

[54] **TUBE SEAMER WITH CLAMP ACTION**

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[58] Field of Search **156/203, 464, 466, 156/469; 53/192; 100/214, 219, 233, 260, 280**

[56] **References Cited**

UNITED STATES PATENTS

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[57] **ABSTRACT**

An arrangement is provided for forming the longitudi-

nal seal or seam of a packaging tube by inward clamping movement of a heated sealing shoe and a backup shoe with equal and diametrically opposite force on opposite sides of the coaxial internal form or filling tube about which the packaging tube is formed or positioned. The pressing engagement of the sealing shoe against the overlapped edges of the film assures a uniform and secure seam and the backup shoe prevents misalignment of the depending filling tube by counteracting the pressing force. The opposite acting shoes are mounted on pivotal arms with 2:1 mechanical advantage gained by the fluid cylinder actuator that interconnects the free ends of the arms. Each pivot lies in a separate plane contiguous with the respective area of shoe engagement with the film on the filling tube to assure radial or straight-in movement; the two planes thus being substantially parallel. The pivotal mounting arms are biased outwardly away from the tube and adjustable stop means is provided to assure equal withdrawal distance of the shoes. The biasing spring is on the backup arm so as to assure that nominal engagement of the sealing shoe precedes the backup shoe and that the engagement is gradual by virtue of the spring force, whereby the sealing shoe has a firm grip or seat on the overlapped edges of the film before sealing pressure is applied.

6 Claims, 4 Drawing Figures

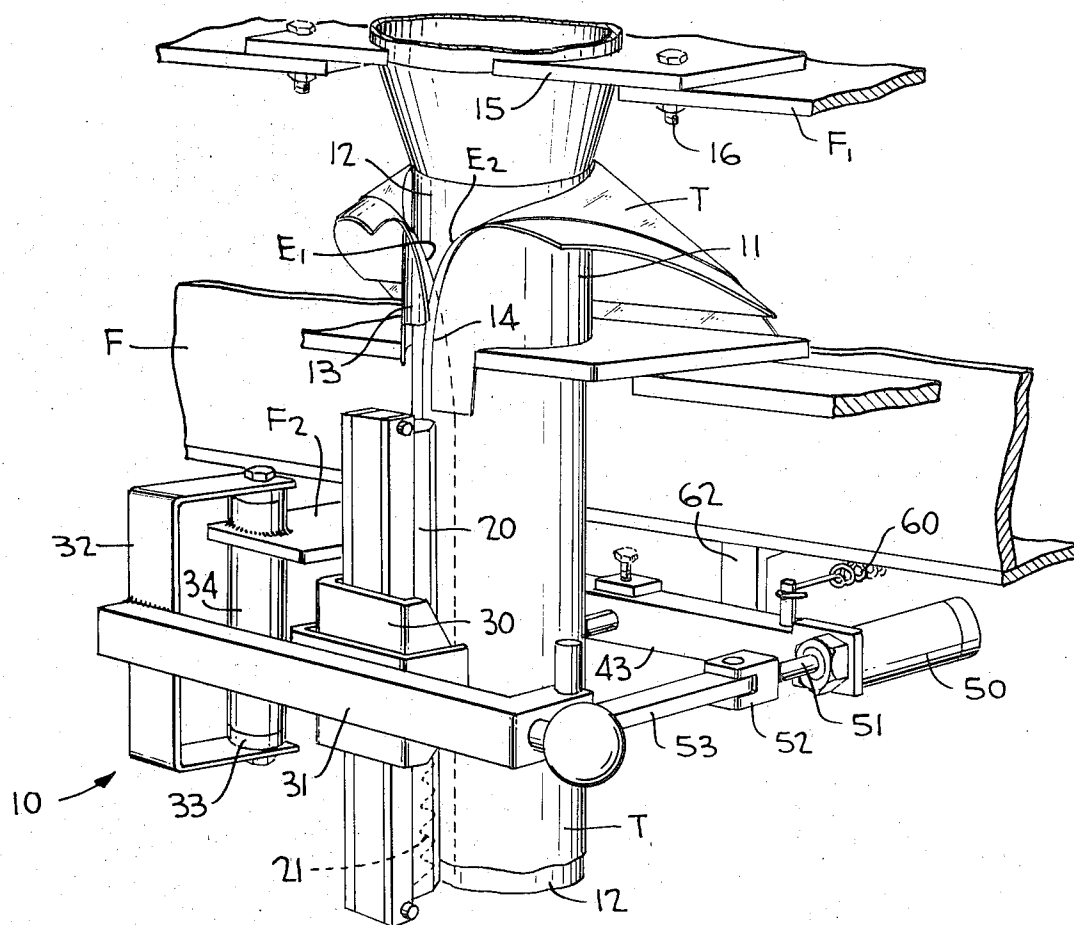


FIG. 1

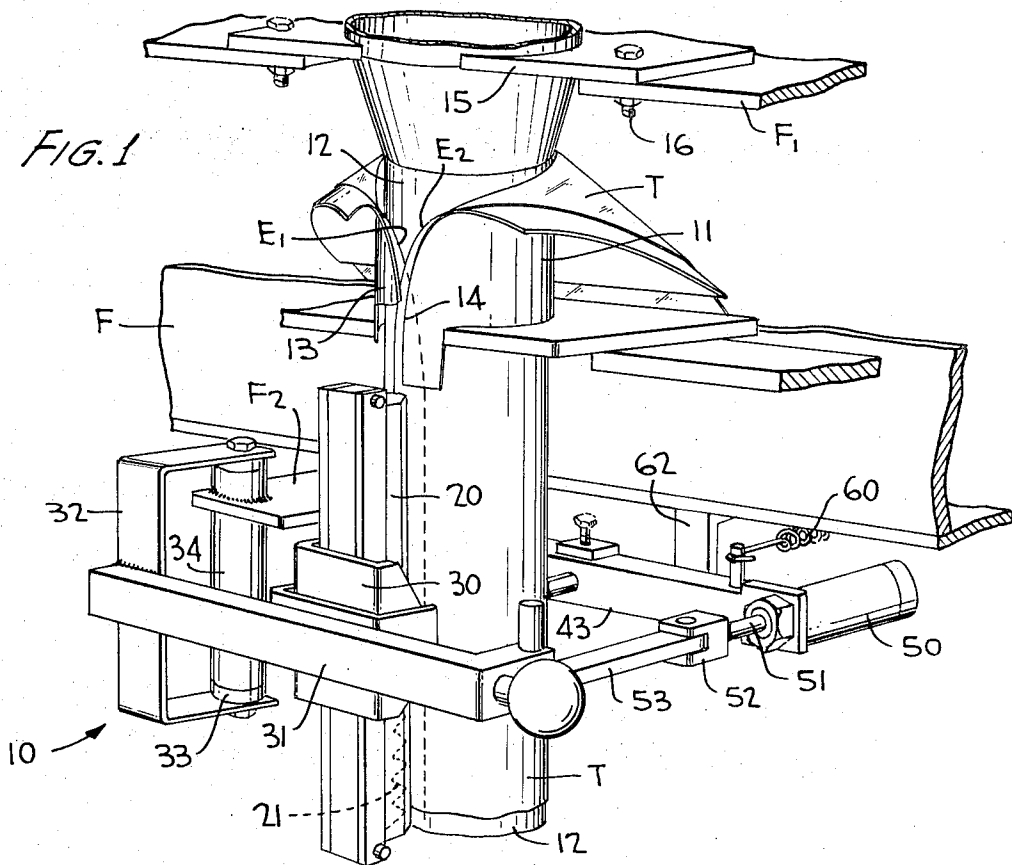
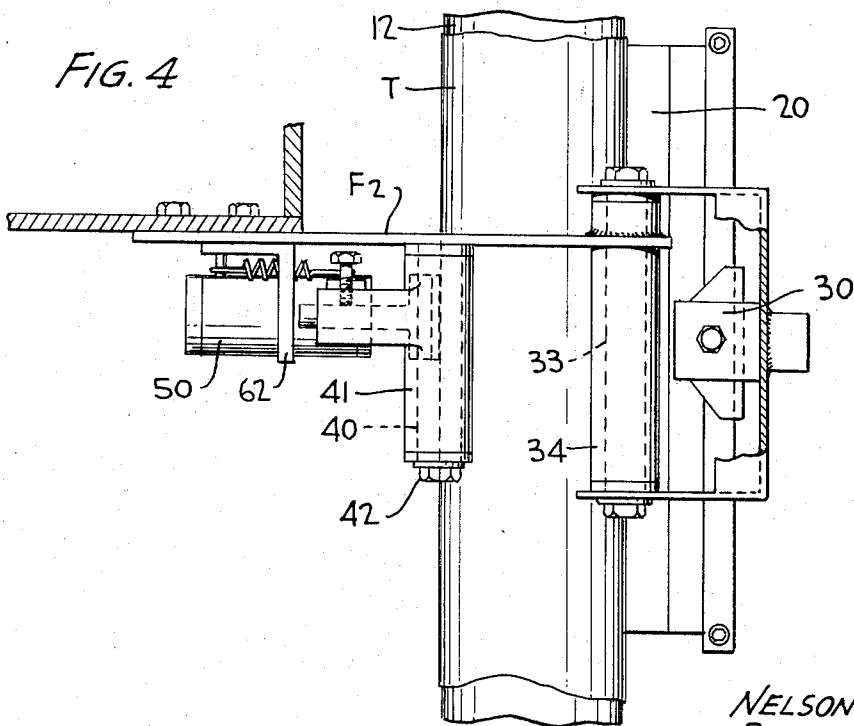
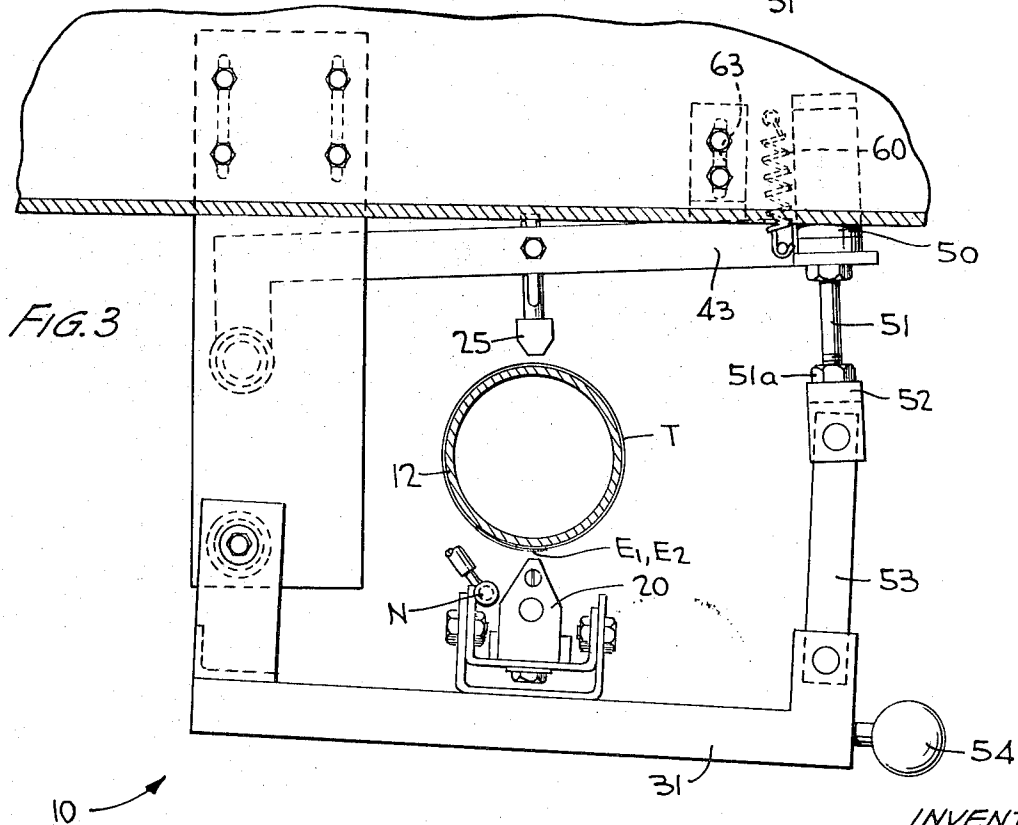
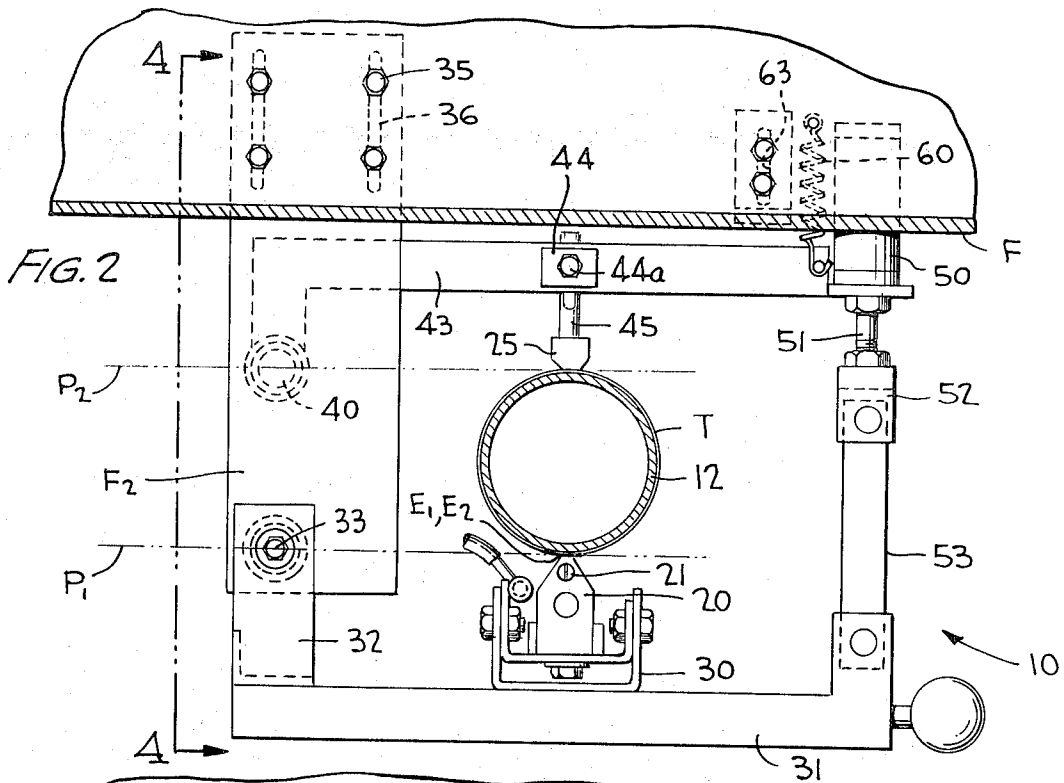


FIG. 4



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TUBE SEAMER WITH CLAMP ACTION

The present invention relates to packaging and, more particularly, to a method and apparatus for forming an endless tube of packaging film for filling with product.

BACKGROUND OF THE INVENTION

In form and fill packaging, a web of packaging film is formed into a continuous tube by passing the same over and down through an external tube former. The overlapping longitudinal edges of the tube are heat sealed together during the tube forming process by a sealing bar or foot that applies the proper amount of heat and pressure to cause the material of the edges to fuse together. A measured batch of the product being packaged passes through a filling tube at the open end of the tube at the former and then passes down into the bottom of the packaging tube. Transverse seals are made across the tube to form the individual packages with the heat sealed, overlapped edges forming the back seam of the package, a new length of material is drawn out and a transverse cut is then made to separate the packages.

When certain relatively "hard" packaging film, such as coated glassine, is used to form the packages, the sealing foot may remain in continuous contact with the overlapped edges and a satisfactory seal may be obtained when the sealing bar is urged against the film with relatively low pressure. An internal "Teflon" coated forming plate is provided behind the overlapped edges inside the tube against which the sealing shoe works to gain the sealing pressure. Heat is provided to the sealing foot to cause the edges of the material to fuse together. Because the pressure of the sealing foot is relatively light, the backup plate may be merely a downward extension of a conventional filling tube.

The form and fill packaging operation is, however, adapted for use with other "softer" types of packaging film or material which has totally different physical and sealing properties from glassine. One such film is polyethylene used mainly for packaging frozen vegetables and the like. When packaging with this material, the seaming operation requires a substantially higher pressure of engagement between the overlapped edges in order to make a high quality seal. Also, it is impractical because of the nature of the material to leave the sealing foot in continuous contact with the film when forming the longitudinal seam since the polyethylene softens rapidly and the film is destroyed in the seal area if the sealing shoe is not quickly withdrawn and the seal cooled by a blast of air. Furthermore, it is predictable that because of the high pressure involved for sealing, as well as the higher coefficient of friction of the film on the former and the filling tube and the tendency of the film to stretch when placed under strain, it is unacceptable to leave the sealing shoe in continuous contact with the film during draw-out. In other words, when sealing polyethylene and other "soft" film it is necessary to engage and disengage the sealing foot during each cycle of the packaging operation.

In the past when a form, fill and seal machine is to be used for packaging with polyethylene, it has been recognized as unsatisfactory to use a part of the filling tube to provide the internal forming means or backstop for the sealing shoe. This is so since the increased pressure and the repeated cycling action of the shoe against a part of the filling tube eventually causes the same to be knocked out of coaxial alignment with the tube being

formed. First, this causes the tube being formed to be smaller than desired since the forming means or plate is then pointing toward the center of the tube and causes the edges of the film to overlap too much. Also, as predicated the misalignment does occur and destroys the proper spacing between the external former and the internal filling tube and thereby causes a binding of the film and deleterious wrinkles to be formed. Further, the increased friction caused by a continuously engaged sealing foot and misalignment drag does tend to increase the stretching force on the web during drawout and possible permanent longitudinal deformation of the film especially in the softened seam area.

Several arrangements have been proposed for thus overcoming these problems and performing the longitudinal seaming operation on the polyethylene type packaging film. These arrangements have typically included a separately supported forming or backup sealing plate that extends down into the open mouth of the tube. This type of arrangement is shown, for example, in U. S. Pat. No. 2,899,875 (FIGS. 4 and 5). However, this type of prior art arrangement is undesirable since the forming plate must be substantially reinforced and this requires that a significant portion of the inside of the tube be excluded from functioning as filling space. In other words, the backup shoe or bar takes up valuable space in the inside of the tube that significantly slows and hinders the filling operation.

OBJECTIVES OF THE INVENTION

Accordingly, it is one object of the present invention to provide a new arrangement for forming the longitudinal seam of a film tube wherein an open internal forming means or filling tube is utilized to position and backup the film for applying relatively high sealing pressure.

It is another object of the present invention to provide a tube forming method and apparatus wherein polyethylene and similar packaging film is formed by intermittent, high pressure engagement of the sealing shoe with the overlapped edges of the tube without causing misalignment of the internal forming means by applying equal and opposite forces on opposite sides of the forming means.

It is still another object of the present invention to provide a method and apparatus for forming the longitudinal seam wherein the depending, full circle filling tube may be used as a form for supporting the overlapped edges of the tube and clamping action across and on the outside of the tube applies the necessary sealing pressure.

It is still another object of the present invention to provide for a method and apparatus wherein the conventional, unreinforced filling tube is utilized as an internal film positioning or forming means and is maintained in perfect, coaxial relationship with the packaging tube during seaming to form a high quality and consistent size bag.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENT

In the preferred embodiment, the longitudinal seam of a film tube on a packaging machine is formed by using the filling tube as an internal forming means for engagement by the high pressure sealing foot or bar with the overlapped edges of the packaging film held therebetween. The novelty of the invention is provided

by applying a backup shoe on the opposite side of the filling tube from the sealing bar in order to counteract the sealing force against the front of the filling tube. Unlike the prior art arrangements of which we are aware, the backup shoe is mounted on the outside of the filling tube with the packaging film therebetween leaving the inside of the tube free and thus not restrictive of the passage of product into the package.

The actuator means for intermittently moving the sealing bar and backup shoe into pressing engagement against the film tube is preferably a single fluid cylinder carried by the mounting means for either the sealing bar or backup shoe and with the operating piston being connected to the mounting means for the other. Since the film is in close surrounding relationship with the filling tube around the full periphery thereof, the engagement of the film by the backup shoe on the outside does not collapse or wrinkle the package, nor does it have any other adverse effect on the packaging film. In fact, the backup shoe may have an inherent advantage of being used as a film holder against drawout during any settling or compressing operation that may be carried out below at the package being formed.

The mounting means for the sealing bar and backup shoe are preferably arms extending transverse to the tube mounted on pivot members extending parallel to the axis of the tube. Planes passing through each pivot member and extending contiguous with the respective area of engagement on the tube being formed are substantially parallel so that the bar and shoe while moving in an arc overall are moving directly in or radially at the point of contact.

The actuator cylinder is carried by the free end of one support arm and the operating piston is connected to the free end of the other arm. With this arrangement, it can be seen that forces counteract each other and the leverage afforded by the clamping relationship of the sealing bar and backup shoe across the filling tube may be used to its fullest extent to assure a high pressure, uniform seam along the film tube without fear of causing misalignment of the filling tube. A spring is provided to urge the clamping arms to an open spaced position from the filling tube and a suitable stop is provided to assure the desired spacing from the tube when in the open position. The spring when placed on the arm supporting the backup shoe causes gradual engagement of the opposite or sealing shoe by the force of the spring so that the edges of the film are firmly gripped just before sealing pressure is applied by engagement of the backup shoe.

Still other objects and advantages of the present invention will become readily apparent to those skilled in this art from the following detailed description, wherein we have shown and described only the preferred embodiment of the invention, simply by way of illustration of the best mode contemplated by us of carrying out our invention. As will be realized, the invention is capable of other and different embodiments, and its several details are capable of modification in various obvious respects, all without departing from the invention. Accordingly, the drawings and description are to be regarded as illustrative in nature, and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the preferred embodiment of the clamping action seamer constructed in ac-

cordance with the principals of the present invention; FIG. 2 is a cross-sectional view taken from above the seamer showing the sealing bar and backup shoe in the engaged position;

FIG. 3 is a cross-sectional view the same as FIG. 2 except with the clamp open and the sealing bar and backup shoe spaced from the tube; and

FIG. 4 is a side view of the seamer taken from the lefthand side of FIG. 1 showing the positioning of the pivots.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference now to FIG. 1 of the drawings, there is shown a tube seamer, generally designated by the reference numeral 10, utilizing the clamp action concept of the present invention. The tube seamer 10 is mounted for illustrative purposes in the environment of a form and fill packaging machine having a basic framework F, as shown in this figure. Attached to the framework is a conventional external former 11 over which a web of packaging film is drawn to form a packaging tube T. Extending down into the mouth of the former 11 is an internal forming means or tubular filling tube 12 coaxially aligned with the former 11 about which the tube T is wrapped or positioned. As is well known in the art, the forward lips 13, 14 of the former 11 lay the overlapped edges E₁, E₂ onto the face of the filling tube 12 for sealing, as shown, which face may be covered with a strip of Teflon to prevent sticking of the film during sealing.

The filling tube 12 depends downwardly into the packaging tube T without lateral support except at the top including a peripheral plate 15 connected by bolts 16 to frame portion F₁ of the framework of the machine. Thus, it will be realized that the filling tube 12, because of its substantial length down into the packaging tube T, is free to move in all lateral directions by inherent bending or flexing action. The tube is made of relatively thin stainless steel metal so that maximum or essentially full internal cross-sectional space is available for accommodating the product during each filling operation. In fact, the flexibility of the filling tube 12 is such that it may be shifted or flexed back and forth within the former 11 by manual pressure on the outside. This flexing or lateral floating action of the tube 12 is beneficial in that it allows the film freedom to shift slightly as may be required during the package forming operation. And, it is this flexing that is uniquely checked or accommodated by clamp action across said tube in accordance with the present invention when the longitudinal seam is formed. This is done by applying sealing pressure to the overlapped edges E₁, E₂, on one side and equal backup on the other side, as will now be explained.

Thus, with reference to FIGS. 2 and 3, in addition to FIG. 1, the improved seamer 10 has a sealing bar or shoe 20 extending along the longitudinal axis of the tubes 12. A heating element 21 is provided embedded therein for causing fusing of the overlapped edges E₁, E₂ together when said sealing bar 20 is brought into pressing engagement therewith, as shown in FIG. 2. As can be seen in this figure, the internal filling tube 12 acts as an internal, full circle form for the packaging tube T; i.e., it serves to support the inside of the film including the back of the overlapped edges E₁, E₂ during the sealing operation. Although the tube T has been

shown for convenience as substantially contiguous with the outer periphery of the filling tube 12, it should be understood that the tube 12 may serve only as a form for making of the seam at the overlapped edges and need not act as a complete forming mandrel since the external former 11 is capable of forming the tube without assistance from inside the tube. Thus, the tube could, if desired, be more loosely surrounding the forming means as long as the edges E_1 , E_2 are properly laid on the forward face or surface, as shown in FIG. 1.

On the opposite side of the filling tube 12, that is, at the rear (FIG. 2), and exactly diametrically opposed to the sealing bar 20 is a backup shoe 25 that, in accordance with the broad principles of the present invention, supplies an equal and opposite reaction force to the sealing pressure. As will be seen, the backup shoe 25 is on the outside of the packaging tube T and thus in no way limits the flow of product through the filling tube and into the package. When the sealing bar 20 and the backup shoe 25 are applied they both trap and press the packaging tube against the filling tube 12. In the case of the sealing bar 20, the high pressure required to form a high quality and uniform seal or seam is attained. Any necessary force may be selected since the force is automatically offset by the back-up shoe 25 (short of causing collapse of the tube 12). This means that there can be no misalignment of the filling tube 12 due to unequal sealing forces acting thereon.

Furthermore, since both the sealing bar 20 and the backup shoe 25 are gripping the tube T at the moment of pressing engagement, the tube T may be held by this means to prevent unwanted draw-out of the film, such as may occur during settling or compacting of the charge in the package being formed below. All that need be done in this regard is to provide for the longitudinal seaming operation to occur during the time that the compacting operation is being performed.

On the other hand, and equally advantageously, when the packaging film tube T is to be drawn out another package length by the transverse sealing jaws (not shown), the sealing bar 20 and the backup shoe 25 are moved away from their pressing engagement so as to allow the tube T to move unimpeded and with complete freedom. This reduces the frictional resistance of the polyethylene packaging film on the filling tube 12 and thus makes the package less susceptible to stretching the formation of deleterious wrinkles.

A support bracket 30 for the sealing bar 20 is mounted on a mounting arm 31, which arm extends transversely to the tubes T, 12. The supported end of the arm is carried by a U-shaped base 32. Spanning the open end of the U is a pivot pin assembly 33 carried by an elongated mounting sleeve 34 and extending parallel to the axis of the tubes T, 12. As illustrated in FIG. 1, the supporting sleeve 34 is mounted on frame member F_2 that is adjustable toward and away from the main framework F by suitable bolts 35 and slots 36 (see FIG. 2).

Similarly, the frame member F_2 as best shown in FIG. 4, supports a downwardly extending pivot pin 40 about which is rotatably positioned a movable sleeve 41 and which is held thereon by a nut and washer combination 42 at the bottom. Extending from the sleeve 41 is an L-shaped mounting arm 43 that carries a locking socket 44 receiving a pin 45 therein for mounting the backup shoe 25.

At the free end of the arm 43 is carried a fluid actuator cylinder 50. It is understood that the cylinder 50 has suitable connections for operating fluid, but which connections are not shown. It is also understood that the cylinder 50 may be either double acting or single acting with spring return, as desired. In any case, the operating piston carries an operating piston rod 51 which is in turn connected to a yoke 52 and connecting link 53 attached to the adjacent free end of the arm 31. A hand grip knob 54 may be provided on the end of the arm 31 to manually position the arms 31, 43 as desired. The sealing bar 20 and the backup shoe 25 thus act on opposite sides of the tube 12 and the seaming of the tube T is accomplished by a clamping action across the tube, which clamping action affords a mechanical advantage. That is, the bar 20 and shoe 25 are mounted at the approximate midpoint of the arms 31, 43 so that 2:1 mechanical leverage is provided along the length of the arms 31, 43. This allows the necessary high pressure to be attained by the single, relatively small fluid cylinder 50.

A suitably calibrated spring 60 is attached at a selected point along the length of the arm 43, preferably, adjacent the cylinder 50, to bias the arm 43 and the backup shoe 25 away from the engagement with the packaging tube T. The spring 60 so positioned attains approximately the same 2:1 mechanical advantage. A limit stop 62 (see FIGS. 1 and 4) is provided adjacent the free end of the arm 43 in order to limit the opening movement of the seamer 10. An adjustment slot mount 63 for the stop (FIG. 3), is provided to properly space the shoes 20, 25 when open.

The spring 60 performs an important function in the apparatus and method of the present invention by insuring that upon actuation of the cylinder 50 to close the clamp seamer 10, or in other words, to perform the sealing operation, the sealing bar 20 will be moved into nominal engagement with the overlapped edges E_1 , E_2 of the packaging film prior to engagement of the backup shoe 25 and thus prior to the application of full sealing pressure. This is so, as can be seen in FIG. 3, since as soon as the piston rod 50 begins to move the sealing bar 20 is moved toward the tube T by itself, the movement of the arm 43 being prevented by the spring 60. After the sealing bar 20 engages the film, the force of the bar 20 against the film is gradually increased by the amount represented by the strength of the spring 60 until finally the backup shoe 25 has reached engagement with the tube 12 and sealing pressure begins. Preferably, the force of the spring 60 is selected to be approximately twelve pounds (24 pounds with effective leverage) which allows the sealing bar 20 to be firmly seated or placed in gripping relationship of the packaging film before the sealing pressure is applied. This lessens any chance of slippage of the sealing jaw 20 on the overlapped edges E_1 , E_2 that would otherwise result from rapid and forceful engagement. This pressure of approximately 24 pounds is sufficient for initial seating of the sealing bar 20, but is insufficient to provide any misalignment to the filling tube 12; it being understood that the pressing engagement required for sealing is approximately five times this amount or approximately 120 pounds (including the force of the cylinder 50 and the 2:1 leverage afforded by the arm 43).

The seamer 10 moves to the open position during each cycle after the sealing operation to disengage the shoes 20, 25 from contact with the film T to allow the

draw-out of a new length. Upon opening of the clamp seamer 10, a blast of cooling air is or may be provided at the seal area E_1 , E_2 from a suitable nozzle N, as shown in FIG. 3. This assures that the seal is cooled and strengthened just before the film is subjected to the draw-out force in providing the next packaging length. By adjusting the stop 62, the sealing bar 20 and the backup shoe 25 are moved away from the tube T substantially the same distance, as shown in FIG. 3. The adjustment of the frame member F_2 along the slots 36, the adjustment of the supporting rod 45 in the socket 44 and the adjustment of the piston rod 51 with locking nut 51a may be used for other relative adjustments of the sealing bar 20 and the backup shoe 25 with respect to the filling tube.

An advantage of the seamer 10 with clamp action is that once engagement has been made by both shoes acting in opposite directions, the pressing force is substantially equal on both sides. The force is self-compensating to gain the equal force since the cylinder 50 is carried by one mounting arm 43 and has its piston rod connected to the other mounting arm 31 and has no other outside support or connection. Because the forces are substantially equal (except for force of spring 60 nominally urging the shoe 20 against the tube 12), there is no misalignment of the filling tube 12 as the necessary high sealing pressure is applied. The filling tube 12 remains in exact coaxial alignment with the external former 11 so that the film packaging tube T is not subject to drag between the juxtaposed surfaces of the parts and consequently the film remains free of wrinkles during drawing out of each package length.

To assure that the sealing bar 20 and the backup shoe 25 move substantially radially inward at the time of sealing engagement, the mounting axes of the pivot pins 33, 40 (see FIG. 4) are in separate planes, each plane of which is contiguous with or passes through the respective area of engagement of the shoes 20, 25. In other words, as viewed in FIG. 2, the pin 33 lies in the plane P_1 and the pin 40 lies in the plane P_2 , which planes are parallel to each other. The arms 31, 43 move in an arcuate path since they are pivoted; however, with the planes P_1 , P_2 as just described and with these planes being parallel to each other, the inward movement of the shoes 20, 25 during pressure engagement is diametrically opposite (see FIG. 2), i.e., the pressure is inward and radial at this point. This means that no misalignment of the tube is encountered in the direction spaced 90° from the points of engagement.

From the foregoing description and analysis of the advantages of the clamp action tube seamer 10 of the present invention, it is believed that the novel contributions to the art may be readily acknowledged by those skilled in this art. To specifically review, the sealing bar 20 is pressed into relatively high pressure sealing engagement with the overlapped edges E_1 , E_2 without causing misalignment of the coaxial relationship of the filling tube 12 with the external former 11. This means that the tube is formed in the proper manner for uniform sizing and a high quality seal at the seam. The clamp action of the sealing bar 20 and the backup shoe 25 provides leverage necessary to impart the high pressure sealing engagement required by the particular packaging film being worked on. Because of the biasing spring 60, the sealing bar 20 comes into nominal engagement with the overlapped edges E_1 , E_2 just before the backup shoe 25 engages so as to insure a steady and

firm grip before the sealing pressure is applied. Misalignment of the filling tube 12 in the direction spaced 90° from the sealing bar 20 and the backup shoe 25 is advantageously avoided by positioning the pivot pins 33, 40 in separate parallel planes extending through or contiguous with the areas of engagement of the respective shoe.

In this disclosure, there is shown and described only the preferred embodiment of the invention, but, as aforementioned, it is to be understood that the invention is capable of use in various other combinations and environment and is capable of changes or modifications within the scope of the inventive concept as expressed herein.

We claim:

1. An apparatus for forming the longitudinal seam of a tube of packaging film comprising an elongated internal form means extending into said tube of packaging film and coaxial therewith, said form means being transversely flexible as a whole upon application of a substantial outside force on one side, a sealing shoe mounted on one side of said form means for pressure sealing the overlapped edges of said tube together to form a seam, a backup shoe on the opposite side of said form means to provide a substantially equal counteracting force opposing the pressing force of said sealing shoe, and actuator means for moving said shoes into and out of pressing engagement with said film against said form means, said actuator means causing sufficient pressing force of said sealing shoe for sealing and causing counteracting force of said backup shoe to be applied substantially simultaneously, whereby the seam is formed by pressing engagement of said sealing shoe with said form means while said backup shoe maintains said form means substantially free of forces tending to misalign the same, first and second movable mounting means for said sealing and backup shoes, respectively, said actuator means comprising a moving means mounted on one of said mounting means, an operating member being provided on said moving means and being connected to the other of said mounting means, whereby upon actuation of the moving means both said mounting means move to provide engagement of said shoes with said form means with substantially equal and opposite forces being assured.

2. The seamer of claim 1 wherein said first and second mounting means for said shoes are carried by pivot means extending parallel to said form means, said pivot means being positioned so as to be spaced from said moving means whereby clamp action is utilized for pressing the film against said form means.

3. The seamer of claim 2 wherein said first and second mounting means further comprises first and second arms extending from said pivot means and transversely with respect to said tube, said moving means being carried by the free end of one of said arms on the side of said tube opposite said pivot means and the operating member being connected to the adjacent free end of the other of said arms, whereby operating leverage is obtained for pressing said shoes against the film.

4. The seamer of claim 2 wherein said pivot means comprises first and second pivots spaced from each other, said pivots being positioned so that planes passing through each pivot and contiguous with the film in the area of engagement with the respective shoes are parallel, whereby the movement of said shoes at the

5. The seamer of claim 1 wherein biasing means is provided on said second mounting means to positively urge the attached backup shoe away from said tube, whereby to assure gradual engagement and a firm seat of said sealing shoe by the spring force prior to pressing engagement by said shoes, the spring force of said biasing means in the extended position being insufficient to

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6. The seamer of claim 5 wherein is further provided an adjustable stop to limit the opening movement of said second mounting means whereby the shoes may be positioned at substantially equal distance from said tubes to assure unimpeded drawing-out movement of said film.

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