United States Patent [19]

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[54] **SYSTEM INDICATOR BOARD**

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[52] **U.S. Cl.** ..... **340/381,** 340/225, 317/101 C, 40/130 R

[51] **Int. Cl.** **G09f 9/14**

[58] **Field of Search** ..... 340/381, 225; 317/101 B, 101 C; 40/130 R, 130 E, 130 L

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Assistant Examiner—William M. Wannisky
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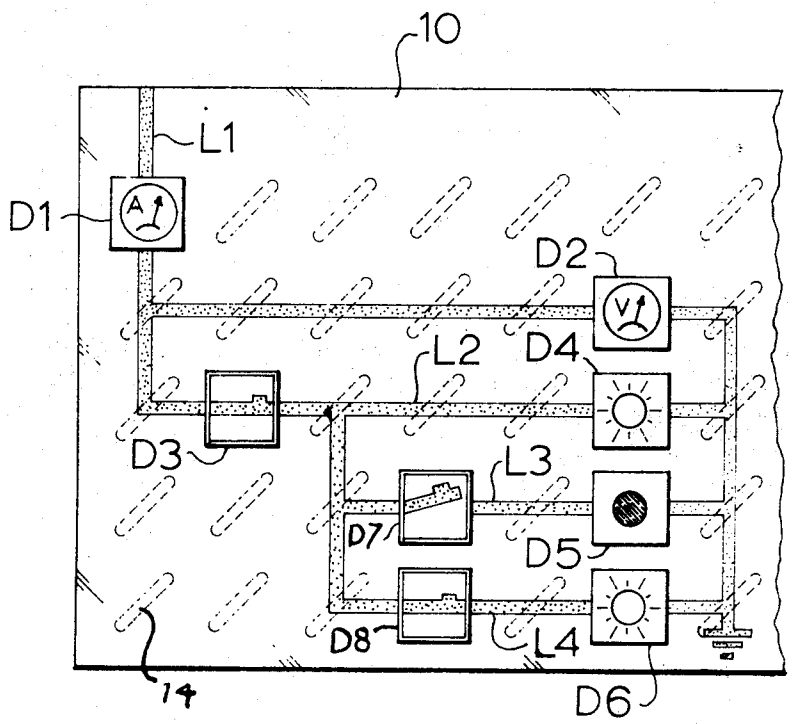
[57] **ABSTRACT**

A board has an array of uniformly arranged slotted openings with surfacing material covering the unused ones of said slotted openings. Electrical indicator devices with projections designed to project through said slotted openings are mounted projecting through selected ones of said slotted openings at which openings the surfacing material has been broken. Means are provided for fastening the device in place. The electrical devices have been designed to represent the state of components or conditions of a system which are to be dynamically represented.

3 Claims, 5 Drawing Figures



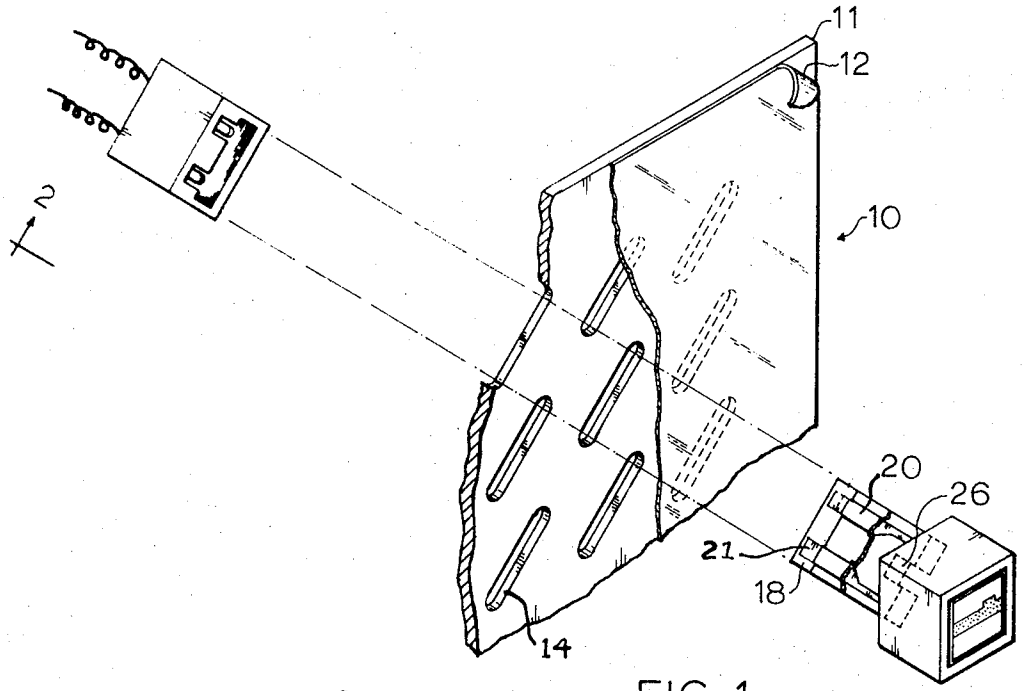


FIG. 1

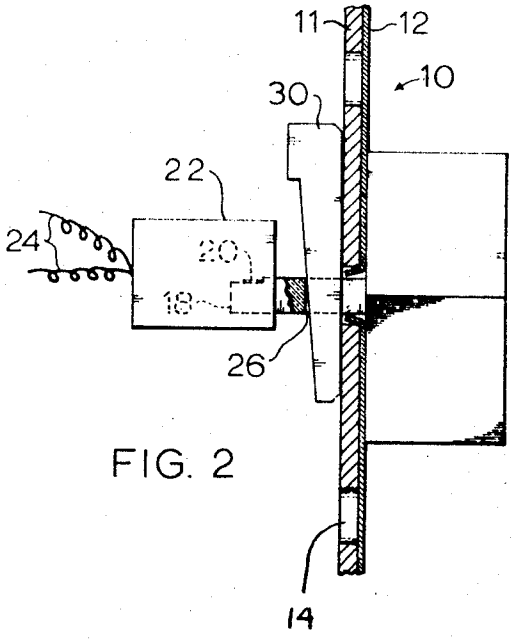


FIG. 2

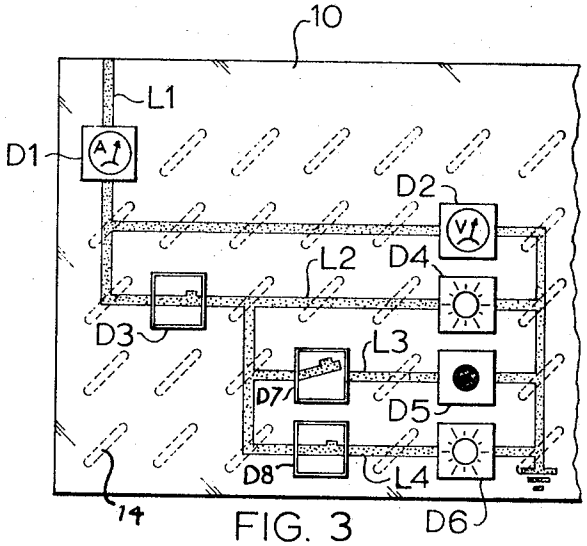


FIG. 3

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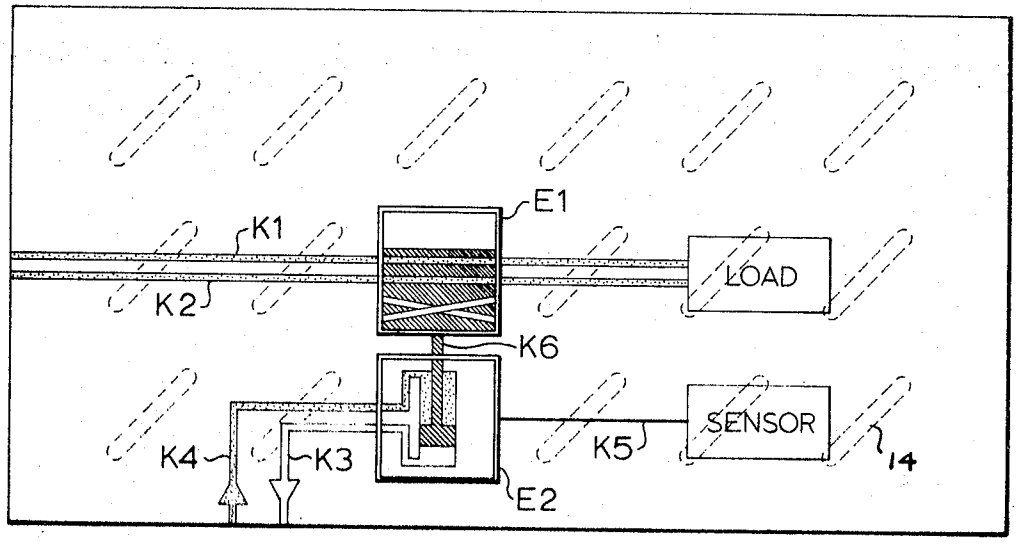

FIG. 4a

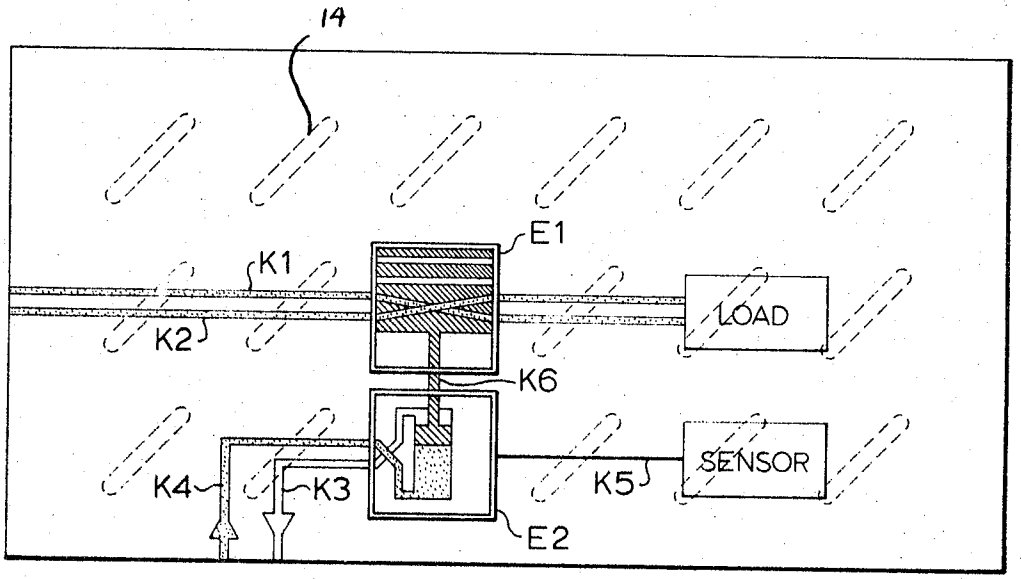

FIG. 4b

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SYSTEM INDICATOR BOARD

This invention relates to means and a method for visually portraying the state of systems wherein some conditions or components of the system are represented dynamically and related to other components of the system which are indicated statically.

For example, in a typical hydraulic control system: control, power, bypass, safety, etc., valves, the location of power operated equipment and such matters as pressure and rate of flow might be considered as normally changeable facets of the system, whose condition or degree might change from time to time and thus should dynamically be represented while the hydraulic power lines or control lines connecting dynamically represented devices would usually be statically represented.

The invention provides means and a method whereby the elements whose changeable status it is desired to portray, are portrayed by changeable electrical indicating elements arranged on a board while the means which are to be statically indicated are displayed (usually by contrasting colors) on the board, indicating the relationship of the hydraulic lines to the elements such as valves which are dynamically indicated.

In another example, an electric distribution system dynamic elements (i.e., facets of the system with a high probability of change during an observation or control period) include: circuit breakers, variable resistances, switches, and the amounts from time to time of current and voltage. On the other hand, the power and control lines connecting these elements, will usually be statically portrayed. Thus in accord with the invention, the elements dynamically represented will be portrayed by electrical indicators on the viewing side of a display board, while (also on the viewing side of such board) the connections between the elements are statically portrayed (usually in contrasting colors).

For the discussion of the representation of systems, in accord with the invention, the term "dynamic system elements" will be used to describe those elements of the system with which, on the display indicator board, whose change of amount, condition or state is dynamically represented, while the term "static system elements" will be used to describe those components of a system which are statically represented.

In accord with the invention, the system indicator comprises: a board, one side of which is visible in the viewing direction. The board is designed to provide a number of locations uniformly distributed thereon (for example, regularly spaced in rows and columns) whereat a projection from an electrical device may be inserted therethrough (the board being apertured or weakened at these locations to allow this).

Devices so mounted, dynamically representing elements whose state or condition is changeable will, in accord with the invention, be shown on the board in functional relationship to elements which are statically portrayed, such as the electrical power or control leads connecting the devices.

The electrical devices are mounted with the projections projecting rearwardly through the board at the selected locations, the projections carrying the electrical connections for coupling to electrical leads for operating the devices. In the preferred form of the invention, the projection provides means for mounting of the device on the board. Electrically operable visible devices are therefore mounted at the selected locations which

are selected to properly portray the system. The connections between the dynamically represented devices in the real system, which are to be represented on the board as static elements, are portrayed therefore as lines or bars of contrasting color, static on the board and arranged in relation to the dynamic elements in a manner which simulates to the viewer, the overall appearance of the system. Other elements than those mentioned, and desired to be represented to the viewer as static or dynamic, are therefore represented on the visible side of the board as static or dynamic representations respectively.

To refer briefly to a further example of the use of the invention, permanent lines or bars on a board may represent the rails of a transportation system, while the changeable dynamic elements, represent the switches, i.e., as open or closed, or as directed to one line or another.

In drawings which illustrate a preferred embodiment of the invention:

FIG. **1** shows an exploded view of a portion of a board in accord with the invention, indicating the mode of application of the dynamic representation elements thereto and the electrical connection thereto;

FIG. **2** shows a side view of one of the devices applied to a board;

FIG. **3** shows a view of an indicator in accord with the invention, showing an indication of an electrical system; and FIGS. **4***a* and **4***b* show a view of an indicator in accord with the invention, showing an indicator of an hydraulic system.

In FIG. **1** is shown a board **10** of laminar form, comprising a metal or plastic (here metal) slotted structure **11** with a thin breakable insulating layer **12** covering the structure and the slots. The layer **12** is preferably made of plastic, preferably a base layer of mylar covering the metal. Where the board is to be exposed to ultra violet light, the mylar, which is somewhat sensitive to ultra violet radiation, is covered with a protective coating. The coating which we prefer is made of polyvinyl fluoride and is sold by Dupont of Canada Limited at Toronto-Dominion Bank Tower, King Street West, Toronto, under the trade mark TEDLAR. The mylar layer of 0.0050 inch and the TEDLAR layer of 0.0015 inch may easily be broken at selected slotted locations. The slots **14** in the board are provided as a convenient form of aperture for the mounting of the electrical indicating devices with leads passing therethrough. Apertures, otherwise shaped, may alternatively be provided. The apertures, rather than being preformed, may be made available through weakened areas or "punch-out" areas. In fact, the board shown in the preferred embodiment may be considered either as an apertured board with an added surface (for uniformity of appearance over unused apertures and for other reasons as pointed out hereafter) or may, with the surfacing material be considered as a non-apertured board with weakened areas.

The apertures, or locations where apertures may easily be made, (both included within the term "aperture location" hereafter) are however uniformly disposed in two or more dimensions on the board. Thus, in the preferred embodiment, the slots are uniformly disposed by being regularly spaced in several directions, including horizontally vertically and diagonally, rendering choices as to the location of dynamic elements equally available in all areas of the board.

It is within the scope of the invention, with a rectangular array of locations, such as that shown, that the row and column spacing may be different, although in each case, the aperture locations are regularly spaced along a row or along a column. It is also within the scope of the invention to have the locations otherwise uniformly disposed over an area, in a different arrangement, such as with the aperture locations so disposed as to be considered as defining three rows at 60° to each other.

With the rectilinear array of slots in row and columns as shown, it is found that the diagonally directed slots **14** leave a larger spacing between slots than would exist if these slots were horizontally or vertically directed.

For mounting at selected aperture locations on the board, electrically controlled devices D are provided, connectible with electrical leads, through the slots to electrical leads at the rear of the board. In the preferred embodiment the electrical device may be a meter, light, or clock, but one of the devices most frequestly used will be a two-position electromagnetic actuable element, of one of the types disclosed in U.S. Pat. Nos.: 3,365,824 issued Jan. 30, 1968; 3,140,553 issued July 14, 1964; or 3,295,238 issued Jan. 3, 1967.

The devices of various types are provided with a rearward projection **18** designed to extend through a selected aperture location, and carry therethrough from the device, the leads necessary, when properly connected, to assure the operation of the device and design for firmly mounting the device D on the display board **10.** As shown in the preferred embodiment, a device for mounting on the board, has a projection **18** designed and shaped to make a relatively easy sliding fit with the slot **14** when the surface coat **12** is broken. Leads **20** connected to operate whichever device D is involved, are embedded in the material, which is preferably of moulded plastic and are led to terminals **21.** The leads **20** are insulated unless effectively prevented from contacting the metal of the display board as hereinafter described. The operating leads **24** for the connector from controls or power sources, not shown, are connected to a suitable terminal member **22** designed to mate with the projection, and in mating, to make the necessary respective electrical connections between leads **24** and leads **20.** Mounting of the device may be achieved in any of a number of possible means. In the preferred embodiment, an aperture **26** is provided on the projection at a location which will appear at the rear of the board. The leads **20** are, of course, diverted to avoid this aperture. The device is therefore held in place by moving a wedged peg **30** into the aperture until the device is retained firmly in place.

The use of the invention is demonstrated in FIG. **3** wherein a portrayal is shown of a portion of an electrical distribution system. The system is graphically portrayed in FIG. **3,** wherein the elements selected for dynamic portrayal on the circuit is line **L1,** the voltage in line **L1** (by voltmeter **D2**) the state of a switch load (indicated by device **D3**) in line **L1,** the current in line **L1,** indicated by ammeter **D1** the operation (or not) in lines **L2, L3,** or **L4,** indicated by devices **D4, D5** and **D6,** the state of a switch in lines **L3** and **L4** indicated by devices **D7** and **D8.**

The ammeter and voltmeter **D1** and **D2** will of course, be actual elements indicating the actual conditions in the system portrayed, but shaped with projection **18** to be mounted and connected as indicated in FIG. **1.** The devices **D3-D8** will be shaped and mounted in FIGS. **1** and **2** and will be preferably two-sided electromagnetic indicators of the type described in U.S. Pat. Nos.: 3,365,824; 3,140,553 or 3,295,238, previously referred to. Thus the load indicators **D4, D5, D6** will, on one side of the reversible elements show a radiant symbol indicating the load is operating, as displayed by elements **D4** and **D6,** and on the other side, show a dull symbol, indicating the load is not operating, as displayed by element **D5.** Alternatively, the dull and radiant symbols may be replaced by contrastingly colored faces. The devices **D3, D7** and **D8** will on one contrasting face show a closed switch (as displayed by devices **D3** and **D8**) and on the other contrasting face show an open switch (as displayed by device **D7**). The electrical connections made to the reverse side of the board will control the indication of the device in accordance with sensing means determining the state of the corresponding devices in the system. Digital numeric or alphanumeric indicators may be attached in the same manner and form a part of the functional circuit.

The devices were placed by selecting the desired slot locations from among the uniform disposition of such locations on the board **10.** These represent the part of the system dynamically displayed. Lines **L1, L2, L3,** the voltmeter connection and the ground connection represent the part of the system statically displayed. These will be painted, taped or otherwise formed on the board. The lines and connections may be of magnetic material, magnetically attached to the board for easy removal. Where the board is of aluminum, plastic, or other non-magnetic material the board may be provided with a layer of magnetic material to allow the correct attachment.

The board, therefore, allows a representation of this system or other systems through a combination of flexibility in location of dynamic elements and the concomitant location of static elements thereon.

FIG. **4** shows a hydraulic control system where static components being fluid lines **K1** and **K2, K3** and **K4** sensor connection **K5,** control connection **K6** and sensor and load are statically indicated by painting or tape. Devices **E1** and **E2** are dynamically indicated devices, mounted in selected slots as demonstrated in FIG. **2. E1** and **E2** will be electromagnetic elements of the type disclosed in the patents previously referred to. **E1** on one face will indicate that lines **K1** and **K2** are directly connected to the load and on the other face will indicate that lines **K1** and **K2** are reversed in connection to the load. Similarly, element **E2** will show, on one side, lines **K3** and **K4** connected in one sense to a servo valve, with upward movement of the valve indicated; and on the other side, element **E2** will show lines **K3** and **K4** connected in the other side to a servo valve with downward movement of the valve indicated. The dynamic devices operated by electrical connections at the rear of the board will display conditions sensed by sensors in the actual system controlling the devices through the leads.

Returning to the specific embodiment of the invention as illustrated in FIG. **2,** the slot-like arrangement with the breakable plastic coating on the metal board provides additional insulation along the long edges of the slot for the electric leads in the projection passing therethrough. With the preferred coating it has been found that the broken coating provides insulation along the long edges of the slot so that, in some applications,

it has been found possible to leave the projection leads bare on a side facing a long edge of the slot and to depend on the inwardly deflected strips of coating to insulate the leads from the metal board.

I claim:

1. System indicating apparatus comprising:

a board having an array of substantially uniformly arranged slotted openings therein,

a surfacing material covering said board and the unused ones of said slotted openings, said surfaces being breakable at said openings,

electrical indicator devices with projections designed to project through said slotted openings located on the viewing side of said board at selected locations corresponding to said slotted openings, with said projections extending through openings at said locations and through surface material broken thereat;

such electrical devices being designed to represent the state of components or conditions of said system which are to be dynamically represented;

means for cooperating with said projections for removably fastening said devices in place,

means on said projections allowing the electrical coupling of electrical connections to said projections, on the rearward side of said board.

2. A system indicating apparatus as claimed in Claim 1 including:

means portraying statically represented components of said system on the viewing side of said board in schematic functional relationship to the electrical devices.

3. Means for portraying the status of a system wherein the system includes elements whose change of state it is desired to observe and members whose change of state is assumed constant during the observation period,

a board having an array of substantially uniformly arranged slotted openings therein;

a surface covering said board and the unused ones of said slotted openings, said surface being breakable at said openings,

whereby electrical indicator devices provided with projections designed to project through said slotted openings are located on the viewing side of said board at selected locations corresponding to said slotted openings,

whereby means for cooperating with said projections are made for removably fastening said device at said selected locations,

such devices and projections being designed so the electrical connections for said devices are made by connection to said projection rearwardly of said board,

said electrical devices being designed and connectable to portray the state of conditions of said system which are dynamically portrayed,

means on the same side of said board as said devices portraying visually the connections between the loci where said conditions exist portrayed by said devices.

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