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(54) **Tumble dryer**

Trommeltrockner

Séchoir à tambour

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• **PATENT ABSTRACTS OF JAPAN vol. 2000, no.
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Description

[0001] This invention relates to tumble dryers.

[0002] A tumble dryer typically consists of a rotating drum in which a load is placed, a heater, and a fan for conveying dry heated air, which has been drawn into the dryer from outside the dryer, through the load. The cooler moist air leaving the drum may be vented directly to the outside atmosphere. Typically, the duct along which the moist air travels is provided with a mesh filter, accessible to the user of the tumble dryer. This mesh filter must be removed periodically for cleaning, or the performance of the dryer will be impaired.

[0003] An alternative proposed tumble dryer arrangement is to include a cyclonic separator, in which the fluff laden air is spiraled or swirled in some manner to centrifugally remove fluff from the stream of moist air leaving the drum. Such tumble dryers with cyclone arrangements may produce a more consistent flow of drying air than produced using a conventional mesh filter, since the latter becomes progressively impeded by fluff. Examples of such tumble dryer proposals are described in US Patents 5706588, 4118207, 6016610, 5560120 and in Japanese patent application number JP 2000329376.

[0004] Document US-A-2 959 044 describes a tumble dryer according to the preamble of claim 1.

[0005] In most of these prior proposals the efficiency and performance of the tumble dryer and in particular the cyclone separation is poor. This is evidenced by the fact that most of these proposals also further include mesh filters to assist in fluff / lint removal. The use of an additional mesh filter adds further complexity to the arrangement and also partially negates some of the advantages of using a cyclone filter.

[0006] Specifically a mesh filter requires the fluff trapped thereon to be scraped or otherwise removed from the filter screen and also as fluff is trapped on the filter screen airflow there through is restricted. Also whilst these arrangements produce a more consistent flow of drying air the overall performance of these proposed tumble dryers is also poor and can be improved. A further problem with some of these proposed arrangements in which a fan is provided upstream of the cyclone separator is that the fluff builds up on the fan thereby reducing the fan performance and flow of air through the drum and dryer leading to poor dryer performance. In the worst case fluff build up on the fan could possibly clog the fan entirely. The various proposed arrangements for collecting and removal of the fluff and lint are also complex and in some cases convoluted and in practical.

[0007] It is therefore desirable to provide an improved tumble dryer that address the above mentioned problems, which has improved dryer performance and in particular which has an improved separator for removing fluff / lint, and/or which provides improvements generally.

[0008] According to the present invention there is provided a tumble dryer as defined in the accompanying claims.

[0009] In an described embodiment a tumble dryer comprises a rotating drum into which a load is placed, a heater, a fan for conveying a stream of dry heated air heated by the heater though drum, and a cyclone separator for removing fluff from the stream of drying air leaving the drum. The fan is located upstream of the drum and blows a stream of dry heated air through the drum. The dryer further comprises a second fan downstream of the drum and upstream of the cyclone separator to increase the velocity of the drying air entering the cyclone separator and suck air through the drum.

[0010] The operating efficiency of this arrangement is enhanced due to the combination of the blowing fan and a sucking fan. The fluff removal in the cyclone separator is also enhanced with the second fan increasing the velocity of the air into the cyclone separator. Consequently no additional mesh filter is required which would throttle the airflow through the dryer and causes some of the above mentioned problems.

[0011] The cyclone separator preferably comprises a cylindrical outer housing, an inner tube, an inlet port, and an end cap. The inner tube is coaxially located within the outer housing and extends part way into one end of the outer tube to define an annular space there between at that one end of the cyclone separator. The inner tube also defines an outlet duct from the separator. The inlet port in the outer tube opens into the annular space between the inner tube and outer housing. The end cap assembly closes off the opposite end of the outer tube and cyclone separator.

[0012] The cyclone separator preferably has a removable portion accessible from the front of the dryer to permit disposal of fluff. In particular the end cap comprises a cylindrical portion which fits within the outer housing of the cyclone separator and within which fluff is in use collected. This end cap is removable and may comprise the removable portion of the cyclone separator accessible from the front of the dryer to permit disposal of fluff. The removable portion may be at least partially transparent so that fluff build-up is visible from outside the tumble dryer.

[0013] With such an arrangement the separated fluff can be easily seen, and removed by removing and emptying the removable portion.

[0014] The removable portion, within which the fluff is collected may have projecting surfaces to prevent the collected fluff from revolving with the cyclone air. These projecting surfaces may comprise radially projecting ribs or vanes. The outer periphery of the inner tube may include a projecting spiral vane which spirals around the circumference of and long at least part of the length of the inner tube.

[0015] The removable portion may be laterally spaced from the opening of a duct through which drying air leaving the drum is directed. The cyclone separator is arranged to receive drying air tangentially.

[0016] A barrier may be provided to shield the second fan from the flow of air from the drum. Furthermore the

second fan may be arranged to draw in and directs a further separate flow of air which is directed to entrain and combine with the air leaving the drum to thereby increase the velocity of air leaving the drum as it enters the cyclone separator as a combined air stream.

[0017] The barrier, and this arrangement of the second fan to entrain the fluff laden flow rather than the fluff laden flow passing through the second fan, reduces the likelihood of fluff build up on the second fan.

[0018] In another described embodiment, a tumble dryer comprises a rotating drum into which a load is placed, a heater, a fan for conveying a stream of dry heated air through drum, and a cyclone separator for removing fluff from the stream of drying air leaving the drum. The cyclone separator comprises a cylindrical outer housing, an inner tube coaxially located within the outer housing and extending part way into one end of the outer tube to define an annular space there between at that one end of the cyclone separator, and an inlet port in the outer tube opening into the annular space between the inner and outer tube. The outer periphery of the inner tube includes a projecting spiral vane which spirals around the circumference of and long at least part of the length of the inner tube.

[0019] In yet another described embodiment a tumble dryer comprises a rotating drum into which a load is placed, a heater, a fan upstream of the drum for conveying a stream of dry heated air heated by the heater through drum, and a cyclone separator for removing fluff from the stream of drying air leaving the drum. The cyclone separator comprises a cylindrical outer housing, an inner tube coaxially located within the outer housing and extending part way into one end of the outer tube to define an annular space there between at that one end of the cyclone separator, and an inlet port in the outer tube opening into the annular space between the inner and outer tube. Within the outer housing there are inwardly projecting surfaces to prevent the collected fluff from revolving with the cyclone air. Preferably the separator further comprises a removable end cap assembly removably fitted to the outer housing and closing off an end of the outer housing tube, and within which the inwardly projecting surfaces comprise internal ribs or vanes of the end cap assembly.

[0020] Advantageously in embodiments of the invention, the cyclone separator has a removable portion accessible from the front of the dryer to enable removal of fluff. The removable portion may be laterally spaced from the opening of a duct through which the air leaving the drum is directed. In this way, the cyclone separator may be arranged to receive the drying air tangentially.

[0021] A tumble dryer constructed in accordance with the invention will now be described in detail, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic perspective, cut away, drawing of the tumble dryer according to the invention;

Figure 2 is a view from underneath, partly in section, of a part of the tumble dryer including a cyclone separator;

5 Figure 3 is a side view of the cyclone separator shown in Figure 2, seen in the direction of the arrows 3-3;

10 Figure 4 is an end view of the cap 14 shown in Figures 1 to 3;

Figure 5 is an axial cross-section of the cap 14;

15 Figure 6 shows an alternative version of the cyclone shown in Figure 3; and

Figure 7 shows an alternative version of the fan 15 shown in Figure 2.

20 **[0022]** Referring to the drawings, the tumble dryer consists of a rotatable drum 1 mounted in a cabinet 2, the drum having an opening 3 provided with a door (not shown) through which the load to be dried, typically clothes which have been washed in a washing machine, have been inserted. A motor 4 drives a fan 5 in a heater box 6 containing a heater unit 7. The motor 4 may also be responsible for rotating the drum 1.

25 **[0023]** The heated air enters the drum at the rear via an opening 8 in the dryer box 6, and passes through the load of clothes while the drum is being rotated. The cooled moist air leaves the front of the drum via a banjo-shaped duct 9, which opens in an annular slot around the mouth of the opening 3, which is of course shielded off by means of the door which is not shown. The banjo-shaped duct 9 is secured to the front of the cabinet and channels the cooler moist air into a duct 10 which eventually leads to the rear of the dryer. The air could for example be vented via the rear of the dryer, through a pipe in an outside wall or to a window.

30 **[0024]** As is well known, the moist air leaving the front of the drum entrains a certain amount of fluff which could block the duct or cause a nuisance at the outside venting position and, for this reason, a mesh filter is usually included in known tumble dryers at some point in the path of the exhausting moist air. In accordance with the invention, a cyclone separator 11 is provided, and the moist air leaving the drum and traveling along duct 10 is diverted via volute 12 to provide a tangential input to the cyclone separator 11. The cyclone separator 11 removes the fluff from the air stream, which then exhausts from the rear of the appliance via duct 13, to be fed to an opening in an outside wall or to a window. A portion of the cyclone separator is removable to enable the fluff built up to be periodically removed, and the cyclone separator 11 has a cap 14 accessible from the front of the dryer to permit this. The cyclone separator 11 will now be described with reference to Figures 2 and 3.

35 **[0025]** The cyclone separator 11, as shown, comprises

a cylindrical hollow outer tube or housing 30. Co-axially located within the outer tube 30 is an inner cylindrical hollow tube 32 which has a outer diameter that is less than the inner diameter outer tube 30. The inner tube 30 extends part way along the length, and into one end, of the outer tube 30 with a distal end 38 of the inner tube 32 located, as shown, within the outer tube 30. An annular space 34 is thereby defined between the inner and outer tubes 30,32 at one end of the separator 11. This annular space 34 then opens out into an enlarged cylindrical chamber 40 at the other end of the separator 11 and beyond the distal end 38 of the inner tube 32. The distal end 38 of the inner tube 32 is closed off by an end wall 42. Circumferentially around the distal end 38 of the inner tube 32 there are a series of slot openings 16 through the inner tube 32 to admit a flow of air into the inner tube 32. An outlet end of the inner tube comprises an outlet port 31 of the cyclone separator 11 and is extended to directly form the exhaust duct 13, or is connected to a separate exhaust duct 13.

[0026] The end of the outer tube 30 into which the inner tube 32 is fitted, and the annular space 34 between the outer tube 30 and inner tube 32, is closed off by an annular end wall 38. Towards that end of the outer tube 30 there is also a tangential inlet port 36 that is connected to an outlet of the volute 12 and duct 10. The inlet port 36 faces and opens onto the outside of inner tube 32 with the inlet port 36 laterally spaced along the length of the separator 11 away from the distal end 38 of the inner tube 32. The inlet port is aligned to direct a flow B of moist air tangentially into the cyclone separator 11 and into the annular space 34 between the inner and outer tubes 30,32 and around the inner tube 32 as shown by arrow B and explained further below. The other end of the outer tube 30 is closed off by the end cap assembly 14 which is shown in more detail in isolation in figures 4 and 5.

[0027] The end cap assembly 14 comprises a circular end plate 46 which closes off a cylindrical main body portion 44 which is dimensioned to closely fit within the end of the outer tube 30, and into the enlarged cylindrical chamber portion 40 of the cyclone separator 11. This end cap assembly 14 is similarly laterally spaced from the inlet port 36. The outer periphery of the end plate 46 extends beyond the outer diameter of the cylindrical main body portion 44 with a peripheral circumferential lip 48 projecting from the end plate 46 to fit over the outside of the outer tube 30 when the end cap assembly 14 is fitted to the outer tube 30 to secure the end cap to the outer tube 30. An inner circumferential surface of the lip 48 and corresponding outer surface of the outer tubular body 30 may be threaded to secure the end cap assembly 14 to the outer tube 30. Alternatively a close interference fit between the lip 48 and outer tubular body, or other arrangement, can be used to secure the end cap assembly 14 to the outer tube 30. Towards the end plate end of the end cap assembly 14 there are a series of internal ribs 17 which project radially from the inside of the cylindrical main body 44. There are also radially extending vanes

18 located and extending from the centre of the cylindrical main body 44. In this embodiment there are four internal ribs and four vanes, although it will be appreciated that different numbers of ribs and vanes and different configurations of ribs and/or vanes could be employed.

[0028] In operation to build up sufficient velocity of the moist air to form a cyclone, volute 12 is provided with a fan 15 immediately upstream of the cyclone separator 11, which is also driven by motor 4. The moist air passing down the duct 10 in the direction of arrow A is driven by the fan 15 in the tangential direction B, and sets up a cyclonic swirling motion C in the cyclone separator 11. The swirling motion passes down the cyclone separator 11 so that fluff builds up at the lefthand end as seen in Figure 3. The internal ribs 17 and vanes 18 of the end cap assembly 14 prevent the collected fluff from revolving with the cyclone air. The cap 14 is periodically removed by the user for cleaning out the fluff. The cap 14 is transparent (but need not be) to make the amount of collected fluff visible from the exterior of the dryer 2. The cyclonic airflow C passes down the outside wall of inner tube 32, which can if desired be conical, within the annular space 34 before exiting through slots 16 in the inner tubular body 32 and exhausting from the rear of the machine D to the outside atmosphere. The slots 16 are disposed circumferentially around the inner cylindrical body 32 and open out radially such that for the air to exit the separator 11 the airflow must flow radially inwardly through the slots 16 and into the inner tube 32 and thence axially (as shown towards the right) along the inner tube 32. The fluff, having a greater mass, is directed radially outwards and axially along the separator 11 (as shown towards the left) by the swirling cyclonic air flow and away from the slots 16 and outlet and in the opposite direction the exhausted air leaving the separator 11. The slots 16 are kept clear of fluff by the swirling air of the cyclone passing over its surface.

[0029] Among the advantages of the dryer described are that the operating efficiency is enhanced due to combined use of the blowing fan 5 and the sucking fan 15 and improved fluff capture. Furthermore the blowing fan 5 which is located upstream of the drum 11 and is not susceptible to fluff deposition, provides the main consistent flow of drying air through the drum whilst the sucking fan 15, whilst assisting in providing airflow through the drum, principally provides and adds an increased velocity to the moist air entering the separator 11. In this manner the main fan 5 can be optimized for maximum flow efficiency whilst the sucking fan 15 can be designed to avoid deposition of fluff with efficiency being less important since the main flow is generated by the main fan 5. Also, there is no mesh filter which would throttle the airflow. The airflow is never impeded by the fluff, resulting in more consistent lower air temperatures throughout the drying cycle and consistent thermostat operations.

[0030] The vanes 18 and ribs 17 in the end cap assembly 14 also ensure that the collected fluff does not block the outlet slots 16 or downstream ducts and that

collected fluff is better retained. This again improves the performance of the cyclone separator 11.

[0031] The internal configuration of the cyclone separator 11 also provides improved separator performance as compared to previous proposals. In particular the lateral spacing of the removable end cap 14 from the slots 16 of the inner tubes 32, and lateral spacing of the inlet port 36 from the slots 16, enhances cyclonic flow and reduces the possibility of fluff impeding or being entrained in the air leaving the separator through the slots 16.

[0032] The method of removing the fluff is straightforward. The fluff is easily tipped out of the cyclone separator, whereas it is less easy to peel fluff off a mesh filter. Further, the receiving space in the cap assembly 14 holds more fluff than the surface of the mesh, hence less frequent cleaning is required.

[0033] The duct 4 feeding the moist air to the cylinder 10, the banjo-shaped 9 is of simple construction.

[0034] Of course, variations may be made without departing from the scope of the invention.

[0035] Thus, referring to Figure 6, the outer periphery of the inner tube 32 may be provided with a spiral-shaped profile and a projecting spiral vane 19 to help convey the air to the front of the cyclone (at the front of the dryer) in a cyclonic manner and to promote an enhanced cyclonic air flow.

[0036] Referring to Figure 7, in an alternative version of the cyclone, a barrier 20 is provided between the flow of fluff-entrained air leaving the drum, and the fan 15, to prevent any possible fluff build-up on the blades of the fan 15. The fan is turned around compared to Figure 2 and sucks air E from inside the dryer instead of from the drum, and blows this air tangentially into the cyclone along with the air A from the drum which is propelled by the rear fan 5. This air flow E from the fan 15 entrains the air for flow A from the duct 10 increasing the velocity of the combined airflow into the separator. This serves to reduce the chances of fluff being deposited on the barrier 20 itself, or of fluff from clogging the fan 15 with the fan being protected from the fluff laden moist airflow A from the drum by the barrier 20.

[0037] Alternatively, the fan 15 may be specially chosen so that it is self-cleaning, to avoid fluff build-up.

[0038] As described the motor 4 is responsible for rotating the drum 1 and for driving the fans 5 and 15. If desired, a separate single directional motor may be used to drive the cyclone fan 15. This would be advantageous in some designs of dryer in which the drum reverses periodically to prevent the clothes tangling in the drum. A single stage cyclone separator has been described, and this may well be sufficient for dryers vented to the outside atmosphere. Nevertheless, a two or more stage cyclonic separator could be provided, in the manner of two or more stage cyclonic separators used in vacuum cleaners such as in EP-A-0 018197 and EP-A-0 042723.

[0039] While the illustrated dryer is rear-venting, the design could be adapted to a front-venting dryer.

Claims

1. A tumble dryer comprising a rotating drum (1) into which a load is placed, a heater (7), a fan (15) for conveying a stream of dry heated air heated by the heater (7) through drum (1), and a cyclone separator (11) for removing fluff from the stream of drying air leaving the drum (1), whereby the fan (15) is downstream of the drum (1) and upstream of the cyclone separator (11)
characterized in that the dryer further comprises a second fan (5) upstream of the drum (1) to increase the velocity of the drying air entering the cyclone separator (17).
2. A tumble dryer as claimed in claim 1, in which the cyclone separator (11) comprises:
 - an outer housing (30);
 - an inner tube (32) coaxially located within the outer housing (30) and extending part way into one end of the outer housing (30) to define an annular space (34) therebetween at that one end of the cyclone separator (11), the inner tube (32) also defining an outlet duct (31) from the separator (11); and
 - an inlet port (36) in the outer tube (32) opening into the annular space (34) between the inner tube (32) and outer housing (30).
3. A tumble dryer as claimed in claim 2 in which the outer housing (30) is cylindrical.
4. A tumble dryer as claimed in claim 2 or 3 in which the inner tube (32) is conical.
5. A tumble dryer as claimed in any of claims 2 to 4 in which an outer periphery of the inner tube (32) includes a projecting spiral vane (19) which spirals around the circumference of and long at least part of the length of the inner tube (32).
6. A tumble dryer as claimed in any of claims 2 to 5 in which slot openings (16) are defined in and around the inner tube (32) through which in use, air from within the outer housing (30) can flow radially into the inner tube (32) and thence to the outlet duct (31).
7. A tumble dryer as claimed in claim 6 in which the slot openings (16) are laterally spaced from the inlet port (36)
8. A tumble dryer as claimed in any of claims 2 to 7 further comprising an end cap assembly (14) closing off the opposite end of the outer tube (30) and cyclone separator (11).
9. A tumble dryer as claimed in claim 8 in which the

end cap (14) comprises a cylindrical portion (44) which fits within the outer housing (30) of the cyclone separator (11) and within which fluff is in use collected.

10. A tumble dryer as claimed in claim 8 or 9 in which the end cap (14) is removable and comprises a removable portion of the cyclone separator (11) accessible from the front of the dryer to permit disposal of fluff. 5
11. A tumble dryer as claimed in any of claims 1 to 9, in which the cyclone separator (11) has a removable portion (14) accessible from the front of the dryer to permit disposal of fluff. 10
12. A tumble dryer as claimed in claim 10 or 11, in which the removable portion (14) is at least partially transparent so that fluff build-up is visible from outside the tumble dryer. 15
13. A tumble dryer as claimed in any of claims 10 to 12, in which the removable portion (14) has projecting surfaces (17, 18) to present the collected fluff from evolving with the cyclone air. 20
14. A tumble dryer as claimed in any of claims 10 to 12 **characterized in that** within the outer housing (30) there are inwardly projecting surfaces (17,18),to prevent the collected fluff from revolting with the cyclone air. 30
15. A tumble dryer as claimed in claim 13 or 14 in which the projecting surfaces comprise radially projecting ribs (17) or vanes (18). 35
16. A tumble dryer as claimed in any of claims 10 to 15 in which the removable portion (14) is laterally spaced from an opening (36) of a duct (12) through which drying air heaving the drum (1) is directed. 40
17. A tumble dryer as claimed any preceding claim, in which the cyclone separator (11) is arranged to receive drying air tangentially. 45
18. A tumble dryer as claimed in any preceding claim, in which a barrier (20) is provided to shield the first fan (15) from the flow of air (A) from the drum (1).
19. A tumble dryer as claimed in any preceding claim, in which the first fan (15) draws in and directs a further separate flow of air (E) which is directed to entrain and combine with the air (A) leaving the drum (1) to thereby increase the velocity of air (A) leaving the drum (1) as it enters the cyclone separator (11) as a combined air stream (B+E). 50 55

Patentansprüche

1. Wäschetrockner mit:

einer rotierenden Trommel (1), in die eine Ladung platziert wird,
einer Heizvorrichtung (7),
einem Lüfter (15) zum Befördern eines Stromes von trockener erhitzter Luft, die von der Heizvorrichtung (7) erhitzt wird, durch die Trommel (1), und
einem Zyklon-Abscheider (11) zum Entfernen von Flusen aus dem Strom von trocknender Luft, der die Trommel (1) verlässt, wobei der Lüfter (15) der Trommel (1) nachgelagert und dem Zyklon-Abscheider (11) vorgelagert ist,

dadurch gekennzeichnet, dass der Trockner des Weiteren einen zweiten, der Trommel (1) vorgelagerten Lüfter (5) umfasst, um die Geschwindigkeit der trocknenden Luft, die in den Zyklon-Abscheider (11) eintritt, zu erhöhen.

2. Wäschetrockner nach Anspruch 1, wobei der Zyklon-Abscheider (11) umfasst:

ein äußeres Gehäuse (30);
eine innere Röhre (32), die koaxial innerhalb des äußeren Gehäuses (30) angeordnet ist und sich teilweise in ein Ende des äußeren Gehäuses (30) erstreckt, um dazwischen einen ringförmigen Raum (34) an dem einen Ende des Zyklon-Abscheiders (11) zu definieren, wobei die innere Röhre (32) außerdem einen Austrittskanal (31) aus dem Abscheider (11) definiert; und
einen Eintrittseinlass (36) in der äußeren Röhre (32), die sich in den ringförmigen Raum (34) zwischen der inneren Röhre (32) und dem äußeren Gehäuse (30) öffnet.

3. Wäschetrockner nach Anspruch 2, wobei das äußere Gehäuse (30) zylindrisch ist.

4. Wäschetrockner nach Anspruch 2 oder 3, wobei die innere Röhre (32) konisch ist. 45

5. Wäschetrockner nach einem der Ansprüche 2 bis 4, wobei eine äußere Begrenzungsfläche der inneren Röhre (32) eine vorstehende spiralförmige Platte (19) beinhaltet, die sich um den Umfang der inneren Röhre herum und entlang zumindest eines Teils der Länge der inneren Röhre (32) windet.

6. Wäschetrockner nach einem der Ansprüche 2 bis 5, wobei Schlitz-Öffnungen (16) in der inneren Röhre (32) und um diese herum definiert sind, durch die im Gebrauch Luft aus dem äußeren Gehäuse (30) radial in die innere Röhre (32) und damit zu dem Aus-

trittskanal (31) fließen kann.

7. Wäschetrockner nach Anspruch 6,
wobei die Schlitz-Öffnungen (16) lateral von dem
Eintrittseinlass (36) beabstandet sind. 5
8. Wäschetrockner nach einem der Ansprüche 2 bis 7,
wobei der Wäschetrockner des Weiteren eine End-
kappenanordnung (14) umfasst, die das gegenüber-
liegende Ende der äußeren Röhre (30) und des Zy- 10
klon-Abscheiders (11) verschließt.
9. Wäschetrockner nach Anspruch 8,
wobei die Endkappe (14) einen zylindrischen Ab-
schnitt (44) umfasst, der in das äußere Gehäuse (30)
des Zyklon-Abscheiders (11) passt und in dem im 15
Gebrauch Flusen gesammelt werden.
10. Wäschetrockner nach Anspruch 8 oder 9,
wobei die Endkappe (14) entferntbar ist und einen 20
entfernbarer Abschnitt des Zyklon-Abscheiders (11)
umfasst, der von der Vorderseite des Trockners zu-
gänglich ist, um eine Entsorgung von Flusen zu er-
möglichen. 25
11. Wäschetrockner nach einem der Ansprüche 1 bis 9,
wobei der Zyklon-Abscheider (11) einen entfernbaren
Abschnitt (14) aufweist, der von der Vorderseite
des Trockners zugänglich ist, um eine Entsorgung
von Flusen zu ermöglichen. 30
12. Wäschetrockner nach Anspruch 10 oder 11.
wobei der entfernbare Abschnitt (14) zumindest teil-
weise transparent ist, so dass ein Ansammeln von
Flusen von außerhalb des Wäschetrockners sicht- 35
bar ist.
13. Wäschetrockner nach einem der Ansprüche 10 bis
12,
wobei der entfernbare Abschnitt (14) vorstehende 40
Flächen (17, 18) aufweist, um zu verhindern, dass
die gesammelten Flusen mit der Zyklon-Luft umlau-
fen.
14. Wäschetrockner nach einem der Ansprüche 10 bis
12, 45
dadurch gekennzeichnet, dass in dem äußeren
Gehäuse (30) nach innen vorstehende Flächen (17,
18) vorgesehen sind, um zu verhindern, dass die
angesammelten Flusen mit der Zyklon-Luft umlau- 50
fen.
15. Wäschetrockner nach Anspruch 13 oder 14,
wobei die vorstehenden Flächen radial vorstehende
Rippen (17) oder Platten (18) umfassen. 55
16. Wäschetrockner nach einem der Ansprüche 10 bis
15,

wobei der entfernbare Abschnitt (14) lateral von ei-
ner Öffnung (36) eines Kanals (12) beabstandet ist,
durch den trocknende Luft, die die Trommel (1) ver-
lässt, geführt wird.

17. Wäschetrockner nach einem der vorangegangenen
Ansprüche,
wobei der Zyklon-Abscheider (11) angeordnet ist,
um trocknende Luft tangential zu empfangen.
18. Wäschetrockner nach einem der vorangegangenen
Ansprüche,
wobei eine Barriere (20) vorgesehen ist, um den er-
sten Lüfter (15) vor dem Zufluss von Luft (A) aus der
Trommel (1) zu schützen.
19. Wäschetrockner nach einem der vorangegangenen
Ansprüche,
wobei der erste Lüfter (15) einen weiteren separaten
Luftstrom (E) einzieht und diesen so führt, dass er
die Luft (A), die die Trommel (1) verlässt, mitnimmt
und sich mit dieser vereinigt, um **dadurch** die Ge-
schwindigkeit der Luft (A), die die Trommel (1) ver-
lässt, zu erhöhen, wenn diese als vereinigter Luft-
strom (B+E) in den Zyklon-Abscheider (11) eintritt.

Revendications

1. Séchoir à tambour comportant un tambour rotatif (1)
dans lequel est placée une charge, un dispositif de
chauffage (7), un ventilateur (15) pour acheminer un
flux d'air sec chauffé par le dispositif de chauffage
(7) à travers le tambour (1), et un séparateur à cy-
clone (11) permettant d'éliminer les peluches du flux
d'air de séchage quittant le tambour (1), de sorte que
le ventilateur (15) se trouve en aval du tambour (1)
et en amont du séparateur à cyclone (11), **caracté-
risé en ce que** le séchoir comprend, de plus, un
second ventilateur (5) situé en amont du tambour (1)
afin d'accroître la vitesse de l'air de séchage entrant
dans le séparateur à cyclone (11).
2. Séchoir à tambour selon la revendication 1, dans
lequel le séparateur à cyclone (11) comprend :

une enceinte extérieure (30) ;
un tube intérieur (32) placé de façon coaxiale à
l'intérieur de l'enceinte extérieure (30) et un es-
pace s'étendant en partie dans une extrémité
de l'enceinte extérieure (30) afin de définir un
espace annulaire (34) entre eux au niveau de
cette extrémité du séparateur à cyclone (11), le
tube intérieur (32) définissant également une
conduite de sortie (31) du séparateur (11) ; et
un orifice d'entrée (36) dans le tube intérieur (32)
s'ouvrant dans l'espace annulaire (34) formé en-
tre le tube intérieur (32) et l'enceinte extérieure

- (30).
3. Séchoir à tambour selon la revendication 2 dans lequel l'enceinte extérieure (30) est cylindrique.
 4. Séchoir à tambour selon la revendication 2 ou 3 dans lequel le tube intérieur (32) est conique.
 5. Séchoir à tambour selon l'une quelconque des revendications 2 à 4 dans lequel une périphérie extérieure du tube intérieur (32) comporte une ailette en spirale faisant saillie (19), laquelle s'enroule en spirale autour de la circonférence, et le long, d'au moins une partie de la longueur du tube intérieur (32).
 6. Séchoir à tambour selon l'une quelconque des revendications 2 à 5 dans lequel des ouvertures sous forme de fente (16) sont définies dans le, et autour du, tube intérieur (32) à travers lesquelles, en fonctionnement, de l'air provenant de l'intérieur de l'enceinte extérieure (30) peut circuler radialement dans le tube intérieur (32) et, de là, vers la conduite de sortie (31).
 7. Séchoir à tambour selon la revendication 6 dans lequel les ouvertures sous forme de fente (16) sont espacées latéralement de l'orifice d'entrée (36).
 8. Séchoir à tambour selon l'une quelconque des revendications 2 à 7 comprenant, de plus, un ensemble de capuchon d'extrémité (14) obturant l'extrémité opposée du tube extérieur (30) et du séparateur à cyclone (11).
 9. Séchoir à tambour selon la revendication 8 dans lequel le capuchon d'extrémité (14) comporte une partie cylindrique (44) qui s'ajuste à l'intérieur de l'enceinte extérieure (30) du séparateur à cyclone (11) et à l'intérieur de laquelle les peluches sont collectées en fonctionnement.
 10. Séchoir à tambour selon la revendication 8 ou 9 dans lequel le capuchon d'extrémité (14) peut être retiré et comporte une partie amovible du séparateur à cyclone (11) accessible à partir de l'avant du séchoir pour permettre l'évacuation des peluches.
 11. Séchoir à tambour selon l'une quelconque des revendications 1 à 9, dans lequel le séparateur à cyclone (11) possède une partie amovible (14) accessible à partir de l'avant du séchoir afin de permettre l'évacuation des peluches.
 12. Séchoir à tambour selon la revendication 10 ou 11, dans lequel la partie amovible (14) est, au moins partiellement, transparente de sorte que l'accumulation des peluches est visible de l'extérieur du séchoir à tambour.
 13. Séchoir à tambour selon l'une quelconque des revendications 10 à 12, dans lequel la partie amovible (14) comporte des surfaces en saillie (17, 18) pour empêcher les peluches collectées d'être mises en rotation avec l'air du cyclone.
 14. Séchoir à tambour selon l'une quelconque des revendications 10 à 12 **caractérisé en ce que**, à l'intérieur de l'enceinte extérieure (30), se trouvent des surfaces faisant saillie vers l'intérieur (17, 18) afin d'empêcher les peluches collectées d'être mises en rotation avec l'air du cyclone.
 15. Séchoir à tambour selon la revendication 13 ou 14 dans lequel les surfaces en saillie comportent des nervures s'avancant radialement (17) ou des ailettes (18).
 16. Séchoir à tambour selon l'un quelconque des revendications 10 à 15 dans lequel la partie amovible (14) est distante latéralement d'une ouverture (36) d'un conduit (12) à travers lequel l'air de séchage sortant du tambour (1) est dirigé.
 17. Séchoir à tambour selon l'une quelconque des revendications précédentes, dans lequel le séparateur à cyclone (11) est agencé en vue de recevoir de l'air de séchage de façon tangentielle.
 18. Séchoir à tambour selon l'une quelconque des revendications précédentes, dans lequel une barrière (20) est prévue pour protéger le premier ventilateur (15) du flux d'air (A) sortant du tambour (1).
 19. Séchoir à tambour selon l'une quelconque des revendications précédentes, dans lequel le premier ventilateur (15) attire et oriente un flux d'air distinct supplémentaire E, lequel est dirigé en vue d'entraîner, et de se combiner avec, l'air (A) quittant le tambour (1) pour augmenter de ce fait la vitesse de l'air (A) quittant le tambour (1) lorsqu'il entre dans le séparateur à cyclone (11) sous la forme d'un flux d'air combiné (B + E).

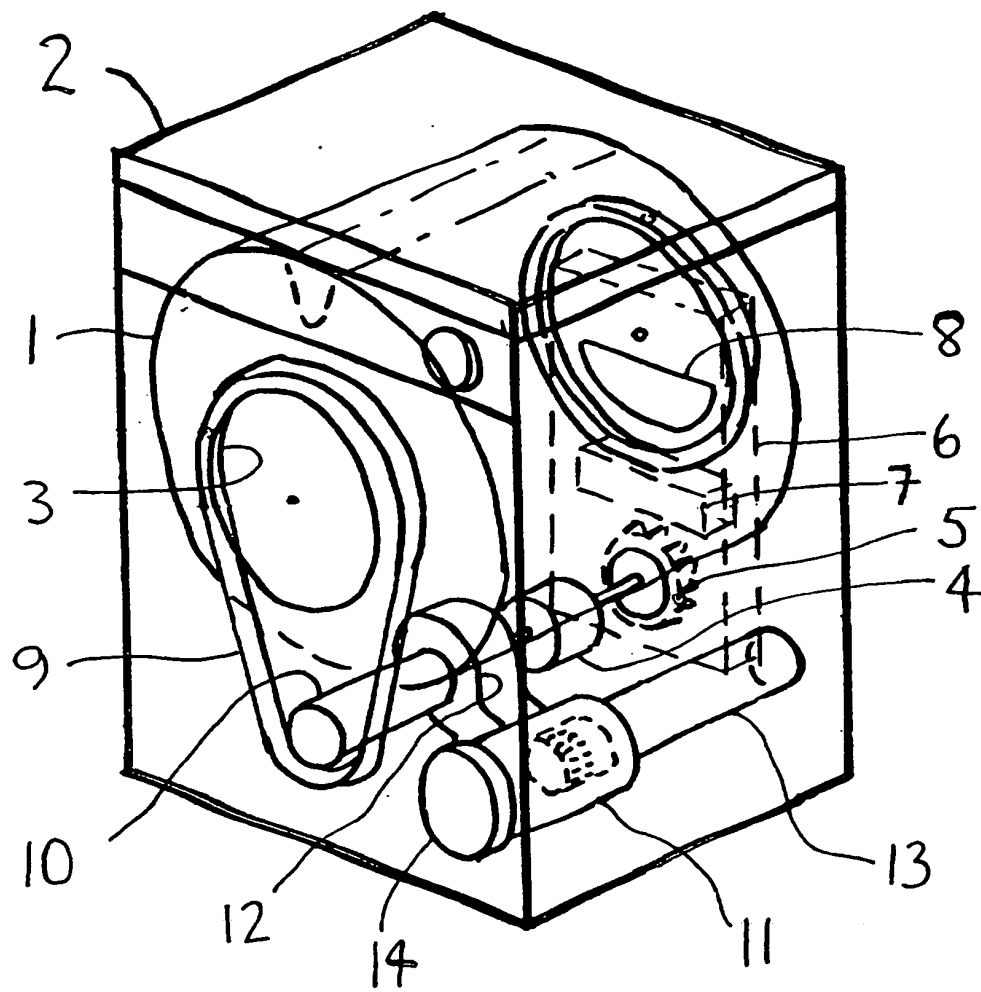


FIG 1

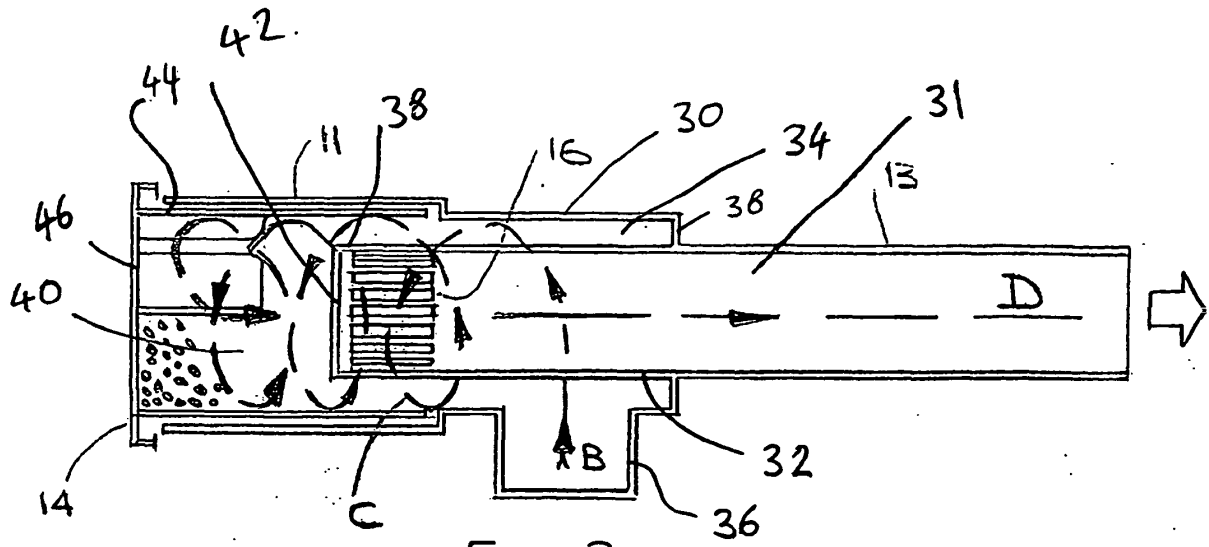


FIG 3

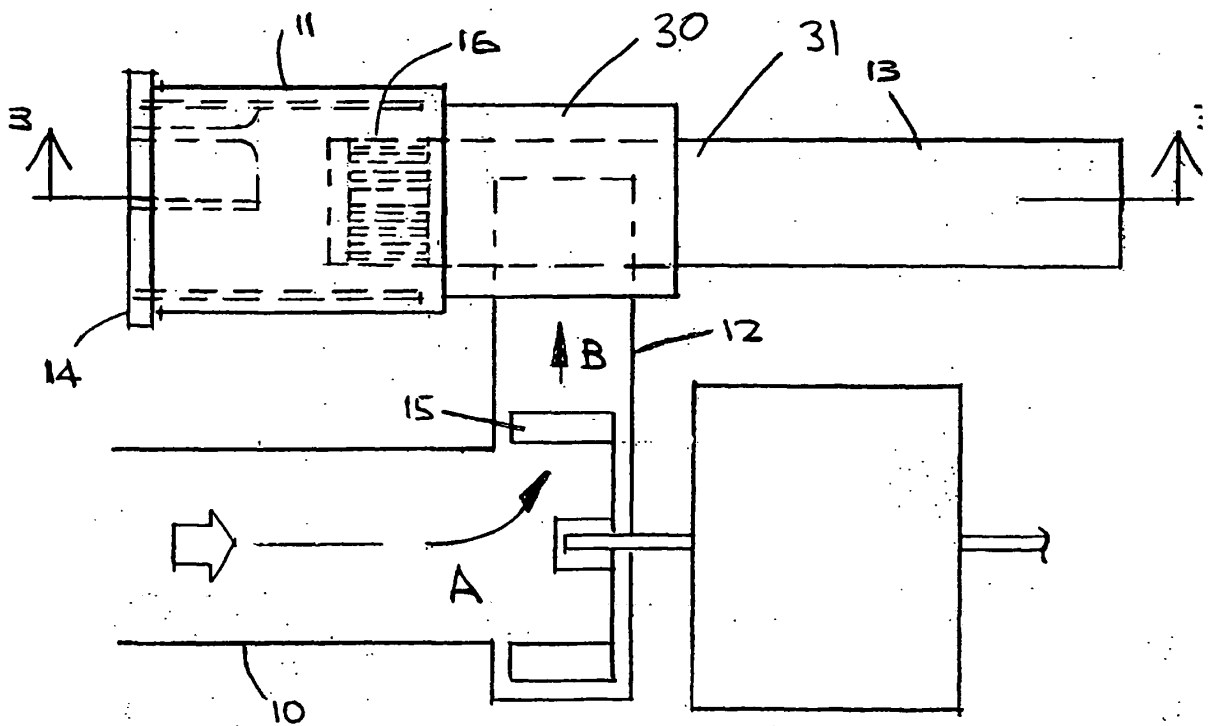


FIG 2

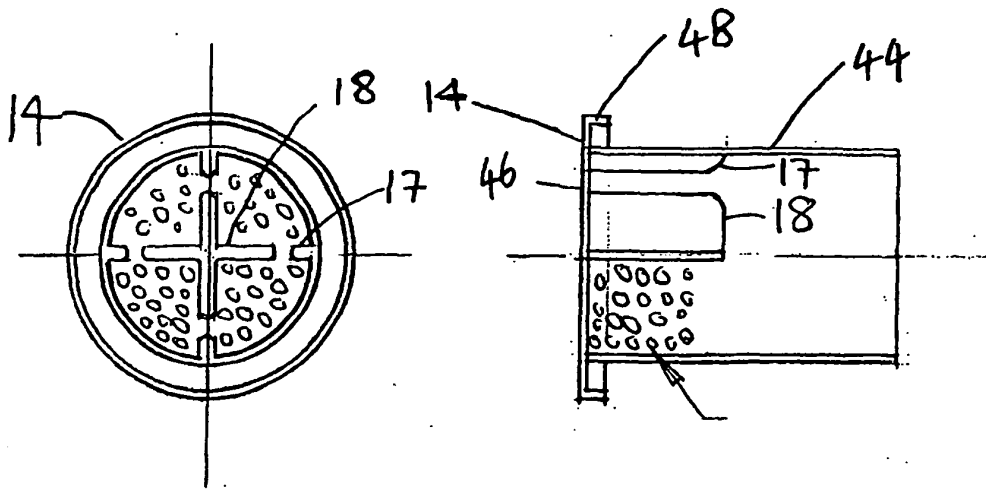


FIG 4

FIG 5

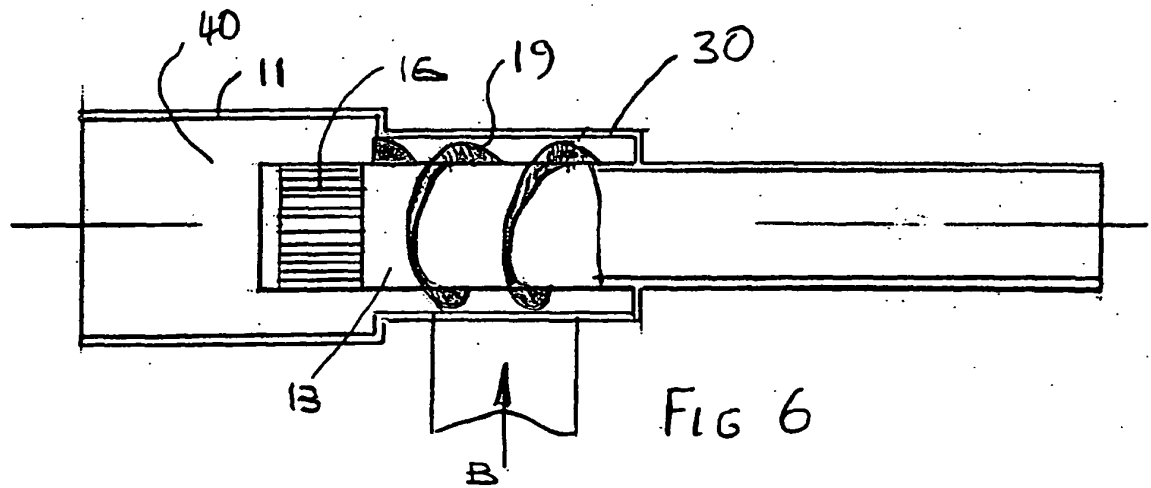


FIG 6

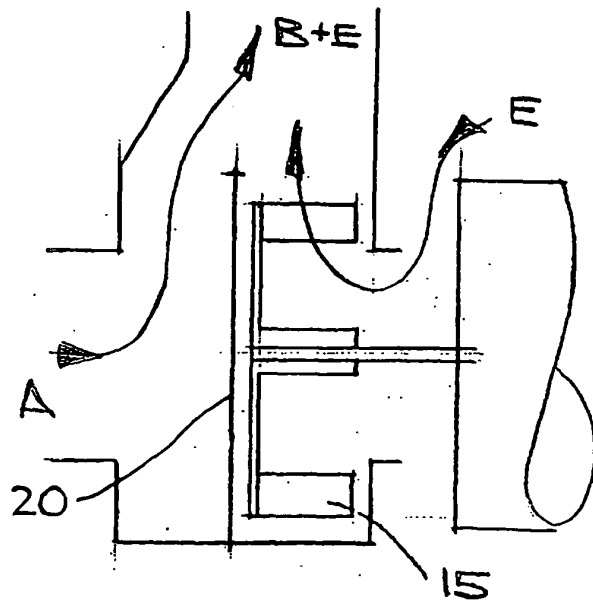


FIG 7

REFERENCES CITED IN THE DESCRIPTION

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