Jan. 23, 1951

A. LATOUR

2,539,308

TOGGLE MECHANISM

Filed July 23, 1947

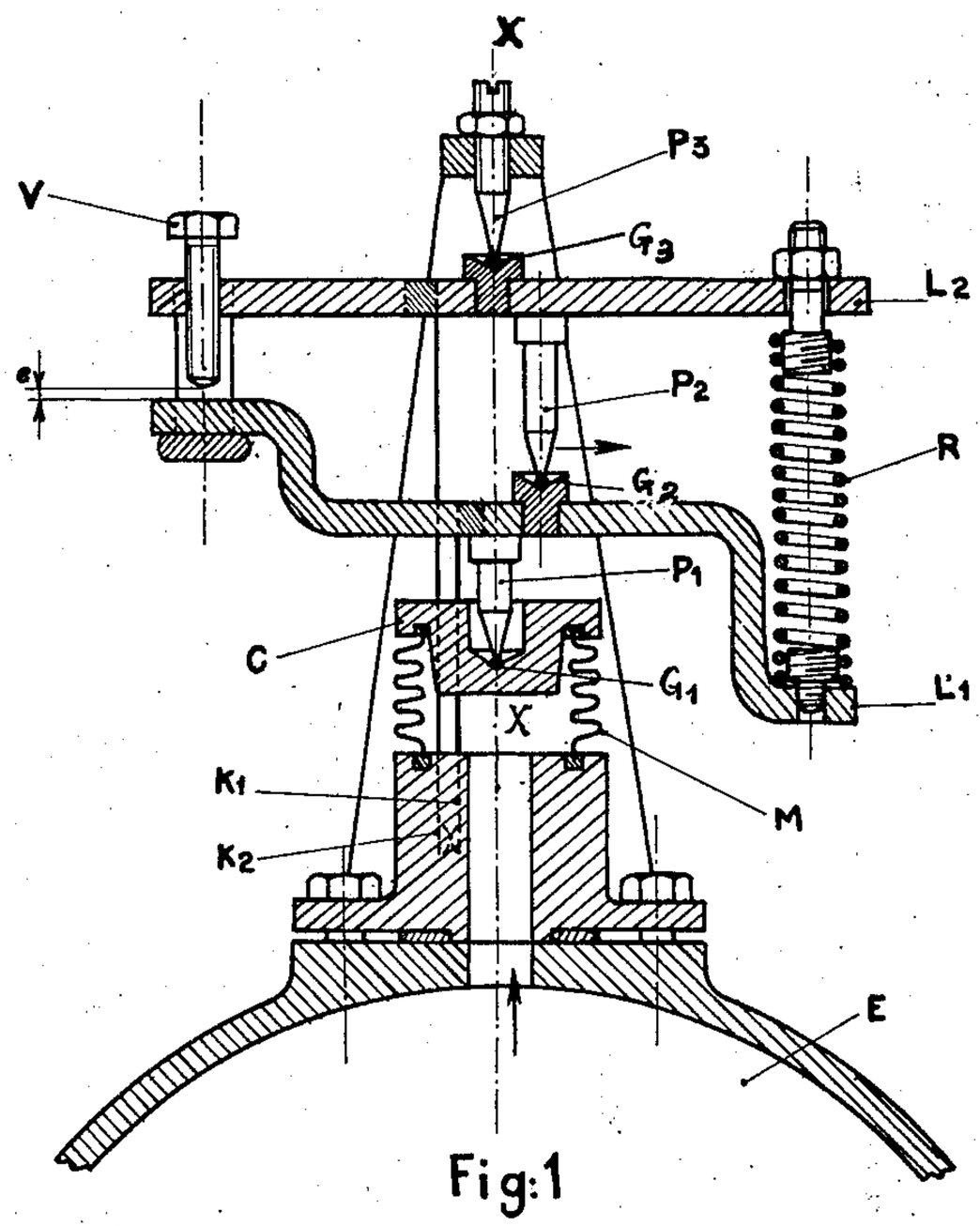

Fig:1

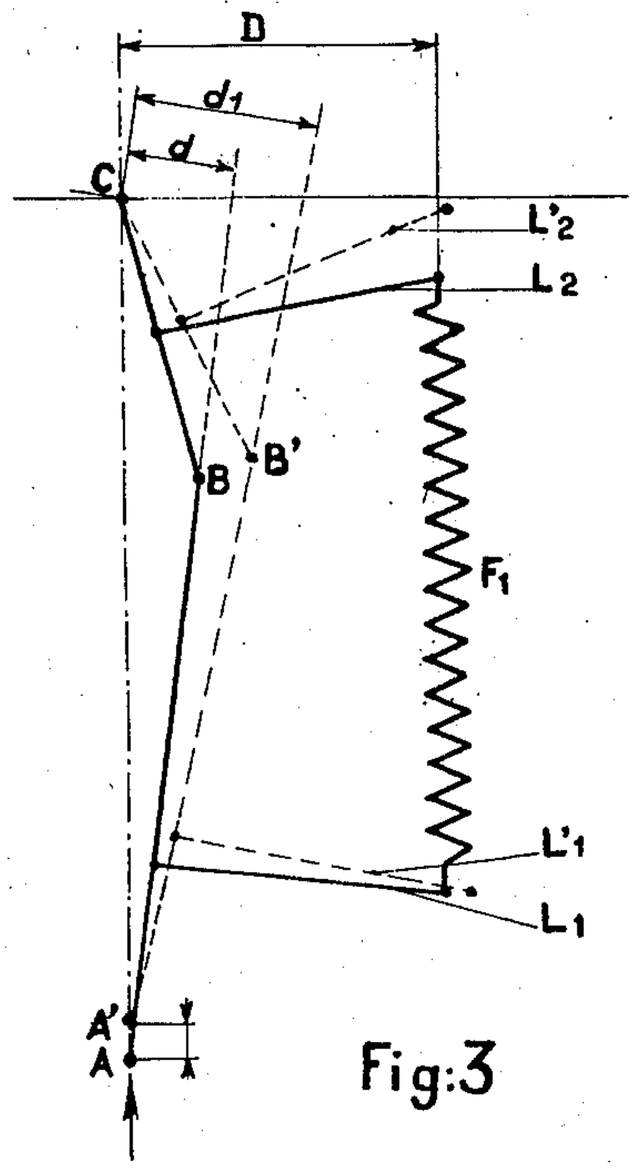

Fig:3

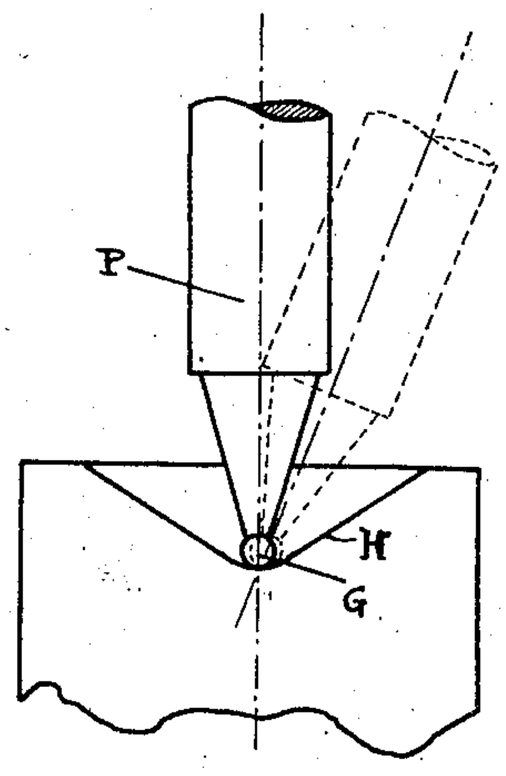

Fig:2

Inventor:
André Latour
By Mudael & Stern
Agts

Patented Jan. 23, 1951 2,539,308

UNITED STATES PATENT OFFICE

2,539,308

TOGGLE MECHANISM

André Latour, Grenoble, France, assignor to Etablissements Merlin & Gerin, Grenoble, France

Application July 23, 1947, Serial No. 763,021
In France July 30, 1943

Section 1, Public Law 690, August 8, 1946
Patent expires July 30, 1963

15 Claims. (Cl. 200—83)

1

The invention relates to toggle devices with snap action and to relay devices including such toggle devices.

The invention has for one of its objects a new toggle device with snap action for application in relays used in pressure regulators or limiters, or in locking devices functioning under lack or excess of pressure and intended to act when the variation of pressure attains a predetermined value, the action consisting, for example, in the closing or opening of an electric switch or of a control device for the flow of the fluid.

Another object of this invention is a relay device actuated by variations of pressure, the action of which consists, for example, in the closing or opening of an electric switch or of a control device for the flow of a fluid.

Another object of this invention is to provide a toggle mechanism and a relay of said type, which are very sensitive to variation of pressure, robust and accurate, and practically unaffected by vibrations.

Another object of the invention is to provide a relay functioning under pressure variation and independent of the time during which the pressure is applied and of the initial pressure amount.

Another object of the invention is the provision of a new toggle device which permits the articulation of the toggle members by means of swivel needles.

The novel features which I consider as characteristic for my invention are set forth in particular in the appended claims. The invention itself, however, will be best understood from the following theoretical considerations and descriptions of various embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a sectional side elevation of an embodiment according to the present invention;

Fig. 2 shows at a larger scale a detail of Fig. 1; and

Fig. 3 is a diagram for explaining the operation of the device shown in Fig. 1.

In Fig. 1 a membrane in the form of a bellows is indicated at M. Its dimensions are determined by the course which it can effect without permanent deformation when it is filled with fluid having the pressure prevailing in the enclosure E to which it can be fixed by brazing, soldering or setting; this membrane forms, with the hood C, soldered to its upper part, an elastic assemblage with reference to the body of the apparatus. The tilting system is constituted by toggle levers L1 and L2 being arranged one above the other and articulated with respect to each other by

2

means of two swivel needles such as P2, and being provided with a swivel G2 at its lower extremity, and being symmetrical with reference to the vertical plane of symmetry of the apparatus. These levers are furthermore articulated, the first lever L1 on the axis of the hood C by means of a central swivel needle P1 with swivel G1, and the second lever P2 on the body of the apparatus by means of two swivel needles such as P3 each with swivel G3, symmetrical with reference to the vertical plane of symmetry of the apparatus. The swivels G1, G2, G3 are not arranged in the same plane; the swivels G2 between the levers L1 and L2 are slightly displaced with reference to the axis of the system so that the reaction thereof acts in the direction of the arrow, the value of this displacement being chosen so as to obtain a safe operation under the action of a fairly weak force communicated by the membrane. The arrangement of the balls constituting the swivels G as indicated in Fig. 2, is such that they may roll on the recessed portion H of the relevant plug, within the limits of a convenient angle, the radii of the balls being smaller than the radius of the recessed portion H. Two conducting strips K1 and K2 rigidly connected to the upper lever L2 and to the lower lever L1, respectively, follow the movements of the two levers, and in the case of the figure, approach each other during the course of the relative movement in one direction, up to the point where they contact each other. By fixing the strips in symmetrical positions on the levers with respect to the vertical plane of symmetry an opening of the contact under the effect of the relative movement of the levers in the opposite direction is obtained. R is a spring inserted between the levers L1 and L2. V is a regulating screw carried by the levers L2, the lower extremity of which is touched by the lever L1 at the end of the movement of approach of the two levers; furthermore, an auxiliary regulating screw (not shown) may be provided permitting the correction of the regulation of the deviation between the strips K1 and K2 (particularly in case of a change of the spring).

The operation of the relay is as follows:

At the end of the building up of the pressure in the enclosure E, the membrane M is stretched and transmits its movement to the tilting system which is displaced in the direction of the vertical arrow up to the complete utilisation of the latitude of relative displacement allowed to the levers so that the contact between the strips K1 and K2 is made. When the pressure decreases below a certain lower limit, the elastic force of the

spring R becomes greater than that exerted by the membrane M and the tilting system is moved in the reverse direction, which ensures its return to the initial position. By altering the length of the adjusting screw V the pressures at which the system is operated can be increased or decreased as desired; by adjusting the strength of the spring R, the value of the initial pressure is increased or decreased, at which the tilting system operates.

Fig. 3 is a diagram for showing the sensitivity of the relay. It is seen from this figure that when, under the action of a small increase in pressure, the lowermost swivel G1 placed at A comes into the adjacent position A', the intermediate swivels G2 placed at B, the distances of which to the other swivels G1 and G2 remain unchanged, take up the position B'. If the point B is located at a distance d from the axis, it can be arranged, in spite of the very small axial displacement undergone by the lowermost swivel, that B' is located at a distance d_1 substantially greater than d from the axis. On the other hand, if the corresponding positions of the levers L1 and L2 are L1' and L2', it is seen that a very small relative stretching of the spring corresponds to a considerable variation in pressure. Now, this spring being located at a distance D from the axis, the equilibrium equation of the system can be written in the form

$$F \times d = F1 \times D$$

where F and F1 are respectively, the projections of the forces transmitted by the membrane and the tension of the spring on d and D, respectively. It is thus seen that the second member of the equation remains substantially constant (since F1 and D only vary to a very small degree) so that if in the product forming the first member the force F undergoes a small change, the acting couple resulting from the small variation of the force F, has a large value and leads to a quick throwing out of balance of the tilting system by a snap action.

What I claim is:

1. A fluid pressure actuated control device, comprising in combination, a stationary frame; an actuating member; means for supporting said actuating member on said stationary frame for a reciprocating movement; conduit means for passing a fluid under pressure against said actuating member so as to impart movement thereto; a first control lever; a first fulcrum member interposed between said first control lever and said actuating member; a second control lever disposed generally parallel to said first control lever; a second fulcrum member interposed between said frame and said second control lever, the said second fulcrum member being arranged in the same plane as said first fulcrum member; a third fulcrum member interposed between said two control levers and being disposed outside the plane of said first and second fulcrum members; and resilient means for urging said first and second control levers into positions parallel to each other.

2. A fluid pressure actuated control device, comprising in combination, a stationary frame; an actuating member; means for supporting said actuating member on said stationary frame for a reciprocating movement; conduit means for passing a fluid under pressure against said actuating member so as to impart movement thereto; a first control lever; a first fulcrum member interposed between said first control lever and

said actuating member; a second control lever disposed generally parallel to said first control lever; a second fulcrum member interposed between said frame and said second control lever, the said second fulcrum member being arranged in the same plane as said first fulcrum member; a third fulcrum member interposed between said two control levers and being disposed outside the plane of said first and second fulcrum members; resilient means for urging said first and second control levers into positions parallel to each other; and adjustable means for limiting the movement of said first and second control levers out of said parallel positions.

3. A fluid pressure actuated control device, comprising in combination, a stationary frame; a bellows secured at one end to said stationary frame; an actuating member secured to the other end of said bellows; conduit means for passing a fluid under pressure into the interior of said bellows so as to impart movement to said actuating member; a first control lever; a first fulcrum member interposed between said first control lever and said actuating member; a second control lever disposed generally parallel to said first control lever; a second fulcrum member interposed between said frame and said second control lever, the said second fulcrum member being arranged in the same plane as said first fulcrum member; a third fulcrum member interposed between said two control levers and being disposed outside the plane of said first and second fulcrum members; and resilient means for urging said first and second control levers into positions parallel to each other.

4. A fluid pressure actuated control device, comprising in combination, a stationary frame; a bellows secured at one end to said stationary frame; an actuating member secured to the other end of said bellows; conduit means for passing a fluid under pressure into the interior of said bellows so as to impart movement to said actuating member; a first control lever; a first fulcrum member interposed between said first control lever and said actuating member; a second control lever disposed generally parallel to said first control lever; a second fulcrum member interposed between said frame and said second control lever, the said second fulcrum member being arranged in the same plane as said first fulcrum member; a third fulcrum member interposed between said two control levers and being disposed outside the plane of said first and second fulcrum members; resilient means for urging said first and second control levers into positions parallel to each other; and adjustable means for limiting the movement of said first and second control levers out of said parallel positions.

5. A fluid pressure actuated control device, comprising in combination, a stationary frame; an actuating member; means for supporting said actuating member on said stationary frame for a reciprocating movement; conduit means for passing a fluid under pressure against said actuating member so as to impart movement thereto; a first control lever; a first fulcrum member interposed between said first control lever and said actuating member; a second control lever disposed generally parallel to said first control lever; a second fulcrum member interposed between said frame and said second control lever, the said second fulcrum member being arranged in the same plane as said first fulcrum member; a third fulcrum member interposed between said two control levers and being disposed outside the

plane of said first and second fulcrum members; resilient means for urging said first and second control levers into positions parallel to each other; and cooperating electrical contact elements attached to said first and second control lever and adapted to be brought into engagement upon movement of said control levers out of said parallel positions.

6. A fluid pressure actuated control device, comprising in combination, a stationary frame; an actuating member; means for supporting said actuaitng member on said stationary frame for a reciprocating movement; conduit means for passing a fluid under pressure against said actuating member so as to impart movement thereto; a first control lever; a first fulcrum member interposed between said first control lever and said actuating member; a second control lever disposed generally parallel to said first control lever; a second fulcrum member interposed between said frame and said second control lever, the said second fulcrum member being arranged in the same plane as said first fulcrum member; a third fulcrum member interposed between said two control levers and being disposed outside the plane of said first and second fulcrum members; resilient means for urging said first and second control levers into positions parallel to each other; and adjacently disposed electrical contact elements of elongated form, one extending from said casing to said first control lever and the other extending from said casing to said second control lever, the said electrical contact elements being adapted to be brought into engagement upon movement of said control levers out of said parallel positions.

7. A fluid pressure actuated control device, comprising in combination, a stationary frame; an actuating member; means for supporting said actuating member on said stationary frame for a reciprocating movement; conduit means for passing a fluid under pressure against said actuating member so as to impart movement thereto; a first control lever; a first fulcrum member interposed between said first control lever and said actuating member; a second control lever disposed generally parallel to said first control lever; a second fulcrum member interposed between said frame and said second control lever, the said second fulcrum member being arranged in the same plane as said first fulcrum member; a third fulcrum member interposed between said two control levers and being disposed outside the plane of said first and second fulcrum members; resilient means for urging said first and second control levers into positions parallel to each other; cooperating electrical contact elements attached to said first and second control lever and adapted to be brought into engagement upon movement of said control levers out of said parallel positions; and adjustable means for limiting the movement of said first and second control levers out of said parallel positions.

8. A fluid pressure actuated control device, comprising in combination, a stationary frame; a bellows secured at one end to said stationary frame; an actuating member secured to the other end of said bellows; conduit means for passing a fluid under pressure into the interior of said bellows so as to impart movement to said actuating member; a first control lever; a first fulcrum member interposed between said first control lever and said actuating member; a second control lever disposed generally parallel to said first control lever; a second fulcrum member interposed between said frame and said second control lever, the said second fulcrum member being arranged in the same plane as said first fulcrum member; a third fulcrum member interposed between said two control levers and being disposed outside the plane of said first and second fulcrum members; resilient means for urging said first and second control levers into positions parallel to each other; and cooperating electrical contact elements attached to said first and second control lever and adapted to be brought into engagement upon movement of said control levers out of said parallel positions.

9. A fluid pressure actuated control device, comprising in combination, a stationary frame; a bellows secured at one end to said stationary frame; an actuating member secured to the other end of said bellows; conduit means for passing a fluid under pressure into the interior of said bellows so as to impart movement to said actuating member; a first control lever; a first fulcrum member interposed between said first control lever and said actuating member; a second control lever disposed generally parallel to said first control lever; a second fulcrum member interposed between said frame and said second control lever, the said second fulcrum member being arranged in the same plane as said first fulcrum member; a third fulcrum member interposed between said two control levers and being disposed outside the plane of said first and second fulcrum members; resilient means for urging said first and second control levers into positions parallel to each other; and adjacently disposed electrical contact elements of elongated form, one extending from said casing to said first control lever and the other extending from said casing to said second control lever, the said electrical contact elements being adapted to be brought into engagement upon movement of said control levers out of said parallel positions.

10. A toggle mechanism, comprising in combination a first fulcrum; a first toggle member articulated to said first fulcrum; a second fulcrum; a second toggle member arranged substantially parallel to said first toggle member and articulated to said second fulcrum; means for exerting a force on one of said members for approaching said members to each other with a snap movement; and resilient means connected to said members and acting on said members in opposition to the snap movement.

11. A relay controlled by pressure variations, comprising in combination a first fulcrum; a first toggle member articulated to said first fulcrum; a second fulcrum; a second toggle member arranged substantially parallel to said first toggle member and articulated to said second fulcrum; means for exerting a pressure on one of said members for approaching said members to each other with a snap movement; and resilient means connected to said members and acting on said members in opposition to the snap movement.

12. A relay controlled by pressure variations, comprising in combination a first fulcrum; a first toggle member articulated to said first fulcrum; a second fulcrum; a second toggle member arranged substantially parallel to said first toggle member and articulated to said second fulcrum; means for exerting a pressure on one of said members for approaching said members to each other with a snap movement; resilient means connected to said members and acting on said members in opposition to the snap movement.

13. A relay controlled by pressure variations,

comprising in combination a first fulcrum; a first toggle member articulated to said first fulcrum; a second fulcrum; a second toggle member arranged substantially parallel to said first toggle member and articulated to said second fulcrum; means for exerting a pressure on one of said members for approaching said members to each other with a snap movement, said force exerting means including a membrane having the shape of a bellows controlled by the pressure; resilient means connected to said members and acting on said members in opposition to the snap movement; two electric contacts rigidly connected to said toggle members, respectively, and adapted to be closed by the snap movement of said members; a recessed bearing member connected with the membrane; and means adapted to transmit the snap movement of said members to a device controlled by the relay.

14. A toggle mechanism, comprising in combination a first fulcrum; a first toggle member articulated to said first fulcrum and having a first arm; a second fulcrum; a second toggle member arranged substantially parallel to said first toggle member and articulated to said second fulcrum and having a second arm arranged substantially parallel to said first arm; means for exerting a force on one of said members for approaching said members to each other with a snap movement; and resilient means connected

to said arms of said members and acting on said members in opposition to the snap movement.

15. A toggle mechanism, comprising in combination a first fulcrum; a first toggle member articulated to said first fulcrum; a second fulcrum; a second toggle member arranged substantially parallel to said first toggle member and articulated to said second fulcrum; means for exerting a force on one of said members for approaching said members to each other with a snap movement; resilient means connected to said members and acting on said members in opposition to the snap movement; and an element for limiting the snap movement of said members.

ANDRÉ LATOUR.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
Re. 17,646	Johnson	Apr. 22, 1930
917,603	Hench	Apr. 6, 1909
1,719,851	Raney	July 9, 1929
1,872,147	Johnson	Aug. 16, 1932
2,228,615	Thomas	Jan. 14, 1943
2,335,797	Schreiber et al.	Nov. 30, 1943
2,428,565	Guidosh	Oct. 7, 1947