US 20020157761A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2002/0157761 A1**

(43) **Pub. Date: Oct. 31, 2002**

Bender et al.

(54) **RETREADED TIRES AND METHOD FOR MAKING THE SAME WITHOUT SPRAY CEMENT**

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(21) Appl. No.: **10/097,827**

(22) Filed: **Mar. 14, 2002**

Related U.S. Application Data

(60) Division of application No. 08/773,864, filed on Dec. 27, 1996, now Pat. No. 6,368,439, which is a continuation of application No. 08/399,070, filed on Mar. 8, 1995, now abandoned.

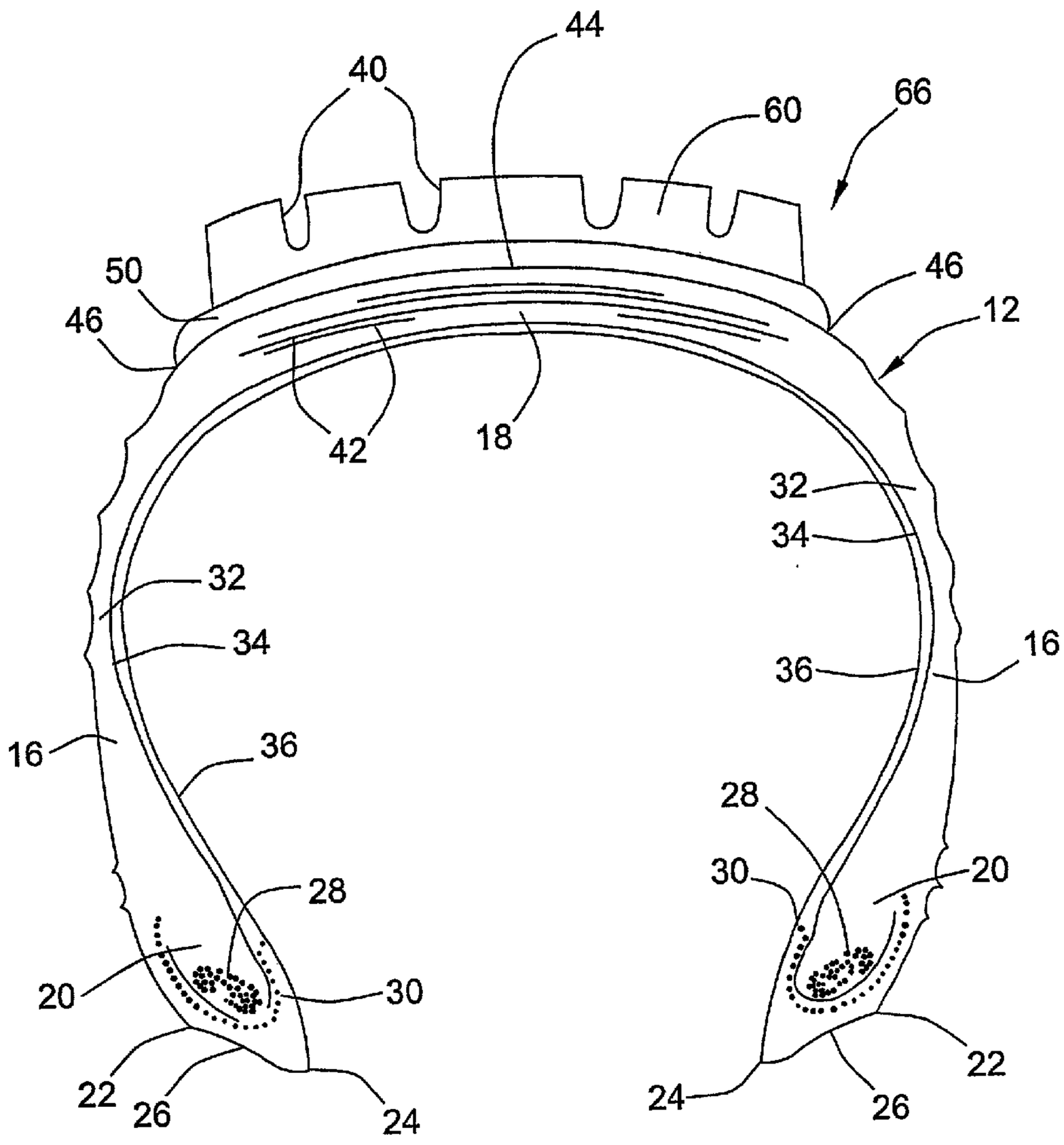
Publication Classification

(51) **Int. Cl.**[7] **B32B 1/00**

(52) **U.S. Cl.** **156/96**; 156/128.1; 156/130; 156/130.3

(57) **ABSTRACT**

A retreaded tire assembly and method for making the same is disclosed. The method and assembly provide for the application of new tread to a buffed tire casing with only a layer of cushion gum disposed therebetween. The cushion gum is applied directly to the buffed circumference of a tire casing without the use of conventional spray cement normally applied to the buffed surface of the entire casing.



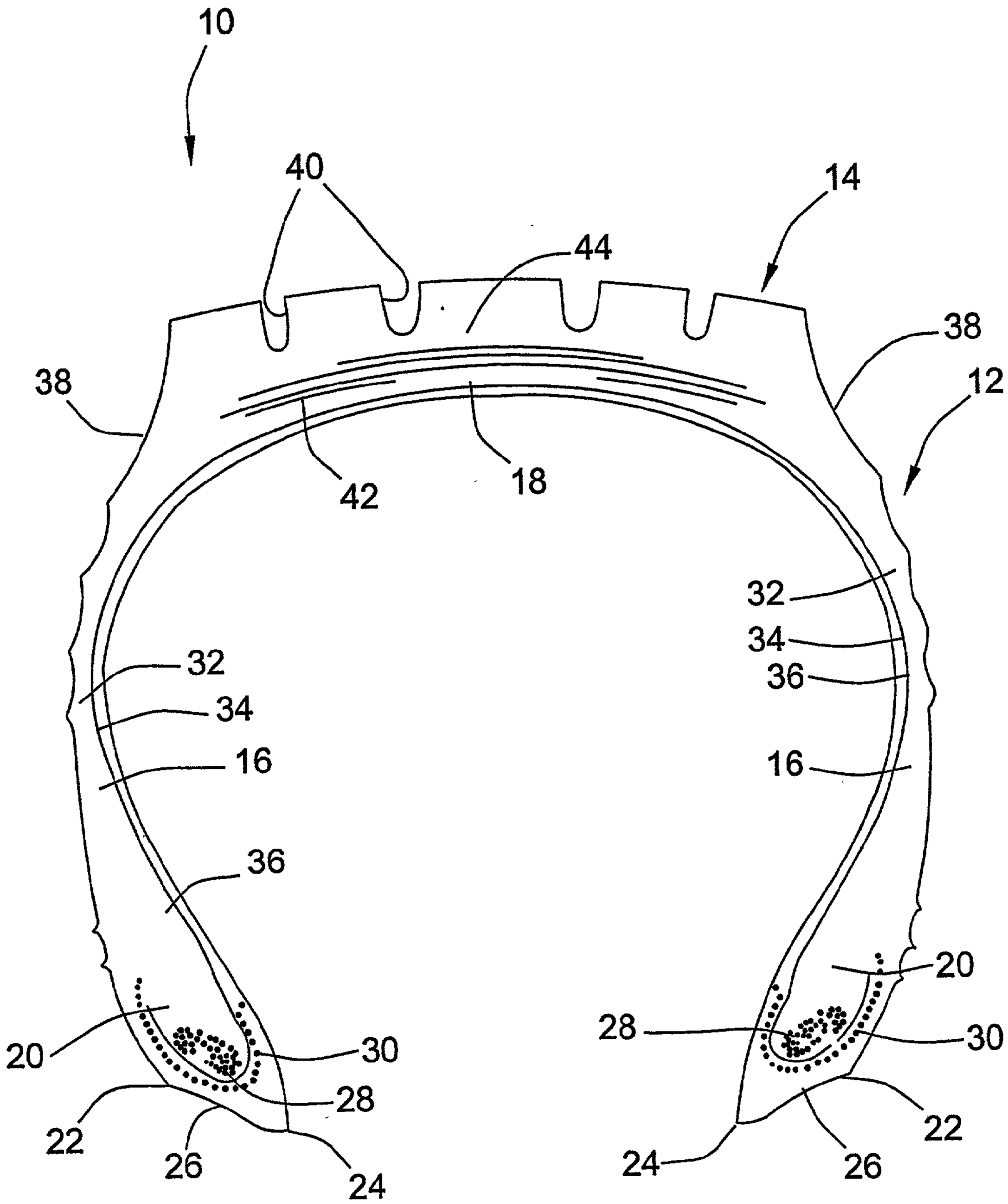

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FIG. 1

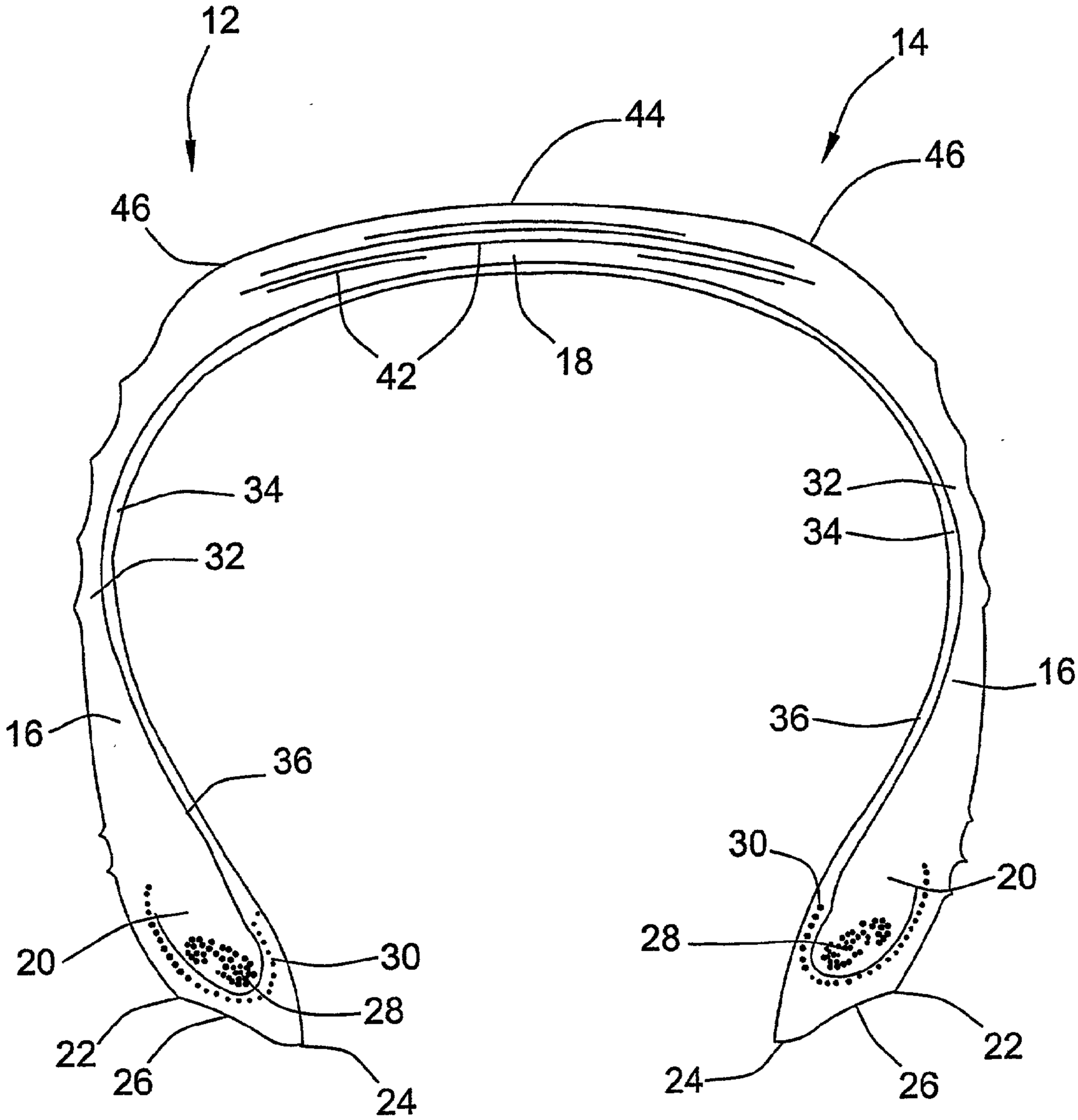
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FIG. 2

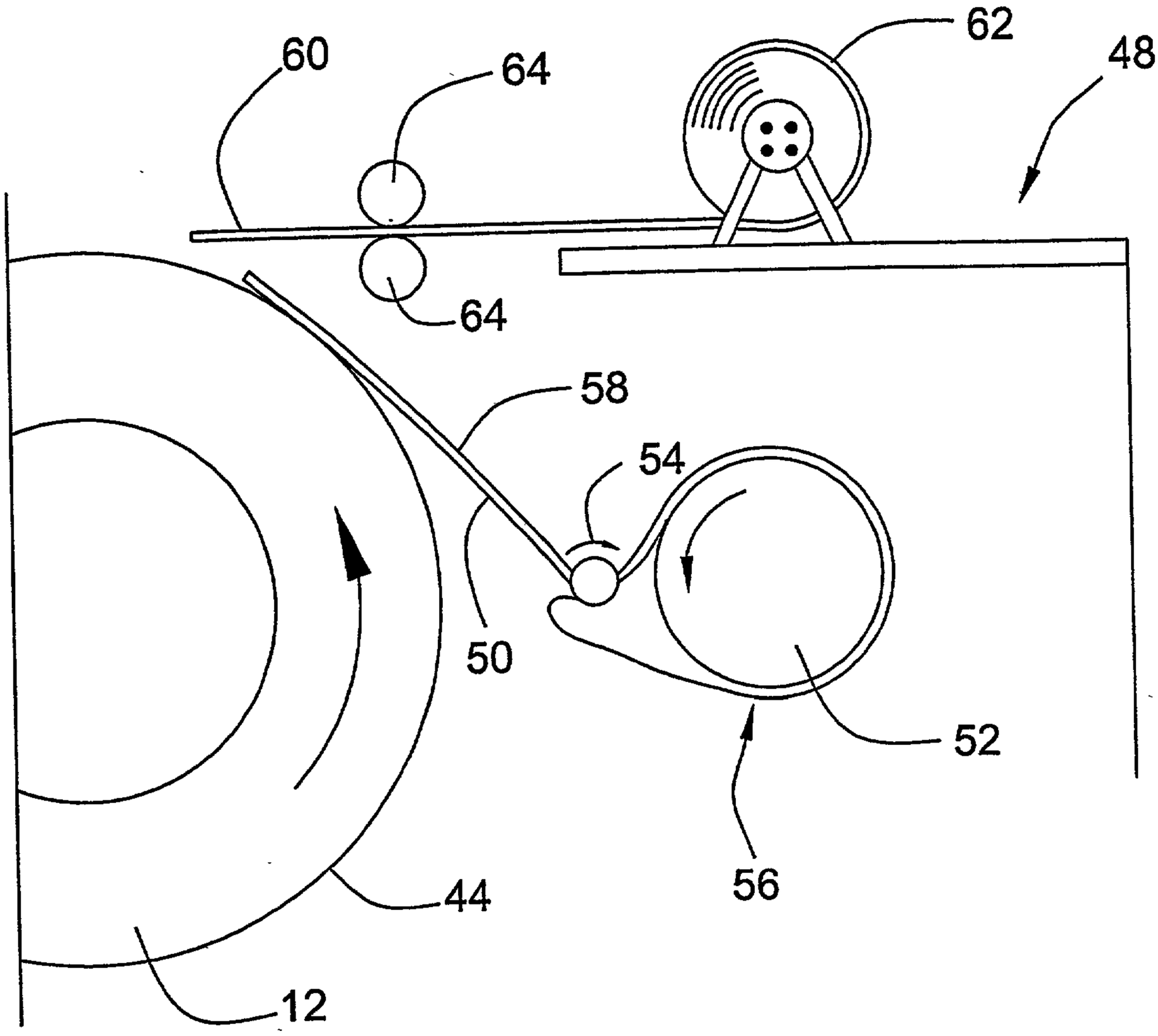

FIG. 3

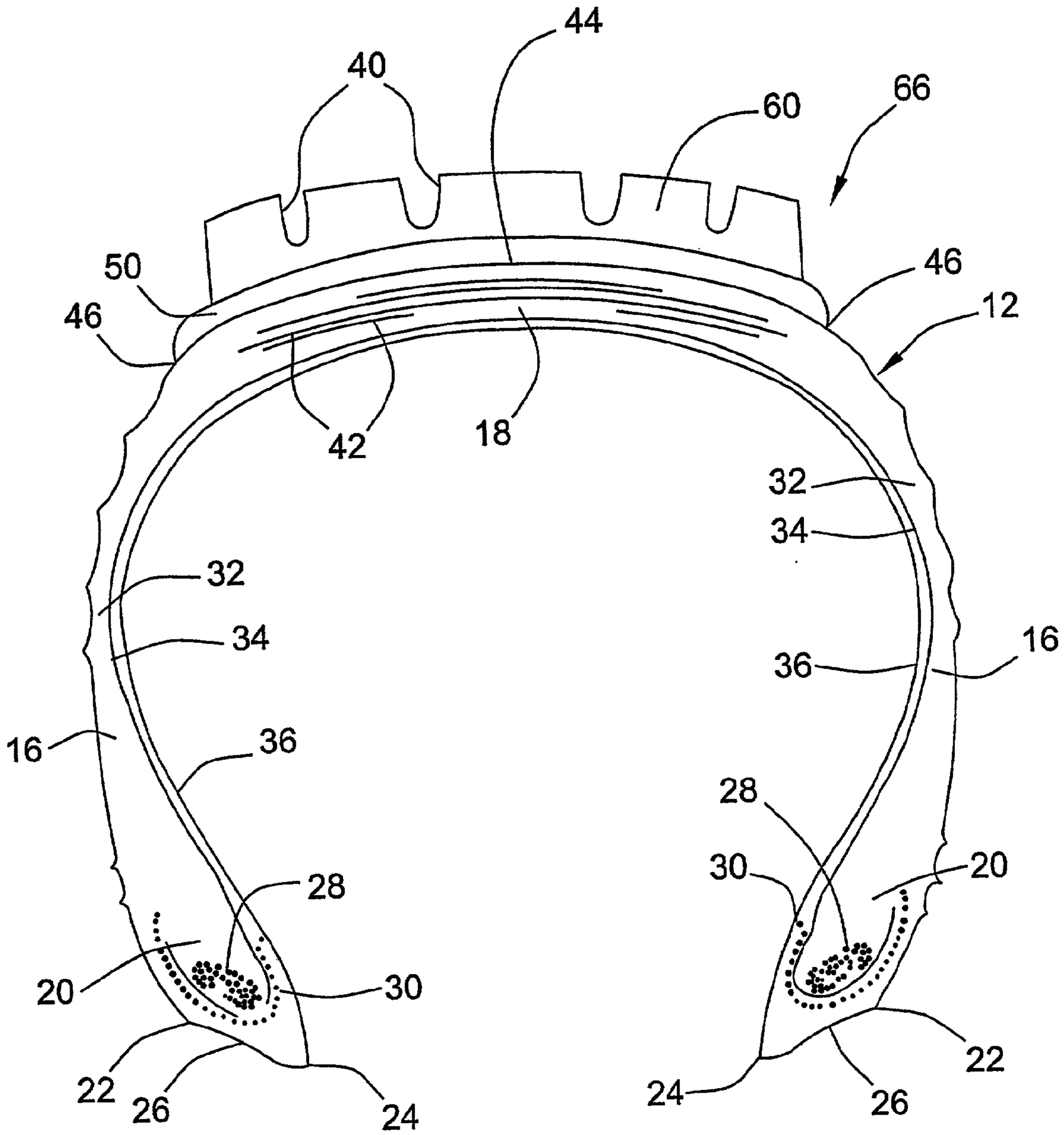
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FIG. 4

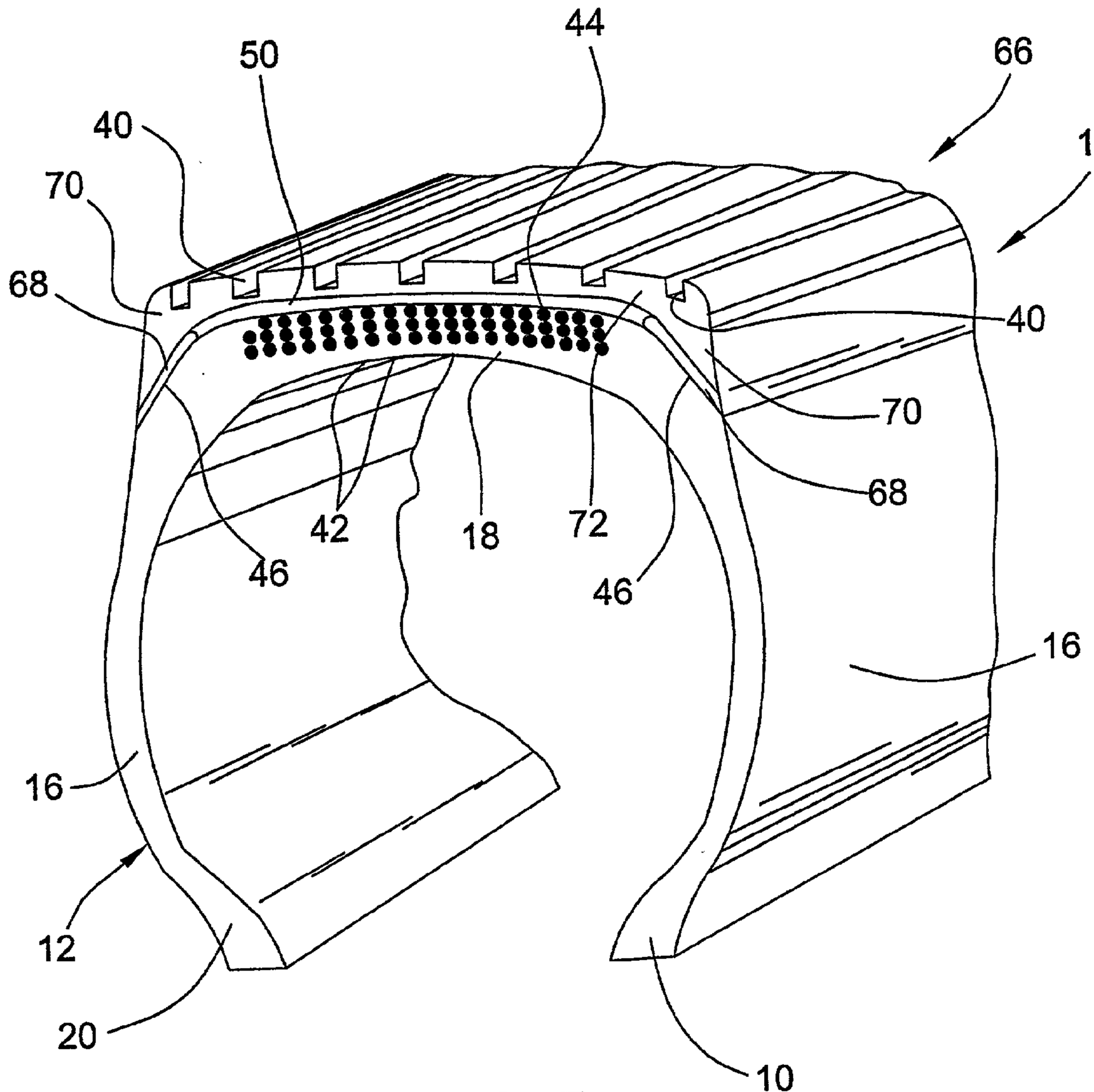

FIG. 5

RETREADED TIRES AND METHOD FOR MAKING THE SAME WITHOUT SPRAY CEMENT

TECHNICAL FIELD

[0001] This invention relates generally to a method for making retreaded tires and particularly to a method for making retreaded tires that eliminates the need for spray cement normally applied to the tire casing.

BACKGROUND OF THE INVENTION

[0002] Retreaded tires have been available for many years and provide an economical way to gain additional use out of a tire casing after the original tread has become worn. According to one conventional method of retreading, sometimes referred to as cold process retreading, the remaining tread on the used tire is removed by a special buffing machine that grinds away the old tread and leaves a buffed surface to which a new layer of tread may be bonded.

[0003] Removal of the old tread from the tire casing provides a generally smooth treadless surface about the circumference of the tire casing. The tire casing may then be examined for injuries, often called skives, which are filled with a repair gum. After completion of the skiving process, the buffed surface is sprayed with a tire cement that provides a tacky surface for application of bonding material and new tread. Then a layer of cushion gum is applied to the back, i.e., the inside surface, of a new layer of tread. The cushion gum and tread are applied in combination about the circumference of the tire casing to create a retreaded tire assembly ready for curing. The cushion gum forms the bonds between the tread and the tire casing during curing.

[0004] Following assembly of the tire casing, cement, cushion gum and tread, the overall retreaded tire assembly is placed within a flexible rubber envelope. An airtight seal is created between the envelope and the bead of the tire. The entire enveloped tire assembly is placed within a curing chamber, and subjected to pressure and a raised temperature for a specific period of time. The combination of pressure, temperature and time chemically bonds the layer of cushion gum to both the tire casing and the new tire tread.

[0005] The above-described method of cold process retreading works well and provides high quality, retreaded tires. However, in certain applications it would be advantageous to eliminate the spray cement. This is particularly true in geographical areas where there is increased regulation of the use of chemicals within spray cement. Generally, available spray cements include either heptane solvent or methyl chloroform. The heptane solvent has been found to contribute to smog formation, and methyl chloroform, although it does not cause smog, has tended to be substantially more expensive than heptane solvent.

[0006] Use of spray cement can also add to the cost of producing retreaded tires due to the product cost and equipment cost. For example, because cementing of the tire casing should only be done in a well ventilated spray booth, retreading shops must purchase appropriate ventilation equipment. Elimination of the spray cement thus eliminates the need to purchase ventilated spray booths.

[0007] A potential solution to smog problems associated with using heptane solvent is the installation of solvent capture equipment at each retreading shop. However, this solution is disadvantageous due to the cost of the equipment and the operational and maintenance costs. The present invention addresses the drawbacks associated with using spray cement during retreading of tires.

SUMMARY OF THE INVENTION

[0008] The present invention includes a method for retreading a tire that comprises the steps of removing the tire tread from a tire casing to present a buffed surface. Then, a layer of cushion gum is applied directly to the buffed surface without spraying cement over the buffed surface. A tread layer is wrapped about the layer of cushion gum, and finally, the tire is treated to form bonds between the casing and the layer of cushion gum and between the tread layer and the layer of cushion gum.

[0009] Another unique aspect of the invention is a retreaded tire assembly prepared for insertion into a pressurized heating chamber. The tire assembly includes a tire casing having a pair of side walls and a radially outer wall spanning the pair of side walls. The radially outer wall has a buffed surface disposed about the outer circumference of the tire casing. A layer of cushion gum is disposed directly against the buffed surface, and a tread layer is disposed against the cushion gum about the outside circumference of the cushion gum. After appropriate heat and pressure treatment, the tire casing, cushion gum and tread layer become bonded into an integral retreaded tire that may be used on an appropriate over-the-road vehicle.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The invention will hereafter be described with reference to the accompanying drawings, wherein like reference numerals denote like elements, and:

[0011] **FIG. 1** is a cross-sectional view of an exemplary original tire;

[0012] **FIG. 2** is a cross-sectional view of the tire of **FIG. 1** after the tread layer has been removed from the tire casing;

[0013] **FIG. 3** is a schematic representation of the layer of cushion gum and the new tread layer being applied to a tire casing;

[0014] **FIG. 4** is a cross-sectional view of the tire casing illustrated in **FIG. 2** with the addition of the layer of cushion gum and the new tread layer; and

[0015] **FIG. 5** is a perspective cross-sectional view of an alternate embodiment of a retreaded tire according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0016] Referring generally to **FIG. 1**, an original tire is shown as having a tire casing **12** from which extends a tire tread **14**. The illustrated tire **10** is a radial tire; however, the invention applies equally to other types of tires, such as bias ply tires.

[0017] More particularly, tire **10** includes a pair of side walls **16** bounded by a generally radially outward wall **18** that spans side walls **16**. Each side wall **16** extends radially inward from outer wall **18** and terminates in a bead area **20** designed for mounting on the tire rim (not shown). Bead

area **20** may be designed in a variety of configurations depending on, for example, tire type, tire size or rim configuration. In the illustrated embodiment, each bead area **20** includes a bead heel **22**, a bead toe **24**, and a bead sole **26**. Each bead area **20** may also include a bead bundle **28** and a chafer ply **30**. Both bead bundle **28** and chafer ply **30** may include, for example, metal strands or wires to improve the strength of bead area **20**.

[**0018**] Side walls **16** may also include multiple layers, such as a rubber layer **32**, a radial ply **34** and an inner liner **36** which cooperate to provide a strong but flexible side wall. Side walls **16** are joined to radially outward wall **18** and tread **14** through a pair of shoulder areas **38**. Shoulder areas **38** extend towards tire tread **14** which, in turn, is disposed radially outwardly from wall **18** of tire casing **12**. Tire tread **14** may include a plurality of grooves **40** designed to channel water and provide added traction during certain road conditions. Additionally, outer wall **18** may be strengthened by a plurality of belts or cords **42** extending circumferentially about tire **10** within wall **18** (see **FIGS. 2 and 5**).

[**0019**] After tire tread **14** wears beyond a certain limit, tire **10** must either be discarded or retreaded before it should be used on the vehicle for which it was designed. In cold process retreading, the remaining tire tread **14** is removed from tire casing **12** by a buffing machine, such as the Model 8110 buffing machine manufactured by Bandag, Incorporated of Muscatine, Iowa. During the buffing operation, the original tire tread **14** is ground away from tire casing **12**, leaving a buffed surface **44** as illustrated in **FIG. 2**. Buffed surface **44** extends circumferentially about tire casing **12** and also extends transversely across the outside of outer radial wall **18** until it terminates at buffed shoulder areas **46**.

[**0020**] Following removal of the used tread layer, a process called skiving and filling is performed on tire casing **12**. Skiving is the removal of damaged material from a tire prior to making a repair. Often, the tire casing **12** accumulates holes, nicks or tears due to stones or other sharp objects the tire comes in contact with during use. The injured or damaged area is first ground smooth by an appropriate grinding tool and then filled with repair gum, such as Bandag extruder repair rope or repair gum or some other suitable material. It is necessary to fill the injured areas to the level of buffed surface **44** to avoid air pockets between buffed surface **44** and the later applied tread layer. Trapped air can have negative effects on the longevity of a typical retreaded tire. Following the skiving and filling operation, a building step occurs in which a layer of cushion gum and a new tread layer are wrapped about the circumference of tire casing **12** along buffed surface **44**.

[**0021**] As illustrated best in **FIG. 3, a** building machine **48** (shown schematically), such as the Bandag 5110 semiautomatic builder manufactured by Bandag, Incorporated, may be used to apply a layer of cushion gum **50**, such as HD30 cushion gum manufactured by Bandag, Incorporated. Although the layer of cushion gum **50** could be applied to tire casing **12** in a variety of ways, the schematic representation of **FIG. 3** shows a roll of the cushion gum **52** rotatably mounted on building machine **48**. The layer of cushion gum **50** moves about a tensioning roller **54** prior to being wrapped circumferentially around buffed surface **44**.

[**0022**] Preferably, cushion gum layer **50** is covered by a bottom plastic sheet **56**, e.g. a poly sheet, and a similar top plastic sheet **58**. As illustrated, bottom sheet **56** is peeled away from cushion gum layer **50** shortly before the cushion gum is wrapped about tire casing **12** along buffed surface **44**. Bottom plastic sheet **56** may then be wrapped about tensioning roller **54** as shown in **FIG. 3**.

[**0023**] Cushion gum layer **50** is preferably applied to buffed surface **44** within eight hours of buffing. Additionally, the application has been found to work best when the layer of cushion gum **50** is applied under tension in the circumferential direction. Depending on the application, it may be desirable to slightly stretch the cushion gum layer **50** to achieve better adherence to buffed surface **44**. Cushion gum layer **50** is cut transversely and the cut edge is spliced with the leading edge so there is no gap between the beginning and the end of cushion gum layer **50**. Any, overlap between the leading edge and the trailing cut edge is preferably limited to one-eighth inch or less.

[**0024**] After cushion gum layer **50** is applied to tire casing **12**, layer **50** is stitched, or in other words pressed, against buffed surface **44** to drive out any air trapped between the cushion layer and buffed surface **44**. Following stitching, the top layer of plastic **58** is removed from cushion gum layer **50** to permit a new tread layer **60** to be applied over the cushion gum. The stitching step also helps prevent the cushion from lifting away from buffed surface **44** when plastic layer **58** is removed and tread layer **60** is applied.

[**0025**] Preferably, tread layer **60** is also applied with the assistance of building machine **48**, although there are a variety of ways to wrap tread layer **60** about the circumference of tire casing **12**. When using building machine **48**, a tread roll **62** is rotatably mounted thereon, and tread layer **60** is guided onto tire casing **12** against cushion gum layer **50** by guide rollers **64**.

[**0026**] Tire casing **12** is rotated an building machine **48** until a sufficient length of tread layer **60** is unraveled from tread roll **62** to extend about the circumference of tire casing **12**. Tread layer **60** is then cut generally transversely to the circumferential direction, and the cut end is butted up against the leading edge of tread layer **60** to form a splice. The tread layer splice is often held together by a plurality of staples (not shown). It is also preferred that the spliced area of cushion gum layer **50** and the spliced area of tread layer **60** be disposed at different points along buffed surface **44**.

[**0027**] Although the application of cushion gum layer **50** and tread layer **60** to a tire casing **12** by building machine **48** has been generally known in the industry for many years, the unique aspects of this inventive method of retreading allows the omission of a previous step, namely the application of spray cement to buffed surface **44**. Previously, spray cement would be initially applied to buffed surface **44**. Then, cushion gum layer **50** would be applied to the inside or lower surface of tread layer **60**. The combination of cushion gum layer **50** and tread layer **60** would be wrapped about cement covered buffed surface **44** and spliced together.

[**0028**] The present method permits the elimination of the spray cement which overcomes certain disadvantages described in the background of the invention section above. By first stretching the layer of cushion gum about the circumference of tire casing **12**, stitching the cushion gum and then applying tread layer **60** over the combined tire casing **12** and cushion gum layer **50**, the necessity of using

spray cement has been eliminated. It has been found that retreaded tires made according to the new method have very desirable characteristics without requiring an extra cementing step.

[**0029**] After application of cushion gum layer **50** and tread layer **60**, a retreaded tire assembly **66** is created and ready for curing under appropriate heat and pressure conditions. A cross section of the retreaded tire assembly **66** is illustrated best in **FIG. 4**. After assembly, the overall tire assembly is inserted into a rubberized curing envelop, such as the appropriate Bandag, Incorporated curing envelope designed for the particular tire type and size being retreaded.

[**0030**] The retreaded tire assembly **66** is sealed within the curing envelope and placed within a curing chamber, such as the Model 4130 or 4120 curing chamber sold by Bandag, Incorporated. Pressure and heat are applied to the retreaded tire assembly **66** within the curing chamber. The amount of time necessary to cure a given retreaded tire may vary depending on the size of the tire and the materials used. However, the time must be long enough to create sufficient bonding between the tire casing **12** and cushion gum layer **50** and between the tread layer **60** and cushion gum layer **50**. Generally, the bonding results from vulcanization between the tire casing, cushion gum layer and tread layer. The times, pressures and temperatures within the curing chamber would be known by one of ordinary skill in the art. However, exemplary parameters during curing within the curing chamber are temperature: approximately 210° F.; pressure: approximately 85 psi; and time: approximately three and one half hours. The above listed temperature, pressure and time parameters are only provided as examples, and are not meant to limit the scope of the invention. As stated previously, the time within the curing chamber may vary depending on the tire size and tire materials. Additionally, other combinations of temperature and pressure can potentially provide satisfactory results. After curing, the retreaded tire may undergo certain minor trimming operations, but otherwise is ready for use on a vehicle.

[**0031**] Another embodiment of retreaded tire assembly **66** is illustrated in **FIG. 5**. The process used for this type of retreaded tire is the same as that described above, except for the addition of a pair of shoulder strips **68** of cushion gum that are added to accommodate arched outer flanges **70** of a slightly different tread layer **72**. In this embodiment, tread layer **72** extends about the circumference of tire casing **12** as described above, but the arched outer flanges **70** curve in the transverse direction generally about shoulder areas **46** of tire casing **12**. Accordingly, additional cushion gum must be added in the form of shoulder strips that run generally along each shoulder area **46** of tire casing **12** and beneath flanges **70**.

[**0032**] Thus, after cushion gum layer **50** is applied to buffed surface **44**, and stitched thereto, the top layer of plastic **58** is removed and shoulder strips **68** are applied along shoulder areas **46**. The tread layer **72** including its arched outer flanges **70** is applied over cushion gum layer **50** and shoulder strips **68**, measured, cut, and spliced similarly to that described above.

[**0033**] The various parameters involved in cementless retreading of tires may vary depending on the overall design of the tire being retreaded and the composition of the retreading materials. However, in general, it is preferred that the temperature of both tire casing **12** and cushion gum layer **50** be at least 65 degrees Fahrenheit when the cushion gum layer is applied to buffed surface **44**. Additionally, the cushion should be applied to the uncemented casing within eight hours of buffing or, if the buffed casing is covered with poly, the cushion application should be within 72 hours of buffing. Furthermore, to ensure a high quality retreaded tire, it is preferred that the centerline of cushion layer **50** be aligned with the center line of the buffed casing within plus or minus one eighth inch. When applying the flat style tread illustrated in **FIG. 4**, there should be at least one eighth inch of cushion layer **50** extending transversely past the base of the tread on each side of tread layer **60**. Similarly, cushion layer **50** should be applied with enough tension to facilitate conformation to the buffed surface **44**, but the tension should not cause the width of cushion layer **50** to be reduced by more than one eighth inch. Generally, the length of cushion layer **50** is approximately 2-8 inches shorter than the circumference of buffed surface **44**.

[**0034**] It will be understood that the foregoing description is of the preferred exemplary embodiment of this invention and that the invention is not limited to the specific form shown. For example, the invention is directed to a tire assembly and a method for retreading tires that does not require the use of spray cement, and therefore a wide variety of equipment may be used to apply the layers of cushion gum and tread to the tire casing. Additionally, the invention encompasses a broad variety of tires, materials, and tread designs that may be assembled according to the invention. The methods of preparing the tire casing and curing the retreaded tire assembly may vary substantially due to differences in materials, equipment and techniques for creating retreaded tires. These and other modifications may be made in the design and arrangement of the elements without departing from the scope of the invention as expressed in the appended claims.

What is claimed is:

1. A method for retreading a tire, comprising the steps of:

removing tire tread from a tire casing to present a buffed surface;

applying a layer of cushion gum directly to the buffed surface;

wrapping a tread layer about the layer of cushion gum; and

treating the tire to form bonds between the casing and the layer of cushion gum and between the tread layer and the layer of cushion gum.

2. The method for retreading a tire as recited in claim 1, wherein the step of applying the layer of cushion gum includes the step of pressing the layer of cushion gum against the buffed surface with sufficient pressure to force any air from between the casing and the layer of cushion gum.

3. The method for retreading a tire as recited in claim 2, wherein the step of applying the layer of cushion gum includes stretching the layer of cushion gum circumferentially about the casing.

4. The method for retreading a tire as recited in claim 1, wherein the step of applying the layer of cushion gum includes the step of applying a pair of shoulder strips to the buffed surface.

5. The method for retreading a tire as recited in claim 3, wherein the step of applying the layer of cushion gum includes the steps of cutting the layer generally transverse to the circumferential direction and splicing the layer at the cut region.

6. The method for retreading a tire as recited in claim 5, wherein the step of wrapping the tread layer includes the steps of cutting the tread layer generally transverse to the circumferential direction and splicing the tread layer at the cut region.

7. The method for retreading a tire as recited in claim 6, further comprising the steps of enclosing the tire in an envelope; heating the tire; applying a vacuum within the envelope; and applying pressure to the outside of the envelope.

8. A method for retreading a tire, comprising the steps of:

removing old tire tread from a tire casing to present a buffed surface;

cutting a tread layer to a length sufficient to encircle the buffed surface along the circumference of the casing;

maintaining the buffed surface free of tire retreading cement;

disposing a layer of cushion gum between the buffed surface and the tread layer;

squeezing the layer-of cushion gum between the buffed surface and the tread layer; and

heating the combined tire casing, tread layer and layer of cushion gum to form a vulcanized bond therebetween.

9. The method for retreading a tire as recited in claim 8, wherein the step of removing old tire tread includes grinding the tire tread from the tire casing.

10. The method for retreading a tire as recited in claim 9, wherein the step of maintaining the buffed surface includes removing contaminants from the buffed surface.

11. The method for retreading a tire as recited in claim 8, wherein the step of disposing the layer of cushion gum includes applying tension thereto in a circumferential direction as the layer of cushion gum is wrapped about the circumference of the tire casing.

12. The method for retreading a tire as recited in claim 11, wherein the step of disposing the layer of cushion gum includes stitching the layer of cushion gum to the buffed surface to drive air from therebetween.

13. The method for retreading a tire as recited in claim 8, wherein the step of squeezing includes the steps of placing the combined tire casing, tread layer and layer of cushion gum within a pressure chamber.

14. The method for retreading a tire as recited in claim 13, wherein the step of squeezing includes the steps of placing the combined tire casing, tread layer and layer of cushion gum within an envelope and creating a vacuum within the envelope.

15. The method for retreading a tire as recited in claim 14, wherein the step of heating occurs while the combined tire casing, tread layer and layer of cushion gum are in the pressure chamber.

16. A retreaded tire assembly prepared for insertion into a pressurized heating chamber comprising:

a tire casing having a pair of sidewalls and a radially outer wall spanning the pair of sidewalls, the radially outer wall having a buffed surface disposed about the outer circumference of the tire casing;

a layer of cushion gum disposed directly against the buffed surface; and

a tread layer disposed against the cushion gum.

17. The retreaded tire assembly as recited in claim 16, wherein the layer of cushion gum is mounted in tension about the circumference of the tire casing.

18. The retreaded tire assembly as recited in claim 17, wherein the layer of cushion gum includes a center strip and a pair of shoulder strips.

19. The retreaded tire assembly as recited in claim 17, wherein the tread layer is arcuate in both the circumferential and the transverse directions.

20. The retreaded tire assembly as recited in claim 17, wherein the tread layer is arcuate only in the circumferential direction.

* * * * *