June 27, 1939. W. W. SAYERS 2,163,706

AIR CONTROL FOR BLOWERS FOR AUTOMATIC STOKERS

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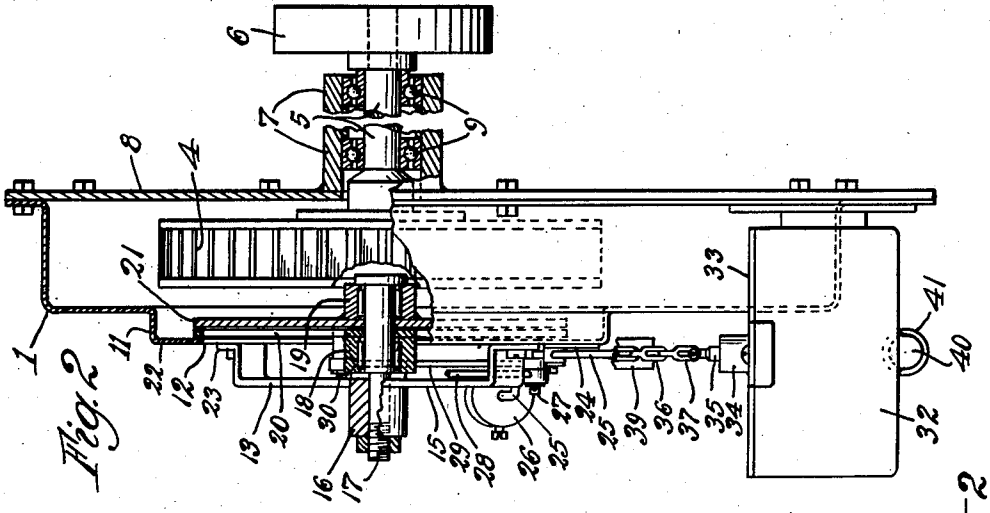


Fig. 2

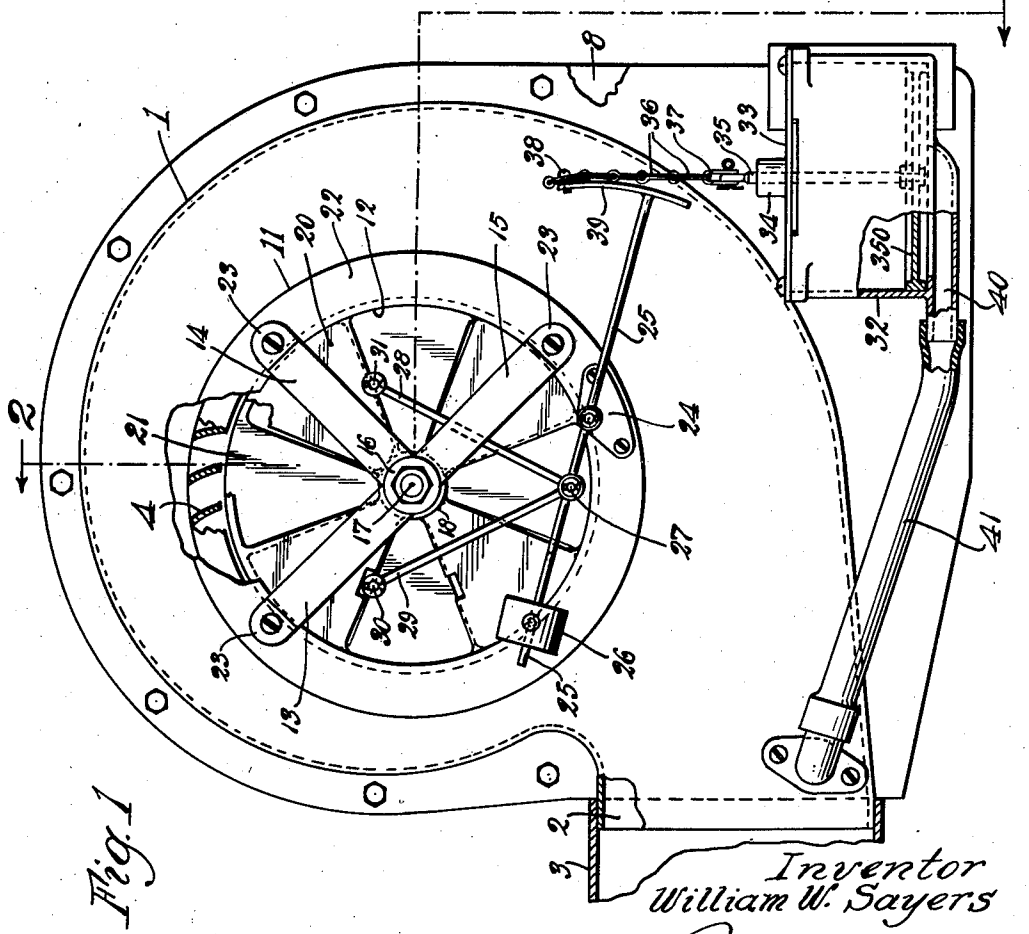


Fig. 1

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Fig. 3

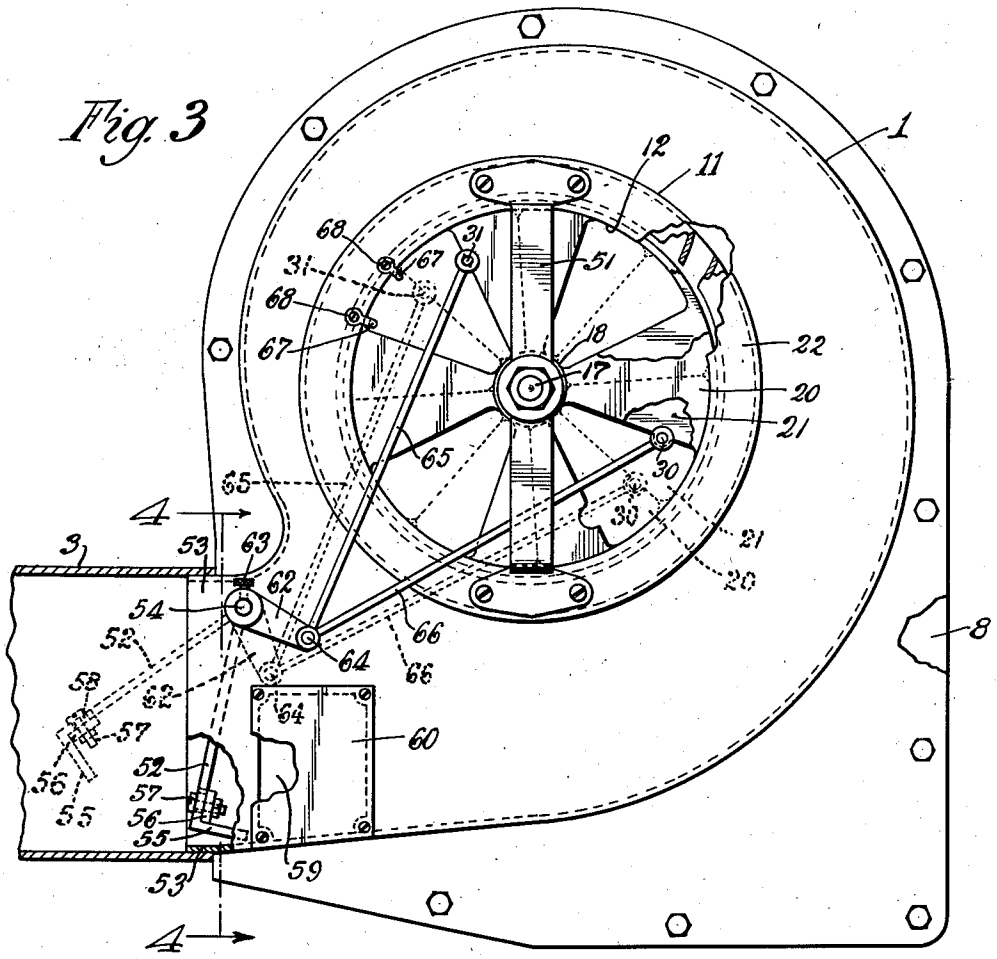
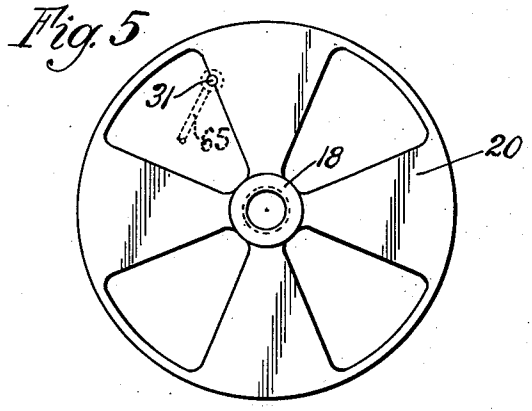


Fig. 5



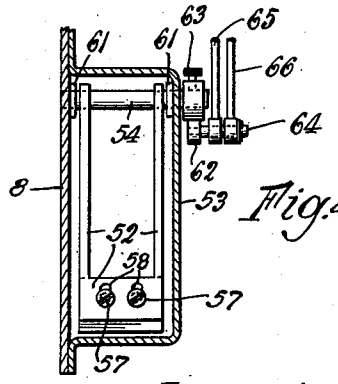


Fig. 4

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UNITED STATES PATENT OFFICE

2,163,706

AIR CONTROL FOR BLOWERS FOR AUTOMATIC STOKERS

William W. Sayers, Chicago, Ill., assignor to Link-Belt Company, Chicago, Ill., a corporation of Illinois

Application August 5, 1938, Serial No. 223,178

2 Claims. (Cl. 230—114)

My invention relates to improvements in air controls for blowers for automatic stokers and the like and has for one object to provide in connection with the blower fan, automatic means responsive to and controlled in part at least by the air discharged from the fan for controlling and adjusting the amount of air supplied to the fan intake. Another object is to provide an arrangement whereby a fan inlet is controlled by a series of moving parts working in opposition one to another and wherein all the air intercepting parts are mounted and controlled for simultaneous movement to change the opening available for air intake.

Another object of my invention is to provide in connection with the air supply for fans and the like a shutter arrangement and means for automatically opening and closing it while maintaining the geometric center of the opening or openings fixed in position irrespective of the degree of opening so that the opening and shutting of the aperture to control the flow of air discharged to the fan will in nowise change the position of the column of air as it enters the fan.

Another object of the invention is to provide an air control having a plurality of movable opening controlling members adapted to travel in opposition one to the other and wherein a relatively wide change in effective aperture results in a relatively short travel of the moving parts.

Other objects will appear from time to time throughout the specification and claims.

My invention is illustrated more or less diagrammatically in the accompanying drawings, wherein—

Figure 1 is a side elevation;

Figure 2 is a section along the line 2—2 of Figure 1;

Figure 3 is a side elevation of a modified form;

Figure 4 is a section along the line 4—4 of Figure 3.

Figure 5 is a plan view of a shutter.

Like parts are indicated by like characters throughout the specification and drawings.

My invention is illustrated in connection with a rotary fan which is well adapted to supply air under forced draft to stokers and the like but the stoker itself is not here illustrated as it forms no part of my present invention.

1 is a fan housing. It has a tangential discharge pipe 2, which may be connected to any suitable hose or discharge passage 3. 4, is a centrifugal fan mounted within the housing on a shaft 5, adapted to be driven by power applied through a pulley 6. 7, is a sleeve projecting from the side 8, of the fan housing and it carries a bearing 9, supporting the shaft 5. The side wall 8, of the fan housing is apertured to permit the shaft to extend through it.

The other wall of the fan housing is provided with a boss 11, apertured at 12. Extending across this aperture are supporting arms 13, 14 and 15, which join together in a central hub 16, containing a pivot shaft 17. Mounted for rotation on this shaft are two separate hubs 18 and 19. Projecting radially from the hubs 18, and 19, are segmental shutters 20, 21. These shutters are in two parallel closely spaced planes and so related that when they are properly spaced angularly with respect one to another they form a continuous closure for the opening 12, to prevent the inflow of air, and as they are angularly displaced from the closed position, they permit a progressive increase of the air intake aperture to a maximum at the time when they completely mask one another.

The ring 22, which is formed by the bossed portion of the housing wall encircling the aperture 12, supports the feet 23 of the arms 13, 14 and 15, and a bracket 24 on which is pivoted a rock lever 25. 26, is an adjustable counterweight on the rock lever. 27, is a wrist pin on the rock lever. 28, and 29, are shutter control links each pivoted at one end on the wrist pin 27, and at the other end respectively on pins 30, and 31, on the shutters 20 and 21 so that angular movement of the rock lever 25, moves the shutters 20 and 21 in opposite directions and from one another to open and close the intake aperture. In the position shown in Figure 1, counterclockwise movement of the lever 25 results in opening the intake aperture.

32, is an air box having a cover 33, in the center of which is an apertured boss 34. 35, is a piston rod extending through the aperture in the boss 34, and connecting with a piston 350. 36, is a chain anchored at one end on the yoke 37, on the piston rod 35, and at the other end on a screw 38, at the upper end of the quadrant 39, which quadrant is fixed on the rack shaft 25, so that as the rock shaft rotates and the piston rod 35 moves up and down, the point of intersection of chain with quadrant remains the same so that the tension on the piston rod 35, is always parallel with its axis.

40, is an air passage communicating with the underside of the housing 32, below the piston. 41, is a pipe connecting 40 and the sleeve 2 so that the pressure at the discharge side of the fan is transmitted directly through the pipe into

the area beneath the piston in the air box and tends to rise so as to cause a counterclockwise rotation of the rock shaft 25, and thereby increase the effective area of the air intake opening. Thus as the pressure on the discharge side increases, the effective intake opening is increased thereby increasing the air flow and vice versa, thus providing a self-adjusting or self-compensating system. The particular means used in connection with the air box 32, to control the response to variation in pressure forms no part of the present invention and so is not disclosed. Any suitable control means might be used.

In the modified form shown in Figures 3 and 4, the general arrangement of the fan and housing is the same. The shutter is supported on a cross bracket 51, supported at each end on the ring 22. The relationship between the shutter blades 20 and 21 and their support is identical. The control, however, is different. 52 is a pivoted vane in the discharge sleeve 53. This vane is supported on a rock shaft 54, and normally hangs in its lower position. The vane has a perpendicular foot 55, and there is associated with it a counterweight 56, being held to the vane by bolts 57, traveling in slots 58, whereby the counterweight may be moved up and down along the vane to change the radius arm through which the counterweight works. 59 is a port having a cover 60, in the wall of the sleeve 53 so that access may be had to the vane to adjust the position of the counterweight. The rock shaft 54 is mounted for rotation in bearings 61, supported on the opposed walls of the sleeve 53. One end of the rock shaft extends outwardly and carries a rock arm 62, which is angularly adjustable on the rock shaft, being adapted to be held against displacement by a thumb screw 63. 64 is a wrist pin on the end of the rock arm 62; pivoted on this wrist pin are shutter control links 65 and 66, which are pivoted at their opposite ends respectively on the pins 30 and 31 on the shutter blades 20 and 21.

As the velocity of the air in the passage 3 increases, it tends to rotate the pivoted vane 52 in a clockwise direction. This causes the links 65 and 66 to move to the left rotating the shutter blades 20 and 21 toward one another, thereby progressively closing the effective air intake opening. The position of the vane with respect to any particular pressure of the air blast, of course, depends upon the position of the counterweight 56, or if desired on the size of the counterweight because various size counterweights may be used. Adjustment may also be made by changing the angular relationship between the rock arm 62, and the rock shaft 54, so that the operator may adjust the response of the shutter control mechanism to insure satisfactory operation of the device. 67, 67 are stop pins adjustably mounted on the ring 22. They may be moved angularly, being held in position by the set screws 68, and are located in the path of the shutter blades 20 so that the maximum degree of opening and closing may be adjusted, the shutter blades being limited in their movement to the range defined by these adjustable pins.

Other exemplifications of this type of shutter control might be used and this mechanism might be used for controlling diaphragm or sliding or rotating valves or shutters as the case may be, without departing materially from the spirit of my invention and I wish, therefore, that the drawings be regarded as in a sense diagrammatic.

This device is primarily intended to be used in connection with automatic stokers wherein the thickness of the fuel bed varies from time to time as fuel is forced into the combustion chamber or pot by the stoker and then burns away so that depending upon the circumstances, under which the device operates, the fuel bed may vary rather widely in thickness. If the bed is thin, only a little air needs to be supplied. If the bed is thick, a great deal of air needs to be supplied. If the bed is thin the resistance to the air is low and so the pressure between the fan and the fuel bed is low. If the bed is thick, the resistance to air escape is high and so the pressure between the bed and the fan is high. My device provides automatic means for corelating the change in air resistance with the apparatus so as to produce a large amount when the pressure is high and a small amount when the pressure is low.

In the device of Figures 1 and 2, as pressure builds up on the discharge side of the fan, the air under pressure passes in through the pipe 41, to raise the piston 350 and open the air valve to permit the fan to get more air to support combustion of the thicker bed which has caused the increase in pressure. As the bed burns down, less air is required, resistance decreases, pressure falls, the plunger moves down and tends to close the valve.

With respect to the device of Figures 3 and 4, when the resistance is high, the air velocity is low, more air is needed to support combustion and so in the position shown in full lines, the valve is at its maximum. As the bed thins out and resistance to air flow decreases, velocity increases. The vane 55 is blown to the left toward the dotted line position by the air blast and the valve is closed to decrease the amount of air fed to the thin bed. It will be understood, of course, that the vane only fills a part of the channel and so does not materially interfere with air flow and as it rotates from the full line position to the dotted line position, an increased area of blade is presented to the air flow so as to increase the effectiveness of the blade as the maximum air velocities are reached. The perpendicular foot 55 is wider than the effective portion of the vane 52. The narrow supporting arms have no appreciable aerodynamic effect on the operation of the device and merely serve to support the vane 52, on the shaft 54. As the vane moves from the position shown in full lines in Figure 3, to the position shown in dotted lines, the perpendicular foot 55, which at first is substantially edge on to the flow of gas, approaches perpendicularity thereto and so as the blade or vane made up of the parts 52 and 55 approaches the dotted line position, the total area presented to the air flow is increased.

While it is a fact that in order to get the maximum efficiency, it is necessary to increase the supply of air as the bed increases in thickness and to decrease it as it decreases in thickness because otherwise inefficient combustion takes place, there is an even more important reason for a control of the type herein disclosed. Automatic stokers especially of the household type add additional fuel periodically to the fire. Only under exceptional conditions is coal fed continuously. When coal is fed periodically the bed is thickened up and as it burns it decreases in thickness. If the water is hot and only a little coal is burned, the bed will always be relatively thin. When it is cold and much coal is

being burned the bed will be thick but it will always vary. The fan is set to supply sufficient air to support combustion with maximum bed thickness. If the bed is thin, that same amount of air rushing out at relatively high velocity and high pressure may blow holes through the bed. It may even blow fire off the grate and leave bare spots. Hence a control mechanism such as mine which insures that when the air velocity of air pressure increases beyond a certain point, the air supply will be reduced, is of the utmost importance because it prevents the formation of blow-holes in the fuel bed. The arms 13, 14, 15, form a support overlying the aperture in the wall upon which the shutter may be supported.

I claim:

1. In combination, a blower, a housing therefor apertured concentric with the blower, a plurality of bladed shutters concentric with and rotatable in the aperture, the blades on each shutter being spaced apart, the blades on one being adapted to coincide with the apertures between the blades on the other, a rock arm, links, between the rock arm and each shutter on opposite sides of the center of rotation of the shutters of such a nature that movement of the rock arm causes the shutters to move in opposition toward and from one another, means responsive to the velocity of the air on the discharge side of the blower to rotate the rock arm to open and close the shutters, said means comprising a rotatable vane exposed to the blast of air discharged by the blower and a mechanical connection between the vane and the rock shaft.

2. In combination, a blower, a housing therefor apertured concentric with the blower, a plurality of bladed shutters concentric with and rotatable in the aperture, the blades on each shutter being spaced apart, the blades on one being adapted to coincide with the apertures between the blades on the other, a rock arm, links, between the rock arm and each shutter on opposite sides of the center of rotation of the shutters of such nature that movement of the rock arm causes the shutters to move in opposition toward and from one another, means responsive to the velocity of the air on the discharge side of the blower to rotate the rock arm to open and close the shutters, said means comprising a rotatable vane exposed to the blast of air discharged by the blower and a mechanical connection between the vane and the rock shaft, the vane comprising two members at right angles to one another extending across the path of the air discharged from the fan.

WILLIAM W. SAYERS.