Nov. 8, 1960 V. A. CAMPANILE 2,959,700

PARTICLE ACCELERATOR

Filed Nov. 24, 1958

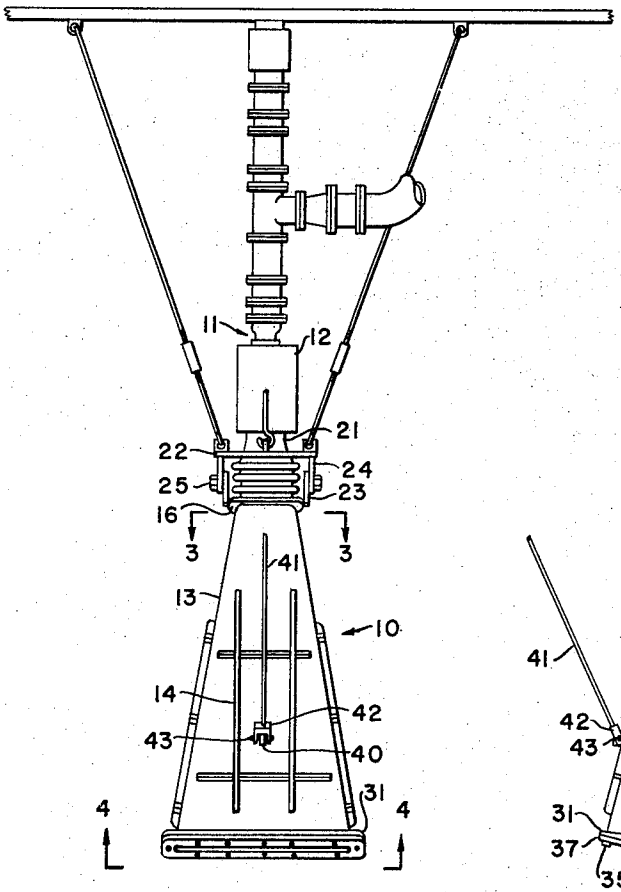


FIG. 1

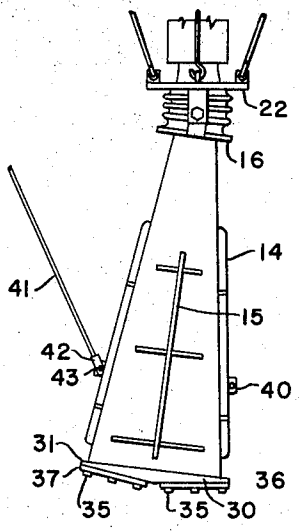


FIG. 2

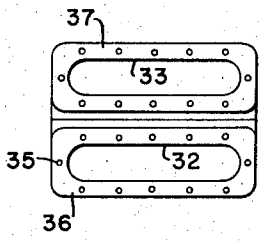


FIG. 4

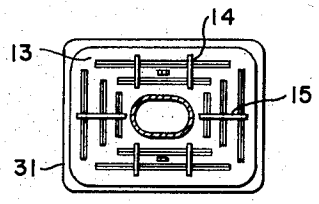


FIG. 3

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United States Patent Office 2,959,700 Patented Nov. 8, 1960

2,959,700

PARTICLE ACCELERATOR

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Filed Nov. 24, 1958, Ser. No. 775,966

4 Claims. (Cl. 313—64)

This invention pertains to particle accelerators and more particularly to a means for rapidly obtaining different types of radiation from a particle accelerator.

A considerable amount of the research being performed today utilizes a particle accelerator as a source of charged particles such as electrons, positive ions, X-rays, gamma rays, neutrons and the like. Two commonly-used accelerators are the Van de Graaff generator and the linear accelerator. In both of these accelerators a beam of electrons is accelerated to a high velocity and directed through a beam tube so that it will pass through a window or impinge upon a target positioned over the exit of the scanning section of the beam tube. When it is desired to produce a beam of electrons the electron beam of the accelerator is passed through an aluminum window while if X-rays are to be produced the electron beam of the accelerator is made to impinge on a gold target. Presently-used accelerators require that in order to change from an electron beam to an X-ray beam one must remove the aluminum window and replace it with a gold target and re-establish the vacuum in the scanning section of the beam tube of the accelerator. The re-establishing of the vacuum in the beam tube is a relatively long process due to the high vacuum required, thus the total time required to change accelerators from one type of radiation to another is a few hours which means that the accelerator is quite inflexible. This inflexibility of the accelerator is particularly bad in those situations where the accelerator is used to perform basic research since very seldom do consecutive experiments require the same type of radiation.

Accordingly, it is the primary object of this invention to provide a means for rapidly changing the character of the energy beam of a particle accelerator.

A further object of this invention is to provide a means for rapidly changing the character of the energy beam of a particle accelerator having a scanning tube section by positioning various types of windows or targets in line with the beam tube of the accelerator.

A still further object of this invention is to provide a particle accelerator with a scanning tube section having a plurality of chambers in order that a plurality of windows or targets may be positioned below the exit of the scanning tube section.

A still further object of this invention is to provide a particle accelerator with a scanning tube section one end of which is both pivotally and hermetically secured to the exit end of the beam tube of the accelerator and whose other end is provided with a plurality of flanged openings. Various scanning windows or targets may be hermetically attached to the flanged openings in order that the beam tube may be rotated about its pivoted end to selectively align one of the scanning windows or targets with the axis of the beam tube.

The above objects of this invention are achieved by providing a particle accelerator with a scanning tube section one end of which is pivotally connected to the beam tube and the other end of which is provided with a plurality of flanged openings to which various scanning windows or targets may be attached. In addition to being pivotally connected to the beam tube the scanning tube section is hermetically sealed to the beam tube and each of the flanged openings in the other end are hermetically closed by a scanning window or target. In order to align various scanning windows or targets with the axis of the beam tube all that is necessary is to rotate the scanning tube section about its pivot which in turn will bring a different scanning window or target into alignment with the axis of the beam tube.

The above and other objects of this invention will be more easily understood by those skilled in the art from the following description of a preferred embodiment when taken in conjunction with the attached drawing in which:

Figure 1 is a front view of a portion of the beam tube of the accelerator with the scanning tube section of this invention attached thereto;

Figure 2 is an end view of the scanning tube section shown in Figure 1;

Figure 3 is a horizontal section taken along the line 3—3 of the scanning tube section; and

Figure 4 is a bottom view of the scanning tube section taken along the line 4—4 of Figure 1.

Referring to Figures 1, 2, 3, and 4, there is shown a scanning tube section **10** which is pivotally and hermetically fastened to the lower end **12** of the beam tube **11** of the particle accelerator. The particle accelerator may be either a Van de Graaff generator or a linear accelerator or any other accelerator which produces a beam of electrons and discharges them through a beam tube. The scanning tube section **10** consists of a flared tubular section having an oblong cross section as shown in Figure 3, preferably formed of a relatively light material having substantially no interaction with electrons such as aluminum or the like. In order to permit the tubular section **13** to be formed of relatively thin material suitable stiffening members **14** and **15** are attached to the flat sides of the lower portion of the tubular member to increase its rigidity. A flange **16** is secured to the upper end of the tube section **13** by any desired means such as welding or the like. A similar flange or plate member **22** is secured to the lower end **12** on beam tube **11**. The opposite ends of a bellows **20** are hermetically sealed to the flange members **16** and **21** by any desired means such as welding or the like. The opposite ends of the bellows **20** may be provided with flanges similar to the flanges **16** and **22** with the flanges being hermetically secured to the flanges **16** and **22** by means of bolts and gaskets.

Two diametrically opposed ears or lug-type members **23** are secured to the outer edge of the flange **16** by any desired means such as welding or the like. Two similar ears or lugs **24** are secured to the flange **21** by welding or the like and are positioned so that they overlap the ears **23**. A pivot pin or bolt **25** passes through holes formed in the overlap portions of the two ears **23** and **24** thus forming a hinged joint having limited movement between scanner tube section **10** and the beam tube **11**. The pivot pin **25** should be a relatively tight fit in the openings in the ears **23** and **24** to eliminate all unnecessary clearance in this hinged joint and insure accurate alignment of the scanning tube section with the beam tube of the accelerator.

The lower end of the tube section **13** is provided with two oblong-shaped flange members **30** and **31**. These flanged members may be attached to the tube section **13** by any desired means such as welding or the like and in addition may be formed from a single member if desired. Each of the flanged members **30** and **31** are provided with a plurality of tapped holes **34** in order that a variety of scanning windows **36** and **37** may be secured to the flanged openings by use of machine screws **35**. Of course,

suitable precautions must be taken to insure a hermetical seal between the scanning windows and the flanges in order to permit one to obtain the high vacuum necessary in the scanning tube section. The plane of the flange members **30** and **31** should be substantially perpendicular to the axis of each half of the scaning tube section **12** as seen in Figure 2.

Two clips or ears **40** are attached by welding or the like to the opposite side walls of the tubular section **13** as shown in Figures 1 and 2. Rod members **41** which are provided with a forked end **42** at one end are connected to the clips **40** by passing a toggle pin **43** or the like through an opening in the clips and similar openings in the forked end **42** of the rods **41**. The opposite ends of the rods **41** not shown in Figures 1 and 2 are secured to any structure surrounding the particle accelerator by means of toggle pins or the like in order to maintain the scanning tube section in a predetermined fixed position. Of course when it is desired to reposition the scanning tube section to align a different scanning window with the axis of the beam tube, rods having different lengths will be required. The same rods may be used for all positions of the scanning tube section if suitable provisions are made for adjusting their length. Likewise, other means may be used to lock the scanning tube section in each position.

When the above-described scanning tube section is attached to a beam tube of a particle accelerator all that is required to align a different scanning window or target with the axis of the beam tube is to rotate the beam tube section **10** about the hinge joint **25** and lock it in position by installing the proper length rods **41**.

While but one embodiment of this invention has been described in detail, many modifications and changes will occur to those skilled in the art.

I claim as my invention:

1. A scanner section for adapting a particle accelerator to selectively produce a plurality of different types of charged particles comprising: a flared tubular scanner section, the small end of said scanner section being hermetically sealed to the end of the beam tube of the accelerator; pivot means adjacent said small end of the scanner section, said pivot means being disposed to permit rotation of the other end of said scanner section about an axis substantially perpendicular to the axis of the beam tube of the accelerator; a plurality of flange openings formed on the large end of the scanner section, the place of each of said flanged openings being substantially parallel to the axis of the pivot means; securing means for securing said scanner section in a plurality of predetermined positions, each of said predetermined positions being disposed to align the plane one of said flanged openings substantially perpendicular to the axis of a beam tube of the accelerator; and a different type of scanning window for hermetically closing each of said flanged openings.

2. A scanner tube for adapting a particle accelerator to selectively produce a plurality of different types of charged particles comprising: a scanning tube, said scanning tube being hermetically sealed to the beam tube of the accelerator; means hermetically disposed on the exit end of said scanning tube for forming a plurality of discharge openings; a different type of scanning window hermetically secured to each discharge opening and means for physically moving said scanning tube to selectively align said discharge openings with the axis of said beam tube.

3. A scanning tube for adapting a particle accelerator to selectively produce a plurality of different types of charged particles comprising: a flared tubular scanning member; a bellows member, one end of said bellows member being hermetically sealed to the small end of said scanning member, the other end of the bellows member being hermetically sealed to the end of the beam tube of the accelerator; hinge means for fastening said scanning member to said beam tube, the axis of said hinge means being substantially perpendicular to the axis of the beam tube; a plurality of flanged openings formed in the other end of said scanning member, the planes of said openings being parallel to the axis of said hinge means in one direction and at an angle to the axis of the scanning member in another direction; a plurality of different scanning windows for hermetically closing said flanged openings; and securing means for securing said scanner member in a plurality of predetermined positions, each of said predetermined positions being disposed to perpendicularly align the plane one of said flanged openings with the axis of the beam tube.

4. A scanning tube for adapting a particle accelerator to selectively produce a plurality of different types of charged particles comprising: a tubular member secured to the beam tube of the accelerator, said tubular member having a plurality of openings at its exit end; a different type of scanning window hermetically secured to each opening and mechanical means for moving the tubular member to selectively direct the beam of the accelerator through a predetermined one of said openings.

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