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De Gouville

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[54] **GAS BURNERS, ESPECIALLY FOR DOMESTIC APPLIANCES**

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[51] **Int. Cl.** **F23d 13/36**

[58] **Field of Search** 431/349; 239/553, 553.3, 239/553.5

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[57] **ABSTRACT**

The gaseous mixture is distributed inside the head of the burner at a certain number of outlet orifices arranged for example in a crown. Means are provided in the head to enable the mixture for a slow burning rate to be distributed preferentially to a selected section of one or several of the orifices thus constituting the slow burner. The means may comprise a diffusing tube bringing the mixture into the head of the burner and distributing it through passages arranged so that the one or more corresponding to the selected section have lower pressure drops than those co-operating with the other flame outlet orifices.

12 Claims, 5 Drawing Figures

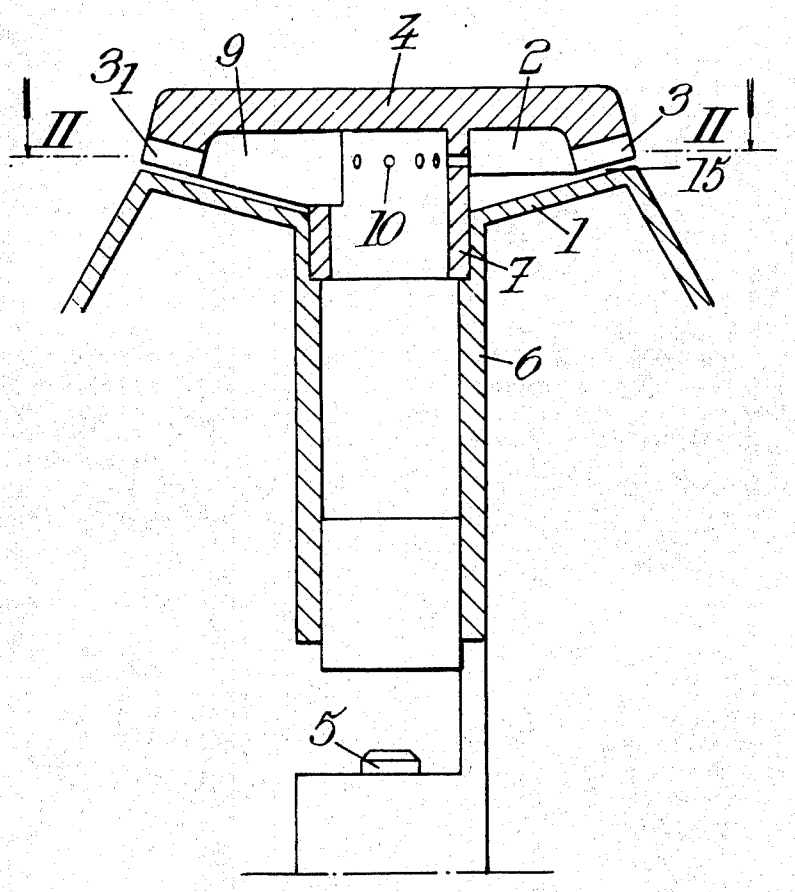

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Fig. 1.

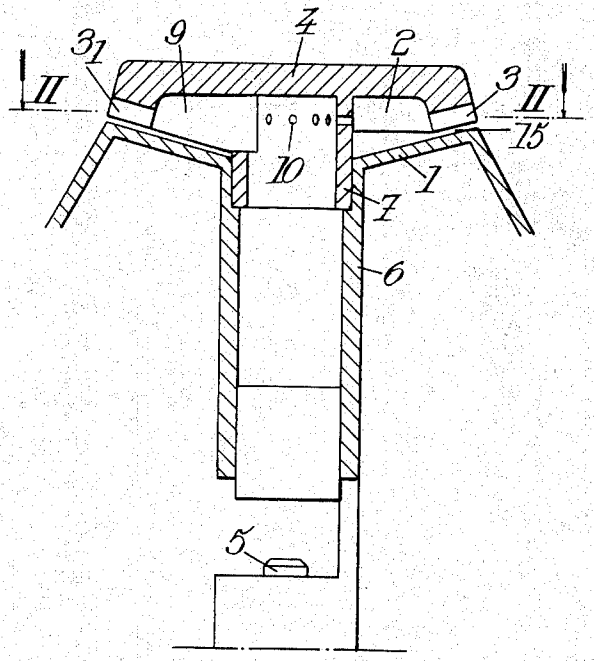


Fig. 2.

Fig. 5.

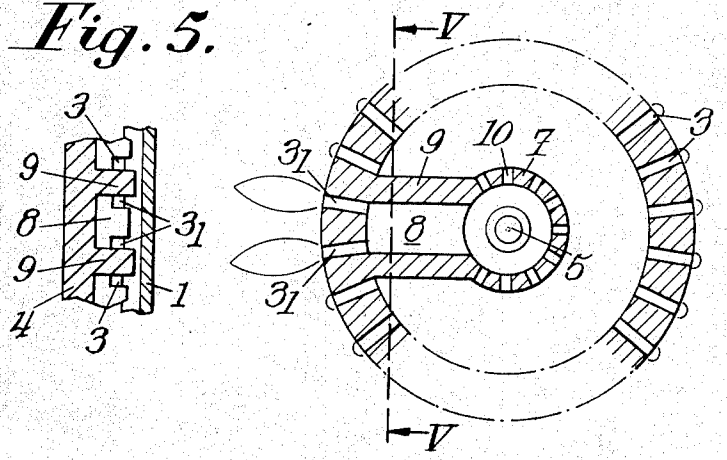


Fig.3.

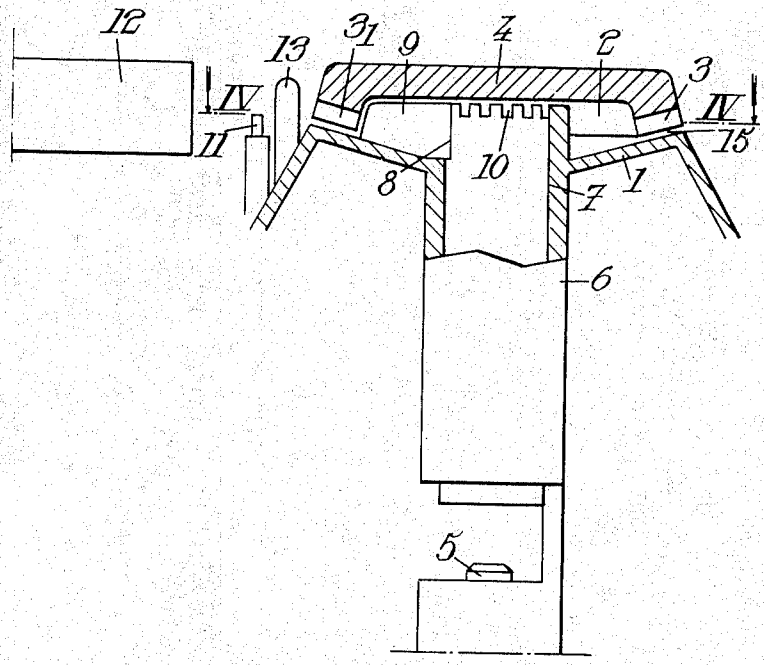
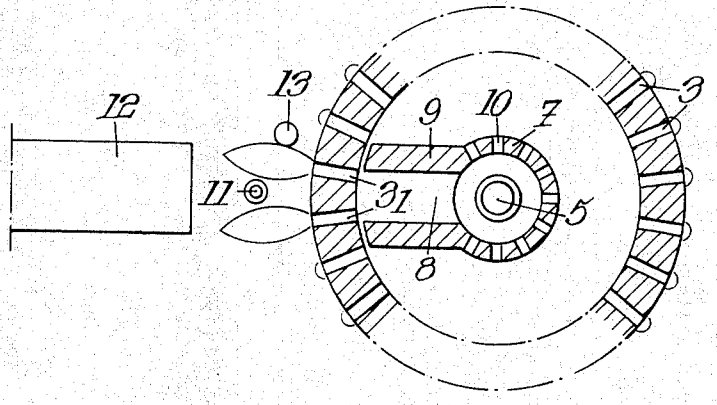


Fig.4.



GAS BURNERS, ESPECIALLY FOR DOMESTIC APPLIANCES

The invention relates to gas burners, especially for domestic appliances such as cookers, re-heaters (in particular for camping), ovens, washing machines, etc.

It is a particular object of the invention to enable a larger range of variations in flow-rate, that is to say reduced slow-rates, with respect to maximum power, with neither risk of extinction nor of back-firing to the injector.

In existing designs, the power at slow-rate is of the order of one-seventh of the nominal power. It is too great, in a general way, to maintain a liquid hot in a container, without reaching boiling point.

It is trying, with these designs, to reduce further the slow-rate power, since one runs up against the following difficulties.

1. If the flow-rate is too low, there is a risk of extinction, due to the fact that the venturi introducing the mixture to the burner has been designed for normal flow-rate, whilst, for low flow-rates, the mixture comprises too large an excess of air and becomes incombustible;
2. there is also risk of back-firing to the injector, especially in the case of sudden passage from the position of normal flow-rate to the position of low flow-rate;
3. the low flow-rates with their small flames, are very sensitive to wind and to draughts, which tend to extinguish them;
4. automatic reignition, after extinction in the slow-burning position (by electric ignition, wave tubes, etc.) becomes difficult;
5. the very extreme low-speeds do not enable in present solutions, the maintenance of a thermocouple safety device positioned close to the burner.

It is therefore an object of the invention to provide very extreme slow burning rates, for example of the order of one-tenth to one-fifteenth of that of normal power, whilst avoiding the above-mentioned difficulties.

It consists, principally, to this end, in a burner whose outlet cross-section for the mixture to be burnt is distributed over a certain number of orifices included in the head of said burner, in providing in said head or close to the latter means adapted to enable at low burning rate, the mixture to be distributed preferentially to a portion of said cross-section, for example to one or two orifices which thus constitute the slow burner.

In this way, secondary air surrounding the active portion, used for the slow-burner, is just sufficient, but not in excess of the needs for the maintenance of the flames thus constituted.

In addition, in this selected portion, the power per unit surface will be easily increased, so that the intensity of the slow-burner flame can be suitable and not risk being blown out by draughts. In addition, this flame will be easily utilisable in combination with any ignitors or safety devices.

For the application of the above-said means one may proceed in various ways. In particular, these means are made to comprise a diffusing member or tube introducing inside the head of the burner the mixture coming from the injector, and, from this tube, the mixture is distributed, towards the outlet orifices of the burner, through passages arranged so that the one co-operating with the selected outlet cross-section above-mentioned has pressure drops distinctly less than those co-operating with the other outlet orifices.

Thus, for example, the diffuser tube will have, on the side of the selected outlet section of the burner, a passage of large cross-section, whilst, to supply the other outlet orifices of the burner, there will be provided on the periphery of said tube a certain number of small orifices adapted to make the mixture pass from the inside of this tube towards the one or more corresponding annular portions provided inside the head of the burner.

Due to this arrangement, it is possible to provide with complete safety, as will be shown below, both for reduced burning rate and for nominal rate, and the various intermediate rates, and this by the bringing into play of the static pressure and the dynamic pressure existing in line with the flame outlet orifices, by reason of the pressure drops resulting from the existence of the two types of passages and distributing orifices considered above, comprised by the tube, and this with the possibility of providing a high ratio between the nominal and the slow speed burning rate.

At slow burning rate, the gaseous flow is localised principally in front of the selected section whilst, from nominal flow-rate to the lower flow-rates, and at least to half flow-rate, the distribution of the gaseous mixture will be practically homogeneous over the whole perimeter of the burner. In other words, for very low flow-rates, the low pressure loss system, that is to say through the above-mentioned low pressure drop passage, there will be supplied in priority the orifices of the selected section of the burner, of which thus the flames wil be able to retain a sufficient length; resisting wind and capable in addition of co-operating with any ignition and/or safety devices. For greater flow-rates, the static pressure and the dynamic pressure will be sufficient both for overcoming all pressure drops and supplying in practically uniform manner the various burner orifices.

The invention consists, apart from the above-mentioned features, of certain other features which are preferably used at the same time and which will be more explicitly considered below.

It realtes more particularly to certain types of application (especially those for which it is applied to burners for domestic equipment or the like), as well as certain embodiments of said features; and it relates, more particularly again and this by way of new industrial products, to burners of the type concerned comprising the application of these same features, as well as the special elements adapted for their construction.

The invention will be more easily understood, in any case, by means of the additional description which follows, as well as of the accompanying drawings, which description and drawings are, of course, given purely by way of illustrative but non-limiting example. In the drawings:

FIGS. **1** and **2** show respectively in axial vertical section and in cross-section through the line II—II of FIG. **1**, one embodiment of a gas burner constructed according to the invention; and

FIGS. **3** and **4** illustrate similarly another embodiment of a burner according to the invention, comprising the use of various auxiliary members such an ignitor, a safety device, and wave tubes.

FIG. **5** is a sectional view taken along the lines V—V of FIG. **2**.

According to the invention, and more especially according to those of its types of application, as well as according to those embodiments of its various parts, to which it would seem that preference should be given, in order for example to construct a gas burner, especially of the crown type, with a range of power extending from a slow burning rate to a maximum or nominal burning rate, procedure is as follows or in similar manner.

This burner is made to comprise, essentially and as is customary, a head **1** comprising a differing annular space **2,** intended to distribute the combustible mixture to a plurality of outlet orifices distributed at the periphery of the burner or at least at a portion of this periphery, the said orifices consisting for example of crenellations **3** formed on the edge of a cover **4** applied on the head of the burner.

There can also be provided, between the cover **4** and the head **1,** in addition to the orifices or crenellations intended for the main flames, supplementary orifices or passages, shown diagrammatically at **15,** intended for pilot flames, according to a known arrangement, especially according to French Patent Application No. 158,550 filed July 9, 1968 by Applicant, now French Pat. No. 1,604,153.

As regards means to Introduce the mixture to the above-mentioned annular space **2,** from an injector **5** and from a venturi or other ad hoc device, instead of relying simply on making the tube **6** coming from the injector and from the venturi open freely inside the said space, there is provided, at the inlet to said space, a diffuser member **7** arranged so as to enable:

- distribution of the mixture, with a very low pressure drop, to a selected outlet section which will constitute the slow-burning orifices, for example two orifices 3_1 selected from the above-mentioned orifices **3,** and being either of the same cross-section as that of the orifices **3,** or a different cross-section (especiallY larger),
- and distributing it, to the other orifices **3,** through means creating higher pressure drops.

Thus, in the embodiment shown, the diffuser **7,** which can be fast to the cover **4** and applied, by its free edge, to the pipe **6,** can include (FIGS. **1** and **2**):

- on one hand, laterally and facing the selected slow-speed orifices 3_1, the wide passage **8,** extended by lateral portions **9** up to said orifices,
- and, on the other hand, over the remainder of its circumference, a certain number of small orifices or passages, of suitable cross-section **10.**

It is furthermore never obligatory for the diffuser **7** to be fast to the cover. It could be constructed in extension of the tube **6** as illustrated by way of modification in FIGS. **3** and **4,** the orifices **10** being arranged for example in the shape of crenellations.

The respective cross-sections of the passage **8** and of the orifices **10,** with respect to the orifices 3_1 and **3, 15,** are of course suitable selected by the technician as a result of comparative tests, taking into account the desired results. Thus in general the cross-section of the passage **8** will be distinctly greater than that of the slow burning orifices 3_1, whilst in addition the overall cross-section of the orifices **10** will in general be such that these orifices lead to a higher pressure drop than that due to the orifices **3** and **15.**

There is then obtained an assembly which operates in the following manner.

If it is assumed that the injector **5** delivers at full rate, that is to say for nominal burning rate, and that the pressures both static and dynamic are established in the head of the burner, the assembly ignites like a normal burner, at its nominal power. It is observed only that the two selected flames are a little bigger than the others.

If now, having thus been ignited, the burner is changed suddenly to slow burning rate and the burner has also not had the time to heat up to its normal temperature, only the two selected flames remain lit, at least it is possible that this particular operation occurs. The mixture supplies principally the orifices 3_1 but it also supplies the other cross-sections **3** and **15,** in a way however which, the burner being again cold and the secondary air being in excess, cannot give rise to combustion. However, little by little, the burner is heated, so that the air/gas mixture inside the burner is also heated, which involves a larger volume, hence a corresponding reduction in the proportion of air. At the most, the increase in temperature has the effect of increasing the speed of propogation of the flame, which also facilitates ignition of the air/gas mixture. As a result the burner ignites at the orifices **3** and **15,** with small slow burning flames.

If one effects the same hypothetical sudden passage from the nominal burning rate to the slow burning rate, but the burner is hot, the burner assembly remains lit, since the static pressure which exists then inside the annular diffusion chamber **2** ensures the maintenance of the flames: in other words, the arrest of dynamic pressure cannot in any way extinguish the burner, this on account of the presence of the small diffusing orifices **10.**

As a result of the foregoing, there being no need to fear the phenomena of burner extinction which are produced in present day burners when one passes from the maximum position to the slow burning position, the ratio of maximum power to slow burning power can be considerably increased. Consequently, it becomes possible to produce a low slow burning power, which is very convenient for the heating of liquid which must not boil.

The following additional advantages will also be noted:

- Backfiring to the injector is avoided, especially on passage to slow-burning rate,
- The two selected flames have a relatively high heating power, in any case greater than that of the flames of a normal slow burning burner, and resist wind better,
- These two selected flames, due to their size and to their power, are easily lit by electronic or wave tube systems,
- These flames are sufficient to supply the thermocouple of an electro-element.
- FIGS. **3** and **4,** it is shown how there can be installed for example:
- an electronic ignition device at **11,**
- a wave tube device at **12,** (for the propagation of the flame to another burner in manner known per se),
- a thermocouple safety device at **13.**

It is self-evident that these elements, which have been shown together in FIGS. **3** and **4,** can be considered independently.

There is given below, again by way of illustration of the invention, and hence in no way limiting, a table of

the values and of the ratios of the cross-sections in two different cases I and II, of a semi-rapid burner and of a rapid burner, these burners being assumed to include flame outlet orifices **3** and orifices or passages **15** for pilot flames.

	I (semi-rapid burner)	II (rapid burner)
Outlet cross section of main flames 3.	95 mm.²	144 mm.²
Outlet cross section of pilot flame 15.	39 mm.²	51 mm.²
Total cross section of the burner outlet.	134 mm.²	195 mm.²
Outlet cross section 3_1 of slow burning flames.	8 mm.²	8 mm.²
Maximum power per unit surface at slow burning rate.	1.96 mmth/mm.²	2.55 mmth/mm.²
Power per unit surface at nominal rate.	12 mmth/mm.²	13 mmth/mm.²
Cross section of the orifices 10 of the diffuser 7 towards the orifices 3 and 15.	85 3 mm.²	168 mm.²
Selected passage cross section 8 of the diffuser 7 towards the orifices 3_1.	32 mm.²	51 mm.²
Out total outlet cross section of the diffuser 7.	117.3 mm.²	219 mm.²
Ratio of the cross section of the orifices 10 of the diffuser/selected passage cross section 8.	2.8	3.2.
Ratio of the total outlet cross-section of the diffuser/outlet cross section of the burner.	117/134=0.82	219/195=1.1.
Ratio of the outlet cross section of the selected passage/outlet cross-section of the two slow burning flames.	32/8=4	51/8=6.4.

It is seen from these examples, and without there being any limitation thereby, that the ratio between the cross section of the passage **8** of the diffuser and the total cross section of the two selected orifices 3_1 is of the order of 4 to 7.

In addition, the total cross section of the orifices **10** of the diffuser is of the same order of magnitude as the total cross section of the outlet orifices of the main flames.

Lastly, in case I, the nominal and slow burning powers are for example;

nominal power P_n: 1,600 kcal/hour,

slow burning power P_r: 160 kcal/hour,

whence ratio $P_n/P_{or} = 10$.

In case II, the figures would be as follows:

$P_n = 2{,}500$ kcal/hour

$P_r = 210$ kcal/hour

$P_n/P_r = 12$

These figures 10 and 12 are distinctly higher than the maximum (7) enabled by pre-existing equipment.

As is self-evident and as emerges already from the foregoing, the invention is in no way limited to those of its types of application and construction which have been more especially considered: it encompasses, on the contrary, all modifications.

I claim:

1. Gas burner comprising a head, a cover on said head, and a diffuser between said cover and said head defining an annular space with said head and said cover, a plurality of gas outlet flame orifices formed between the periphery of said head and said cover and communicating with said annular space, a pipe arranged to lead the gas mixture into said annular space, said diffuser member being located at the outlet end of said pipe and arranged to lead a portion of the gas mixture always to a selected section comprising at least one of said gas outlet flame orifices with a lower pressure drop than to the other said gas outlet flame orifices, said selected section thus forming a slow burner.

2. Burner according to claim **1**, wherein said diffuser member comprises a tube having passages arranged so that one or more of said passages correspond to the selected section and have pressure drops smaller than those passages co-operating with said other gas outlet flame orifices.

3. Burner according to claim **2**, wherein the diffuser tube has on the side of the selected section, a large passage directing the mixture directly towards this section, and a plurality of orifices of smaller cross section distributing the mixture to said annular space.

4. Burner according to claim **3**, wherein the cross section of the large passage supplying the slow burner is several times greater than the selected section of the slow-burner orifices.

5. Burner according to claim **4**, wherein the ratio of the two cross sections is comprised between 4 and 7.

6. Burner according to claim **3** wherein the total cross section of the orifices of the diffuser tube supplying the flame orifices is of the same order of magnitude as the total cross section of said flame orifices.

7. Burner according to claim **2**, said being removable, wherein the diffuser tube is fast to said cover and has been adjusted on the end of the tube bringing the mixture from an injector.

8. Burner according to claim **2**, wherein the diffuser tube is constructed in extension of said pipe for the mixture and forms an integral part with the latter.

9. Burner according to claim **8**, wherein the passages of said diffuser are arranged in the form of castellations at the end of said tube under said cover of the burner.

10. Burner according to claim **1** wherein the slow-burner is arranged so that its flames co-operate with an electric or electronic ignitor.

11. Burner according to claim **1** wherein the slow-burner is arranged so that its flames co-operate with a thermocouple safety device.

12. Burner according to claim **1**, wherein the slow-burner is arranged so that its flames co-operate with a wave tube.

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