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D E C I S I O N
of 9 July 1996

Case Number: T 0157/95 - 3.2.3

Application Number: 91902076.8

Publication Number: 0458955

IPC: B03C 3/14

Language of the proceedings: EN

Title of invention:

Compact Hybrid Particulate Collector (COHPAC)

Applicant:

Electric Power Research Institute

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (yes after amendment)"

Decisions cited:

-

Catchword:

-



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Boards of Appeal

Chambres de recours

Case Number: T 0157/95 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 9 July 1996

Appellant:

ELECTRIC POWER RESEARCH INSTITUTE, INC
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Representative:

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Decision under appeal:

Decision of the Examining Division 2.3.13.113 of
the European Patent Office posted 11 October 1994
refusing European patent application
No. 91 902 076.8 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: F. E. Brösamle
Members: H. Andrä
L. C. Mancini

Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal on 20 December 1994 - paying the appeal fee on the same day - against the decision of the Examining Division of 11 October 1994 to refuse European application No. 91 902 076.8. The Statement of Grounds of Appeal was received on 1 February 1995.

The Examining Division had expressed the view that the claims underlying its decision lacked inventive step in the light of

(D3) W.B. Smith et al "INTERNATIONAL CONFERENCE ELECTROSTATIC PRECIPITATION", October 1981, Pittsburgh, US, pages 83-106: "Electrostatic Enhancement of Fabric Filter Performance".

In the oral proceedings held before the Examining Division on 27 September 1994 the documents

(D1) "Air Pollution Engineering Manual", Air & Waste Management Association, page 12, and

(D2) "Proceedings: Tenth Particulate Control Symposium and Fifth International Conference on Electrostatic Precipitation", by Southern Research Institute, Birmingham, Alabama, pages 6.1 - 6.6

were discussed.

The International Search Report is based on

(D5) US-A-1 853 393

and the Supplementary European Search Report comprises

(D4) FR-A-877 722.

II. The appellant requests to set aside the impugned decision and to grant a patent on the basis of Claims 1 to 9 - according to the 4th auxiliary request filed with letter of 27 June 1996 - as the single request, in combination with pages 1, 7 and 9 to 11 as originally filed, pages 2 to 6 and 8 submitted in the oral proceedings before the Board held on 9 July 1996, and with the two drawing sheets as originally filed.

III. Claims 1 and 5 of the above request read as follows:

"1. A method of removing particulates from a flue gas comprising the steps of:

 flowing said flue gas through an electrostatic precipitator (34) which imparts a residual electric charge on remaining particulates exhausted from said electrostatic precipitator in said flue gas;

 flowing said flue gas through a barrier filter (44) placed downstream of said electrostatic precipitator (34); said barrier filter being placed in the proximity of the electrostatic precipitator to receive said remaining particulates;

 said barrier filter (44) collecting the charged particulates exhausted from said electrostatic precipitator (34);
characterised in that

 said electrostatic precipitator removes 90-99% (not including 90%) of said particulates,

 said barrier filter (44) is adjusted in size to filter the flue gas at a high filtration velocity in the range of from 4.06-20.32 centimeters per second (8-40 feet per minute), and

said residual electric charge on the remaining particulates is maintained by said flue gas flowing from said electrostatic precipitator (34) to said barrier filter (44) passing along an electrically insulated duct (38) to prevent the charge to particles in the flue gas from discharging before collection in the barrier filter."

and

"5. A method for retrofitting the filtering of particulates in a flue gas from a combustion source having an existing electrostatic precipitator connected to a smoke stack by way of a duct comprising the steps of:

inserting a barrier filter (44) downstream of said electrostatic precipitator (34) for collecting particulates exhausted from said electrostatic precipitator in said flue gas, said barrier filter being positioned in close proximity to said electrostatic precipitator for receiving said particulates exhausting from said electrostatic precipitator; characterised in that

the electrostatic precipitator removes 90-99% (not including 90%) of the particulates and said barrier filter being sized to maintain a filtration velocity of flue gas through said barrier filter in the range of from 4.06-20.32 centimeters per second (8-40 feet per minute), and

said residual electric charge on the remaining particulates is maintained by said flue gas flowing from said electrostatic precipitator (34) to said barrier filter (44) passing along an electrically insulated duct (38) to prevent the charge to particles in the flue gas from discharging before collection in the barrier filter."

IV. Appellant's essential arguments in the oral proceedings in respect of the above request can be summarised as follows:

- prior art apparatuses for removing particulates from a flue gas operate at low filtration velocities and are therefore large, require significant space, are costly to build and unattractive as replacements for existing precipitators;
- increasing the filtration velocities leads to an increased pressure drop across the barrier filter;
- there is no incentive in the prior art to envisage higher filtration velocities and (D3) as the nearest prior art document discloses in its Table 2 only 10,4 feet per minute as the highest filtration velocity if "felted Nomex" is used as filter material; from Table 3 last line of (D3) it can be seen that a filtration velocity of 9,1 feet per minute leads to a pressure drop of 18.0 inches of water which is unacceptably high;
- a skilled person had to overcome therefore a prejudice against the application of higher filtration velocities;
- the present invention seeks to reduce the size of filter that can be used in new and existing installations employing precipitators;
- the teaching of Claims 1 and 5 is based on a high filtration efficiency in the electrostatic precipitator, on a high filtration velocity due to adjusting the size of the barrier filter and on maintaining a residual electric charge of the

particulates entering the barrier filter *inter alia* by the provision of an electrically insulated duct between the electrostatic precipitator and the barrier filter;

- since the claimed barrier filter is highly efficient and smaller than in the prior art it can retrofit known barrier filters;
- the subject-matter of Claims 1 and 5 has therefore to be seen as inventive so that the patent should be granted on the basis of documents defined in above paragraph II.

Reasons for the Decision

1. The appeal is admissible.
2. *Amendments*
 - 2.1 Claim 1 is based on all features of originally filed Claim 1 plus the features disclosed in originally filed Figure 1 and page 6, lines 26 to 37, namely maintaining the electric charge on the remaining particulates by providing an electrically insulated duct between the electrostatic precipitator and the barrier filter.
 - 2.2 Claims 2 to 4 correspond to originally filed Claims 2 and 3 and essentially to Claim 4.
 - 2.3 Claim 5 is based on all features of originally filed Claim 5 plus the feature disclosed in Figure 1 and page 6, lines 26 to 37 as originally filed, i.e. maintenance of the electric charge on the remaining

particulates and provision of an electrically insulated duct between the electrostatic precipitator and the barrier filter.

2.4 Claims 6 to 9 correspond to originally filed Claims 6 to 9.

2.5 As a consequence of the foregoing observations Claims 1 to 9 are not open to objections under Article 123(2) EPC.

3. *Novelty*

Novelty was not disputed by the Examining Division and by the Board so that this issue needs no further argument since Claims 1 and 5 were restricted in the appeal proceedings by incorporating still further features.

4. *Inventive step*

4.1 Nearest prior art:

(D3) has to be seen as the nearest prior art document. From (D3) it is known to employ a precipitator removing up to 90% of particulates by a baghouse. However, this reference is principally concerned with observing pressure drop across a filter and discloses that if gas stream velocity through the filter is increased, an unacceptable large pressure drop occurs at the filter resulting in the necessity to use an unacceptable large filter.

4.2 The present invention seeks to reduce the size of filter that can be used in new and existing installations employing precipitators.

4.3 The above object of the invention is solved with features of Claim 1 (method of removing particulates from a flue gas) and Claim 5 (method for retrofitting the filtering of particulates in a flue gas from a combustion source having an existing electrostatic precipitator) in that the electrostatic precipitator removes 90 to 99% of the particulates, in that the barrier filter is adjusted in size so that a filtration velocity between 4,06 to 20,32 centimeters per second is obtained, whereby the residual electric charge is maintained until the particulates reach the barrier filter. The duct between the electrostatic precipitator and the barrier filter according to Claims 1 and 5 is an electrically insulated duct to prevent discharging before collection in the barrier filter.

4.4 By these features of Claims 1 and 5 an efficiency of precipitation of up to 99% is achieved in the electrostatic precipitator and the size of the barrier filter can be reduced considerably due to the existence of filtration velocities up to 20,32 centimeters per second. The efficiency of the barrier filter is also enhanced by maintaining the electric charge of the particulates until they enter the barrier filter. This is achieved partly by the electrically insulated duct between the electrostatic precipitator and the barrier filter and partly by their close neighbourhood, (see published application page 6, lines 26 to 37).

Due to the small size of the claimed barrier filter it is possible to retrofit this barrier filter into existing boiler systems between the electrostatic precipitator and the smoke stack, (see present Claim 5 and page 8, lines 16 to 24 of the published application).

4.5 An electrically insulated duct between the electrostatic precipitator and the barrier filter is not derivable from (D1) and (D3) to (D5).

(D1) only discloses "typical gas to cloth ratios for various industries", (see Table 5, and in particular a value 2,5 or 5 for fly ash). It is, however, not clear in which unit these values are set out so that (D1) is irrelevant.

4.6 (D3) only shows the pre-characterising features of Claims 1 and 5 but does not disclose a more efficient precipitation than 90% and does not disclose the possibility of increasing the filtration velocity without a substantial pressure drop. From its Figure 9 it is clear that charging the particulates reduces the degree of penetration through the barrier filter, it is, however, not known from (D3) to maintain an electric charge on the particles until these enter the barrier filter by bringing the electrostatic precipitator and the barrier filter close together and by providing an electrically insulated duct therebetween which prevents discharging before collection in the barrier filter. There is thus no hint for a skilled person of how a barrier filter can be reduced in its volume to allow it to retrofit a known filter system within the meaning of Claim 5.

4.7 (D4) essentially deals with a filtering system for automobiles and addresses therefore another technical field. Even if considered, (D4) is silent about precipitation efficiencies in the electrostatic precipitator up to 99% or to filtration velocities in the barrier filter. (D4) only covers therefore the features of the preambles of independent Claims 1 and 5

but not more. According to its single figure it is doubtful whether a duct is present in the known arrangement.

4.8 (D5) teaches away from the claimed subject-matter since the purpose of the known electrostatic precipitator is to **agglomerate** the particulates and not to remove up to 99% of the particulates in the electrostatic precipitator, see page 2, lines 43 to 46 ("... be some precipitation of the particles") or page 3, lines 28 to 31 ("The majority ... are carried by the gas stream over into the filtering apparatus ...").

4.9 It can be summarised that the prior art teaches charging of particulates according to curve "61" of Figure 2 of the application. From curve "62" - i.e. charging of particulates **and** maintaining the electrical charge until the particulates enter the barrier filter - of the application it can clearly be seen that **even higher** filtration velocities do not produce a higher pressure drop when the claimed combination of features is observed. In Figure 3 of the application it is shown that charging and maintaining the electrical charge on particulates until these enter the barrier filter reduces the emissions across the barrier filter provided the same filtration velocities are used.

The features of Claim 1 produce therefore technical effects which cannot be found in the prior art. Reduction of the size of the barrier filter allows the replacement of known barrier filters i.e. retrofitting in the meaning of Claim 5.

4.10 Under the above circumstances even a combination of the cited documents would not lead a skilled person to the solution as claimed. Claims 1 and 5 define therefore inventive subject-matter, Article 56 EPC, so that these claims can form the basis for grant.

4.11 Claims 2 to 4 and 6 to 9 are dependent claims and are likewise allowable.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to grant a patent in the following version:

Description: pages 1, 7, 9 to 11 as originally filed;
pages 2 to 6, 8 filed at the oral
proceedings on 9 July 1996;

Claims 1 to 9 received on 28 June 1996 (4th auxiliary
request);

drawings: two sheets as originally filed.

The Registrar:



N. Maslin

The Chairman:



F. Brösamle