

June 16, 1936.

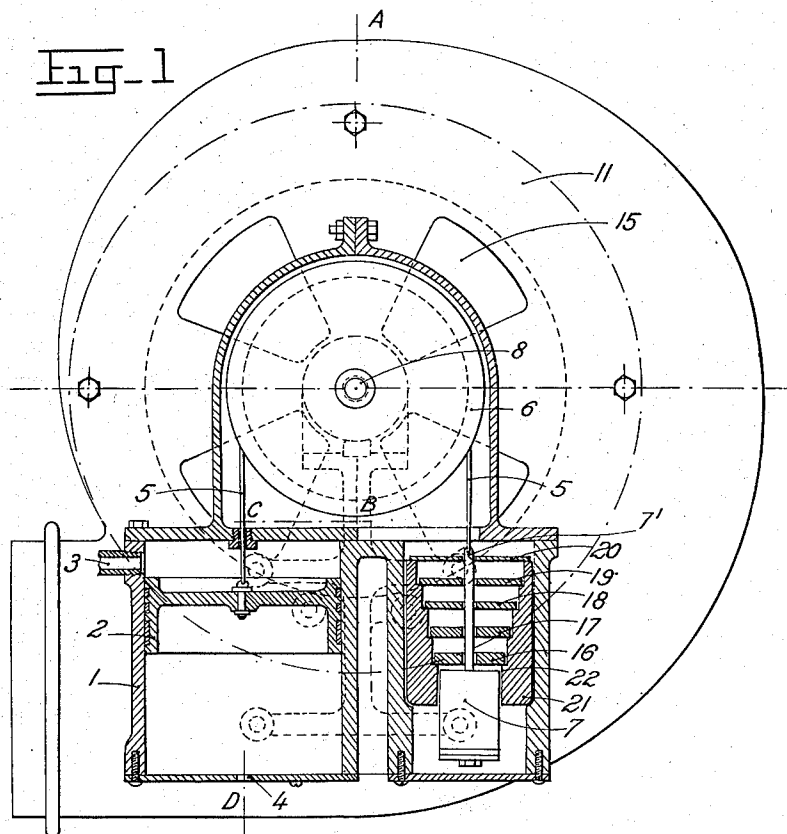
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2,044,646

FLOW CONTROL MECHANISM

Filed Oct. 18, 1933

3 Sheets-Sheet 1



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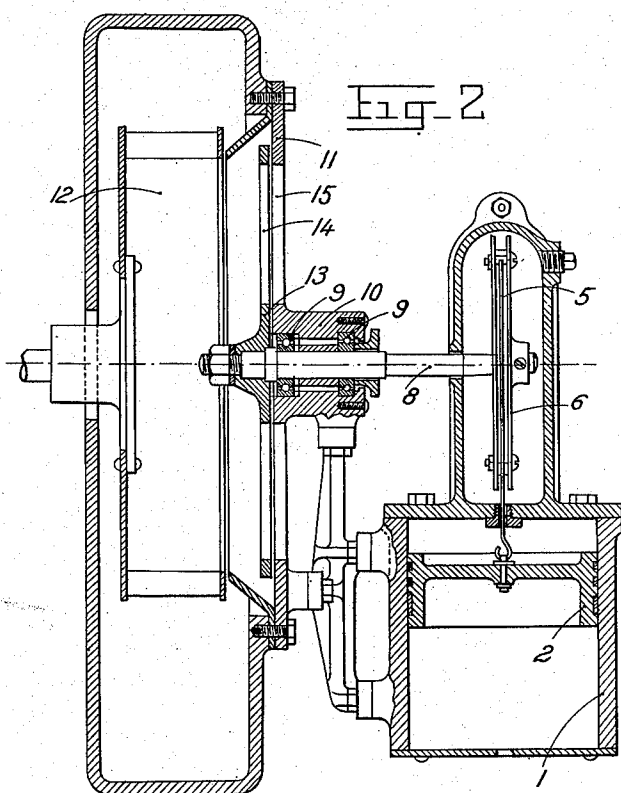
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Fig. 3

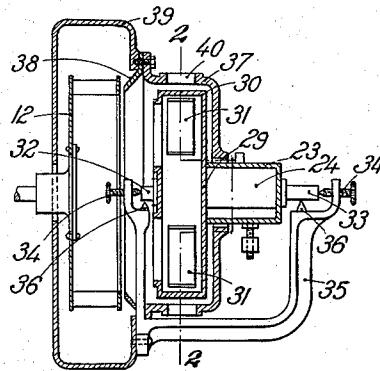


Fig. 4

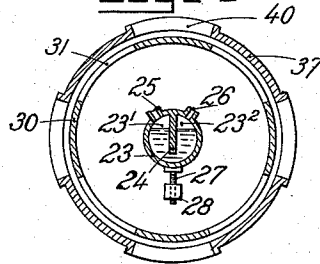
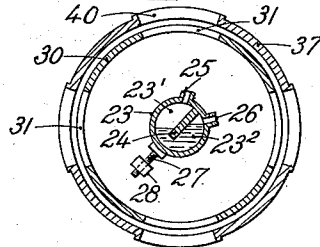


Fig. 5



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FLOW CONTROL MECHANISM

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3 Claims. (Cl. 137—153)

The present invention relates to a device for the automatic regulating, in a forced draught furnace, of the necessary amount of air which is proportional to the quantity of coal to be burned.

In the said device, the regulating is obtained by the automatic control of the air damper, that is, its opening or closing is gradual or is complete, according to the static pressure of the air which prevails under the furnace grate.

The said device, which has been specially designed for underfeed furnaces, is also applicable to all types of forced draught furnaces.

Its principle is based upon the fact that when the furnace operates at its maximum rate, in which case the thickness of the fuel on the grate is more considerable, the pressure of the air delivered under the grate increases. On the contrary, when the furnace operates at a reduced rate, with a small amount of fuel, the air finds only a small resistance when traversing the layer of coal, and the pressure below the grate is much less than the pressure at the full rate.

There is thus a certain relation between the quantity of coal burned per hour and the static pressure of the air below the grate.

The device, the subject-matter of the invention, thus makes use of an apparatus which operates by the variations of the static pressure prevailing below the furnace, as a source of power, in order to control a damper or register which is mounted at the suction end of the draught fan.

The invention is particularly set forth with reference to the accompanying drawings.

Fig. 1 is a side view, with certain parts in section, of an embodiment of the invention.

Fig. 2 is a section on the line A—B—C—D of Fig. 1.

Fig. 3 is a vertical section of another embodiment of the invention.

Figs. 4 and 5 are irregular cross-sections on the line 2—2 of Fig. 3 and show the parts in two different positions.

The apparatus, which is shown in Figs. 1 and 2, comprises a cylinder 1 in which a piston 2 has a vertical motion. The upper face of the piston is in communication with the air-chamber of the furnace by means of a conduit 3, whilst the lower face of the piston has an atmospheric connection through an orifice 4.

The piston 2 is suspended from a cable 5 which passes over a grooved pulley 6 and carries at its other end a counterweight 7 which serves to counterbalance the piston 2 and to bring it into the initial position, which is shown in the figure

and corresponds to a zero value of the air pressure under the grate.

The grooved pulley 6 is keyed to a shaft 8 which is mounted on ball bearings 9 in a bearing 10, mounted on the side-plate 11 of the casing of the draught fan 12. On the shaft 8 and next the inner side of the plate 11, is mounted a damper or register consisting of a disc 13 pierced with apertures 14. The damper 13, by its rotation, may bring the whole or a part of its apertures 14 into coincidence with apertures of like shape which are formed in the face 11 of the fan casing.

When the air pressure below the furnace increases, and owing to the connection at 3 between the latter and the cylinder 1, the piston 2 will move downwardly for a well-defined value of this pressure. During its descent, the piston 2 will draw with it the cable 5, thus rotating the pulley 6 and hence the damper 13.

The said damper, which as above stated consists of a disc with apertures 14 which are progressively uncovered according to its position, is so arranged that the degree of its opening will correspond at all times to an amount of air which is proportional to the pressure prevailing below the furnace, and hence to the quantity of coal to be burned.

If the rate of combustion of the furnace is increased, the layer of coal will become thicker, and the air pressure below the furnace will also increase.

At this time, the piston 2 would tend to proceed to the end of its stroke, unless a special arrangement were provided, which latter consists of a set of auxiliary counterweights 16, 17, 18, 19, 20, engaged upon a rod 7¹ placed above the counterweight 7, their diameter and thickness being suitably determined. In the inoperative position, the said auxiliary counterweights rest upon circular offsets 22 formed in the interior of a member 21 in which the counterweight 7 is movable. In this manner, when the piston 2 descends, the counterweight 7 which it moves by means of the cable 5, while turning the damper 13, is stopped by the first auxiliary counterweight 16, and then, in succession, by the other counterweights 17, 18, 19, 20 which are above it, each corresponding to a certain increase of the static pressure.

Thus the piston 2, and hence the damper 13, can move step by step according to the distance between two consecutive auxiliary counterweights and as the latter are successively lifted, and this affords an approximate regulating which is quite sufficient in practice.

The apparatus is contained in a casing, thus

forming a unit which is entirely protected against dust and is quite accessible.

Due to the mounting of the damper 13 on the ball bearings 9, the low pressures obtained in practice can be utilized to their fullest extent.

It is obvious that the piston may be replaced by a diaphragm consisting of any suitable substance, or by a bellows device, and that the damper may consist of an iris diaphragm, a cylinder, or a member of any other form which serves the same purpose.

Instead of the auxiliary counterweights, it is also feasible to employ a weight immersed in a liquid, a spring, a counter-pressure produced by air, or the like.

The apparatus shown in Figs. 3 to 5 comprises an entirely closed cylinder 23, divided into two chambers of equal size 23¹—23² by a partition 24, which however affords at its lower end a connection between the chambers.

The chamber 23¹ communicates through a neck 25 with the air chamber of the furnace; the chamber 23² is connected by a neck 26 with the atmosphere.

On the periphery 23 and on the axis of the partition 24 is mounted a threaded rod 27, upon which may be mounted, for regulating purposes, a heavy mass 28 which serves as a counterweight.

Against the cylinder 23 is mounted, by means of a side portion 29, a second cylinder 30 of larger diameter, on whose periphery are formed a certain number of apertures 31 the cylinder being entirely open on the side next the orifice of the draught fan 12. The device consisting of the two cylinders 30 and 23 is supported by axles 32 and 33 which are maintained in the horizontal position by pressure screws 34 engaged in a main frame 35. The axles 32 and 33 are adapted to turn upon knife-edges 36.

The cylinder 30 is contained in a casing 37 which is secured to the open part 38 of the draught fan 12, which part is secured to the fan casing 39.

In the periphery of the casing 37 are formed apertures 40, in the same size and number as the apertures 31 of the cylinder 30.

The cylinder 23 is filled to $\frac{3}{4}$ of its volume with a suitable liquid which by reason of the connection made between the chambers 23¹ and 23² below the partition 24, attains a uniform level.

As above, the chamber 23¹ is connected with the furnace air chamber, and the chamber 23² with the atmosphere, and thus, for a given pressure between the two chambers, the liquid will proceed from one into the other, and will assume a position of equilibrium on each side of the partition 24 of the cylinder. In consequence, the

cylinders 23 and 30 will turn upon the axes 33 and 34, upon the knife-edges 36, through a fraction of a revolution, until the weight of the liquid in one of the chambers 23¹—23² counterbalances the action of the counterweight 28 which tends to assume the vertical position.

Owing to its movement in one direction or the other, the cylinder 30 will place its apertures 31 more or less in coincidence with the apertures 40 of the casing 37.

The apparatus is regulated in such manner that for a maximum pressure in the air chamber of the furnace, and hence in the chamber 23¹, the apertures 31 of the cylinder 30 will exactly coincide with the apertures 40 of the casing 37, by which the damper will be opened to the maximum degree (Fig. 3). On the contrary, for a pressure of zero value in the air chamber of the furnace, the apertures 31 of the cylinder 30 will be brought against the wall of the casing 37, 20 which corresponds to the entire closing of the damper (Figs. 1 and 2) or to the stopping of the draught fan 12.

I claim:

1. A flow control mechanism comprising a casing, a shaft rotatable in said casing, a flow control member carried by said shaft, a pair of cylinders supported by said casing and arranged side by side, one of said cylinders having communication at one end with a point of variable pressure and communicating at its opposite end with the atmosphere, a counterweight guided in the other cylinder, a connection between said counterweight and said piston connected with said shaft whereby the latter is actuated incident to changes in the relative positions of said piston and counterweight.

2. A mechanism as claimed in claim 1 characterized by the provision of additional counterweights, supports in the second mentioned cylinder for said additional counterweights in which the latter are normally supported, the first mentioned counterweight being adapted during movement in one direction to successively lift the several additional counterweights.

3. A mechanism as claimed in claim 1 characterized by the provision of additional counterweights, supports in the second mentioned cylinder for said additional counterweights in which the latter are normally supported, the first mentioned counterweight being adapted during movement in one direction to successively lift the several additional counterweights, a grooved pulley on said shaft engaged by said connection, and a housing carried by said cylinders receiving said pulley and the medial portion of said connection.

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