United States Patent

Courbon

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[54] **HUMID DE-DUSTING DEVICE FOR GAS-CONVEYOR CONDUITS**

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[52] **U.S. Cl.** **55/238,** 55/257, 55/260, 55/435, 55/457, 261/116, 261/DIG. 54

[51] **Int. Cl.** **B01d 47/10**

[58] **Field of Search**.....55/240, 238, 257, 260, 435, 55/457; 261/116, DIG. 54

[56] **References Cited**

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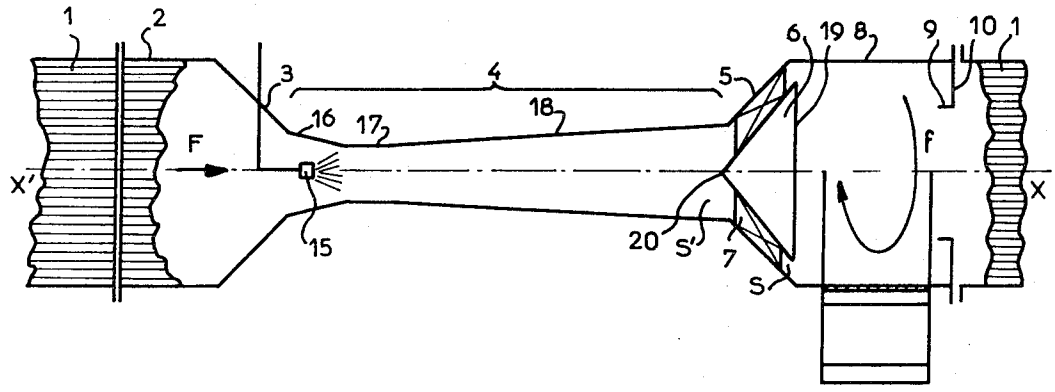
[57] **ABSTRACT**

Device intended to free a flow of gas from the dust and solid particles which it carries in suspension.

It comprises a venturi wherein water is sprayed and which is comprised between a junction converging portion having a apex angle in the vicinity of 90° and a junction diverging portion having an apex angle in the vicinity of 90°. This latter is provided, on the one hand, with means for setting into rotation the flow of humidified gas, on the other hand, with a centrifugal separation conduit with an axial transfer sleeve.

This de-duster device may be inserted into a conduit system of ventilation air such as the ventilation pipes of underground mine workings.

7 Claims, 5 Drawing Figures



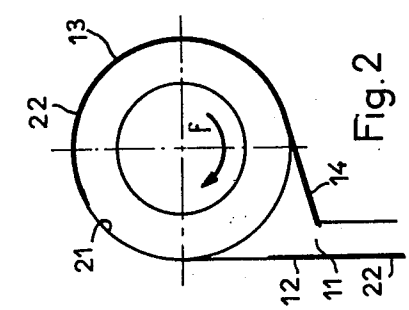


Fig.2

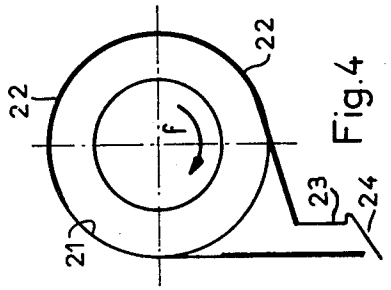


Fig.4

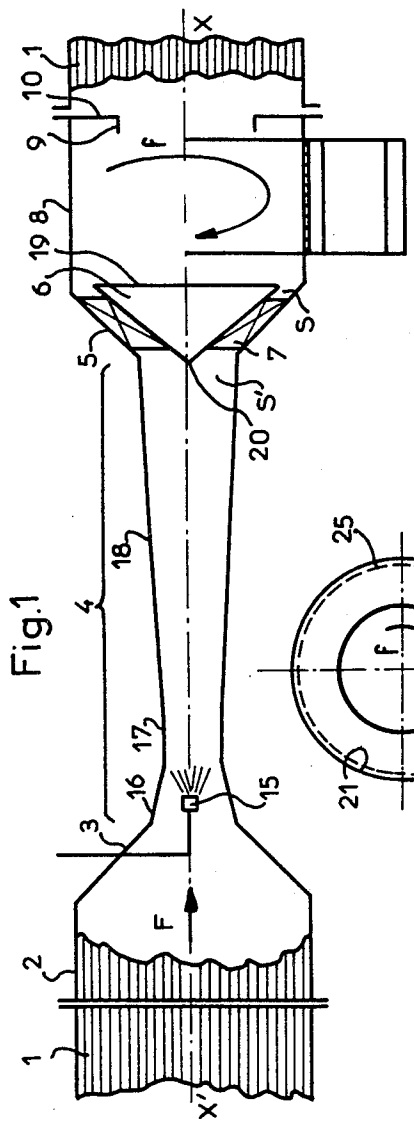


Fig.1

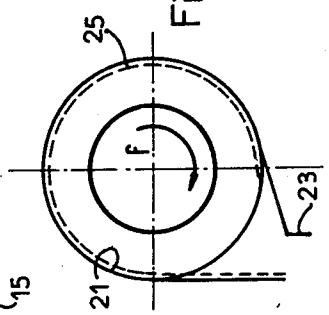


Fig.5

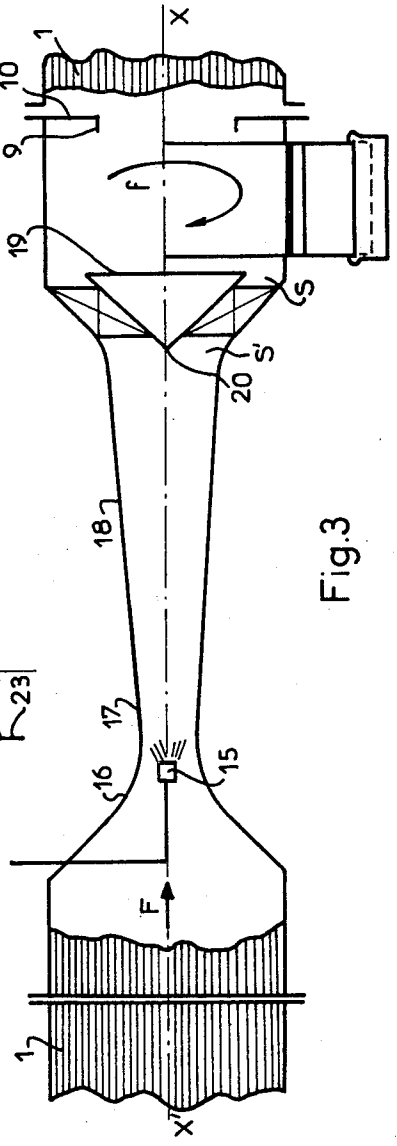


Fig.3

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HUMID DE-DUSTING DEVICE FOR GAS-CONVEYOR CONDUITS

The present invention relates to a device known as de-dusters, intended to free a flow of gas from the dust and solid particles which it carries in suspension.

De-dusting apparatus is already known which utilizes the principle of the increase in weight of solid particles of pollution by mixing the flow of polluted gas with an aerosol dispersed in the turbulent medium formed by the neck of a venturi, the droplets of polluted water being subsequently arrested by transverse impact means such as impact plates or rings.

The known devices are complicated and generally have dimensions and loss of pressure such that they can only be used with difficulty for de-dusting a flow of gas circulating in very long conduits.

The present invention relates to an apparatus of simple construction, of small overall size and more particularly adapted to be inserted in a conduit system of ventilation air such as the ventilation pipes of underground mine workings.

The device according to the invention is characterized by the fact that the venturi is on the one hand preceded by a junction stage constituted successively by a cylindrical portion having a diameter equal to the diameter of the conduit, and by a convergent portion having an apex angle in the vicinity of 90°, and on the other hand it is followed by a header stage formed successively by a frusto-conical divergent junction having an apex angle in the vicinity of 90° and provided with means for setting in rotation the humidified flow of gas, and by a centrifugal separation conduit of generally cylindrical shape and provided with an axial transfer sleeve.

The present invention will be better understood by reference to the description which follows below, and referring to the accompanying drawings, in which :

FIGS. 1 and 3 are two views in cross-section-elevation of two forms of embodiment of the device according to the invention;

FIGS. 2 and 4 show respectively two views in transverse section made at the level of the centrifugal separation conduit;

and FIG. 5 is a view in transverse section of an advantageous alternative form of the centrifugal separation conduit.

In the figures of the accompanying drawings, the reference 1 indicates the conduit in which the flow of gas to be purified is set into circulation in the direction of flow shown symbolically by the arrow F, by means of a fan (not shown).

In the text which follows, it will be assumed that all the elements described have a form of revolution having as their axis $x'x$ the axis of the conduit.

The de-dusting device according to the invention comprises, in succession in the direction F:

An upstream cylindrical junction section 2 having a diameter equal to that of the conduit 1;

An upstream frusto-conical coupling convergent 3 having an apex angle in the vicinity of 90°;

A venturi 4;

A downstream coupling divergent 5 having an apex angle in the vicinity of 90°, provided with means for setting the flow of gas in rotation, constituted by a divergent conical deflector 6 having an axis $x'-x$, supported by radial blades 7 fixed to the internal wall of the divergent 5 and impressing on the flow of gas a movement of rotation shown symbolically by the arrow f;

And a centrifugal separation stage, constituted by a conduit 8 of generally cylindrical shape, having a diameter equal to the diameter of the conduit 1 and coupled to the downstream portion of the conduit by means of a transfer sleeve 9 passing through a transverse wall 10.

The separation stage 8 has the shape of an elongated ejector, the tangential opening 11 of which is directed downwards and in the direction opposite to the rotation of the flow of gas f.

In more precise terms, the wall of the collection stage comprises a flat vertical portion 12 tangential to a cylindrical portion 13 which is in turn coupled to the opening 11 by means of a flat tangential portion 14 inclined with respect to the horizontal.

The venturi is provided with water-spraying means 15 discharging in proximity to the intake of the neck of the venturi.

Advantageously, the convergent portion 16 and the neck 17 of the venturi have an identical length with a value equal to that of the diameter of the neck 17.

In FIG. 1, the convergent portion 16 and the divergent portion 18 of the venturi have a frusto-conical shape and have respectively apex angles of 21° and 7°.

As shown in FIG. 3, the convergent 16 and the divergent 18 may be shaped so as to form a discharge nozzle.

The apex angle of the conical deflector 6 preferably has a value such that the straight annular outlet section S provided for the passage of the flow of gas at the level of the base 19 of the deflector 6, is at least equal to the straight inlet section S' provided for the passage of the flow of gas at the level of the point 20 of the deflector 6.

The dust in suspension in the flow of gas is collected in the following manner. It is collected in the venturi by the droplets of water spray; the blades 7 impress on the purified glow of gas and on the droplets of polluted water a movement of rotation f which is superimposed on the movement of translation F, and centrifugal force drives the droplets of water against the internal wall 21 of the collection stage 8, the flow of purified gas being evacuated by means of the transfer sleeve 10.

In this stage, the inclined flat portion 14 serves as a run-off plane for a film of water 22 deposited against the internal wall 21 of the collection stage, while the flat vertical portion 12 serves as an impact plate for the finest droplets of water which are not deposited against the internal wall 21 at the outlet of the setting-in-rotation stage, and at the same time prevents a continuous movement of rotation of the film of water 22 which would be likely to be established if the internal wall 21 were entirely cylindrical.

The form of embodiment shown in FIGS. 1 and 2 is more particularly adapted to the case in which the fan (not shown) is located on the upstream side of the collection device.

In the form of embodiment shown in FIGS. 3 and 4, the opening of the evacuation conduit 23, which extends downwards the opening 11 of the ejector, is provided with lower closure clappers 24. This form of embodiment is more particularly adapted to the case in

which the fan is located on the downstream side of the collection device.

In order to improve the collection and evacuation of the droplets of polluted water, it may be advantageous to make the internal wall **21** of the conduit **8** rough, for example by means of a rough coating or of a curved plate of expanded metal **25** (see FIG. **5**).

I claim :

1. A de-dusting device of the type comprising a venturi, at the neck of which is discharged a water-spraying device, inserted in a conveyor conduit of a flow of gas for the purpose of removing dust and solid particles which are carried in suspension in the said gas, said device comprising:

on the upstream side of said venturi, a junction stage constituted successively by: a cylindrical portion of the same diameter as that of the upstream portion of said conveyor conduit; and by a convergent portion having an apex angle in the vicinity of 90°;

on the downstream side of said venturi, a collector stage constituted successively by: a frusto-conical junction divergent having an apex angle in the vicinity of 90°; and by a centrifugal separation conduit of generally cylindrical shape provided with an axial transfer sleeve communicating with the downstream portion of said conveyor conduit;

and means for setting into rotation the flow of humidified gas coming from the venturi, constituted by a divergent conical deflector coupled to the internal wall of said frustoconical junction divergent by means of radial blades and delimiting with this latter a passage having a straight annular section;

the apex angle of said deflector being determinal so that the surface area of the straight section provided for the passage of the gases at the level of the base of said deflector is at least equal to the surface area of the straight section provided for the passage of the gases at the level of the point of said deflector.

2. A de-dusting device as claimed in claim **1**, in which said centrifugal separation conduit has the shape of an elongated ejector provided at its lower portion with a longitudinal evacuation slot directed in the opposite sense to the direction of movement of rotation impressed on said flow of gas by said radial blades.

3. A de-dusting device as claimed in claim **2**, in which said evacuation slot is delimited in width by a vertical wall tangential to the upper cylindrical portion of said separation conduit, and by the edge of the wall slightly inclined downwards and tangential to the lower cylindrical portion of said separation conduit.

4. A de-dusting device as claimed in claim **3**, in which said evacuation slot is extended downwards by a parallelepiped evacuation conduit provided at its lower portion with a closure clapper opened by gravity.

5. A de-dusting device as claimed in claim **1**, in which the internal wall of said separation conduit is made rough.

6. A de-dusting device as claimed in claim **1**, in which the internal wall of said separation conduit is covered by a curved surface of expanded metal.

7. A de-dusting device as claimed in claim **1**, in which said convergent and the neck of said venturi have identically the same length having a value equal to that of the diameter of said neck.

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