C. K. HARDING.

INVERTED INCANDESCENT MANTLE.

APPLICATION FILED OCT. 21, 1910.

1,022,133.

Patented Apr. 2, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

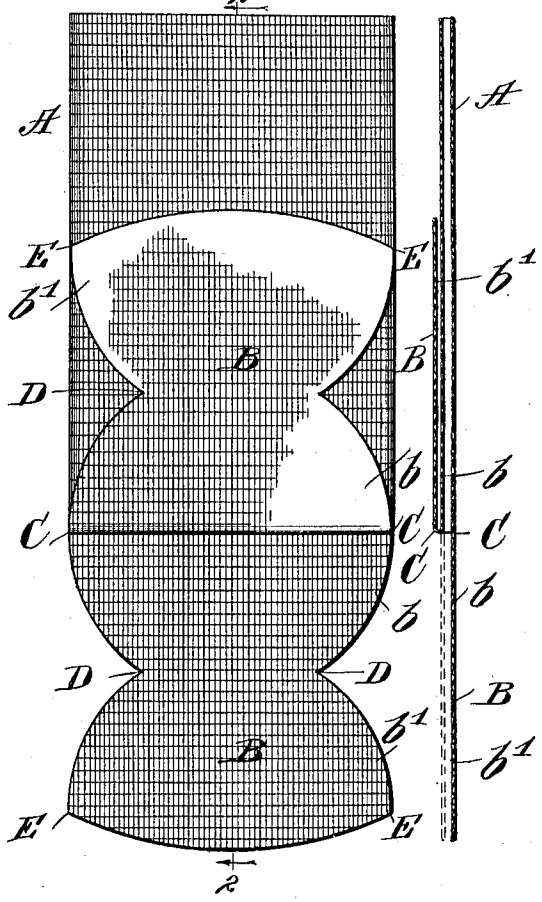


Fig. 2.

Fig. 3.

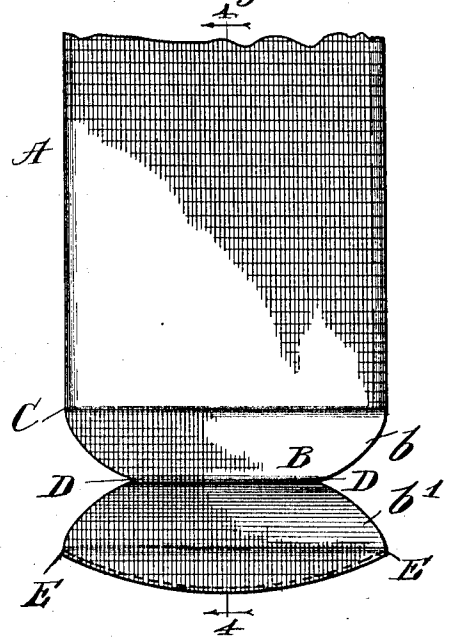


Fig. 4.

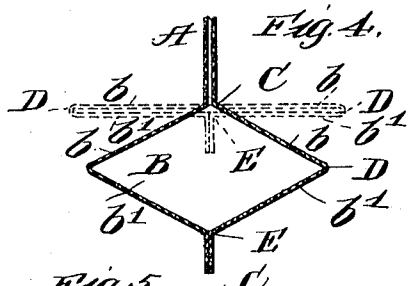


Fig. 5.

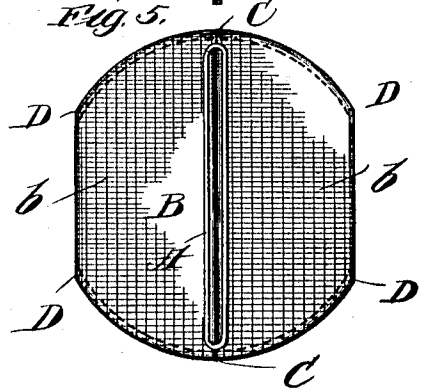
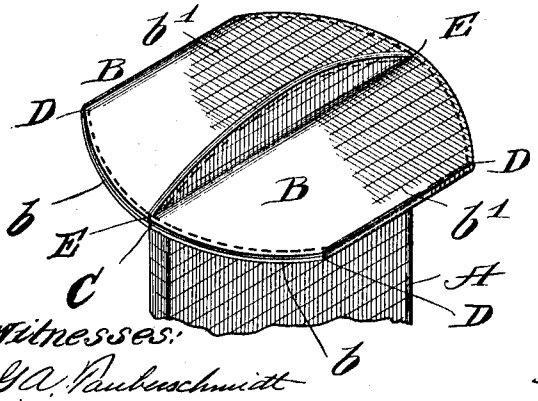


Fig. 6.



Witnesses:

G. A. Paubenschmidt

G. W. Dowarus Jr.

Inventor:

Charles Knox Harding

C. K. HARDING.

INVERTED INCANDESCENT MANTLE.

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2 SHEETS—SHEET 2.

Fig. 7.

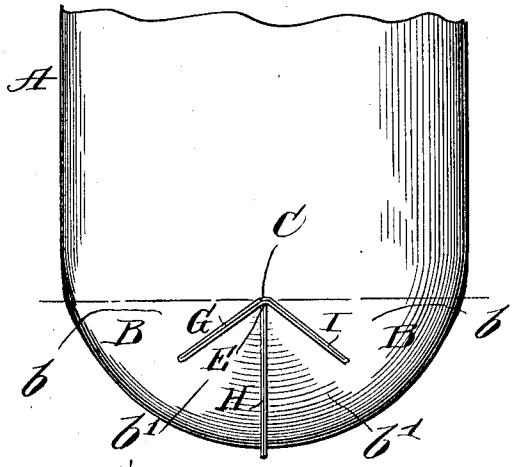


Fig. 12.

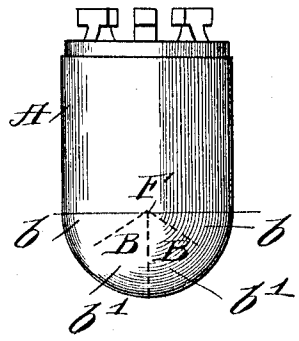


Fig. 13.

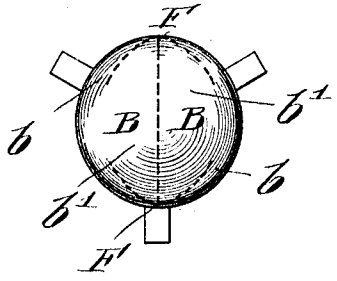


Fig. 8.

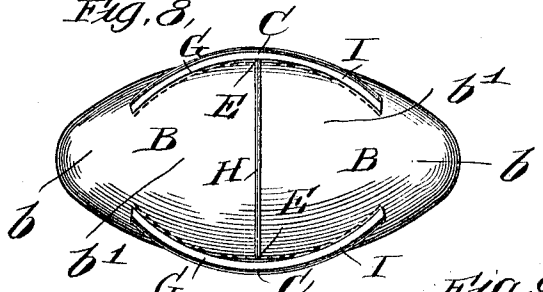


Fig. 9.

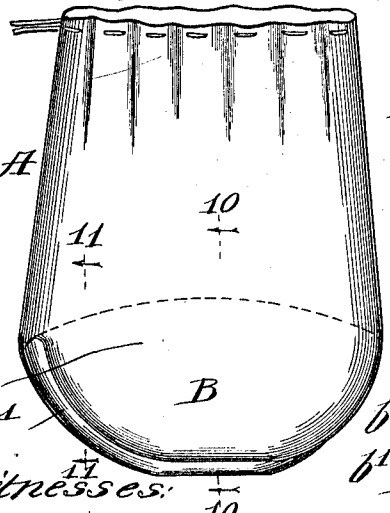


Fig. 10.

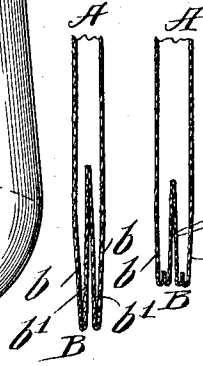


Fig. 11.

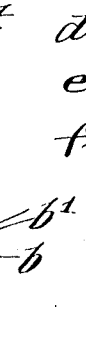
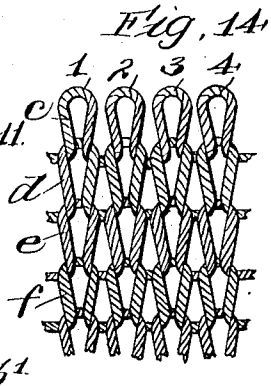


Fig. 14.



Witnesses:

O. A. Paubenschmitt

G. W. Donaruss Jr.

Inventor:

Charles Knox Harding.

UNITED STATES PATENT OFFICE.

CHARLES KNOX HARDING, OF CHICAGO, ILLINOIS.

INVERTED INCANDESCENT MANTLE.

1,022,133. Specification of Letters Patent. Patented Apr. 2, 1912.

Application filed October 21, 1910. Serial No. 588,366.

To all whom it may concern:

Be it known that I, CHARLES KNOX HARDING, a citizen of the United States, and a resident of Woodlawn, city of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Inverted Incandescent Mantles, of which the following is a specification.

This invention relates generally to incandescent structures for lighting made by what has been generally known as the Welsbach process, which consists of impregnating a knitted fabric of cotton or other fibrous cellulose with solutions of the refractory earths, which are to constitute the finished mantle. The dimensions of this impregnated fabric are usually from 100 to 200 per cent. greater than that of the finished product after the cellulose and other volatile matter is burned out, but this large structure is fashioned and formed approximately to such shape as will produce the desired form of the finished mantle after it has been shrunken.

Among the objects of my invention is to facilitate the production of inverted mantles of uniform and symmetrical shape which can be manufactured with the greatest economy of time, skill and labor without sacrificing any of the prerequisites necessary where the best results are required. To attain these ends and other useful results, I employ the features in the construction and arrangement and configuration of the several parts, as will appear hereinafter more fully described and claimed and shown in the accompanying drawing, which illustrate forms of mantles embodying my invention, in which—

Figure 1 shows a front elevation of a length of tubular fabric severed so as to form the mantle blank. Fig. 2 is a section of same on line 2—2 of Fig. 1. Fig. 3 is a front view of same, showing the lower curved edges united by a seam running transversely across the lower end of the fabric. Fig. 4 is a section on the line 4—4 of Fig. 3. Fig. 5 is a top plan view, showing the bottom in the position indicated by the dotted line in Fig. 4. Fig. 6 is a perspective view of the bottom of same after the seams are sewed. Fig. 7 shows the lower end portion of my improved mantle after it is opened up. Fig. 8 shows a bottom view of the fabric mantle opened out as in Fig. 7. Fig. 9 is a perspective view of a finished fabric mantle made in accordance with my invention and folded so it may be placed in a flat envelop for the market. Fig. 10 is a section on line 10—10 of Fig. 9. Fig. 11 is a section on line 11—11 of Fig. 9. Fig. 12 shows a side elevation of a finished burned out mantle attached to a carrying ring at its top. Fig. 13 is a bottom view of the mantle, illustrated in Fig. 12. Fig. 14 is a detailed view enlarged in the drawings about ten diameters of a section from the perpendicular side of a finished burned out inverted incandescent mantle formed from a knitted fabric of a kind found from experience to be most suitable.

Both upright and inverted incandescent mantles have generally been made from tubular knitted fabric, which has special properties which peculiarly fit it for the purpose. The typical mantle fabric has 88 loops around a circumference of about 5 inches and about 11 or 12 rows of loops to the inch of length so that a square inch of fabric has more than three times as many threads running lengthwise as it has crosswise. This unequal distribution of the amount of threads materially facilitates the forming of cylindrical mantles, for though the shrinkage might be considered uniform in the lineal dimensions of the thread, the vertical shrinkage is only resisted by the force of gravity while the pressure of the gas flame within the mantle prevents it from shrinking nearly as much circumferentially.

According to my invention, I cut out a major portion of the stock for the gores from a point in the fabric at some distance above the lower end and surrounding two points on diametrically opposite sides of the mantle. I cut and sew the sections that are to form the closed end in the fabric mantle so as to form an elongated rounded terminal closed lower end portion having very materially longer horizontal dimensions in one direction than it has in the other at right angles thereto, but so arranged that the maximum shrinkage of all the sections is combined to act in one direction—the direction of the greatest length of the elongated bottom portion and the direction in which the major portion of the threads of the mantle fabric extend—and so arranged that the minimum shrinkage acts on and in the direction of the length of each individual section at right angles to the longest dimension, whereby a semi-spherical

shaped closed end portion is produced in the finished burned out mantle without having a symmetrical hemispherical bottom portion in the unburned fabric with the attendant disadvantage of having all of the gores cut out from points close to the center of the bottom portion of the mantle, and all the seams formed from uniting their respective edges united at and radiating from the same point in the center of this most useful portion of an inverted incandescent mantle. As illustrated in the drawing I retain the full length of the fabric in an up and down direction for a zone extending around the closed end of the mantle in one direction in which the greatest shrinkage takes place and cut out most of the gores surrounding two points at the ends of a semi-circumference extending at right angles from the center of the said zone in the direction where the shrinkage is the least.

In a preferred embodiment of my invention I employ a piece of tubular knitted fabric of the ordinary or typical construction as illustrated in Fig. 1, severed on a slightly curved line and slitted up its opposite edges to the points C, C, where the bottom of the tubular body portion is to terminate and leaving the two projections B, B, of a single thickness of mantle fabric, depending from opposite sides of the tubular body portion. Both sides of each of these projections B, B, have triangular gores C, D, E cut from their edges. The two sides of the triangular gore, adjacent to the apex D are formed along similarly curved lines, D, C and D, E. The two curved lower edges of the depending projections B, B, are united by a seam running transversely across the lower curved ends of the fabric from E to E, as shown in Fig. 3. In the next operation the projections B are each folded along a line from D to D and along a line at the lower edge of the body portion from C to C and bent outwardly. They are also folded along a straight line from E to E and the two folds at D of each section are drawn apart, bringing the folds from E to E up close to the line of the folds from C to C, as shown in the full line of Fig. 4. When the two folds D, D are extended the full distance apart and assume the position shown by the dotted line in Fig. 4, it will bring the folds running from E to E up to and in contact with the folds extending from C to C. This will bring the points C into contact with the points E at the extremities of the lower seam and the upper and lower edges of the gores will be brought into parallel planes in contact with each other, and their edges disposed symmetrically about the center of the lower round flat end of the mantle. In this position the mantle may be revolved and its edges carried under a suitable sewing machine, and thus sew the curved seams through the points B, C, D, and thus unite the respective edges of the gores in a very simple and expeditious manner. The points E at the center of the lower half of the bottom portion will be merged with the point C of the upper half of the bottom portion at the point indicated by the letter F in Figs. 12 and 13. The seams formed by uniting the edges of the gores will practically divide the sides of each of the projections B into two sections designated in the figures by *b* and *b'*. These elongated sections running crosswise of the fabric, so that at the points where E and C meet designated by the letter F in Figs. 12 and 13, there will be a junction of all the ends of each of the four elongated sections, but the junction of the four sections will only require the presence of three seams radiating from this one point as compared with four seams that would be necessary if the ends of four sections were united at one point in the lower central axis of the closed bottom, as was the former practice where four sections were employed. In the art of knitting a fabric is produced by forming a row of loops with a single thread through which loops another row of loops are linked, and so on consecutively. The rows of loops crosswise is sometimes referred to as a chain, but where rows in both directions are distinguished, the rows of linked loops endwise of the fabric will be referred to as a chain of loops. Thus in Fig. 14 of the drawing the loops *c*, *d*, *e*, *f*, constitute a chain of loops lengthwise of the fabric, and the rows, as 1, 2, 3, 4, are called rows of loops to distinguish them as running crosswise. The length of each loop is usually greater lengthwise of the fabric, and the width is less crosswise. As each loop has two sides and one end formed from a short piece of thread and its other end formed by the end of an adjacent loop, the shrinkage in the length of the thread in burning out acts to reduce the length of the loops more than it does their width and as there are many more loops to the inch of fabric measured crosswise than lengthwise, it results that the fabric has many more threads disposed lengthwise than it has crosswise of the fabric.

In manufacturing my improved mantle, I cut out and sew the parts for the closed bottom from sections cut from the projections depending from the tubular fabric of the body portion and of exactly such an area as will produce the proper shape in the finished mantle without regard to a symmetrical shape in the fabric except that if it is almost twice as long in one horizontal direction, it tends to promote the simplicity and accuracy of manufacture, but it must comprise a fixed area which I have found approximately equal to the area of

two circles, the diameter of the tubular fabric combined or integrated side by side endwise of the chains of loops of the knitting. The area of two circles so combined would be the area of an ellipse having a minor axis, the diameter of one of the circles, and a major axis equal to the diameter of the two circles. The four semi-circular shaped sections tend to thus integrate themselves into an elliptical rounded form having the correct area and relation to each other, and tend when opened up to produce a horizontally elongated, semi-ellipsoidal form in the bottom portion. When an ellipse is revolved on its longer axis, the surface described is an ellipsoid. The shape of the lower surface of such a horizontal semi-ellipsoid corresponds closely to the relative shape and area of the closed lower end portion of a fabric mantle should have when made according to this invention, to produce a perfectly round semi-spherical end when the mantle is burned out and in use on the flame. The relative length of the axes of the ellipsoid will as heretofore mentioned vary in accordance with the relative length and width of the loops of the knitted fabric and with the number of threads disposed lengthwise and crosswise of the fabric. The longer axis will be in the direction of and proportionate to the maximum shrinkage and the minor axis will be proportional to the minimum shrinkage.

It will be understood that the mantles are provided with the usual opening in the top of the body portion.

Having now described my invention and illustrated one method by which it may be carried out, what I claim is:

1. An incandescent mantle constructed from a tubular fabric, having a cylindrical body portion and a semi-spherical shaped closed end formed by uniting the edges of a plurality of curved end sections integral with the fabric of the body portion, each of said sections having a length of about the semi-circumference of the semi-spherical closed end, and each of said sections having a width such that the sum of the combined widths of all the sections equals the semi-circumference of the semi-spherical closed end portion.

2. An incandescent mantle constructed from a tubular fabric, having a cylindrical body portion and a semi-spherical shaped closed end formed by uniting the edges of four curved end sections integral with the fabric of the body portion, each one of the four sections having a length of about the semi-circumference of the semi-spherical closed end, and each of said four sections having a width such that the sum of the combined widths of all the sections equals the semi-circumference of the semi-spherical closed end portion.

3. The method of making a mantle, consisting of slitting lengthwise opposite sides of one end of a tubular fabric, thereby producing opposite flaps, cutting the opposite side edges of each flap to form similar laterally disposed gores at each of said edges, sewing together the adjacent edges of the gores at each side of each flap, and sewing together the ends of the flaps.

In witness whereof I have hereunto set my hand this 19th day of October, A. D. 1910, in the presence of two witnesses.

CHARLES KNOX HARDING.

Witnesses:
E. G. ANDERSON,
H. G. JOHNSON.