Oct. 2, 1945. W. W. EITEL 2,385,973

APPARATUS FOR MAKING GRIDS

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Fig. 2

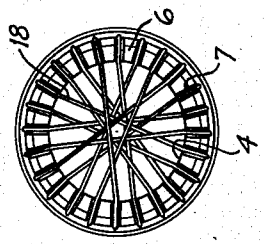


Fig. 1

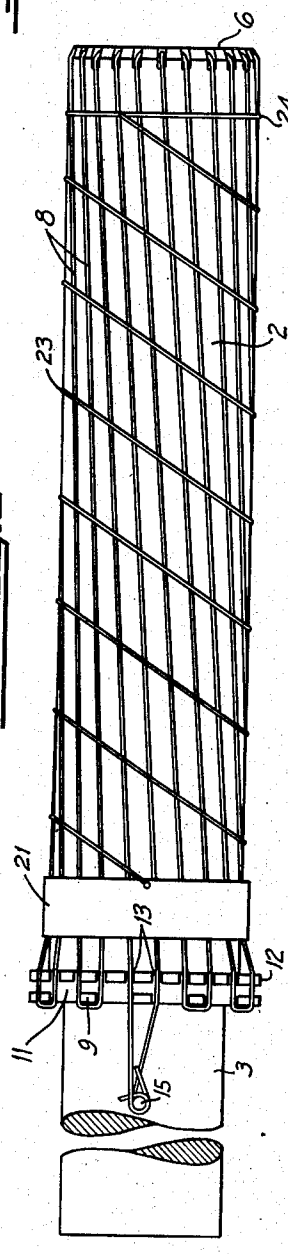


Fig. 3

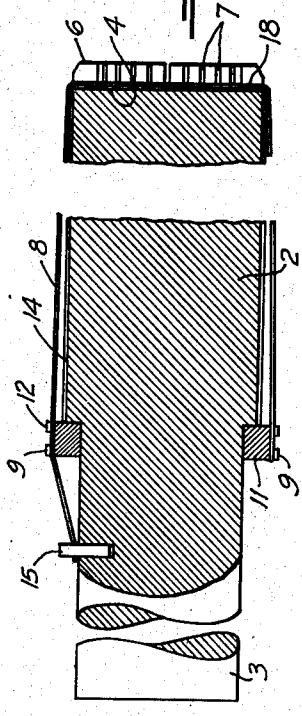
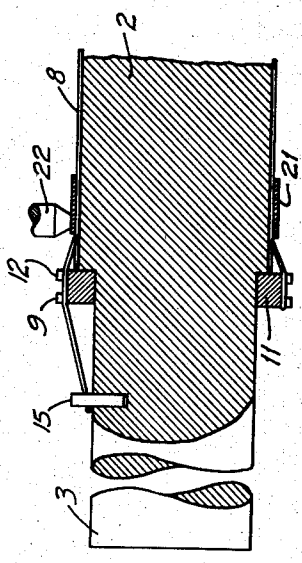


Fig. 4



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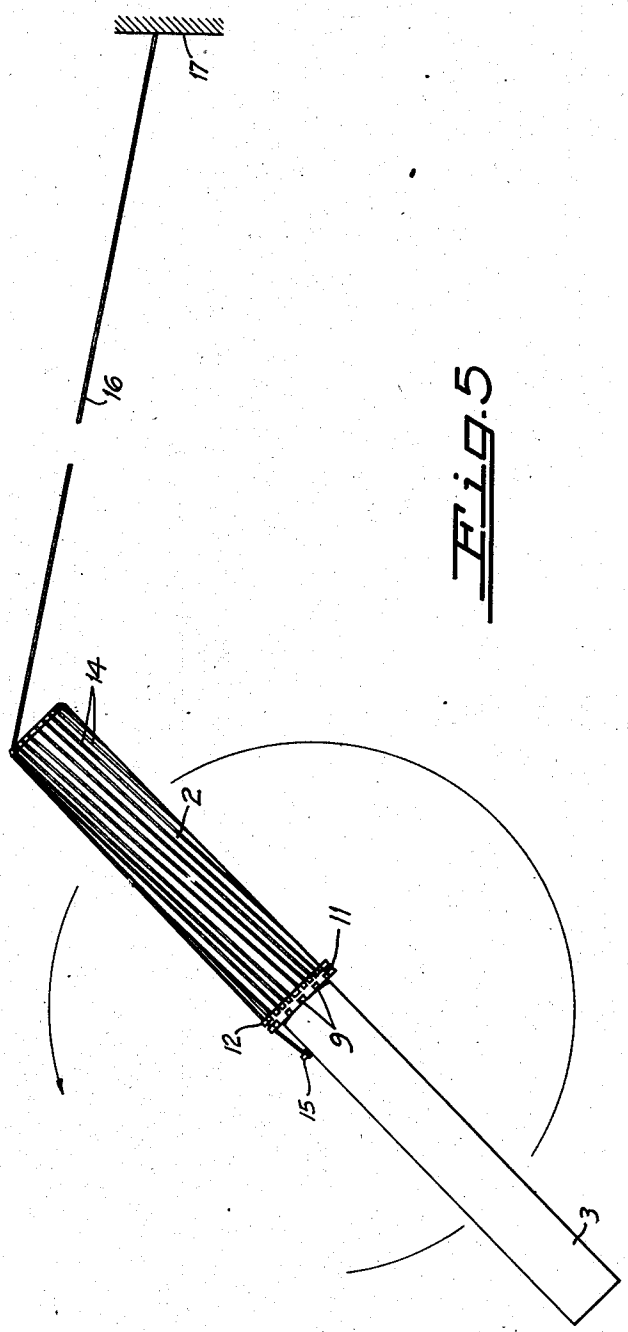


Fig. 5

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APPARATUS FOR MAKING GRIDS

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Original application August 24, 1942, Serial No. 456,126, now Patent No. 2,359,514, dated October 3, 1944. Divided and this application March 29, 1943, Serial No. 481,045

1 Claim. (Cl. 140—92.1)

This is a division of our copending application, Serial No. 456,126, filed August 24, 1942, in which is claimed the method embodying the improvements of our invention, while this application is particularly directed to the apparatus.

Our invention relates to the manufacture of a cage-type grid electrode for electronic tubes.

It is among the objects of our invention to provide an improved mandrel upon which the grid is formed, whereby the grid bars are more accurately positioned and uniformly tensioned.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of our invention. It is to be understood that we do not limit ourselves to this disclosure of species of our invention, as we may adopt variant embodiments thereof within the scope of the claim.

Referring to the drawings:

Figure 1 is a side elevational view of our improved mandrel having a grid formed thereon; and

Figure 2 is an end view of the same.

Figures 3 and 4 are fragmentary sectional views of the mandrel at different stages of forming the grid; and

Figure 5 is a diagrammatic side elevational view illustrating our method.

In terms of broad inclusion, our grid-making mandrel comprises an elongated core having wire receiving slots in the top end thereof, and wire engaging pegs on the core arranged in an annular row spaced from the slotted end. Wire receiving grooves are also preferably provided in the core, extending between the pegs and the slotted end. The grid is formed by securing an end of a wire to the mandrel, looping the wire up along a side and over the top and down along the opposite side of the mandrel to form a pair of grid bars, hooking the wire over a peg, relooping the wire over the end of the mandrel to form another pair of grid bars, hooking the wire over another peg, and continuing the looping and hooking steps until the desired number of grid bars are made.

In greater detail, and referring to the drawings, the grid is formed on a mandrel comprising an elongated cylindrical core 2, preferably of copper, having a lower extension 3 providing a handle. This core has a diameter substantially equal to the inside diameter of the grid. The upper end of the core has a recess 4 bounded by an annular flange 6 having a series of radial wire receiving slots 7. Twenty-four slots are shown, it being understood that this number may be varied depending on the number of grid bars 8 desired.

An annular row of radial pegs 9 is spaced below the upper end of the core a distance depending upon the length of grid desired. In a mandrel for a 24-bar grid there are twelve of these pegs. The base ends of the pegs are spaced from the surface of core 2 by a collar 11 press-fitted onto the core and on which the pegs are integrally formed. A flange 12 is also preferably formed on the collar ahead of pegs 9 and has a series of twenty-four wire spacing slots 13 aligned with the edges of the pegs. Wire receiving grooves 14, preferably cut at a slight angle to the mandrel axis, are provided in core 2 between pegs 9 and slots 7. A tie pin 15 on handle 3 adjacently below the row of pegs completes the mandrel structure.

Our method of making the grid comprises fastening an end of a wire 16 to a fixed element 17, and tying the other end to mandrel pin 15. The operator then turns the mandrel counterclockwise as viewed in Figure 3 about an axis transverse to the mandrel axis to loop the wire up along a side and over the top and down along the opposite side of the core to form a pair of the grid bars 8. These bars thus lie along grooves 14 and are connected at the top by a bight 18 engaging a pair of the slots 7. The operator then hooks the wire about peg 9; again turns the mandrel about the transverse axis to reloop the wire over the end; and hooks the wire about another peg, thus forming another pair of grid bars. These looping and hooking steps are continued until all twenty-four grid bars are laid. The other end of the wire is then tied to pin 15 and released from fixed element 17. At this stage the grid structure appears as shown in Figure 3.

Recess 4 at the end of the mandrel core provides space for bights 18 criss-crossing at the top. In fabricating a grid having a large number of bars, bights 18 are preferably laid offcenter through slots 7 so that the crossovers come at different points instead of all piling up at the center. See Figure 2.

Since the bases of pegs 9 are spaced from the surface of core 2, grid bars 8 diverge outwardly toward the pegged ends, and thus lie in conical formation. The slope of the bars is illustrated in Figure 3. This is to apply tension to the wire bars when ring 21 is applied.

Ring 21 is a metallic band having a diameter slightly larger than core 2 so that it fits snugly over bars 8 lying in shallow grooves 14. The ring is engaged over the top end of the mandrel and is forced inwardly over the bars to the final

position shown in Figure 1; the structure with ring 21 applied also being illustrated in Figure 4. As the wires are constricted inwardly from initial conical formation toward the cylindrical surface of core 2 they are put under tension. This straightens out the bars and brings them into parallelism, with each bar lying in its respective groove 14.

Inasmuch as the grid at this stage is all one piece of wire, merely looped back and forth on the mandrel, there is a compensating action or movement permitted between the several lengths of wire when ring 21 is forced on. This tends to equalize the tension in bars 8, and prevents the wires from breaking; it being further noted that there are no welds between the wires or between the wires and ring 21 to break loose when tension is being applied.

Ring 21 forms the terminal element at the base of the final grid structure, and is therefore welded to bars 8. This is done by passing a suitable welding current through the mandrel (which functions as an electrode) and another electrode 22 engaged with the outer surface of ring 21 as illustrated in Figure 4. Subsequently, one or more wire helixes 23 are welded to bars 8, and a wire ring 24 is welded to the bars adjacent the top of the grid. Core 2 is also used as an electrode for this welding. The wires are then severed at the lower edge of ring 21, and the completed grid is slipped off the end of the mandrel.

We claim:

A mandrel for making a cage-type wire grid, comprising a core along which the wire may be laid to form longitudinal bars of the grid, wire receiving slots at one end of said core spacing the bars circumferentially about the core, and wire engaging pegs arranged in an annular row remote from said end for holding the bars away from the surface of the core, whereby the bars diverge outwardly from said end toward the pegs.

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