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(54) **A ROTARY OIL BURNER**

DREHBARER ÖLBRENNER

BRULEUR A COUPELLE ROTATIVE

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Description

[0001] The invention relates to a burner to combust oil in a combustion chamber. The burner is of the kind that comprises a burner casing; an atomizer cup mounted in the burner casing and arranged to supply oil to be burned to the combustion chamber and designed with a base and a tubular wall having a peripheral edge; an oil pump for metering the oil during operation to the interior of the atomizer cup; a shaft rotatably journaled in the burner casing and firmly connected to the base of the atomizer cup; a motor for rotating the shaft during operation at such high rates that the centrifugal force will make the oil in the atomizer cup leave its peripheral edge in a mist of fine oil particles; and a blower for supplying air to the combustion chamber for burning of the oil particles.

[0002] Oil is largely used as fuel in e.g. boilers for production of heat energy. However, the oil does not burn readily in the combustion chamber of such a boiler as long as it is in its original liquid state. Normally the oil is therefore atomized to fine oil particles that burn far better and purer in the combustion chamber.

[0003] Because of the relatively high cost of the oil, the environment, and the state of the combustion chamber, it is however important that the combustion takes place as completely as possible, that is without or with a minimum content of unburned elements such as e.g. carbon hydrides, carbon monoxides, and carbon in the gaseous effluents.

[0004] In attempts to solve this problem oil burners have therefore been developed in the course of time that are based on rather different atomization techniques. One particular technique can therefore be best suited for one particular combination of oil grade and boiler size but not for another.

[0005] A widely used atomization technique consists in the oil being forced into the combustion chamber at a relatively high pressure via a nozzle and is atomized on discharge from the nozzle outlet where the pressure drops suddenly. To avoid the nozzle clogging more or less, a not too heavy a fuel must be used in this case which also is of a high and uniform quality. These demands will normally be met by oil which is used for heating private residences where the boilers are relatively small.

[0006] This technique is especially suited for small boilers as the flame easily can be modulated to a small size fitting the relatively small combustion chambers of the boilers at the same time as the flame is kept at such a great distance from the nozzle that this nozzle is not damaged by the heat from the flame.

[0007] Heavy oils of varying grade are normally less expensive than the above oils and are therefore readily used if possible. These oils can especially be used as fuel in relatively large boilers where they are atomized by means of rotary burners with rapidly rotating atomizer cups which are not likely to clog as nozzles are.

[0008] From EP Patent No. 0026426 is known a rotary burner of this type. This known rotary burner has a hollow shaft which is driven by a motor with high shaft speed and which at the end is firmly connected to an atomizer cup. Via the hollow shaft, the oil is metered during operation by means of an oil pump at relatively low pressure onto the inside face of the rotating cup where the oil under the influence of the centrifugal force forms a very thin oil layer which concurrently with the metering of the oil is moving towards the peripheral edge of the cup from which the oil layer is ultimately thrown out into the combustion chamber in form of a fine oil mist.

[0009] Rotary burners of this type are well suited for, as mentioned above, relatively large boilers with correspondingly large combustion chambers that allow the flame to spread freely.

[0010] The reason that a relatively large flame is formed on application of this technique is that the oil must necessarily be thrown out of the combustion chamber at such a high rate and force that the oil particles formed are sufficiently fine to be able to burn at the required speed and purity.

[0011] However these known rotary burners are not suited for relatively small boilers with small combustion chambers as it is not possible under these circumstances to control the flame sufficiently to keep it at the necessary distance from the chamber wall and atomizer cup.

[0012] This may result in the combustion being incomplete at the wall and in the atomizer cup being damaged by the heat from the flame. If the damages are unevenly spread, the atomizer cup will easily be thrown off balance. In this state the atomizer cup will then be able to make the entire boiler vibrate and shake in a damaging manner during its rapid rotation.

[0013] From US Patent Nr. 1,490,861 and GB 620.596 is known oil burners for combusting oil in a combustion chamber. None of those oil burners are however equipped with means for effectively cooling the air passing the burner which therefore is in danger of being damaged from the heat from the flame.

[0014] In a first aspect according to the invention a burner of the kind mentioned in the opening paragraph is provided, which is arranged to be used in relatively small boilers.

[0015] In a second aspect according to the invention a burner of the kind mentioned in the opening paragraph is provided, which is provided with an atomizer cup which, during operation, is rotating at greater speeds than hitherto known.

[0016] In a third aspect according to the invention a burner of the kind mentioned in the opening paragraph is provided, which is arranged in such a way that the atomizer cup is not damaged by the heat stress from the flame.

[0017] In a fourth aspect according to the invention a burner of the kind mentioned in the opening paragraph is provided, which is arranged to burn heavy oils of varying grade, for example vegetable oils.

[0018] In a fifth aspect according to the invention a burner of the kind mentioned in the opening paragraph

is provided, which is provided with an automatic suction atomizer cup.

[0019] In a sixth aspect according to the invention a burner of the kind mentioned in the opening paragraph is provided, which has a simple and reliable construction.

[0020] According to the invention the burner comprises an inlet cup facing in opposite direction from the atomizer cup and designed with a tubular wall with a peripheral edge and a base joint with the base of the atomizer cup; at least one guide channel extending obliquely through this base at a shorter distance from the rotational axis on the side of the inlet cup than on the side of the atomizer cup; and at least one oil duct connected to the at least one oil pump and opening into an area between the shaft and the inside of the wall of the inlet cup.

[0021] Such a burner can function with a relatively small cup and correspondingly very high rotational speed in a relatively small combustion chamber of the type found in boilers for heating of e.g. private residences.

[0022] The oil is supplied to the inlet cup in an area outside the shaft and led from there to the atomizer cup via the guide channels, after which it is thrown in finely atomized state out of the peripheral edge of the atomizer cup under the influence of the centrifugal force.

[0023] As the oil now is not led through a hollow shaft during operation as conventionally, the conventional gaskets for keeping the joint between the shaft and the oil inlet sealed are advantageously avoided. Such a gasket would not last in the long run at the very high rotational speeds with which the shaft necessarily has to rotate to be able to make a relatively small cup atomize the oil with the required degree of fineness.

[0024] In an advantageous embodiment the burner casing can be designed with an air chamber receiving combustion air from the blower of the burner and defined in the burner casing by a first partition at the atomizer cup and a second one at the atomizer cup.

[0025] A slit for primary air can furthermore be made in the second partition at the peripheral edge of the atomizer cup and a number of apertures or a slit for secondary air can be made near the periphery of the burner casing.

[0026] During operation the oil is led into the inlet cup and from there further onto the atomizer cup via the guide channels in the joint base. Thereby the supplied oil is momentarily taken to the same high rotational speed as the cup whereby it is affected by a very high centrifugal force.

[0027] As the guide channels are inclined in the base, this base functions as a centrifugal pump which furthermore affects the oil with a significant force in the direction of the channels. The combination of this force and the centrifugal force causes the oil to settle on the inside of the atomizer cup in an extremely thin oil film.

[0028] According to the invention the inside face of the atomizer cup is cone-shaped. Therefore the centrifugal force has a component directed towards the peripheral edge of the atomizer cup. Under the influence of this component of force the oil film travels on the interior wall of the atomizer cup continuously towards its peripheral edge where the extremely thin oil film now is successively broken into extremely fine oil particles that are spread in the combustion chamber as a mist.

[0029] The extremely fine oil particles burn far quicker than conventionally, resulting in a relatively small flame being able to develop just as much heat as a larger one but burning slower than a conventional flame. The burner according to the invention is therefore suitable for use in relatively small boilers with relatively small combustion chambers.

[0030] The inlet cup communicates with the air chamber via a relatively narrow slit between the first partition and the peripheral edge of the atomizer cup.

[0031] As mentioned the base between the inlet cup and the atomizer cup functions as a centrifugal pump pumping oil from the inlet cup to the atomizer cup. At the same time the centrifugal pump is however pumping air from the inlet cup to the atomizer cup whereby a negative pressure is created in the inlet cup that drives an airflow through the narrow slit.

[0032] Thereby the air expands and its temperature lowered so that the air now will act as cooling air to the inlet cup, the joint base and the atomizer cup which thereby continuously can stand the heat from the flame without being damaged.

[0033] The invention will be explained in greater details below, describing only exemplary embodiments with reference to the drawing, in which

Fig. 1 is an axial view of an oil burner according to the invention, and fig. 2 shows on a larger scale a detail of the oil burner in fig. 1.

[0034] The oil burner shown comprises a burner 1 with a motor 2. The burner supplies a combustion chamber 3 in a boiler 4 with finely atomized oil which is spread in a mist of extremely fine oil particles burning in a flame 5.

[0035] A shaft 8 is rotatably journaled in a burner casing 6 by means of ball bearings 7, the shaft being rotated by the motor 2 during operation at very high shaft speed, for example 25,000 n/min.

[0036] On the shaft a blade wheel 9 is furthermore mounted that together with a blower chamber 10 made in the burner casing between a back wall 11 and a partition 12 form a blower.

[0037] The blower draws air into the blower chamber via a number of intake apertures 13 made in the wall of the burner casing and blows the drawn-in air out via a number of blow-off apertures 14 made in the partition 12.

[0038] Together with a second partition 15 the partition 12 defines an air chamber 16 which is provided with air from the pump chamber via the blow-off apertures 14. The second partition 15 increases outwards in the firing direction in a configuration that mainly follows the back of the flame 5 at an appropriate distance. Therefore there is no unfavourable space between the second partition

and the flame, in which turbulent flows could be generated that would disturb the flame so that this flame would not be able to burn properly and purely.

[0039] On a cone 17 at the end of the shaft 8 a base 18 is firmly mounted with an atomizer cup 19 facing its opening in towards the combustion chamber 3 and an inlet cup 20 facing its opening in towards the partition 12 in the burner casing 6.

[0040] In a second partition 15 a slit 21 is made near the atomizer cup and a number of apertures or a slit 22 is made near the periphery of the burner casing.

[0041] The second partition 15 is extending inwards towards the first partition 12 in a funnel 23 surrounding the outer face 24 of the inlet and atomizer cup 20, 19 and together with this outer face defining an annular air nozzle 25 opening into the slit 21.

[0042] As seen best in fig. 2, the atomizer cup 19 has a first tubular wall 26 with a first conical inside face 27 and a first peripheral edge 28. The inlet cup 20 has a second tubular wall 29 with a second conical inside face 30 and a second peripheral edge 31. Both inside faces 27 and 30 are located on a conical surface with peak in the rotational axis 32 and in the case shown, on the.same conical surface.

[0043] It has been found that the flame formation is controlled the best at the same time as the formed oil particles obtain the desired extremely small size if the conical surface forms an angle with the rotational axis 32 of between 6° and 10°, especially between 7° and 9° in combination with the peripheral edge of the atomizer cup 19 having a diameter of between 20 mm and 100 mm, preferably between 20 mm and 50 mm, and especially 30 mm, and the rotational speed being between 10,000 n/min. and 40,000 n/min., preferably between 20,000 n/min. and 30,000 n/min., and especially 25,000 n/min.

[0044] The joint base 18 of the cups is furthermore designed with a number of guide channels 33 that open at a shorter distance from the rotational axis 32 on side of the inlet cup than on the side of the atomizer cup.

[0045] The first partition 12 is designed with a projection 34 extending into the inlet cup 20 at a short distance from the base 18 and near the peripheral edge 31 of the inlet cup which furthermore is near the partition 12. As it appears, a narrow slit 35 is thereby formed between the inlet cup 20 on the one hand and the partition 12 with its projection 34 on the other hand.

[0046] A pump (not shown) serves for pumping the oil to be burned into the inlet cup 20 via an oil duct 36 made in the first partition 12 and in through the projection 34 of this partition to near the base 18 of the cup and at least essentially within the circle of outlets of the guide channels 33 in the inlet cup.

[0047] The burner is furthermore provided with an air distributor shell 37 extending in continuation of the burner casing 6 a distance into the combustion chamber 3 and also with an igniter 38 located near the distributor shell and connected to an ignition unit (not shown) via an electric line 39.

[0048] The burner is furthermore provided with a control box, not shown, with among other things monitoring automatics and flame monitor.

[0049] When the burner is in operation, the inlet cup 20 receives oil from the oil pump via the oil duct 36 in the first partition 12. The inclined guide channels 33 function as the blades in a centrifugal pump which effectively pumps air from the air chamber 16 to the atomizer cup 19 via the narrow slit 35 between the inlet cup 20 and the partition 12 with its projection 34.

[0050] In the inlet cup a negative pressure is thereby created that supplies the inlet cup with an automatic suction power. The pump can therefore, at least essentially, be unpressurized and mainly only function as metering pump to meter the amount of oil that is continuously used for producing the desired heating effect.

[0051] As mentioned above, the outlet of the oil duct 36 is near the base 18 of the inlet cup 20 and at least partly within the outlet of the guide channels 33 in the inlet cup. The oil therefore settles in a thin oil layer on the base. Under the influence of the centrifugal force this oil layer travels continuously outwards in direction towards the conic inside face 30 of the tubular wall 29 of the inlet cup 20.

[0052] At the outlet of the guide channels on the side of the inlet cup the oil layer undergoes a severe splitting resulting in at least a part of the oil layer being transformed into oil particles that are mixed with the cooling airflow. The centrifugal force makes the rest of the oil layer flow through the guide channels in liquid state along the area that is farthest from the rotational axis 32.

[0053] At the outlet of the guide channels in the atomizer cup the pressure built-up in the cooling air during its passage in the guide channels drops suddenly. Thereby the oil particles are separated which, together with the liquid oil flowing out of the outlet of the guide channels, settle as an extremely thin oil film on the conic inside face 27 of the tubular wall 26 of the atomizer cup 19 under the influence of the very great centrifugal force produced due to the very fast rotational speed of the cup.

[0054] The oil film continuously travels towards the peripheral edge 28 of the atomizer cup where it is split up into extremely small oil particles that leave the edge as a flat mist.

[0055] The blower draws fresh air into the blower chamber 10 via the intake apertures 13 and blows the drawn-in air into the air chamber 16 via the blow-off apertures 14.

[0056] In the air chamber the air is now divided into three airflows, namely a primary airflow, a secondary airflow, and a cooling airflow that all finally will form part of the combustion air for the combustion process.

[0057] The primary air constituting a smaller part of the total amount of air is blown at appropriate rate out through the air nozzle 25. This primary airflow serves to, via the air distributor shell, draw the flat oil mist leaving the peripheral edge of the atomizer cup out into the combustion chamber of the boiler so that it will not burn so close to

the atomizer cup that this cup is damaged by the heat from the flame. It has proven that the peripheral edge of the atomizer cup and the flame can be spaced between 10 mm and 40 mm.

[0058] The secondary air is blown out through the apertures or slit 22 of the second partition 15 near the air distributor shell 37 where it modulates the flame and keeps it free of the inside face of the shell. The secondary air contributes with the chief part of the required combustion air.

[0059] At start-up the mixture of combustion air and extremely fine oil particles is ignited by means of the igniter 38 so that a flame is produced. The combustion process is now in progress.

[0060] Especially the atomizer cup is located at a position in which it inevitably will receive a significant amount of radiation heat from the flame and its surroundings. It is important that the cup is not damaged during this so that it is thrown off balance and shakes the burner to pieces during its rapid rotation.

[0061] The cooling air flowing out through the aperture of the atomizer cup acts to some extent as a shield shielding the cup against the heat stress, the cooling air absorbing heat concurrently with it getting nearer the flame.

[0062] This air is in itself cooled when it is drawn via the narrow slit 35 between the inlet cup 20 and the partition 12 with its projection 34 into the atomizer cup 19 from the air chamber 16 of the joint base 18 of the cups, the base functioning, due to the presence of the guide channels 33, as a centrifugal pump which is very effective because the cooling air passing the guide channels is mixed with oil particles that are much heavier than the air.

[0063] The sharp pressure drop produced over the narrow slit 35 causes the air to expand and thereby its temperature to drop drastically.

[0064] The now cold air or the cooling air subsequently flows through the inlet cup, the guide channels, and the atomizer cup. Thereby the entire cup is cooled so effectively that it can be made of a material such as e.g. aluminium which in conventional burners would be destroyed by the great heat impact from the burning flame.

[0065] The application of such a well heat-conducting material as aluminium furthermore has the significant advantage in that the atomizer cup which is affected the most by the heat quickly conducts the absorbed heat on to the inlet cup which is cooled the best.

[0066] The burner according to the invention is well suited for heavy oils of varying grade such as e.g. vegetable oils. Thereby a perspective of global significance is opened.

[0067] Combustion of the vast amounts of oil brought up from the subsoil will gradually create more carbon dioxide than the forests and green areas on the planet will be able to assimilate.

[0068] However just as much of the atmosphere content of carbon dioxide is used for production of vegetable oils as is later released on combustion. Heating with vegetable oils is therefore neutral with respect to the atmosphere content of carbon dioxide.

Example

[0069] A boiler is burned with 2 kg rape oil per hour by means of a rotary oil burner according to the invention.

[0070] The rape oil is of the following quality:

Ash	0.068 w%
Coke remainder	0.51 w%
Density at 15°C	0.9209 g/ml
Flash point.	>140 °C
Upper calorific value	44.35 MJ/kg
Lower calorific value	41.78 MJ/kg
Pour point	-24 °C
Sediments at extraction	0.02 w%
Sulphur	<0.05 w%
Viscosity at 40°C	34.7 cSt
Water	1480 ppm by weight

[0071] The atomizer cup of the burner had a diameter at the peripheral edge of 30 mm and a depth, of 10 mm whereas its inlet cup had a diameter at the peripheral edge of 20 mm and a depth of 10 mm. The joint base of the two cups had a thickness of 10 mm and their conicity was 8° measured as the angle between a generator and the rotational axis.

[0072] The entire cup was made of aluminium and was mounted on a shaft which was rotated at a rotational speed of 25,000 rpm by means of a direct-driven motor of 0.25 kW.

[0073] In the joint base six guide channels were arranged with axes forming an angle of 8° with the rotational axis. The diameter of the guide channels was 3 mm and during their rapid rotation a strong airflow was generated from the inlet cup to the atomizer cup.

[0074] The air was drawn in from an air chamber with an air temperature of 40 °C via a narrow slit with a width of 0.1 mm and length of about 11 mm whereby the air temperature dropped to minus 12 °C.

[0075] The cold air kept the atomizer cup temperature at about 115 °C. After 100 operating hours there were no signs of the atomizer cup being damaged by the heat from the flame.

[0076] The flame burned continuously purely. The content of carbon monoxide was 15 ppm and total unburnt was 22 ppm.

Claims

1. A burner for combusting oil in a combustion chamber (3) comprising

   - a burner casing (6),
   - an atomizer cup (19) mounted in the burner

casing (6) and arranged to supply the combustion chamber (3) with the oil to be burned and designed with a base (18) and a first tubular wall (26) with a first peripheral edge (28).
- at least one oil pump for metering the oil to the interior of the atomizer cup (19) during operation,
- a shaft (8) rotatably journaled in the burner casing (6) and at one end firmly connected to the base (18) of the atomizer cup (19),
- a motor (2) for rotating the shaft (8) during operation at such a high rate that the centrifugal force makes the oil in the atomizer cup (19) leave the peripheral edge of this cup in a mist of fine oil particles,
- at least one blower (9,10) for supplying the chamber (3) with air to combust the fine oil particles,
- an inlet cup (20) facing in the opposite direction to the atomizer cup (19) and designed with a second tubular wall (29) with a second peripheral edge (31) and the base (18) which is joint with the base (18) of the atomizer cup (19), and
- at least one oil duct (36) connected to the at least one oil pump and opening into an area between the shaft (8) and the inside face (30) of the wall (29) of the inlet cup (20)

characterized in that the burner furthermore comprises

- at least one guide channel (33) for combustion air and oil is extending obliquely through the base (18) at a shorter distance from the rotational axis (32) on the side of the inlet cup (20) than on the side of the atomizer cup (19), whereby a first partition (12) is extending into the inlet cup (20) with a projection (34) in such a way that a slit (35) narrow enough to create a sharp pressure drop in the combustion air passing the slit is formed between the inlet cup (20) and the partition (12) and its projection (34).

2. A burner according to claim 1, **characterized in that** the first - and second inside faces (27;30) of the tubular wall (26) of the atomizer cup (19) and the tubular wall (29) of the inlet cup (20) respectively are located on each their surface of revolution with an increasing diameter in the direction from the inlet cup (20) to the atomizer cup (19).

3. A burner according to claim 1 or 2, **characterized in that** the first - and second inside faces (27; 30) of the tubular walls (26;29) of the atomizer cup (19) and the inlet cup (20) respectively are located on a conical surface with peak in the rotational axis (32).

4. A burner according to claim 1, 2 or 3, **characterized in that** the inside face of the at least one guide channel (33) through the base (18) separating the inlet cup (20) and the atomizer cup (19), is flush with a generatrix of the conical surface along a line or an area.

5. A burner according to any of the claims 1-4, **characterized in**

- **that** the air chamber (16) for receiving the combustion air from the at least one blower (9,10) is designed in an area around the inlet cup (20) and the atomizer cup (19) in the burner casing,
- **that** the air chamber (16) is defined by a first partition (12) at the inlet cup (20) and a second partition (15) at the atomizer cup (19), and
- **that** a slit (21) is made in the second partition (15) near the atomizer cup (19) and a number of apertures or a slit (22) is made near the periphery of the burner casing (6).

6. A burner according to claim 5, **characterized in**

- **that** the inlet cup (20) and the atomizer cup (19) have a joint outer face (24),
- a funnel (23) is located at a distance around this outer face (24) and is extending from an area near the first partition (12) to an area around the slit (21) in the second partition (15), and
- **that** said outer face (24) defines an annular air nozzle (25) together with the inside face of the funnel (23).

7. A burner according to claim 6, **characterized in that** the first partition (12) is located at a relatively small axial distance from the peripheral edge of the inlet cup (20),

- that said projection (34) is annular , which projection is surrounding the shaft (8) and extending into the inlet cup (20) at a relatively short radial distance from the peripheral edge (31) of this cup and at the same time at a relatively short axial distance from its base (18), and
- that the at least one oil duct (36) is made in the first partition (12) and is opening into the projection (34) of this partition.

8. A burner according to claim 6 or 7 **characterized in**

- **that** the blade wheel (9) of the blower is mounted on the shaft (8),
- **that** the shaft (8) is partly journaled in the first partition (12), partly in a back wall (11) in the burner casing (6),
- **that** a blower chamber (10) for the blade wheel (9) is made between the back wall (11) and the first partition (12),

- **that** the pressure side of the blower chamber (10) is connected to the air chamber (16) via blow-off apertures (14) in the first partition (12) and the suction side is connected to the surroundings via intake apertures (11) in the burner casing (6).

9. A burner according to any of the claims 1-8, **characterized in that** a generatrix of the conical surface is forming an angle with the rotational axis of between 6° and 10°, especially between 7° and 9°.

10. A burner according to any of the claims 1-9, **characterized in that** the atomizer cup at its peripheral edge has a diameter of between 20 mm and 100 mm, preferably between 20 mm and 50 mm, and especially 30 mm, and that its rotational speed is between 10,000 n/min. and 40,000 n/min., preferably between 20,000 n/min. and 30,000 n/min. and especially 25,000 n/min.

Patentansprüche

1. Ein Brenner zum Verbrennen von Öl in einer Brennkammer (3), mit

- einem Brennergehäuse (6),
- einem Atomisierungsbecher (19), der in dem Brennergehäuse (6) montiert ist und zum Liefern von zu verbrennendes Öl in die Verbrennungskammer angeordnet und mit einer Kammer (18) mit einer ersten ringförmigen Wand (26) mit einer ersten Umfangskante (28) versehen ist,
- wenigstens einer Ölpumpe zum dosierten Einbringen des Öls in das Innere des Atomisierungsbechers (19) während des Betriebs,
- einer Welle (8) die drehbar in dem Brennergehäuse (6) gelagert ist und an einem Ende fest mit der Basis (18) des Atomisierungsbecher (19) verbunden ist,
- einem Motor (2) zum Drehen der Welle (8) während des Betriebs mit einer derart hohen Rate, dass die Zentrifugalkraft das Öl in dem Atomisierungsbecher (19) den Umfangsrand dieses Bechers in einem Nebel von feinen Ölpartikeln verlässt,
- wenigstens einem Gebläse (9, 10) zum Zuführen von Luft in die Kammer (3) zum Verbrennen der feinen Ölpartikel,
- einem Einlassbecher (20), der in die entgegengesetzte Richtung zu dem Atomisierungsbecher (19) weist und mit einer zweiten ringförmigen Wandung mit einem zweiten Umfangsrand (31) und mit der Basis (18), die mit der Basis (18) des Atomisierungsbechers (19) verbunden ist, ausgebildet ist,
- wenigstens einer Ölleitung (36) die mit der wenigstens einen Ölpumpe verbunden ist und sich in einen Bereich zwischen der Welle (8) und der Innenfläche (30) der Wand (29) des Einlassbechers (30) öffnet,

dadurch gekennzeichnet, dass der Brenner weiter aufweist:

- wenigstens einen Führungskanal (33) für die Verbrennungsluft und das Öl, der sich schräg durch die Basis (18) mit einem kürzeren Abstand von der Rotationsachse (32) auf der Seite des Einlassbechers (20) als auf der Seite des Atomisierungsbechers (19) erstreckt, wobei eine erste Trennwand (12) sich mit einem Vorsprung (34) in das Innere des Einlassbechers (20) derart erstreckt, dass ein Schlitz (35) nahe genug zum Erzeugen eines plötzlichen Druckabfalls in der Verbrennungsluft, die den Schlitz passiert, der zwischen dem Einlassbecher (20) und der Trennwandung (12) und dessen Vorsprung (34) gebildet wird.

2. Ein Brenner nach Anspruch 1, **dadurch gekennzeichnet, dass** die erste- und zweite Innenfläche (27; 30) der ringförmigen Wandung (26) des Atomisierungsbechers (19) und die ringförmige Wand (29) des Einlassbechers (20) auf jeder ihrer Rotationsflächen mit einem zunehmenden Durchmesser in der Richtung von dem Einlassbecher (20) zu dem Atomisierungsbecher (19) angeordnet sind.

3. Ein Brenner nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die erste und die zweite Innenfläche (27; 30) der ringförmigen Wand (26; 29) des Atomisierungsbechers (19) bzw. des Einlassbechers (20) an einer konischen Fläche mit der Spitze in der Drehachse (32) angeordnet sind.

4. Ein Brenner nach Anspruch 1, 2 oder 3, **dadurch gekennzeichnet, dass** die Innenfläche des wenigstens einen Führungskanals (33) durch die Basis (18), die den Einlassbecher (20) von dem Atomisierungsbecher (19) trennt, mit einer Erzeugenden der konischen Fläche entlang einer Linie oder einem Fläche fluchtet.

5. Ein Brenner nach einem der Ansprüche 1 - 4, **dadurch gekennzeichnet, dass**

- die Luftkammer (16) zum Aufnehmen der Verbrennungsluft von dem wenigstens einen Gebläse (9, 10) in einer Fläche um den Einlassbecher (20) und dem Atomisierungsbecher (19) in dem Brennergehäuse ausgebildet ist,
- die Luftkammer (16) durch eine erste Trennwand (12) in dem Einlassbecher (20) und eine

zweite Trennwand (15) an dem Atomisierungsbecher (19) begrenzt wird, und
- ein Schlitz (21) in der zweiten Trennwand (15) nahe dem Atomisierungsbecher (19) vorgesehen ist und eine Anzahl von Öffnungen oder ein Schlitz (20) nahe der Peripherie des Brennergehäuses (6) vorgesehen ist.

6. Ein Brenner nach Anspruch 5, **dadurch gekennzeichnet, dass**

- der Einlassbescher (29) und der Atomisierungsbecher (19) eine gemeinsame Außenfläche haben,
- ein Kanal (23) mit einem Abstand um diese Außenfläche angeordnet ist, der sich von einem Bereich nahe der ersten Trennwand (12) zu einem Bereich nahe dem Schlitz (21) der zweiten Trennwand erstreckt, und
- die Außenfläche (24) gemeinsam mit der Innenfläche des Kanals (23) eine ringförmige Düse (25) bildet.

7. Ein Brenner nach Anspruch 6, **dadurch gekennzeichnet, dass**

- die erste Trennwand (12) mit einem relativ geringen axialen Abstand von dem Umfangsrand des Einlassbechers (20) angeordnet ist,
- der Vorsprung (34) ringförmig ausgebildet ist, wobei der Vorsprung die Welle (8) umgibt und sich in den Einlassbecher (20) mit einem relativ kurzen radialen Abstand von dem Umfangsrand (31) dieses Bechers und gleichzeitig mit einem relativ kurzen axialen Abstand von seiner Basis gegeben ist, erstreckt, und
- die wenigstens eine Ölleitung (36) in der ersten Trennwand (12) vorgesehen ist und sich in den Vorsprung (34) dieser Trennwand öffnet.

8. Ein Brenner nach Anspruch 6 oder 7, **dadurch gekennzeichnet, dass**

- der Ventilator (9) des Gebläses auf der Welle (8) montiert ist,
die Welle (8) einerseits in der ersten Trennwand und andererseits n einer Rückwand (11) in dem Brennergehäuse (6) gelagert ist,
- eine Gebläsekammer (10) für den Ventilator (9) zwischen der Rückwand (11) und der ersten Trennwand (12) vorgesehen ist und
- die Druckseite der Gebläsekammer (10) mit der Luftkammer (16) über Ausblasöffnungen (14) in der ersten Trennwand (12) verbunden ist und die Saugseite mit der Umgebung über Einlassöffnungen (12) in dem Brennergehäuse (6) verbunden ist.

9. Ein Brenner nach einem der Ansprüche 1 - 8, **dadurch gekennzeichnet, dass** eine Erzeugende der konischen Fläche einen Winkel mit der Drehachse von zwischen 6° und 10°, insbesondere zwischen 7° und 9°, bildet.

10. Ein Brenner nach einem der Ansprüche 1 - 9, **dadurch gekennzeichnet, dass** der Atomisierungsbecher an seiner Umfangsfläche einen Durchmesser von zwischen 20mm und 100mm vorzugsweise zwischen 20mm und 50mm und insbesondere 30mm hat, und dass die Rotationsgeschwindigkeit zwischen 10.000 n/min und 40,000 n/mm, vorzugsweise zwischen 20,000 n/min und 30,000 n/min und besonders bevorzugt zwischen 25.000 n/min beträgt.

Revendications

1. Brûleur pour faire brûler de l'huile dans une chambre de combustion (3), comprenant :

- un corps de brûleur (6),
- une coupelle de pulvérisateur (19) montée dans le corps de brûleur (6) et agencée pour alimenter la chambre de combustion (3) avec l'huile à faire brûler et conçue avec une base (18) et une première paroi tubulaire (26) avec un premier bord périphérique (28),
- au moins une pompe à huile pour doser l'huile à l'intérieur de la coupelle de pulvérisateur (19) pendant le fonctionnement,
- un arbre (8) entraîné en rotation dans le corps de brûleur (6) et au niveau d'une extrémité, fermement raccordé à la base (18) de la coupelle de pulvérisateur (19),
- un moteur (2) pour faire tourner l'arbre (8) pendant le fonctionnement à une vitesse telle que la force centrifuge fait sortir l'huile située dans la coupelle de pulvérisateur (19) par le bord périphérique de cette coupelle sous la forme d'un brouillard de fines particules d'huile,
- au moins une soufflante (9, 10) pour alimenter la chambre (3) avec de l'air pour faire brûler les fines particules d'huile,
- une coupelle d'entrée (20) faisant face, dans la direction opposée, à la coupelle de pulvérisateur (19) et conçue avec une deuxième paroi tubulaire (29) avec un deuxième bord périphérique (31) et la base (18) qui est jointe à la base (18) de la coupelle de pulvérisateur (19), et
- au moins un conduit d'huile (36) raccordé à la -au moins- pompe à huile et débouchant dans une zone entre l'arbre (8) et la face interne (30) de la paroi (29) de la coupelle d'entrée (20),

caractérisé en ce que le brûleur comprend en

outre :

- au moins un canal de guidage (33) pour l'air et l'huile de combustion s'étend de manière oblique à travers la base (18) à une plus courte distance de l'axe de rotation (32) du côté de la coupelle d'entrée (20) que du côté de la coupelle de pulvérisateur (19), moyennant quoi une première séparation (12) s'étend dans la coupelle d'entrée (20) avec une saillie (34), de sorte qu'une fente (35) assez étroite pour créer une chute de pression nette dans l'air de combustion passant dans la fente, est formée entre la coupelle d'entrée (20) et la séparation (12) et sa saillie (34).

2. Brûleur selon la revendication 1, **caractérisé en ce que** les première et deuxième faces intérieures (27 ; 30) de la paroi tubulaire (26) de la coupelle de pulvérisateur (19) et de la paroi tubulaire (29) de la coupelle d'entrée (20) respectivement, sont positionnées, sur chacune de leur surface de révolution, avec un diamètre croissant dans la direction allant de la coupelle d'entrée (20) à la coupelle de pulvérisateur (19).

3. Brûleur selon la revendication 1 ou 2, **caractérisé en ce que** les première et deuxième faces intérieures (27 ; 30) des parois tubulaires (26 ; 29) de la coupelle de pulvérisateur (19) et de la coupelle d'entrée (20) respectivement, sont positionnées sur une surface conique avec un pic dans l'axe de rotation (32).

4. Brûleur selon la revendication 1, 2 ou 3, **caractérisé en ce que** la face intérieure du au moins un canal de guidage (33) passant par la base (18) séparant la coupelle d'entrée (20) et la coupelle de pulvérisateur (19) est de niveau avec une génératrice de la surface conique le long d'une ligne ou d'une zone.

5. Brûleur selon l'une quelconque des revendications 1 à 4, **caractérisé**

- **en ce que** la chambre d'air (16) pour recevoir l'air de combustion de la -au moins-soufflante (9, 10) est conçue dans une zone située autour de la coupelle d'entrée (20) et de la coupelle de pulvérisateur (19) dans le corps de brûleur,
- **en ce que** la chambre d'air (16) est définie par une première séparation (12) au niveau de la coupelle d'entrée (20) et une deuxième séparation (15) au niveau de la coupelle de pulvérisateur (19), et
- **en ce qu'**une fente (21) est réalisée dans la deuxième séparation (15) à proximité de la coupelle de pulvérisateur (19) et on réalise un certain nombre d'ouvertures ou une fente (22) à proximité de la périphérie du corps de brûleur (6).

6. Brûleur selon la revendication 5, **caractérisé en ce que**

- la coupelle d'entrée (20) et la coupelle de pulvérisateur (19) ont une face externe de joint (24),
- un entonnoir (23) est positionné à une distance autour de cette face externe (24) et s'étend à partir d'une zone à proximité de la première séparation (12) jusqu'à une zone située autour de la fente (21) dans la deuxième séparation (15), et
- **en ce que** ladite face externe (24) définit une buse d'air annulaire (25) conjointement à la face intérieure de l'entonnoir (23).

7. Brûleur selon la revendication 6, **caractérisé en ce que** la première séparation (12) est positionnée à une distance axiale relativement petite du bord périphérique de la coupelle d'entrée (20),

- **en ce que** ladite saillie (34) est annulaire, laquelle saillie entoure l'arbre (8) et s'étend dans la coupelle d'entrée (20) à une distance radiale relativement courte du bord périphérique (31) de cette coupelle et en même temps, à une distance axiale relativement courte de sa base (18), et
- **en ce que** le -au moins- conduit d'huile (36) est réalisé dans la première séparation (12) et débouche dans la saillie (34) de cette séparation.

8. Brûleur selon la revendication 6 ou 7, **caractérisé**

- **en ce que** la roue à aubes(9) de la soufflante est montée sur l'arbre (8),
- **en ce que** l'arbre (8) est partiellement entraîné en rotation dans la première séparation (12), partiellement dans une paroi arrière (11) dans le corps de brûleur (6) ;
- **en ce qu'**une chambre de soufflante (10) pour la roue à aubes (9) est réalisée entre la paroi arrière (11) et la première séparation (12),
- **en ce que** le côté de pression de la chambre de soufflante (10) est raccordé à la chambre d'air (16), par l'intermédiaire des ouvertures de purge (14) dans la première séparation (12) et le côté d'aspiration est raccordé au milieu ambiant par l'intermédiaire d'ouvertures d'admission (11) dans le corps de brûleur (6).

9. Brûleur selon l'une quelconque des revendications 1 à 8, **caractérisé en ce qu'**une génératrice de la surface conique forme un angle avec l'axe de rotation compris entre 6° et 10°, en particulier entre 7°

et 9°.

10. Brûleur selon l'une quelconque des revendications 1 à 9, **caractérisé en ce que** la coupelle de pulvérisateur, au niveau de son bord périphérique, a un diamètre compris entre 20 mm et 100 mm, de préférence entre 20 mm et 50 mm, et en particulier 30 mm, et **en ce que** sa vitesse de rotation est comprise entre 10000 n/min et 40000 n/min, de préférence entre 20000 n/min et 30000 n/min et en particulier 25000 n/min.

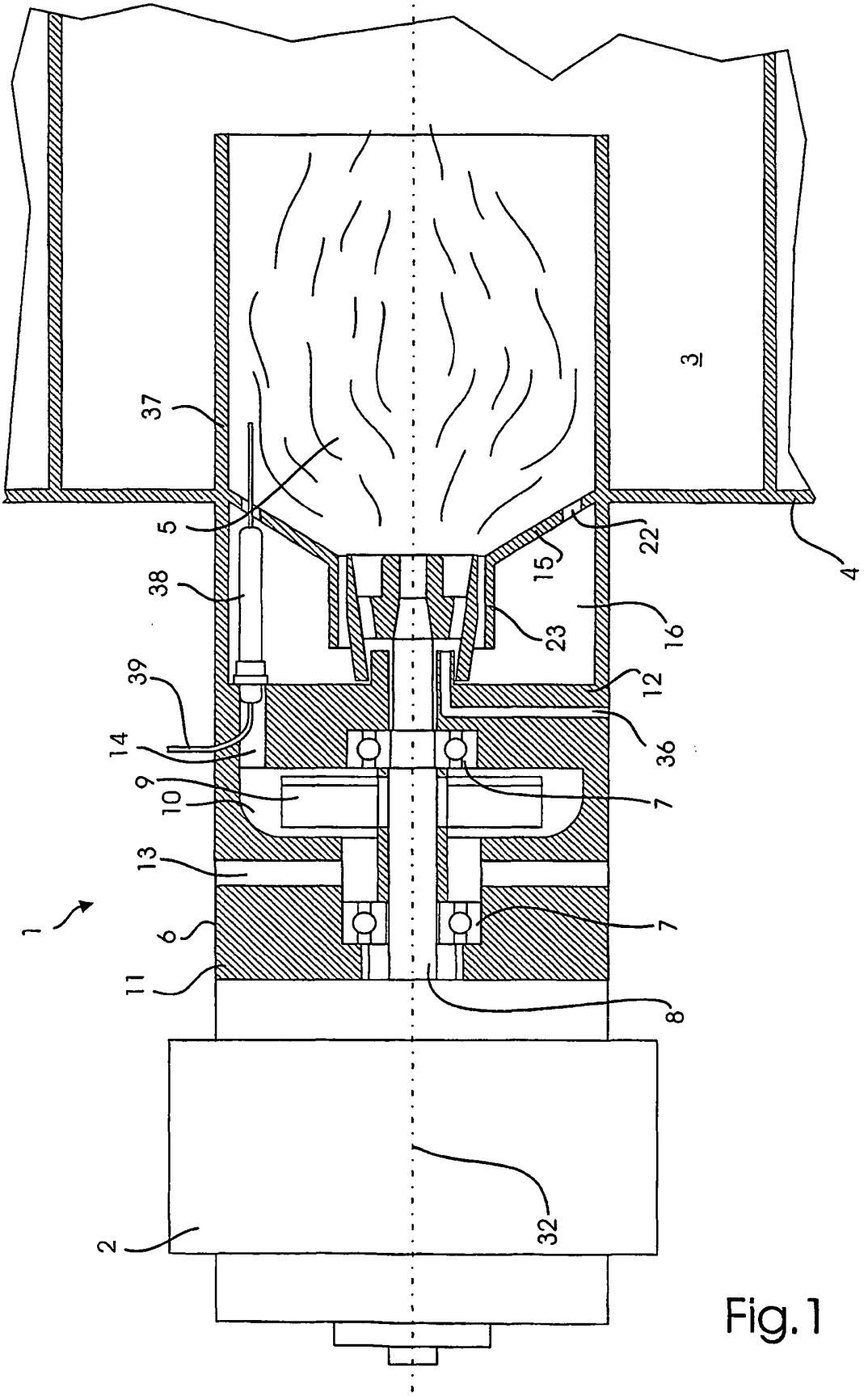

Fig.1

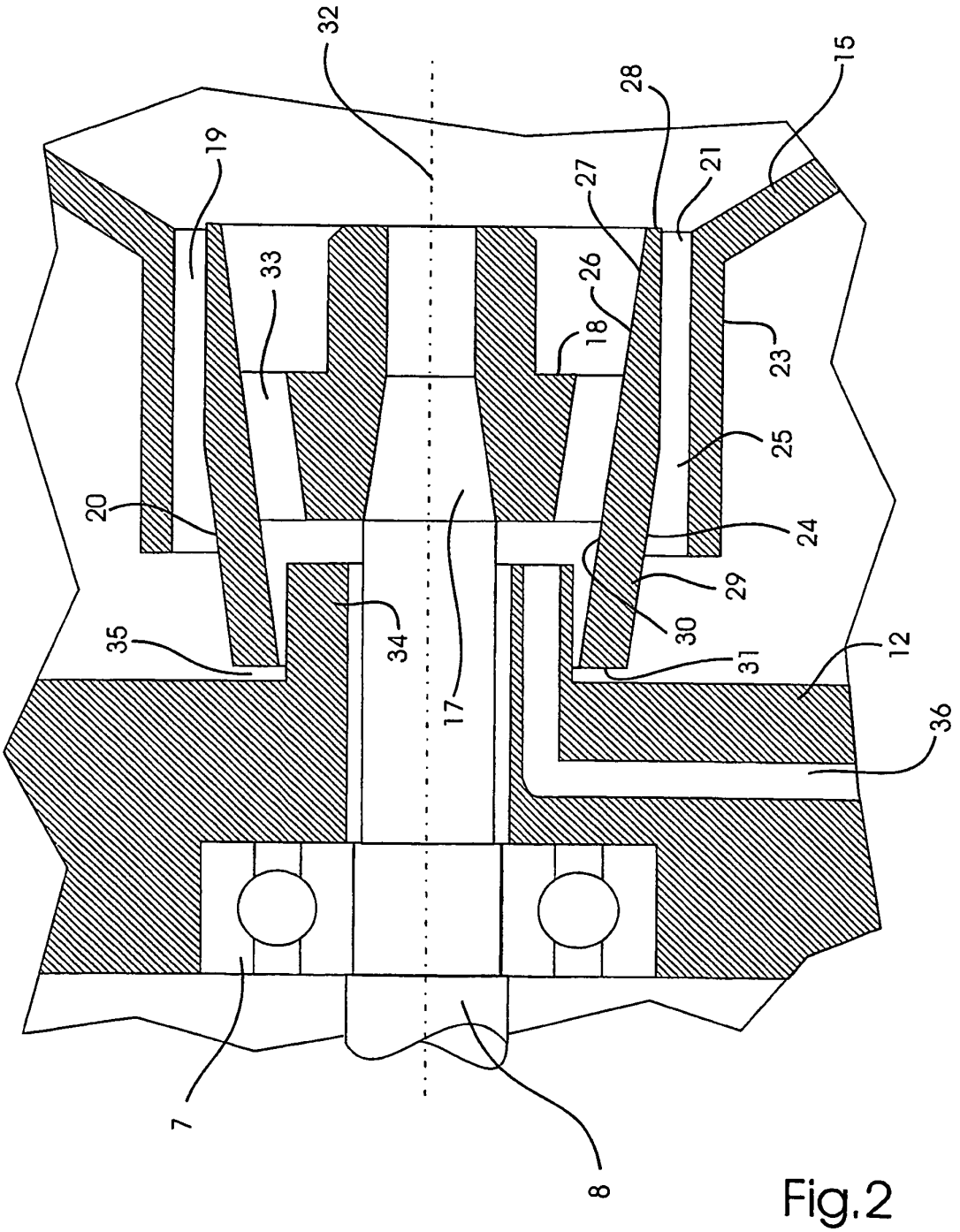

Fig.2

REFERENCES CITED IN THE DESCRIPTION

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