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DEVICE FOR AUTOMATICALLY OPENING AND CLOSING VALVES.

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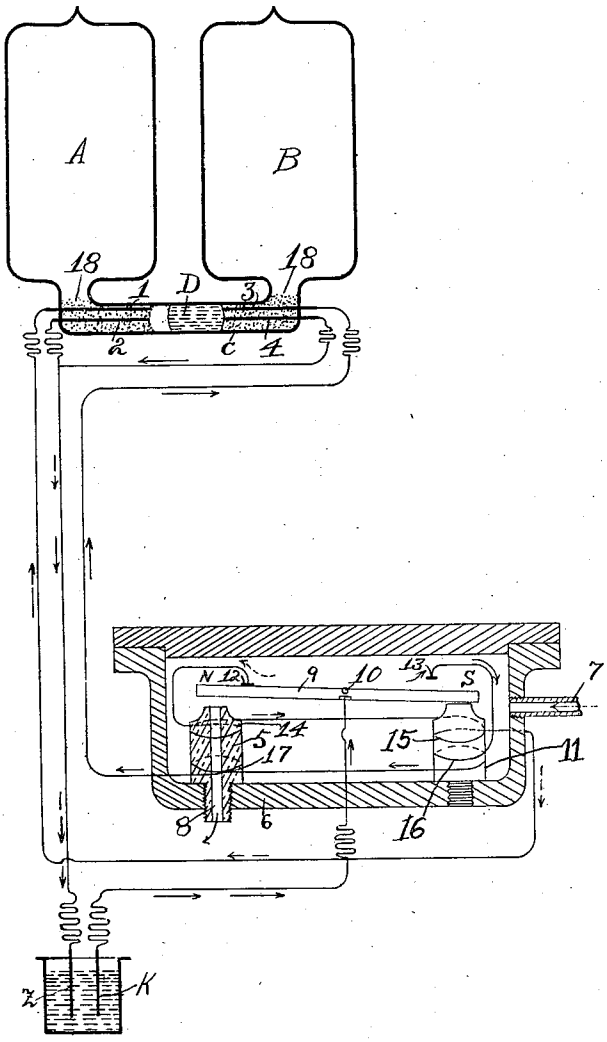


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# UNITED STATES PATENT OFFICE.

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## DEVICE FOR AUTOMATICALLY OPENING AND CLOSING VALVES.

1,011,756. Specification of Letters Patent. Patented Dec. 12, 1911.

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*To all whom it may concern:*

Be it known that I, GUSTAF DALÉN, engineer, subject of Sweden, residing at Stockholm, Sweden, have invented new and useful Improvements in Devices for Automatically Opening and Closing Valves, of which the following is a specification.

The present invention has for its object a device, by means of which a gas conduit can be opened or shut by the influence of light in such a manner, that the gas conduit will be shut in broad day light, but opened in darkness.

The invention is especially employable for light buoys, light houses and similar signal apparatus, which up to date have been burning day and night, but which in fact need to burn only in darkness. According to the present invention such an apparatus can be caused to extinguish automatically in broad day light, and to burn in darkness or in cloudy weather. It will be clear that by this means a considerable saving of the quantity of gas, necessary for the working of the apparatus, is obtained, whereas the security of the working of the signal apparatus is completely maintained, the arrangement being such, that the signal apparatus may continue to burn accidentally when it possibly could be extinguished, but on the contrary can not be extinguished when it should burn.

The invention is characterized by the arrangement of two fluid bodies, which may be liquid or gaseous each of which is inclosed within a vessel, of which vessels one is light reflecting and the other light absorbing. By the influence of light the bodies or their vessels receive and maintain unequal temperatures, whereby they expand unequally. The bodies are by electrical means connected in such manner with a valve or the like inserted in a gas conduit, that the valve is kept closed owing to said unequal expansion, but that the same opens, when the light and consequently said difference of temperature and expansion of the bodies disappears.

On the accompanying drawing a schematic view is shown, partly in section, of an apparatus, in which gaseous bodies are employed in connection with electric means for operating the valve.

In the apparatus shown A and B indicate two vessels of a suitable material, connected with one another through a pipe C. The surface of one of the vessels, for instance A, is made light reflecting, whereas the surface of the other vessel B is made light absorbing. A suitable contact member D, for instance a mercury body or column, is inclosed in the pipe C. On both sides of said contact member two electric terminal contacts 1, 2, 3, 4 are inserted in the pipe C.

A valve body 5 is inclosed in a casing 6 provided with a gas supply pipe 7 and a gas outlet 8 through the valve body 5, the said outlet 8 leading to a burner (not shown). A valve plate 9 is pivoted on the pin 10. In one position of the plate, which is shown in Fig. 1 of the drawings, the valve is open and said plate on the opposite side of the pivot 10 from the said valve abuts against the stud 11, and simultaneously the portion of the plate 9 adjacent to the valve body 5, as shown in Fig. 1 of the drawings, abuts against an electric contact 12, while the portion of the said plate adjacent to the said stud 11 has moved away from the contact 13. When the plate 9 abuts against the valve 5, closing this latter, the contact at 12 is interrupted, and the contact at 13 is closed. The contact 12 is connected with a coil 14 on the valve 5, which coil 14 is connected with a coil 15 on the stud 11 and connected with the terminal contact 1 in the pipe C. The contact 13 is connected with a second coil 16 on the stud 11, said coil 16 being connected with a second coil 17 on the valve 5 conducting to the terminal contact 3 in the pipe C. The terminal contacts 2 and 4 are both connected with one pole Z of an electric source, the second pole K of which is connected with the valve plate 9 or with contacts connecting with the same and applied opposite the contacts 12, 13. The valve plate 9 is constituted of a permanent magnet with north end at N and south end at S. The valve body 5 and the stud 11 are made of soft iron or other magnetic material.

In the position shown on the drawing the mercury contact member D abuts against the terminal contacts 3 and 4 and the valve 5 is open. The electric circuit is not closed, the circuit from K and the plate 9 being interrupted at 13, whereas the circuit from K and 9 through the contact 12, the coils 14 and

15 leads to terminal contact 1, where the circuit also is interrupted. Thus when contact member D abuts against terminal contacts 3 and 4 the valve is not operated. This will be the case as long as the gas or air inclosed in the vessel A has the same temperature as the gas or air inclosed in B owing to equal temperatures of the vessels A and B, which will be the case at darkness, the pipe C being arranged in such a manner, for instance inclined toward B, that the contact member of itself abuts against the terminal contacts 3 and 4. At broad day light or at sun light B will be more heated than A owing to its light absorbing property, whereby the gas or air in B is expanded and moves the mercury index D over to the terminal contacts 1, 2. The circuit being closed a current of electricity will pass through the coils 14, 15 and will magnetize the valve 5 and the stud 11. The direction of the current through the circuit is indicated by dotted lines. Said coils 14, 15 are wound in such a direction, that a south pole is generated in the upper end of 5 and also in the upper end of 11. Consequently the north end N of the valve plate 9 is attracted, whereas simultaneously the stud 11 repels the south end S of the valve plate, whereby the position of the valve plate is reversed and the valve closed. During said reversion of the position of valve plate the contact at 12 is interrupted, and the contact 13 is closed, whereby the said circuit is interrupted. The valve plate 9 remains however in its closed position owing to the influence of magnetic action. This position is maintained, that is the valve is kept closed, as long as the pressure in B is higher than the pressure in A, that is as long as B owing to the light absorption, is kept warmer than A. But if darkness or cloudy weather comes on, A and B assume the same temperatures and the air in B receives the same pressure as the air in A. The mercury contact member D thus takes the position shown on the drawing, connecting the terminal contacts 3 and 4. However as now contact is established at 13 the current will take its way as indicated by full drawn arrows through the coils 16 and 17 and the terminal contacts 3, 4, whereby now north pole is generated in the upper ends of 5 and 11, the coils 16 and 17 being wound in opposite direction to the coils 14, 15. Thus the south end S of the plate 9 is energetically attracted to the stud 11, whereas simultaneously its north end N is repelled by the valve body 5, so that this latter is opened and the plate 9 assumes the position shown on the drawing. The contact 12 is thus closed and the contact 13 interrupted, in which position the electric source is out of the circuit.

For the object of avoiding a too long pipe C, which would be necessary for enabling a large movement of the contact member D, when the vessel B is much heated, plugs 18 of a porous or granular material are inserted into the pipe, permitting the passage of the air or gas, but preventing the mercury from moving farther than to the terminal contacts 1, 2, 3, 4. By this means the distance through which the contact member D has to move at each variation of the light intensity can be made small, and the apparatus be rapidly working.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed I declare that what I claim is:—

1. In a device for automatically opening and closing a valve, the combination of two communicating vessels of which one is light reflecting whereas the other is light absorbing, two pairs of electric contacts, a contact member in the communication between the said vessels and movable between said pairs of electric contacts, a source of electrical energy and means energized by currents therefrom for actuating the said valve to open and close the same.

2. In a device for automatically opening and closing a valve, the combination of two vessels connected together by a communicating channel, one of which vessels is light reflecting and the other is light absorbing, a movable contact member in the said channel, a pair of terminal contacts situated on each side of said movable contact members, a valve, a source of electrical energy, two circuits one of which includes one of the said pairs of terminal contacts and the other one of which includes the other pair of said terminal contacts, and means energized by the passage of electrical currents through the said circuits to actuate the said valve.

3. In a device for automatically opening and closing a valve, the combination of two vessels connected by a communicating channel, one end of which channel is lower than the other end thereof and one of the said vessels being light reflecting and the other light absorbing, a movable contact member in the said channel, pairs of terminal contacts located upon opposite sides of said movable contact member, the said contact member contacting with one of the said pairs of terminal contacts under the influence of gravity and being adapted to contact with the other of the said pairs of terminal contacts under the influence of the expansion of the fluid in the light absorbing vessel, a valve, a source of electrical energy having circuits which include the said pairs of terminal contacts, and means energized by the said circuits for actuating the said valve to open and close the same.

4. In a device for automatically opening and closing a valve in a conduit the combination of two communicating vessels, of

which one is light reflecting, whereas the other is light absorbing, two pairs of electric terminal contacts, a contact member in the communication between the said vessels which member is movable between the said pairs of contacts, a rocking valve plate, constituting a permanent magnet, a valve body, constituting an electromagnet, and situated opposite one end of the valve plate, a stud constituting an electromagnet, situated opposite the other end of the valve plate, and electric means connected with the said contacts for opening and closing the valve.

5. In a device for automatically opening and closing a valve, the combination of two vessels connected by a communicating channel, one end of which channel is lower than the other end and one of the said vessels being light reflecting and the other light absorbing, an expansible fluid in the said vessels, means in the said channel for limiting the movement of the said contact member, pairs of terminal contacts situated upon opposite sides of said contact member and the said contact member contacting with one of the said pairs of terminal contacts under the influence of gravity, a source of electrical energy, circuits extended therefrom through the said respective pairs of terminal contacts, and a valve actuated by the passage of currents through the said circuits and thereby opened and closed.

6. In a device for automatically opening and closing a valve, the combination of two vessels connected by a communicating channel, one of which vessels is light reflecting and the other of which is light absorbing, pairs of terminal contacts located upon opposite sides of the said contact member, a source of electrical energy, circuits extending therefrom and including the said respective pairs of terminal contacts, a valve pivoted intermediate its ends, metallic bodies located adjacent to the opposite ends of the said valve one of which bodies is provided with a valve opening and the said circuits being provided with windings around the said metallic bodies whereby the passage of currents through the said circuits magnetize the said metallic bodies and actuate the said valve about its pivot to open and close the said valve opening.

7. In a device for automatically opening and closing a valve, the combination of two vessels connected by a communicating channel, one of which vessels is light reflecting and the other of which is light absorbing, and the said vessels inclosing an expansible fluid which is expanded and contracted under the influence of light and darkness, a movable contact member located in the said channel, movement of which in one direction is caused by the expansion of the fluid in one of the said vessels, pairs of terminal contacts located upon opposite sides of the said contact member against which the said contact member is adapted to contact, a source of electrical energy, circuits extended therefrom and including the said terminal contacts which circuits are adapted to be completed and interrupted by the movement of the said contact member, a valve pivoted intermediate its ends, the said valve consisting of a magnet, bodies of metal located adjacent to the opposite ends of the said valve, one of the said bodies being provided with a valve opening and the said circuits being provided with coils extending around the said metallic bodies in such direction that when a current is passed through one of the said circuits the portions of the said metallic bodies adjacent to the said valve become south poles and when passed through the other of the said circuits the said portions become north poles, whereby the opposite ends of the said valve are alternately attracted and repelled whereby the said valve is operated to open and close the valve opening.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GUSTAF DALÉN.

Witnesses:
WALDEMAR BOMAN,
T. EKEBOHM.