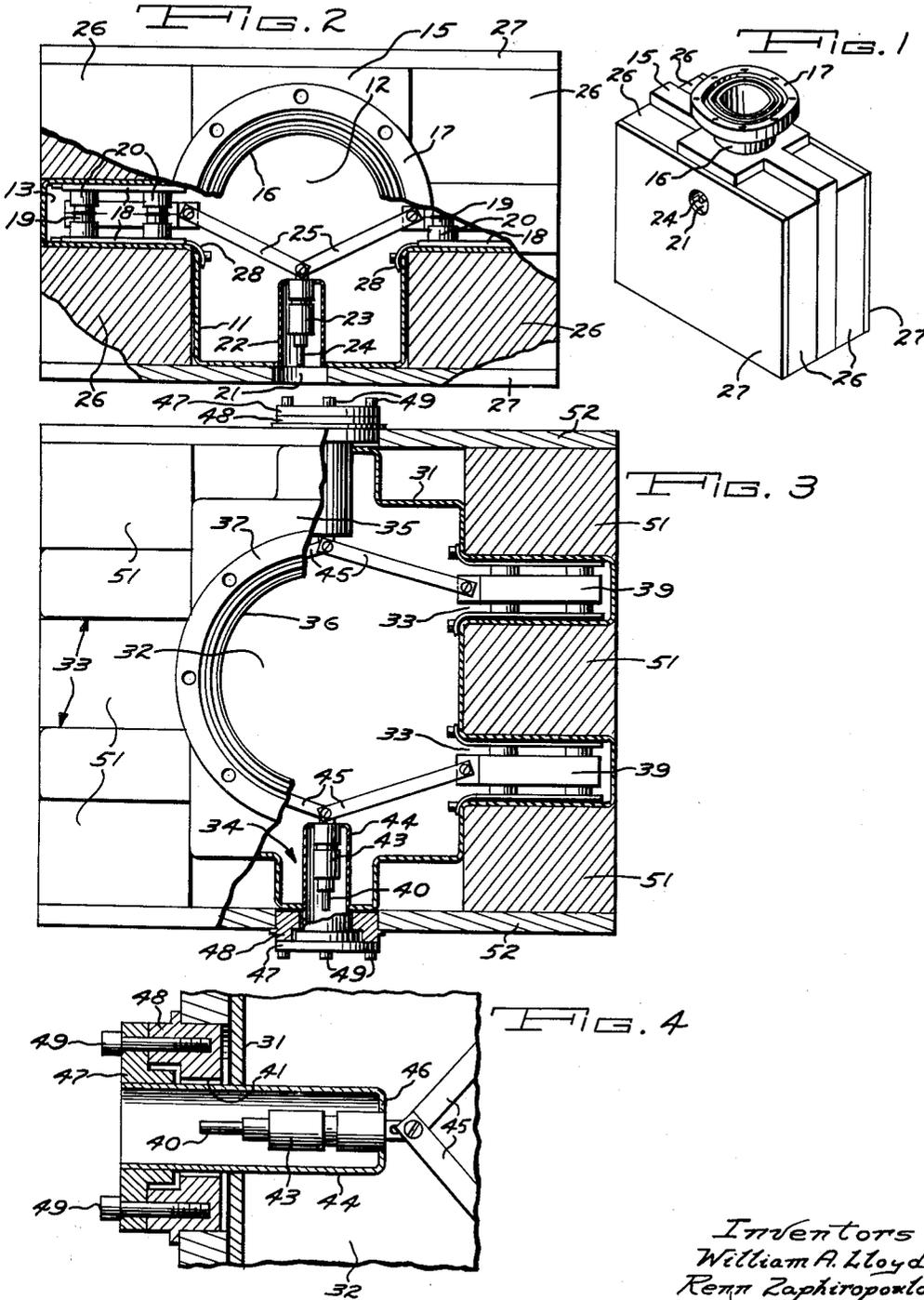


April 9, 1963

W. A. LLOYD ETAL  
IMPROVED VACUUM PUMPS

3,084,848

Filed Oct. 3, 1960



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**IMPROVED VACUUM PUMPS**

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 Filed Oct. 3, 1960, Ser. No. 60,156  
 12 Claims. (Cl. 230-69)

The present invention relates in general to getter ion vacuum pump apparatus and more specifically to a novel getter ion vacuum pump which is compact in structure and substantially even-surfaced throughout its external surface and in which the high voltage feedthrough is recessed thereby eliminating a possibility of the insulator being damaged.

Heretofore pumps of the present type have been inconvenient to employ in cramped quarters because of the awkward shapes and various protruding portions, especially the magnet components and high voltage leads. These high voltage leads which supply voltage to the pumping elements and make up the high voltage feedthrough have protruded outwardly from the pump surface. The insulators and high voltage leads were exposed to a possibility of damage and, therefore, a distinct advantage may be seen in recessing the high voltage feedthrough thereby removing the possibility of physical damage.

It is, therefore, the object of the present invention to provide a novel ion pump structure which is compact and provides a relatively smooth outer surface configuration and in which the possibility of damage to the electric feedthrough system into the pumping elements is lessened by recessing the high voltage insulators.

One feature of the present invention is the provision of a recessed feedthrough housing for the high voltage connectors thereby providing a smooth unbroken outer surface of the vacuum pump.

Another feature of the present invention is the use of a demountable recessed feedthrough housing such that damaged or worn insulators and high voltage connections may be easily replaced.

Another feature of the present invention is the provision of a novel magnet arrangement which results in a smooth-surfaced, compact pump.

Another feature of the present invention is the provision of a lesser chamber serving as a strengthening rib for the pump envelope.

Other and further features of the present invention will become apparent upon a perusal of the following specification taken in connection with the accompanying drawings wherein,

FIG. 1 is a perspective view showing a novel vacuum pump which embodies the present invention,

FIG. 2 is a top view partially cutaway of the pump shown in FIG. 1,

FIG. 3 is a top view partially cutaway of another pump embodying the present invention, and

FIG. 4 is an enlarged view showing a novel demountable recessed feedthrough.

Referring now to the drawings of FIGS. 1 and 2, there is shown a novel getter ion vacuum pump apparatus of the present invention. More specifically, a vacuum tight envelope 11 as of, for example, stainless steel is provided with a central rectangular-shaped chamber 12 having a pair of lesser rectangular chambers 13 communicating therewith through longitudinal openings in the side walls of the central rectangular chamber 12. The ends of envelope 11 are closed off by ends walls 15 suitably sealed to the side walls of the envelope 11 by, for example, heliarc welding.

A cylindrical adapter tubing 16 as of, for example, stainless steel is carried from the apertured end wall 15

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and communicates with the central chamber 12. An annular flange 17 as of, for example, stainless steel is carried from the end of the adapter tubing 16 in a vacuum tight manner and is adapted for communication with any structure it is desired to evacuate.

The pumping elements of the present embodiment are carried within the two lesser chambers 13, the pumping elements each include cathode plates 18 and anode member 19. Cathode plates 18 and anode 19 are made of a reactive material as of, for example, titanium being fixedly secured within the lesser rectangular chambers 13 by means of cathode spacers 20, the spacers 20 are ceramic insulators serving to insulate the anode 19 from the cathodes 18 and to preserve the correct spacing between the cathode plates 18 and cellular anode 19. Cathode plates 18 are electrically connected, via element clamp 28, to the grounded pump envelope 11.

High voltage is supplied to anode 19 through an aperture 21 and the side wall of envelope 11 which is provided with a recessed, hollow, cylindrical chamber 22, provided to accommodate in its closed inner end, a ceramic insulator 23 which, in turn, carries high voltage lead 24 into the pumping elements via lead 25 secured to anode 19 in any desired manner. Chamber 22 is secured in a vacuum tight manner to the aperture rim in envelope 11 as by heliarc welding.

A magnetic field of 1000 to 1800 gauss is applied perpendicular to the cathode plates 18 via a plurality of rectangular ferrites 26. The ferrites are fixedly secured to rectangular pole pieces 27 which are fixedly secured to pump envelope 11 by any desired means.

In operation, the apparatus is evacuated to a pressure of approximately  $10^{-2}$  millimeters of mercury via, for example, a mechanical pump (not shown). A positive potential as of, for example, 3000 volts is applied to the anodes 19 with respect to the cathode plates 18 for initiating a glow discharge therebetween while the magnetic field is applied by the ferrites 26 of between 1000 and 1800 gauss.

The resulting ionization and bombardment of the negative cathode plates by the positive ions is well known in the getter ion vacuum pump art and will not be described. Reference is herein made to the co-pending application, Serial No. 38,028 of Lloyd et al., entitled "Improved Vacuum Pump," filed June 22, 1960, now Patent No. 3,042,824, in which a complete description of operation is given. In the present invention with the high voltage feedthroughs recessed, we have eliminated the possibility of damage to the insulators 23 and high voltage leads 24 by placing them inside the pumping area and out of the way.

It is herein noted that the physical design of the present pump is such as to accommodate rectangular ferrites 26 which fit neatly adjacent the pumping elements. In this manner the pump occupies the smallest possible space and presents a compact, uniform, flat-surface shape for easy use and handling.

Referring now to FIGS. 3 and 4 there is shown another embodiment of the present invention. A vacuum tight envelope 31 as of, for example, stainless steel is provided with a central rectangular-shaped chamber 32 having two pairs of lesser rectangular chambers 33 and communicating therewith through longitudinal openings in opposite side walls of central rectangular chamber 32. The number of lesser chambers 32 could be increased depending upon the size and pumping speed desired and is purely a matter of choice. Additional rectangular chambers 34 are provided in the side walls adjacent the side walls containing the lesser chambers 33. Chambers 34 are provided to give strength to the envelope 31 by acting as a corrugated rib member. The ends of en-

velope 31 are closed off by end walls 35 suitably sealed to the side walls of the envelope 31 by, for example, heliarc welding.

A cylindrical adapter tubing 36 is carried from the apertured end wall 35 and communicates with central chamber 32. An annular flange 37 is carried from the end of adapter tubing 36 in a vacuum tight manner and is adapted for communication with any structure it is desired to evacuate.

The pumping elements are carried within the four lesser chambers 33 and are identical to the pumping elements shown in the embodiment of FIGS. 1 and 2.

High voltage is supplied to anodes 39 of the pumping elements through an aperture 41 in the side wall of main chamber 32 which is provided with a recessed hollow cylindrical chamber 44 provided to accommodate a ceramic insulator 43 which carries high voltage lead 40 into the pumping elements via lead 45 secured to anodes 39 in any desired manner. It is noted that the internal portion of lead 40 is secured to lead 45 by any of the well known quick disconnect means available.

In the present embodiment, as best seen in FIG. 4, recessed chamber 42 has an apertured closed end 46 extending into the central pumping chamber 32. An annular flange 47 is carried from the open end of recessed chamber 42 extending outside the pump envelope 31 and is adapted for communication with the pump through flange support ring 48 secured, as by welding, to envelope 31. Both flange 47 and support ring 48 are provided with threaded holes for communicating with bolts 49 for securing recessed chamber 42 within the pump in a vacuum tight manner.

In the present embodiment, a demountable recessed feedthrough chamber 44 is provided such that damaged or worn insulators 43 and high voltage leads 40 may be easily replaced merely by removal of bolts 49 and replacing the entire recessed chamber 43.

A magnetic field is applied to the pumping elements via permanent ferrites 51, which are fixedly secured to apertured pole pieces 52 which are, in turn, secured to envelope 31 in any desired manner.

Operation of the embodiments shown in FIGS. 3 and 4 is exactly the same as that shown in FIGS. 1 and 2.

We have shown the novel getter ion vacuum pump configuration whereby the high voltage feedthrough including the high voltage insulators and high voltage leads have been contained within the pump itself which, together with the form of magnet structure, results in a unitary pump presenting a smooth unbroken outer surface which makes for more easy utilization in areas of confined space and, furthermore, greatly reduces any chance of accidental damage to the high voltage leads and insulators thus preventing costly repairs. We have further shown a demountable high voltage feedthrough whereby worn or damaged high voltage leads and insulators may be easily replaced without need of costly repairs.

Since many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A getter ion vacuum pump apparatus including an envelope defining a central hollow chamber communicating with the structure it is desired to evacuate, a plurality of lesser envelopes defining a plurality of lesser chambers communicating with said central chamber, anode and cathode members disposed within said lesser chambers, means for supplying a potential difference between said anode and cathode members of sufficient magnitude to produce a glow discharge therebetween for pumping gaseous matter within said envelope and said

lesser chambers, means for producing and directing a magnetic field directed substantially at right angles to said anode and cathode members for enhancing glow discharge, a voltage feed-through means for feeding the potential difference to said anode and cathode members, and a recessed feed-through housing means for supporting said feed-through means entirely within said envelope in a vacuum tight manner.

2. The apparatus according to claim 1 wherein said feed-through means includes a high voltage lead and an insulator means surrounding said high voltage lead to insulate said high voltage lead from said envelope.

3. The apparatus according to claim 2 wherein said recessed feed-through housing means includes a hollow member having a closed free inner end and an open outer end secured to said envelope in a vacuum tight manner.

4. The apparatus according to claim 3 wherein said closed inner end is apertured to accommodate said voltage feed-through means in a vacuum tight manner.

5. The apparatus according to claim 3 wherein said lesser chambers extend outwardly and longitudinally of said central chamber, and said means for producing and directing a magnetic field includes a plurality of ferrite members positioned on opposite sides of said lesser envelopes and adjacent said envelope defining said hollow central chamber such that the external appearance of said vacuum pump apparatus presents smooth, unbroken surfaces.

6. The apparatus according to claim 3 wherein said recessed feed-through housing member includes an integral flange at its outer end for removably securing said feed-through means to the outer surface of said envelope in a vacuum tight manner.

7. The apparatus according to claim 6 further including a connecting member between said voltage feed-through means and said anode and cathode members, said voltage feed-through means including a quick-disconnect member to allow easy removal of the recessed feed-through housing means from said envelope.

8. An electrical vacuum pump apparatus utilizing the principle of cathode disintegration by particle bombardment including, a vacuum envelope, an anode structure having a plurality of glow discharge passageways being grouped transversely to the longitudinal axis of said passageways, a cathode structure aligned with said anode passageways and spaced from said anode structure, said anode and cathode structures being contained within said envelope, means for applying a potential difference between said anode and cathode structures of sufficient magnitude to provide simultaneous glow discharge within a plurality of said glow discharge passageways and to bombard said cathode structure with positive ion particles of sufficient velocity to sputter portions of said cathode structure on to adjacent structure to getter gas coming in contact therewith, a recessed feed-through housing means including a voltage feed-through member supported thereon for supplying said potential difference through said envelope in a vacuum tight manner, said feed-through housing being positioned entirely within said envelope, and means for producing and directing a magnetic field coaxially of and within a plurality of said glow discharge passageways for enhancing the glow-discharges within said passageways and thus the pumping speed of the pump.

9. The apparatus according to claim 8 wherein said envelope defines a central hollow chamber and a plurality of lesser chambers communicating with the central chamber and extending length-wise and outward of the central chamber, a portion of the lesser chambers containing said anode and cathode structures and the remaining of said lesser chambers being utilized as strengthening ribs for said envelope.

10. The apparatus according to claim 8 wherein said feed-through means includes a high voltage lead and

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an insulator member surrounding said high voltage lead, said insulator member insulating the high voltage lead from said envelope.

11. The apparatus according to claim 10 wherein said recessed feed-through housing means includes a hollow member having a closed, free, inner end and an open outer end secured to the envelope in a vacuum tight manner.

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12. The apparatus according to claim 11 wherein said hollow member includes an integral flange on the open outer end for removably affixing said feed-through housing means to the outer surface of said envelope in a vacuum tight manner.

No references cited.