

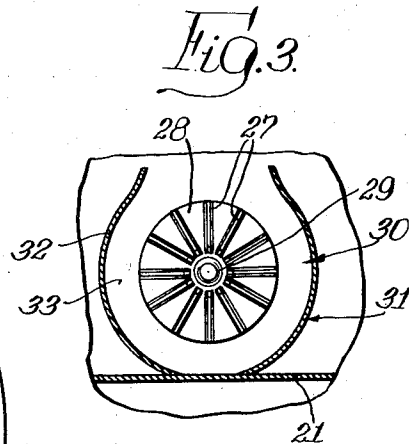
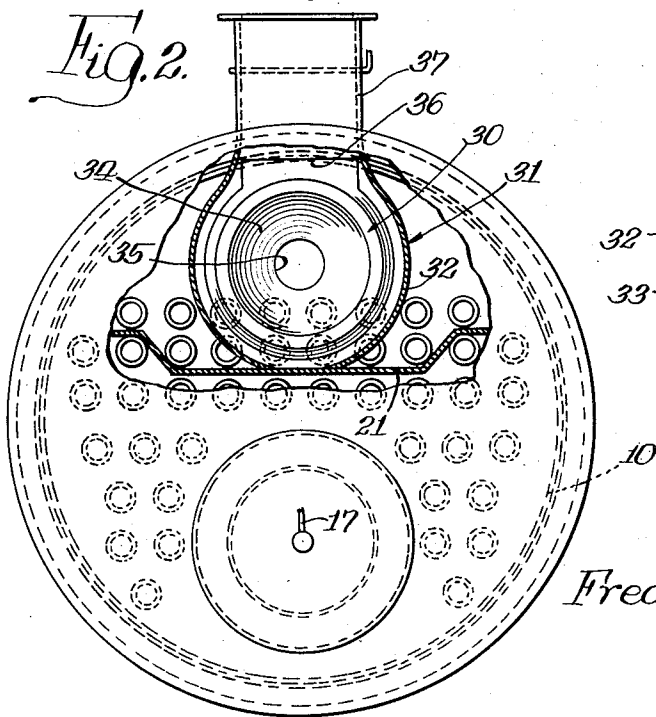
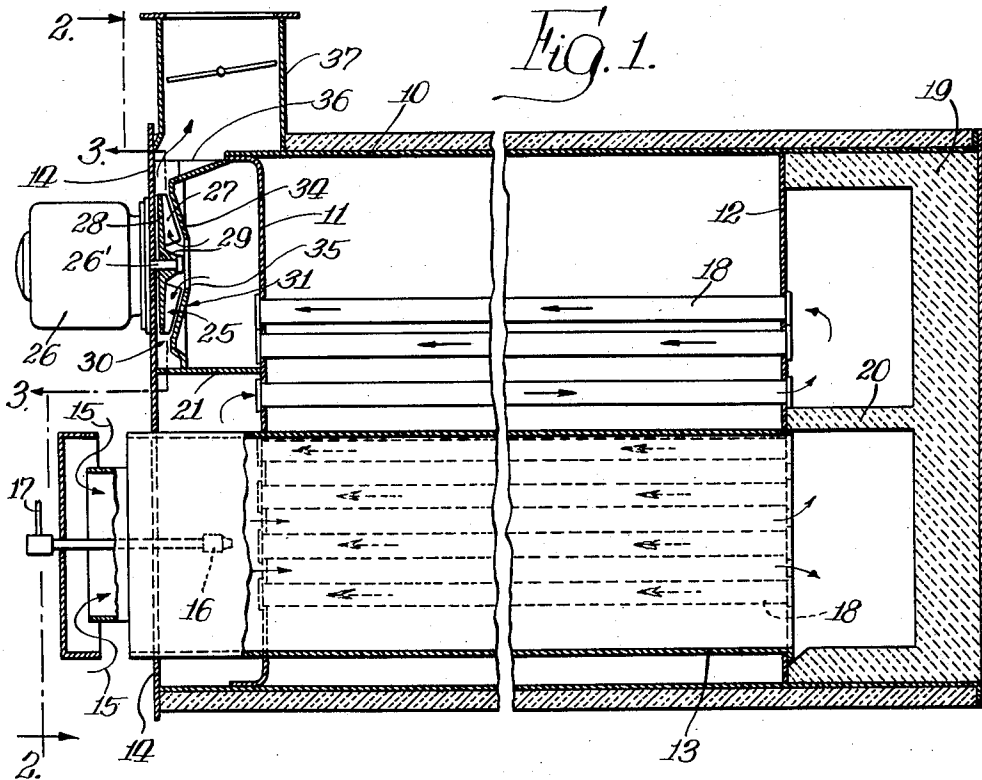
June 2, 1959

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2,888,910

INDUCED DRAFT BOILER FAN STRUCTURE

Filed Jan. 20, 1956



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2,888,910

INDUCED DRAFT BOILER FAN STRUCTURE

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Application January 20, 1956, Serial No. 560,308

3 Claims. (Cl. 122—149)

This invention relates to boilers and more particularly to the fan structures of induced draft boilers for inducing a draft in tubes forming multiple passes through the boiler for combustion products.

It is a general object of the invention to provide a new and improved fan structure for induced draft boilers.

In the past, induced draft boiler installations utilizing fans for inducing a draft have been of rather complicated and cumbersome construction, wherein the fan and its housing have been a separate structure apart from the boiler itself. This arrangement required that separate duct work be provided from the combustion products tubes to the fan, and additionally required duct work leading from the fan to an exhaust stack for disposing of the combustion products after their use in the boiler. Such arrangements have required an expensive original outlay and have been difficult and costly to maintain.

With the above and other considerations in mind, it is an object of this invention to simplify fan structures in induced draft boilers.

Another object is to provide in an induced draft boiler a new and improved fan structure which is compactly arranged and easily accessible for repair and maintenance.

A further object is to provide a new and improved fan structure for induced draft boilers, wherein the fan is mounted in a chamber formed in the boiler shell between a tube sheet and a head plate in communication with the passes for combustion products so as to draw air from atmosphere to a burner located in the fire tube and to draw combustion products from the burner through multiple passes in the boiler and to deliver same to an exhaust outlet.

Other objects and advantages will become readily apparent from the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a vertical sectional view, partly in elevation, taken through the center of a boiler structure embodying the present invention;

Fig. 2 is an end elevational view, partly in section, and with the fan wheel removed, taken at about the line 2—2 of Fig. 1; and,

Fig. 3 is a fragmentary sectional view, taken at about the line 3—3 of Fig. 1, illustrating the construction of the fan wheel.

While an illustrative embodiment of the invention is shown in the drawings and will be described in detail herein, the invention is susceptible of embodiment in many different forms, and it should be understood that the present disclosure is to be considered as an exempli-

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fication of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

Referring now to the drawings, as illustrated, the invention is embodied in a boiler having an outer tubular shell 10 covered with insulating material. Tube sheets 11 and 12 are mounted in the shell 10 in spaced relation to the ends of the shell and support a fire tube 13 of a relatively large diameter extending lengthwise of the shell. The left end of the shell, as viewed in Fig. 1, is closed by a head plate 14 which may be removably attached to the end of the shell by means such as bolts or screws, not shown. The fire tube 13 extends through the head plate 14 and is open to atmosphere to admit air, as indicated by arrows 15, to the fire tube and to a burner 16 situated in the fire tube. Fuel, either gas or oil, may be supplied to the burner 16 through a conduit 17 from a source not indicated.

Tube sheets 11 and 12 also support additional, relatively small tubes 18 which provide multiple passes through the shell for gases including products of combustion from the fire tube. The right end of the boiler shell is closed by a head 19 constructed of refractory material and fashioned with a baffle 20 to direct gases emerging from the fire tube 13, which forms the first pass, to the smaller tubes 18 below the level of the baffle 20, the latter tubes forming the second pass through the shell for gases from the fire tube. At the left end of the shell, as viewed in Fig. 1, a baffle 21, which may be of suitable metal protected by refractory, is mounted between the tube sheet 11 and the head plate 14 to direct gases from the second pass to tubes 18 above the level of baffle 20 and below the level of baffle 21, these tubes forming the third pass. Gases emerging from the third pass at the right end of the shell above the baffle 20 return to the left through tubes 18 above the baffle 21, these tubes forming the fourth and final pass through the shell.

In order to establish a draft for drawing air from atmosphere into the fire tube and to pull the gases including combustion products from the fire tube through the multiple passes, the present invention contemplates the use of fan structure forming an integral part of the boiler construction itself. Accordingly, a fan wheel 25 and its driving motor 26 are mounted on the head plate 14. The motor is mounted exteriorly on the head plate and has its drive shaft 26' projecting through the head plate, and the fan wheel is mounted on the shaft interiorly of the shell with one side of the fan wheel closely adjacent the head plate 14 and separated therefrom by only a running clearance.

The fan wheel, as illustrated, is of a type having radial blades 27 outstanding on a full shroud 28 extending from a central hub 29. As seen best in Fig. 1, the inner termini of the blades are slightly spaced from the hub where air is drawn into the wheel, and the height of the blades tapers downwardly toward the outer periphery of the wheel. 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.

The fan wheel is received in a chamber 30 formed in part by a dish-shaped, casing-like part 31 which is supported on the baffle 21 and may be secured to the tube sheet 11 or shell 10 by suitable means such as welding or sheet metal screws. The formation of the chamber 30 in which the fan is received is completed by the head plate 14 which fits against the open side of the part 31 when the head plate is mounted on the end of the shell 10. The part 31 includes a cylindrical wall 32 which encircles the periphery of the fan wheel in spaced relation thereto and forms between the wall and the fan an annular duct 33 (Fig. 3). The dished portion of the casing-like part 31 provides a generally flat wall 34 of a size and shape corresponding to that of the fan wheel at its open side so that when the fan is received in the chamber 30 the wall 34 shrouds one side of the fan with only a running clearance between the fan blades and the wall. The wall 34 is formed with a circular inlet opening 35 centrally disposed relative to the fan wheel so that gases emerging from the last of the multiple passes to the area between tubes sheet 11 and head plate 14 above the baffle 21 are drawn into the chamber 30 by the operation of the fan.

The cylindrical wall 32 and the wall 34 of the casing-like part 31 are blended together at the top to form a passage 36 leading from the chamber 30 to an exhaust fitting 37 provided on the upper part of the shell 10 and adapted to be connected with a suitable stack provided for the purpose of disposing of the gases after their use in the boiler. The part 31 may be easily formed in an economical manner from sheet metal.

In operation, the fan may be controlled either automatically or manually to run in a manner found suitable for the particular installation and when running is confined in the chamber 30 on one side by the head plate 14 and on the opposite side by the wall 34 of the casing part 31 so that it functions to push gases in the chamber 30 radially outwardly of the fan wheel and along the annular duct 33 to the exhaust fitting 37 to which a suitable stack may be connected. This operation will be effective to draw gases from the area between tube sheet 11 and head plate 14 above the baffle 21 into the chamber 30 through inlet opening 35. The draft thus created is effective to draw air from atmosphere into the fire tube to the burner and to draw gases including the products of combustion through the fire tube and through the multiple passes provided by tubes 18.

It can now be appreciated that the fan structure provided is of simplified construction, compactly arranged within the boiler shell and yet readily accessible simply by removal of the head plate for maintenance and repair, thus securing reduced initial costs and savings in operation and maintenance.

I claim:

1. In a horizontal fire tube boiler having an outer tubular boiler shell, upright tube sheets mounted in the shell in positions spaced from each other and spaced respectively from opposite ends of the shell, upright head plates closing opposite ends of the shell and spaced respectively from the tube sheets to form gas pass areas between the tube sheets and the head plates, horizontally disposed partitions respectively dividing the two gas pass areas each into two gas pass chambers thereby forming four gas pass chambers, a fire tube supported on the tube sheets and having one end opening into a first one of said gas pass chambers, a fuel burner in the fire tube, means forming a passage for admitting combustion air to the opposite end of the fire tube, a plurality of additional tubes supported on the tube sheets and forming multiple gas passes leading from said first gas pass chamber to the fourth one of said gas pass chambers, and an exhaust fitting on the shell adjacent said fourth chamber, in combination therewith, an induced draft fan structure,

comprising a fan motor having a base secured on the outside of the head plate adjacent said fourth chamber and a drive shaft projecting through the head plate into the fourth chamber, a suction fan wheel secured on the drive shaft in the fourth chamber with only running clearance between one side of the fan wheel and the inside of the adjacent head plate, a partition member dividing said fourth chamber into an exhaust chamber communicating with the last of said multiple gas passes and a fan chamber communicating with said exhaust fitting, said partition member including an upright wall portion adjacent and spaced from the opposite side of the fan wheel by only running clearance and having an opening therethrough opposite a central portion of the fan connecting the exhaust chamber and the fan chamber, and said partition member including a cylindrically shaped wall portion joined to the upright wall portion and encircling the periphery of the fan wheel in concentric spaced relation thereto to define an annular duct surrounding the fan wheel and communicating with said exhaust fitting so that rotation of the fan wheel is effective to draw air into the fire tube to the burner and to draw combustion products through the multiple passes and deliver same to the exhaust fitting.

2. In a horizontal fire tube boiler having a tubular boiler shell, an upright tube sheet mounted in the shell adjacent one end thereof, a head plate spaced from said tube sheet and closing said one end of the shell, means including said shell, said tube sheet and said head plate forming a gas chamber in the upper portion of said shell at the end thereof, means forming a combustion chamber in the shell having an air inlet means at one end and an outlet at the other end, a burner in the combustion chamber, means including tubes supported on the tube sheet forming gas passes leading from the combustion chamber outlet to said gas chamber, and an exhaust fitting on the shell connecting said gas chamber to atmosphere, in combination therewith, an induced draft fan structure, comprising, a fan motor having a housing secured on the outside of the head plate adjacent said gas chamber and a drive shaft projecting through the head plate into the gas chamber, a fan wheel secured on the drive shaft in the gas chamber with only running clearance between the fan wheel and the head plate, a partition member dividing the gas chamber into an exhaust chamber communicating with said gas passes and a fan chamber communicating with said exhaust fitting, said partition member including an upright wall portion having only running clearance with said fan wheel and having an opening therethrough connecting the exhaust chamber and the fan chamber and centrally disposed relative to the fan wheel, and said partition member having arcuate wall portions extending from the upright wall portion outwardly to the head plate and skirting the periphery of the fan wheel in concentric spaced relation thereto to define an annular duct surrounding the fan wheel and open at the top to the exhaust fitting so that on rotation of the fan wheel air is drawn into the combustion chamber and combustion gases are drawn from the combustion chamber and delivered to the exhaust fitting.

3. In a stationary boiler having an outer tubular shell, a tube sheet extending transversely in the shell adjacent one end thereof, means including a head plate spaced outwardly from the tube sheet forming a gas chamber at said one end of the shell between the tube sheet and the head plate, means forming a combustion chamber in the shell having an air inlet means at one end and an outlet at the other end, a burner in the combustion chamber, means including tubes supported on the tube sheet forming gas passes leading from the combustion chamber outlet to said gas chamber, and an exhaust fitting opening from the gas chamber to atmosphere, in combination therewith, an induced draft fan structure, comprising, a partition dividing said gas chamber into an

exhaust chamber communicating with said gas passes and a fan chamber communicating with said exhaust fitting, said partition including a wall adjacent but spaced from the head plate and having an opening connecting the exhaust chamber and the fan chamber, a fan motor 5 having a base secured on the outside of the head plate and a drive shaft projecting into the fan chamber, a fan wheel secured on the drive shaft in the fan chamber between the head plate and the wall with the central portion of the fan wheel opposite said connecting opening 10 and with only running clearance between the fan wheel and the head plate and between the fan wheel and said

wall, so that rotation of the fan wheel is effective to draw air into the combustion chamber to the burner and to draw combustion gases from the burner and deliver same to the exhaust fitting.

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