M. R. HUTCHISON.

ELECTROGRAPHIC DISPLAY APPARATUS AND METHOD.

APPLICATION FILED OCT. 30, 1905.

1,068,774.

Patented July 29, 1913.

2 SHEETS—SHEET 1.

Fig. 1

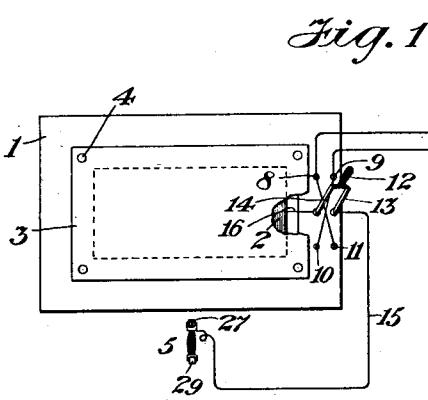


Fig. 1a

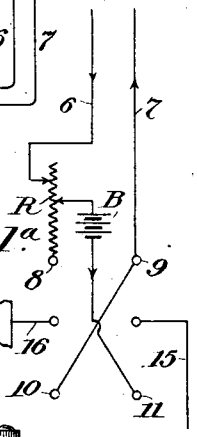


Fig. 2



Fig. 3

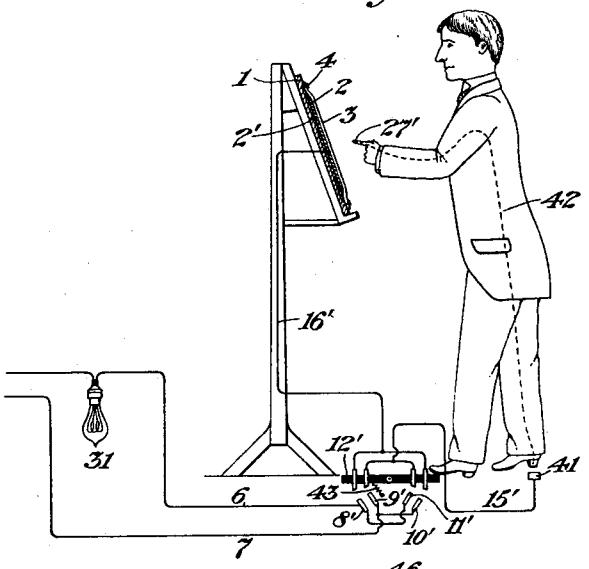


Fig. 6

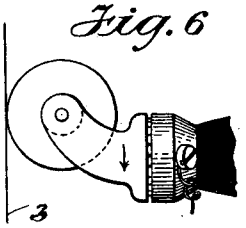
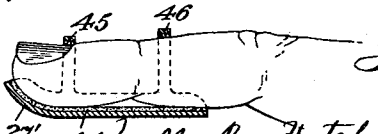


Fig. 5



Fig. 4



Witnesses
Chas. F. Clagett
H. F. Stage

Miller Reese Hutchison, Inventor

By his Attorney G. A. Adleson

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

M. R. HUTCHISON.

ELECTROGRAPHIC DISPLAY APPARATUS AND METHOD.

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2 SHEETS—SHEET 2.

Fig. 7

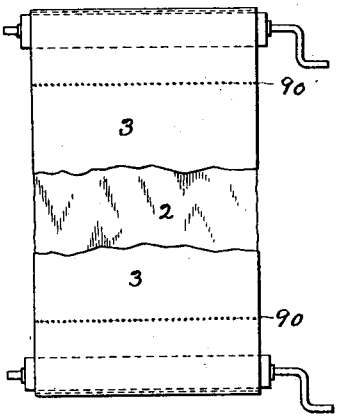


Fig. 9

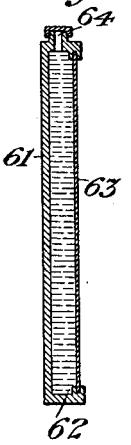


Fig. 8

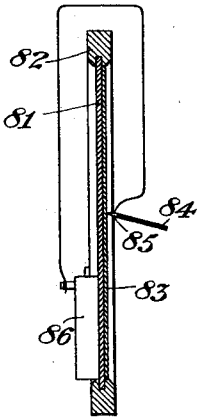


Fig. 10

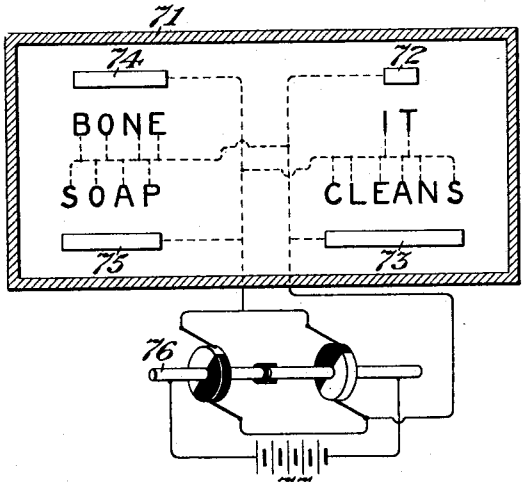
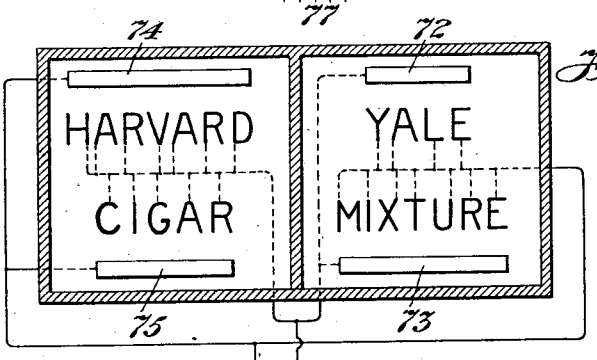


Fig. 11



Witnesses
Chas. F. Clagett
Lillian V. King

Miller Reese Hutchison, Inventor
By his Attorney G. C. Moore

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

MILLER REESE HUTCHISON, OF BRONXVILLE, NEW YORK.

ELECTROGRAPHIC DISPLAY APPARATUS AND METHOD.

1,068,774. Specification of Letters Patent. Patented July 29, 1913.

Application filed October 30, 1905. Serial No. 285,141.

To all whom it may concern:

Be it known that I, MILLER REESE HUTCHISON, citizen of the United States, and resident of Bronxville, in the county of Westchester and State of New York, have invented certain new and useful Electrographic Display Apparatus and Method, of which the following is a specification.

The inventions herein disclosed relate to the production of visible indications or designs as by writings, sketches, etc., the markings thereof being preferably in marked contrast to the background.

My method depends upon mechanical, chemical or electrolytic change, produced by the passage of an electric current through, over or upon a material capable of visible change of state, or of color, in response to the electric current. The material to be thus visibly changed as to its state or color, may be any that is suitable or desirable, but I prefer one depending for its operation, on electro-chemical, or electrolytic reaction or decomposition, preferably one which causes the mark or indication by a change of color of the electrolytic material, and preferably one which operates by cathode reaction to produce a precipitate or solution, preferably of striking color. It is highly desirable, though not necessary, that such electrolyte or material be capable of electro-chemical reversal, by change of polarity, to cause disappearance of such colored precipitate or solution, thereby effecting erasure of the marks. If desired, an anode reaction may be utilized to produce the mark and a cathode reaction to erase it.

The apparatus consists essentially of a surface of such character as will be capable of the changes above described, together with means for bringing the electric current into operative relation thereto. I may utilize the surface of an absorbent body, such as blotting paper, felt or unglazed pottery, moistened with the electrolyte, though it is quite within the spirit of my invention to utilize the liquid surface of a bath of a suitable electrolyte. Quite pleasing effects may be produced in this way, though if the electrolyte is very fluid, they may be somewhat fleeting, because of the tendency of the coloring matter to be displaced and the design confused, either by diffusion or by convection currents. The latter difficulty may be minimized by using a thin layer or film of the liquid upon a smooth surface. Very pleasing effects may be produced by using a sheet of metal with its surface freshly covered over or wetted with a film of fluid electrolyte. In such case, the surface and the film should be of such character as to maintain the continuity of the film without tendency to agglomeration in drops.

A body of viscous electrolyte may be employed or a fluid electrolyte may be rendered more or less viscous in any desired way, as by glycerin or gelatin solutions. Designs, etc., may be sketched in three dimensions or in a single plane in the body of the liquid. Solidified or semi-solid gelatin or jelly-like sheets may be employed.

When porous material is employed as a supporting medium for the sensitive substance, the moistening may be effected by hand or by a fountain pad or reservoir upon which the porous material rests, or said porous material may form a horizontal or vertical wall of the reservoir. Many other variations will suggest themselves.

For many reasons, I prefer to use plain paper impregnated with a suitable material, adapted to form an electro-chemically, sensitive electrolyte, upon the application of moisture. I employ any suitable support for the paper, preferably one formed with a conducting surface, and in connection therewith, any suitable means for causing the current to pass to the front or visible side of the paper from said conducting surface or vice versa. I have contemplated forming a composite sheet comprising one or more sheets of impregnated paper with one or more sheets of tin foil.

The essentials of my electro-graphic apparatus may be embodied in a variety of forms, for a variety of purposes. Among the appliances contemplated, are display boards for advertisements, bulletins, etc., and magic easels for the performance of various magical tricks, either in business places, shop windows, etc., or for parlor entertainment, or for semi-dramatic theatrical performances.

Having thus explained the nature and objects of my invention, I will proceed to describe the same more particularly in con-

nection with the accompanying drawings wherein:

Figure 1 is an elevation of a suitable marking surface and marker with simple visible circuit connections. Fig. 1ª is a diagram showing modified connections for the reversing switch. Fig. 2 is a longitudinal section of a desirable form of marker. Fig. 3 is a view of an easel with a diagram of concealed circuits adapted more particularly for parlor magic or theatrical performances. Fig. 4 is a view of a marker which may be used in place of that shown in Fig. 2, especially where the device is intended for mystification of the spectator. Fig. 5 is a vertical transverse section of the device shown in Fig. 4. Fig. 6 is a detail of the marking roller of Fig. 2, at right angles to the position shown in the latter figure. Fig. 7 is a detail of a modified form of writing surface. Fig. 8 is a sectional view of a toy. Fig. 9 is a sectional detail of a reservoir. Figs. 10 and 11 are views of a modification.

While I show and describe with some accuracy and in some detail, various specified forms of the device, it will nevertheless be understood that the invention is as broad as above indicated, and I do not limit myself to any specific embodiment thereof.

Referring to Fig. 1, 1 is a suitable support which may conveniently be of the character and size of a small blackboard, signboard or picture, though of course, there is no necessary limitation as to size. Upon or in the front surface thereof, is formed or mounted a conducting coating or surface, 2, which in turn is covered and concealed by the sensitive paper or other writing surface, 3. Any porous material may be used for this purpose, and it may be made a permanent part of the structure, or as in the case of paper, may be held by removable thumb tacks or other fastening 4, for ready adjustment and renewal at desired intervals.

Suitable circuit connections for the marking surface 2 and the marker, 5, are provided and in the apparatus shown in Fig. 1, they are intentionally arranged in the most open and visible manner, with the purpose that when the device is used in a show window or similar place, for advertising, even the most ignorant spectator will appreciate the fact that the writing or artistic composition being traced by an operator is electrically produced. To this end, wires 6, 7 connected to any suitable direct current source, are led to the contacts 8, 9 and cross connected to oppositely located similar contacts, 10, 11. Intermediate the two opposite pairs of contacts, is the double throw switch 12, comprising separate blades 13, 14 connected respectively through 15 and 16, to the marker 5 and to the conducting surface or sheet 2.

The marker is preferably of the construction shown in Fig. 2, although it may be of any other convenient construction, as for instance, that shown in Figs. 4 and 5. The form in Fig. 2 comprises a conducting shank, 17, provided with an insulated covering, 18, to be grasped by the operator. At one end, the shank 17 is provided with a suitable head, 19, upon which is mounted a roller marker, which as will be evident from the drawing, is mounted similarly to a swiveled roller bearing caster, the swivel comprising the integral head 20, smooth shank 21, and reduced screw 23, the same having a square shoulder adapted to be screwed home against the face of enlargement 19, to lock the swivel pivot against accidental unscrewing. Suitable anti-friction balls and annular grooves are provided between the face of said enlargement and the backside of the stirrup or bifurcated arm, 25. In the bifurcation of the latter and mounted upon axle 26 are the spaced disks 27, constituting in effect a roller adapted to have anti-friction bearing on the marking surface. This is desirable where the surface used is moistened blotting paper which might be worn or roughened by frictional or sliding marking devices. The disks 27 are spaced apart either by washers or by thickening of the hubs thereof, the latter method being shown in the drawing. The outer disks are preferably beveled off on their outer sides or the arms 25 bowed outwardly to give a proper clearance to the outer sides of the disk, as there is sometimes a tendency to accumulation of wet blotting paper and chemical products of electrolysis either from the metal of the marker which serves as an electrode or from the electrolyte. The disks 27 rotate independently because in tracing curves and angles, the disks on the outer side of the curve must travel farther and therefore rotate faster than those traveling the shorter path on the inner side of the curve. In default of such provision, there would necessarily be the slip and rubbing contact which it is desirable to avoid. The circuit connection to the marker may be at any convenient point, as at the binding screw 28. At the rear end of the handle 18, and conductively connected with the core 17, is a roller 19, preferably secured by screw 30.

The operation of the above apparatus is as follows: The marking surface is charged with a solution such as phenol phthalein, or if already impregnated with such substance, moistening only will be necessary. The switch is then thrown up to make contact with terminals 8 and 9, so that the current will flow through 6, 8, 14 and 16 into 2, and then into 3, whence it will emerge through roller 27 back through 15 and 9 and through lamp 31 and conductor 7, out to line.

With the solution described, the disks 27 will, in this situation, be cathodes of an

electrolytic conducting material included in a circuit, and when phenol phthalein is the solution employed there will be deposited at such cathode a very vivid and very beautiful red or crimson precipitate, forming a most striking contrast with the white or neutral back ground presented by that part of the surface which has not been colored by the passage of the current therethrough. The color appears instantaneously at the touch of the roller, and it is therefore possible for an artist, penman or advertiser to write or draw any desired design, picture or writing or printed legend descriptive of goods or to do each alternately, for the amusement and instruction of a crowd. When the device is used for quasi-scientific instruction of the masses, as an incident to the main object of advertising, all the connections are preferably in full view, as is also the incandescent lamp, 31. Every time the roller 27 touches the paper, the circuit is closed and the light 31 flashes up, continuing to glow as long as the roller continues in contact with the electrolytic conducting surface, 3.

The operator may at any time reverse the double throw switch 12, and use the smooth roller which is preferably of greater width than roller 27, for the purpose of partly or wholly erasing the red designs or writing made while the switch was in the first position. This is because phenol phthalein is almost completely reversible electro-chemically, and whenever the current is caused to pass in the reverse direction, the red precipitate returns to its original colorless condition. It is desirable that the porous body be thick enough to prevent any red precipitate forming at points of contact of the back side of the paper with conducting plate 2, from diffusing and spreading out through the paper, so as to be visible on the front side thereof. This may occur when the current is reversed and 2 becomes the cathode.

One reason for making the marking surface in the form of separated disks 27 is because the desired cathode reaction is so pronounced and diffused, particularly on the moist paper, that the spread of the current and the diffusion of the precipitate will completely fill in for a considerable distance on each side of the points of contact. Of course it is possible to make the separation of the disks 27 sufficient so that there will remain white streaks between the red, so that the marks instead of being broad, solid lines will consist of parallel lines of white and red.

Whenever phenol phthalein, or any similar electrolytic solution, capable of practically complete electro chemical reversal is employed, a different method of procedure may be adopted. For instance, proceeding as before to put in position and prepare a fresh moistened sheet, 3, the operator may throw the switch into the uppermost position and using the roller 29, may pass it over the entire surface of the sheet, changing the surface thereof to a uniform solid red. Then reversing the switch and using either 27 or 29 as the marker, he may produce white lines on the red background, because in this relation of parts, the marker being the anode, produces the hereinbefore described chemical reversal whereby the red precipitate is restored to the colorless condition.

It will be understood that many other sensitive electrolytes besides phenol phthalein may be used, and these will readily suggest themselves to one familiar with the art. Among those possible of use are solutions such as sympathetic inks of the cobalt compounds. These give a blue mark instead of a red, and it is possible to prepare a paper impregnated in one part with one solution and in another with another solution, or to have opposite surfaces impregnated with different solutions, with an intermediate sheet of tin foil arranged after the manner shown in Fig. 7.

A striking effect may be produced by impregnating a one or more different color producing electrolytes in the paper in the form of a predetermined advertising pattern, so that the electrically produced markings will appear in different colors on different parts of the surface, and when the entire sheet is traced over with amusing or instructive matter, the pattern of the advertising matter will be revealed. To best produce this effect, the impregnated, primarily invisible pattern should be on broad lines and on a large scale, while the writing or design traced by the operator should be on a comparatively small scale. The advertising matter may constitute the impregnated pattern or the operator's design or both, or one or both designs may be artistic or instructive.

When my invention is to be applied for purposes of mystification, as in parlor magic or theatrical performances, the entire mechanism of the operation should be concealed so that the operation will appear as mysterious as possible, and for such purposes I have indicated in Fig. 3, certain arrangements which are capable of being varied indefinitely to suit the conditions, or the taste of the user. In this figure, 1 indicates the support, 2 is the conducting electrode surface, 2^1 is a pad of any suitable absorbent material adapted to serve as a reservoir of electrolyte, to maintain the removable sheet 3 in moistened condition. In this case, the wires 6, 7 and lamp 31, together with contacts 8^1, 9^1, 10^1, 11^1, and reversing switch 12^1 and marker connection

15 are preferably concealed. The contact plate 41 is located out of sight of the audience, and is adapted to form an electrical connection through the heel of the operator with the conductor 42, any of the expedients commonly employed in the art being available for effecting this connection. The reversing switch 12^1 is preferably flush with the floor and may be covered by a rug, or concealed in any other desired way. It is preferably normally spring pressed by spring 43 in such direction that the marker is a cathode and gives the red indication when phenol phthalein is the electrolyte. The connection 16^1 corresponding to 16 is concealed in the legs of an easel upon which is supported the magic board or picture 1, 3. In this connection, durability of the sensitive surface is a minor consideration and I prefer to form the marker with a smooth contact surface 27^1, subordinating the desirable anti-friction bearing to the purpose of concealment of the contact. The latter is clearly shown in Figs. 4 and 5 to consist of a removable finger tip comprising a conducting outer surface, conveniently of sheet metal, lined with non-conducting material such as rubber, as indicated at 44. It is shaped to conform to the finger tip and to be as inconspicuous as possible. In the form shown, it is adapted to be held to the finger by bands 45, 46, which may be simple elastic, preferably white in color, or which may be of metal, as shown, and preferably white. With this arrangement, the operator may make connection through one leg with the contact 41, and write any desired pattern upon the surface 3. By inconspicuous and unnoticed movement of the other foot, he may open the switch, thereby losing his magic power to produce the marks on the board, or he may press still harder and reverse the current, thereby causing the contact 27^1 to become an anode, so that it will no longer produce magic designs and will cause those already produced to disappear. Obviously, there may be two performers, each provided with his own contact 41 and reversing switch 12 and the reversing switch of either may be controlled by the other. One may write and the other may erase. The permutations and combinations of such devices and expedients and the dramatic possibilities thereof will be obvious to those skilled in such matters.

In Fig. 9, 61 is a tank or reservoir containing a desired electrolytic solution 62, in contact with a porous plate 63, preferably of unglazed pottery. In this device, the entire rear surface of the sensitive plate is in direct contact with a comparatively large supply of electrolyte. The conducting surface 61, which is normally the anode, is distant from the visible sensitive surface 63, so that when the current is reversed to erase the colored markings on 63, said surface 63 is completely out of range of possible diffusion of any coloring matter which may be precipitated on 61 acting as an anode. This is also one of the advantages of a thick pad 2^1, as shown in Fig. 3. The reservoir 61 may be filled and emptied through the screw closed opening 64.

In all the forms, the electrodes should be of material such as will not seriously interfere with the electro-chemical reaction, as for instance, aluminum for the normal anode 2 and phosphor-bronze for the cathods 5. The material of the electrodes may however be copper or cobalt compounds as may serve to facilitate and even participate in the desired reaction, either to produce marks or to erase them. Any cobalt salts, such as are used for sympathetic ink, which is to be invisible when written and to become blue on exposure to heat, may be used for this purpose.

The broad method of this invention may be applied to any desired arrangement of fixed or movable electrodes operated mechanically or electrically according to a predetermined pattern or at will. For instance, any of the display apparatus utilizing incandescent lamps to form elements of a pattern, design or legend may be utilized by substituting a cathode reaction as the display element in place of the incandescent lamp. To this end, cathodes immersed in or moistened with a solution of electrolyte may be used in connection with pattern operated commutators or switches to cause current to pass into or out of one or any desired number of such cathodes from one or more anodes, which may or may not be concealed.

Anodes and cathodes may be given any desired configuration and may be grouped in any desired way. I have diagrammatically indicated in Figs. 10 and 11 illustrative forms of such arrangement. In Fig. 10 groups of electrodes having the configuration of letters are arranged for operation in connection with electrolyte applied in any desired way, as by immersing said electrodes in a bath having a transparent wall. In said Fig. 10 the tank or other support 71 is shown in vertical section. The electrodes are given such configuration as to represent a desired legend or design, as for instance, "Bone soap" and "It cleans." One of the numerous possible methods of connection is shown in said Fig. 10, wherein the electrodes representing the legend "Bone soap" are conductively connected in parallel with each other, and preferably also with electrodes 72, 73 adjacent to the electrodes "It cleans," which latter are of opposite polarity and are connected in parallel with the electrodes 74, 75, adjacent to the electrodes constituting the legend "Bone soap." When arranged

as described, the surface of 72 should preferably be substantially equal to the surface "It," and the surfaces 73, 74, and 75 respectively, substantially equal to the total surfaces of "Cleans," "Bone," "Soap." As will be obvious, these electrodes 72, 73, 74 and 75 are hardly necessary in a solution because of the law of resistances and distribution of current above referred to, whereby there is a tendency to equalization of current density over all parallel connected electrode surfaces.

The two legends are connected to a commutator 76, adapted to periodically reverse the polarity of the battery or other source of direct current indicated at 77. Thus arranged, and with the rotation of the commutator properly timed, the colored precipitate will appear, changing the legend "Bone soap" from the normal color of the metal or other conducting material to the red or blue or other color. Upon reversal of the current, the legend "It cleans" will similarly become colored, while the color will gradually disappear from the legend "Bone soap." Where thin moistened paper is used, the supplemental electrode surfaces 72, 73, 74 and 75 are more essential to reasonably low resistance and practically uniform distribution of density of current flow, because in the case of thin paper, the spreading of lines of flow between electrodes is practically limited to the two dimensions of a plane and is therefore less marked than in the case of the three dimensions of a body of electrolyte.

In Fig. 11, I have shown a modification wherein the two legends are arranged as the electrodes of two different solutions, one giving a crimson color and the other a blue color as the characteristic electrode reaction. These colors are particularly appropriate for use respectively with the names "Harvard" and "Yale."

As will be obvious to those skilled in the art of electric advertising, the use of time cut outs, after the manner of the commutator 76, operating to cut in and cut out portions of a pattern or legend, is capable of wide variation both as to the time and as to the portions of the pattern which will be cut out.

In all arrangements the resistances will of course be adjusted in accordance with the character of the source of supply of current and the nature of the work to be done. In the form shown in Figs. 1 and 2, the serially arranged incandescent lamps 31 serve as current limiting devices. One or more of these may be used either in series or parallel to suit the conditions; or any suitable form of rheostat may be used as a supplement to or substitute for the same.

Any of the marking electrodes used to trace patterns, designs or writings may be used in connection with crayons, pencil, pens or other conventional or usual graphic instruments, anywhere where marking is desirable for display, instruction or amusement; and the writing surface may be supplied with printed designs to be traced over and colored or otherwise illuminated by the electrical current reaction.

In Fig. 8 I have shown a device adapted for juvenile use as a toy or educational appliance. The device has a general form of a slate comprising a plane surface 81, surrounded by a frame 82. 81 may be conducting or supplied with a conducting surface adapted to receive a sheet of sensitive paper 83. A suitably insulated pencil 84 having a conducting tip 85, adapted to serve as a marking electrode, may be serially connected with a suitable source of current, the other pole of which is connected to the support 81. The source may be a case 86, containing three or four dry cells connected to a suitable resistance with the circuit just described.

A plain sensitive sheet or a composite sheet consisting of paper, with tin foil either as a backing to a single sheet, or interleaved between two sheets, may be prepared in a continuous sheet and mounted upon rollers as indicated in Fig. 7. The arrangement may be as shown, to unwind from a supply roller and rewind on a storage roller; or one roller only may be used, a continuous sheet being provided with suitable perforations for ready separation of a convenient length. When the tin foil, or other conductor, 2 is interleaved between two sheets, 3, as indicated in said Fig. 7, conducting connection of one side of the circuit may be made with 2, in any desired way, as by connection through thumb tacks used to secure the sheet after the manner shown in Fig. 1 where the tin foil or other conducting sheet is used merely as a backing for a single paper sheet, 3, a contact may be made with 2, directly, through any suitable terminal, at the back side of the same, as for instance, a terminal set in the support 1, Fig. 1. If desired, the rollers may be operated automatically at intervals, and the continuous web may be a single thin sheet of paper moistened with a suitable electrolytic solution. The latter arrangement is well adapted for use where the marking or indicating electrode is on the back side of the paper and the colored design is intended to show through on the front side.

With some electrolytes, it will be found that it requires either a longer time or a greater current to erase a mark, (*i. e.* render a precipitate colorless) than it does to cause such precipitate in the first instance. For this reason, it will sometimes be found desirable to arrange the double throw switches of Figs. 1, 2, 8 and 9, or the commutating apparatus of Figs. 10 and 11 in such man-

ner that when the direction of current is changed for the purpose of rendering the precipitate colorless, a desired amount of increase of current shall be rendered available, either by cutting out resistance or by increase in applied electro-motive force, as will be evident from Fig. 1ª, wherein both of these expedients are utilized. To do this, it is only necessary to put a resistance in the lead 6 to the contact 8 of the double-throw switch, and a battery or other additional source of direct electromotive force in the connection to the contact 11.

Many modifications and combinations of the above described elements, features and methods will readily suggest themselves as within the sphere of my invention.

I claim:

1. A display device comprising a body having a display surface and an electric marker comprising an antifriction roller mounted upon a handle for universal movement and movable into and out of contact with said surface, in combination with a source of electromotive force and connections whereby circuit is closed through said marker and said surface whenever they are brought into contact.

2. An electrically conducting display surface comprising a body having a display surface and an electric marker comprising an antifriction roller mounted upon a handle for universal movement and movable into and out of contact with said surface, in combination with a source of electromotive force and connections whereby circuit is closed through said marker and said surface whenever they are brought into contact.

3. A graphic device comprising an electrolytically conducting body, adapted to produce visible effects in the electrolyte, upon passage of electric current in one direction, and to cause such effects to disappear, when the current is reversed, in combination with a source of direct current and means for causing said current to pass through said body in either direction at will.

4. A graphic device comprising an electrolytically conducting body, adapted to produce visible effects at a cathode, and to cause such effects to disappear, when the current is reversed, in combination with a source of direct current and means for causing said current to pass through said body in either direction at will.

5. A graphic device comprising an electrolytically conducting body, adapted to produce color effects at one electrode, upon passage of current in one direction, and to cause such color effects to disappear, when the current is reversed, in combination with a source of direct current and means for causing said current to pass through said body in either direction at will.

6. A graphic device comprising an electrolytically conducting body, in combination with a direct current source and means for causing electric current to flow out of a surface of said body, said means comprising a concealed anode of large area and a visible cathode of small area.

7. A graphic device comprising an electrolytically conducting body adapted to produce color effect at regions where electric current flows out of said body, in combination with means for causing such flow in the region of a visible portion of the surface of said body, said conducting body being sufficiently thick so that color effects produced on one side thereof are not visible upon the other side.

8. A graphic device comprising an electrolytically conducting body adapted to produce a visible effect at one electrode, upon passage of current in one direction, in combination with a conductor adapted for application to the surface of said body, as a cathode of the electrolyte and means for reversing the direction of current flow through said conductor.

9. A graphic device comprising an electrolytically conducting body, adapted to produce color effects at an electrode, upon passage of current in one direction, in combination with a conductor adapted for application to the surface of said body, as a cathode of the electrolyte and means for reversing the direction of current flow through said conductor.

10. A graphic device comprising an electrolytically conducting body, in combination with an anode of considerable area, extending over the rear surface thereof, and a coöperating movable cathode of relatively small area on the front side thereof, together with means for reversing the polarity of said anode and cathode respectively.

11. A graphic device comprising an electrolytically conducting body, in combination with an electrode surface of considerable area, and a second electrode of relatively small area, said electrolytically conducting body being adapted to produce a colored substance adjacent one electrode only, the thickness of said conducting body being sufficiently great so that color effects produced by an electrode on one surface of the body will not be visible on the other surface.

12. A graphic device comprising an electrolytically conducting body, in combination with an electrode surface of considerble area, and a second electrode of relatively small area, said electrolytically conducting body being adapted to produce, under electric current flow, a colored substance adjacent one electrode only, together with

means for reversing the direction of current flow through such electrode.

13. A display device for advertising, amusement, etc., comprising a body of suitable material having an electro-chemically sensitive surface, in combination with electrical means for causing the material at or near said surface, to produce a colored substance, together with means controllable at will for causing said substance to become invisible.

14. An anti-friction marking contact device capable of movement in all directions against a display surface and comprising laterally adjacent rolling contact surfaces mounted for independent rolling contact at different rates.

15. An anti-friction contact device for marking purposes capable of movement in all directions against a display surface and comprising laterally adjacent independently rotatable disks.

16. An anti-friction contact device, for marking purposes capable of movement in all directions against a display surface and comprising laterally spaced, adjacent, independently rotating disks.

17. A graphic device comprising a body having a marking surface, and an anti-friction marker comprising a shank and a roller bearing contact surface together with a swivel connection for said parts, the axis of said swivel being out of line with the center of rotation of said roller contact device and perpendicular to a plane containing said centers of rotation and a perpendicular from the latter to said axis and electrical connections from a source of electricity to said body and said marker.

18. A graphic device comprising a body having a marking surface and a marker comprising a shank and sectional, spaced roller contacts and a swivel device securing the latter eccentrically to the axis of the former and electrical connections from a source of electricity to said marking body and marker.

19. As an article of manufacture, a porous sheet impregnated with different electrolytic materials in different portions thereof, said electrolytic material being adapted to produce different colors under influence of the electric current.

20. As an article of manufacture, a porous sheet impregnated with different electrolytic materials in different parts thereof according to a predetermined design, pattern or legend, said electrolytic material being adapted to produce different colors under influence of the electric current.

21. In a graphic device, a body containing an electrolyte subject to change of appearance when an electric current is passed through the same, an electric contact device movable freely on and over the surface of said body while maintaining contact therewith so that unbroken lines and delineations may be produced by electro-chemical action at the traveling point of contact, a source of direct current, a connection from one pole of said source to said body of electrolyte, and a connection from the other pole of said source to said traveling contact device.

22. In a graphic device, a body containing an electrolyte subject to change of appearance when an electric current is passed through the same, an electric contact device movable freely on and over the surface of said body while maintaining contact therewith so that unbroken lines and delineations may be produced by electrochemical action at the traveling point of contact, a source of direct current, a connection from one pole of said source to said body of electrolyte, and a connection from the other pole of said source to said traveling contact device, said electrolyte being of a nature such that the lines or delineations produced as aforesaid become invisible when the current is reversed, and means for reversing the direction of the current.

23. In a graphic device, a body containing an electrolyte subject to change of appearance when an electric current is passed through the same, an electric contact device movable freely on and over the surface of said body while maintaining contact therewith so that unbroken lines and delineations may be produced by electrochemical action at the traveling point of contact, a source of direct current, a connection from one pole of said source to said body of electrolyte, and a connection from the other pole of said source to said traveling contact device, said body of electrolyte being such that the color effects of the delineations and the back ground thereof on the body containing the same are reversible by reversal of the current, and means for reversing the current.

24. In a graphic device, a body containing an electrolyte subject to change of appearance when an electric current is passed through the same, an electric hand controlled contact device movable freely on and over the surface of said body while maintaining contact therewith so that unbroken lines and delineations may be produced by electrochemical action at the traveling point of contact, a source of direct current, a connection from one pole of said source to said body of electrolyte, and a connection from the other pole of said source to said traveling contact device.

25. In a graphic device, a body containing an electrolyte subject to change of appearance when an electric current is passed through the same, a substantially frictionless electric contact device movable freely on and over the surface of said body while maintaining contact therewith so that un-

broken lines and delineations may be produced by electrochemical action at the traveling point of contact, a source of direct current, a connection from one pole of said source to said body of electrolyte, and a connection from the other pole of said source to said traveling contact device.

Signed at New York city in the county of New York and State of New York.

MILLER REESE HUTCHISON.

Witnesses:
G. C. DEAN,
A. G. STAGE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents. Washington, D. C."