

Sept. 24, 1968

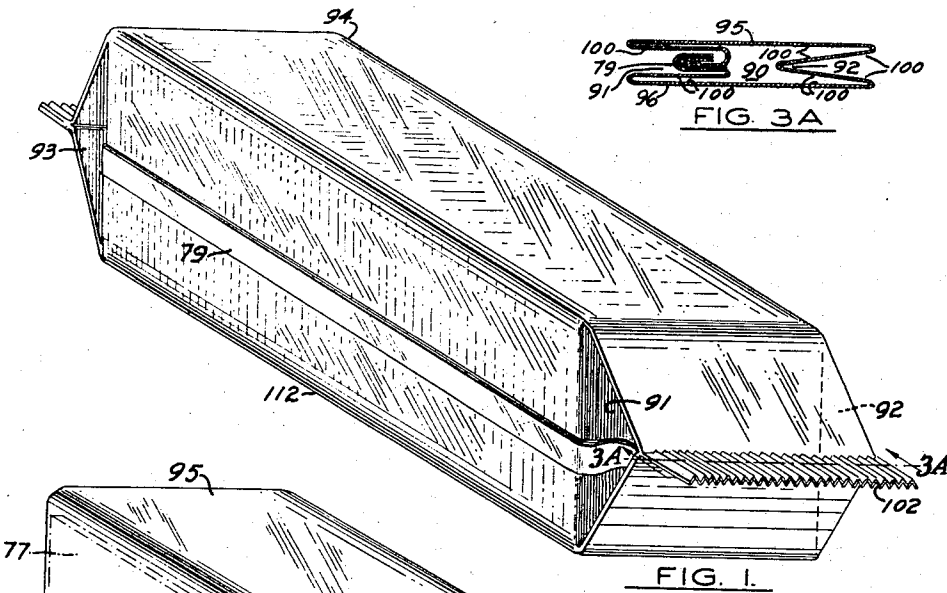
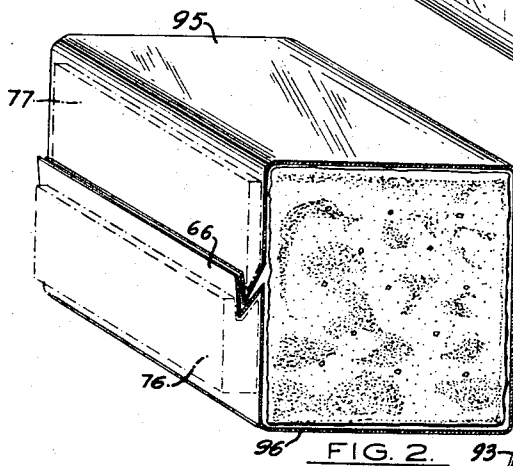
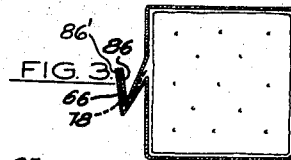
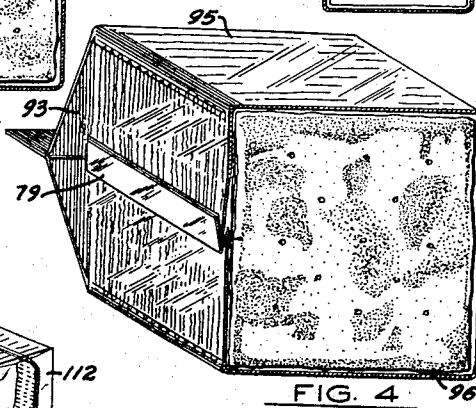
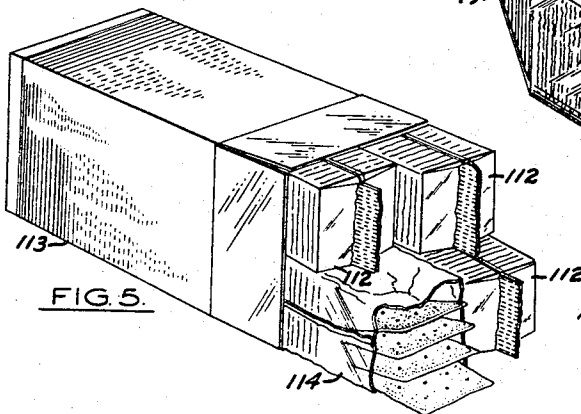
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3,403,033

METHOD OF PACKAGING ARTICLES

Original Filed Sept. 19, 1952

3 Sheets-Sheet 1



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METHOD OF PACKAGING ARTICLES

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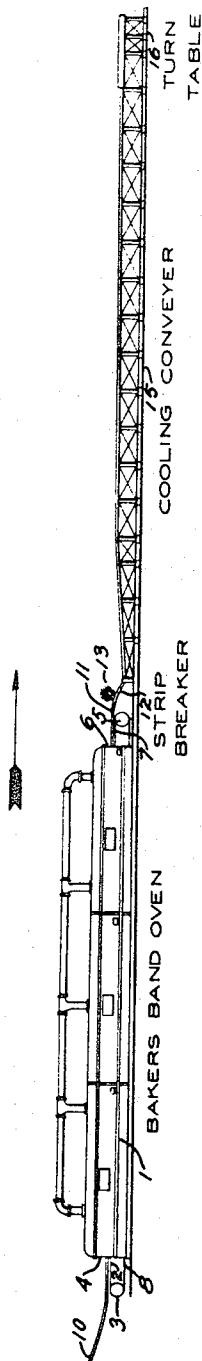


FIG. 7

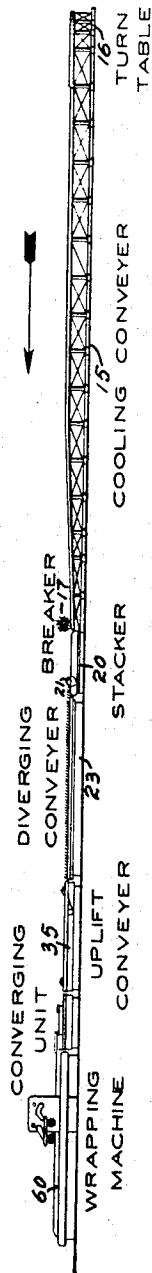


FIG. 8

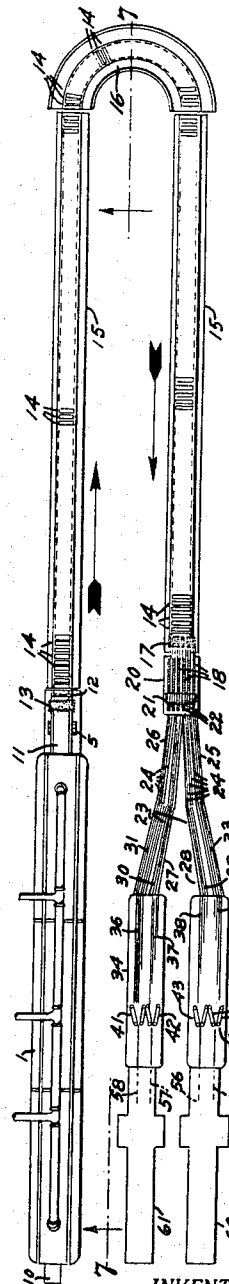


FIG. 9

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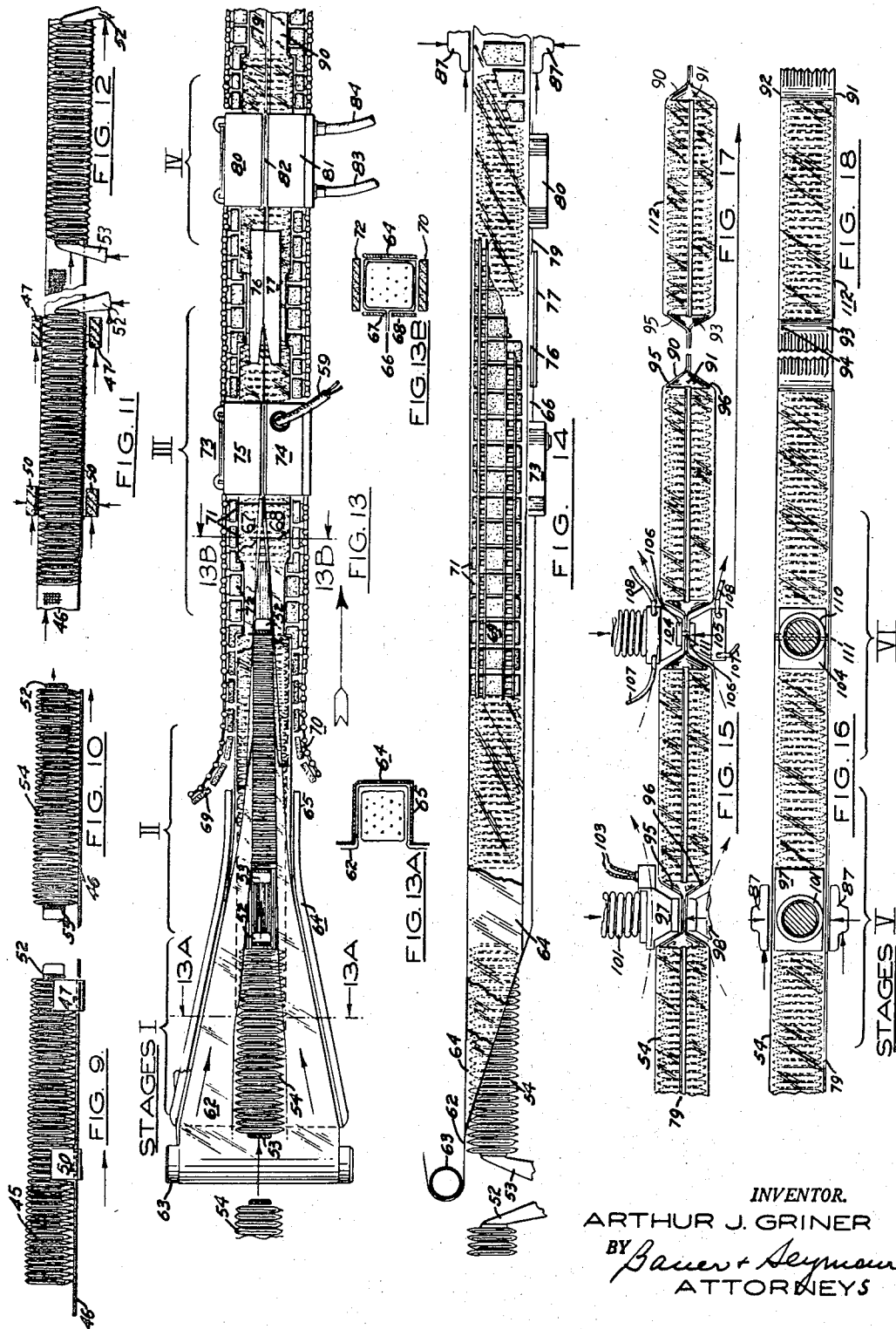
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METHOD OF PACKAGING ARTICLES

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3 Sheets-Sheet 3



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3,403,033

METHOD OF PACKAGING ARTICLES

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Continuation of application Ser. No. 310,532, Sept. 19, 1952. This application June 21, 1966, Ser. No. 559,242
17 Claims. (Cl. 99—171)

ABSTRACT OF THE DISCLOSURE

Packaging articles by continuously advancing a closed column of articles, dividing the advancing column into spaced units and progressively applying a completely sealed wrapper about each article as it continues to move in open column formation.

This application is a continuation of my application Ser. No. 310,532, filed Sept. 19, 1952, for "Packaging Method and Means," now abandoned.

The present invention pertains generally to the art of packaging, and more particularly to a method of continuously conveying biscuit from a commercial baker's band oven and effecting automatic packaging of the biscuit as they are discharged from the oven. The term "biscuit" is generic to all crackers and cookies, and while hereinafter soda crackers will be used in describing the invention, it will be understood that the invention applies equally well to all biscuit.

The main purpose of the invention is to provide an automatic method of wrapping crackers during their continuous flow as they emerge from a band oven (by which method there shall be performed the work now requiring an extended series of interrupted manual and mechanical operations) leaving little except occasional adjustments to be made by the attendants in charge of the equipment.

In its fullest development, the method of the present invention comprises the steps of conveying, separating, shingling and stacking the crackers edgewise for delivery in a single column preparatory to metering, segregating and wrapping measured groups of crackers in heat sealable packaging material.

While the complete process comprises the operations thus recited, various of the steps are susceptible of separate or independent operation. Hence, while the combination of the several steps is claimed hereinafter, certain of the separate steps, as for example those directed entirely to the wrapping operation, are claimed per se.

Heretofore, continuous automatic packaging of crackers, such as soda crackers discharging in continuous flow directly from the unloading end of a band oven, has not been practicable. There are several problems involved in such automatic packaging of soda crackers, some of which are as follows: One is the metering or measuring off and segregating of quantities of the crackers, the thickness of which varies not only from day to day but from hour to hour in spite of attempts to hold to uniformity. A further problem is encountered when it is contemplated that the crackers are to be stacked edgewise to enable them to be metered in a quantity which provides the contents for a completely sealed enclosure later to be fabricated around those contents. Soda crackers are designated by the baking industry as "sponge goods" and in order to "proof" or raise the dough for that type of cracker it is necessary to cause fermentation, which in turn makes it difficult to maintain exact control of cracker thickness. Consequently, the amount of gas generated in the proofing varies from batch to batch, so that in the subsequent baking process the cracker will expand or

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fail to expand according to the carbon dioxide content of the dough. In fact, any number of variables such as mixing time of the dough, temperature of the oven, speed of the oven band, slight variations in the amount of any specific ingredient and atmospheric conditions, such as humidity, may influence the thickness of the cracker. Quite often blisters develop on the cracker surfaces during the baking process, and this results in a high degree of inconsistency in the thickness of different portions of the individual crackers. The metering and segregating mechanism is therefore assigned the extraordinarily difficult step in the complete process in that it must separate a suitable quantity of crackers, which vary in thickness, to form a standard length of package and at the same time not produce a package either too tightly or too loosely packed, or substantially above or below a given weight.

The present method contemplates an arrangement of crackers as they emerge on a conveyor from a band oven in flat, scored sheets which are separated first to form transverse strips of unseparated crackers and later separated again into 15 or 16 individual crackers depending upon the width of the cracker and the width of the oven band. The rows of individual crackers, lying flatwise, are carried away and then stacked on edge on belts moving continuously but at relative speeds. By means of various steps to be described later in further detail, the individual side-by-side rows of stacked crackers are first diverted, i.e. fanned out laterally so that the distance between each adjacent row is progressively increased; then the speed of belt travel of certain rows is increased to advance one row ahead of its adjacent rows, in which manner several rows of crackers are eventually brought into a single row. By this method the full width of the cracker sheet, as carried on the oven band, is transposed from its total of 16 crackers across the width of the band to a continuous automatic feed of crackers stacked edgewise and in four columns.

To form the packages, each cracker column is metered and segregated into groups automatically as the column advances. A web of wrapping material, preferably a heat sealable, moisture-vapor and grease proof paper, is then brought together with successive separated groups of crackers, wrapped about the crackers, and the wrapping web sealed lengthwise of each group and at opposite ends thereof. Thus a chain of sealed packages is produced which are then separated by severing the web laterally between each group of crackers to form individually wrapped packs, which are aptly called "slug packs."

It is contemplated that one, two or more of the wrapped packs may be inserted in a paperboard carton. Thus the ultimate consumer may preserve the shelf life of the crackers by keeping the unused crackers intact in their individually sealed packs until required.

Although very frangible, since the crackers are stacked one-by-one edgewise, they can be removed from the wrapper with comparative ease in small groups without breakage. One end of the wrapper may be opened and by gently tilting the crackers from their edgewise position to a flat position they may be slid freely from the wrapper. After removal of the desired quantity, the atmosphere may be exhausted by collapsing the empty portion of the end-opened wrapper and refolding it to retain the freshness of the unused crackers until such time as they are desired. Thus, the net result of the foregoing features is a package characterized by its relatively great capacity for keeping thin, crisp crackers fresh and intact until all are finally consumed.

A more detailed description of the mechanism and the several steps comprising the improved method of wrapping biscuit, and of the construction of the improved

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package, may be had by referring to the drawings accompanying and forming a part of this specification.

In the accompanying drawings the invention has been shown merely by way of example and in preferred form, but obviously many modifications and variations may be made therein, and in its mode of application, which will still be comprised within its spirit. It is understood, therefore, that the invention is not limited to any specific form or embodiment, except insofar as such limitations are specified in the appended claims.

Referring to the drawings:

FIG. 1 is a view in perspective, showing a package of biscuit wrapped in accordance with the principles of the present invention;

FIG. 2 is a fragmentary cross-sectional view of a column of biscuit, showing details of the surrounding wrapper during the side-seam forming stage;

FIG. 3 is a sectional view of the slug pack, showing the folded side-seam structure partially formed;

FIG. 3A is a cross-sectional view, taken on the line 3A—3A of FIG. 1, showing the wrapper before the end-sealing operation has been completed;

FIG. 4 is a cross-sectional view of the completed slug pack shown in FIG. 1;

FIG. 5 is a perspective view, showing an outer carton of semirigid paper-board filled with slug packs made in accordance with the present invention, one pack of which is broken open to display the contents;

FIG. 6 is a diagrammatic plan view of the general organization of conveying and packaging equipment for carrying out the present invention;

FIG. 7 is a view in elevation of a part of the equipment shown in FIG. 6, the view being taken on line 7—7, looking in the direction of the arrows;

FIG. 8 is a front view in elevation of the equipment shown in FIG. 6;

FIG. 9 is a side elevation of a portion of a single moving column of crackers stacked edgewise preparatory to the segregation and wrapping operations;

FIG. 10 is a side elevation of a metered quantity of crackers, segregated and advanced ahead of the column as shown in FIG. 9;

FIG. 11 is a top plan view of the cracker column shown in FIG. 9;

FIG. 12 is a top view of the metered quantity of cracker shown in FIG. 10;

FIG. 13 is a view in side elevation of that portion of the equipment in which a wrapper is first applied to the moving column of crackers and a longitudinal side-seam is formed;

FIG. 13A is a section taken on the line 13A—13A of FIG. 13, with parts omitted, looking in the direction of the arrows;

FIG. 13B is a section taken on the line 13B—13B of FIG. 13, looking in the direction of the arrows;

FIG. 14 is a top plan view of the structure shown in FIG. 13;

FIG. 15 is a view in side elevation of the end sealing and web severing mechanism;

FIG. 16 is a top plan view of the mechanism shown in FIG. 15;

FIG. 17 is a view in side elevation of a finished package made according to the present invention; and

FIG. 18 is a top plan view of the finished package shown in FIG. 17.

In describing the present invention, the features of conveying, wrapping, and the completed package will be treated in that order.

CONVEYING OPERATIONS

Referring to the drawings, it will be seen that in FIG. 6, which is a diagrammatic top plan view of the general organization of equipment for continuous, automatic delivery of crackers from a band oven to a wrapping machine, there is shown a band oven 1 which, according to

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standard practice in the baking industry, consists of a long baking chamber of successive tunnel sections rising from a suitable base support. An endless baking band 2 (FIG. 7) is trained over a driving drum 3 at the entrance end 4 of the chamber and a driven drum 5 at the exit end 6 of the oven chamber. An upper run 7 of the band 2 extends through the heated section of the chamber, whereas a lower run 8 returns beneath the heated section. Both upper and lower runs 7 and 8 are suitably supported and guided for continuous, straight-line movement through the chamber. Baking heat may be applied, if the oven is gas fired, by a series of gas burners suitably arranged within the tunnel.

An endless dough sheet 10, of a width sufficient to cover the band 2 save for small margins at the side edges, is fed continuously into the entrance end of the oven 1. The dough sheet, having had its top surface die stamped or scored transversely and longitudinally prior to baking in order to define thereon individual crackers of rectangular shape will, upon completion of baking, be discharged from the exit end of the oven in the form of a baked sheet 11. The baked sheet 11 is then transported by a conveyor belt through a strip breaker 12, which comprises a revolving brush 13 exerting pressure upon the baked sheet 11 as it is transported on a moving belt over a portion of the conveyor that varies sharply from the normal plane of travel. In conventional practice, this is effected by a deflector plate (not shown) positioned beneath the revolving brush 13 at which point the transverse rows of biscuit forming the baked sheet 11 are caused by tension from the change in their normal path of travel to bend and snap off along their transverse frangible scoring lines to form transverse strips 14 consisting usually of 15 or 16 crackers connected to each other at their side edges.

The strips 14 are transported onto a cooling conveyor 15, consisting of an endless fabric apron or belt trained over rollers which revolve at a suitably moderate speed to allow the cracker strips 14 to throw off excess heat. Crackers coming directly from the oven are usually too soft for immediate stacking or packaging operations and, by transporting them over a cooling conveyor 15 such as shown in FIGS. 6, 7, and 8, they may be conditioned for subsequent breaking and stacking operations preparatory to wrapping. Any suitable or conventional drive means may be provided to operate the conveyor 15.

The cooling conveyor arrangement shown in FIGS. 6, 7, and 8 is only one of a variety of conveyor arrangements which may be made depending upon available space. Should sufficient space be available, the band oven, the entire length of the cooling conveyor, and the wrapping section, may be installed along one straight line, or as in the illustrated example FIGS. 6, 7 and 8 herein, the cooling conveyor may be provided with a turn table 16 of conventional design to enable the conveyor line to be doubled back alongside the initial section thereof, thereby securing maximum length in a minimum of space. On the other hand, the cooling apparatus may take the form of an inclined conveyor which can be projected through two or more floors, doubling back beneath the band oven which may be located on one floor with the cooling conveyor directly below, and the wrapping section either on a level with the cooling conveyor or else disposed on a still lower level.

When the cooling has been accomplished, the cracker strips are presented to a breaker 17 which functions in a manner similar to the previously described strip breaker 12 except that the first breaker 12 separated the baked sheet 11 along transverse score lines whereas now the breaking operation upon the strip 14 is effected along longitudinal score lines to separate the strips into individual crackers 18.

Immediately following the breaker 17, the individual crackers 18 pass onto an endless band forming part of a shingling and stacking unit 20, which may be of any con-

ventional design. In the present embodiment, the crackers are conveyed flatwise onto a transversely mounted roller 21 which forms part of the stacking unit 20. A plurality of moving belts 22, one for each of the 16 longitudinal rows of crackers, are disposed at a relatively lower level than the aforesaid roller and travel at a relatively slower surface speed than the roller 21. As a consequence, the crackers in their movement over the roller are caused to tip slightly as they fall onto the belts 22, thus acquiring a shingled effect. As the crackers continue their travel through the stacker, they gradually assume a vertical position, standing edgewise in sixteen closely-spaced longitudinal columns, discharging continuously and at an even rate of surface speed from the stacker 20.

In order to condition the columns of crackers for subsequent alignment in a single column, it is necessary first to spread them apart so that they will be distributed over a wider area. For this purpose, a diverging conveyor 23 is coupled with the discharge end of the stacker 20 and is comprised of a plurality of individual conveyor belts 24 arranged in side-by-side relation. At the entrant end of the diverging conveyor there is a group of eight closely spaced conveyor belts 25 and another group of eight belts 26 (FIG. 6), which groups of belts gradually diverge and lead to two further groups of conveyor belts 27 and 28 comprising, respectively, sub-groups 30, 31 and 32, 33 of four belts each.

To sum up the scheme of column distribution, it will be recalled that the oven band discharges a sheet of baked dough made up of strips of 16 undetached crackers transversely disposed across the bank which, upon being separated and stacked according to the foregoing method, provides four sub-groups, each comprised of four columns of crackers stacked edgewise and moving forwardly and divergently at equal rates of speed. At this stage, suitable clearance is obtainable so that side guides may be arranged between adjacent columns.

The discharge end of the conveyor groups 27 and 28 connect and feed crackers directly to units identified as uplift conveyors 34 and 35, each comprising two sections 36 and 37, and 38 and 39, respectively, and each of which sections in turn comprises four conveyors. The main purpose of the uplift conveyor is to segregate, one at a time, moving columns of crackers into given lengths, say ten feet, each of which is lifted vertically a short distance above the plane of its adjacent columns of crackers. Considering one section only, say section 39, as soon as one ten foot length is elevated, that entire length of stacked crackers is advanced linearly at four times the speed at which its adjacent three columns are moving in order to place it ahead of its immediately adjacent column. As soon as such advance is completed, then the said immediately adjacent column is elevated and carried forward, and so on successively and repeatedly with crackers from the four columns comprising the section. The timing is such that groups of crackers which had been moving along side by side in four columns are successively moved ahead so that the leading end of one group is in substantially transverse alignment with the following end of the group which was advanced immediately before it.

In order to bring into single columns the groups of crackers in each of sections 36, 37, 38 and 39 which have been advanced by the uplift conveyors 34 and 35, there are provided four converging devices 41, 42 and 43, 44, respectively, into each of which one group of four columns comprising a section is fed. Still speaking with respect to section 39 only, by way of example, the converging device 44 consists of two endless belts 40, each belt being trained about a separate pair of vertically mounted pulleys arranged so that the belts are angularly disposed toward one another. Each pair of pulleys is comprised of a driving and a driven pulley arranged so that the surfaces of the belts facing one another travel continuously toward the narrowest point of convergence. An endless horizontal belt sufficiently wide to extend across

the entrance of the converging device 44 is disposed thereunder to convey the four columns of ten foot lengths of crackers as they are fed to the converging device. During this operation, a ten foot length of crackers arriving off-center at the entrance to the converging device 44 will be carried forward until its front end strikes one of the angularly disposed belts. The ten foot length of crackers will then be diverted from its former straight path of travel and caused to follow the angular direction of the endless belt toward the exit. When the ten foot length reaches the apex formed by the two converging belts, a passageway is provided just wide enough for a single column of crackers to pass therethrough. In this manner, each ten foot length of crackers will be joined immediately by its following section to form, in contrast with the previously laterally disposed lengths, a single unbroken column of crackers, stacked edgewise and fed continuously at an even rate of speed. Each converging device 41, 42, 43, 44 converges four separate columns of crackers into a single column preparatory to the wrapping operation now to be described.

METERING AND SEGREGATION

The steps involved previous to the metering and segregating operations have been concerned mainly with the problem of combining a plurality of lines of crackers into a single column stacked on edge for feeding into a wrapping machine. FIGS. 9 and 10 show such a single column of crackers 45 stacked edgewise and supported on a conveyor belt 46 advancing in the direction of the arrows. Inasmuch as the various segregating and wrapping operations are all co-ordinated in speed and timed relation, a unit of space-time relationship termed a "cycle" is adopted to facilitate the description. Therefore, in the following description of the metering, segregating and wrapping operations, the term "cycle" will be understood to indicate that period of operation of the machine required to perform the final steps in the wrapping method developed by the present invention.

In FIGS. 9 and 11 there are shown two pair of rubber-faced grippers 47 and 50 which, together with a plurality of like pairs of grippers, are carried on an endless belt (not shown). The belt is mounted on pulleys and is provided with an upper run adapted to travel in close proximity to the undersurface of the conveyor belt 46. All of the rubber-faced grippers are cam operated for transverse movement relative to the direction of travel of the cracker column 45. Normally, they are held by spring tension in an "open" position so that they can be elevated to the position shown in FIG. 9 for engagement with the sides of the cracker column, and when operated by their respective cams they will be actuated to close inwardly and clamp the column as shown in FIG. 11. The column of crackers 45 is advanced by the conveyor belt 46 a distance of $13\frac{1}{4}$ " per cycle. The grippers 47 and 50 are carried at a uniform rate of speed, advancing $7\frac{1}{2}$ " per cycle. Thus, under the restraining influence of the grippers 47 on the column of crackers the belt slips relatively to the crackers approximately $\frac{3}{4}$ " for each inch of travel of the crackers.

Still referring to FIGS. 9 and 11, when the cracker column 45 has advanced a distance of $7\frac{1}{2}$ " under the retarding influence of the leading pair of grippers 47, the grippers 47 are released and the following pair of grippers 50 become effective to clamp the sides of the column and thus free or meter off the group of crackers between the grippers 47 and 50.

However, for a fraction of a second prior to the instant that the rear pair of grippers close upon the sides of the column, the front grippers 47 release their hold at the head of the column.

Just prior to the release of the grippers 47 a flight finger 52 traveling at the same speed as the belt 46 is inserted in front of the leading cracker to prevent the crackers from falling forward when released. Upon release, the

entire column of crackers moves at the higher speed of the belt 46, so that by the time the grippers 50 become effective the length of the group of crackers 54 being metered has been increased from $7\frac{1}{2}$ " to approximately $8\frac{1}{4}$ ". When the grippers 50 close and restrain this increased speed of movement of the column of crackers, the metered group 54 continues to travel at the higher speed thereby creating a space into which a second flight finger 53 is inserted. Thus the metered group of crackers is confined between and carried by the fingers 52 and 53.

During the following cycle, the column of crackers retarded by the grippers 50 travels $7\frac{1}{2}$ " only, while the metered group 54 travels $13\frac{1}{8}$ ". Assuming the distances to be exact and constant, since the group 54 measures $8\frac{1}{4}$ ", a space of $4\frac{7}{8}$ " ($13\frac{1}{8}$ "— $8\frac{1}{4}$ ") is created between the group 54 and the group next to be metered. This is the space required for sealing the wrapper at opposite ends of the group 54 as will be described later.

It is to be understood that the cycle for metering and segregating the slug 54 is repetitive and each projection and retraction of a gripper or a flight finger is periodically effected so that the cycle is continuously occurring at a rapid rate of speed.

It is to be noted also, that the steps which were described for metering and segregating were directed to only one metered group of crackers, or so-called "slug," whereas the full embodiment of the invention as shown particularly in FIG. 6, calls for four lines 55, 56, 57 and 58 of slugs in order to feed two wrapping machines 60 and 61. Lines 55 and 56 form the left and right-hand slug feed, respectively, for feeding wrapping machine 60, and lines 57 and 58 form the left and right-hand slug feeds, respectively, for feeding wrapping machine 61, when viewing the machines endwise from their slug receiving end.

WRAPPING OPERATION

Referring now to Stage I, FIGS. 13 and 14, the slug of crackers 54 is shown entering one of the cracker feed lines 55, 56, 57 and 58, or any of them. At this stage, which is preparatory to the wrapper application, conveyor belt 46 has begun its return run and no longer supports the slugs 54. Each cracker slug is now held by its respective flight fingers 52 and 53 which advance the slug adjacent the path of a continuous web 62 of flexible, heat sealable, transparent wrapping material preferably of waxed paper, or waxed paper including butyl rubber, a well known heat-sealing medium. An end of the wrapping material is unwound from a supply reel (not shown) and fed around an idler roll 63 to tension the web 62 while it is drawn through a former plate 64 along with the cracker slug 54. The former plate 64 may be compared with a funnel, open along one side in its initial stages, and gradually enveloping its passageway as it progresses. The web 62 is drawn against the inner face of the former plate, the contour of which folds the web into a sleeve or channel, open at one side. The slug of crackers, held between the flight fingers 52 and 53, moves along with the progressively forming sleeve of wrapping material, which in Stage I surrounds the bottom, rear and top of the slug, its extended longitudinal margins later serving to close the open side.

During Stage II, the slug 54 is supported by a bottom panel 65 (FIG. 13A) of the former plate 64, and the flight fingers 52 and 53 are successively withdrawn through the open side by cam action so as not to interfere with the web 62, the longitudinal margins of which are progressively folded inwardly about each cracker slug by folder plates 67 and 68 as it advances through the former plate. Prior to the retraction of the flight fingers 52 and 53, the web of wrapping material and the slug of crackers are held together and carried through the former plate by a belt mechanism to be described shortly.

During the completion of Stage II and the commencement of Stage III of the wrapping operation, the longitu-

dinal margins of the wrapper web, which when folded inward overlap substantially, are gradually brought together with their opposed edge portions in face-to-face contact, taking the form of a lip 66 of double thickness (FIG. 13B) extending laterally from the side of the slug 54 and lying parallel with the direction of travel of the slug and wrapper. The lip 66 is pressed together by a pair of folder plates 67 and 68 (partially shown only) which are adapted to guide the marginal edges of the wrapper as they are drawn into face-to-face relationship. The wrapper, now surrounding the slug 54, has become slightly taut as the slug advances in Stage III preparatory to the heat sealing and seam pressing of the lip 66.

Referring to FIGS. 13 and 14 there is shown fragmentary portions of two sponge-rubber block belts 69 and 70, each of which is comprised of a plurality of rubber blocks 71, preferably of a soft sponge rubber, suitably fastened to a metal base mounted on a roller chain. The belts 69 and 70 are endless, mounted on sprockets and driven at substantially the same speed in the direction indicated by the arrows, the direction in which the slugs are moving. The belts are arranged in vertical alignment and spaced apart to accommodate the slugs between them. As shown in FIG. 13, at intervals corresponding to the spacing between the terminal ends of the slugs 54, certain rubber blocks 72 may be substantially thicker than other blocks 71 which span the top and bottom of the slugs, so that the blocks 72 may be pocketed between the terminal ends of the spaced slugs, thus forming upper and lower shoulders abutting the end crackers of each slug. The wrapper encased slugs 54 are propelled by the flight finger 53 into the entrance between the belts 69 and 70 and, as the slugs move onward sufficient pressure from the belts is brought to bear upon the wrapped slug to hold the crackers in slug form and carry the wrapper and crackers forward.

To form a strong seam of the marginal edges comprising the longitudinal lip 66, the edges are first drawn through a heat sealing device, indicated as a whole by the numeral 73 (FIG. 13), which comprises members 74 and 75 mounted for swinging movement outwardly (not shown) to gain access to the wrapper in case of tearing, and for threading the wrapper web when operation of the apparatus is commenced. The member 74 carries an electrical heating element (not shown) and conductors 59 leading to a source of electric current. Each of the members 74 and 75 may be formed of any of the well known heat retaining metals which will rapidly heat the surfaces of the lip 66 of the wrapper, causing the wax or butyl rubber layers of the heated areas to melt and congeal, thus forming an adhesive bond between the surfaces as indicated by the dotted line 78 in FIG. 3.

As the wrapper enfolded slugs traverse wrapping Stage III (FIGS. 13 and 14), the heat sealed lip 66 is caused to enter a pair of seam forming plates 76 and 77 set in the path of the lip, the web of which is still in a sufficiently molten condition permit the lip to be progressively folded to acquire the V-shaped conformation shown in FIG. 3. The upper plate 76 is set into the lower plate 77 as shown in dot-and-dash outline in FIG. 2, except for the entrant portion at which area the plates diverge scissors-like (FIG. 13) to engage and guide the moving lip. As the lip 66 of the wrapper moves into the forming section of the plates 76 and 77, the clearance therebetween is progressively decreased, causing pressure to bear against the lip and bend it as at 79 into the condition shown in FIG. 3. In this manner, an off-set seam-forming operation is advantageously effected without applying direct lateral pressure or heat to the enclosed crackers, the frangible nature of which very likely would not enable them to withstand a directly formed seaming operation.

By reason of the fact that the paraffin or butyl rubber, whichever is employed to form that part of the wrapping material which is to effect the bond, when heated to its melting point will remain in a soft state for a substantial

period of time, a cooling device is employed to rapidly dissipate the heat generated during the sealing operation, so that the seal will "set." To this end, the wrapper enclosed slugs 54 are now drawn through Stage IV (FIGS. 13 and 14) in which the previously heated seam 79 is chilled. The cooling device 80 comprises cooling blocks 81 surrounding a seam presser 82 which is adapted to flatten the bonded seam 79 against the adjacent side wall of the wrapped slug. The cooling block 31 is provided with a refrigerant intake connection 83 and a refrigerant discharge connection 84 through which the adjacent surfaces of the seam presser 82 are maintained at low temperature.

A further result of the operation during Stage IV is the adherence of the seam 79 to the side wall of the wrapper, in case a wrapper material is provided with paraffin or butyl rubber coatings on both sides. In this event, the previous heat-sealing operation which was effected during Stage III will also have melted the outer wax or butyl rubber covered areas 86 and 86' (FIG. 3) of the lip 66 which, when traversing under pressure of the cooling device 80, will become effectively sealed to the side wall of the wrapper at the respective adjacent areas before becoming thoroughly chilled. Should a wrapper material having a wax or butyl rubber coating on one side only be employed, then effective use of an end sealing operation, later to be described, can be relied upon to tighten the seam 79 by pulling of the wrapper lengthwise so that it becomes taut against the sides of the slug.

When the wrapper enclosed slugs 54 approach Stage V (FIGS. 15 and 16), there is formed an air tight seam 79 lengthwise of the wrapper, and the wrapper extends without any break in continuity between the slugs, linking across the intervening spacing to form a chain of wrapper-enclosed groups of crackers, stacked on edge, in metered quantities of predetermined amount. The sponge rubber belts 69 and 70 now change their course, moving away from the unwrapped slugs as they travel to their inoperative runs, thus clearing the slug line area for the end-sealing operations next to be described.

As the wrapper enveloped slugs 54 continue to advance through the wrapping machine, there is disposed at each side of the advancing slugs (FIG. 16) a plurality of pairs of opposed traveling tucking jaws 87 carried on endless roller chains (not shown). Each pair of tucking jaws advances in unison and each jaw is mounted for limited reciprocal movement laterally into and out of the path of travel of the advancing slug packs, and is activated by cam motion to reciprocate in unison and in alignment with intervening connecting portions 90 of the chain of wrapper-enclosed slugs. Referring to FIGS. 3A, 17 and 18, side tucks 91, 92 and 93, 94 are shown in the connecting portions 90 of the wrapper. In effect, the inwardly projecting tucking jaws 87 (FIG. 16) serve to gusset the opposing sides of the connecting portions of the wrapper intermediate adjacent slugs, partially serving to form a bellows fold best illustrated in FIG. 3A.

Referring again to FIGS. 15 and 16, the tucking jaws are withdrawn from their respective gusset folds in order to permit upper and lower heat sealing jaws 97 and 98, respectively, to compress the wrapper between the spaced slugs 54 in such a manner as to form sealed areas 100. The timing is such that the tucking jaws are retracted just before the sealing jaws come together, thus assuring that the tucks remain and the desired seal is effected. The tucking jaws fit closely between successive slugs 54 insuring that the crackers do not become displaced, and the tucking exerts a tension on the wrapper along the sides of the slug. The sealing jaws, of course, exert a pull on top and bottom walls 95 and 96 of the wrapper, and thus a neat, firm wrapping results. Furthermore, the ends of the side seam 79 are tucked in between the walls 95 and 96 of the wrapper and become sealed therebetween.

The jaws 97 and 98 are substantially identical in construction and each includes an electrical heating element

and flexible conductors 103 leading to a source of electric current.

The heat sealing jaws 97 and 98 are mounted in opposed relation and each is caused to travel in separate elliptical orbits, in counterwise direction to one another, but in synchronous unison, so that at specific intervals the upper and lower blocks will meet in alignment with the connecting portions 90 of the advancing wrapper. Each heat sealing jaw is spring mounted, a heavy coil spring 101 being arranged so that by adjusting the amount of separation between the upper and lower jaws so that their elliptical orbits will intersect as they approach each other, compressive yielding of the springs 101 will prevent jamming of the jaws 97 and 98, the resilient action of the springs, however, being effective to collapse and compress the top and bottom of the wrapper at the gusset area. The upper jaw 97 travels in a counterclockwise direction and the lower jaw 98 in a clockwise direction, so that travelling in elliptical orbits in timed relation to the linear speed of the slugs 54, under the influence of the springs 101 they partake of substantially a linear movement along with the wrapper during the sealing interval. Thus there is no form of intermittent motion in the travel of the slugs 54 or during the compressing and heat sealing operations.

The chain of wrapper enclosed slug packs are now advanced to Stage VI, wherein a second pair of jaws 104 and 105, mounted in tandem with the previously described heat sealing jaws 97 and 98, are effective to crimp the previously heat sealed portions 100 of the wrapper, to cool the softened wax or other thermoplastic material which forms the sealing medium of the wrapper, and finally to sever the sealed connecting portions 90 of the wrapper medially of the seal. The jaws 104 and 105 travel in parallel orbits with the heat sealing jaws 97 and 98, respectively, and the two pairs of jaws are spaced from each other a distance equivalent to the length of a slug. Consequently, the crimping, cooling and severing operation performed by jaws 104 and 105 upon the advancing end of a slug pack is effected simultaneously with the heat sealing operation upon the opposite end of the slug pack.

The jaws 104 and 105 are spring mounted similarly to the sealing jaws, and each includes a crimping block 106 having complementary longitudinal corrugations or serrations, the effect of which will be to corrugate the top and bottom layers of wrapper material in juxtaposition and the areas previously heat sealed by jaws 97 and 98. The jaws 104 and 105 are each equipped with a cooling chamber having a refrigerant intake connection 107 and a refrigerant discharge connection 108, preferably of flexible construction to permit continuous operation of the cooling chamber during its elliptical travel. As a result of the cooling effect to chill the sealing thermoplastic, corrugations or ridges 102 (FIG. 1) pressed into the wrapper will take a permanent set. The elements of the mechanism are coupled and synchronized so that the time required for the tandem mounted jaws 97, 98 and 104, 105 to make one complete revolution throughout their elliptical orbit is the same as that required for the wrapper enclosed chain of slugs to advance longitudinally a distance equivalent to the length of one slug pack.

The final operation of Stage VI comprises the severing of the chain of slug packs. This is accomplished by severing mechanism 111 carried by the jaws 104 and 105. This may be briefly described as consisting of a transversely slotted holder carried in the lower jaw 105 and adapted to serve as a shear plate when receiving a complementary shear blade depending from the upper jaw 104. In operation the chilling of the seal and severing of the wrapper occur simultaneously.

The severed slug pack now takes the appearance of the package 112 shown in perspective in FIG. 1, in side elevation in FIG. 17, and in top plan view in FIG. 18. Two or more of the packs may be inserted into a semi-rigid carton 113 as shown in FIG. 5, one pack 114 of which is shown in open condition. The end seal of each pack is

easily opened by grasping any of the oblique end walls of the pack, and rupturing the seal, thus exposing the crackers which may be readily tilted flatwise and slid from the wrapper. After collapsing the emptied portion of the wrapper, it may be folded endwise to preserve the crackers remaining therein.

Having thus described my invention, what I claim is:

1. A method of packaging articles which comprises continuously advancing a column of articles stacked on edge, dividing said column of articles as it advances into a plurality of shorter groups to form packageable units, continuously folding a web flexible material about said advancing units to provide a wrapper therefor, heat sealing the longitudinal free edges of said web together while it advances along with the confined articles, and collapsing and heat sealing said wrapper intermediate said units to form a chain of packaged articles.

2. A method of wrapping articles which comprises continuously advancing a column of articles stacked on edge, separating predetermined quantities of said moving column of articles into spaced apart packageable units, conjointly advancing a continuous web of wrapping material lengthwise adjacent said columnar units of articles and progressively folding said web initially about said columnar units in substantially channel shape becoming progressively tubular in cross section with outturned marginal edges, progressively folding and heat sealing said marginal edges together adjacent to said articles, and collapsing and heat sealing said wrapper at said spaced apart points intermediate said unit quantities of articles by bringing opposed sides of said wrapping at said points into contact with one another while applying heat and pressure thereto, thereby forming a series of successive interlinked packages.

3. In a method of continuously wrapping packageable quantities of stacked articles in heat sealable packaging material, the steps comprising progressively folding and wrapping a web of said packaging material in substantially tubular shape about said articles with the free marginal edge portions of the wrapping material in contact and forming a lip extending laterally from the articles, progressively forming said lip longitudinally in a substantially V-shaped fold, applying heat to said lip to effect hermetic sealing thereof, then cooling and flattening said fold against the wrapped articles to form a longitudinal seam, tucking opposed sides of said wrapper at the terminal ends of said quantities of stacked articles to form a bellows fold in the sides, one side including said longitudinal seam, flattening the top and bottom of said wrapper at the terminal ends of said quantities of stacked articles into contact with one another, heat sealing said top with said bottom in the areas of the wrapper forming said bellows fold, and severing the wrapper transversely across the sealed bellows folds at a point medially between the quantities of articles enclosed in the web of packaging material.

4. The method of wrapping articles as set forth in claim 3, wherein all the steps enumerated therein are effected concurrently and repeatedly on a continuously advancing column of articles.

5. The method of continuously packaging biscuit which comprises the steps of imparting a linear movement to baked biscuit in flat continuous sheet form, separating the moving sheet into a plurality of separately moving rows of biscuit stacked on edge in vertical on-edge position, increasing the transverse separation between adjacent rows of said biscuit while moving them in stacked row formation, converging a plurality of said rows into a single moving column of stacked biscuit, separating said moving column of stacked biscuit at spaced intervals to form packageable units thereof and progressively forming a completely sealed wrapper about each of said units of stacked biscuit as they continue to move.

6. The method of continuously packaging biscuit according to claim 5, which includes forming said wrapper

about each of said units by advancing a continuous web of flexible heat sealable packaging material longitudinally in the same direction and adjacent said moving column of packageable units of biscuit, progressively folding said web about said column of biscuit in substantially channel form so that the web envelopes one side and the opposed top and bottom with the longitudinal edge portions of the web left outstanding from the unclosed side and lying parallel to the direction of travel of the column of biscuit, heating and pressing the outstanding edge portions of said web against one another to form the longitudinal seam of the wrapper, folding and flattening the longitudinal seam adjacent the side of the wrapped biscuit, collapsing opposed side areas of said wrapper at the terminal ends between said packageable units of biscuit into contact with one another, heat sealing the wrapper at each of said areas of contact to form a chain of individually sealed packages enclosing stacked biscuit.

7. A method of continuously wrapping articles comprising the steps of delivering metered quantities of stacked articles in successive units, enveloping said articles within a wrapper progressively formed about said metered quantities, sealing the marginal edges of said wrapper longitudinally adjacent said articles, forming tucks in opposed sides of said wrapper at the terminal ends of said metered quantities of stacked articles and bringing the top and bottom of the wrapper at said terminal ends into contact with one another, and heat sealing and severing the wrapper transversely between said units to form a plurality of individual sealed packages each enclosing a metered quantity of stacked articles.

8. A method of packaging articles which comprises continuously horizontally advancing a closed column of articles to be packaged, each said article being in contact with the adjacent preceding and adjacent succeeding articles in the column, dividing said column of articles as it advances into an open column of a plurality of packageable units spaced apart in the direction of column advance, and progressively forming a completely sealed wrapper about each of said units as the same continues to move in open column formation.

9. A method of packaging articles as defined in claim 8 wherein the step of dividing said column into packageable units includes periodically momentarily retarding the trailing portion of the closed column while advancing a leading packageable unit thereof into spaced relation to said trailing portion.

10. A method of packaging articles as defined in claim 8 wherein each of said spaced packageable units is supported at each end and advanced by engaging the leading and trailing ends thereof during the initial formation of the wrapper thereabout.

11. A method of packaging articles which comprises continuously advancing a column of articles to be packaged, dividing said column of articles as it advances into a plurality of spaced packageable units, continuously advancing and folding a web of flexible material about said spaced advancing units to provide a tubular wrapper therefor, sealing the longitudinal free edges of said web together while it advances along with the confined articles, and collapsing and sealing said wrapper intermediate said units to form a chain of packaged articles.

12. A method of packaging articles as defined in claim 11 which includes gripping each of said advancing units laterally through said wrapper during the sealing of said free edges.

13. A method of packaging articles as defined in claim 11 comprising engaging each end of each of said advancing units to support the articles comprising the unit while the web is being partially folded thereabout, gripping each of said advancing units laterally through said partially folded web, and disengaging the ends of the unit to permit sealing of the longitudinal free edges of the web.

14. A method of packaging articles which comprises continuously advancing a column of articles to be pack-

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aged, dividing the leading end of said column as it advances into a plurality of packageable units in said column, continuously folding a web of flexible material progressively and successively about said advancing units to provide a wrapper therefor, progressively sealing the longitudinal free edges of the web together while it advances along with said units, and collapsing said wrapper intermediate said units to form end closures at the ends of said units.

15. A method of packaging articles which comprises continuously advancing spaced units of articles to be packaged in a column, engaging each end of each unit to support the articles comprising said unit as the column advances, continuously folding a web of packaging material partially about the continuously advancing column of said units to provide a wrapper thereabout while the units are thus engaged and supported, engaging the wrapper externally to support said advancing units in the wrapper, disengaging the ends of said units, further folding said web to complete a tubular wrapper encircling said advancing units, progressively sealing the longitudinal free edges of said web together while it advances with said units, and collapsing said tubular wrapper between adjacent units to form end closures at the ends of said units.

16. A method of packaging articles which comprises continuously advancing said articles as spaced apart packageable units in a column, supporting each of said advancing units by releasably gripping the same endwise, continuously advancing a web of flexible material adjacent said units and progressively folding said web about said advancing units while the latter are thus supported to provide a tubular wrapper therefor with outturned marginal edge portions in face-to-face engagement, transferring the support of each of said units to the exterior of said tubu-

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lar wrapper prior to completing the formation of the latter about such unit, progressively folding said marginal edge portions against the tubular wrapper, and collapsing said wrapper between the ends of adjacent units to form end closures at the ends of said units.

17. A method of packaging articles which comprises continuously advancing a column of articles to be packaged, dividing said column of articles as it advances into a plurality of spaced packageable units, continuously advancing and progressively folding a web of flexible material about said spaced advancing units to provide a tubular wrapper therefor with outturned marginal edge portions in face-to-face engagement, progressively folding said marginal edge portions into interlocking relation and against said tubular wrapper while it advances along with the confined articles, and collapsing said wrapper between the ends of adjacent units to form end closures at the ends of said units.

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