April 17, 1956 W. S. CLOUD 2,742,080

METHOD AND APPARATUS FOR MAKING BAGS

Filed Dec. 5, 1951 4 Sheets-Sheet 1

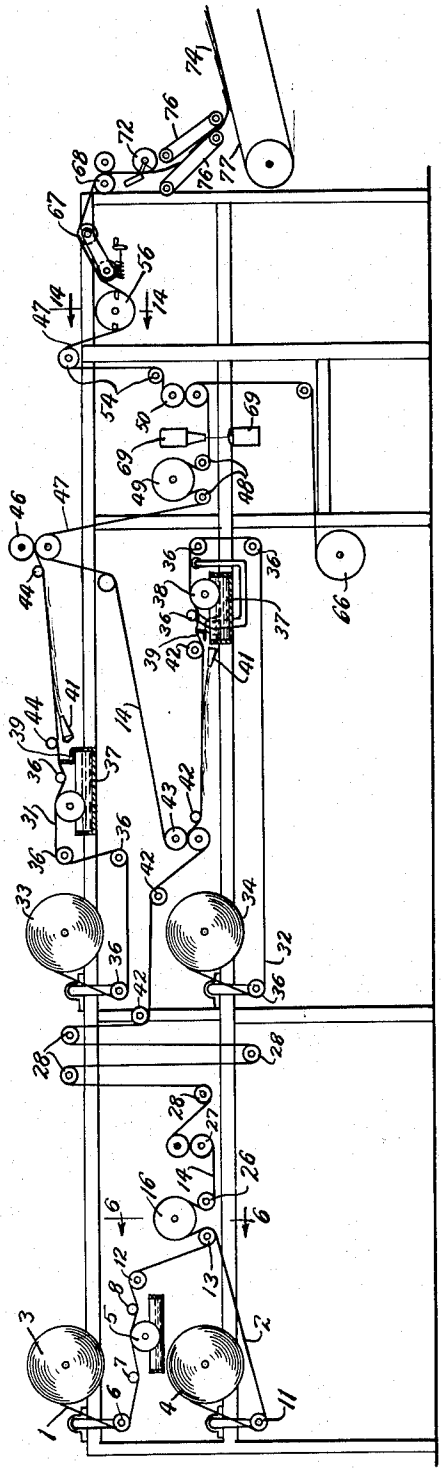


Fig. 1

INVENTOR.
William S. Cloud
BY William D. McFarland
Atty.

April 17, 1956 W. S. CLOUD 2,742,080

METHOD AND APPARATUS FOR MAKING BAGS

Filed Dec. 5, 1951 4 Sheets-Sheet 2

Fig-2

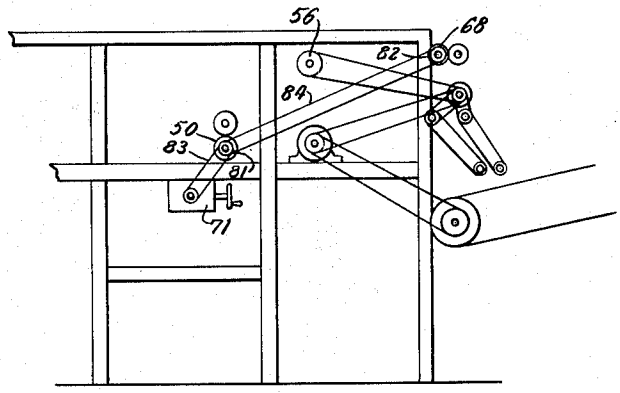


Fig-3

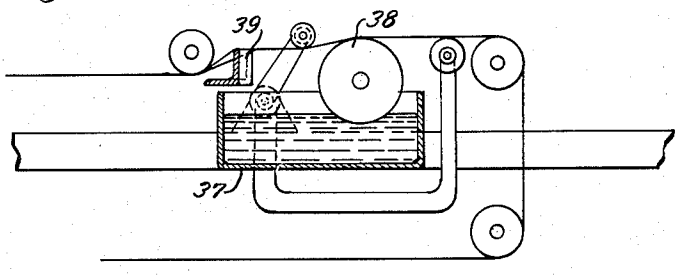


Fig-5

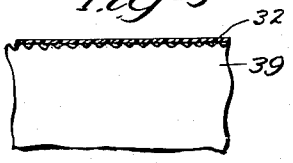
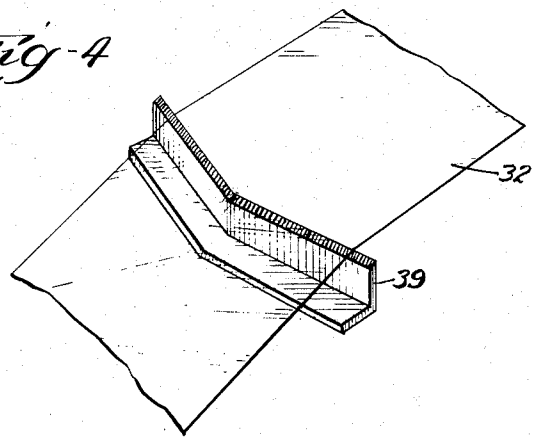


Fig-4



INVENTOR.
William S. Cloud
BY
William D. McFarland
Atty.

April 17, 1956 W. S. CLOUD 2,742,080

METHOD AND APPARATUS FOR MAKING BAGS

Filed Dec. 5, 1951 4 Sheets-Sheet 3

Fig-6

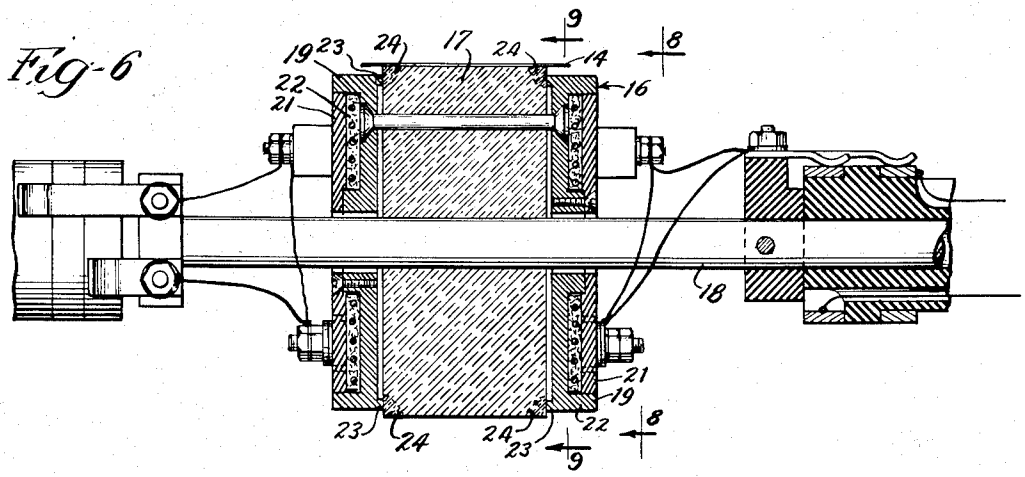


Fig-7

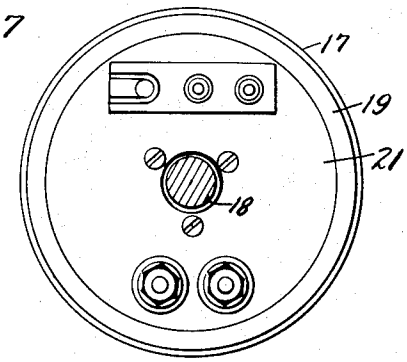


Fig-8

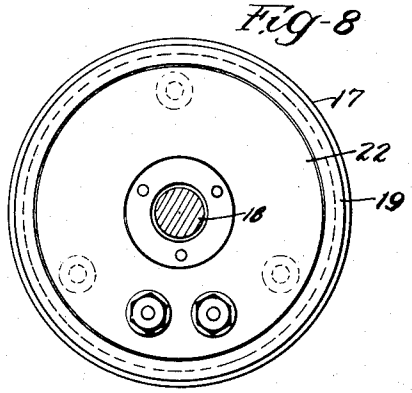


Fig-10

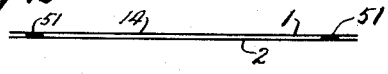


Fig-11

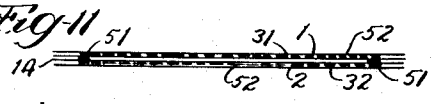


Fig-12

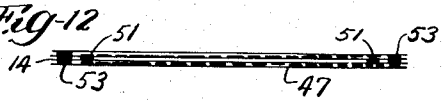


Fig-13

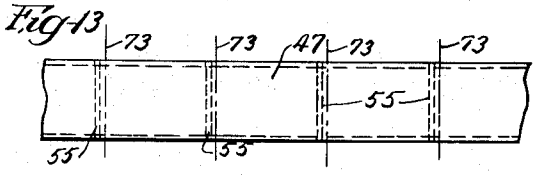
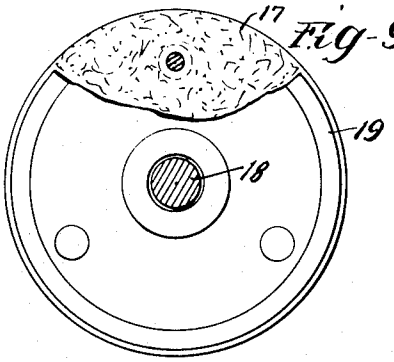


Fig-9



INVENTOR.

William S. Cloud

BY

William D. McFarland

Atty.

April 17, 1956 W. S. CLOUD 2,742,080

METHOD AND APPARATUS FOR MAKING BAGS

Filed Dec. 5, 1951 4 Sheets-Sheet 4

Fig-14

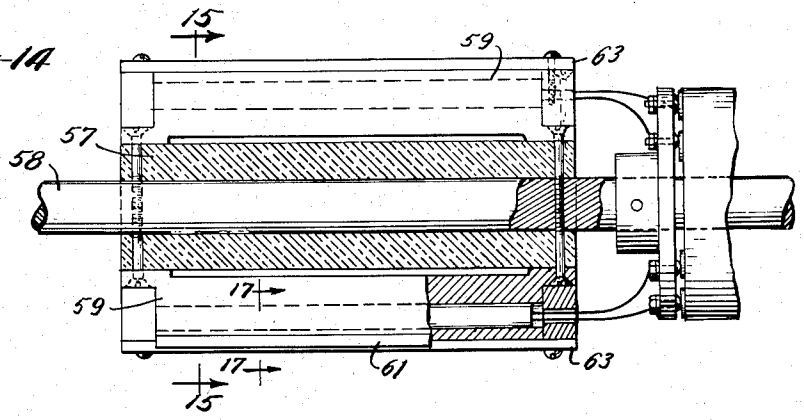


Fig-15

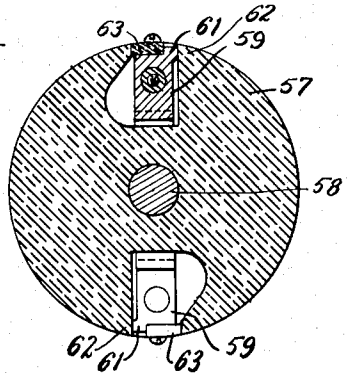


Fig-16

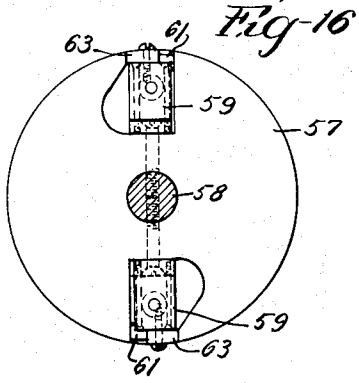


Fig-18

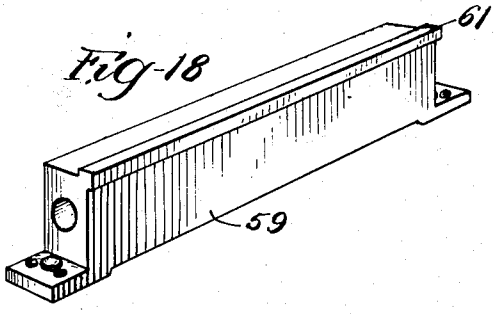
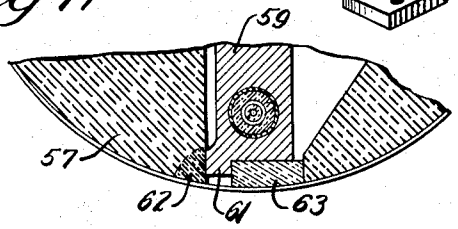


Fig-17



INVENTOR.
William S. Cloud
BY
William D. McFarland
Atty.

United States Patent Office 2,742,080 Patented Apr. 17, 1956

2,742,080

METHOD AND APPARATUS FOR MAKING BAGS

William S. Cloud, Wilmette, Ill.

Application December 5, 1951, Serial No. 259,999

2 Claims. (Cl. 154—42)

This invention relates to methods of making heat-sealed bags of plastic sheet material, such as "Pliofilm," and to apparatus for practicing such methods.

The conventional method of heat-sealing plastic material is to place two surfaces of the material together in a face-to-face relationship, and then to apply a heated metal sealing bar to the uper surface. This method creates a weak line in the material where the portion of the material contacted by the sealing bar joins the portion not contacted. If bags formed by this method are dropped, or roughly treated, they will split along this weak line.

One method, commonly called the "bulk seal" method, has been devised to eliminate this weak line. The "bulk seal" method contemplates stacking a large number of bag-sized blanks of sheet material so that their edges are exactly aligned; and applying a hot sealing plate against the edge of the stock, so that the heat will gradually diminish as it is transmitted away from the edge through the material to produce a gradient seal.

A principal object of my invention is the provision of an improved, continuous method for joining together the edge portions of sheets of plastic material with a gradient heat-seal.

A further object of my invention is the provision of a method for joining together the edge portions of laminated sheets of plastic material with a gradient heat-seal which welds together all layers of the material, including those previously laminated.

A further object of my invention is the provision of a method for making gradient heat-seals at predetermined intervals across a tube of plastic material.

Other objects and advantages will appear from the following description and from the accompanying drawings, in which:

Fig. 1 is a diagrammatic side view partly in section of an apparatus for practicing my invention.

Fig. 2 is a vertical fragmentary view of the drive mechanism at the right end of the apparatus of Fig. 1.

Fig. 3 is a detail sectional view of the apparatus for applying the laminant to the sheet material.

Fig. 4 is a perspective view of the scraper blade of the laminating apparatus.

Fig. 5 is a detail vertical view of portion of the scraper blade.

Fig. 6 is a vertical, sectional view taken approximately on the line 6—6 in Fig. 1.

Figs. 7, 8, and 9 are detail views, showing one end of the heat-sealing roller in various stages of assembly.

Figs. 10, 11, and 12 are sectional views showing the several changes in the tube made by the illustrated embodiment of the invention.

Fig. 13 is a plan view of a length of the finished tube.

Fig. 14 is a vertical, sectional view partly broken away of one of the cross-sealing units taken approximately on the line 14—14 in Fig. 1.

Fig. 15 is a detail section taken approximately on the line 15—15 in Fig. 14.

Fig. 16 is a detail view of one end of the cross-sealing roller.

Fig. 17 is a detail section taken approximately on the line 17—17 in Fig. 14.

Fig. 18 is a perspective view of the heating bar of the cross-sealing unit.

Although the law requires a full and exact description of at least one form of the invention, such as that which follows, it is, of course, the purpose of a patent to cover each new inventive concept therein, no matter how it may later be disguised by variations in form or additions of further improvements; and the appended claims are intended to accomplish this purpose by particularly pointing out the parts, improvements or combinations in which the inventive concepts are found.

General description

In the form of the invention shown in the drawings, two webs or sheets of plastic material are drawn from rolls over edge-sealing units to form a tube. A laminant is applied to one surface of each of two additional sheets, drawn from rolls, and the coated surfaces of these sheets are pressed against and laminated to opposite sides of the tube. The tube is then drawn over edge-sealing units to heat-seal together all four sheet layers. At bag-length intervals seals are made across the tube, which is then cut adjacent each cross-seal to form a series of bags.

Sheet feed

Rolls 3, 4, 33, and 34 of sheets 1, 2, 31, and 32 respectively are mounted in the usual manner on shafts which are free to rotate in half-bearings which rest upon and are fastened to the frame. A brake (not shown) may be applied to each shaft or roll to ensure smooth unrolling. The sheets are drawn or pulled through the machine by one or more pairs of feed or wringer rolls, which may be driven in any conventional manner. In Fig. 2, feed rolls 50 and 68 have been illustrated as being driven through pulleys 81 and 82 by V-belts 83 and 84. A number of freely rotating guide rollers are provided to guide each sheet through the several parts of the machine. It will be understood that the requisite number and placement of driven wringer rolls and freely rotating guide rollers may vary, depending upon the exact sheet material and laminant used. Thus wringer rolls 27, 43, and 46 may also be driven, if desired.

Forming single tube

As is best illustrated in Fig. 1, sheets 1 and 2 are drawn from rolls 3 and 4, positioned in a face-to-face relationship with their edges aligned, and passed over edge-sealing unit 16, to join their edges with a gradient heat seal, thus forming tube 14.

If the sheet material used is "Pliofilm," or some other material reacting similarly, it may be desirable to treat at least one of the inner surfaces of tube 14 before forming it to lessen or prevent difficulty in opening the bags. In the case of "Pliofilm" bags, it will be found that cutting heat or pressure may create a hair-line seal at the bag mouth which is easily broken if the bag surfaces can be rubbed against each other. However, the "Pliofilm" surfaces are so smooth that they adhere, especially if they are stacked before use. This tendency to adhere can be substantially eliminated by coating one inside surface of tube 14 with a thin film of water or other similar material which will not be objectionable in the final bag, or by printing on it. In Fig. 1, I have illustrated the coating of one surface of web 1 with water, freely rotating rollers 6, 7, and 8 guiding sheet 1 over water applicator 5.

Sheets 1 and 2 are drawn to a face-to-face position with their edges aligned, over guide rollers 11, 12, and 13. Their edges are then heat-sealed together to join

the sheets into a tube 14. To avoid a weak line where the heat-sealed edges join the balance of the tube, the application of sealing heat should be primarily at the extreme outer edges of the seal areas, with a progressive decrease in degree of heat toward the center of the sheet material. This can be accomplished by application of heat to the edges, as by running the edges against a heated plate positioned at right angles to the plane of the sheet material. Because this requires exact contact either for an extended time or with a highly heated plate, it raises aligning and heating problems, frequently resulting in either unsealed stretches or scorched portions. A preferred cylindrical heat-sealing unit is best illustrated in Fig. 6.

A cylinder 17 of material which is a relatively poor conductor of heat is carried by shaft 18 which in turn rotates in bearings fastened to the frame. The material I now prefer to use for cylinder 17 is "Transite," an asbestos-cement composition. Bolted to either end of cylinder 17 are housings, comprising a hollow shell 19 and a cover 21, containing a heating element 22 which may be heated in any conventional manner. Shell 19 is of slightly smaller diameter than cylinder 17 and has an inwardly projecting shoulder 23 contacting cylinder 17 near the outer edge of its end. Sealing heat is transmitted from element 22, through shoulder 23 of shell 19, which is preferably of metal, heating primarily a portion or segment 24 of cylinder 17. The outer part of portion 24 (the part adjacent shoulder 23) may thus be heated to whatever degree is necessary to heat-seal the particular sheet material used, while the temperature toward the inner part of portion 24 will gradually diminish until it is no longer high enough to heat-seal, thus leaving no sharp, weak line of demarcation, but rather forming a gradient heat-seal.

In Fig. 6, I have illustrated tube 14 being drawn over heat-sealing unit 16, the friction thereby created rotating unit 16, and forming a seal spaced from the edge of the tube. At present I prefer not to have the seal of the inner tube at the edge when I am making a laminated tube for reasons set forth below. The seal could be placed at the edge, of course, if desired.

After sheets 1 and 2 have been guided over edge-sealing unit 16 by rollers 13 and 26, with certain materials it may be desirable to draw tube 14 between wringer rolls 27, at least one of which is preferably resilient, to press the heat-softened portions firmly together to ensure an adequate seal. With some materials better results can be obtained by allowing the seal to set, as while the tube is drawn over rollers 28.

Forming laminated tube

Sheets 31 and 32 are drawn from rolls 33 and 34, and guided by freely rotating guide rollers 36 over conventional laminators 37. The laminant used, of course, will vary depending upon the exact sheet material used. Preferably, the laminant will be heat-sealing, so that it will be possible to heat-seal all four layers of the laminated tube 47 together through the laminant, thus forming a seal which is stronger than that made where the inner layers are heat-sealed and the outer layers secured only by the laminant. At present there is no such commercially available heat-sealable laminant for use with "Pliofilm." Accordingly, when using "Pliofilm," I use any suitable, commercially-available adhesive, such as "Pliolite" or "Pliogrip," through neither of which can sheets be heat-sealed, but do not apply them clear to the edges of sheets 31 and 32. Thus, transfer cylinder 38 will not be as wide as sheet 32, and scraper blade 39 will be V-shaped so that any excess laminant will not be spread to the edges of sheet 32 when it is drawn over the scraper blade. With some laminants, such as those named above, the provision of a serrated edge on the scraper blade, as illustrated in Fig. 5, has proven effective. As both "Pliolite" and "Pliogrip" contain solvents which affect "Pliofilm," it will be advisable when using those combinations to apply a thin coating of the laminant. It may also be desirable to blow air on the coated sheets, as through nozzles 41, to evaporate at least a part of the solvent.

The surface of sheet 32 which has been coated with the laminant is positioned in a face-to-face relationship with one surface of tube 14 by guide rollers 42. They are pressed together by wringer rolls 43. In a similar manner, guide rollers 44 position laminant-coated sheet 31 against the other surface of tube 14. The joined sheets are then firmly squeezed together by wringer rolls 46 to form a laminated tube. The joining of sheets 31 and 32 and tube 14, of course, may be accomplished at the same time if desired.

The laminated tube is then guided by rollers 48 around edge-sealing unit 49, which, though operating at a slightly higher temperature, is identical to sealing unit 18, described above, in all respects except that it is wider so that the heated portions of the "Transite" cylinder corresponding to portions 24 contact and weld or heat-seal together the edges of sheets 1, 2, 31, and 32.

As described above with respect to the forming of a single tube, with certain materials it may be desirable to draw tube 47 through feed or wringer rolls 50 to press the heat-softened edges together to ensure an adequate seal; and it may also be desirable to provide a setting period (not shown).

The tube 47 thus formed, as shown in its several stages in Figs. 10 through 12, comprises sheets 1 and 2 joined along each side edge by a gradient seal 51 spaced a slight distance from their edges, a layer of laminant 52 covering the outer surfaces of sheets 1 and 2 except along their edges and holding sheets 31 and 32 thereto, the edges of all four sheets being joined along each side edge by a gradient seal 53. It will be noted that unheated portions of sheets 31 and 32, laminated to sheets 1 and 2 over gradient seal 51, reinforce that point to minimize the possibility of breakage of the side seal by dropping the bag.

Bag forming

Tube 47 is guided by rollers 54 over transverse-sealing unit 56. If the laminant used is heat-sealable, unit 56 forms a gradient seal 55 joining all four sheets at spaced intervals across the tube; if it is not, only sheets 1 and 2 are joined with a gradient seal by the illustrated apparatus. A gradient seal joining all four sheets can be obtained, even if the laminant used is not heat-sealable, if care is taken not to apply laminant to those portions of sheets 31 and 32 which are contacted by the sealing portions 62 of cylinder 57. This may be accomplished by cutting a channel across laminant-transfer cylinder 38 or periodically lifting a portion of the sheet from contact with it, and by rotating cylinders 38 and 57 in timed relationship. In such case, scraper blade 39 would not be used.

Unit 56 is, in many respects, similar to edge-sealing unit 16. A cylinder 57 of "Transite" is carried by shaft 58, rotating in bearings attached to the frame. Bolted in channels parallel to the axis and extending the length of cylinder 57 are heating elements 59, positioned so that shoulders 61, abutting and heating portions 62 of cylinder 57, are slightly recessed or inset from the surface of cylinder 57. The portion of the channel opposite shoulders 61 and heated portions 62 may be cut away to provide an insulating air gap, and the portion of cylinder 57 thereabove may be surfaced with an inlay 63 of material having especially good insulating qualities, such as "Marinite," an asebstos-cement composition.

When using some materials which are rather delicate or flimsy and difficult to handle and cut, it may be desirable to provide a backing sheet of paper, which may be drawn from roll 66 and positioned against one surface of tube 47. This has been found desirable with "Pliofilm," where a heat-softened sealed area has not completely set.

Laminated tube 47 is then drawn over driven rollers

67, whose speed may be regulated manually in a conventional manner, through feed rolls 68, whose speed may be regulated by electric eye device 69 through gear box 71 for registration purposes, and into the bite of a conventional rotary knife 72. The knife will be timed in a conventional manner, as by being chain-driven with transverse-sealing unit 56, with adjustable angularity between them, so that its cut 73 will adjoin gradient seal 55, to cut bag-length sections 74 having gradient seals on both sides and on the bottom. These sections may be guided by belts 76 to take-away conveyor 77.

As is well known, plastic sheet materials have many differing characteristics. This is especially true with respect to their sealing. With many, a more secure seal can be obtained by allowing it to set, although the requisite period varies. In Fig. 1, I have illustrated apparatus for providing a setting period only after the formation of a single tube. A time interval before further processing of tube 14 is provided by drawing it over a series of rollers 28. During this period, if there are being used certain sheet materials having the characteristic of requiring only a lowering of temperature to set, it may be desirable to cool the sealed areas of tube 14 which were heated during the sealing process, as by blowing cold air on the tube or passing it through a cooling tunnel. With other materials which do not set as they cool, an even more extended setting period may be desirable. For example, with "Pliofilm," good results have been obtained by rolling tube 14 on a spool and allowing it to set overnight. It will be understood that if the provision of a setting period is desirable with the particular sheet material used, appropriate apparatus will be provided not only after the formation of the single tube, but also after the second edge-sealing and after the cross-sealing.

Rather than providing two sheets 1 and 2 of plastic material, a single sheet may be used if desired, being folded over by conventional apparatus. Similarly, a single folded sheet might be substituted for sheets 31 and 32. These, of course, are equivalents to the illustrated apparatus. Using a folded sheet, however, one edge seal may be eliminated in the single tube, if desired, thus effecting a saving in sheet material.

Other variations of the invention can be effected by making gradient seals extending in two directions, rather than just one, and by cutting at the securely sealed central portions of the two-way gradient seals, thereby creating adjoining, oppositely-positioned bag sections each having gradient seals extending inwardly from their edges. In such equivalent apparatus the heat sealing units would be similar in many respects to cross-sealing unit 56. However, rather than fastening the heating element in a channel cut in the surface of the cylinder, thereby heating a surface portion of the unit adjoining only one edge of the channel, the heating element would be positioned below an unbroken surface portion, thereby heating the surface portion above it to sealing heat and adjoining portions of the surface extending in both directions from that portion to gradually decreasing degrees of heat. In a typical application of this variation, two sheets of plastic material are carried over a longitudinal heat-sealing unit, positioned to form a two-way gradient seal longitudinally midway between the edges of the sheets, and then over a transverse heat-sealing unit, positioned to form a two-way gradient seal across the sheets at bag-width intervals. The center portion of each seal is then cut, as by a hot wire, thereby producing two sets of bags having gradient seals along their bottoms (which are the joined center-portion of the two sheets) and along both sides.

What I claim is:

1. Apparatus for forming a heat-sealed tube of plastic sheet material including means for advancing two layers of plastic sheet material in a face-to-face relation, rotatable heat-sealing means positioned to contact one face of the layers along a line extending longitudinally of the layers while they are being advanced and means for laminating an additional layer to said face, said heat-sealing means comprising a rotatable shaft the axis of which parallels the direction of advancement of the sheet material, a cylindrical heating unit carried by said shaft and rotating therewith, and a sealing cylinder, which has poor heat conductivity and is of greater diameter than said heating unit, carried by said shaft adjacent said heating unit and rotating therewith, the outer portion of said sealing cylinder extending beyond the edge of said heating unit to contact the face of the layer.

2. Apparatus for making bags of plastic material including means for advancing a flattened tube of plastic sheet material heat-sealing means positioned to contact the tube along successive lines extending across said tube to heat-seal it at bag-length intervals, and means for dividing the tube into sections by severance adjacent the cross-seals, said heat-sealing means comprising a rotatable shaft, the axis of which is perpendicular to the direction of advancement of the sheet material, a sealing cylinder, which has poor heat conductivity, carried by said shaft and rotating therewith, said cylinder having at least one channel in its surface parallel to its axis and extending the length of the cylinder, and a heating element recessed in said channel below the surface of said cylinder.

References Cited in the file of this patent

UNITED STATES PATENTS

2,125,758	Waters	Aug. 2, 1938
2,238,342	Riehl	Apr. 15, 1941
2,256,506	Wagner	Sept. 23, 1941
2,326,931	Dalton et al.	Aug. 17, 1943
2,343,117	Vincent	Feb. 29, 1944
2,380,914	Billeb	Aug. 7, 1945
2,422,725	Gilfillan	June 24, 1947
2,442,091	Mann et al.	May 25, 1948
2,444,685	Waters	July 6, 1948
2,479,375	Langer	Aug. 16, 1949
2,488,212	Lloyd	Nov. 15, 1949
2,530,221	Bender	Nov. 14, 1950
2,627,213	Nye	Feb. 3, 1953
2,635,671	Mere et al.	Apr. 21, 1953