

June 20, 1939.

P. ROSENBLATT

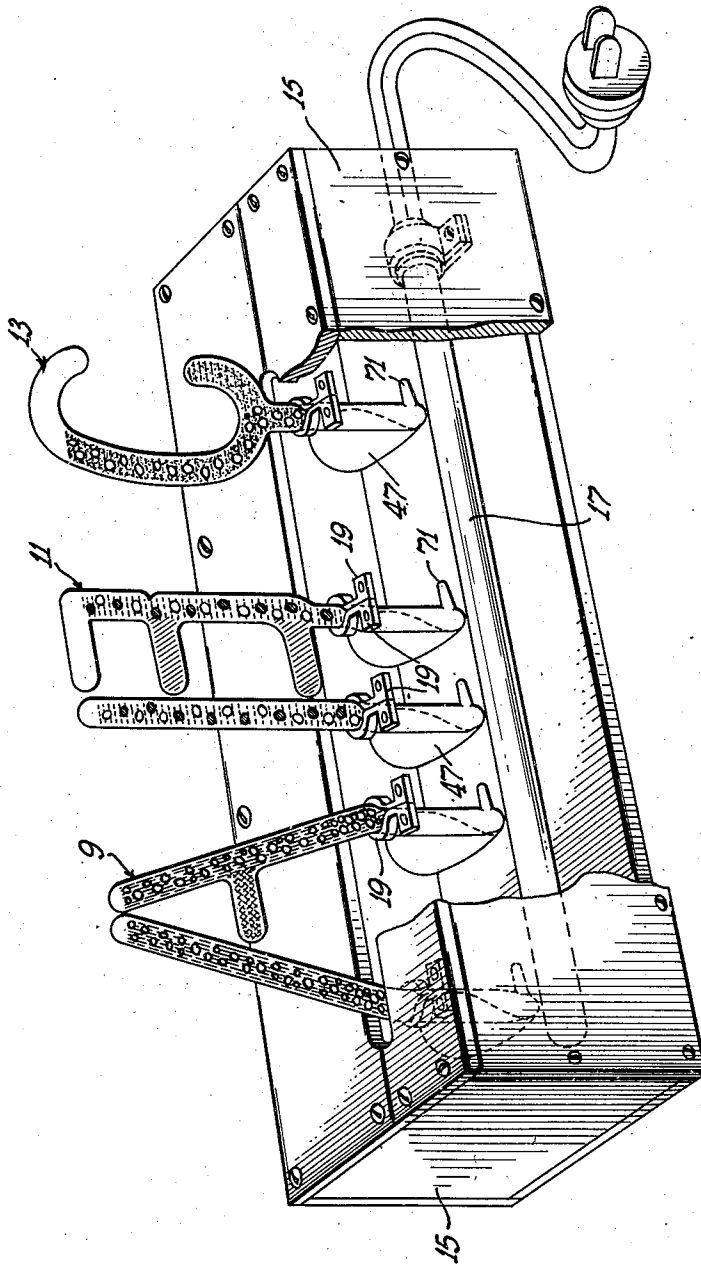
2,162,897

DISPLAY DEVICE

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3 Sheets-Sheet 1

Fig. 1.



INVENTOR.

Philip Rosenthal

BY

Frederic P. Warfield
ATTORNEYS.

June 20, 1939.

P. ROSENBLATT

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Fig. 2.

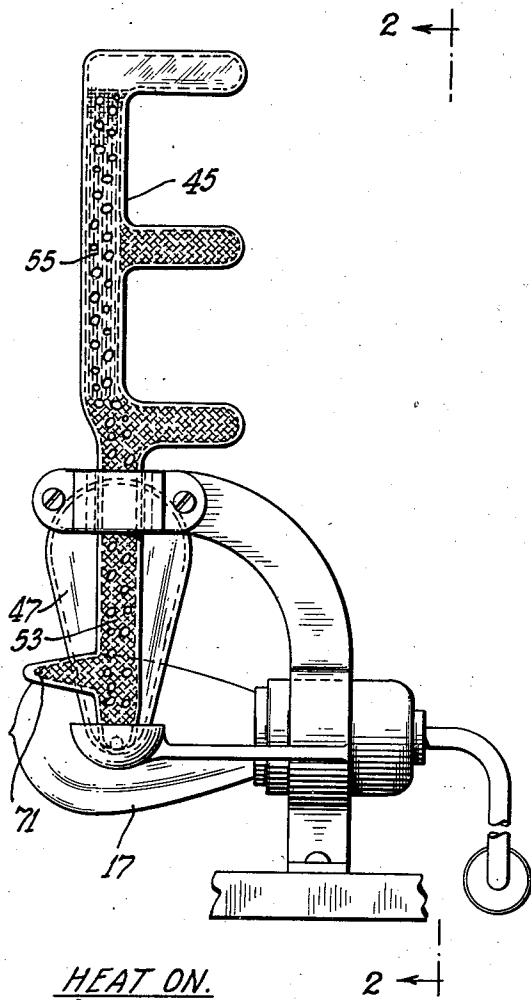
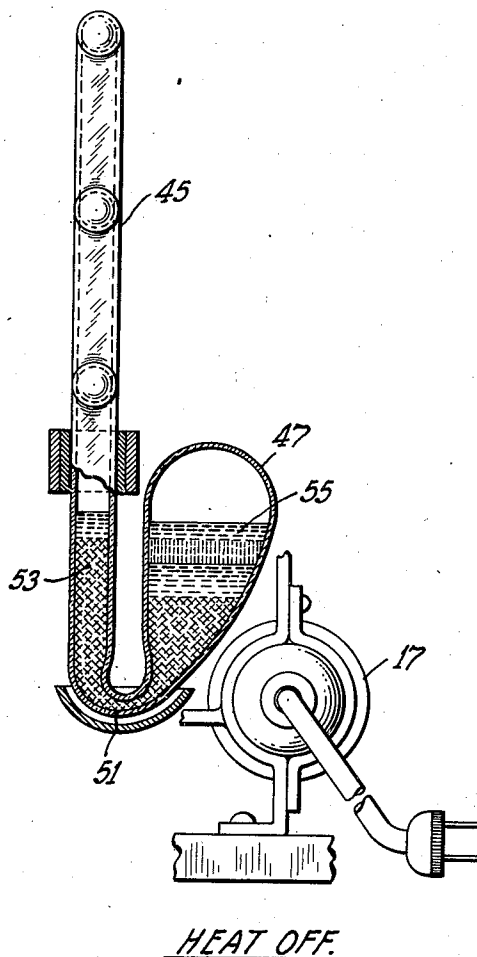


Fig. 3.



INVENTOR.

Philip Rosenblatt

BY

Frederic P. Wenzel
ATTORNEYS.

June 20, 1939.

P. ROSENBLATT

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Fig. 7.

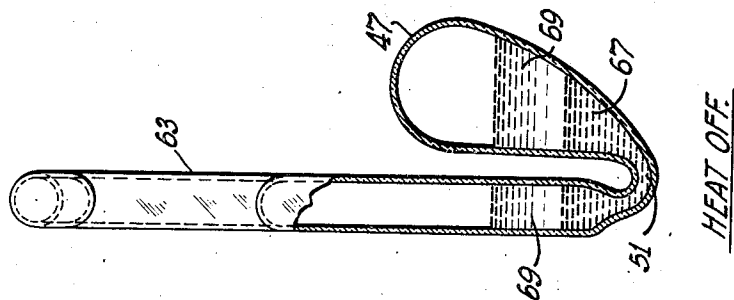


Fig. 6.

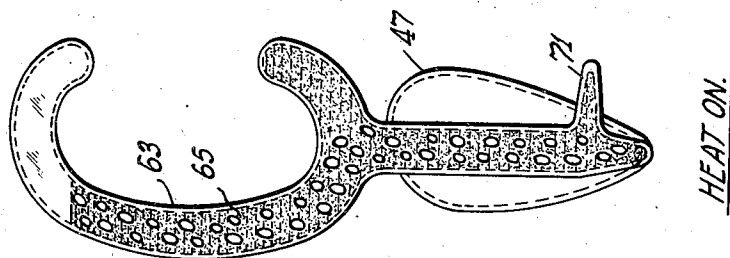


Fig. 5.

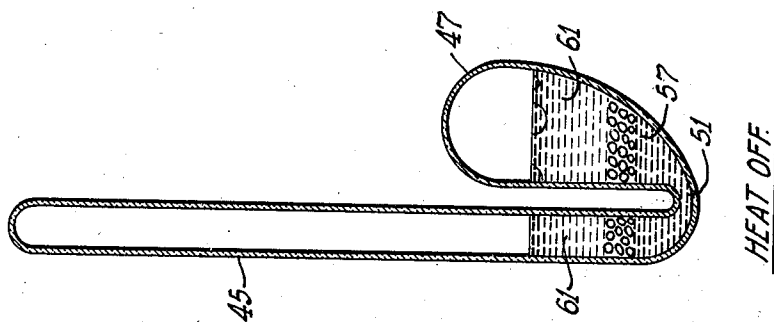
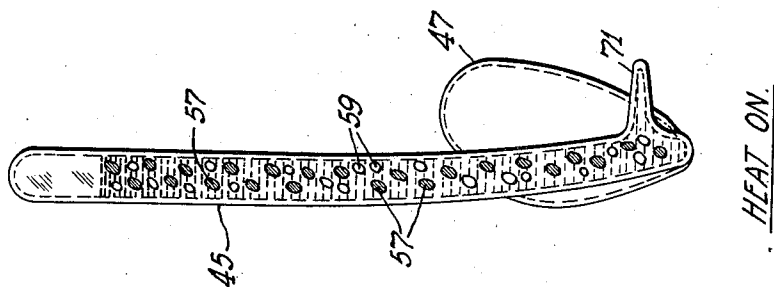


Fig. 4.



INVENTOR.

Philip Rosenblatt
BY
Frederic P. Mayfield
ATTORNEY.

UNITED STATES PATENT OFFICE

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DISPLAY DEVICE

Phillip Rosenblatt, Brooklyn, N. Y., assignor to
Biolite Incorporated, New York, N. Y., a cor-
poration of New York

Application February 8, 1937, Serial No. 124,623

6 Claims. (Cl. 40—130)

There are known in the art, display or exhibit devices employing so-called "animated" indicia for advertising or the like, wherein moving liquids are present in transparent or translucent tubes shaped and arranged to form the said indicia. These tubes define any desired characters which may be in the form of letters, numerals, or emblems, or the like, the tubes usually being evacuated of air and contain a liquid of low boiling point which is adapted to be boiled upon application of a moderate amount of heat under the low atmospheric pressure in the tubes, so that proximity of the tubes to an electric light bulb or other suitable source of heat will cause an active and sustained ebullition of the liquid in the tubes. In such constructions it is customary to utilize only a single liquid which contains suitable coloring matter to increase the visibility of the moving liquid in the indicia.

The present invention offers a modification over the above generally described display device, in that instead of the single liquid heretofore usually employed, there are provided a plurality of relatively immiscible liquids in the tube, which liquids may carry suitable coloring agents dissolved therein, whereby a plurality of contrasting colors may be produced within each tube, thereby enhancing the appearance of the display as the indicia containing this plurality of liquids and colors are illuminated and a succession of bubbles are generated therein.

In accordance with the present invention, the tubes making up the present assembly or sign, or any selected tubes of such assembly, may contain at least two relatively immiscible liquids, such as, for example, a solution of alcohol in water and a quantity of benzol, whereby two distinct phases are produced, the liquids forming distinct lines of separation therebetween, the liquids being either in continuous phase, or one of them may be in a dispersed phase in the remainder.

A coloring material which is soluble in alcohol, but insoluble in benzol, is dissolved in the alcohol before introduction thereof into the tube, and a second coloring material, preferably of a color which contrasts sharply to that of the previously maintained color, and which is soluble in benzol but not in the alcoholic solution, is dissolved in the benzol prior to the introduction of the benzol into the exhausted indicia tube.

It will be seen from the above, therefore, that the principal object of the invention is to provide an illuminated sign or display of the above indicated character, wherein a plurality of distinctly colored and contrasting liquids are placed

in each tube, or selected tubes of the assembly, and these variously colored contrasting liquids are caused to move by application of heat through the agency of bubbles generated in the said liquids.

A still further object of the invention is to provide an illuminated sign or display made up of an assembly of tubes containing contrastingly colored liquids, as aforesaid, together with supporting means for the tubes, and means for heating and lighting the tubes to produce the desired succession of bubbles therein, and to illuminate the indicia, letters, or slogan, composed of the said tubes.

Further objects and advantages of the present invention will become apparent as the description proceeds, and the features of novelty will be pointed out in particularity in the appended claims; and the invention accordingly comprises the features of construction, combination of elements, and arrangement of parts, which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the claims.

The invention will be understood more readily by reference to the accompanying drawings in which

Fig. 1 is a front perspective view of an illuminated sign embodying the features of the present invention, and including transparent tubes assembled to form letters, and each tube being filled with differently colored, immiscible liquids.

Fig. 2 shows an elevation of a tube formed into a single letter, and mounted for producing the bubbling display effect, the view showing differently colored, immiscible liquids in continuous phase within the tube, and the source of heat turned on to produce the bubbling effect.

Fig. 3 is an elevational view of the tube and mounting of Fig. 2, with the heat supply shut off, the view being taken at right angles to Fig. 2 looking from the line 2—2 in the direction of the arrows on Fig. 2.

Fig. 4 is a view of a tube constructed in accordance with the present invention, and containing immiscible, differently colored liquids in disperse phase, the view showing the bubbling in the tube with the supply of heat turned on.

Fig. 5 is a view similar to Fig. 4, but with the tube unheated.

Fig. 6 is a view of a different form of tube in which the liquids are in disperse phase and uncolored, thereby presenting a generally turbid or opalescent appearance in the tube, the view illustrating the appearance of the tube when heated,

Fig. 7 is a view taken at right angles to Fig. 6, the view showing the tube partly in section.

It has been indicated above that the immiscible liquids may be in continuous phase or in disperse phase, and that differently colored materials may be dissolved in the liquids. Thus, for example, where the liquid system is made up of an aqueous solution of alcohol as one of the liquid components, and benzol is the other liquid component, a coloring substance which is soluble in the alcoholic solution is dissolved therein, and a different coloring material soluble in benzol, but insoluble in the alcohol, is dissolved in benzol. The selection of coloring materials is such that contrasting colors may be obtained.

The trade offers a wide variety of materials which are suitable for use as the coloring agents, basic dyes being used for the alcoholic solution, for example, while dyestuffs which are soluble in benzol or oil may be used as the solute in the benzol. Examples of the latter are identified to the trade as "Du Pont Oil Red", "Du Pont Oil Yellow", and other similar products produced by the Du Pont Corporation.

Either or both liquid components may be colored with appropriate materials, or neither liquid need be colored in order to produce the display effect, in the latter case reliance being placed upon the different indices of refraction of the components of the liquid system in the tube to produce the desired display effect.

If an aqueous alcoholic solution-benzol system is employed as the vehicle for the coloring materials, or as the attractive element of the display, various effects may be produced depending upon whether the liquids are in continuous or in disperse phase. Thus, both liquids may be continuous, with a relatively sharp line of division between the layers, or the benzol only may be in continuous phase with the alcohol-water solution in disperse phase in the benzol. The densities of the liquids may be adjusted so that either the benzol or the alcohol will form the heavier layer, depending upon the effects which are desired to be produced; or the phases of the liquids may be adjusted so that either the benzol will be in continuous phase with the alcohol in disperse phase therein, or the alcohol may be continuous, with the benzol as disperse phase.

These different results are obtained, of course, by suitable dilution of the respective liquids with suitable solvents therefor before the liquids are sealed into the tubes; or the densities of the liquids may be controlled both by the action of solvents and/or the quantity of dissolved material present therein; and while an alcoholic-benzol system has been referred to specifically above, and will be used as the specific example in the detailed description to be given hereinafter, it will be understood that this system is only illustrative of any relatively immiscible, low boiling solvents which may be employed, and it will be evident also that, if desired, more than two materials may be used, so that instead of showing only two distinct layers of liquid, there may be three or more such layers in a given tube, in order still further to diversify the visual appearance of the display. Since each character of the display is made up of at least one tube which is independent of each of the remaining tubes of the display assembly, it becomes apparent that a wide variety of different appearances may be produced by the development involved in the present invention.

Referring more particularly to the drawings, it will be seen that the invention comprises a

plurality of light-transmitting tubes which may form, or which may be assembled into, suitable indicia in the manner, for example, as shown in Fig. 1, wherein there is shown an assembly of tubes defining three different letters, indicated generally at 9, 11, and 13, each of the tubes forming such letters being illustrated as containing immiscible liquids in different phases. Thus, the tubes forming the letter A are shown as containing two relatively immiscible liquids both of which are in continuous phase, whereas the tubes forming the letter B contain one of the liquids in disperse phase with the other liquid in continuous phase, the particles of the dispersed liquid being, however, sufficiently agglomerated to form individual drops; and the letter C comprises a tube in which also one liquid is in disperse phase in the other, but sufficiently finely dispersed so as to be more or less emulsified, presenting a cloudy, turbid or opalescent appearance due to differences in the refractive indices of the liquids. The liquids in the letters A and B are supposed to contain suitable coloring matter dissolved therein, whereas the letter C is intended to be uncolored.

All of the above-described details, however, obviously may be varied at will as may be desired; and instead of two liquids three or more may be used in each tube, with the degree of dispersion of any one or more of the liquids being varied as may be desired, depending upon the visible effect which is desired to be produced.

The indicia tubes are mounted conveniently upon a suitable mounting device, such as a box or the like 15, which contains lighting and heating means 17, which may be suitably disposed in the box to heat and to light the tubes, which tubes are shown as being supported by suitable clamping means 19, which preferably are made adjustable relative to the box 15. The heating means 17 may be, conveniently, one or more incandescent lamps of suitable wattage, and which may be disposed adjacent to the tubes forming the indicia in order to produce the requisite ebullition of the liquids in the tubes for imparting the desired "animation" to the tubes when the display is in operation.

It will be apparent from the drawings that the letters are made up of one or more independent tubes, each of which is indicated at 45, assembled to form the letters or indicia when more than one tube is utilized in defining the desired letter or other indicia.

Each suitably shaped tube 45, is evacuated of air and has introduced a predetermined volume of liquid which is sealed into the tube while the said tube is evacuated.

Each tube 45 is formed with an enlarged, up-turned end 47, defining a vapor chamber, which is adapted to be heated by the lamp or lamps 17, and which is connected with the tube 45 by a restricted tubular connecting section 51.

In accordance with the present invention, each of the tubes is filled with a two-phase liquid system, such as the alcohol-benzol system described above, which forms at least two distinct liquid layers within the tube.

These liquids may be in continuous phase as indicated at 53 and 55, where, in the illustration above, the alcohol solution forms the heavier layer 53, and the benzol forms the lighter layer 55, this lighter layer of course floating upon the heavier layer 53.

When the heating means 17 are or is, actuated, the liquid contents of the tube will become warmed, and vaporized, so that the vapor cham-

ber 47 will become filled with vapor the formation and expansion of which causes the liquid to rise in the indicia portion 45 of the tube.

The liquid tends to flow back into the chamber 47, where it is vaporized, the excessive amounts of vapor rising through the liquids in a continuous succession of bubbles which actively agitate the liquids, the resulting ebullition producing various effects in the tubes depending upon the degree of dispersion of the mutually immiscible liquids, and causing an animated movement in the liquid layers, which are illuminated by light transmitted from the heating and lighting means 17 so that the contrasting coloring becomes very clearly visible by the light transmitted through the tubes.

Fig. 2 indicates the bubbling action and the differences in appearance between the two separate liquids when the display is operating, and the different liquids are in continuous phase; whereas Fig. 3 illustrates the state of the system illustrated in Fig. 2 when the liquids are at rest in the tube.

Fig. 4 is a view of a tube wherein the different liquids are colored, the water and alcohol being in a disperse phase in the benzol, as designated at 57, the benzol forming vapor bubbles 59 when the tube is heated, which rise up through the liquid column in the indicia portion 45 of the tube, the vapors comprising these bubbles becoming condensed in the upper or cooler portion of the tube.

As will be seen from Fig. 5 the dispersed liquid, when the heat is off, assumes a position at the bottom of the tube, settling out as a liquid layer, whereas the other liquid assumes the position shown by the upper layer 61. It will be seen that both liquids when quiescent occupy a portion of the tube 45 and a portion of the vapor chamber 47.

It will be understood that both liquids may be colored by incorporating contrastingly colored solutions therein.

In addition to the above, the liquids may be colorless.

In Figs. 6 and 7 there is represented this condition, where both liquids are colorless, thereby imparting a cloudy or turbid appearance to the indicia tube 63, which appearance is indicated at 65.

The difference in refractive indices between the two liquids presents a very effective display especially when viewed by light transmitted through the tube and liquid. The bubbling of the liquid contents of the tube produces a very attractive movement in the dispersed droplets of the dispersed liquid, which may be so small in size as to present a cloudy or opalescent appearance, or they may be sufficiently large, as indicated in Fig. 4, so as to enable a large part of the individual droplets to be visible to the eye as the movement thereof reflects and refracts the light which illuminates the tube.

In Fig. 7 there is shown the condition when the uncolored liquids of Fig. 6 come to rest with the removal of heat from the tube. The dispersed liquid assumes the lower layer 67 which partially fills the vapor chamber 47 and extends into the indicia tube 63, whereas the liquid matrix in which the liquid 67 is dispersed floats thereon as the upper layer 69.

As has been mentioned above, any system of immiscible liquids may be used, and the densities thereof may be adjusted so as to cause either one or the other of the liquids to be higher in spe-

cific gravity. This may be done by the addition of suitable solvent liquids of proper specific gravity, as for example, by the addition of suitable amounts of water and alcohol to the alcoholic component of the liquids, whereby the specific gravity of the alcoholic component may be rendered less than, or heavier than the benzol component, so that either the alcohol or the benzol may be the floating layer. Other immiscible liquids may be used instead of the alcohol-benzol mixture. For example, acetone may be substituted for the alcoholic solution and ether for the benzol phase; or ether may be used in conjunction with the alcoholic solution instead of benzol.

It will be seen, from the above description, that the structure of the present invention is a glass tube which may be bent or otherwise formed into a shape to resemble, either alone, or when properly assembled with other selected tubes, any desired figure, letter, or other indicia, or any combination thereof to form any desired number, word, sentence, or advertising slogan, the tubes being either transparent or translucent, and are positioned so as to be properly illuminated from a suitable source of light, which also provides means for warming the tubes to effect the vaporization of the liquid contained therein.

The tubes are evacuated, and the liquids are inserted in the tubes while the tubes are in exhausted or evacuated condition, and the tubes are then sealed off, so as to maintain the liquids in the tubes at much less than atmospheric pressure. In view of the fact that the liquids are contained in the tubes under a vacuum, the boiling points of these liquids will be substantially depressed below the normal values of their boiling points under atmospheric pressures. Since the liquids are chosen so as to have normally low boiling points, only a very small amount of warming of the tubes will be necessary to bring at least the more volatile components of the liquid system in the tubes to the boiling point. The movement of the resulting bubbles, coupled with the contrasting colors in the liquid or liquids, produces a very attractive display. In practise, the heat of the hand may be a sufficient amount of warmth to produce the bubbling action, although in practise, the tubes are desirably mounted upon a cabinet containing a source of light and heat and a suitable reflector therefor for directing light from the said source onto the tubes for illuminating the contents of the tubes and to accentuate the different colorings in the liquids. The invention is not limited to a system of liquids containing only two immiscible liquids, but it contemplates the utilization of three, or more layers, as well as a two-layer system.

As the tube is warmed, the liquid contents will be expelled from the vapor chamber 47 by pressure of the vapors generated therein from the liquid, and the liquids are pushed by the pressure of the vapor into the indicia portion of the tube, through the constricted portion 51, which connects the indicia portion 45 of the tube with the vapor chamber 47, the bubbles forming in the neighborhood of the bend 51. As the bubbles of vapors rise through the column of liquid in the indicia portion of the tube, they condense in the cooler portion of the tube, and the condensed liquid flows back as a reflux along the walls of the tube, so as to maintain constant the volume, and consequently the height, of the liquid in the indicia tubes. As the bubbles ascend through the liquid, they produce an agitation in the various liquid layers, so as to accentuate the visibility

thereof and the contrast therebetween. The gaseous phase of the components within the tube is produced solely by the application of heat to the indicia, which produces an intermittent but regular motion within the liquid. In addition to soluble dyes, colored suspensions or powders may be used, or a combination of dyes and powder.

The tubes are bent by the application of heat in the usual manner, to form the indicia portion of the tubes, which is then sealed to the vapor chamber portion of the tubes, this portion having been prepared by first blowing a heated end of a tube into a bulb of desired size, while compressing the tube just above the bulb by the application of suitably applied compression, the tube being then heated in the region of the constriction, and then bent into a substantially U-shaped bend whereby the vapor chamber is brought into an upstanding position.

An opening is blown into the straight portion of the tube above the bend and an exhausting tube is sealed on at this opening. The indicia portion of the tube has an opening blown therein at a desired location, and it is sealed onto the vapor chamber section so that the latter is brought into direct communication through the opening with the interior of the indicia section.

The exhausting tube is then attached to a suitable type of evacuating apparatus and suction is applied so as to exhaust the air from the assembled tube, and while the tube is so exhausted, a measured amount of the liquids to be inserted in the tube is then introduced by way of the exhaust tube, which is then sealed off, as indicated by the tip 71, the introduced liquids being thereby maintained under a vacuum so as to produce a ready vaporization of the volatile liquid in the tube as described above.

It will be understood that the present invention is not limited, necessarily, to the precise details of the steps, manipulations, and structure, as are herein specifically illustrated and described, but it will be apparent that such details are subject to various modifications which will become apparent readily to one skilled in the art, without departing from the spirit of the invention; and it will be understood, therefore, that it is intended and desired to include within the scope of the invention such modifications and changes as may be necessary to adapt it to varying conditions and uses. It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. A display device comprising a pair of closed chambers, a tube connecting said chambers and permitting flow of liquid therebetween, a plurality of immiscible liquids contained therein, at least one of said liquids having a low boiling point, and means for creating such temperature differ-

ences between said chambers as to vaporize at least the most volatile liquid in one chamber and condense the vapor in the other chamber and thereby to produce continuous movement of vapor bubbles through said liquids and through said tube.

2. A display device comprising a pair of closed chambers, a tube connecting said chambers and permitting flow of liquid therebetween, a plurality of immiscible, differently colored liquids contained therein, at least one of said liquids having a low boiling point, and means for creating such temperature differences between said chambers as to vaporize at least the most volatile liquid in one chamber and condense the vapor in the other chamber and thereby produce continuous movement of vapor bubbles through said liquids and through said tube.

3. A display device comprising a pair of closed chambers, a light-permeable indicia tube connecting said chambers and permitting flow of liquid and vapor therebetween, and a plurality of relatively immiscible, low boiling liquids of different densities partially filling said chambers and indicia and volatilizable upon application of warmth to one of said chambers to produce movement of vapor bubbles of at least the most dense liquid through the other liquids and through said indicia tube.

4. A display device comprising a pair of closed chambers, a light-permeable indicia tube connecting said chambers and permitting flow of liquid and vapor therebetween, and a plurality of relatively immiscible, differently colored, low boiling liquids of different densities partially filling said chambers and indicia and volatilizable upon application of warmth to one of said chambers to produce movement of vapor bubbles of at least the most dense liquid through the other liquids and through said indicia tube.

5. A display device comprising a pair of closed chambers, a light-permeable indicia tube connecting said chambers and permitting flow of liquid and vapor therebetween, and a plurality of relatively immiscible, low boiling liquids partially filling said chambers and indicia and volatilizable upon application of warmth to one of said chambers to produce movement of vapor bubbles through the liquids in said indicia tube, the densities of said liquids being so nearly alike that the agitation produced by the passage of said bubbles will emulsify the mixture.

6. A display device comprising a pair of closed chambers, a light-permeable indicia tube connecting said chambers and permitting flow of liquid and vapor therebetween, and a plurality of relatively immiscible, differently colored, low boiling liquids partially filling said chambers and indicia and volatilizable upon application of warmth to one of said chambers to produce movement of vapor bubbles through the liquids in said indicia tube, the densities of said liquids being so nearly alike that the agitation produced by the passage of said bubbles will emulsify the mixture.

PHILIP ROSENBLATT.