Nov. 17, 1942. C. E. BEACH 2,301,924

CIRCUIT CONTROLLER FOR SIGNALING MEANS

Original Filed Feb. 19, 1940

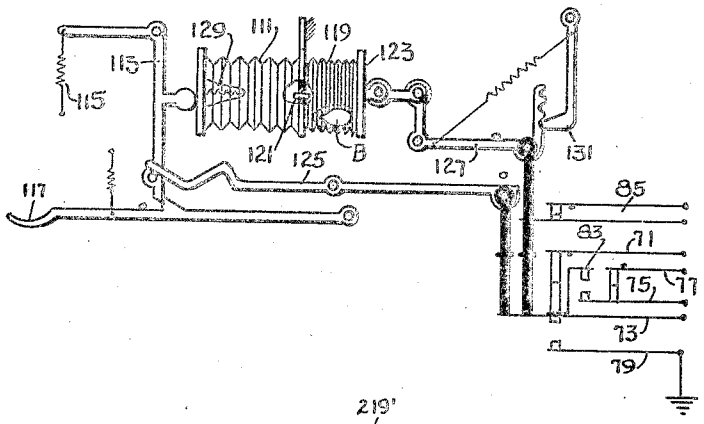

FIG. 1

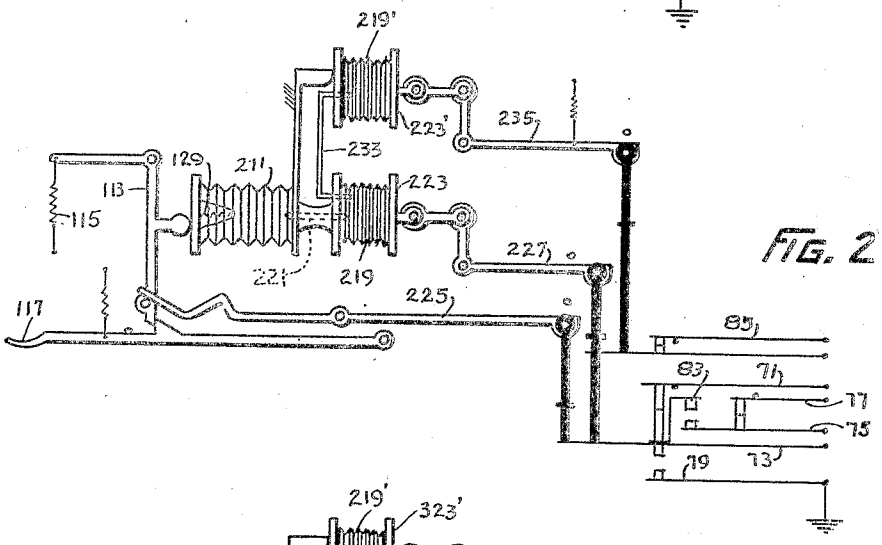

FIG. 2

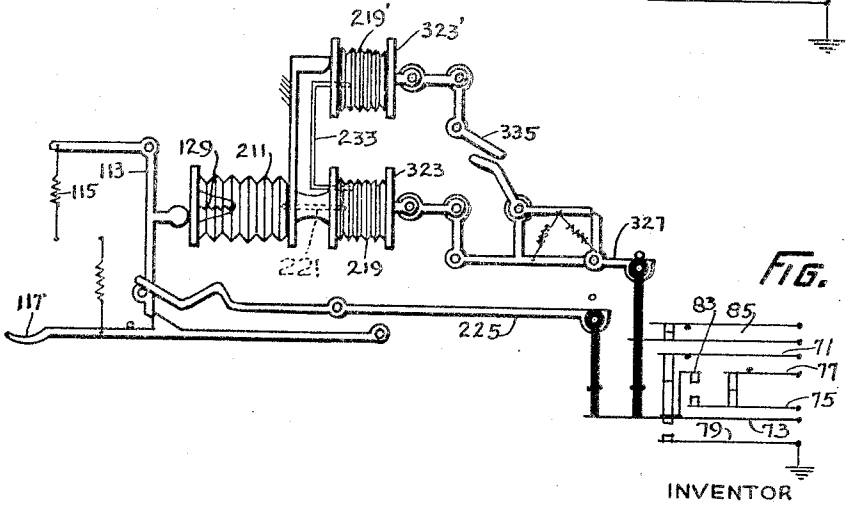

FIG. 3

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CIRCUIT CONTROLLER FOR SIGNALING MEANS

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Original application February 19, 1940, Serial No. 319,628. Divided and this application January 16, 1941, Serial No. 374,656

18 Claims. (Cl. 177—369)

This invention relates to circuit controllers for signaling means, and, more particularly, to circuit controllers for effecting two or more changes in relationships between circuit controllers or contacts in suitable and predetermined time relationship.

The subject matter of this invention was originally set forth in previous application filed February 19, 1940, Serial No. 319,628, of which this is a division.

This invention is specially suited for embodiment in sub-stations of so-called "auxiliary" fire alarm systems; such, for example, as that disclosed in the aforesaid previous application.

For certain uses and service situations, it is found to be impracticable to conduct tests of mechanisms at all sub-stations of such auxiliary firm alarm systems with a desirable degree of frequency, and it is therefore important that substation mechanisms utilized under such conditions and involving time measuring facilities shall not depend upon the functioning of pivoted escapement or other comparatively fast moving mechanism for which the starting and driving force is of so low an order that impairment of bearing surfaces, such as is likely to result from long periods of disuse, may disable or render uncertain the operation of such mechanism.

It is, therefore, an important object of this invention to provide sub-station mechanism which will be devoid of governing mechanism or other parts of such construction as to be at all likely to fail or be rendered uncertain in operation resultant from long periods of disuse, and which mechanism can be set in operation, manually or otherwise, by a very simple movement of a tripping mechanism or the like, and which will thereafter dependably operate to effect an initial circuit change and to subsequently effect another or other circuit changes only after the expiration of a suitable predetermined time.

It is a further important object of this invention to provide sub-station mechanism having, supplemental to the characteristics just referred to, the inherent characteristic of performing all of its intended functions when subjected to extraordinarily high temperature, such as results from fire conditions, in the absence of normally intended tripping actuation.

It is a still further object of this invention to so construct and arrange such sub-station mechanism that it may be caused to operate in the intended manner responsive to variations in pressure between the interior and exterior of closed areas (such, for example, as compression chambers) or responsive to movement of parts of mechanism for controlling or extinguishing fires or for effecting other results for the safe-guarding of lives or property.

In applying circuit controllers constructed in accordance with this invention to auxiliary system sub-stations, there is provided a collapsible chamber, an expansible chamber, a restricted passage between these chambers, and means for compressing the collapsible chamber and thereby forcing fluid therefrom into the expansible chamber at such rate that a wall of the expansible chamber will have predetermined movement imparted thereto following the termination of a suitable time; contacts being so associated with the mechanism that an initial change will be effected in relationship therebetween incident to the commencement of the compression of the first chamber and further change or changes in contact relationship will be effected by predetermined movement of a wall of a second chamber.

Various characteristics of this invention, as well as certain more detailed features thereof, are shown by the accompanying drawing and set forth in the following detailed descriptions. It should be understood, however, that the embodiments illustrated, though practical, are by no means the only embodiments which this invention may assume, wherefore this invention is not confined to any strict conformity with the showing of the drawing, but may be changed and modified in various ways so long as such changes and modifications make no material departure from the salient features of this invention, as set forth in the appended claims.

In the accompanying drawing

Figure 1 indicates, in a more or less schematic and diagrammatic manner, an auxiliary system sub-station mechanism embodying an aspect of this invention;

Fig. 2 correspondingly shows such a sub-station mechanism embodying another aspect of this invention; and

Fig. 3 shows a modified form of the mechanism of Fig. 2.

The sub-station mechanism of Fig. 1 comprises collapsible bellows 111, a lever 113 movable responsive to the spring 115 for compressing said bellows and for rocking the contact actuating lever 125, a trigger 117 for engaging said lever 113 to prevent such movement and subject to disengagement therefrom by manual or other actuation, an expansible chamber 119 connecting with the interior of said bellows through a restricted passage 121 and having a wall 123 mov-

able responsive to the expansion of said chamber for swinging the finger 127 upon attainment of predetermined pressure within said chamber. The contact 73 is subject to partial actuation by said lever 125 and to supplemental actuation together with contacts 75 and 85, responsive to said finger 127.

Means should be provided, such as the spring 129, for assuring extended conditioning of the bellows 111 while the lever 113 is retained by the trigger 117.

The bellows 111 and the chamber 119 may contain air or other fluid, and the various parts should be so relatively proportioned that, when the trigger 117 has been disengaged from the lever 113, the spring 115 will act through said lever to compress the fluid in said bellows 111 and thereby to slowly force a portion of such fluid through the passage 121, whereby to build up pressure in the chamber 119 sufficient to cause the wall 123 to act through the finger 127 to impart suitable actuation to the contacts associated therewith.

The restriction of the passage 121 should be such that, from the commencement of the compression of the bellows 111 to the attainment of a pressure in the chamber 119 such as will cause full actuation of the associated contacts as hereinafter more fully explained, there will elapse a predetermined time. For many service conditions, this time should be longer than the longest open circuit interval incident to any signal in the main circuit of an auxiliary fire alarm system; such, for example, as that indicated in the aforesaid prior application of which this is a division.

It has been found that, if the flow of air or other gaseous fluid is to be measured by the passage 121, the use of an obstruction of ceramic or other densely porous material within such passage will permit the use of a passage of far larger area, together with a bellows 111 and a chamber 119 of smaller capacity, than if there is a free opening of any commercially practicable size through such passage; and the use of such an obstruction will entirely avoid possibility of the sealing of the passage, as might occur through the entry of a particle of dust in such a very small orifice as would otherwise be needful.

If desired, the bellows 111 and the chamber 119 may contain a liquid instead of an exclusively gaseous fluid, the passage 121 being then made of greater area and preferably so positioned as to be at all times submerged in such liquid. However, even in the event of such use of a liquid, it is likely to be desirable that at least a portion of the chamber 119 shall be occupied by a fluid which can be so compressed as will cause it to expand enough to maintain adequate pressure against the wall 123 during its outward movement, especially if such movement is arranged for a so-called "snap action," as hereinafter more fully referred to.

Air or other gaseous fluid contained in the cavities of the bellows 111 and chamber 119 should be desiccated, so as to avoid condensation and/or freezing of moisture therein at low temperatures, or otherwise; which moisture if reaching the passage 121, might obstruct same so as to prevent or alter the rate of fluid flow therethrough if such passage is only suited for non-liquid fluid flow. For like reasons, said bellows and chamber cavities should be permanently sealed, both to prevent entrance of any moisture or other contaminating substance incident to so-called "breathing" due to barometric or temperature changes as well as to prevent escape of fluid therefrom during actuation.

The amount of fluid contained in said cavities should be such that, when chilled to the lowest temperature at which the station should be operable, there will be sufficient fluid volume to assure adequate expansion of the chamber 119 responsive to intended compression of the bellows 111; and the volume of such fluid should not be so great as to cause objectionable expansion of said chamber 119 resultant from the expansion of such fluid when the device is heated to any non-hazardous temperature.

With such a proportioning of said fluid content, there may be more or less of a vacuum within said bellows and chamber at low temperatures; in fact, perhaps enough vacuum to slightly space the adjacent wall of said bellows from the lever 113. For uses in which it is desirable that the sub-station shall be actuated when it is heated beyond a predetermined temperature, as by fire, a portion of the fluid cavities may be occupied by a liquid having a boiling point such that it will greatly expand when heated to the selected temperature. The use of such a liquid will require adaptation of the passage 121 for the presence thereof (as already pointed out) unless such liquid is contained in a frangible capsule or other receptacle to be ruptured upon the attainment of dangerous temperature; such as the bulb B. Such a capsule should, preferably, be contained in the chamber 119, so as to hasten response to the rupture thereof; and it will be evident that replacement or reconditioning of the associated chamber, bellows and connecting passage should take place after any rupture therein of such a capsule.

For service such as contemplated by the aforesaid prior application, the lever 125 is so associated with the lever 113 and the contact 73 that, when said lever 113 is moved by the spring 115 to the position which it assumes when released from the trigger 117, the contact 73 will be moved away from the contact 71, and thereby interrupt current flow therebetween.

For like service, the finger 127 should be so associated with the wall 123 and with the contact 73 that when said wall moves from its normal position (after the contact 73 has been actuated by the lever 125, as already explained), the contact 73 will be brought into engagement with the contact 79, and so that the same or further movement of said contact 73, acting through the extension 83, will move contact 75 away from contact 77. Such movement of the finger 127 should also operate the contacts 85.

In order that contact 73 will be firmly actuated, and transient or chattering connections may be avoided, it is desirable that the steps of actuation of said contact shall be effected quickly by the finger 127. To this end, the free end of said finger is shown as having notches formed therein, and the spring pressed dog 131 so engages said notches that said finger will not move from its normal to its intermediate position until there is sufficient pressure in the chamber 119 to assure practically instantaneous or "snap" action, and, correspondingly, as to movement from intermediate to fully abnormal position.

In place of or supplemental to the dog 131, other means may be provided for a like purpose, such as an inwardly dished, or "snap-disk" formation of the wall 123 of the chamber 119, so

arranged as to suddenly spring or snap from presenting an outer concave surface to presenting an outer convex surface, thereby to assure firmly rapid actuation of the associated contacts.

Restoration of the mechanism thus far described may be effected, after it has acted following disengagement of the trigger 117 from the lever 113, by moving the lever 113 against the urge of the spring 115, and effecting reengagement thereof by the trigger 117; whereupon the spring 129 will expand the bellows 11, thus creating a relative vacuum in bellows 111 such as will cause substantially all of the fluid which has been forced into the chamber 119 to return into said bellows, whereupon the wall 123 will be restored to its normal position, and (the lever 125 having been moved away from the contact 73 when the lever 113 was restored) the various contacts associated with the finger 127 will return to normal positioning.

If operating conditions are such that it is found desirable to distinctively provide for a third operating step resultant from compression of bellows such as 111, this may be accomplished as indicated in Fig. 2 by use of a supplemental chamber 219', the interior of which is connected with that of the chamber 219 through the passage 233, and through the passage 221 with the collapsible bellows 211, which corresponds with the bellows 111 of Fig. 1.

With the arrangement here shown, the use of such a supplemental chamber will cause a distinctive added step of actuation to be imparted to the contact 73, whereby said contact will be first moved away from the contact 71, either by the lever 113 acting through the lever 225, or resultant from initial movement of the wall 223, and, thereafter following a suitable delay, said contact 73 will be moved into engagement with contact 79 when the wall 223 of the chamber 219 is moved to its fully abnormal position. Still later, following a second suitable delay, the finger 235 will be moved by abnormal positioning of the wall 223' of the chamber 219' to cause the contact 73 to carry the extension 83 into engagement with the contact 75 and thereby move said contact 75 away from the contact 77.

Likewise, as indicated in Fig. 3, the finger 335 (which corresponds generally to the finger 235 of Fig. 2) may be utilized for neutralizing the effect of the actuation of the contact 73 by the finger 327, to the end that, after the contacts 73 and 75 have been connected to the contact 79 for a desired time, the contact 73 will be permitted to move away from the contact 79 and will carry the extension 83 away from the contact 75, permitting said contact 75 to reengage the contact 77.

If additional operating steps are desired, still more chambers, such as the chamber 219' (Figs. 2 and 3) may be provided; such chambers to be connected through a sequence of restricted passages extending from a chamber such as 219 so that there will be desired time delay between attainment of significant pressures in various ones of such chambers.

In any event, it is evident that, with an arrangement such as that of Fig. 2, as fluid passes from the bellows 211 into the chamber 219 and builds up pressure therein, fluid will also be passing more slowly from the chamber 219 into the chamber 219' through the passage 233, and that the pressure in said chamber 219' will rise less rapidly than that in said chamber 219, so that the wall 223 will assume its abnormal position suitably in advance of the time when the wall 223' similarly acts.

Correspondingly, if there are two or more chambers sequentially connected with a chamber such as 219, the pressure in chambers nearest to 219 will build up more rapidly than those more distant therefrom in the sequence, and action of contacts or other mechanism responsive to pressure in such chambers will be consecutive, with desired intervening delays.

It should be understood that the compression of bellows such as 111 or 211 of Figs. 1, 2 and 3 may be advantageously effected in many ways. For example, such bellows may be situated in the retarding chamber of an automatic sprinkler alarm equipment (as, for instance, in the chamber 16 shown in patent to Howard, No. 2,019,134, dated Oct. 29, 1935) and a chamber such as 119 placed outside of such sprinkler system chamber and connected to such interior bellows through the chamber wall by a duct including a restricted passage such as 121.

It should also be noted that the sub-station mechanism of Fig. 1 will serve as an automatic fire alarm in that, if such a sub-station is subjected to extremely high temperature, the fluid in the bellows 111 and in the chamber 119 will expand to an extent such that the fluid which is in said chamber will be supplemented by fluid passing thereto from bellows 111, thereby to effect abnormal positioning of the wall 123.

It will be apparent that this invention is susceptible of varied embodiments, some of which may differ extensively from those indicated in the accompanying drawing and hereinbefore described in more or less detail; hence, it should be understood that it is intended to set forth, by suitable expression in the appended claims, all of the novelties which this invention possesses, inclusive of all statements of the scope of this invention which, as a matter of language, might be said to fall therebetween.

I claim:

1. A circuit controller for signaling means having, in combination, a collapsible chamber, an expansible chamber, thermally expansive fluid within said chambers, a restricted passage connecting said chambers, means for compressing said collapsible member, a frangible cell containing a volatile liquid and situated in one of said chambers, circuit controlling mechanism operable for effecting changes in current path conditionings, and operating means involving said compressing means, said expansible chamber and said mechanism for effecting certain of such conditioning changes responsive to respectively diverse degrees of gradually attained expansion of said expansible chamber and for effecting one of such changes incident to such compressing action; said operating means comprising structure for imparting substantially instantaneous functional actuations to said mechanism resultant from such gradually attained expansions.

2. A circuit controller for signaling means having, in combination, a collapsible chamber, an expansible chamber, thermally expansive fluid within said chambers, a restricted passage connecting said chambers, means for compressing said collapsible chamber, a frangible cell containing a volatile liquid and situated in one of said chambers, circuit controlling mechanism operable for effecting changes in current path conditionings, and operating means involving said compressing means, said expansible chamber and

said mechanism for effecting certain of such conditioning changes responsive to respectively diverse degrees of expansion of said expansible chamber and for effecting one of said changes incident to such compressing action.

3. A circuit controller for signaling means having in combination, a collapsible chamber, an expansible chamber, thermally expansive fluid within said chambers, a restricted passage connecting said chambers, means for compressing said collapsible chamber, circuit controlling mechanism operable for effecting changes in current path conditionings, and operating means involving said compressing means, said expansible chamber and said mechanism for effecting certain of such conditioning changes responsive to respectively diverse degrees of expansion of said expansible chamber and for effecting one of such changes incident to such compressing action.

4. A circuit controller for signaling means having, in combination, a collapsible chamber, an expansible chamber, thermally expansive fluid within said chambers, a restricted passage connecting said chambers, means for compressing said collapsible chamber, circuit controlling mechanism operable for effecting changes in current path conditionings, and operating means involving said compressing means, said expansible chamber and said mechanism for effecting certain such conditioning changes responsive to respectively diverse degrees of expansion of said expansible chamber and for effecting one of such changes incident to such compressing action.

5. A circuit controller for signaling means having, in combination, a collapsible chamber, an expansible chamber, fluid within said chambers, a restricted passage connecting said chambers, means for compressing said collapsible chamber, a frangible cell containing a volatile liquid and situated in one of said chambers, circuit controlling mechanism operable for effecting changes in current path conditionings, and operating means involving said compressing means, said expansible chamber and said mechanism for effecting certain of such conditioning changes responsive to respectively diverse degrees of expansion of said expansible chamber and for effecting one of such changes incident to such compressing action.

6. A circuit controller for signaling means having, in combination, a collapsible chamber, an expansible chamber, fluid within said chambers, a restricted passage connecting said chambers, means for compressing said collapsible chamber, circuit controlling mechanism operable for effecting changes in current path conditionings, and operating means involving said compressing means, said expansible chamber and said mechanism for effecting certain of such conditioning changes responsive to respectively diverse degrees of expansion of said expansible chamber and for effecting one of such changes incident to such compressing action.

7. A circuit controller for signaling means having, in combination, a collapsible chamber, an expansible chamber, fluid within said chambers, a restricted passage connecting said chambers, and circuit controlling mechanism operable for effecting changes in current path conditionings; said mechanism associated with said chambers for effecting one of such changes incident to collapsing of said first named chamber and for effecting various other such changes responsive to diverse degrees of expansion of said expansible chamber.

8. A circuit controller for signaling means having, in combination, a collapsible chamber, an expansible chamber, fluid within said chambers, a restricted passage connecting said chambers, means for compressing said collapsible chamber, circuit controlling mechanism operable for effecting changes in current path conditionings, and operating means involving said compressing means, said expansible chamber and said mechanism for effecting one of such conditioning changes incident to such compressing action and for effecting another such change responsive to expansion of said expansible chamber.

9. A circuit controller for signaling means having, in combination, a collapsible chamber, an expansible chamber, fluid within said chambers, a restricted passage connecting said chambers, means for compressing said collapsible chamber, and circuit controlling mechanism operable for effecting changes in current path conditionings; said mechanism associated with said means for effecting one of such changes incident to compressing action thereof and associated with and for effecting another of such changes responsive to expansion of said expansible chamber.

10. A circuit controller for signaling means having, in combination, a collapsible chamber, an expansible chamber, fluid within said chambers, a restricted passage connecting said chambers, and circuit controlling mechanism operable for effecting changes in current path conditionings; said mechanism associated with said chambers for effecting one of such changes incident to collapsing of said collapsible chamber and for effecting another of such changes responsive to expansion of said expansible chamber.

11. A circuit controller for signaling means having, in combination, a collapsible chamber, a plurality of expansible chambers, means comprising restricted passages connecting said chambers for effecting predetermined expansions of said plurality of chambers in timed sequence responsive to compression of said collapsible chamber, circuit controlling mechanism operable for effecting various changes in current path conditionings and associated for response to operation of said compressing means for effecting one of such conditionings and for actuations responsive to expansions of respective ones of said plurality of chambers for effecting other of said changes.

12. A circuit controller for signaling means having, in combination, a collapsible chamber, a plurality of expansible chambers, means comprising restricted passages connecting said chambers for effecting predetermined expansions of said plurality of chambers in timed sequence responsive to compression of said collapsible chamber, circuit controlling mechanism operable for effecting various changes in current path conditionings and associated for actuations responsive to expansions of respective ones of said plurality of chambers for effecting certain of said changes.

13. Signal mechanism having, in combination, a collapsible chamber, a plurality of expansible chambers, means comprising restricted passages connecting said chambers for effecting predetermined expansions of said plurality of chambers in timed sequence responsive to compression of said collapsible chamber, means operable for compressing said collapsible chamber, and signal

means associated for functional actuations responsive to operation of said compressing means and responsive to the expansions of the several ones of said plurality of chambers.

14. Signal mechanism having, in combination, a collapsible chamber, a plurality of expansible chambers, means comprising restricted passages connecting said chambers for effecting predetermined expansions of said plurality of chambers in timed sequence, and signal means associated with said chambers for functional actuations responsive to abnormal chamber conditionings.

15. Signal mechanism having, in combination, a collapsible chamber, an expansible chamber, a restricted passage connecting said chambers, thermally expansible fluid within said chambers, means operable for compressing said collapsible chamber, a frangible cell containing a volatile liquid and situated in one of said chambers, and signal means associated with said expansible chamber for having imparted thereto a plurality of functional actuations responsive to respectively diverse degrees of expansion of said expansible chamber.

16. Signal mechanism having, in combination, a collapsible chamber, an expansible chamber, a restricted passage connecting said chambers, fluid within said chambers, means operable for compressing said collapsible chamber, a frangible cell containing a volatile liquid and situated in one of said chambers, and signal means associated with said compressing means for functional actuation incident to such operation thereof and associated with said expansible chamber for functional actuation responsive to expansion thereof.

17. Signal mechanism having, in combination, a collapsible chamber, an expansible chamber, a restricted passage connecting said chambers, means operable for compressing said collapsible chamber, signal means associated with said expansible chamber for having imparted thereto a plurality of functional actuations responsive to respectively diverse degrees of expansion of said expansible chamber, and fluid within said chambers which fluid is of a character such that it will cause functional expansion of said expansible chamber responsive to compression of said collapsible chamber and/or responsive to attainment of predetermined chamber temperature.

18. Signal mechanism having, in combination, a collapsible chamber, an expansible chamber, thermally expansible fluid within said chambers, a restricted passage connecting said chambers, means operable for compressing said collapsible chamber, and signal means associated with said compressing means for functional actuation incident to such operation thereof and associated with said expansible chamber for supplemental functional actuation responsive to expansion thereof.

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