

Oct. 27, 1959

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2,910,109

BUILDING CORE FOR PNEUMATIC TIRES

Filed Jan. 16, 1956

4 Sheets-Sheet 1

FIG. 1

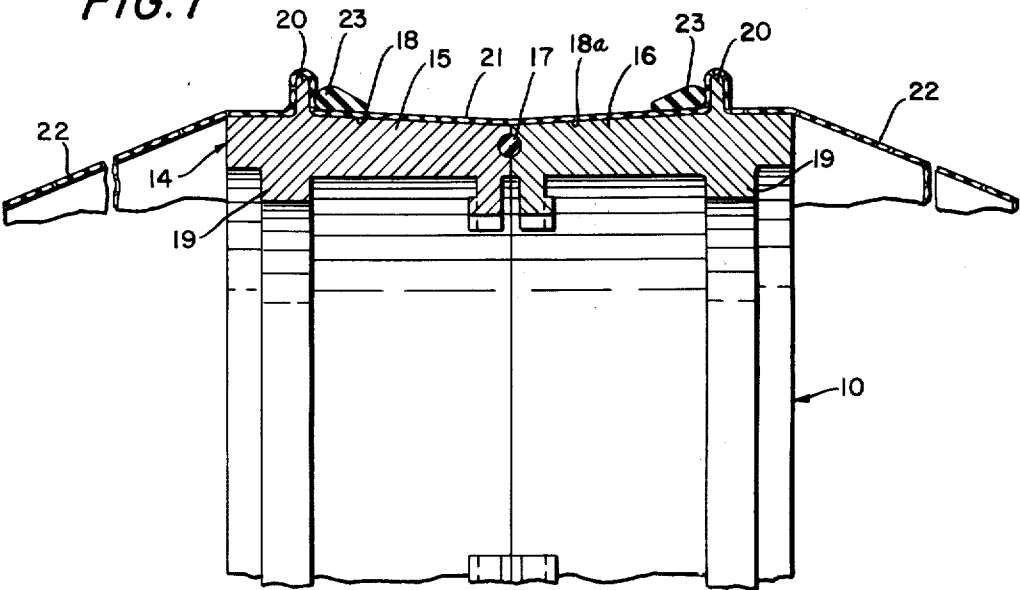
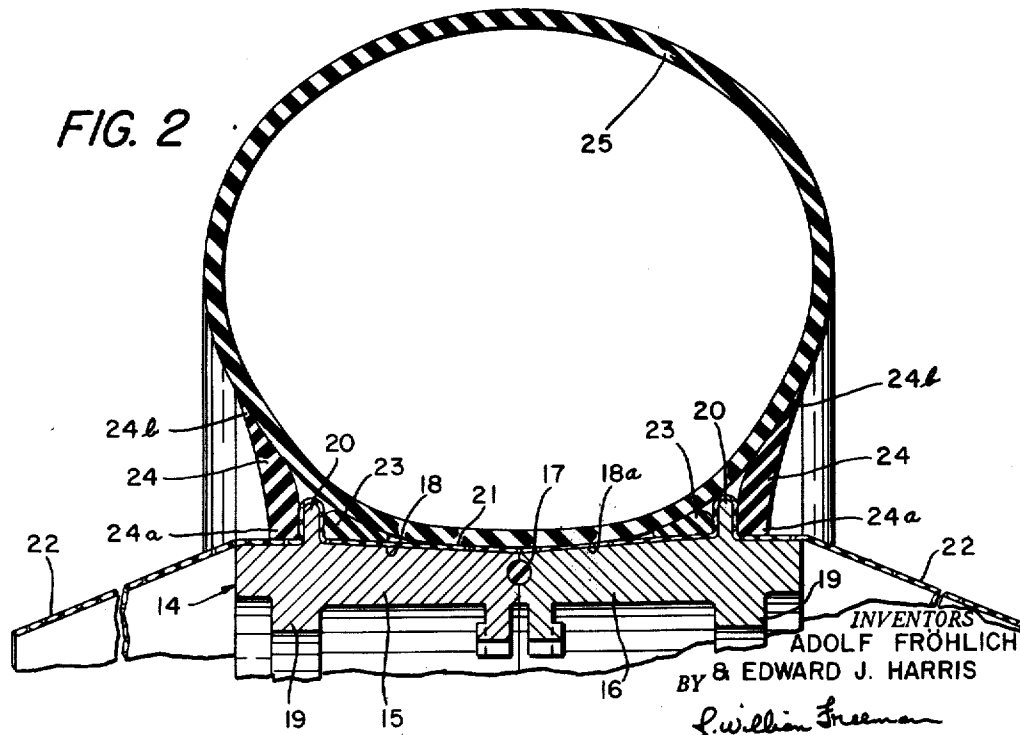


FIG. 2



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FIG. 3

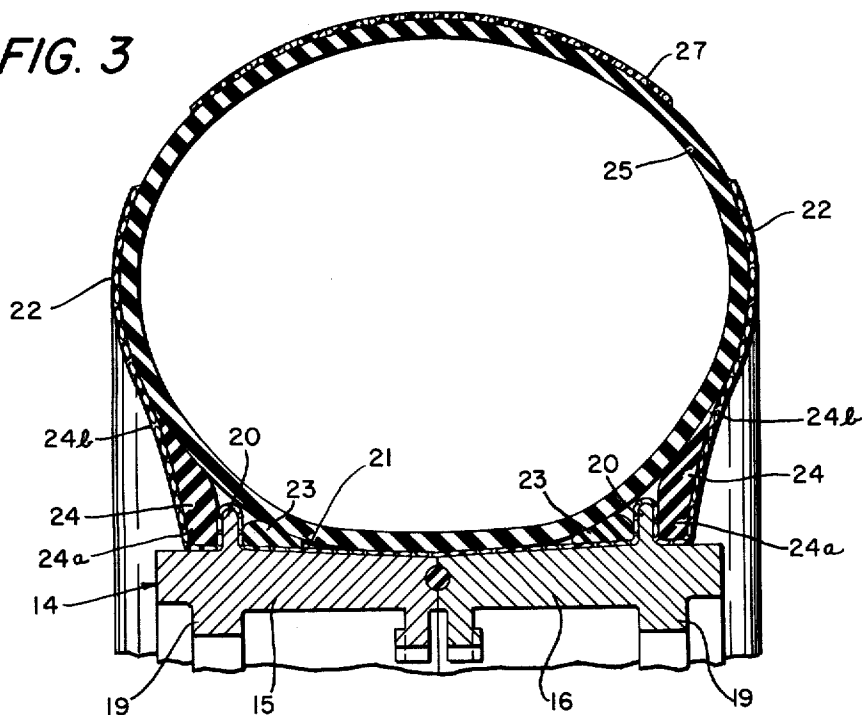
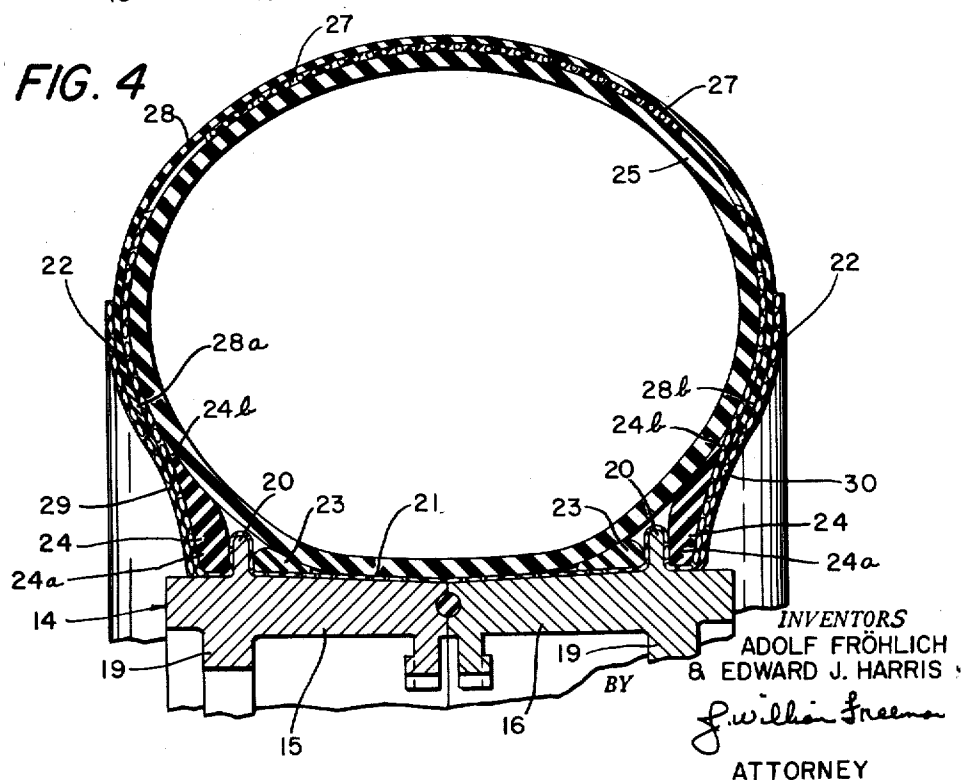


FIG. 4



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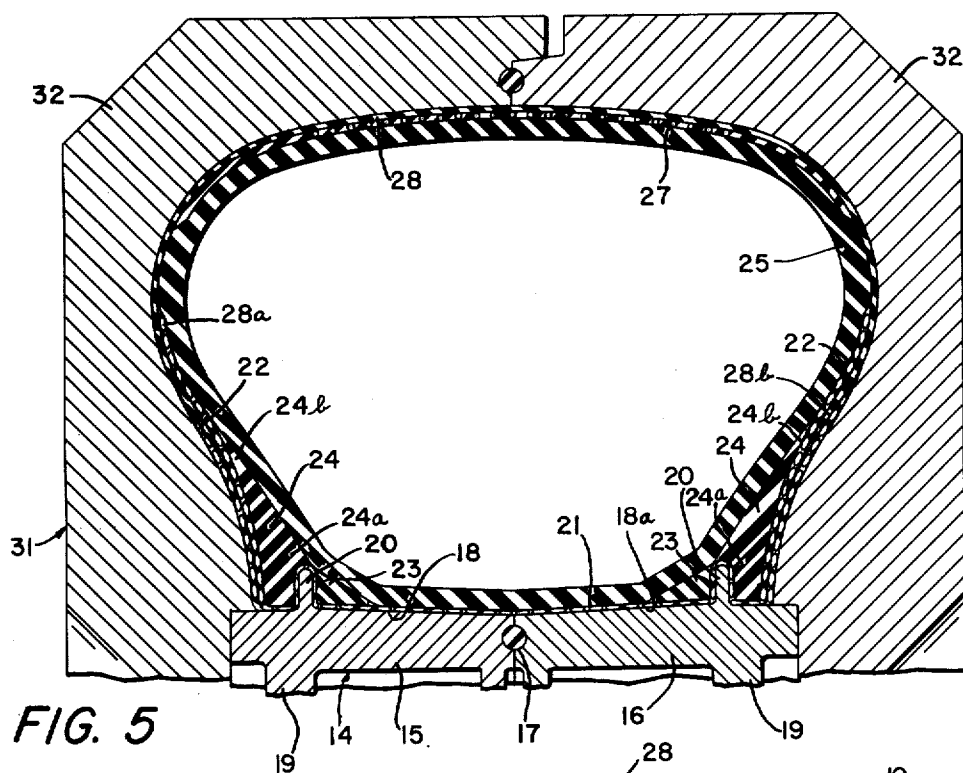


FIG. 5

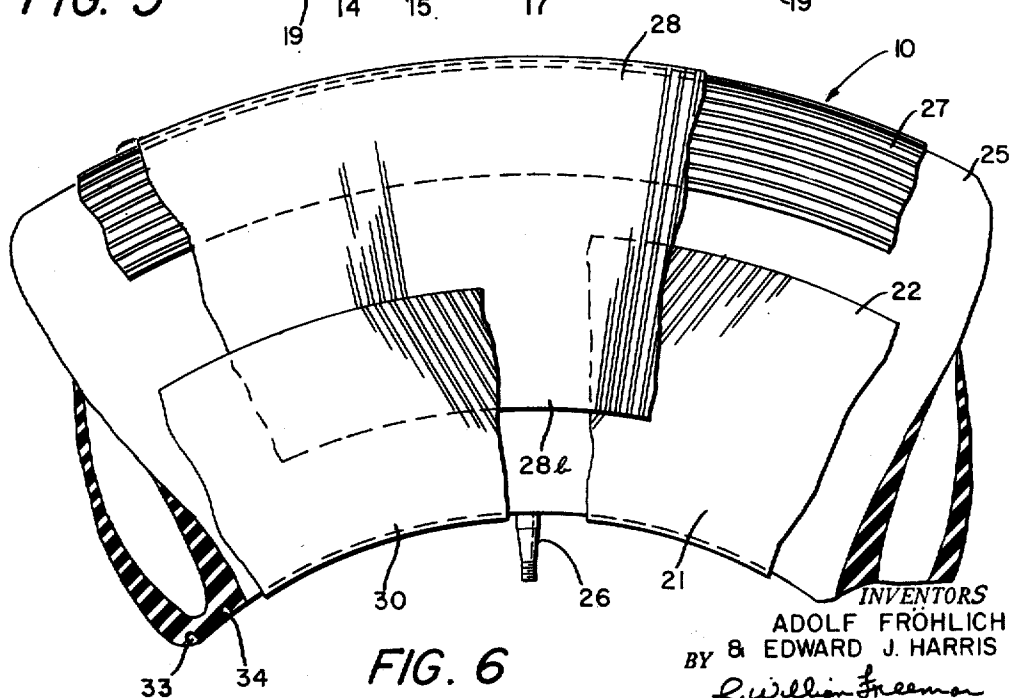


FIG. 6

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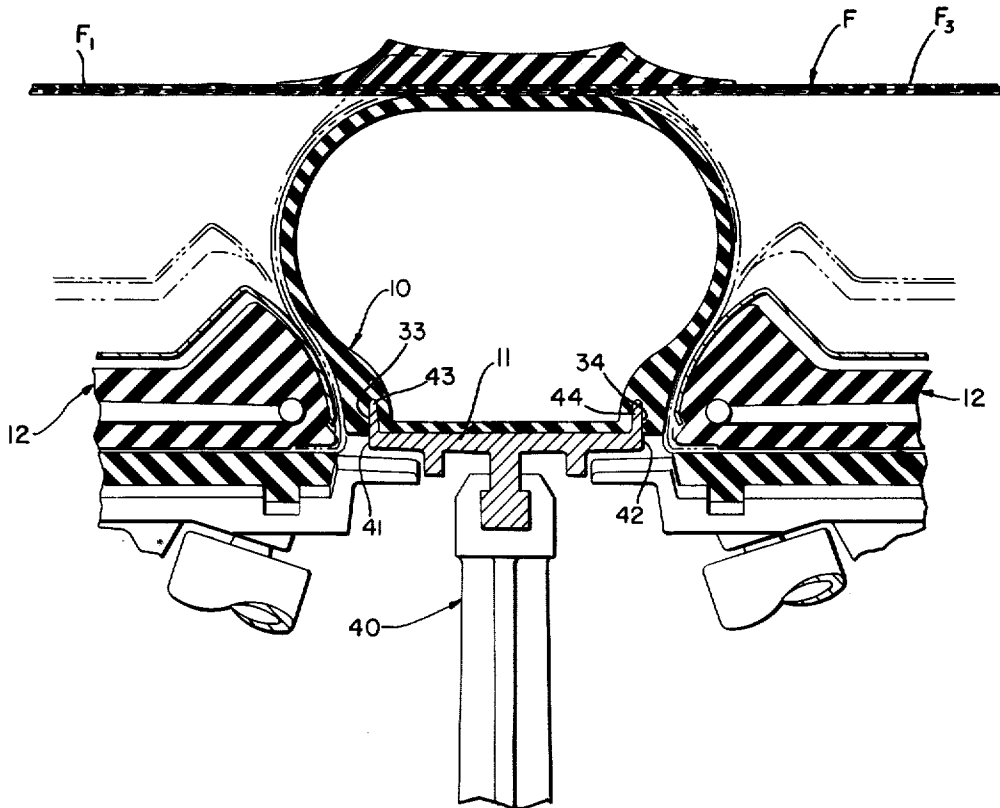
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FIG. 7



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BUILDING CORE FOR PNEUMATIC TIRES

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4 Claims. (Cl. 154-9)

This invention relates to the manufacture of pneumatic tires, and in particular relates to the structure of the building form used in such manufacture.

While the great majority of pneumatic tires are presently built in a flat cylindrical form as a result of application of the fabric plies about a similarly shaped drum, recent improvements have been directed towards the use of a building form that is toroidal in configuration. A building form of this type is illustrated in U.S. Patent 2,503,815, issued on April 11, 1950, to Adolf Frohlich. In this patent two series of gripping arms, each arranged in a circular course on opposite sides of the building form, grip the opposed edges of the fabric ply and then move through a retracting curvilinear path so that the fabric is applied to the building form and assumes the contour thereof. After the requisite number of plies have been applied to form is then collapsed and the tire body removed therefrom.

It has been found that an ordinary inflatable annulus of resilient material will not operate satisfactorily for several reasons.

First, to insure uniformity in production, it is apparent that the toroidal annulus would have to maintain uniform dimensions upon successive inflations. This ideal condition, in addition to being difficult to obtain from a practical standpoint, is impossible to maintain, because the degree of "stretch" in rubber will vary as the use and wear thereof continues, and thus the "growth" that occurs during subsequent usage precludes the obtaining of uniform dimensions.

A second disadvantage is that it has been found that the inflatable former will shift axially during the movement of the gripping arms, with the result that the fabric ply will be unevenly applied over the building form.

It has been found that improved results can be obtained if the inflatable toroidal building form is reinforced with longitudinally non-extensible cord members that are positioned to limit radial and axial expansion of the form upon inflation.

It has been further found that if the building form is shaped to include a complementary portion of a mechanical interlock between the form and the supporting ring for the same, that relative axial movement between these component parts will be obviated.

It accordingly becomes one object of this invention to provide an annular, collapsible building form of resilient material that has the axial and radial expansion thereof limited.

It is a further object of this invention to provide a two-piece building form that includes a collapsible supporting ring and an inflatable annulus received thereon that is characterized by the presence of a mechanical interlock between said component parts.

These and other objects of the invention will become more apparent upon a reading of the following brief specification, considered and interpreted in the light of the accompanying drawings.

Of the drawings:

Figures 1 through 4 are similar sections showing the building form in various stages of construction.

Figure 5 is a sectional view of the form being cured in a mold.

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Figure 6 is a side elevation partly broken away to illustrate the construction of the building form.

Figure 7 is a section illustrating the improved building form in use and further showing the edge portions of the fabric ply being applied against the exterior surface of the same.

Referring now to the drawings, and first considering Figure 7 thereof, it will be seen that the annular building form, generally designated as 10, is mounted upon a collapsible supporting ring 11 so that the edge portions F_1 and F_3 of a fabric ply F can be applied against the bead area of the form 10 as a result of gripping elements 12, 12 moving through a retracting curvilinear path as indicated in chain-dotted lines.

As best indicated in the step-by-step illustrations of Figures 1 to 4, inclusive, the building form 10 is made by the application of a plurality of fabric layers about an annular ring 14 that is preferably collapsible to a reduced diameter to facilitate removal of the form 10 from ring 14 when the form 10 has been completely built up, as will be described.

To the end of effectuating such building up of fabric ply upon the ring 14, the same (ring 14) is shown segmented to define complementary sections 15 and 16 that abut against each other as shown, with ring 17 insuring alignment of the outer peripheral surfaces 18 and 18a and with reinforcing ribs 19, 19 being provided on the internal wall of ring 14 for the purpose of adding rigidity to the same. In like manner, each outer peripheral surface includes a radially outwardly projecting rib 20 that coacts with the building form 10, as will be described.

Turning now to the detailed description of the component parts of the building form 10, it will first be seen from Figure 1 that the innermost radial wall thereof is defined by a thin sheet of fabric ply 21 that is applied against the outer surfaces 18 and 18a of the ring 14, and which is also applied against the exterior surfaces of the ribs 20, 20, so that the opposed edge portions 22, 22 thereof overhang the edges of the ring 14. Superimposed over this first-applied layer 21 adjacent the ribs 20, 20 are resilient annular members 23, 23 that fill in the space between ribs 20, 20 and layer 21 as shown in the drawings. These members 23, 23 are conventionally called "noodles."

The addition of the next two component parts is shown in Figure 2 of the drawings, and accordingly in Figure 2, there is shown a pair of endless resilient rings or "noodles" 24, 24, each of which abuts against the opposite side of ribs 20, 20 so as to be spaced with respect to the "noodles" 23, 23. The rings 24, 24 are opposite hand and taper in cross-section from a thickened base 24a to a thin feathered edge 24b, with the exterior surface 24c thereof having a reverse concave curvature so as to provide a properly shaped bead area on the pneumatic tire that is formed thereof. In addition to the rings 24, 24, Figure 2 also discloses an endless tube 25 of thin-walled resilient material that has a toroidal shape so as to serve as the inflatable portion of core 10 upon passage of air through valve stem 26. This tubular member 25 is shown having the external surface thereof engaging the fabric ply 21, rings 24, 24, fabric ends 22, 22 that have been turned up over bead rings 23, 23. In addition, a fabric ply 27 is attached to the exterior surface of tube 25 in the lower or outer radial area as shown in Figure 3.

Referring next to Figure 4, it will be seen that the fabric ply 27 is encircled by still another fabric ply 28 that has the edge portions 28a, 28b thereof respectively overlapping the edge portions 22, 22 of fabric ply 21, so that the tube 25 is completely surrounded by fabric ply 21, 27 and 28. Additional strength at the critical bead areas may if desired, be provided by positioning fabric plies 29, 30 (see Figure 4) in this area.

It will be noted that while the numerals 21, 27, 28, 29 and 30 have been employed to designate the various fabric plies utilized, that no specific reference has been made to the direction in which the cord members thereof run. It is to be understood that variation in this regard is permissible, both as to the angle of cord disposition and the number and strength of cord members employed.

As will best be shown in Figure 6, fabric ply 21 (including edge portions 22, 22 thereof) has the embedded cord members extending transversely thereof at an acute angle so as to provide a combined resistance against axial and radial expansion of tube 25, which may be devoid of cord members in the preferred embodiment illustrated. Similarly disposed cord members are included in the outer fabric plies 29 and 30; the only illustrated difference being that the acute angle of cord disposition is angularly disposed with respect to the cords in fabric ply 21 to achieve a "crossing" effect that provides multi-directional resistance to expansion.

In fabric ply 27 (see Figure 6) the cords are shown extending longitudinally of the ply member and in this manner these cords serve to limit the radial dimension to which the tube 25 can be expanded. By like token, sidewise or axial expansion of tube 25 is limited by the cords in fabric ply 28 which extends transversely of the ply sheet at approximately right angles to the edge portions thereof. In the preferred embodiment of the invention illustrated, there are no cords in rings 24, 24, although it is apparent that the same could be modified to include the same.

The construction of a building core of the type above described will proceed along the lines above indicated, with fabric ply 21 and beads 23, 23, rings 24, 24, tube 25, and fabric ply 27 being applied as shown in Figure 1, followed by turning up of edge portions 22, 22, and application of fabric plies 28, 29 and 30 as shown in Figures 3 and 4.

When the form 10 has been built as just described, the same, together with supporting ring 14, may be placed in a mold section 31 (see Figure 5) having mating sections 32, 32; and at this time the core 10 may be vulcanized by applying vulcanizing heat thereto in known manner. Upon vulcanization, the ring 14 may be collapsed and removed, and at this time a cured form 10, having circumferentially extending grooves 33, 34 (see Figure 6) will be presented. It is, of course, apparent that the above structure could be reversed with the ring 14 being provided with one or more circumferentially extending grooves, while the annulus would include an equivalent number of circumferentially extending, radially inwardly projecting ribs that would be received in the grooves of the ring member.

This cured form 10 may then be mounted on a collapsible supporting ring 40 of the type shown in Figure 7 of the drawings, and which is similar to ring 14, except that the axial width thereof as defined by spaced faces 41, 42 is narrower than the base portion of form 10 between fabric plies 29 and 30. This narrowed width permits the gripping elements 12, 12 to directly apply the fabric edges F_1 and F_2 against fabric plies 29 and 30.

In use or operation of the form 10 when the same has been mounted on ring 40 with ribs 43, 44 being respectively received in grooves 33, 34 of form 10, the tube 25 will first be filled with air through valve 26, and during such inflation it is manifest that the outer shape and size of the form 10 will be controlled and limited by the fabric plies that envelop the tube 25, with fabric ply 27 preventing excessive radial expansion, fabric ply 28 preventing axial expansion, and fabric plies 21, 29 and 30 offering a combined resistance to axial and radial expansion.

It will be noted that during the application of fabric ply F about the form 10 that the engagement of the ribs 43, 44 within grooves 33, 34 prevents relative axial movement of form 10 with respect to the rings 40. Also, by

spacing the grooves 33, 34 inwardly from the outer radial walls of the form 10, the ribs 43, 43 provide rings of resistance that prevent the tire beads from being improperly positioned.

From the foregoing, it has been shown how a new and improved type of building form has been provided that permits uniformity with respect to tire bodies built thereon. It has also been shown how the improved building form minimizes error in applying fabric, with the result that the overall cost per tire is reduced.

Modifications of the invention may be resorted to without departing from the spirit thereof or the scope of the appended claims.

What is claimed is:

1. A building form for pneumatic tires, comprising; a mounting ring of cylindrical configuration having an axially extending cylindrical surface defined by the outer perimeter thereof; an inflatable annulus having an axially extending, inner perimetric surface receivable on said outer surface of said ring; at least one circumferentially extending rib projecting radially outwardly from said axially extending cylindrical surface of said mounting ring with said rib being located at an axial distance from one axial end of said mounting ring; said inner perimetric surface of said inflatable annulus including at least one circumferential groove; said groove receiving said rib when said inner perimetric surface of said inflatable annulus is received on said outer surface of said mounting ring, whereby relative axial movement is prevented between said mounting ring and said inflatable annulus.

2. A building form for pneumatic tires, comprising; a mounting ring of cylindrical configuration having an axially extending cylindrical surface defined by the outer perimeter thereof; an inflatable annulus having an axially extending, inner perimetric surface receivable on said outer surface of said ring; at least one circumferentially extending groove provided on said axially extending cylindrical surface of said mounting ring with said groove being located at an axial distance from one axial end of said mounting ring; said inner perimetric surface of said inflatable annulus including at least one circumferentially extending radially inwardly projecting rib; said rib being received in said groove when said inner perimetric surface of said inflatable annulus is received on said outer surface of said mounting ring, whereby relative movement is prevented between said mounting ring and said inflatable annulus.

3. The device of claim 1 further characterized by the fact that said inflatable annulus includes an air impervious inflatable resilient toroid; a plurality of fabric plies each having a portion applied directly against the exterior surface of said toroid; said fabric plies having cord members therein; said cord members of at least one fabric ply extending circumferentially of said annulus.

4. The device of claim 1 further characterized by the fact that said inflatable annulus includes an air impervious inflatable resilient toroid; a plurality of fabric plies each having a portion applied directly against the exterior surface of said toroid; said fabric plies having cord members therein; said cord members of at least one fabric ply extending circumferentially of said annulus; said cord members of another said fabric ply extending radially of said annulus.

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