June 12, 1956 N. F. SMITH ET AL 2,749,733

GAS CANDLE

Filed Dec. 24, 1952 2 Sheets-Sheet 1

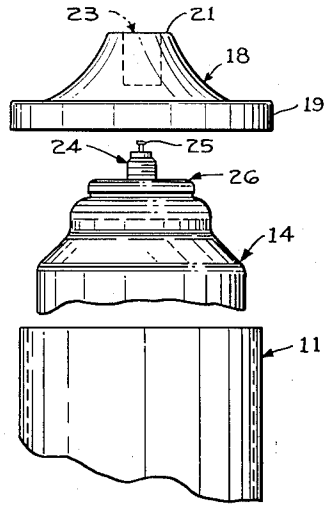

Fig. 2.

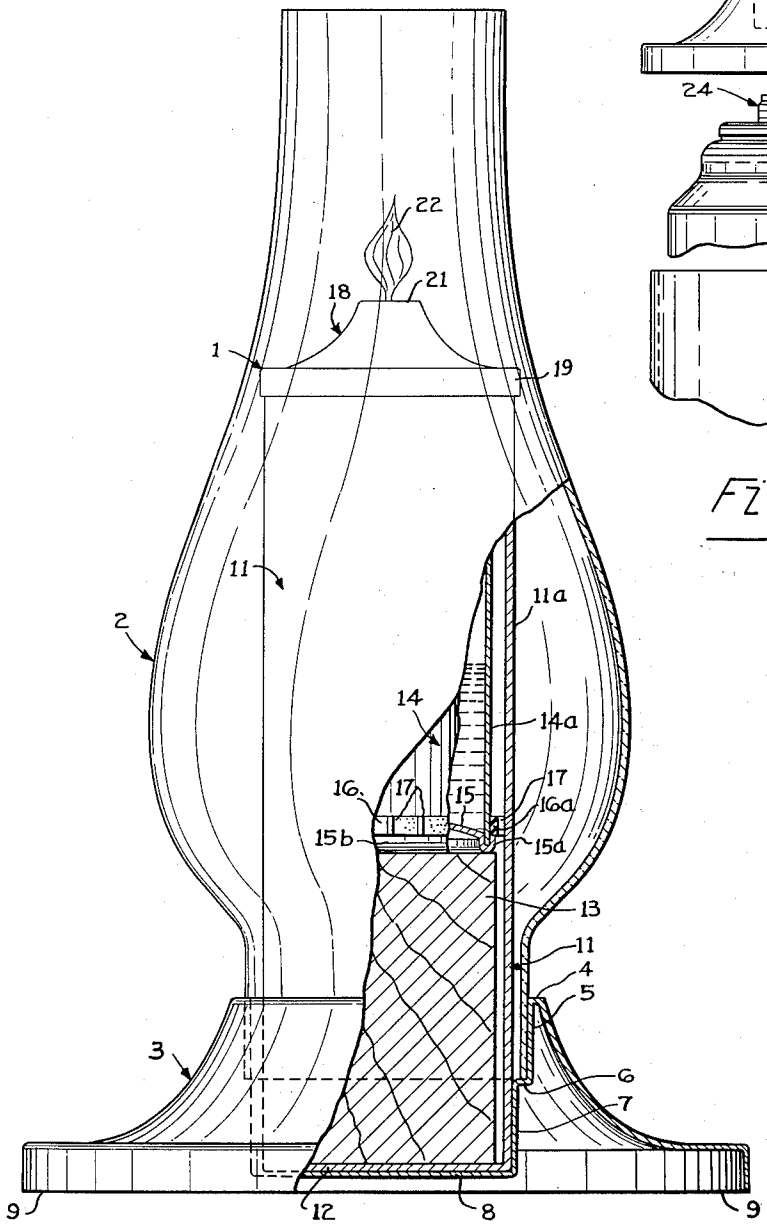

Fig. 1.

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Fig. 3.

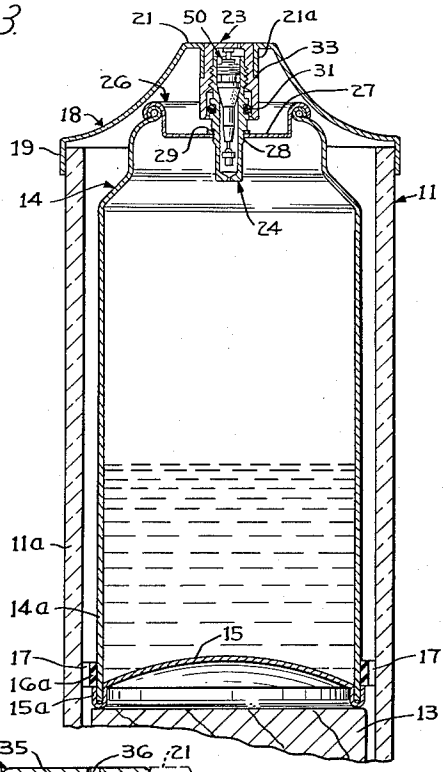
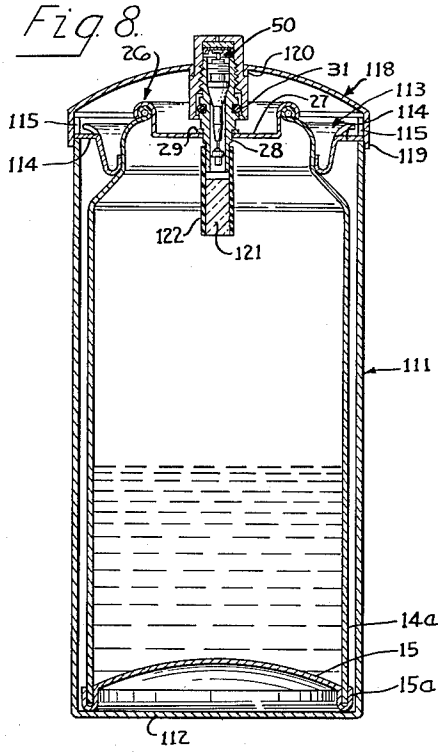


Fig. 8.



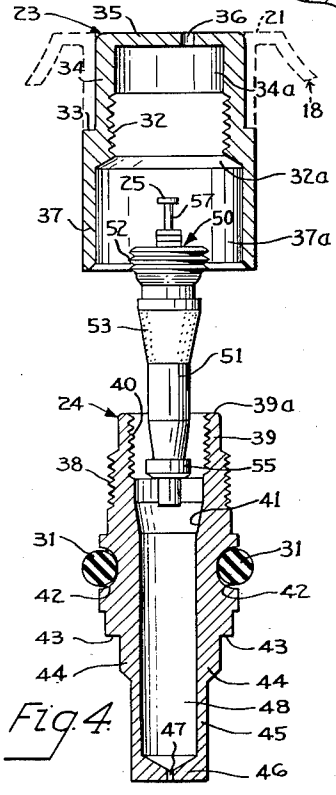


Fig. 4.

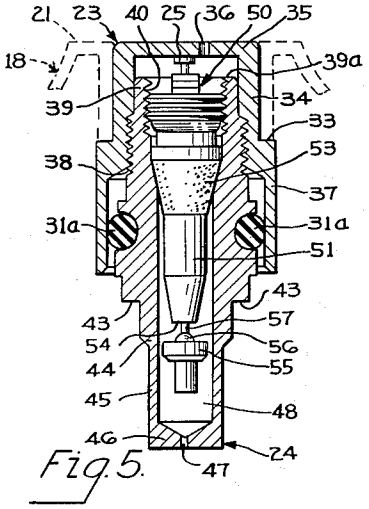


Fig. 5.

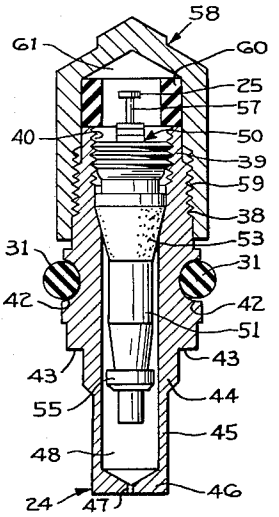


Fig. 7.

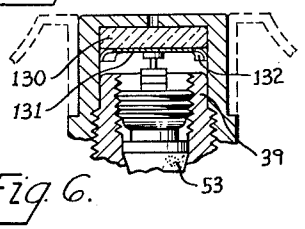


Fig. 6.

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United States Patent Office 2,749,733 Patented June 12, 1956

2,749,733

GAS CANDLE

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Application December 24, 1952, Serial No. 327,842

8 Claims. (Cl. 67—87)

This invention relates to a simulated candle and, in particular, to a device of this kind adapted to burn a gaseous fuel that is derived from the vaporization, at ordinary room temperatures, of a liquid fuel maintained under a moderate pressure.

Although herein called a "candle," what is referred to by that term may, if desired, be employed for purposes other than those for which candles are ordinarily used; for example, certain features of the invention may be embodied in a lamp for use in place of the conventional alcohol lamp for sterilizing small instruments. One of the objects of the invention is to provide a device of the type described that is equipped with a replaceable fuel reservoir of the cartridge type. Another object of the invention is to provide such a reservoir with fittings adapted to control the flow of a gas vaporized at room temperatures from a liquid that is itself under superatmospheric pressure. A further object of the invention is to provide a candle having these and other features lending itself to use in a torchere or, in another form, on a table or similar piece of furniture as a decorator's item.

Other objects and advantages of the invention will be apparent from the description which follows and from the accompanying drawings, in which:

Figure 1 is a side elevation, partly broken away to show certain of the parts in section, of the candle of the present invention as incorporated in a hurricane lamp.

Figure 2 is an exploded view, likewise in side elevation, of certain of the parts making up the candle of Figure 1.

Figure 3 is a central vertical section with parts in elevation showing the details of the candle on a larger scale than in Figures 1 and 2.

Figure 4 is an exploded view on a still larger scale showing the fittings and valve assembly used in the candle of Figure 3, the fittings being in section and the valve assembly in side elevation.

Figure 5 is a view showing in assembled relation to each other the same parts as in Figure 4, the fittings being in section and the valve assembly in elevation.

Figure 6 is a view showing in fragmentary fashion a somewhat modified upper fitting used in place of the upper fitting of Figure 5.

Figure 7 is a view similar to Figure 5 in which, however, a shipping cap replaces the upper fitting.

Figure 8 is a central vertical section generally similar to that of Figure 3 showing a modification in which the candle is designed for use in a torchere.

In Figure 1, the candle generally is designated **1**. It is enclosed with a glass globe **2** of conventional size and shape that is mounted on a spun metal base **3**. The latter is characterized by a shoulder **4** at its top, by a first relatively wide sleeve-like portion **5** of a size accommodating the end of globe **2**, by an intermediate shoulder **6**, by a second relatively narrow sleeve-like portion **7** of a size accommodating the end of candle **1**, and by a bottom platform **8** which closes off the lower end of sleeve-like portion **7**. It is on intermediate shoulder **6** and platform **8** that globe **2** and candle **1**, respectively, are supported. In the form of the invention shown in Figure 1, base 3 is open across its bottom and rests on its bottom edge **9**.

A hollow shell of generally cylindrical shape, designated **11** in Figures 1, 2 and 3, makes up the body of candle **1**. Its side wall is shown in cross section at **11***a*. Toward its lower end it is provided with means that are present primarily to position the various other components of candle **1**. Such primary positioning means include an integrally formed bottom portion **12** that lies in a plane extending transversely of the longitudinal axis of cylinder **11** and, in the form of the invention shown in Figures 1 and 3, also a cylindrical plug-like spacer of wood, designated **13**, that rests on and is supported by bottom portion **12** of cylinder **11**. Spacer **13** may be present or absent in a given case and, if present, may be of any suitable form and of any convenient material; for example, it may, if desired, take the form of a hollow cardboard cylinder of the same dimensions as the wooden plug shown in Figures 1 and 3.

Supported by means of spacer **13** from bottom portion **12** of cylinder **11** is a replaceable metal fuel reservoir **14** of the cartridge type. Such fuel reservoir preferably contains a conventional liquid hydrocarbon such as butane under moderate superatmospheric pressure that vaporizes at ordinary room temperatures to provide a constant low-pressure source of a gaseous fuel that will burn freely in air. In general, reservoir **14** is cylindrical in shape, although for reasons which appear hereinafter it is provided at its upper end with a stepped neck portion that is best seen in Figure 2. At its lower end it has a crimped-on bottom **15**, the outer edges of which are formed into a chime cooperating with the lowermost portions of side wall **14***a* of fuel reservoir **14**. Such bottom chime is shown in section at **15***a* in Figures 1 and 3 and in side elevation at **15***b* in Figure 1. The construction of fuel reservoir **14** as regards the details of the side wall, bottom and bottom chime is conventional: such liquid- and gas-tight constructions as that shown are well known.

At any convenient level, but usually somewhat above the top of spacer **13**, candle **1** is provided with auxiliary positioning means for supporting and holding in position fuel reservoir **14**. Such conveniently may take the form of a positioning ring **16**, shown in section at **16***a*, which fits around the periphery of fuel reservoir **14** and extends thence into engagement with cylinder **11**. It may, if desired, be provided at half-inch intervals, more or less, with radial fin-like gripping portions **17** that extend outwardly into contact with the inner face of cylinder **11**. Positioning ring **16** and fin-like gripping portions **17** are perferably formed integrally of a resilient material such as rubber; if so, fuel reservoir **14** will be held frictionally and will have little or no tendency to move or rotate within cylinder **11**; instead, it will be positioned and supported in rattle-free relation to the encompassing body portion of the candle.

At its top, candle **1** is provided with a closure **18** for the open upper end of cylinder **11**. In the embodiment of the invention shown in Figures 1, 2 and 3, such closure takes the form of a frusto-conical cap having on its top surface a peripheral concavity intended to impart to it the shape of the upper end of a wax candle. In the form of the invention illustrated in the drawings, closure **18** has a depending collar **19** which conforms closely in size and shape to the upper end of cylinder **11** and which overlaps it as indicated. In some forms of the invention, closure **18** may rest on the upper end of cylinder **11**, but in the preferred form of the invention there is ordinarily a clearance not greatly less and usually more than that which appears in Figure 3. Closure **18** is provided at its nar-

rowest portion with a flat area **21** (Figures 2 and 3) from which depends an annular lip **21***a*, best seen in Figure 3. When the candle is seen from the side, as in Figure 1, flame **22** appears to come from the center of the flat area **21** at the top of closure **18**.

Affixed to lip **21***a* where it depends from flat area **21** at the top of closure **18** is an upper fitting **23** of metal which, in general, is of cylindrical construction. In the preferred form of the invention, closure **18** is held by a press fit on the upper end of fitting **23**. As indicated in Figure 3, the upper end of fitting **23** is largely, but not entirely, closed. The flat area **21** at the top of closure **18** and the closed upper end of fitting **23** are preferably substantially flush with each other, but slight departures by either from the plane of the other are not objectionable. Cooperating with upper fitting **23** is a lower fitting **24** of metal which likewise is more or less cylindrical in shape and which, like upper fitting **23**, is provided with an end that is largely but not entirely closed. As indicated in Figures 2 and 3, lower fitting **24** incorporates a valve assembly **50** of the tire-valve type having a central stem provided with a headed end **25** (Figure 2). In general, such valve assembly is conventional in construction, size and shape.

Reference has already been made to the stepped neck portion at the top of fuel reservoir **14**. What would otherwise be an opening in the necked portion of fuel reservoir **14** is spanned by a metal sealing element **26**. The latter is crimped into liquid- and gas-tight relation to the top of fuel reservoir **14**. As shown in Figure 3, sealing element **26** is characterized by a depressed portion **27** which serves as a platform for mounting lower fitting **24**. In mounting it on sealing element **26**, lower fitting **24** is crimped into engagement with depressed portion **27** of sealing element **26**. The crimped portion of lower fitting **24** appears at **28** in Figure 3.

On the opposite side of sealing element **26** is a gasket **29** fitting between the upper face of depressed portion **27** and a downwardly facing shoulder on lower fitting **24**. Gasket **29** precludes the escape of fuel in either gas or liquid form around the outside of the body portion of lower fitting **24**. Where the lower end of upper fitting **23** adjoins lower fitting **24**, the latter is provided with a sealing ring **31** of deformable material, this to preclude the escape of fuel through lower fitting **24** and thence past the lower end of upper fitting **23**. The manner in which sealing ring **31** performs this function will be apparent from a comparison of Figures 4 and 5. In the former, sealing ring **31** takes the form of a torus; in the latter, its cross section is deformed as indicated at **31***a*.

The details of the construction of upper fitting **23** are shown in Figures 4 and 5. As best seen in Figure 4, upper fitting **23** is hollow and provided approximately halfway between its two ends with a series of internal threads **32**. Outwardly of the threaded portion **32**, upper fitting **23** is provided with an annular shoulder **33**. Projecting upwardly from shoulder **33** is an upper cylindrical portion **34** containing a chamber **34***a*. Cylinder portion **34** terminates as shown in a ported baffle **35** extending transversely of the longitudinal axis of chamber **34***a*.

Baffle **35** may have more than one opening **36** through which fuel can escape to feed flame **22** (Figure 1), but in the form of the invention illustrated in Figures 3 to 5 of the drawings there is in baffle **35** a single eccentrically located opening **36** measuring about 0.030" in diameter. Opening **36** is located eccentrically in order that it will not be closed by the headed end **25** of the valve stem forming part of the valve assembly **50**. Except for the presence of one or more openings **36**, the upper end of upper fitting **23** is closed by baffle **35**. Preferably, baffle **35** is formed integrally with upper cylindrical portion **34** of upper fitting **23**, although it may if desired be formed separately and mounted thereon in any convenient way.

On the opposite side of shoulder **33**, upper fitting **23** is characterized by a depending cylindrical sleeve **37** of somewhat greater diameter than upper cylindrical portion **34**. It is provided as shown with a cylindrical chamber **37***a* that is open at both ends. The parts are so proportioned that the chamber **37***a* provided within depending sleeve **37** is of greater diameter than the chamber **34***a* within upper cylindrical portion **34**. It is also of greater diameter than threaded portion **32**. At the base of threaded portion **32**, upper chamber **34***a* is flared into chamber **37***a* by a frusto-conical portion **32***a*.

For cooperation with internally threaded portion **32** of upper fitting **23** an externally threaded portion **38** is formed near the top of lower fitting **24**. For reasons which will appear hereinafter, a sleeve **39** with a flat end surface **39***a* projects upwardly beyond the upper end of externally threaded portion **38**. Sleeve **39** is threaded internally as indicated at **40** (Figure 4) and such internally threaded portion **40** extends downward below the lower end of upwardly projecting sleeve **39** to a point approximately mid-way between the ends of externally threaded portion **38**.

Internally threaded portion **40** is provided to accommodate valve assembly **50**, which is threaded into the upper end of lower fitting **24**. The valve assembly seats on a frusto-conical portion **41** formed within lower fitting **24** below the level of the bottom of externally threaded portion **38**. When the valve assembly is seated in this way on frusto-conical portion **41**, the headed end **25** of the valve stem projects upward as shown in Figure 5 beyond flat end surface **39***a* on sleeve **39** at the upper end of lower fitting **24**.

The sealing ring **31** to which reference has already been made fits snugly in an annular groove **42** (Figure 4) about mid-way between the two ends of lower fitting **24**. It projects outwardly therefrom in order to permit it to contact depending sleeve **37** on upper fitting **23**. A short distance below groove **42** is the downwardly-facing shoulder, designated **43**, that bears against gasket **29** when the parts are assembled as shown in Figure 3. Below downwardly-facing shoulder **43** is a thick portion **44** which, in the crimping operation previously described, flows upwardly and outwardly to form crimped portion **28** (Figure 3).

The lower cylindrical portion **45** of lower fitting **24** is largely but not entirely closed by an integral baffle **46** having a centrally located port **47**. In a typical case the latter measures about 0.002". Port **47** controls the flow of fuel into lower fitting **24**. By limiting the flow it serves to prevent flame **22** from assuming excessively large portions when the gas candle is in use. Overlying baffle **46** is a long narrow cylidrical chamber **48** accommodating those parts of valve assembly **50** that extend downward below the frusto-conical portion **41** on which valve assembly **50** seats when it is located in place in lower fitting **24**.

Valve assembly **50** is best seen in Figure 4. It includes a hollow body portion **51** of metal formed toward its upper end with external threads **52** for cooperation with internally threaded portion **40** of lower fitting **24**. Surrounding body portion **51** below the level of threaded portion **52** is a hard rubber member **53**, frusto-conical in shape, which seats upon frusto-conical portion **41** of lower fitting **24**. Toward the lower end of valve assembly **50** body portion **51** thereof terminates in an annular valve seat **54**. Cooperating therewith is an upwardly facing cup-like valve **55** provided with an annular sealing gasket (not shown) that surrounds and is located by a hemispherical enlargement **56** on the axially extending valve stem **57** by which valve **55** is carried.

Normally valve **55** is biased into closed position on valve seat **54** at the lower end of body portion **51**. This condition obtains until closure **18** and upper fitting **23** are depressed by manual rotation of the latter about the longitudinal axis of lower fitting **24** to an extent sufficient to bring baffle **35** into contact with headed end **25** on the upper end of valve stem **57**. To rotate upper fitting

23, closure 18 is first grasped between the fingers, usually toward the top of closure 18, and then turned in the desired direction.

Downward movement of closure 18 and therefore of upper fitting 23 ultimately forces valve stem 57 downward, thereby separating cup-like valve 55 from valve seat 54. Under such conditions, gas under pressure can enter lower fitting 24 through port 47, travel axially through hollow body portion 51 of valve assembly 50, and make its escape around valve stem 57 through opening 36 in baffle 35 in the upper end of upper fitting 23. When so escaping, it can readily be ignited by a match or the like. The state of affairs represented in Figure 5, and on a smaller scale in Figure 3, is that which obtains when escaping gas burns to form flame 22 (Figure 1).

To extinguish the flame, closure 18 and upper fitting 23 are manually rotated in the opposite direction, causing them to move upward on lower fitting 24. As upper fitting 23 moves upward, cup-like valve 55 of valve assembly 50 seats on valve seat 54, thereby cutting off the supply of gas. Further upward movement of upper fitting 23 beyond this stage develops a clearance above headed end 25 of valve stem 57. Continued upward movement of upper fitting 23 ultimately results in disengagement of upper fitting 23 from lower fitting 24. So long as depending sleeve 37 on upper fitting 23 is in contact with it, sealing ring 31 is effective to prevent gas leaks in the manner indicated in Figure 5; when such contact disappears as result of continued upward movement of upper fitting 23, sealing ring 31 returns to its original toroidal contour, shown in Figures 4 and 7.

Figure 6, to which reference will be made hereinafter, shows a modification of the upper end of upper fitting 23 in which an auxiliary baffle is employed to control the flow of gas through the fitting.

For shipping purposes, a temporary upper fitting similar in other respects to upper fitting 23 but without port 36 in the baffle 35 thereof may be used in place of or as a shipping cap; however, it will usually be preferred to use a shipping cap 58 of the kind shown in Figure 7 that is designed in such a way that its upper end cannot make contact with headed end 25 on the upper end of valve stem 57. It will be noted that shipping cap 58 has no port in its upper end to permit the escape of gas to the atmosphere. It is characterized, among other things, by an internally threaded portion 59 adapted to cooperate with the externally threaded portion 38 on lower fitting 24.

Held frictionally in place above threaded portion 59 is an annular sealing element 60 of rubber or similar material that is adapted to engage flat end surface 39*a* (Figures 4 and 5) of the upwardly projecting sleeve 39 at the upper end of lower fitting 24. Downward movement of shipping cap 58 within the limits permitted by threaded portions 38 and 59 merely compresses sealing element 60 without permitting contact to develop between shipping cap 58 and headed end 25 of valve stem 57. Preferably, shipping cap 58 is provided for this purpose with dome-like chamber 61 at its upper end.

The embodiment of the invention shown in Figure 8 has to do with a candle for a torchere of the type used in conjunction with services, rituals, etc. The reservoir is formed in the same manner as before and has fittings that are the same in many respects as those shown on an enlarged scale in Figures 4 and 5. The reservoir and its fittings are supported within a thin-walled cylindrical shell 111, the bottom of which is closed by a transversely extending end portion 112. The latter constitutes the primary means for supporting and positioning the reservoir. No auxiliary means of the nature of positioning ring 16 of the previously described embodiment of the invention are employed, this for the reason that the fit between the bottom chime and shell 111 can ordinarily be close enough so that there is no need for positioning means below the top of the reservoir. However, frictional means for keeping reservoir 14 from rotating may be provided at the upper end of the reservoir, the same taking the form of closely fitting metal ring 113 provided with two or more outwardly extending legs 114 that seat in slots 115 at the top of cylindrical shell 111.

In the candle shown in Figure 8, most of which will be concealed within the top of a torchere, there is little reason for simulating the upper end of the wax candle. Accordingly, closure 118 thereof may take any convenient form such as the convex form illustrated. It is, however, preferably provided with a depending collar 119 analogous to collar 19 on closure 18 (Figure 3) that fits over the upper end of shell 111. Where closure 118 abuts the upper fitting, it is provided with a depending lip 120 adapted to engage shoulder 33; in consequence, a press fit can be utilized to hold closure 118 in place on the upper fitting. The projecting portion of the upper fitting may extend well above the top of closure 118, this being unobjectionable where, as in a torchere, the parts are concealed from view. The presence of such upwardly projecting portion is advantageous when it is desired to light the candle for the reason that it provides a grasping portion by which the upper fitting may be rotated to unseat the valve.

It will be noted that in Fig. 8 the lower fitting does not have a ported baffle similar to baffle 46. In lieu thereof, a cylindrical plug 121 of a permeable material is held in place below the open lower end of the fitting by means of a rubber sleeve 122. The permeable plug 121 may be of any suitable permeable material such as graphite, sintered metal or one of the conventional porous ceramic materials. It should have a porosity of about 25%. If of graphite, it is preferably graphitized petroleum coke of fine grain and uniform porosity such as National Carbon Company's grade C–30. This material is supplied in the form of a rod that can be cut to length, which will ordinarily be several times the diameter of the rod.

By using a baffle of the nature of permeable plug 121, it is possible to dispense with the operation of forming a small port in a transversely-extending metal baffle at the lower end of the lower fitting, an operation that is difficult to perform where the port is of the order of a few thousandths of an inch in diameter.

The upper fitting shown in Fig. 8 likewise differs from the upper fitting used in the previously described embodiment of the invention. It corresponds to what is shown in detail in Fig. 6, in which the ported baffle at the upper end of the upper fitting is supplemented by a baffle 130 of one of the materials referred to above as being available for use in permeable plug 121. Such auxiliary baffle preferably is a rather thin disc backed by a metal retaining element 131 of suitable shape characterized by a plurality of downwardly turned lugs 132 and, between the lugs, by one or more open areas through which the gas may reach baffle 130. Retaining element 131 is held in place within the upper end of the upper fitting by a friction fit. The presence of the auxiliary baffle, which is for the purpose of preventing a spurt of flame when the escaping gas is first ignited, makes it unnecessary to locate the overlying port in non-centric position; accordingly, it may be centered as shown in Figs. 6 and 8.

In general, where the parts hereinabove referred to are not described as being made of metal, rubber, etc. or in similar specific language, the material of which the candle is made may vary over a very considerable range. Usually it will be necessary or desirable to have the fuel reservoir and the fittings of metal. The closure at the upper end of the candle can be advantageously be of metal but in many cases may be made of a non-combustible metal, as, for example, a glass-reinforced resin. The cylinder forming the body of the candle may be of a ceramic material, of glass, of synthetic resin or of any other appropriate material.

It is intended that the patent shall cover, by summariza-

tion in appended claims, all features of patentable novelty residing in the invention.

What is claimed is:

1. A simulated candle comprising an upright shell; supporting means toward the lower end of the shell, said supporting means extending transversely of the vertical axis of the shell; a fuel reservoir carried by said transversely extending supporting means; a first fitting rigidly mounted on said fuel reservoir; a second fitting extending upward therefrom into proximity to the upper end of the shell; valve means incorporated in one of said fittings for operation by movement of the second fitting; and, closely encompassing the second fitting, a closure for the upper end of the shell.

2. A simulated candle as in claim 1 in which the top of the closure for the upper end of the shell is substantially flush with the top of the second fitting.

3. A simulated candle as in claim 1 in which the closure for the upper end of the shell is carried by a shoulder intermediate the ends of the second fitting.

4. A simulated candle comprising an upright shell; primary positioning means toward the lower end of the shell, said positioning means extending transversely of the vertical axis of the shell; auxiliary positioning means above the level of the primary positioning means; a fuel reservoir carried by said primary positioning means; a first fitting rigidly mounted on said fuel reservoir; a second fitting extending upward therefrom into proximity to the upper end of the shell; valve means incorporated in one of said fittings for operation by movement of the second fitting; and, closely encompassing the second fitting, a closure for the upper end of thes hell.

5. A simulated candle as in claim 4 in which the auxiliary positioning means take the form of a frictionally-held ring mounted on the fuel reservoir in engagement with the inner surface of the shell.

6. A simulated candle as in claim 5 in which the ring

is provided at intervals around its periphery with radially extending gripping portions.

7. A simulated candle comprising an upright shell; supporting means toward the lower end of the shell, said supporting means extending transversely of the vertical axis of the shell; a fuel reservoir carried by said transversely extending supporting means; a first fitting rigidly mounted on the fuel reservoir; a second fitting movably mounted on the first fitting, said second fitting extending upward therefrom into proximity to the upper end of the shell; deformable sealing means carried by one of said fittings in gas-tight engagement with the other fitting for operation by movement of the second fitting; and, closely encompassing the second fitting, a closure for the upper end of the shell.

8. A simulated candle comprising an upright shell; supporting means toward the lower end of the shell, said supporting means extending transversely of the vertical axis of the shell; a fuel reservoir carried by said transversely extending supporting means; a first fitting rigidly mounted on said fuel reservoir; a second fitting extending upward therefrom into proximity to the upper end of the shell; a valve assembly of the tire-valve type mounted in the first fitting for operation by movement of the second fitting; and, closely encompassing the second fitting, a closure for the upper end of the shell.

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