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GAS CLEANING APPARATUS

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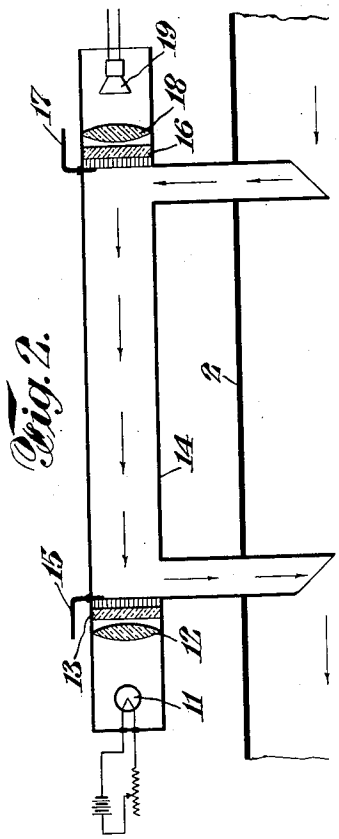


Fig. 2.

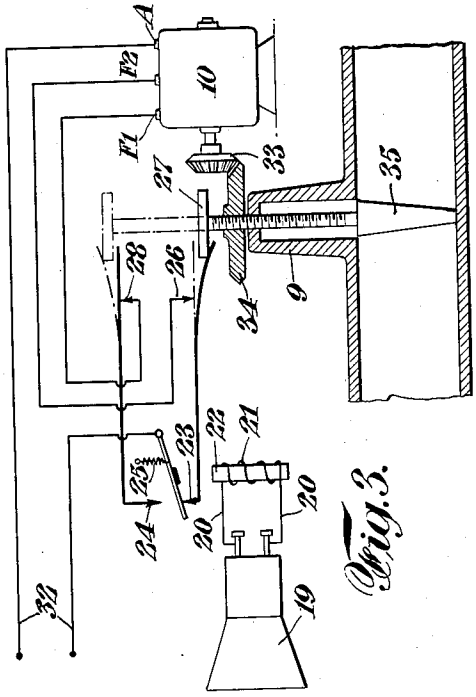


Fig. 3.

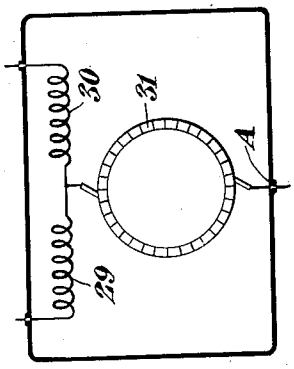


Fig. 4.

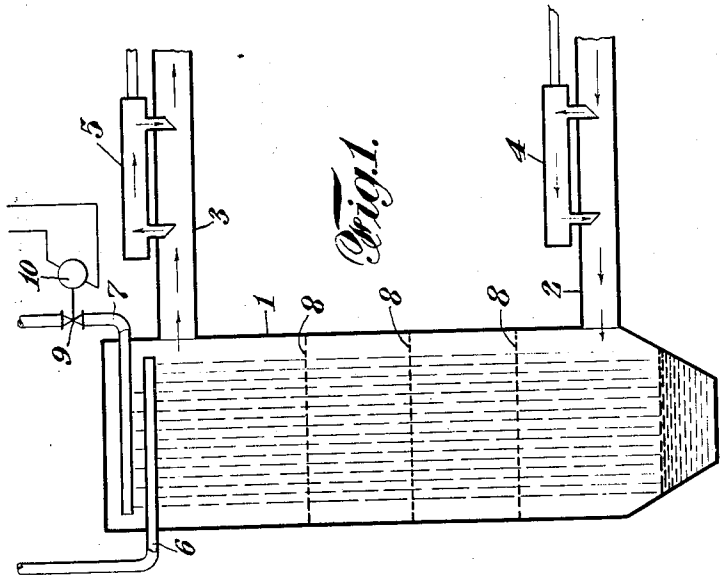


Fig. 1.

INVENTORS
ALFRED WALTER SIMON
LEONARD CAROTHERS KRON
HENRY RAYMOND

ATTORNEYS

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GAS CLEANING APPARATUS

Alfred Walter Simon, Birmingham, Leonard Carothers Kron, Ensley, and Henry Raymond, Pratt City, Ala.

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5 Claims. (Cl. 23—253)

This invention relates to smoke density measuring devices and more particularly to smoke density meters of the radiation type disclosed and claimed in copending application Serial No. 390,634 filed September 5, 1929.

Briefly, the smoke density meter of the above identified copending application comprises a smoke stack, means to project a beam of light through a predetermined distance, means to pass at least a portion of the smoke gases therein through said predetermined distance, and light responsive means energized by the amount of light traversing the distance through the gases to indicate and to record the density of the smoke gases. The amount of light that is transmitted by a column of dust laden gases is dependent upon its dust content.

One of the objects of the present invention is to utilize the transmitted light as a means to automatically operate, regulate or control the action of gas cleaning apparatus.

Another object of the present invention is to improve the operation of gas cleaning apparatus.

Another object of the present invention is to provide means to automatically control and regulate gas cleaning apparatus with respect to the amount of material to be cleaned from the gases.

Other objects and advantages will become apparent as the invention is more fully disclosed.

In accordance with the objects of the present invention we have devised a control and regulating means for gas cleaning apparatus which is energized by the light permeability of the influent or effluent gases of the apparatus. Before further disclosing the nature and scope of the present invention reference should be made to the accompanying drawing wherein:—

Fig. 1 is a schematic sectional side elevation view of a gas cleaning apparatus known to the art as a tower washer.

Fig. 2 is an enlarged sectional view of the gas testing apparatus.

Fig. 3 is a schematic plan view partly in section of a preferred method of controlling and regulating the water input to the tower washer; and

Fig. 4 is a schematic plan view of the internal wiring of an electric motor element included in the diagram of Fig. 3.

Referring to the drawing, Fig. 1, numeral 1 represents the shell of a tower washer, 2 the inlet gas main carrying the dirty gas to the washer, and 3 the outlet gas main carrying the washed gas away from the washer, 4 represents the primary or pick-up end of the control device, 5 an alternative placing of this pick-up end, 6 and 7 suitable sets of water sprays in the top of the washer, 8 grids to break up the water in its fall and increase the cleaning action, 9 a motor-operated water valve, operated by the motor 10.

Referring to Fig. 2, which shows the essential features of the pick-up end, 11 represents a small concentrated filament lamp, 12 a lens which renders the light rays from the lamp approximately parallel, 13 a window thru which the light enters the pipe 14, which carries a representative sample of the gas flowing in the main 2, 15 the blade of a motor-driven wiper to keep the window 13 transparent, 16 a second window thru which the parallel beam of light after having traversed the tube 14 leaves the same, 17 a second wiper to keep the window 16 transparent, 18 a lens which reconcentrates the beam on a light sensitive element 19, such as a thermopile, photoelectric cell, selenium cell, etc., which generates a current of amount dependent on the amount of dust in the gas, since the current generated by the light sensitive element depends on the light falling on it, and this in turn depends on the amount of light getting thru the dust-laden gas, which amount depends in turn on the actual quantity of dust present.

Fig. 3 shows how the current generated by the light sensitive element is made to actuate the water valve 9 thru suitable electrical apparatus. In this figure, 19 represents the light sensitive element as before, 20 the leads which go to the winding 21 of a magnetic relay, of which 22 is the soft iron armature and 23, 24 the contacts. In the normal position when the gas is clean and requires no water, the current thru the winding 21 is large (due to large amount of light getting through) and the armature is held against the contact 23 against the pull of the spring 25. The pull of this spring is made adjustable. However, no circuit is made since the circuit is broken by the open limit switch 26, which is held open by the stem 27 of the (now closed) gate valve 9.

As the gas becomes dirty (and thus requires more water than the one set 6, of sprays, left on continuously, can give it) and at a predetermined dust content (fixed by adjusting the spring 25), the armature springs back and makes the contact 24, thus closing the circuit thru the contact 24, limit switch 28, terminal F_1, and field winding 29 of the motor 10, (the internal wiring of this motor is shown in Fig. 4) thence thru the armature 31 of this motor, thru the terminal A and back to the line 32. The motor 10 is so

wound and connected that if current is passed thru the field 29 the motor turns in one direction, namely, such as to open the valve 9, while if it is passed thru the winding 30, the motor rotates in the opposite direction, thus closing the valve 9. This is accomplished by winding two field windings on the motor poles in opposite directions.

Having made the circuit just described, the motor starts and sets in rotation the bevel gear 33, which in turn rotates the bevel gear 34 causing the stem valve 27 and gate 35 to rise, the stem 27 being threaded into the bevel gear 34. The stem continues to rise until it opens the limit switch 28, thus opening the circuit and stopping the motor. The valve gate 35 is thus fully opened and water admitted to the set 7, of sprays.

As the stem 27 left the lower position, the limit switch 26 was allowed to close. The valve gate 35 thus remains open as long as the dust content of the incoming gas exceeds the predetermined value, the set 7, of sprays being left on the while. When the dust content of the incoming gas drops below the fixed value, the current thru the relay winding 21 reaches a value where the pull on the armature 22 exceeds the pull of the spring 25 and contact is made at 23. The limit switch 26 being now closed, the circuit is made thru the terminal F_2 and winding 30, causing the motor 10 to close the valve until the limit switch 26 breaks the circuit, and leaves the valve gate 35 closed, cutting off the extra set 7, of water sprays.

While we have shown only one set of additional sprays, in practice, of course, one or more may be used depending on the extent of the fluctuations in dust content and water to be saved. When more than one set of sprays is used the current from the sensitive element is passed thru the windings of as many relays as there are sets of sprays, each relay being set to disengage at a proper dust content.

In the particular application just described, the pick-up end was installed on the inlet gas main and the water regulation carried out in accordance with the amount of dust in the inlet gas. An alternative arrangement is to put the pick-up end in the outlet gas main and carry out the regulation on the basis of the dust content of the clean gas. The latter is an advantage in the case of a system of gas cleaners, where if one of the system broke down or worked inefficiently, the efficiency of the remainder could automatically be raised to compensate for it. By means of this alternative (outlet) end pick-up installation it would also be possible to hold the outlet gas below a definite maximum value by arranging the relays to supply continually more water until this value is reached.

In place of the relay shown, in which the magnetic pull is balanced by means of a spring 25, it would, of course, be better to use a so-called galvanometer type of relay.

While we have shown an ordinary tower washer, it is of course understood that the device would work equally well with the centrifugal type of wet-washer, such as the so-called Theissen washer, or any other type of wet-washer.

Another application would be to the process of conditioning of the gas entering a Cottrell cleaner, which consists in spraying a liquid into the gas before it enters the Cottrell cleaner, usually water, although tar, oil, etc., can also be used. The present device can, of course, be used to regulate the supply of these liquids exactly in accordance with the instantaneous requirement of the dirty gas.

Also, while we have shown the motor with two fields, a single field motor could also be used, the current thru either field or armature being reversed by a suitable system of relays actuated by the current from the thermopile.

It is apparent that there may be many adaptations and modifications made in the specific embodiment herein disclosed without departing essentially from the nature and scope of the same, and such modifications and departures are anticipated as fall within the scope of the following claims.

What is claimed:

1. In combination, gas cleaning apparatus including a tower washer, means to spray water through said tower, conduit means to conduct gases to be cleaned into and out of said tower, a smoke density meter disposed in at least one of said gas conduit means, and means actuated by said meter device to vary the volume of water sprayed through said tower washer in response to variations in the density of smoke passing through said meter device.

2. In the combination described and claimed in claim 1, a smoke density meter of the radiation type including a source of radiation, a radiation sensitive element, means to support said source of radiation and said radiation sensitive element in determined and spaced relationship, means to project radiation from said source upon said radiation sensitive device, means to bypass gas from said gas conduit means between said spaced source of radiation and radiation sensitive device and through said projected radiation, and means to utilize the current flow of said radiation sensitive device to actuate mechanism operative to control the volume of water sprayed in said tower washer.

3. In the combination described and claimed in claim 1, means actuated by the meter device to vary the volume of water in said tower washer in response to variations in the density of smoke passing through the meter device, said means comprising an electromagnet electrically connected in series with said meter device to be energized thereby, a pivotally connected contact element spring supported to maintain one electrical circuit closed and positioned with respect to said electromagnet to be moved from said spring supported position to close a second electrical circuit upon energization of said electromagnet by a current flow from said meter device, a reversible motor in series with each circuit, the drive shaft of said motor being geared to a valve controlling the flow of water to said tower washer, and means actuated by said valve at the termination of a determined degree of rotation upon energization of said motor by the closing of either of said circuits by said contact element to automatically open the said energizing circuit.

4. In the combination described and claimed in claim 1, means to vary the volume of water sprayed in said tower in response to variations in the density of gases flowing therethrough, said means comprising a radiation responsive element energized by radiation passing through a known portion of the gases being cleaned, the electric current generated therein being utilized to energize electromagnetic means, a movable contact element adapted to close one electric circuit in rest position and adapted to be displaced therefrom to contact with a second elec-

trical circuit in response to the electromagnetic current in said electromagnetic means, adjustable tension means to resist the displacing of said contact member from its rest position, a reversible field wound motor energized by the current flow in said two electric circuits, valve means to control the volume of water flowing to said spray tower and means to operatively connect the armature of said motor to said valve means to open and close the said valve in response to energization of said motor.

5. In the combination described and claimed in claim 1, means to vary the volume of water sprayed in said tower in response to variations in the density of gases flowing therethrough, said means comprising a radiation responsive element energized by radiation passing through a known portion of the gases being cleaned, the electric current generated therein being utilized to energize electromagnetic means, a movable contact element adapted to close one electric circuit in rest position and adapted to be displaced therefrom to contact with a second electrical circuit in response to the electromagnetic current in said electromagnetic means, adjustable tension means to resist the displacing of said contact member from its rest position, a reversible field wound motor energized by the current flow in said two electric circuits, valve means to control the volume of water flowing to said spray tower and means to operatively connect the armature of said motor to said valve means to open and close the said valve in response to energization of said motor and means to automatically break the circuit energizing said motor when the said valve has been opened and closed a determined amount.

ALFRED WALTER SIMON.
LEONARD CAROTHERS KRON.
HENRY RAYMOND.