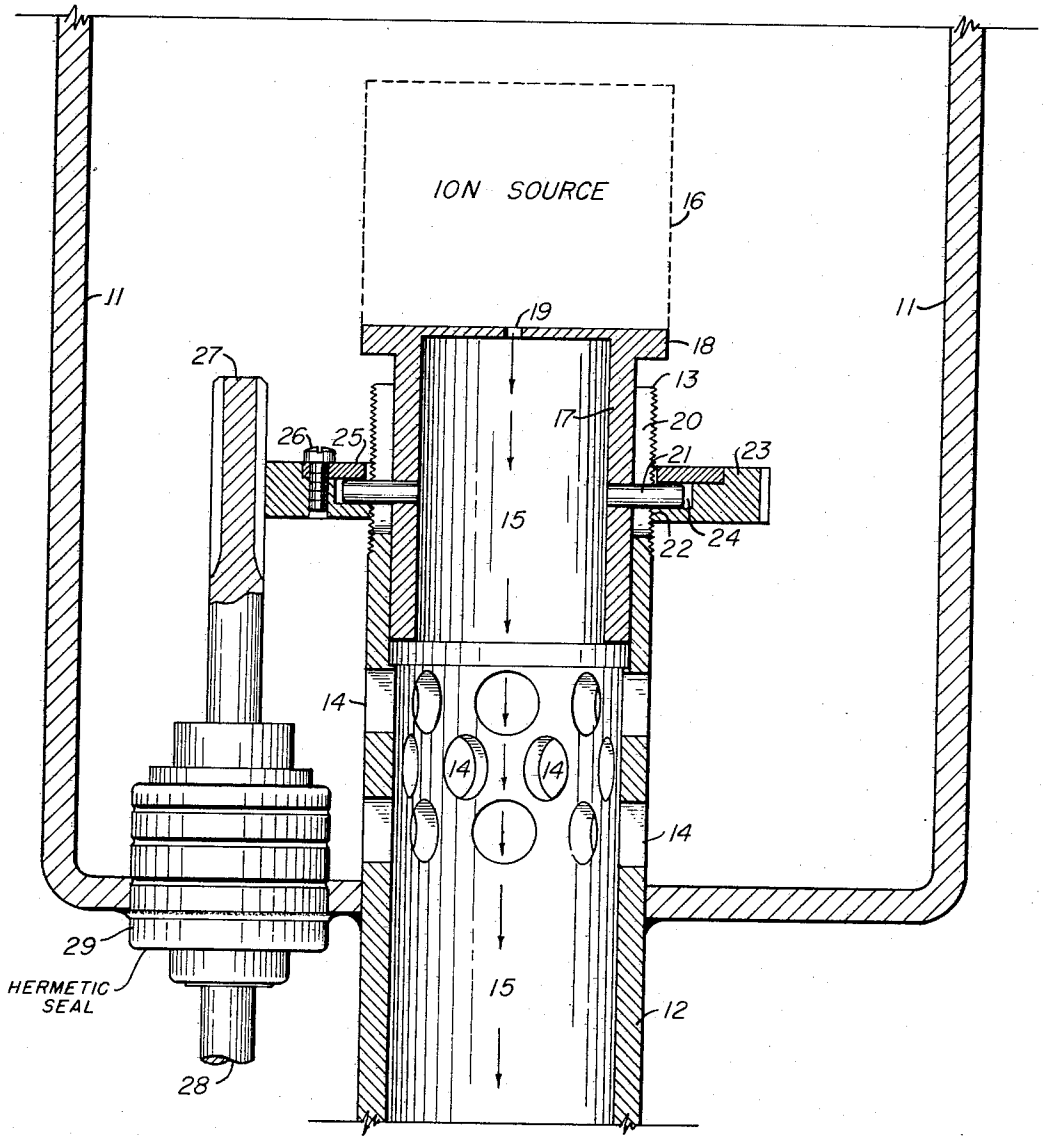
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ALIGNMENT APPARATUS FOR SOURCE OF IONS

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ALIGNMENT APPARATUS FOR SOURCE OF IONS

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The present invention is directed to apparatus for aligning an ion source with apparatus utilizing ions. More particularly, the invention is directed to an alignment apparatus for aligning an ion source along the axis of the ion path. In its more specific aspects, the invention has to do with apparatus for aligning an ion source with a mass spectrometer.

The present invention may be briefly described as an alignment apparatus for a source of ions which comprises, in combination, a first tubular member adapted to project within a pressure reducing means to define a path for ions which is in fluid communication with the pressure reducing means. The first tubular member is provided with at least one slot adjacent its free end in the pressure reducing means. A second tubular member is coaxially arranged in the first tubular member for movement longitudinally in the first tubular member. The second tubular member is adapted to support the source of ions and the second tubular member is provided with means protruding into the slot for resisting rotational movement. Means are operatively connected to the second tubular member for moving the second tubular member along the axis of the ion path.

The pressure reducing means is suitably a vacuum pump provided with a housing which encloses the tubular members.

The means for moving the second tubular member may comprise a ring gear threadably attached to the second tubular member which meshes with a pinion which is operated from the exterior of the vacuum pump housing either manually or by power means.

The invention will be further illustrated by reference to the drawing in which the single figure illustrates a preferred embodiment.

Referring now to the drawing, numeral **11** designates a vacuum pump housing having a tubular member **12** sealed therewith and projecting with its free end **13** into the vacuum pump housing.

The tubular member **12** is provided with a plurality of lateral ports **14** which fluidly communicate with the vacuum pump housing to provide a path of flow **15** for the ion beams which originate from an ion source **16** shown in dotted lines. This ion source may be any suitable ion source and may comprise means for ionizing the solid, liquid, or gas sample (such as by electron or ion bombardment, by sparking, arcing, etc.), accelerating potentials to withdraw the ions from interior regions of the source, and suitably spaced and insulated slotted plates which may serve the double function of physically aligning and collimating the ion beam and electrically focusing, bending and accelerating the ion beam. The ion source **16** is adapted to rest on a second tubular member **17** which has an annular shoulder **18** and has a slit **19** for the ions to enter the path **15** which is further defined by the second tubular member **17**.

The free end **13** of the first tubular member **12** is provided with a slot **20** into which are arranged pins or projections **21** which are rigidly connected to the second tubular member **17**.

Threadably connected to the first tubular member **12** by mating threads **22** is a ring gear **23** which is provided with recesses **24** to receive the pins **21**. The pins **21** are held into the recesses **24** by an annular member **25** which in turn is held in the ring gear **23** by screws **26**.

The gear **23** is engaged meshingly with a pinion **27**, the free end **28** of pinion **27** protrudes by way of seal **29** through the vacuum pump housing **11**.

In accordance with the present invention, the ion beam which originates with ion source **16** and travels through the slit **19** into the path **15** may suitably be directed into a mass spectrometer or suitable particle accelerators, such as Van de Graaf accelerators and the like. The ion beam may suitably be directed into other apparatus such as mass spectrometer leak detectors which utilize ions.

The sealing means **29** may suitably comprise a hermetic arrangement, to insure a vacuum-tight seal on passage of the member **28** through the housing **11**. The hermetic bellows arrangement **29** is described in U. S. Patent 2,419,074, issued April 15, 1947, to F. D. Herbert, Jr. It will be preferred to use the hermetic bellows design, such as illustrated, although other sealing means may be used.

It is not infrequently desirable to move an ion source during operation of a mass spectrometer, and the like. When this is done, the ion source must be properly aligned with the mass spectrometer in three dimensions. In addition, the ion source must be positioned with the mass spectrometer in regard to rotation. Even after a different alignment has been had initially, it is often advantageous to change the position of the ion source in one dimension along the axis of the ion path. This has been difficult heretofore. In accordance with the present invention, the best position is determined and the ion source moved to the position. However, it is sometimes desirable to change the position if and when it becomes necessary to replace one ion source with another ion source or to change the position for the mass of the ion. Likewise, the ion source position is sometimes changed to compensate for contamination.

In accordance with the present invention, the alignment apparatus may allow this adjustment along the path of the ion beam by moving the member **28** which causes rotation of the ring gear **23** and, therefore, moves the tubular member **17** along the longitudinal axis of the ion beam. Thus the pins resist the rotation of the tubular member **17** and allow the tubular member **17** to be moved from the position shown in the drawing to a second position along the direction of the arrows, indicating the degree of adjustment.

The present invention is quite advantageous in that the supporting structure for the ion source is kept a substantial distance away from the high voltages employed in the upper parts of the ion source which is illustrated diagrammatically. Furthermore, the supporting structure is kept away from the electrical leads which are connected with the ion source. These advantages inure to the present invention besides the advantage of having a positive mechanical adjustment for an ion source which is quite useful in mass spectroscopy.

It will be seen from the foregoing description that the invention is of considerable utility and will lead to more precise adjustments of instruments utilizing ion source than has been possible heretofore.

The nature and objects of the present invention having been completely described and illustrated, what we wish to claim as new and useful and to secure by Letters Patent is:

1. Alignment apparatus for a source of ions which comprises, in combination, a first tubular member adapted

to project within a pressure reducing means to define a path for said ions in fluid communication with said pressure reducing means, said first tubular member being provided with at least one slot adjacent its free end in said pressure reducing means, a second tubular member coaxially arranged in said first tubular member for movement longitudinally in said first tubular member and adapted to support said source of ions, said second tubular member being provided with means protruding into said slot for resisting rotational movement, and means operatively connected to said second tubular member for moving said second tubular member along the axis of said ion path.

2. Alignment apparatus for a source of ions which comprises, in combination, a first tubular member adapted to project within a pressure reducing means to define a path for said ions in fluid communication with said pressure reducing means, said first tubular member being provided with at least one slot adjacent its free end in said pressure reducing means, a second tubular member coaxially arranged in said first tubular member for longitudinal movement in said first tubular member, said second tubular member having at least one pin arranged in said slot for resisting rotational movement of said second tubular member and being adapted to support said source of ions, and means operatively connected to said second tubular member for moving said second tubular member along the axis of said ion path.

3. Alignment apparatus for a source of ions which comprises, in combination, pressure reducing means, a first tubular member arranged to project within said pressure reducing means to define a path for said ions provided with at least one port in fluid communication with said pressure reducing means, said first tubular member being provided with at least one slot adjacent its free end in said pressure reducing means, a second tubular member coaxially arranged in said first tubular member for longitudinal movement in said first tubular member, said second tubular member having at least one pin arranged in said slot for resisting rotational movement of said second tubular member, said second tubular member being adapted to support said source of ions, and means operatively connected to said second tubular member for moving said second tubular member along the axis of said ion path.

4. Alignment apparatus for a source of ions which comprises, in combination, pressure reducing means, a first tubular member arranged to project within said pressure reducing means to define a path for said ions provided with a plurality of lateral ports in fluid communication with said pressure reducing means, said first tubular member being provided with at least one slot adjacent its free end in said pressure reducing means, a second tubular member coaxially arranged in said first tubular member for longitudinal movement in said first tubular member, said second tubular member having at least one pin arranged in said slot for resisting rotatational movement of said second tubular member, said second tubular member being adapted to support said source of ions, gear means operatively connected to said second tubular member for moving said second tubular member along the axis of said ion path, and power means operatively connected to said gear means projecting outside said pressure reducing means.

5. Apparatus in accordance with claim 4 in which the pressure reducing means is a vacuum pump enclosing said tubular members.

6. Alignment apparatus for a source of ions which comprises, in combination, a vacuum pump housing, a first tubular member arranged to project within said vacuum pump housing to define a path for said ions provided with a plurality of lateral ports in fluid communication with said pressure reducing means, said first tubular member being provided with at least one slot adjacent its free end in said pressure reducing means, a second tubular member coaxially arranged in said first tubular member for longitudinal movement in said first tubular member, said second tubular member having at least one pin arranged in said slot for resisting rotational movement of said second tubular member, said second tubular member being adapted to support said source of ions, a gear operatively connected to said second tubular member for moving said second tubular member along the axis of said ion path, a pinion operatively engaged with said gear, and means projecting outside said vacuum pump housing for moving said pinion.

No references cited.