beneficial to be able to accomplish this variation in the successive adjustment of each article while the member 6' is maintained in continuous operation, and the mechanism described diagrammatically illustrates this feature.

Accordingly, it may be seen that positioning of the web will cause the trailing edge of the tongue 2' of each wrapper to be successively positioned so that it is disposed at the front side of the corresponding finder. Since the tongue 2' bears a definite relationship to the common boundary between adjacent wrappers, along which it is desired to complete the separation into individual wrappers, it may be seen that suitable cutting means may be actuated to sever the wrappers in the region slightly

ahead of each finder element. Figs. 6 and 7 illustrate a cutting means of a conventional type for performing a cut at a fixed position with respect to the feed member 6'. Cutter blades 51 are inserted at each side of the member 6' to extend in a direction axially of the member 6' for a distance sufficient to underly the unsevered portions of the web. Fixed cutter blades 52 best seen in Figs. 6 and 7 are mounted adjacent the periphery of the feed member 6' and cooperate with the cutter blades 51 to sever or pinch off the web. Either or both of the cutter blades 51 and 52 can be mounted for adjustment with respect to each other so that they may maintain their proper cutting relationship. The form of cutters are illustrative, and other suitable means for separating the wrappers may be employed.

In the form of the invention shown in Fig. 6, the means for gripping the web to the surface of the feed member 6' is illustrated as a roll or rolls 53 mounted for rotation on a shaft 54. The roller may be driven in timed relation with the feed member 6' or may be freely rotatable to turn by frictional contact with the web as the member 6' is driven. Roll 53 is fabricated of or has a covering of a flexible and elastic material, such as rubber or the like to provide appropriate frictional engagement, and to permit deforming of the surface of the roll without losing contact with the web as projections from the surface 8' pass adjacent the periphery of the roll. These projections include the cutter blades 51 and the cylindrical surface of the adjuster members 42 when they are presented to the periphery of the member 6'. If desired, the periphery of the roll may be cut or recessed to permit passage of the projections. To avoid contacting the finders 9', it is preferable that two spaced rolls be utilized, so that they contact the unsevered portions of the web.

The apparatus shown in Figs. 6 and 7 is also provided with a means for applying the wrappers to appropriate receiving members after the wrappers have been successively positioned, gripped and separated from the web. These applier members are indicated by the numeral 55 and are pivotally mounted on shafts 56 journaled in the member 6'. The appliers are pivoted to their inward position (shown, for clarity, as being within hollowed out recesses of the member 6') during most of the rotation of the member 6'. Each member 55 has divergent applying surfaces 57, and it is believed desirable that when the members 55 are at their inner position one of the surfaces 57 be flush with the surface 8' of the member 6'. After each applier 55 has passed the fixed cutting blade 52, it may be actuated so that it is pivoted outwardly from the member 6' carrying with it the leading wrapper of the web. In this outer position, the surfaces 57 of the applier member may mesh with receiving surfaces of a receiving member 58 which may be one of a plurality of similar members to move in a path which passes adjacent the member 6'. The receiving members 58 are preferably pivotally mounted on arms 59 which may for example, comprise spaced spokes of a wrapping wheel. In its outermost position, the apex of the divergent surfaces 57 of each applier 55 is disposed at a fixed predetermined distance from the common boundary between adjacent wrappers at the trailing edge of such wrapper, where the severing action is to occur. Thus, each wrapper is applied to its receiving member with its edges in predetermined position or registry with the receiving member. As may be seen in Fig. 6, the apex of the surfaces 57 of the applier 55 is in engagement with an apex of the receiving surfaces of the member 58, just prior to the time that the leading wrapper is severed from the web. To complete the application of the wrapper, the applying member 55 is retained in its outermost position and moves the receiving member 58 which oscillates about its pivotal connection with the arm 59 causing the wrapper to be applied to both receiving surfaces of the member 58. The receiv-

ing member 58 may be resiliently mounted during the pivotal movement to facilitate its meshing action with the member 55 with a minimum tendency to disturb the positioning of the wrapper. Upon severance of the wrapper, the receiving member may be further pivoted (in a clockwise direction, viewing Fig. 6) to release the applying member which may then be actuated to move to its innermost position. Each of the applying members 55 is controlled during its operation by a control lever 60, fixed to the pivotal shaft 56 of the member 55 and carrying a roller 61. During rotation of the member 6', each applier 55 is held in its inner position by cam surfaces 62 which contact roller 61. The appliers are caused to move outwardly and apply wrappers to the receiving members 58 by a cam surface 63, which contacts the roller 61 during a portion of its travel. If desired, the cam surface 63 may be omitted and outward movement of the appliers obtained by a torsion spring disposed around the shaft 56, and acting to resiliently urge the applier into engagement with the receiving member 58.

In the methods of positioning of the web which have been described, the correction or adjustment has been obtained by varying the peripheral distance between adjacent finders of the feed member by a fixed adjustment, which, in the form of invention shown in Figs. 6 through 8, may be changed in amount, as desired. If the precision switch mechanism and its feeler roller were mounted to travel with the feed member during a portion of its movement, the positioning mechanism could be made variable whereby the corrective action could be variable and continue until the roller indicated that the positioning of the web was correct. A similar result would be approached if two measuring stations were provided, with each station capable of applying a small fixed correction. Measurement and correction could occur at the first station, and could be repeated at the second measuring station if warranted by the conditions encountered there. For most purposes, however, it is believed that sufficient accuracy can be obtained by making a single fixed correction as has been described in connection with the drawings.

It will be appreciated that the configuration of the shaped slits in the web may be considerably varied. It is desirable that the slits between adjacent articles be shaped to define a tongue and provide flexibility of a portion of the web to permit insertion of the finder elements and a spreading of the marginal edges of the slits to accomplish positioning or registry control in a positive and simple manner as has been described. It is obviously advantageous that the slits be dimensioned and shaped so that they will operate in conformity with the size and shape of the finder elements. It is desirable that the tongue or tongues be readily movable or slidable with respect to the finder elements to facilitate application of the web, insertion of the finders and positioning of the web with respect to the finders.

To illustrate a desirable variation in the configuration of the slit, Fig. 9 shows a fragment of a web including a shaped slit, indicated generally by 1'. It is believed that this form of slit is preferable for use in connection with the type of severing means disclosed in Fig. 6 and 7. The shaped slit 1' defines a central flap or tongue 2' extending rearwardly with respect to the direction in which the web is to be fed. Adjacent the central flap or tongue 2' are a pair of flaps or tongues 3'. The slit then terminates in portion 64 which extend longitudinally of the web and provide a distance in the region of the common boundary within which the cut accomplished by the coating knives 51 and 52 may occur. If the length of the portions 64 corresponds to or is slightly greater than the tolerance acceptable in the positioning of the web, it may be seen that the completion of the cut will intersect the portion 64 and complete the severance of the individual wrappers.

Exteriorly of the slit, the adjacent wrappers are connected by integral portions 5' which are dimensioned to provide sufficient strength for feeding and tensioning of the web.

A sinuous slit, symmetrical with the common boundary between adjacent wrappers, as illustrated in Figures 1 and 9, is considered very advantageous for use in accordance with the present invention. Further, it provides or results in a minimum of encroachment on the individual articles. When the articles are wrappers, one edge of each wrapper will be sinuous and have a central tongue extending therefrom while the opposite edge of each wrapper will be sinuous and have a pair of tongues. It is believed that such sinuous edges will not be objectionable in appearance and when overlapped to provide a seam the tongues may be used for gripping and opening the wrapped package. The edges of the articles and the slits may be serrated or notched with the desired number and shape of serrations, or may have other suitable configuration, and if this pattern along the edges is appropriately dimensioned, it may provide the flexible portion of the web and the tongue or flap for measuring and positioning of the articles.

The drawings illustrate mechanism for carrying out the present invention in schematic form, for purposes of simplification. Many other mechanisms may be used to advantage for the various applications of the present invention, and further other apparatus may be incorporated. It is desired to point out that the positioning of a web may be accomplished in a simple fashion and with a minimum of mechanism, which will result in decreased maintenance and more efficient operation.

In the schematic showing of the apparatus in the drawings, the means for adjusting the peripheral distance between adjacent finders results in some cases in a projection from the feed surface. When the gripping means comprises a roller, such as the roll 53 in Fig. 6 with a flexible or resilient surface, certain sheet materials may be adversely affected by pressure of the roller over the material at the projection. As described, this may be overcome by using two rollers, each recessed to avoid contacting the projection, and spaced to alternate in their gripping function. Obviously, other gripping means may be employed to obviate such a condition, or the adjustment may be obtained by projections shaped so as not to interfere with the gripping. Further, when gripping rollers are utilized, it is advantageous to secure the adjusting means by some suitable locking means to insure the retention of the positioning of the articles on the feed surface.

It is desired to emphasize that the present invention provides a method and apparatus for successively positioning, gripping and severing individual sheet material articles which may be operated to perform these functions while the articles are continuously advanced as a web toward the location where they are to be utilized. This results in smoother operation and less tendency for disturbing of the web due to starting and stopping of the feeding means. Further, the present method and apparatus are adapted for synchronized operation with other units which may function on a continuous operating cycle, and provide efficient, high-speed and high capacity performance with acceptable accuracy. This feature is extremely valuable for applications, such as the accurate and positive feeding in sequence of wrappers, labels and the like.

It will be understood that in the drawings, proportions have been exaggerated in some instances to provide a greater understanding of the invention.

It will be understood that the foregoing description of preferred embodiments of the invention is for the purpose of explanation and illustration, and numerous variations and modifications other than those which have

been described, may be made without departing from the spirit of the invention.

What I claim is:

1. Apparatus for feeding sheet material articles imprinted in a pattern on a web with said web sub-divided into individual articles by slits in registry with said imprinting and defining a tongue in the region of the common boundary between adjacent articles which comprises a rotary feed member to which said web may be applied, a plurality of projections at predetermined locations on the surface of said feed member insertible into said slits to deflect said tongues, determining means mounted in predetermined relation with respect to said feed member for ascertaining the position of said tongues with respect to said projections, means for varying the peripheral distance along the surface of said feed member between adjacent projections, and means for actuating said last mentioned means controlled by said determining means.

2. The method of controlling the registry of a plurality of flexible sheet material articles disposed in joined end-to-end relationship, which comprises continuously advancing and applying said articles to the surface of a moving element, maintaining the articles on said surface, sensing the position of said articles with respect to said surface, and flexing said articles to position them with respect thereto and while the articles are maintained on the surface of said moving element.

3. The method of controlling the registry of a plurality of flexible sheet material articles disposed in joined end-to-end relationship, which comprises continuously advancing and applying said articles to a curved surface of a rotating element, maintaining the articles on said surface, sensing the position of said articles with respect to said surface, and flexing said articles to position them with respect thereto and while the articles are maintained on the surface of said rotating element.

4. The method of controlling the registry of a plurality of flexible sheet material articles disposed in joined end-to-end relationship and applying said articles to a receiving element, which comprises continuously advancing and applying said articles to the surface of a moving element, successively positioning said articles with respect to predetermined locations on said surface, successively applying a portion of each of said positioned articles in register with a receiving element and maintaining the articles in such applied position, and successively severing said articles from the next succeeding article while in said predetermined location with respect to the moving element and while in register with the receiving element.

5. The method of controlling the registry of a plurality of flexible sheet material articles disposed in joined end-to-end relationship and applying said articles to a receiving element, which comprises continuously advancing and applying said articles in a first position to the surface of a moving element, successively positioning said articles in a second position with respect to predetermined locations on said surface and maintaining the articles in such second position, successively folding and applying the folded edge of said positioned articles in register with a reentrant receiving element while maintaining portions of the articles in the second position, and successively severing said articles from the next succeeding article while in said last named location with respect to the moving element and while in register with the receiving element.

6. The method of controlling the registry of a plurality of flexible sheet material articles disposed in partially severed joined end-to-end relationship and applying said articles to a receiving element which comprises continuously advancing and applying said articles in a first position on the surface of a moving element, successively positioning said articles in a second position with respect to predetermined locations on said surface and maintaining the articles in such second position, applying said positioned articles successively to a receiving element while maintaining portions of the articles in the second

position, and finally successively completely severing said articles from the next succeeding articles while in said last named locations with respect to the moving element.

7. The method of controlling the registry of a plurality of flexible sheet material articles disposed in partially severed joined end-to-end relationship and applying said articles to a receiving element which comprises continuously advancing and applying said articles in a first position on the surface of a moving element, successively positioning said articles in a second position with respect to predetermined locations on said surface and maintaining the articles in such second position, moving a portion only of said positioned articles successively away from said surface and applying the same to a receiving element while retaining another portion thereof fixed with respect to the moving surface in said second position, and finally successively completely severing said articles from the next succeeding articles while the said another portion thereof remains fixed with respect to the moving surface.

8. Apparatus for controlling the registry of a plurality of flexible sheet material articles connected together in end-to-end relationship, comprising means forming a moving surface, means to hold said flexible sheet material articles against said surface, means for sensing the position of said articles with respect to said surface, and means on and movable relative to the moving surface forming means responsive to the sensing means for varying the position of said articles with respect to said surface.

9. Apparatus for controlling successively the registry of a plurality of flexible sheet material articles connected together in end-to-end relationship and applying said articles to a receiving element, comprising first means forming a moving surface, means to hold said flexible sheet material articles against said surface, means for sensing the position of said articles with respect to said surface, means on the first means responsive to the sensing means and movable relative to said moving surface for varying the position of said articles with respect to said surface, a receiving element operatively spaced with respect to the first means, and means on said first means to apply the articles to said receiving element.

10. Apparatus for controlling successively the registry of a plurality of flexible sheet material articles connected together in end-to-end relationship and applying said articles to a receiving element, comprising first means forming a moving surface, means to hold said flexible sheet material articles against said surface, means for sensing the position of said articles with respect to said surface, means on the first means responsive to the sensing means and movable relative to said surface for varying the position of said articles with respect to said surface, a receiving element, means on said first means to apply the articles to said receiving element, and means on the first means to sever said applied articles from the next succeeding articles while the severed articles are held with respect to the moving surface.

11. Apparatus for controlling successively the registry of a plurality of flexible sheet material articles connected together in end-to-end relationship and applying said articles to a receiving element, comprising first means forming a moving surface, means to hold said flexible sheet material articles against said surface, means for sensing the position of said articles with respect to said surface, means on the first means responsive to the sensing means and movable relative to said surface for varying the position of said articles with respect to said surface, a receiving element operatively spaced with respect to the first means and formed with a reentrant portion, means on said first means to move a portion of said articles away from the moving surface to form a fold therein and apply the fold to the reentrant portion of the receiving element while holding another portion of the articles fixed with respect to the moving surface,

and means on the first means to sever the articles from succeeding articles while being so held.

12. Apparatus for controlling successively the registry of a plurality of flexible sheet material articles connected together in end-to-end relationship, comprising means forming a moving surface, means to hold said flexible sheet material articles against said surface, finder elements on said moving surface forming means, means for sensing the position of said articles with respect to the finder elements, and means on and movable relative to the moving surface forming means responsive to the sensing means for varying the position of said articles with respect to said surface.

13. Apparatus for controlling the registry of a plurality of sheet material articles connected together in end-to-end relationship, comprising a rotatable member having an outer surface for receiving said articles, means on said member extending outwardly from said surface for deflecting portions of said articles away from said surface, sensing means to detect misalignment of said portions and said deflecting means, and means on said rotatable member and movable relative thereto for moving the trailing end of an article relative to said surface to change the spacing between its ends, and means responsive to said sensing means for actuating the means for moving the trailing end of the article.

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