May 15, 1962 L. PÉRAS 3,034,726

HEATING AND ATOMIZING DEVICE

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FIG. 1

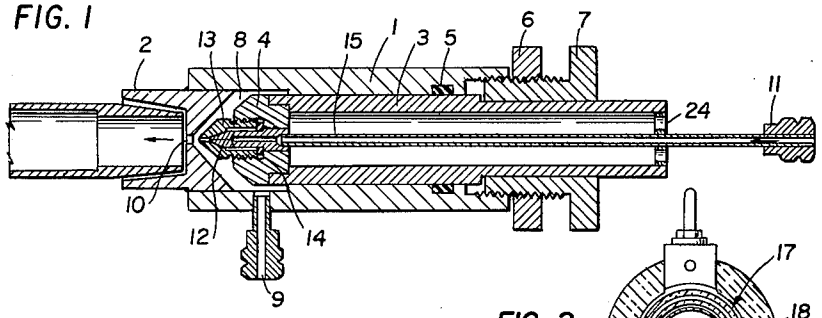


FIG. 3

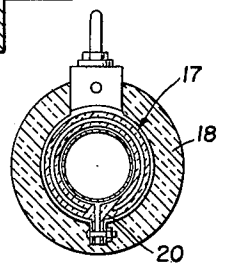


FIG. 2

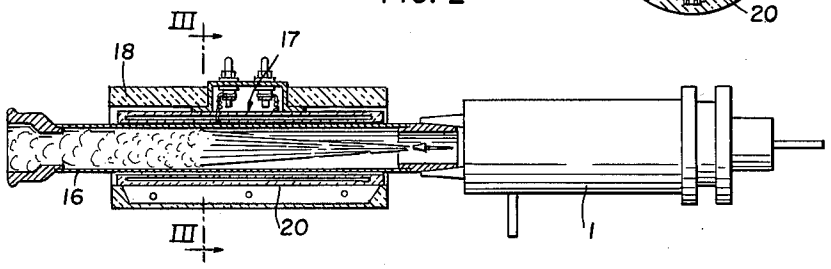


FIG. 4

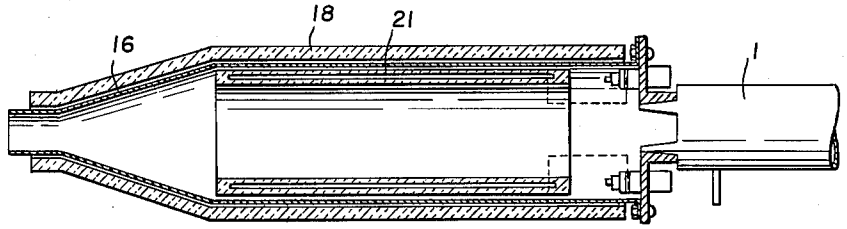
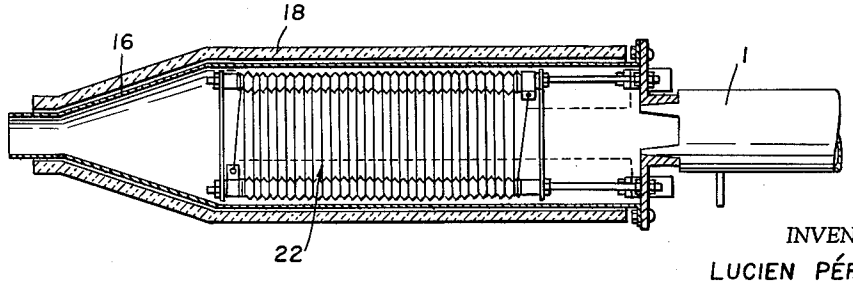


FIG. 5



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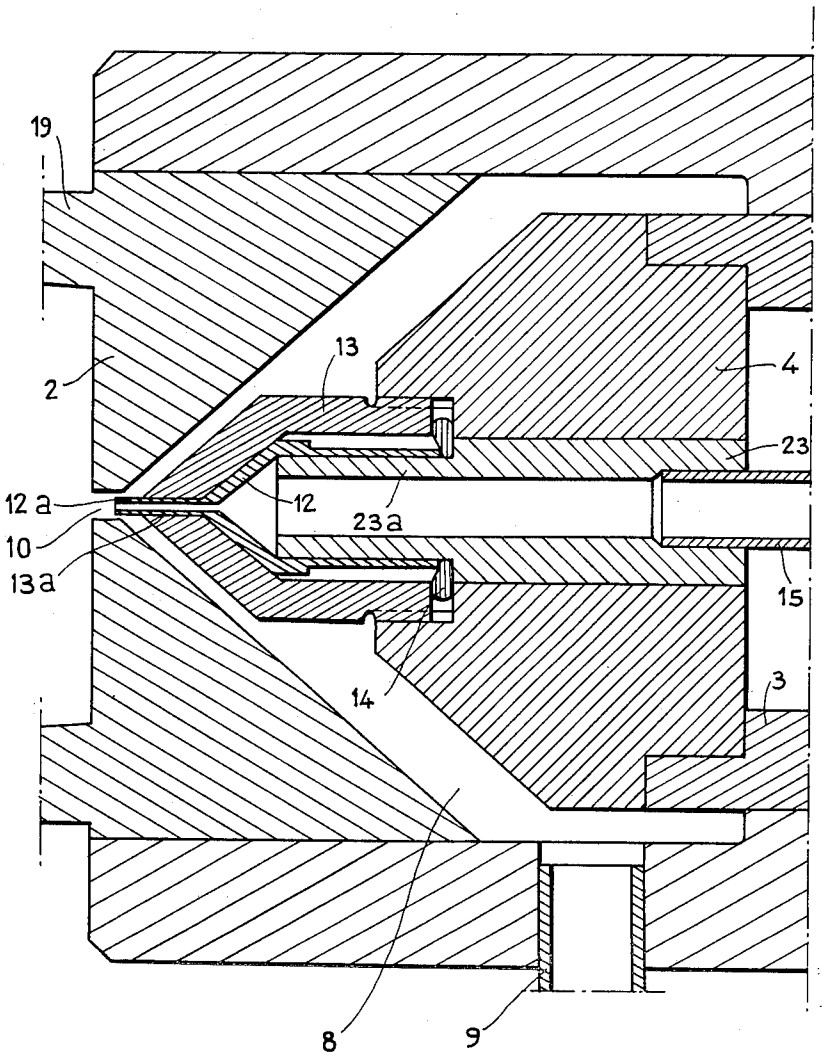
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Fig-6



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3,034,726

HEATING AND ATOMIZING DEVICE

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5 Claims. (Cl. 239—132)

This invention is concerned with a device for atomizing a liquid by means of a gas under pressure, which is combined with a device for heating the gas loaded with atomized liquid, whereby an atmosphere consisting of a gas having a predetermined proportion of vapour of a liquid substance at room temperature can be obtained.

This apparatus consists of two portions interconnected by a fluid-tight joint permitting an instantaneous interfitting of the two portions, namely, an atomizer and a heater. The gas is fed under a constant and pre-adjusted pressure to the atomizer and escapes therefrom by expansion through an annular orifice leading to the heater. The liquid is fed similarly under a constant and pre-adjusted pressure to the atomizer and escapes therefrom through a small tube co-axial with the aforesaid annular orifice.

The diameter of said annular orifice is relatively small, so that the rate of flow of the gaseous stream is increased to a relatively high speed by expansion, thus causing the liquid to be atomized in the form of a mist.

The resulting mist is volatilized in the heater at a temperature slightly superior to the dew point of the resulting gas-and-vapour mixture.

The apparatus according to this invention is so designed that the liquid particles of the mist have no time to coalesce before they are volatilized, and that this volatilization cannot take place at an excessive temperature, as this would in certain cases entail the decomposition of the liquid.

The specific features of the apparatus of this invention aim at achieving this result while ensuring an easy maintenance and a low cost of the apparatus.

Reference will now be made to the accompanying drawing forming part of this specification and illustrating diagrammatically by way of example a few typical forms of embodiment of the invention. In the drawing:

FIGURE 1 is a section taken upon a plane passing through the axis of the atomizer of the apparatus;

FIGURE 2 is a complete view showing the assembly comprising the atomizer and the heater, the latter being illustrated in axial section;

FIGURE 3 is a cross section taken upon the line III—III of FIG. 2;

FIGURES 4 and 5 are axial longitudinal sections showing two different forms of embodiment of the heater;

FIGURE 6 illustrates on an enlarged scale a detail of FIGURE 1.

Referring now to FIGURES 1 to 3 of the drawings, the atomizer comprises a tubular casing 1 formed at its front end with an internally enlarged diameter portion in which is inserted and secured by welding a spray nozzle plug-like body 2 formed at its inner end with a conical recess and formed with an axial passage 10 of circular cross-section. A barrel 3, fitted with a liquid nozzle unit at its front end, is mounted with a sliding frictional fit in the casing 1, the friction being caused by an annular rubber packing 5 housed in a circular groove formed in the inner surface of the casing 1. The operative position of the barrel 3 and of its nozzle unit in the casing 1 is determined by a collar 7 which is screwed into an internally increased diameter portion at the rear end of the casing 1 and which engages a shoulder on the barrel 3. A nut 6 carried by the collar 7 locks the latter in its set position by engaging the rear end of the casing 1. The relative axial positions of the barrel 3 and of the casing 1 are thus adjustable.

The nozzle unit, fitted at the front end of the barrel 3, is shown in greater detail in FIGURE 6. This unit comprises a capillary jet member 12 consisting of a fountain-pen of the kind used by technical draftsmen, that is to say the jet member 12 is generally cup-shaped, the bottom of the cup being internally and externally conical and extended by a capillary tube 12*a* which communicates with the interior of the cup. Such pens are conventional and may be purchased on the open market. Consequently, it is advantageous to employ these pens as capillary jet members for the liquid for both manufacturing and replacement purposes, in the illustrated construction. Moreover, since these draftsmen's pens are obtainable with different capillary tube sizes, the diameter of the outlet of the jet member can be selected as required.

The jet member 12 is slidably mounted on a tubular carrier 23 having an externally reduced diameter portion 23*a* which extends to the bottom of the cup-shaped portion of the jet member. The carrier 23 is in turn housed in an axially bored plug 4 closing off the front end of the barrel 3. The jet member 12 is held in position on its carrier 23 by a hollow nut 13 screwed into the plug 4 until the outer conical surface of the nozzle 12 is engaged by a corresponding internal conical surface of the nut 13, the capillary tube of the jet member 12 being accommodated in an axial hole 13*a* of the nut. The nut 13 also holds in position a sealing washer 14 for preventing the escape of liquid between the jet member 12 and its carrier 23. A liquid feed pipe 15 of constant internal diameter, so as to avoid the formation of stagnating gas pockets likely to interfere with the regular flow of liquid in case the latter were not properly freed of gas traces, is fitted at one end into the rear end of the carrier 23 and extends axially through the barrel 3, through a perforated support disc 24 fitted in the rear end of the barrel, and is provided at its opposite end with a coupling member 11 for coupling the pipe 15 to a source of vaporizable liquid under pressure. The space between the pipe 15 and the barrel 3 defines an air cooling jacket which communicates with the atmosphere through the perforated support disc 24. Thus, any abnormal heating of the apparatus as a whole, which might be caused by the conduction of heat from the heater, can be avoided or at least mitigated and there is no risk of causing liquid to boil in the feed pipe, thus protecting the sealing packings and the joints.

Gas under pressure is supplied through the coupling member 9 formed with an axial passage communicating with a chamber 8 surrounding the plug 4 and the nut 13 and in turn communicating with the passage 10 between the bottom of the internal conical recess of body 2 and a corresponding conical portion of nut 13. The tube 12*a* of the jet member 12 and the passage 10, which are coaxially mounted, are so arranged that the spray of mist will form, during operation, a cone having a very small apex angle. By adjusting the relative axial positions of the barrel 3 and of the casing 1, the angle at the apex of the cone of mist can be varied at will. The further the tip of the capillary tube 12*a* extends into passage 10, the greater will be the speed at which the gas will flow through the passage and the lesser will be the angle at the apex of the cone of mist.

The heater comprises (as shown in FIGURES 1 and 3) a tubular body 16 whose inlet is defined by an externally tapered portion fitted within a correspondingly tapered annular flange 19 extending axially from the outer end of the plug 2 of the atomizer. The tubular body 16 is sur-

rounded over the greater part of its length by heating means **17** which in turn is surrounded by a heat-insulating lining **18**. The heating element **17** consists essentially of a sleeve-like electrical resistance **20** connected to terminals mounted on a bracket extending radially through the lining **18**.

The diameter of the tubular body **16** and hence its effective internal heating surface are sufficiently large, and the temperature of this surface is so chosen, that the mist projected into the tubular body **16** by the atomizer will be vaporized but will not lead to decomposition of the liquid.

In the modified form of embodiment shown in FIG. 4, the heat-insulated tube **16** is heated internally by a sleeve-type resistance **21**.

In the alternate case shown in FIG. 5 the heat-insulated tube is heated from within by a bare wire resistance **22** wound on insulating supports.

One of the features common to these different forms of embodiment is that the obstacles likely to arise in the jet of mist are reduced to a minimum, whereby this mist will contact the inner wall of the heater at a point as remote as possible from the atomizing orifices. Thus, the liquid vesicles in suspension in the mist will not coalesce before the jet contacts the hot wall of the heater. As the mist is rather thin and the area of contact between the cone-shaped jet of mist and the hot wall of the heater is relatively large, the vaporization is extremely rapid and takes place at a relatively low temperature.

This compound atomizer and heater device is not subjected to the drawbacks characterizing hitherto known systems. Thus, in bubbling or surface-licking systems the gas to liquid volumetric ratio is subordinate to the efficiency of the bubbling or surface-licking system; in other words, it varies as a function of the gas output and the nature of the liquid substance. On the other hand, the operation of these former systems actually starts only when the liquid temperature has become stabilized in the bubbler, which may take some time. Moreover, with these systems it is scarcely possible to produce atmospheres containing more than 50% of vapour (which is the maximum theoretical efficiency of any bubbling or surface-licking system).

Besides, in the system utilizing the dropwise fall of a liquid on a hot plate to form a constant and homogeneous gas-and-vapour mixture, the drops must fall onto the plate at a relatively high rate, and therefore under practical conditions it is not possible to form atmospheres requiring an output of only a few tens of cubic inches per hour. Finally, the plate must be heated to a relatively high temperature to permit a sufficiently rapid volatilization; under these conditions, a decomposition of the liquid may be expected in many cases.

In the atomizing and heating device of this invention, the gas output and the liquid output can be adjusted separately, even for very low liquid outputs for example of the order of a few cubic inches per hour.

Moreover, with this device is is possible, by properly adjusting the gas and liquid outputs, to prepare an atmosphere consisting of this gas charged with the vapour of said liquid in a pre-adjusted proportion, in all cases requiring both an accurately metered gas-to-vapour ratio in the resulting mixture and a high homogeneousness of this mixture, for example in the adjustment of gas generators for producing water gas, of atmospheres containing organic product vapour for case-hardening and like applications, of combustion atmospheres, etc.

I claim:

1. Apparatus for charging a gas with the vapour of a vapourizable liquid in a pre-determined ratio, said apparatus comprising an atomizer including an outer sleeve-like casing, a barrel adjustably mounted for axial adjustment in the casing and disposed in sliding and fluid tight engagement therewith, said casing having an outlet end provided with a spray nozzle forming member, a liquid nozzle unit carried by said barrel at the outlet end thereof, said liquid nozzle unit including a removable capillary jet member for discharging the liquid through the spray nozzle forming member, a tube disposed coaxially in the barrel for feeding liquid to the liquid nozzle unit, an external pipe connected to the casing for delivering gas to the interior thereof, an annular chamber provided between the liquid nozzle unit and the spray nozzle forming member and receiving the gas from the external pipe, and a heater, having a tubular body in axial alignment with the spray nozzle forming member, for vaporizing the particles of atomized liquid issuing from said member.

2. Apparatus as set forth in claim 1, wherein said tube disposed coaxially to said barrel is spaced from the barrel by an air cushion which communicates with the atmosphere.

3. Apparatus for charging a gas with the vapour of a vaporizable liquid comprising an atomizer device including an outer cylindrical body, a barrel adjustably mounted for axial adjustment in the body and disposed in smooth and liquid tight engagement therewith, said body having an outlet end provided with a spray nozzle forming member, a liquid nozzle unit carried by said barrel at the outlet end, said liquid nozzle unit including a capillary jet member for discharging the liquid through the spray nozzle forming member, a tube disposed coaxially in the barrel and spaced from the barrel by an air cushion which communicates with the atmosphere, said tube feeding liquid to the liquid nozzle unit, an external pipe connected to the barrel for delivering gas to the interior thereof, an annular chamber provided between the spray nozzle carrier and the nozzle forming member and receiving the gas from the external pipe, said atomized liquid passing out through the spray nozzle forming member and a heater device arranged in communication with the nozzle forming member to receive and heat the gas mixed with the particles of atomized liquid.

4. Apparatus as claimed in claim 3, wherein said heater comprises a heat insulated tubular body having an electrical resistance located in close vicinity of the tube wall and mounted so as not to interfere with the flow of atomized liquid therethrough.

5. Apparatus for charging a gas with the vapour of a vaporizable liquid in a pre-determined ratio, said apparatus comprising an atomizer for atomizing said vaporizable liquid by means of said gas under pressure, said atomizer including an axial spray nozzle having a readily removable orifice element having a passage of circular cross section, and further comprising a heater mounted downstream of the spray nozzle passage outlet and disposed in axial alignment therewith for vaporizing the particles of atomized liquid issuing from the spray nozzle, said heater including a readily removable tubular body having heating means located in close vicinity of the wall of said tubular body so as substantially not to interfere with the flow of atomized liquid therethrough.

References Cited in the file of this patent

UNITED STATES PATENTS

1,642,418 Kovanda ---------- Sept. 13, 1927