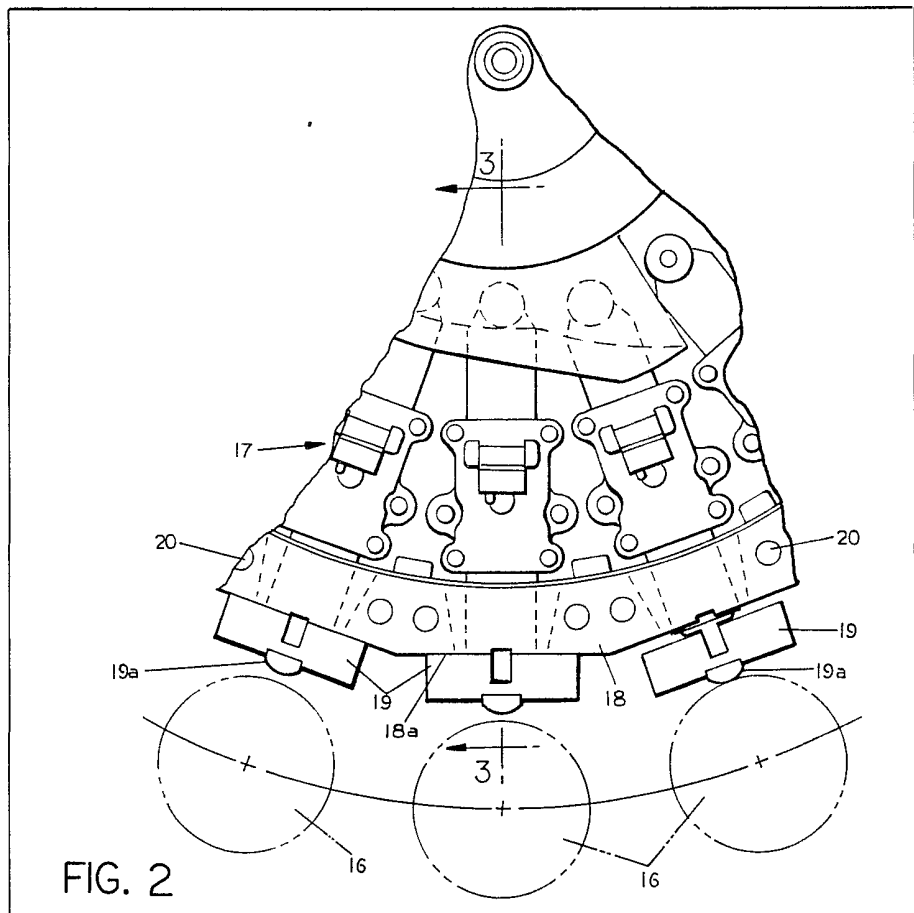


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(54) **Apparatus for forming tubular plastics sleeves for application to containers**

(57) Apparatus is for forming tubular sleeves of heat-shrinkable cellular polymeric material from a predecorated web or roll. Predecorated body labels having precisely pre-sized dimensions are formed from a web or roll on a turret type machine by serially winding rectangular thin sheet blanks of such material on cylindrical mandrels and overlapping the ends of each blank prior to seaming the same to make a pre-sized tubular sleeve. The sleeve seam is formed by thermal fusion using a heated sealing bar which is heated during its retraction into contact with an annular metallic support ring having a series of internal cartridge type heaters therein. The ring is adapted to ra-

pidly heat up and accurately control the heating of the sealing bars to a precise uniform temperature. The sleeves can then be transferred axially onto the containers for subsequent thermocontractive heat-shrinking into final disposition on the container body portion.



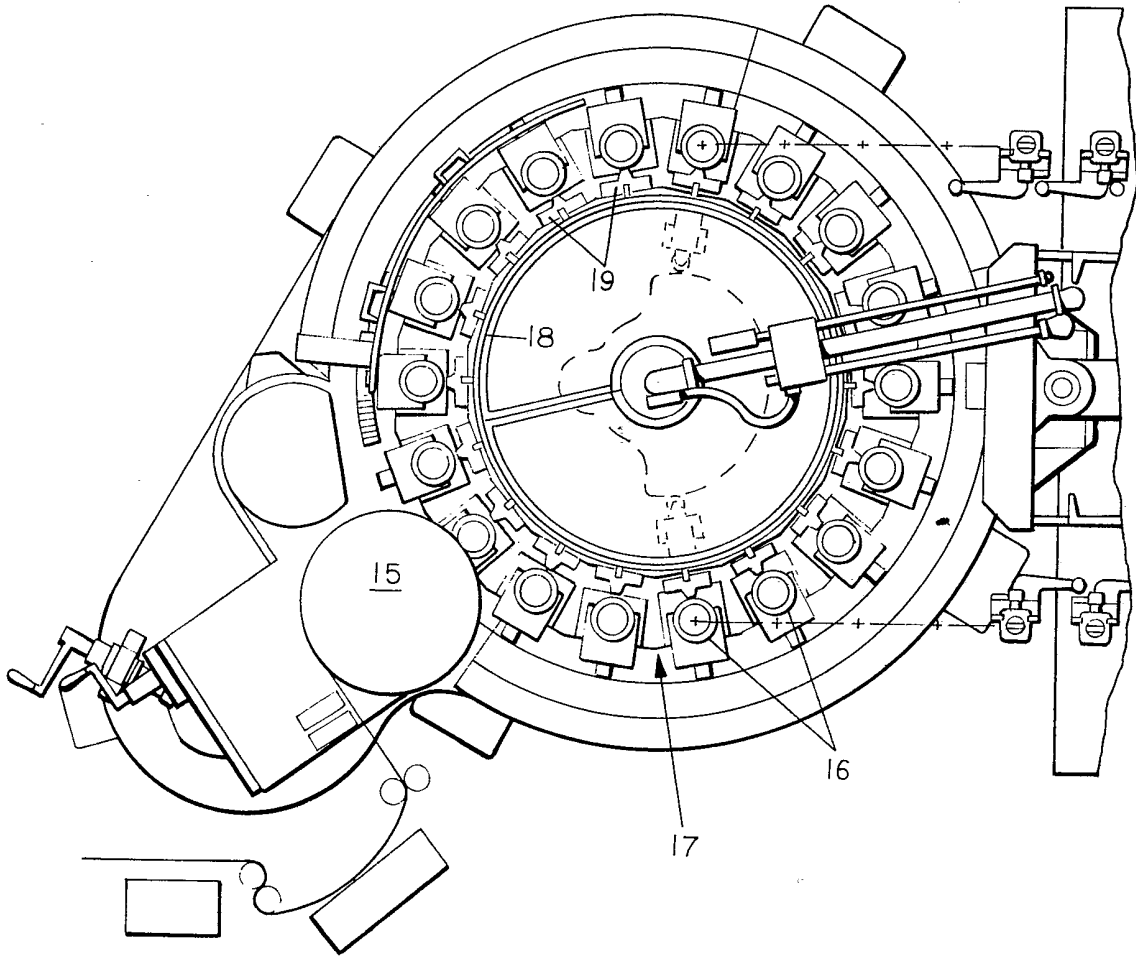


FIG. 1

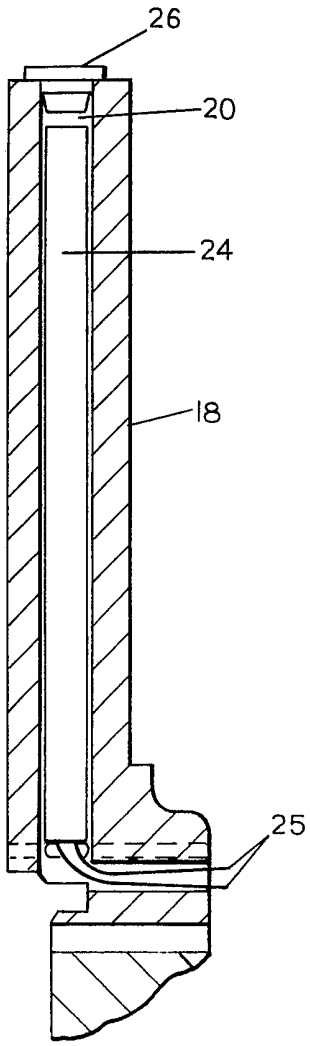


FIG. 6

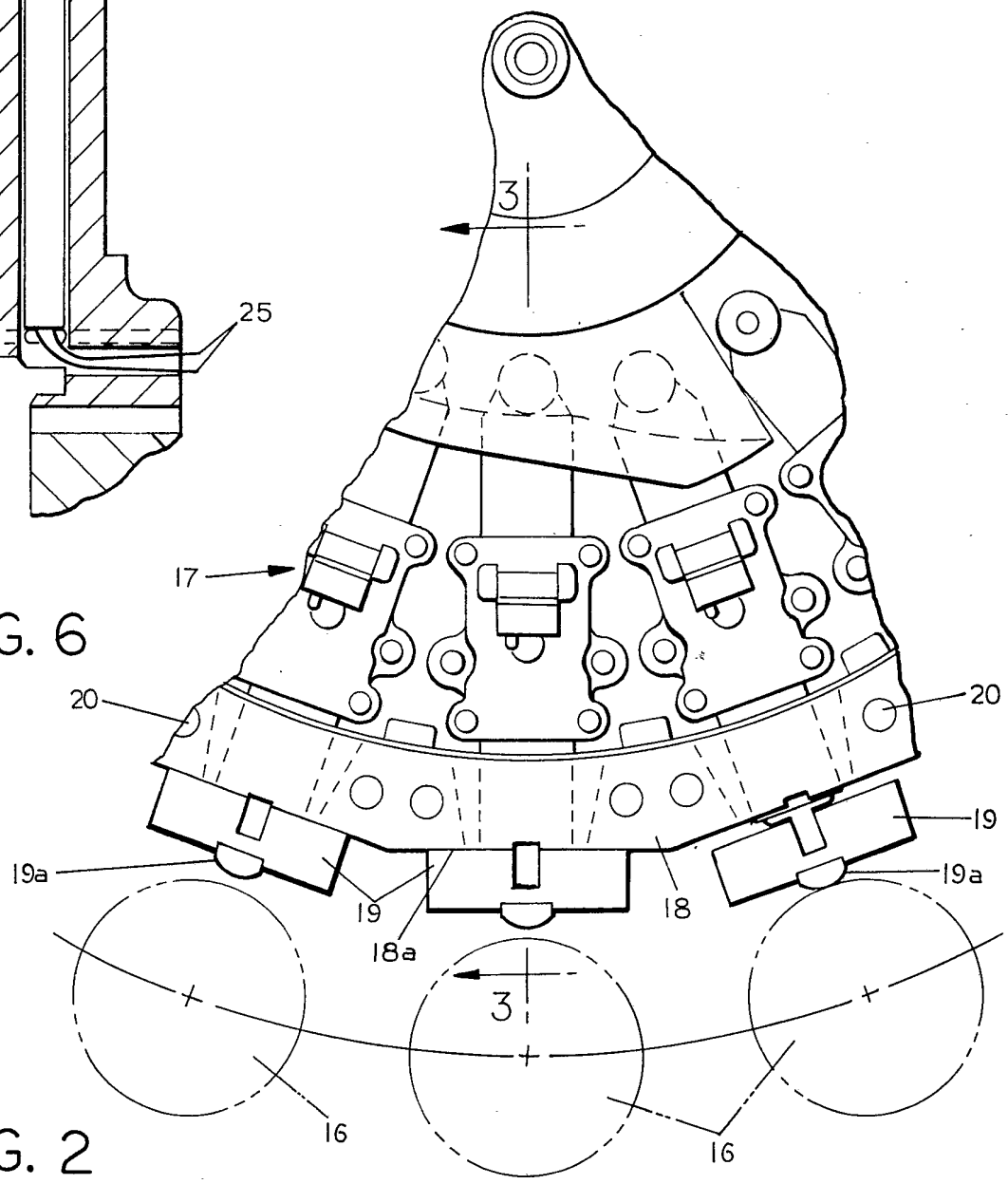


FIG. 2

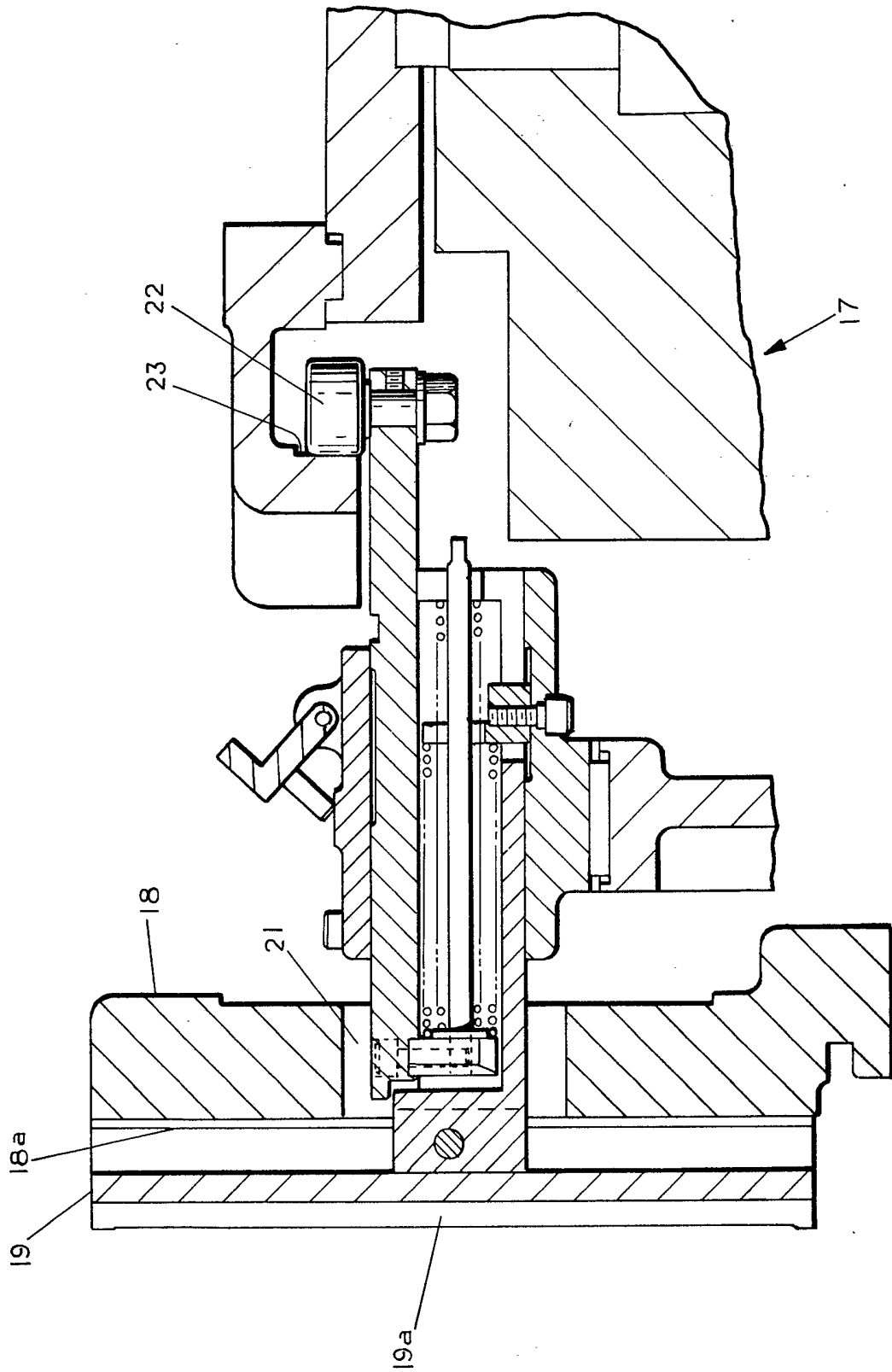


FIG. 3

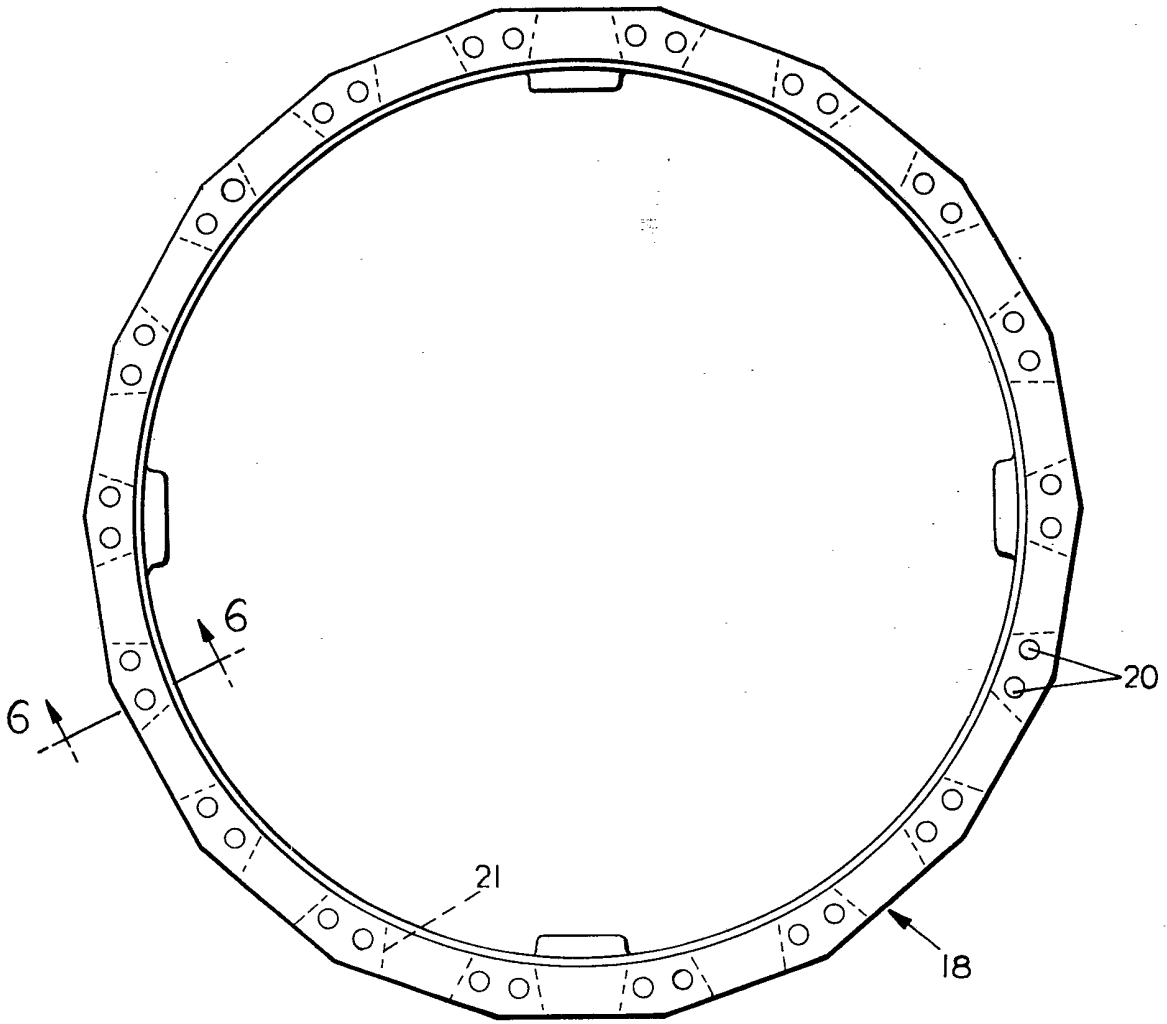


FIG. 4

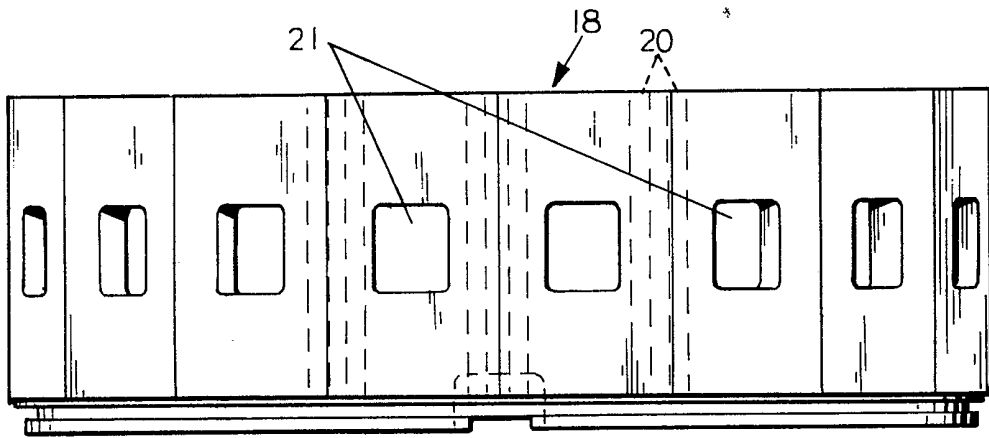


FIG. 5

## SPECIFICATION

**Improvements in or relating to apparatus for forming tubular plastics sleeves for application to containers**

The present invention relates to apparatus for forming tubular plastics sleeves for application to containers. A hollow tubular plastics sleeve or label can be subsequently heat-shrunk onto the body portion of a hollow glass or plastics container. The sleeve is preferably formed from a continuous web or roll of heat-shrinkable oriented thermoplastic plastics material immediately prior to its application to the container. Alternately, the sleeve may be pre-formed, flattened and stored, and later taken to a position adjacent the container where it is opened and moved into telescopic alignment with the container retained in upright relation. The final shrinking of the sleeve into tightly engaging condition around the container body is normally performed by subjecting the sleeve to controlled hot air or infrared radiation heating during passage of the aligned surrounding sleeve and container through a tunnel oven.

In the methods and apparatus disclosed in United States Patent Specifications Nos. 3,767,496, 3,802,942, and 3,959,065 a tubular sleeve is formed which is telecopically assembled onto the article from below by a push-up mechanism. None of these disclosures pertain to the thermal constriction of a thin tubular sleeve of thermoplastic material which is telescoped upwardly over the upright container during their coincidental alignment and retention of the sleeve in place for selective and controlled heating using infrared radiation for the thermoconstrictive process. United States Patent Specification No. 4,246,059 discloses a method and apparatus for forming a tubular sleeve of shrinkable polymer material from a predecorated web for making tubular neck labels. The tubular sleeves are formed on apparatus which constituted an earlier form of sleeve making equipment. Hitherto the prior art required making the labels for containers from preprinted or predecorated rolls of prepared material which were cut to length into individual blanks for forming the presized sleeves. The cut blanks were precisely placed on a cylindrical forming mandrel and heat sealed into tubular form on the mandrel, using individual heated sealing bars which varied in temperature and sealing capability. The sleeves were then applied directly to the containers or flat folded into stored condition in a multipack for subsequent application to the containers. However, their fusion seams varied in strength and uniformly throughout their length due to sealing bar variations.

According to one feature of the present invention there is provided combined apparatus of the rotary turret type for serially form-

ing presized tubular sleeves from thin sheet blanks of heat-shrinkable thermoplastic plastics material, said apparatus comprising a rotary turret, a series of equi-spaced rotary cylindrical mandrels mounted in radial arrangement on said turret, means for rotating said mandrels, each said mandrel being adapted to wrap a said sheet blank thereon in partially overlapped relation when rotated, an annular metal ring mounted on said turret interiorly adjacent and facing each of said cylindrical mandrels, a series a spaced-apart reciprocable sealing bars mounted in radial arrangement on said annular metal ring with each said bar adapted to engage an overlapped portion of the sheet blank wrapped on one of said mandrels, said annular metal ring having a height greater than the length of said cylindrical mandrels, said annular metal ring having a series of apertures therein extending substantially throughout its height substantially parallel to said sealing bars, an electrical cartridge heater mounted within each said aperture in said annular metal ring, and means for connecting each said cartridge heater to an electrical power source, each said cartridge heater being adapted to internally heat the said annular metal ring, said reciprocable sealing bars being heated by surface-to-surface thermal contact with said annular ring in their retracted non-sealing position.

According to another feature of the present invention, there is provided combined apparatus for forming presized tubular sleeves from thin rectangular sheet blanks of heat-shrinkable thermoplastic plastics material immediately prior to their serial application to cylindrical containers, said apparatus comprising a rotary turret, a series of similar rotary cylindrical mandrels mounted in equi-spaced vertical relation on said rotary turret in radial arrangement, each mandrel being adapted to wrap an individual sheet blank thereon in partially overlapped relation, means for rotating each said mandrel during its travel around the sleeve-forming portion of the circular path of turret travel, an annular metal ring mounted on said turret in horizontal relation interiorly adjacent the said series of cylindrical mandrels, said annular metal ring having a height greater than the length of said cylindrical mandrels, a series of reciprocable sealing bars mounted on equi-spaced radial relation on said annular metal ring with each sealing bar facing an individual cylindrical mandrel adapted to engage an overlapped portion of said sheet blank on said mandrel when in stationary relation, said annular metal ring having a series of transverse apertures therein extending substantially throughout its height adjacent its peripheral surface substantially parallel to said sealing bars, an electrical cartridge heater mounted within each said transverse aperture, and an electrical power source connected to each said cartridge heater

adapted to internally heat the said annular metal ring, said reciprocable sealing bars being heated by surface-to-surface thermal contact with the exterior peripheral surface of said annular metal ring when in their retracted position.

Apparatus embodying the present invention is suitable for forming heat-shrinkable tubular sleeves of thin thermoplastic material which are applicable to mounting on either glass or plastics bottles, the sleeves normally being placed on such containers while both are conveyed in coaxial vertical alignment. The sleeves are preferably comprised of thin film or foam oriented thermoplastic material adapted to shrink primarily in a circumferential direction and to a lesser degree in a vertical direction. The containers preferably have right cylindrical body portions for mounting the sleeves thereon.

A preferred embodiment of the present invention, as disclosed hereinafter, provides apparatus for forming uniform preformed thin tubular bands or sleeves having an axial fusion weld which is formed by overlapping a portion of a rectangular blank on a cylindrical mandrel. A series of reciprocable heated sealing bars is employed to form the axial seam by compressive force applied to the material backed by the mandrel to form a durable strong seam. The sealing bars can be rapidly heated up to a uniform operating temperature by an annular metal ring which comprises a heat-sink against which the sealing bars are heated in their retracted non-sealing position. The annular ring contains a symmetrical series of apertures in its sidewalls in which are mounted a series of cartridge heaters connected in parallel to permit uniform heating of the sealing bars by an electrical energy source.

The apparatus employs a rotary turret mechanism having a series of similar equispaced cylindrical mandrels mounted thereon, the mandrels being rotated to wrap the individual sleeve blanks thereon in overlapped relation.

The invention will be further described by way of example with reference to the accompanying drawings in which,

*Figure 1* is a top plan view of a machine for forming tubular sleeves in accordance with the present invention,

*Figure 2* is a fragmentary top plan view to a larger scale of one portion of the machine shown in Fig. 1,

*Figure 3* is a partial vertical sectional view of one portion of the machine taken along line 3-3 of Fig. 2,

*Figure 4* is a reduced top plan view of an entire heat-sinking ring member of the machine shown in Figs. 2 and 3,

*Figure 5* is a side elevational view of the ring member shown in Fig. 4, and

*Figure 6* is vertical sectional view to a larger

scale of one portion of the ring member taken along the line 6-6 of Fig. 4.

The apparatus for producing containers with plastics sleeves thereon, frequently consists of a rotary turret machine which is adapted to fabricating the tubular plastics sleeves immediately prior to their mounting on the containers. The predecorated heat-shrinkable plastics material preferably consists of a web or roll of oriented sheet film or oriented foamed sheet having a thickness ranging from about 2 to 20 mils (0.05 to 0.51 mm) such as foamed oriented polystyrene plastics, for example, having a thickness ranging from about 5 to 20 mils (0.13 to 0.51 mm). The material may also consist of thin film polyvinyl chloride having a thickness ranging from 2 to 6 mils (0.05 to 0.15 mm). The plastics web is delivered to the forming apparatus preferably in a roll mounted on a conventional supply reel. A multicolor printed pattern or decoration is commonly preprinted repeatedly over one surface of the supply web for providing predecorated labels. The printed pattern or decoration for a given label has a longitudinal pattern on the web which is less than the length dimension of the blank to be severed from the web. Frequently, spaced indicia are printed along the lengthwise dimension of the web to mark the blank cutting area. Each pattern or decorative copy is placed on the web between these indicia leaving blank end portions undecorated. The width of the web or blank is substantially equal to the height dimension of the label after it is shrunken on the container. The plastics material of the supply web is appreciably oriented or stretched in a longitudinal or machine dimension of the web. Only minimal or slight orientation exists in the cross or width dimension of the web which then constitutes the vertical dimension of the tubular sleeve.

The web or roll of thermoplastic plastics material extends from a slitting device over a pull roller which is driven, pulling the web through the slitting knife and roller. The pull roller is fastened on a vertical shaft mounted in suitable bearings located on opposite ends of the pull roller. The top is retained in a seat aperture in the top plate of the roller assembly. The top plate is spaced from the bottom plate by a series of hollow tube supports and bolts which extend through each of the supports to fasten the two plates together. The drive shaft of the pull roller is connected to a drive train element such as disclosed in United States Patent Specification No. 4,013,496. Also additional elements of the web roll pull roller are shown in United States Patent Specification No. 4,013,496.

The mandrels are mounted in series in equispaced vertical alignment in a radial pattern on a rotary turret which is continuously rotated in a given direction. The sleeves are severed into individual rectangular blanks and

each is tightly wrapped on an individual mandrel where their overlapped ends are joined by a fusion type axial seal. The forming of the blanks into resized sleeves on the rotating mandrels during the winding and sealing cycles is disclosed in various embodiments in the aforementioned United States Patent Specification. The mechanism for rotating the mandrels during blank winding are disclosed in Fig. 15 of United States Patent Specification Nos. 3,883,388 and 3,914,152.

After the tubular sleeves are fully formed having a diameter slightly greater than the container body portion and an axial length comparable to the container body height to be surrounded, they are ready to be mounted on the container bodies whether the containers be either plastics or glass bottle or jars. The sleeves are preferably formed from predecorated blanks immediately prior to their application to the individual containers. The feed drum for the web material is positively rotated in a position tangential to the machine turret. A cutter roll is also mounted in tangential relation to the feed drum to permit severance of the blanks from the roll stock. The stock is held in the feed drum by vacuum so that the blanks may be severed by a cutter element contacting and being forced through the sheet at equi-spaced intervals. The feed drum is preferably hard-surfaced and the cutter element is brought into close proximity therewith during the cutting operation. The cutter roll has one or more cutter elements thereon to sever the desired uniform length blanks of thermoplastic plastics material, the feed roll controls the rate of delivery of the web stock to the feed drum on which the uniform blanks are severed.

As shown in Fig. 1 the blanks are fed off the feed drum 15 onto individual cylindrical mandrels 16 mounted in series on the rotary turret 17 of the machine. The mandrels are right-cylindrical in shape having a length slightly greater than the blanks width. The mandrels are mounted in vertical equi-spaced radial relation around the periphery of the machine turret. Each mandrel is rotated during its interval of wrapping the blank thereon upon its delivery from the feed drum. Each mandrel has an axially extending series of apertures (not shown) which are connected to a vacuum line to retain the leading edge of the blank thereon during wrapping. The mandrels each have precisely-similar diameters and axial dimensions so that when the blanks are individually wrapped therearound, the ends of the blank are overlapped to a slight extent to permit their being sealed at undecorated areas to form a sleeve having tubular form.

As the leading edge of the blank is fed to an individual mandrel, it is forcibly engaged by the lineal series of vacuum apertures and the blank is tightly wrapped around the

smooth cylindrical surfaces of the mandrel. Apparatus for wrapping the blank on the mandrel as aforesaid is known in the art and does not constitute a major part of this invention. Several arcuately-shaped spaced-apart horizontal guide rails arranged in stacked relation with respect to the mandrels are located around one portion of the turret to assist the blank into firm contact with an individual mandrel. The blanks once wrapped on the mandrels are then ready to be axially seamed by the subject apparatus.

The rotary turret of the machine has an annular ring 18 mounted interiorly of the mandrels which bear a spaced-apart radial series of heat-sealing bars 19. The annular ring 18 comprises a modified heat sink comprised of an aluminium ring with a series of equal dimensioned flattened surfaces facing exteriorly. As shown in Fig. 2 each of the sealing bars 19 faces an individual mandrel 16 on which the sheet blank is wrapped. The annular ring 18 has a series of transversely extending apertures 20 therein arranged in symmetrical relation around its entire periphery, the apertures extending essentially throughout the vertical height of the ring. The ring is shown in its entirety in Fig. 4 with a pair of transverse apertures 20 disposed adjacent a heat-sealing bar 19 which extends through an aperture in its sidewall.

The sealing bar 19 as shown in Fig. 3 extends through the aperture 21 in the annular ring and is reciprocable horizontally by a cam 22 which follows an interior cam track 23. Each sealing bar 19 has an curvilinear operating face in the form of a cylindrical segment 19a which is adapted to forcefully contact the overlap portion of the blank for sealing the same by fusion heating. The exterior surface of annular ring 18 has a coating 18a of electroless nickel thereover to facilitate surface to surface thermal contact between the ring and sealing bar 19.

Each aperture 20 has a cartridge-type heating element mounted therein, as shown in Fig. 6 which serves to heat ring 18 to a uniform operating temperature. Electrical leads 25 extend to each of the cartridge heaters for providing electrical power to the cartridge heater for its operation. A plug 26 is employed to close the upper end of each aperture 20 as also shown in Fig. 6. Fig. 2 shows, on the left hand side, sealing bar 19 in thermal contact with a flattened surface of annular ring 18 and, on the right hand side, the sealing bar is extended heat sealing position with its cylindrical sealing surface 19a contacting the overlapped blank.

The heat-sink ring is used to provide heat for the sealing bars of the sleeve labeling machine by improved thermal conduction. The ring provides increased heat-sink temperature capabilities and stability for the sleeve sealing operation.



A thermocouple is mounted on an arm which rides on the inside surface of the ring to detect the ring temperature. The thermocouple is the sweep contact type with direct  
 5 feed back control. The ring is maintained within a temperature range of from 350° to 550°F depending upon the sleeve material and thickness being employed. The heated ring permits lower heat loss and shorter  
 10 warm-up time for the machine and also less machine down-time is required to maintain and replace defective heating elements. By improving the heating of the sealing bars closely associated mechanical parts are main-  
 15 tained at lower operating temperatures thus preserving lubrication of moving parts. In a typical operation the sealing bars are maintained at a temperature of about 400°F. to obtain improved sealing of the sleeves. A nine  
 20 inch cartridge heater, Watlow Model No. L8NX30A or a thirteen-inch cartridge heater Watlow Model No. L12AX3933 can be used depending upon ring height and sealing bar length. Both heaters are made and sold by  
 25 Watlow Company, St. Louis, Missouri, United States of America.

Thus, it has been found that start-up time of the machine has been reduced by as much as 60 to 70% lending to significantly in-  
 30 creased production. The cartridge heating elements may be replaced readily by working on the turret from exposed surfaces. The cartridge type heaters may be connected in a variety of circuitry modes either in a parallel  
 35 arrangement or with certain segments of the ring periphery connected to a single circuit

Various modifications can be resorted to within the scope of the appended claims.

#### 40 CLAIMS

1. Combined apparatus of the rotary turret type for serially forming presized tubular sleeves from thin sheet blanks of heat-shrinkable thermoplastic plastics material, said apparatus comprising a rotary turret, a series of  
 45 equi-spaced rotary cylindrical mandrels mounted in radial arrangement on said turret, means for rotating said mandrels, each said mandrel being adapted to wrap a said sheet blank thereon in partially overlapped relation  
 50 when rotated, an annular metal ring mounted on said turret interiorly adjacent and facing each of said cylindrical mandrels, a series of spaced apart reciprocable sealing bars mounted in radial arrangement on said annular  
 55 metal ring with each said bar adapted to engage an overlapped portion of the sheet blank wrapped on one of said mandrels, said annular metal ring having a height greater than the length of said cylindrical mandrels,  
 60 said annular metal ring having a series of apertures therein extending substantially throughout its height substantially parallel to said sealing bars, an electrical cartridge heater  
 65 mounted within each said aperture in said

annular metal ring, and means for connecting each said cartridge heater to an electrical power source, each said cartridge heater being adapted to internally heat the said annular  
 70 metal ring, said reciprocable sealing bars being heated by surface-to-surface thermal contact with said annular ring in their retracted non-sealing position.

2. Combined apparatus for forming pre-sized tubular sleeves from thin rectangular sheet blanks of heat-shrinkable thermoplastic plastics material immediately prior to their  
 75 serial application to cylindrical containers, said apparatus comprising a rotary turret, a series of similar rotary cylindrical mandrels mounted in equi-spaced vertical relation on said rotary turret in radial arrangement, each mandrel  
 80 being adapted to wrap an individual sheet blank thereon in partially overlapped relation, means for rotating each said mandrel during its travel around the sleeve-forming portion of the circular path of turret travel, an annular  
 85 metal ring mounted on said turret in horizontal relation interiorly adjacent the said series of cylindrical mandrels, said annular metal ring having a height greater than the length of said cylindrical mandrels, a series of reciproca-  
 90 table sealing bars mounted in equi-spaced radial relation on said annular metal ring with each sealing bar facing an individual cylindrical mandrel adapted to engage an overlapped portion of said sheet blank on said mandrel  
 95 when in stationary relation, said annular metal ring having a series of transverse apertures therein extending substantially throughout its height adjacent its peripheral surface substan-  
 100 tially parallel to said sealing bars, an electrical cartridge heater mounted within each said transverse aperture, and an electrical power source connected to each said cartridge heater  
 105 adapted to internally heat the said annular metal ring, said reciprocable sealing bars being heated by surface-to-surface thermal contact with the exterior peripheral surface of said annular metal ring when in their retracted  
 110 position.

3. Combined apparatus for forming pre-sized tubular sleeves as claimed in claim 1, wherein the said series of equi-spaced rotary  
 115 cylindrical mandrels is mounted in vertical relation on the said rotary turret surrounding said annular metal ring, said annular metal ring being disposed in horizontal relation and having said series of equi-spaced rigid metallic  
 120 sealing bars mounted thereon in outwardly-facing vertical relation with each bar facing one juxtaposed cylindrical mandrel for seaming a cylindrical sleeve thereon by thermal fusion and compressive force.

4. Combined apparatus for forming pre-sized tubular sleeves as claimed in claims 1, 2  
 125 or 3, including a pair of cylindrical cartridge heaters mounted in complementary apertures within said annular metal ring parallel and  
 130 adjacent to each said reciprocable sealing

bar for maintaining the same at an elevated uniform operating temperature when in operation.

5 5. Combined apparatus for forming pre-sized tubular sleeves as claimed in claim 4, wherein, when in operation, the said series of reciprocable sealing bars is maintained at a uniform elevated temperature by a temperature-sensing device controlling the said electrical power source connected to each cartridge heater.

10 6. Combined apparatus for forming pre-sized tubular sleeves as claimed in any of claims 1 to 5, wherein said thin sheet blanks of heat-shrinkable thermoplastic plastics material comprise either oriented sheet film or oriented foamed sheet having a thickness ranging from about 2 to 20 mils (0.05 to 0.51mm).

20 7. Combined apparatus for forming pre-sized tubular sleeves as claimed in any preceding claim, wherein said annular metal ring comprises an aluminium alloy having a coating of electroless nickel over at least its exteriorly-faced surfaces to form a heat sink for surface-to-surface conductive heating of said sealing bars.

25 8. Combined apparatus for forming pre-sized tubular sleeve as claimed in any preceding claim, wherein each of said sealing bars is mounted on said annular metal ring to be operated reciprocably therefrom to engage a sleeve blank of thermoplastic plastics material on said mandrel to effect an overlapped fusion seal thereof in its extended position and to thermally contact the heated annular metal ring in its retracted position to maintain the said sealing bars in heated uniform operating condition.

40 9. Combined apparatus for forming pre-sized tubular sleeves as claimed in any preceding claim, wherein each of said reciprocable sealing bars has an operating surface in the form of a cylindrical segment adapted to contact and form a thermal fusion joint at the overlapped portion of the individual sheet blank.

45 10. Combined apparatus for forming pre-sized tubular sleeves as claimed in any preceding claim, wherein said annular metal ring has a series of flattened surfaces around its periphery against which said series of sealing bars are heated in their retracted position.

50 11. Combined apparatus for forming pre-sized tubular sleeves as claimed in any preceding claim, wherein said annular metal ring has a series of vertically drilled apertures distributed symmetrically about the sidewalls of the ring.

60 12. Combined apparatus for forming pre-sized tubular sleeves as claimed in any preceding claim, wherein the said series of electrical cartridge heaters mounted within each of said transverse apertures are connected in a suitable electrical mode to a set of terminal

blocks and to said electrical power source.

70 13. Combined apparatus for forming pre-sized tubular sleeves, constructed and arranged and adapted to operate substantially as hereinbefore particularly described with reference to and as illustrated in the accompanying drawings.

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