W. F. HENDRY.

METHOD OF MANUFACTURING AUDIONS.

APPLICATION FILED APR. 30, 1919.

1,426,734. Patented Aug. 22, 1922.

3 SHEETS—SHEET 1.

Fig. 1.

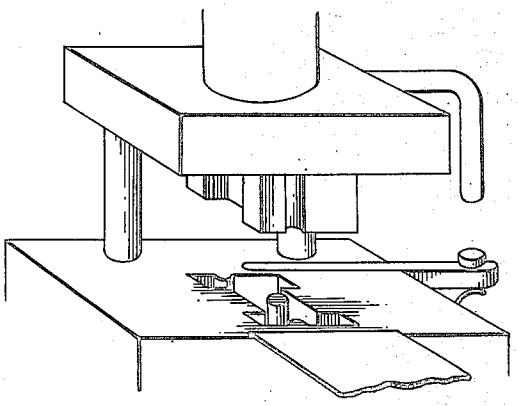


Fig. 2.

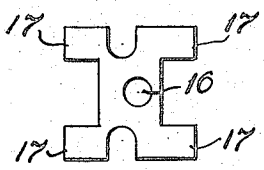


Fig. 3.

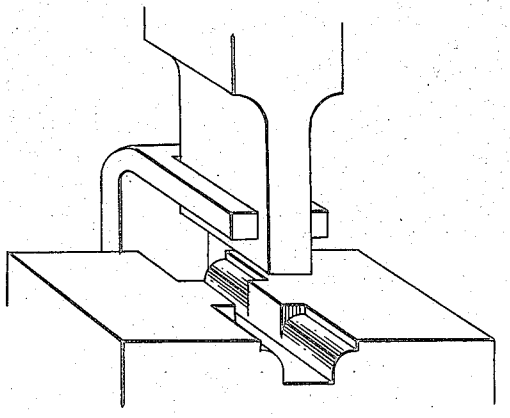


Fig. 4.

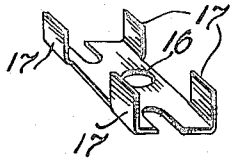


Fig. 5.

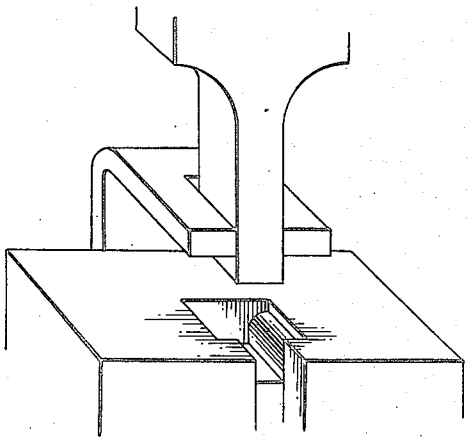
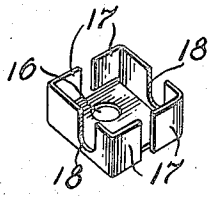


Fig. 6.



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3 SHEETS—SHEET 2.

Fig. 7.

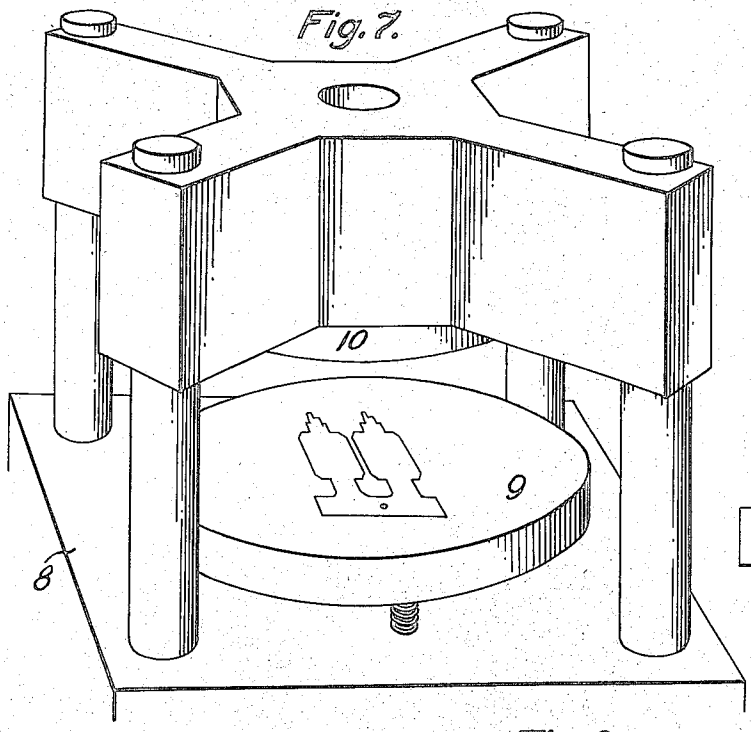


Fig. 8.

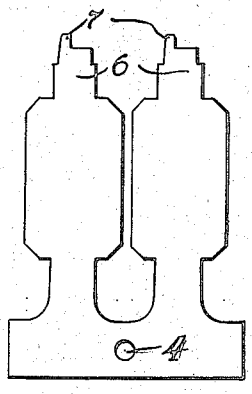


Fig. 9.

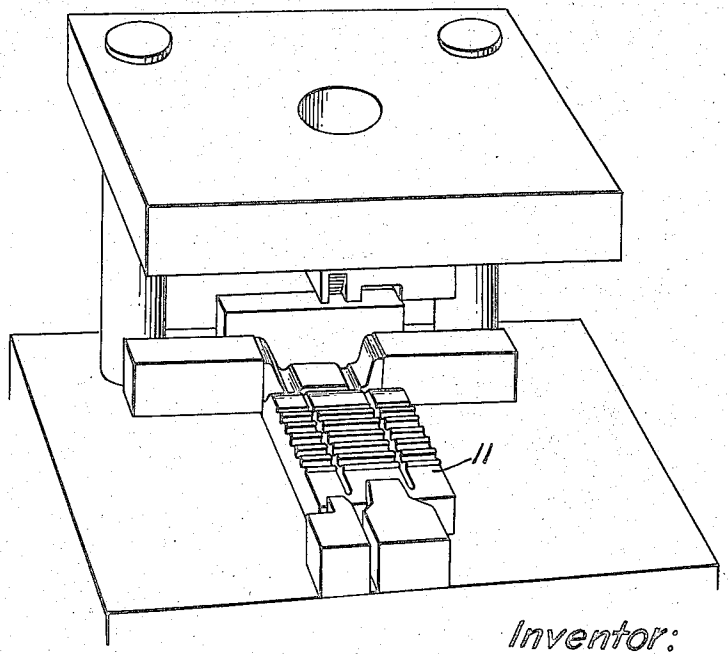
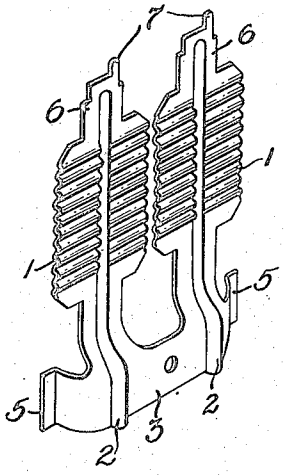


Fig. 10.



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3 SHEETS—SHEET 3.

Fig. 11.

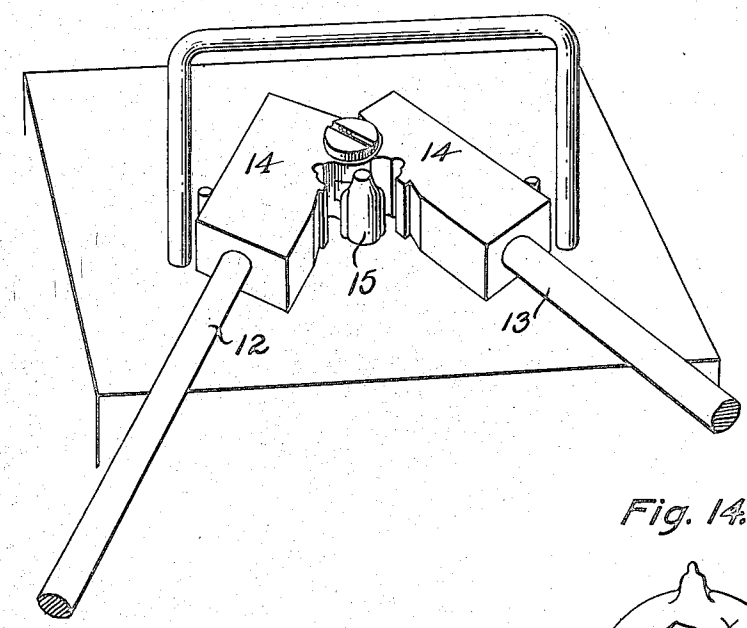


Fig. 12.

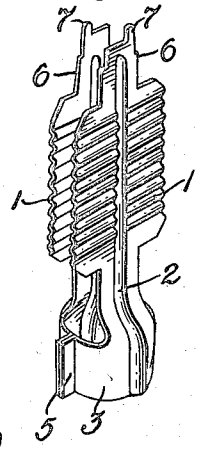


Fig. 13.

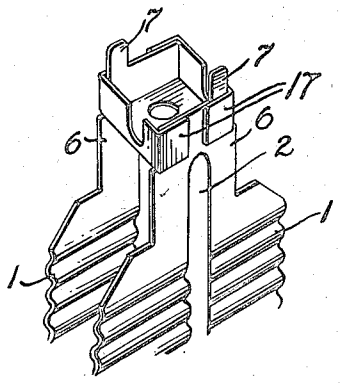
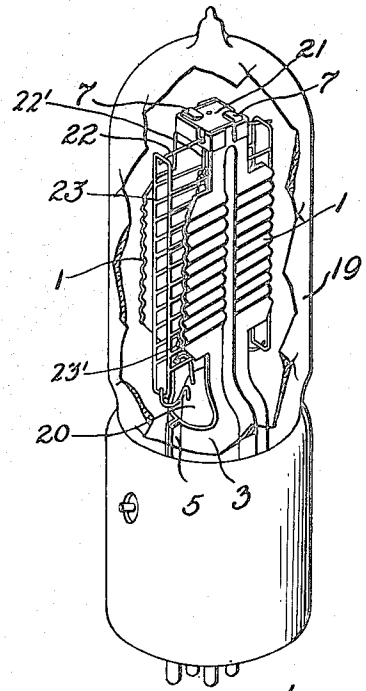


Fig. 14.



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UNITED STATES PATENT OFFICE.

WILLIAM F. HENDRY, OF NEW YORK, N. Y., ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

METHOD OF MANUFACTURING AUDIONS.

1,426,734. Specification of Letters Patent. Patented Aug. 22, 1922.

Application filed April 30, 1919. Serial No. 293,838.

To all whom it may concern:

Be it known that I, WILLIAM F. HENDRY, a citizen of the United States, residing at New York, in the county of New York, State of New York, have invented certain new and useful Improvements in Methods of Manufacturing Audions, of which the following is a full, clear, concise, and exact description.

This invention relates to a method of making an electrode structure for so-called stemless type audion tubes wherein the use of a glass arbor, stem, cane or the like for supporting the electrodes, is avoided. Prior constructions have involved the use of two separate electrode surfaces.

The object of this invention is to produce a unitary multiple surface electrode from stock material.

To accomplish this object a plurality of dies are used which successively treat the electrode material to shape it into its final form. The electrode which results from this treatment is of the form shown herein and is claimed in my co-pending application Serial No. 217,565, filed February 16, 1918, entitled "Vacuum tubes." The electrode in its final form comprises two parallel spaced surfaces of a corrugated form joined at their lower ends by a collar of the same material, which collar is adapted to surround and grip the stem of the tube and support the electrode structure. At their upper ends the surfaces are joined by a boxlike structure made of sheet metal and in which is supported a block of insulating material which serves as a base for supporting the wires from which the other electrodes are supported.

The method of producing these electrodes is in general as follows:—

1. The metal for the electrode surface is supplied in the form of ribbon of the required dimensions and is preferably of substantially pure nickel.

2. This material is first passed through a punch press in which is a die so shaped as to stamp out in a flat piece the multiple electrode structure with the connecting collar.

3. This rough blank is then passed through another press in which it is subjected to a forming operation by a die, the result being that the electrode surfaces are corrugated in the manner described in the above mentioned co-pending application. The structure is still in the form of a flat blank however.

4. The structure is then placed in a simple bending machine which bends the collar into its cylindrical form and arranges the electrode surfaces in planes parallel with each other. The structure is then ready for assembly with the other electrodes.

5. The metal box at the top of the electrode structure is formed into shape in three operations in punch presses by dies comprising one blanking and two forming operations which will hereinafter be described more in detail.

The invention is illustrated in the drawings of which Fig. 1 represents a die for blanking the box structure; and Fig. 2 represents the resultant product; Fig. 3 represents the die for the first forming operation on the box structure; and Fig. 4 represents the resultant product; Fig. 5 represents the die for performing the second forming operation on the box structure; and Fig. 6 represents the resultant product; Fig. 7 represents the die for blanking the electrode structure; and Fig. 8 represents the resultant product; Fig. 9 represents the die for forming the electrode structure; Fig. 10 represents the resultant product; Fig. 11 represents the device for bending the electrode structure; and Fig. 12 represents the resultant product; Fig. 13 represents the manner in which the upper ends of the electrodes are joined to the boxlike structure; and Fig. 14 represents the unit assembled in an audion tube. As shown in the drawings, (Figs. 10, 12, 13 and 14) the electrode structure comprises two surfaces, each of which is provided with a series of transverse corrugations 1 and longitudinal reinforcing ribs 2. These surfaces are joined at their lower ends by a collar portion 3. The middle portion of the collar portion is provided with an aperture 4 into which is adapted to fit a nib on the stem of the tube when the electrode is assembled thereon. At its ends the collar portion is provided with flanges 5 which, when the electrode structure is bent into its final form, are welded together in the position shown in Fig. 12. The upper ends of the electrode structure are provided with projecting flange portions 6, 6 and projecting ear portions 7, 7. These portions are adapted to

receive the box member above mentioned which will be described in detail hereinafter.

The first step in the manufacture of the electrode structure is that of blanking the ribbon. The ribbon is run in through a die 8 (Fig. 7) which comprises a lower member 9 and a cooperating member 10. This die is used in any suitable style of punch press and the result of its operation on the ribbon strip is the blank form shown in Fig. 8.

This blank is then passed to another machine of the same general type in which a die 11, Fig. 9, is used. In this step the longitudinal and transverse ribs are formed and the resultant product is shown in Fig. 10.

The formed blank is then passed to a bending machine of the type shown in Fig. 11. This machine comprises two pivoted arms 12, 13, each having in its inner face a die member 14 of the shape into which the blank is to be bent. When in their closed position these die members are adapted to embrace in a spaced manner a central post 15 which likewise is of the proper form. To bend the blank it is placed in between the jaws of the die members and the arms 12, 13 are then closed bending the blank into the shape shown in Fig. 12, with the surfaces parallel and the flanges 5 of the collar abutting each other. It has previously been said that these two flanges are welded together when the electrode is assembled on the tube stem. The other electrodes in the tube are adapted to be supported from the above electrode structure by placing in the top of the above described electrode structure an insulated block into which are placed the wires for the support of the other electrodes. This arrangement is accomplished by providing a box at the top of this double surface electrode structure, which not only serves to support the other electrodes therefrom, but also serves to join the upper ends of the double surface electrode into a rigid unitary structure. This box is formed from strip metal by placing the strip in a punch press containing a die member shown in Fig. 1. In the manner well known in punch pressing, the product shown in Fig. 2 is formed. This blank has an aperture 16 and four projecting ears 17. The next operation to which this blank is subjected is that of forming, and it is passed to another punch press Fig. 3 in which the product shown in Fig. 4 is produced. In this form it will be noticed that the ears 17 are upturned all in parallel planes. The last operation to which the box is subjected, is a second forming operation, the product of which is shown in Fig. 6, the die for performing this operation being shown in Fig. 5. In this operation the ends of the blank are upturned to form the box. This box has the aperture 16 and the grooves 18 therein, which permit of the free passage of the wires to the insulated block in the box without contact with the metal of the box.

The dies used in the above mentioned operations are constructed to produce these forms by means well known in the tool maker's art, and are used in well-known types of punch presses. These dies comprise a male and female member cut to conform to the required form.

Fig. 13 shows the manner in which the box serves to join the top of the electrode structure. When the ends of the box blank are bent up in the second forming operation, the inner faces of the ears are slidably spaced from the bottom edges of the box to permit the flanges 6 and the ears 7 of the electrode surface to be inserted therebetween, as shown. The overlapping portions of these two structures are then welded together, leaving the ears 7 projecting above the level of the top of the box.

As shown in Fig. 14 this unit is mounted within an envelope 19, in which is a stem 20 embraced by the collar 3, the lapping portions 5 of which are welded. By means of this construction the electrode unit is rigidly mounted in the envelope, the electrode surfaces 1 being rigidly spaced by the box at the top. When the insulating block 21 is put into the box, the ears 7 are then bent over to hold the block in place. From this block 21 extend wires such as 22 and 22′ to support the other electrodes such as the grid 23 and the filament 23′.

By this method the use of glass stems which are fragile and subject to cracking under heat is eliminated and a rigid self sustaining unit is evolved. The parts of the unit are simply made and readily assembled to form an efficient audion unit.

What is claimed is:

1. The method of making an electrode unit which comprises cutting out in blank two surfaces adapted to serve as vacuum tube electrode surfaces with an integral collar portion connecting their lower ends, bending said surfaces into parallel opposed relation, and bending said collar portion to embrace a support, joining the upper ends of the surfaces by a metallic connection, associating insulating material with said connection and supporting other electrodes from said insulating material.

2. The method of making an electrode unit which comprises cutting out in blank two surfaces adapted to serve as vacuum tube electrode surfaces with an integral collar portion connecting their lower ends, bending said surfaces into parallel opposed relation and bending said collar portion to embrace a support, joining the upper ends of the surfaces by a metallic box connection, inserting insulating material in said box and

supporting other electrodes from said insulating material.

3. The method of making a caneless audion tube which comprises cutting out in blank two surfaces adapted to serve as vacuum tube electrode surfaces with an integral collar portion connecting their lower ends, bending said surfaces into parallel opposed relation, clamping the collar portion around the press of the audion, and joining the upper ends of the surfaces by a metallic connection.

4. The method of making a caneless audion tube which comprises cutting out in blank two surfaces adapted to serve as vacuum tube electrode surfaces with an integral collar portion connecting their lower ends, bending said surfaces into parallel opposed relation, clamping the collar portion around the audion press, joining the upper ends of the surfaces by a metallic connection, associating insulating material with the connection, and supporting other electrodes from said insulating material.

5. The method of making an electrode unit which comprises cutting out in blank two surfaces adapted to serve as vacuum tube electrode surfaces with an integral collar portion connecting their lower ends, bending said surfaces into parallel opposed relation and bending said collar portion to embrace a support, and joining the upper ends of the surfaces by a metallic connection.

In witness whereof, I hereunto subscribe my name this 24th day of April A. D., 1919.

WILLIAM F. HENDRY.