

May 26, 1959

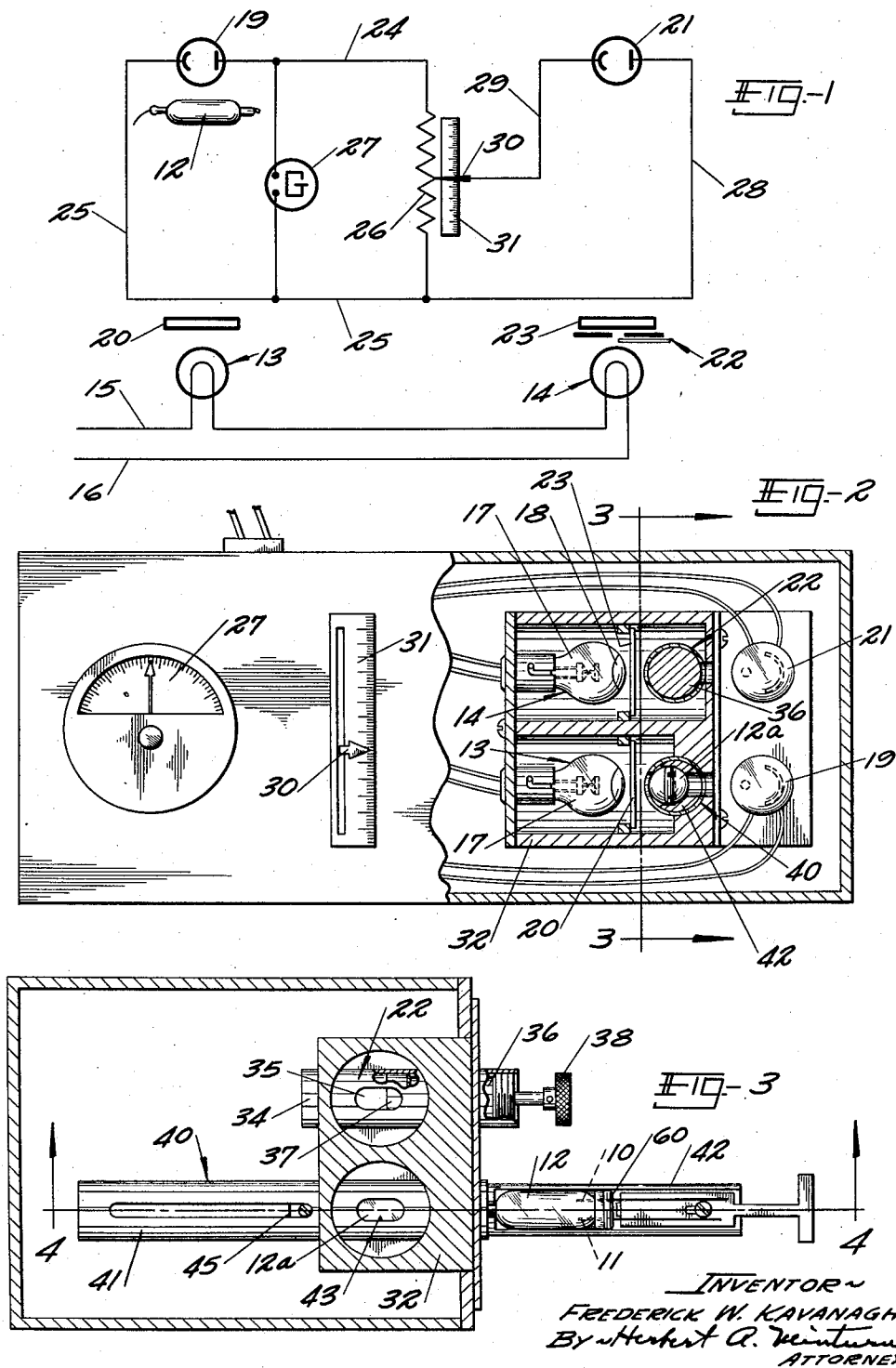
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DEVICE FOR DETERMINING LAPSED TIME

Filed March 24, 1958

2 Sheets-Sheet 1



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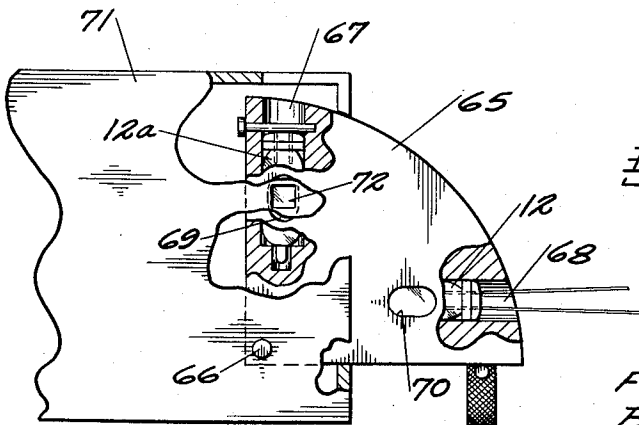
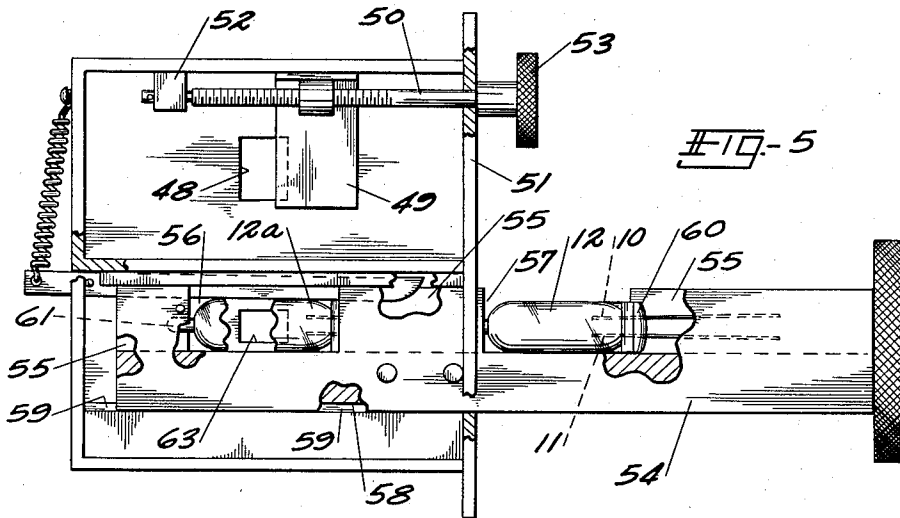
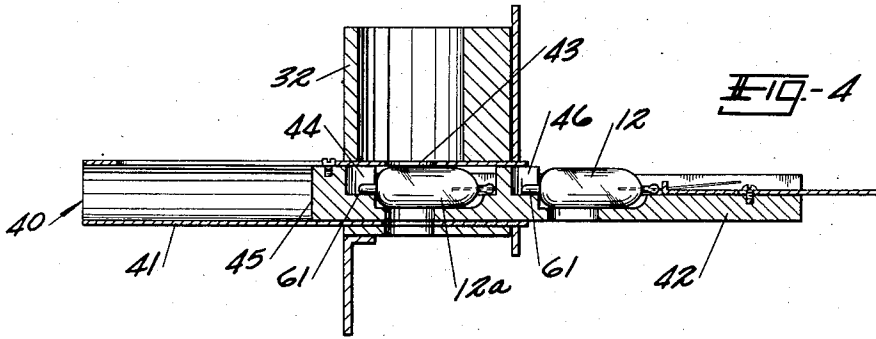
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2 Sheets-Sheet 2



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DEVICE FOR DETERMINING LAPSED TIME

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5 Claims. (Cl. 250—218)

This invention relates to a device for quickly determining the duration of time an electric circuit has been energized. The device finds use in many different situations, one particular use being in a television circuit whereby the hours of energization of a picture tube may be determined so as to permit determination of whether or not the tube has met its normal hours of performance. The device is equally well adapted to any other electrical circuit to determine the life of units which may be in that circuit, permitting a quick determination to that end.

The invention is illustrated in the accompanying drawings, in which

Fig. 1 is an electrical diagram of the device;

Fig. 2 is a view in side elevation and partial section of one particular form of a device embodying the invention;

Fig. 3 is a view in section on the line 3—3 in Fig. 2;

Fig. 4 is a view in section on the line 4—4 in Fig. 3;

Fig. 5 is a view in end elevation and partial section of a modified form of structure embodying the invention; and

Fig. 6 is a detail in elevation and partial section of a tube shifting mechanism.

The invention employs a commercially obtainable ampoule containing a water solution of copper sulphate. This ampoule is embodied in the electric circuit, the duration of energization of which is to be checked. The ampoule has a pair of internally exposed electrodes 10 and 11, Fig. 5, inserted within the ampoule 12, in a sealed manner. Current from the circuit being checked is applied to the two electrodes, so as to electrodeposit copper of the copper sulphate solution on one of the electrodes. This electrolytic action depletes the copper sulphate content of the solution in the ampoule 12, and in so doing, the water solution changes its intensity of color. The longer the duration of plating action within the ampoule 12 the clearer the solution becomes within the ampoule, and thus more transparent to passage of light there-through.

These ampoules 12 are standardized in respect to their copper sulphate solutions.

Reference is made to Fig. 1, wherein two lamps 13 and 14 are shown as hooked together in series to be energized by any suitable source of current through the lead wires 15 and 16 which permit the two incandescent lamps to be wired either in series or in parallel, the series connection being preferred due to longer life obtained of the lamps.

Applicant obtains good compensation for line voltages when the lamps are either in series or in parallel. With the lamps in series, the current through them is constant, but the "color temperatures" and voltage drop across the filaments are not necessarily identical as the examiner has pointed out. A small change in line voltage changes the current, the voltage, and the "color temperatures." Applicant has found that the change in one lamp is nullified by the change in the other so that balance of

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the instrument is not affected. This is new in the art. When the lamps are in parallel, the same voltage is across each lamp, but the current through them may not be identical, nor will the power dissipated by each and the "color temperature" be identical. Nevertheless, compensation for line voltage fluctuation is obtained. The compensation in either event is critical to the invention. These lamps 13 and 14 are of the reflector type, Fig. 2, wherein there is a silvered interior coating 17 leaving an end aperture 18 through which light may be emitted directly from the filament. A photo-electric cell 19 is located in spaced relation from the lamp 13, and between the lamp and the cell there is inserted the ampoule 12 and a filter 20. A second photo-electric cell 21 is provided in spaced relation from the lamp 14, and between the lamp and the photo cell is a variable apertured device 22 and a filter 23.

The photo cell 19 is in series through the wires 24 and 25 with a resistance 26. A galvanometer 27 is hooked across the wires 24 and 25 between the photo cell 19 and the resistance 26. The photo cell 21 is connected in series through the wire 28 and the wire 29 through a variable contact member 30 with the resistance 26. A scale 31 is provided to indicate the change in positioning of the member 30 in relation to the resistance 26.

Referring to the embodiment of the invention as illustrated in Figs. 2 and 3, a body 32 carries the two lamps 13 and 14 and also the photo-electric cells 19 and 21 together with the variable aperture device 22 and means for shifting the ampoule 12 in and out of the device for checking.

The variable aperture device 22 consists in this particular form of a tube 34 having an elongated opening 35 therethrough, and carrying a plug 36 screw-threadedly engaged in the tube 34 to have an inner end portion 37 traverse the opening 35 upon rotation of the plug 36 by any suitable means such as by the external knob 38. A shiftable ampoule carrier generally designated by the numeral 40 is in this particular embodiment a tube 41 slidably receiving a plunger 42 across a window 43. This plunger 42, Fig. 4, is recessed to carry in spaced apart relation two ampoules 12 and 12a. For convenience, this ampoule 12a is carried in a recess 44 nearest the inner end 45 of the plunger 42, and a second recess 46 carries the ampoule 12 which would be the ampoule being checked for its degree of copper sulphate remaining in solution.

One particular method of employing the invention is to use an ampoule 12a containing nothing but pure water. The positioning of the ampoule 12a with this content to intercept the light beam from the lamp 13 to the photo cell 19 will give a reading on the galvanometer 27. The filter 20 may be of a red color to remove unwanted light going into the photo cell. Then with the reading of the galvanometer being noted, the aperture device 22 is manipulated by shifting a member, the plug 36 in the form shown in Figs. 2-4, to vary the effective opening 35 so as to vary the degree of light being transmitted from the lamp 14 to the photo cell 21, and by so manipulating the device 22, the galvanometer is restored to a zero setting.

After obtaining the zero setting, the plunger 42 is pulled up to the position as indicated in Fig. 3, where it will have been during the obtaining of the zero reading with the ampoule 12a being across the opening 43. The ampoule 12, which is the one that has been removed from the electric circuit to be checked for its duration of previous energization, is inserted in the recess 46 and then the plunger 42 is shifted oppositely, where the light beam from the lamp 13 will pass through it to the photo cell 19, giving a new reading on the galvanometer 27.

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The electrical balance, being indicated by a zero reading of the galvanometer 27, is restored by shifting the member 30 along the resistance as in a potentiometer, and then the difference between the original reading of the position of the member 30 along the scale 31 and the new balance position is taken. This scale 31 may be calibrated to give readings of hours directly.

In other words, the amount of light passing through the ampoule 12 will through this circuitry give the indication of the depletion of the copper sulphate from the solution which is proportional to the time taken to plate out the copper on one of the electrodes in the ampoule itself.

While the description above has been made in reference to obtaining an initial zero circuit balance condition in reference to an ampoule of water, the circuit may be balanced upon use of a standard ampoule containing the copper sulphate solution before any electrolytic action has been induced within the ampoule, and that may be used as a basis in comparison to a "used" ampoule 12. The same procedure would be followed.

The actual construction of the device embodying the circuitry of Fig. 1, may be varied. For example in Fig. 5, the aperture device may consist of the light aperture 48, across which is shifted a shutter 49 to vary the opening of the aperture 48. This shutter 49 is shown as being screw-threadedly carried on the shaft 50 which is held against longitudinal displacement by the box wall 51 and an internal bracket 52, and rotated by an external knob 53. The ampoule carrying member consists of a rectangular slide bar 54 slidably guided through the wall 51, and being provided with a vertically disposed slot 55 extending throughout the length of the slide bar 54, opening from the topside thereof. The slide bar 54 is transversely notched entirely therethrough as at 56 and 57, the longitudinal length of these notches being sufficient to receive the ampoules 12a and 12. The underside of the slide bar 54 has a longitudinal slot 58 into which is received a tongue 59 to confine the slide bar 54 in its in and out travel to a straight line direction. The ampoules 12 and 12a being of the same external dimensions and configurations uniformly have a sealed end 60 approximately rectangular in shape, and this end 60 is inserted at the end of the notch 57 into the slot 55 in the one instance, and likewise into the slot 55 at the end of the notch 56, the ampoule in each instance also having a sharper pointed sealing off end 61 entering the slot at the other end of the notch in each instance. In this manner, the ampoules 12 and 12a are fixed in position to prevent them from rolling laterally of their notches as the slide 54 transfers them across the light aperture 63. In this form, the lamps 13 and 14, and the photo cells 19 and 21 are employed on opposite sides respectively of the apertures 63 and 48 in accordance with the diagram as indicated in Fig. 1.

A further ampoule shifting device is indicated in Fig. 6 wherein there is a quadrant 65 pivoted on a pin 66, and carrying bores 67 vertically in the positions shown, and 68 horizontally. The quadrant 65 has light apertures 69 and 70 permitting light beams to be carried entirely across from one side and out the other side of the bores 67 and 68, and the ampoules 12a and 12 are carried in these respective bores. By rocking the quadrant 65, the apertures 69 and 70 may be brought around to register with an aperture through the holder 71, this aperture being designated by the numeral 72. Again the same relative positioning of the lamps and the photo cells and aperture opening will be had as indicated in Fig. 1.

It is to be pointed out further that, contrary to expectations, there is, as opposed to one lamp, an automatic compensation is achieved by use of the two lamps 13 and 14 either in series or in parallel, in that line voltage fluctuations do not disrupt the balance in the circuitry, since changes in light emission from the lamps due to such

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fluctuations are proportionate, one lamp with another, so that the initial balance is not upset. Also the two lamp combination, particularly in series, produces less heat than would be the case when in parallel and the life of the lamps is almost indefinite, both by reason of the reduction of voltage across each filament.

Thus it is to be seen that I have presented an exceedingly simple form of a checking device employing a simple circuitry and also an extremely simple operating mechanism for the purpose intended. Therefore while I have described my invention in reference to the one particular circuit, embodied in the various mechanical forms, I do not desire to be limited to the precise forms beyond the limitations which may be imposed by the following claims.

I claim:

1. Means for determining lapsed time of operation of an electric circuit in which electrodes of an ampoule of copper sulphate-water solution have been included to plate out copper from the solution; which comprises a photoelectric cell; a light source directing a beam of light on said cell inducing a cell voltage output; a resistance; a galvanometer; an electric circuit consisting of said cell, said resistance and said galvanometer across said cell; means shiftably carrying said ampoule into and out of said light beam; a second photoelectric cell; a second light source directing a beam of light on said second cell inducing a voltage output; means varying the amount of light striking said second cell in said second light beam; and a second circuit consisting of the second cell and a selected variable amount of said resistance; the voltage of said second cell output being employed to balance, through said light varying means and an amount of said resistance, the galvanometer reading to a base reading without said ampoule interception of said first light beam, and then, upon intercepting the first light beam by said ampoule to give a changed galvanometer reading by reason of change in the first cell voltage output, the difference between the base reading and the changed reading indicating a degree of copper plating out in said ampoule which is proportionate to lapsed time required for that plating out.

2. The structure of claim 1 in which said ampoule shifting means comprises a base member; a shiftable member carried by the base member; means receiving and retaining said ampoule on said shiftable member; said base member being interposed between said first light source and said first cell and having opposite apertures through which the light beam may pass; said ampoule being carried by said shiftable member between said apertures.

3. Means for determining lapsed time of operation of an electric circuit in which have been included electrodes of an ampoule containing copper sulphate-water solution causing plating out of copper from the solution; which comprises a photoelectric cell; a light source directing a beam of light on said cell inducing a cell voltage output; a resistance; a galvanometer; an electric circuit consisting of said cell, said resistance, and said galvanometer connected across said cell; means shiftably carrying said ampoule into and out of said light beam; a second photoelectric cell; a second light source directing a beam of light on said second cell inducing a voltage output; means varying the amount of light striking said second cell in said second light beam; a second circuit consisting of said second cell and a selected variable amount of said resistance; a second ampoule of pure water positioned to intercept said first light beam in the absence of said first ampoule; said second cell light varying means being adjusted to give an electrical balance galvanometer base indication; and said first ampoule being substituted for the second ampoule in the first light beam, and varying said resistance to achieve a new electrical balance galvanometer indication, the difference between the two electrical balances being indicative of the lapsed time of current flow through said first ampoule.

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4. The structure of claim 2 in which each of said light sources consists of an incandescent lamp and both lamps are in series to compensate for line voltage fluctuations and maintains said balance.

5. The structure of claim 2 in which said light varying means comprises an apertured wall interposed between the second cell and its inciting light source, and a shutter member variably positioned across the apertured wall.

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