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(54) **Aerodynamic air intake opening of a tunnel ventilation unit**

Aerodynamischer Lufteinlass einer Tunnelbelüftungseinrichtung

Entrèe d'air aerodynamique d'un système de ventilation d'un tunnel

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- **PATENT ABSTRACTS OF JAPAN vol. 13, no. 169 (C-587)(3517) 21 April 1989 & JP-A- 63 319072 (FUJI ELECTRIC) 27 December 1988**

EP 0 577 153 B1

Description

BACKGROUND OF THE INVENTION

(Field of the Invention)

This invention relates to a tunnel dust collecting system according to the preamble of claim 1 in which an electrical dust collector is used to remove dust and smoke from the contaminated air in a tunnel thereby to use the air again, and more particularly to a tunnel dust collecting system which is installed on the ceiling of a tunnel which is provided mainly for automobiles.

(Prior Art)

There are available a variety of tunnel dust collecting systems. Typical ones of the systems, are a tunnel dust collecting system of bypass tunnel type as shown in Fig. 2 (A), and a tunnel dust collecting system of ceiling installation type as shown in Fig. 2(B) and Figs. 3(A) and 3(B). Figs. 3(A) and (B) are a plan view and a sectional view of the tunnel dust collecting system shown in Fig. 2(B).

In the tunnel dust collecting system of bypass tunnel type as shown in Fig. 2(A), a bypass tunnel is connected, as a dust collecting chamber 2, to the main tunnel 1 provided for automobiles, so that the air contaminated in the tunnel 1 is led into the dust collecting chamber at one end opened in the side wall of the main tunnel 1, where it is decontaminated with an electrical dust collector 3 (hereinafter referred to merely as "a dust collector 3", when applicable). The air thus processed is supplied into the main tunnel 1 with an air blower 4 through the other end of the dust collecting chamber 2.

On the other hand, in the tunnel dust collecting system of ceiling installation type, a ceiling board 5 is installed in such a manner as to form a dust collecting chamber 2 in the upper portion of a tunnel. The dust collecting chamber 2 has one end 2a which is used to suck air from the tunnel (hereinafter referred to as "an air sucking end 2a", when applicable), and the other end 2b which is used to supply decontaminated air into the tunnel (hereinafter referred to as "an air supplying end 2b", when applicable). The contaminated air sucked into the dust collecting chamber 2 through the air sucking end 2a is decontaminated with dust collectors 3, and the air thus decontaminated is supplied into the tunnel with air blowers 4 provided near the air supplying end 2b. When compared with the tunnel dust collecting system of bypass tunnel type, the tunnel dust collecting system of ceiling installation type is advantageous in that its installation cost is lower because it is unnecessary to form the bypass tunnel.

In the tunnel dust collecting system of ceiling installation type, as shown in Fig. 3, two dust collectors 3 are provided in the dust collecting chamber 2 in such a manner that they are separated from each other with a partition board 6. More specifically, the dust collecting chamber is divided by the partition board 6 into two parts,in which the two dust collectors are provided, respectively. Two axial flow type air blowers 4 with cylindrical casings 4b are provided at the air supplying end 2b of the dust collecting chamber 2, and air sucking inlets 7 are provided at the air sucking end of the dust collecting chamber 2. The air in the upper portion of the tunnel is sucked through the air sucking inlets 7 linearly along the central axis of the tunnel into the dust collecting chamber and decontaminated with the dust collectors 3, and the air thus decontaminated is linearly supplied into the tunnel with the air blowers 4 through air supplying outlets 4a.

The ceiling board 5 serves as a base board which supports the dust collectors 3 etc. Generally, the ceiling board 5 is extended to the air supplying outlets 4a of the air blowers 4, being utilized as means for making access to the air blowers for inspection or maintenance.

In the case of Fig. 3, only two dust collectors 3 are provided. However, in the case where more than two dust collectors are employed, they are arranged staggered in the dust collecting chambers from the air sucking end 2a towards the air supplying end 2b.

In the tunnel dust collecting system shown in Fig. 3, the air sucking end 2a of the dust collecting chamber 2 is employed as the air sucking inlets 7. On the other hand, there is available a tunnel dust collecting system of ceiling installation type in which, as shown in Fig. 4 , the end of the dust collecting chamber corresponding to the above-described air sucking end is closed, and instead an air sucking inlet is opened in the end portion of the ceiling board 5 (hereinafter referred to as "a tunnel dust collecting system of upward suction type", when applicable).

In the tunnel dust collecting system of upward suction type, as shown in Fig. 4, the air sucking end 2a of the dust collecting chamber 2 defined by the ceiling board 5 is closed with a closing board 8, and instead a rectangular-window-shaped air sucking inlet 9 is formed in the ceiling board 5 near the closing board 8. The contaminated air in the tunnel is led through the air sucking inlet 9 into the dust collecting chamber as indicated by the arrows, and decontaminated with the dust collectors 3. The air thus decontaminated is supplied into the tunnel with the air blowers 4.

A tunnel dust collecting system according to the preamble of claim 1 is known from JP-A-63-319 072. An air ventilation system rather than a dust collecting system is shown in CH-A-433424 and showing an opening in the ceiling board formed as a long slot having rounded edges. The shape of the slot is determined in order to equalize the pressure distribution along the channel of the ventilation system by equalizing a friction term and a term taking account of pressure change due to release or introduction of a side stream along the channel length.

The space for installation of a dust collecting system

is limited because of limitations in public engineering works. It is desirable to increase the flow rate of decontaminated air as much as possible with the installation space per station decreased as much as possible.

In the dust collecting system of upward suction type described above, the air sucking inlet 9 is formed in the ceiling board 5 in such a manner that its edges are perpendicular to the ceiling board. Therefore, as shown in Fig. 5 , the air sucked into the dust collecting chamber 2 forms a contraction flow; that is, the air sucked into the dust collecting chamber tends to concentrate at the center of the dust collector 3 leaving the front and rear edges 9a an 9b of the air sucking inlet 9. As a result, only 85 to 90% of the capacity of the dust collector is used, and the pressure loss at the air sucking inlet 9 is as high as 5 to 10%.

SUMMARY OF THE INVENTION

Accordingly, a general object of this invention is to provide a tunnel dust collecting system in which these difficulties are eliminated, thereby to improve the cleanliness of the air in a tunnel. This will be described in more detail.

An object of the invention is to provide a tunnel dust collecting system of upward suction type which is high in dust collection efficiency being free from the above-described difficulties and in which the dust collectors are made to work at their full capacity.

The foregoing objects and other objects of the invention have been achieved by a tunnel dust collecting system according to the claim.

According to the claim of the invention, in a tunnel dust collecting system of upward suction type, the air sucking inlet formed in the ceiling board has a first wall upstream thereof the upper and lower edges of which are rounded continuously with a first radius R_1 and a second radius R_2 smaller than the first radius, respectively, and a second wall downstream thereof the upper and lower edges of which are rounded continuously with the second and first radii, respectively. In this connection, it is preferable that R_1 = t to 3t, and R_2 = t/5 to t/3, where t is the thickness of the ceiling board.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

Fig. 1 is a longitudinal sectional view showing essential components in a tunnel dust collecting system according to a fourth aspect of the invention;

Fig. 2(A) is a perspective view showing a typical example of a conventional tunnel dust collecting system of bypass tunnel type;

Fig. 2(B) is a perspective view showing an example of a conventional tunnel dust collecting system of ceiling installation type;

Figs. 3(A) and 3(B) is a plan view and a longitudinal sectional view of the tunnel dust collecting system of ceiling installation type shown in Fig. 2(B), respectively;

Fig. 4 is a longitudinal sectional view showing a typical example of a tunnel dust collecting system of upward suction type; and

Fig. 5 is a longitudinal sectional view showing essential components of the tunnel dust collecting system illustrated in Fig. 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the tunnel dust collecting system of upward suction type, according to the invention, the air sucking inlet formed in the ceiling board has a first wall upstream thereof and a second wall downstream thereof whose upper and lower edges are continuously rounded with two different radii in such a manner that the first and second walls are inclined in the direction of air stream. As a result, the difficulties are eliminated that the air stream leaving the ceiling board at the edges of the air sucking inlet flows flow irregularly, thus causing pressure loss.

An embodiment of the invention, a tunnel dust collecting system, will be described with reference to Fig 1.

A tunnel dust collecting system of upward suction type, is a shown in Fig. 1 . In the system, contaminated air is led into a dust collecting chamber 2 through an air sucking inlet 9 as indicated by the arrows. The air sucking inlet 9 has an upstream wall 9a and a downstream wall 9b which are curved in section inwardly. More specifically, the lower and upper edges of the upstream wall 9a are continuously rounded with radii R_1 and R_2 ($R_1 > R_2$), respectively; and similarly, the lower and upper edges of the downstream wall 9b are continuously rounded with radii R_2 and R_1, respectively. Hence, the contaminated air is sucked through the air sucking inlet 9 into the dust collecting chamber 2 obliquely upwardly along the gradients of the upstream and downstream walls 9a and 9b. Therefore, the air thus sucked is allowed to go along the ceiling board, thus forming no contraction flow. The air flows to substantially the whole of the air sucking surface of the dust collector 3, so that it is decontaminated with high efficiency contacting the electrode boards not shown. In addition, the pressure loss at the air sucking inlet 9 is minimized.

As is apparent from the above description, the tunnel dust collecting system of the invention has the following effects or merits:

In the tunnel dust collecting system of upward suction type according to the invention, the air sucking inlet formed in the ceiling board has the first wall upstream thereof the lower and upper edges of which are rounded continuously with the first radius and the second radius smaller than the first radius, respectively, and the second wall downstream thereof the lower and upper edges of which are rounded continuously with the second and first radii, respectively. As a result, the difficulty is sub-

stantially eliminated that the air stream leaves from the ceiling board at the air sucking inlet. Accordingly, concentration of the air steam at the central portion of the air sucking surface of the dust collector is substantially suppressed, and the pressure loss is minimized, with the dust collection efficiency increased 10% to 15%.

While there has been described in connection with the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is aimed, therefore, to cover in the appended claim all such changes and modifications as fall within the scope of the invention.

Claims

1. A tunnel dust collecting system comprising: a dust collecting chamber (2) formed in the upper space of a tunnel (1) with a ceiling board (5) in such a manner that said dust collecting chamber (2) has one end serving as an air sucking end (2a) and the other end serving as an air supplying end (2b); electric dust collectors arranged in said dust collecting chamber (2); an air sucking inlet (9) formed in said ceiling board (5) near said air sucking end (2a); and air blowers (4) in said dust collecting chamber at the air supplying end (3b); **characterised in that** said air sucking inlet (9) has a first wall (9a) upstream thereof the lower and upper edges of which are rounded continuously with a first radius (R_1) and a second radius (R_2) smaller than said first radius (R_1), respectively, and a second wall (9b) downstream thereof the lower and upper edges of which are rounded continuously with said second (R_1) and first (R_2) radii, respectively.

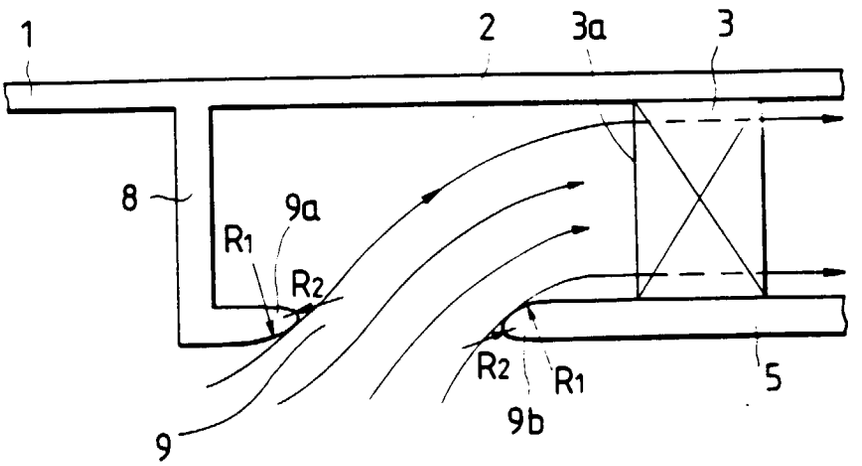
Patentansprüche

1. Ein System zum Sammeln von Staub in einem Tunnel mit: einer Staubsammelkammer (2), die in dem oberen Raum eines Tunnels (1) mit einer Deckenplatte (5) auf solche Weise ausgebildet ist, daß die Staubsammelkammer (2) ein als Luftansaugende (2a) dienendes Ende aufweist und das andere Ende als ein Luftbereitstellungsende (2b) dient; in der Staubsammelkammer (2) angeordneten elektrischen Staubsammlern; einem in der Deckentafel (5) in der Nähe des Luftansaugendes (2a) ausgebildeten Luftansaugeinlaß (9); und mit Luftgebläsen (4) in der Staubsammelkammer an dem Luftbereitstellungsende (3b); **dadurch gekennzeichnet,** daß der Luftansaugeinlaß (9) eine erste stromaufwärts gelegene Wand (9a) aufweist, deren untere und obere Kanten kontinuierlich jeweils mit einem ersten Radius (R_1) und einem zweiten Radius (R_2), der kleiner ist als der erste Radius (R_1), abgerundet sind, und eine davon stromabwärts gelegene zweite Wand (9b), deren untere und obere Kanten kontinuierlich jeweils mit dem zweiten (R_2) und dem ersten (R_1) Radius abgerundet sind.

Revendications

1. Ensemble collecteur de poussières de tunnel, comprenant une chambre collectrice de poussières (2) formée dans l'espace supérieur d'un tunnel (1) par un panneau de plafond (5) de manière que la chambre collectrice de poussières (2) ait une première extrémité utilisée comme extrémité d'aspiration d'air (2a) et une autre extrémité utilisée comme extrémité de transmission d'air (2b), des collecteurs électriques de poussières placés dans la chambre collectrice de poussières (2), une entrée d'aspiration d'air (9) formée dans le panneau de plafond (5) près de l'extrémité d'aspiration d'air (2a), et des ventilateurs (4) placés dans la chambre collectrice de poussières à l'extrémité (3b) de transmission d'air, caractérisé en ce que l'extrémité d'aspiration d'air (9) a une première paroi (9a) placée en amont et dont les bords inférieur et supérieur sont arrondis de façon continue avec un premier rayon (R_1) et un second rayon (R_2) qui est inférieur au premier rayon (R_1) respectivement et une seconde paroi (9b) placée en aval et dont les bords inférieur et supérieur sont arrondis de façon continue avec le second rayon (R_1) et le premier rayon (R_2) respectivement.

FIGURE 1



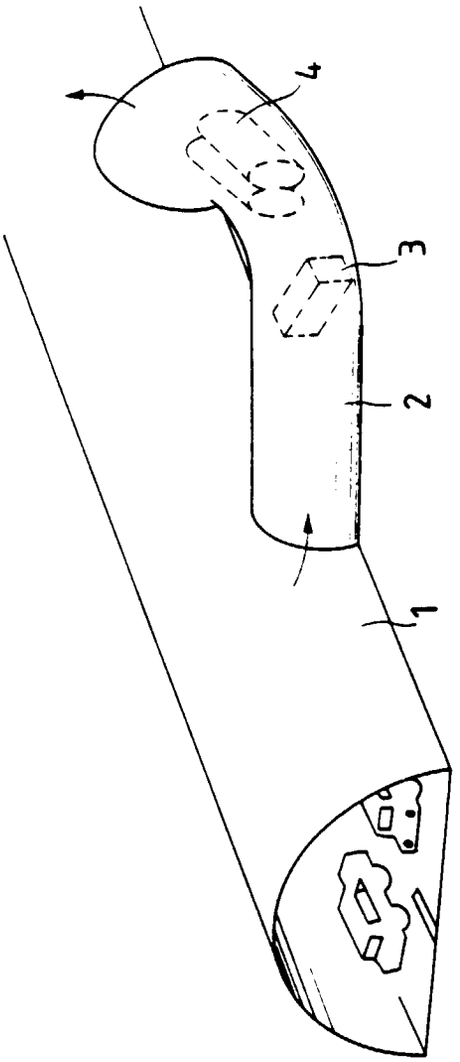


FIGURE 2 (A)

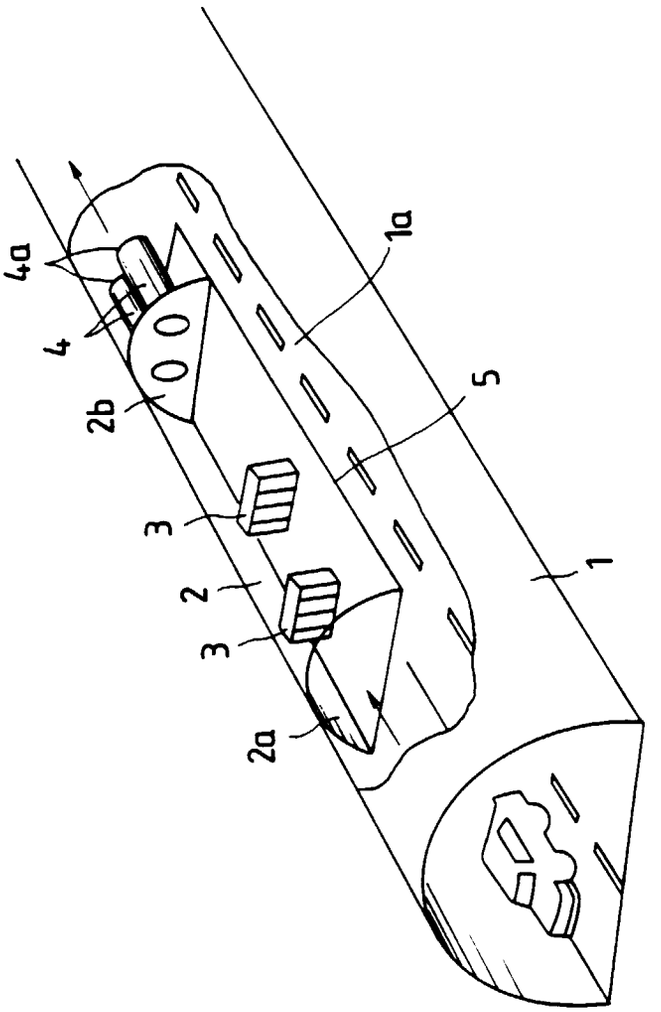


FIGURE 2 (B)

FIGURE 3 (A)

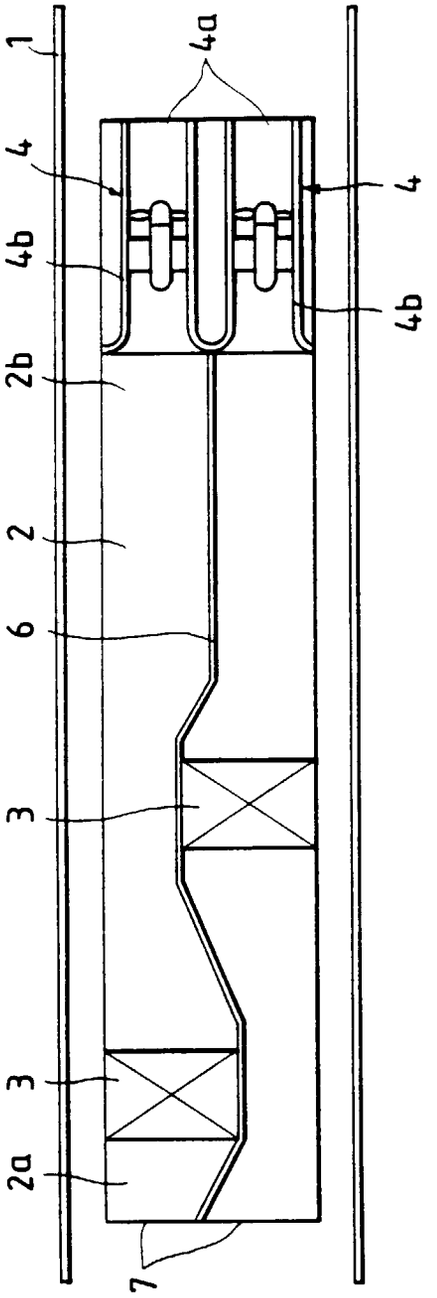


FIGURE 3 (B)

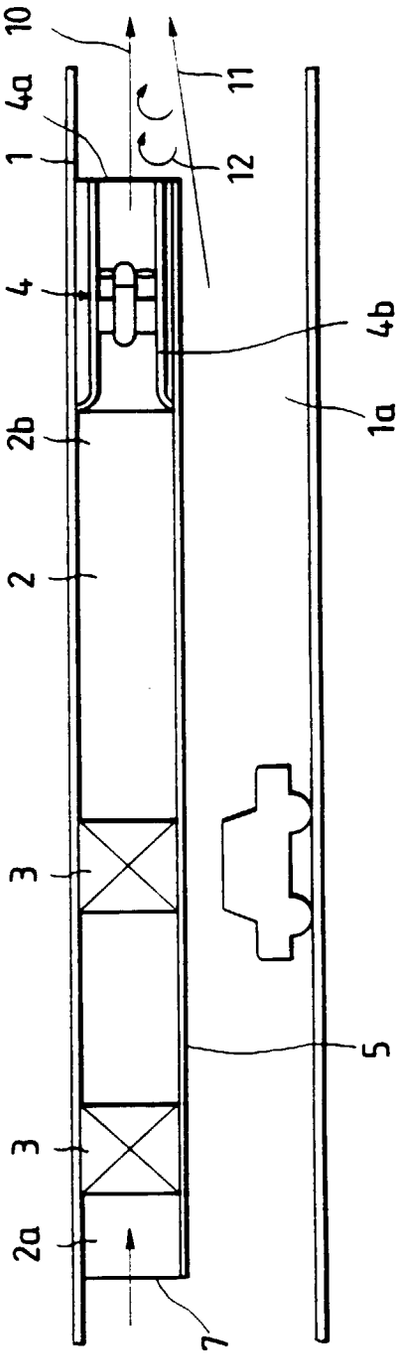


FIGURE 4

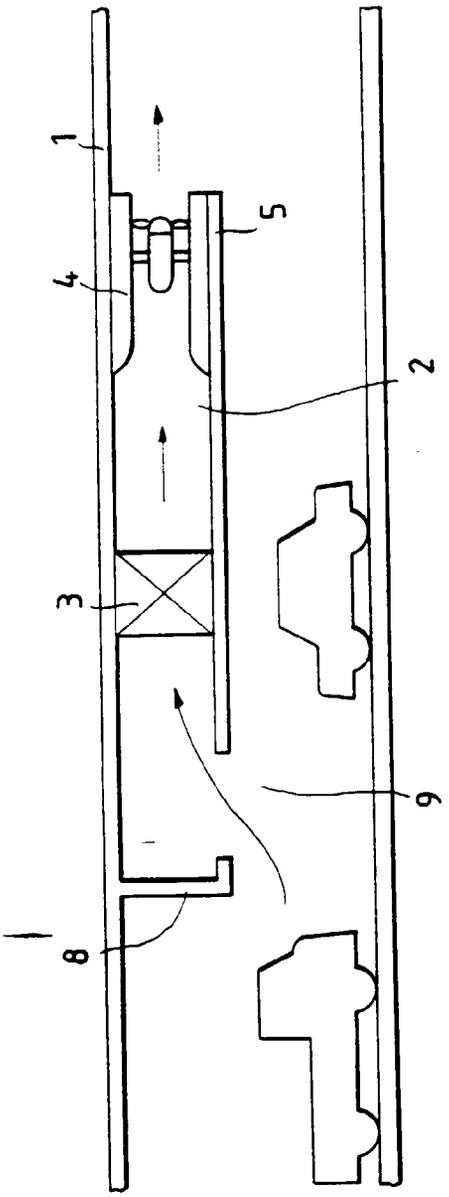


FIGURE 5