

Nov. 14, 1933.

H. F. HAGEN

1,935,120

FAN

Filed Oct. 31, 1929

2 Sheets-Sheet 1

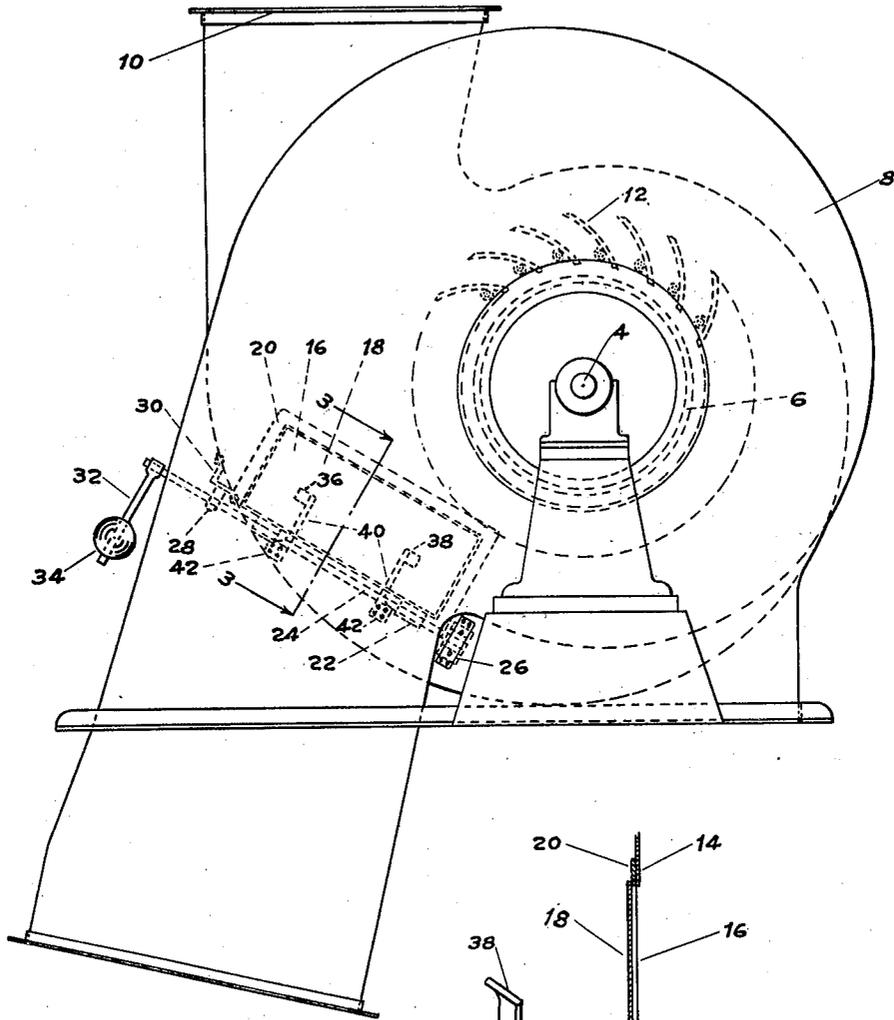


FIG 1

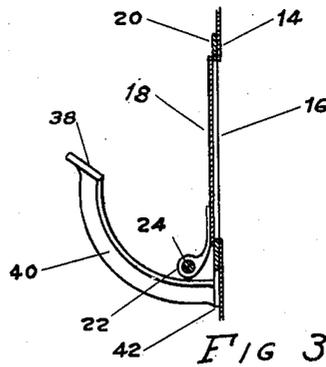


FIG 3

INVENTOR
Harold F. Hagen
By
Van Emmer, Fish, Wilborth & Cary
ATTORNEYS

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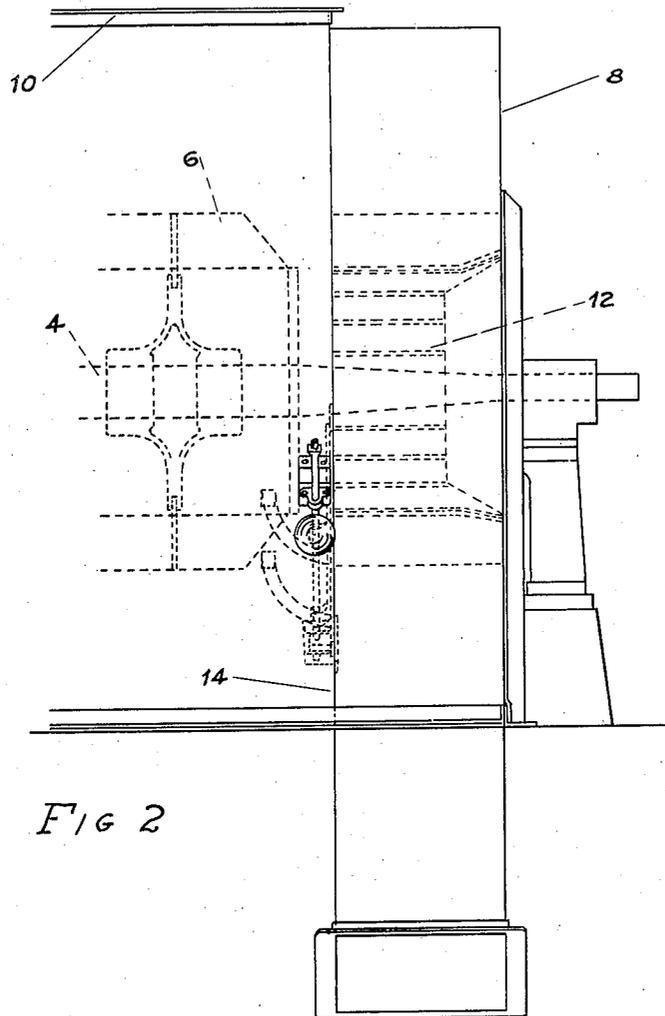


Fig 2

INVENTOR
Harold F. Hagen
By
Van Coven, Fish, Hildreth & Cary
ATTORNEYS

UNITED STATES PATENT OFFICE

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FAN

Harold F. Hagen, Dedham, Mass., assignor to
B. F. Sturtevant Company, Hyde Park, Mass.,
a corporation of Massachusetts

Application October 31, 1929. Serial No. 403,752

5 Claims. (Cl. 230—114)

The present invention relates to fans.

During periods of light load, mechanical draft fans are frequently shut down to permit operation of the boilers on the stack draft alone. When the fans are thus shut down, care must be exercised to make sure that the stack passages are unimpeded, otherwise severe damage is likely to result. Inasmuch as fans are often provided with output controlling devices, such as throttling means, in earlier constructions, or spin controlling devices of the type described in my co-pending application Serial No. 210,666, filed August 4, 1927, an additional burden is placed on the operator to open the passage during periods of stack draft operation.

It is evident, however, that serious consequences may follow in the event of neglect on the part of the operator.

The object of the present invention is to provide automatic means for insuring an unimpeded draft passage for the flue gases whenever a fan is shut down to permit operation on the stack draft alone.

With this object in view, the principal feature of the invention comprises by-pass means connecting the inlet and outlet of the fan adapted to be normally inoperative during operation of the fan but constructed and arranged to open the passage upon shutting down of the fan. In its simplest form, the invention comprises a counter-balanced by-pass damper adapted to be actuated by the difference in pressure existing between the inlet and outlet of the fan upon the decrease in pressure in the fan outlet brought about by operation of plant on the stack draft.

Other features of the invention consist in certain novel features of construction, combinations and arrangement of parts hereinafter described and particularly defined in the claims.

In the accompanying drawings, Fig. 1 is a side elevation of the preferred form of induced draft fan and inlet and outlet connections embodying the features of the present invention; Fig. 2 is a front elevation of the fan shown in Fig. 1; and Fig. 3 is a fragmentary detail in section on an enlarged scale taken on line 3—3 of Fig. 1.

The illustrated embodiment of the invention comprises a fan having a shaft 4, a wheel 6, a pair of inlet chambers or scrolls 8, and an outlet chamber 10 leading to the stack. The fan is provided with output controlling means which in the preferred form comprise the vanes 12 arranged to produce varying spin velocities of entering air. This construction is similar to that described in my co-pending application above referred to.

During normal operation of the fan, the vanes are adjusted to any desired inclination to control the amount of flue gases handled by the fan. At the lightest load which the fan can handle at a given speed, the vanes are entirely closed, the spin velocity being then a maximum and the gas being passed entirely through leakage spaces between the vanes. For even lighter loads, the fan is shut down and the stack draft is availed of to operate the plant.

Inasmuch as the stack draft alone is insufficient to create any appreciable current of air through the vanes when closed, provision is made for by-passing the flue gases directly from the inlets to the outlet. According to this construction, the plates 14 which are common both to the inlet scrolls and the outlet, are provided with by-pass openings 16. A swinging damper 18 is adapted normally to close each opening. The damper is adapted to swing inwardly as shown in Fig. 2, that is to say, into the outlet, upon a diminution of outlet pressure below the pressure existing in the inlet.

Each damper normally closes against a flange 20 secured to the plate 14 around the opening. The damper is provided with ears 22 which are secured to a shaft 24 journaled in bearings 26 and 28. The bearing 26 is attached to the inner side of the plate 14 and the bearing 28 is mounted on an angle iron 30 secured to the periphery of the outlet box. The shaft is counter-weighted by means of an arm 32 carrying a ball 34. The counter-weight is nicely adjusted so that upon the slightest increase in pressure in the inlet over the outlet, the damper swings open. The damper is limited in its opening movement by a pair of stops 36 and 38 secured to arcuate brackets 40 which are attached to the plate 14 at 42.

During normal operation of the fan, the pressure in the outlet is somewhat greater than the pressure in the inlet. The damper therefore remains closed and in no way interferes with the mechanical draft. The damper remains closed for all positions of the vanes 12 even when the latter are in fully closed position, provided only that the fan is running at normal speed.

If the fan is shut down, the stack draft becomes operative and the pressure in the outlet box is immediately reduced below the pressure in the inlet. The damper therefore swings open and the flue gases are free to pass directly from the inlet boxes to the outlet and thence upwardly through the stack.

It will be seen, therefore, that it is unnecessary to exercise care to make sure that the vanes 12

are open when the fan is shut down. It is im-
 material whether the vanes are opened or not. If
 the vanes are opened, the difference in pressure
 between the inlet and outlet may not be sufficient
 5 to open the damper but in such case, opening of
 the damper is unnecessary because a sufficient
 unimpeded passage is afforded through the fan
 itself. However, if the vanes are closed, the pres-
 10 sure difference between the inlet and outlet opens
 the damper and thus assures an unimpeded pas-
 sage of air through the by-pass. The damper
 mechanism therefore operates automatically to
 avoid the consequence of careless operation.

It will be obvious that although the inven-
 15 tion has been described as embodied in a con-
 struction employing spin controlling vanes for
 varying the output of the fan, such particular
 output controlling means is not essential, and the
 invention may be embodied in other constructions
 20 employing any type of output control such, for
 example, as throttling means.

Having thus described the invention, what is
 claimed is:

1. A centrifugal fan having a rotor and a cas-
 25 ing comprising an outlet scroll and an inlet scroll
 at the side thereof with a partition between, the
 partition being provided with a by-pass opening,
 devices in the inlet scroll for controlling the flow
 of fluid from the inlet to the rotor, and means
 30 normally closing the opening and opening auto-
 matically when the flow of fluid through the rotor
 reaches a predetermined minimum.

2. An induced draft fan adapted to receive fluid
 35 and deliver it to a stack comprising a rotor, an
 outlet adapted to be connected to the stack, an
 inlet adapted to be connected to the source of the
 fluid, devices for controlling the delivery of fluid
 to the rotor, and normally closed by-pass means

between the inlet and outlet operating auto-
 matically by the suction produced by the stack
 for opening said means when the rotor is out of
 operation and said devices prevent the flow of
 fluid through the rotor. 80

3. The combination with a fan having an inlet,
 an outlet, a rotor, and output controlling means
 for varying the passage of fluid through the rotor
 from inlet to outlet and having provision for sub-
 85 stantially impeding the passage of fluid when the
 rotor is stationary, of means operated auto-
 matically by a decrease of pressure in the outlet
 below that in the inlet to by-pass fluid around the
 output controlling means.

4. The combination with a fan having an inlet,
 an outlet, a rotor, and output controlling means
 for varying the passage of fluid through the rotor
 from inlet to outlet and having provision for sub-
 90 stantially impeding the passage of fluid when the
 rotor is stationary, of by-pass means around the
 output controlling means, and a pressure oper-
 ated damper in the by-pass means to open by a
 drop in pressure in the outlet below that in the
 inlet, occasioned by stopping the rotor with said
 output controlling means in closed position. 100

5. The combination with a mechanical draft
 fan having an inlet, an outlet, and a rotor, and
 adapted to be connected to a stack to subject the
 outlet to a suction by stack draft, of output con-
 105 trolling means to vary the passage of air through
 the fan when the rotor is running and adapted
 when closed to substantially impede passage of
 air with the rotor stationary, and a by-pass
 damper normally closed and operated by the stack
 suction to permit direct passage of air from the
 110 inlet to the outlet on impeding the passage
 through the rotor.

HAROLD F. HAGEN.

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