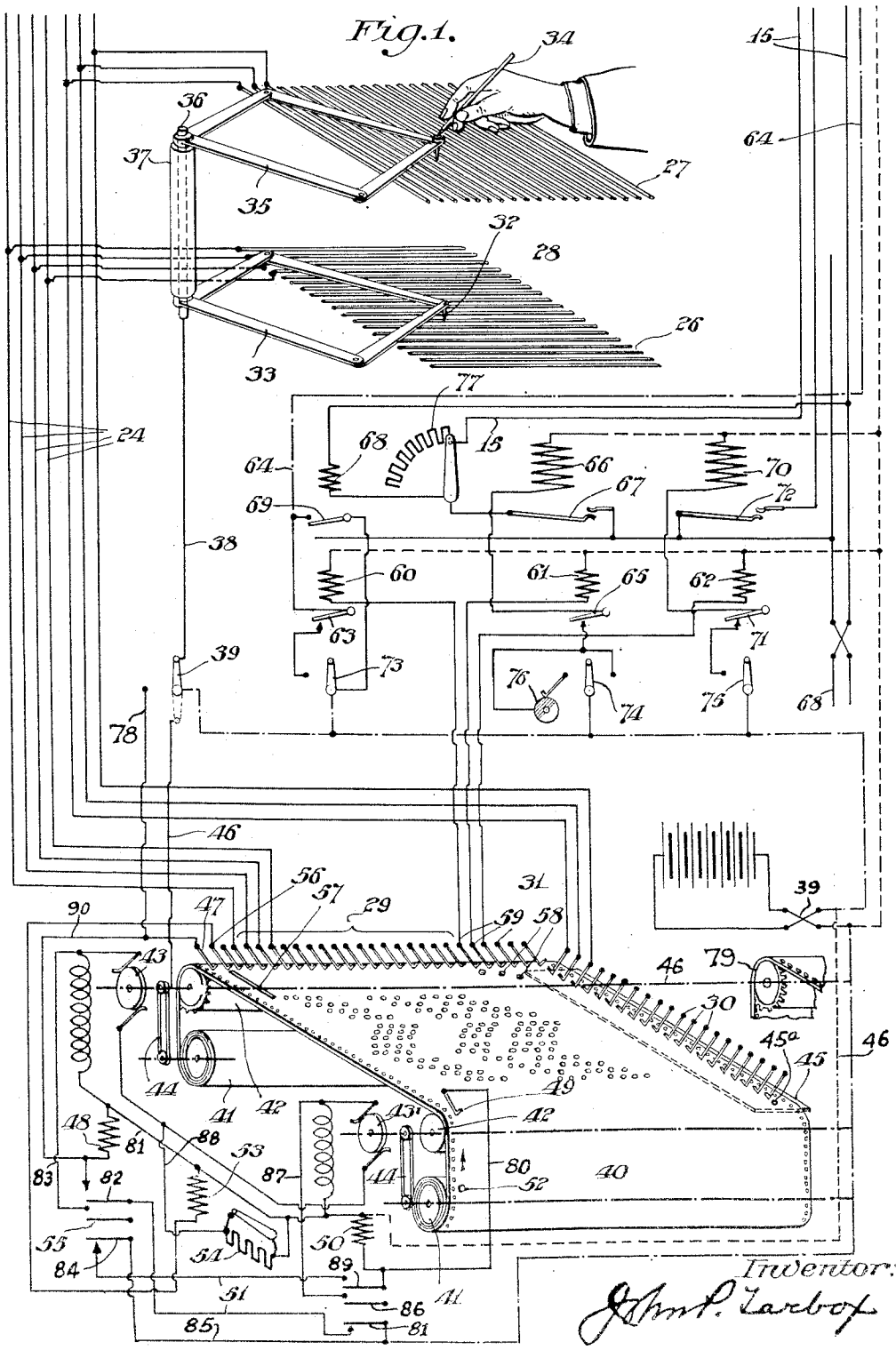
July 3, 1934. J. P. TARBOX 1,965,206

ELECTRIC DISPLAY SYSTEM

Filed March 10, 1928 4 Sheets-Sheet 1

Fig. 1.



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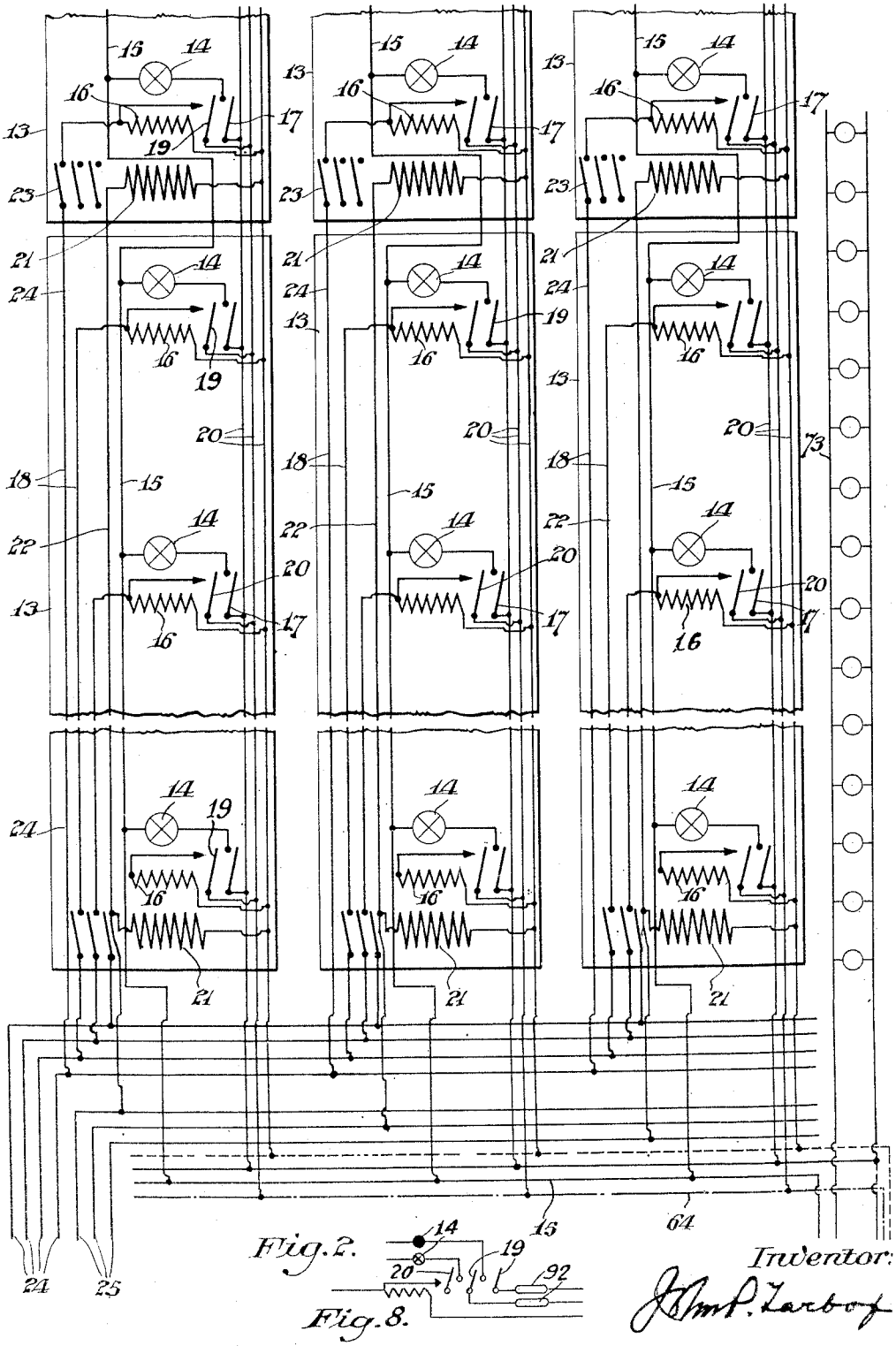


Fig. 2.

Fig. 8.

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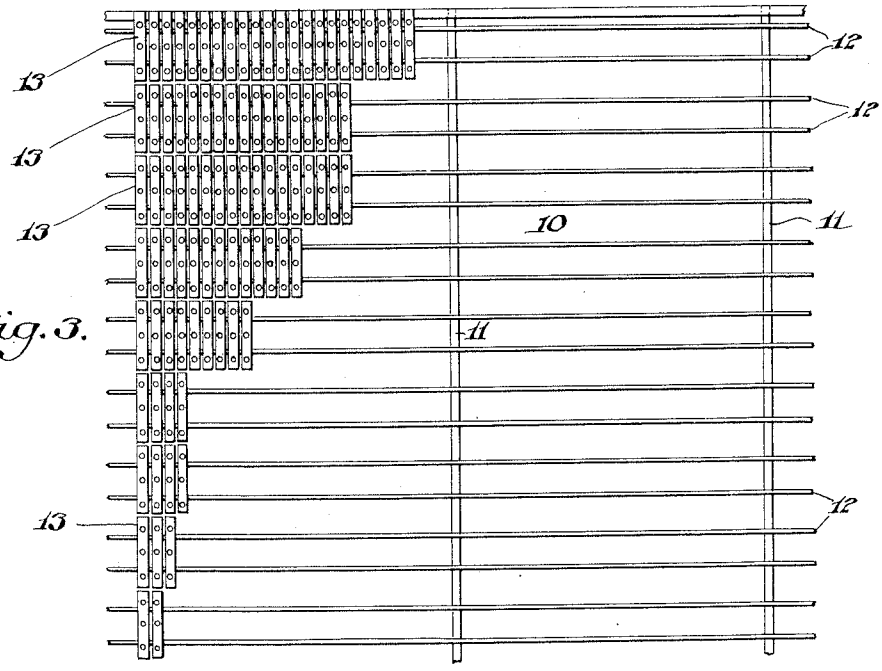


Fig. 3.

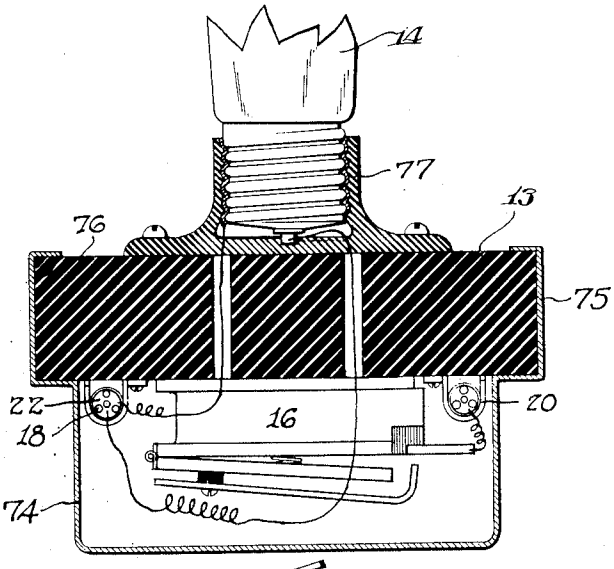


Fig. 4.

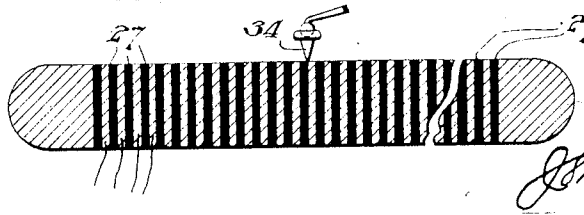


Fig. 5.

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Filed March 10, 1928 4 Sheets-Sheet 4

Fig. 6.

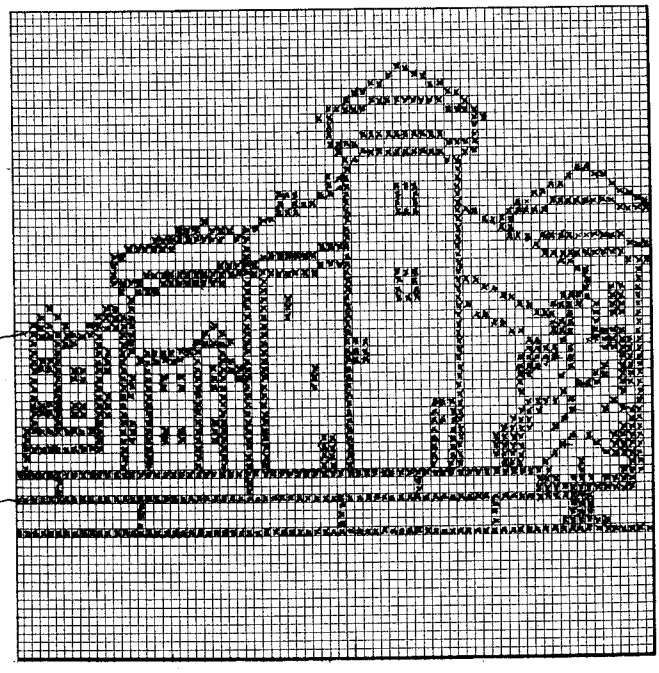
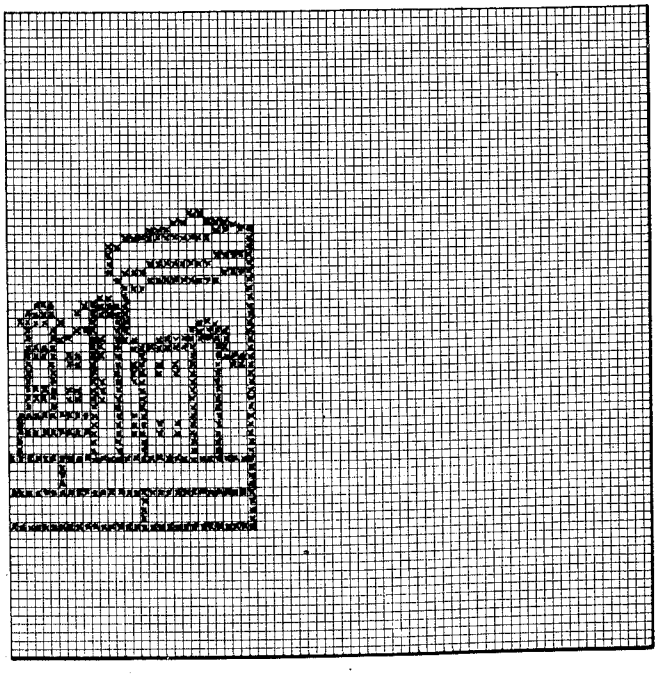


Fig. 7.



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Patented July 3, 1934 1,965,206

UNITED STATES PATENT OFFICE

1,965,206

ELECTRIC DISPLAY SYSTEM

John P. Tarbox, Philadelphia, Pa.

Application March 10, 1928, Serial No. 260,705

7 Claims. (Cl. 177—350)

My invention is an electric display system of the outdoor display type. It is of special adaptation to those display systems in which the display is composed of combinations of incandescent lamps or other individual lamps.

Its object is the display in such a system of pictures of objects rather than letters as is the common practice.

Its aim is to control the display of such pictures either manually through a drawing board upon which an operator draws the pictures or automatically through a scroll of the order of the piano player or typewriter duplicator scroll.

Other aims are the retention and control of the display after it is set up or made. Thus, the picture may be set up and subsequently displayed as a whole or it may be in effect unrolled from any side of the display board or reversely as between one side and another. Else it may be flashed on and off after its production, etc.

Of the drawings—

Figure 1 is a general diagrammatic representation of the control circuits both manual and automatic.

Figure 2 is a general diagrammatic representation of the circuits of the display board per se.

Figure 3 is a diagrammatic illustration of the mechanical structure of the display board.

Figure 4 is a cross section of one of the lamp boxes.

Figure 5 is a cross section of a portion of the manual control drawing board.

Figure 6 is a diagrammatic illustration of a picture as produced in entirety.

Figure 7 shows the same picture in process of unrolling as it were from the left side of the display board.

Figure 8 is a diagram of the circuits of lamp relays equipped with duplex contacts 19 and connected respectively to lamps 14 of different color.

Referring first to Fig. 3, the display board itself comprises the structural iron framework 10 composed of vertical members 11 and horizontal stringers 12. Arranged in picket formation on the pairs of stringers 12 vertically are a number of series of elongated lamp boxes 13. These lamp boxes are in cross section of the form shown in Fig. 4. They are relatively narrow, from three to six inches in width and relatively long, from four to eight feet long. On each is mounted a single row of electric lamps. But three are shown for the purposes of clarity but actually there are about three lamps to each foot, which is to say, twelve lamps on a four foot box and twenty-four lamps on an eight foot box. The boxes are spaced apart like the pickets of a fence so as to relieve the wind pressure, but are yet placed so close that corresponding lamps of adjoining boxes form squares, in the example cited, four inch squares. The boxes of the successive series from top to bottom are arranged in alignment with each other. Thus, the lamps four inches apart are located on the board according to a system of rectangular coordinates, the same lamps in vertical and in horizontal rows. Diagrammatically illustrated in Figs. 6 and 7, each square of the diagram shown represents a lamp. In the five inch diagram are represented sixty-four hundred lamps, eighty rows of eighty each. This would represent eighty vertical rows of boxes of the series 13 and each row of which has vertically eighty lamps. The picture shown in Figs. 6 and 7 is formed by the lighting of the lamps in those squares in which an "x" is placed. These lamps are lighted over the control circuits shown in Figs. 1 and 2.

The control circuits for these lamps are diagrammatically illustrated in Fig. 2. The individual lamps are designated 14. The lamps are lit from power mains 15 which run vertically through the elongated boxes of the rows. Their connection with these power mains is controlled by lamp relays 16, one individual to each lamp. The control is through normally open contact 17, closed when the relay is energized. The relays in turn are individually controlled over control circuits 18 individual to the respective relays 16. Each relay, when energized over its individual circuit 18, is locked up by contact 19 to the common low voltage circuit 20 which supplies all of the relays.

The individual lamp relays, however, are in turn controlled in groups from group control relays 21. The individual relays of each vertical row of display boxes are controlled by the group relays 21 of that vertical row. There is one of these relays 21 for each display box 13, but the relays 21 of all the display boxes in that vertical row are energizable in parallel over common conductor 22. The circuits 18 of each display box 13 are separately controlled by the multiple normally open contacts of the group relay 21. Control circuits 18 are normally open at contacts 23.

Contacts 23 of the group controlled relays receive energy over the control board multiples 24. These multiples 24 are connected in parallel with the contacts 23 of the respective vertical rows as clearly shown. On the other hand, the group relays 21 receive their energy from

the control multiples 25 not through multiple connection of the vertical rows, but through an individual connection of the group relays of each vertical row with an individual one of the multiples 25.

The lamp relay multiples 24 and the group relay control multiples 25 extending respectively to the horizontal and vertical sections 26—27 of the manual control or drawing board 28 and to the corresponding portions 29—30 of the automatic scroll control 31, are all shown in Fig. 1. The portions 26—27 of the manual control or drawing board are at different levels spaced apart in orthogonal projection. They are coextensive. Each is composed of a series of metallic bars lying close together but spaced apart by insulating material as shown in detail in Fig. 5. In the one 26 there is a number of bars equal to the number of individual lamps in each vertical group, from top to bottom of the display board. In the other there is a number of bars equal to the number of groups of lamps from left to right of the board. But the bars of the section 26 are horizontally arranged while those of the section 27 are vertically arranged as we look at the perspective of the diagram. The bars are connected to those multiples 24—25 respectively, which connect individually with the individual lamps or the individual groups in the display board which correspond in coordinate position on the display board with the coordinate position of the bars in the control board 28. Coacting with the bars of section 26 is a common contact 32 having an end which may be slidably moved over the bars in any direction. This contact is carried by a pantograph movement 33. A similar common contact 34 coacts with the section 27 of board 28 in a similar manner and is borne by a similar pantograph 35. The two pantographs are mechanically connected to be moved in unison by the manipulation of either one, the one 34 is illustrated. This mechanism comprises concentric axes 36 and 37. Corresponding arms of pantographs 33 and 35 are connected to the same axis of the pair 36—37 and opposite arms to different axes. The axes 36—37 and the contacts 32—24 directly are connected to positive battery through lead 38 governed by manual control switch 39. The switch 39 being closed and contacts 32—24 moved over the faces of the two sections 26—27 of the control board 28, relays 16 and 21 are variously energized group by group and lamp by lamp of each group in rectangularly coordinated order in precise accordance with the coordinated relation of the common contacts 32—34.

The automatic control comprises a perforated scroll 40 wound at its opposite ends over storage rolls 41. Intermediate the storage rolls and adjacent them, it is engaged by actuating rolls 42 provided with teeth which engage in perforations in the margins whereby the scroll 40 is positively driven. Driving rolls 42 are driven by individual electric motors 43 diagrammatically illustrated as directly connected but which, of course, are connected through appropriate gearing. Motors 43, 43' are positively geared to rolls 42. They impositively through the slip belt or similar gear 44 drive the storage rolls 41. By proper excess ratio on connection 44, the scroll 40 may be always kept in proper tension and freed of slack. The rolls 42 are of conducting material, and coacting with one of them is a row of brushes 29 arranged transversely of the scroll 40, one brush for each longitudinal row of perforations of the roll. Coacting with one margin of the scroll 40 inwardly of the roll of driving perforations is another series of brushes constituting the section 30 of the automatic control. The section 29 contains a number of brushes corresponding to the number of individual lamps in each vertical group. Section 30 contains a number equal to the number of vertical groups. Beneath the brushes of section 30 is a single longitudinally extending conductor bar 45 with which any one of the brushes may contact if a perforation 45a passes longitudinally beneath it. Thus, the lamps 14 may be energized in rectangularly coordinated order, the individual lamps of the groups through transverse rows of perforations in the scroll 40 enabling brushes 29 to contact with roll 42, and the groups consecutively by a single perforation in line with the row of brushes 30 and successively as it passes beneath them permitting the individual brushes of the group 30 to contact with conductor 45, successively energizing the vertical groups. Battery is supplied to common conductors 42—45 through lead 46 connecting with the remaining pole of the double throw switch 39 and therethrough with positive battery.

Motors 43, 43' are controlled from the scroll 40 itself, the one from brush 47 which controls its circuit through locking relay 48 and the other from brush 49 which controls its circuit through locking relay 50. The locking circuit 51 of each relay is through a normally closed contact opened by the other when energized. Two perforations one near each terminal end of the roll 40 coact with the brushes 47—49 and are diagrammatically illustrated by the single perforation 52, misplaced for the sake of clarity. When the perforation 52 at that end of the scroll 40 adjoining brush 49 reaches brush 49 in the direction shown in the arrow, relay 50 is energized opening the circuit of motor 43, (which we will assume was heretofore in action) by opening its locking circuit 51 and simultaneously closing the circuit of motor 43' and thereby reversing the movement of the roll. The movement continuing in the opposite direction until the opposite terminus of the roll 40 approaches brush 47, relay 48 is in turn energized de-energizing relay 50 cutting out motor 43' and again energizing motor 43, again reversing the movement of roll 40. The circuit of relay 50 is closed from positive battery received from the roll 42 driven by motor 43' through brush 49, conductor 80, relay 50 and to negative battery. The circuit of motor 43' is closed thereby at its intermediate contact 86 which is connected with positive battery as shown, and extends through conductor 87 the motor 43', and common conductor 88, through resistance 54 to negative battery. Simultaneously with closing this circuit of motor 43' relay 50 opens the circuit of motor 43 at its lower-most contact 81. This is accomplished by opening the locking circuit 51 of relay 48, which locking circuit was previously closed by relay 48 at its contact 82. Simultaneously relay 50 closes a locking circuit for itself by way of contact 89, the upper locking circuit 51, and the back contact 84 of relay 48 and conductor 85 to positive battery. When a perforation 52 located at the opposite end of the scroll 40 reaches brush 47, relay 48 is again energized. This energization is over brush 47 from positive battery at the roll driven by motor 43, conductor 90, relay 48, common conductor 81, and negative battery by way of conductor 46. Motor 43 is energized from contact 55 which receives positive battery from

connection 85 and transmits current over conductor 83 to the motor and from thence by common conductor 88 and resistance 54 to negative battery. Relay 48 unlocks relay 50 at its lowermost back contact 84 and simultaneously closes its own locking circuit by way of contact 82. The nature of the brushes 29 with their bent ends is such that the roll may proceed in either reverse or obverse directions with equal facility. The speed of operation of the rolls and thereby the dwell of any picture display is controlled by a relay 53 which by operation of its armature 53' cuts into and out of series connection with motors 43—43' a resistance 54. Relay 53 has its circuit controlled from a brush 56 shown adjoining brush 47 and contacting on occasion with the conductor drive roll 42 through elongated slot-like perforations such as 57 shown. Resistance 54 being normally out of circuit, its introduction into the circuit through the energization of relay 53 will slow up the driving motor 43 or 43' very greatly and thereby effect a dwell of a given display.

During this dwell the display may have its quality variably controlled. In the longitudinal extent of the slot 57, there are provided in roll 40 no perforations cooperating with the brushes 29 or with the brushes 30. But there are provided perforations 58 cooperating with brushes 59 in alignment with those of the row 29. These perforations which may also be slot-like in character control respectively the relays 60—61, 62. Relay 60 when energized will open the normally closed contact 63 through which it controls the application of positive battery to the common terminal conductor 64 of all of the locking lamp relays. Thereby the entire display originally set up through roll 40 may be extinguished.

Relay 61 through its normally closed contact 65 controls the application of positive battery to circuit breaker 66. This circuit breaker through its contact 67 controls the application of power through the relay 68 to one side of mains 15. By energizing relay 61 through a perforation in roll 40 the lamps normally illuminated may be extinguished. This is entirely independent of the extinguishing action incident to the removal of common battery from lamp relays 16 through relays 60. But it is undesirable to break the lamp circuits by the contacts of the relays 16, for this introduces undue wear and uncertainty in the action of these relays. Therefore, as long as circuit breaker 66 is energized, there is also energized through its contacts 67 a relay 68 supplemental to relay 60. Relay 68 as long as energized retains closed its contact 69 in parallel to contact 63, effectually preventing unlocking of relays 16 until after circuit breaker 66 has taken the power from mains 15 and relieved the relays 16 of power current.

Relay 62 controls circuit breaker 70 through its contacts 71. Circuit breaker 70 by its contacts 72 applies and removes power from the border or letter display of the sign board designated in Fig. 2, 73. Thereby during the dwell of any picture display the fixed letter or border display may be changed as desired merely by providing an appropriate perforation 58 to coact with the appropriate brush 59.

These same variations of quality of the display may be effected manually in connection with the manual control of the board 28 or indeed, in connection with the automatic control just described. To this end a series of individual control switches 73—74—75 are arranged in parallel with the contacts of the relays 60—61—62, respectively. In connection with the flash control of relay 61 and switch 74 is a flashing commutator 76 which may be cut in by switch 74 through movement to an alternate position thereby alternately energizing and de-energizing the circuit breaker 66. In connection with the circuit breaker 66 and the mains 15 is a dimming device 77 in the form of a resistance by means of which the illumination of the picture display may be alternately raised and lowered.

Now trace any group relay circuit from the pantograph control Fig. 1. It starts at the positive battery lead 38, and extends through pantograph center 37, pencil 34, a bar 27, a conductor 25, (Fig. 2), and relay 21—(say the left lowermost one of Fig. 2) and thence to negative battery via the dotted line battery bus. Relay 21 cuts onto multiples 24 all the individual lamp relays 16 of its panel group. Simultaneously lower pantograph pencil 32 cuts in the lamp relay corresponding to its position, via the same positive battery bus 38, a bar 26, a multiple 24, (Fig. 2) and say the second relay 16 from the bottom on the left lower panel, and thence also to the negative battery bus indicated in dotted lines. Relay 16 pulling up locks itself by contact 20 to positive line 20^a of battery bus 64—shown in dot and dash at the bottom of the figure. By contact 17—it closes the circuit of its lamp 14 to power, thus: from power source 68 (Fig. 1 and Fig. 2) contact 17, lamp 14, power line 15 (Fig. 2 and Fig. 1) circuit breaker contact 67, and back to the source 68. So any group, and any individual lamp of a group may be energized, one group and one individual lamp of the group being energized for each position of the pencils 32 and 34. Clearly through the rectangularly coordinated system of manual or of automatic control I may illuminate the board according to any design whatsoever within its scope, it being possible to individually illuminate and control any light anywhere in the whole board. Arranged as illustrated, I may control 10,000 lamps, a board about 35 feet square, by 200 small leads, a cable not much bigger than one's thumb.

An artist has but to draw with the point 34 upon the upper level 27 of the control board 28 whatever picture he may desire and it is faithfully reproduced upon the display board, the lamps of the board in this instance being illuminated one by one as the point 34 and the point 32 cross the projected inter-sections of the coordinate bars of the board.

The scroll 40 and its contacts 29, 42 and 30, 45 are in parallel with the pantograph 28. They similarly control the groups and the lamps over identical circuits except that positive battery instead of following lead 38, follows lead 46 and thence passes through the contacts 42, 29 and 45, 30 of the individual and group rows.

In the instance of the scroll control 31 the display will be evolved either from the right or from the left of the board according to the then direction of motion of the roll 40. The illumination will be according to the vertical rows progressively, all lamps of each row to appear in the picture being simultaneously illuminated. The effect is as if a scroll containing the picture were being unrolled. But a single perforation 45^a controls the progress from group to group over the brushes 30.

Each picture may be individually flashed or dimmed or otherwise controlled and the remainder of the display board in form and in sub-

ject matter simultaneously or otherwise controlled through either manual or automatic control.

The manual control is by the switches 73, 74 and 75 which respectively control the application of positive battery to locking line 64 and circuit breakers 66 and 70—and these latter respectively control the cutting out of the exhibit, its cutting on and off, dimmed or undimmed by resistance 77, and the cutting on and off of the fixed exhibit, for breakers 66 and 70 control by contacts 67 and 72, the connection of power line 15 and the lamps 73 to the power source 68. Commutator 76 may be cut in by switch 74 to flash the exhibit acting on circuit breaker 66. All the latter vary the quality of the display.

The automatic variation of quality is through relays 60, 61 and 62 and scroll controlled contacts 59. Through perforations 58 positive battery is variably put onto contacts 59 and relays 60, 61 and 62 variably energized to variably open and close at contacts 63, 65 and 71, the quality control circuits of switches 73, 74 and 75 as just now set forth. As heretofore stated, groups of quality control perforations are simply intervened on the scroll 40 between groups of picture set up perforations. Brushes 59 coact with the scroll in either forward or backward movement. The proper perforations to control quality immediately precede and follow the groups of picture perforations, but obviously they can flank such groups and quality changes can be made during the set up itself if desired.

The number of pictures automatically displayable from any roll 40 depends only upon the length of the roll. They follow each other successively in reverse and obverse direction depending upon the direction and motion of the roll. Inasmuch as the speed of travel is greatly reduced during the dwell period, the length of the roll is kept within reasonable bounds and is principally occupied by the picture display itself. A single picture may be completely displayed through but one or two feet of length of the roll and the quality control exercised through but three or four inches additional.

Nor is the display limited to pictures for obviously any subject matter whatsoever, in whatsoever type one may desire, may be displayed with the same facility as a picture.

In Fig. 4 is shown but a practical construction for the lamp boxes. The box is in the form of an elongated metal channel 74.

The upper edges of the side walls are offset at 75 to receive an insulating base board and cover 76 of pitched wood or other insulating material. This is simply slid in from one end. On its face are mounted the lamps 14 in sockets 77. Leads from lamps pass through the board within the box. The various leads 18—22, etc., are run in group form on either side of the magnets beneath suitable clips. The ends of the boxes may be closed in any suitable manner (as by means of covers not shown).

By making every other lamp of color instead of white, and staggering the colors as between the rows, two colors may be used in interspersed squares. Placing the lamps fairly close together will enable the use of either color in any particular picture. But one set of relays 16 is needed, an extra contact being placed on the relay for the extra color in each case. Two colors may be independently controlled. A single such relay is shown in Figure 8 with its lamp contacts 17 duplicated and one connecting to white lamp 14, and another to a red lamp 14', and each being connected independently through switching device 92 with the source of power. It is intended that this diagrammatically illustrated connection 92 shall be the equivalent of the connections of the power circuit 15 to the source.

Manual control board 28 may include a third section in the form of an actual drawing board or pad of sheets of paper in orthogonal relation to the two sections 26—27 and mechanically related to them through a pantograph connected with the same axes 36—37. This enables actual pencil drawings to be made on the board or on the special paper and retained if desired. Of course, the actual drawings are expected to be made upon the section 27 in fluid flowing from the contact 34 or by suitable conducting pencil, the drawing in each case being removed before a succeeding drawing is placed on the board.

The relay controls 60—61—62 are by means of contacts 63—65—71 in series with the manual contacts 73—74—75 rather than in parallel since when the automatic control board 29 is not energized, it is desired that contacts 63—65—71 close their circuits and the circuits be subject entirely at that time to the manual control 73—74—75. The special starting circuit 78 in the path of switch 39 preliminarily pulls up the proper one of the relays 48, 53 to institute operation of the scroll 40.

A duplicate scroll 79 is shown operated from the same control system utilized in operating the one. On other large boards such duplicate scrolls may be operated in synchronism so as to govern the whole board from one motor control system in synchronized fashion. Thereby the pictures are produced in sections in unison and the whole displayed in complete harmony. In connection with the obverse and reverse movements of the scroll, it will be of advantage to repeat the quality control perforations such as 57—58 at each end of a given area of perforations so that the same quality control is had at the termination of each display whether effected from one side of the board or the other, in one direction of scroll 40 or the other. This is very simply effected by appropriate provision of control for relays 60—65—62 in the proper order, for duplicating the control 57 and the like.

While I have shown and described several modifications which embody the generic invention, I do not wish to limit myself to the particular constructions shown, but desire to cover such other modifications and changes as clearly fall within the spirit and scope of the appended claims.

What I claim as new and useful and desire to protect by Letters Patent is:

1. An electric display system comprising display lamps, a high voltage power circuit therefor, low voltage relays controlling the connection of the lamps to the power circuit, relay locking circuits, and electro-magnetically actuated means maintaining the locking circuits closed as long as the lamps are energized from the high voltage circuit which means is itself actuatable from the high power voltage circuits.

2. In combination, electric display lamps, a traveling controller for variably illuminating said lamps having high speeds and low speeds, means whereby the controller initially determines the illumination at high speed, and means operable during low speeds thereof to vary the quality of the display set up.

3. An electric display system comprising a lamp display board, lamp relays individually control-

ling the lamps and having locking circuits, means controlling the locking circuits, a power circuit for the lamps and means operated therefrom rendering the locking circuit control means ineffective when the power is on.

4. An electric display system comprising a lamp display board, individual lamp relays controlling the application of power to the lamps, a relay control circuit, a lamp power circuit, and means operated from the power circuit locking the relay control circuit against operation while the power is on.

5. An electric display system comprising a display board of rectangularly coordinated lamps, and control means therefor comprising superimposed rectangularly coordinated conductors corresponding in linear arrangement to the linear arrangement of the coordinated rows of lamps, independent contact points playing over said groups of conductors and a parallel motion mechanism between said contact points.

6. An electric display system comprising a display board of rectangularly coordinated lamps, and control means therefor comprising superimposed rectangularly coordinated conductors corresponding in linear arrangement to the linear arrangement of the coordinated rows of lamps, independent contact points playing over said groups of conductors and a parallel motion mechanism between said points in the form of pantograph connection between said contacts whereby movement of one is identified with the movement of the other.

7. An electric display system comprising a display board of rectangularly coordinated lamps and control means therefor comprising superimposed rectangularly coordinated conductors corresponding in linear arrangement to the linear arrangement of the coordinated rows of lamps, independent contact points playing over said groups of conductors and a parallel motion mechanism between said contact points, together with a unitary traveling surface controller for said display board having longitudinally arranged fixed brushes connected in multiple with one group of said coordinated conductors and exercising group control of the lamps of said display board in the direction of travel of said controller, and having a transversely arranged fixed set of brushes connected in parallel with the other group of said coordinated conductors and exercising individual control of the lamps of said board transversely of the direction of travel of said controller.

JOHN P. TARBOX.