

July 11, 1950

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2,514,518

DIAGONAL GRADING OF SHOES AND LASTS

Filed July 15, 1949

2 Sheets-Sheet 1

Interchangeability Chart of Last Parts for Men's Shoes
of a given style.

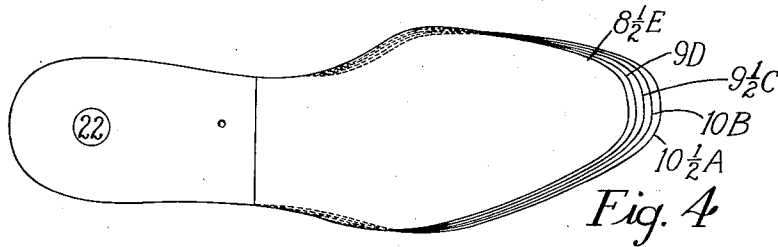
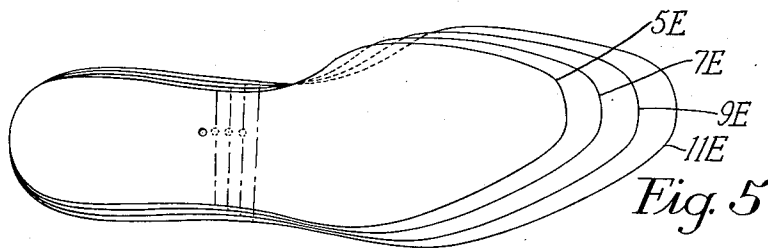
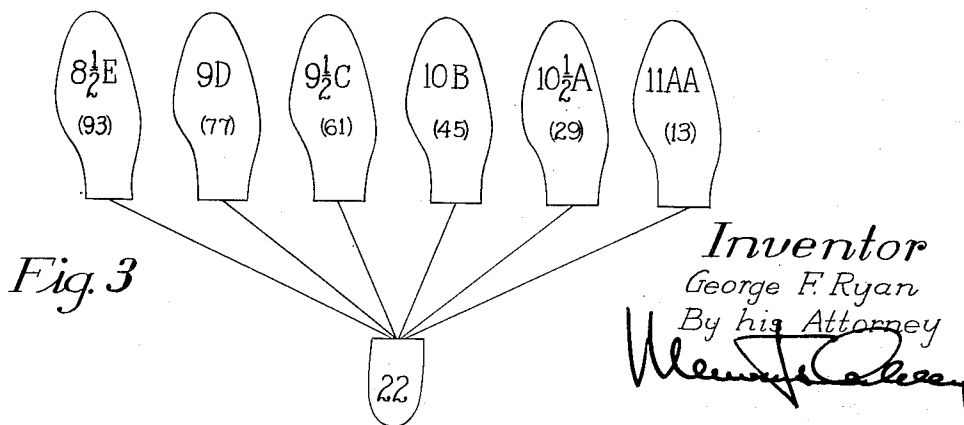
Widths

W	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13
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length = s(for size)

Fig. 1

0	AA	¹ X	² X	³ 12	⁴ 13	⁵ 14	⁶ 15	⁷ 16	⁸ 17	⁹ 18	¹⁰ 19	¹¹ 20	¹² 21	¹³ (22)	¹⁴ 23	¹⁵ 24	¹⁶ 25	¹⁷ 26
1	A	¹⁸ X	¹⁹ 12	²⁰ 13	²¹ 14	²² 15	²³ 16	²⁴ 17	²⁵ 18	²⁶ 19	²⁷ 20	²⁸ 21	²⁹ (22)	³⁰ 23	³¹ 24	³² 25	³³ 26	³⁴ 27
2	B	³⁵ 12	³⁶ 13	³⁷ 14	³⁸ 15	³⁹ 16	⁴⁰ 17	⁴¹ 18	⁴² 19	⁴³ 20	⁴⁴ 21	⁴⁵ (22)	⁴⁶ 23	⁴⁷ 24	⁴⁸ 25	⁴⁹ 26	⁵⁰ 27	⁵¹ 28
3	C	⁵² 13	⁵³ 14	⁵⁴ 15	⁵⁵ 16	⁵⁶ 17	⁵⁷ 18	⁵⁸ 19	⁵⁹ 20	⁶⁰ 21	⁶¹ (22)	⁶² 23	⁶³ 24	⁶⁴ 25	⁶⁵ 26	⁶⁶ 27	⁶⁷ 28	⁶⁸ 29
4	D	⁶⁹ 14	⁷⁰ 15	⁷¹ 16	⁷² 17	⁷³ 18	⁷⁴ 19	⁷⁵ 20	⁷⁶ 21	⁷⁷ (22)	⁷⁸ 23	⁷⁹ 24	⁸⁰ 25	⁸¹ 26	⁸² 27	⁸³ 28	⁸⁴ 29	⁸⁵ X
5	E	⁸⁶ 15	⁸⁷ 16	⁸⁸ 17	⁸⁹ 18	⁹⁰ 19	⁹¹ 20	⁹² 21	⁹³ (22)	⁹⁴ 23	⁹⁵ 24	⁹⁶ 25	⁹⁷ 26	⁹⁸ 27	⁹⁹ 28	¹⁰⁰ 29	¹⁰¹ X	¹⁰² X



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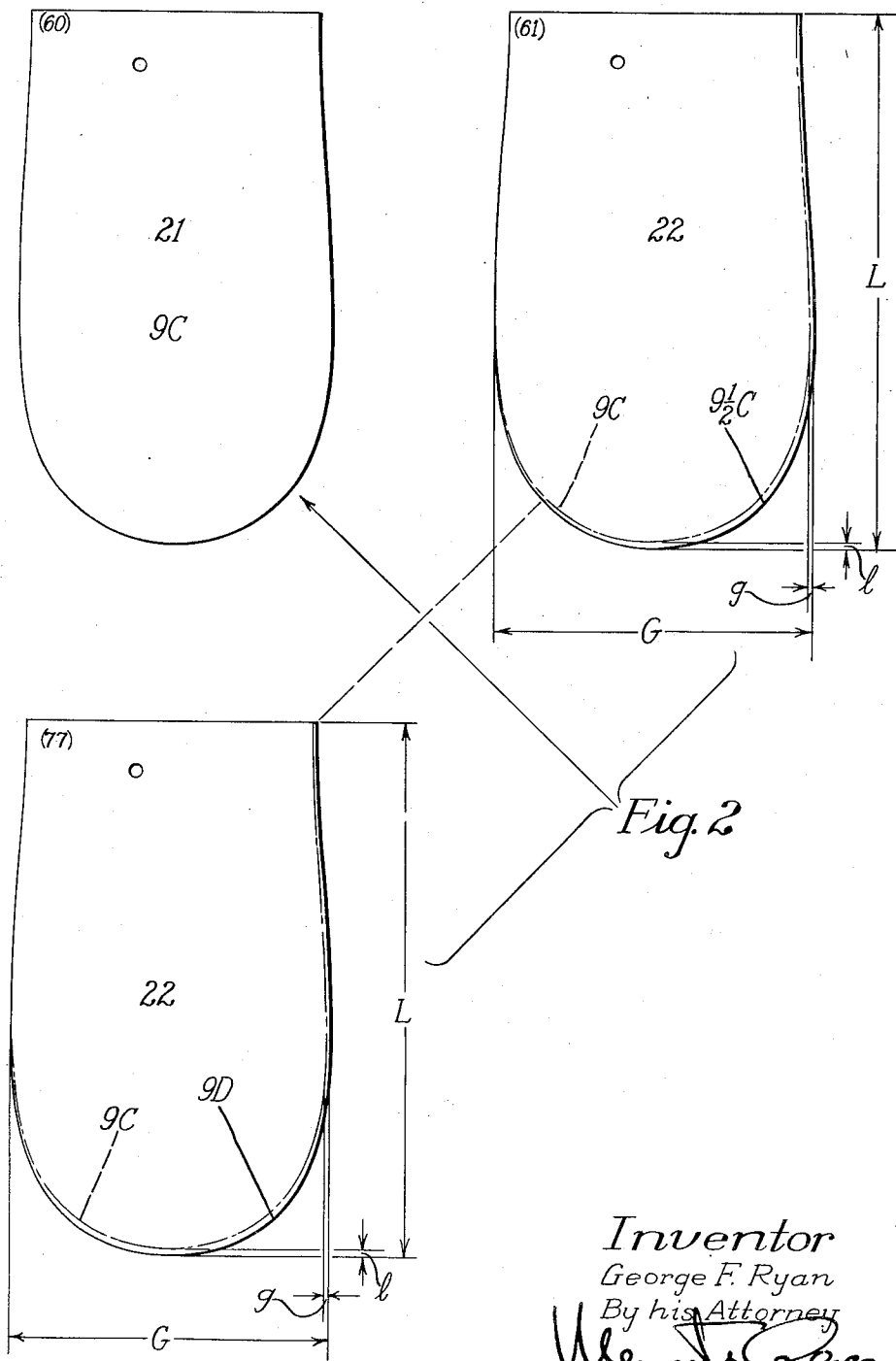
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DIAGONAL GRADING OF SHOES AND LASTS

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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DIAGONAL GRADING OF SHOES AND LASTS

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Application July 15, 1949, Serial No. 105,019

3 Claims. (Cl. 12-146)

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This invention relates to the manufacture of shoes and, more particularly, to a method concerned with the manufacture of graded lasts for use in the making of shoes.

To understand and appreciate better the nature of my invention a few preliminary remarks concerning certain conditions now obtaining in the last and shoemaking art are pertinent. Customarily, shoes of any given style are individually manufactured in shoe factory units called "case lots." These lots require the provision of one or more sets of corresponding lasts therefor. Now, for a given style and within the different measurement ranges allotted to "men's," "women's," and "misses'," etc., a set of lasts normally includes a right and a left for each of the graduated size and width combinations, and it becomes apparent that a very large number of lasts is required to enable a factory to manufacture a graduated run of shoes in several styles. Lasts accordingly represent a considerable initial investment and they usually must be replaced when damaged or outmoded.

Since hard wood such as rock maple, from which the great majority of lasts preferably are turned, is becoming increasingly expensive, last construction of the two-part collapsible type is being more commonly employed. Each heel-part and fore-part can then be separately generated in a last lathe from a smaller rough block. Moreover, a heel-part or a fore-part may be replaced when necessary without the need for replacing an entire last. In view of these circumstances and others, artisans suggest that lasts, and especially the less stylized heel-parts of lasts, be turned out of more durable and dimensionally stable materials than wood. Also, it is recognized that when improving the functional role of lasts and last-parts in shoemaking further means should be sought by which to economize on whatever last materials are employed.

In general the term "grading," as used in the manufacture of lasts and patterns for shoemaking, refers to their pantographic generation from models. The length of the graded last is the dimension of the model parallel to its longitudinal axis (the axis on which it is usually suspended in a last lathe), magnified or reduced. Similarly, the width of the graded last may be considered to be the magnified or reduced radial dimension of the model measured from, and perpendicular to, its longitudinal axis.

Heretofore, last makers are believed to have been unsuccessful in making a last-part accurately fit more than one last in a systematically

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graded set of lasts. The idea has long been entertained, however, that if interchangeability of last-parts and shoe-parts were feasible, such interchangeability would tend to simplify last making and, to some extent, shoemaking. While the substitution of certain shoe parts, such as counters, for ones which do not exactly match in size is sometimes indulged in, the resulting construction is not ordinarily tolerated in fine shoemaking. Grading of shoes and the whole lasts over which the shoes were made has almost invariably been in accordance with either of two plans, namely: (a) an arithmetic grading system wherein lengths and widths are respectively enlarged or diminished in equal increments, or (b) a geometric grading system, as set forth in United States Letters Patent No. 1,948,547, granted on an application of L. E. Topham, under which length and width increments respectively increase or diminish in accordance with a fixed percentage. It is this latter, and relatively recent, development which forms the preferred basis for practicing the novel method of last-part grading hereinafter to be described although it will be understood that the invention can also be used with arithmetic grading. Not the least of the advantages foreseen for practicing the present method with respect to the heel-parts of lasts, for example, is that heels and counters may then be preformed or premolded in large quantities but in fewer sizes, thereby lowering unit costs and facilitating shoemaking.

In view of the above conditions an object of the present invention is to provide an improved method for obtaining schematic interchangeability of last parts with corresponding parts of lasts in a graded set whereby the cost of the latter may be reduced, last functionality bettered, and the duration of service of a last set lengthened.

One feature of the invention is the provision of an improved method of grading parts such as the heel ends of lasts of a graded set whereby their interchangeability with corresponding parts in a number of lasts of the set will be assured and attained without detriment to foot-fitting requirements or style aspects of the set.

A further feature of the invention is the provision of a method of grading the heel-ends of lasts in a systematic set whereby their adaptability with fore-parts of the set in last forming relation will be greatly increased.

Another feature of the invention resides in the provision of a convenient method for identifying the heel-parts of a set which are mutually interchangeable and the fore-parts with which the

interchangeable heel-parts may be employed in last forming relation.

The above and other features of the invention together with valuable aspects thereof will now be further described and explained in connection with the accompanying drawings, in which

Fig. 1 is a chart illustrating the different size and width combinations required in a graded set of lasts or individual last-parts for men's shoes; in addition to representing a last or shoe, each consecutively numbered square may be considered to represent a diagonally graded heel-part of a last;

Fig. 2 is a diagrammatic view of heel-parts conveniently taken along their bottoms, but typical of any longitudinal section dimensionally related in accordance with this invention and exemplifying derivation of a portion of the chart of Fig. 1;

Fig. 3 illustrates the interchangeability of a heel-part (specifically the one designated 22 in Figs. 1 and 2) graded in accordance with the method of this invention with different lasts of a set having geometrically graded fore-parts, the several outlines being taken along the respective last bottoms for convenience;

Fig. 4 is a view of superimposed last bottoms of a partial set having the same interchangeable heel-part last graded by the present method; and

Fig. 5 shows a run of odd sizes, all in E width, the fore-parts being geometrically graded and the heel-parts diagonally graded.

Terms to describe relative dimensions of lasts and footwear are often used with different meanings. It may aid in avoiding confusion to consider that the following concepts for present purposes hereinafter apply. "Length" and "size," indicated numerically, are interchangeable and pertain to longitudinal linear dimension of a last or shoe, or a part of a last or shoe. "Girth" and "width," indicated alphabetically, are interchangeable and pertain, unless otherwise stated, to transverse circumferential dimension of a last or shoe, or of a part of a last or shoe.

The invention will be described with respect to the heel-parts of lasts although it will be understood other last-parts, and even shoe parts, may be similarly treated. The invention is recognized as having special merit when applied to heel-parts since they are least subject to dimensional variation by reason of style factors and foot-fitting requirements.

It will be seen from the consecutively numbered squares of Fig. 1 that at present there are required in the normal manufacture of a single style of shoes for men approximately two hundred different lasts, including rights and lefts. Unless it be quite by accident, no last or last-part is precisely interchangeable with any other in the set regardless of whether arithmetic or geometric grading be used. Each consecutively numbered square in the chart may be considered to represent a uniquely sized last or last-part in the series, increments of length and/or width (actually girth) being added systematically to progress from the smallest (5-AA) which is not usually made in volume to the largest (13-E) which may not often be carried in stock.

If the lasts (Fig. 1) be graded systematically, each one bears a known but different dimensional relation to another. Likewise, each heel-part, for example, of these approximately two hundred lasts is different and cannot at present be satisfactorily substituted for another heel-part in the series. To obtain interchangeability of heel-parts to the extent possible without impairing the foot-

fitting requirements of shoes constructed from the graded set of lasts it is hereby proposed to grade up the heel end of a last of a given size, between successive widths, by adding length and girth increments respectively equal to the length and girth increments obtained from systematically grading to the next size larger than said given size. This "next size," as is seen in Fig. 1, is numerically a half size greater than the given size.

To take an example under this method of grading, suppose a set comprises a geometrically graded last of size 9C, found in square No. 60 of the chart. By the method of this invention the heel part for the 9C last (Figs. 1 and 2) may be geometrically graded as taught by the Topham patent cited to produce a $9\frac{1}{2}$ C heel-part and, as seen by comparing the bottoms shown in Fig. 2, length and width or girth increments, respectively designated l and g , have thus been added to produce a $9\frac{1}{2}$ C heel-part having an over-all length L and girth G at its bottom. The bottom views are preferred since they represent the insole pattern which is of prime importance to fit and to design. Obviously G and L , or g and l , may differ for other longitudinal sections of lasts in a set. The aim being to obtain interchangeability, the method provides that the heel-part for a 9D last of the set (found in square 77) is "made" or generated schematically from the 9C in the same way as the $9\frac{1}{2}$ C heel end. The $9\frac{1}{2}$ C heel end may then be used in lieu of the 9D heel end, and vice versa; they are duplicates.

Pursuing the method of this instance further, the same heel-end, $9\frac{1}{2}$ C or 9D, becomes interchangeable with lasts of the series having the length-girth combinations $8\frac{1}{2}$ E, 10B, $10\frac{1}{2}$ A, 11AA, and these all fall along a diagonal of the chart of Fig. 1 (squares 93, 45, 29 and 13 respectively). Likewise the length-girth combinations of heel-ends lying on other chart diagonals, such as that indicated by squares 8, 24, 40, 56, 72 and 88, will be interchangeable. Developing the idea more generally, the method thus determines in this illustration that a single heel-end diagonally graded may be used on any one of six lasts, and, as may be determined from an inspection of Fig. 1, diagonal grading of last-parts enables the usage of only 18 pairs of different heel-parts in lieu of the about 96 different pairs of heel-parts that would have been required to satisfy this particular class of men's shoes.

To recapitulate, diagonal grading of the heel-parts of lasts comprises grading the heel end of a last of a given size, between successive widths, by algebraically changing the length and girth, respectively, by increments equal to the increments obtained from length grading said given size. While this method provides added interchangeability of heel-parts of lasts of a set and preserves uniformity and other benefits important to shoemaking, it does not sacrifice the advantages to be derived from geometric grading when it is desired to employ this latter system. The lasts required for the entire series may retain their over-all geometric proportions by suitably enlarging or diminishing the fore-parts as may be required by the individual diagonally graded heel-parts of a set.

Incidental to the diagonal grading method disclosed, a convenient way for readily ascertaining the interchangeability of last-parts with others of a diagonally graded series is illustrated by the chart of Fig. 1. The interchangeable last-parts all bear the same identification num-

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ber. This number is easily determined in accordance with this formula: the identification number equals $2S+W$, where S is the size of the last and W is the numerical value of the width, which ranges in whole numbers from 0 for AA width to plus 5 for E width, as seen in Fig. 1.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. The method of diagonally grading individual parts of multi-part lasts the complements of which have been systematically graded from a primary model, which comprises grading the length and girth of the individual part of a last of a given size, between successive widths, by algebraically changing the length and girth respectively by increments equal to the length and girth increments obtained from length grading said given size.

2. The method of diagonally grading the heel-parts of lasts, the fore-parts of which have been

geometrically graded from a primary model, comprising grading the length and girth of the heel-end of a last of a given size, between successive widths, by algebraically changing the length and girth respectively by increments equal to the length and girth increments obtained from geometrically grading said given size.

3. The method of diagonally grading the heel-parts of lasts, the fore-parts of which have been geometrically graded from a primary model, which comprises grading up the length and girth of the heel-end of a last of a given size, between successive widths, by adding length and girth increments respectively equal to the length and girth increments obtained from geometrically grading to the next size larger than said given size.

GEORGE F. RYAN.

No references cited.