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MULTICELLULAR VELOCITY-MODULATED TUBE

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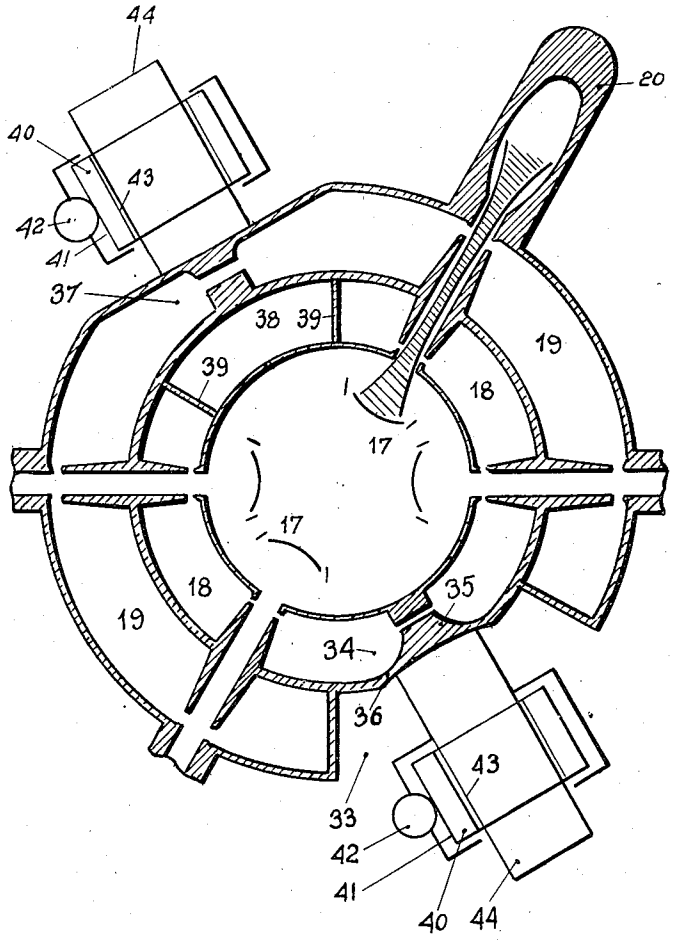

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MULTICELLULAR VELOCITY-MODULATED TUBE

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3 Claims. (Cl. 315—6)

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The present invention relates to velocity-modulated tubes of the type of those described in J. Bernier's co-pending United States application Ser. No. 664,156 filed on April 23, 1946, now Patent No. 2,539,985. Such tubes are essentially formed by the association in parallel of a plurality of cells, each of which comprises an electron beam adapted to pass across a system of cavity resonators of prismatic shape with a rectangular or trapezoidal base, or of sectorial cylindrical shape bounded by two concentric surfaces. Said resonators are provided over the whole or a part of their height with a re-entrant portion across which the beam is adapted to pass, and the successive resonators are arranged either in a straight line or in a circle, the system providing in the latter case a radially symmetrical tube.

One of the chief difficulties of construction encountered in this type of tube is the impossibility of tuning the cells in an efficient and simple manner by deforming their walls.

Certain devices proposed, such as inserting a piston into the inductive portion of the resonators, give only an extremely narrow tuning band.

The object of the invention is to enable simple tuning over a wide band to be obtained in tubes of this type.

The improvement according to the invention comprises eliminating one of the operative cells in the row or in the belt of such cells, and mounting the deforming means in the portion of the enclosure that corresponds to the eliminated cell.

With said improvement are associated suitable embodiments of the deforming means.

The figure of the accompanying drawing shows by way of example a sectional plan view of a multi-cellular klystron to which the improvement according to the invention is applied.

The figure shows a sectional plan view of a radially symmetrical klystron comprising a plurality of cathodes 17, an inner belt of cavities 18, an outer belt of cavities 19, and a plurality of similar anodes 20 only one of which is illustrated. The cross-sectional shape of the resonators shown herein corresponds to the shape of Fig. 8 J. Bernier's aforesaid co-pending application, but it is to be understood that the shape specified in my co-pending application, for "Multi-cellular Velocity Modulated Tubes" Serial No. 92,373, filed May 10, 1949, could just as well be used without affecting the possibility of applying the improvements hereinafter described. The resonators of each belt are coupled to one another by eliminating the common walls,

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but they could be coupled to one another by other means, for example by means of loops.

In the improvement according to the invention, a portion 33 of the outer belt is eliminated and the corresponding cavity resonator 34 of the inner belt is replaced by a special cell in which the front surfaces of the re-entrant portion 35 are solid while the outer cylindrical wall 36 is replaced by a flat or slightly concave wall. By these means the inner belt can be readily reached in order to enable deforming means to be applied thereto which will act on a wall that has been rendered readily deformable.

In the same manner, a resonator of the outer belt is replaced by a cell 37 with a solid re-entrant portion and a flat or slightly concave outer wall, while the corresponding inner resonator 38 is rendered inoperative by interposing the walls 39. In this manner, the wall of the outer belt is also rendered readily deformable.

Furthermore, the elimination of a cell in each of the belts has the advantage of introducing a gap between the input and the output of the chain of oscillating circuits formed by the cells and of thereby preventing reaction which may be objectionable in the case in which it is desired to use the tube as an amplifier.

The decrease in inductance produced by the shape given to the wall is compensated by the increase in capacitance that corresponds to the front surfaces of the re-entrant portion which are no longer hollow to allow the beam to pass, but solid. The tuning frequency of the special cell can therefore be kept at the same value as that of the operative cells.

In the case in which the magnitude of the deformation which it is desired to obtain is not too great for example in the case of an amplifier operating on a given frequency, it would however be possible to restore the hollow shape of the re-entrant portion, the beam and the anode, by providing a suitable deforming system round the anode. In this case, the capacitance of the cell cannot be increased by widening the front surfaces, since the overlap of the high-frequency field might become preclusive. On the other hand, it is possible in this case to increase the capacitance by mounting grids in the passage of the beam across the cavity resonator.

In the figure, the suitable deforming means for the system in question are shown schematically, said means comprising for example a core 40 which is secured to the stationary portion of the cavity resonator and is provided at its pe-

riphery with a toothed portion 41 driven by a worm 42. Said core is provided on the inside thereof with a screw-thread 43 which is adapted to actuate a screw-threaded member 44 secured to the wall to be deformed.

What I claim is:

1. A velocity modulation tube having a plurality of cells each comprising a cathode, an anode, a first cavity resonator and a second cavity resonator, the first cavity resonator of each cell communicating with the first cavity resonator of each of the other cells and with a first adjustment cavity resonator having at least one deformable wall, the second cavity resonator of each cell communicating with the second cavity resonator of each of the other cells and with a second adjustment cavity resonator having at least one deformable wall, and mechanical means connected to said adjustment cavity resonators for deforming the walls of said adjustment cavity resonators.

2. A tube according to claim 1 wherein the

cells and the adjustment cavity resonators are circular, the first cavity resonators and the second adjustment cavity resonator being arranged along an inner circle and the second cavity resonators and the second adjustment cavity resonator being arranged along an outer concentric circle.

3. A tube according to claim 1 wherein the adjustment cavity resonators have a re-entrant cross-section with a solid re-entrant portion.

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The following references are of record in the file of this patent:

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