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(54) Vacuum cleaning equipment for ceramic firing tunnel furnace carts

Staubsauger zum Reinigen von Tunnelofenwagen bei dem Brennverfahren für keramische Materialien

Aspirateur pour le nettoyage de chariots de four à tunnel de cuisson des céramiques

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Description

This invention refers to vacuum cleaning equipment for the carts used in ceramic firing tunnel furnaces. Specifically, the equipment of the invention is used to clean the cart surfaces which -once the material fired has been unloaded- are left covered with ceramic fragments of different sizes, ash, clay dust, etc.

Said equipment is of the type which consists of at least one aspirating nozzle, one intake conduit, several vacuum units and several filtering units.

Background of the invention

As is well known, the process used to fire ceramic pieces in tunnel furnaces requires that the cart loading surfaces be cleaned once the fired material has been removed, otherwise ceramic debris (generally known as rubble) has a negative effect on the stability of the new cart load and lowers the life of the refractory coating of the carts.

Manual cleaning of the cart surfaces often requires more time than is available for this operation between the unloading and loading of the ceramic material and is costly.

Automatic cleaning of the cart surfaces is done with vacuum cleaning machines and a number of models are available in the market. These machines generally consist of one or more portable aspirating nozzles and a vacuum and filtering unit which is either stationary or mobile with respect to the aspirating nozzle(s).

A machine of this type is known from the German Patent DE-U-93 02 202.6, which discloses a vacuum cleaning equipment for ceramic firing tunnel furnaces carts including at least one aspirating nozzle, one intake conduit, and at least one vacuum and filtering unit, the latter being located in a stationary position remote from the path of the carts and connected to the aspirating nozzles via the intake circuit.

On the other hand, US-A-3,854,910 discloses an apparatus for removing fine dust particles collected from an airstream, comprising a so called "cyclone" separator, surrounded by a plurality of filter bags, such apparatus being susceptible for its use as the vacuum and filtering unit of a vacuum cleaning equipment for ceramic firing tunnel furnace carts.

Equipments of the said type are also known in the art, in which the aspirating nozzle/s is/are suspended from a trolley which can be moved back and forth over an overhead horizontal rail located in a stationary gantry, under which the carts travel.

Machines with a stationary vacuum and filtering unit have a major disadvantage, which is that the connection between the vacuum and filtering unit and the aspirating nozzles is very complex. Furthermore, these machines are quite large.

Machines in which the vacuum and filtering unit is mobile also have a major disadvantage which is that,

due to its structure, the vacuum and filtering unit is rather small, thus affecting the vacuum capacity and, consequently, the cleaning of the cart surfaces.

5 Detailed description of the invention

In order to provide a solution to the aforementioned problems posed by operating automatic machinery to clean the cart surfaces, vacuum cleaning equipment for the ceramic firing tunnel furnace carts has been designed, with a new structure and system of operation.

The equipment of the present invention is of the type which includes at least one aspirating nozzle; one intake circuit; several vacuum units; and several filtering units, each vacuum unit consisting of a vertical cyclone, located above a debris collection chamber, the filtering units consisting of filter bags surrounding the said chamber, and the aspirating nozzle/s being suspended from a trolley which can be moved back and forth over an overhead horizontal rail located in a stationary gantry, under which the carts travel and characterized in that this intake conduit consists of a duct with a square cross-section, with an open bottom and a length practically the same as the aforementioned overhead horizontal rail, where said bottom is covered with a flat strip slightly wider than the duct itself and constructed of material which is somewhat flexible but rigid in the crosswise direction, such as metal sheet, with one end fixed to one end of the duct and the other end rolled up over a rotating drum turning on a shaft perpendicular to the gantry's vertical plane and mounted on the aforementioned trolley which can be moved below the duct, in such a way that the length of the intake conduit varies in accordance with the position of the trolley.

35 Brief description of the drawings

The attached drawings illustrate a nonrestrictive example of how this invention can be preferably used.

40 Fig. 1 is a front view of the equipment of the invention;

Fig. 2 shows a side view of the nozzle and the trolley supporting it;

45 Fig. 3 contains a front schematic representation of the vacuum and filtering units of the equipment;

Fig. 4 is a schematic representation of the aspirating nozzle, intake conduit and filtering units of the equipment of the invention; and

50 Fig. 5 is a schematic view of the V-V cross section in Fig. 4.

Detailed description of an embodiment

55 In these drawings, it is possible to see that the vacuum cleaning equipment of the invention for the ceramic firing tunnel furnaces -described as an embodiment example- consists of several vacuum units (1), several

filtering units (2), an intake conduit (3), an aspirating nozzle (4) and a trolley (5). The duct (3), aspirating nozzle (4) and trolley (5) are mounted on a stationary gantry (6).

The equipment of the invention is designed to clean the loading surface (7) of carts similar to the one shown (8) in Figs. 1, 2 and 4. Said cart (8) can be moved on wheels (9) over rails (10) anchored to the floor S, crossing through the stationary gantry (6) in the direction of travel indicated by arrow A in Fig. 2.

The vacuum units (1), which consist of an electric motor (11) coupled to a turbine (12), are located on the top of a tank (13) for filtering units (2). The tank (13) is mounted in a high position on brackets (14) and is located rather close to the path of the cart (8).

Inside the tank (13) of the filtering units (2) there is a vertical cyclone (15) placed in a coaxial position and surrounded by a number of filter bags (16) in an essentially vertical position. The vertical cyclone (15) is connected at the top to the intake conduit (3) through the inlet (17) for air containing dust and debris whereas the filter bags (16) empty at the top into some outlets (18) for the filtered air. At the bottom of the tank (13) there is a debris collection chamber (19).

The stationary gantry (6) consists of an overhead horizontal rail (20) on which the intake conduit (3) and the trolley (5) are mounted. The latter can be moved by sliding in either direction along the rail (20). An elbow section (21) is coupled as one unit to the trolley (5). This elbow section has a square cross section and is sized so that its upper tip (22) is snugly connected in the intake conduit (3) whereas its lower tip (23) contains the aspirating nozzle (4).

The lower tip at the end (24) of the aspirating nozzle (4) is very narrow compared to its length and is connected to the lower tip (23) of the elbow section (21) by means of a square duct (25). In the vacuum direction, said section becomes gradually larger until reaching the lower tip (23) of the elbow section (21).

The intake conduit (3) has a generally square cross section. The conduit (3) consists of a duct (26) in the shape of an upside-down "U" open on the bottom (27) and a flat strip (28) made of a flexible material that is rigid in its crosswise direction.

The flat strip (28) is sized in such a way that its width is larger than the width of the open bottom (27) of the duct (26). The flat strip (28) acts as a cover for the bottom (27) as it rests on some lengthwise joints (29) located on the respective side ridges of the open bottom (27).

The duct (26) of the intake conduit (3) stretches over practically the entire length of the overhead horizontal rail (20) of the stationary gantry (6). One of the ends of the flat strip (28), which is the fixed end marked with reference 30, is securely joined to the end (31) of the duct (26), which empties into the inside of the filtering units (2), whereas the other end portion (32) is rolled onto rotating drum (33), fixed securely to the trolley (5)

and placed under the duct (26).

The rotational axis (34) of the rotating drum (33) is placed perpendicularly with respect to the vertical plane defined by the stationary gantry (6), i.e., the rotational axis (34) is in a crosswise position relative to the duct (26).

With this position of the duct (26), flat strip (28) and rotating drum (33), the length of the intake conduit (3) is determined by the position of the trolley (5) on the overhead horizontal rail (20) of the stationary gantry (6), i.e., by the length in which the flat strip (28) has unrolled from the rotating drum (33) as it covers the open bottom (27) of the duct (26), as shown in Figs. 4 and 5.

Operation of the equipment of the invention is as follows. Once the loading surface (7) of the cart (8) is properly situated with respect to the aspirating nozzle (4), the vacuum units (1) are started and the trolley (5) begins to move back and forth over the width of said loading surface (7), vacuuming the air (35) loaded with dust and debris from the surface (7) through the lower tip at the end (24) of the aspirating nozzle (4).

As the trolley (5) moves, the flat strip (28) is rolled and unrolled over the rotating drum (33), covering and uncovering, respectively, the open bottom (27) of the duct (26) of the intake conduit (3). The flat strip (28) maintains this open bottom (27) in closed position, thanks to a powerful vacuum exerted on the flat strip (28) in its unrolled position by the depression produced in the intake conduit (3) by the vacuum units (1). When there is no aspiration, the flat strip is held by magnet attraction of its edges to a number of attached magnets on the ridges of the open bottom (27).

The air (35) loaded with dust and debris continues to move through the lower tip (24), square duct (25), elbow section (21) and intake conduit (3) until it enters the filtering units (2).

Conduits carrying the respective nozzles can be connected to an opening (36) located near the inlet (17) of the filtering units (2) for auxiliary cleaning purposes, for example, a flexible hose for manual cleaning.

The air (38) loaded with dust and debris, which may consist of a mixture of air (35) aspirated by the nozzle (24) and air (37) from the opening (36) enters the cyclone (15) where gravity is used to unload a receptacle (39) in the debris collection chamber (19) located at the bottom of the cyclone (15).

The debris-free air (38) is forced later towards a dif-fusor (40) located on the top of the tank (13). By means of a turbine (12), the air (38) is forced to an area (41) where the filter bags (16) operate in such a way that the dust contained in the air (38) falls, by gravity, into a receptacle (42) and the filtered air (43), which passes through the side wall of the filter bags (16), is expelled into the atmosphere through the outlets (18) located in the top of the tank (13).

The dust collection receptacle (42) is placed in a coaxial position with respect to the debris collection receptacle (39) and conveniently secured to the same.

Having given a sufficiently detailed description of the nature of the invention as well as of the way of putting it into practice, let it be placed on record that anything that does not alter, change or modify the main principle can be subject to variations in the details of the essential characteristics, and for this reason, an invention patent is requested, as summarised in the following claims.

Claims

1. Vacuum cleaning equipment for ceramic firing tunnel furnace carts, of the type including at least one aspirating nozzle (4), one intake conduit (3); several vacuum units (1); and several filtering units (2), each vacuum unit consisting of a vertical cyclone (15) located above a debris collection chamber (19), the filtering units consisting of a number of filter bags (16) surrounding the said chamber, and the aspirating nozzles (4) being suspended from a trolley (5) which moves back and forth over the overhead horizontal rail (20) of a stationary gantry (6) above the path of the carts (8), characterised in that said intake conduit (3) consists of a duct (26) with a square cross-section, with an open bottom (27) and a length practically matching the length of the aforementioned overhead horizontal rail (20), where said bottom (27) is covered by a flat strip (28) with a width somewhat larger than that of the aforementioned duct (26) and made of a material, such as metal sheet, which is somewhat flexible but rigid in the crosswise direction, and which has one of its ends (30) secured to one of the ends (31) of the duct (26), and the other end (32) rolled up over a rotating drum (33) around an axis (34) which is perpendicular to the gantry's vertical plane (6), mounted on the aforementioned trolley (5) below the duct (26), all in such a way that the length of the aforementioned intake conduit (3) varies depending on the position of the trolley (5).

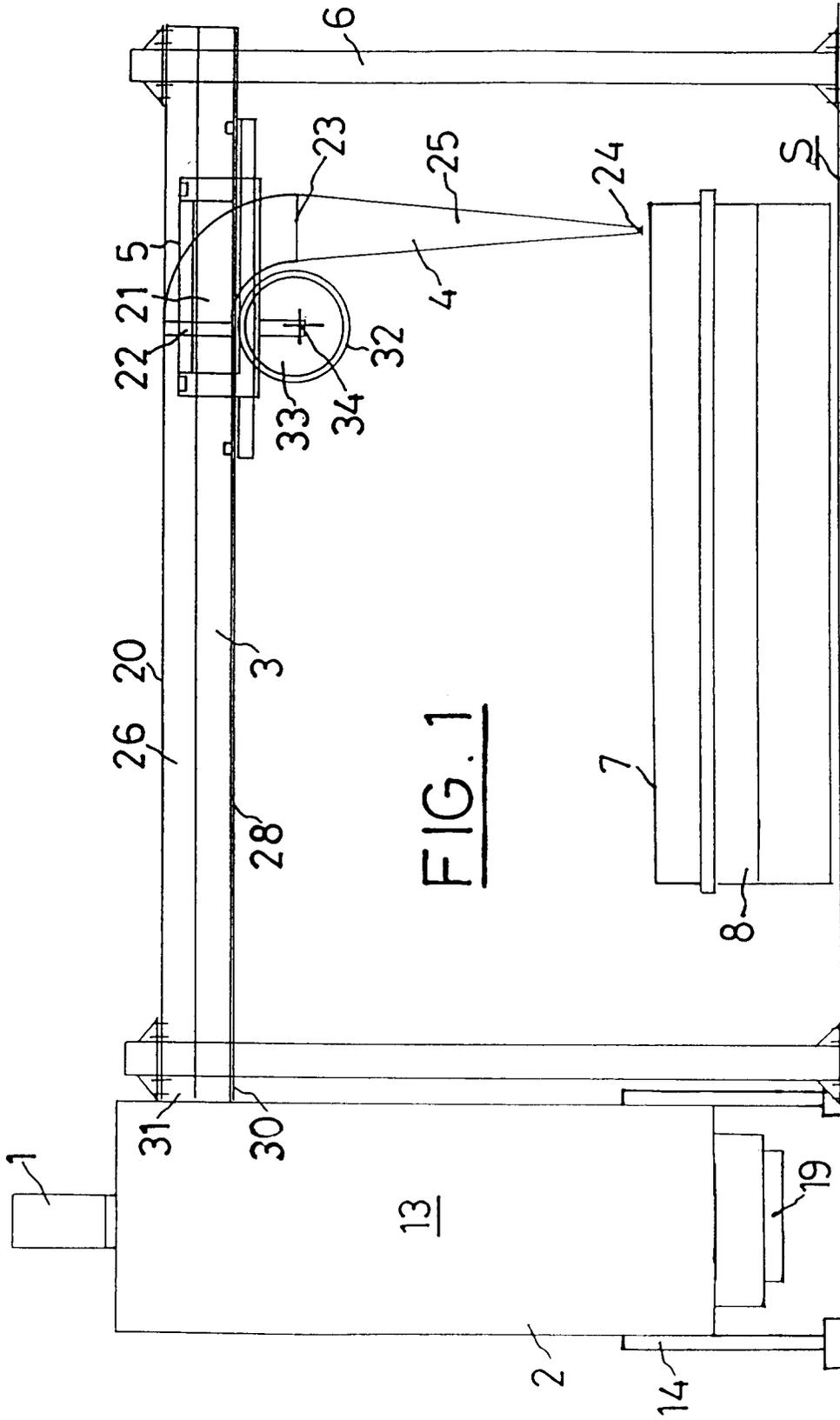
Patentansprüche

1. Vakuuminigungsgerät für Tunnelofenwagen für Brennverfahren für keramische Materialien des Typs mit wenigstens einer Ansaugdüse (4), einer Einlaßleitung (3); mehreren Vakuumeinheiten (1); und mehreren Filtereinheiten (2), wobei jede Vakuumeinheit aus einem vertikalen Zyklon (15) besteht, der oberhalb einer Sammelkammer (19) für überbleibsel angeordnet ist, die Filtereinheiten aus mehreren, die Kammer umgebenden Filtertüten (16) bestehen, und die Ansaugdüsen (4) aufgehängt sind an einem Wägelchen (5), das sich über die über Kopf laufende horizontale Scheine (20) eines stationären Portals (6) oberhalb der Bahn der Wagen (8) rückwärts und vorwärts bewegt, dadurch gekennzeichnet, daß die Einlaßleitung (3)

aus einem Kanal (26) mit rechteckigem Querschnitt besteht, der einen offenen Boden (27) sowie eine Länge hat, welche praktisch der Länge der zuvor erwähnten, über Kopf laufenden horizontalen Schiene (20) entspricht, wobei der Boden (27) von einem flachen Streifen (28) abgedeckt ist, der eine Breite hat, die etwas größer ist als diejenige des zuvor erwähnten Kanals (26) und aus einem Material hergestellt ist wie beispielsweise Metallblech, das in gewisser Weise flexibel, jedoch in kreuzweiser bzw. Querrichtung steif ist und wobei eines seiner Enden (30) an einem der Enden (31) des Kanals (26) befestigt und das andere Ende (32) über eine rotierende Trommel (33) um eine Achse (34) aufgewickelt ist, die senkrecht zu der vertikalen Ebene (6) des Portals ist, und die an dem zuvor erwähnten Wägelchen (5) unterhalb des Kanals (26) montiert ist, und zwar all dies auf solche Weise, daß die Länge der zuvor erwähnten Einlaßleitung (3) in Abhängigkeit von der Position des Wägelchens (5) variiert.

Revendications

1. Equipement pour le nettoyage par aspiration pour wagonnets de fours tunnels de cuisson de la céramique, du type comprenant au moins une buse aspirante (4), un conduit d'entrée (3); plusieurs unités aspirantes (1) et plusieurs unités filtrantes (2), chaque unité aspirante étant constituée par un cyclone vertical (15) placé au-dessus d'une chambre collectrice de débris (19), les unités filtrantes étant constituées par un certain nombre de sacs filtrants (16) qui entourent ladite chambre, et les buses aspirantes (4) étant suspendues à un chariot (5) qui se déplace dans les deux sens sur le rail horizontal aérien (20) d'un portique fixe (6) au-dessus du trajet des wagonnets (8), caractérisé en ce que ledit conduit d'entrée (3) est constitué par une gaine (26) de section transversale carrée présentant un fond ouvert (27) et possédant une longueur pratiquement égale à la longueur du rail horizontal aérien (20) mentionné plus haut, où ledit fond (27) est recouvert par une bande plate (28) d'une largeur quelque peu plus grande que celle du conduit (26) mentionné plus haut et faite d'une matière, telle qu'une feuille métallique, qui est quelque peu flexible, mais rigide dans la direction transversale, et dont une des extrémités (30) est fixée à une des extrémités (31) de la gaine (26) et dont l'autre extrémité (32) est enroulée sur un tambour rotatif (33) tournant autour d'un axe (34) qui est perpendiculaire au plan vertical (6) du portique, et monté sur le chariot (5) mentionné plus haut au-dessous du conduit (26), tout ceci d'une manière que la longueur du conduit d'entrée (3) mentionné plus haut varie en fonction de la position du chariot (5).



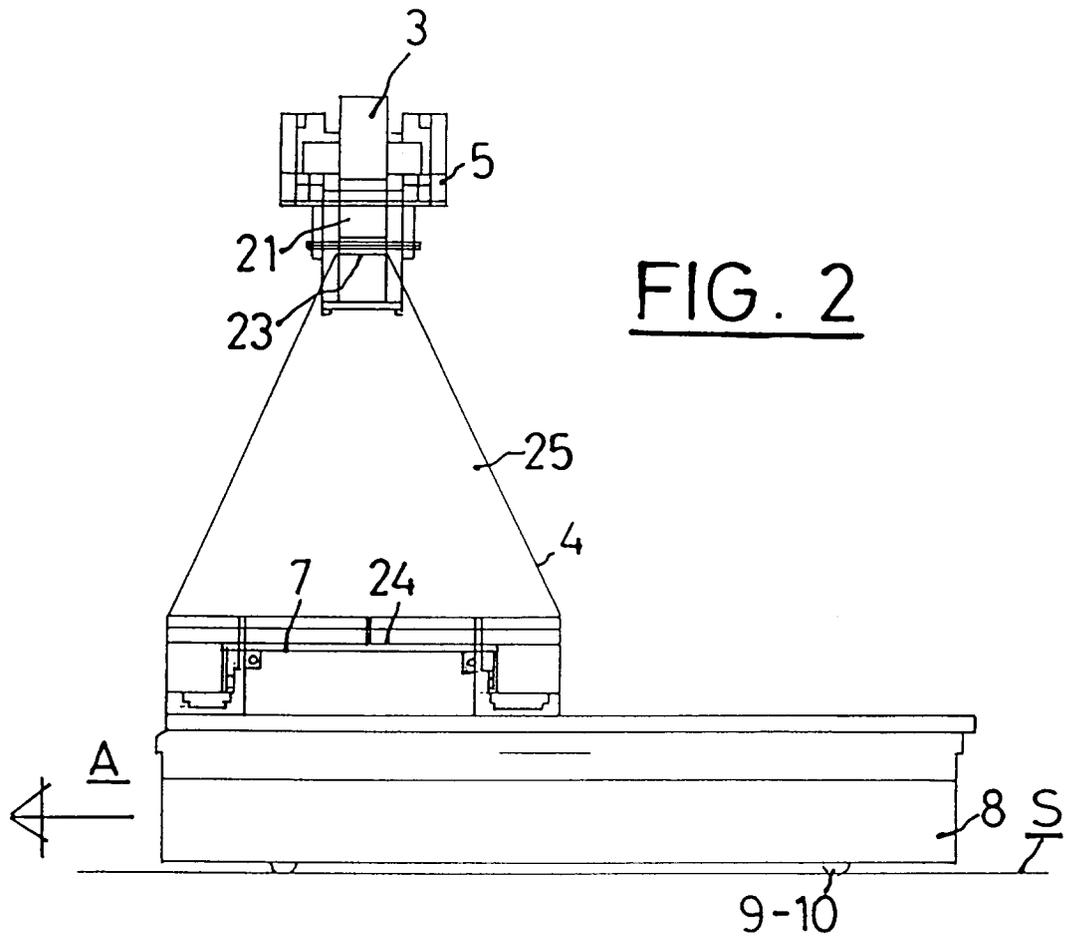


FIG. 2

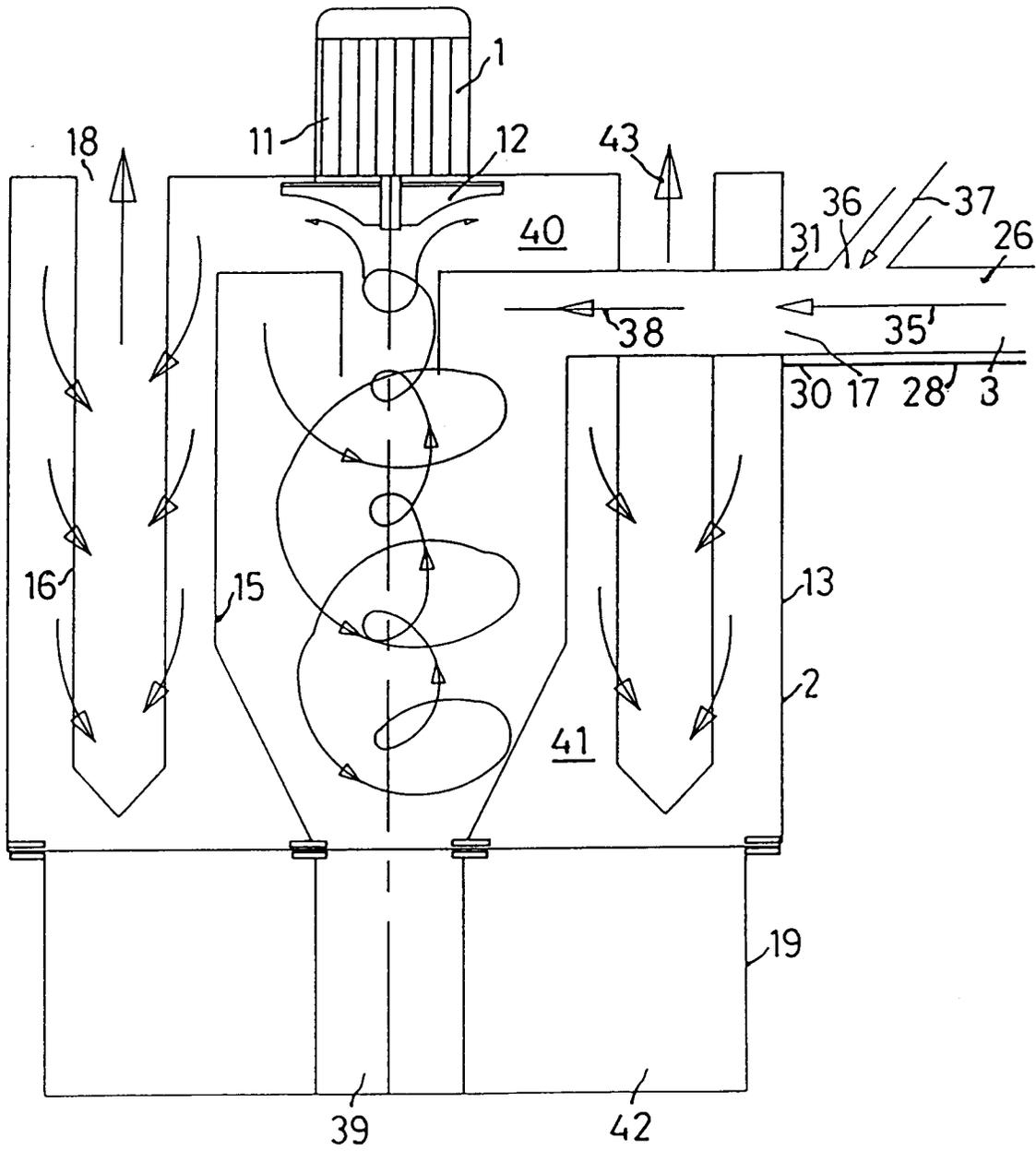


FIG. 3

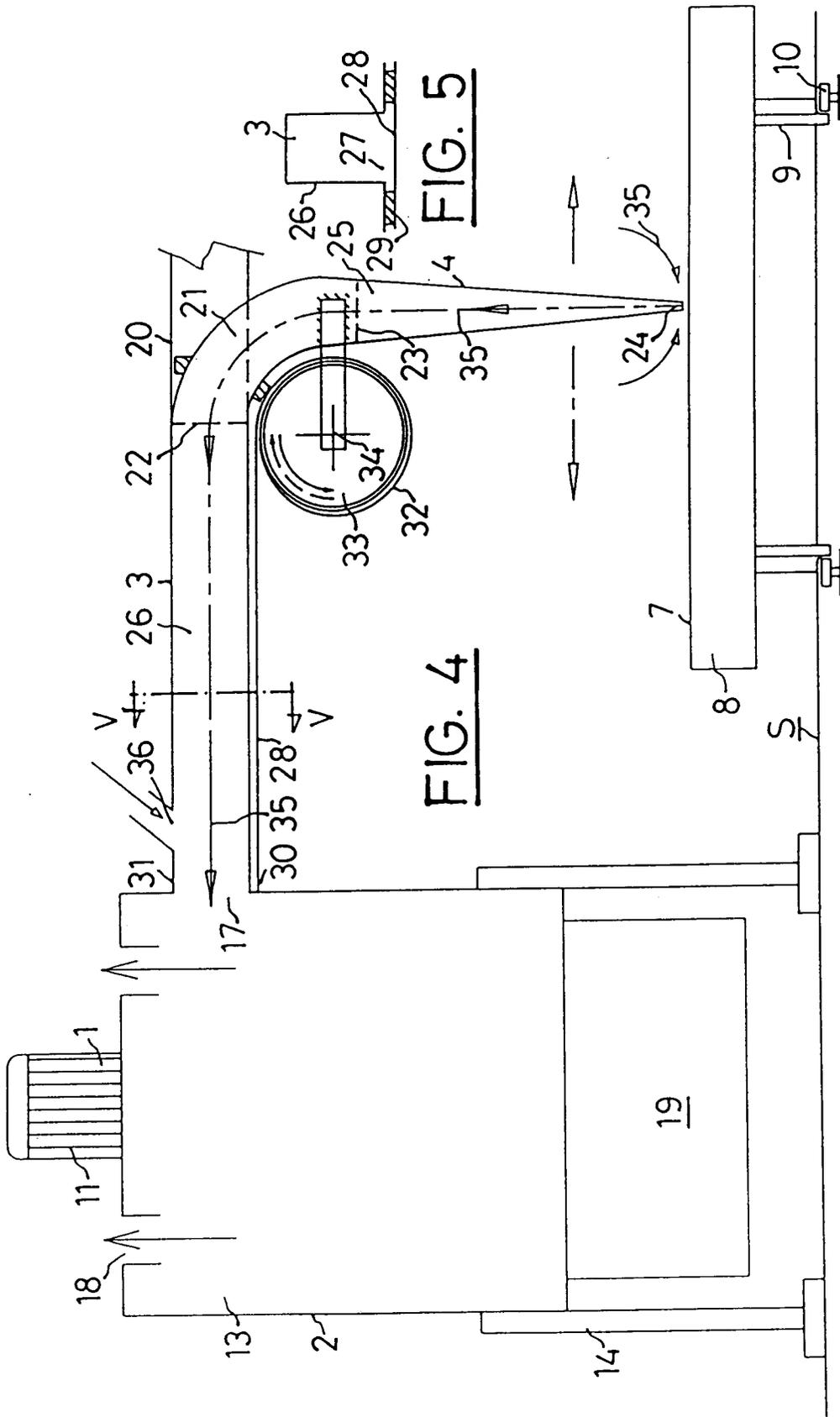


FIG. 4

FIG. 5