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(54) **A device for additional cleaning of dustladen medium, which to some extent has already been cleaned in an electrostatic presipitator.**

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CH-A- 369 750
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DE-A-2 441 233
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Description

TECHNICAL FIELD

The present invention relates in particular to an apparatus as stated in the preamble of claim 1.

In accordance with the invention means are provided which enable part of the medium cleansed in the precipitator to be recycled therein and/or further cleansed in a separate cleaning device herefor, preferably a separate filter.

BACKGROUND ART

Various types of apparatus intended for further cleansing of a dustladen medium which has already been partially cleaned in an electrostatic precipitator are known to the art.

It is also known that the medium cleansed in an electrostatic precipitator will stratify as it leaves the precipitator and passes through an outlet connected thereto, therewith to form different flow layers or layers of varying dust concentration, in which the layer containing the most dust is located in the lowermost parts of the outlet, while layers of lower dust concentration become oriented above this lowermost layer, and consequently the layer located in the uppermost part of the outlet will have a low dust concentration.

Consequently, in order to further cleanse the dustladen medium already partially cleansed in the electrostatic precipitator it has been proposed in DE—A—1457095 that the lower part of the outlet is given the form to transport continuously a dust laden medium to a further separator.

The apparatus illustrated and described in German Patent Specification 314 171 also forms part of the prior art, in which apparatus part of the rapped down dust is removed through specially constructed ducts arranged in the immediate vicinity of two collecting or passive electrodes. As will be understood, when the collecting electrodes are rapped, a large quantity of dust is liable to be carried through these ducts.

Also forming part of the this art is the arrangement illustrated and described in the Swiss Patent Specification 369 750, comprising a mechanical separator which is connected to a connecting conduit and in which a major part of the dust is extracted. In order to be able to extract all the dust contained by the gas, that part of the gas leaving the mechanical separator can be passed back to the inlet through a re-cycling conduit. The process is a continuous process.

Finally, it can be mentioned that the present state of this art also includes the arrangement illustrated and described in the German Offenlegungsschriften 2 442 233, in which there is located beneath each collecting electrode a specific arrangement capable of either returning dust to the inlet of the electrostatic precipitator or of feeding said dust to a separate dust collector.

SUMMARY OF THE PRESENT INVENTION

TECHNICAL PROBLEM

With reference to the present state of this art one technical problem is of providing conditions which enable said further cleansing of the partially cleansed dustladen medium to be carried out during those periods of time and during such periods as those at which particularly high dust concentrations can be expected or are present.

A further technical problem is one of providing conditions which enable as little of the medium cleansed in the precipitator to be re-cycled therein, thereby to increase the efficiency of the precipitator, or to be supplied to a separate filter. Another technical problem in this art is one of providing conditions which enable emission to be decreased or minimized by cleansing and handling in a separate or special cleansing device, preferably a separate filter, as small a percentate of high dust concentration as possible of the medium cleansed in the precipitator.

Another technical problem in this respect is one of providing conditions such that when the dustladen medium cleansed in the precipitator stratifies, in simple fashion, in an outlet connected to the precipitator, a layer of high dust concentration can be separated, with the aid of simple means, from a layer of lower dust concentration, so that the percentage of medium removed from the outlet has truly a high concentration of dust.

Another technical problem is one of enabling in existing plants further cleansing of a medium which has already undergone a cleansing process, with the aid of simple means.

A further technical problem in this art is to provide conditions such that the measures taken will not adversely affect the aerodynamic properties of the precipitator. A still more complicated technical problem is one of providing conditions which enable a medium containing large quantities of dust to be taken-out discontinuously, normally periodically, and then only during those time durations when high dust concentrations are present and/or can be expected to occur.

SOLUTION

The present invention now provides an apparatus which enables further cleansing of a dustladen medium which has already been cleansed to some extent in an electrostatic precipitator as stated in the preamble of claim 1.

The invention is particularly suited for application in those electrostatic precipitators provided with a tapering outlet section.

In accordance with the invention arranged in the upwardly sloping lower part of the outlet section, as seen in the direction of flow, is one or more openable outlets, which enable a percentage of partially cleansed medium to be taken-out through the outlet discontinuously over those time periods in which high dust concentrations prevail and/or are to be expected.

It is also proposed in accordance with the

invention that the percentage of medium removed is suitably at most 10% of the total flow of medium passing through the outlet, preferably at most 5%.

It is also proposed in accordance with the invention that with respect to a layer in which the dust concentration varies in the horizontal plane the percentage of medium removed is taken from that part or those parts or regions where a high dust concentrations prevail and/or can be expected to prevail. This quantity can then be removed through one or more openable and closeable outlets selected from a number of such outlets arranged side by side.

When rapping a flat electrode, the outlet located adjacent this electrode is caused to open in response thereto. This opening of the outlet may be delayed for a time period equal to, or slightly less than the time taken for the particles to move from the rapped electrode to the openable outlet in question.

ADVANTAGES

The advantages primarily afforded by an apparatus according to the present invention reside in the possibility of being able to further cleanse in a simple manner a dustladen medium which has already been cleansed to some extent in an electrostatic precipitator, and in conjunction herewith to adapt this further cleansing of the medium to those periods and over those time durations determinative of those process periods at which high dust concentrations prevail or are expected to prevail in the medium cleansed in the precipitator.

BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment of the invention at present preferred and exhibiting the characteristic features of the invention will now be described in more detail with reference to the accompanying drawing, in which:

Figure 1 is a perspective view of a plant comprising a plurality of electrode groups arranged in a flue gas chamber, and illustrates in an exploded view above the electrodes one of a number of transformer/rectifier units intended to serve a respective electrode group;

Figure 2 illustrates in side view and in section an outlet which forms part of the precipitator and which has connected thereto means which enable further cleansing of a partially cleansed dustladen medium, in accordance with the invention;

Figure 3 illustrates in side view and in section an alternative embodiment of the outlet illustrated in Figure 2, provided with means for enabling further cleansing of a partially cleansed dustladen medium, in accordance with the invention; and

Figure 4 is a horizontal sectional view through the precipitator and its outlet.

DESCRIPTION OF A PREFERRED EMBODIMENT

In Figure 1 there is illustrated in perspective an embodiment of an electrostatic precipitating plant 1, comprising a plurality of mutually parallel chambers, each provided with four electrode groups. Each of these electrode groups requires the provision of a transformer/rectifier unit. In the Figure 1 illustration, however, only one such unit has been shown, this unit being intended for the electrode group 2 and being referenced 3. In practice, the electrode groups are positioned so that the outlet of one group is connected directly to the inlet of a subsequent group, etc. Since the electrode group 2 of the illustrated embodiment constitutes the last group in the electrode-group array, the outlet of this group is connected to a chimney 4.

It will be understood that although the illustrated precipitator is shown to comprise a plurality of electrode groups, there is nothing to prevent each electrode group from forming part of an individual electrostatic precipitator.

The electrostatic precipitator plant 1 is of the kind in which a dustladen medium is introduced to an inlet 5 and caused to pass into the first group of electrodes, this dustladen medium normally being dustladen air although, as will be understood, said medium may also comprise some other dustladen gas or gaseous mixture, and primarily dustladen flue gas. When passing this electrode group, and also other electrode groups, the particles carried by the medium are electrically charged by the electric field generated by mutually ajacent collecting electrodes and emission electrodes arranged therebetween, by applying a high direct-current voltage to the emission or discharge electrodes. A dust particle entering this field becomes negatively charged electrically and will then be attracted to the positive collector electrode and repelled by the negative discharge electrode, thereby causing a collection of particles to accumulate primarily on the collector electrodes. The air progressively cleansed during its passage through the sequence of electrode groups then passes out through the outlet 5a and enters the chimney 4.

Under the influence of the aforesaid electric field electrically charged particles of dust will collect mainly on the plates of the flat collecting electrodes, to form a coating thereon. When this coating had reached a given thickness, the coating is shaken or rapped from the plates mechanically, and falls downwardly therefrom. The particles accumulated in the precipitator 2 will therefore normally collect in collecting hoppers or some other particle-collecting unit provided in the bottom part 2a of the precipitator.

The medium cleansed in the precipitator is arranged to exit therefrom through a funnel-shaped outlet 6.

As is well known, a dustladen medium which passes through an electrostatic precipitator will only be cleansed to a certain extent, and consequently the medium passing through the outlet still contains dust, i.e. has only partially been cleansed.

Under normal conditions it is accepted that the medium passing through the outlet will contain a

certain amount of dust. It is also known that the dustladen medium will stratify in the outlet 6 to form layers of varying dust concentration, such that the concentration of dust in the lower part 7 is much higher than the dust concentration of layers located thereabove, while a layer located in the upper part 8 will have but low dust concentration.

Practical experience has shown that a layer located immediately adjacent the bottom part 6a contains far more dust than a layer located only some centimeters thereabove.

As beforementioned, the plates are rapped mechanically as soon as the dust coating thereon reaches a given thickness, this dust coating then falling down into the bottom part 2a of the precipitator.

It will readily be understood that this method greatly increases the concentration of dust in the medium passing through the outlet during that period of time in which the plate is rapped, and that it would be to advantage to further cleanse during solely this period of time, the dustladen medium which has already been partially cleansed in the precipitator.

This advantageous further cleansing of the medium is effected in accordance with the invention by recycling in the precipitator part of the medium cleansed therein and/or removing part of said medium and cleaning the same in a separate cleaning device herefor, preferably a separate filter.

When turning to Figure 2 it will be seen that the bottom part 6a of the outlet has connected thereto one or more pipes 10 which communicate with a respective pipe 12 through a fan means 11. The pipe 12 can either be connected to the inlet 5 or to a location in the vicinity of said inlet. Alternatively, the pipe 12 may be connected by means not shown to a filter, also not shown. This filter may advantageously comprise a separate low-capacity filter. The pipe 10 is closed when the fan is stationary.

According to the present invention, the percentage of medium removed is taken from a layer of relatively high dust concentration, and consequently the lower part of the exiting, partially cleansed medium is chosen for this purpose.

The fan 11 may be controlled by a control means 14, through a conductor 13, so that the removal of said medium takes place periodically and over time periods or durations at which high dust concentrations prevail and/or can be expected to occur. For example, the control means 14 can be controlled by a signal passed through a conductor 15 when mechanical rapping of the flat collector electrodes takes place, and the control means 14 may incorporate a delay circuit which, when activated, causes dustladen medium to be removed from the outlet throughout a predetermined period of time.

The speed at which the fan operates is controlled by the control means 14 in response to a signal sent by a known opacity meter 16 through a conductor 17, such that when the medium in the vicinity of the opacity meter 16 contains large quantities of dust the fan speed will increase, and will decrease when the dust concentrations in the vicinity of said meter are low, in response to applicable signals from said meter. This enables the dust concentration to be corrected or regulated.

As will be understood, the control means 14 can be adapted to control the fan 11 in dependence on other parameters such as the dust concentration sensed in the inlet 5 for example in response to signals sent through a conductor 18 and to prepare for further cleansing of the dustladen medium leaving the precipitator through the outlet when the amount of dust contained by the medium entering the precipitator exceeds the separating capacity of the electrostatic precipitator.

The control means 14 may suitably incorporate control funcitons which are effective to recycle the medium when conditions in the electrostatic precipitator are such as to enable further cleansing to be carried out, and which in the absence of such conditions cause this further cleansing of the medium to be effected in a separate filter.

Figure 3 illustrates in side view and in section an alternative outlet to the outlet illustrated in Figure 2, said alternative outlet being provided with means for enabling, in accordance with the invention, further cleansing of a partially cleansed dustladen medium.

Connected to the bottom part 6a of this alternative outlet means is a number of mutually adjacent hoppers 20, 21, 22, of which only one is shown in Figure 3. Located in the lower part of respective hoppers is a valve 23 through which medium containing large quantities of dust is allowed to pass. A discharge pipe 24, similar to the pipe 10 of the Figure 2 embodiment, is connected to the hopper, in the manner illustrated in Figure 2.

The electrostatic precipitator 1 is provided with a plurality of flat collector electrodes, of which only a few are shown, these electrodes being referenced 30, 30a, 30b and 31, 31a, 31b.

When the collector electrode 31 is rapped, dust collected thereon will fall downwardly, although part of this dust will accompany the flow of medium towards the outlet 6. In this case it may be suitable to open solely the valve co-acting with the hopper 21 and to deflect a part of the medium which has a high dust concentration.

Those parts of the medium removed correspond at most to 10% of the total medium flow through the outlet, preferably at most 5%.

This part of said medium is preferably removed over a time duration of at most 5%.

Rapping of certain flat collector electrodes results in a layer in which dust concentration varies in the horizontal plane, and it is proposed that the aforesaid part of said medium is removed from that part or those parts in which a high dust concentration prevails and/or is expected to occur.

This part of the medium flow is advantageously removed through one or more of a plurality of

openable and closeable outlets arranged in side-by-side relationship. These outlets may also be controlled by the control means 14.

The arrangement is such that when a flat collector electrode is rapped, the outlet located adjacent thereto is opened. This opening of the outlet may be slightly delayed, suitably by a delay time slightly shorter than the time taken for the particles shaken from the electrode to move to the openable outlet.

As will be understood, the control means of the Figure 2 embodiment may also have the form of the control means of the Figures 3 and 4 embodiments. The flow rate of the dustladen medium through the precipitator is calculated by means not shown, and the relevant delay time between the rapping of respective flat collector electrodes and the opening of one or more outlets is calculated in the control means.

It will be understood that the invention is not restricted to the aforedescribed embodiments, given by way of example only, and that modifications can be made within the scope of the invention defined in the following claims.

Claims

1. An apparatus for further cleansing a dustladen medium which has already been cleansed to some extent in an electrostatic precipitator (1), comprising means for recycling in the precipitator part of the medium partially cleansed therein and/or means for cleansing said part of said medium in a separate cleaning device, preferably a separate filter, and in which the precipitator (1) is provided with a tapering outlet means (6), characterized in that located in the upwardly sloping lower part (6a) of the outlet section (6), as seen in the flow direction, are one or more openable outlets (10); in that the said part of said partially cleansed medium is removed through the outlet (10) discontinuously over those periods of time in which a high dust concentration (7) prevails and/or is expected to prevail.

2. An apparatus according to Claim 1, characterized in that the amount of medium removed is at most 10% of the total medium flow through the outlet, preferably at most 5%.

3. An apparatus according to Claim 1, characterized in that in dust concentrations varying within different layers (7, 8) in the horizontal plane that part of the medium flow removed is taken from the part or parts at which high dust concentration (7) prevails and/or is expected to prevail.

4. An apparatus according to Claim 1 or Claim 3, characterized in that said part of the medium flow is removed through one or more of a plurality of openable and closeable outlets (20, 21, 22) arranged in side-by-side relationship.

5. An apparatus according to Claim 4, characterized in that when rapping a flat collector electrode the outlet (20, 21 or 22) located adjacent thereto or the outlet located downstream of the electrode in the flow direction of the medium is opened.

6. An apparatus according to Claim 5, characterized in that opening of the said outlet (20, 21 or 22) is delayed from the time of rapping one or more collector electrodes for a period of time of slightly shorter duration than the time taken for the particles to move from a rapped electrode to the openable outlet (20, 21 or 22).

Patentansprüche

1. Eine Vorrichtung zur komplettierenden Reinigung eines staubgeladenen Mediums, das schon in einem gewissen Umfang in einem elektrostatischen Abscheider (1) gereinigt wurde, umfassend Vorrichtungen, mit deren Hilfe im Abscheider ein Teil des dort bereits teilweise gereinigten Mediums in Kreislauf zurückgeführt werden kann, und/oder Vorrichtungen, mit deren Hilfe der genannte Teil des genannten Mediums in einer separaten Reinigungsvorrichtung, vorzugsweise in einem separaten Filter, gereinigt werden kann, und wobei der Abscheider (1) mit einer konisch zulaufenden Austrittsvorrichtung (6) ausgestattet ist, dadurch gekennzeichnet, daß im mit Neigung nach oben ausgeführten unter Teil (6a) des Austritts (6), in Fließrichtung gesehen, ein oder mehrere Austritte (10), die sich öffnen lassen, vorgesehen sind; daß der genannte Teil des genannten, teilweise gereinigten Mediums diskontinuierlich durch den Austritt (10) während derjenigen Zeitspannen abgezogen wird, in denen eine hohe Staubkonzentration (7) vorliegt und/oder mit dem Vorliegen einer solchen Konzentration zu rechnen ist.

2. Eine Vorrichtung gemäß Anspruch 1, dadurch gekennzeichnet, daß die Menge des abgezogenen Mediums höchstens 10% des gesamten Medienstroms, der den Austritt durchströmt, vorzugsweise jedoch höchstens 5% beträgt.

3. Eine Vorrichtung gemäß Anspruch 1, dadurch gekennzeichnet, daß bei Staubkonzentrationen, die innerhalb verschiedener Schichten (7, 8) in horozontaler Ebene variieren, derjenige Teil des abgezogenen Medienstroms demjenigen Teil oder denjenigen Teilen entnommen wird, bei denen eine hohe Staubkonzentration (7) vorliegt und/oder mit einer solchen Konzentration zu rechnen ist.

4. Eine Vorrichtung gemäß Anspruch 1 oder Anspruch 3, dadurch gekennzeichnet, daß der genannte Teil des Medienstroms durch einen oder mehrere einer Vielzahl von Austritten (20, 21, 22), die sich öffnen und schließen lassen und nebeneinander angeordnet sind, abgezogen wird.

5. Eine Vorrichtung gemäß Anspruch 4, dadurch gekennzeichnet, daß, wenn eine flache Sammelektrode freigeklopft wird, der direkt daneben angeordnete Austritt (20, 21 oder 22) oder, in Medienfließrichtung gesehen, der hinter der Elektrode angeordnete Austritt geöffnet wird.

6. Eine Vorrichtung gemäß Anspruch 5, dadurch gekennzeichnet, daß das Öffnen des genannten Austritts (20, 21 oder 22), gerechnet von Zeitpunkt des Freiklopfens von einer oder

mehreren Sammelektroden, um eine Zeitspanne verzögert wird, die geringfügig kürzer als diejenige Zeitspanne ist, die die Partikel benötigen, um sich von einer freigeklopften Elektrode zum Austritt (20, 21 oder 22), der sich öffnen läßt, zu bewegen.

Revendications

1. Dispositif pour l'épuration additionelle d'un fluide poussiéreux qui a déjà été épuré jusqu'à un certain point dans un dépoussiéreur électrostatique (1), comprenant des moyens pour recycler dans le depoussiéreur une fraction du fluide partiellement épuré dans celui-ci et/ou des moyens pour épurer ladite fraction dudit fluide dans un appareil d'épuration séparé, de préférence un filtre séparé et dans lequel le dépoussiéreur (1) est pourvu de moyens de sortie (6) de section dégressive, caractérisé en ce qu'il y a, disposées dans la partie inférieure (6a), inclinée vers le haut du tronçon de sortie (6), vu dans la direction de l'écoulement, une ou plusieurs sorties (10) pouvant s'ouvrir; et en ce que ladite fraction dudit fluide partiellement épuré est prélevée à travers la sortie (10) de manière discontinue pendant des périodes de temps où une haute concentration en poussières (7) existe et/ou est susceptible de se produire.

2. Dispositif suivant la revendication 1, caractérisé en ce que la quantité de fluide prélevée est au maximum 10% du courant total de fluide à travers la sortie, et de préférence au maximum 5%.

3. Dispositif suivant la revendication 1, caractérisé en ce que, dans des concentrations en poussières variant à l'intérieure de différentes couches (7, 8) dans le plan horizontal, la fraction du courant de fluide prélevée est tirée de la partie ou des parties où une haute concentration en poussières (7) existe et/ou est susceptible de se produire.

4. Dispositif suivant la revendication 1 ou la revendication 3, caractérisé en ce que ladite fraction du courant de fluide est prélevée à travers une ou plusieurs d'une pluralité de sorties (20, 21, 22) pouvant s'ouvrir ou se fermer, disposées côte à côte.

5. Dispositif suivant la revendication 4, caractérisé en ce que, lorsque l'on secoue une électrode collectrice plate, la sortie (20, 21 ou 22) située à proximité de celle-ci ou la sortie située en aval de l'électrode dans le sens du courant de fluide s'ouvre.

6. Dispositif suivant la revendication 5, caractérisé en ce que l'ouverture de ladite sortie (20, 21, 22) est retardée par rapport à l'instant du secourage d'une ou de plusieurs électrodes collectrices, d'une période de temps d'une durée légèrement plus courte que le temps requis pour que les particules provenant de l'électrode secouée parviennent à la sortie (20, 21 ou 22) à ouvrir.

Fig.1

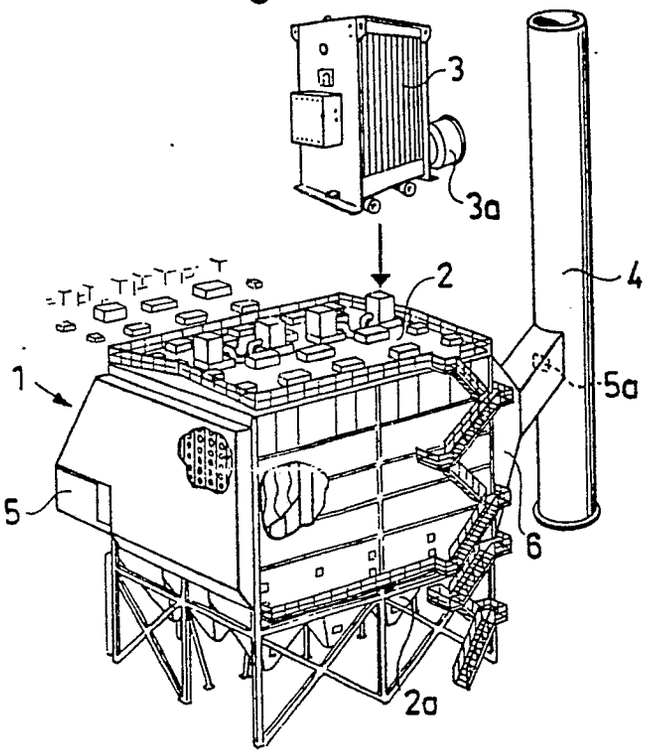


Fig. 2

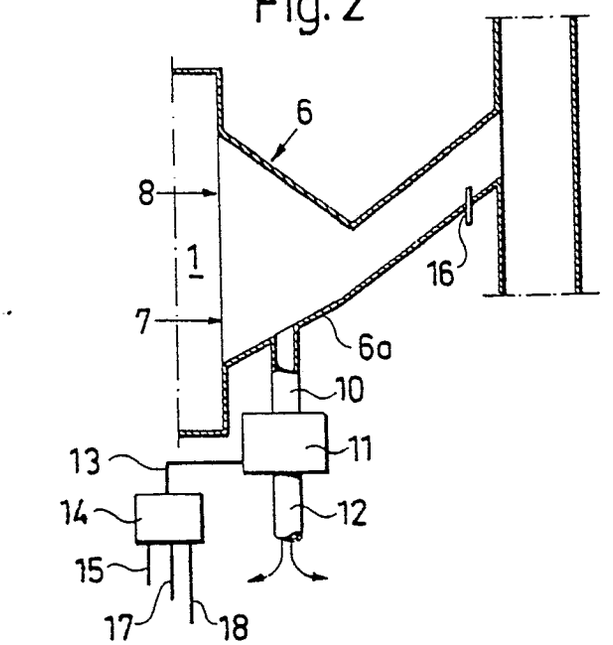


Fig. 3

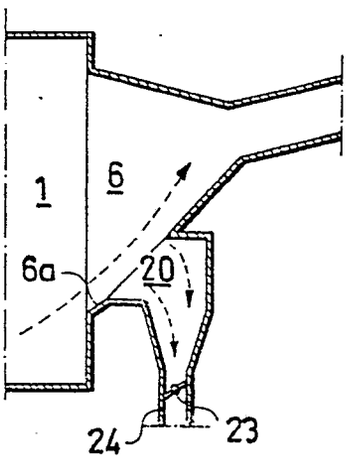


Fig. 4

