No. 702,800. Patented June 17, 1902.

U. KLEINER.

ARTIFICIAL EAR DRUM.

(Application filed Aug. 6, 1901.)

(No Model.)

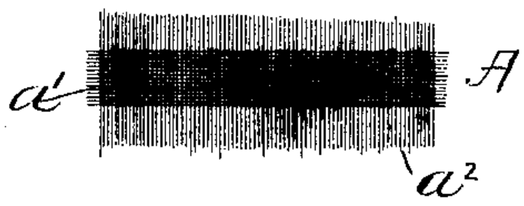

Fig. 1.

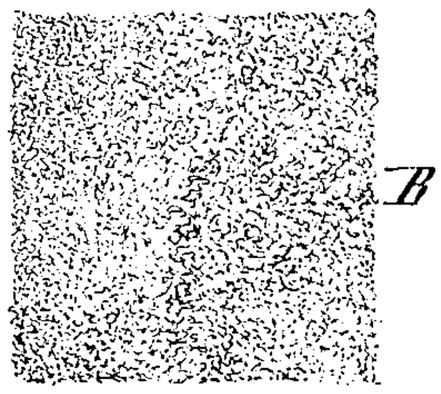

Fig. 2.

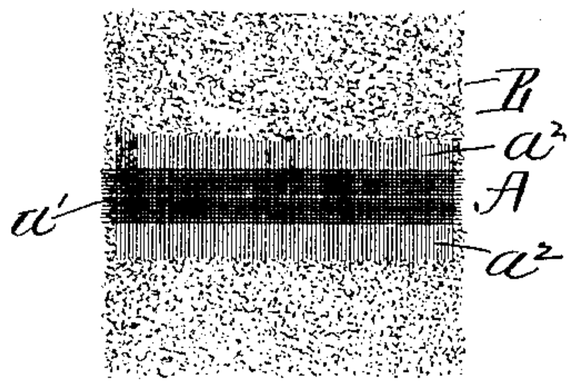

Fig. 3.

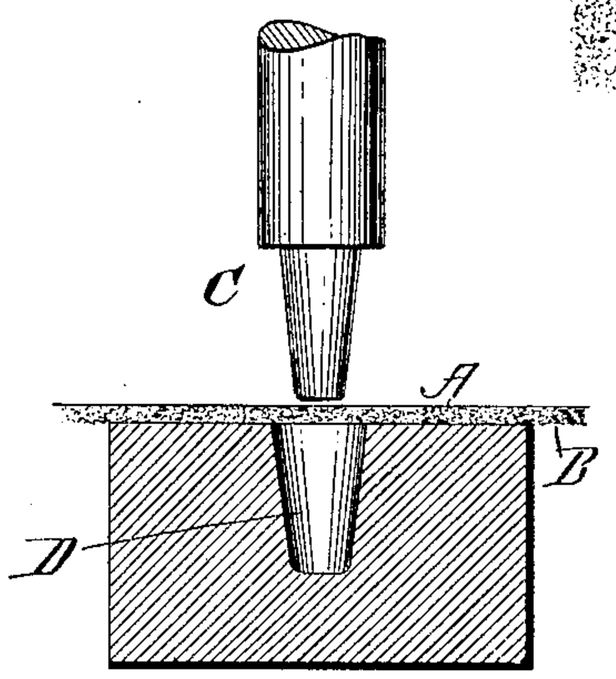

Fig. 4.

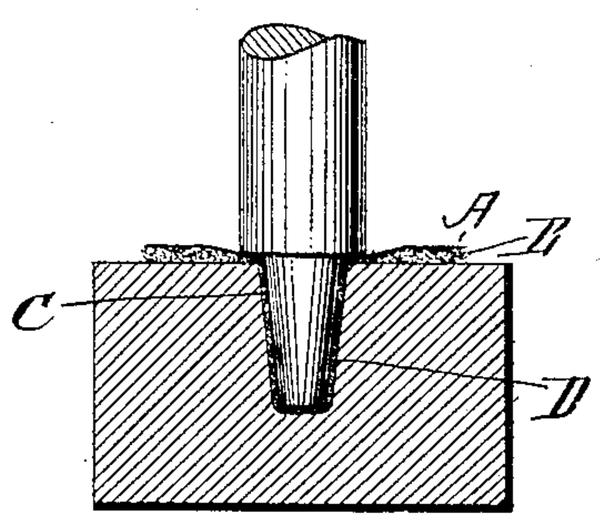

Fig. 5.

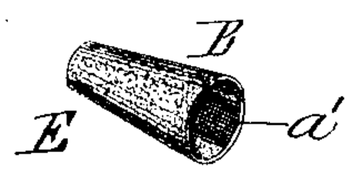

Fig. 6.

Fig. 7.

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UNITED STATES PATENT OFFICE.

ULRICH KLEINER, OF BROOKLINE, MASSACHUSETTS.

ARTIFICIAL EAR-DRUM.

SPECIFICATION forming part of Letters Patent No. 702,800, dated June 17, 1902.

Application filed August 6, 1901. Serial No. 71,097. (No model.)

To all whom it may concern:

Be it known that I, ULRICH KLEINER, a citizen of the United States, and a resident of Brookline, in the county of Norfolk and State of Massachusetts, have invented new and useful Improvements in Artificial Ear-Drums, of which the following is a specification.

My invention consists in improvements in artificial ear-drums and in the method of constructing the same. Artificial substitutes for injured ear-drums have been heretofore made and used; but so far as I am aware these contrivances have proved to be only partially successful, and in some cases their use has resulted in troublesome irritation of the membrane of the auditory meatus. Experiment with artificial ear-drums embodying my invention has demonstrated that they are excellent substitutes for the natural ear-drum and that their presence in the auditory canal produces no irritation, so that they may be left in position in the ear for a long time, thus obviating the troublesome necessity of frequent removal and replacement.

In the drawings hereto annexed, which illustrate an ear-drum embodying my invention and the mode of manufacturing the same, Figure 1 represents a partially-raveled strip of textile material, and Fig. 2 a thin sheet of fibrous absorbent material, such as absorbent cotton. Fig. 3 shows the manner of arranging the textile strip and absorbent sheet preparatory to molding the same. Figs. 4 and 5 show the mandrel and die used for molding the artificial ear-drum in two positions. Fig. 6 shows the completed artificial ear-drum in perspective, and Fig. 7 shows the same in end elevation.

In manufacturing artificial ear-drums according to my invention the method which I prefer to follow is this: Take a strip of thin textile material, such as sheer silk, like that known to the trade as "liberty" silk, about half an inch wide and an inch and a quarter in length and ravel out the long threads from each edge, leaving a woven strip about three-sixteenths of an inch wide in the middle, with the short threads or ravelings projecting at right angles thereto. The appearance of a strip of silk thus prepared is shown in Fig. 1, where A designates the strip as a whole, a' is the woven central rib, and a^2 is the lateral raveling. Next cut a square from a thin sheet of absorbent cotton, about one and one-quarter inches on a side, and lay the partially-raveled silk strip across the middle of the square of cotton. Fig. 2 shows the square of cotton B, and Fig. 3 the cotton with the silk strip across it. The composite sheet thus prepared is then laid between a mandrel and a die corresponding thereto, as shown in Fig. 4, where C is the mandrel, D the die, and A B the composite sheet. The mandrel and die are trunco-conical in shape. Of all the materials which I have tried for these tools bone or ivory is the best for the purpose. Before applying the mandrel to the material A B dip the mandrel in melted white wax and hold it over a clear flame, like that of a Bunsen burner, until the mandrel is quite hot. Then press the hot waxed mandrel on the sheet A B, taking care that the truncated point of the mandrel strikes squarely in the middle of the silk strip A. The woven part of the strip A should be about as wide as the truncated point of the mandrel. A slight variation in this respect will not be sensible. The object to be observed is to have the truncated end of the artificial ear-drum made by the mandrel and die reinforced substantially over its entire area with the woven part of the textile strip A. When the mandrel and die are pressed together, the sheet A B is pressed into the form desired and the absorbent fibrous material matted with the wax into a thin translucent cone. By turning the mandrel C back and forth while maintaining pressure between it and the die D the wax wherewith the mandrel was coated is distributed over and absorbed by the textile and fibrous components of the sheet and gives the resulting product the desired stiffness and smoothness. The effect of using a partially-raveled strip of textile material is shown in the final product. The woven portion a', which remains in the middle of the strip, has only to bend in one place. If the whole strip were to be left unraveled, it would crease when pressed down by the die, while if a narrow strip, like a', were used with no side ravelings the textile material and fibrous sheet would be only imperfectly incorporated together. As it is the raveled ends a^2 fold up without creasing when the mandrel and die are pressed together

and by incorporation with the fibrous and absorbent-cotton sheet serve to bind the textile strip thoroughly to the loose fibrous envelop. When the work of forming the truncated cone of cotton, silk, and wax is complete, the protruding edges of the cotton and silk are trimmed off and the product shown in Figs. 6 and 7 remains. It consists of a cup, having a flat end, and is adapted by its shape and texture to enter and fit the auditory canal.

This product, the artifical ear-drum E, is applied to the ear as follows: Dip the drum E in some warm melted lubricant, which is also an emollient, such as vaseline, and insert while warm into the auditory canal. If the natural ear-drum is merely punctured, insert the artificial drum far enough to apply the truncated end thereof to the injured part. The artificial drum thus becomes a patch on the natural drum and performs the functions of the normal drum perfectly. If the natural drum is destroyed, usually one or two of the bones of the inner ear, which normally are juxtaposed to the inner side of the ear-drum, are also either destroyed or injured. In this case insert the artificial ear-drum until it touches the outermost of the bones remaining, which transmits sound-vibrations to the sensory portions of the inner ear.

In instances where the natural ear-drum, together with the "hammer" and "anvil," are entirely destroyed artificial ear-drums constructed as above described and applied in the manner directed have by contact with the remaining bone (the "stirrup") restored the ear to its normal capacity.

The application of warm lubricant, like vaseline, renders the artificial ear-drums sufficiently plastic to be fitted to the auditory passage and adapted to any degree of insertion which the case requires. The absorbent character of the materials used in the construction of this artificial ear-drum render it entirely agreeable to the membranes with which it comes in contact and non-interferent with the normal secretions of the ear. No soreness results from the use of these ear-drums, so that they can remain in the ear without removal for an indefinite time. After a month of use they are still effective and usually last longer than this.

What I claim, and desire to secure by Letters Patent, is—

1. An artificial ear-drum consisting of a cup, with a flat end, composed of fibrous absorbent material compressed with wax and adapted by its shape and proportion to penetrate and fit the auditory canal.

2. An artificial ear-drum consisting of a truncated cone adapted to penetrate the auditory canal as far as the tympanum, and composed of fibrous absorbent material, the apex whereof is of woven material.

3. An artificial ear-drum, consisting of a truncated cone adapted to penetrate the auditory canal so far as the tympanum, and composed of fibrous absorbent material having smooth waxy surface.

4. An artificial ear-drum, consisting of a truncated cone adapted to penetrate the auditory canal as far as the tympanum and composed of fibrous absorbent material, reinforced at the apex by a sheet of woven material, the whole compressed into an integral structure with wax and presenting a smooth waxen surface.

5. An artificial ear-drum, consisting of a truncated cone adapted to penetrate the auditory canal as far as the tympanum, and made of a thin sheet of absorbent cotton, compressed with wax and presenting a smooth waxen surface.

6. An artificial ear-drum, consisting of a truncated cone adapted to penetrate the auditory canal as far as the tympanum and made of a thin sheet of absorbent cotton, reinforced at the apex by a piece of woven silk, the whole compressed into an integral structure with wax and presenting a smooth waxen surface.

7. An artificial ear-drum, consisting of a truncated cone adapted to penetrate the auditory canal as far as the tympanum, and composed of fibrous absorbent material into which is incorporated a strip of woven material having raveled edges, in such manner that the apex of the cone is reinforced by the web portion of the said strip and the raveled edges thereof are incorporated with the sides of the cone.

Signed by me at Cottage City, Massachusetts, this 27th day of July, 1901.

ULRICH KLEINER.

Witnesses:
LUCY P. SMITH,
C. M. SMITH.