April 21, 1953 L. J. HERSH 2,635,565

INDUCED DRAFT SYSTEM

Filed April 3, 1950 2 SHEETS—SHEET 1

FIG_2

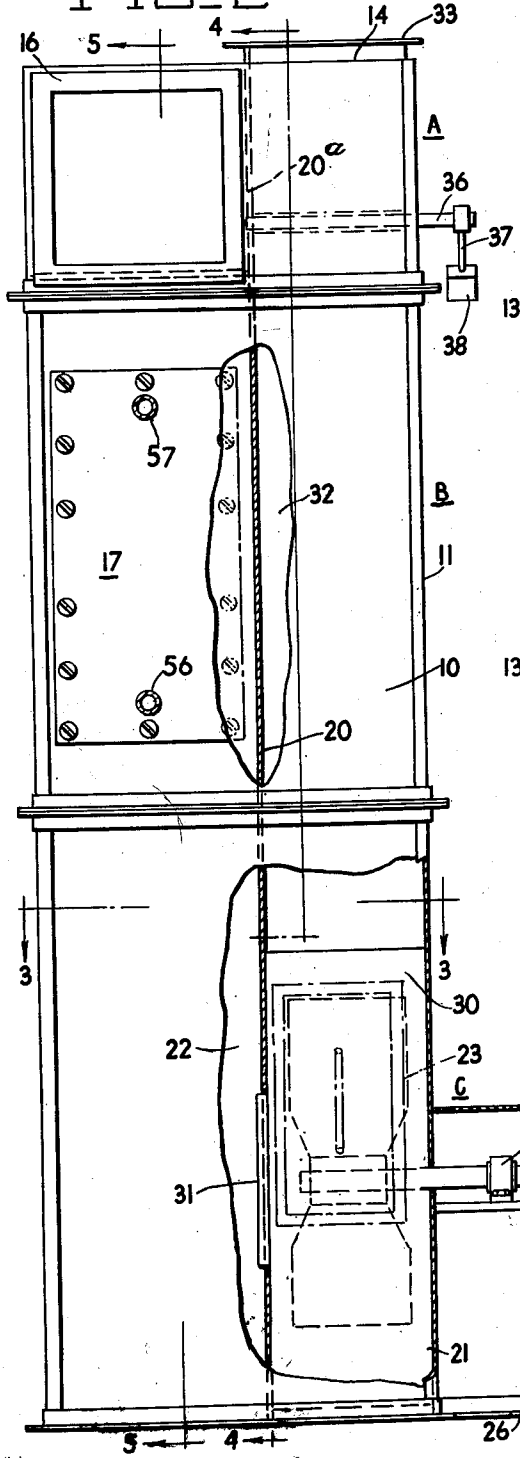
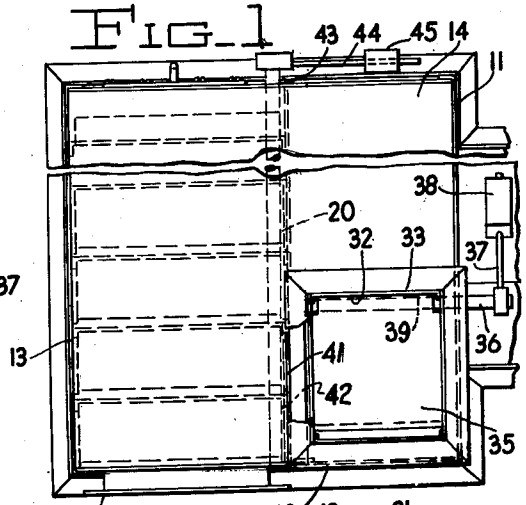


FIG_1



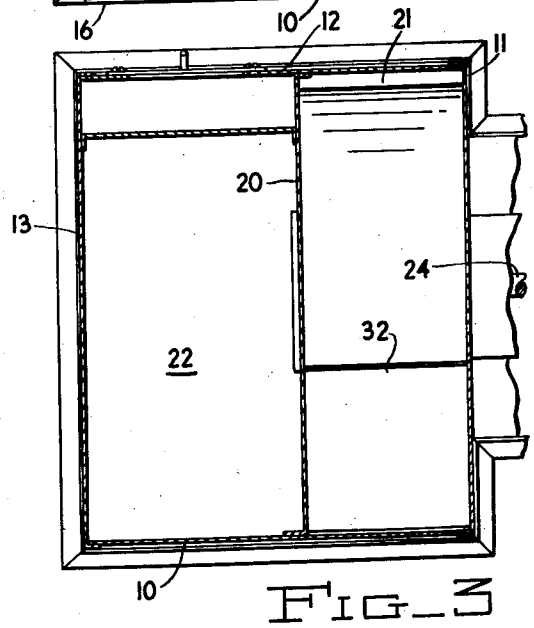


FIG_3

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FIG_4

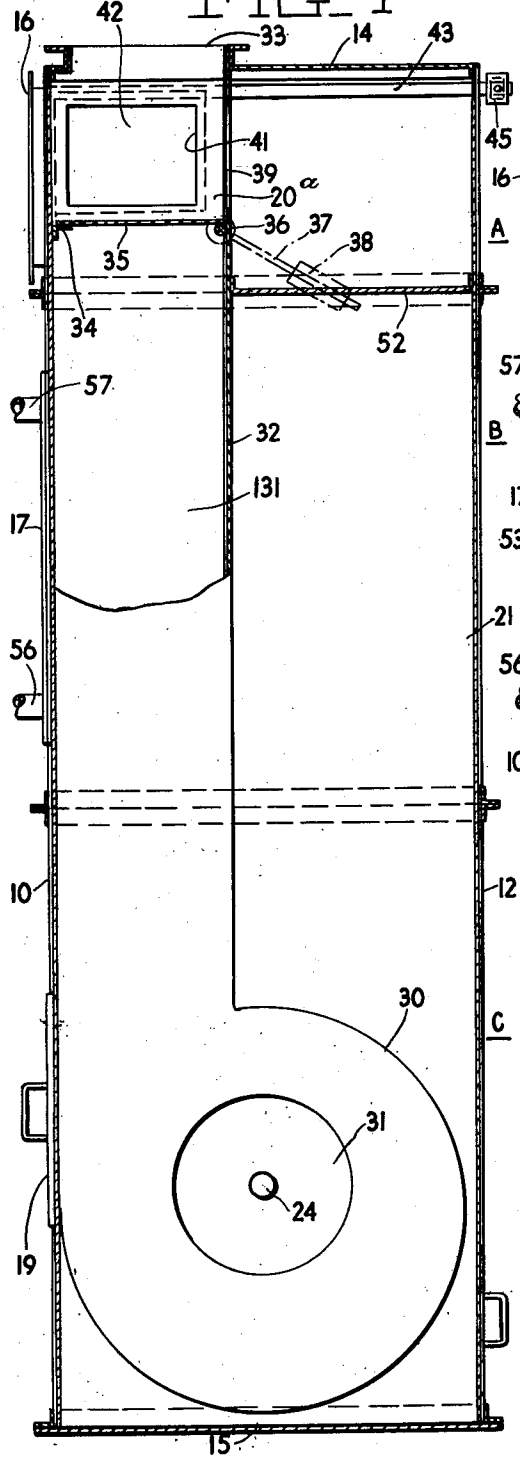
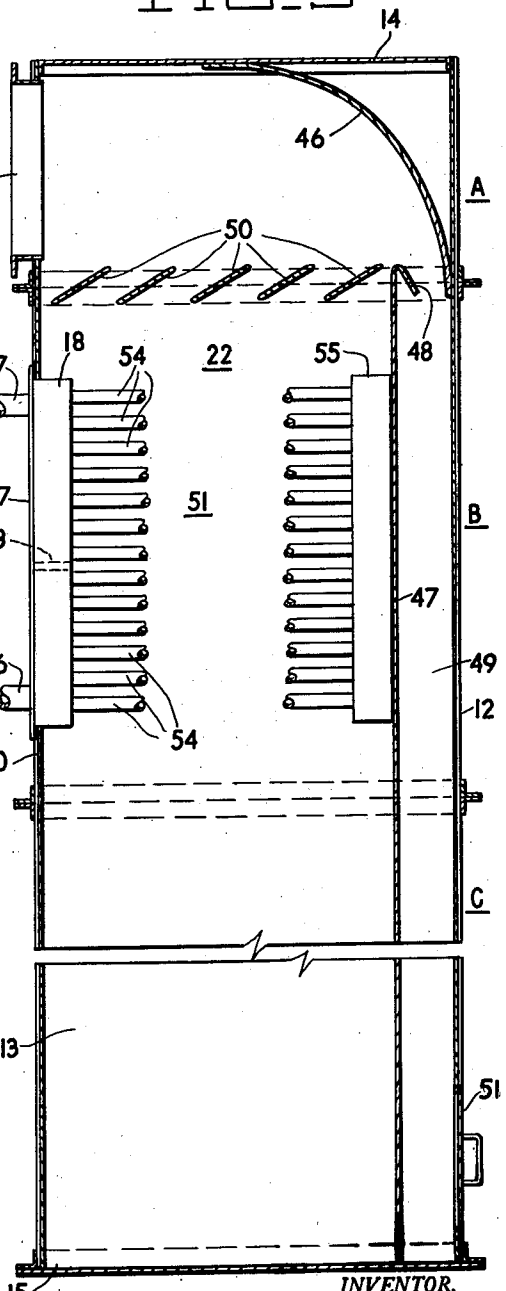


FIG_5



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Patented Apr. 21, 1953 2,635,565

UNITED STATES PATENT OFFICE

2,635,565

INDUCED DRAFT SYSTEM

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Application April 3, 1950, Serial No. 153,542

2 Claims. (Cl. 110—162)

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This invention relates to induced draft systems and more particularly to an induced draft fan and associated structure and the assembly thereof in a compact unit.

It has heretofore been proposed, in smaller boiler or furnace installations, to connect an induced draft fan directly to the stack and to the breeching from the boiler so that all of the combustion gases pass through the fan.

It has also heretofore been proposed to insert, between the fan and the breeching of the boiler, other apparatus such as cinder or dust collectors, air heaters, and feed water heaters, and the like. This additional equipment has heretofore customarily been made as separate units, any one of which requires considerable space and is costly to manufacture and to install. Such additional equipment also usually causes considerable resistance to the natural flow of the gases.

It has also heretofore been proposed to control the volume of gas flow by resistance dampers, or by speed control of the induced draft fan. The equipment for effecting automatic control of this character is rather costly.

It has also heretofore been the practice, when employing small induced draft fans, to equip the same with bearings that are air cooled or have other provisions, dependent upon fan rotation, to prevent the transmission of heat through the fan shaft to the bearings. With such fans, when the fan rotation is stopped, the heat dissipating provisions are not effective and the heat transmitted through the shaft may cause damage to the bearings. Also, when the fan is not being operated, the fan wheel or rotor provides considerable resistance to the natural flow of the gases.

It is the principal object of the present invention to provide an induced draft fan system, preferably unitary in character, which will have numerous advantages not possessed by the equipment now available.

It is a further object of the present invention to provide a unit having, as one component thereof, an induced draft fan, and with which an additional collecting or heat transferring component, or both, may be readily combined in an effective manner.

It is a further object of the present invention to provide an induced draft fan with provisions for bypassing the combustion gases when the fan is not operated.

It is a further object of the present invention to provide an induced draft fan with provisions for bypassing the combustion gases, which provisions are controlled, at least in part, by the operation or non-operation of the fan.

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It is a further object of the present invention to provide, in combination with an induced draft fan, a simplified control of the path of the gases dependent upon the operation of the fan.

It is a further object of the present invention to provide a compact unit, including an induced draft fan and a separator, together with control mechanism for determining the path of the gases through the separator.

Other objects and advantageous features of the invention will be apparent from the specification and claims.

The nature and characteristic features of the invention will be more readily understood from the following description, taken in connection with the accompanying drawings forming part hereof, in which:

Figure 1 is a top plan view of a preferred embodiment of the invention;

Fig. 2 is a front elevational view, parts being broken away to show the details of construction;

Fig. 3 is a horizontal sectional view taken approximately on the line 3—3 of Fig. 2;

Fig. 4 is a vertical sectional view taken approximately on the line 4—4 of Fig. 2; and

Fig. 5 is a vertical sectional view taken approximately on the line 5—5 of Fig. 2.

It should, of course, be understood that the description and drawings herein are illustrative merely, and that various modifications and changes may be made in the structure disclosed without departing from the spirit of the invention.

Like numerals refer to like parts throughout the several views.

Referring more particularly to the drawings, an exterior casing is provided, with an upper section A, an intermediate section B, and a lower section C. The casing is preferably constructed from sheet metal plates and structural angles and includes a vertical exterior front wall 10, a vertical exterior side wall 11, a vertical exterior rear wall 12 parallel to the front wall 10, a vertical exterior side wall 13, parallel to the side wall 11, a horizontal exterior top wall 14, and a horizontal bottom wall 15 supported on a suitable foundation (not shown). The side, rear, top and bottom walls, at their contiguous or meeting edges, are preferably made gas-tight, in any desired manner.

The front wall 10 at the upper portion thereof, and to one side and adjacent the wall 13, is provided with a flanged inlet opening 16 which is adapted to be connected to the breeching of the

boiler, furnace, or the like (not shown), from which the gases of combustion are delivered.

The front wall 10 is also provided, below the inlet opening 16, with a cover plate 17 for a manifold 18 in the interior of the intermediate section B, as hereinafter explained.

Within the interior of the casing, and intermediate the side walls 11 and 13, an interior partition wall 20 is provided, extending from the bottom of the upper section A to the bottom wall 15 and from the front wall 10 to the back wall 12. The interior of the housing is thus separated into interior chambers 21 and 22.

In the chamber 21, an induced draft fan is provided which includes a fan rotor 23 mounted on a shaft 24. A fan rotor access door 19 is provided in the wall 10. The shaft 24 is supported in outboard bearings 25 disposed beyond the side wall and supported on a suitable frame 26. The shaft 24 is preferably driven through a suitable driving connection 27 by an electric motor 28 which is also supported on a suitable frame 29. The fan rotor 23 is preferably enclosed within a suitable fan housing 30 of scroll shape, a gas inlet opening 31 to the rotor 23 being provided in the interior wall 20. The fan housing 30 has a gas delivery duct 13 extending upwardly therefrom, the boundary walls of which include portions of the interior wall 20, the front wall 10, the side wall 11, and a duct wall 32 disposed between the interior wall 20 and the side wall 11 and which extends vertically upwardly to the top wall 14.

At the upper end of the duct 131, and spaced above the top wall 14, a flanged gas outlet opening 33 is provided for connection to the stack (not shown).

Spaced downwardly from the flanged opening 33 and disposed in the duct 131, a horizontal valve seating flange 34 is provided on which a valve plate or vane 35 is adapted to seat in one of its positions and close the duct 131, as hereinafter explained.

The plate 35 is connected at one edge to a shaft 36 to permit of swinging movement thereof. The shaft 36 extends outwardly through the side wall 11 and has an arm 37 connected thereto with a balance weight 38 slidable along the arm 37 for adjustment, as hereinafter explained.

The duct wall 32 is also provided, between the top wall 14 and the inner pivotal edge of the plate 35, with an opening 39 which serves as a valve port, and which is adapted to be partly or wholly closed by movement of the valve plate 35.

The interior partition wall 20 has an extension 20a extending to the top wall 14 and, above the seating flange 34 and below the top wall 14, is provided with a flanged valve port 41. A valve plate or vane 42 is provided which is adapted to seat in one of its positions to close the port 41.

The plate 42 is connected at one edge to a shaft 43 to permit of swinging movement thereof. The shaft 43 extends outwardly through the wall 12 and has an arm 44 connected thereto, with a balance weight 45 slidable along the arm 44 for adjustment, as hereinafter explained.

In the interior of the casing, and in the upper part of the compartment 22, a curved deflector plate 46 is mounted, extending from the top wall 14 to the rear wall 12 and between the interior partition 20 and the side wall 13.

At the lower part of the upper section A and extending from the intermediate partition wall 20a to the exterior wall 11, and from the exterior wall 12 to the duct 32, a horizontal partition 52 is provided, the space thereabove being in communication with the inlet opening 16. Spaced inwardly from the rear wall 12, and parallel thereto, a vertical wall 47 is provided between the side wall 13 and the interior partition 20. The upper terminus of the wall 47 is approximately in line with or slightly below the lower edge of the inlet opening 16, and has a downwardly and rearwardly inclined flange 48 which, with the curved deflector plate 47, functions as a cinder trap for delivery of cinders to a cinder collecting space 49 provided between the wall 47, and the rear wall 12, the interior partition wall 20 and the wall 13. At the lower part of this space 49, a clean out door 51 is provided carried by the wall 12, and removable to permit the extraction of cinders delivered to the space 49.

Between the upper section A and the intermediate section B and at the upper part of the compartment 22, and aiding in the delivery of cinders to the cinder collecting space 49, a plurality of inclined deflector plates 50 are provided in spaced relation and at the level of the flange 48.

In the compartment 22, below the deflector plates 50, a heat exchanger 51 is preferably provided, for extraction of heat from the hot gases of combustion and this may be a feed water heater, air heater, or the like, depending upon the specific installation. Merely by way of illustration, the front manifold 18 is shown as having a horizontal interior partition 53 and is connected by heat transfer tubes 54 to a rear manifold 55. The cover plate 17 may be provided with a fluid inlet connection 56 for the fluid to be heated and a fluid delivery connection 57 for the fluid heated in the tubes 54.

The mode of operation will now be pointed out. With the fan 23 shut down, the valve plate 35 will be seated on its seat 34 and the inlet 16 will be directly in communication, through the space above the deflectors 50 and the space above the horizontal wall 52 with the upper portion of the exhaust duct 32 through the valve port 39. As soon as the fan 23 is started, the pressure thus set up in the duct 31 will tend to move the valve 35 from its seat 34 and will tend to close the port 39, at least partially. The movement and positioning of the valve 35 will be controlled by the pressure conditions effective on its opposite faces and by the setting of the weight 38.

The flow of gas will thus be permitted through the inlet opening 16 then downwardly past the deflectors 50 and in contact with the heat exchanger 51 in the compartment 22, then through the fan inlet 31 and through the fan to the exhaust duct 131, for discharge past the valve 35 to the stack (not shown). The solids carried by the gases will be delivered to the collecting space 49. The primary function of the valve 35 is to bypass gases directly into the stack when the fan rotor 23 is not in operation. At the same time, when the fan rotor 23 is operated, the velocity pressure produced by the rotor 23 will cause the valve 35 to open, and move to a position to close the port 39. The negative pressure in the chamber above the wall 52 will also aid in holding the valve 35 in open position and away from the seat 34.

By proper setting of the weight 38, the valve 35 can also function for volume control. With the valve 35 in a partially closed position, a portion of the gases, by reason of the negative pressure in the chamber above the wall 52, will circulate back through the fan.

It will also be noted that the valve 35 functions as an explosion door and serves to prevent possible damage to the fan and other equipment in

the event of secondary combustion of the gases in the breeching.

It will also be noted that with the valve **35** in its open position, it is possible to operate a boiler or furnace on natural draft, if the intermediate equipment such as the heat exchanger **51** is bypassed.

The valve **42**, which is located between the fan discharge or positive pressure side and the negative pressure side is preferably held in proper position by the weight **45** and, when this weight is adjusted for normal operation, no flow will occur past this valve.

If, however, there is a reduction in the system pressure and the fan has tended to increase its capacity, the additional volume will cause the valve **42** to open, due to an increase in static pressure, permitting a portion of the gases to recirculate back through the fan. The volume of gases drawn from the boiler or furnace is thus controlled. By proper adjustment or setting of the valve **42** to effect partial recirculation, it is also possible to have the fan maintain a constant volume even though an increase in the system resistance occurs.

I claim:

1. In an induced draft system, a casing, a vertical partition in said casing separating the interior into a first and a second chamber, an inlet connection on the exterior of said casing in communication with said first chamber, a fan housing having a fan therein in said second chamber and having an inlet in communication with said first chamber, a fan discharge duct in said second chamber, an adjustable valve normally closing said duct and adapted to be moved from closed position by gas pressure from said fan, said discharge duct having a port interposed between said first chamber and said discharge duct beyond said valve, and an additional adjustable valve for controlling said port.

2. In an induced draft system, a casing having upper, intermediate and lower sections, a vertical partition in said intermediate and lower sections separating the interior thereof into a first chamber and a second chamber, an inlet connection in communication with said upper section, said upper section and said first chamber being in communication and said upper section and said second chamber being separated by a horizontal partition, a fan housing in said lower section and in said second chamber having a fan therein and having an inlet in communication with said first chamber, a fan discharge duct in said second chamber and extending upwardly through said intermediate and upper sections, an adjustable gas pressure operated valve in said upper section normally closing said duct and adapted to be moved from closed position by gas pressure from said fan, said discharge duct having a port interposed between said upper section and said discharge duct and controlled by said valve, said discharge duct having a second port between said duct and the interior of said upper section, and an additional adjustable gas pressure operated valve in said upper section for controlling said second port.

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