J. P. NAYLOR.

ADVERTISING OR SIGNALING APPARATUS.

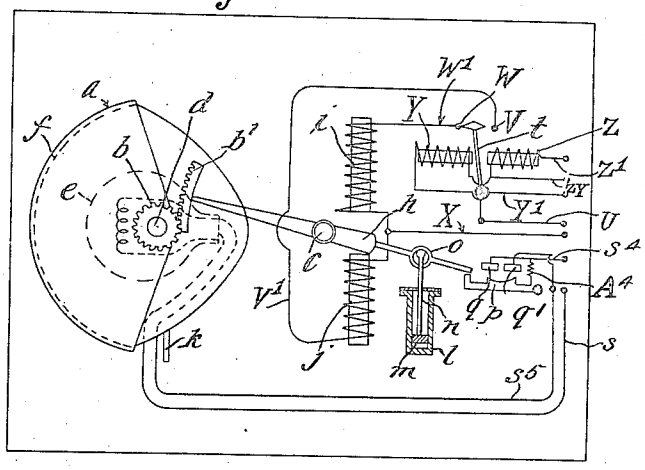
APPLICATION FILED APR. 14, 1914.

1,222,658.

Patented Apr. 17, 1917.

4 SHEETS—SHEET 1.

Fig: 1.



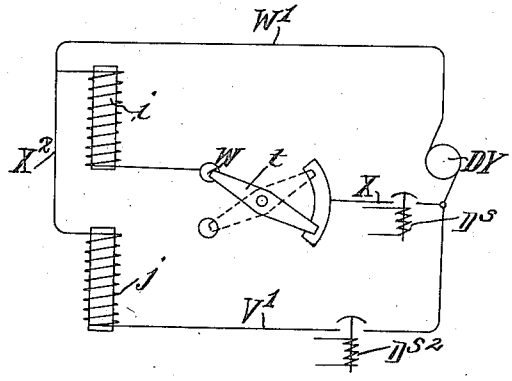
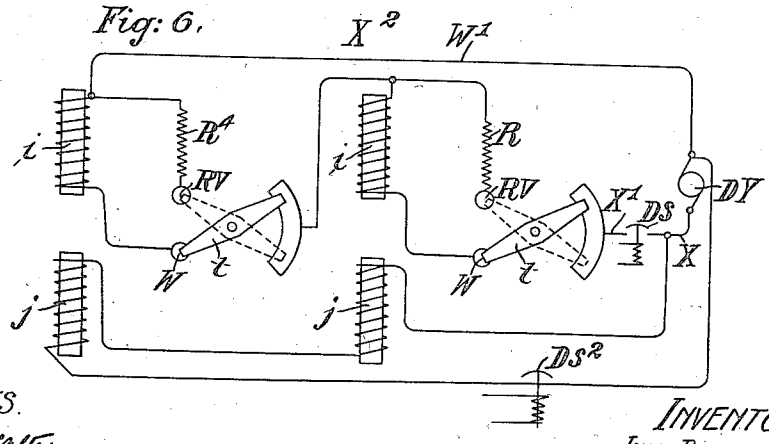


Fig: 5.

Fig: 6.



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4 SHEETS—SHEET 2.

Fig: 2.

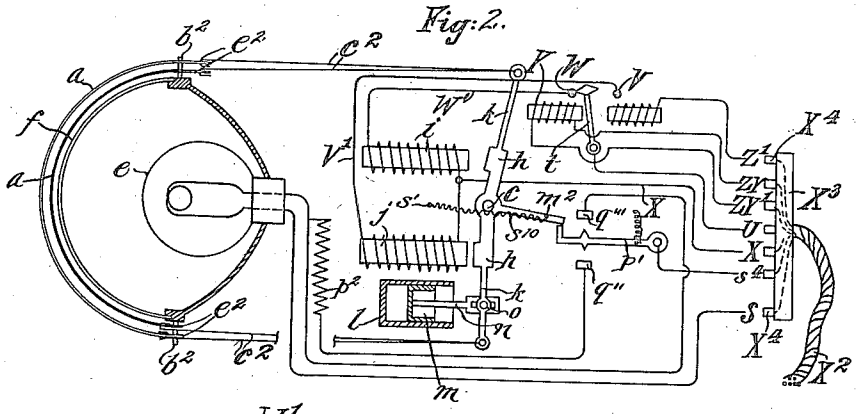


Fig. 3.

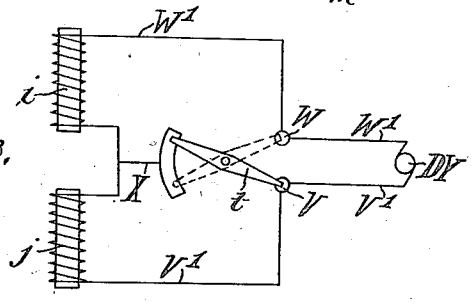
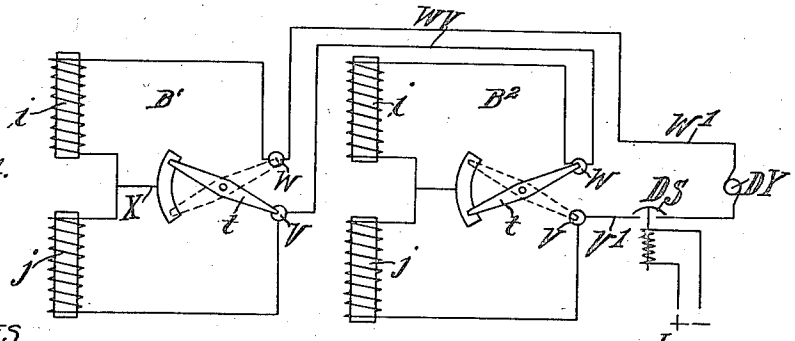


Fig: 4.



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4 SHEETS—SHEET 3.

Fig: 7.

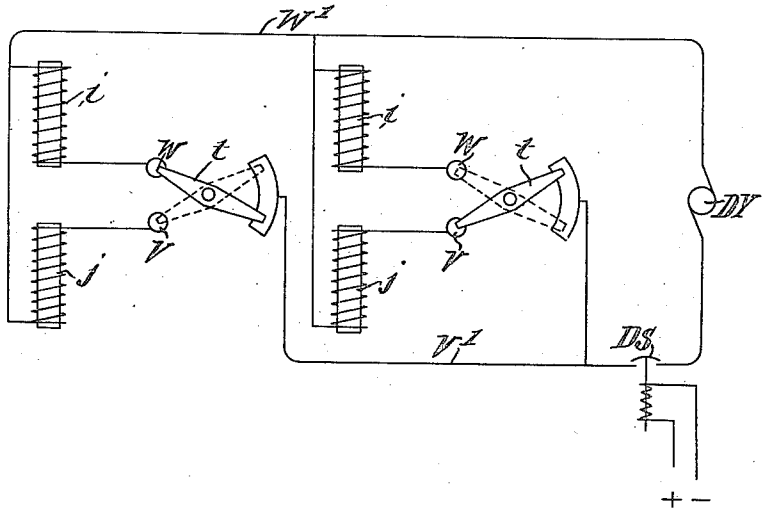
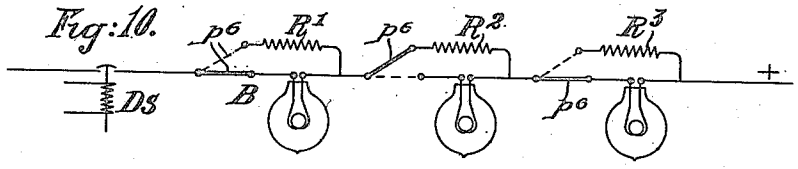


Fig: 10.



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4 SHEETS—SHEET 4.

Fig: 8.

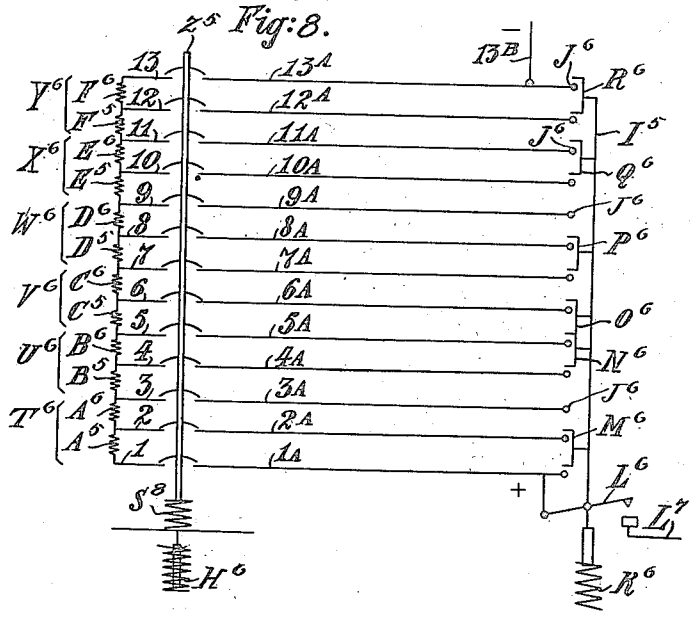
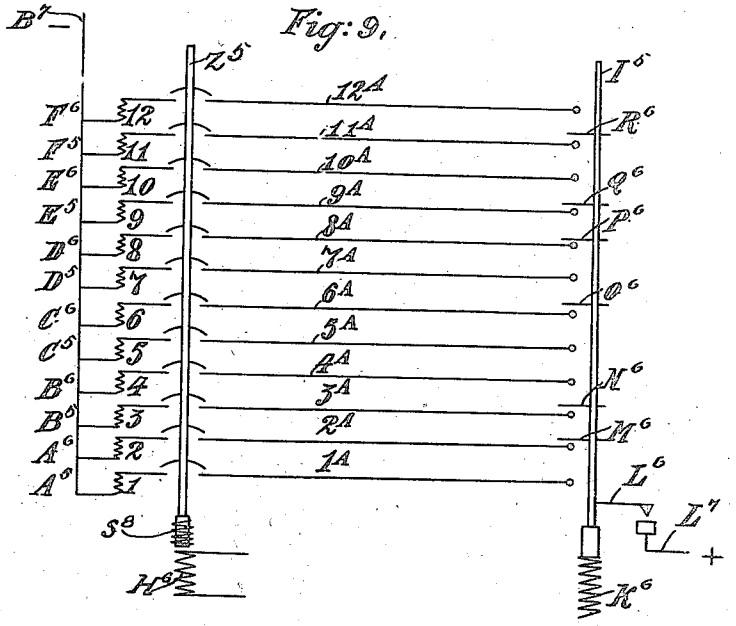


Fig: 9.



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UNITED STATES PATENT OFFICE.

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ADVERTISING OR SIGNALING APPARATUS.

1,222,658. Specification of Letters Patent. Patented Apr. 17, 1917.

Application filed April 14, 1914. Serial No. 831,751.

To all whom it may concern:

Be it known that I, JAMES PRIESTNALL NAYLOR, a subject of the King of England, residing at Dulwich, in the county of Surrey, in England, have invented certain new and useful Improvements in Advertising or Signaling Apparatus, of which the following is a specification.

This invention relates to an advertising or signaling apparatus of the same class as described in the specification of my pending application, Serial No. 642,030 filed 2nd August, 1911, but in the present invention improvements have been introduced in the construction of the elements; in the method of electrically connecting same; in the means for controlling the elements section by section; and in the arrangements of connections leading thereto for automatically actuating the elements.

The objects of these improvements have been to render the apparatus more versatile so that it is capable of reproducing devices, words, phrases, letters or signs in a larger variety and in a larger number of methods or order of appearance and capable of being controlled by fewer conductors, than is possible by the use of the apparatus described in the before mentioned specification, and primarily to enable a sign or signaling apparatus to be constructed, which, by the operation of relays acting as composing devices and coöperating with primary relays connected with each element to predetermine the elements to be subsequently displayed, when mechanism directly operating the visual sections of said elements are energized.

In the principal form of the invention each individual element is so constructed that it possesses a double predetermining function and a double operating function, the predetermining function being operable without disturbing or actuating the visual section of the element, this predetermining function being provided by what may be called a primary relay and being controlled, operated or set by a secondary relay or composing device. When it is stated that the elements are operable by four functions, four specific functions to each individual element are implied, namely:—

1. The setting of the primary relay switch to so affect the display mechanism that the visual member of the element will operate to display when other devices are energized.

2. The energization of the display mechanism to cause actual display of the visual member as predetermined by the primary relay.

3. The setting of the primary relay switch to so affect the non-display mechanism that the visual members will cease displaying when other devices are energized.

4. The energization of the non-display mechanism to cause non-display of the visual element as predetermined by the primary relay.

These four functions do not include the function of the composing devices or secondary relays.

In the previous specification above referred to, means are disclosed whereby a plurality of elements are controlled by the manipulation of composing keys or collective relays which might be deemed relays operating the elements, but in the present invention I construct elements with individual relays introduced upon the conductors between the composing keys or secondary operating relays to directly and independently control the mechanism which actuates the visual section of each element, so that the composing devices may set the relays within or combined with the elements in the section by section manner disclosed in the said previous specification but without affecting the visual member of the element, such visual member being subsequently caused to operate in a manner that has been predetermined by the primary relays, and the changing of the display being effected independently of the excitation or manipulation of the composing devices or vice versa, solely by the energization of the actuating mechanism operating the visual sections of the elements through independent switching devices.

The invention also comprises means of constructing the electro-magnetic devices of both the relay system and the actuating system in such a manner that the displaying and non-displaying functions of each element may each be connected in series and a group of such elements may also be connected either in electrical series, parallel or combinations of series and parallel.

In the accompanying drawings, Figure 1

is a sectional side elevation of one form of element and its electric circuits. Fig. 2 is a similar view to Fig. 1 showing a modified form of element. Figs. 3 to 7 are diagrams showing various arrangement of element operating relays and their electric circuits or connections. Figs. 8 and 9 are diagrams showing two methods of selecting and controlling the actuation of the elements by means of composing keys or secondary relays. Fig. 10 is a diagram, illustrating a means of connecting element lamps hereinafter described.

The element consists of a member or members for display when light falls upon its surface and such member is hereinafter termed the "non-luminous" member and it may be provided with a lamp, preferably electric, capable of illuminating or defining the position of the said visual member during night or for the period that sufficient light does not fall upon its surface to properly visualize it, such lamp being hereinafter termed the "luminous" member, the term "visual" member being applied to the members adapted for display both in light and darkness and the term "sign" being used to denote an assemblage of elements together with their cellular or other supporting background and controlling means. The element and its means for direct actuation is constructed as a self-contained unit removable as a whole from its supporting background, such method of construction being adopted to facilitate manufacture, repair and transport as described in the previous specification aforesaid.

Alternative means of electrically connecting the element actuating devices are disclosed herein so that it is not necessary to move the relay into the non-displaying position before energizing the power circuit to cause the elements to assume the non-display position.

In order that the construction of the element may be comprehended, reference is directed to Fig. 1, which represents an element with a hemispherical shutter *a* adapted to be rotated as by means of the pinion *b* and rack b^1 upon the center *d* into a position at the back of the lamp *e* thus disclosing the member *f* which may consist of white opal glass also of hemispherical form containing a lamp *e* and termed the visual member. The rack b^1 is pivoted at *c* and has an extension consisting of a magnetic device or armature *h*. Located in proximity to said armature are the power coils *i* and *j* and if it is desired to display the visual member *f*, the power coil *i* is energized, thus attracting armature *h* and rotating the rack upon the pivot *c*, causing the shutter *a* to rotate upward and backward and assume a position behind said visual member, (the travel being limited as by a stop *k*), causing it to be displayed, and to so remain displayed after the cessation of the excitation of the magnet coil *i*. It will further be seen that owing to the location of the pivot *c* and pinion *b* the said shutter will not be easily brought to rest in any position between fully open and fully closed (in front of or behind the visual member) since gravity always tends to bring it into one or the other extreme position, and if power is applied to the armature *h* to cause the shutter to rotate through an angle of slightly more than 90 degrees and then ceases, the force of gravity will cause the shutter to continue its travel until it is arrested by the stop *k*, this action occurring both in displaying and causing non-display of the visual member, the force of gravity being used to practically lock or retain the shutter in a position in front of or behind the visual member *f*.

It will be understood that on the shutter striking the stop *k* noise may be emitted, and that during continued work damage may also be caused to the shutter at the point of contact, and in order to avoid these objections, I provide a dashpot *l* for retarding the moving parts and preventing violent action. The plunger *m* of the dashpot *l* is connected by a rod *n* by means of a pin and slot connection *o* to the arm *h* carrying the rack b^1. The arm may be free to move the shutter *a* through an angle of more than 90 degrees when operating in either direction without engaging with the dashpot or until the shutter is in a position to be operated on by gravity.

An extension from the armature *h* is provided to operate a contact switch *p* which is capable of making metallic contact with two contacts *q* and q^1. The contact *q* is connected with a conductor s^4 leading to one pole of a source of electricity and the contact q^1 is connected to a conductor s^5 leading to one pole of the lamp *e* used for illuminating the element by night. A further conductor *s* also connects the said lamp to the opposite pole of a source of electricity. It will be seen that when the rack b^1 travels downward in order to remove the shutter and disclose the visual member, the contact switch *p* is permitted to engage the contacts *q*, q^1 due to the tension of a spring S^4, thus establishing a circuit through them and causing the lamp *e* to light when the conductors *s*, s^4 are energized.

So far as this description has gone it will be seen that the excitation of the coil *i* causes the element to be displayed, due to the shutter *a* being removed from the front of the visual member *f*, and the excitation of the coil *j* causes the element to disappear due to the shutter *a* covering said visual member. In order to determine or predetermine which of these coils shall be energized, I provide a relay switch, the armature *t* of which is

capable of engaging a contact V connected to the coil j by a conductor V^1, or alternatively engaging a contact W connected with the coil i by means of the conductors W^1. I so construct the relay switch that it will not take up a position intermediate the contacts. The opposite ends of the coils j and i are connected together and to a conductor X so that when the conductors X, U, (the latter connected to armature t) are connected to a source of electricity, the movement of the armature t will alternatively connect the coils i and j to the conductor W^1 or V^1 and thus cause the excitation of the coil i or j respectively. The said relay switch is adapted to be operated by two electromagnets Y and Z, the magnet Z being connected to the conductors Z^1, ZY and the magnet Y to the conductors Y^1, ZY. It will be seen that if the conductors Z^1, ZY are connected to a source of electricity, the relay armature t will be brought upon the contact V and after cessation of current in said conductors the relay armature will remain on contact V but no energy will flow in the coils i, j and consequently no movement of the element shutter will take place until the conductors X, U are energized, whereupon the coil j is energized and, attracting the armature h, causes the shutter to move in the direction to obscure the visual member. When it is desired that the shutter should move in the opposite direction to disclose the visual member, the relay coil Y is energized due to the conductors Y^1, ZY being connected to the source of electricity, whereupon the switch armature t is attracted to cause contact to be made at W but no movement of the shutter a takes place until the conductors X, U are again energized, the power coil i being then energized to bring the shutter into the display position.

The provision of the individual relay system t, W, V, Z, Y, to each group of elements enables them to be set or actuated in a panel by panel method as described in the prior specification previously referred to so as to predetermine which elements shall actuate without actually causing movement of the shutters until the conductors X, U, are energized as by the closing of an auxiliary contact or contacts causing, as predetermined by the position of their individual relays, the elements upon one panel only or the elements upon the whole of the panels forming a sign to be energized and operated together.

Fig. 2 represents an adaptation of the form of mechanism just described in Fig. 1, to operate a hemispherical shutter composed of two quarter spheres, aa representing the shutters which are free to rotate through an angle of approximately 90 degrees on the bearings b^2, b^2, small extensions e^2, e^2 on the shutters forming arms or levers for operating same. hh represents a rocking armature which may be actuated in a see-saw manner by coil i to close and by coil j to open the shutters. The armature hh is provided with extensions kk which, when the armature is actuated by either of the coils i or j, convey their acquired motion to the shutter levers e^2, e^2, by means of the contacting wires c^2, c^2. A tension spring S^{10} may be provided between point m^2 on an extension of the armature, and point S^1 on the other side of the armature bearing, and by its tendency to draw these two points together, the spring will assist in maintaining point m^2 either above or below the dead center c of the armature and so constitute a means of locking the shutter in either its closed or open position. As in the mechanism represented in Fig. 1, the motion of the armature and shutter may be retarded by the introduction of the dashpot l, and similarly, the disposition and action of the relay, locking spring, switch, lamp and connection and the electrical conductors generally may be considered in effect to be applicable to both operating mechanisms of the examples, Figs. 1 and 2.

In the example under consideration the switch p^1 is arranged to engage contact q''' when the shutters are open, so as to illuminate the lamp, and to engage contact q'' when the shutters are closed in such manner that an alternative circuit including a resistance p^2 of equal ohmic and ampere capacity is substituted in the circuit for the lamp.

The particular utility of this arrangement is that it enables the lamps in groups of elements to be connected in series, permitting low C.P. and low voltage metallic lamps to be used. The manner in which a number of lamps are connected together is shown by Fig. 10 where the two way lamp switch p^1 in Fig. 2 is denoted by p^6 so that it will be seen that any combination of lamps or resistances may be placed in series and after the actuation of the element switches the circuit switch DS may be closed, thus causing all the lamps that are in circuit by the contacting of their switches p^1 Fig. 2 to be illuminated. By operating the circuit switch DS to close later than, and to interrupt earlier than, the switches p^6, such switches may be operated with no current flowing through their contacts so as to lengthen their life by avoiding burning or damage to their metallic contacts. It is also desirable that the switches p^6 should make contact with the resistances R^1, R^2 and R^3 before interrupting the lamp circuit and vice versa so that in the event of their being actuated with the current flowing through them they will never interrupt the main circuit. There may be a multiplicity of switches DS preferably of equal number to the switches causing actuation of the

display mechanism of the elements, so that the illumination may be caused in like sequence. It will be understood that the switches DS Fig. 10, may remain in the off position during the day time or other period that it is not desired that self illumination of the elements shall occur.

In the previous specification referred to, it was proposed to arrange the internal connections and terminals located upon the elements so that the insertion of an element in its aperture or cell would also establish the correct electrical connections, and this method is also applicable to this type of element but when it is desired to arrange elements in a monogram by dispensing with these connections, it is possible to pack them more closely together, and there has therefore been devised the alternative method of connecting the terminals as from X, U, ZY, Z^1, s^4, etc., to a flexible conductor X^2 (Fig. 2) which is connected to a plug X^3 containing as many contact pins X^4 as there are terminals or element conductors to be connected. This plug engages with a counterpart and by irregular disposition of the pins it is impossible to incorrectly insert them into their counterparts so that by the provision of the said plug the removal and replacement of an element and its correct connection is greatly facilitated.

Auxiliary contacts energizing the actuating coils *i* and *j* may be connected and electrically actuated and operated from a controller as shown in Figs. 3—7 hereinafter described.

In the example above referred to (Fig. 2) there is illustrated an element with a hemispherical shutter for the purpose of displaying or obscuring the visual member, but it is manifest that the motion of the armature *h* may by suitable mechanical means be adapted to operate any desired type of element shutter such as those illustrated in the previous specification comprising shutters of flat formation or double shutters or nests of shutters for producing multi-color effects, etc., and although the interior electrical connections both of the relay switch and power coils are described as connected in parallel, variations in the method of electrically connecting the coils both of the relay and the actuating mechanism or power coils may be made. Examples of some such variations are illustrated by simple diagrams, Figs. 3 to 7, hereinafter described.

The amount of power required to actuate the normal sized element mechanism and relay coils being comparatively small, it is not commercially economical to construct their operating coils of such resistance as to enable them to be connected in parallel upon a 100 or 200 volt circuit (such being the lowest usual pressures at which public supply companies supply electricity). There may be upon one panel twenty elements more or less and if connected in series the potential difference upon each pair of coils can be sufficiently low to enable the said coils to be wound with comparatively thick and low resistance wire, the total resistance of a series of such elements being such that they may be connected through the conductors X, U, (Figs. 1 and 2) to each other and the series so formed may then be connected directly to the electric supply companies mains.

Fig. 3 represents one method of connecting the actuating coils of one element and Fig. 4 represents the connections when two or more of such elements are connected together in series. In Fig. 3 the source of electricity is represented by DY and the actuating or power coils by *i* and *j*. These two power coils are connected together by means of the conductor X to the relay armature *t*, the opposite end of the coil *i* being connected by conductor W^1 to the relay contact W and thus to one pole of the source of electricity DY, the opposite pole of the coil *j* being connected by conductor V^1 to the relay contact V and thus to the opposite pole of the source of electricity DY. Now when the relay switch *t* contacts with V it will be seen that coil *j* is thereby shortcircuited, and that current will flow from DY through the wire V^1 to the switch *t* by the conductor X through the winding of coil *i* and conductor W^1 back to the opposite pole of the source so that the coil *i* will be energized, coil *j*, being practically non-magnetic, owing to the shortcircuiting effect of the relay switch *t*. If the relay switch *t* is moved so as to contact with W, the coil *i* will then be shortcircuited and when energy flows from the source DY it will then pass by the conductor V^1 to coil *j* returning by X through *t*, W and W^1 to the opposite pole of the source. The relay switch *t* being so constructed as not to remain in a position intermediate between V and W, it therefore follows that there will always be a shortcircuit on either the coil *i* or *j*, determined by the position of the relay switch *t* and, if both coils *i* and *j* are of equal resistance, the circuit from W^1 through the relay switch and coils to V^1 will always be of practically equal resistance.

Fig. 4 represents two of such elements connected in series, DY representing the source of electricity and the circuit being from W^1 to contact W of element B^1 through the internal connections as described in Fig. 3, to conductor WV connecting with the contact V and also to the contact W in element B^2, and from contact W to the opposite pole of the source of electricity. Now if both the relay switches *t* are respectively in contact with V current will flow from the source DY through W^1 to coil *i* (element B^1)

switch t, contact V, conductor WV to contact W of element B^2 through its coil i, switch t contact V and conductor V^1 to the opposite pole of the source, thus causing both the coils i to be energized and both the coils j will not be effectively energized owing to the short circuiting effect of the armature t. If both relay switches t are caused to contact with their conductors W, the two coils j will be energized, and if one switch contacts with V and the other contacts with W, and coil i will be energized upon one element and the coil j energized upon the other.

It will be readily seen that if these coils actuate the shutter mechanism as illustrated in Figs. 1 or 2, this method of connection will enable the elements to be operated in series, and it is obvious that as many of such elements as may be desired may be connected in series in this manner, and as the relay switch t is so constructed that it cannot take up an intermediate position out of contact with X, W or X, V there will always be in circuit in each element either the coil i or j. Pluralities of such elements connected in series will therefore be of constant resistance irrespective of the relay switch t being upon contacts W or V. The description of Fig. 1 has shown that it is not necessary to maintain excitation of the power coils after the shutters have assumed the desired position, therefore the conductor V^1 is energized and deënergized by means of the switch DS which may be operated electromagnetically or otherwise so that the relay switches t may be moved to either of their contacts V or W after the switch DS is opened, the said switch being required to establish contact only for a sufficient interval of time to permit the shutters to assume the desired positions.

During the periodic interruption of circuit V^1, W^1, the relay switches t can again be moved to predetermine whether coils i or the coils j shall be energized, when the switch DS is again closed so that the mechanism operated by the said power coils will again assume or retain the position predetermined by the relay switches.

Fig. 5 illustrates an element for operating with its actuating coils connected in parallel, in which the coil i causing the visual element to be displayed, when the relay switch t connects it to X but it can be caused to assume the non-display position by the energization of the circuit feeding the coil j without the actuation of the relay switch t. This is accomplished by connecting one end of the display coil i to one pole of the source of electricity DY and the other end of the coil to the contact W and thence through relay switch t and conductor X through the circuit switch DS to the opposite pole of the source, so that when the relay switch is in the position shown and the circuit switch DS is closed and DS^2 is open, the conductors W^1 and X will then be energized and the shutter will move to the displayed position. When it is desired that the element should assume the non-displaying position the conductor V^1, is energized by the closing of the switch DS^2, the coil i being normally deenergized until the switch DS is closed, so that the coil j will then actuate mechanism to bring the shutter into the non-displaying position. The whole of the coils j throughout a sign or groups may be connected together so that the operation of the auxiliary switch DS^2 will always cause the elements to assume the non-display position or clear the sign. It will be observed that when the auxiliary switch DS feeding conductor X is operated it will cause only the coils i to be energized, which are connected therewith by the relay switches t contacting W with X.

Elements internally connected in a manner similar to that illustrated by Fig. 5, may by the addition of an internal resistance or other alternative path be connected, and operated in groups connected in series, the method whereby this may be accomplished being illustrated by Fig. 6, where it will be seen that the resistance R^4 and coil i are alternatively connected by the relay switch t to the source DY through circuit switch DS, the resistance R preferably being of equal ohmic and ampere capacity to the coil i, and may conveniently be contained within the element. When it is desired that coils i in both elements shall be energized, the relay switches are first operated so that they are in the position shown in the drawing, connecting to one pole of the source DY through X to the contacts of switch DS through X^1 to relay switch t then through contact W and first coil i through conductor X^2, second relay switch t and second contact W to the second coil i, connected to the opposite pole of the source of electricity by conductor W^1, so that current flows through both coils i in series when the circuit switch DS is closed. If it is desired that only the second coil i should be energized, the first relay switch t is moved to engage contact RV and current will flow through resistance R and then through X^2, second relay switch t, coil i and conductor W^1, the current being kept constant due to resistance R being in circuit as a substitute for first coil i and it will be readily seen that according to the positions of relay switches t either, neither or both of the coils i may be energized when the switch DS is operated and that current flowing in the coils i or the resistance R (if of equal capacity to i) will be kept constant. The coils j used to cause non-display of the elements are connected in series through the auxiliary switch DS^2 to the source DY so that when said auxiliary switch is closed all the coils j forming the series will be ener-

gized, thus bringing all the shutters displaying the visual elements into a position to obscure them and all other shutters already in the non-display position will be virtually unaffected although their coils will be energized. This method of connection permits a sign composed of a number of similar elements to be "cleared" independently of the actuation of the relay switches *t*, so that during the display of one device another may be predetermined by the resetting of the relay switches, the first device being then cleared by closing the switch DS^2 for a short interval. The second device is then displayed by closing the switch DS for a short interval and the device can be caused to appear and disappear successively by the alternate action only of the switches DS and DS^2.

The resistance R may be located within the element in such position as to be usable to remove climatic effects from the shutter such as frost, snow or moisture.

Where a supply of low voltage is available or other circumstances may render such a course desirable, there may be connected a number of elements so that their power coils operate in electrical parallel; two elements so connected are illustrated by Fig. 7, where it will be seen that one end of the winding of all the coils *i* and *j* are connected together by the conductor W^1 to one pole of the electrical source DY, the other ends of the coils being connected respectively to the relay switch contacts W and V the relay switches *t* also being connected by means of conductors V^1 and through switch DS to opposite pole of source DY. With the element connected in this manner, if the two relay switches *t* contact with W and the auxiliary switch DS is closed, current will flow through the two coils *i*, and with the relay switches upon the contact V and auxiliary switch DS closed, the two coils *j* will be energized. The relay switches *t* may be put in such position that when the auxiliary switch DS is closed the coil *i* upon one element and the coil *j* upon the other element may be energized.

Elements with internal connections may also be connected in series as in Fig. 7.

It will be obvious that other methods of connection of the operating coils or groups may be adopted such as connecting in series groups already in parallel, thus forming a series parallel but the systems above described are found most suitable for the purpose in view.

In the foregoing diagrams, the provision of the switches DS permits the relay switches T to be operated with no electricity passing through their contacts, by which means it does not expose the contacts to the slight carbonizing effect that would otherwise be caused, thereby thus lengthening their life and efficiency. It is not always intended to operate the relay switches with the current interrupted by the switches DS, as for certain effects upon the sign face it may be desirable to first close the switch DS and then operate the relay switches to cause the element shutters to operate, as and when the movements of the relay switches take place.

When an element is provided with more than one set of shutters as with color changing elements, each set of shutters may be actuated independently, and in such circumstances there should be provided mechanism capable of actuation by four impulses for each set of shutters, so that if for example an element were provided with a black shutter and a red shutter the red shutter being used as a visual member covering a white visual member, it is obvious that to display the white member, both the black and the red shutters should be operated to take up a position behind the white visual member and to produce the red element only the black shutter should be operated to such position. Again if it were desired to display at will either the white or the red visual section each set of shutters is operated by mechanism operating with four functions, so that a two-colored element would have eight functions and a three-colored element would have twelve functions and so on, adding four functions for each color that the element was constructed to produce but for the purpose of this specification I regard such an element as a four function element.

One relay may also be applied to supply a predetermining function to an element constructed in the manner illustrated by Fig. 5 of the specification previously referred to, in which the colors are successively displayed by the successive energization of the magnetic system, but it is preferred to provide the four independent functions for each color because the order in which the colors shall change can then be predetermined, whereas if a relay is added to the successively energized single magnetic system, the colors can only appear one by one in succession determined by the construction of the element. It is also possible to provide the relay comprised within a multi-colored element with one magnetic coil, the successive excitation of which would cause the power coils to be successively selected in a step by step manner, but such an arrangement is open to the objection above stated, that the colors could only be caused to appear in the sequence determined by the construction of the said step by step relay.

Although the element has been described as comprising a luminous member for displaying in darkness, a non-luminous member to display when light falls upon the face of the sign together with a relay to determine

if an individual element shall display or not, it is obvious that the invention is not limited to an element combining all these features.

Having described a number of methods by which the conductors feeding the coils may be internally connected or electromagnetic devices used for actuating the visual members of the elements together with the connections to their individual relay switches and also methods of electrically connecting the actuating devices of the visual members together and in groups, which may be in series, parallel, or series parallel, I will now describe in detail a series system and a parallel system of connection showing the manner in which the actuating or electromagnetic systems of the relay switches (hereinafter called the relay coils) may be connected to the composing switch or secondary relay.

The method of connecting in series and actuating a number of relay coils from a composing key or collective relay is illustrated by Fig. 8, showing the series connections of the relay coils of six elements to a composing key I^5, so that such key will cause the sequence of the relay coils to be energized as may be predetermined by the disposition of contacts upon such key and consequent selective operation of the element relay switches connected therewith, thus predetermining the action of the desired element shutters, so that it may operate when the power circuit is energized.

The coils marked A^5 to F^5 represent the relay coils whose function as has already been explained is to actuate a switch to connect the non-display or clearing power coils, and the relay coils marked A^6 to F^6 are to connect the displaying power coils. The coils shown are all connected in series, both the coils actuating each relay together with the coils actuating the relay switches of the six other elements. Conductors numbered 1 to 13 connect to the coils in the manner shown and to the contacts of a multiple switch Z^5, which consists of a number of contacts carried by a common stem and insulated therefrom and from each other so that all the contacts may connect conductors 1—13 to 1^A to 13^A, when the coil H^6 is energized. Said switch is normally in the disconnecting position and by energization of the coil H^6 connects conductors 1 to 13 and 1^A to 13^A. The coil H^6 may be energized either from a panel selector or by the manual or electrical manipulation of a key or contact connecting it to a source of electricity. A compression spring S^8 returns the switch Z^5 to non-contacting position upon the deenergization of the coil H^6. The conductors 1^A to 13^A terminate at the contacts J^6 upon the secondary relays or controller keyboard. The composing key I^5 is provided with pairs of metallic fingers or contacts M^6, N^6, O^6, R^6 arranged to shortcircuit pairs of the conductors at contacts J^6, but such pairs of fingers unless adjacent as N^6, O^6 are not in electrical contact with others upon the key stem from which they are insulated. The composing key I^5 may be actuated manually or by the excitation of a coil K^6 to cause it to contact with the conductors at the points J^6 at the same time connecting L^6, L^7 with one pole of a source of electricity, the opposite pole of such source being connected to a conductor 13^A as at 13^B directly or through a second contact as indicated at L^6, L^7. When the conductors 1—13 are connected to 1^A—13^A by means of the multiple switch, the key I^5 may be operated to make its group of contacts at J^6 and current will then flow from a source of electricity through the switch contacts L^6, L^7, to the conductor 1^A then by the shortcircuiting contacts M^6 upon the key I^5 to the conductor 2^A and thus through the multiple switch Z^5 to the conductor 2, thence to the coil A^6 of the element T^1 to the conductor 3 through the coil B^5 to the element U^6, to the conductor 4, then through 4^A to contact N^6 to the shortcircuiting contact O^6 through the conductor 6^A, through the multiple switch to 6 and thence through the coil C^6 to 7, through the multiple switch and conductor 7^A through the shortcircuiting contacts P^6 to conductor 8^A, through the multiple switch to 8, through coil D^6 to coil E^5, thence to conductor 10, through multiple switch to 10^A, through the shortcircuiting contact Q^6 to the conductor 11^A, through multiple switch to 11, through coil F^5, to the conductor 12, through multiple switch to 12^A and through shortcircuiting contact R^6 to the opposite pole 13^B of the same source of electricity supplying the contacts L^6, L^7. It will be seen that current will not flow along conductors 3^A, 9^A, due to there being no connection established upon the contacts J^6 attached thereto. By suitably proportioning the resistance of the conductors, coils and contacts, the current flowing through the coils which are shortcircuited will be of negligible quantity and not capable of sufficiently energizing the said coils to operate the relay switches. The current flowing through the path just described passes through the relay coils A^6, B^5, C^6, D^6, E^5, F^5, thus causing them to operate or retain their relay switches in the required position. Assuming the coils A^5 to F^5 are to operate the relay switches so as to connect the displaying power coils of their elements, and A^6 to F^6 are arranged to connect the clearing power coils or disconnect the display coils, by reference to Figs 3–7, it will be seen that elements T^6, V^6 and W^6 will have their relays assume a position to predetermine display, and elements U^6, X^6 and Y^6 will predetermine non-display, when the

composing key I^5 is operated. To display one element only, all the non-display coils of the relays are placed in series with the one coil of the displaying circuit all the other coils being necessarily shortcircuited. All intermediate stages of operating the element relays between one and all is attained by always shortcircuiting and energizing the same number of coils, by this means keeping the total resistance of the series constant, and it will be understood that the number of groups of coils as A^5 to F^5 may be extended as may be desired as also the number of coils in each group and also the number of composing keys I^5. Each group of relay coils A^5 to F^5 is then separately actuated from the composing keys I^5 as determined by the operation of the multi-contact switch Z^5 placing the desired group of relays A^5 to F^5 into connection with the actuated composing key I^5, so that any group of primary relays may be connected to any one of a plurality of keys I^5 provided with dissimilar contacts so that any key I^5 can actuate any group of elements T^6 to Y^6.

Relay operating coils connected in parallel and selectively operated by a composing key are illustrated by Fig. 10 in which the composing key I^5 and the multiple switch Z^5 are operated in the manner previously described with reference to Fig. 8, but in this instance the contacts M^6 to R^6 upon said composing or secondary relay key I^5, are in metallic contact with each other as by means of the key stem and such key when depressed is connected to one pole of the source of electricity through contacts L^6, L^7. When the multiple switch Z^5 and the composing key I^5 are operated together, current will flow through L^7 to L^6, thence to the stem of the key I^5 through the contacting tongues M^6 to R^6, then to the conductors with which they contact and the tongues of the multiple switch Z^5 of the relay selective coils A^5 to F^5 and then to the opposite pole of the source B^7, thus causing the relay switches to take up a position predetermined by the disposition of the contacts upon the key I^5. In the example given, actuation of the key I^5 will cause relay coils A^6, C^6, D^6, to operate its relay coils into the display position and coils B^5, E^5, and F^5 to operate into the non-display position, so that upon actuation of the composing key I^5 and the multiple switch Z^5 the individual primary relays assume the desired position whereby subsequent excitation of the circuit feeding the mechanism actuating the visual member will cause the display that has been predetermined firstly by the key I^5, although said key I^5 is no longer contacting with conductors 1^A to 12^A, and secondly by the individual primary relays.

In the two examples illustrated in Figs. 8 and 9, which is considered to be the most versatile arrangement, is shown namely the ability of the composing key to select the relay coils required to display and the relay coils not required to display, so that subsequent energization of the mechanism operating the visual members causes certain of the elements to display, certain of the elements that are already displaying to assume the non-displaying position, and certain of the elements will have no motion imparted to them. By this means one character that may be already displayed may be caused to dissolve into another character.

What I claim as my invention and desire to secure by Letters Patent of the United States is:—

1. In a changeable electric display mechanism, an element comprising a shutter, separate primary electromagnetic devices adapted to move the shutter into positions of display and non-display, a relay including separate secondary electromagnetic devices adapted to determine which of said primary magnetic devices shall be energized, an alternative circuit connected to said primary electromagnetic devices, and means for operating said alternative circuit to subsequently energize the primary device determined by said relay.

2. In a changeable electric display mechanism a visual element, means for artificially illuminating same, a shutter adapted to uncover and cover the visual element for display and non-display thereof, separate primary magnetic devices adapted to move the shutter into positions of display and non-display, a relay including separate secondary electromagnetic devices adapted to determine which of said primary magnetic devices shall be energized, an alternative circuit connected to said primary electromagnetic devices and means for operating said alternative circuit to subsequently energize the primary device determined by said relay.

3. In a changeable electric display mechanism, an element comprising a lamp, a movable shutter for said lamp, electrical means to operate said shutter, cushioning means to prevent violent action of said shutter, said cushioning means comprising a dash-pot with a lost-motion joint to said shutter-operating means, an alternative circuit to said lamp including a resistance substantially equal to the resistance of the lamp, said shutter-operating means controlling the lamp-circuit and the alternative circuit, electrical connections arranged so that when the shutter is closed the lamp circuit is opened and the alternative circuit is closed, and when the shutter is open the lamp circuit is closed and the alternative circuit is opened.

4. In a changeable electric display mechanism, a plurality of independent elements each comprising a lamp, a movable shutter for said lamp, electrical circuits and con-

nections for actuating said lamp, an alternative circuit to said lamp, including a resistance, electrical circuits and connections for actuating said shutter, means to electrically connect a plurality of said independent elements in a panel to be collectively operated, and means including a relay and electrical connections to connect the lamp or alternative circuit of one element in the panel with the lamp or alternative circuit of another element in the panel.

5. In a changeable electric display mechanism, a plurality of independent elements each comprising a lamp, a movable shutter for said lamp, shutter-operating means, electrical circuits and connections for actuating said lamp, an alternative circuit to said lamp including a resistance, electrical circuits and connections for actuating said shutter, means to collectively operate the shutter circuits of a plurality of elements in a panel, said shutter-operating means operating contacts and connecting the lamp in the circuit when the shutter is open, and operating other contacts and connecting up the alternative resistance circuit when the shutter is closed.

6. In a changeable electric display mechanism, a plurality of independent elements each comprising a lamp, a movable shutter for said lamp, shutter-operating means, electrical circuits and connections for actuating said lamp, an alternative circuit to said lamp including a resistance, electrical circuits and connections for actuating said shutter, means to collectively operate the shutter circuits of a plurality of elements in a panel, said shutter-operating means operating contacts and connecting the lamp in the circuit when the shutter is open, and operating other contacts and connecting up the alternative resistance circuit when the shutter is closed, and means including a relay and electrical connections to connect the lamp or alternative circuit of one element in a panel with the lamp or alternative circuit of another element.

7. In a changeable electric display mechanism, a plurality of independent elements each comprising a lamp, an alternative circuit to said lamp including a resistance, electrical circuits and connections for actuating said lamp, a movable shutter for said lamp, electrical circuits and connections for actuating said shutter, means to connect a plurality of said independent elements in a collective circuit, and means including a relay and electrical connections to connect the lamp or alternative-circuit of one element in the collective circuit with the lamp or alternative-circuit of another element.

8. In a changeable electric display mechanism, a plurality of independent elements each comprising a lamp, an alternative circuit to said lamp including a resistance, electrical circuits and connections for actuating said lamp, a movable shutter for said lamp, shutter-operating means, electrical circuits and connections for actuating said shutter-operating means, the shutter circuits of the several elements connected in a collective circuit, said shutter-operating means operating contacts and connecting the lamp in circuit when the shutter is open, and operating other contacts and connecting up the alternative resistance in circuit when the shutter is closed.

9. In a changeable electric display mechanism, a plurality of independent elements each comprising a lamp, an alternative circuit to said lamp including a resistance, electrical circuits and connections for actuating said lamp, a movable shutter for said lamp, shutter-operating means, electrical circuits and connections for actuating said shutter-operating means, the shutter circuits of the several elements connected in a collective circuit, said shutter-operating means operating contacts and connecting the lamp in circuit when the shutter is open, and operating other contacts and connecting up the alternative resistance in circuit when the shutter is closed, and means including a relay and electrical connections to connect the lamp or alternative circuit of one element in a collective circuit with the lamp or alternative circuit of another element.

10. In a changeable electric display mechanism, a plurality of independent elements each comprising a lamp, an alternative circuit to said lamp including a resistance, a relay controlling the connections to said lamp and resistance, a movable shutter for said lamp, shutter-operating means, said shutter-operating means comprising magnets, contacts, and circuits to connect with a current-carrying circuit, switch-devices to control the opening and closing of the shutter, and a multi-contact switch to simultaneously connect together a plurality of said shutter-operating means.

11. In a changeable electric display mechanism, a plurality of independent elements each comprising a lamp, an alternative circuit to said lamp, including a resistance, electrical circuits and connections for actuating said lamp, a plurality of shutters for said lamp, shutter-operating means, electrical circuits and connections for said shutter-operating means, said shutter-operating means controlling the connections of said lamp and resistance, means for connecting the circuits of the shutter-operating means of a plurality of elements together, and means connecting the lamp circuits of a plurality of elements together.

12. In a changeable electric display mechanism, a plurality of independent elements each comprising a lamp, an alternative circuit to said lamp including a resistance, electrical circuits and connections for actu-

ating said lamp, a plurality of individual shutters for said lamp, the individual shutters being differently colored, selective shutter-operating means, electrical circuits and connections for said shutter-operating means, said shutter-operating means controlling the connections of said lamp and resistance, means for connecting the circuits of the shutter-operating means of a plurality of elements together, and means connecting the lamp circuits of a plurality of elements together.

13. In a changeable electric display mechanism, a plurality of independent elements each comprising a lamp, an alternative circuit to said lamp including a resistance, a relay controlling the connections to said lamp and resistance, a movable shutter for said lamp, shutter-operating means, said shutter-operating means controlling said relay, and a multi-contact switch to simultaneously control a plurality of the relay-controlled circuits.

14. In a changeable electric display mechanism, a plurality of independent elements each comprising a lamp, an alternative circuit to said lamp including a resistance, a relay controlling the connections to said lamp and resistance, a movable shutter for said lamp, shutter-operating means, said shutter-operating means comprising magnets and conductors to connect with a current-carrying circuit, independent switches to select individual movable shutters and control their opening and closing, and a multicontact switch to simultaneously control the operation of a plurality of the selected shutters.

15. In a changeable electric display mechanism, a plurality of independent elements each comprising a lamp, an alternative circuit to said lamp including a resistance, a relay controlling the connections to said lamp and resistance, a movable shutter for said lamp, shutter - operating means, said shutter-operating means controlling said relay and comprising magnets and conductors to connect with a current-carrying circuit, independent switches to select individual movable shutters and control their opening and closing, and a multi-contact switch to simultaneously control the operation of a plurality of the selected shutters.

16. In a changeable electric display mechanism, a plurality of independent elements each comprising a lamp, an alternative circuit to said lamp including a resistance, a relay controlling the connections to said lamp and resistance, a movable shutter for said lamp, shutter-operating means, said shutter-operating means controlling said relay and comprising magnets and conductors to connect with a current-carrying circuit, a multicontact switch to simultaneously control a plurality of the relay-controlled circuits, independent switches to select individual movable shutters and control their opening and closing, and a multicontact switch to simultaneously control the operation of a plurality of the selected shutters.

17. In a changeable electric display mechanism, a plurality of independent elements each comprising a lamp, an alternative circuit to said lamp including a resistance, a movable shutter for said lamp, shutter-operating means comprising an opening magnet and a closing magnet, the magnets of one element connected in circuit with the magnets of other elements, means to maintain an unbroken shutter-operating circuit of substantially constant resistance through a magnet in each of a plurality of elements, and means to select which magnet in each element is to be included in the shutter-operating circuit.

18. In a changeable electric display mechanism, a plurality of independent elements each comprising a two-unit circuit, one of said units constituting a lamp, the other unit constituting a resistance, a movable shutter for said lamp, shutter-operating means comprising an opening magnet and a closing magnet, the magnets of one element connected in circuit with the magnets of other elements, the two-unit circuit of one element connected in a lamp-circuit with the two-unit circuits of other elements, means to maintain an unbroken lamp-circuit of substantially constant resistance through one of the units in each of a plurality of elements, and means to select which unit in each element is to be included in the lamp-circuit.

19. In a changeable electric display mechanism, a plurality of independent elements each comprising a two-unit circuit, one of said units constituting a lamp, the other unit constituting a resistance, a movable shutter for said lamp, shutter-operating means comprising an opening magnet and a closing magnet, the magnets of one element connected in circuit with the magnets of other elements, means to maintain an unbroken shutter-operating circuit of substantially constant resistance through a magnet in each of a plurality of elements, means to select which magnet in each element is to be included in the shutter-operating circuit, the two-unit circuit of one element connected in a lamp-circuit with the two-unit circuits of other elements, means to maintain an unbroken lamp-circuit of substantially constant resistance through one of the units in each of a plurality of elements, and means to select which unit in each element is to be included in the lamp-circuit.

20. In a changeable electric display mechanism, a plurality of panels, a plurality of independent elements in each panel, each element comprising a lamp, a lamp-circuit, a movable shutter for said lamp, a shutter-op-

erating means including an opening-magnet and a closing magnet, a shutter-operating circuit, an automatic switch-device to select one of said magnets and include it in the shutter-operating circuit, circuits to said switch-device, multi-contact switches to connect the lamp-circuits together in one panel and the shutter-operating circuits together in one panel, and further multi-contact switches to simultaneously connect the similar circuits of a plurality of panels together, and a display-circuit closing switch to connect the display-mechanism with a supply circuit after the several connections of the plurality of panels and elements have been effected, and to disconnect the display-mechanism from the circuit before the several connections of the plurality of panels and elements are readjusted.

21. In a changeable electric display mechanism, a plurality of panels, a plurality of independent elements in each panel, each element comprising a lamp, a lamp-circuit comprising a two-unit circuit, one of said units consisting of said lamp, and the other a resistance substantially equal to the resistance of said lamp, a movable shutter for said lamp, a shutter-operating means including an opening-magnet and a closing magnet, said shutter-operating means actuating contacts to connect the lamp in the circuit when the shutter is open, and to connect the resistance in circuit when the shutter is closed, a shutter-operating circuit, an automatic switch-device to select one of said magnets and include it in the shutter-operating circuit, circuits to said switch-device, multi-contact switches to connect the lamp-circuits together in one panel and the shutter-operating circuits together in one panel, and further multi-contact switches to simultaneously connect the similar circuits of a plurality of panels together, and a display-circuit closing switch to connect the display-mechanism with a supply circuit after the several connections of the plurality of panels and elements have been effected, and to disconnect the display-mechanism from the circuit before the several connections of the plurality of panels and elements are readjusted.

In witness whereof I have signed this specification in the presence of two witnesses.

JAMES PRIESTNALL NAYLOR.

Witnesses:
A. J. HADDAN,
S. FORD.