CONVENTION APPLICATION FOR A PATENT

(1) Here insert (in full) Name or Names of Applicant(s).

(2) Here insert Title of Invention.

(3) Here insert number(s) of basic application(s) and name of country or countries, and basic date or dates.

(4) Here insert Name of basic company and signatures of its officers as prescribed by its Articles of Association.

(5) Signatures of Applicant(s).

Here insert (in full) Name or Names of Applicant(s), followed by Address(es).

We Centro Pirelli, Piazza Duca d'Aosta No. 3,
Milan, Italy

hereby apply for the grant of a Patent for an invention entitled: "PROCESS AND APPARATUS FOR STITCHING THE TREAD OF PNEUMATIC TYRES"

which is described in the accompanying complete specification. This application is a Convention application and is based on the application numbered

29 262 A/78

for a patent or similar protection made in ITALY on 31st October, 1978

My address for service is Messrs. Edwd. Waters, Sons, Patent Attorneys, 50 Queen Street, Melbourne, Victoria, Australia.

DATED this 30th day of OCTOBER, 1979

by: Wayne McMaster

(Wayne McMaster)

To:

THE COMMISSIONER OF PATENTS.
COMMONWEALTH OF AUSTRALIA

Patents Act 1952 - 1962

DECLARATION IN SUPPORT OF A CONVENTION APPLICATION FOR A PATENT OR PATENT OF ADDITION

In support of the Convention application by INDUSTRIE PIRELLI SpA

(hereinafter referred to as the applicant) for a Patent for an invention entitled:
"PROCESS AND APPARATUS FOR STITCHING THE TREAD OF PNEUMATIC TYRES"

I, GIORGIO MARIANI, Patent Manager

Industrie Pirelli SpA, Centro Pirelli, Piazza Duca D'Aosta No. 3, 20100 Milan, Italy do solemnly and sincerely declare as follows:

1. I am authorised by the applicant for the patent to make this declaration on its behalf.

2. The basic application(s) as claimed by Section 141 of the Act was/were made in ITALY on the 31st day of October 1978 by INDUSTRIE PIRELLI SpA

3. RINALDO GESSAGA an Italian citizen of Cesano Maderno (Milan) Via Mercantini 13, Italy is/are the actual inventor(s) of the invention and the facts upon which the applicant is entitled to make the application are as follows:-

The Applicant is the assignee of the said RINALDO GESSAGA

4. The basic application(s) referred to in paragraph 2 of this Declaration was/were the first application(s) made in a Convention country in respect of the invention the subject of the application.

DECLARED at Milan, Italy this 5th day of October 1979

INDUSTRIE PIRELLI
Società per Azioni
Servizio Brevetti

(Giorgio Mariani)
Patents Manager
Claim

5. Apparatus for stitching the tread of a pneumatic tyre which comprises a toroidal carcass and a reinforcing structure surrounding the carcass beneath the tread, the reinforcing structure having discontinuities of radial thickness across its axial width, the apparatus comprising at least one composite roller assembly which comprises both at least one brush with filamentary bristles and metal discs coaxially mounted to be rotatable about a common axis, the arrangement being such that the brush or brushes can be brought to exert a stitching action upon the tread between said discontinuities of thickness, or between and on opposite sides of said discontinuities, while the metal discs act on the portions of the width of the tread overlying said discontinuities.
Complete Specification for the invention entitled:

"PROCESS AND APPARATUS FOR STITCHING THE TREAD OF PNEUMATIC TYRES"

The following statement is a full description of this invention, including the best method of performing it known to us:
PROCESS AND APPARATUS FOR STITCHING THE TREAD OF PNEUMATIC TYRES

The present invention relates to a method and apparatus for stitching the tread of a pneumatic tyre, in particular a radial tyre of the kind comprising a radial carcass, a reinforcing or breaker structure formed by a plurality of reinforcing layers or plies having different width and a tread.

As is known, the manufacture of radial tyres involves the main steps of shaping the carcass to a toroidal configuration and applying to it the reinforcing structure and the tread, the tread undergoing so-called "stitching" to cause its adhesion to the underlying reinforcing structure and eliminate air pockets entrapped between the tread and the reinforcing structure.

Conventionally, stitching is performed by metallic discs used in one of two different ways indicated herebelow as "dynamic" stitching and "static" stitching. Dynamic stitching of the tread of a tyre while the carcass is still mounted on a building drum is performed by two metallic discs at first advanced into contact with each other in a plane perpendicular to the axis of rotation of the building drum coinciding with the median plane of the carcass and then, while applying pressure to the tread, displaced on the tread symmetrically towards its opposite axial ends, whilst the drum is rotated.

This solution is not quite satisfactory since the action of the edges of the discs on the tread can cause
deformation or displacement of the underlying reinforcing layers.

Moreover the movement of the discs produces sometimes displacement of the tread with respect to the underlying breaker structure, and/or the carcass.

A further drawback of "dynamic stitching" consists in the fact that the paths followed by the two discs are substantially helicoidal so that certain portions of the tread are not stitched with the consequence of entrapment of air between the tread and the reinforcing structure.

There is a further drawback of dynamic stitching. Due to the plasticity of the rubber before vulcanisation a thickness of the rubber occurs in lateral zones where the stitching operation stops, causing an unavoidable increase in the tread width.

Finally, it is difficult to provide for the synchronus drive of the two discs parallel to the axis of the drum and even if this is achieved there is the drawback that the displacement of the discs involves too much time.

The "Static" stitching is by means of a group of thin metallic discs, the width of the group corresponding to that of the tread, mounted to be rotatable parallel with the axis of the building drum.

By means of a central disc, the stitching of a central portion of the tread arranged astride the median plane of the carcass is first effected, and then
stitching is performed symmetrically with respect to the median plane progressively axially outward by means of a series of disc pairs at increasing distances from the central disc.

This alternative avoids the drawback of dynamic stitching of possible mis-alignment of the tread with respect to the reinforcing structure. However the impact action of the discs on the tread is again experienced, which can lead to damage to the tread and the underlying reinforcing structure.

The progressive stitching of the tread is made difficult by the impossibility of perfectly copying the carcass profile. In particular, "Static" stitching is not suitable for radial tyres in which between a reinforcing layer immediately below the tread and the metallic belt, strips of a different width are inserted at the axial ends of the belt, for example rubber strips comprising reinforcing cords which do not extend beyond the edges of the belt or also lateral strips having reinforcing cords, said strips extending from the axial ends of the belt along the sidewalls to the beads.

In this case, the discs during the stitching step on the central portion of the tread tend to deflect the underlying parts of the reinforcing layers causing lateral annular grooves which entrap air in the spaces between the upper reinforcing layer and the belt edges of the rubber strips or lateral layers.

The subsequent progressive stitching with a pair
of discs of the portions of the tread overlying the rubber strips seals the grooves more tightly making impossible the escape of air entrapped therein giving rise to unacceptable tyres with inadequate adhesion of the tread to the carcass.

Therefore it is clear that "Static" stitching by means of metallic discs is not suitable for a radial tyre having a reinforcing structure which has discontinuities of thickness.

Therefore solutions known up to now do not guarantee an effective stitching of the tread and consequently a primary object of the present invention is to provide a method and apparatus for the stitching of the tread of a tyre which will avoid the above drawbacks.

In accordance with one aspect of the present invention there is provided a method of stitching the tread of a pneumatic tyre onto a toroidal carcass of the tyre to which the tread has been applied over a reinforcing structure which has portions of its axial width of increased radial thickness, the method comprising stitching a central portion of the tread with the aid of first brush means comprising filamentary bristles; subsequent to commencement, but during, the stitching of the central portion stitching lateral portions of the tread which overlie the thickened portions of the reinforcing structure with the aid of second brush means similar to the first brush means while stitching the portions of the tread which lie between
said central and said lateral portions thereof with the aid of metal discs, subsequently stitching said lateral portions of the tread by means of metal discs and finally stitching axial extremities of the tread axially beyond said thickened portions of the reinforcing structure by means of metal discs.

Preferably, while the lateral portions of the strip are being stitched with metal discs to the portions of the reinforcing structure of increased thickness and before the stitching by metal discs of the axial extremities of the tread the latter are deflected toward but not into contact with the carcass by means of third brush means similar to said first and second brush means.

The method of the invention is preferably applied to a tyre which comprises a radial carcass and a reinforcing structure between the carcass and the tread which structure comprises a belt comprising at least two layers of parallel metal cords superimposed so that the cords of one layer cross the cords of the other layer, the cords of the two layers forming similar angles with planes containing the axis of the carcass, and at least two reinforcing strips overlying respective axial end portions of the belt, and preferably the tyre comprises a reinforcing structure which comprises reinforcing strips of cord-reinforced rubber overlying each axial end of the belt of which the radially outer has its cords lying parallel with the equatorial plane of the tyre, which cords are of a kind which will reduce in length when subjected to heat.
The achievement of good results arises from the use of brushes, whose action is less energetic than metal discs, to press the tread onto the central portion of the reinforcing structure which, not having discontinuities of thickness, requires lower stitching pressures, and to press down lateral portions of the tread where, at least to begin with, lower stitching pressure is required in order to permit away of escape for the air thrust outwards by the stitching action of the metallic discs between the central and lateral brushes.

The advantages of the method derive from the non-co-ordinated action of the single filaments of the brushes so that the profile of the extruded green tread is not modified, but there is a stitching action of the tread onto the carcass.

Subsequently, when the formation of air pockets between the tread and the reinforcing structure is excluded, the stitching of the tread portions above the rubber strips is performed by the metallic discs.

In accordance with another aspect of the present invention there is provided apparatus for stitching the tread of a pneumatic tyre which comprises a toroidal carcass and a reinforcing structure surrounding the carcass beneath the tread, the reinforcing structure having discontinuities of radial thickness across its axial width, the apparatus comprising at least one composite roller assembly which comprises both at least one brush with filamentary bristles and metal discs coaxially mounted
to be rotatable about a common axis, the arrangement being such that the brush or brushes can be brought to exert a stitching action upon the tread between said discontinuities of thickness, or between and on opposite sides of said discontinuities, while the metal discs act on the portions of the width of the tread overlying said discontinuities.

The apparatus is preferably adapted for stitching the tread of a radial tyre which comprises a radial carcass and a reinforcing structure surrounding the carcass beneath the tread, the reinforcing structure comprising a metal belt formed by superimposed layers of parallel metal cords, the cords of one layer lying in crossing relation with the cords of the other layer and the cords of the two layers forming similar angles with planes containing the axis of the carcass and at least two strips of rubber of less width than and overlying respective axial ends of the belt, each strip being reinforced by pylon cords parallel with the equatorial plane of the carcass, wherein said at least one composite roller assembly comprises a central brush with filamentary bristles to stitch a central region of the tread, lateral brushes positioned to stitch the portions of the width of the tread which overlie said strips and metal discs interposed between the central and the lateral brushes.

The apparatus preferably comprises a second composite roller assembly comprising two axially spaced-
apart groups of metal discs rotatable about a common axis parallel with the axis of the first composite roller assembly, the discs of each group being of progressively increasing diameter axially outwardly of the second composite roller and arranged to stitch the respective portion of the width of the tread which overlie the strips after these have been acted upon by the first composite roller assembly.

The second composite roller assembly preferably further comprises brushes with filamentary bristles disposed axially outwardly of the groups of metal discs to act on the axial extremities of the tread.

The or each composite roller assembly preferably comprises a shaft on which flanges for the lateral support of annular brushes are selectively insertable to be moveable axially of the shaft. The two composite roller assemblies are preferably mounted on a common stitching bench and means is preferably provided for moving the bench toward a tyre carcass mounted on a building drum. Said moving means preferably comprises two piston-and-cylinder assemblies, the rods of the pistons being pivotally connected to the bench in alignment with the respective axes of rotation of the roller assemblies.

Preferred embodiments of the present invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a partial perspective view of a
tyre of the kind to which the invention can be applied;

Figure 2 shows stitching apparatus in accordance with the invention,

Figure 3 shows the construction of one of the brushes of the apparatus illustrated in Figure 2;

Figure 4 is a sectional elevation of the apparatus illustrated in Figure 2;

Figure 5 shows the apparatus illustrated in Figure 2 mounted on a stitching bench in three positions a), b), and c);

Figures 6, 7, 8 and 9 show the device indicated in Figure 2 in the various sequences of the tread stitching relating to the tyre shown in Figure 1 stripped of the radially outermost reinforcing layer; and

Figure 10 shows an alternative embodiment of the stitching device according to the invention used for stitching a tread comprising circumferential grooves.

The present invention is concerned with the manufacture of radial tyres having reinforcing or breaker structures differing from one another both in respect of the number and the dimensions of the layers making up the structure.

Figure 1 shows an example of such a tyre.
The pneumatic tyre 1 comprises a radial carcass 2, a tread 3 and a reinforcing or breaker structure 4 placed between the tread and the carcass.

The reinforcing structure 4 is constituted, from the inside outward in the radial direction, by a metallic belt formed by two layers 5 and 6 of parallel metallic cords with the cords of one layer crossing the cords of the other layer, lateral strips 7 and 8 made of rubber and reinforced by nylon cords parallel to the equatorial plane of the carcass, each strip 7 and 8 being superimposed on one axial end portion of the metal belt and covering about 20% of the belt width and by two layers 9, 10 of nylon cords parallel to the equatorial plane of the carcass, the width of each layer 9, 10 being substantially equal to that of the belt 5, 6.

What it is desired to show is the fact that in the tyre 1 of Figure 1 in the two planes parallel to the equatorial plane of the carcass at the axially innermost edges 11, 12 of the strips 7, 8, there is a discontinuity of thickness of the reinforcing structure and in particular the structure is of reduced thickness between the axially inner edges of the strips 7, 8.

Tyres having such discontinuities of thickness, the tread of which were stitched by means of metallic discs according to known processes, had air pockets formed under the grooves made by the stitching discs in the radially outermost strips 9, 10, in the regions of the edges 11, 12.

A further tyre to which the invention can be
applied, is one identical to that shown in Figure 1 except that the layers 9,10, of nylon cords are omitted.

Also in this case, the thickness of the rubber strips overlying the axial ends of the metallic belt will, in the conventional stitching of the tread solely by means of metallic discs, produce grooves entrapping air (see for example the air pockets A, B in Figure 6).

The invention overcomes this drawback and it will now be described with reference to the manufacture of the radial tyre of the second embodiment.

The device 13 (Figure 2) for stitching the tread of a pneumatic tyre having the carcass already shaped to a toroidal configuration comprises, first and second stitching assemblies 14, 15 each formed by a composite system of brushes made of synthetic plastics or natural bristles, or metallic filament bristles and by metallic discs mounted to rotate respectively around the axes of first and second rotatable shafts 16,17, and a driving mechanism of any type suitable to bring the two stitching assemblies in a predetermined sequence onto the tread separately or also contemporaneously.

The stitching assemblies and the related driving mechanism are provided on a stitching bench for the tread indicated at 18, in Figure 5.

The first stitching assembly 14 is constituted by a central brush 19 the axial width of which is less than that of that portion of the tread which overlaps the metallic belt between the axially inner edges of the strips
7 and 8, by two lateral brushes 20, 21 the axial widths of which are such that they are arranged to stitch at least a part of each lateral portion of the tread overlying the strips 7,8 and by two metallic discs 22, 23 placed between the central brush 19 and the lateral ones 20, 21 and having a diameter and axial width such that they are able to concentrate pressure on the tread portion adjacent the strips 7,8.

The brushes and the metallic discs are located between two flanges 24, 25.

The second stitching assembly 15 is formed by first and second groups of metallic discs 26, 27, and by two lateral brushes 28, 29.

Each group of metallic discs 26 or 27 comprises discs which are of progressively increasing diameter in the axially outward direction arranged to stitch those portions of the tread overlying the strips 7,8 subsequent to the operation of the first assembly 14 as will be explained below.

The lateral brushes 28, 29 have cylindrical surfaces designed to bring the axial ends of the tread to the toroidal carcass.

The brushes, both of the first and of the second assembly made, for example, by securing filaments in a channel 30 formed by a metallic tape 30' which is then helically wound, as shown in Figure 3, and then arranged on a rotatable hub, as shown in Figure 4, which shows the first stitching assembly 14.
The same Figure 4 illustrates the means for varying the number and the composition of the rollers on the shaft and for relating the brushes and discs to form the desired stitching assembly.

Said means comprises two flanges 24, 25 provided with cylindrical bases 32, 33 adapted to support the tapes 30' of the brushes 20, 21 and abutting at their free end surfaces 34, 35 parts 36, 37 of the discs 22, 23 which are thus located against abutment surfaces or steps 38, 39 of the hub 31. Said flanges have lateral surfaces 40, 41 adapted to engage the end parts 42, 43 of the brushes.

These means comprise further on in each flange and on the hub threaded holes 44, 44' to receive appropriate locking screws 45.

The driving mechanism for the displacement of the stitching assemblies can be constituted by piston-and-cylinder assemblies adapted to apply forces to each assembly 14 or 15.

In an embodiment by way of example the stitching assemblies are mechanically independent from each other and the movement of one assembly leaves the other in an unchanged position.

In the preferred embodiment of the stitching bench 18, the first and second assemblies 14, 15 are rigidly connected together by means of two levers 46, 47 (Figure 2) which in their turn rotate about a connecting pivot 48 through the driving mechanism.
The shape of the levers, the association of the levers to the frame 49 (Figure 5) of the stitching bench and the driving mechanism are all as described in more detail in the Patent Specification No. 1 429 885. It is considered sufficient to say, in relation to Figure 5 that the driving mechanism comprises two double-acting cylinders 50, 51, pivoted to the frame 49, whose stems 52, 53 are pivoted respectively to a connecting pin 54 of the ends 55 of the two L-shaped levers and to a block 56 where a second pin connecting the levers coincides with the second stitching assembly.

The block 56 permits moreover a rigid connection of the levers with the frame 49 by means of a strut 57 able to support the weight of the assembly.

The thrust exerted by the stem 52, 53 in the direction indicated by the arrows in Figure 5, determines the desired and pre-determined position of the two stitching assemblies with respect to the building drum 58.

The operation of the apparatus will now be explained referring to Figures 6, 7, 8 and 9.

In Figure 6, the tyre 1 is shown after alteration of the shape of the carcass from the cylindrical to the toroidal, subsequent to the application of the metallic belt and of the strips 7, 8 on the toroidal carcass and to further expansion of the carcass to reach a final toroidal configuration.

These operations and the means to carry them out are already known.
For example, the toroidal configuration of the carcass can be produced on a drum provided with an expansible membrane, or without a membrane, by letting in air under pressure inside the cavity formed by the innermost layer of the carcass shaped as a cylindrical sleeve.

The tread is then applied around the belt and the strips 7,8 and the ends of the tread strip are spliced.

From now on the stitching of the tread is carried out as follows:

- the driving mechanism of the bench 18 is started so as to advance the central brush of the first stitching assembly 14 into contact with and to exert pressure on the tread, as schematically shown in Figure 5 (position a). During this step the building drum is rotated and the filaments of the central brush apply uniform pressure on the central region of the tread to reach the configuration represented in Figure 6, i.e. so that a central portion T of the tread is adhered to the underlying belt portion but the remainder of the tread makes little or no contact with the strips 7 and 8.

As clearly shown in Figure 6, the stitching action of the central brush produces annular pockets A and B leaving, however, a way of escape for the air between the tread inner surface and the outer surfaces of the strips 7 and 8.

- Subsequently, the pressure of the fluid in the first cylinder 50 of the driving mechanism is increased so as to increase the pressure of the whole first stitching
assembly 15 on the tread and the second cylinder 51 is actuated so as to bring the second stitching assembly nearer to the building drum see Figure 5,(b), and to bring the brushes of the second assembly to press with a light pressure on corresponding portions of the tread. During this step, whilst the filaments of the central brush of the first assembly definitely stitch the tread central portion, with pressures higher than those employed in the first step, the contiguous metallic discs 22 and 23 acting with a continuous and concentrated stitching pressure at first reduce and then completely eliminate the annular pockets A and B constraining the air still contained therein to escape between the tread and the strips 7 and 8 (Figure 7). At the same time, the lateral brushes of the first and second stitching assemblies 14, 15 apply uniform pressures on portions of the width of the tread over the strips 7 and 8, (Figures 7 and 8). The action of the lateral brushes is incremental since fluid pressure in the cylinder is increased little by little so as to allow the stitching of the tread on the strips 7 and 8 with a force sufficient to give rise to a partial adhesion, but still leaving a possibility for the escape of air still contained therein.

In a further and successive step, the driving mechanism moves the first stitching assembly 14 away from the tread and increases the pressure exerted on the tread by the second stitching assembly (see Figures 5, 6). During this
step whilst the metallic discs 26, 27 (Figure 9) apply a continuous strcrg pressure to the portions of the width of the tread over the strips 7, 8 causing complete adhesion, the lateral brushes 28, 29 bring the axial ends of the tread nearer to the toroidal carcass. Finally the two stitching assemblies 14, 15 are moved away from the building drum and the stitching of the sloping axial extremities of the tread is completed by means for example, of metallic discs (not shown) mounted on the stitching bench 18 or an equivalent device (not shown). A further application of the stitching bench 18 according to the invention, in connection with the stitching of a tread in which in the uncured state there are grooves or ribs, will now be described.

Generally, as is known, the tread pattern is obtained in the vulcanisation mould through the radial movement of sectors of the mould on whose inner surfaces then are projections corresponding to the grooves it is desired to impress in the uncured tread. In this case the radial displacement towards the interior of the mould of the sectors causes a certain displacement of the tread compound and in cases in which the tread is constituted by different compounds there could be undesirable thickening of a particular compound in zones where this was not intended. In order to limit this phenomenon, sometimes grooves of limited depth are already provided in the uncured tread and the stitching bench according
to the invention is in fact suitable for stitching a tread of this type. This bench comprises two further stitching assemblies connected to each other by means of a driving mechanism similar to that shown in Figure 5 and the two stitching assemblies differ from the one already described only in the dispositions of the various elements, i.e. brushes and metallic discs, which are assembled together according to the number and the position of the grooves in the tread.

For example, for stitching a tread having two circumferential grooves symmetrically disposed with respect to and near the equatorial plane of a tyre which has a reinforcing structure without discontinuities placed under the tread, the preferred embodiment of the bench comprises:

- a first stitching assembly 60 (Figure 10) having two metallic discs 61, 62 positioned to stitch the bases of the grooves in the tread and two lateral brushes 63,64 to stitch the remaining central portion of the tread on opposite sides of the grooves and a second stitching assembly 65 having two lateral brushes 66,67 to bring the axial extremities of the tread toward the carcass and stitch them.

The operation of the bench of Figure 10 takes place substantially in the sequence indicated by the three positions a, b, c of Figure 5.

In the first step a), through the two metallic discs 61, 62 the stitching of the bases of the tread
grooves on the underlying reinforcing structure is obtained.

The use only of brushes would not ensure the elimination of air pockets between the tread and the reinforcing structure, since the bristles of the brushes would not apply adequate pressure to the tread adjacent the edges of the strip 7,8 or over the grooves in the reinforcing structure.

The advantage common to all embodiments of the present invention is obtained from the use of brushes, made of filaments oriented radially with respect to their supports able to apply at first a light pressure which will not deform the components to be stitched and subsequently able to level the tread eliminating possible mis-shaping due for example to the different rates of cure of the various components.

The same brushes are moreover moveable by piston-and-cylinder assemblies so as subsequently to develop higher pressures in order to finish the stitching operation.

Generally the composite roller comprising brushes made of filaments and metallic discs, is applied to radial tyres having belts of complex shape, in particular belts in which the presence of rubber strips constitute an obstacle for the escape of air.

Moreover since the bristles of the brushes easily fit the tread profile stitching is practically unaffected by the different cure rates of the tread strips and to variations of room temperature so that the operator is
not obliged to change the position of the stitching bench to accommodate variations in the shape of the tyres.

In the past when only metallic discs were used their rigid peripheries were unable to adapt to variations of the tread profile caused by different cure rates which obliged the operator at particular times to modify the position of the stitching bench.

Consequently, in both the "static" or "dynamic" stitching it was not only practically impossible to pre-determine once and for all the position of the metallic pressing rollers, but more seriously the correction of the bench position was made by the operator and therefore the stitching depended more or less on the sensitivity and the experience of the operator.

Consequently, the invention constitutes an improvement over all the stitching techniques known up to now and the very good results clearly appear at the end of the stitching since the splices of the various elements under the tread can be seen externally of the tyre. This is a clear sign of the effectiveness of the stitching operation described.
The claims defining the invention are as follows:-

1. A method of stitching the tread of a pneumatic tyre onto a toroidal carcass of the tyre to which the tread has been applied over a reinforcing structure which has portions of its axial width of increased radial thickness, the method comprising stitching a central portion of the tread with the aid of first brush means comprising filamentary bristles; subsequent to commencement, but during, the stitching of the central portion stitching lateral portions of the tread which overlie the thickened portions of the reinforcing structure with the aid of second brush means similar to the first brush means while stitching the portions of the tread which lie between said central and said lateral portions thereof with the aid of metal discs, subsequently stitching said lateral portions of the tread by means of metal discs and finally stitching axial extremities of the tread axially beyond said thickened portions of the reinforcing structure by means of metal discs.

2. A method as claimed in claim 1 wherein while the lateral portions of the strip are being stitched with metal discs to the portions of the reinforcing structure of increased thickness and before the stitching by metal discs of the axial extremities of the tread the latter are deflected toward but not into contact with the carcass by means of third brush means similar to said first and second brush means.

3. A method as claimed in either preceding claim when applied to a tyre which comprises a radial carcass and
a reinforcing structure between the carcass and the tread which structure comprises a belt comprising at least two layers of parallel metal cords superimposed so that the cords of one layer cross the cords of the other layer, the cords of the two layers forming similar angles with planes containing the axis of the carcass, and at least two reinforcing strips overlying respective axial end portions of the belt.

4. A method as claimed in claim 3 when applied to a tyre which comprises a reinforcing structure which comprises two reinforcing strips of cord-reinforced rubber overlying each axial end of the belt of which the radially outer has its cords lying parallel with the equatorial plane of the tyre, which cords are of a kind which will reduce in length when subjected to heat.

5. Apparatus for stitching the tread of a pneumatic tyre which comprises a toroidal carcass and a reinforcing structure surrounding the carcass beneath the tread, the reinforcing structure having discontinuities of radial thickness across its axial width, the apparatus comprising at least one composite roller assembly which comprises both at least one brush with filamentary bristles and metal discs coaxially mounted to be rotatable about a common axis, the arrangement being such that the brush or brushes can be brought to exert a stitching action upon the tread between said discontinuities of thickness, or between and on opposite sides of said discontinuities, while the metal discs act on the portions of the width of the tread over-
lying said discontinuities.

6. Apparatus as claimed in claim 5 adapted for stitching the tread of a radial tyre which comprises a radial carcass and a reinforcing structure surrounding the carcass beneath the tread, the reinforcing structure comprising a metal belt formed by superimposed layers of parallel metal cords, the cords of one layer being in crossing relation with the cords of the other layer and the cords of the two layers forming similar angles with planes containing the axis of the carcass and at least two strips of rubber of less width than and overlying respective axial ends of the belt, each strip being reinforced by nylon cords parallel with the equatorial plane of the carcass, wherein said at least one composite roller assembly comprises a central brush with filamentary bristles to stitch a central region of the tread, lateral brushes positioned to stitch the portions of the width of the tread which overlie said strips and metal discs interposed between the central and the lateral brushes.

7. Apparatus as claimed in claim 6 and comprising a second composite roller assembly comprising two axially spaced-apart groups of metal discs rotatable about a common axis parallel with the axis of the first composite roller assembly, the discs of each group being of progressively increasing diameter axially outwardly of the second composite roller and arranged to stitch the respective portions of the width of the tread which overlie the strips after these have been acted upon by the first composite roller assembly.
8. Apparatus as claimed in claim 7, wherein the second composite roller assembly further comprises brushes with filamentary bristles disposed axially outwardly of the groups of metal discs to act on the axial extremities of the tread.

9. Apparatus as claimed in any one of claims 5 - 8 wherein the or each composite roller assembly comprises a shaft on which flanges for the lateral support of annular brushes are selectively insertable to be movable axially of the shaft.

10. Apparatus as claimed in claim 7 or claim 8, or claim 9 as appendant to claim 7 or claim 8, wherein the two composite roller assemblies are mounted on a common stitching bench and wherein means is provided for moving the bench toward a tyre carcass mounted on a building drum.

11. Apparatus as claimed in claim 10, wherein said moving means comprises two piston-and-cylinder assemblies, the rods of the pistons being pivotally connected to the bench in alignment with the respective axes of rotation of the roller assemblies.

12. A pneumatic tyre made by the method or by means of the apparatus claimed in any one of the preceding claims.

13. A method as stitching the tread of a pneumatic tyre substantially as herein described with reference to the accompanying drawings.

14. Apparatus for stitching the tread of a pneumatic tyre substantially as herein described with reference to and as shown in the accompanying drawings.