

July 21, 1942.

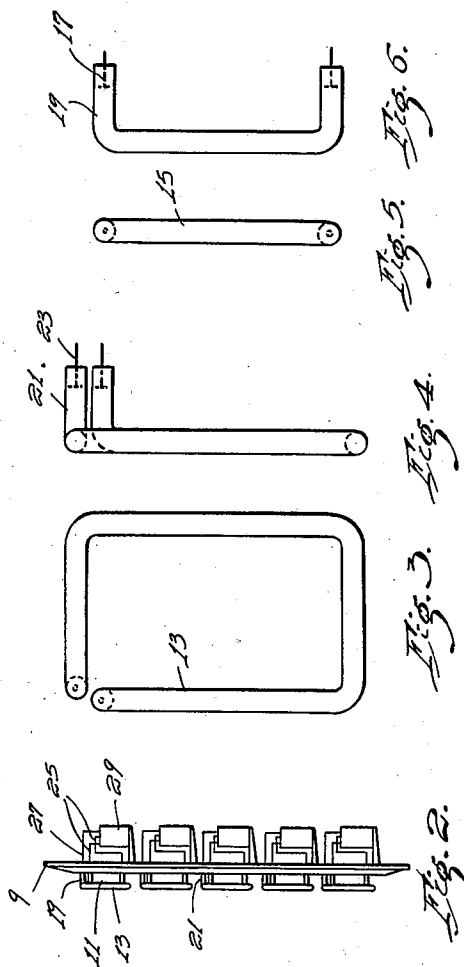
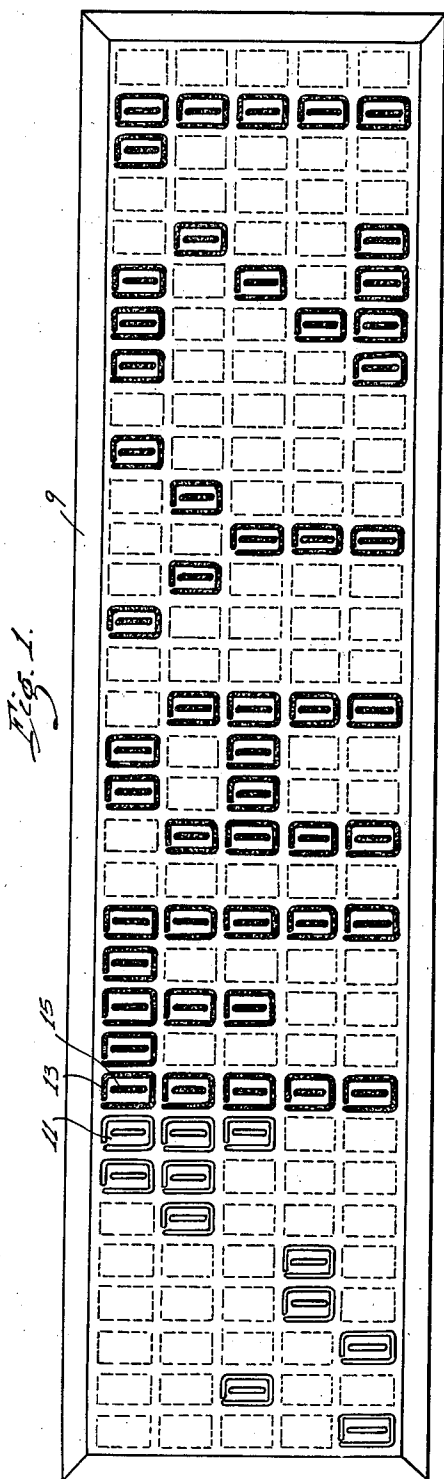
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2,290,280

DISPLAY APPARATUS

Filed Dec. 1, 1939

3 Sheets-Sheet 1



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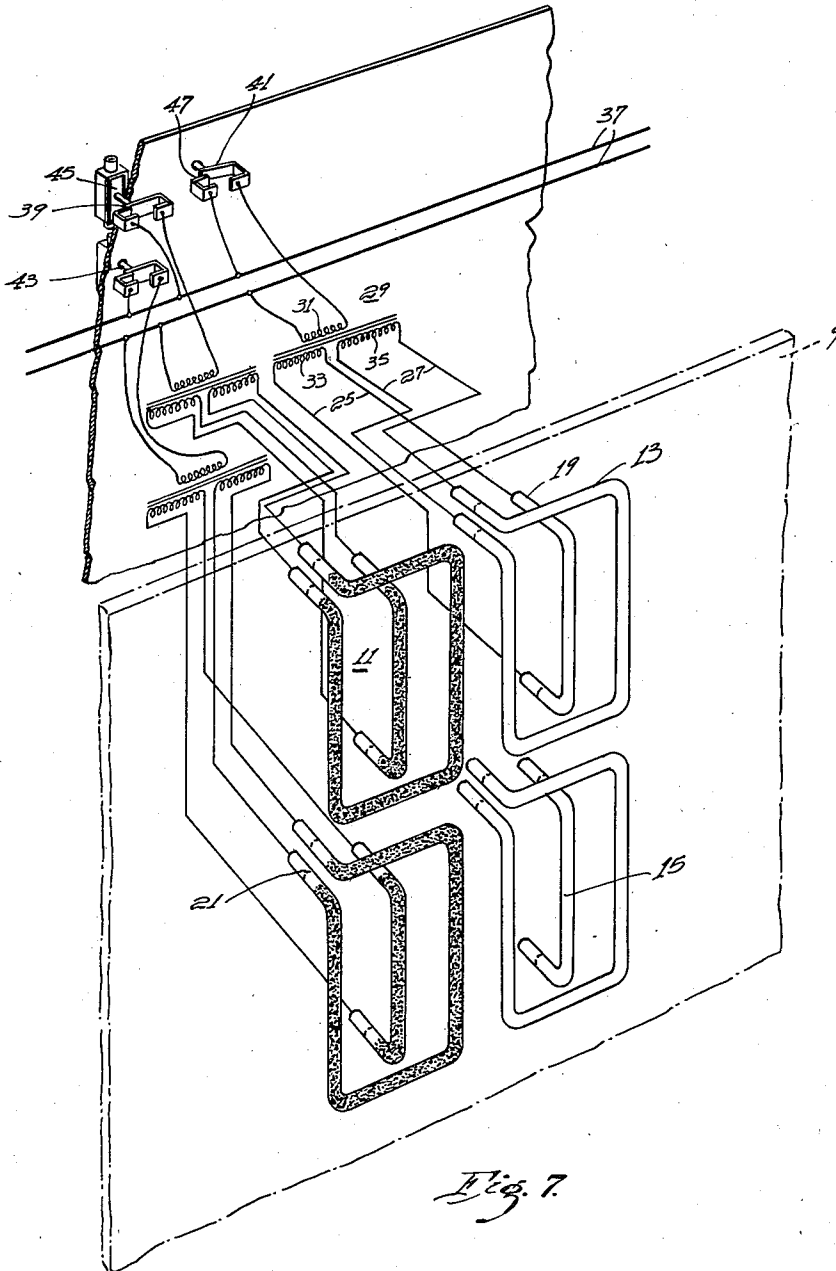


Fig. 7

WITNESSES:

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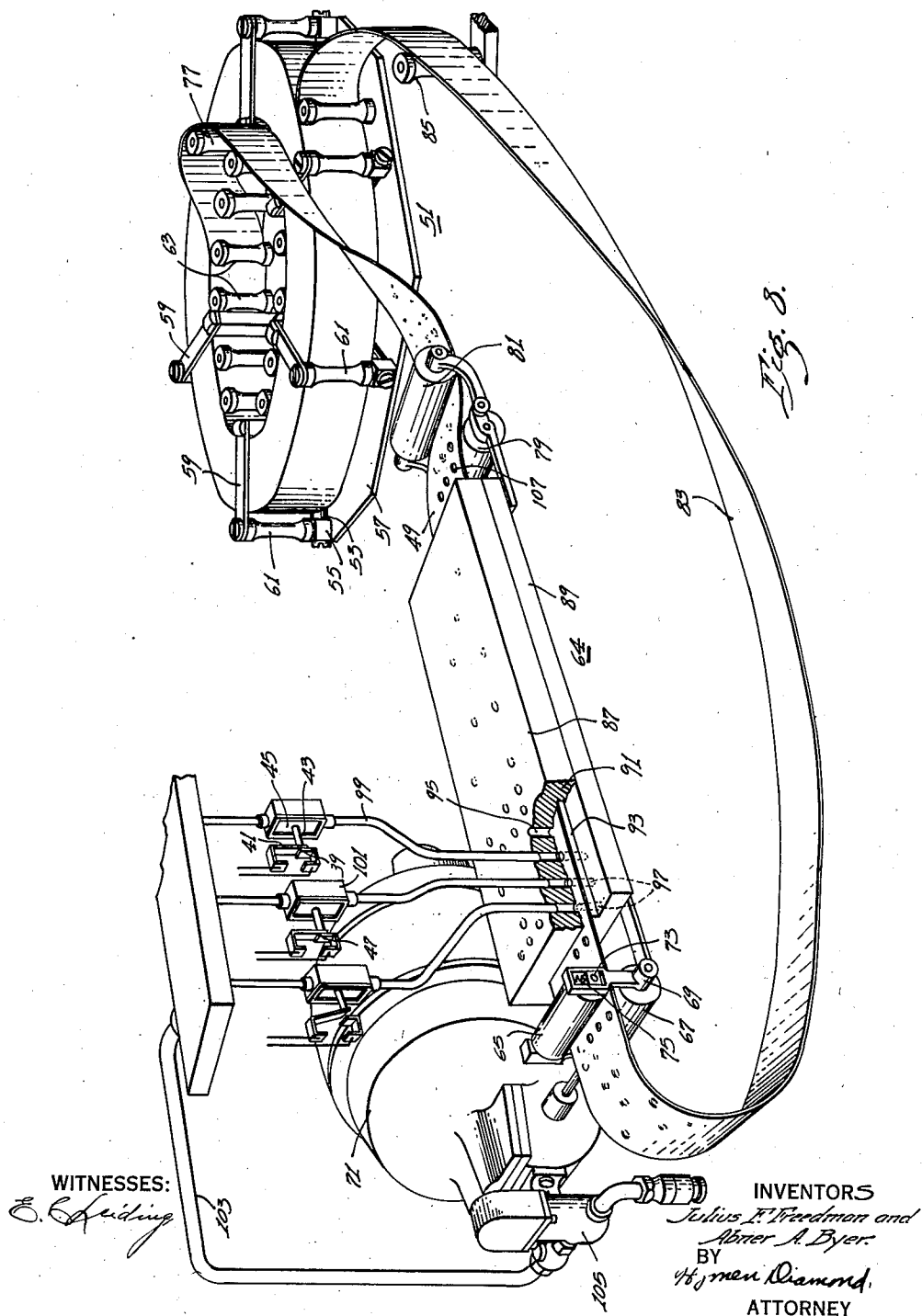
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UNITED STATES PATENT OFFICE

2,290,280

DISPLAY APPARATUS

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15 Claims. (Cl. 177—346)

Our invention relates to display apparatus and has particular relation to luminous signs for displaying a dynamic or traveling pattern.

In traveling signs constructed in accordance with the teachings of the prior art, of which we are aware, the pattern is produced by an array of incandescent lamps which are selectively energized. To dissipate the heat which is produced by the filaments so that it is harmless, the lamp envelopes are preferably substantially spherical. Incandescent lamps with which an elongated luminous column is produced are available but because of the difficulties involved in the design and construction of such lamps, their cost for sign purposes is prohibitive. The spherical lamps which are used are necessarily relatively small and, therefore, for a sign of ordinary structure, a large number of lamps are required. In one case of which we are aware, a traveling sign for conveying messages has 22,000 lamps.

The excessive number of illuminating units is undesirable because of the servicing demands that it imposes. Numerous failures necessarily occur continually among so great a multitude of lamps and continuous replacement is required. This condition is aggravated by the fact that lamps which are intermittently turned on and off have a relatively short life. A more serious consequence of the numerous lamps is a consequence of the condition that a selective contact element must be associated with each lamp. The number of contacts which must, therefore, be used is large and the labor involved in servicing the contacts is prodigious. In addition, a large space must be set aside for mounting the contact board. In the case of the 22,000 lamp sign, there are 22,000 contacts.

Another disadvantage involved in the use of incandescent lamps to produce the luminosity in a traveling sign arises from the fact that the radiation emitted from an incandescent filament does not correspond to the instantaneous current flow through the filament. There is a substantial time-lag and when the current flow through the filament is discontinued, the lamp continues to emit illumination for a short time interval. The display produced by a sign made up of incandescent lamps is, therefore, somewhat hazy.

In many situations, it is desirable that the elements of the pattern produced shall have double outlines. For example, where words are displayed, double line letters are often preferred to single line letters. To produce a double line display with an array of spherical incandescent

lamps is not practicable because of the difficulties involved in properly selecting the contacts to be operated. Incandescent lamps bent into substantially closed curves, such as rectangles, are not available. Such lamps, even if they could be manufactured, would have a rather short life because the filament as it sags when heated would fuse through the glass envelope, particularly at the corners.

It is accordingly an object of our invention to provide a sign in which the number of luminous units shall be a minimum.

Another object of our invention is to minimize to space necessary for the selective contacts of a luminous sign of the dynamic type.

A further object of our invention is to provide a dynamic luminous sign of simple and inexpensive structure.

Still another object of our invention is to provide a dynamic sign that shall require a minimum of servicing.

A still further object of our invention is to provide a dynamic sign, the cost of operation of which shall be a minimum.

A more specific object of our invention is to provide a luminous sign for displaying configurations such as numbers or letters having a double outline.

Another specific object of our invention is to provide a luminous sign in which the outlines of the configurations displayed shall be multi-colored.

A further specific object of our invention is to simplify the control apparatus used in producing a multi-colored luminous dynamic display.

An ancillary object of our invention is to provide an array of selective contacts for the control of a dynamic luminous display that shall occupy a relatively small space.

Another ancillary object of our invention is to provide a reliable selective control system for a dynamic sign.

An incidental object of our invention is to provide an electric discharge sign without using glow discharge tubes of numerous different structures.

More concisely stated, it is an object of our invention to provide a sign, for producing a traveling luminous pattern, that shall require a relatively small number of luminous units and a relatively small selective contact system of simple structure.

In accordance with our invention, a luminous sign made up of a rectangular array of glow discharge devices of similar structure is pro-

vided. The form of the glow discharge devices used in our sign depends on the character of the display desired. Where a simple single line display is involved, each glow discharge device may be simply a longitudinal envelope having electrodes at its ends, and provided with an attenuated ionizable medium corresponding to the color desired. When a suitable potential is impressed between the electrodes, a luminous column corresponding to the length of the tube is produced. The tube may be of substantial length since there is no limitation as to the dissipation of heat. We have found, for example, that a tube 2 feet long may be used. Such a tube produces the same visual effect as a column of lamps two feet long and when the tube is used, substantially fewer contacts are necessary than for lamps.

Where a double line display is desired, each luminous unit is a tube in the form of a substantially closed plane curve such as a rectangle for example. When an array of such luminous units is energized selectively, a double line display is produced. In this case, also, the dimensions of the tube may be substantial. In a sign three feet high and twenty feet long according to our invention which we have found to operate successfully, 280 rectangular tubes are used. Each tube is six inches high by four inches long. For a similar sign three hundred feet long, the number of luminous units required is 5200. The dimensions of the last mentioned sign are comparable to the lamp sign in which 22,000 lamps are required. The selective control arrangement required in accordance with our invention is thus substantially smaller than that required for prior art signs. Still further saving in space and number of contacts may be effected in the practice of our invention by increasing the dimensions of the illuminating units.

The power consumption of our sign is also considerably smaller than that of an incandescent lamp sign. The usual illuminating unit according to our invention passes .015 ampere at 2000 volts; i. e., its power rating is 30 watts. The units of a corresponding lamp sign certainly have a higher power rating and in addition the number of units in the latter is several times as great as in our sign.

Finally it is to be noted that the height of a sign according to our invention may be increased by the simple expedient of increasing the height of the illuminating units. In the lamp signs additional lamps must be added.

For more elaborate displays, each unit may be composed of a plane curve tube, in the center of which one or more longitudinal tubes are disposed. The individual tubes of each unit may be filled with different ionizable media and thus a multi-colored display is achieved.

Regardless of the character of the sign, one of the significant features of our invention arises from the fact that it is made up of a large number of units of similar structure. Prior art electric discharge signs require a large number of tubes of different structures.

To control the excitation of the luminous units, we provide a pneumatic system. The contacts associated with the various units are actuated by diaphragms, the movement of which is selectively controlled from a system of suction tubes. The latter, in turn, are selectively opened and closed to the atmosphere by a tape which is perforated to correspond to the desired display.

The novel features that we consider charac-

teristic of our invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description when read in connection with the accompanying drawings, in which:

Figure 1 is a view in front elevation showing a preferred embodiment of our invention;

Fig. 2 is a view in end elevation of the embodiment shown in Fig. 1;

Fig. 3 is a view in front elevation of an illuminating unit used in the practice of our invention;

Fig. 4 is a view in side elevation of the illuminating unit shown in Fig. 3;

Fig. 5 is a view in front elevation of another unit used in the practice of our invention;

Fig. 6 is a view in side elevation of the illuminating unit shown in Fig. 5;

Fig. 7 is a diagrammatic view showing a section of a sign in accordance with our invention and the control equipment for operating the sign; and

Fig. 8 is a view in perspective showing a control system for a sign in accordance with our invention.

The apparatus shown in Figs. 1 to 7 comprises a vertical support 9 of the form customarily used in travelling signs on which an array of illuminating units 11 are mounted. Where words are to be displayed, as in the case in the Fig. 1 structure, the array should be at least five units deep and its length in units should correspond to the character of the display desired. At least five illuminating units are necessary along the vertical dimension to properly display such letters as M and X.

Each illuminating unit 11 comprises a glow discharge tube 13 in the form of a rectangle and a linear tube 15 disposed in the center of the region bounded by the rectangle. The envelope of the linear tube 15 is formed of a hollow bar of a transparent insulating material such as glass which is bent over at its ends so that a C-shaped structure results. Electrodes 17 are sealed through the bent over projections 19. During the course of its construction, the tube is exhausted and an ionizing medium, such as an inert gas or mercury at a low pressure is provided therein. The envelope for the rectangular tube 13 is formed of a hollow bar of a transparent insulating material. The ends of the bar are first bent at right angles as in the case of the linear tube. Thereafter the bar is bent at right angles to the bent over end projections 21 at three points which are so selected that the projections 21 lie adjacent to each other at right angles to the plane of the substantially closed rectangle which is bounded by the tube. Electrodes 23 are sealed through the projections 21 and a suitable ionizing medium is provided within the envelope after it has been exhausted.

Preferably, the radiant energy emitted from the linear tube 15 when it is energized should be of a different color from that emitted from the rectangular tube 13. To achieve this object, different ionizing media are used in the tubes. For example, mercury may be used in the linear tube 15 to produce a blue discharge while neon may be used in the rectangular tube 13 to produce an orange-red discharge.

The tubes 13 and 15 are mounted on the support 9 with their right angle projections 19 and 21, respectively, extending horizontally through

the support. Conductors 25 and 27, in each case, interconnect the electrodes 19 and 23, respectively, and a transformer 29 through which the units 11 are energized. Each transformer 29 comprises a primary 31 and a plurality of secondaries 33 and 35. The electrodes 17 of the linear tube 15 are connected, in each case, across one of the secondaries 33 while the electrodes 23 of the corresponding rectangular tube 13 are connected across another secondary 35.

The tubes 13 and 15 are energized by connecting the primaries of the corresponding transformers 29 across the line conductors 37 of a power source (not shown) which may be of the usual commercial, 60-cycle type. For this purpose, a contact device 39 is associated with each of the primaries 31. The movable element 41 of the contact device 39 is actuated by a rod 43 secured to a movable diaphragm 45 and engages or disengages the cooperative fixed element 47 in accordance with the movement of the rod. The circuit for each illuminating unit 11 extends from one of the line conductors 37 through the fixed element 47 of the corresponding contact device 39, the movable element 41 of the contact device, the primary 31 of the transformer 29 to the other line conductor 37. In Fig. 7, the circuits through the two left hand units 11 are shown as closed and the circuit through the upper right hand unit is shown as open.

The excitation of the illuminating units is controlled from a suitably perforated tape 49. The tape 49 may be of ordinary paper, a cellulose web, or it may be of a paper made up of a phenolic condensation product. It is wound on a continuous reel 51 and rides on horizontal rollers 53 journaled in blocks 55 secured to a ring shaped base 57. The tape is held on the reel between horizontal strips 59 pivotally secured to studs 61 extending from the outer blocks 55 and vertical flanged rollers 63 journaled in the base 57. The strips 59 may be turned about the studs 61 to permit insertion or removal of the tape 49.

The tape 49 is advanced through a gate 64 by a plurality of motor-driven friction rollers 65 and 67 between which it is compressed. The lower roller 67 is mounted on fixed bearings 69 and is rotated by a motor 71. The upper roller 65 is mounted in bearings 73 slidable radially relative to the lower roller 67 and is urged towards the lower roller by springs 75 which engage the bearings 73.

The tape 49 is advanced from the inner periphery of the toroid within the reel 51 over deflecting idlers 77 which are mounted on the base 57 at proper angles to the base. Near the gate 64 it passes over a fixed idler 79 mounted on the gate support and under a gravity idler 81 pivotally supported from the fixed idler. The gravity idler 81 maintains the tape taut as it advances through the gate. On leaving the friction rollers 65 and 67, the tape 49 passes into a loop 83 whence it passes over guiding idlers 85 and is wound on the outer periphery of the toroid.

The gate 64 comprises a perforated guiding block 87 adjacent to which a perforated supporting block 89 is removably mounted. The blocks 87 and 89 may be mounted on suitable brackets which are not shown because they do not concern the present invention and the movable block 89 may be supported, hinged or slidable on the brackets in the same manner as in a motion picture gate. The guiding block 87 is provided with longitudinal flanges 91 which limit the lateral

movement of the tape 49. The supporting block 89 is provided with a central longitudinal raised portion 93 of the same width as the recessive portion of the guiding block 87. When the gates 87 and 89 are disposed adjacent to each other, the flanges 91 extend over the raised portion 93 and between them there is a narrow slot through which the tape advances. The supporting block 89 may be disengaged from the guiding block 87 to facilitate the threading of the tape 49 in the apparatus.

The perforations 95 and 97 in the block 87 and 89, respectively, are coextensive. They are arranged in a pattern corresponding in form to the illuminating units 11. The openings 95 and 97 are thus five deep and their number in length is equal to the number of illuminating units along the corresponding dimension.

From each of the openings 95 in the guiding block 87 a tube 99 extends. Each tube 99 communicates with an air-tight container 101, one surface of which is the flexible diaphragm 45 to which the rod 43 is secured. The containers 101 are, in turn, all in communication with a conductor 103 leading from a suction pump 105 of any well known structure, which is operated by the motor 71, whereby the tape is advanced. The diaphragm container 101 is, of course, only one of a number of contrivances which may be used in the practice of our invention. The containers 101 may, for example, be replaced by Sylphons or bellows of suitable structure.

As the tape 49 advances between the perforated blocks 87 and 89, certain of the perforations 95 and 97 in the blocks are maintained closed while others are open because perforations 107 in the tape coincide with openings in the blocks. When an unperforated portion of the tape is disclosed between the perforations 95 and 97 in the blocks 87 and 89, respectively, the pump 105 withdraws the air from the corresponding container 101 and the corresponding diaphragm 45 recedes, opening the corresponding contact 39. When a perforation in the tape is coincident with coextensive openings in the blocks, air flows into the corresponding container 101 and the diaphragm 45 is urged outwardly so that the corresponding contact 39 is closed. The transformers 29 and the illuminating units 11 with which they are associated are thus energized or deenergized in accordance with the positions of the perforations in the tape and a display corresponding to the perforations is produced.

While the use of the suction contact control has many advantages in the practice of our invention, our invention in its broader aspects contemplates the use of contact controls of other types. For example, pressure contact control may be applied or the contact rods may be mechanically actuated by a tape which is in direct engagement with their free ends.

The suction contact control may, in accordance with the broader aspects of our invention, be used with illuminating units of other types than those disclosed and such use is contemplated as falling within our invention.

Although we have shown and described certain specific embodiments of our invention, we are fully aware that many modifications thereof are possible. Our invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

We claim as our invention:

1. In combination an array of elongated glow discharge devices of similar structure arranged

in columns and rows each of said devices being capable of producing a luminous column when energized and means for selectively energizing said devices in a predetermined sequence to produce the effect of a moving display, a plurality of said devices from different columns and rows of said array being combined to produce each single separately identifiable element of said display.

2. In combination an array of elongated glow discharge devices of similar structure arranged in columns and rows with their long dimension extending vertically, each of said devices being capable of producing a luminous vertical column when energized and means for selectively energizing said devices in a predetermined sequence to produce a moving display of letters, numbers and figures, a plurality of said devices from different columns and rows of said array being combined to produce each letter, number or figure of said display.

3. In combination an array of elongated glow discharge devices of similar structure arranged in vertical rows of at least five devices with their long dimension extending vertically, each of said devices being capable of producing a luminous vertical column when energized and means for selectively energizing said devices in a predetermined sequence to produce a moving display of letters, numbers and figures, a plurality of said devices from different columns and rows of said array being combined to produce each letter, number or figure of said display.

4. In combination an array of glow discharge units arranged in columns and rows each of said units consisting of a plurality of glow discharge devices, at least one of which is elongated, a transformer having a single primary and a plurality of secondaries corresponding in number to the devices in each of said units associated with each unit, means for connecting a secondary of each of said transformers to a glow device of each of said units and means for selectively energizing the primaries of said transformers to produce a luminous display, a plurality of said units from different columns and rows of said array being combined to produce each single separately identifiable element of said display.

5. In combination an array of elongated glow discharge devices of similar structure arranged in columns and rows each of said devices being capable of producing a luminous column when energized and means for selectively energizing said devices to produce a moving display, a plurality of said devices from different columns and rows of said array being combined to produce each single, separately identifiable element of said display.

6. In combination an array of glow discharge units arranged in columns and rows each of said units consisting of a plurality of glow discharge devices, at least one of which is elongated, a transformer having a single primary and a plurality of secondaries corresponding in number to the devices in each of said units associated with said unit, means for connecting a secondary of each of said transformers to a glow device of each of said units and means for selectively energizing the primaries of said transformers in a predetermined sequence to produce a luminous moving display, a plurality of said units from different columns and rows of said array being combined to produce each separately identifiable element of said display.

7. In combination an array of glow discharge

units arranged in columns and rows each of said units consisting of a plurality of glow discharge devices, at least one of which is elongated, each of the devices of each of said units having a different ionizable atmosphere so that when said devices are energized each unit is a luminous configuration of a plurality of colors, a transformer having a single primary and a plurality of secondaries corresponding in number to the devices in each of said units associated with said unit, means for connecting a secondary of each of said transformers to a glow device of each of said units and means for selectively energizing the primaries of said transformers in a predetermined sequence to produce a luminous moving display, a plurality of said units from different columns and rows of said array being combined to produce each separately identifiable element of said display.

8. In combination an array of glow discharge devices of similar structure arranged in columns and rows each of said devices comprising an envelope having at least one bend therein and when energized capable of producing a luminous band of corresponding form and means for selectively energizing said devices in a predetermined sequence to produce a luminous moving display, a plurality of said devices from different columns and rows of said array being combined to produce each single, separately identifiable element of said display.

9. In combination an array of glow discharge units arranged in columns and rows each of said units consisting of a plurality of glow discharge devices, at least one of which is elongated, corresponding devices of different units being of the same structure, a transformer having a single primary and a plurality of secondaries corresponding in number to the devices in each of said units associated with said unit, means for connecting a secondary of each of said transformers to a glow device of each of said units and means for selectively energizing the primaries of said transformers in a predetermined sequence to produce a luminous moving display, a plurality of said units from different columns and rows of said array being combined to produce each separately identifiable element of said display.

10. In combination an array of glow discharge devices of similar structure arranged in columns and rows each of said devices comprising an envelope substantially in the form of a closed plane curve and when energized capable of producing a luminous band in the form of a plane curve and means for selectively energizing said devices in a predetermined sequence to produce a luminous moving display of double lined letters and numbers, a plurality of said devices from different columns and rows of said array being combined to produce each letter or number of said display.

11. In combination an array of glow discharge devices of similar structure arranged in columns and rows each of said devices comprising an envelope substantially in the form of a closed plane curve and when energized capable of producing a luminous band in the form of a plane curve and means for selectively energizing said devices to produce a luminous display of double lined letters and numbers, a plurality of said devices from different columns and rows of said array being combined to produce each letter or number of said display.

12. In combination an array of glow discharge units arranged in columns and rows each unit

consisting of a glow discharge device comprising an envelope substantially in the form of a closed plane curve within which a glow discharge device comprising a substantially linear envelope is disposed, each unit when energized producing a luminous plane curve with a luminous band therein, and means for selectively energizing said units to produce a luminous display, a plurality of said units from different columns and rows of said array being combined to produce each single, separately identifiable element of said display.

13. In combination an array of glow discharge units arranged in columns and rows each unit consisting of a glow discharge device comprising an envelope substantially in the form of a closed plane curve within which a glow discharge device comprising a substantially linear envelope is disposed, the ionizable gases within said curve and linear envelopes being different, each unit when energized producing a luminous plane curve with a luminous band of a color different than the color of said curve therein, and means for selectively energizing said units to produce a luminous display, a plurality of said units from different columns and rows of said array being combined to produce each single, separately identifiable element of said display.

14. In combination an array of glow discharge units arranged in columns and rows each unit consisting of a glow discharge device comprising an envelope substantially in the form of a closed plane curve within which a glow discharge device comprising a substantially linear envelope is disposed, the ionizable gases within said curve and linear envelopes being different, each unit when energized producing a luminous plane curve with a luminous band of a color different than the color of said curve therein, and means for selectively energizing said units in a predetermined sequence to produce a luminous moving display, a plurality of said units from different columns and rows of said array being combined to produce each single, separately identifiable element of said display.

15. Apparatus according to claim 12, characterized by the fact that with each unit a transformer having a primary and at least two secondaries is associated, said secondaries being connected each to a glow discharge device of the corresponding unit and by means for selectively supplying current to the primaries of said transformers to selectively energize said units.

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