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ARRANGEMENT FOR PRODUCING FILTERS

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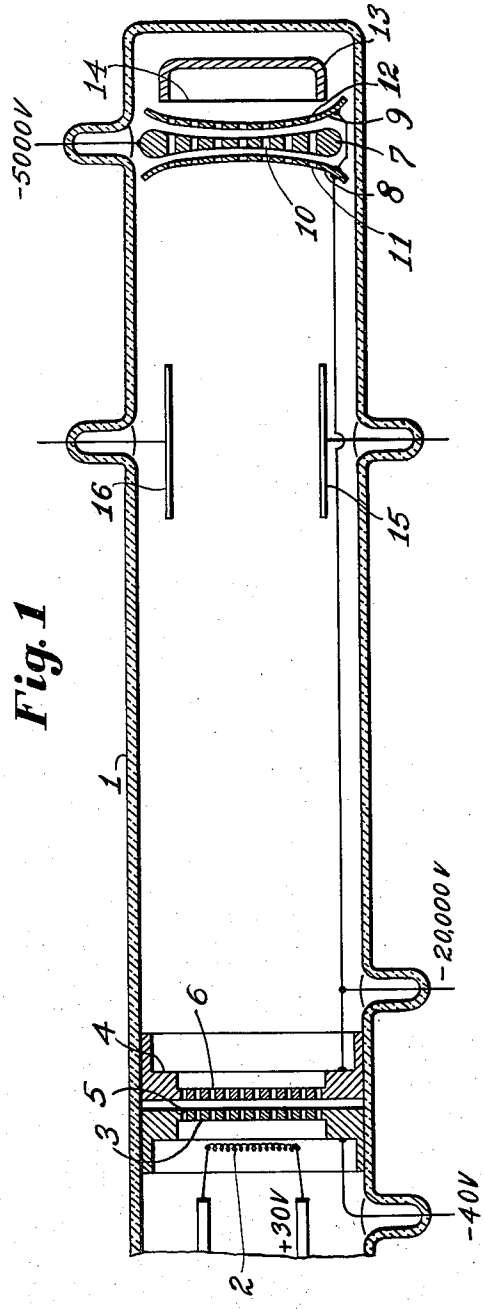

Fig. 1

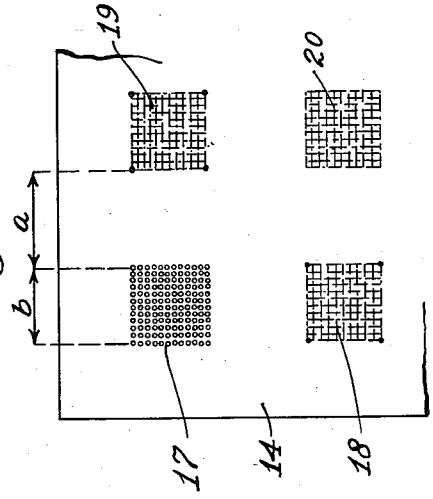

Fig. 2

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ARRANGEMENT FOR PRODUCING FILTERS

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7 Claims. (Cl. 164—85)

This invention relates to an arrangement for producing filters.

To produce surface filters and ultra-filters which have the properties of an ideal filter it is known in the art to burn in a foil with the aid of ion rays perforations of constant magnitude and form and in a desired spaced relation from one another.

The object of the present invention is to provide an arrangement, whereby the greatest possible number of very fine perforations are burnt in a filter film so as to reduce the filter resistance (resistance to flow). This may be accomplished according to the invention by the fact that the cross-section through which pass the ion rays issuing from the ion emitting source is projected by means of an electrostatic multiple lens on the foil to be perforated. To this end, a short focus multiple lens is preferably employed in front of the foil. By providing the electrostatic multiple lens with a plurality of accurately aligned perforations, it is also possible to burn when producing filters a corresponding plurality of perforations in the foil. In carrying the invention into practice a multiple lens is preferably employed consisting of two electrodes impressed with a high negative potential and provided with a plurality of perforations and of an electrode interposed between these two electrodes and impressed with a lower negative potential and also provided with perforations.

Since the distance between the individual elements of the multiple lens is relatively great, perforations are obtained in the foil during the burning operation between which there may be relatively broad stripes of the foil which are not perforated. In order to provide also these stripes with perforations to the greatest possible extent, the arrangement according to the invention is so designed that the ion rays may be deflected after the first burning operation by means of deflecting magnetic fields in a corresponding manner.

A further possibility of increasing the number of perforations obtainable with one burning operation consists according to the invention in the fact that the ion emitting source is provided in a known manner with two electrodes having a plurality of perforations which form a plurality of cross-sections for the passage of electron rays. By means of the multiple lens not only a single ion ray cross-section but a plurality of ion ray cross-sections are therefore projected simultaneously.

In the accompanying drawing, Fig. 1, is shown an embodiment of the invention in diagrammatic form. The reference numeral 1 denotes a canal ray tube in which is arranged an oxide-coated incandescent cathode 2. Directly in front of the incandescent cathode are disposed two series-arranged electrodes 3 and 4. These electrodes are each provided with a plurality of accurately aligned perforations 5 and 6, respectively. These electrodes are spaced from each other a distance of about 3 mm. The electrode 3 may, for instance, be impressed with a voltage of −40 volts and the electrode 4 with a voltage of −20,000 volts. Hydrogen at a pressure of 10^{-2} millimeters Hg may be supplied to the tube. The arc gas discharge resulting therefrom may, for instance, burn at a potential of 40 volts. In this known arrangement an ion emitting source is provided by means of which a plurality of fine ion rays corresponding to the number of perforations 5 and 6 is produced. The reference numerals 7, 8, 9 denote an electrostatic short focus multiple lens which serves to project the numerous cross-sections for the passage of the ion rays on a foil 14 arranged directly behind the multiple lens. To this end, the foil 14 is stretched on a carrier 13. The three electrodes of the multiple lens are each provided with a plurality of perforations 10, 11 and 12. In this manner a number of elements of the multiple lens are obtained corresponding to the number of the perforations. The central electrode 7 is, for instance, impressed with a potential of −5,000 volts, whereas the other two electrodes 8 and 9 with a potential of −20,000 volts.

In the operation of the device a plurality of fine ion rays are emitted at the openings 6 of electrode 4, as previously mentioned. These rays are so formed, due to the potential on the electrode 4, that each ray has a sufficiently large cross-section in the plane of the electrostatic multiple lens 7—9 to cover the entire area of the lens. Thus the ions composing small sections of each ray enter the openings 11 of the front electrode 8 of the multiple lens 7—9. Looking at it from the standpoint of the multiple lens, each individual lens thereof receives a plurality of ion ray sections, which are parts of the ion rays emitted from the plurality of openings 6, respectively. The ray sections received by each individual lens are affected by the lens potential in known manner and are focused on the foil 14, whereby perforations are burned in the foil. In this connection, it may be pointed out that since each ray section received at an individual lens reaches the lens from a different direction from the directions of the other ray sections, these ray sections are focused at different points on the foil 14, and the perfora-

tion pattern produced at the foil is a reproduction of the opening pattern at electrode 4, although much reduced in size.

In Fig. 2 is shown a top view of a portion of the foil film 14 provided with perforations obtained by the burning process. The reference numerals 17, 18, 19 and 20 denote fields of filter perforations, each produced by one element of the multiple lens. Each perforation in such a field corresponds to the projection of a corresponding perforation in the electrodes 3 and 4 of the electron emitting source as above explained.

Since from a constructional point of view the distance a between the individual fields of the perforations produced by each element of the multiple lens is great in proportion to the width b of the field, also the portions of the foil not yet provided with perforations may be perforated by the use of electrostatic deflecting fields which may be, for instance, produced by deflecting plates 15 and 16 which deflect the ion rays in a known manner. With the aid of the above-described arrangement the greatest possible number of fine, nay ultra-microscopic filter perforations may be attained. Assuming, for instance, that in the electrode 4 there are one hundred perforations of a diameter of 0.5 mm. and that the electrostatic multiple lens has 50 perforations, 5,000 perforations are obtained at the same time in the filter foil with one burning operation.

When carrying the invention into practice it is particularly advantageous to use such ions which react with the filter substance. This is, for instance, the case when employing oxygen and pyroxylin foils.

What is claimed is:

1. An arrangement for producing filters, whereby fine perforations are made in a foil by means of ion rays, comprising a source of ions, an electrostatic multiple lens for forming a plurality of overlapping ion beams, and a second electrostatic multiple lens arranged to produce a plurality of ion beams from each of said first mentioned beams and project them on the foil to be perforated.

2. An arrangement for producing filters, whereby fine perforations are made in a foil by means of ion rays, comprising a multiple electrostatic lens for projecting ions on to the foil to be perforated, a source of ions, and a second multiple electrostatic lens for directing a plurality of beams of ions toward said first multiple lens, the first-mentioned of said multiple electrostatic lenses receiving in each of its individual lenses a part of each of said beams of ions whereby each of said individual lenses directs a pattern of individual beams composed of individual parts of each of said beams.

3. An arrangement as set forth in claim 1, wherein the projecting lens comprises three spaced electrodes having aligned perforations therein, the two outer electrodes being impressed with a high negative potential and the central electrode with a lower negative potential.

4. An arrangement according to claim 1, wherein the ions are produced from a gas which is capable of reacting with the foil.

5. Apparatus for producing fine perforations in a foil or the like, comprising a source of ions, means cooperating with said source to form a plurality of ion rays which have overlapping cross-sections in a given plane, and a multiple lens located substantially in said plane, said lens comprising a plurality of individual lenses each operative to receive a section of each of said ion rays and focus such sections at different points, respectively, on said foil.

6. In apparatus for producing filters by making perforations in a foil by means of ion rays, means constituting a source of a plurality of individual beams having overlapping cross-sections with the central axis of all of the beams substantially parallel but with the rays forming each beam out of parallel relationship, and a multiple lens assembly positioned in the path of said beams comprising a plurality of individual lenses each of which is operative to receive a section of each of said beams and direct the sections at different points respectively on the foil.

7. Apparatus as described in claim 6 wherein deflectors are provided at the sides of the path of the beams for producing a field to deflect the beams.

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