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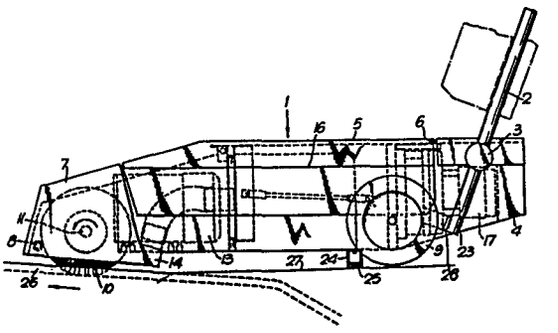
(54) A vacuum cleaner.

(57) A vacuum cleaner particularly intended to be used for cleaning the moving treads of an escalator includes a body (1) with at least one cylindrical brush (10) mounted for rotation about a substantially horizontal axis (11) adjacent the front of the body (1). The body is supported to allow to pivot about a horizontal pivot axis which is parallel to that of the at least one brush (10) and which is located towards the rear of the body (1) so that, in use, the weight of the cleaner pivoting about the horizontal pivot axis is the sole factor determining the downward pressure exerted on the brush (10). The vacuum cleaner also includes braking means (19, 20, 22 or 24, 25) to prevent movement of the cleaner in use. To use the cleaner the body (1) is placed on the stationary platform (27) leading to the moving treads (26) of an escalator with the at least one brush engaging the moving treads (26).



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A VACUUM CLEANER

Vacuum cleaners conventionally include a body which houses a vacuum motor and which is supported by three and usually four wheels. A handle is pivotally connected to the body and one or more dust bags are supported within the body or from the handle. The vacuum cleaner usually includes a cylindrical brush mounted for rotation about a substantially horizontal axis adjacent the front of the body of the vacuum cleaner, the brush being surrounded by a vacuum chamber to which a vacuum is applied so that dirt and debris swept by the brush is carried by the air flow created by the vacuum motor into the dust collecting bag. The height of one or more of the wheels is usually adjustable to cause the body of the vacuum cleaner to tilt and, in so doing, move the cylindrical brush and vacuum chamber towards and away from the surface being cleaned. This adjustment enables the vacuum cleaner to be set up to operate on polished surfaces or on carpets with differing depths of pile. Such a vacuum cleaner is effective for cleaning most surfaces but is ineffective when it is used to clean the moving treads of an escalator since the moving treads of an escalator have a deeply ribbed structure which is impossible to clean with a conventional vacuum cleaner, even when it is adjusted to set its brush in its lowermost position since the bristles of the brush do not penetrate sufficiently to engage the base of the grooves between adjacent ribs.

According to this invention a vacuum cleaner particularly intended to be used for cleaning the moving treads of an escalator includes a body with at least one cylindrical brush mounted for rotation about a substan-

tially horizontal axis adjacent the front of the body the body being supported to allow it to pivot about a horizontal pivot axis which is parallel to that of the at least one brush and which is located towards the rear of the body so that, in use, the weight of the cleaner pivoting about the horizontal pivot axis is the sole factor determining the downward pressure exerted on the brush, and braking means to prevent movement of the cleaner in use, when the body of the cleaner is placed on the stationary platform leading to the moving treads of an escalator, with the at least one brush engaging the moving treads of the escalator.

By selecting the length of the bristles of the brush, their resilience, the total length of the brush and the downward pressure exerted on the brush, it is possible to arrange for the ends of the bristles to engage the base of the grooves between adjacent ribs on the moving treads of an escalator with sufficient force effectively to sweep dirt and debris from the base of the grooves between the ribs. With conventional vacuum cleaners, the downward pressure on the brush is not significant since the body of a conventional vacuum cleaner is supported by three or four wheels and is not free to pivot about a horizontal axis. With the cleaner in accordance with this invention, by selecting the position of the horizontal pivot axis and the weight distribution of the components around the body of the vacuum cleaner, it is possible to provide a predetermined downward pressure on the at least one brush which, together with the selection of the length of the at least one brush and the length and nature of the bristles forming the at least one brush the penetration of the bristles to the base of the moving treads between adjacent ribs is ensured.

Preferably the length of the bristles on the at least one brush is between 25 mm and 40 mm when the bristles are made from nylon having a diameter of 0.6mm or from a mixture of nylon and abrasive carbides known as Tynex, (Registered Trade Mark) having a diameter of 0.5 mm. The at least one brush may also be made from a mixture of bronze and nylon filaments. With the at least one brush having bristles of this length and quality, the cleaner is preferably arranged so that a downward pressure of about 0.79 kg per 10mm length of brush is provided.

Preferably the cleaner includes two or more wheels, all mounted on a common axis. In this case the common axis of the wheels may provide the pivot axis about which the body of the cleaner pivots and also in this case the braking means is a braking mechanism which preferably engages at least one of the wheels to prevent rotation of the at least one wheel when the cleaner is in use. The brake mechanism may be manually operable so that, after the cleaner has been placed with its wheels on the platform leading to the moving treads of an escalator, the operator actuates the brake mechanism. However, it is preferred that the brake mechanism is biased into a position in which the brake mechanism is actuated. The handle of the cleaner may be pivotally connected to the body of the vacuum cleaner and then the brake mechanism be arranged to be released by movement of the handle of the vacuum cleaner to pull the vacuum cleaner rearwards along the ground. To achieve this, the brake mechanism preferably includes a first order level one end of which bears directly against one of the wheels or engages a further element which bears against the wheels and the other end of which is connected to a spring to bias the lever into position with its one end operating the brake. The pivoted handle of the machine preferably extends beyond its pivot point and a portion of the handle extending beyond the pivot point

includes an abutment which engages the other end of the lever to overcome the bias of the spring and thereby release the brake when the handle is pulled to pull the cleaner in the rearwards direction. Preferably the brake mechanism operates to prevent rotation of both or all of the wheels.

Preferably however, the braking means is formed by a brake bar extending downwards below the body and parallel to the axis of the at least one brush. In this case, in use, the brake bar engages the platform at the end of the escalator and the body pivots about the brake bar. Preferably the brake bar includes a rubber or rubber like elastomeric strip to increase the friction between the brake bar and the platform at the end of the escalator. When the cleaner includes a brake bar it preferably includes two or more wheels mounted about a common axis located to the rear of and above the brake bar so that when the cleaner is in use, with its brush engaging the moving treads of an escalator and its brake bar engaging the platform at the end of the escalator the wheels are above and clear of the platform at the end of the escalator.

There may be a single brush extending across the entire width of the cleaner or, alternatively, three brushes arranged in a gang fashion with two aligned with one another but spaced apart from one another and the third placed immediately in front of, or behind, the space between the other two. However, it is preferred that there are two brushes arranged on a common axis but spaced apart from one another by a distance less than the length of each of the two brushes. Escalators have one of three standard widths and it is preferred that the length of each of the brushes is approximately a quarter of the width of the narrowest escalator. In this case, the overall width of the machine is approximately three quarters of the width

of the narrowest escalator and then, in a single operation the cleaner cleans approximately half the surface area of the escalator but in two separate paths. The cleaner is then moved sideways to clean the remainder of the escalator.

Two examples of a vacuum cleaner in accordance with this invention will now be described with reference to the accompanying drawings; in which:-

Figure 1 is a side elevation of a first example with the handle raised;

Figure 2 is a plan of the first example with the casing removed and the hamdle in its lowered position;

Figure 3 is a side elevation of the second example; and

Figure 4 is a plan of the second example.

The vacuum cleaner comprises a body 1 and a handle 2 pivotally connected to the body 1 by bolts 3. The body includes a fixed vacuum motor casing 4 at the rear of the machine and to which the handle 2 is pivotally connected and a main casing 5 which is also pivotally connected to the vacuum motor casing 4 by a hinge 6. A brush cowl 7 is provided at the front of the vacuum cleaner and mounted on a shaft 8 to enable it to be pivoted forwards, away from the remainder of the cleaner. The body is mounted on a pair of wheels 9 freely rotatably mounted on a common axis.

At the front of the machine a pair of generally cylindrical brushes 10 are mounted on axles 11 extending away from a gearbox 12. The brushes 10 include bristles made from nylon having a diameter of 0.6mm or a mixture of nylon and abrasive carbide particles known as Tynex (Registered Trade Mark) having a diameter of 0.45mm. The bristles are arranged in eight tufts around the brush with the tufts which are adjacent the axial direction being offset in the circumferential direction so that a line of tufts along the brush is generally V-shaped. The brushes are driven through their axles 11 and the gearbox 12 by the brush motor 13.

The brushes are arranged so that they rotate in an anti-clockwise direction as seen in Figure 1, that is to say, the lowermost parts of the brushes which, in use, are adjacent the moving treads of the escalator, move rearwards towards the wheels 9. A pair of vacuum chambers 14 are located against the rearmost portions of the brushes 10 and are connected by pipes 15 to a removable dust bag 16. A pair of independent vacuum motors 17 are used to apply a vacuum to a casing containing the dust bag 16 with exhausted air being vented along channels 18.

A brake mechanism, only parts of which are shown, includes a pair of pivoted first order levers 19 one end 20 of which engages the outer periphery of the wheels 9 whilst the other end which terminates in an abutment 21 is engaged by a tension spring 22. The tension spring 22 pulling against the other end of the lever 19 urges the end 20 against the periphery of the wheel 9 to prevent rotation of the wheel 9. However, when the handle 2 is pulled to pull the cleaner in a rearwards direction, the handle 2 pivots about the bolts 3 and an end 23 of the handle 2 engages against the abutment 21 to oppose the pull of the spring 22 and thereby release the one end 20 from the periphery of the wheel 9 to allow the wheel 9 to rotate and allow the cleaner to be pulled in the rearwards direction. The handle 2 folds flat against the casing as shown in Figure 2 for packing and storage.

The bristles in the brushes 10 have a length of 40 mm when new, and may continue to be used until they have worn to a length of about 25 mm. At this point the brushes are replaced. Once the brush cowl 7 is pivoted forwards away from the remainder of the machine, the brushes 10 can be removed axially from the axles 11 and preferably there is a simple snap-on fixing between the brushes 10 and the axles 11.

To use the vacuum cleaner in accordance with this

invention, the vacuum cleaner is placed at the base of an upwardly moving escalator, or alternatively at the top of a downwardly moving escalator, with the wheel 9 in position on the stationary platform leading to the moving treads of the escalator and with the brushes 10 engaging the flat portion of the moving treads of the escalator where their upper surfaces are all aligned with one another. The position of the escalator is shown by the chain dotted lines in Figure 1. The brush and vacuum motors 13 and 17 are activated and, with the cleaner in position adjacent one side of the escalator the escalator is allowed to run until the moving treads of the escalator have completed one complete circuit. The vacuum cleaner is then moved sideways until it is aligned with the opposite side of the escalator and again the moving treads of the escalator are allowed to proceed through one complete cycle. In this way, the space between the two brushes 10 which is taken up by the gearbox 12 and which is not cleaned whilst the cleaner is in its first position on the escalator is cleaned when the cleaner is moved sideways and so aligned with the other side of the escalator. Typically, the brushes 10 have a length of 140 mm, which is just over a quarter of the width of the narrowest escalator so that the entire width of the narrowest escalator can be cleaned, with only a single sideways movement of the vacuum cleaner.

The second example is generally similar to the first but is slightly simpler in construction. In this second example the brake mechanism is replaced by a fixed bar 24 having a rubber or rubber-like elastomeric foot 25. The bar 24 is fixed to the base of the body 1 and forms the lowermost point of the cleaner so that the cleaner rests on and pivots about the foot 25. The wheels 9 are freely rotatable about an axis located behind and above the bar 24 so that, in use, with the cleaner resting

on the bar 24 the wheels 9 are lifted out of contact with the platform of the escalator. In Figure 3 the moving treads of the escalator are indicated by the reference numeral 26 and the platform by reference numeral 27. To move the cleaner the handle 2 is pulled rearwards to tilt the cleaner which engages the wheels 9 with the ground and then further movement lifts the foot 25 and bar 24 away from the ground, to allow the cleaner to be wheeled around. In the second example the ends 22 of the handle 2 engage fixed abutments 28. Bolts 29 are also provided to lock the handle 2 in its lowered position so that the cleaner may be easily carried by two people with one grasping the top of the handle and one the ends 23 of the handle 2. This is particularly useful for man-handling the cleaner up and down stairs.

C L A I M S

1. A vacuum cleaner particularly intended to be used for cleaning the moving treads of an escalator including a body (1) with at least one cylindrical brush (10) mounted for rotation about a substantially horizontal axis (11) adjacent the front of the body (1), the body (1) being pivoted to allow it to pivot about a horizontal pivot axis which is parallel to that of the at least one brush (10) and which is located towards the rear of the body so that, in use, the weight of the cleaner pivoting about the horizontal pivot axis is the sole factor determining the downward pressure exerted on the brush (10), and braking means (19,20,22 or 24, 25) to prevent movement of the cleaner in use, when the body (1) of the cleaner is placed on the stationary platform (27) leading to the moving treads of an escalator, with the at least one brush engaging the moving treads (26) of the escalator.

2. A vacuum cleaner according to claim 1, which includes two or more wheels (9) all mounted on a common axis.

3. A vacuum cleaner according to claim 1 or 2, in which the braking means is formed by a brake bar (24) extending downwards below the body (1) and parallel to the axis (11) of the at least one brush (10), in use, the brake bar (24) engaging the platform (27) at the end of the escalator and the body (1) pivoting about the brake bar (24).

4. A vacuum cleaner according to claim 3, in which the brake bar (24) includes a rubber or rubber-like elastomeric strip (25) to increase the friction between the brake bar (24) and the platform (27) at the end of the escalator.

5. A vacuum cleaner according to claim 2 or claim 3 or 4 when dependent upon claim 2, in which the two more wheels, (9) are mounted on a common axis located to the rear of and above the brake bar (24), so that when the cleaner is in use, with its brush (10) engaging the moving treads (26) of an escalator, and with its brake bar (24) engaging the platform (27) at the end of the escalator, the wheels (9) are above and clear of the platform (27) at the end of the escalator.

6. A vacuum cleaner according to claim 2, in which the braking means is formed by a braking mechanism which engages at least one of the wheels (9) to prevent rotation of the at least one wheel (9) when the cleaner is in use, the brake mechanism being biased into the position in which the brake mechanism is actuated.

7. A vacuum cleaner according to any one of the preceding claims in which there are two brushes (10) arranged on a common axis (11) but spaced apart from one another by a distance less than each of the two brushes (10).

8. A vacuum cleaner in accordance with any one of the preceding claims, in which the length of the bristles on the at least one brush (10) is between 25 mm and 40mm when the bristles are made from nylon having a diameter of 0.6mm or from a mixture of nylon and abrasive carbides having a diameter of 0.45 mm.

9. A vacuum cleaner according to claim 8 in which a downward pressure of about 0.79 kg per 10mm length of brush (10) is provided to ensure that the bristles engage the base of the treads between adjacent ribs of the moving treads of the escalator.

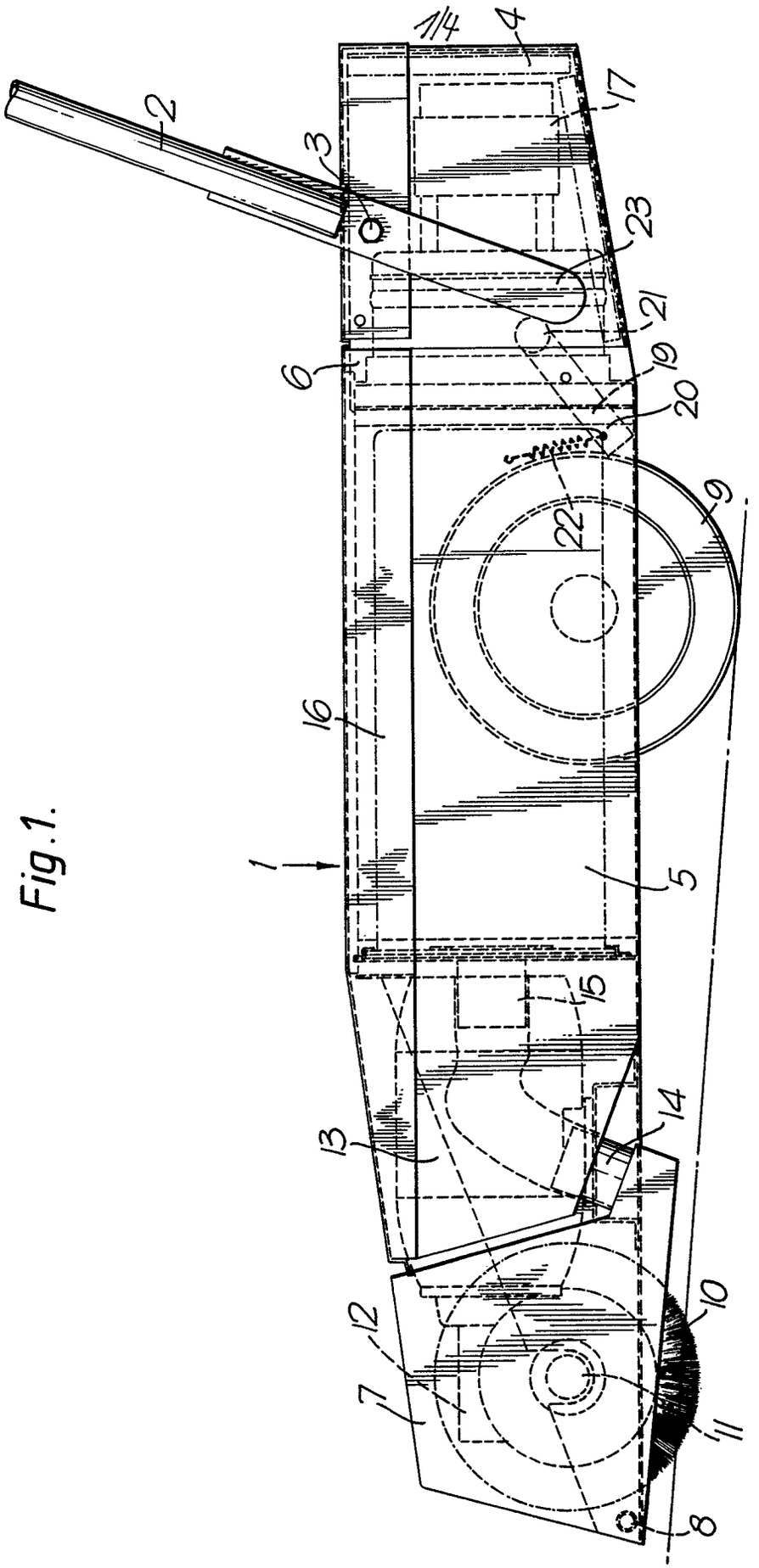

Fig.1.

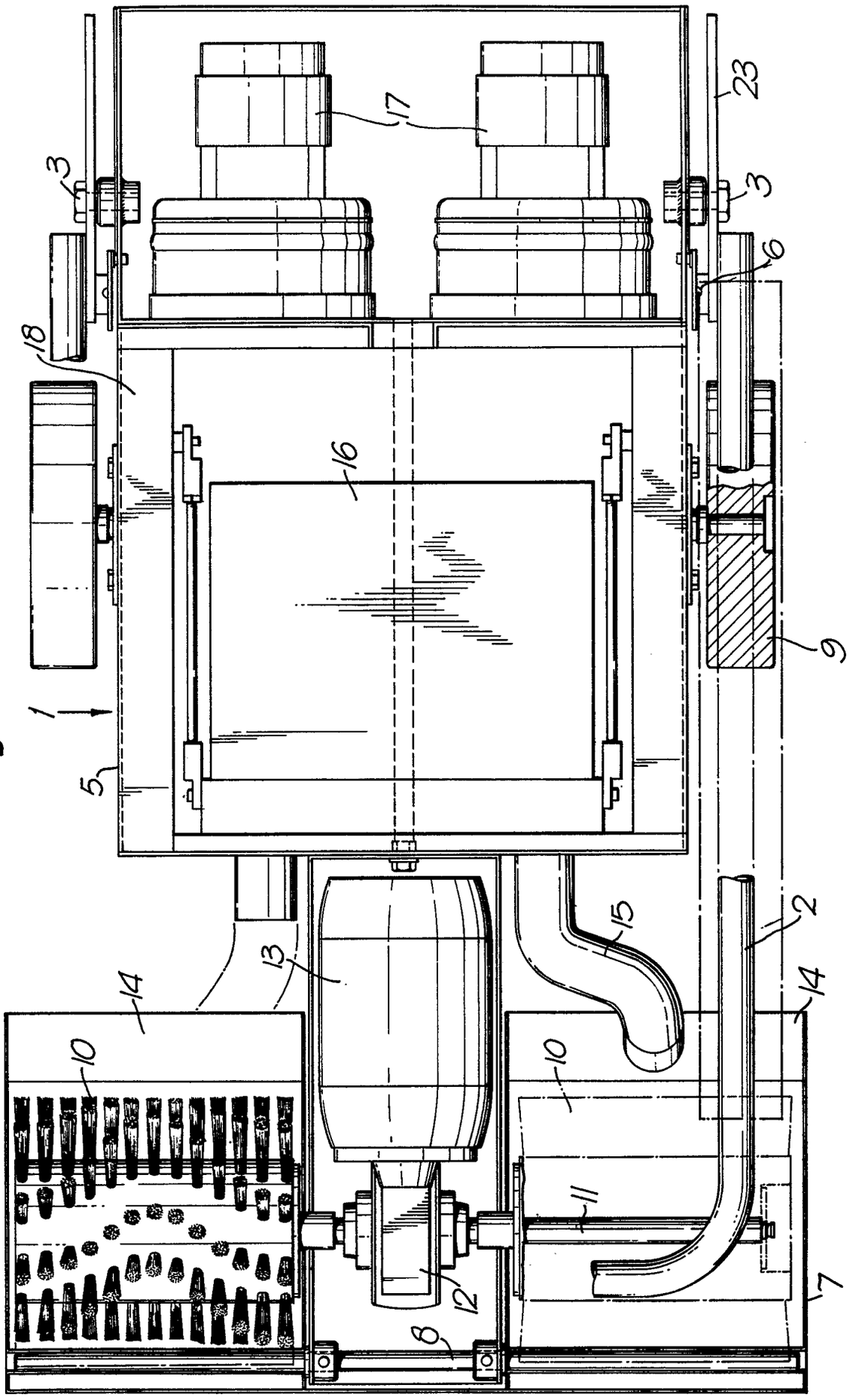

Fig. 2.

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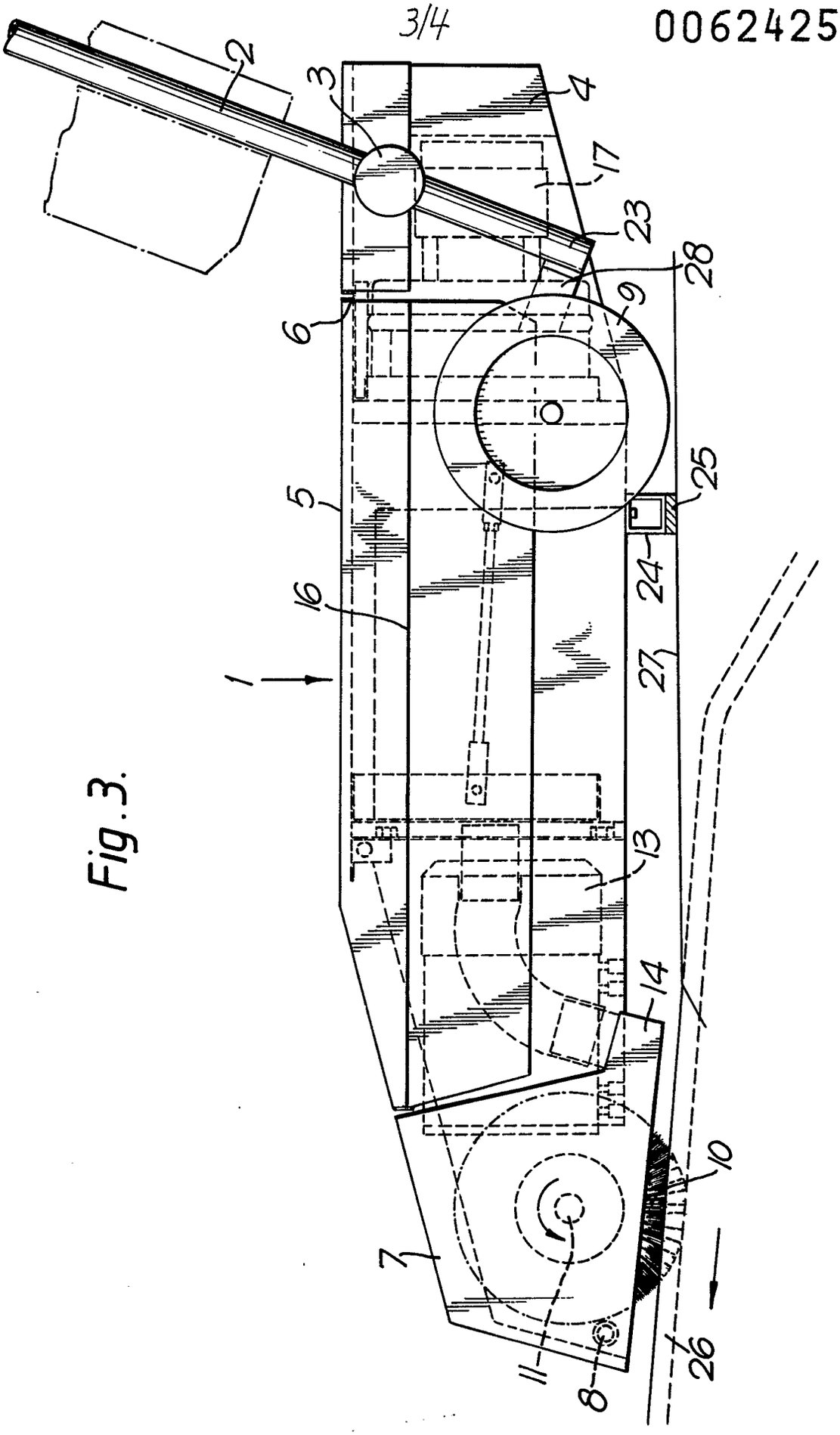

Fig. 3.

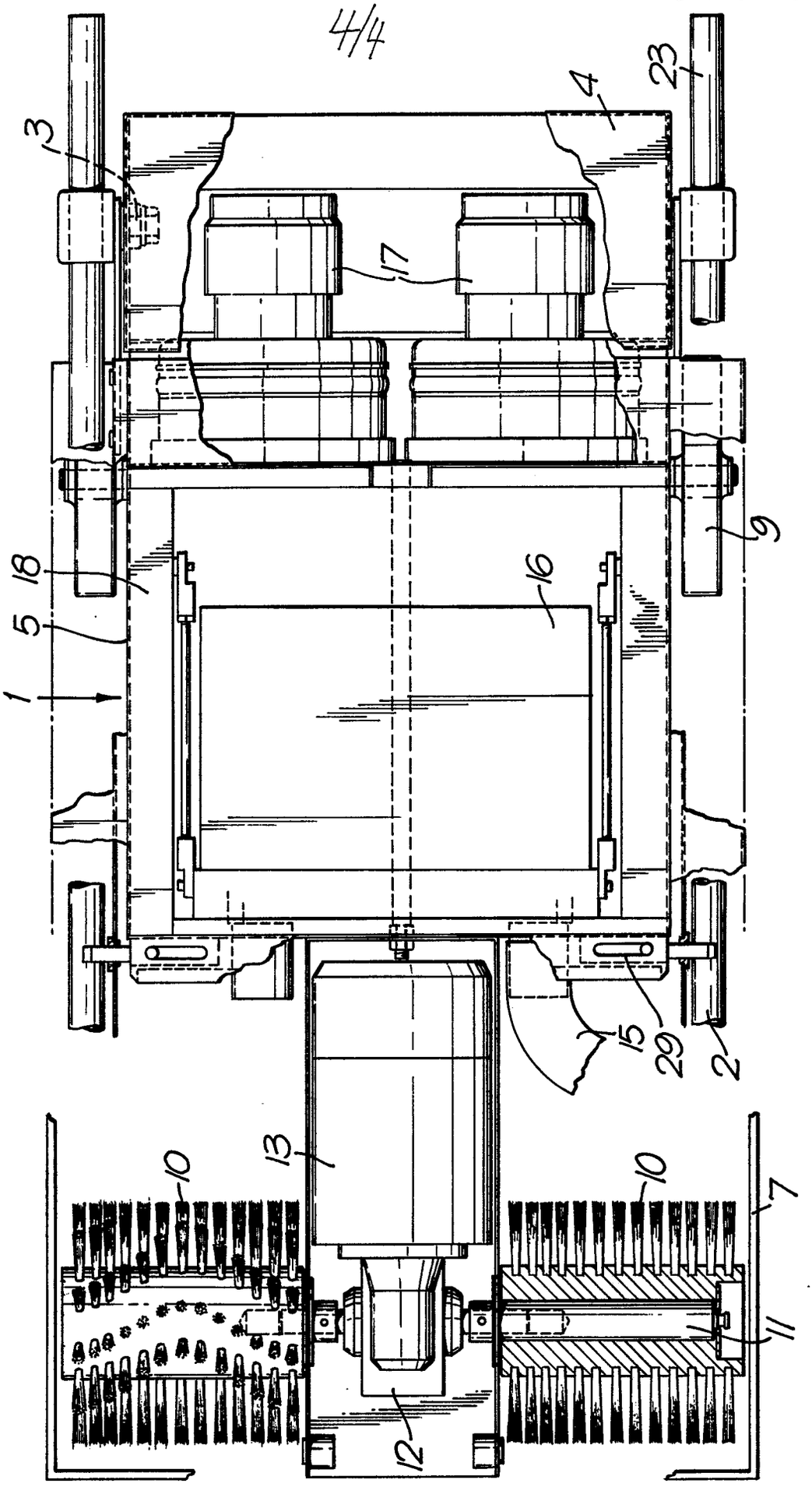

Fig. 4.

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EUROPEAN SEARCH REPORT

0062425
Application number

EP 82 30 1376

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	US-A-3 584 329 (CRAVITS P.) *Column 3, lines 20-75; column 4, lines 9-75; column 5, lines 1-54; figures 5-7 and 10*	1,2,3, 5	A 47 L 7/00
A	US-A-2 740 985 (KAUFMAN G.E.) *Column 2, lines 3-32; figure 1*	7	
A	FR-A-2 250 297 (LABONNE G.R.)		

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

A 47 L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	07-07-1982	MUNZER E.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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