

June 4, 1957

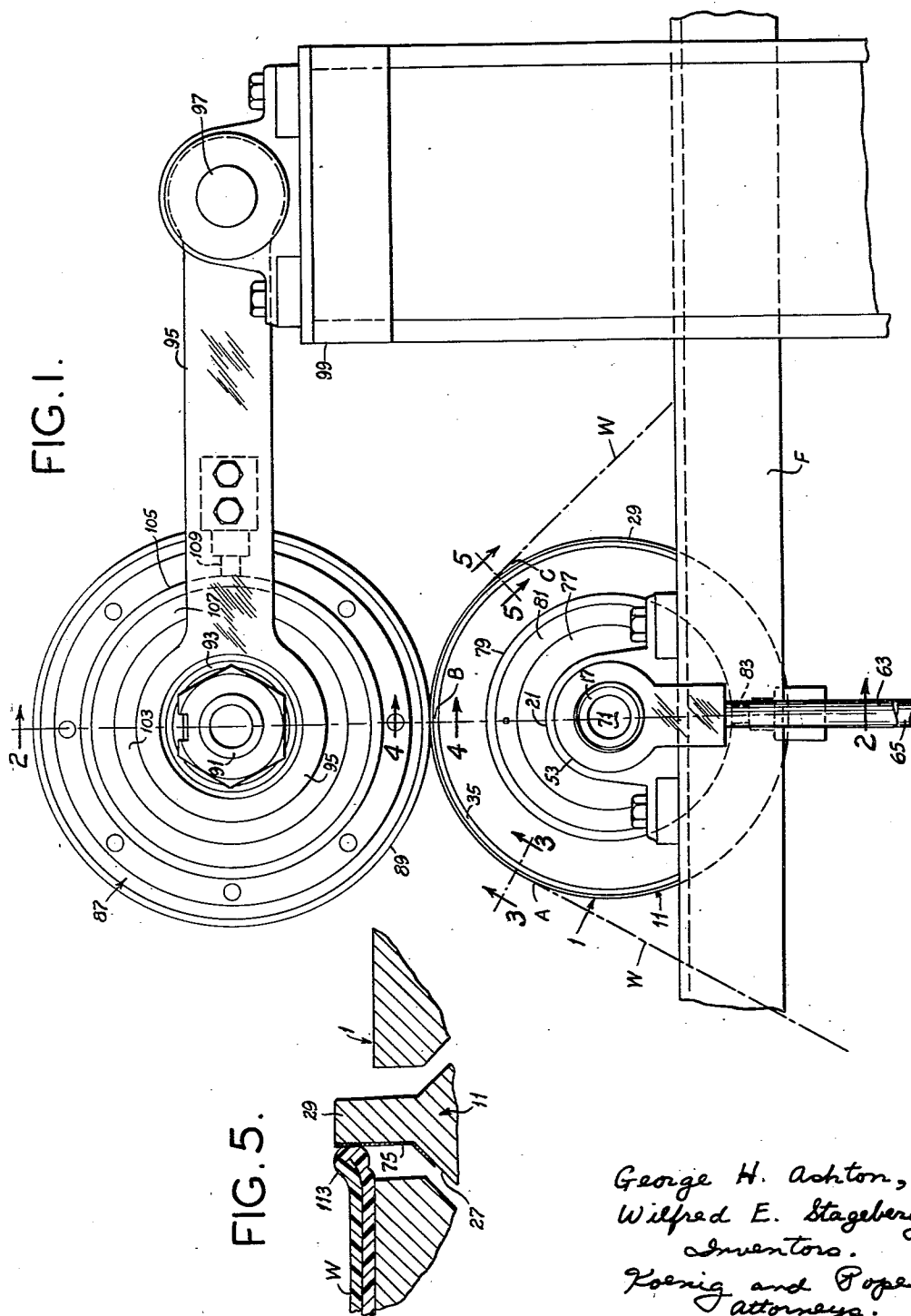
G. H. ASHTON ET AL

2,794,485

SEAMING APPARATUS

Filed Dec. 24, 1954

2 Sheets-Sheet 1



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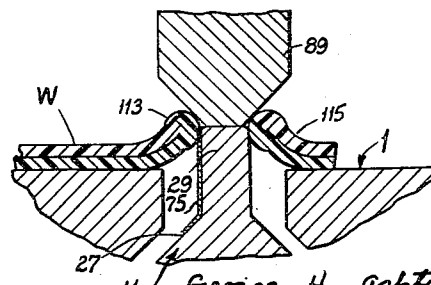
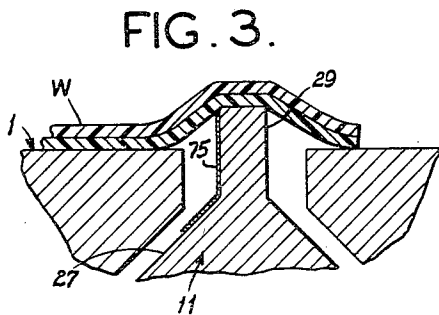
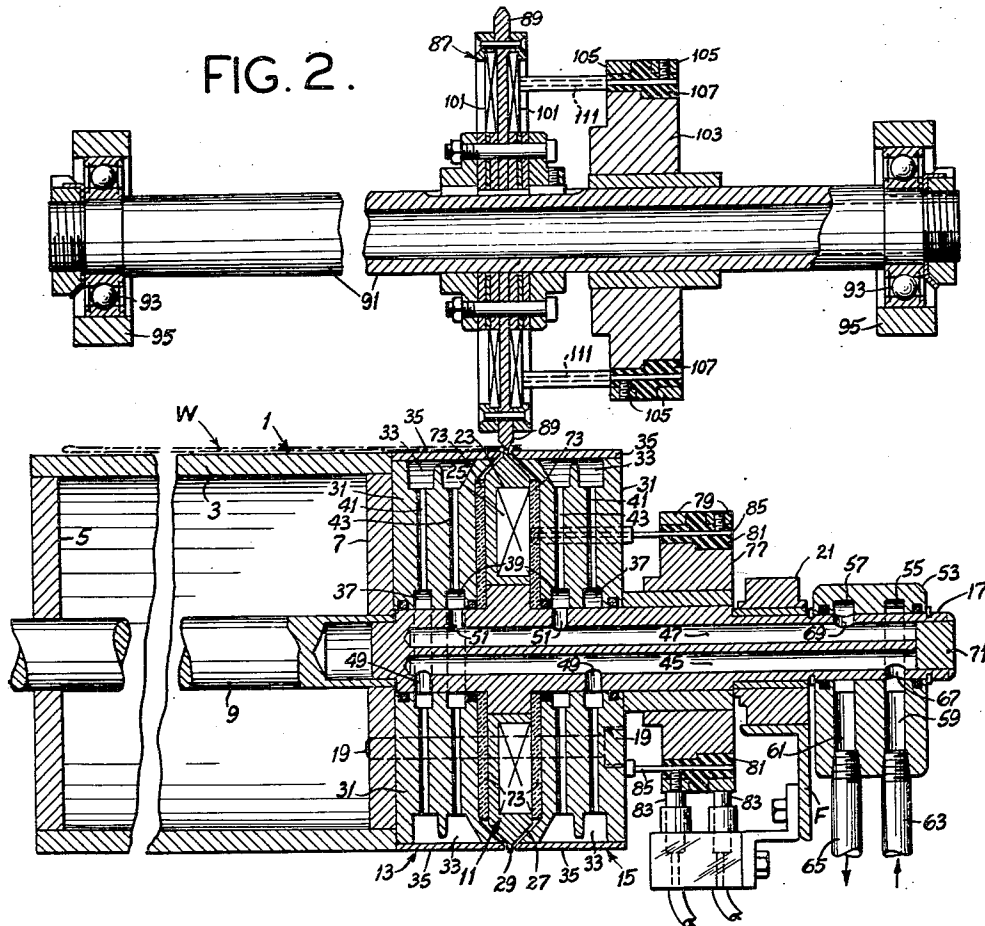
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2 Sheets-Sheet 2



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2,794,485

SEAMING APPARATUS

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8 Claims. (Cl. 154—42)

This invention relates to apparatus for seaming heat-sealable sheet material, such as polyethylene, such apparatus being useful, for example, to form a web of the material into bag tubing adapted to be segmented into individual bags.

Among the several objects of the invention may be noted the provision of apparatus of the class described which is capable of forming a tough, flexible, inconspicuous heat-sealed seam; the provision of apparatus of this class which is adapted to form a smooth edge seam; the provision of apparatus of this class which is so constructed as to avoid detrimental effects of thermal expansion of the heat-sealable sheet material; and the provision of apparatus of this class which is economical to construct and operate and which is reliable in operation. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the constructions hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated,

Fig. 1 is a side elevation of an apparatus of this invention;

Fig. 2 is a vertical section taken on line 2—2 of Fig. 1;

Fig. 3 is an enlarged fragmentary section taken on line 3—3 of Fig. 1;

Fig. 4 is an enlarged fragment of Fig. 2 showing the formation of a seam, being taken on line 4—4 of Fig. 1; and,

Fig. 5 is an enlarged fragmentary section taken on line 5—5 of Fig. 1.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Referring to the drawings, an apparatus of this invention is shown to include a roll 1 over which heat-sealable sheet material, such as polyethylene, may be fed. The material as herein illustrated consists of a continuous polyethylene web W which is doubled upon itself to bring its side edges together. The doubled web is to be longitudinally seamed adjacent the side edges to form it into tubing which may be ultimately segmented into bag lengths.

The roll 1 is shown as comprising a hollow cylinder 3, which may be a steel cylinder, for example, having end plates 5 and 7 mounted on a shaft 9. Incorporated in the roll 1 is a sealing wheel 11 positioned between two water-cooled heat-exchange roll sections 13 and 15. The wheel 11 and sections 13 and 15 are mounted on a shaft 17 and secured to one end of the cylinder 3. As shown, this securement is made to end plate 7 by means of screws 19. Shaft 17 is aligned with and constitutes an extension from one end of shaft 9, being journaled in a bearing 21 mounted on a frame F. The bearing for the other end of shaft 9 is not shown.

The sealing wheel 11, which may be made of hard

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steel, for example, has an annular groove 23 in the side thereof toward the outer end of the shaft 17. Located in this groove 23 is a ring-shaped electrical resistance heating element 25. The sealing wheel 11 is tapered at its periphery as indicated at 27 and has a narrow annular flat-sided peripheral ridge 29. The diameter of the sealing wheel 11 measured to the outside of the ridge 29 is somewhat greater than the outside diameter of the cylinder 3.

The water-cooled heat-exchange roll sections 13 and 15 are generally identical. Each comprises a generally cylindrical body 31, made of brass for example, having an annular peripheral groove 33 closed by a peripheral ring 35, such as a nickel-plated copper ring. The outside diameter of ring 35 is equal to the outside diameter of the cylinder 3. The body 31 has two internal annular grooves 37 and 39 and radial passages 41 and 43 between grooves 37 and 39 and the peripheral groove 33. The shaft 17 has two axial passages 45 and 47. Ports 49 in shaft 17 connect passage 45 and grooves 37 of the two sections 13 and 15. Ports 51 in shaft 17 connect passage 47 and grooves 39 of the two sections 13 and 15.

The end of the shaft 17 outward of the bearing 21 is rotary in a head 53 having two internal annular grooves 55 and 57, with radial passages 59 and 61 in communication with these grooves. A water supply pipe 63 is connected to passage 59 and an exhaust pipe 65 is connected to passage 61. The shaft 17 has a port 67 connecting passage 45 and groove 55, and a port 69 connecting passage 47 and groove 57. The outer end of the shaft 17 is closed by a plug as indicated at 71, and the passages 45 and 47 are closed at their inner ends.

Each body 31 has a recessed side receiving the sealing wheel 11. The wheel 11 is thermally insulated from sections 13 and 15 as by means of asbestos disks 73. The opposed edges of the rings 35 of sections 13 and 15 are spaced apart a distance somewhat greater than the width of the ridge 29 of the sealing wheel, and the ridge projects outward from between the two rings 35 beyond the periphery of the roll 1, being out of contact with the rings 35. The inner side of the ridge 29 has a coating 75 of a polymerized tetrafluoroethylene sold under the trade name Teflon. This is used to avoid having melted material stick to the ridge. Other coatings suitable for the purpose may be used.

Fixed on the shaft 17 outward of the outer water-cooled section 15 is a drum 77 carrying slip rings 79. The slip rings are mounted on an insulation sleeve 81. Brushes 83 mounted on the frame F engage the slip rings. Wires 85 connect the slip rings and the terminals of the heating element 25. The heating element is adapted to heat the ridge 29 to a temperature sufficient to soften the heat-sealable material, but not high enough to melt the material. For example, in the case of polyethylene sheet material 0.0015 inch thick travelling at a speed of about 100 feet per minute, this temperature may be from about 225° F. to 250° F.

The apparatus further includes a sealing wheel 87 cooperable with wheel 11. Wheel 87 has a narrow rim 89 in contact with a portion of the ridge 29 of wheel 11. Wheel 87 is mounted on a shaft 91 journaled at its ends in bearings 93 at the free ends of a pair of pivoted arms 95. These arms are pivoted as indicated at 97 on an elevated portion 99 of the frame F. The wheel 87 is located above and gravity-biased downward against the wheel 11. Wheel 87 has two ring-shaped electrical resistance heating elements 101 incorporated therein for heating rim 89 to a temperature sufficient to melt the heat-sealable material. For polyethylene of the thickness stated above and travelling at the speed stated above, this temperature may be from about 600° F. to 800° F.

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Fixed on the shaft 91 alongside the wheel 87 is a drum 103 carrying slip rings 105. The slip rings are mounted on an insulation sleeve 107. Brushes 109 (see Fig. 1) mounted on the adjacent arm 95 engage the slip rings. Wires 111 connect the slip rings and the terminals of heating elements 101.

The doubled web W is fed over the roll 1, being guided so that its margin which is to be seamed travels between the sealing wheels 11 and 87, and so that it is in contact with roll 1 over a substantial degree of arc before and after passing between the wheels. As shown in Fig. 1, the web comes onto the roll 1 at A, engages the roll for a considerable arc before its margin passes between wheels 11 and 87 at B, and passes off the roll 1 at C. The marginal portion of the web in contact with the ridge 29 from A to B is heated and softened, and expands or bulges out around the ridge 29 (see Fig. 3). The ridge 29 projects from the periphery of roll 1 a distance so related to the thermal expansion of the heat-sealable material that the softened and expanded portion of the material lies substantially taut on the ridge but is not substantially stretched.

Circulation of water in the roll sections 13 and 15 maintains the portions of the roll 1 alongside the ridge 29 cool. Water is pumped in through pipe 63, passage 59, groove 55 and port 67 to passage 45 in the shaft 17, flows from passage 45 through ports 49, grooves 377 and passages 41 to grooves 33, and exits from grooves 33 via passages 43, grooves 39, ports 51, shaft passage 47, port 69, groove 57, passage 61 and pipe 65. Hence, heating of the heat-sealable material is limited generally to the portion of the material which overlies the ridge 29.

As the margin of the heat-sealable material travels between the sealing wheels 11 and 87, the pre-softened portion of the material coming into contact with the rim 89 of wheel 87 at B is melted. The melted material is extruded out sidewise from between the region of contact of rim 89 and ridge 29 (see Fig. 4). The melted material extruded in inward direction forms into a bead 113 along the edges of the two layers of the doubled web on the inside of the sealing wheels, welding the two layers together. The portion of the material outward of the sealing wheels, indicated at 115 in Fig. 4, is trimmed off and discarded. Initially, the beaded margin of the material on the inside of the sealing wheels is hot, hence thermally expanded, and is curled outward away from the roll 1 as shown in Fig. 4. As the material travels over roll 1 from B to C, the beaded margin progressively cools by heat transfer to the wheel 11 (which is relatively cool compared to wheel 87) and by heat transfer to the ring 35 of the inner water-cooled roll section 13. This results in progressive contraction of the margin, which brings the beaded edge of the material alongside the ridge 29 (see Fig. 5) and smooths out the edge to make it even. The coating 75 prevents the material from sticking to the ridge 29. The resultant seam is tough, flexible and inconspicuous.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim:

1. Apparatus for seaming heat-sealable sheet material comprising a member having a surface over which the material may be fed with the material in contact with said member for a substantial distance in the direction of feed of the material, said member having a ridge projecting from said surface and extending in the direction of feed of the material, means incorporated in said member for heating the ridge to a temperature such as to soften the portion of the material in contact with the

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ridge, a member engaging a portion of the ridge, and adapted for engagement by the softened portion of the material in contact with the ridge at an intermediate point along said distance over which the material is in contact with the first-named member, and means incorporated in said last-named member for heating it to a temperature higher than the temperature of the ridge and sufficient to melt the softened portion of the material coming into contact therewith.

2. Apparatus for seaming heat-sealable sheet material comprising a member having a surface over which the material may be fed with the material in contact with said member for a substantial distance in the direction of feed of the material, said member having a ridge projecting from said surface and extending in the direction of feed of the material, means incorporated in said member for heating the ridge to a temperature such as to soften the portion of the material in contact with the ridge, means for cooling portions of said member alongside the ridge, a member engaging a portion of the ridge and adapted for engagement by the softened portion of the material in contact with the ridge at an intermediate point along said distance over which the material is in contact with the first-named member, and means incorporated in said last-named member for heating it to a temperature higher than the temperature of the ridge and sufficient to melt the softened portion of the material coming into contact therewith.

3. Apparatus for seaming heat-sealable sheet material comprising a roll over which the material may be fed with the material in contact with the roll throughout a substantial arc of the periphery of the roll, said roll having an annular ridge projecting from its periphery, means incorporated in the roll for heating the ridge to a temperature such as to soften the portion of the material in contact with the ridge, a member engaging a portion of the ridge and adapted for engagement by the softened portion of the material in contact with the ridge at an intermediate point along said arc, and means incorporated in said member for heating it to a temperature higher than the temperature of the ridge and sufficient to melt the softened portion of the material coming into contact therewith.

4. Apparatus for seaming heat-sealable sheet material comprising a roll over which the material may be fed with the material in contact with the roll throughout a substantial arc of the periphery of the roll, said roll having an annular ridge projecting from its periphery, means incorporated in the roll for heating the ridge to a temperature such as to soften the portion of the material in contact with the ridge, means for cooling portions of the roll alongside the ridge, a member engaging a portion of the ridge and adapted for engagement by the softened portion of the material in contact with the ridge at an intermediate point along said arc, and means incorporated in said member for heating it to a temperature higher than the temperature of the ridge and sufficient to melt the softened portion of the material coming into contact therewith.

5. Apparatus for seaming heat-sealable sheet material comprising a roll over which the material may be fed with the material in contact with the roll throughout a substantial arc of the periphery of the roll, said roll having an annular ridge projecting from its periphery, means incorporated in the roll for heating the ridge to a temperature such as to soften the portion of the material in contact with the ridge, a wheel having its rim engaging a portion of the ridge and adapted for engagement by the softened portion of the material in contact with the ridge at an intermediate point along said arc, and means incorporated in the wheel for heating the rim of the wheel to a temperature higher than the temperature of the ridge and sufficient to melt the softened portion of the material coming into contact therewith.

6. Apparatus for seaming heat-sealable sheet material

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comprising a roll over which the material may be fed with the material in contact with the roll throughout a substantial arc of the periphery of the roll, said roll having an annular ridge projecting from its periphery, means incorporated in the roll for heating the ridge to a temperature such as to soften the portion of the material in contact with the ridge, means for cooling portions of the roll alongside the ridge, a wheel having its rim engaging a portion of the ridge and adapted for engagement by the softened portion of the material in contact with the ridge at an intermediate point along said arc, and means incorporated in the wheel for heating the rim of the wheel to a temperature higher than the temperature of the ridge and sufficient to melt the softened portion of the material coming into contact therewith.

7. Apparatus for seaming heat-sealable sheet material comprising a roll over which the material may be fed, said roll having two axially spaced heat-exchange sections and a sealing wheel positioned between said heat-exchange sections and thermally insulated therefrom, said wheel having an annular peripheral ridge projecting from between the heat-exchange sections beyond the periphery of the roll, said wheel having means for heating the ridge to a temperature such as to soften the portion of the material in contact with the ridge, and a second sealing

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wheel having a rim in engagement with the ridge, said second wheel having means for heating its rim to a temperature sufficient to melt the softened portion of the material coming into contact therewith.

8. Apparatus as set forth in claim 7 wherein the first-mentioned sealing wheel is tapered at its periphery and the ridge is a flat-sided ridge projecting outward from the tapered portion of the wheel, the heat-exchange sections at their periphery being spaced apart a distance somewhat greater than the width of the ridge, and the ridge projecting outward from between the peripheries of the heat-exchange sections and being out of contact therewith.

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