(CONVENTION. By one or more persons and/or a Company,)

COMMONWEALTH OF AUSTRALIA

Patents Act 1952-1969

CONVENTION APPLICATION FOR A PATENT

PESTED AT SUB-OFFICE

MAIL OFFICER

Dated at Melbourne, 9 Jul 1987

We hereby apply for the grant of a Patent for an invention entitled:

APPARATUS FOR COLLECTING DUST FROM GAS

which is described in the accompanying complete specification. This application is a Convention application and is based on the application numbered

P36 23 147.9

for a patent or similar protection made in Federal Republic of Germany on 10th July 1986

Our address for service is Messrs. Edwd. Waters & Sons, Patent Attorneys,

50 Queen Street, Melbourne, Victoria, Australia.

DATED this 8th day of July 1987

METALLGESELLSCHAFT
AKTIENGESSELLSCHAFT

Wayne McMaster
Registered Patent Attorney
In support of the Convention Application made by (CONVENTION Company),
METALLGESELLSCHAFT AKTIENGESELLSCHAFT
(hereinafter referred to as the applicant) for a Patent for an invention entitled:
APPARATUS FOR COLLECTING DUST FROM GAS

We, KURT MULLER and ANNELIESE GASTEYER both of Reuterweg 14, D-6000 Frankfurt/Main, Federal Republic of Germany,
do solemnly and sincerely declare as follows:

1. We are authorised by the applicant for the patent to make this declaration on its behalf.

2. The basic application as defined by Section 141 of the Act was made in the Federal Republic of Germany on the 10th day of July 1986 by METALLGESELLSCHAFT AKTIENGESELLSCHAFT

3. DIETER REICHEL, Rusterrweg 15, D-8750 Aschaffenburg, RUDOLF JAKOBS, Lorscher Strasse 8, D-6380 Bad Homburg, LOTHAR BRELMANN, Sachsenhauser Landwehrweg 69, Frankfurt/Main, and GUNTER QUAS, Adolf-Leweke-Strasse 15, D-6000 Frankfurt/Main, Federal Republic of Germany are the actual inventors of the invention and the facts upon which the applicant is entitled to make the application are as follow:

The applicant is the assignee of the said actual inventors

4. The basic application referred to in paragraph 2 of this Declaration was the first application made in a Convention country in respect of the invention the subject of the application.

DECLARED at Frankfurt/Main, West Germany

this 26th day of June 1987

METALLGESELLSCHAFT AKTIENGESELLSCHAFT
1. Apparatus for collecting dust from gases at temperatures up to 900°C and under pressures up to 20 bars by means of gas-permeable two-dimensional filter elements, characterized by:
   a) a pressure-resisting cylindrical housing to which a conical dust-collecting bin is joined at the bottom of the housing and which has a cambered cover and a cylindrical top extension and is provided on the inside with a heat-insulating brick liner and on the outside with an insulation and comprises a gas inlet in its lower portion and an upper horizontal gas outlet in its cylindrical top extension.
   b) a gas-tight pear-shaped inner housing, which is movably mounted in the housing by means of a heat-insulating carrying structure and is provided with a tubular gas outlet port and comprises a cambered bottom in which cylindrical filter elements are secured, and
   c) a gas-tight compensator disposed between the tubular gas outlet port of the inner housing and the gas outlet of the housing.
COMPLETE SPECIFICATION

Class I

Application Number: Lodged:

Complete Specification Lodged:

Priority:

Related Art:

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Name of Applicant: METALLGESELLSCHAFT AKTIENGESELLSCHAFT

Address of Applicant: Reuterweg 14, D-6000 Frankfurt/Main, Federal Republic of Germany

Actual Inventor: DIETER REICHEL, RUDOLF JAKOBS, LOTHAR BREHM and GUNTER QUAS

Address for Service: EDWD. WATERS & SONS, 50 QUEEN STREET, MELBOURNE, AUSTRALIA, 3000.

Complete Specification for the invention entitled:

APPARATUS FOR COLLECTING DUST FROM GAS

The following statement is a full description of this invention, including the best method of performing it known to us.
DESCRIPTION

This invention relates to apparatus for collecting dust from gases at temperatures up to 900°C and under pressures up to 20 bars by means of gas-permeable two-dimensional filter elements.

In an effort to improve the thermal efficiency of power plants, combined plants have been designed in which the energy of hot combustion gases is utilized primarily in gas turbines and secondarily in steam turbine. In such plants the fuels are reacted with air under elevated pressure so that an adequate pressure drop is available for the gas turbine.

In all processes in which chemically bound energy is converted to mechanical and/or electric energy by a combustion, the efficiency will ultimately depend on the maximum temperatures at which the available materials can be used. On the other hand it is known that the NO_x content of the exhaust gases, i.e., the pollution of the environment will increase with the combustion temperature. For this reason it has already been proposed to burn particularly fuel in a stationary or circulating fluidized bed. In that case the difference between the highest temperature which occurs and the highest temperature which can be utilized in the process can be kept much smaller than in conventional combustors. But the hot exhaust gases from fluidized bed combustors necessarily contain substantial quantities of dust, which would effect an erosion in gas turbines and for this reason must be removed from the gas before. Apparatus for collecting dust from gases at temperatures up to 900°C and under pressures up to 20 bars are required for such and other purposes. In the present case, dust is to be collected by means of gas-permeable two-dimensional filter elements. Such filter elements consist in most cases of cylinders, which are closed at the bottom, and a plurality of such filter elements are suspended in a common plate. Whereas such filters are conventionally described as "bag filters", that term is not used for high-temperature filters where the filter elements are rigid rather than flexible.
The flow of gas through such filter elements is intermittently interrupted and the filter elements are then cleaned by pure gas flowing through the filter element in the opposite direction. When such filter elements are used under the conditions mentioned first hereinbefore, the filter elements cannot be inserted in the usual manner in a flat tube plate because the tube plate must be designed to withstand a differential pressure up to 0.2 bars in both directions (operation/cleaning) and to take up the weight of the filter elements at 900°C. Besides, the tube plate must be joined to the outer housing and the pressure-confining wall of that housing must not be subjected to temperatures in excess of 200°C if heat losses would be avoided and economically justifiable materials can be used. Calculations have shown that the resulting temperature difference of 700°C is so high that it does not permit a gas-tight joint to be made between a tube plate and the pressure-confining wall of the outer housing. A water-cooled tube plate would involve a disadvantage because it necessarily involves heat losses and it has been found that nevertheless it cannot be used to solve the structural problem which arises.

For this reason it is an object to provide an apparatus which serves to collect dust from gases at temperatures up to 900°C and under pressures up to 20 bars by means of gas-permeable two-dimensional filter elements and in which the filter elements can be disposed in the gas stream for a reliable operation and without an occurrence of the above-mentioned disadvantages involved in the use of a conventional tube plate.
It is proposed to accomplish said object by the provision of an apparatus which is of the kind described first hereinbefore and which is characterized by

5 a) a pressure-resisting cylindrical housing, to which a conical dust-collecting bin is joined at the bottom of the housing and which has a cambered cover and a cylindrical top extension and is rovided on the inside with a heat-insulating brick liner and on the outside with an insulation and comprises a gas inlet in its lower portion and an upper horizontal gas outlet in its cylindrical top extension,

b) a gas-tight pear-shaped inner housing which is movably mounted in the housing by means of a heat-insulating carrying structure and is provided with tubulargas outlet port and comprises a cambered bottom in which cylindrical filter elements are secured, and

c) a gas-tight compensator disposed between the tubular gas outlet port of the inner housing and the gas outlet of the housing.

In a first preferred embodiment the cylindrical top extension of the housing is closed by a screwed-on cover and the inner housing is closed by a welded-on cover, which is U-shaped in cross-section.

In a second preferred embodiment the housing comprises an elongate neck so that the housing can repeatedly be opened and closed in that the seam weld is ground off and a cover is again joined by welding.

In a third preferred embodiment the housing is centered and movably mounted by means of lugs on three U-shaped supports, which are uniformly peripherally spaced apart and provided by a cylindrical carrying element which is centered and movably mounted by means of lugs in U-shaped supports of the housing.
In a fourth preferred embodiment, heat-insulating materials are provided between the lugs and the supports.

In a fifth preferred embodiment, the cylindrical filter elements are secured in a manner known per se in conical sockets in the bottom of the housing by means of rings and wedges and with sealing means interposed.

In a sixth preferred embodiment, the compensator is gas-tightly secured by welding to the tubular gas outlet port and the gas outlet and is designed to reduce to non-critical value the heat transfer from the tubular gas outlet port to the gas outlet.

The crux of the invention resides in that the conventional tube plate for receiving the filter elements is replaced by a gas-tight pear-shaped inner housing, which is movably mounted in the outer housing by a heat-insulating carrying structure. As a result, the "supporting" and "sealing" functions can be separated from each other so that the difficulties can be overcome which result from the high temperature difference between the outer housing and the internal components.

Further details and advantages of the invention will be explained more in detail with reference to the illustrative embodiment shown in Figures 1 to 3.
Figure 1 is a vertical longitudinal sectional view showing an apparatus in accordance with the invention. Figure 2 is a horizontal sectional view taken on line A-A in Figure 1. Figure 3 is an enlarged view of the detail 8.

The apparatus shown in Figure 1 essentially comprises a cylindrical housing 1, which is provided with a dust-collecting bin 2 joined to the bottom of the housing 1, which comprises a cambered cover 3 and a cylindrical top extension 4 and which is provided on the inside with a heat-insulating brick linking 5 and on the outside with an insulation 6. The housing 1 is provided in its lower portion with a gas inlet 7 and is provided in the cylindrical top extension 4 with an upper horizontal gas outlet 8. The apparatus also comprises a gas-tight pear-shaped inner housing 9, which is movably mounted in the housing 1 by means of a heat-insulating carrying structure 18 to 22 and is provided with a tubular gas outlet port 11 and comprises a cambered bottom 12, in which cylindrical filter elements 13 are secured. A gas-tight compensator 14 is disposed between the tubular gas outlet port 11 of the inner housing 9 and the gas outlet 8. The inner housing 9 is centered and movably mounted by means of lugs 18 in three peripherally uniformly spaced apart, U-shaped supports 19 provided by a cylindrical carrying element 20. The latter is centered and movably mounted by means of lugs 21 in U-shaped supports 22 provided by the housing 1. Heat-insulating materials 23 are disposed between the lugs 18, 21 and the supports 19, 22. As a result, the inner housing 9 can be supported by and centered in the outer housing 1 in spite of the high temperature difference of up to 700°C whereas the thermal expansion of the inner housing 9 in vertical and horizontal directions will not be obstructed.

This is also true for the tubular gas outlet port 11, which is secured to the housing 9 and which by the compensator 14 is gas-tightly connecting to the gas outlet 8 of the outer housing 1. It will be sufficient to design that compensator 14 so as to ensure a gas-tightness and a decrease of the heat transfer to a non-critical value whereas the compensator need
not support the filter elements. On the other hand, as the inner housing 9 as well as the compensator 14 are subjected on the inside and outside to the same pressure, with the exception of the pressure difference that is due to the pressure drop across the filter elements 13, the inner housing 9 will have to be designed in consideration only of its function to support the filter elements and to ensure a gas-tight seal whereas substantial stresses which would be due to pressure differences need not be taken into account in that design. The differential pressure between the gas and the environment is applied to the compensator 14. The inner housing 9 and the filter elements 13 are supported by means of the heat-insulating carrying structure 18 to 22. As a result, the pressure-confining and "supporting" functions are performed by different structures so that the design difficulties described have been overcome.

The inner housing 9 is closed by a welded-on cover 16, which is U-shaped in cross-section. The cylindrical top extension of the housing 1 is closed by a screwed-on cover. The housing 9 has an elongate neck 17, so that the housing 9 can repeatedly be opened and closed in that the seam weld 17a is ground off and a cover 16 is again joined by welding. The covers 15 and 16 close a service opening, which is accessible from above and which is required for the introduction of the filter elements 13 and possibly for their replacement. The interior volume of the cylindrical top extension 4 and of the upper horizontal gas outlet is filled with insulating material. The housing 1 has also a service opening 28 and in its lower portion a dust outlet 27.

Figure 2 is a horizontal sectional view taken on line A-A in Figure 1. The cylindrical carrying element 20 and the elongate neck 17 of the inner housing 9 are represented by concentric circles. The horizontal tubular gas outlet port 11 branches from the elongate neck 17.
Three lugs 18, which are regularly peripherally spaced apart, have been welded to the elongate neck 17 and extend into correspondingly spaced apart, U-shaped supports 19 of the cylindrical carrying element. As a result, the housing 9 is movably mounted and centered and its thermal expansion in a horizontal direction will not be obstructed.

Figure 3 is an enlarged view showing the detail 8 of Figure 1. The cylindrical filter elements 13 are closed at the bottom and at their top end have a conical extension and said extensions are secured in conical sockets 26 in the bottom 12 of the housing 9 in a manner known per se by means of rings 10 and wedges 25 and with sealing means 24 interposed. This ensures a reliably fixation of the filter elements 13 in the bottom 12 so that a gas-tightness will be ensured even under changing operating conditions.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Apparatus for collecting dust from gases at temperatures up to 900°C and under pressures up to 20 bars by means of gas-permeable two-dimensional filter elements, characterized by

   a) a pressure-resisting cylindrical housing to which a conical dust-collecting bin is joined at the bottom of the housing and which has a cambered cover and a cylindrical top extension and is provided on the inside with a heat-insulating brick liner and on the outside with an insulation and comprises a gas inlet in its lower portion and an upper horizontal gas outlet in its cylindrical top extension.

   b) a gas-tight pear-shaped inner housing, which is movably mounted in the housing by means of a heat-insulating carrying structure and is provided with a tubular gas outlet port and comprises a cambered bottom in which cylindrical filter elements are secured, and

   c) a gas-tight compensator disposed between the tubular gas outlet port of the inner housing and the gas outlet of the housing.

2. Apparatus according to claim 1, characterized in that the cylindrical top extension of the housing is closed by a screwed-on cover and the inner housing is closed by a welded-on cover, which is U-shaped in cross-section.

3. Apparatus according to claim 2, characterized in that the housing comprises an elongate neck so that the housing can repeatedly be opened and closed in that the seam weld is ground off and a cover is again joined by welding.

4. Apparatus according to any one of claims 1 to 3, characterized in that the housing is centered and movably mounted by means of lugs on three U-shaped supports,
which are uniformly peripherally spaced apart and provided by a cylindrical carrying element which is centered and movably mounted by means of lugs in U-shaped supports of the housing.

5. Apparatus according to claim 4, characterized in that heat-insulating materials are provided between the lugs and the supports.

6. Apparatus according to any one of claims 1 to 5, characterized in that the cylindrical filter elements are secured in a manner known per se in conical sockets in the bottom of the housing by means of rings and wedges and with sealing means interposed.

7. Apparatus according to any one of claims 1 to 6, characterized in that the compensator is gas-tightly secured by welding to the tubular gas outlet port and the gas outlet and is designed to reduce to non-critical value the heat transfer from the tubular gas outlet port to the gas outlet.

DATED this 8th day of July 1987.
METALLGESELLSCHAFT AKTIENGESELLSCHAFT

EDWD. WATERS & SONS
PATENT ATTORNEYS
50 QUEEN STREET
MELBOURNE. VIC. 3000.
Fig. 2
(A-A)

Fig. 3