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(54) **ATOMIZING BURNER**

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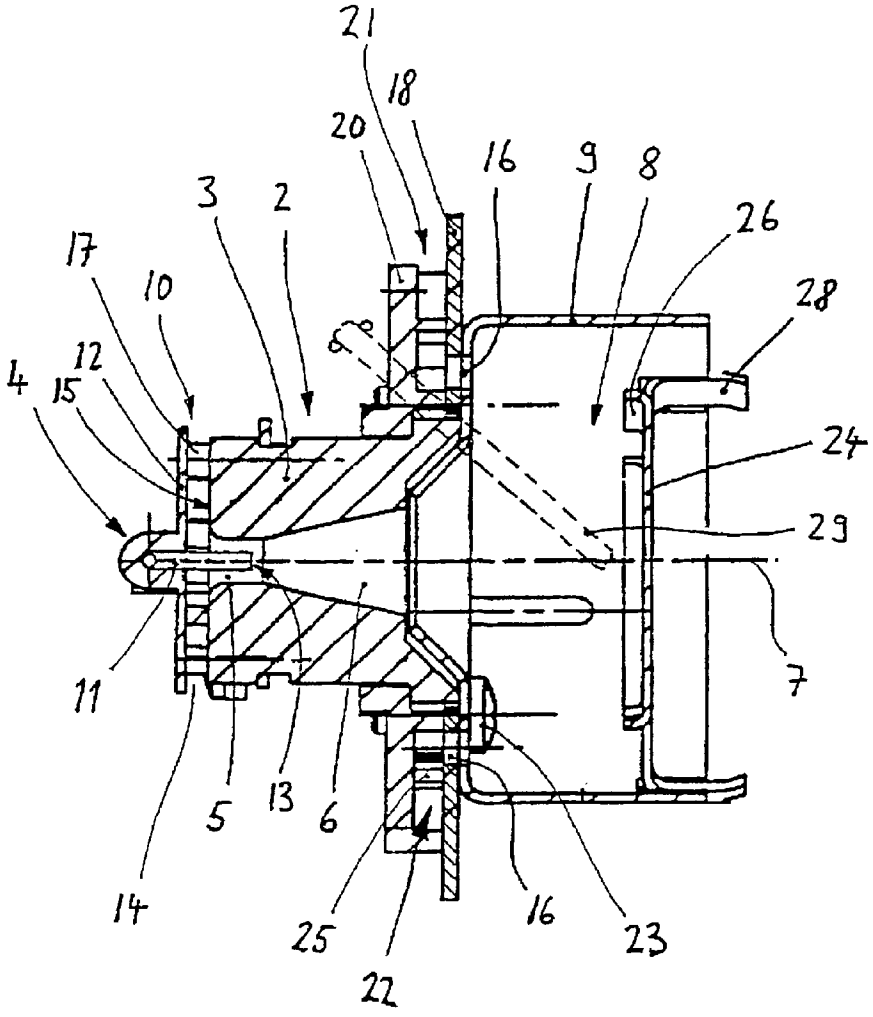
(57) **ABSTRACT**

The invention relates to an atomizing burner, especially for use in an automobile auxiliary heating system, comprising an atomizing nozzle (**2**) for processing the fuel, an ignition device (**29**) and a combustion chamber (**8**). An iar conduction device (**10, 12, 14**) is connected upstream of a nozzle holder (**3**) of the atomizing nozzle (**2**) in order to achieve finer atomization of the fuel. Said air conduction device subjects the combustion air streaming into the atomizing nozzle (**2**) to a swirl.



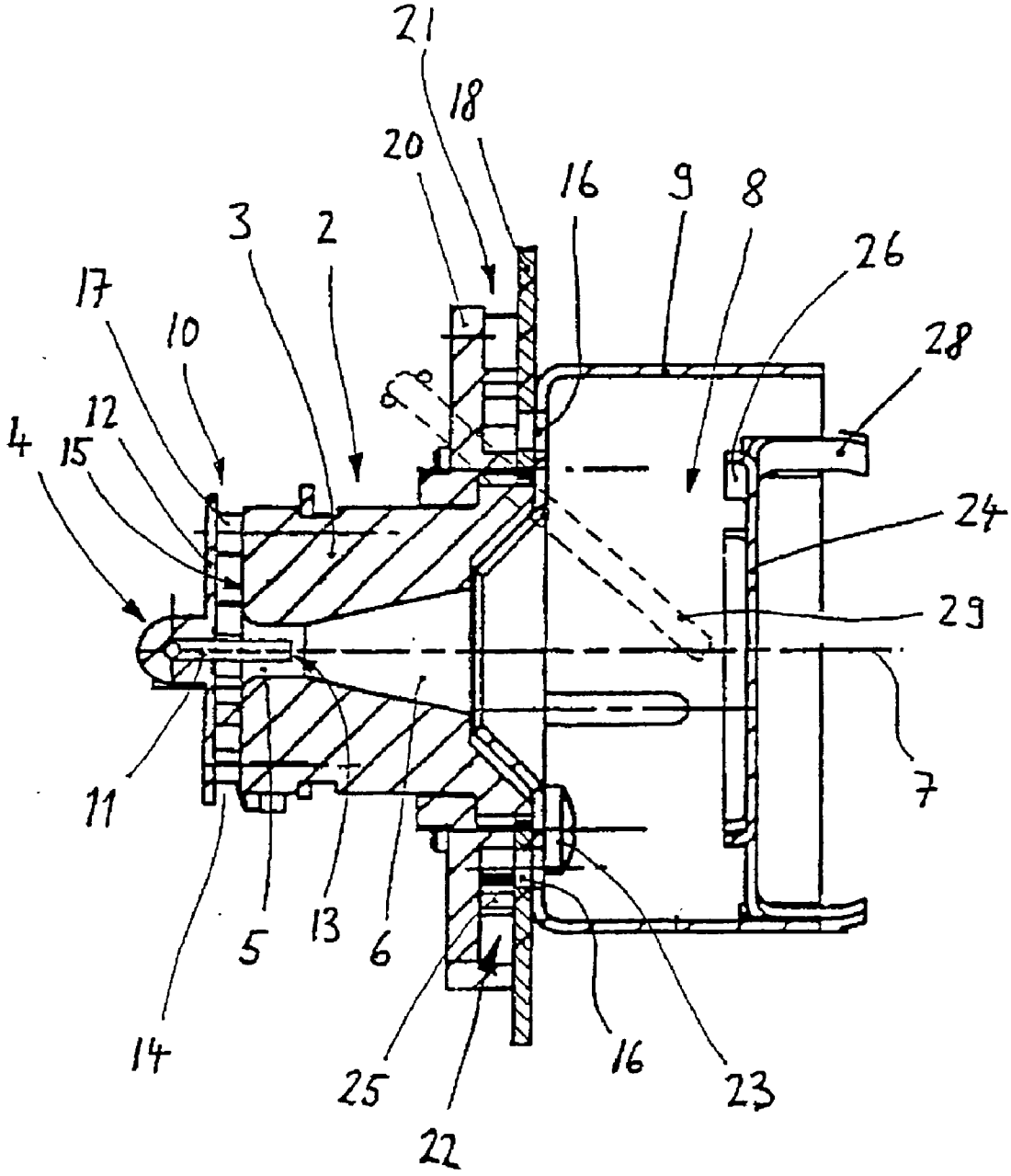


Fig. 1

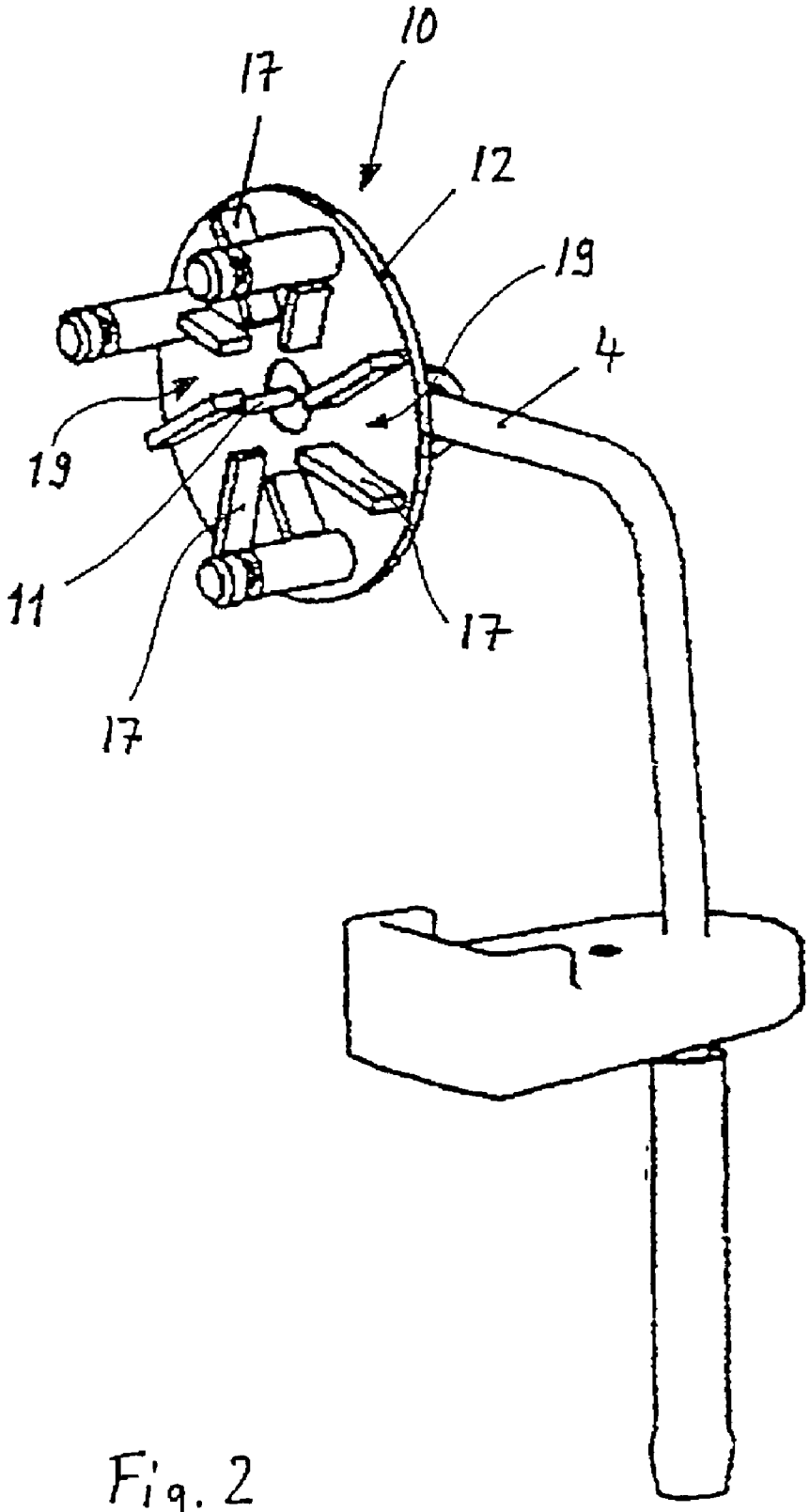


Fig. 2

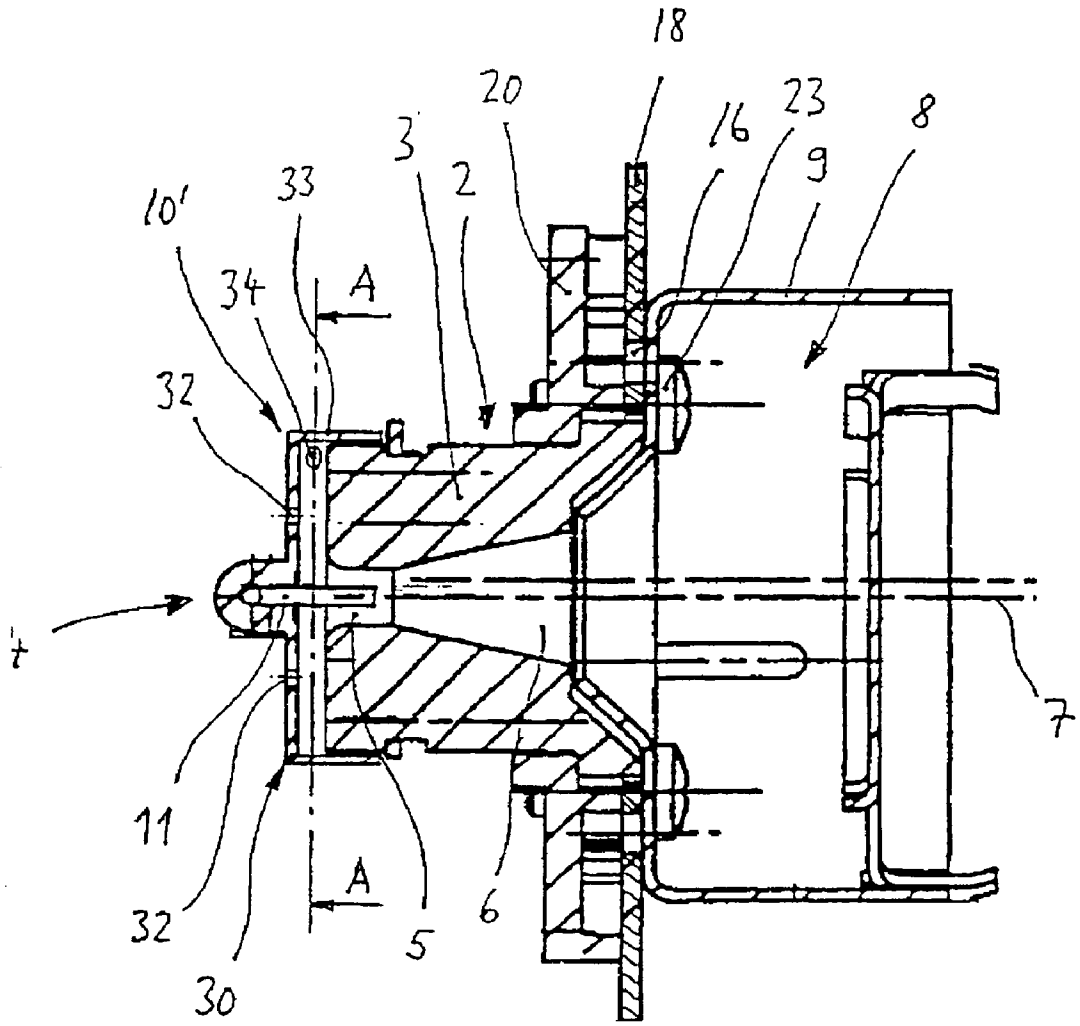


Fig. 3

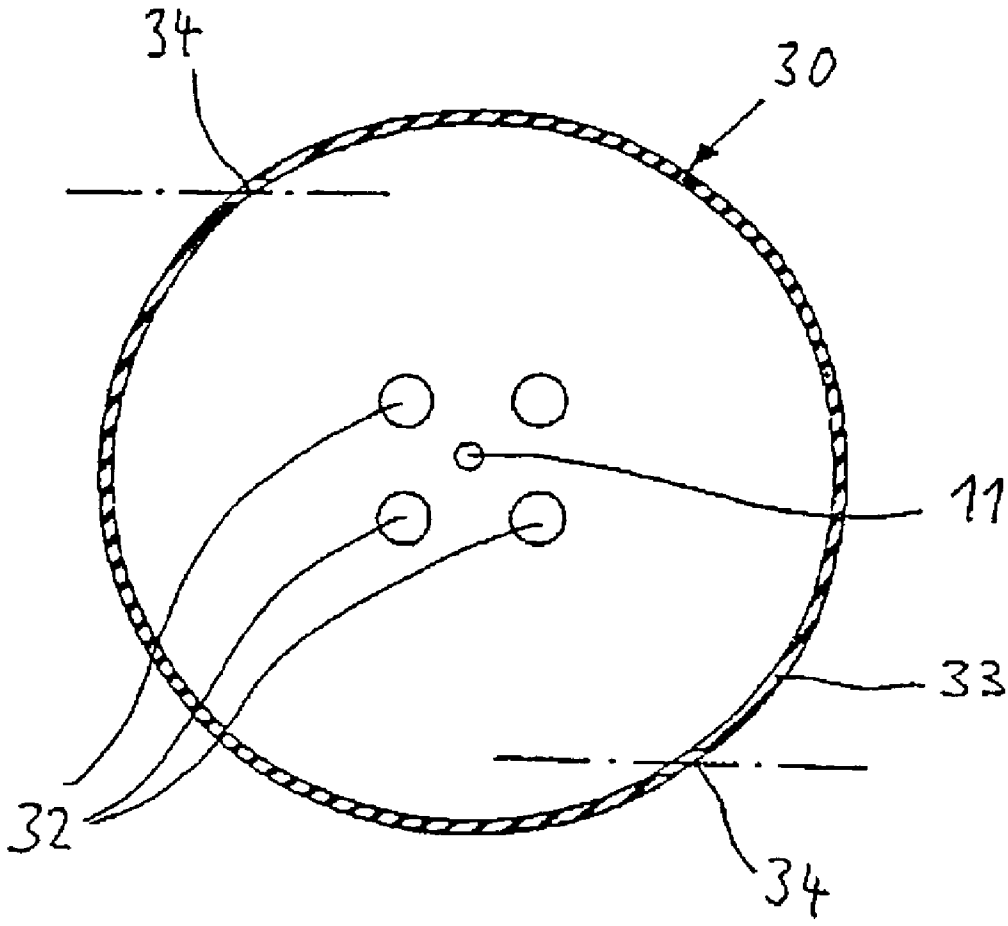


Fig. 4

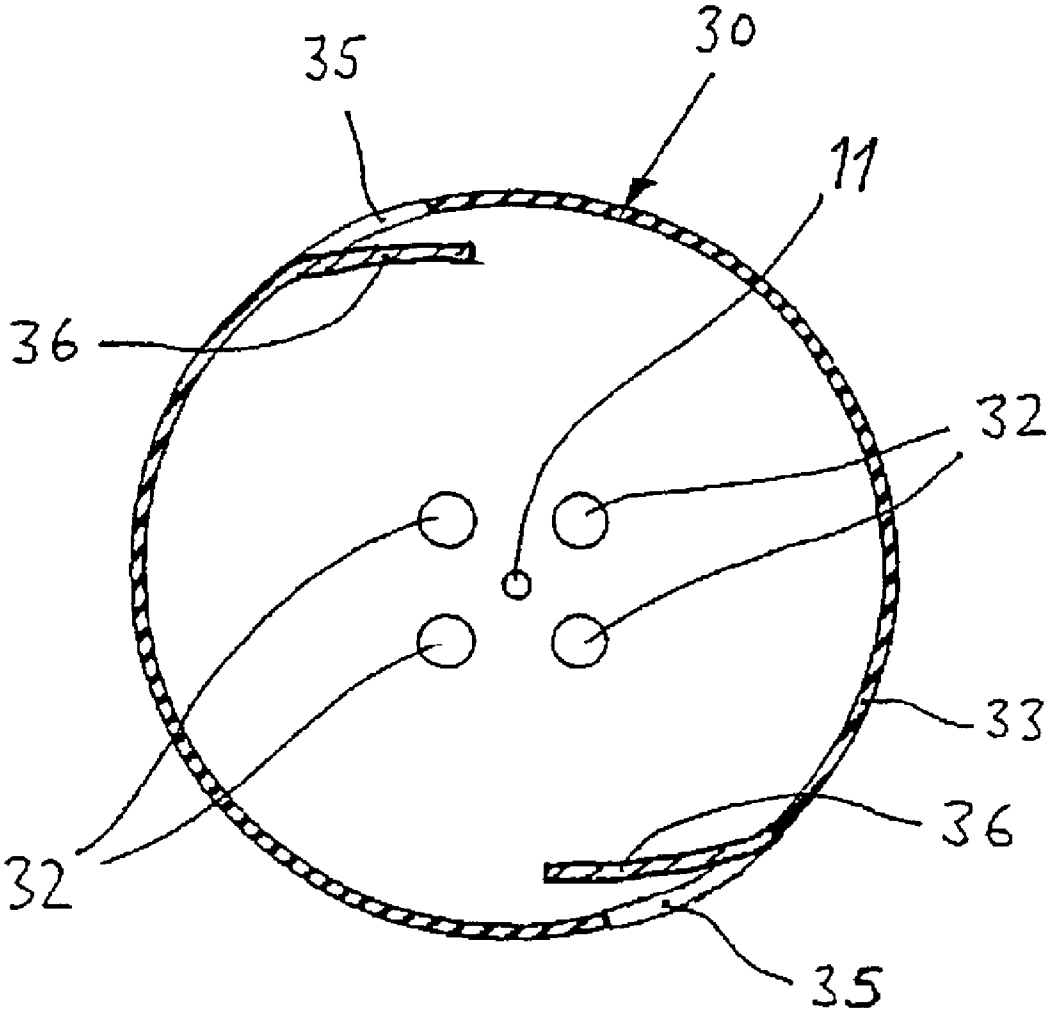


Fig. 5

ATOMIZING BURNER

[0001] This invention relates to an atomizer burner, especially for use in a motor vehicle auxiliary heating system, with an atomizer nozzle to prepare the fuel, an initiation means, and a combustion chamber.

[0002] In the most varied applications, for example the area of fuel-fired heaters as heaters for a motor vehicle or auxiliary heating systems for motor vehicles it is necessary to prepare the liquid fuel which is to be burned for example in a burner and to bring it into a state suitable for combustion.

[0003] A known device which is used especially in auxiliary heating systems for motor vehicles or other mobile units contains an absorbent body, for example a nonwoven to which liquid fuel is supplied by a fuel supply line. The fuel supplied to this absorbent body vaporizes as the combustion air flow is delivered and can then be ignited using for example a glow plug.

[0004] In spite of the advantages of this simple type of gasification of liquid fuels, this device also has disadvantages. Thus, in these vaporizers which are used in burner devices, considerable time is required until a usable flame has formed, adversely affecting the response times of burners equipped with one such vaporizer.

[0005] To circumvent these defects, atomizer burners have been developed in which the vaporizer means is replaced by an atomizer nozzle. But it has been shown that the atomizer nozzles used in atomizer burners cannot effect the required atomization in every case.

[0006] The object of this invention is therefore to devise an atomizer burner which enables high-quality atomization of the fuel for quick response times of the burner and high efficiency thereof and which can be operated and produced easily and economically.

[0007] This object is achieved in a generic atomizer burner as claimed in the invention in that upstream of the burner nozzle assembly of the atomizer nozzle an air-guiding means is connected which swirls the combustion air which flows into the atomizer nozzle. By swirling this nozzle air the atomization quality and thus the efficiency of the atomizer burner can be greatly improved since the combustion air velocity and nozzle air velocity are additionally increased as a result of the impressed tangential motion component.

[0008] Advantageous embodiments of the invention are given in the dependent claims.

[0009] When a Venturi diffusor is connected downstream of the arrangement, its opening angle advantageously increases with increasing swirl.

[0010] In one preferred embodiment the air-guiding means has swirl blades which impress a swirl on the combustion air flow on its path to the atomizer nozzle.

[0011] It is advantageously provided that the swirl blades are located on a carrier mounted on the burner nozzle assembly and that two swirl blades at a time together with the carrier and the burner nozzle assembly form a conical channel. Depending on the angle adjustment of these swirl blades to one radial plane at a time the tangential air proportion and thus the nozzle air swirl can be adjusted. The swirl blades can be arranged roughly radially or essentially tilted to the radial. The swirl blades can be made planar or curved in the flow direction.

[0012] According to one alternative preferred embodiment it is provided that the air-guiding means has a pot-shaped sleeve with axial holes and tangential holes made in it and that the sleeve is mounted on the burner nozzle assembly, and the mounting can be made form-fitted or force-fitted. Alternatively the sleeve can be slipped onto the burner nozzle assembly.

[0013] The axial and tangential holes are matched to one another such that a defined swirl is imparted to the combustion air. The swirl can thus be determined by the choice of size, arrangement and execution of the tangential and axial holes to one another with respect to its characteristics.

[0014] Preferably the atomizer nozzle has an internal cross section which has a pressure profile over its run which at least directly around the outlet opening of the fuel from the fuel feed shows a value which is reduced compared to the pressure prevailing in the fuel feed. The amount of pressure reduction is chosen such that the fuel is sucked out of the fuel feed and is atomized in doing so. The internal cross section of the atomizer nozzle is feasible made as a Venturi nozzle.

[0015] Other properties and advantages of this invention follow from the description of preferred embodiments with reference to the attached drawings.

[0016] **FIG. 1** shows in a schematic lengthwise cross sectional view one preferred embodiment of an atomizer burner as claimed in the invention;

[0017] **FIG. 2** shows in a perspective view the air-guiding means of the atomizer burner of **FIG. 1**;

[0018] **FIG. 3** shows in a schematic lengthwise cross sectional view a second preferred embodiment of an atomizer burner as claimed in the invention;

[0019] **FIG. 4** shows in a schematic cross sectional view along line A-A in **FIG. 3** the air-guiding means of the embodiment as shown in **FIG. 3**; and

[0020] **FIG. 5** shows in a schematic cross sectional view as shown in **FIG. 4** an alternative embodiment of the air-guiding means.

[0021] An atomizer burner which is intended especially for use in a motor vehicle auxiliary heating system contains (see **FIG. 1**) an atomizer burner **2** with a burner nozzle assembly **3**, fuel supply **4** for feeding fluid fuel to the atomizer area **6** of the atomizer nozzle **2** and a combustion chamber **8** which is surrounded by a heat shield **9** as the peripheral boundary. Upstream of the burner nozzle assembly **3** of the atomizer nozzle **2** an air-guiding means **10** is connected; it impresses a swirl on the nozzle air flowing into the atomizer nozzle **2**. In the embodiment shown in **FIG. 1** the atomizer nozzle **2** is made as a Venturi nozzle which has an air inflow channel **5** and an atomizer area **6** which widens in the flow direction and through which flows the atomizer air flow which flows into the atomizer nozzle **2** via the air-guiding means **10**. A fluid or fuel feed **11**, for example a fuel needle, projects into the air inflow channel **5** of the atomizer nozzle **2** (see also **FIG. 2**) and has a specifically arranged outlet opening **13**. The fuel feed **11** is located

preferably on the middle axis **7** of the atomizer nozzle **2** or of the air inflow channel **5** and of the atomizer area **6** of the Venturi nozzle.

[**0022**] If a combustion air flow flows through the atomizer nozzle **2**, within the atomizer nozzle **2** a pressure profile builds up, in the air inflow channel **5** first a high static pressure prevailing which decreases in the flow direction to the atomizer area **6** and which at the outlet opening **13** of the fuel feed **11** for the fuel to be atomized has reached its minimum. The fuel delivered from the fuel feed **11** to the outlet opening **13** is intaken for this reason such that upon emerging from the outlet opening **13** of the fuel feed **11** it is broken up by the high air velocity at this point and is thus atomized. The fuel feed **11** can be a line, a fuel needle, or a fluid nozzle in order to deliver the fuel to be atomized almost unpressurized to the Venturi nozzle.

[**0023**] Since the atomizer nozzle **2** according to the embodiment of the burner shown in **FIG. 1** is exposed to high thermal loads, it is preferably made of ceramic. Compared to steel a ceramic material as an alternatively usable material has important thermomechanical advantages such as lower thermal conductivity and lower coefficient of thermal expansion.

[**0024**] The air-guiding means **10** contains in the embodiment of the atomizer burner shown in **FIG. 1 a** carrier **12** which is located at a distance to the end face **15** of the burner nozzle assembly **3**, which is formed for example as a round disk, and which together with the end face **15** of the burner nozzle assembly **3** forms an annular gap **14**. On the carrier **12** there are swirl blades **17** which are pointed against the end face **15** of the burner nozzle assembly **3** and adjoin it in the installation position. The swirl blades **17** are arranged offset on the carrier with respect to a radial line through the center point of the carrier **12** formed by the fuel feed **11** in order to produce a tangential flow component. Two swirl blades **17** at a time together with the carrier **12** and the burner nozzle assembly **3** form a conical channel **19** (see FIG. **2**). Upon inflow into the atomizer nozzle **2** a swirl is impressed on the combustion air flow flowing through the annular gap **14** by the swirl blades **17** and the conical channels **19**.

[**0025**] The heat shield **9** or the combustion chamber **8** in the embodiment shown in **FIG. 1** on its bottom has secondary air holes **16** which can be distributed over the annular edge area of the bottom of the heat shield **9**. **FIG. 1** shows by way of example only two of these secondary air holes **16**. In addition, in the side or peripheral wall of the heat shield **9** there can be secondary air holes. The heat shield **9** of the combustion chamber **8** is securely attached as a separate component via a seal **18** and a flange **20** to the burner nozzle assembly **3** for example by means of screws **23**. The flange **20** contains another air-guiding means **21** for swirling the secondary air which is flowing into the combustion space **8** through the secondary air holes **16**. The air-guiding means **21** likewise contains in an annular gap **22** swirl blades **25** which are arranged roughly radially and which cause a tangential flow component for generating swirls in the manner already described.

[**0026**] The atomizer burner furthermore contains within the combustion chamber **8** in the atomization direction of the fuel in the flame zone a damming body which is preferably a baffle plate **24** which can be made preferably conical, convex or concave. The baffle plate **24** in this embodiment is made pot-shaped as a disk with a collar **26** against the atomization direction of the fuel, the diameter of the baffle plate **24** being less than that of the combustion chamber **8**, and the ratio of the diameter of the baffle plate **24** to the diameter of the combustion chamber **8** preferably being between 0.6 and 0.9. The baffle plate **24** is mounted on the heat shield **9** with mounting brackets **28**. The ratio of the axial distance of the baffle plate **24** from the atomization point of the fuel at the outlet opening **13** of the fuel feed **11** to the diameter of the combustion chamber **8** is preferably between 0.3 and 0.6. An ignition means **29** which is shown schematically with broken lines for igniting the atomized fuel is located in the combustion chamber **8** following the Venturi nozzle.

[**0027**] A second embodiment of an atomizer burner (see **FIGS. 3 and 4** in which compared to the first embodiment identical elements are provided with identical reference numbers) contains an air-guiding means **10'** which has a pot-shaped sleeve **30**, in the bottom of which axial air holes **32** are formed, for example, axial holes, and in its peripheral wall **33** peripheral air holes **34** are formed which are also called tangential holes due to their alignment. The sleeve **30** is mounted on the burner nozzle assembly **3** of the atomizer nozzle **2**, for example by slipping it onto the burner nozzle assembly **3** or by some other form-fitted, force-fitted or material connections. The axial holes **32** and the tangential holes **34** are matched to one another such that a defined swirl is imparted to the combustion air which flows into the air inflow channel **5** and afterwards into the atomizer area **6**.

[**0028**] **FIG. 4** shows a sample arrangement of the axial air openings or axial holes **32** and the peripheral air openings or tangential holes **34** in the sleeve **30**. By varying the number of openings or holes **32**, **34** and their size and arrangement the swirl of the combustion air flow can be adjusted if necessary.

[**0029**] The pot-shaped sleeve **30** which is shown in **FIG. 5** has in its peripheral wall **33** air openings **35** which are bounded towards the center of the sleeve **30** by one air guide blade at a time. A tangential flow component is impressed on the inflowing combustion air by the air guide blades **36**.

[**0030**] It is apparent that combinations of the individual features of the two embodiments for adjusting the desired air-guiding action are possible.

[**0031**] Reference Number List

[**0032**] **2** atomizer nozzle

[**0033**] **3** burner nozzle assembly

[**0034**] **4** fuel supply

[**0035**] **5** air inflow channel

[**0036**] **6** atomizer area

[**0037**] **7** middle axis

[**0038**] **8** combustion chamber

[**0039**] **10** air-guiding means

[**0040**] **10'** air-guiding means

[**0041**] **11** fuel feed

[**0042**] **12** carrier

[0043] **13** outlet opening

[0044] **14** annular gap

[0045] **15** end face

[0046] **16** secondary air hole

[0047] **17** swirl blade

[0048] **18** seal

[0049] **19** channel

[0050] **20** flange

[0051] **21** air-guiding means

[0052] **22** annular gap

[0053] **24** baffle plate

[0054] **25** swirl blade

[0055] **26** collar

[0056] **28** mounting bracket

[0057] **29** ignition means

[0058] **30** sleeve

[0059] **32** axial hole

[0060] **33** peripheral wall

[0061] **34** air opening

[0062] **35** air opening

[0063] **36** air guide blade

1. Atomizer burner, especially for use in motor vehicle auxiliary heating systems, with an atomizer nozzle (**2**) for preparing the fuel, an ignition means and a combustion chamber (**8**), characterized in that the air-guiding means (**10**, **10'**) is connected upstream of the burner nozzle assembly (**3**) of the atomizer nozzle (**2**) and swirls the combustion air flowing into the atomizer nozzle (**2**).

2. Atomizer burner as claimed in claim 1, wherein the air-guiding means (**10**) has swirl blades (**17**).

3. Atomizer burner as claimed in claim 2, wherein the swirl blades (**17**) are located on a carrier (**12**) which is mounted on the burner nozzle assembly (**3**) and wherein two swirl blades (**17**) at a time together with the carrier (**12**) and the burner nozzle assembly (**3**) form a conical channel (**19**).

4. Atomizer burner as claimed in claim 1, wherein the air-guiding means (**10'**) has a pot-shaped sleeve (**30**) which is mounted on the burner nozzle assembly (**3**) with axial air openings (**32**) formed in it and peripheral air openings (**34**, **35**) formed in the peripheral wall (**33**).

5. Atomizer burner as claimed in claim 4, wherein the peripheral air openings (**34**) are holes formed almost tangentially to the peripheral wall (**33**).

6. Atomizer burner as claimed in claim 4 or **5**, wherein there are air guide blades (**36**) on the peripheral air openings (**35**).

7. Atomizer burner as claimed in one of claims 4 to 6, wherein the axial air openings (**32**) and the peripheral air openings (**34**; **35**) are matched to one another such that a defined swirl is imparted to the combustion air.

8. Atomizer burner as claimed in one of claims 4 to 7, wherein the sleeve (**30**) is connected by form-fit to the burner nozzle assembly (**3**).

9. Atomizer burner as claimed in one of claims 4 to 7, wherein the sleeve (**30**) is connected by force-fit to the burner nozzle assembly (**3**).

10. Atomizer burner as claimed in one of claims 4 to 7, wherein the sleeve (**30**) is slipped onto the burner nozzle assembly (**3**).

11. Atomizer burner as claimed in one of the preceding claims, wherein the atomizer nozzle (**2**) has an internal cross section which has a static pressure profile over its run which has at least directly around the outlet opening (**13**) of the fuel from the fuel feed (**11**) its minimum, resulting in a high flow velocity which tears the fuel out of the fuel feed (**11**) and atomizes it.

12. Atomizer burner as claimed in one of the preceding claims, wherein the atomizer nozzle (**2**) is a Venturi nozzle.

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