

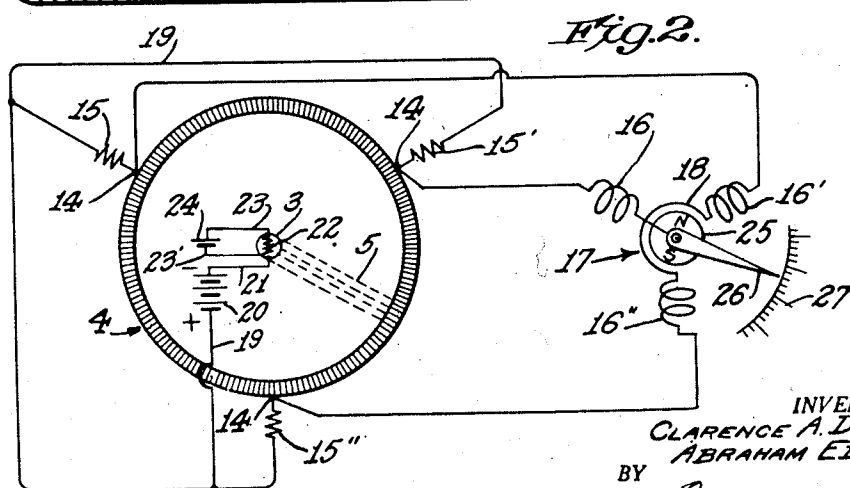
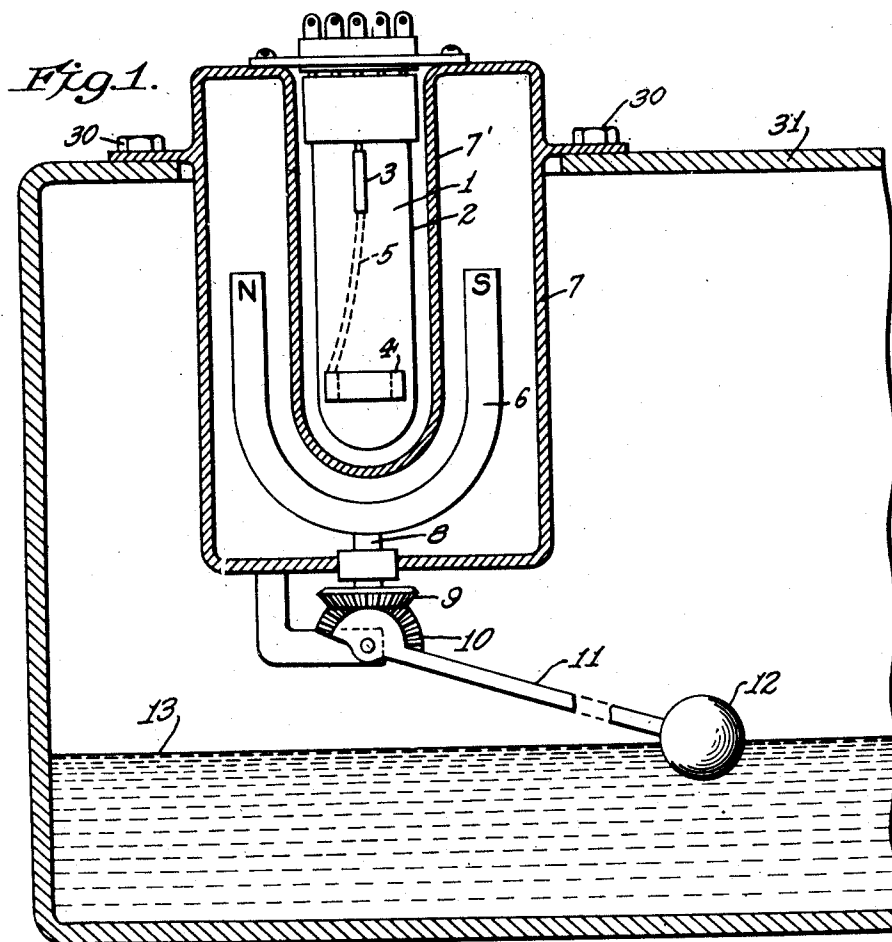
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ELECTRON TUBE TYPE TRANSMITTER

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ELECTRON TUBE TYPE TRANSMITTER

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This invention relates to measuring devices for indicating and/or control purposes in which a variable resistor controlling the device is controlled by a magnitude to be supervised. The invention relates particularly to measuring devices in which a transmitter, including a variable resistor controlled by a magnitude to be supervised, transmits signals to a receiver.

In devices of the type described it is generally known to provide a slider controlled by a prime mover and riding on a resistance element. It has been found that the movements of such slider entail an appreciable frictional resistance and hence require a corresponding expenditure of power to effect movements. As a consequence, such an arrangement does not lend itself to a number of applications, particularly where accuracy depends upon sensitivity to changes which are to be measured.

Accordingly, it is an object of the invention to provide a novel and improved means for controlling a variable resistor in devices of the type described without requiring a relative movement of parts in frictional engagement.

Another object of the invention is to provide a novel and improved means by which a delicate prime mover can be used to control a variable resistor without any mechanical connection between the prime mover and the variable resistor. This has the advantage that the container for the magnitude to be supervised or measured, as, for instance, gasoline, can be completely closed, thereby avoiding any danger caused by electrical sparks, explosive vapors, breakage, etc.

Other and further objects, features and advantages of the invention will appear hereinafter and in the appended claims forming part of the application.

According to a now preferred embodiment of the invention, the previously enumerated and other objects of the invention, some of which are pointed out hereinafter, are attained by controlling a resistance element by the direction of an electron beam. The direction of this electron beam which corresponds to the slider of a conventional variable resistor is controlled by the direction of a magnetic field which in turn is controlled by a prime mover.

In the accompanying drawing a now preferred embodiment of the invention is shown by way of illustration and not by way of limitation.

Fig. 1 is a diagrammatic view of a transmitter according to the invention controlled by a liquid level to be supervised, and

Fig. 2 is a diagrammatic view of the circuit system of a measuring device according to the invention including a transmitter according to Fig. 1.

Referring now in detail to Fig. 1, the transmitter shown includes an electron tube generally designated 1. The electron tube, the external connections of which will be more fully explained

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in conjunction with Fig. 2, comprises an evacuated envelope 2 in which are mounted an electron gun 3 and an anode assembly 4 consisting of a ring type resistance element either of composition or wire-wound design. The electron gun cathode is connected in a conventional manner well known in the art to emanate electrons, thereby forming an electron beam 5 toward the anode. The envelope 2 is surrounded by a substantially U-shaped permanent magnet 6, the polarity of which is as indicated. As will be obvious, the normally straight electron beam 5 is deflected by the magnet field, the direction of the curvature of the beam being determined by the location of the north pole of magnet 6 relative to anode 4. The strength of the permanent magnet is so selected as to cause the electrons to impinge upon the anode assembly and be absorbed within a small spot. Electron tube 1 and magnet 6 are supported by a housing 7 fastened by screws 30 to a closed tank 31. The walls of housing 7 are recessed to form a cavity 7' of non-magnetic material and in which the tube 1 is placed, the walls of the cavity separating the tube and the magnet 6 and protecting the tube against damage. The magnet 6 is rotatably supported, and its position relative to the anode assembly of the electron tube is controlled by a prime mover which in turn is controlled by a magnitude to be supervised. In the embodiment illustrated in Fig. 1 the magnet 6 is mounted on a shaft 8 journaled in a bearing supported in the housing 7, the axis of the shaft being in alignment with the axis of the electron tube so that a rotation of shaft 8 rotates the field of the magnet thereby also rotating the plane in which electron beam 5 is curved. The lower end of shaft 8 supports a gear 9 which engages a second gear 10 also supported by the housing and is rotated by the angular movements of an arm 11 supporting a float 12 floating on the liquid, the level of which is indicated at 13. Level 13 may be the surface of liquid in a tank such as a fuel tank of an airplane.

As will be apparent from the previous description level 13 will control the position of magnet 6 relative to anode 4 and hence the portion at which the electron beam will impinge upon or strike the anode.

The location of the anode portion at which the beam strikes the anode under the control of the liquid level position is employed to control the transmission of signals to a receiver. Any suitable conventional receiver controllable by signals of the type described may be used. According to the arrangement shown in Fig. 2, the ring resistor of the anode assembly is tapped at three equidistant points 14. Resistors 15, 15', 15'' and coils 16, 16', 16'' of a conventional ratiometer, generally designated 17, each have one terminal respectively connected to taps 14 as shown. The

coils are connected together at their other terminals by a common wire 18, and the three resistors are also connected together at their other terminals by a common wire 19. The resistors are further connected through the common wire 19 to the positive terminal of a D. C. source of current, such as a battery 20. The negative terminal of the battery is connected by a wire 21 to cathode 3 which is heated by a conventional heater resistance 22 connected by wires 23, 23' to a source of current, such as a battery 24.

It should be understood that for the sake of clarity the cathode is shown in its simplest practical form, but that the cathode may include additional elements which are well known and conventional for such electron sources as here described.

A magnet rotor 25, such as a permanent magnet, is rotatably mounted centrally within the magnetic fields of the ratiometer coils, to be influenced and turned in the direction of resultant of the magnetic fields of the coils as is well known for ratiometer indicators. A pointer 26 fastened to the rotor indicates the rotor position on a scale 27. Scale 27 may be calibrated in units of liquid height or liquid contents. It should also be understood that instead of employing rotor 25 to operate a pointer, the angular rotor movements can be used to operate a suitable control system, for instance contacts in a relay circuit.

As has been previously mentioned, the direction in which the electron beam is curved and the portion of the anode resistor assembly 4 upon which it impinges, is determined by the direction of the magnetic field acting on the electron beam. This direction in turn is controlled by the liquid level 13 to be supervised. The portion of the anode resistor assembly 4 upon which the electron beam 5 impinges controls the relationship of the currents through the ratiometer coils 16, 16', 16''. Hence the permanent magnet rotor 25 will be placed in an angular position corresponding to the beam curve, so that the indications of pointer 26 on scale 27 are a function of the liquid level to be supervised.

In the embodiment shown in Fig. 2 the anode resistor assembly 4 and the ratiometer coils are directly connected, but it should be understood that it is quite practical and within the scope of the invention to interpose a suitable conventional amplifier between the anode and the ratiometer coils, thereby increasing the total power variable at the ratiometer coils in the event that the ratiometer type used is of a type requiring more power than is available without such amplification.

While the invention has been described in detail with respect to a certain now preferred example and embodiment of the invention it will be understood by those skilled in the art after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention and it is intended, therefore, to cover all such changes and modifications in the appended claims.

What is claimed is:

1. In a resistance type transmitter for a measuring device of the type described, the combination of an electron tube having an anode assembly comprising a wire wound resistor, a movably supported magnetic means arranged to control the direction of an electron beam produced in the electron tube, and a prime mover controlled by a variable physical magnitude to be

supervised and controlling the position of the magnetic means relative to said resistor for placing the electron beam in a position in which it impinges upon a portion of said resistor corresponding to the respective magnitude of the variable physical magnitude.

2. In a resistance type transmitter for a measuring device of the type described, the combination of an electron tube, an anode assembly in said tube comprising a ring type resistance element, a movably supported magnetic means arranged to control the direction of an electron beam produced in the electron tube, and a prime mover controlled by a variable physical magnitude to be supervised and controlling the position of the magnetic means relative to the resistance element for placing the electron beam in a position in which it impinges upon a portion of the resistance element corresponding to the position of the prime mover.

3. In a resistance type transmitter for a measuring device of the type described, the combination of an electron tube having an anode assembly comprising a tapped ring resistor, a substantially U-shaped magnet rotatably supported adjacent to the resistor in the tube for controlling the direction of an electron beam produced in the electron tube, a prime mover controlled by a variable physical magnitude to be supervised and controlling the angular position of the magnet relative to the resistor for placing the electron beam in a position in which it impinges upon a portion of the resistor circumference corresponding to the position of the prime mover.

4. In a resistance type transmitter for a measuring device for measuring liquid in a container, the combination of an electron tube having an anode assembly comprising a tapped annular wire wound resistor, a means for supporting the electron tube outside of said container, a magnetic means arranged to control the direction of an electron beam produced in the electron tube for controlling the portion of said resistor at which such electron beam impinges thereupon, means for rotatably supporting the magnetic means so that the flux thereof will pass through said electron tube, a prime mover controlled by a change of the liquid level in the container and controlling the angular position of the magnetic means relative to the resistance element for placing the electron beam in a position in which it impinges upon a portion of the resistance element corresponding to the prime mover position.

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