Nov. 8, 1955 T. W. HALLERBERG ET AL 2,723,389

WARNING LIGHT WITH DIM-LIGHT DISPLAY

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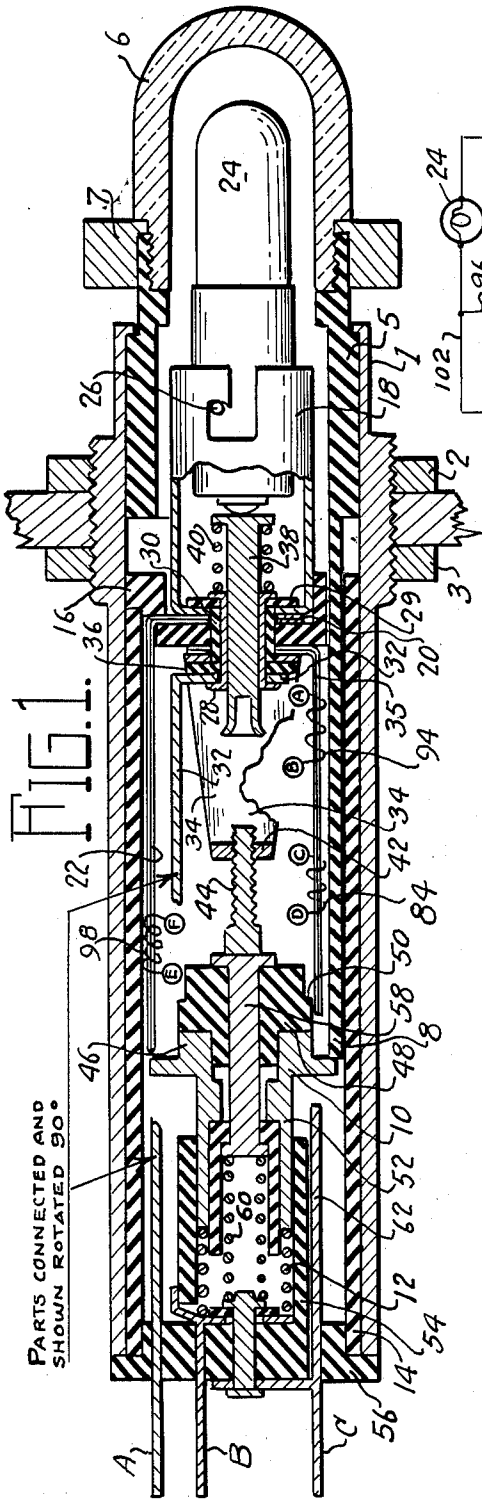


FIG. 1.

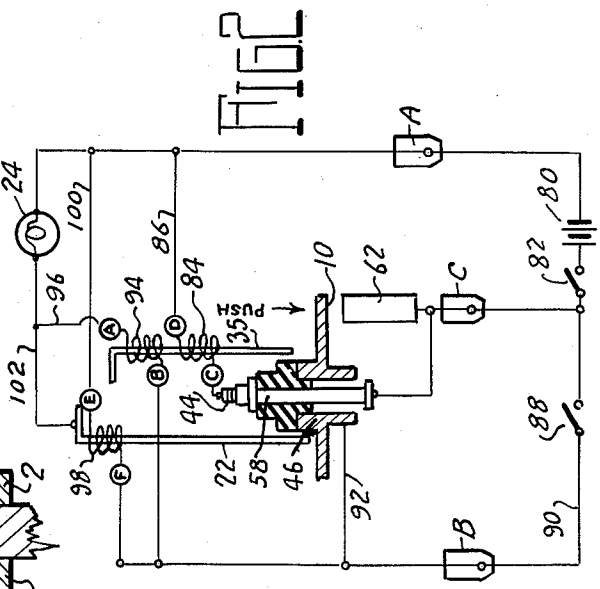


FIG. 2.

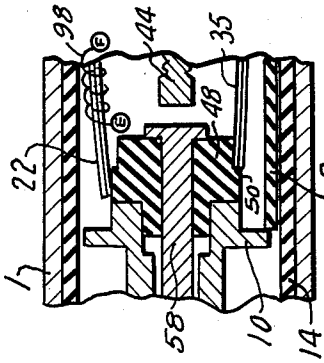


FIG. 4.

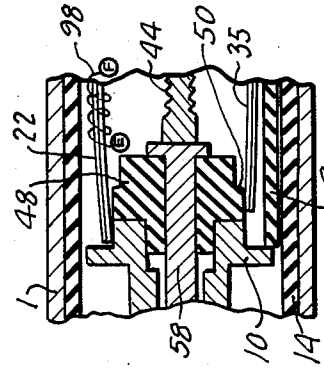


FIG. 3.

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WARNING LIGHT WITH DIM-LIGHT DISPLAY

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2 Claims. (Cl. 340—252)

This invention relates to warning lights of the type used in aircraft or the like to indicate a failure or misfunction of an operating device or mechanism. The primary object of the invention is to provide a simple and efficient device which gives an initial warning by means of a subdued light and thereafter a warning by means of a bright light in the event that the operator has disregarded the initial warning.

Other objects and advantages of the invention will become apparent from the following detailed specification describing a preferred embodiment thereof, reference being had to the accompanying drawings in which—

Fig. 1 is a central vertical sectional view, partially diagrammatic of a warning light embodying the present invention;

Fig. 2 is a somewhat diagrammatic circuit diagram;

Fig. 3 is a fragmentary view of certain of the parts in the position occupied when the display of the warning lamp is bright, and

Fig. 4 is a view similar to Fig. 3 showing the parts latched in the position in which the display of the warning lamp is dim.

Referring to Fig. 1, a device embodying the present invention is there shown as including a housing **1** which may be held in place with respect to a bulkhead or instrument panel by gland nuts **2** and **3** threaded over an end of the housing and clamping the entire instrument in place. At its outer end, the housing is formed to slidingly receive a lens assembly comprising a tubular insulating body **5** having a threaded outer end to which a lens **6** is attached, the lens carrying an operating ring **7** for the convenience of the operator. A finger extension **8** of the insulating body **5** is passed along one side wall of the housing interior and engages a disk-like contact member **10** which is biased outwardly by a spring **12**, the spring also acting as a current carrying element as hereinafter described. The spring **12** serves to maintain the entire lens assembly in an outward or extended position from which it can be moved whenever the operator presses against it for purposes of testing or dimming the display of the warning light as will be later described.

The housing **1** is lined by a tube of insulation **14** at one end of which is carried a partition **16**. A lamp socket **18** is fixed to the partition, being disposed over a contact plate **20** and also over an inturned end of a first bimetallic arm **22** which extends inwardly from the partition and along one side of the housing. A lamp **24** is connected to and held in place in the socket **18** in any suitable manner as by the usual pin **26** on the lamp base so that the lamp is electrically connected at its shell contact to the bimetallic arm and to the contact plate **20**.

The lamp socket is preferably fixed to the partition by a rivet **28** turned over an insulating grommet **29** at its outer side and passed through an insulating tube **30**. At its inner side the rivet is turned over a depending contact **32** and fixes in place a yoke **34**, as well as a second bimetallic arm **35**. The yoke **34** is insulated from contact **32** by a disk **36**. The rivet **28** being itself a tubular

member, it is utilized to receive a spring pressed center lamp contacting plunger **38** which is thus electrically connected to the depending contact **32** and to the center contact of the lamp. A small spring **40** biases the plunger **38** outwardly against the lamp.

At its inner end the yoke **34** has a radial extension **42** to which is adjustably connected a contact screw **44** which thus forms a stationary contact of a switch which will be hereinafter described.

Contact member **10** is formed with a disk-like portion above which is a cylindrical extension which forms a side contact **46**. Above the contact member and its side contact is an insulating button **48** which has a shoulder **50** cut thereon. A depending tubular extension **52** of the contact member **10** guides the member and its associated parts for reciprocation in a cylindrical insulating member **54** which is preferably formed as a cup-like extension of a housing closure or base plate **56**. The reciprocable assembly carries a contact **58** at its center which is insulated from the depending tubular extension **52** and which receives current through a spring connector **60**.

Contact **58** is reciprocable to and from the stationary contact screw **44** and cooperates therewith to form a switch which may be opened whenever the operator presses inwardly on the lens assembly ring **7** and thus moves the contact member **10** inwardly through the movement of the finger **8**.

The contact member **10** is adapted to form a movable portion of a testing switch, the stationary contact of which comprises a metallic stem **62** disposed in the path of movement of the contact **10**.

Contact prongs A, B and C extend from the inner end of the unit and either comprise or are connected with contact **32**, center spring contact **12**, and test contact stem **62** respectively.

Turning now to the schematic diagram shown in Fig. 2, corresponding parts shown or indicated in Fig. 1 have been given corresponding reference numerals in Fig. 2 insofar as possible in the disclosure of the circuit. Power for the lamp **24** is supplied from a battery **80** and is controlled in general by a power switch **82**. From power switch **82** connection is made to terminal C and thus to center contact **58** as well as to the metallic stem **62** which forms the stationary contact of a test switch of which the contact assembly **10** is a part. The contact **44**, which cooperates with contact **58**, is in circuit with a coil **84** wound around and in heat transfer relationship with the second bimetallic arm **35** and constitutes, with contact **58**, what will hereinafter be called the "ready" switch and controls the flow of current to what will hereinafter be called the "ready" winding or coil **84**. The opposite end of the "ready" winding **84** is returned to the battery by lead **86** and terminal A.

The battery **80** is connected to a function circuit including a function switch **88** which may be any known type of circuit closing device suitably responsive to the condition which it monitors. Thus the switch may be pressure actuated if it is to monitor pressure or thermally actuated if the condition which causes it to close is characterized by an increase or decrease of temperature.

The function switch **88** is connected by a lead **90** to terminal B of the warning device. Terminal B is connected to two parallel circuits each of which contains a heating resistance associated with a bimetallic arm and is also connected by spring **12** (connection **92** in Fig. 2) to the body of contact **10**. One of the aforementioned resistances is designated **94** in Fig. 2 and is called a "hold" winding. This winding is associated with the second bimetallic arm **35** and is in series with the warning lamp by a connection **96** and thus acts to dim the display of the

lamp whenever the circuit thereto is completed through the resistance of the holding winding 94.

The other parallel circuit to which terminal B is connected includes a heating coil 98 disposed around the first bimetallic arm 22 but insulated therefrom, and returned to the battery by connection 100. The heating coil 98 is called a "bright" winding for the reason that it serves to increase the temperature of the bimetallic arm 22 so as to cause it to deform from its normal position in which it is disengaged, into engagement with the cylindrical part 46 of the contact 10. The arm 22 being itself connected to the lamp by a lead 102, it will be seen that a low resistance circuit is established from terminal B to the lamp by way of lead 92, contact 10, arm 22 and lead 102 whenever the arm is electrically connected to the contact 10. The low resistance circuit thus formed shunts the dim, or higher resistance circuit from terminal B to the lamp which includes the resistance 94 and connection 96.

The operation of the device will now be described.

When power switch 82 is closed the unit may be immediately tested to determine the condition of the lamp 24 which is normally extinguished. For this purpose the operator pushes in on the protruding portion of the instrument by pressing against ring 7. This moves the insulating cylinder 5 and its extension finger 8 inwardly relative to the casing or housing 1. Finger 8 presses contact 10 inwardly until it comes up against the metallic stem 62 which constitutes the stationary contact of the test switch. If the lamp 24 is in proper condition current now flows from the battery 80 to terminal C, to stem 62, contact 10, lead 92, through resistance 94 and lead 96 to the lamp, and from the lamp back via terminal A to the battery.

As soon as the power switch is closed a circuit is also established from terminal C through the "ready" switch contacts 53 and 44 to the resistance of "ready" winding 84 around the terminal arm 35. Arm 35 thus becomes heated and swings in against the insulating disk 48 in position to move in over shoulder 50 should the disk and its associated parts be moved inwardly by the operator. It will be seen that the disk will be retained in its lowered position so long as arm 35 is heated, but that the circuit to the "ready" winding will be broken by opening contacts 44 and 53, contact 44 being stationary in the housing. The action of the thermal arm 35 is thus that of a latch member cooperating with the detent formed by shoulder 50.

During normal operation the lamp 24 shows no signal, but when function switch 88 is closed a circuit is immediately established which will cause the lamp to burn with a dim light. This circuit is from the battery, through the function switch 88, lead 90, resistance winding 94, lead 96 to the lamp 24. At the same time a parallel circuit is established through the "bright" winding 98 around the thermal arm 22. Thus the thermal arm 22 also begins to heat up and to deform inwardly in the direction of contact 10 and the device is preferably so proportioned that about ten to fifteen seconds is required for the arm to deform sufficiently to make contact with the cylindrical extension 46 of the contact 10. This time factor can be varied by changing the resistance of the "bright" winding 98 or by changing the thickness, length, or material of the arm 22.

If the operator fails to note the warning given by the initial dim light, a bright signal will be given to him as soon as the time has elapsed for the arm 22 to reach and make contact with the extension 46 of the contact 10. The "bright" circuit then established is from battery 80 through the function switch 88, lead 90, lead 92 to contact 10, via arm 22, lead 102 to the lamp.

If the operator notes the presence of the warning signal and does not wish to have the bright display, which may be annoying to him, or if the bright display has come on and he wishes to dim it, he can do so quickly and easily by pushing in on the protruding portion of the instrument in the same manner as he used for testing it. He thus pushes contact 10 down to such an extent that the arm 22 bears against the insulating member 48 instead of the metallic extension 46 of the contact and the "bright" circuit is broken at this point. The contact assembly will thereafter be held down by the latch including arm 35 which has been heated and has been standing against the member 48 biased inwardly by the heat of winding 84 as well as winding 94. The arm 35 thus moves in over the shoulder 50 and will remain in this position in which it prevents the return of the contact 10 assembly so long as current continues to be supplied to the winding 94 by reason of the function switch being closed. Thereafter until the trouble or misfunction is cleared, or until the power from the battery is cut off the lamp 24 will continue to burn dim.

If the function is cleared so that switch 88 is opened, all current to "hold" winding 94, which has been heating arm 35 and holding it in position over shoulder 50, is cut off. The arm then cools quickly, straightens and moves away from shoulder 50. When the arm has cleared the shoulder, spring 12 acts to restore the contact assembly 10 to its original position and the parts are ready to operate again if the misfunction recurs.

Similarly, at the end of a flight the parts will be restored to their original position because the power switch 82 will be opened thus cutting off the flow of current to the winding 94 at this point.

While the invention has been disclosed in conjunction with a specific form and disposition of the parts it should be appreciated that various modifications and changes may be made without departing from the spirit of the appended claims.

We claim:

1. A warning device comprising in combination a power source, a power switch controlling said source, a warning lamp, a function switch responsive to a condition to be monitored and acting when closed to complete a first relatively high resistance circuit from said power source to said lamp and to complete a second circuit from said power source, means operated by said second circuit to establish after a predetermined time delay a relatively low resistance shunt circuit to said lamp around said first circuit, whereby said lamp displays a dim light when said function switch is first closed and a brighter light after said predetermined time delay and the operation of said last means, manually operable means to open the low resistance circuit established by said last means, and a thermally energized latch means to hold said manually operable means in its open position.

2. A warning device comprising in combination a power source, a power switch controlling said source, a warning lamp, a function switch responsive to a condition to be monitored and acting when closed to complete a first relatively high resistance circuit from said power source to said lamp and to complete a second circuit from said power source, a heating winding in said second circuit, a bimetallic arm associated with said heating winding and connected to said lamp, and a movable contact connected to said function switch and associated with said bimetallic arm, said arm being normally out of engagement with said contact and moved into engagement therewith when heated by said heating winding, to establish a relatively lower resistance shunt circuit to said lamp around said first circuit, whereby said lamp displays a dim light when said function switch is first closed and a brighter light after said thermal arm has engaged said contact, manually operable means to move said contact out of engagement with said bimetallic arm, and latch means to hold said contact in its out-of-engagement position, said latch means being energized only when said power switch is closed.

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