Feb. 8, 1966 E. SEUTHE 3,234,357

ELECTRICALLY HEATED SMOKE PRODUCING DEVICE

Filed Oct. 29, 1962 2 Sheets-Sheet 1

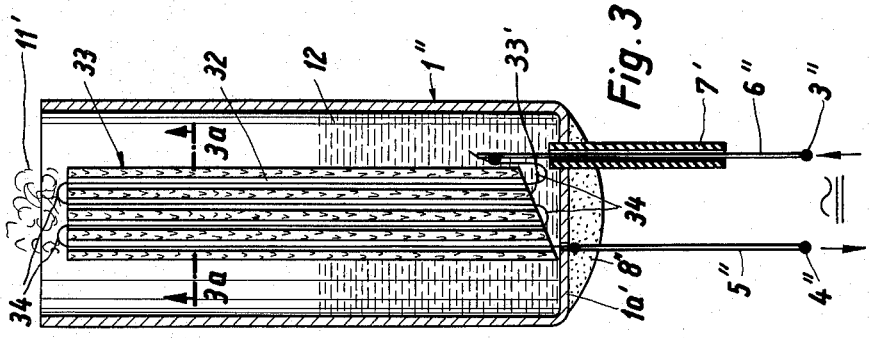

Fig. 3

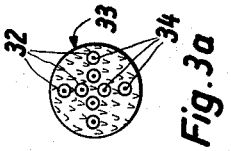

Fig. 3a

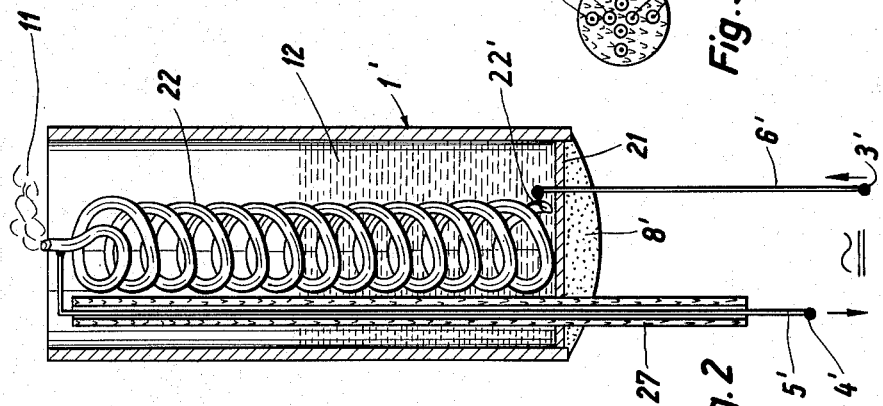

Fig. 2

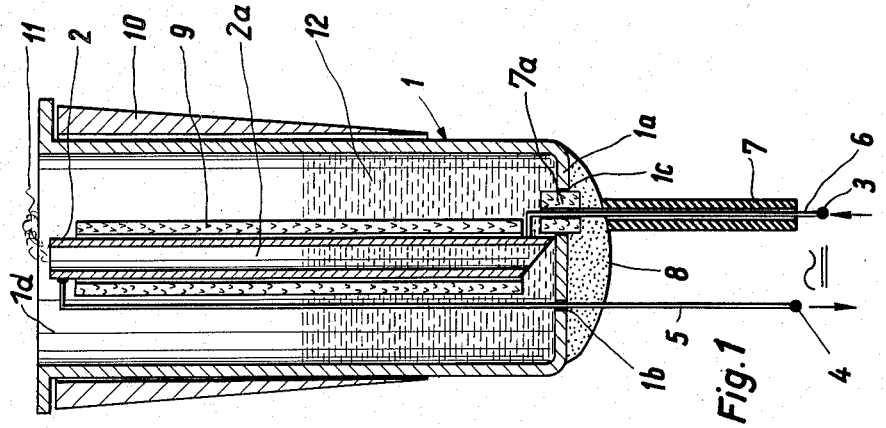

Fig. 1

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ELECTRICALLY HEATED SMOKE PRODUCING DEVICE

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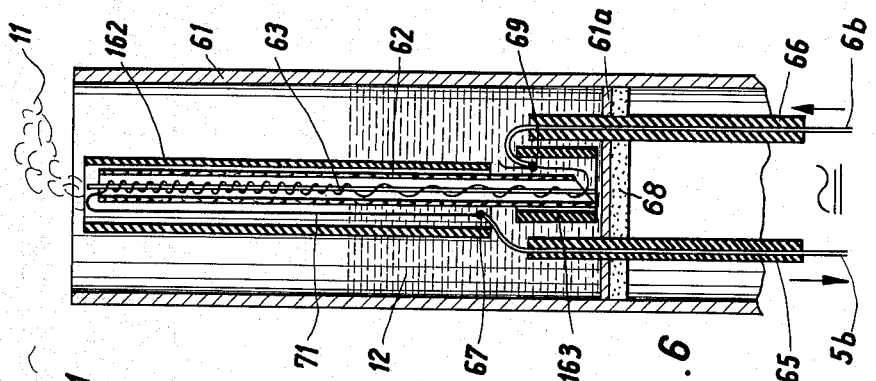

Fig. 6

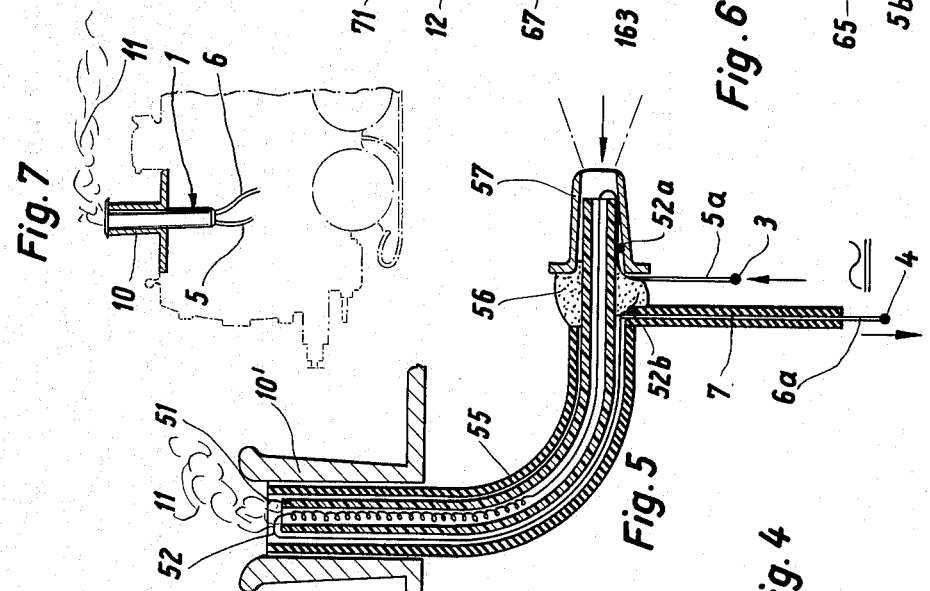

Fig. 7

Fig. 5

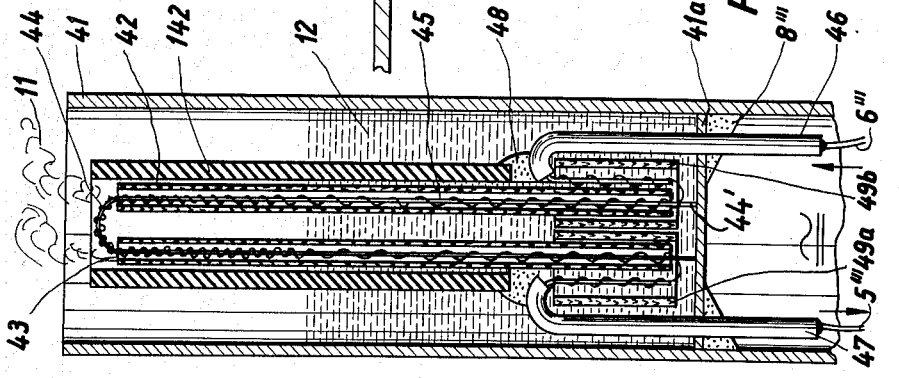

Fig. 4

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3,234,357

ELECTRICALLY HEATED SMOKE PRODUCING DEVICE

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Claims priority, application Germany, Nov. 2, 1961, S 76,518
9 Claims. (Cl. 219—273)

This invention relates in general to smoke, fume or vapor producing devices, and in particular to a new and useful device for producing smoke by the evaporation of oil or similar liquid, especially for use with toy locomotives, buildings and the like.

The present invention is particularly concerned with a device for producing a visible fume, vapor or smoke, and such devices are hereinafter referred to collectively as "smoke-producing devices." With known devices of this type, it is usual to provide a heating wire or similar heating element which is arranged adjacent to, or wound around, an evaporation medium such as an oil in a tube or container. With constructions of this type it is necessary to provide sealing means for the heating wire, including special jackets or covers of heat or electrically insulating material. One difficulty with apparatus of this type is that it is very complicated and expensive to manufacture and, in addition, occupies a large space. A further disadvantage of devices of this character is that auxiliary devices such as a movable piston and the like are required for effecting the pumping of the exiting smoke in order to simulate, for example, the exhaust of a locomotive.

In accordance with the present invention, there is provided an improved construction which includes a tubular element or riser tube having a capillary size bore which is arranged in a reservoir for the evaporating liquid. A feature of the construction is that the heating means for the evaporating liquid may advantageously comprise a single heating element which is arranged to extend through the riser tube or it may comprise the riser tube itself in order to provide suffiicent heating within the tube, so that smoke is generated from the top end thereof, exiting in a puffing fashion. In one embodiment, the tube having the capillary bore may advantageously be a riser pipe surrounded by an insulating cover, each made of flexible, inexpensive material and arranged to communicate with a reservoir or supply line for the evaporating liquid. With such a construction, a flexible or pliable riser is provided which may be bent and adapted to various space requirements, so that it may be easily incorporated into the many types of prefabricated toys such as locomotives, houses, etc. A particularly simple construction is obtained when the riser pipe is made as a spiral tube which extends upwardly through the liquid to be evaporated and which is made of an electrically conductive material which is electrically connected at opposite ends within the reservoir for the evaporating liquid.

In accordance with another feature of the invention, the pipe having the capillary bore is advantageously made of a material which provides an electrical heating resistance for the evaporating agent or, alternatively, the tube may contain an electrical resistance within the capillary bore.

Accordingly, it is an object of this invention to provide a smoke producing device.

A further object of the invention is to provide a compact smoke producing device which includes a tubular element advantageously having a capillary bore through which an electrical heating element extends which is suspended in a liquid which will vaporize or from smoke when heated.

A further object of the invention is to provide a smoke

producing device which includes a reservoir of a material such as an oil which will readily evaporate into smoke, in which reservoir is arranged a riser tube having a capillary bore therein which is connected electrically to produce a heating resistance for the heating of the material and generation of smoke.

A further object of the invention is to provide a smoke producing device which may be adapted for incorporation in toys of various configurations and which is of a construction which may be simply varied or bent in order to provide a universal use therefor.

A further object of the invention is to provide a device which is simple in design, rugged in construction and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there are illustrated and described preferred embodiments of the invention.

In the drawings:

FIG. 1 is a transverse section, on an enlarged scale, of a smoke generator constructed in accordance with the invention;

FIGS. 2 and 3 are sections similar to FIG. 1, of another embodiment of the invention;

FIG. 3*a* is a section taken on the line 3*a*—3*a* of FIG. 3;

FIGS. 4, 5 and 6 are transverse sections similar to FIG. 1, of other embodiments of the invention; and

FIG. 7 is a fragmentary section of a portion of a locomotive having a smoke generator installed thereon which is constructed in accordance with the invention.

Referring to the drawings in particular, the invention as embodied therein in FIG. 1 includes a smoke generating device comprising a tubular container for a reservoir generally designated **1** which is made of a material such as metal and which is filled with vaporizable liquid **12** which is introduced through an open top **1***d*.

In accordance with the invention, a riser pipe or tubular element is supported within the container **1** at a location spaced upwardly from the bottom wall **1***a* thereof and is provided with a bore **2***a* of capillary size. The pipe **2** consists of an electrically conductive material, for example, metal. The pipe **2** is advantageously made of a thin walled construction in order to obtain a heating resistance of a rather low ohmic value, for example, of about 5 ohms.

Electrical current supply lines **5** and **6** extend from terminals or poles **3** and **4** through openings **1***b* and **1***c* defined in the bottom wall **1***a* of the container **1**. The supply line **5** is connected to the upper part of the pipe **2**, while the supply line **6** is connected to the lower part of the pipe **2**. Insulation **7** is arranged around the supply line **6** at the exterior of the container **1**, and an insulating sleeve **7***a* is provided around the supply line **6** at the location of its entrance to the inner container **1**. The bottom wall **1***a* is sealed against the exit of liquid from the interior of the container **1** by means of an insulating cement **8**.

The riser pipe **2**, in the embodiment of FIG. 1, is surrounded by tube **9** of an insulating material which is advantageously porcelain or a synthetic material known in the trade as "Steofit" and insulates both against eletcric current and heat. Instead of providing separate pipes, a coating of the same or similar thickness as the pipe **9** may be applied around the pipe **2**. Such a coating may be applied by means of dipping, painting or spraying, for example.

The entire device is then advantageously supported in an opening formed by a wall **10** of a chimney which may

incorporate the stack of a toy locomotive, for example. Such an arrangement is indicated on a smaller scale in FIG. 7. During operation of the smoke producer, when the electric current is switched on, the liquid rises in the capillary bore 2*a* of the pipe 2, as it is heated by the current which is directed through the riser tube 2. The liquid 12 is evaporated and is such that smoke or vapor is formed and ejected from the locomotive, either continuously or intermittently, as desired. In doing so, a puffing noise takes place, whereby faithful reproduction of the real phenomenon of the operation of a toy locomotive is produced.

In the embodiment of FIG. 2, there is provided a container 1′ which is filled with a liquid 12 of a low boiling point which, when evaporated, produces a smoke 11 as in the other embodiment. The container 1′ in this embodiment is provided with a removable bottom 21 upon which is mounted a riser pipe or tube element 22 having a capillary size bore extending completely therethrough. The lower end 22′ is exposed above the surface of the plate 21, so that it will be at a location to draw in liquid 12 by capillary action. The tubular element 22 advantageously is made of a thin metal material and has a heating resistance slightly higher in ohmic value than in the embodiment of FIG. 1 and may be, for example, in the neighborhood of 50 ohms. An electric line 6′ is passed through a suitable opening made in the plate 21 without any insulation and is connected to the pipe 22 adjacent the lower end thereof. An electrical line 5′ is arranged within an insulating sleeve 27 which is mounted in a vertical manner in a suitable opening in the plate 21 to extend to the upper end of the pipe 22 and connects to the pipe 22 at this location.

A feature of the construction of this embodiment is that the riser pipe 22 and the associated electrical lines 5′ and 6′ with the insulation 27 may be mounted on the plate 21 and the whole assembly inserted through the bottom end of the tube 1′ and cemented in place by material 8′ to form a water tight connection. When the current is applied to the lines 5′ and 6′, liquid in the riser pipe 22 is vaporized and smoke is generated which exits as indicated at 11.

In the embodiment indicated in FIGS. 3 and 3*a*, a tubular element or reservoir 1″ is provided in which is located a riser pipe assembly or tubular element generally designated 33. The riser pipe assembly 33 advantageously includes a plurality of bores 32 defined therein extending from one end to the other, and the lower end 33′ is advantageously angled in respect to a bottom 1*a*′, so that each of the bores is exposed to the liquid 12 within the reservoir 1″. In this embodiment, a continuous heating wire or element 34 is directed successively up one bore 32 and down another in a continuous manner, and one end is connected to an electrical conduit 6″ and an opposite end is connected to an electrical conduit 5″ at locations adjacent the bottom edge 33′ but on opposite sides of the riser pipe 33. In this embodiment, the line 6″ is conducted through the bottom 1*a*′ and is surrounded at such location by an insulating sleeve 7′. The bottom is made water tight by the use of a cement material 8″.

In this construction, the liquid 12 rises in each of the bore 32 and is vaporized by the heating element 34 when the current is applied thereto, to cause a simultaneous formation of several smoke columns which issue as a plurality of puffs of smoke 11′. Puffing through the tops of each of the bores will take place at spaced intervals in accordance with the generation of the vapor in the individual bores. The riser pipe 33 in this embodiment may advantageously consist of porcelain or synthetic material, as indicated in FIG. 3*a*.

In FIG. 4, two spaced riser pipes or tubular elements 42 and 43 are arranged within the interior of a container or evaporating liquid reservoir 41. Evaporating liquid 12 is positioned within the container 41 as in the other embodiment, and a single electric heating wire 44 is advantageously wound around guiding elements 44′ and passed through capillary size bores defined in each of the riser pipes 42 and 43 in a continuous manner up one pipe and down the other. The ends of the wire are advantageously connected to electrical conduits 5‴ and 6‴ which are connected to a suitable source of electrical current. The guide elements 44′ are advantageously made of a material which is easily wetted by the evaporating liquid 12. The electrical lines 5‴ and 6‴ are advantageously covered with insulation sleeve 47 and 46, respectively, and they are passed through the bottom wall 41*a* of the container 41 in a fluid tight manner which is assured by providing cement 8‴. A portion of each of the lines 5‴ and 6‴ is exposed without any insulation at the interior of the container at locations within spaced insulation tubes or elements 49*a* or 49*b*. The riser pipes 42 and 43 are surrounded by an insulation sleeve or tubular element 142 which is also cemented in position above the insulating tubular elements 49*a* and 49*b*.

Sealing cement 48 is applied between the insulating sleeve 142 and the insulating sleeves 46 and 47 to stabilize the entire structure and also to provide adequate heat and current insulation. The bubble formation which is produced when the liquid 12 is evaporated by heat from the current supplied to the heating element 44 is particularly enhanced since the heating element 44 also extends directly above the top openings of these tubes and a particularly strong heat generation takes place in this vicinity. The container 41 in this embodiment may advantageously be made as a continuous pipe with the removable bottom 41*a*, and it may be made of a material such as metal, hard paper, cardboard or synthetic material.

In FIG. 5, the smoke producing unit is inserted into a chimney 10′ of a toy locomotive and is advantageously made flexible throughout its length so that it may be accommodated to the particular configuration of the cavity defined within the toy. In this embodiment, a riser tube or capillary pipe 51 is provided which consists of a heat resistant, flexible insulating hose through which heating wire 52 is passed. The heating wire 52 is advantageously coiled only in the upper portion of the capillary pipe 51 and the two ends of the heating wire 52 are connected with current supply lines 5*a* and 6*a* by means of soldering at locations 52*a* and 52*b*. The line 6*a* is surrounded by an insulating sleeve 7 which forms part of a hose 55. The hose 55 is connected by means of cementing material 56 at one end of a plug member or collar 57. The plug member 57 may advantageously comprise a small size hollow rivet which widens outwardly toward its flanged ends which are in fluidtight communication with a reservoir for the smoke producing liquid 12. The evaporating liquid is advantageously introduced into the opposite end of the hollow rivet 57 and it rises in the capillary tube 51 and is heated by the heating wire 52. This smoke producing unit permits a particularly universal use due to its flexible construction and it can be adapted to any possible number of devices, such as, for example, factory chimneys, locomotives and other toy structures. In addition, it can be produced very simply and inexpensively.

In FIG. 6 there is indicated a somewhat modified arrangement of the embodiment indicated in FIG. 4 which comprises a container 61 which may, for example, consist of an insulating hard paper pipe. The bottom 61*a* of the container 61 is advantageously made separate and may be of the same material. Insulating cement 68 is applied over the whole surface of the bottom 61. Current supply lines 5*b* and 6*b* are encased in insulation sleeves 65 and 66, respetcively, and are passed through the bottom 61*a* in a fluid tight manner. The lines 5*a* and 6*b* are connected at their inner ends at points 67 and 69 with the heating wire 71 which is directed through the interior of a capillary pipe 62. The wire 71 is advantageously coiled around a wick or mandrel 63 which is easily wetted. In order to obtain a stronger heating effect, the

wire in the upper region is wound in a tighter coiled manner than the lower portion. An insulating pipe **162** surrounds the capillary pipe **62** and the upper end of the heating wire **71**. The lower region of the capillary tube **62** is surrounded by an insulating sleeve **163** which is spaced downwardly from the insulating sleeve **162** and offset slightly therefrom. In some instances, it is desirable to provide insulating cement between the insulating sleeves **162** and **163**, and **65** and **66**.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A device for vaporizing a liquid such as a liquid which produces smoke, comprising a riser pipe having an open ended bore defined therethrough of a capillary size, an electrical heating wire extending through said bore in said riser pipe, the diameter of said wire being smaller than the diameter of said bore, said riser pipe having one end portion extending substantially vertically and having an opposite end portion disposed and operatively supported in said device for communication of said bore with the vaporizaable liquid, and an electric power source operatively connected to said heating wire.

2. A device according to claim **1**, wherein said riser pipe is made of flexible material.

3. A device according to claim **1**, wherein said riser pipe is made of flexible material, and including an outer tubular member of flexible insulation material substantially coextensive with at least said vertically extending end portion and surrounding said riser pipe, a plug member extending around said opposite end portion of said riser pipe and exposed at one end to the vaporizable liquid and connected at its opposite end to said outer tubular member and said riser pipe, said plug member having a passage therethrough which is in communication with said bore of said riser pipe.

4. A device according to claim **3**, wherein said plug member is a hollow rivet having an open end exposed for communication with the vaporizable liquid, the connection between said rivet and said outer tubular member and said riser pipe including cement material.

5. In a toy, a device for producing smoke and the like by vaporizing a liquid, comprising storage means for said liquid in said device, tube means operatively supported by said storage means so as to extend at least partially into said liquid, said tube means including a capillary tube section having at least one capillary bore extending therethrough, said bore being adapted to receive part of said liquid and cause it to vertically rise by capillary action in said bore, an electric power source, and an electrical heating wire substantially extending into said bore of said capillary tube section, the diameter of said electric heating wire being smaller than the diameter of said capillary bore, said electrical heating wire being operatively connected to said electric power source.

6. In a device according to claim **5**, wherein said tube means comprises a capillary tube section which has a plurality of bores defined therethrough of capillary size, and wherein said electrical heating wire comprises a single heating wire passed continuously through said plurality of bores.

7. A device according to claim **5**, wherein said heating wire is coiled, with the coils being tighter near the upper end of said capillary tube section than at the lower end thereof.

8. The device according to claim **5**, wherein said electrical heating wire extends through the entire tube means and is connected at opposite ends thereof to said electric power source.

9. In a toy, a device for producing smoke and the like by vaporizing a liquid, comprising storage means for said liquid in the toy, flexible plastic tube means operatively supported in the toy so as to extend at least partially into said liquid in said storage means, said tube means including a flexible tube having a bore therethrough of capillary cross-section in communication with said liquid, an electric power source, and a flexible electric heating wire disposed in said bore of said flexible tube, the diameter of said electric heating wire being smaller than the diameter of said bore said flexible electric heating wire being operatively connected to said electric power source.

References Cited by the Examiner

UNITED STATES PATENTS

912,994	2/1909	Conrad	219—300
1,739,817	12/1929	Beals	261—142
1,977,232	10/1934	Ginder	219—274
2,461,664	2/1949	Smith	219—274 X
2,696,548	12/1954	Bencetti	219—275
3,085,145	4/1963	Wray	219—272

FOREIGN PATENTS

327,614	3/1958	Switzerland.

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