PATENT SPECIFICATION (11) 1 593 684

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(21) Application No. 41389/77 (22) Filed 5 Oct. 1977 (19)

(31) Convention Application No. 7630155 (32) Filed 6 Oct. 1976 in

(33) France (FR)

(44) Complete Specification Published 22 Jul. 1981

(51) INT. CL.[3] B60C 25/06

(52) Index at Acceptance
B7C 73C

(54) MACHINE FOR USE IN FITTING/REMOVING TYRES

(71) We, MICHELIN & CIE (Compagnie Generale Des Etablissements Michelin), a French Body Corporate, of 4 Rue du Terrail, Clermont-Ferrand, Puy-de-Dome, France, do hereby declare the invention for which we pray that a Patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:

This invention relates to machines for use in the fitting of pneumatic tyres to wheel rims or in the removal of pneumatic tyres from wheel rims, operations commonly referred to as fitting and removal and to a method of using such machines. The invention is applicable to machines for use in fitting and removing tyre covers to and from rims which have a base provided with a fitting groove (drop centre), and are terminated on either side by a non-detachable flange.

Machines for this purpose employ a freely rotatable disc which is brought to bear against the assembly of the tyre and rim as the assembly is slowly rotated about its axis which is fixed in respect of the axis of rotation of the disc. The axis of rotation of the disc is inclined with respect to the axis of rotation of the rim. The disc is frustoconical shaped and is intended to exert pressure on the side wall of the tyre, so that it can be applied tangentially against that part of the tyre wall which is adjacent the bead. Furthermore, the support which rotatably carries the disc may be caused to perform a translatory movement parallel with the axis of rotation of the rim, in order to give effect to the action of the disc which seeks to engage the bead over the edge of the rim if a tyre is being fitted or to free the bead from its seat on the rim if a tyre is being removed.

In order to improve engagement or disengagement of the bead with the rim, it has been suggested that the plane of rotation of the disc should be inclined so that this plane forms an acute angle with the plane of rotation of the rim. This acute angle opens up in opposition to the direction of rotation of the rim. By virtue of the conicity or convexity of the zone of contact of the disc against the rubber covering the wall of the tyre when the disc is applied against the tyre, the disc rolls with a very slight sliding action over the wall of the tyre.

However, such a disposition of the disc in respect of the axis of rotation of the rim and the plane of rotation of the rim has a drawback with regard to fitment or removal of tyres which have very flexible walls such as tyres having a radial carcass. With such tyres, the wall undergoes deformation upstream of the disc, that is to say before it comes in contact with the disc, and forms a ridge which interfers with the operation of engaging or dis-engaging the bead. In order to get rid of this disturbing ridge, it is necessary to stop the operation, move the disc away from the wall and then apply it to the wall again, which means a considerable loss of time and the inevitable need to supervise the machine.

The object of the invention is to overcome this disadvantage.

According to the invention there is provided a machine for use in fitting or removing radial carcass tyres from wheel rims which comprises means for mounting a wheel rim so it is rotatable in one direction about its axis, a frusto conical-shaped disc which is adapted to be applied to a side wall of a tyre to be fitted or removed, said disc being freely rotatable and mounted on a support such that the axis of rotation of the disc and the axis of rotation of the wheel rim have a fixed angle of inclination relative to each other which is less than 90° and the plane of rotation of the disc and the plane of rotation of the wheel rim having an angle of inclination relative to one another which is less than 90°, the disc being capable of

translatory movement parallel to the axis of rotation of the rim and capable of being positioned by pivotal movement of its support so that in use the centre of the disc is offset with respect to a radial reference plane (as defined herein) in the direction of rotary movement imposed upon the rim by a distance which is less than the distance from the edge of the rim to the axis of rotation of the wheel rim, the zone of contact of the disc forms an acute angle with the circle along which the disc is applied to a side wall of the tyre, and the dihedral angle formed by said two planes of rotation is open in a direction opposite to that of movement of the rim about its axis of rotation.

The present invention also provides a method of using a machine as described above which method comprises mounting the wheel rim either with the tyre fitted on said rim or with a tyre bead positioned for fitting on said rim, rotating the rim, positioning the disc to its offset position and moving the disc parallel to the axis of rotation of the wheel rim so that it engages the side wall of the tyre associated with the tyre bead to be fitted or a side wall of the fitted tyre thereby respectively fitting the tyre bead on the rim or freeing a tyre bead from its seat.

The principle underlying solution adopted by the invention is that by appropriate positioning of the disc, one can introduce slip between the disc and the wall of the tyre, this slip being oriented not tangentially to the circle described by the zone of contact of the disc on the wall of the tyre but obliquely in the direction of the tread of the tyre. In other words, the trajectory of the zone of contact of the disc forms an acute angle with the large circle along which the disc is applied to the tyre wall.

By reason of the invention, it is possible to avoid formation of the ridge upstream of the disc. The operations of fitment or removal of the tyres from wheel rims can therefore be considerably shortened and simplified.

By the term "plane of rotation of the disc" we mean any plan which is at right-angles to the axis of rotation of the disc, this disc being considered as a body of revolution about its axis of rotation. Likewise, the rim can be considered to be a body of revolution about its axis of rotation. Consequently, by the term "plane of rotation of the wheel rim" we mean any plane which is at right angles to the axis of rotation of the rim.

The "radial reference plane" in respect of which, according to the invention, the offset of the disc centre is reckoned, is defined as that plane which contains both the axis of rotation of the wheel rim and the axis about which the support for the disc is pivoted, this plane also containing the axis of rotation of the disc if the support is pivoted to a position in which the axis of rotation of the rim and axis of rotation of the disc intersect.

Preferably, the length by which the axis of the disc is offset does not exceed the maximum diameter of the disc.

In the machine of the invention the position of the disc can be adjusted to suit the very varied dimensions of different tyres and rims. This adjustment can be left to the initiative of a man skilled in the operation of the machine.

It is convenient to provide two discs on the same machine, one for each side of the tyre which is to be fitted or removed.

The invention will now be described, by way of example, with reference to the accompanying diagrammatic drawings, in which:

Figure 1 is a side elevational view of a machine according to the invention the view being taken in a plane parallel to the radial reference plane;

Figure 2 is an elevational view of a part of the machine according to Figure 1 illustrating the angle of inclination of the plane of rotation of the disc in relation to the plane of rotation of the rim; and

Figure 3 is a plan view to show the offset of axis of the disc in relation to the radial reference plane illustrated in Figure 1.

The machine for use in fitting and removing tyres shown in Figure 1 includes a rotatable disc 5 of frusto conical shape mounted on a support 50 which is mounted on a vertical support 41 and joined by a rigid connecting member 4 to a column 3. The support 50 may be pivoted about vertical support 41 and is capable of vertical movement up and down the vertical support 41. On the column 3 is placed a rim 2 from which a tyre 1 mounted on it is to be removed. The rigid connecting member 4 ensures the stability of the support 50 of disc 5 in regard to the axis of rotation 6 of the rim 2 mounted on the column 3.

The disc 5 has a zone 51 which is adapted to come into contact with the wall of the tyre. The axis of rotation 52 of the disc 5 intersects the axis of rotation 6 of the rim at a point 7 situated on the same side of the rim 2 as the disc 5 when the support 50 is pivoted so that the centre of the disc is in the radial reference plane. Thus, the axes of rotation 6 and 52 form an angle α which is less than 90°. A second disc 5' situated on the other side of the rim 2, is shown in broken lines.

Figure 2 shows in section the tyre 1, the rim 2, the axis of rotation 6 of the rim 2 and also the rigid connecting member 4. The plane of rotation 53 of the disc 5 makes an angle β with the plane of rotation 21 of the rim. The angle β is less than 90° and opens in the direction opposite to that (marked by

the arrow F) of movement of rotation of the rim. Thus, Figure 2 illustrates the second angle of inclination of the disc 5.

Figure 3 is a plan view showing the tyre 1 carried by the rim 2 on the column 3, and of the disc 5 offset according to the invention. The axis of rotation 6 of the rim 2 is represented by the intersection of the trace 526 of the radial reference plane and the straight line 6'. The direction of rotation of the rim is indicated by the arrow F.

Thus, the axis of rotation 52 of the disc 5 is inclined at an angle α as defined above in connection with Figure 1, is inclined by an angle β as defined with reference to Figure 2 and finally, according to the invention, offset by a distance A in relation to the radial reference plane of trace 526, in the direction F of the rotating movement of the rim. The distance A is less than the distance r from the edge of the rim to axis of rotation of the wheel rim.

WHAT WE CLAIM IS:

1. A machine for use in fitting or removing radial carcass tyres from wheel rims which comprises means for mounting a wheel rim so it is rotatable in one direction about its axis, a frusto conical-shaped disc which is adapted to be applied to a side wall of a tyre to be fitted or removed, said disc being freely rotatable and mounted on a support such that the axis of rotation of the disc and the axis of rotation of the wheel rim have a fixed angle of inclination relative to each other which is less than 90° and the plane of rotation of the disc and the plane of rotation of the wheel rim having an angle of inclination relative to one another which is less than 90°, the disc being capable of translatory movement parallel to the axis of rotation of the rim and capable of being positioned by pivotal movement of its support so that in use the centre of the disc is offset with respect to a radial reference plane (as defined herein) in the direction of rotary movement imposed upon the rim by a distance which is less than the distance from the edge of the rim to the axis of rotation of the wheel rim, the zone of contact of the disc forms an acute angle with the circle along which the disc is applied to a side wall of the tyre, and the dihedral angle formed by said two planes of rotation is open in a direction opposite to that of movement of the rim about its axis of rotation.

2. A machine as claimed in Claim 1 in which the disc may be positioned so that its centre is offset with respect to the radial reference plane (as defined herein) by a length which is less than the maximum diameter of the disc.

3. A machine for use in fitting or removing tyres from wheel rims, substantially as herein described with reference to the accompanying drawings.

4. A method of using a machine as claimed in Claim 1 which method comprises mounting the wheel rim either with the tyre fitted on said rim or with a tyre bead positioned for fitting on said rim, rotating the rim, positioning the disc to its offset position and moving the disc parallel to the axis of rotation of the wheel rim so that it engages the side wall of the tyre associated with the tyre bead to be fitted or a side wall of the fitted tyre thereby respectively fitting the tyre bead on the rim or freeing a tyre bead from its seat.

5. A method as claimed in Claim 4 substantially as herein described with reference to the accompanying drawings.

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Printed for Her Majesty's Stationery Office,
by Croydon Printing Company Limited, Croydon, Surrey, 1981.
Published by The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.

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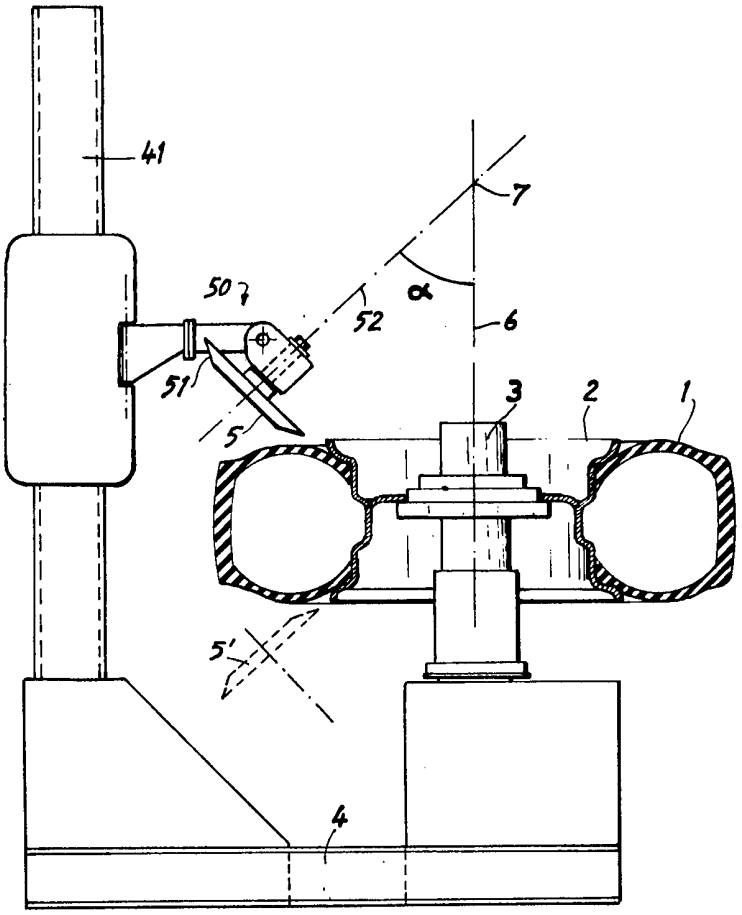
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

Fig. 1



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Sheet 2

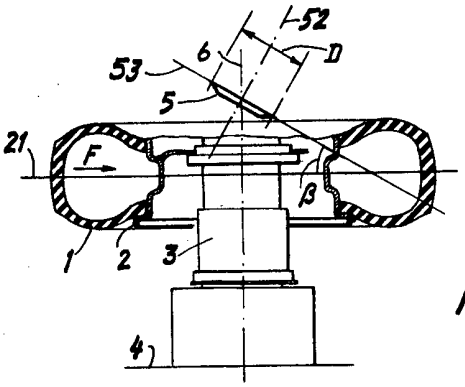

Fig. 2

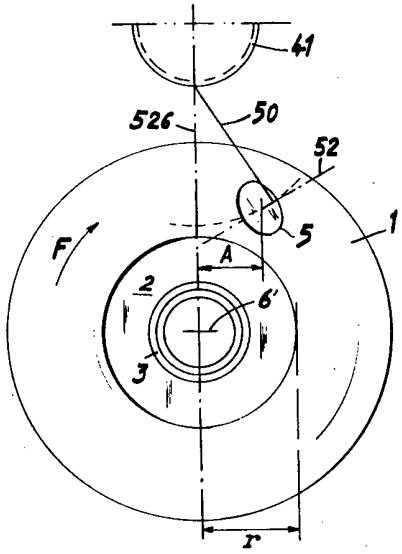

Fig. 3