Dec. 31, 1957 J. S. YARROW 2,817,916

OSCILLATORY DISPLAY DEVICE HAVING BIMETALLIC ACTUATOR

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Fig. 1.

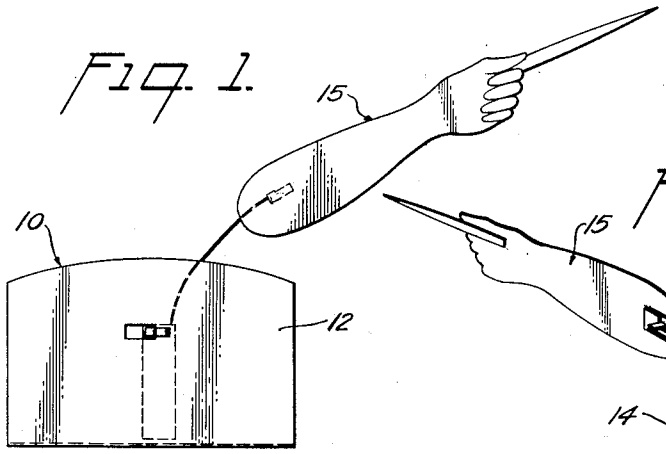


Fig. 2.

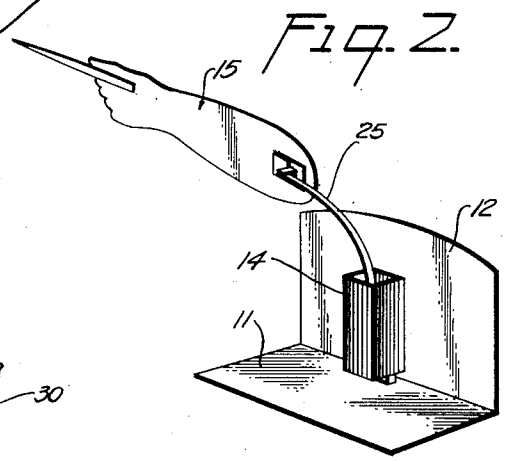
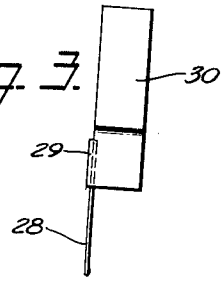


Fig. 3.



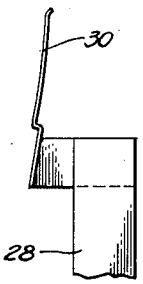
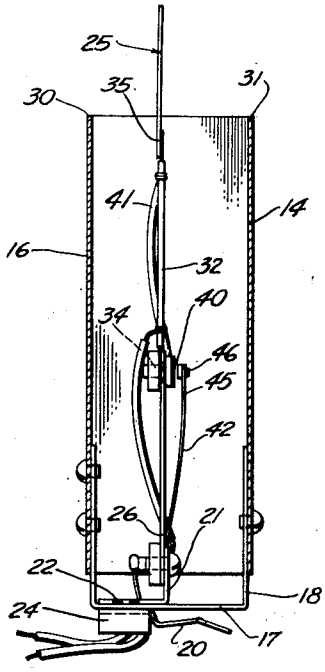
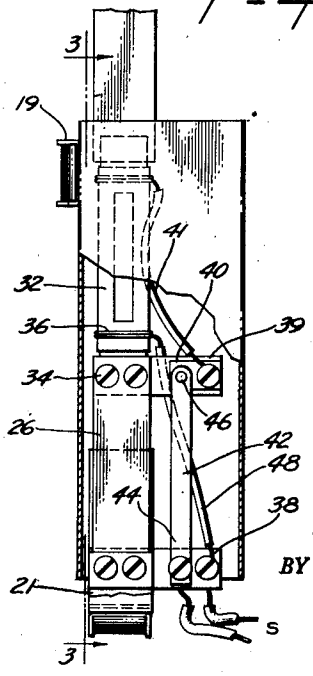


Fig. 4.



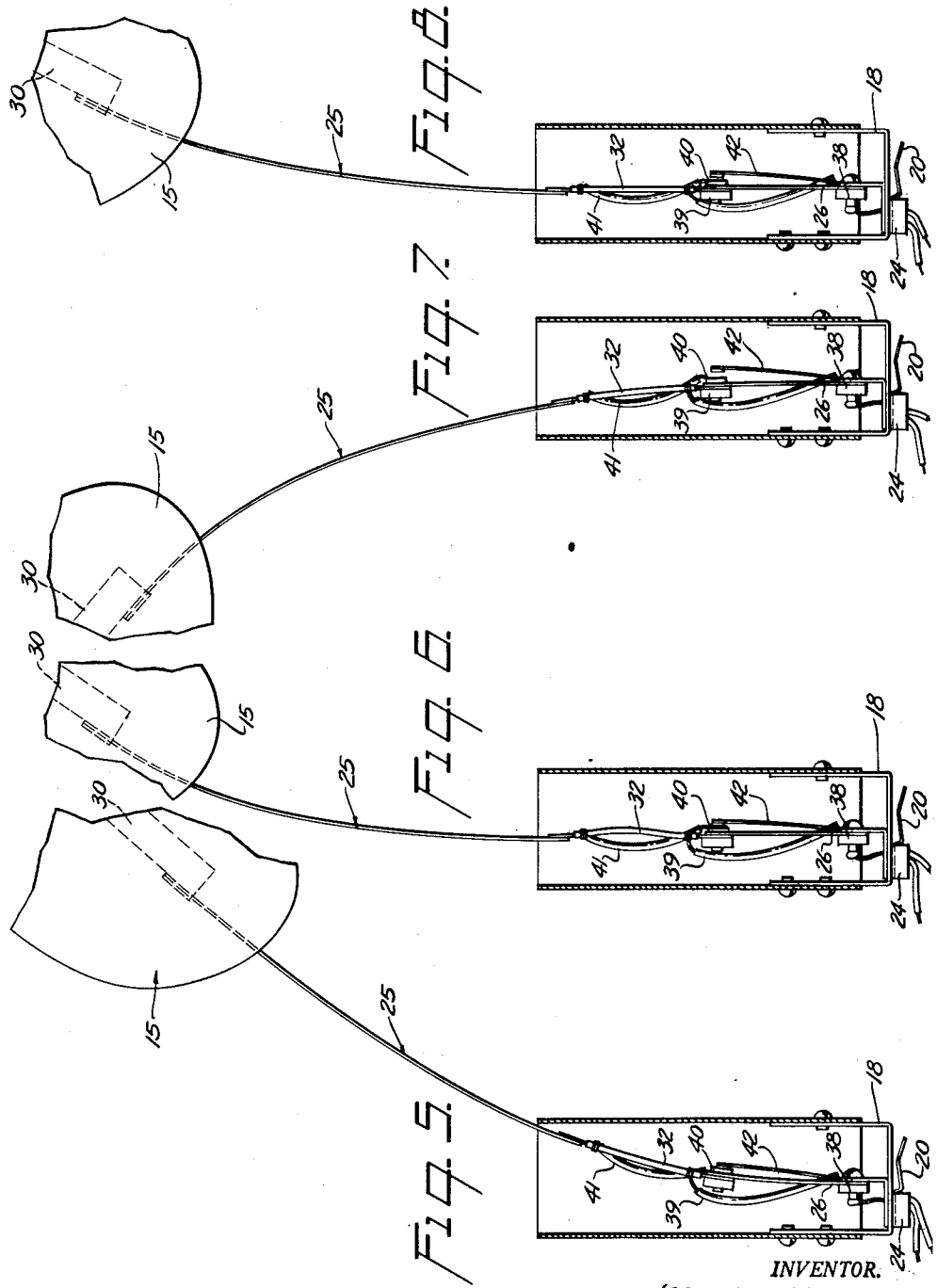


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United States Patent Office 2,817,916
Patented Dec. 31, 1957

2,817,916

OSCILLATORY DISPLAY DEVICE HAVING BIMETALLIC ACTUATOR

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Application July 23, 1953, Serial No. 369,774

5 Claims. (Cl. 40—139)

This invention relates to electrically actuated oscillatory display devices and more particularly to one in which motion of an actuator is induced by the alternate heating and natural cooling of a bi-metallic element.

One object of the invention is to produce a motion unit which will have a relatively long period and which does not require reducing gears and the like to reduce the speed of a faster moving motor.

Another object is to provide a motion unit in which the average power consumption is low.

Still another object is to provide a motion unit in which the speed of motion is more or less the same during forward and return motion so that a portion of the display has a motion more or less symmetrical about a given line or plan.

For the attainment of these and other objects which will become apparent as the description proceeds, I provide an upwardly projecting resilient strip having a splice of bi-metallic material in the lower portion.

In the accompanying drawing showing, by way of example, one of many possible embodiments of the invention,

Fig. 1 is a front elevation of the display;

Fig. 2 is a rear perspective of the display;

Fig. 3 is vertical sectional view of the actuator, the section being taken substantially along the line 3—3 of Fig. 4 looking in the direction of the arrows of said line;

Fig. 4 is fragmental side elevation of the actuator, and

Figs. 5, 6, 7 and 8 are views showing operational positions of parts of the actuator.

The display device **10** includes a base **11** and a panel front **12** an actuator **14** secured thereon and a movable display piece **15** mounted on the actuator. The actuator, which is the heart of the invention, comprises a tubular upright housing or chimney **16** and a U member **18** secured to the bottom portion of housing, the yoke **17** of the member extending below the housing. Clips **19** and **20** secured on the housing and yoke as by welding are provided for securing the actuator to the base and panel front.

An upwardly projecting bracket **21** is secured to the yoke and within the housing, the clip **20** and bracket **21** being secured to the yoke as by welding at **22** and **24**. The principal moving part of the actuator is a spliced oscillatory strip **25**, mostly of stiff resilient material, such as steel, and having a lower end portion **26** mounted fast on the bracket and an upper portion **28** projecting upwardly well above the housing, the extreme upper end **29** having a mounting piece **30** secured thereon for mounting the display piece **15** on the upper end **29**. The strip **25** is adapted to oscillate, by bending, in a plane parallel to that of the panel front. The upper rim edges **30**, **31** of the housing may act as stops to limit partially the motion of the strip, though their action is not critical.

Motion of the strip **25** is induced by alternate heating and cooling of a bimetallic strip or element **32** consisting of metals having different coefficients of thermal expansion interposed between the upper end **34** of the lower portion **26** and the lower end **35** of the upper portion **28** for causing the oscillatory strip **25** to buckle in the region of the element with changes of temperature. Heating is accomplished by selectively applying current to a resistance wire **36** wound on the bimetallic strip.

Offset fixed and movable mounting members **38** and **39** of insulating material are mounted fast on, and project rearwardly from, the bracket **21** and upper end **34** of the steel lower portion **26** for carrying appurtenances for the control of the current. The control is carried out by the use of a contact point member **40** on the movable mounting member **39** connected as by conductor **41** to one end of the resistance wire, and a resilient leaf spring **42** having a lower end **44** secured fast to the member **38**, the upper end **45** bearing a contact point **46** engageable with the contact member **40**.

As shown in Fig. 3, with no moving body **15** attached, the oscillatory strip **25** is slightly biased off the vertical, at room temperature, toward the contact **46**.

It will be noted that under no load, such as the body **15**, the contact member **40** does not quite touch the point **46**.

In operation the weight of the movable display piece **15** causes the strip **25** to become greatly bent over to one side as in Figs. 1, 2 and 5 with the leaf spring **42** yielding as in Fig. 5. Current flows from source S (Fig. 4) through conductor **48** to the wire **36** and back through conductor **41**, contacts **40—46** and leaf **42**. As the bimetallic strip is heated by the current, the right (Figs. 5–8) half of the strip is preferentially elongated causing the strip to buckle gradually as shown exaggerated in Fig. 6 and urge the display member **15** toward the left, eventually past the vertical. In doing so, the strip **25** as a whole begins to bend about the lower portion **26** and the contacts separate as in Fig. 7 and the bimetallic strip begins to cool. However the weight of the movable display piece **15** causes the strip **25** as a whole to bend so as to assume a position substantially symmetrical to that shown in Fig. 1.

As the element **32** cools, the system reverts to the position of Fig. 8 and, because sufficient heating does not occur instantly, the weight of member **15** causes further bending in the steel portions of the strip and the movable piece returns to the Fig. 5 position.

While a number of factors will influence the period of oscillation, I have found that if the steel upper and lower portions of the strip **25** be of about ½ inch clock spring steel about six inches and two inches in length and if the bimetallic element, such as used for thermostats, be about two inches in length and wound with bare resistance wire upon a light asbestos covering for the element and 110 v. current is used with a heavy cardboard moving part **15** the period is about two to three seconds. Covered wire cools more slowly and causes a long period and necessitates, if symmetrical rates of motion are desired, a longer heating period.

The invention claimed is:

1. In a display device, an actuator comprising a mount; an upwardly projecting strip having resilient portions and having its lower end portion secured to said mount; a bimetallic element consisting of metals having different coefficients of thermal expansion interposed between said resilient portions and secured fast thereto; a resistance heater secured substantially fast with respect to the element and adjacent thereto for heating same whereby the heater will move with the element and will continue heating the element at the same rate as the latter moves as long as constant current is supplied to the heater; and switch means for supplying current to the heater.

2. In a display device an actuator comprising a mount;

a normally upwardly projecting spliced oscillatory strip mostly of stiff resilient material, and having a lower end portion of stiff resilient material mounted fast with respect to the mount and an upper portion of said material projecting upwardly; the extreme upper end of the strip being adapted for mounting a movable display piece on the upper end; the strip being adapted to oscillate from side to side by bending; a bimetallic element consisting of metals having different coefficients of thermal expansion interposed between the upper end of the lower portion and the lower end of the upper portion for causing the oscillatory strip to buckle with changes of temperature; a resistance wire wound on the bimetallic strip element; and a switch having a part fixed with respect to the strip and movable therewith and another part fixed with respect to the mount for supplying current to the wire during the cycle when the strip is substantially on one side of the vertical.

3. In a display device comprising a mount; an oscillatory strip having a lower end portion of stiff resilient material mounted fast with respect to the mount and an upper portion of said material projecting upwardly; a movable display member fast on the upper end of the strip, the strip being adapted to oscillate from side to side by bending; a bimetallic element consisting of metals having different coefficients of thermal expansion interposed between the upper end of the lower portion and the lower end of the upper portion for causing the oscillatory strip to buckle with changes of temperature; a resistance wire wound on the bimetallic strip element; and means for selectively supplying current to the wire.

4. In a display device an actuator comprising a mount; a spliced oscillatory strip having a lower end portion of stiff resilient material mounted fast with respect to the mount and an upper portion of said material projecting upwardly; the extreme upper end being adapted for mounting a movable display piece on the upper end; the strip being adapted to oscillate by bending; a bimetallic element consisting of metals having different coefficients of thermal expansion interposed between the upper end of the lower portion and the lower end of the upper portion for causing the oscillatory strip to buckle with changes of temperature; a resistance wire wound on the bimetallic strip element; and a switch for controlling a flow of current through said wire having a contact on and movable with the strip.

5. In a display device, an actuator comprising a tubular upright housing; a spliced oscillatory strip having a lower end portion of stiff resilient material mounted fast with respect to the housing and an upper portion of said material projecting upwardly well above the housing; the extreme upper end of the strip being adapted for mounting a movable display piece on the upper end; the strip being adapted to oscillate by bending; a bimetallic element consisting of metals having different coefficients of thermal expansion interposed between the upper end of the lower portion and the lower end of the upper portion for causing the oscillatory strip to buckle with changes of temperature; a resistance wire wound on the bimetallic strip element; a contact point member mounted to move with lower portion, and a resilient leaf spring bendable with the lower portion and having a lower end secured fast with respect to the housing and the upper end bearing a contact point engageable with the contact member to supply current to the wire.

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