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ELECTROMAGNETIC DEVICE

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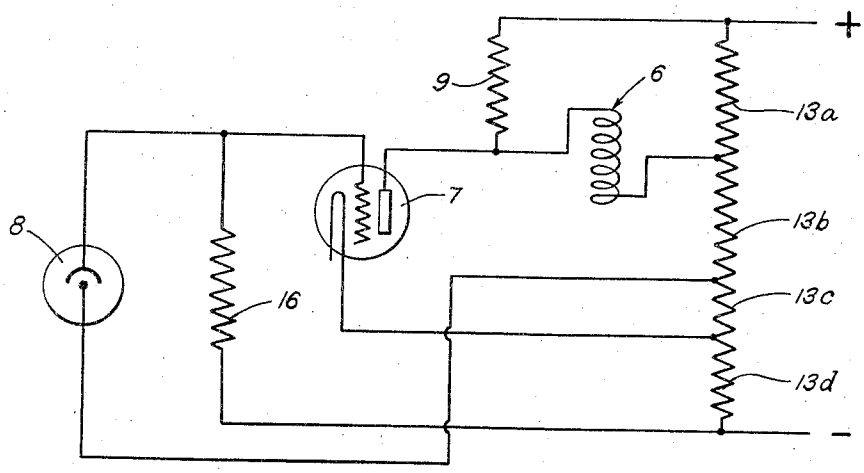

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ELECTROMAGNETIC DEVICE

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2 Claims. (Cl. 250—41.5)

This invention relates to electromagnetic devices, and particularly to electromagnetic devices of the type wherein reversal of current causes a corresponding reversal in the direction of force application, and hence a reversal of movement of a part, such as a valve, lever, switch element, or servo-motor, actuated thereby.

An object of the invention is to provide novel means for controlling the flow of current to an electromagnetic device of the indicated character.

A second object is to provide light sensitive control of the current flow.

A third object is to provide, in combination with an electromagnetic element and a light sensitive device, such as a photo-electric cell, a system of electrical circuits and devices connecting said cell with said electromagnetic element in such a manner as to achieve the above mentioned objectives.

These and other objects of the invention will become apparent from inspection of the following specification when read with reference to the accompanying drawing wherein is illustrated the preferred embodiment of the invention. It is to be expressly understood, however, that the drawing is for the purpose of illustration only, and is not designed as definition of the limits of the invention, reference being had to the appended claims for this purpose.

In the drawing, reference character **6** designates a coil which may be part of a magnet, relay, motor, etc.; and, **7** designates a thermionic vacuum tube, **8** a photo-cell, and **9**, **13** and **16** are resistors.

The fixed grid bias of vacuum tube **7** is initially adjusted so that the plate current of the vacuum tube is small enough to allow the necessary relay operating current to flow from resistor **9**, through coil **6** and through resistors **13***b*, **13***c*, and **13***d* of the voltage divider **13**. When a small amount of light is allowed to fall on the photo-cell the cell will pass current through itself and resistor **16**, causing a voltage drop in **16** and decreasing the grid bias of vacuum tube **7**. As the grid bias is decreased the plate current will increase causing more voltage drop in **9**. As the amount of light is increased the voltage drop in **9** will also increase until a point is reached where the voltage drop in **9** is exactly the same as that in **13***a*. When this occurs there will be no current flow in coil **6** and it will be in its neutral position.

If the amount of light on the photo-cell is still further increased the voltage drop in **9** will become greater than that in **13***a* and the current will flow in relay **6**, but in a direction opposite to the first described direction of flow. (Current through **9** plus current through **6** being the total plate current of vacuum tube **7**.)

An example of a use to which the above invention may be applied is as follows:

Suppose an instrument to be so arranged that light from a light source placed behind it can pass through an aperture in the instrument face and fall on the photo-cell. Now suppose the instrument to be equipped with a movable index element adapted to assume any one of three positions, such that in the first position maximum light will act upon the photo-cell, in the second position a moderate amount of light will fall on the cell, and in the third position all light from the light source will be excluded.

Let position **2** be the normal position of the index element. When in this normal position, let it be assumed that the grid bias, light intensity, etc., will be so adjusted that the voltage drop in **9** and **13***a* are equal. If so, no current will flow in relay **6**. Now should the index element move to position **1**, the increase in light falling on the photo-cell will cause the relay **6** to operate in one direction; and should the pointer move to position **3**, the decrease in the amount of light falling on the photo-cell will cause the relay **6** to operate in the opposite direction.

The foregoing is merely a suggestion of one field of utility for the element **6**. Other uses will be obvious, in the light of the explanation set forth in the introductory paragraphs of this specification. Likewise, possible variations in the circuit arrangement (such as the substitution of other current consuming elements for the resistors **13**) will be obvious, and are embraced in the appended claims.

What I claim is:

1. The combination with a photo-electric cell and a thermionic device having a grid element, a resistor having at least three sections (**13***b*, **13***c*, **13***d*) two of which (**13***b*, **13***c*) are in shunt relationship to the thermionic device, and a third section in series relationship thereto, a source of electrical energy for the photo-electric cell, means exclusive of said energy source for electrically connecting one electrode of said photo-cell with said resistance element, at a point between the two first-named sections thereof, means electrically connecting the other electrode of said photo-cell with said grid element, electromagnetic means interposed in the circuit between said thermionic device and said resistor, and means cooperating with said electromagnetic means to

reverse the direction of current flow through said electromagnetic means in response to variations in the grid potential of said thermionic device.

2. The combination with a photo-electric cell and a thermionic device having a grid element, a resistor including a series of resistance elements in Wheatstone bridge association with said thermionic device, a source of energy for the photo-electric cell, means exclusive of the source of energy for electrically connecting one electrode of said photo-cell with said resistance elements, means electrically connecting the other electrode of said photo-cell with said grid element, electromagnetic means interposed in the circuit between said thermionic device and said resistor, and means alternating between a shunt and series relationship to said electromagnetic means to correspondingly alternate the direction of current flow through said electromagnetic means in response to variations in the grid potential of said thermionic device.

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