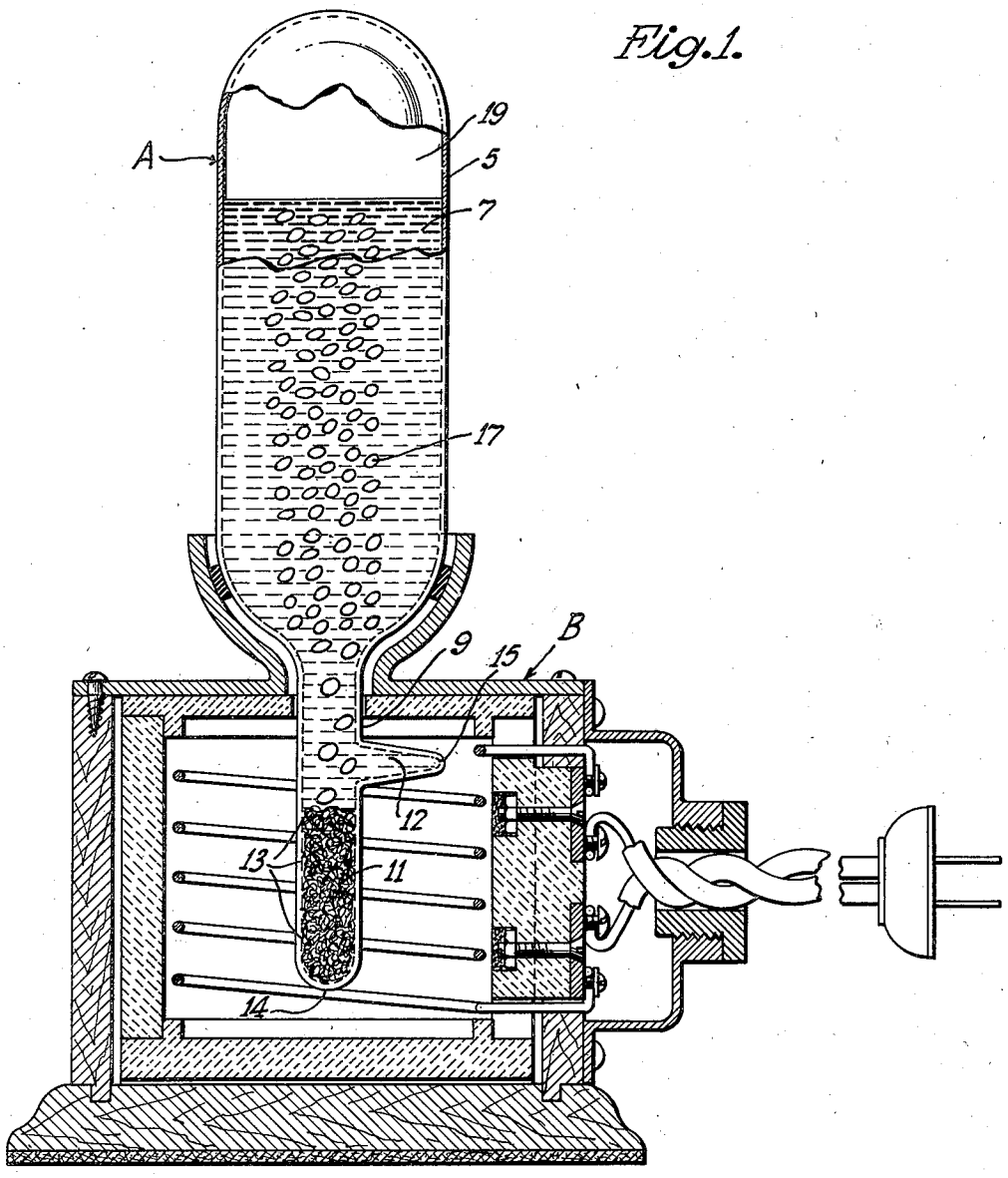
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DISPLAY DEVICE

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Fig. 1.



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Fig. 2.

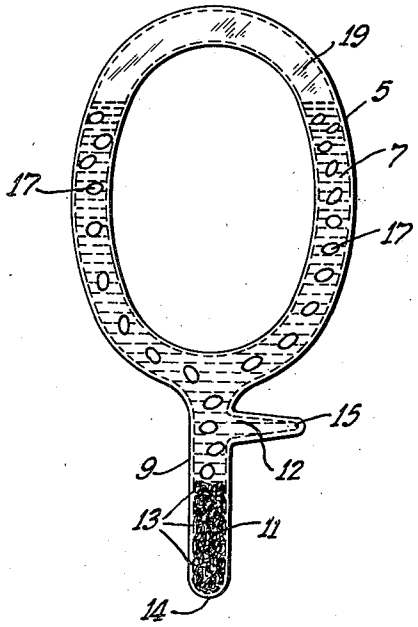
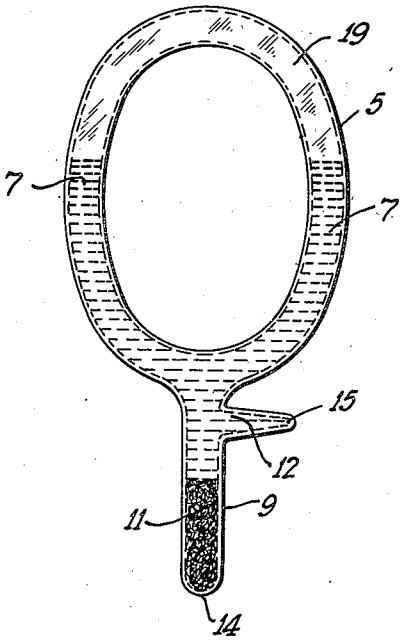


Fig. 3.



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DISPLAY DEVICE

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Application February 8, 1937, Serial No. 124,622

3 Claims. (Cl. 40—130)

It is known to produce highly effective display devices by providing suitable light transmitting tubes which are shaped to form desired characters, such as numerals, letters, or other indicia, which may be combined to define a slogan, word, or any other kind of display, the tubes being evacuated of air and containing a suitable low-boiling liquid, which when operatively associated with a suitable source of heat, is caused to boil or bubble, thereby being set in motion to accentuate the prominence and the attractiveness of the display.

The production of active bubbling in such tubes may be difficult to start and to maintain unless the tubes be of special construction or means be otherwise provided to initiate and sustain a certain and smooth evolution of bubbles in the liquid; and such means frequently are not sure to operate satisfactorily, resulting in irregular evolution of bubbles, bumping of the tubes, and other detriments.

The present invention provides a display tube which employs bubbling agitation or movement of a liquid contained in the tube for enhancing the display qualities of the tube, which, however, assures a smooth and continuous production of the bubbles, with a reduction in the heating period required to start the evolution of the bubbles, which when started will proceed quietly and without tendency to bump.

In this connection it may be mentioned again that when it is attempted to heat liquids, and especially where a substantial depth of liquid is presented to the source of heat, it may be difficult to start ebullition in the liquid, and that the liquid may become superheated below its surface before there is formation of subsurface vapor, so that there may be a sudden transition of a relatively large volume of the liquid into vapor, which may be violently expelled as a single large bubble, with the result that there may be produced a more or less violent bumping of the receptacle containing the liquid. When such action occurs, the expulsion of the large bubble carries out from the liquid all of the subsurface vapor, which must be reformed all over again with possibly a repetition of the violent bumping previously experienced, and with the certainty of an intermittent or discontinuous ebullition, instead of a regular and quiet bubbling with continuous agitation of the liquid.

As has been indicated above, the present invention provides a tube which produces a bubbling display, but which obviates any specially shaped tube except in the indicia portion thereof and which assures a continuous and smooth production of the bubbles without tendency of bumping and with almost instantaneous formation of the bubbles upon activation of a suitable source of heat, thus producing active and continuously sustained ebullition and agitation of the liquid contents of the tube.

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.

Generally speaking, the present invention comprises a transparent or light-transmitting tube at least a portion of which is formed into a desired indicia, the said tube being exhausted of air and containing a low-boiling liquid which will actively bubble in the evacuated tube with the application of relatively slight amounts of heat. The tube is characterized by having contained in a portion thereof a material, preferably of a fibrous character, which is submerged in the said liquid and which acts as a nucleus for the production of bubbles of vapor while retaining continuously an encapsulating volume or bubble of vapor from which a continuous succession of bubbles separates and rises through the liquid as gentle warmth is supplied to the tube, this formation of bubbles proceeding smoothly and quietly with attendant continuous agitation of the liquid. The tube may be provided with a supporting extension which opens into the interior of the indicia portion of the tube, and which, in addition to providing a supporting means for the tube, serves conveniently as the container for the said nucleus-providing material which thereby is prevented from interfering with the visible effects produced by the indicia portion of the tube, the tube being mounted conveniently with this extension concealed, in a suitable manner, from the view of an observer whose attention is directed to the bubbling indicia and the liquid which is agitated by the motion of the bubbles.

The retained bubble enclosing the nuclear material provides a start for the production and maintenance of the continuous stream of bubbles. Apparently the liquid adjacent to the retained vapor bubble enters the vapor space interiorly of the retained bubble and is vaporized

in turn, the resulting excess of vapor breaking away to produce the stream of bubbles mentioned above. The nuclear material and its entrained vapor accordingly form a vapor chamber in which additional quantities of liquid become vaporized and which controls the evolution of the resulting bubbles as a smooth and evenly produced operation.

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

Fig. 1 is a sectional elevation of one form of tube embracing the features of construction of the present invention, the tube being shown as being mounted in suitable heat-producing instrumentalities, the form of which may vary, however, within wide limits, as will be apparent,

Fig. 2 is a view of a different form of tube which is illustrated as being sufficiently heated to generate vapors which are shown to be bubbling through the liquid in the tube,

Fig. 3 is a view of a cold tube, showing the tube in inactive condition.

Referring more particularly to the drawings, wherein there are shown two forms of tubes embodying this invention, although it will be apparent that the size, shape, and formation of the tubes may be varied within virtually indefinitely wide limits, A represents the tube generally, which in Fig. 1, is shown to comprise a display section 5, which may be of transparent glass or other light-transmitting material, and which may be shaped into any form, the tube being exhausted of air and containing a quantity of low-boiling liquid, indicated at 7, which liquid may be of a volatile character such as acetone, ether, carbon tetrachloride, alcohol, or the like, which normally has a low boiling point, this being substantially depressed by virtue of the vacuum contained in the tube.

Conveniently, a portion of the tube 5 may be provided with a tubular appendage or extension 9, which may be either straight or curved, and which forms a container for a quantity of fibrous vapor-retaining material, such as glass wool, 11, which comprises a means for starting production of vapors in the body of the liquid 7, it being understood that the material 11 is submerged in this liquid 7. When the extension 9 is warmed, the liquid which permeates and contacts with the material 11 is vaporized and forms a large vapor space or bubble, 13, which envelopes the material 11 but which is prevented by the said material from becoming disengaged therefrom, and which defines a vapor space into which the adjacent liquid passes continuously while the tube is in operation, and becoming vaporized, the resulting excess vapor separates from the nuclear bubble 13, to rise through the liquid as a continuous succession or stream of bubbles 17, the nuclear bubble 13 being retained around the glass wool 11 and within the interstices thereof, thereby affording a means for controlling the ebullition of the liquid 7 to produce a quiet and sustained bubbling of the liquid.

In making the tube, after the tube 5 has been bent or otherwise formed into the desired shape, a suitable portion thereof may be heated and drawn out into the appendage 9, or the latter may be a separate member sealed to the tube 5 so as to communicate with an opening provided therefor in the tube 5. The appendage or extension 9 is provided originally with an open end 14, which is of sufficient diameter to enable insertion of the glass wool 11, or other material, into the extension 9, and the extension is formed with an evacuating opening 12 intermediate the display portion of the tube and the glass wool, this opening 12 communicating with a branch tube, which is sealed to the extension 9 at the opening 12 for connecting the tube 5 to a suitable exhausting and filling apparatus for evacuating the tube and filling it with liquid while in the evacuated condition. A sufficient but small quantity of the glass wool 11 is inserted in the extension 9 through the end 14, which then is sealed, as shown on the drawings.

After the introduction of the glass wool, or some equivalent material, such as for example, compressed graphite grains, or other similar material which is insoluble in the liquid, and which may be held in place by glass wool or other fibrous material, and which may be packed within the extension 9, the tube structure is exhausted by connecting the side tube, which has been sealed to the appendage 9 around opening 12, to a suitable exhausting apparatus. After the tube is thus evacuated, the liquid 7 is introduced, and while the tube is still evacuated, the side arm connection is sealed off, leaving the tip 15.

The tube is then ready for operation, and when heated, as by mounting in suitable heating instrumentalities, such as are indicated generally by the electric heater B, so that the extension 9 containing the glass wool has the heat from the said instrumentalities applied thereto, the liquid around the glass wool 11 and within the interstices of the glass wool, becomes vaporized very quickly to produce the large restrained nuclear bubble 13, into the interior space of which nuclear bubble passes the adjacent unvaporized liquid, which in turn becomes vaporized, and breaks away from the retained nuclear bubble and rises continuously through the liquid as the continuously sustained stream of bubbles which is designated at 17, the bubbles breaking at the surface of the liquid, to permit the vapors to escape into the cool space 19 above the liquid, where they recondense and return to the body of liquid in liquid form.

In this way, there will be produced a very prompt and regular bubbling action in the tube as soon as a moderate degree of warmth is applied to the extension 9; and the bubbling will proceed quietly and continuously so long as the tube is in operation.

The tubes may be mounted in a heating device, as shown, or this heating device may be replaced by a low power electric lamp, and the tubes may be mounted in a suitable casing, wherein an electric lamp acts both as a source of heat and a source of illumination for the tubes.

The restrained nuclear bubble facilitates a sustained vaporization and ebullition of the liquid 7. The glass wool, or other equivalent material, results in a shorter heating period for the tube, the liquid in and around the glass wool becoming entrapped therein, and the surrounding liquid enters the resulting nuclear bubble, which accordingly defines a vapor chamber and becomes vaporized within the said nuclear bubble, thereby causing the bubble to grow until the excess vapor detaches itself therefrom as the stream 17, leaving a portion of the nuclear bubble behind. If the bubbles were free to rise as they are formed, as would be the case were the glass wool or other material omitted, they would simply rise through the liquid, and a completely new bubble would have to form in the liquid, requiring longer heat and producing only an in-

termittent bubbling effect in the liquid. Also, bubbles would be suddenly thrown up in the tube, so that the localized heat of the bubble would be dispersed throughout the large mass of liquid, which would have to become reheated to start again the formation of the bubbles, the production of which would be always intermittent and likely to be accompanied by violent bumping.

Although it is preferred to use some fibrous material, such as the glass wool 11, or the like, which may be used either alone or in conjunction with other nuclei-forming bodies, other materials may be used, such as shot, glass beads or the like, or other solid suspensoids may be employed to start the formation of the bubbles. The main requirement for the material is that it should contain a quantity of relatively small interstices, and thus be capable of entrapping and holding a relatively large bubble of vapor.

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 specially 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 tube adapted for use in connection with illuminated displays and the like, which comprises a display portion and a tubular extension communicating therewith, a volatile liquid contained within the tube and extension, and a quantity of glass wool retained in the said extension and adapted to control the production and liberation of vapor bubbles when the tube is heated.

2. A display device for illuminated signs and the like comprising a light-transmitting, evacuated tube, a quantity of low-boiling liquid in the tube, the said tube comprising a sealed tubular extension projecting therefrom, and a quantity of glass wool within the extension and surrounded and permeated by the said liquid.

3. A device adapted for use in connection with illuminated displays, which comprises a transparent glass display tube, a vaporizable liquid in the tube adapted to boil upon application of vaporizing heat to the tube, and a quantity of glass wool in the tube immersed in the liquid for initiating and sustaining a quiet ebullition of the liquid while inhibiting complete release of vapor produced in the body of liquid to form a nucleus for further vaporization of the liquid.

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