Aug. 4, 1970 J. C. WYLIE ET AL 3,522,689

SEAL FORMING MACHINE FOR FORMING SUCCESSIVE TRANSVERSE-SPACED SEALS BETWEEN THE PLIES OF A PLURAL-PLY STRIP IN A PACKAGING OR OTHER APPARATUS

Filed Aug. 21, 1967 2 Sheets-Sheet 1

Fig. 1

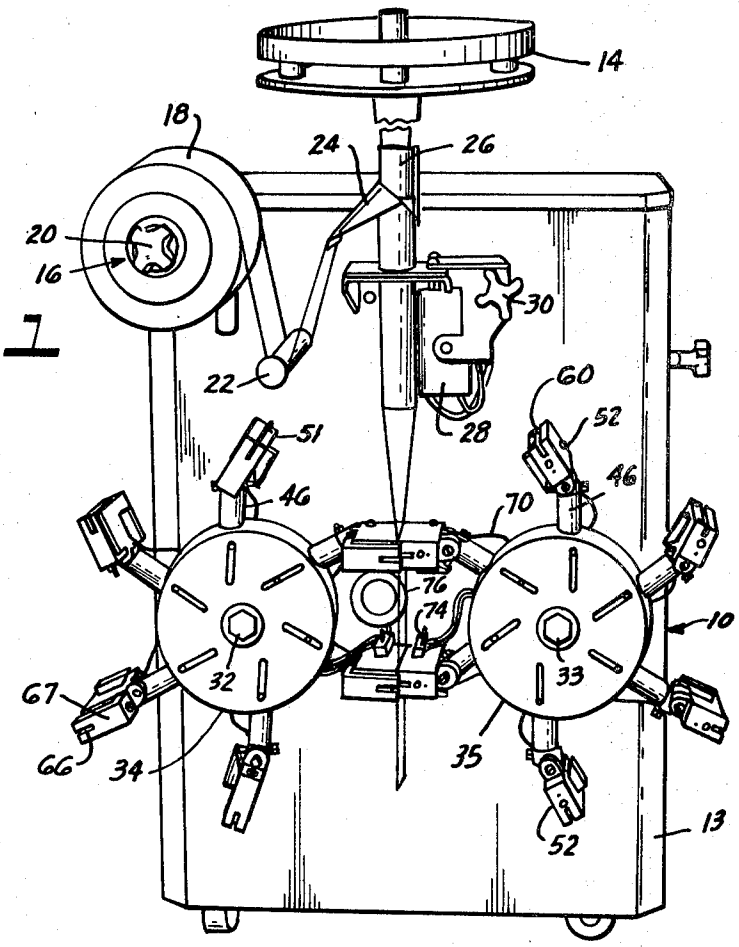


Fig. 2

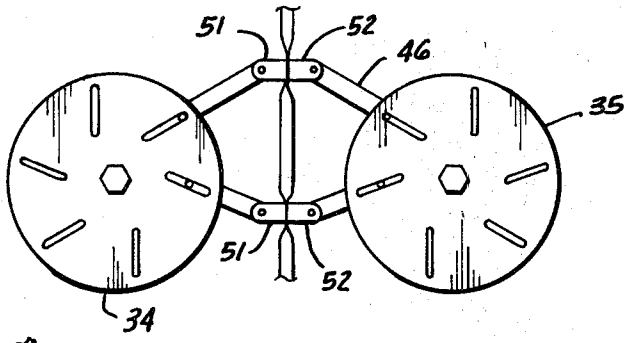
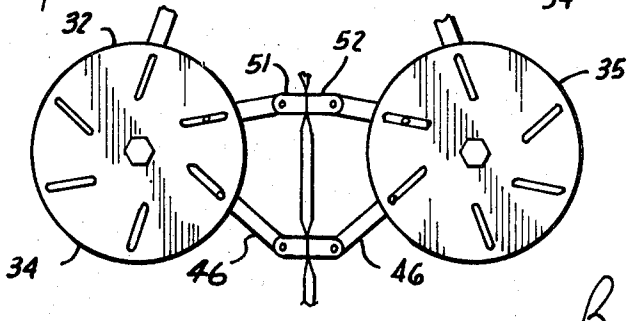


Fig. 3



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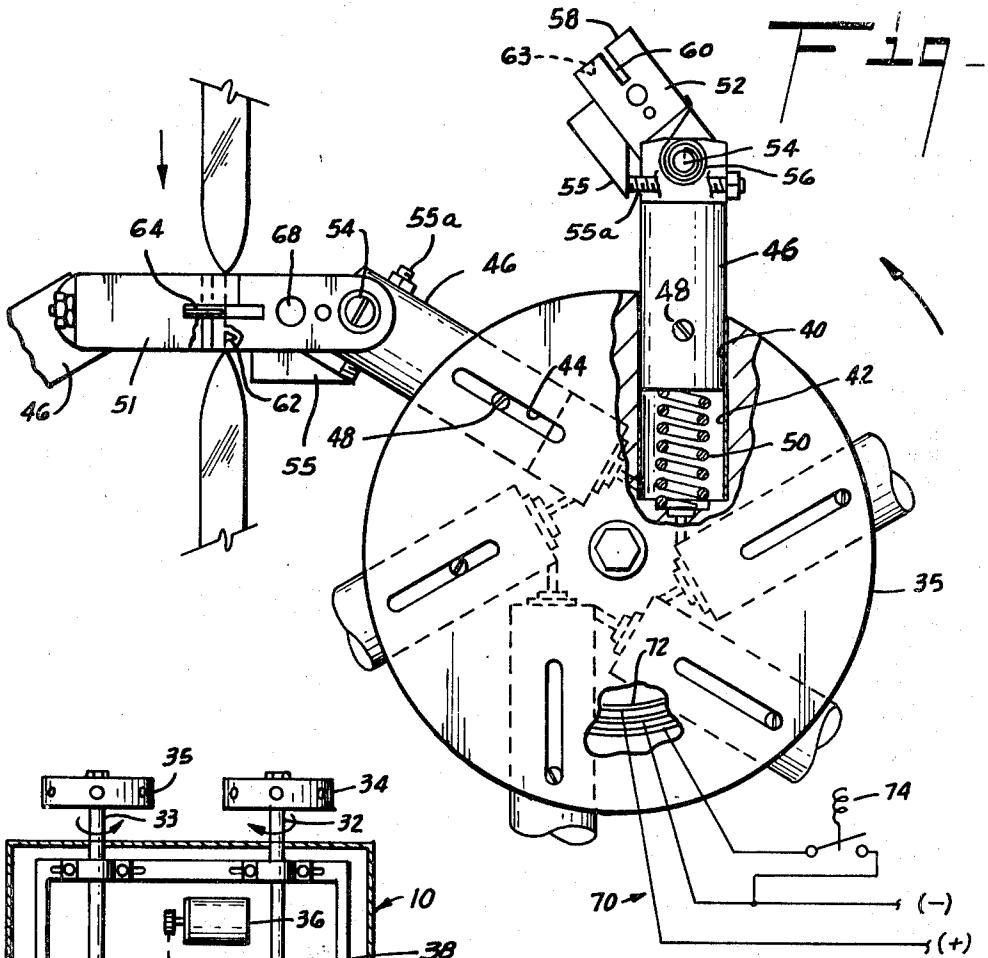

Fig. 4

Fig. 6

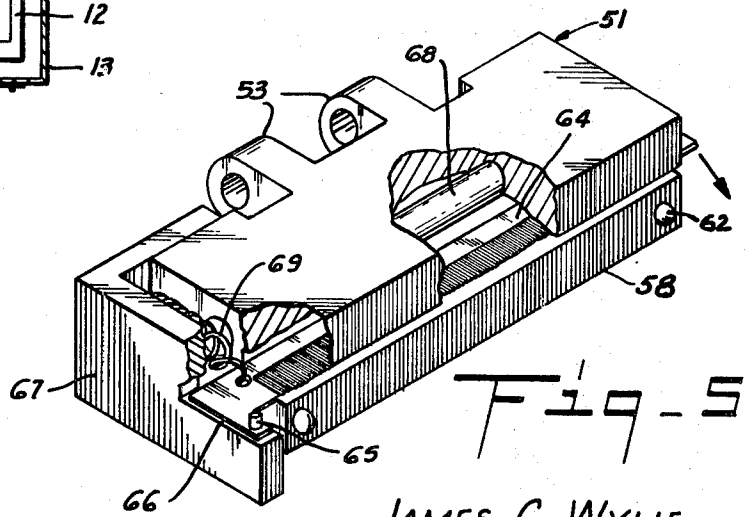

Fig. 5

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SEAL FORMING MACHINE FOR FORMING SUCCESSIVE TRANSVERSE-SPACED SEALS BETWEEN THE PLIES OF A PLURAL-PLY STRIP IN A PACKAGING OR OTHER APPARATUS

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17 Claims

ABSTRACT OF THE DISCLOSURE

A packaging machine for forming a continuous web of heat-sealable material into a tubular form and then providing transverse seals between opposed sides of the tube to divide the tube into individual packages at the time the individual packages are filled. Tubular-forming means forms a web of material into tubular form and provides a longitudinal seal. Filling means are aligned with the formed tube. A pair of oppositely-rotating wheels are located under the tubular-forming means. The wheels are provided with a plurality of spaced bores in each of which is positioned a reciprocating plunger. Pivotally mounted on the outer portion of each plunger is a sealing element. Mating sealing elements contact the tubular-formed material and press the opposite sides together as plies of a plural-ply strip while transporting it through the machine. The sealing elements have means to cut the seal in half to provide the top seal for one package and bottom seal for the succeeding package.

BACKGROUND OF THE INVENTION

This invention relates to packaging machines and, more particularly, to novel apparatus for providing transverse seals between the plies of a plural-ply strip as required in such machines and elsewhere.

Many commodities which were formely packaged in boxes or other containers are now packaged in flexible packages automatically produced from heat and/or pressure-sealable material. As a rule, a strip of the material is formed into a tubular configuration and a heat-sealing element provides a longitudinal seal. The tubular material is advanced to a sealing means which provides a transverse seal. The sealed tube is filled from such seal toward the position at which the tube is being formed with a predetermined desired quantity of the commodity to be packaged and a second transverse seal is formed enclosing within the tube between seals said quantity of commodity. The sealing means usually form the first transverse seal for the adjacent succeeding unfilled package at the time it forms the second seal of the preceding filled package.

Various types of packaging machines have been developed to perform such functions. In order to economically produce such flexible packages, it is desirable that the speed of operation be as fast as possible. However, due to their construction, some of the prior art machines have an intermittent operation, i.e., the travel of the packaging material is momentarily halted while the heat seal is being formed. In other types of machines the sealing elements reciprocate and there is only sealing and production fifty percent (50%) of the operating time. Moreover, many of the prior machines are very complex, combining inter-related hydraulic, mechanical and pneumatic systems.

Accordingly, it is an object of the present invention

to provide a novel sealing machine or device suitable for use as part of a form and fill packaging machine which overcomes the disadvantages of the prior machines in a simple and expeditious manner.

It is another object to provide such a sealing machine for a packaging machine in which the sealing apparatus has rotating sealing elements which provide transport as well as sealing.

It is another object to provide such a sealing apparatus which, when part of a packaging machine, will provide a continuous progression of the material through the machine and a sealing cycle greater than the rate of production.

It is a further object to provide a novel packaging machine having pivotal heat and/or pressure-sealing elements mounted on synchronized pairs of rotating reciprocating arms, the sealing elements coming together in register on one side of the plane of the axes of the rotating arms and remaining in pressurized contact substantially past said plane.

SUMMARY OF THE INVENTION

The novel sealing machine of this invention, although having many other possible uses, is especially suited for and is illustrated as part of a packaging machine having means which form the packaging material into the desired form and longitudinally seal it. A pair of oppositely-rotating synchronized wheels are positioned to receive between them the formed material from the forming means. Each wheel is provided with a plurality of circumferentially-spaced guides, each having at least a part extending generally inwardly from the rim of the wheel, and in what might be described as an inward-outward relationship to the wheel axis. A reciprocating arm is mounted in each of the guides and extends outwardly therefrom, and a heat and/or pressure-sealing element is pivotally mounted on the outer portion of each arm. The guides are so positioned that mating sealing elements from the two wheels contact on one side of the plane of the axes of the wheels and remain in contact substantially past said plane. The sealing elements not only provide the transverse seal, but also advance the material. Each pair of sealing elements is provided with a cutting element which cuts the seal formed by such pair in two intermediate its ends so that each set of sealing elements automatically forms the top seal for one package and the bottom seal for the adjacent succeeding package. With such construction, there can be a continuous movement of the formed material and at the same time a sealing time for each seal which is greater in length than the time of production per package.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference will now be had to the drawings, wherein like reference characters will be used throughout to designate like parts:

FIG. 1 is a pictorial view of a packaging machine constructed in accordance with the present invention;

FIG. 2 is a schematic view showing the initial contact of a second set of sealing elements while the first set are still in contact;

FIG. 3 is a view similar to FIG. 2 showing the termination of contact of the first set of sealing elements;

FIG. 4 is a view, partly in cross section, of one of the wheels showing the alignment of the guides in the wheel and also details of the mounting of one of the arms;

FIG. 5 is a perspective view of one of the sealing elements, portions being in section to illustrate the mounting of the cutting element and heating element;

FIG. 6 is a top view of the power train.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the preferred embodiment, it can be seen that the novel packaging machine **10** has a supporting frame **12** about which there is a cabinet **13**. Mounted on top of the cabinet is a filling apparatus **14** which may be of any conventional construction, as is well known in the art.

Extending outward from the cabinet is a cantilevered, material-holding, axle **16** on which is mounted a roll of heat-sealable flexible material **18**. The end of axle **16** may be provided with a removable hub **20** which will secure the roll of material on the axle. Spaced from the axle **16** is a roller **22** which acts as a guide for the continuous web of heat-sealable material.

The forming means **24** forms the material into tubular form and provides a longitudinal seal therefor. A funnel **26** extends down from the filling mechanism to the inside of the former. The longitudinal seal is provided by a heat-sealing element **28** which may be pivotally-mounted through pivot **30**.

Extending outward from cabinet **13** are two shafts **32** and **33** which are laterally spaced with their axes in parallel relation. Mounted on the shafts for opposite rotation are carrier members **34** and **35**; as can be seen in the preferred embodiment, the carriers are wheels. The shafts and wheels are driven by a motor **36** through gear mechanism **38** which is constructed so that the wheels are synchronously rotated in opposite directions.

Each wheel is provided with a plurality of spaced guides **40** which extend in an inward-outward direction relative to the axis of the wheel. The guides **40** may be bores located in a plane normal to the axis of the wheel. The bores **40** are preferably positioned along non-radial lines with their outer ends inclined forwardly in the direction of rotation relative to a true radius. See FIG. 4. However, it is to be understood that not all phases of this invention are limited to inclination of the guides in the direction indicated or even to an inclination relative to a radius. Each bore may be provided with a cylindrical liner **42**, providing a guide bearing and having a pair of opposing elongated slots **44**. Slidably-carried by each guide is a reciprocating arm **46** which is biased outwardly. As shown in FIG. 4, the reciprocating arm may be a plunger mounted in the bore. To limit outward and inward movement, the plunger has a pair of transversely-extending members **48** which cooperate with the slots **44**. One means of biasing the arms outward is to position a spring **50** between the arm and the bottom of the guide. Opposing springs **50** on the two wheels should be balanced so that mating arms will reciprocate synchronously. Other means of providing outwardly-biased reciprocating arms may be utilized if desired.

Mating sealing elements **51** and **52** are pivotally-mounted on the outer ends of the respective arms **46** of the two wheels. The elements **51** are on the arms on wheel **34** and the elements **52** are on the arms on wheel **35**. The wheels are mounted so that the sealing elements on one wheel synchronously mate with correspondingly positioned sealing elements on the other wheel as the wheels oppositely rotate. One means of pivotally-mounting such sealing element on its arm is to provide the sealing element with a bifurcated portion **53** which fits over the exterior end of the arm. A pin **54** which extends through the arms of the bifurcated portion and the end of the corresponding arm **46** makes the pivoted attachment. Each sealing element may be provided with a stop member **55** positioned to engage an adjustable stop **55***a* to regulate angular movement of the sealing element relative to the arm. Also, springs **56** may be provided between the sealing element and the arm to properly bias the sealing elements to a position such that each will have its face parallel to its mate on the other wheel when the two come into engagement. The contact face **58** of each sealing member is generally rectangular

and is provided with a transverse knife slot **60**. The faces **58** of the sealing elements **51** and **52** which mate with each other are provided respectively with mating indexing tapered dowel pins **62** and holes **63** whereby the mating faces will automatically be brought into register upon contact. Such indexing means allows for substantial tolerance in the construction of the machine and avoids necessity for excessive close machine work. Each sealing element **51** is also provided with a pivotally-mounted knife element **64** which is mounted for operation in the slot **60**, as will be explained subsequently. Each sealing element is provided with an electrical heating element **68** which obtains its power from leads **70** attached to contact rings **72** on the rear side of each wheel. A thermostatic switch **74** or other thermometric device may be provided in one sealing element to maintain the proper sealing temperature.

The wheels **34** and **35** oppositely rotate in synchronism and, as can be seen, the sealing elements **51** and **52** come into contact above the plane of the axes of the shafts **32–34**. The spring elements **56** and adjustable stop means **55** align the mating faces **58–58** so that upon contact they are in parallel facing relation. By having the guide bores **40** positioned along non-radial lines with their outer ends inclined forwardly toward the direction of rotation, the directions in which the arms or slides must begin to move upon contact are more nearly aligned with one another. With this arrangement, the axes of the carrier wheels **34** and **35** may be placed closer together and thereby the contact of the sealing elements may be made at a greater angular displacement from the axes than would be the case if the bores **40** were placed along radial lines. In such case, slide reciprocation will be along a line tending to move the contacting arms axially inward along their bores and less in a circumferential direction which would tend to bend the arms or cause them to frictionally bind against the sides of the bores in which they move. At the same time, at the end of contact the arms will be in a position permitting springs **50** to freely extend them. Moreover, the pivoted connection and springs **56** will provide a snap action which will tend to disengage the formed package from contact with the sealing elements.

The closer the axes of the carriers are to each other the greater will be each arc of sealing engagement between sealing element pairs. As can be seen in FIGS. 2 and 3, the axes of wheels **34** and **35** may be close enough together that the mating faces **58** come in contact at a substantial distance prior to the plane of the axes of the carriers and remain in contact a substantial distance thereafter, and these distances may be such that each pair comes in contact at least as soon as and even before the preceding pair breaks contact. As can be further seen, it is readily possible when there are six sets of sealing elements per carrier, and in certain arrangements with as few as three, for there to be some concomitant or simultaneous engagement by adjacent sets of sealing elements. In such cases, the heating cycle will be greater in length than the rate of production or the interval of time required for production of each package. In arrangements in which the guides are inclined relative to true radii of their respective carriers, and there is concomitance of engagement of successive pairs of sealing elements, the distance between successive seals will change to some degree during the simultaneous engagement. This will be dependent on the amount and direction of inclination and the amount of simultaneous engagement of successive pairs.

Each knife **64** has one end pivoted at **65** in a slot **66** in a bracket **67** which is rigidly mounted on each element **51** with the slot **66** aligned with the slot **60** in such element. The knife normally is retained in slot **60** by a suitable spring **69**. Each knife at its end opposite its pivot **65***a* has a part projecting from slot **60** toward the cabinet **13**. A cam **76** extends outwardly from the cabinet along the linear line of travel of sealing element **51** in position to deflect each such projecting knife end and cause it to

swing across into the slot **60** in the mating element **52**, thus severing the package material and detaching the lead and providing the formed, filled and sealed package. Since knife **64** is located midway of the sealing jaws the severing of the seal will always be at such location. Therefore, the leading end or bottom seal of one package and the final or top seal of the preceding package will be formed simultaneously and will be of the same width. Inasmuch as each sealing element is spring-loaded in a direction to move it to a position on its arm for initial engagement, the mating faces will tend to swing apart in going out of contact and thereby snap out the completed package and prevent sticking of the material to the sealing faces, which is sometimes the tendency in heat-sealing machines.

Utilizing the above principles, a packaging machine has been built which will produce filled packages at the rate of 300 per minute without any strain on any of the elements. Such machine utilizes wheels with six sets of sealing elements mounted on reciprocating plungers positioned in spaced bores extending along non-radial lines, see FIG. 4. The production is continuous and, as can be seen, there is an overlapping heat-sealing cycle.

One of the advantages of the machine is that it can be adjusted within relatively broad range to make different size packages. For example, the spacing between the wheels may be changed which will change the length of the package. Further, while six sets of sealing elements have been illustrated, other numbers may be used. In some circumstances there may be only one set, in which case there would be intermittent operation. Moreover, it is to be noted that the mechanism is simple, and complicated inter-related pneumatic, hydraulic systems have been eliminated. Also, various types of filling means may be utilized and film registration mechanisms may be easily incorporated.

While the preferred embodiment discloses a packaging machine forming a tubular package having one longitudinal seal and two transverse seals, the invention may also be utilized to form other types of packages. For example, the package may be formed from two rolls of strip material in which case there will be means to form two longitudinal seals. Also, if it is desired, it is possible to fill the package and provide the longitudinal seal after the transverse seals have been formed.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the apparatus.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

We claim:

1. An apparatus for forming a strip of flexible material into a package, filling said package with a commodity, and sealing said package, comprising: a frame, means extending from said frame to hold a supply strip of flexible material; means receiving material from said supply-holding means, forming said strip of material into substantially tubular shape and longitudinally sealing it; filling means for delivering a measured amount of the commodity to the tube; a pair of shafts extending outwardly from said frame, said shafts laterally spaced approximately equidistant from a line formed by a projection of the center line of said tube; a pair of wheels mounted on said shafts; a plurality of spaced guides on each of said wheels, said guides extending in an inward-outward direction; a reciprocating arm slidably carried by each guide; means biasing said arm outwardly in said guide; stop means limiting outward movement of said arm; a sealing element pivotally mounted on the outer portion of each arm, and means for rotating said wheels in opposite directions and in synchronization with one another to cause the corresponding sealing elements from the two wheels to come together in register with one another against said material on one side of the plane through the axes of the shafts and remain in contact substantially past said plane whereby contacting sealing elements transport the material through the apparatus while engaging it in sealing contact.

2. The apparatus specified in claim **1** wherein the sealing elements have mating transverse grooves along their contacting faces and there is a cutting member pivotally mounted adjacent one of its ends in said groove in one of each pair of registering elements, each cutting member having a part projecting from said groove spaced from said pivotal mounting, and there is a cam positioned in the line of movement of said projecting part during contact of the sealing elements to automatically move the cutting member through the material and into the groove in the opposing sealing element severing the material and dividing the formed seal into two seals.

3. The apparatus specified in claim **1** wherein the guides extend along non-radial lines in planes normal to the shaft axes and at acute angles to radii through the pivotal mountings of the sealing elements.

4. The apparatus specified in claim **1** wherein the number of sets of sealing elements are such as to have concomitant engagement of adjacent sets of sealing elements whereby there is continuous progression of the material through the apparatus.

5. The apparatus specified in claim **1** wherein the number of sets of sealing elements and the space between said shafts is such as to provide overlapping of the engaging portions of the cycles of two successive pairs of mutually-opposed sealing elements.

6. In an apparatus for providing transverse seals between the plies of a plural-ply strip of material; a pair of laterally-spaced shafts; a pair of carrier members mounted on said shafts; an arm slidably-carried by each carrier member for reciprocation inwardly and outwardly with respect to the shaft on which said carrier member is mounted; means biasing said arm outwardly; stop means limiting outward movement of said arm; a sealing element pivotally-mounted on the outer portion of each arm; and means for rotating said carrier members on said shafts in opposite directions and in synchronization with one another to cause the sealing elements to come together in register with one another against said material on one side of the plane of the axes of the shafts and remain in contact substantially past said plane whereby contacting sealing elements transport the material through the apparatus while engaging it in sealing contact.

7. The apparatus specified in claim **6** wherein the arms each reciprocate along lines having one end inclined in the direction of rotation relative to a radius.

8. The apparatus specified in claim **6** wherein the means biasing the arms outward are springs interposed between each arm and its carrier member.

9. The apparatus specified in claim **6** in which means are provided between the sealing element and its arm to establish a parallel relation between the mating faces of corresponding sealing elements at the time they come together.

10. The apparatus specified in claim **9** in which mating sealing elements are provided with registration means.

11. The apparatus specified in claim **6** wherein the carrier members continuously rotate during the operation of the machine.

12. The apparatus specified in claim **11** wherein the number of sets of sealing elements and the space between said shafts is such as to provide concomitant engagement of adjacent sets of sealing elements whereby there is continuous progression of the material through the apparatus.

13. The apparatus specified in claim **12** in which the

number of sealing elements and the space between said shafts is such as to provide overlapping of the sealing cycles of two successive pairs of mutually-opposed sealing elements.

14. The apparatus specified in claim **6** in which the sealing elements have mating transverse grooves along their mating faces and there is a cutting member pivotally mounted adjacent one of its ends in said groove in one of each pair of registering elements, each cutting member having a part projecting from said groove spaced from said pivotal mounting, and there is a cam positioned in the line of movement of said projecting part during contact of the sealing elements to automatically move the cutting member through the material and into the groove in the opposing sealing element, severing the material and dividing the formed seal into two seals.

15. In an apparatus for providing transverse seals between the plies of a plural-ply strip material, a pair of sealing elements having sealing surfaces adapted to engage opposite sides of said material in parallel opposed relation to one another, means oppositely circulating said elements about spaced closed paths in synchronism so that they will be directly opposed to one another when on those portions of said paths closest together, pivotable, retractable and extendible mounting means mounting said elements for such movement and permitting them to pivot into such parallel relation to one another when approaching and remain in such relation throughout engagement with one another, and for maintaining, without relative motion between them, parallel pressurized sealing contact of said elements with said material along a predetermined substantial length of each of said paths, whereby the sealing elements will transport the material through the apparatus while engaging it in sealing contact.

16. The apparatus specified in claim **15** wherein there are a plurality of sealing elements moving about each path.

17. The apparatus specified in claim **16** wherein there are a pair of carriers movable about said paths having guides spaced about the carriers, the sealing elements are reciprocatively-mounted in said guides for guided inward and outward movement relative to said axes, and there are biasing means for outward biasing of the sealing elements.

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