

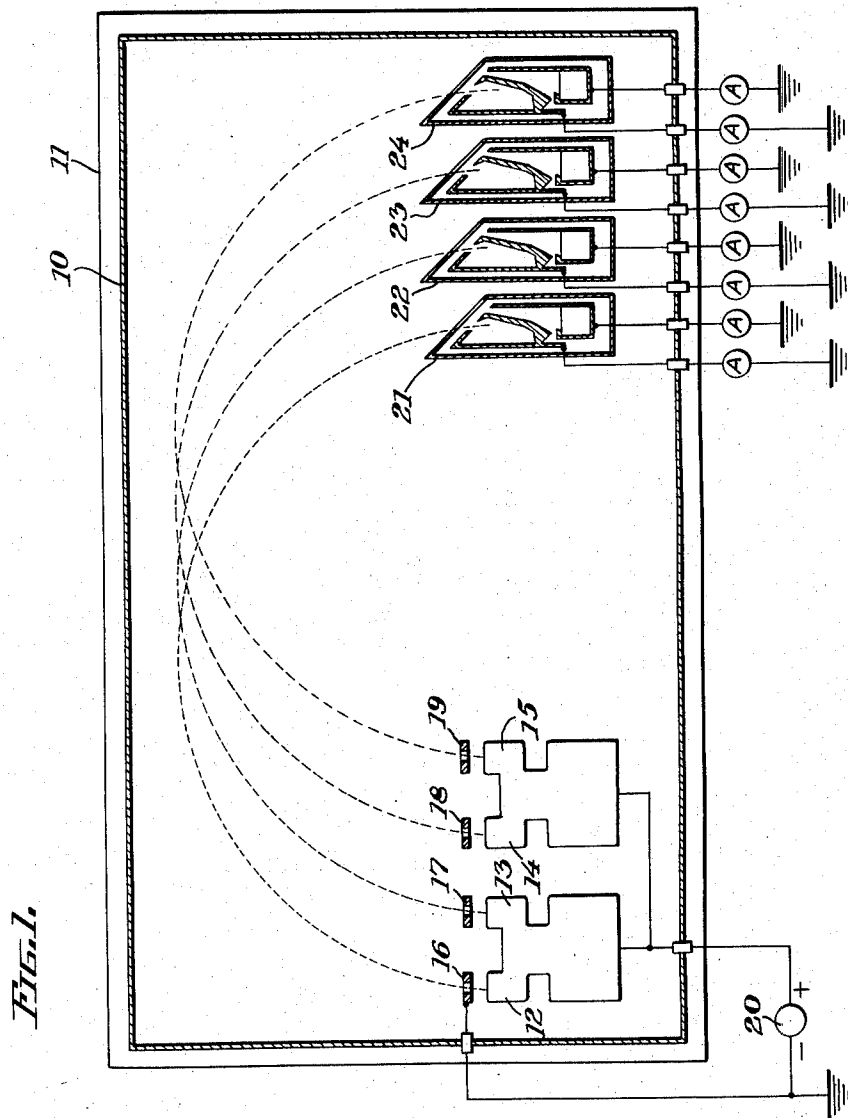
July 7, 1959

H. F. YORK
CALUTRON RECEIVER

2,894,137

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2 Sheets-Sheet 1



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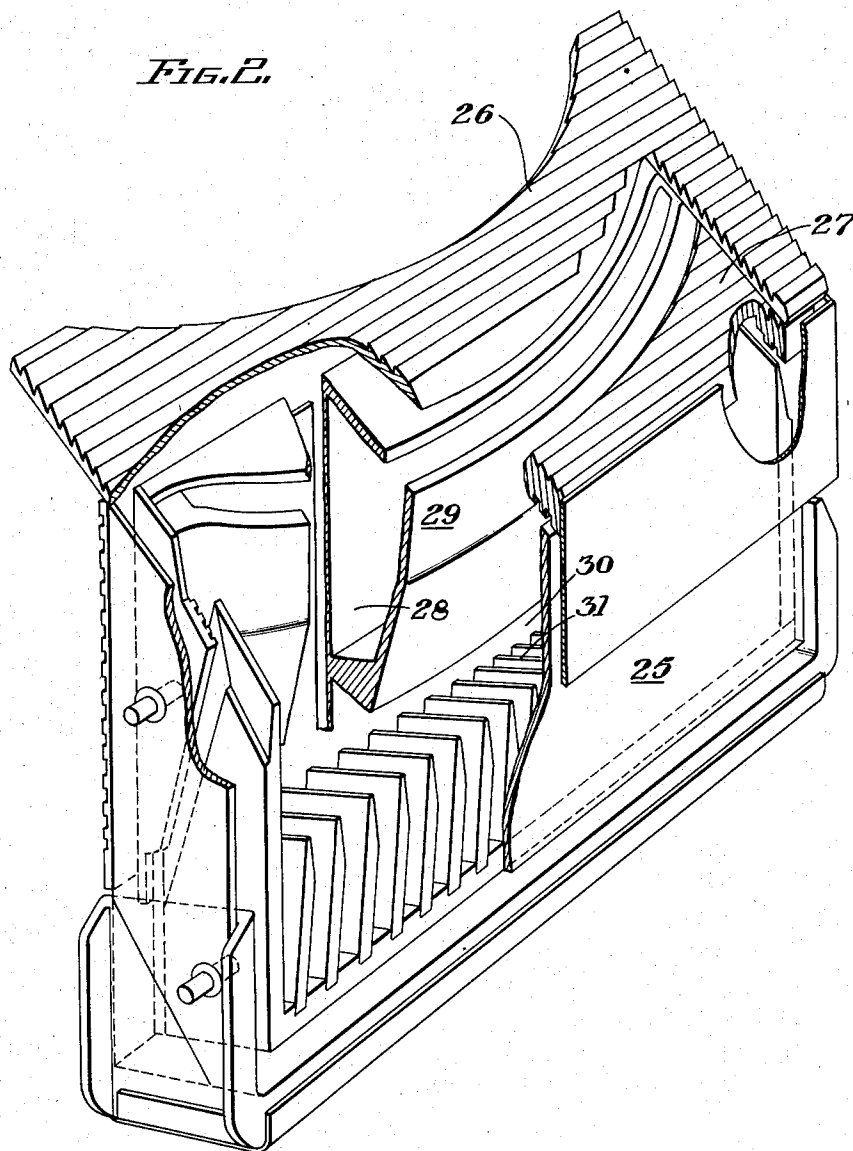
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CALUTRON RECEIVER

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4 Claims. (Cl. 250—41.9)

The present invention relates to apparatus for the electromagnetic separation of the isotopes of an element and more particularly to a receiver construction for improving separation in multiple unit apparatus i.e., apparatus having two or more ion sources and an individual receiver unit for each source.

In the electromagnetic separation of isotopes, a common form of apparatus comprises the combination of a partially evacuated closed vessel and a magnetic field of such strength as to constrain uniform velocity ions projected within the vessel to motion on circles having radii which are a predetermined fixed function of the momentum of the ions. By such means it is known that the magnetic mass spectrum of ions having a common origin will appear after 180° of travel. In order to utilize effectively the evacuated vessel and the magnetic field, it is usual in such apparatus to provide a plurality of ion sources each of which is elongated in a direction parallel to the magnetic field and all of which lie in a single plane. For separately collecting the ions according to their magnetic mass spectrum, a corresponding number of receiver units are properly positioned with their entrance slots occupying the same plane as the ion sources. Space is economized by arranging the receiver units, as well as the ion sources, as closely adjacent as is physically feasible.

In such apparatus it is usually desirable to perturb the magnetic field to increase the definition of the mass spectrum and as is well known this results in the spectrum appearing in a space curve which requires, for efficient collection, receivers having entrance slots similarly curved. Thus the face plates defining such entrance slots are placed at an angle to the plane of the ion sources but parallel to the magnetic field. With this arrangement of the receivers, ions striking the face plate of one receiver are likely to be scattered or sputtered into the entrance slots of another receiver with resultant contamination. Such scattered ions are referred to as background material.

It is a primary object of the present invention to provide receiver means so constructed as to prevent or materially reduce the scattering of background material onto adjacent receivers.

Another object of the invention is to provide the face plates of ion receivers with a configuration adapted to capture a portion of the ions impinging thereon and to direct most of the others in harmless directions.

The aspects of the invention which I desire to protect herein are pointed out with particularity in the appended claims. The invention itself, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a partially sectionalized elevation of an electromagnetic isotope separating apparatus for which the invention is adapted; and

Fig. 2 is a view in perspective with parts torn away of a receiver unit incorporating the preferred embodiment of the invention.

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The arrangement shown in the drawings is largely diagrammatic and consists of only those features necessary to a complete understanding of the invention. The various supporting structures and auxiliary equipment may take any suitable form known to those skilled in the art and constitute no part of the present invention. Accordingly, such structure and equipment have not been shown since it would serve only to obscure rather than disclose the invention.

Referring to Fig. 1, there is shown a closed vessel 10 positioned in a strong magnetic field provided by a magnet, one pole piece 11 of which is shown. The vessel 10 provides a space within which electromagnetic separation of ions may take place and is preferably highly evacuated, although the presence of a small amount of gas is generally desirable to avoid so-called "space charge" effects.

Within the closed vessel 10 and also within the region of influence of the magnetic field produced by the pole piece 11, there are provided a plurality of sources 12, 13, 14 and 15 of ions of a material the isotopes of which it is desired to separate and which in conjunction with accelerating electrodes 16, 17, 18 and 19, respectively, serve to project in a direction normal to the magnetic field individual streams or beams of high velocity ions. The accelerating electrodes 16, 17, 18 and 19 are made negative with respect to their associated ion sources 12, 13, 14 and 15 from any suitable direct current supply 20 which preferably is adjustable.

As is known, the ion beams projected through the accelerating electrodes 16, 17, 18 and 19 will, as indicated in Fig. 1, follow substantially circular orbits of equal curvature and after 180° of travel the different isotopes in each beam will attain maximum separation. It is at this point in each beam that individual receiver units 21, 22, 23 and 24 are positioned with their entrance slots occupying a plane substantially coincident with the plane of the ion sources 12, 13, 14 and 15.

For reasons which will be apparent from the description of Fig. 2, the faces of the receivers 21—24 are positioned at an angle to the incoming beams and this arrangement results in some contamination due to background material scattering or sputtering from one face plate into the entrance slot of an adjacent receiver. As was pointed out above, such background material comes from ions striking the face plates and being scattered as neutral particles. Such scattering is predominately in a direction perpendicular to the surface doing the scattering and is relatively independent of the angle of incidence of the incoming ions.

Referring now to Fig. 2, a receiver unit 25 such as may well be employed in the apparatus of Fig. 1 is shown as comprising an overall rectangular box having a face plate consisting of two sections 26 and 27 surrounding an opening constituting the entrance slots to the receiver pockets. In accordance with the invention, the face plate sections 26 and 27 are provided with a "shark tooth" corrugated surface so arranged that one side only of the teeth sees the incoming ion beam while the other side is a shadow surface to which about 25% of the scattered ions adhere. The particular internal structure of the receiver 25 has no direct relation to the present invention and is here shown merely to illustrate one of the many types of receivers to which the invention is applicable. In this particular case the receiver 25 is adapted for use in the separation of two isotopes of a single chemical element with emphasis on the collection of one of these isotopes for discarding from the process cycle. One of these isotopes is collected in a pocket 28 one wall 29 of which separates this pocket 28 from a pocket 30 for the collection of the other of these isotopes. This latter pocket 30 has at its bottom a series of transversely arranged

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inclined baffle members 31 which aid in retaining the material entering the pocket 30.

It will be noted that the entrance slots to the pockets 28 and 30 are curved in the plane of the face plates 26 and 27 and thus present space curves to the incoming ion beam. In this way the region of focus of the beam can more nearly be matched when as above suggested the magnetic field is perturbed.

The exact configuration of the corrugated surface of the face plates 26 and 27 is not critical but should extend in the same general direction as the magnetic field and should have a portion of the surface shaded from direct bombardment by the incoming ions.

While for the purpose of illustrating the invention a particular apparatus has been described, it is to be understood that the invention is not limited to the particular apparatus but is of the scope of the appended claims.

I claim:

1. In a receiver unit for an electromagnetically established ion beam, a face plate defining an opening to a collector pocket, said face plate being arranged at an angle to the impinging ion beam and having its surface

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provided with parallel ridges so disposed that one side only of each ridge is exposed directly to the ion beam.

2. The unit as claimed in claim 1 in which the parallel ridges are sawtooth shape in cross-section and extend parallel to the magnetic field employed in establishing the ion beam.

3. A multiple receiver unit for electromagnetic isotope separating apparatus of the type in which a plurality of ion beams are projected from a plurality of closely adjacent aligned ion sources, comprising a plurality of closely adjacent aligned collecting pockets for receiving the respective ion beams, a plurality of face plates, each defining an opening to the associated pocket, the surface of each of said face plates having a number of upstanding ridges so disposed that one side only of each ridge is exposed directly to the incoming ion beam.

4. A unit, as claimed in claim 3, in which the ridges are sawtooth shape in cross section and extend parallel to the magnetic field employed in the isotope separating apparatus.

No reference cited