Jan. 6, 1948. J. C. HEINTZ 2,434,156

METHOD OF RETREADING TIRES

Filed June 6, 1945 2 Sheets-Sheet 1

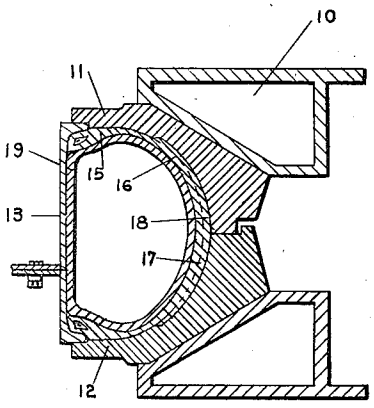


FIG. 2

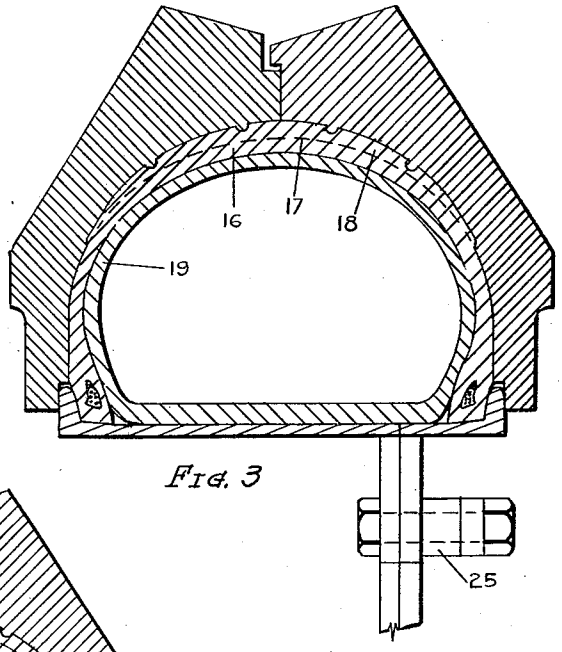


FIG. 3

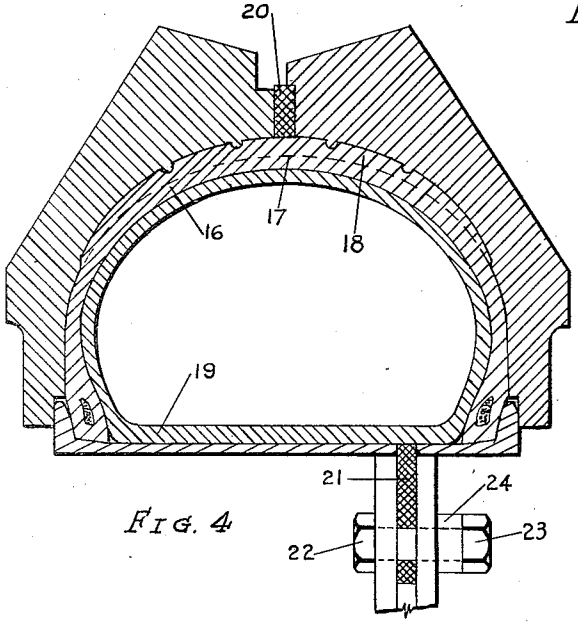


FIG. 4

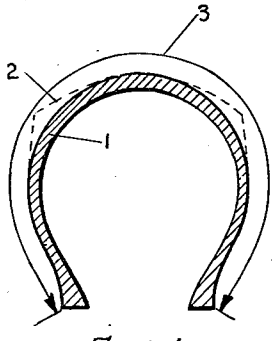


FIG. 1

MATRIX	SPACER	BUFFED DIM.			BUILT-UP TIRE			STOCK SIZE
		MIN.	IDEAL	MAX.	MIN.	IDEAL	MAX.	
AP 570	NO SPACER	38¼"	38¾"	39¼"	39"	39½	40"	140-190-14-12
	½" "	38¾"	39¼"	39¾"	39½"	40"	40½	140-190-14-12
	1" "	39¼"	39¾"	40¼"	40"	40½"	41"	150-200-14-12
	1½ "	39¾"	40¼"	40¾"	40½"	41"	41½"	150-200-14-12

FIG. 5

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FIG. 6

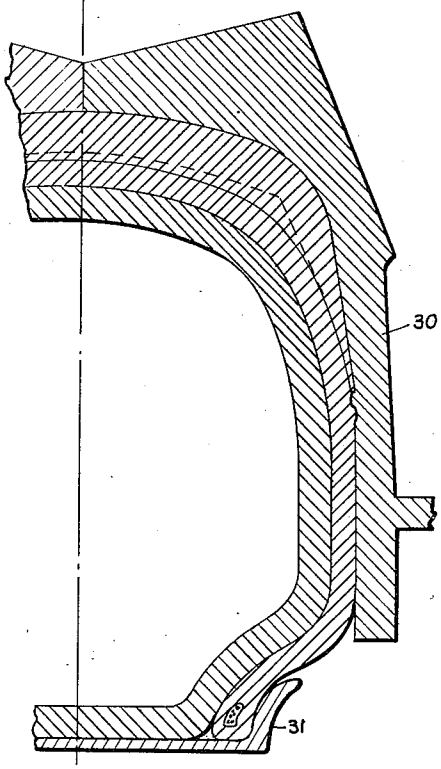


FIG. 7

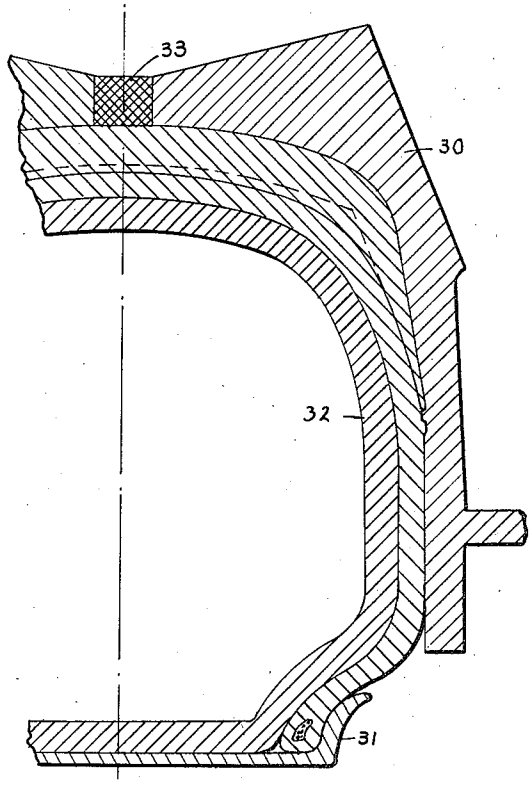


FIG. 8

	24 x 11 RIM							24 x 12½ RIM							24 x 14 RIM							24 x 15½ RIM						
	BUFFED DIM.			BUILT-UP DIM.			MATRIX	BUFFED DIM.			BUILT-UP DIM.			MATRIX	BUFFED DIM.			BUILT-UP DIM.			MATRIX	BUFFED DIM.			BUILT-UP DIM.			MATRIX
	MIN.	IDEAL	MAX.	MIN.	IDEAL	MAX.		MIN.	IDEAL	MAX.	MIN.	IDEAL	MAX.		MIN.	IDEAL	MAX.	MIN.	IDEAL	MAX.		MIN.	IDEAL	MAX.	MIN.	IDEAL	MAX.	
No SPACER	48¼	49	49¾	50¼	51	51¾	53	47½	48¼	49	49½	50¼	51	52¼	47	47¾	48½	49	49¾	50½	51¾	46½	47¼	48	48½	49¼	50	51¼
7/8"	49¾	50½	51¼	51¾	52½	53¼	54½	48¾	49½	50¼	50¾	51½	52¼	53½	48¼	49	49¾	50¼	51	51¾	53	47¾	48½	49¼	49¾	50½	51¼	52½
1¾"	52	52¾	53½	53¼	54	54¾	55¾	51¼	52	52¾	52¾	53¼	54	55	50½	51¼	52	51¾	52½	53¼	54¼	49¾	50½	51¼	51	51¾	52½	53½

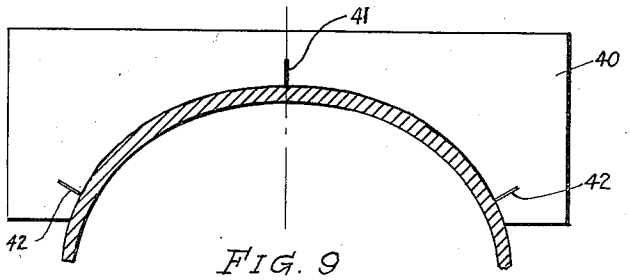


FIG. 9

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Patented Jan. 6, 1948 2,434,156

UNITED STATES PATENT OFFICE

2,434,156

METHOD OF RETREADING TIRES

James C. Heintz, Lakewood, Ohio

Application June 6, 1945, Serial No. 597,871

4 Claims. (Cl. 154—14)

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This invention relates to an improved method of retreading tires. More particularly, it relates to a new method of controlling the fit of a tire in a retreading mold so that the tire is retreaded without distortion. It includes a template designed for use in carrying out the process.

According to this invention the buffed contour of the tire is measured from bead to bead before the application of the camelback used for retreading; and the tire is either buffed to a predetermined bead-to-bead measurement to fit a particular molding cavity, or if several molding cavities of different sizes are available, such as the graded sizes of molding cavities obtained by the use of interchangeable matrices and spacers in a single mold, the correct cavity for retreading the tire is selected from the tire's buffed measurement. A template may be used to control the buffing if desired.

In the past the manufacturers of retreading equipment, generally speaking, haven't given sufficient attention to the necessity for retreading the tire in its natural shape. In fact, certain designers of retreading equipment anticipate the distortion of a tire to accommodate it to the type of mold they have designed. Some equipment requires the spreading of the beads or flattening of the tread; other equipment squeezes the tire in the molding cavity. There has been no general recognition of the fact that instead of forcing the tire to conform to the shape of a particular mold, a plurality of graded mold cavities should be provided, and the tire should be prepared for retreading in the cavity in which it can be retreaded with the least distortion and, preferably, without any distortion.

According to this invention the selection of the best mold for retreading a tire and the control of the fit of the tire in a retreading mold are conducted scientifically. The mold is selected on the basis of the bead-to-bead measurement of the tire to be retreaded after buffing, and the tire may even be buffed to the exact contour of the tire that the mold is more particularly designed to retread. The tire is buffed to a predetermined size to fit a particular molding cavity, or the proper molding cavity is selected on the basis of the contour of the buffed tire. The camelback used must, therefore, be of standard dimensions so that the space it will occupy can be determined in advance.

In carrying out my invention, I measure the buffed tire from one bead, over the tire, to the other bead. If after the first buffing the measurement is such that the tire must be squeezed

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to fit into the available mold cavity, the buffing may be continued until a contour of the desired measurement is reached. Such buffing may be done in conjunction with and controlled by a template which fits the buffed contour of the tire for which the mold was more particularly designed.

The recent tendency in the manufacture of the carcass of a tire—particularly a tire which is to be subjected to high-temperature operations, such as an airplane tire or a truck or bus tire—is to make the carcass of a synthetic fabric. Rayon, nylon, and the like have been used extensively. These synthetics lose less tensile strength than cotton when subjected to high temperatures, but they stretch. Because they are not very elastic, the tire gradually enlarges. This enlargement is commonly called "growth." It makes accurate measurement of the tire prior to retreading more necessary than previously when tires did not grow sufficiently to appreciably change the tire size through use and all tires of an original rated size could be retreaded in a mold designed for that rated size.

The need for accurate measurement of a tire as a preliminary to retreading is greatest in airplane tires and other tires which are entirely enclosed in the retreading mold. Generally, in the retreading molds used for otter tires, such as passenger tires and truck and bus tires, the molding cavity is confined to the tread and shoulders and may include, also, a part of the side walls. However, the lower portion of the side walls of such tires is generally not enclosed in the retreading mold. Such molds may be used with tires mounted on rims of several different widths because the lower portion of the side wall of the tire is not confined in the mold but may bulge more or less between the rim and the bottom of the outer mold surface.

Whether employed with an airplane tire or a different type of tire, the method of measuring and fitting herein described results in better retreading than has heretofore been possible because the tires are retreaded without stretching or other distortion which is necessary when the cavity in which a tire is to be retreaded is selected by guess or as the result of less accurate measurement than here contemplated.

In preparing a tire for retreading according to this process, some old rubber is buffed off. It is necessary to remove the shoulders and to give the tire a smoothly arched cross-sectional contour. The contour must be uniform throughout the whole circumference of the tire. This is

readily obtained by mechanical buffing. The buffing may advantageously be controlled by gauging the buffed contour with a suitable template. After buffing and before placing the new raw rubber stock (called camelback) in place, the outer contour of the tire is measured from the heel of one bead to the heel of the other bead. The measurement is most advantageously made with a tape.

The bead-to-bead measurement of the tire is the important measurement in fitting the tire into the molding cavity. The rim diameter is kept constant by the metallic beads. There are numerous variables which should be considered. Any tire may be mounted on rims of different widths for retreading, and for each rim width a molding cavity of different size is required. A tire of shorter bead-to-bead measurement mounted on a wide rim may be cured in the same mold as a tire of longer bead-to-bead measurement mounted on a narrower rim. Different lug designs occupy different proportions of the volume of the molding cavity. In a mold without interchangeable parts the range of bead-to-bead measurements which can be accommodated for each rim width is easily calculated. Similar calculations may be made for molds with interchangeable matrices and spacers, each combination of any of the spacers with any of the matrices being particularly designed for a tire of a particular bead-to-bead measurement and buffed contour. The range of bead-to-bead measurements for each rim width for which each molding cavity is particularly designed should be calculated and tabulated for ready reference in carrying out this invention. Thereafter, when the bead-to-bead measurement of any tire becomes known, the mold and rim width suitable for retreading the tire, and also the particular spacer and matrices in molds provided with them are available at a glance.

The guesswork is thus eliminated. The tires are accurately fitted to the mold by selecting a mold cavity known to satisfactorily retread a tire mounted on a rim of a particular width and with a bead-to-bead measurement in the range of the measurement of the tire in question. The measurement is made before the application of the camelback.

Any particular mold cavity is designed more particularly for retreading a tire having a particular buffed contour. When a tire of this particular contour is retreaded in this mold, it is distorted less than a tire of any other contour. Due to the plasticity of the camelback some departure from the ideal is not serious. However, buffing to a particular contour for any selected mold cavity gives improved results. When a tire is to be buffed to a particular contour, as by testing with a template, it may be buffed till the bead-to-bead measurement is about ½ inch greater than the range recommended for any mold before testing with the template. Then on subsequent buffing to fit the template, the bead-to-bead measurement is brought within the range which the mold is designed to retread.

When a mold is equipped with a series of interchangeable matrices and spacers, the ranges of bead-to-bead measurements which adjacent members of the series will satisfactorily accommodate should preferably overlap somewhat. The range of measurements which any particular combination may satisfactorily accommodate may vary 1 to 2 or 3 per cent each way from the calculated ideal. Less variation is possible with molds which completely enclose a tire than with the other type of mold in which the side wall of the tire bulges more or less between the rim and the mold.

The invention will be further described in connection with the accompanying drawings, in which:

Fig. 1 illustrates schematically the method of measurement of a tire;

Fig. 2 is a cross section of an airplane tire in a retreading mold;

Fig. 3 is an enlarged view of the airplane tire shown in Fig. 2 with the matrices and adjustable rim shown on an enlarged scale;

Fig. 4 shows the same matrices used on a larger airplane tire with a spacer between the matrices and another in the rim;

Fig. 5 is a chart showing the variation provided by a series of spacers with a single matrix and the different sized airplane tires which can be thereby accommodated;

Fig. 6 is a cross section of a tire with ordinary straight side walls—e. g., a passenger, bus or truck tire—with its tread and shoulders confined by matrices, the tire being mounted on a rim (partly broken away);

Fig. 7 is a cross section of a larger tire with a spacer between the matrices;

Fig. 8 is a chart showing the variation in a molding cavity which is provided by a single set of matrices using different spacers and rims of different widths; and

Fig. 9 illustrates the testing of a buffed tire with a template.

In Fig. 1 the tire 1 is shown in its buffed condition in full lines. The old shoulders 2, shown in dotted lines, must be buffed away before the tire is measured. The line with arrows 3 shows how the measurement is to be made from the heel of one bead to the heel of the other bead; but in measuring, the tape employed must be laid flat against the buffed contour of the tire. Ordinarily, the contour of the tire is concave just above the bead. This may or may not be bridged, but all measurements should be made in the same manner. The tape must otherwise be laid flat against the tire in order to secure an accurate measurement of the contour.

The illustrated full-circle mold, the cavity of which is variable by the insertion of interchangeable matrices and spacers, is of a well-known type. It comprises annular steam chambers, such as the steam chambers 10 shown in Fig. 2. The annular matrices 11 and 12 together with the adjustable rim 13 completely enclose the airplane tire 15. The tire is shown in Figs. 2–4 as composed of the old tire 16 with the buffed contour 17 shown in dotted lines and the new tread stock or camelback 18.

The camelback has a smooth contour and does not fill the mold until pressure is applied. When a steam bag or air bag 19 is inserted and inflated in the usual manner, it presses the camelback against the surface of the matrix so that the new tread takes the design of the matrices as illustrated in Figs. 2–4.

Fig. 3 shows the matrices and rim without any spacer. As the matrices and rim completely enclose the tire in airplane-tire molds of the type illustrated, it is necessary to use spacers of the same size between the matrices and in the rim if any spacer is employed. The spacer between the matrices is indicated by the reference numeral 20 and the spacer in the rim by the reference numeral 21. The width of the rim is

readily adjusted by removing the nut **22** from the bolt which fits onto the head **23** and using a washer **24** or **25** or other suitable size, as required.

Fig. 5 shows how with a single set of matrices, known in the trade as AP570, the size of the mold cavity may be varied by using no spacer, or spacers of different widths. The table gives both the buffed dimension and the built-up dimension of the tire. The buffed dimension is the bead-to-bead dimension discussed above. In the table under "Buffed dimensions" are three columns. The column headed "Ideal" gives the medium bead-to-bead measurements for tires to be retreaded in the mold when equipped with a particular set of matrices and different spacers, as indicated. For example, with no spacer, a tire measuring 38¾ inches from the heel of one bead to the heel of the other bead fits nicely into the mold. The minimum and maximum dimensions given under the two other columns headed "Buffed dimensions" show that some variation in bead-to-bead measurement is possible without stretching or distorting the tire to any harmful extent. For example, with no spacer, a tire with a bead-to-bead measurement of 38¼ to 39¼ inches may be retreaded. With a ½ inch spacer, a tire which measures a half inch more may be retreaded, as shown in the table. The increase in the size of the spacer increases the mold cavity, and as the bead-to-bead measurement increases, a larger mold cavity is required. It will be noted that using the same set of matrices and only the three spacers shown in the table, tires varying 2½ inches in bead-to-bead measurement—namely, from 38¼ to 40¾ inches—may be retreaded without appreciable distortion or stretching.

The "stock size" given in the table refers to the camelback which should be employed. There are four standard measurements for camelback for such tires. The first figure, **140**, refers to the hump width of the stock. The hump widths vary by ⅛ inch. **140** indicates fourteen and no eighth inches hump width. **190** represents the base width. This, likewise, varies in ⅛ inch. **190**, therefore, represents a base width of 19 inches. The 14 refers to the thickness of the material in the center, and this is measured in thirty-seconds of an inch. The 14 represents $^{14}/_{32}$. The 12 is the thickness of the stock at a point at the end of the hump width. This, likewise, is measured in thirty-seconds. Therefore, the camelback used with no spacer and with a ½ inch spacer measures 14 inches at the hump width, 19 inches at the base width, $^{14}/_{32}$ inch thick in the center, and $^{12}/_{32}$ inch thick at the end of the hump width. A different size of camelback is used with the wider spacers. The camelback measurements are standard.

To retread an airplane tire according to this invention, the tire is buffed to a smoothly arched contour, and the contour is then measured from the heel of one bead to the heel of the other bead. Assume, for example, that the bead-to-bead measurement is 39 inches. Referring to the columns in the table of Fig. 5 which give the buffed dimensions, we find that a tire measuring 39 inches may be vulcanized equally well in the mold without any spacer or with a ½ inch spacer. The spacer in the rim spreads the tire so that a tire having a certain bead-to-bead measurement mounted on one rim may be retreaded in the same mold as a tire having a longer or shorter bead-to-bead measurement if mounted on a narrower or wider rim.

Having selected the matrices and spacers (if any) to be used, the mold is equipped, the camelback is stitched to the buffed surface after cementing, etc., as usual, and the tire with the camelback in place is provided with the steam or air bag and mounted on the rim, the retreading mold closed around it, and then the steam or air is turned into the bag, and steam is turned into the steam chests of the mold to effect vulcanization in the usual manner.

Figs. 6 and 7 illustrate a mold equipped with matrices of the type generally employed for passenger, truck, and bus tires. It is noted that the tire is not entirely confined but that it is free between the bottom of the matrix **30** and the top of the rim **31**. This permits bulging which gives a little more flexibility with this type of mold so that tires with a somewhat wider range of bead-to-bead measurements can be satisfactorily retreaded in such equipment than where the matrix and rim come together as in the molds shown in Figs. 2–4.

Fig. 7 shows how a spacer **35** may be inserted between the matrices when used with a wider rim. But the rim width is not definitely tied to the size spacer employed because the fact that the side wall of the mold does not contact the rim permits rims of different widths to be used with no spacer and spacers of different widths. This is more fully illustrated in the table of Fig. 8 where it is seen that such molds afford greater flexibility than is possible with molds of the type illustrated in Figs. 2–4.

The table of Fig. 8 relates to the retreading of tires in molds such as those shown in Figs. 6 and 7, and is similar to the table of Fig. 5 except that it shows the bead-to-bead dimensions of tires suitable for retreading with rims of different widths. Using spacers of only two different widths and rims 11, 12½, 14, and 15½ inches wide, respectively, as shown in the table, a tire with a buffed bead-to-bead dimension varying anywhere from 46½ inches (the minimum for a 15½ inch rim) to 53½ inches (the maximum for an 11 inch rim) may be very satisfactorily retreaded without substantial stretching or distortion. The camelback employed for retreading in such molds is standard and is of such size as to properly fill out the tread design, allowing for the usual "undertread" or rubber below the grooves in the tread design.

The process is illustrated by the following example: Assume that an 18.00 x 24 tire is to be retreaded with the matrices shown. The tire is buffed to a smoothly arched contour and is measured from the heel of one bead to the heel of another bead. Assume, for example, that the measured distance is 50 inches. The table shows that this tire, buffed to this dimension, may be satisfactorily retreaded using the 11 inch rim and ⅞ inch spacer or using the same spacer with the 12½ inch rim or using the 15½ inch rim and the 1¾ inch spacer. Each of the three combinations will give a very satisfactory retread. Guesswork is eliminated. The tire is actually measured and fitted to the exposed mold surface.

After deciding what rim width is most desired, cement, etc., and standard camelback are applied to the buffed tire as usual, the mold is made ready with the designated matrices and spacer, the tire is equipped with a steam or air bag **32** and mounted on a rim of the size selected, and the tire is retreaded.

For the most accurate control, the tire is buffed to a bead-to-bead measurement just larger than that actually to be used. From this measurement the mold cavity best suited for retreading this tire is selected, bearing in mind the fact that the bead-to-bead measurement is to be reduced about ½ inch by further buffing before the camelback is applied and the tire is put into the mold. Using a template with the contour of the tire for which this particular mold cavity was more particularly designed, the tire is then buffed to this template. As a check, the bead-to-bead measurement of the tire may be retaken after such further buffing to see that it falls within the intended range.

The template **40** of Fig. 9 is illustrative. It is provided with a marker **41** to indicate the center line of the tread and markers **42** to indicate the position of the shoulders. Such markers are desirable although not necessary. Using such a template, any tire **43** may be buffed to the exact contour of the tire the mold is more particularly designed to retread.

Although the drawings illustrate more particularly the application of the invention with a mold with interchangeable matrices and spacers, it is to be understood that the drawings and examples are illustrative. The invention is defined in the appended claims. In the claims reference to the use of a spacer refers to the use of a spacer of any width or no spacer at all.

What I claim is:

1. The process of retreading a tire, having available (*a*) a limited number of full-circle retreading molds of different tread contour, (*b*) a series of templates each cut to the contour of the buffed tire which each of the molds is particularly designed to retread, and (*c*) a chart giving the bead-to-bead measurements over the buffed contours of the tires which said molds are particularly designed to retread when mounted on rims of different widths; which process comprises (1) buffing the tire to the general contour desired for retreading, (2) measuring the tire from bead to bead over the buffed contour, (3) on the basis of this measurement and with the aid of the chart selecting from the available molds that designed for retreading a tire with a bead-to-bead measurement over the buffed contour, which is just less than that of the measured contour of the tire to be retreaded and noting on the chart the rim width which gives such measurement, (4) buffing the tire further so as to simultaneously (*a*) fit its buffed contour to that of the template cut to the contour of the buffed tire which the selected mold is particularly designed to retread and (*b*) reduce the buffed contour so that it more closely approximates that of the tire the selected mold is more particularly designed to retread, (5) mounting the buffed tire on the rim of noted width and applying camelback thereto, and then (6) curing the tire thus treaded in the selected mold.

2. The process of retreading a tire in a mold provided with a series of spacers of different width and adapted for retreading tires mounted on rims of different widths, using (*a*) a chart giving the measurements over the buffed contours from one bead to the other bead of the tire which the mold is more particularly designed to retread when used with each of the respective spacers of said series while mounted on rims of different widths and (*b*) a series of templates each having the contour of the buffed tire which the mold is more particularly designed to retread when used with each of the spacers; which process comprises (1) buffing the tire to give its tread the general contour of a tire which is to be retreaded, (2) measuring the tire over the buffed contour from one bead to the other bead, (3) from the chart selecting the spacer and rim width which gives a measurement over the buffed contour from bead to bead which is just less than the measured distance, (4) buffing the tire to the contour of the template which gives the contour of the buffed tire which the mold is more particularly designed to retread when equipped with the selected spacer and thereby bringing the bead-to-bead measurement of the buffed contour closer to that which the chart gives for the tire which the mold is more particularly designed to retread, (5) applying the camelback to the buffed surface and mounting the tire on the rim of determined width, and then (6) curing the camelback while the tire is mounted on the rim.

3. The method of forming a new tread on a worn tire which comprises buffing the tire to a smoothly arched contour, measuring the buffed tire from bead to bead over said smooth contour before mounting on a rim, providing a molding cavity which is designed for use with a tire of somewhat smaller bead-to-bead measurement when uncured tread stock of standard dimensions is in place thereon and the tire is mounted on a rim of selected width, buffing old rubber from the outer surface of the tire to bring it to a bead-to-bead measurement which is substantially the aforesaid smaller bead-to-bead measurement, placing uncured tread stock of standard dimensions in place on the buffed tire, and after mounting the tire on a rim of the selected width curing the tread stock to the tire in the molding cavity.

4. The method of forming a new tread on a worn tire which comprises buffing the tire to a smoothly arched contour, measuring the buffed tire from bead to bead over said smooth contour before mounting on a rim, providing a molding cavity which is designed for use with a tire of somewhat smaller bead-to-bead measurement when uncured tread stock is placed thereon and the tire is mounted on a rim of selected width, selecting from a series of templates a template with a contour which is the preferred contour for a tire with said desired bead-to-bead measurement, buffing old rubber from the outer surface of the tire to bring it to a bead-to-bead measurement which is substantially the aforesaid smaller bead-to-bead measurement and cause it to fit the contour of the template, placing uncured tread stock of standard dimensions in place on the buffed tire and after mounting of the tire on a rim of the selected width curing the tread to the tire in the molding cavity.

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