PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION

Improvements relating to the Reconditioning of Pneumatic Tyres

We, HENRY SIMON LIMITED, a Company incorporated under the Laws of Great Britain, of Bird Hall Lane, Cheadle Heath, Stockport, Cheshire, and GEOFFREY BROTHERTON LETT, British Subject, of the Company's address, do hereby declare the nature of this invention to be as follows:—

This invention relates to the retreading of pneumatic tyres and has for its object to provide improved and simplified apparatus for this process by means of which a large range of tyre sizes may be treated in the one apparatus.

Generally speaking worn casings of pneumatic tyres are reconditioned by one or other of the following methods according to the condition of the casing, namely:—

(a) Top-capping, in which the tread or road engaging crown surface only of the tyre is replaced.

(b) Re-capping, in which the tread and part of the shoulder and sidewall rubber are replaced, a foundation of the original rubber being left on the carcass of the tyre in the region of the shoulders.

(c) Re-treading, in which all the tread, shoulder and part of the sidewall rubber is removed and replaced with new rubber.

(d) Bead to bead re-moulding, in which all the tread, shoulder and sidewall rubber is removed and replaced.

The last mentioned method requires one complete mould for each size of tyre but with the other three methods as hitherto practised it is possible to treat a range of tyre sizes in one mould by using a series of different sized matrices and spacer rings.

Such conventional re-treading moulds usually have the main body of the mould formed of cast steel with steam cavities or electric elements for heating, the mould being split into two halves circumferentially, either hinged to one another or completely separate and brought together by a centre screw device or in some cases the mould body is split transversely into two or more segments either hinged together or brought together by other suitable means.

The matrices are usually made of aluminium alloy divided into sections corresponding to the sections of the main body, the matrices forming the complete moulding surfaces for the tread, shoulder and part of the sidewall of the tyre and being shaped with a contour similar to that of a new tyre mould.

In all conventional moulds the matrices are secured to the main body of the mould before the tyre is placed therein and become an integral part of the mould. Each matrix, however, even with the use of spacer rings to allow for tyres of greater width will accommodate only a very limited number of tyre sizes with the result that frequent changing of matrices is necessary if a large range of tyre sizes is to be treated with consequent loss of production, man power and heat. Moreover, the whole assembly is heavily constructed, costly, consumes a comparatively large amount of steam or electric current and has a very restricted productive capacity.

The present invention which has for its object to obviate the difficulties and disadvantages of existing apparatus is based upon the observation that for all practical purposes the shoulder portion of the tyre may be taken as involving a straight line section and as usually it is only the tread and shoulder portions of the tyre that are renewed there is no advantage gained in using matrices to make contact with the curved part of the sidewall and in fact there is a distinct disadvantage in such an arrangement since more of the tyre is heated than is necessary and frequently the edge of the matrix marks the sidewall of the tyre.

According to our invention we form our re-treading mould of three separate members, namely a tread ring in the form of a light flexible annular band, and two shoulder plates, each of which is of annular form with its inner surface of straight line form such that when a

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tyre with tread ring attached thereto is inserted in place between the side plates the straight line walls of the latter converge towards the tread ring and a mould formed of three such parts (to each of which heat is applied by suitable means) is capable of accommodating a very large range of tyre sizes.

Further features of the invention will be apparent from the description given hereafter.

In carrying our invention into effect in one convenient manner we form the tread ring as a light flexible annular band constructed of light gauge steel sheet or other suitable material with the tread pattern forming members contained therein as an integral part of the ring or secured thereto by suitable means. The ring is heated by a steam coil secured upon its outer surface or by other suitable means and the edges of the ring are preferably reinforced by strengthening bands secured to the outer surface of the ring. The width of the ring is equal to the desired width of the road engaging crown surface of the tread and its internal diameter is smaller than that of the tyre to be re-treaded when in its normal inflated condition, preferably approximately equal to the diameter of the inflated tyre when in contact with the road. The tread ring is fitted to the tyre before the latter is placed between the shoulder plates constituting the remaining portions of our improved mould and for this purpose it is necessary to reduce the overall diameter of the tyre by spreading the beads apart by suitable means. Each of the shoulder plates of the mould may be cast in steel or aluminium alloy with steam heating cavities or other suitable heating means therein and the inner straight line surface of the annular shoulder plates may have convenient pattern forming members inscribed or secured thereon or alternatively the plates may be cast in solid form and heated by electric elements, heating coils or other suitable means secured upon their outer surfaces or they may be rolled or pressed from light gauge sheet metal and suitably heated by any of the means above referred to.

In operation the tread ring is fitted to the tyre and a curing tube or inflatable air bag is fitted in the tyre which is then mounted on a suitable rim. This assembly is then placed centrally between the two shoulder plates which are brought together by suitable means until their inner surfaces make contact with the edges of the tread ring in which condition the whole unit is secured by suitable means and in this way the tread ring and shoulder plates form a mould round the tread and shoulders of the tyre, whilst the remainder of the tyre is free and does not make contact with any heated surface.

One convenient method of assembling the members of the mould in one unit is to secure one shoulder plate in a horizontal position to a suitable press or table bottom and the other shoulder plate to the press or table top which can be suspended by a wire rope passing over a pulley and counterweighted. A centre screw fixed to the table passes through a screwed bush in the centre of the table bottom thus enabling the shoulder plates to be brought into engagement with the edges of the tread ring and the whole secured into one unit.

A centring device may be fitted to the table to ensure that the tread ring and tyre assembly are placed centrally between the shoulder plates and are held there during vulcanisation, one convenient method of doing this being by means of a sleeve fixed to the centre bush of the table bottom of sufficient length to project above the bottom of the tyre rim when it is in position in the mould and the tyre rim is fitted with a centre collar having an inside diameter just sufficient to allow it to slide over the sleeve, thus automatically centring the tyre and rim assembly on the bottom shoulder plate.

The screw of the table top should be of a diameter to make a slide fit in the sleeve which thus acts as a guide and centres the top shoulder plate in relation to the tyre and bottom table.

By means of our invention we are able to employ tread rings of different diameters to suit different sizes of tyres with the one set of shoulder plates so that a large range of tyre sizes can be effectively dealt with and since in each case the tread ring is fitted to the tyre before the latter is placed between the shoulder plates any number of tyres may have rings fitted ready for vulcanising so that there is no delay and any size of tyre can follow any other in the process since there is no changing of matrices required.

Dated this 12th day of August, 1946.
MARKS & CLERK.

COMPLETE SPECIFICATION

Improvements relating to the Reconditioning of Pneumatic Tyres

We, HENRY SIMON LIMITED, a Company incorporated under the Laws of Great Britain, of Bird Hall Lane, Cheadle Heath, Stockport, Cheshire, and

GEOFFREY BROTHERTON LETT, British Subject, of the Company's address, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the reconditioning of pneumatic tyres and has for its object to provide improved and simplified apparatus for this process by means of which a large range of tyre sizes may be treated in the one apparatus.

Generally speaking worn casings of pneumatic tyres are reconditioned by one or other of the following methods according to the condition of the casing, namely:—

(a) Top-capping, in which the rubber of the tread or road engaging crown surface only of the tyre is removed and replaced by new rubber.

(b) Re-capping, in which all or part of the rubber of the road engaging crown surface, part of the rubber of the shoulder regions, and sometimes part of the rubber of the sidewall regions is removed and replaced by new rubber, a foundation of the original rubber being left on the carcass in the shoulder regions, and all or part of the original rubber being left in the sidewall regions.

(c) Re-treading, in which the rubber of the road engaging crown surface, the rubber of the shoulder regions, and sometimes the rubber of part of the sidewall regions, is removed entirely from the carcass down to the carcass plies and replaced by new rubber.

(d) Bead to bead re-moulding, in which all the rubber of the road engaging crown surface, of the shoulder regions, of the sidewall regions and of the reinforced regions, is removed and replaced by new rubber.

The last-mentioned method requires one complete mould for each size of tyre but with the other three methods as hitherto practised it is possible to treat a range of tyre sizes in one mould by using a series of different sized matrices and spacer rings, or in some cases a limited range of sizes can be treated by using tread rings of different thicknesses.

Such conventional moulds usually have the main body of the mould formed of cast steel with steam cavities or electric elements for heating, the mould being split into two halves circumferentially, either hinged to one another or completely separate and brought together by a centre screw device or in some cases the mould body is split transversely into two or more segments either hinged together or brought together by other suitable means.

The matrices are usually made of aluminium alloy divided into sections corresponding to the sections of the main body, the matrices forming the complete moulding surfaces for the road engaging crown surface, shoulder regions and part of the sidewall regions of the tyre and being shaped with a contour similar to that of a new tyre mould.

In conventional moulds the matrices are secured to the main body of the mould before the tyre is placed therein and become an integral part of the mould. Each matrix, however, even with the use of spacer rings to allow for tyres of greater width will accommodate only a very limited number of tyre sizes with the result that frequent changing of matrices is necessary if a large range of tyre sizes is to be treated, with consequent loss of production, man power and heat. Moreover, the whole assembly is heavily constructed, costly, consumes a comparatively large amount of steam or electric current and has a very restricted productive capacity.

The present invention which has for its object to obviate the difficulties and disadvantages of existing apparatus is based upon the observation that for all practical purposes the contour of the rubber of the shoulder regions of the tyre may be taken as involving a straight line section and as usually it is only the road engaging crown surface and shoulder regions and a part of the sidewall regions of the tyre that are renewed there is no advantage gained in using matrices to make contact with that part of the sidewall regions that is not renewed and in fact there is a distinct disadvantage in such an arrangement since more of the tyre is heated than is necessary and frequently, due to the impossibility of ensuring a perfect fit between the tyre and the matrix, the edge of the matrix marks the sidewall of the tyre.

The invention consists in apparatus for the reconditioning of tyres comprising a circular tread ring in the form of an annular band, two shoulder matrices of identical form having internal surfaces of the form of a frustum of a cone for engaging the shoulders of a tyre, means for supporting a tyre with the tread ring attached thereto, means for supplying heat to the two shoulder matrices and the tread ring, adjustable means for supporting the shoulder matrices on a common axis with and in contact with the tread ring and the said tyre and on either side thereof, the apices of the cones being remote from one another such that for tyres of different widths and diameters,

having appropriate sizes of tread rings attached thereto, the shoulder matrices are adjustable to contact, with the said internal conical surfaces thereof, the edges of tread rings of different widths and diameters.

Further features of the invention will be apparent from the description given hereafter.

The accompanying drawings illustrate one convenient form of apparatus in accordance with the invention.

Figure 1 is a cross-section of a tyre illustrating what is meant herein by the expressions "road engaging crown surface", "shoulder regions", "side-wall regions" and "reinforced regions".

Figures 2, 3 and 4 are views showing one form of shoulder matrix or plate, Figure 2 being a part sectional plan on the line A—A of Figure 3 which is a section on the line B—B of Figure 2, while Figure 4 is an enlarged section through a part of the shoulder plate.

Figure 5 is a part sectional elevation of the complete apparatus showing a tyre in place therein.

In carrying the invention into effect in one convenient manner the tread ring a is formed as a light flexible annular band constructed of light gauge steel sheet or other suitable material with the tread pattern forming members a^1 ~~con~~ contained therein as an integral part of the ring or secured thereto by suitable means. The ring is heated by a steam coil a^2 secured upon its outer surface or by other suitable means applied thereto thereby attaining vulcanising temperature within a few minutes. The edges of the ring are preferably reinforced by strengthening bands a^3 secured to the marginal edges of the ring. The width of the ring is equal to the desired width of the road engaging crown surface of the tyre and its internal radius is smaller than that of the tyre to be re-treaded when in its normal inflated condition, preferably approximately equal to the radius of the inflated tyre at the point of contact with the ~~road~~. The tread ring is fitted to the tyre before the latter is placed between the shoulder plates constituting the remaining portions of the improved mould and for this purpose it is necessary to reduce the overall diameter of the tyre by spreading the beads apart by suitable means.

Alternatively the tread ring a may be constructed as a non-flexible continuous annular band or be built up from segments secured together to form a non-flexible annular band.

Each of the shoulder matrices or plates b of the mould are of identical form and may be cast in steel or aluminium alloy with steam heating cavities b^1 or other suitable heating means therein and the inner straight line surface b^2 of the plate may have convenient pattern forming members inscribed or formed therein or secured thereon, one convenient pattern forming surface being shown enlarged in Figure 4. Alternatively the plates may be cast in solid form and heated by electric elements, heating coils or other suitable means secured upon their outer surfaces or they may be rolled or pressed from light gauge sheet metal and suitably heated by any of the means above referred to. The outer surfaces of the shoulder plates may be lagged with suitable heat insulating material indicated at c.

In constructing the tread ring it is preferred that the cross section be flat in order to vulcanise the tread rubber in the approximate position it assumes when in contact with the road under load, but to reduce the volume of rubber at the shoulder regions the outer ribs of the tread are sloped by reducing the diameter of the outer edges of the ring to less than the diameter of the remainder of the ring.

Alternatively, the cross section of the ring may be curved with a radius approximately half-way between that of the inflated tyre ~~tha~~ free from load, and the radius of the tread when in contact with the road under load.

In operation the tread ring a is fitted to the tyre d (Figure 5) and a curing tube or inflatable air bag e is fitted in the tyre which is then mounted on a suitable rim f. This assembly is then placed centrally between the two shoulder plates which are brought together by suitable means until their inner surfaces make contact with the edges of the tread ring in which condition the whole unit is secured by suitable means and in this way the tread ring and shoulder plates form a mould round the road engaging crown surface and those parts of the shoulder and side wall regions which are to be renewed whilst the remainder of the tyre is free and does not make contact with any heated surface.

One convenient method of assembling the members of the mould in one unit is shown in Figure 5. One shoulder plate is secured in a horizontal position to a suitable press or table bottom g and the other shoulder plate to the press or table top h which can be suspended by a wire rope h^1 passing over a pulley h^2 and counterweighted at h^3. A centre screw i passing through a hole in the table top is adapted to pass through a threaded bush k in the centre of the table bottom thus by rotating the screw enabling the shoulder plates to be brought into engagement with the edges of the tread ring and the whole

secured into one unit, the inner straight surfaces of the shoulder plates converging towards the tread ring lying between them.

A centring device is fitted to the table to ensure that the tread ring and tyre assembly are placed centrally between the shoulder plates and are held there during vulcanisation, one convenient method of doing this being by means of a sleeve *l* fixed to the centre bush *k* of the table bottom of a sufficient length to project above the bottom of the tyre rim *f* when it is in position in the mould and the tyre rim is fitted with a centre collar *f*¹ having an inside diameter just sufficient to allow it to slide over the sleeve *l* thus automatically centring the tyre and rim assembly on the bottom shoulder plate.

The screw *i* should be of a diameter to make a slide fit in the sleeve *l* which thus acts as a guide and centres the top shoulder plate in relation to the tyre and bottom table.

By means of the invention it is possible to employ tread rings of different sizes to suit different tread widths and diameters of tyres with the one set of shoulder plates so that a large range of tyre sizes can be effectively dealt with, and since in each case the tread ring is fitted to the tyre before the latter is placed between the shoulder plates any number of tyres may have rings fitted ready for vulcanising, and any size of tyre can follow any other in the process without causing delay since there is no changing or pre-heating of heavy matrices required.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Apparatus for the re-conditioning of tyres comprising a circular tread ring in the form of an annular band, two shoulder matrices of identical form having internal surfaces of the form of a frustum of a cone for engaging the shoulders of a tyre, means for supporting a tyre with the tread ring attached thereto, means for supplying heat to the two shoulder matrices and the tread ring, adjustable means for supporting the shoulder matrices on a common axis with and in contact with the tread ring and the said tyre and on either side thereof, the apices of the cones being remote from one another such that for tyres of different widths and diameters, having appropriate sizes of tread rings attached thereto, the shoulder matrices are adjustable to contact, with the said internal conical surfaces thereof, the edges of tread rings of different widths and diameters.

2. Apparatus according to Claim 1 in which the tread ring is a light flexible annular band.

3. Apparatus according to Claim 1 in which the tread ring is constructed as a non-flexible continuous annular band, or as segments secured together to form a non-flexible annular band.

4. Apparatus according to Claim 1 in which the shoulder matrices are secured respectively to upper and lower press or table parts one of which is secured to a central screw adapted to co-operate with a central threaded bush in the other part.

5. Apparatus according to Claim 4 comprising a rim on which the tyre to be treated is mounted, a centre collar secured to one side of said rim and of an internal diameter such that it will just fit over a sleeve secured to the threaded bush and through which sleeve the centre screw passes to engage said bush.

6. Apparatus according to Claim 1, 3 or 4 in which the tread ring is of a radius slightly smaller than that of the tyre with which it is used when in its normal inflated condition so that the overall diameter of the tyre must be reduced to enable the tread ring to be fitted thereto.

7. Apparatus according to Claim 1, 3 or 4 in which the tread ring is of a radius smaller than that of the tyre with which it is used when in its normal inflated condition by approximately the amount by which the tyre is reduced in radius at its point of contact with the road when under load.

Dated this 22nd day of July, 1947.

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secured into one unit, the inner straight surfaces of the shoulder plates converging towards the tread ring lying between them.

A centring device is fitted to the table to ensure that the tread ring and tyre assembly are placed centrally between the shoulder plates and are held there during vulcanisation, one convenient method of doing this being by means of a sleeve *l* fixed to the centre bush *k* of the table bottom of a sufficient length to project above the bottom of the tyre rim *f* when it is in position in the mould and the tyre rim is fitted with a centre collar *f*¹ having an inside diameter just sufficient to allow it to slide over the sleeve *l* thus automatically centring the tyre and rim assembly on the bottom shoulder plate.

The screw *i* should be of a diameter to make a slide fit in the sleeve *l* which thus acts as a guide and centres the top shoulder plate in relation to the tyre and bottom table.

By means of the invention it is possible to employ tread rings of different sizes to suit different tread widths and diameters of tyres with the one set of shoulder plates so that a large range of tyre sizes can be effectively dealt with, and since in each case the tread ring is fitted to the tyre before the latter is placed between the shoulder plates any number of tyres may have rings fitted ready for vulcanising, and any size of tyre can follow any other in the process without causing delay since there is no changing or pre-heating of heavy matrices required.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Apparatus for the re-conditioning of tyres comprising a circular tread ring in the form of an annular band, two shoulder matrices of identical form having internal surfaces of the form of a frustum of a cone for engaging the shoulders of a tyre, means for supporting a tyre with the tread ring attached thereto, means for supplying heat to the two shoulder matrices and the tread ring, adjustable means for supporting the shoulder matrices on a common axis with and in contact with the tread ring and the said tyre and on either side thereof, the apices of the cones being remote from one another such that for tyres of different widths and diameters, having appropriate sizes of tread rings attached thereto, the shoulder matrices are adjustable to contact, with the said internal conical surfaces thereof, the edges of tread rings of different widths and diameters.

2. Apparatus according to Claim 1 in which the tread ring is a light flexible annular band.

3. Apparatus according to Claim 1 in which the tread ring is constructed as a non-flexible continuous annular band, or as segments secured together to form a non-flexible annular band.

4. Apparatus according to Claim 1 in which the shoulder matrices are secured respectively to upper and lower press or table parts one of which is secured to a central screw adapted to co-operate with a central threaded bush in the other part.

5. Apparatus according to Claim 4 comprising a rim on which the tyre to be treated is mounted, a centre collar secured to one side of said rim and of an internal diameter such that it will just fit over a sleeve secured to the threaded bush and through which sleeve the centre screw passes to engage said bush.

6. Apparatus according to Claim 1, 3 or 4 in which the tread ring is of a radius slightly smaller than that of the tyre with which it is used when in its normal inflated condition so that the overall diameter of the tyre must be reduced to enable the tread ring to be fitted thereto.

7. Apparatus according to Claim 1, 3 or 4 in which the tread ring is of a radius smaller than that of the tyre with which it is used when in its normal inflated condition by approximately the amount by which the tyre is reduced in radius at its point of contact with the road when under load.

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