

May 20, 1958

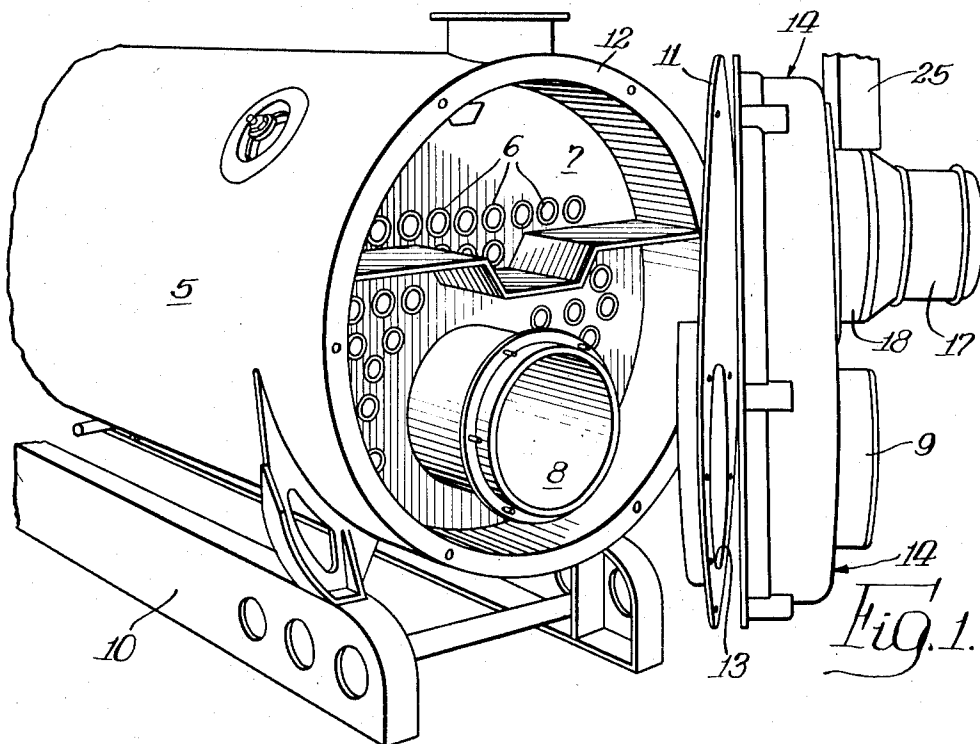
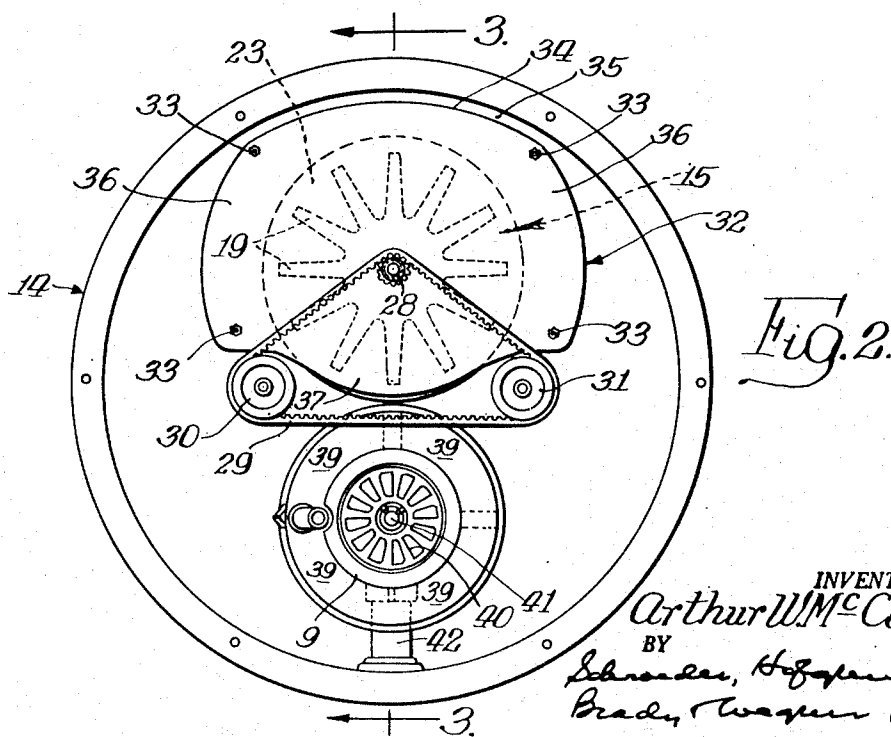
A. W. McCLURE

2,835,320

FAN STRUCTURE

Filed July 21, 1954

2 Sheets-Sheet 1



INVENTOR.
Arthur W. McClure,
BY
Schroeder, H. G. & Co.
Brady, Wagner & Attys.

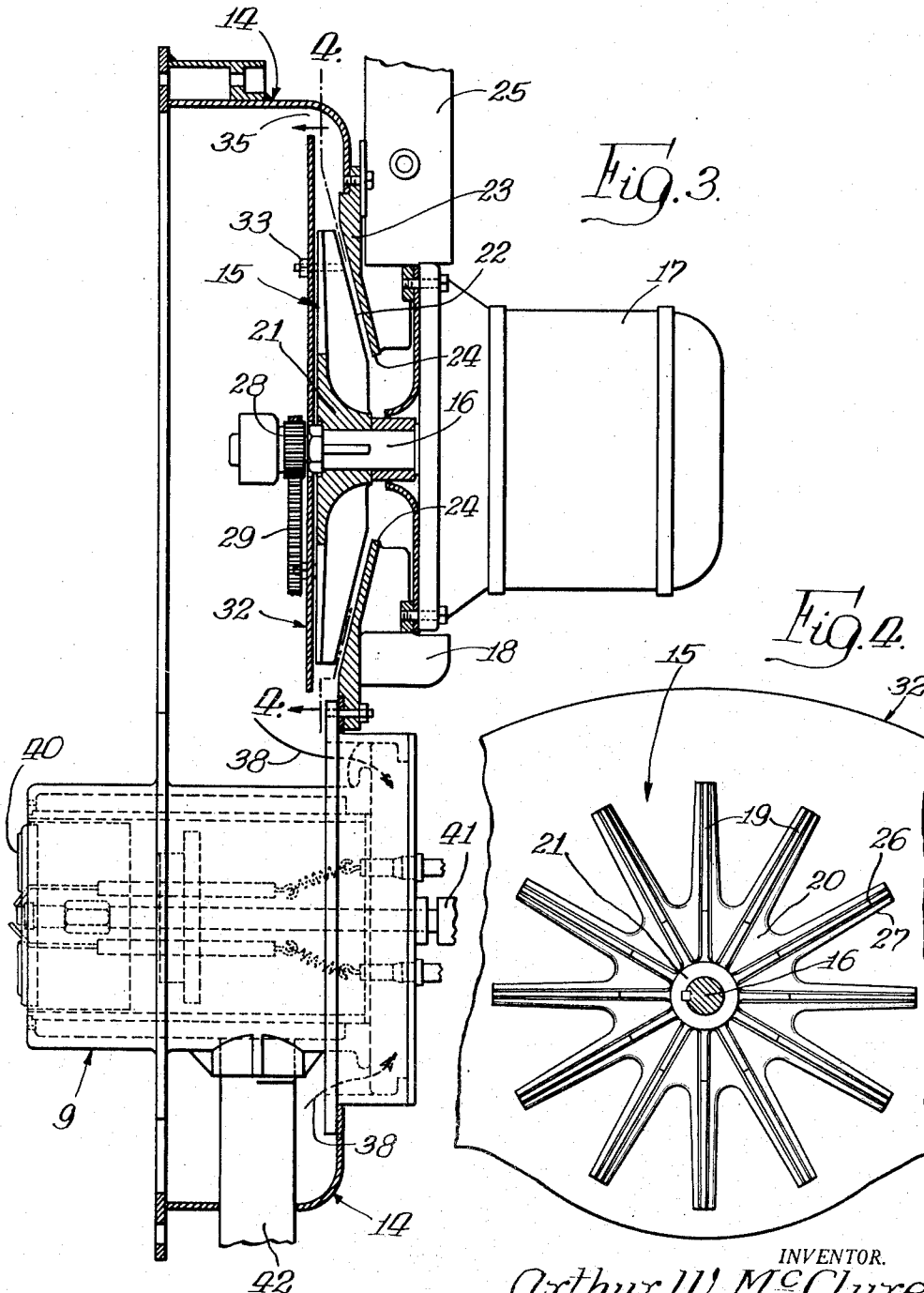
May 20, 1958

A. W. McCLURE
FAN STRUCTURE

2,835,320

Filed July 21, 1954

2 Sheets-Sheet 2



INVENTOR.
Arthur W. McClure,
BY
Schroeder, Hagan,
Brady, Swagman Attys.

1

2

2,835,320

FAN STRUCTURE

Arthur W. McClure, Milwaukee, Wis., assignor to
Cleaver-Brooks Company, a corporation of Wisconsin

Application July 21, 1954, Serial No. 444,806

1 Claim. (Cl. 158—2)

This invention relates to a fan structure and more particularly to a fan for delivering air at superatmospheric pressures without requiring the usual casing.

Fans have been used extensively to produce a static head of air. In the past, these fan structures have utilized a rotary wheel mounted within a casing to direct the air by flow into a chamber or other receptacle to obtain a static pressure. The use of these fan structures has been usual in connection with the fuel burners of steam power plants such as boilers. The air is provided by combustion of the fuel and is ordinarily conducted to the burner by duct work extending from the casing of the fan to the burner. The form of the invention chosen for purposes of illustration is in a boiler setting wherein the air delivered by the fan is used for the combustion of either a gaseous or liquid fuel. The use of the fan in other installations, however, should be readily apparent from the description of a single embodiment in a particular use as will hereinafter appear.

It is the principal object of this invention to provide a new and improved fan structure of the character described.

A further object is to provide a fan structure requiring no casing as has been usual practice in the past.

Another object is the provision of a fan of the character described which may be simply manufactured and installed with a minimum of fabricated parts and which is immediately available because of its structure for servicing and repair.

Other features, advantages and objects of the invention will be apparent from the description of one embodiment illustrated in the accompanying drawings in which:

Figure 1 is a fragmentary perspective view of a steam generating boiler in which the fan structure of the present invention is incorporated;

Figure 2 is an elevational plan view of the inside of the door on the boiler showing the fan wheel in dotted outline;

Figure 3 is a fragmentary vertical sectional view through the door and fan and taken substantially along line 3—3 in Figure 2; and

Figure 4 is a fragmentary sectional view looking toward the fan wheel and taken substantially along line 4—4 in Figure 3.

As previously mentioned, one use of an air fan is to provide air to a burner in a boiler. Such a boiler is illustrated in Figure 1 and has a fan structure of the present invention incorporated in the outer door on the boiler. The structure illustrated includes the boiler shell 5 proper in which boiler tubes 6 are supported by a tube sheet 7. The fire tube 8 is provided to receive the combustion products directly from the burner 9. Appropriate skids 10 support the boiler shell in position on a factor floor or in any location of use.

The end of the boiler illustrated in Figure 1 includes a pair of doors which together form an air chamber for conducting air at superatmospheric pressure to the burner

9. The inner door 11 closes directly upon the flange 12 of the boiler shell 5. It has an opening 13 through which the burner 9 extends when the doors are closed upon the shell. The outer door 14 is cup-shaped so that when it is closed against the inner door 11, an air plenum chamber is formed between these doors. The structure of the boiler and doors is more particularly set out in the copending application of Messrs. Cleaver, Loebel, and Horvath, Serial No. 403,286, filed January 11, 1954, assigned to the present assignee.

The fan structure with which this invention is concerned may be mounted in various manners but is herein illustrated in this particular embodiment as mounted directly in the outer door 14 of the steam generating unit. As best seen in Figures 2-4, a fan wheel 15 is mounted directly upon a shaft 16 of a driving motor 17. The motor is mounted upon a support bracket 18 directly connected to the outer door 14. The wheel is of a type having radial blades 19 with a semi-shroud 20 extending from the hub 21 of the wheel part way along one side of the radial extending blades. This wheel is mounted with the one side 22 of the blades directly adjacent a portion 23 of the outer door. The portion 23 is a separately formed part with a central aperture 24 set into the outer door so as to provide proper running clearance for the wheel and at the same time provide the central aperture 24 through which the motor shaft 16 extends. This central opening also serves as the air inlet to the wheel. A screened air entrance box 25 communicates with the aperture 24 to direct outside air to the hub portion of the fan wheel.

The form of the wheel is best illustrated in Figures 2 and 4. The radial fins or blades 19 emanate from the hub to the periphery of the wheel and each blade has an upstanding rib 26 with a slightly tapering flanged portion 27 on the inner side of the blade. The type of wheel may be changed from that illustrated since it could be entirely open, semi or fully shrouded. The blades illustrated extend along radial lines from the hub, however, they may be curved in either forward or reverse direction. A single suction wheel is illustrated in the present embodiment, however, a double suction may be provided if desired.

As previously stated, the fan wheel is mounted directly upon the motor shaft 16. This shaft extends through the wheel and into the plenum chamber formed within the door 14 so as to mount a belt pulley 28 over which an endless belt 29 may run an atomizing air pump 30 and a fuel oil pump 31 when the burner 9 is burning oil. This structure is set out and described in the above mentioned copending application.

The air from the fan wheel is used in the burner to support combustion of the fuel whether it is oil or a gas. In order that the air in the plenum chamber be at the proper superatmospheric pressure, a diffuser plate, generally indicated 32, is mounted in the door so as to cover the fan wheel and extend beyond the wheel's periphery. The plate is most conveniently mounted upon a plurality of threaded posts 33 so that it may be readily removed for servicing of the wheel if necessary. The particular diffuser plate illustrated in the drawings has an upper edge 34 extending generally parallel and spaced from the upper side portion of the door 14. The space indicated as 35 is left for the escape of air from between the diffuser plate and the door. Laterally, to either side of the fan wheel, the diffuser plate has a portion 36 extending beyond the wheel and generally parallel to the end of the door 14. Below the wheel, a plate portion 37 is cut out so as to fit around the driving shafts of the atomizing air pump 30 and fuel oil pump 31 without interfering with their operation. The peripheral lines of the plate portions 36 could be extended so that the periph-

3

eral space thus formed around the wheel would be of substantially uniform extent. There is no requirement of uniformity, however, since the purpose of the space formed around the wheel is to provide for the conversion of the kinetic pressure of air delivered from the fan to a static pressure within the air chamber. Sufficient space around the fan should be provided to convert at least a substantial part of the kinetic pressure into a static head. The shape of the plate may be varied while still accomplishing this purpose. Vanes may be added in the plate, if desired, or it may be made simply flat as illustrated in the embodiment shown.

It has been found that the fan structure of the present invention can deliver air of sufficiently high pressure to satisfy efficient operation in the burner 9. In Figure 3, it will be noted that the air from the plenum chamber may follow the direction of the arrows 38 through openings 39 in order to get into the back side of the burner 9. This air then passes through a louver plate 40 on the front of the burner which is either supplied with oil through the rotary cup 41 or with gas through the connection 42.

The fan wheel illustrated may have different sizes of the wheel to deliver air in accordance with the following example. At a speed of 3500 R. P. M. and with wheel ranging in size from 6 inches to 24 inches, it is found that the air delivery and its static head pressure are as follows:

C. F. M.	165	350	700	6,000
Static head pressure—In. H ₂ O.....	4.0	8.6	10.8	20.0

The maximum pressure attainable is limited by structural considerations, such as stress in impellers, and critical speeds. However, a pressure in excess of 10 p. s. i. g. could be attained. The maximum volume is limited by impeller diameter and speed; volumes in excess of 45,000 C. F. M. are possible.

It will be noted in the design of the present fan structure no casing or other complicated case parts are required. The inner side of the door cooperates with the flat diffuser plate and the fan wheel to deliver the air to the plenum chamber at a static head. While the mounting of the fan wheel is shown as directly upon the shaft of the motor 17, any other mounting and driving connection suitable may be utilized. The fan wheel could be carried upon a shaft having separate bearings with a belt, gear or other drive to the shaft. With the present invention, a very simple mechanism to manufacture is provided as well as one which can be serviced quite readily. Economies both in the construction and maintenance are thus achieved.

While I have shown and described a certain embodiment of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claim.

I claim:

In a heating equipment burner structure having a

4

burner and an air-tight, relatively large chamber adapted to contain combustion supporting air at superatmospheric pressure and having an air outlet connected with the burner, in combination, means for producing and maintaining an air supply in the chamber at superatmospheric pressure, comprising: an impeller mounted on the interior of a wall of the chamber, said chamber having an elongated wall having an opening in the upper portion thereof small in comparative size to the wall and forming an entrance for atmospheric air to the chamber; said impeller including a rotatably mounted wheel having a central portion generally coinciding with the opening; a shroud plate mounted in the upper portion of said chamber and spaced from said opening, said shroud plate having a substantial extent normal to the axis of rotation of the wheel and having its lower end terminating materially above the bottom of the chamber, the lower end of the shroud plate and the wall constituting an open downwardly directed passage, said chamber wall being inclined from said opening toward said shroud so that the wall and shroud form an elongated, narrow, tapered passage therebetween extending circumferentially of the opening; said wheel including a plurality of circumferentially spaced blades extending radially outwardly from the axis of rotation of the wheel and forming generally V-shaped spaces between the blades; the outer portions of the blades being tapered and free and generally coinciding with the shape of said tapered passage, said blades extending radially outwardly a distance only slightly less than the radial extent of the passage and said blades having side clearances with the wall and shroud only sufficient to avoid contact therewith, said shroud extending radially beyond the tips of the blades a short distance parallel to said wall so that said narrow elongated passage extends substantially unobstructedly all about the blade tip periphery and thereby creating a downwardly directed discharge of air, and a motor for rotating the fan wheel at speeds effectively drawing air from the atmosphere through the central opening and then forcing the air sufficiently rapidly outwardly therefrom along the blades between the shroud and said wall to provide the air with substantial kinetic energy so that it may pass into the elongated narrow passage between the shroud and wall beyond the blade tip periphery and thereby convert the kinetic energy of the air to static air pressure above atmospheric in the chamber.

References Cited in the file of this patent

UNITED STATES PATENTS

1,535,417	Huff	Apr. 28, 1925
1,858,837	Messer	May 17, 1932
1,935,538	Baumann	Nov. 14, 1933
2,126,230	Troxell, Jr.	Aug. 9, 1938
2,179,893	Lyon	Nov. 14, 1939

FOREIGN PATENTS

204,622	Germany	Nov. 14, 1907
1958/26	Austria	May 21, 1926