

May 13, 1924.

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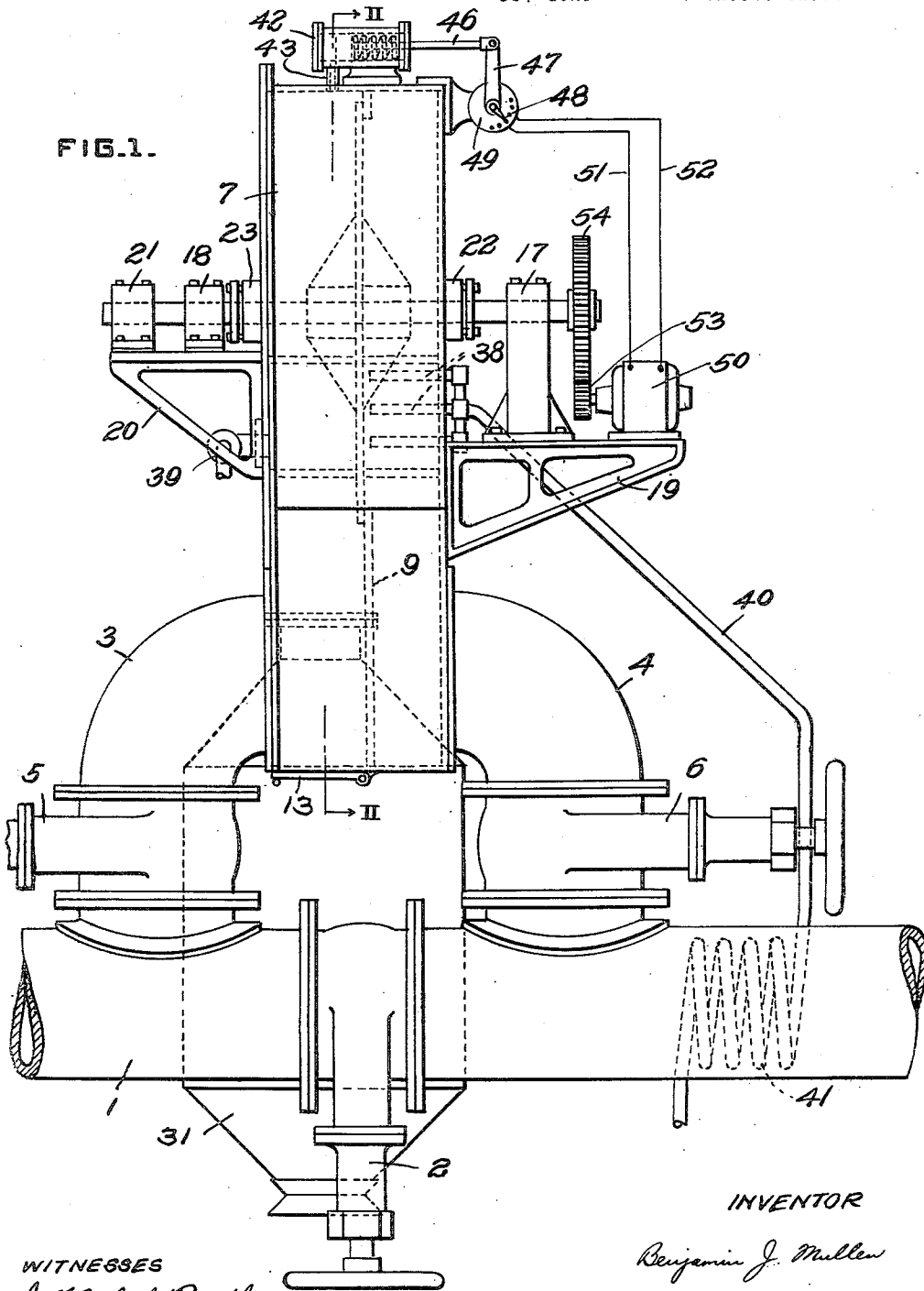
B. J. MULLEN

GAS CLEANER

Filed Nov. 30, 1921

3 Sheets-Sheet 1

FIG. 1.



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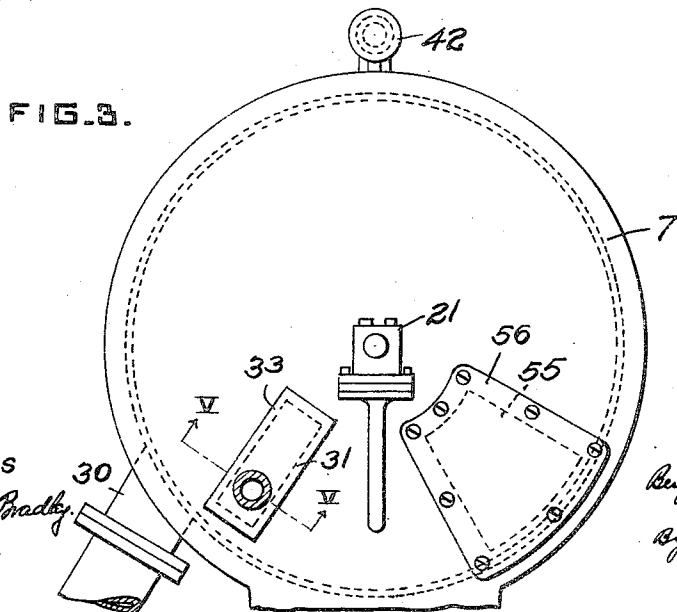
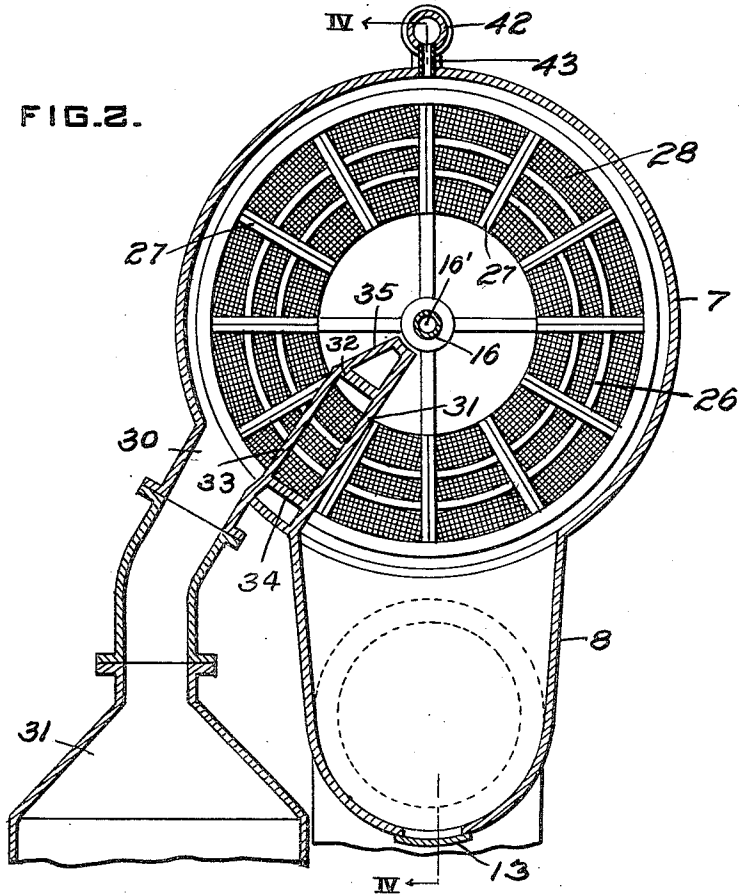
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

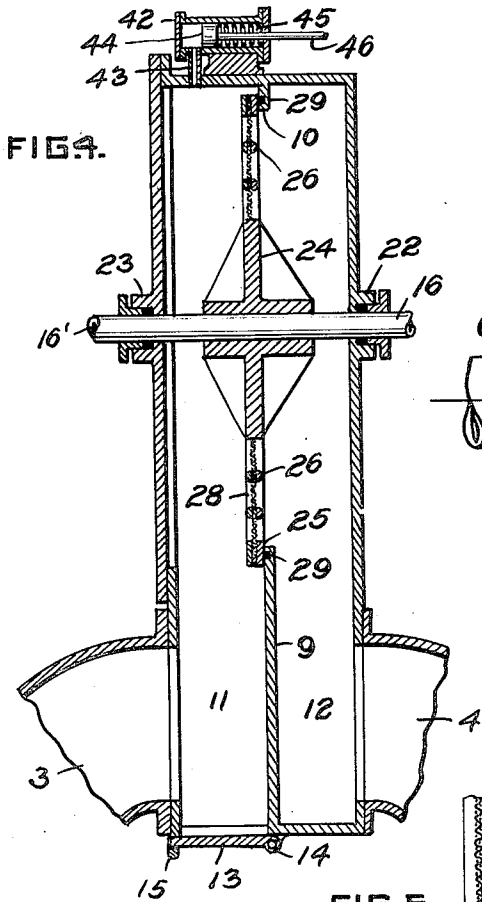


FIG. 6.

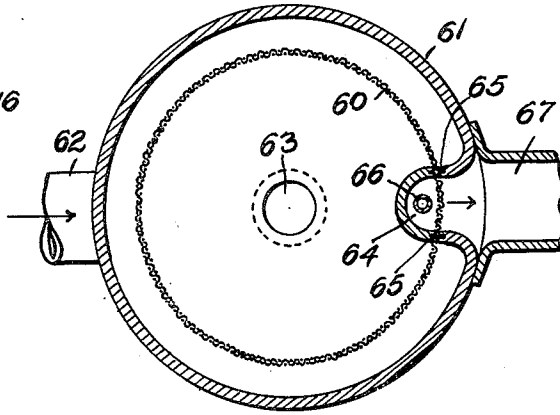
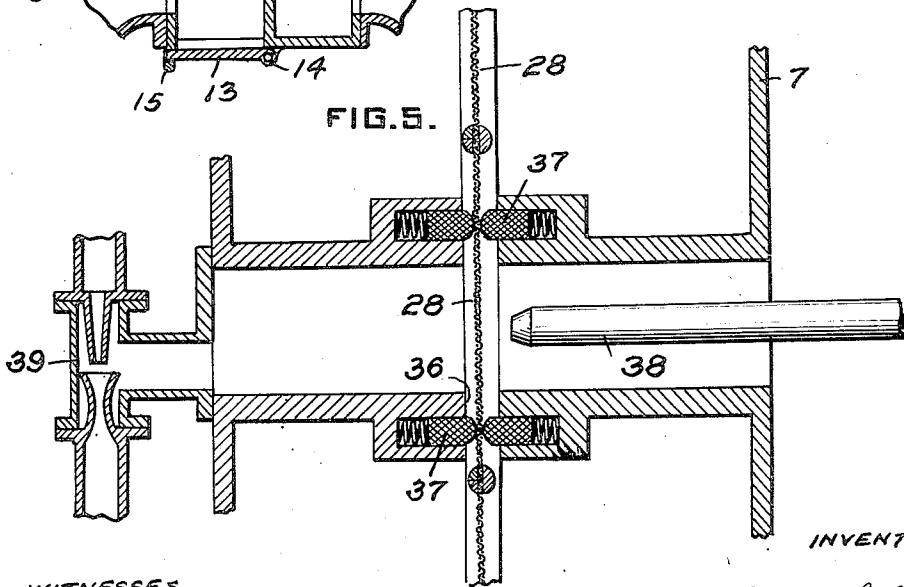


FIG. 5.



WITNESSES

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UNITED STATES PATENT OFFICE.

BENJAMIN J. MULLEN, OF RIDLEY PARK, PENNSYLVANIA.

GAS CLEANER.

Application filed November 30, 1921. Serial No. 518,791.

To all whom it may concern:

Be it known that I, BENJAMIN J. MULLEN, a citizen of the United States, and a resident of Ridley Park, in the county of Delaware and State of Pennsylvania, have invented a new and useful Improvement in Gas Cleaners, of which the following is a specification.

This invention relates to gas cleaners and particularly to that type for removing particles of dust-like solids therefrom by the use of screens.

In the reduction of iron in a blast furnace a very large amount of gas is necessarily produced on account of the quantity of coke required to be used. This gas is conducted from the top of the furnace through gas mains of sufficient capacity, to the boilers and stoves employed in connection therewith, that going to the stoves being used to preheat the air passing to the furnace in order to reduce the quantity of coke required for the smelting process. The gas from the furnace is filled with enormous quantities of fine dust-like particles of ore, limestone and coke, which going to the boilers and stoves soon foul the same to such an extent as to necessitate constant cleaning in order to maintain their efficiency. Such cleaning requires much labor and is expensive, sometimes necessitating the shutting down of the units several days at a time.

It is the object of the invention to provide a gas cleaner of the type referred to, which will effectively remove the objectionable particles of dust from the gases of the furnace in a simple and efficient manner, which will function continuously thus obviating putting the device out of commission at intervals, and which will preserve the sensible heat in the gas cleaned.

It is a special object of the invention to provide a device, the screens of which will be automatically cleaned during operation by means of projecting a blast of air or other gas therethrough, without mixing such air with the gas being cleaned. It is also an object to so associate the several parts as to preheat the air used for cleaning the screens to substantially the temperature of the gas cleaned so as to avoid either condensation or evaporation of the moisture therein. And it is still a further object to provide a device in which the

larger and heavier particles of dust will be separated from the gas centrifugally, and the smaller lighter particles removed by an air blast, and to so relate the means forming the air blast as to form a part of the centrifugal separator.

In the accompanying drawings Fig. 1 is an elevational view showing the preferred embodiment of the invention; Fig. 2 a transverse section taken on the line II—II of Fig. 1; Fig. 3 a fragmentary elevation of the cleaner casing taken in a plane at right angles to that of Fig. 1; Fig. 4 a vertical section taken on the line IV—IV of Fig. 2; Fig. 5 a detailed sectional view through the blast compartment taken on the line V—V of Fig. 3; and Fig. 6 a sectional view illustrating a modified form of the invention.

A conduit for conveying the gas from the furnace to the stoves and boilers is indicated at 1. This conduit is provided with a cutoff valve 2 and connected thereto at the opposite sides of valve 2 is a by-pass pipe formed of two sections 3 and 4 in which are located the respective control valves 5 and 6.

A substantially cylindrical casing 7 having the base portion 8 is interposed between the sections 3 and 4, said sections being connected to the opposite sides of the portion 8. An upstanding partition 9 having a circular opening 10 within the casing divides it into an inlet chamber 11 and an outlet chamber 12, and disposed in the floor of chamber 11 is a cleaning door 13 pivoted at 14 and locked by any suitable means as indicated at 15.

A shaft 16 provided with a bore 16' through which a cooling fluid may be passed is journaled in the casing, being mounted in the bearings 17 and 18 supported upon the respective brackets 19 and 20 fixed to the outer sides of the casing and is also provided with the thrust bearing 21 at one end thereof. Leakage around the shaft is prevented by suitable packing means 22 and 23.

Fixed to the shaft within the casing is a circular disk comprising a hub portion 24 from which the peripheral rim 25 and concentric ribs 26 are supported by the radial spokes 27. The apertures formed between the rim, rib, and spokes portions are covered by a very fine meshed screen 28.

This screen is preferably made of an abrasion-resisting material and in a number of sectors, each of which is clamped to the disk by a correspondingly sector-shaped plate. The peripheral rim portion 25 contacts and forms a running joint with the edge of opening 10 which is provided with a spring pressed packing 29 for preventing leakage therebetween, the contact at such point being controlled by means of adjustment of the thrust bearing 21.

Casing 7 is provided with a dust outlet 30 connected to a receptacle 31. Formed with the casing and extending therethrough at a point between the outlet 30 and the base portion 8 is a radial blast compartment bound by walls 31—34, the inner ends of the walls 31 and 32 being extended to a point adjacent the shaft 16 and the extension of the wall 33 being inclined as indicated at 35, which together with the wall 33 form a deflecting guiding surface. The blast compartment extends from one side to the other of the casing and forms a wall thereacross. A slit 36 of sufficient width to receive the disk screen is formed in the walls of the compartment and through the same extends as clearly shown in Figs. 2 and 5. In order to prevent the escape of gas from within the casing into the blast compartment, and also to prevent the air used therein from finding its way into the casing and mixing with the gas, suitable spring pressed packing means such as indicated at 37 is employed. This packing and sealing means is disposed completely around the compartment so as to effectively prevent any commingling of the gas and blast fluid.

A series of nozzles 38 is disposed within the blast compartment at the discharge side of the screen, and connected to the compartment at its opposite side is an aspirator 39 of any suitable construction for creating a partial vacuum within the same. Compressed air is preferably employed as the blast fluid, being led to the nozzles 38 by means of the pipe 40 which is provided with a coiled portion 41 disposed within the conduit 1, in order to preheat the air to substantially the temperature of the gas before reaching the nozzles. By preheating the blast fluid to such extent evaporation or condensation of moisture in the gases themselves or the casing is prevented.

Mounted upon the casing 7 is a pressure cylinder 42 having communication at one end through the pipe 43 with the inlet side thereof. A piston 44 is urged towards the pipe 43 by a spring 45 and its rod 46 is attached to an arm 47 for actuating the contact member 48 of a controller 49 to vary the speed of an electric motor 50 mounted on bracket 19, said motor being connected to the controller by the conductors 51 and 52. The shaft of motor 50 has attached there-

to a pinion 53 meshing with the gear 54 fixed to the extremity of shaft 16.

Access to the interior of the casing, whenever such is necessary, may be had through the manhole 55 provided with a cover plate or door 56. This manhole is sector shaped, as clearly shown in Fig. 3 and is of such size as to admit the ready entry and removal of the screen sections and clamping plates therefor.

Fig. 6 illustrates a modification in which a cylindrical screen is employed. Screen 60 is suitably mounted within the casing 61 to which the gas to be cleaned is conveyed through inlet pipe 62 and exhausted through the outlet 63. The screen passes through the blast compartment 64 which is effectively sealed from the interior of the casing 61 by packing 65. The blast pipe 66 is disposed within the compartment 64 and directs the blast outwardly through the screen into the discharge indicated at 67.

In operation the dust-laden gas is carried by the conduit 1, the valve 2 being closed and valves 5 and 6 being open, through branch pipe 3 into the inlet chamber 11 of casing 7. Due to the impact against the partition 9 and the changed direction of flow a quantity of the heavier particles will fall to the bottom of the inlet chamber and may be removed through the cleaning door 13 from time to time. Due to centrifugal action the heavier particles of dust upon reaching the screen are thrown outwardly and are whirled around in an anti-clockwise direction (Fig. 2) until they are intercepted by the wall formed by the blast compartment and discharged through outlet 30 into the receptacle 31. The inclined surface 35 and the inclination of the wall 33 to the radius of the screen aid in directing and guiding the particles to the outlet 30. It is thus seen that all the larger and heavier particles of dust are removed from any portion of the screen during the time it moves from a point opposite the base portion 8 until it reaches a point opposite the outlet 30. Only the smaller lighter particles are left deposited upon it or lodged between the meshes as it passes within the blast compartment. In passing through the blast compartment all particles remaining on the screen are removed by the blast of compressed air delivered through the nozzles 38. This blast is directed through the screen in a direction opposite to that of the flow of gas so as to effectively remove all particles deposited thereon or adhering thereto. The effectiveness of the blast is enhanced by producing a partial vacuum on the inlet side of the screen by the use of an aspirator 39 by which the particles removed from the screen together with the air for the blast is discharged. By passing every portion of the screen through

the cleaning blast once during each revolution thereof it is maintained clean at all times.

By preheating the air used for the blast before it reaches the nozzles all danger of condensation or evaporation of moisture in the gas is eliminated, and by reason of the sealing of the blast chamber from the interior of the casing escape of gas or commingling of the air with the gas is entirely prevented.

The filtered gas after passing the screens into the outlet chamber 12 finds its way to the branch pipe 4 and back to the conduit 1 through which it passes to the stoves and boilers or other point of use.

There are times when a blast furnace through "slips" and irregularities of working will produce an excessive quantity of dust within a very short period. During such conditions the gas pressure in the mains is increased by the action of the furnace, and in order to provide for such emergencies the pressure controlling device indicated at 42-49 comes into play. During normal operation the pressure within the cylinder 42 keeps the contact arm 48 in a position to maintain the speed of the motor 50 at a point to rotate the screen at a rate sufficient to effect the desirable cleaning action. Should the pressure of the gas increase, the piston 44 is forced towards the right, Fig. 4, thus moving the arm 48 to a position to cause an increase in the speed of operation of the motor, thus effecting a more rapid cleaning of the screen and consequently maintaining its efficiency. Whenever it is necessary or desirable to cut off the flow of gas through the cleaner, as in making adjustments or repairs, all that is necessary is to close the valves 5 and 6, during which times the gas may be passed through the conduit 1 upon opening of valve 2.

The operation of the modification shown in Fig. 6 is obvious from the above description. Compressed air is delivered to the blast pipe 66 and is discharged outwardly through the screen, carrying with it the particles of dust deposited on the exterior thereof into the outlet 67.

It is thus seen that the invention provides a simple, compact, and efficient device for the purpose intended, one in which the screen is continuously cleaned under all the varying conditions of operation, and in which there is no danger of mixing the blast fluid with the gas being cleaned.

I claim:

1. A gas cleaner comprising a casing forming a gas passage, a rigid movable screen arranged in the casing transversely of the flow of gas through it, the wall of the casing being provided with slots through which a portion of the screen extends and is

exposed outside of the casing, means for moving said screen continuously to successively expose all portions of it, and means for directing a blast of cleaning gas through the successively exposed portions of the screen, said cleaning gas being under higher pressure than the gas being cleaned by the screen, and said cleaning gas being directed through the screen in a direction opposite to the flow of the gas being cleaned.

2. A gas cleaner comprising a casing provided with a partition having an opening through it, the casing being further provided with a gas inlet and dust outlet at one side of the partition and a gas outlet at the opposite side thereof, the casing forming a radially disposed compartment arranged between the gas inlet and dust outlet, a rigid rotary screen covering said opening and having a portion of it traversing said compartment, means to continuously rotate the screen to cause it to traverse said compartment, and means within the compartment for directing a cleaning blast through the screen to clean it without commingling the cleaning blast with the gas being cleaned.

3. A gas cleaner comprising a substantially cylindrical casing provided with a partition having a port through it and provided further with a gas inlet and dust outlet at one side of the partition and a gas outlet at the other side thereof, a compartment disposed between the gas inlet and dust outlet formed by the walls of said casing, said walls being provided with slots adjacent to said compartment, a shaft journaled in the casing, a disk screen mounted on the shaft covering said port and having a portion of it traversing said compartment through said slots, means for continuously rotating the shaft and disk attached to it, sealing means between the sides of said slots and disk to cut off communication between the interior of said casing and said compartment, and means for forcing a blast through the compartment to clean said screen without commingling the cleaning gas with the gas being cleaned.

4. A cleaner for removing solid particles from metallurgical furnace gases comprising a casing provided with a passage there-through, a compartment adjacent the passage but sealed therefrom, a movable screen interposed in said passage and traversing the compartment, means for forcing a blast through the compartment to clean the screen, and means for preheating the blast fluid to substantially the temperature of the screen.

5. A cleaner for removing solid particles from metallurgical furnace gases comprising a casing forming a passage for gas, a partition therein provided with an opening, a gas inlet pipe opening into the casing at one side of the partition, a gas outlet pipe leading from the casing at the other side

thereof, a rotary screen covering said opening, a compartment sealed from the interior of the casing and extending therethrough, said screen traversing the compartment, a
5 nozzle for forcing a blast through the screen in the opposite direction to the flow of gas through the screen, and a pipe connected to said nozzle traversing the outlet pipe whereby the fluid for the blast is preheated to substantially the temperature of the gas being
10 cleaned before reaching the nozzle.

6. A gas cleaner comprising a casing provided with a partition having a port there-through, a gas inlet and a gas outlet con-

nected to the casing at opposite sides of the 15 partition, a shaft journaled in the casing, a screened disk fixed to the shaft and covering the opening, a motor for driving the shaft, a controller for varying the speed of said motor, and means responsive to the 20 pressure of gas within the casing at the inlet side of the partition for regulating the speed of the motor.

In testimony whereof, I sign my name.

BENJAMIN J. MULLEN.

Witnesses:

JAMES L. RANKIN,
MARIE OCH.