

Nov. 17, 1931.

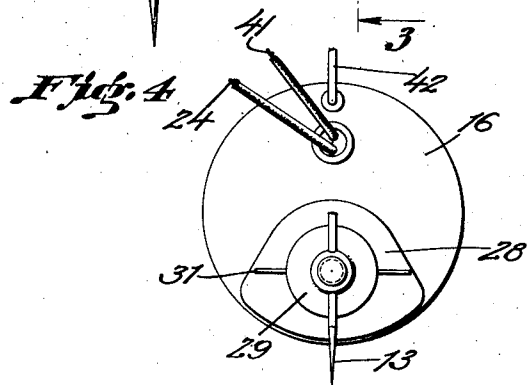
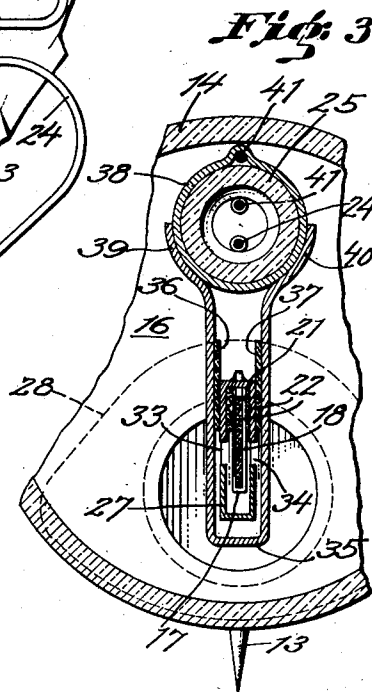
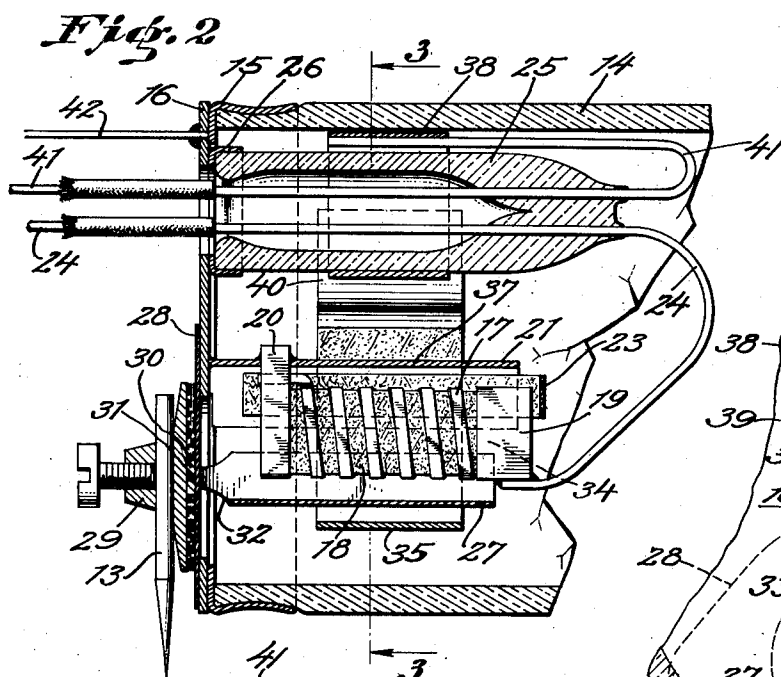
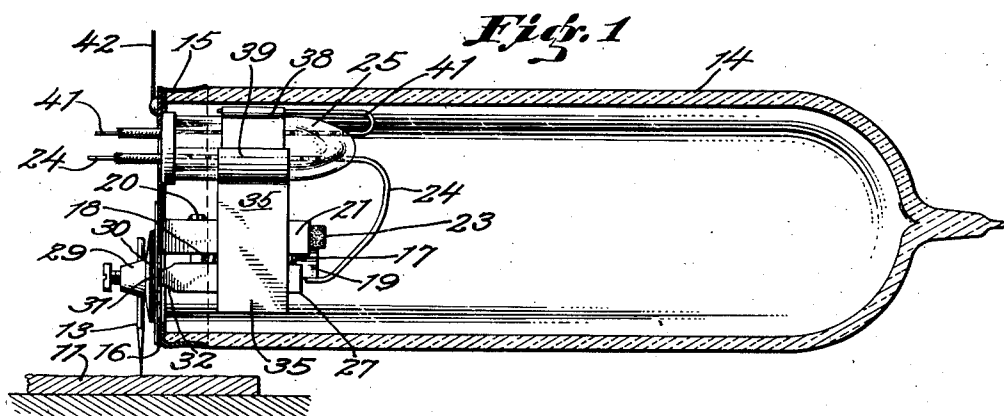
T. W. SUKUMLYN

1,831,977

VACUUM TUBE PICK-UP DEVICE

Filed July 28, 1930

2 Sheets-Sheet 1



INVENTOR.
Thomas W. Sukumlyn.
 BY *John Flann*
 ATTORNEYS.

Nov. 17, 1931.

T. W. SUKUMLYN

1,831,977

VACUUM TUBE PICK-UP DEVICE

Filed July 28, 1930

2 Sheets-Sheet 2

Fig. 5

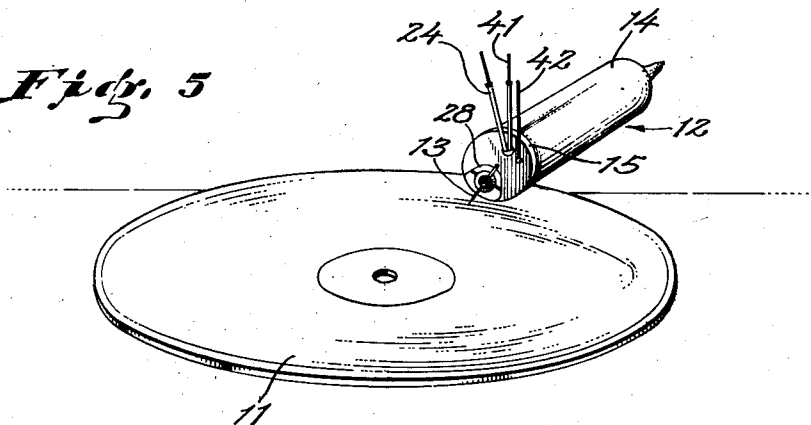


Fig. 6

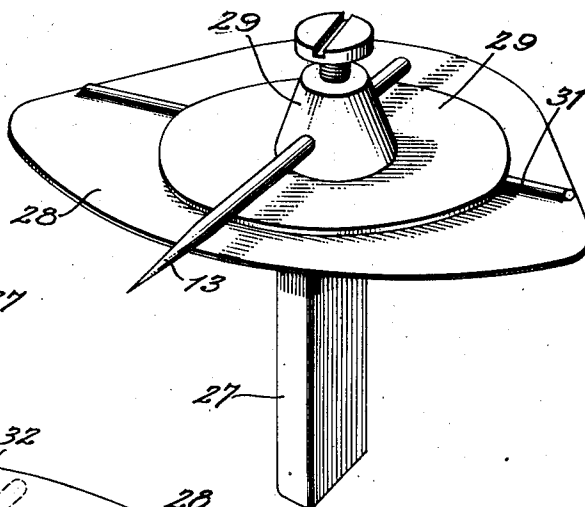


Fig. 7

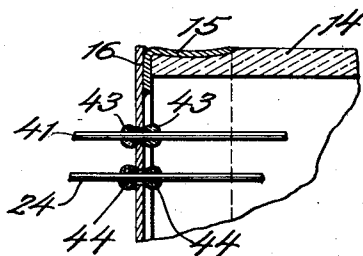
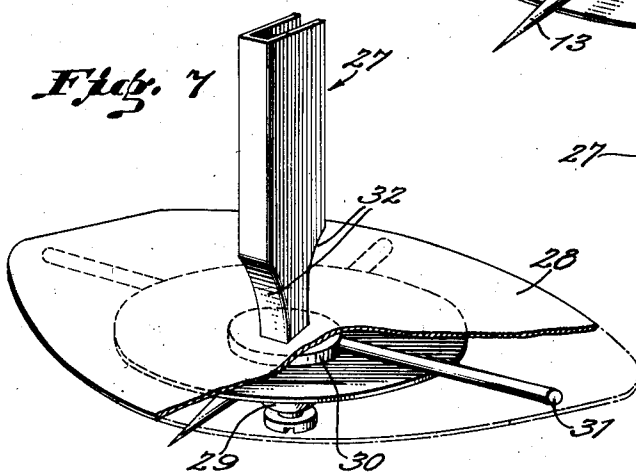


Fig. 8

INVENTOR
Thomas W. Sukumlyn.
BY John Flam
ATTORNEYS.

UNITED STATES PATENT OFFICE

THOMAS W. SUKUMLYN, OF LOS ANGELES, CALIFORNIA

VACUUM TUBE PICKUP DEVICE

Application filed July 28, 1930. Serial No. 471,120.

This invention relates to a device that operates to translate weak impulses, either electrical or mechanical, into large variations in current flow; for example, it can be used to produce a variation in current corresponding to the mechanical movement of a stylus, as actuated by a phonographic record.

A similar device is disclosed in one of my prior patent applications, Serial No. 423,416, filed January 25, 1930, and entitled Electron emission device. My present application is directed to a modified or improved form of such a device, and can be used in general for the same purposes as outlined in my said prior application.

In my prior application, I describe a device including a closed evacuated vessel, such as one made of glass, and having a metal cover secured thereto. Inside of the evacuated vessel, are a series of electrodes; one being a cathode, another an anode, and a third being a gate electrode for controlling the passage of electrons from the cathode to the anode. This control effect is accomplished by mechanically moving the gate electrode so as to define a variable aperture through which the electrons are to pass between the cathode and anode.

It is one of the objects of my invention to make it possible to support the various electrodes from the closure only, whereby the adjustment and assembly of the parts can be simplified.

It is another object of my invention to provide a novel and simple form of seal for the conductors that extend into the vessel and connect to the various electrodes.

My invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of one embodiment of my invention. For this purpose I have shown a form in the drawings accompanying and forming part of the present specification. I shall now proceed to describe this form in detail, which illustrates the general principles of my invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of my invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a longitudinal sectional view of a vacuum tube device embodying my invention, said device being shown on an enlarged scale for the sake of clarity;

Fig. 2 is a detailed section of the left hand portion of the device as shown in Fig. 1, said detailed section being still more enlarged than the section of Fig. 1;

Fig. 3 is a detailed section taken along plane 3—3 of Fig. 2;

Fig. 4 is an end view of the device illustrated in Fig. 1;

Fig. 5 is a perspective view showing in a general way my device in use on a flat disk record;

Figs. 6 and 7 are detail perspective views of a portion of the mechanism, illustrating particularly the manner in which the stylus is supported on the closure for the evacuated vessel; and

Fig. 8 is a detail fragmentary sectional view showing a modified form of structure for leading the electrical conductors into the evacuated vessel.

Since the main features of the present device are similar to the features described and claimed in my aforesaid application, it is considered unnecessary to describe them again in any great detail.

Thus in Fig. 5 is indicated in general a flat phonographic disk record 11 which is shown as cooperating with my vacuum tube pick up device 12. The stylus 13 on this device is arranged to be accommodated in the groove of record 11, and to be moved or vibrated transversely of its axis, thereby operating a gate electrode, such as described in my prior application.

Fig. 1 shows a tubular vessel 14, which can conveniently be made of glass or analogous material, and in which are disposed the various electrodes. In the present instance, all of the electrodes are supported directly from a cover or closure member for the evacuated vessel 14 in a manner now to be described.

As shown most clearly in Figs. 1 and 2, a metal flange 15 is sealed or otherwise joined to the end of the vessel 14. Over this flange

is fastened, as by welding or soldering, a comparatively thick metal plate 16 which serves to seal the vessel 14.

When evacuating vessel 14, after assembly of the parts 15, 16, etc., the vessel is heated to drive off the entrapped gases. Since solder is used to hold parts 15, 16, 26, 28 together, this solder may soften. To obviate any separation of the parts during evacuation, a plating of copper or other suitable metal is placed over these parts after they are assembled, said plating holding the soldered parts firmly against displacement. Other parts not needing to be plated can be covered with a protective coating during the plating operation.

The cathode structure in this instance is quite similar to the structure disclosed in my prior application. It includes a flat ribbon or filament 17 wound upon a strip of insulation material 18. The ends of this strip 17 terminate in the caps or ends 19, 20. The cap 20 is soldered or otherwise attached to the stationary gate electrode 21 whereby the inner end of the filament or cathode structure is supported. The stationary gate electrode 21 as shown most clearly in Fig. 3 is U-shaped, and has its parallel legs extended close to and adjacent the sides of the filament structure. It is fastened directly to the cover 16 which can be considered as a grounded element, whereby one terminal of the filament, as well as the stationary gate electrode 21 is also grounded.

In order further to ensure against displacement of the filament structure 17, 18, 19, 20, there may be provided an insulation strip 23, which is U-shaped and has the horizontal legs 22 interposed between the cathode structure and the electrode 21.

The ungrounded terminal of filament 17 is connected to a lead 24, soldered to the cap 19 and extending through a sealing tube 25. This tube can be made of glass, with its axis extending substantially parallel to the main vessel 14. Its open end can be provided with a metal flange 26, such as copper, to which the glass is sealed, said copper flange ring 26 being soldered or welded to plate 16, thus providing a sealed lead-in connection 24. As will be described hereinafter, the tubular member 25 acts as an insulation support for other electrodes of the device.

The movable gate electrode is formed by U-shaped metal member 27, the legs of which define with the stationary gate electrode 21, a pair of gates of variable size dependent upon the transverse movement of the electrode 27. This electrode 27 can be directly fastened to a thin diaphragm 28 covering an aperture in the cover 16. In order to rock this electrode 27 in accordance with the vibrations of the stylus 13, this stylus 13 is accommodated in a holder 29 having an extending boss 30 joined to the outer surface of the diaphragm 28. In order to ensure rocking

vibration of stylus 13, on an axis at right angles to the axis of the stylus, there may be provided a rocking bar 31 passing through the boss 30, and defining a transverse axis for the whole stylus holder 29. As shown most clearly in Fig. 2, the holder 29 has a flange overlying but closely spaced from the diaphragm 28 to accommodate a thin film of damping fluid, such as oil, as described in my prior application. Furthermore, in order to reduce the force necessary to rock the movable gate electrode 27, this electrode where it joins the diaphragm 28, can be narrowed in the direction of movement of the electrode. This is indicated at 32, Fig. 7.

It is thus apparent that a pair of gates 33, 34 (Fig. 3) is provided by the electrode members 21 and 27. The anode is so formed that the electrons passing from the cathode 17 through the gates 33, 34 are passed to an anode structure, such as a U-shaped member 35. This member 35 has its legs rather closely spaced from the electrodes 21, 27. In order to provide this spacing, there may be provided layers of insulation material 36 and 37 between the member 35 and the stationary gate electrode 21, all as clearly shown in Fig. 3.

The tubular supporting member 25 is also utilized for the support of the anode member 35. This can be accomplished for example, by the aid of a metal band or ring 38 closely encompassing the exterior of the tubular support 25, to which in turn is soldered or otherwise attached the ends 39, 40 of the member 35. To provide a connection to the anode 35, a lead 41 can extend through the interior of the member 25 and sealed therein. It can be reversely bent to be accommodated underneath the ring 38.

It is apparent that since all of the electrodes are supported on the top closure 16, these electrodes can be correctly proportioned and accurately aligned prior to their insertion into the vessel 14. The two gate electrodes 21 and 27, as well as one terminal of the filament 17 being grounded on the closure 16, can be connected into any appropriate circuit, as by the aid of a ground connection 42 soldered or otherwise attached to the member 16.

In the form shown in Fig. 2, the sealing of the leads 41 and 24 is accomplished by the aid of the glass support 25, through which these leads extend. It is possible, however, to seal the electrodes directly into the metal closure 16 in a manner disclosed in Fig. 8. Thus as shown therein, the lead 41 can extend through a clearance aperture in the closure member 16. Glass beads such as 43 can be used to seal the space around the lead 41. This glass is first heated to a plastic condition; and the material used for part 16 is preferably copper, properly treated so as to be capable of being placed in tight bond

with the glass bead 43. Preferably these beads are placed one on each side of the clearance aperture and upon cooling, serve to close up any gap existing between the conductor 41 and the member 16.

In this form of sealing, the glass that forms the bead 43 can flow down and through the clearance aperture, although this is not necessary. Thus lead 24 in Fig. 8 is shown as being sealed by a pair of glass beads 44 which do not extend into the clearance aperture through the member 16, but serve only as overlying members closing the aperture.

I claim:

1. An evacuated vessel having a closure, a cathode and an anode supported in the vessel and on the closure, and a movable gate electrode mounted for movement transversely between the anode and the cathode, and supported on the closure.

2. An evacuated vessel, a closure for the vessel at one end, said closure having at least a part thereof formed of flexible material, a cathode and an anode supported on the closure, and a movable gate electrode mounted on the flexible material to permit movement of the gate electrode transversely between the cathode and anode.

3. An evacuated vessel, a closure for the vessel, a cathode of flat form, in the vessel, a U-shaped anode between the legs of which the cathode is disposed in parallel relation to said legs, and a gate electrode having a movable and a stationary portion, disposed between the anode and cathode and defining a pair of variable transverse openings between the cathode and anode at respectively opposite sides of the cathode.

4. An evacuated vessel, a closure for the vessel, a cathode of flat form, in the vessels, a U-shaped anode between the legs of which the cathode is disposed in parallel relation to said legs, a gate electrode having a movable and a stationary portion, disposed between the anode and cathode and defining a pair of variable transverse openings between the cathode and anode at respectively opposite sides of the cathode, and external means for operating the gate electrode, said means and all the electrodes being supported on the closure of the vessel.

5. The combination as set forth in claim 3, with the addition of an insulation support for holding the U-shaped anode and fastened to the closure.

6. The combination as set forth in claim 3, with the addition of a tubular insulation support fastened to the closure, over which support the anode is fastened, and through which support the leads for electrodes are passed to the interior of the vessel.

7. An evacuated vessel, a metallic closure for the vessel, electrodes therein, a lead for one of the electrodes passing through an

aperture in the metallic closure, and a vitreous means disposed around the lead and sealing the aperture in the closure.

In testimony whereof, I have subscribed my name.

THOMAS W. SUKUMLYN.

70

75

80

85

90

95

100

105

110

115

120

125

130