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BURNER

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Fig. 1

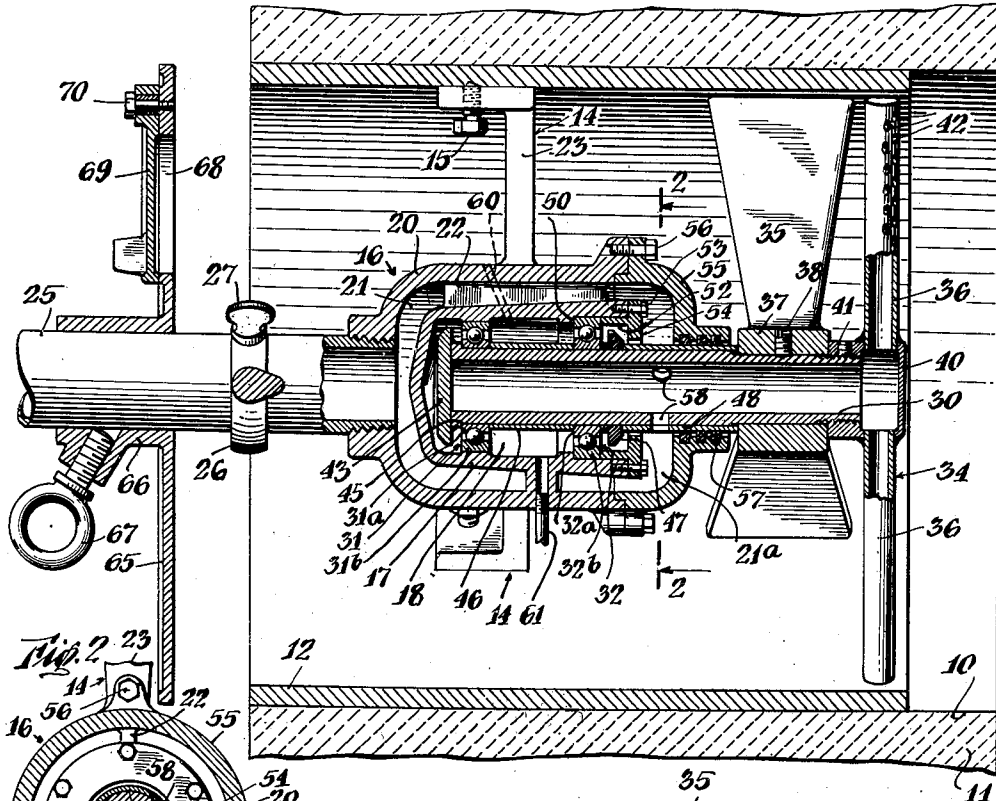


Fig. 2

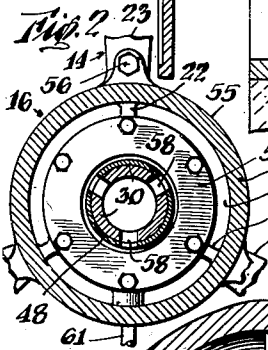
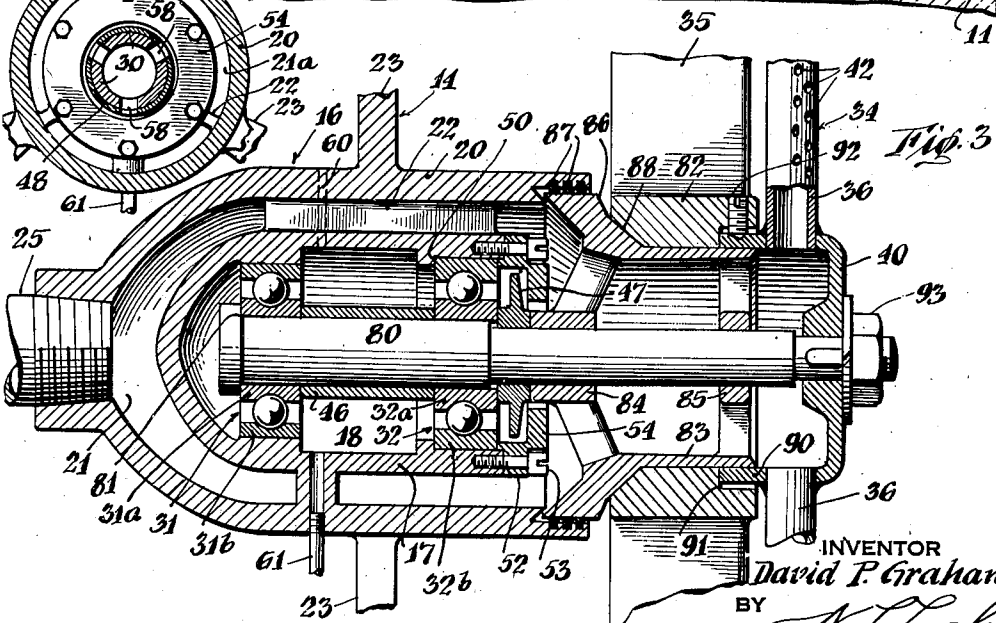


Fig. 3

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BURNER

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10 Claims. (Cl. 158—118)

This invention relates to fuel burners and more particularly to rotary fuel burners of the reaction type wherein fuel issuing from a reaction rotor drives the air fan.

The invention is particularly applicable to industrial gas or oil burners, although it may be applied to various burners which are adapted to use a fuel capable of furnishing the necessary reaction forces for driving the rotor.

An object of the invention is to provide a novel and improved burner of the above type in which the fuel is prevented from passing through the rotor bearings.

Another object is to provide a burner of the above type in which the bearings are cooled by the fuel supplied to the burner.

Another object is to provide a burner of the above type having novel and improved combinations of parts and details of construction.

Various other objects and advantages will become apparent as the nature of the invention is more fully disclosed.

Although the novel features which are believed to be characteristic of this invention are pointed out more particularly in the claims appended hereto, the invention itself may be better understood by referring to the following description, taken in connection with the accompanying drawing, in which a specific embodiment thereof has been set forth for purposes of illustration.

In the drawing,

Fig. 1 is a longitudinal section through a burner embodying the present invention;

Fig. 2 is a partial transverse section taken on the line 2—2 of Fig. 1; and

Fig. 3 is a partial longitudinal section similar to Fig. 1 illustrating a further embodiment of the invention.

Referring to the drawing more in detail, the invention is shown as applied to a burner associated with a burner opening 10 in a furnace wall 11. The burner comprises a tubular shell 12 positioned within the burner opening 10 and forming a longitudinal channel through which the air for combustion passes. A spider 14 is adjustably secured in the shell 12 by means of set screws 15. The spider 14 is provided with a hollow hub member 16 having an inner wall 17 forming a central bearing chamber 18 closed at one end, and an outer wall 20 spaced from the wall 17 to provide an annular fuel passage 21. The inner and outer walls may be secured together by ribs 22 which are shown as arranged in alignment with arms 23 of the spider 14. A fuel supply pipe 25 is secured to the outer wall 20

of the hub 16 to supply fuel to the annular fuel passage 21. In the embodiment shown the fuel pipe 25 extends rearwardly from the hub 16 at the closed end of the bearing chamber coaxially with the hub and with the shell 12. The pipe 25 is shown as held by a thumb screw 27 in a bracket 28 which is secured in the shell 12 by suitable means not shown.

A hollow shaft 30 is mounted for rotation in anti-friction bearings 31 and 32 within the bearing chamber 18, shown as ball bearings. The shaft 30 projects forwardly beyond the hub 16 and carries, at its forward (furnace) end, a reaction rotor 34 and a fan 35. The fan 35 is provided with a hollow hub 37 which is secured to the shaft 30 by means of a set screw 38. The reaction rotor 34 comprises reaction arms 36 secured in a cap 40, which is threaded over the open end of the shaft 30 and held by a set screw 41. The arms 36 are provided with a plurality of apertures 42 which are spaced radially for the purpose to be described. The inner or rear end of the shaft 30 is closed by a cap 43.

The inner ball race 31a of the bearing 31 is seated against a shoulder 45 on the shaft 30. A spacing member 46 extends between the inner ball race 31a of the bearing 31 and the inner ball race 32a of the bearing 32. A shield or oil finger 47 is shown as mounted on the shaft 30 adjacent the bearing 32. A spacing member 48 extends from the finger 47 to the hub 37 of the fan 35. All of the parts above mentioned are accordingly clamped in axial position by the threaded hub 40 of the reaction rotor.

The outer ball race 32b of the bearing 32 is held in position between a shoulder 50 formed in the wall 17 and a follower 52 which is secured over the end of the wall 17 by screws 53 and is provided with a flange 54 which forms a cover substantially closing the bearing chamber 18.

A cover 55 is attached to the outer wall 20 of the hub 16 by bolts 56. This cover 55 is spaced from the flange 54 to provide a continuation 21a of the annular fuel passage 21 and is sealed by suitable means, shown as a labyrinth packing 57, to the spacing member 48 on shaft 30. A plurality of apertures 58 are formed in the shaft 30 and in the spacing member 48 in registration with the continuation 21a of the annular fuel passage 21.

Suitable oil means shown as an oil supply hole 59 and an oil drain pipe 61 may be provided for oiling the bearings 31 and 32.

The flow of combustion air through the passage within the shell 12 may be controlled by a

shield 65 having a hub 66 which is mounted on the pipe 25 and adjustably held in position by a set screw 67. The shield 65 may be provided with a sight and ignition opening 68 having a cover 69 pivotally secured thereto by a bolt 70.

Operation

In the operation of this device, the fuel, which may comprise gas or oil or other fluid fuel, is fed by the stationary pipe 25 to the annular fuel space 21 within the hub 16 from which it passes through the apertures 58 into the interior of the hollow shaft 30, to the hollow cap 40, the reaction arms 36 and the apertures 42. The reaction of the fuel issuing from the apertures 42 causes the rotor, including the arms 36, shaft 30 and fan 35 to rotate. The apertures 42 are so positioned as to produce a substantially uniform distribution of fuel across the entire cross-sectional area of the burner. The fan 35 produces through the shell 12 a flow of air for combustion which is thoroughly mixed with the fuel issuing from the apertures 42 to form a combustible mixture. The bearings are cooled by the flow of fuel through the passage 21 and by the flow of air over the hub 16.

The closed rear end of the shaft 30 prevents the escape of fuel into the bearing chamber 18. Inasmuch as the bearing chamber 18 is closed at one end fuel is thus prevented from passing therethrough.

It is to be noted that the burner may be shifted axially by adjusting the position of the spider 14 in the shell 12. The shield 65 may also be shifted axially independently in accordance with the air flow desired.

The fan 35 may be provided with any desired number of blades depending upon the air flow characteristics and the reaction rotor 34 may be provided with a plurality of arms 36 which may or may not be the same in number as the number of blades of the fan 35, depending upon the characteristics of the fuel being burned. The driving (reaction) arms may be removed and replaced without disturbing the fan and may be adjusted to any desired angular relationship with respect to the fan blades.

By positively eliminating the flow of fuel through the bearing chamber, the life of the bearings is materially increased. This is accomplished in the embodiment shown in a simple and efficient manner. The burner is sturdy and dependable and is well suited to commercial use.

Fig. 3

The embodiment of Fig. 3 operates similarly to the embodiment of Figs. 1 and 2. The construction, however, has been altered to permit the use of a solid shaft or spindle instead of the hollow shaft 30 of Fig. 2. Referring to Fig. 3, parts similar to Figs. 1 and 2 have been given the same reference characters and will not be redescribed. In this embodiment the hollow shaft 30 is replaced by a solid shaft 80, which is mounted to rotate in the bearings 31 and 32. The shaft 80 is provided with a shoulder 81 against which the inner ball race 31a of the bearing 31 is seated. The fan 35 is shown as provided with a hollow hub 82 which is mounted on a hollow sleeve 83. The sleeve 83 is provided with a pair of hub members 84 and 85 which are mounted on the shaft 80. The hub member 84 bears against the finger 47 for clamping the parts in position. The sleeve 83 is provided with an upturned flange 86 having a running fit within the outer wall 23

of the hub 16 to which it is sealed by a labyrinth packing 87.

The cap 40 is formed with a skirt 90 which extends over the sleeve 83 and engages a shoulder 91 formed in the hub 82 of the fan 35. The skirt 90 may be secured to the hub 82 by means of a set screw 92. In this embodiment the cap 40 may be keyed on the shaft 80 and secured by a nut 93. The nut 93 clamps the skirt 90 of the cap 40 against the hub 82 of the fan 35. This, in turn, is clamped against the upturned flange 86 of the sleeve 83, the hub 84 of which is caused to engage the finger 47. The finger 47 bears against the inner ball race 32a of the bearing 32 from which the clamping force is exerted through the spacing member 48 and the inner ball race 31a of the bearing 31 against the shoulder 81 of the rotating shaft 80. The flange 86 is shown as contacting the hub 82 of the fan 35 on an inclined line 88 which extends at an angle so related to the relative coefficients of expansion of the various parts that it is suited to compensate for any inequalities in rate of expansion so that the hub 82 may be tightly clamped against the sleeve 83 by means of the cap 40 as above described. The hub 82 may, however, be secured to the sleeve 83 by other means, such as a set screw, if desired.

In the construction shown in Fig. 3, the fuel from the pipe 25 passes through the annular fuel passage 21 and thence to the interior of the sleeve 83, which communicates through the cap 40 with the arms 36. Inasmuch as there is no passage for the fuel through the bearing chamber, there is no tendency for fuel to flow therethrough. The solid shaft in this embodiment permits the use of comparatively small diameter bearings and thus reduces the weight of the rotating parts.

Both of these embodiments are characterized by the provision of a bearing chamber which is permanently closed at one end so as to prevent any through passage of fuel. The passage 21 may extend substantially around the bearing chamber for cooling purposes or may be limited to the closed end of the hub if the cooling effect is not required in any particular installation. The burner may be used with gaseous fuel or with liquid fuel, such as oil, or oil which has been atomized by steam or other agents.

Although a specific embodiment has been shown for purposes of illustration, it is to be understood that various changes and modifications may be made therein and that the invention is only to be limited in accordance with the scope of the following claims.

What is claimed is:

1. A burner comprising a stationary supporting hub having a central bearing chamber, a shaft rotatably mounted in said bearing chamber, an air fan to supply air for combustion mounted on said shaft, a reaction rotor driven by the fuel for combustion mounted on said shaft to drive said shaft and said fan, said reaction rotor including a hollow hub member and reaction arms having passages communicating therewith and apertures forming reaction jets, a fuel passage rotating with said hollow hub member and communicating therewith to supply fuel to said rotor for driving the same, and a stationary fuel supply conduit communicating with said rotating fuel passage at a point between said bearing chamber and said reaction rotor, said conduit being constructed and arranged to avoid flow of fuel through said bearing chamber.

2. A burner comprising a stationary supporting hub having a central bearing chamber closed at one end, a shaft rotatably mounted in and projecting from the open end of said bearing chamber, an air fan to supply air for combustion mounted on said shaft, a reaction rotor driven by the fuel for combustion mounted on said shaft to drive said shaft and said fan, said reaction rotor including a hollow hub member and reaction arms having passages communicating therewith and apertures forming reaction jets, a fuel passage rotating with said hollow hub member and communicating therewith to supply fuel to said rotor for driving the same, and a stationary fuel supply conduit communicating with said rotating fuel passage at a point between said bearing chamber and said reaction rotor, said conduit being constructed and arranged to avoid flow of fuel through said bearing chamber.

3. A burner comprising a stationary supporting hub having a central bearing chamber, a shaft rotatably mounted in said bearing chamber, an air fan to supply air for combustion mounted on said shaft, a reaction rotor driven by the fuel for combustion mounted on said shaft to drive said shaft and said fan, said reaction rotor including a hollow hub member and reaction arms having passages communicating therewith and apertures forming reaction jets, a fuel passage rotating with said hollow hub member and communicating therewith to supply fuel to said rotor for driving the same, and a stationary fuel supply passage substantially surrounding said bearing chamber and communicating with said rotating fuel passage at a point between said bearing chamber and said reaction rotor, whereby the fuel flowing through said stationary passage serves to cool said bearing chamber, said stationary passage being constructed and arranged to avoid flow of fuel through said bearing chamber.

4. A burner comprising a stationary supporting hub having a central bearing chamber having a closed end, a shaft rotatably mounted in and projecting from the open end of said bearing chamber, an air fan to supply air for combustion mounted on said shaft, a reaction rotor driven by the fuel for combustion mounted on said shaft to drive said shaft and said fan, said reaction rotor including a hollow hub member and reaction arms having passages communicating therewith and apertures forming reaction jets, a fuel passage rotating with said hollow hub member and communicating therewith to supply fuel to said rotor for driving the same, and a stationary fuel supply passage substantially surrounding said bearing chamber and communicating with said rotating fuel passage at a point between said bearing chamber and said reaction

rotor, whereby the fuel flowing through said stationary passage serves to cool said bearing chamber, said stationary passage being constructed and arranged to avoid flow of fuel through said bearing chamber.

5. A burner comprising a stationary supporting hub having a central bearing chamber closed at one end and having a fuel passage substantially surrounding said bearing chamber, spaced anti-friction bearings in said chamber, a shaft rotatably mounted in said bearings and projecting from the open end of said chamber, an air fan and a reaction rotor driven by the fuel for combustion mounted on said shaft, a fuel supply pipe co-axial with said hub supplying fuel to said passage at the closed end of said chamber, means supplying fuel from said fuel passage after flowing around said bearing chamber to said reaction rotor whereby the fuel flowing through said fuel passage serves to cool said bearing chamber, means at the open end of said bearing chamber forming a fluid seal with said shaft, and an oil finger on said shaft between said last means and said bearings.

6. A burner according to claim 1 in which the shaft is hollow and provides the rotating passage to supply fuel to said reaction rotor, said shaft having apertures to receive fuel from said fuel supply conduit.

7. A burner according to claim 2 in which the shaft is hollow and provides the rotating passage to supply fuel to said reaction rotor, said shaft having apertures to receive fuel from said fuel supply means, the end of said shaft in said bearing chamber being closed to prevent leakage of fuel into said bearing chamber.

8. In a burner according to claim 1, a hollow sleeve mounted on said shaft to provide the rotating passage, said sleeve being in communication with said fuel supply means and with said reaction rotor to supply fuel from said fuel supply means to said rotor.

9. In a burner according to claim 1, a hollow sleeve mounted on said shaft to provide the rotating passage, said sleeve being in communication with said fuel supply means and with said reaction rotor to supply fuel from said fuel supply means to said rotor, said fan having a hollow hub and being mounted on said sleeve.

10. In a burner according to claim 1, a hollow sleeve mounted on said shaft, said sleeve being in communication with said fuel supply means and with said reaction rotor to supply fuel from said fuel supply conduit to said rotor, said fan having a hollow hub and being mounted on said sleeve, and means clamping said reaction rotor, fan and sleeve on said shaft for rotation in unison.

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