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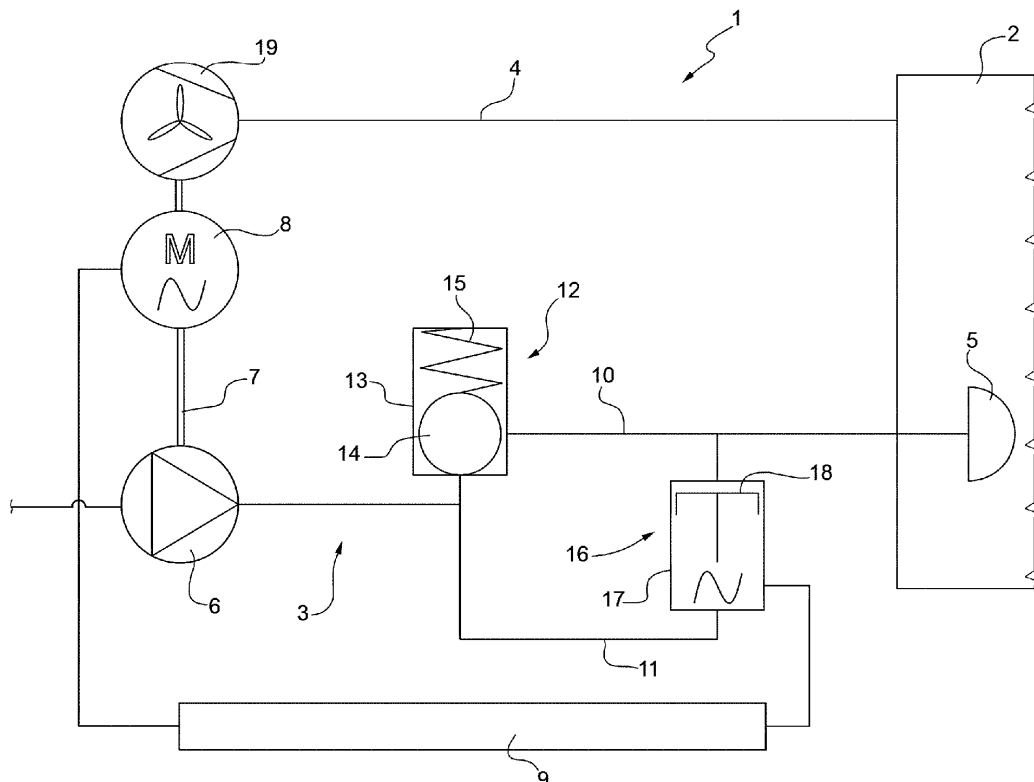
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(54) **LIQUID-FUEL MULTISTAGE BURNER**

(57) A liquid-fuel multistage burner has a combustion head (2) provided with an atomizing nozzle (5), a pneumatic circuit (4) to feed oxidizing air to the combustion head (2), a pumping device (6) to feed liquid fuel from a containing tank to the atomizing nozzle (5), and two feed-

ing branches (10, 11), which are arranged in parallel to one another between the pumping device (6) and the atomizing nozzle (5) so as to feed liquid fuel to the atomizing nozzle (5) with respective feeding pressures, which are different from one another.



DescriptionCROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority from Italian patent application no. 102020000017968 filed on 24/07/2020.

TECHNICAL FIELD

[0002] The invention relates to a liquid-fuel multistage burner.

BACKGROUND ART

[0003] In particular, the invention relates to a liquid-fuel multistage burner of the type comprising a combustion head; a hydraulic circuit to feed liquid fuel to the combustion head; and a first pneumatic circuit to feed oxidizing air to the combustion head.

[0004] The hydraulic circuit comprises an atomizing nozzle projecting into the combustion head; a pumping device to feed liquid fuel from a containing tank to the atomizing nozzle; and an electrically operated flow rate adjuster, which is mounted between the pumping device and the atomizing nozzle so as to selectively control the liquid fuel flow rate fed to the atomizing nozzle and, hence, the heat power of the burner.

[0005] The burner further comprises a second pneumatic circuit to feed a flow of air under pressure, which is suited to atomize the liquid fuel, to the atomizing nozzle.

[0006] The first pneumatic circuit generally comprises a motor-driven impeller connected to the combustion head and the second pneumatic circuit comprises a compressor connected to the atomizing nozzle.

[0007] Known liquid-fuel multistage burners of the type described above are affected by some drawbacks, which are mainly due to the fact that the electrically operated flow rate adjuster always has to be supplied with power for any heat power of the burner, in order to ensure the supply of liquid fuel to the atomizing nozzle.

[0008] Furthermore, the presence of the two pneumatic circuits and, hence, of the impeller, of the compressor and of the relative operating motors makes known liquid-fuel multistage burners of the type described above relatively complex and expensive.

DISCLOSURE OF INVENTION

[0009] The object of the invention is to provide a liquid-fuel multistage burner, which does not suffer from the drawbacks described above and can be manufactured in a simple and economic fashion.

[0010] According to the invention, there is provided a liquid-fuel multistage burner as claimed in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The invention will now be described with reference to the accompanying figure, which schematically shows a nonlimiting embodiment thereof.

BEST MODE FOR CARRYING OUT THE INVENTION

[0012] With reference to the accompanying figure, number 1 indicates, as a whole, a liquid-fuel multistage burner.

[0013] The burner 1 comprises a combustion head 2; a hydraulic circuit 3 to feed liquid fuel to the head 2; and a pneumatic circuit 4 to feed oxidizing air to the head 2.

[0014] The hydraulic circuit 3 comprises an atomizing nozzle 5, which is mounted inside the head 2, and a first pumping device 6, specifically a gear pump, to feed liquid fuel from a containing tank (which is not shown) to the nozzle 5.

[0015] The device 6 is connected to an output shaft 7 of an operating motor 8, specifically a brushless electric motor, whose operation is selectively controlled by an electronic control unit 9 of the burner 1.

[0016] The hydraulic circuit 3 further comprises two feeding branches 10, 11, which are arranged in parallel to one another between the device 6 and the nozzle 5 and are connected to one another downstream of the device 6 and upstream of the nozzle 5.

[0017] The branch 10 is provided with a check valve 12, which is mounted along the branch 10 and comprises a valve body 13, a ball shutter 14 and a spring 15, which is interposed between the valve body 13 and the shutter 14 so as to move the shutter 14 to - and normally hold it in - a closing position to close the valve 12.

[0018] The branch 11 is provided with a second pumping device 16, which is mounted along the branch 11, is connected to the unit 9 and comprises a pump body 17 and an electrically operated piston 18, which is engaged in the pump body 17 in a sliding manner.

[0019] The pneumatic circuit 4 comprises an impeller 19, which is coupled to the shaft 7 of the motor 8 in angularly fixed manner and is pneumatically connected to the head 2.

[0020] According to a first operating mode corresponding to a first heat power of the burner 1:

the pumping device 16 is not activated so as to prevent liquid fuel from flowing along the branch 11; and the motor 8 is activated by the unit 9 with a first rotation speed so as to allow the pumping device 6 and the impeller 19 to supply the nozzle 5 and the combustion head 2, respectively, with a liquid fuel flow rate and with an oxidizing air flow rate, respectively, which are such as to ensure a correct combustion of the liquid fuel as well as the delivery of the first heat power of the burner 1.

[0021] With regard to what discussed above, it should

be pointed out that the operation of the motor 8 is controlled by the unit 9 so as to allow the pumping device 6 to feed, along the branch 10, liquid fuel at a feeding pressure that is such as to:

exert upon the shutter 14 a thrust that, in any case, is greater than the thrust exerted upon the shutter 14 by the spring 15, thus moving the shutter 14 to an opening position to open the valve 12; and ensure the atomization of the liquid fuel flowing out of the nozzle 5.

[0022] In a second operating mode corresponding to a second heat power of the burner 1, which is greater than the first heat power:

the motor 8 is activated by the unit 9 with a second rotation speed, which is higher than the first rotation speed, so as to allow the pumping device 6 and the impeller 19 to supply the nozzle 5 and the combustion head 2, respectively, with a liquid fuel flow rate and with an oxidizing air flow rate, respectively, which are such as to ensure a correct combustion of the liquid fuel as well as the delivery of the second heat power of the burner 1; and the pumping device 16 is activated by the unit 9 so as to supply the nozzle 5 with liquid fuel at a feeding pressure which is greater than the feeding pressure of the pumping device 6.

[0023] Since the branches 10, 11 are connected to one another upstream of the nozzle 5, the liquid fuel fed by the pumping device 16 to the nozzle 5 and, hence, to the valve 12 cooperates with the spring 15 in order to move the shutter 14 to its closing position.

[0024] As a consequence, the liquid fuel fed to the nozzle 5 has a feeding pressure which is substantially the same as the delivery pressure of the pumping device 16 and greater than the delivery pressure of the pumping device 6 and is such as to ensure:

the correct atomization of the liquid fuel flowing out of the nozzle 5; and the correct delivery of the second heat power.

[0025] The burner 1 leads to some advantages that are mainly due to the fact that:

the pumping device 16 is supplied with power only when the second heat power of the burner 1 is requested; and the connection of the branches 10, 11 upstream of the nozzle 5 allows the check valve 12 to be used, namely a relatively simple and economic mechanical valve, which is configured to close due to the thrust of the liquid fuel fed by the pumping device 16.

[0026] According to a variant which is not shown here-

in, the two branches 10, 11 are arranged in parallel between the pumping device 6 and the nozzle 5, are not connected to one another upstream of the nozzle 5 and are provided with respective electrically operated pumping devices, which are configured to feed liquid fuel to the nozzle 5 with different feeding pressures.

Claims

1. A liquid-fuel multistage burner comprising a combustion head (2); a hydraulic circuit (3) to feed liquid fuel to the combustion head (2); and a pneumatic circuit (4) to feed oxidizing air to the combustion head (2); the hydraulic circuit (3) comprising an atomizing nozzle (5) projecting into the combustion head (2) and a first pumping device (6) to feed liquid fuel from a containing tank to the atomizing nozzle (5); and **characterized in that** the hydraulic circuit (3) further comprises two feeding branches (10, 11), which are arranged in parallel to one another between the first pumping device (6) and the atomizing nozzle (5) and are configured to feed liquid fuel to the atomizing nozzle (5) with respective feeding pressures, which are different from one another.
2. A liquid-fuel multistage burner according to claim 1, wherein the hydraulic circuit (3) comprises, for each feeding branch (10, 11), a respective control device to selectively control the feeding of liquid fuel along the feeding branch (10, 11).
3. A liquid-fuel multistage burner according to claim 1 or 2, wherein the hydraulic circuit (3) further comprises a valve device (12), which is mounted along a first feeding branch (10), and a pressure adjusting device (16), which is mounted along a second feeding branch (11).
4. A liquid-fuel multistage burner according to claim 3, wherein the two feeding branches (10, 11) are connected to one another downstream of the valve device (12) and of the pressure adjusting device (16) and upstream of the atomizing nozzle (5).
5. A liquid-fuel multistage burner according to claim 3 and 4, wherein the pressure adjusting device (16) comprises a second pumping device (16), which is mounted along the second feeding branch (11) so as to feed liquid fuel to the atomizing nozzle (5) with a feeding pressure which is greater than a feeding pressure of the first pumping device (6).
6. A liquid-fuel multistage burner according to any one of the claims from 3 to 5, wherein the valve device (12) comprises a check valve, which is mounted so as to open due to the thrust of the liquid fuel fed along the first feeding branch (10) by the first pumping de-

vice (6).

7. A liquid-fuel multistage burner according to claim 6, when it depends on claim 5, wherein the two feeding branches (10, 11) are connected to one another downstream of the check valve and of the second pumping device (16) and upstream of the atomizing nozzle (5) so as to allow the liquid fuel fed by the second pumping device (16) to close the check valve. 5 10
8. A liquid-fuel multistage burner according to any one of the preceding claims, wherein the pneumatic circuit (4) comprises an impeller (19) to generate an oxidizing air flow. 15
9. A liquid-fuel multistage burner according to claim 8 and further comprising one single operating motor (8) to control the operation of the impeller (19) and of the first pumping device (6). 20
10. A liquid-fuel multistage burner according to claim 8 or 9, when they depend on claim 5, and further comprising an electronic control unit (9) to selectively control the operation of the impeller (19), of the first pumping device (6) and of the second pumping device (16). 25

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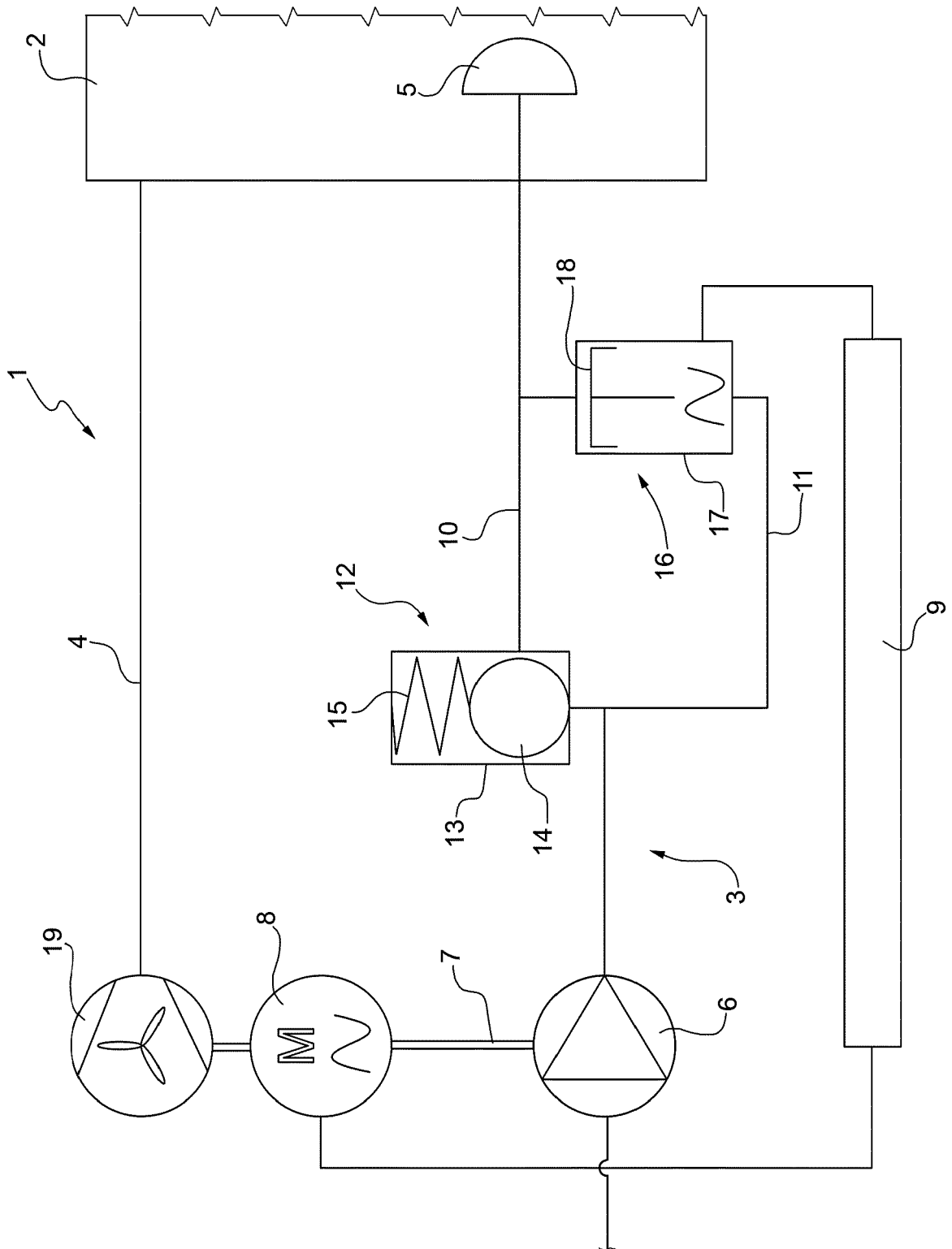
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EUROPEAN SEARCH REPORT

Application Number

EP 21 18 7540

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 24 18 886 A1 (ALLWEILER AG) 30 October 1975 (1975-10-30)	1, 2, 8, 9	INV. F23K5/14
A	* page 5, line 2 - page 6, line 24; figure 1 *	3-7, 10	F23D11/24

A	FR 1 096 237 A (FLEURY) 16 June 1955 (1955-06-16) * page 2, column 1, line 29 - line 38; figure 1 *	1, 8, 9	

A	JP 2003 065532 A (NORITZ CORP) 5 March 2003 (2003-03-05) * the whole document *	1	

			TECHNICAL FIELDS SEARCHED (IPC)
			F23D F23K
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 7 December 2021	Examiner Hauck, Gunther
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 21 18 7540

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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07-12-2021

10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
	DE 2418886	A1	30-10-1975	NONE

15	FR 1096237	A	16-06-1955	NONE

	JP 2003065532	A	05-03-2003	NONE

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- IT 102020000017968 [0001]