

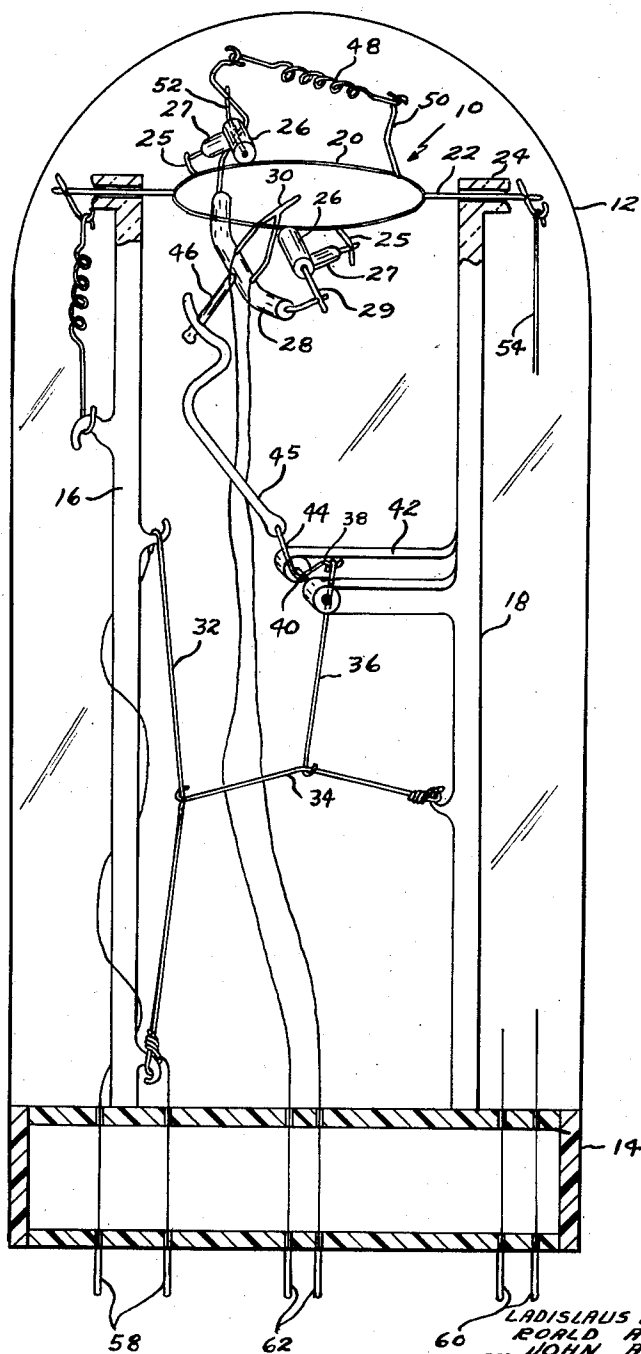
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L. L. MARTON ET AL

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HIGH VACUUM GIMBALS

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INVENTORS
LADISLAUS L. MARTON
ROLD A. SCHERCK
JOHN R. SIMPSON
BY *Wade County*
Julius F. Schubert
ATTORNEYS

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HIGH VACUUM GIMBALS

Ladislaus L. Marton and Roald A. Schrack, Washington, D. C., and John A. Simpson, Fairfax, Va., assignors to the United States of America as represented by the Secretary of the Air Force

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The invention described herein may be manufactured and used by or for the United States Government for governmental purposes without payment to me of any royalty thereon.

This invention relates to a gimbal mechanism and more particularly to a device supported by a gimbal mechanism inside a high-vacuum envelope.

Certain devices, such as electrodes or emitters of various sorts, which are normally mounted inside a sealed enclosure or a high-vacuum tube must be properly positioned to assure proper operation of the apparatus of which they are a part. For example, research studies, such as investigations in field emission, require elements such as tungsten points to be adjustably mounted in a high-vacuum enclosure so they can be precisely oriented in any direction. Reliable and simple mechanisms for doing this were not previously available. This was because they had to be controlled from a point outside of the enclosure. Direct mechanical controls extending through the enclosure are not an appropriate solution in such an environment since they inevitably involve a certain amount of leakage. Accordingly, a need has arisen for a remote control mechanism which satisfies these considerations. This is achieved by mounting the device to be oriented on a gimbal mechanism mounted inside a high vacuum glass envelope. This gimbal mechanism is controlled by expansion wires which are also mounted inside the glass envelope. The expansion of these wires is determined by heat induced in them by the passage of an electric current through them. The current in these wires, and hence the control of the gimbal mechanism, can be conveniently applied from a point outside of the glass envelope.

Therefore, the primary object of this invention is to provide a gimbal mechanism mounted in a high-vacuum envelope which can be precisely controlled from a point outside of the envelope.

A further object of this invention is to provide a heat controlled gimbal mechanism mounted inside a high-vacuum envelope for controlling the orientation of a device mounted on the gimbal.

Still another object of this invention is to provide a remote control gimbal mechanism that is simple to construct, economical to make, and durable.

These and other objects and advantages of this invention will become more apparent from the following description and drawing wherein:

The drawing discloses a front elevation partly in perspective and partly in section of the remote control gimbal mechanism embodying this invention.

Referring now to the drawing, the gimbal mechanism indicated generally at 10 is mounted inside a high-vacuum envelope 12. The envelope 12 is closed by a base member 14. Parallel support rods 16 and 18, made of glass or other insulating heat resistant material, are mounted on this base member and extend inside the envelope.

The gimbal mechanism as indicated in the drawing includes an almost circular wire loop member 20. This

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member has diametrically opposite, outwardly projecting journals 22, which extend into bearings 24, integrally formed on the end of rods 16 and 18. This structure rotatably supports member 20 on the rods. Diametrically outwardly projecting bearings 26 are held perpendicular to journals 24 by means of an L-shaped flexible wire 25 and attached support member 27. As seen in the drawing, one end of wire 25 is secured to ring 20 while the free end of support member 27 is secured to bearings 26. This arrangement permits the bearings to be precisely positioned on the gimbal. An arcuate member 28 is rotatably mounted in bearings 26 on journals 29. With this arrangement, the axis of rotation of members 20 and 28 are perpendicular to each other. A device 30 such as an electrode or emitter, etc., is mounted on member 28.

The gimbal mechanism and hence the orientation of the device 30 is controlled as follows: A hot wire movement is independently connected to members 20 and 28 by an appropriate linkage. For the sake of simplicity only the hot wire movement controlling the rotation of member 28 is disclosed in the drawing, the other is similar. The movement comprises an expansion wire 32 mounted under tension inside the glass envelope 12. The expansion wire 32 is hooked substantially at its center by one end of the linkage wire 34. The other end of wire 34 is secured to support 18. A second linkage wire 36 is hooked or otherwise connected at one and substantially at the center of linkage wire 34. The opposite end of linkage wire 36 is secured to a lever member 38 which is connected to a shaft 40. Shaft 40 is rotatably journaled in a support member 42 which is rigidly secured to support member 18. An additional arm 44 is also connected to shaft 40 substantially perpendicular to lever arm 38. The opposite end of this arm 44 is rigidly connected to an enlarged arm 45. Arm 45 engages projection arm 46 depending from member 28 as seen in the drawing. The projection arm 46 is biased into engagement with arm 45 by a torque produced in member 28 by a spring 48. This is easily accomplished by securing one end of spring 48 to an upwardly extending projection 50 mounted on member 20, and securing the other end to journals 29 by means of a lever arrangement 52, as shown in the drawing.

In the same manner (not shown), the expansion of another hot wire actuates a wire 54 for controlling the rotation and orientation of member 20. Power is supplied to the expansion wires by means of electrodes 58 and 60 mounted in the base 14, and heating current and high voltage are brought to the device 30 by means of electrodes 62.

In operation, current is passed through the expansion wires. The current passing through these wires heats them and causes them to expand, the degree of expansion of the wire being proportional to the current passing through them. The expansion of these hot wires controls the orientation of device 30 by actuating the linkage mechanism and supporting gimbals shown. In this way, it is only necessary to control the current passing through the hot wires to control the orientation of the device 30 and this may be done conveniently from any point outside the glass envelope. In the example shown in the drawing, a full deflection of up to 30° off the central axis was obtained when the applied voltage was 2 v. A. C. and the current .4 of an amp. The expansion wire 32 used in the device was No. 39 Nichrome and was 13 cm. long.

The above drawing and specification is to be interpreted as merely illustrative and not restrictive. Obviously, many modifications and variations of the present invention are possible within the scope of the appended claims wherein:

We claim:

1. An apparatus of the class described comprising in combination a high-vacuum envelope, a gimbal mounted in said envelope, a device mounted on said gimbal so it can be oriented in any direction, thermal control means inside the envelope connected to said gimbal for controlling the orientation of the device, and means outside the envelope connected to said thermal control means for actuating it.

2. The apparatus set forth in claim 1 wherein said thermal control means comprises a thermal expansion wire, a linkage mechanism connected at one end to the expansion wire, and at the other end to said gimbal, means for passing a predetermined current through the expansion wire to increase its temperature and cause the resulting expansion of the wire to actuate said linkage and control said gimbal.

3. An apparatus of the class described comprising in combination a high-vacuum envelope, a gimbal mounted in said envelope, an electrode mounted on said gimbal so it can be oriented in any direction, thermal expansion wires mounted in said envelope, linkage mechanisms connected at one end to said gimbal and at the other end to said wires, means for passing a predetermined current through said thermal expansion wires to increase their temperature so that the resulting expansion of the wires will actuate said linkages and control said gimbal.

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