June 29, 1937. A. B. DU MONT 2,085,576

COMMUTATING DEVICE

Filed March 25, 1935

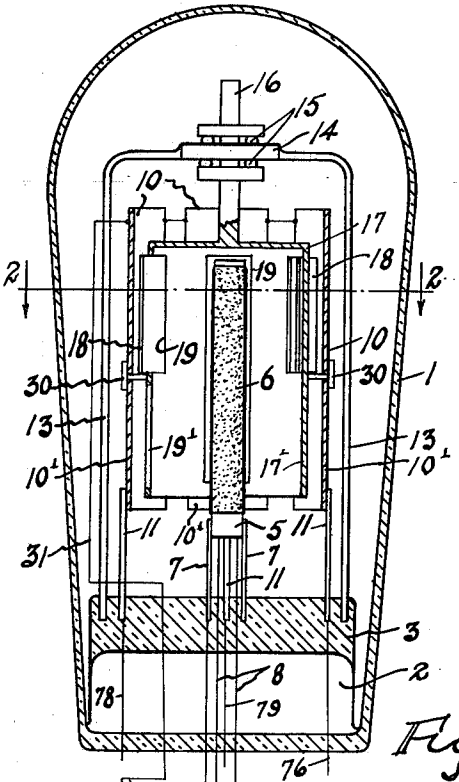

Fig. 1.

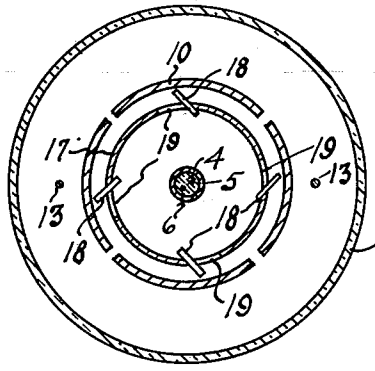

Fig. 2.

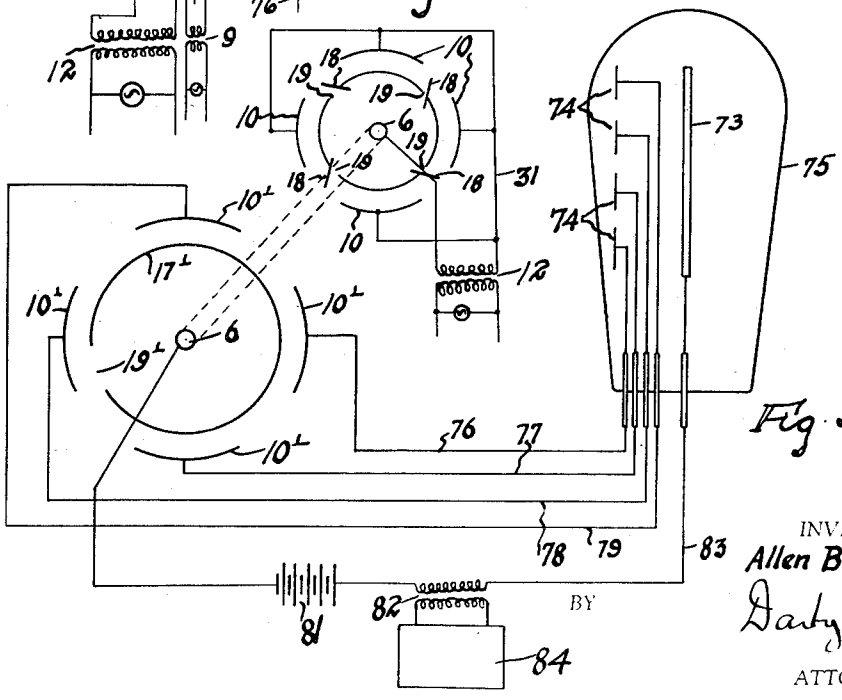

Fig. 3.

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COMMUTATING DEVICE

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Application March 25, 1935, Serial No. 12,853

1 Claim. (Cl. 250—27.5)

This invention relates to improvements in commutating devices.

An object of this invention is to provide a commutating or switching device operated by an electronic or ionic stream.

A further object of this invention is to provide a switching and commutating device which is not subject to leakage, sparking, and variable resistance characteristics common to mechanical types of commutators.

These and other objects, as will be obvious to those skilled in the art and apparent from the following description, are secured by means of this invention.

This invention resides substantially in the combination, construction, arrangement, and relative location of parts, all as will be described in greater detail in the following specification.

This application is a continuation in part of my Patent No. 1,999,407 issued April 30, 1935 for Electron turbine.

In the drawing,

Figure 1 is a vertical, central, cross-sectional view with some parts in elevation of one form of structure in accordance with this invention;

Figure 2 is a cross-sectional view on the line 2—2 of Figure 1; and

Figure 3 is a diagrammatic view of the device of Figure 1 associated with a multi-target lamp.

While the details of structure and association of the parts of this invention may take many and varied forms without departure from the scope thereof, the principles and one form of construction have been illustrated in Figures 1 and 2.

The device as shown comprises an evacuated container 1, which has been illustrated as similar to the usual audion bulb but, of course, may take any necessary configuration and shape to adapt the device for particular uses. This container or vessel is preferably evacuated in accordance with knowledge in the vacuum discharge device art. The container is shown having a re-entrant stem 2 terminating in the usual press 3 from which the various electrodes of the device are supported. At the center of the vessel and supported from the press by means of rods or wires 7 is a cathode structure of the indirectly heated type. The cathode comprises a central insulating rod or body 4 having passages therethrough within which a heater wire is mounted in accordance with well known principles in the vacuum tube art. Surrounding the insulating rod is a thin metal sleeve 5 which has an electronically active coating 6 which emits electrons when heated. The supporting rods or wires are attached to the metal sleeve 5 by sliding, or in any other suitable manner, to provide both mechanical and electrical contact. As will be apparent to those familiar with this art, the cathode structure may take many forms and hence the form illustrated is simply by way of example. The heater filament is connected to the secondary of an energizing transformer 9 by means of the wire 8. The primary of this transformer is connected to any suitable current source for elevating the temperature of the heater to the proper degree.

Supported within the vessel and surrounding the cathode are the motor anodes 10. The switching anodes 10' are shown supported below the motor anodes and are interconnected therewith mechanically by means of an insulating sleeve or spacer member 30. The groups of anodes are supported from the press by means of wires or rods 11. The anodes 10 are all electrically connected together, as illustrated, and provided with a common lead 31 which terminates at one terminal of the secondary of a transformer 12. The other terminal is grounded to the sleeve 5 of the cathode through one of the supporting rods 7, as shown. The commutator anodes 10' are individually provided with wire leads as shown at 78, 79 and 76 and 77, which are respectively connected to the supporting wires attached to those anodes. As illustrated, the motor and commutator anodes each comprises a sector-like metal plate arranged on the circumference of the circle concentric with the cathode. In the form illustrated there are four anodes in each group, but depending upon the requirements of the device the number of anodes may be varied in accordance with the various modifications of the device illustrated in the parent application mentioned above. A rotor 17 is mounted between the cathode and the anodes. This rotor is illustrated in the form of a cylinder of metal supported from the ball thrust bearing 15. This bearing is mounted upon a pair of standards 13 extending upwardly from the press 3 and terminating in a bearing plate 14. The rotor itself is supported from the bearing by means of the rotor shaft 16. The upper portion of the rotor in alignment with the motor anodes is provided with four windows or openings 19, at the edge of each of which is provided a vane 18.

This vane may be either attached to the edge of the opening or the opening and vane simultaneously formed by striking out the vane mem-

bers directly from the rotor. The lower portion 17' of the rotor is in the form of a continuous cylinder having but one window 19' which is in alignment with the switching anodes 10'.

The motor portion of the device is, as will be apparent, of the synchronous type. When the cathode is energized so that electrons are being ejected by the coating thereon, these electrons will flow in radial streams outwardly towards the motor anodes 10 if they are maintained at a higher potential than the cathode. This is accomplished by means of the transformer 12, which, being energized with alternating current, causes the anodes to be successively positive and negative. During the positive halves of the energizing current waves the electrons will move with increasing velocity from the cathode to the anodes. Since the vanes 18 are interposed in the paths of these electrons, many of them will strike the vanes in attempting to pass through the windows 19 to the anodes. The vanes, being positioned at an angle to the radial electron paths, will be given circumferential impulses, causing the rotor to revolve. It is obvious that rotation thereof will be at synchronous speed with respect to the biasing potential applied to the anodes. Of course, during the negative halves of the current waves no electrons will pass to the anodes. The particular speed at which the rotor revolves depends, of course, upon the frequency of the current employed to energize transformer 12 and the number of windows and vanes and anodes employed. The switching portion of the device will not be described in operation until Figure 3 is analyzed in detail.

This figure illustrates the application of the mechanism to the operation of a multi-target lamp of the type disclosed, for example, in United States Patent No. 1,683,137, to Charles F. Jenkins. The lamp is diagrammatically illustrated as including an exhausted envelope which may or may not have a content of gas which emits a glow discharge when excited. Mounted within this envelope is a common anode 73 positioned in alignment with a plurality of cathode glow targets 74. The anodes 10' of the switching portion of the device are respectively connected to these targets by means of the wires 76, 77, 78 and 79. The cathode 6 is connected through a current source 81 and the secondary of the transformer 82 to the common anode 73 by means of the wire 83. This source is so connected as to maintain the anode 73 positive with respect to the cathode targets. An arrangement of this type is particularly adapted for use with television apparatus, which will require rotation of the switching device at the proper speed ratio with respect to the scanning or analyzing device at the transmitter, as illustrated in the above noted patent. In other words, the portion 17' of the rotor will revolve once for one complete rotation of the scanning device with the result that its window 19' will register once with each anode 10' for each revolution. Consequently, as the window 19' registers with an anode 10' a circuit is closed to the associated target 74.

The source 81 is so adjusted that when no image or picture signals are being received from the transmitter or source 84 the targets are just in the neighborhood of the striking voltage, with the result that when the circuit thereto is completed through the commutator as described the target will immediately glow. The impressing of an image signal between that target and the anode 73 from the source 84 by way of transformer 82 will cause the brilliancy of the target to vary in accordance with well known principles to reproduce the image. If desired, the source 81 may be omitted and the incoming signal amplified sufficiently to directly light the targets 74.

It is, of course, apparent that this device may be employed in any system wherein accurate timing, even at high speeds and voltages, is necessary. It is obvious that such a device has many advantages over known switching devices for television systems employing mechanical contacting brushes or the like, which introduce disturbances due to leakage, wear, non-uniform pressure, and the like. These disturbances are particularly objectionable in television and similar signaling systems because they are incorporated in the reproduced image or picture and prevent faithful reproduction thereof. The device illustrated herein entirely eliminates sparking, wear at contacts, rubbing, and the like.

While a particular way of utilizing the kinetic energy of an electronic or ionic stream has been disclosed, it will be understood that other ways may be employed. For example, the rotor member may itself be the anode co-operating with the electron emitting cathode. It is also to be noted that if the rotor should accumulate a negative charge to an undesirable extent due to the impinging of negative particles thereon, the rotor may be connected to ground or to a source of suitable positive potential to neutralize this space charge. It is likewise apparent that when desired an additional control electrode or grid may be employed to further modify the flow of electrons from the cathode to the anodes.

From the above description it will be apparent that this invention resides in certain principles of construction and operation which may be embodied in many other physical forms. I do not, therefore, desire to be strictly limited to the disclosure as given for purposes of illustration but rather to the scope of the appended claim.

What I seek to secure by United States Letters Patent is:

A combination comprising an evacuated vessel, a cathode adapted to emit electrons, anodes mounted around the cathode, an apertured member rotatably mounted between the cathode and anodes, whereby electrons in traveling from the cathode to the anodes through said apertures cause rotation of said member, a second set of anodes positioned to receive electrons from said cathode through apertures in said member.

ALLEN B. DU MONT.