Dec. 20, 1966 F. P. HODGKINSON 3,292,347

DUST AND LINT DISPOSAL APPARATUS

Filed Dec. 16, 1964 2 Sheets-Sheet 1

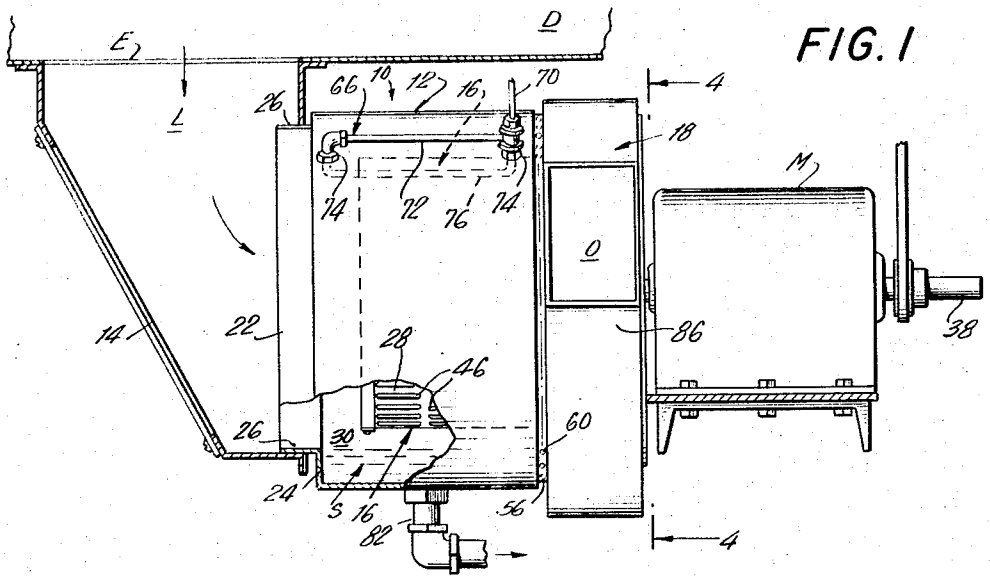



FIG. 1

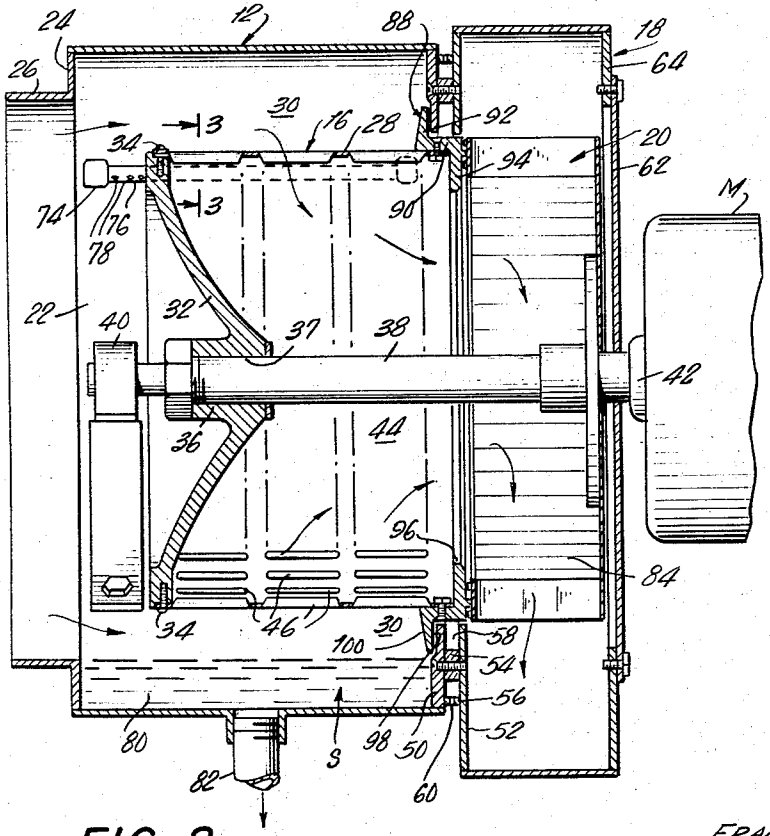



FIG. 2

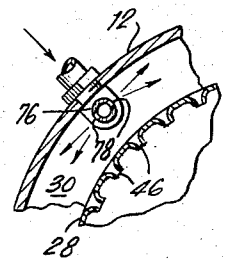



FIG. 3

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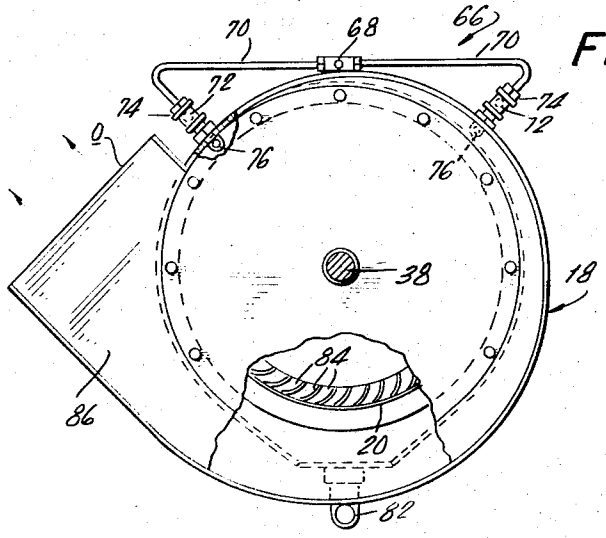



FIG. 4

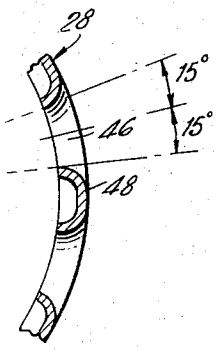



FIG. 6

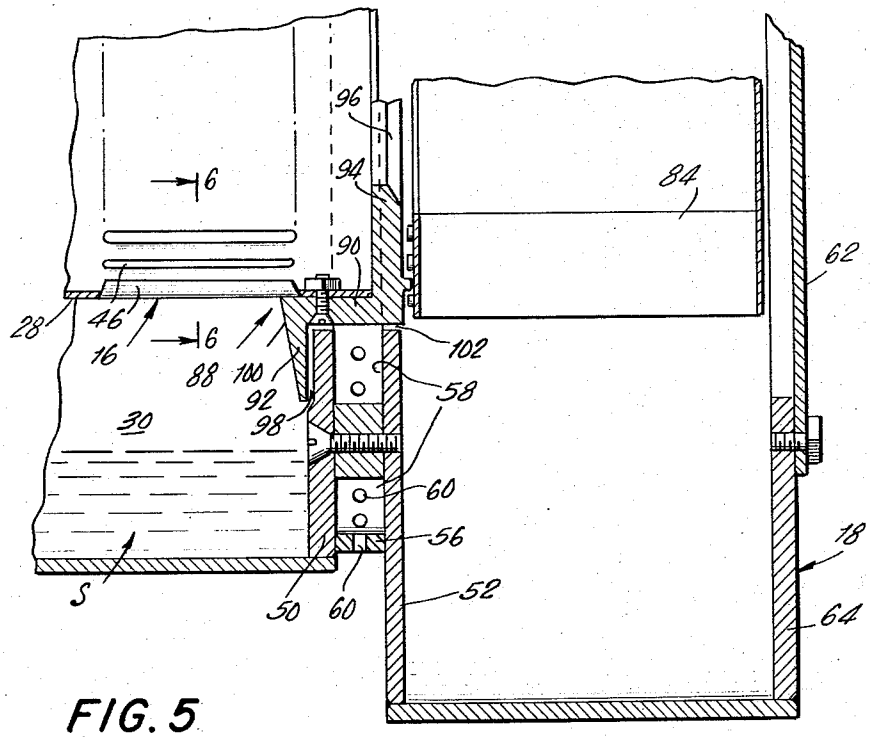



FIG. 5

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# DUST AND LINT DISPOSAL APPARATUS

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3 Claims. (Cl. 55—257)

This is a continuation-in-part of application Ser. No. 97,242 of Mar. 21, 1961, entitled Lint Disposal Apparatus, and now abandoned.

The present invention relates generally to laundry-drying apparatus, and particularly to a lint and/or dust collecting and disposal apparatus for use in a laundry dryer.

It has long been known to provide laundry-drying equipment which is constructed with a rotary drum for containing the laundry and means for circulating air through the drum and thereafter exhausting the air into the atmosphere. This air which is to be exhausted into the atmosphere is laden with lint, dust and other particles which have become separated from the articles being dried, particularly when such articles are made of terrycloth and flannel, that cause a high concentration of lint to be dispersed in the drying air. Of the many devices which have been provided for removing the contaminants from the drying air, perhaps the most common device has been the provision of a filter located at the exhaust outlet which is fabricated of a screen of wire mesh material. A serious disadvantage encountered in these conventional types of filtering arrangements has been occasioned by the frequent removal of the filters which is necessary for cleaning, the necessity of replacing the filter element when cleaning will no longer effectively remove all of the particles, and the ineffectiveness of the filters in completely removing all of the contaminating particles from the drying air, particularly the very small particles which pass through the filter. Thus, it can readily be appreciated that the maintenance of conventional filtering devices has proven costly and time-consuming, and such filters have not proven effective in removing all of the air-borne particles from the drying air.

Another system which has heretofore been used in dealing with this problem has been the provision of a centrifugal type separator which is operated in connection with a removable receptacle for collecting the air-borne particles. This type of system is usually used in large buildings or on board ships which have centralized ventilating systems for supplying fresh air to the various compartments, and the exhaust air from the drying apparatus is usually introduced into the duct system supplying the fresh air. Although this exhaust air coming from the drying tumblers is relatively free of lint, such exhaust air does contain other unhealthful contaminants and is also relatively hot and moist and would of necessity have to be exhausted outside of the building or enclosure in order to protect the comfort of the operating personnel. This presented a particularly difficult situation with respect to the use of laundry equipment on board ships, since of necessity, the exhaust air had to be exhausted directly into the room in which the equipment was located. The exhaust air could not be introduced into the ventilating system of the ship because there always was the possibility of any filtering system failing, and such a malfunction would result in an extremely dangerous fire hazard caused by the lint and dust-laden air that would be introduced into the central ventilating system. Thus, in the use of all types of conventional laundry drying equipment on board ships, it is necessary to exhaust the air directly into the compartment containing the equipment, which resulted in a great increase in the ambient temperature and relative humidity of the



compartment. The severity of this problem can be appreciated by the fact that on board ship it is common practice to rotate the operating crews in half hour intervals due to the unbearable heat and moisture.

While the present invention is particularly suited for use in connection with laundry drying equipment, it should be noted that the device which is to be disclosed herein is also capable of separating lint, dust, and other like air-borne contaminants from diverse environments. Thus, the present invention can be used with a drying tumbler or separately, such as for example, to remove coal dust from the shaft of a coal mine.

Broadly, it is an object of the present invention to provide a dust and lint disposal and collecting apparatus which obviates one or more of the aforesaid difficulties. Specifically, it is within the contemplation of the present invention to provide a lint disposal apparatus for use in commercial laundry equipment which is capable of effectively collecting and disposing of air-borne particles from air exhausted by a laundry dryer and which further provides for an appreciable amount of evaporative cooling within the confines of the lint disposal apparatus such that the exhaust air, because of its low temperature and relative humidity could be exhausted into the room containing the laundry dryers.

In accordance with an illustrative embodiment demonstrating objects and features of the present invention, there is provided an apparatus for collecting and disposing of lint and dust laden air from a laundry dryer including an open-ended cylindrical housing and a cylindrical separator arranged coaxially of and within the housing for cooperating therewith to define a substantially annular air-cleansing space therebetween which has a closed end and an open end. There is also provided means for journaling the separator for rotation about a separator axis extending longitudinally of the housing, as well as means connected to one end of the housing and the adjacent open end of the air-cleansing space for introducing dust and lint laden air into the housing. The end of the separator contiguous to the one end of the housing is closed such that the lint laden air only is directed into the air-cleansing space. In a typical machine, provision is also made for introducing water into the air-cleansing space such that the lint from the lint laden air is washed down into a lower portion of the air-cleansing space which serves as a disposal trap. The separator has apertures in communication with the air-cleansing space such that the cleansed air may be admitted into the interior of the separator, and a blower is placed in communication with the interior of the separator for drawing lint laden air into the air-cleansing space and cleansed air into the separator. The provision of an air outlet in communication with the blower allows for the passing of cleansed air to the atmosphere, and drive means are operatively connected to the separator and blower.

The above brief description as well as further objects, features and advantages of the present invention will be more fully appreciated by referring to the following detailed description of a presently preferred, but nonetheless illustrative embodiment, when taken in connection with the accompanying drawings wherein:

FIG. 1 is an elevational view with parts broken away, of a typical laundry drying apparatus incorporating a lint-disposal device in accordance with the present invention;

FIG. 2 is an enlarged sectional view of the drying apparatus with directional arrows showing the movement of the exhaust air;

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 2, looking in the direction of the arrows and showing the spray apparatus used in connection with the dust and lint disposal unit;

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 1 and looking in the direction of the arrows, with portions of the housing of the dust and lint disposal device being broken away and sectioned for the purpose of illustration;

FIG. 5 is an enlarged fragmentary sectional view of a portion of the apparatus shown in FIG. 2; and

FIG. 6 is an enlarged fragmentary sectional view taken along the line 6—6 of FIG. 5 and looking in the direction of the arrows to more clearly show the configuration of the slots provided in the separator drum.

Referring now specifically to the drawings, there is shown in FIG. 1 a typical lint and dust disposal apparatus, generally designated by the reference numeral **10**, which is used in connection with a conventional laundry dryer D. Many of the details of the construction of the laundry dryer D are conventional and well known, and thus need only be referred to briefly for the purposes of illustrating the relation to the novel features of the lint and dust disposal apparatus **10**. The laundry dryer D includes a large rotary drum or tumbler which is perforated and mounted on a shaft for rotation. A fragmentary view of the portion of the laundry dryer D to which the lint and dust disposal apparatus **10** is mounted, can be seen in FIG. 1 with the initial path of the lint and dust laden air L being shown by the directional arrows.

The lint disposal apparatus **10** includes a separator housing **12** which is cylindrical in shape and open at one end for connection to the laundry dryer D by means of a duct **14**, and a cylindrical separator **16** is coaxially mounted in the housing **12**. A blower housing **18** is mounted at the other closed end of the housing **12**. Coaxially disposed within the blower housing **18** is a cylindrical blower fan **20** which is operatively connected to a motor drive M and the separator **16** for drawing the lint and dust laden air L towards the separator **16** and through an outlet O on the blower housing **18** which is in communication with the atmosphere.

Detailed reference will now be made to the structure of the lint and dust disposal apparatus **10** which is illustrated herein as being connected to the housing of the conventional laundry dryer D by means of the duct **14** which is provided with an exhaust opening E, disposed in communication with the dryer D, and a duct opening **22** which is in communication with the separator housing **12**. As best seen in FIG. 2, the separator housing **12** is of general cylindrical configuration and is provided with an annular shoulder **24** which is fixed to the separator housing at the open end thereof, and a sleeve **26**, which extends from the inner periphery of the shoulder **24**, is provided for seating the duct **14**.

For the purpose of coaxially arranging the separator **16** within the housing **12**, the separator is formed in the shape of a hollow drum **28** having an outer diameter which is smaller than the inner diameter of the housing **12** to thereby define a substantially annular air-cleansing space **30**. The end of drum **28** adjacent the duct opening **22** terminates in a cover plate **32** which is conveniently attached by means of threaded bolts **34**. As shown in FIG. 2, the cover plate **32** is formed with a bearing yoke **36** which has a through bore **37** for receiving a mounting shaft **38** which is fixed to the cover plate **32**. The shaft **38** is journaled for rotation on the motor M and a bearing mount **40** which is spaced apart from the motor M. The drum **28** and cover plate **32** define a separating chamber **44** which communicates with the lint collecting area **30** by means of elongated slotted apertures **46** which are formed on the drum **28**. It should be noted that configuration and dimensional size of the slots **46** play an important part in separating coloidal dust from the air L. Experience has shown that by providing slots which are substantially two inches in length and .06 inch in width, with 58 rows of three slots each disposed along the cylindrical periphery of the drum **28**, and by forming the elongated edges of slots **46** with a beveled configuration, as best seen in FIG. 6, the micron size of the colloidal dust which passes into the separating chamber **44** will be relatively small in size. The aforementioned conditions are predicated on the peripheral speed of the drum **28** being such that the blower fan **20** will provide a sufficient cubic feet per minute flow of air through the dryer D so as to perform the drying function in the required length of time, which is generally 1200 c.f.m. of air passing through the dryer to accomplish the drying function in the usual 20 to 25 minutes of time which is generally allotted. The slot configuration which will best accomplish this function can best be seen in FIG. 6 wherein the slots **46** are illustrated as being formed with beveled longitudinal edges **48**, with the outer wall of drum **28** which forms slot **46** being inclined at an angle of substantially 15 degrees from the radial center line of the slots **46**. Thus, by providing the configuration, dimensional size, and peripheral speed described herein, it is possible to exclude colloidal dust from the separating chamber **44** which would be deemed objectionable and would constitute contamination of the cleansed air.



For the purpose of drawing the lint laden air L out of the separating chamber **44**, the exhaust fan **20** is mounted on the end of shaft **38** adjacent motor M. The separator housing **12** and blower housing **18** are each provided with an end-plate **50** and a baffle plate **52** which are disposed in confronting relation when the blower housing **18** is mounted to the separator housing **12** by means of a series of spacer blocks and threaded screw arrangements **54**. Prior to the assembly of the spacer block arrangements **54** to the separator housing **12** and blower housing **18**, a cylindrically walled separator ring **56** is positioned over the outer periphery of the spacer blocks **54** so as to define an annular intermediate chamber **58** which is located between housings **12** and **18**. The intermediate chamber **58** communicates with the outer atmosphere by means of a series of apertures **60** which are formed along the circular periphery of the separator ring **56**. The blower housing **18** is provided with an end plate **62** which is conveniently bolted to end wall **64** of housing **18** adjacent to the drive motor M.

A water dispersing system, generally designated **66**, is provided for introducing water into the air cleansing space **30**. This is accomplished by mounting a pipe network, of the water dispersing system **66** in the air cleansing space **30**, which is provided with an inlet **68** that is connected to a source of water. As best seen in FIGS. 1 and 4, the pipe network **66** includes a water supply line **70** which is controlled by a conventional needle valve arrangement which has not been shown. The supply line **70** is connected to inlet pipes **72** that are mounted on the housing **12** by means of fittings **74** which are positioned over apertures in the housing **12** that communicate with the air cleansing space **30**. The fittings **74** also serve to connect elongated hose nozzles **76** to the inlet pipes **72**, with the hose nozzles **76** being positioned within the air cleansing space **30** of separator housing **12**, along the longitudinal axis of rotation of drum **28** and spaced apart from the drum **28** in confronting relation therewith. A series of pairs of opposing nozzle apertures **78** are formed on the nozzle hoses **76** which extend longitudinally along the length of the nozzle hoses **76**, and as shown by the directional arrows in FIG. 3, a water spray is radially dispersed in the air cleansing space **30**.

As will be more fully described herein, the dispersion of water through the system **66** results in an appreciable amount of evaporative cooling taking place in the lint disposal apparatus **10** such that the temperature of the air which is ultimately exhausted into the room containing the laundry equipment is lowered. A lint and water reservoir **80** is formed at the base of the separator housing **12** for collecting the water and lint solution S which is disposed of by means of gravity flow through a waste drain **82** that is located beneath the lint reservoir **80**.

By referring to FIGS. 2 and 4, it can be seen that the fan **20** is formed in the shape of an annulus with

an outer cylindrical configuration. The fan **20** includes a series of blades **84** which extend longitudinally along the axis of rotation of shaft **38**. The rotation of the fan **20** causes the air to be exhausted through an exhaust duct **86** which is provided in the lower portion of blower housing **18**. The fan blades **84** are fabricated of steel and are radially curved as shown in FIG. 4 to direct the flow of air in a spiral toroidal path towards the exhaust duct **86**.

In the illustrative embodiment of the lint disposal apparatus **10** which is illustrated in FIG. 1, the motor M is shown with a double ended shaft with the forward end of the shaft driving the fan **20** and separator drum **28** and the rearward end of the shaft being provided with a V-belt pulley arrangement for driving the tumbler of the drying unit D, which is not shown herein. In this connection, it should be noted that the lint and/or dust disposal apparatus **10** could equally as well perform the function of separating the lint and/or dust from the air without being used in connection with a laundry drying apparatus. An example of an environment that is totally different than that which is found in the laundry field, is a mine shaft in which the duct arrangement **14** could be installed in order to utilize the separator apparatus **10** to remove coal dust from the mine shaft. In such a situation, it would not be necessary to utilize a motor having a double shaft. Further, in conventional laundry drying apparatus, the tumbler basket is usually driven by a quarter horse power motor, and the separator apparatus **10** could easily be operated by a second motor which would in no way interfere with the function of the separator apparatus and would also make the separator unit **10** compatible with existing laundry drying equipment.

In order to prevent the air in air-cleansing space **30** from passing into the blower housing **18**, a labyrinth seal is formed by providing a slinger ring **88** which is mounted on the outer periphery of drum **28** proximate to the end-plate **50**. The slinger ring **88** is integrally formed with a relatively narrow cylindrical base **90** with an annular disc blade **92** extending outwardly from the rearward end of the base **90** and an annular baffle plate **94** extending inwardly from the forward end of the base **90**. The baffle plate **94** is provided with a central opening **96** such that separating chamber **44** communicates with blower housing **18**. The initial portion of the labyrinth seal is formed by the portion of disc blade **92** which is spaced apart from the end plate **50** to form a narrow channel or clearance space **98**. An inclined rearward edge **100** is formed on disc blade **92** which is effective in rejecting substantially all of the dust and lint particles from air-cleansing space **30**. The remaining portion of the labyrinth seal extends into the intermediate housing **58**, and includes a clearance slot **102** which is disposed between intermediate housing **58** and blower housing **18**. Since the slinger ring **88** is mounted for rotation on drum **28**, pumping and sealing action takes place in clearance space **98** which would normally prevent the lint-laden air L from passing from the air-cleansing space **30** into intermediate housing **58**. However, the air leaving the fan blades **84**, manifests itself as kinetic energy or velocity pressure and creates a vortex which results in negative pressure acting on the clearance slot **102**. In order to prevent a partial vacuum from being formed in the intermediate housing **58** due to this negative pressure in clearance slot **102**, which would cause the moisture-laden air to pass through clearance space **98** and into the blower housing **18**, the series of apertures **60** on the separator ring **56** have been provided. In this manner, it is possible to help break the partial vacuum that would otherwise be formed in intermediate housing **58**, and also permit relatively cooler atmospheric air to be drawn through apertures **60** and into the blower housing **18** and air-cleansing space **30**. In order to more fully appreciate the formation of the partial vacuum in intermediate housing **58**, without the connection to the atmosphere provided through the apertures **60**, it should be understood that the negative pressure outlined above acts against the sealings and pumping action created by the slinger ring **88** on clearance space **98**. Thus, the provision of the apertures **60** prevent the lint-laden air L from being drawn from the air-cleansing space **30** through the clearance space **98** and clearance slot **102** into blower housing **18**. Accordingly, by means of the apertures **60**, which are provided on separator ring **56**, it is possible to reduce the negative pressure acting against the sealing and pumping action of slinger ring **88**, which prevents lint-laden air from being drawn from the air-cleansing space **30** into blower housing **18**. Further, cool atmospheric air is drawn into intermediate housing **58**, through the apertures **60**, and is then drawn into blower housing **18** and air-cleansing space **30** by action of the reduced negative pressure in clearance slot **102** and the pumping action in clearance space **98**, respectively.

Reference will now be made to the drawings for a detailed description of the construction and operation of the lint-disposal apparatus **10**. By progressively inspecting FIGS. 1 and 2, it can be appreciated that the rotation of the blower fan **20** causes the air to move from the tumbler of the drying apparatus D through the interconnecting duct **14** into the air-cleansing space **30** of separator housing **12**, then through the slots **46** into separating chamber **44**, then through the central baffle opening **96** into blower housing **18**, and the air is finally exhausted through the exhaust duct **86**. The exhaust port O is preferably located in the room which contains the laundry equipment. This path of flow of the air from the laundry drying equipment D through the lint disposal apparatus **10** into the room containing the equipment is illustrated by the directional arrows shown in FIGS. 1 and 2. In this respect, it will be appreciated that the air, from the interconnecting duct **14** which moves through the inlet opening **22**, is very hot and is laden with dust and lint, and as this air enters the air-cleansing space **30**, the movement of the air begins to assume a cylindrically spiral path which is caused by the rotation of the lint separator drum **28**. A substantially small amount of moisture is introduced into this whirling spiral toros of lint and dust laden, hot air by means of the hose nozzles **76**, such that a substantial amount of moisture is absorbed preferentially by the lint and dust, thereby increasing the effective weight of the lint and dust laden air L. This increase in weight of the lint and dust laden air L assists the centrifugal force action and causes the majority of the lint and dust particles to be thrown outwardly against the wall of separator housing **12** to ultimately be washed from the walls into the lint collecting reservoir **80** and out through the waste drain **82**. A substantial amount of water that comprises the spray which is emitted from the nozzle apertures **78** is evaporated by the hot lint and dust laden air L, such that the temperature of the ar entering the separating chamber **44** is effectively reduced. This evaporative cooling is aided by the influx of relatively cooler atmospheric air into air-cleansing space **30**. It should be noted that the colloidal dust which is not particularly effected by the addition of moisture in the foregoing manner, is prevented from passing through the slots **46** by the size and configuration of slots **46** as well as the peripheral speed of the separator drum **28**. Thus, the micron size of the dust particles which will be admitted through the slots **46** is controlled by the adherence to the lip configuration **48** as previously described herein.

A latitude of modification, change and substitution is intended in the foregoing disclosure and in some instances some features of the invention will be employed without a corresponding use of other features. Accordingly it is appropriate that the appended claims be construed broadly and in a manner consistent with the spirit and scope of the invention herein.

What I claim is:

1. Apparatus for collecting and disposing of dust and lint-laden air from a laundry dryer comprising an open ended cylindrical housing, a horizontally oriented cylindrical drum forming a separating chamber which is arranged coaxially of and within said housing and cooperating therewith to define a substantially annular air-cleansing space therebetween having a closed end and an open end, means journaling said drum for rotation within said housing about an axis oriented substantially parallel to the horizontal, means connected to one end of said housing and the adjacent open end of said air-cleansing space for introducing dust and lint-laden air into said housing, the end of said drum contiguous to said one end of said housing being closed such that said dust and lint-laden air only is directed into said air-cleansing space, perforated conduit means in said annular air-cleansing space on opposite sides of and substantially parallel to and above said drum axis, said perforated conduit means being substantially coextensive in length with said drum and in spaced apart confronting relation with both said drum and housing, said perforated conduit means having nozzle apertures spaced along the length thereof for introducing a spray of water into said air-cleansing space such that the dust and lint from said dust and lint-laden air is washed downwardly by said water spray into a lower portion of said air-cleansing space serving as a disposal trap, said drum having elongated slotted apertures in communication with said air-cleansing space such that the cleansed air may be admitted into the interior of said drum, a blower in communication with the interior of said drum for drawing dust and lint-laden air into said air-cleansing space and cleansed air into said drum, beveled edges formed on the elongated portions of said apertures for excluding colloidal dust particles from said separating chamber, an air outlet in communication with said blower for passing cleansed air to the atmosphere, and drive means operatively connected to said drum and to said blower.

2. Apparatus according to claim 1 wherein said beveled edges of said drum are inclined at an angle of substantially 15 degrees from the radial center line of said apertures for providing optimum conditions for excluding colloidal dust particles from said separator chamber.



3. Apparatus according to claim 1 wherein said blower includes a cylindrical blower housing arranged adjacent said drum and in communication with the interior of said drum, a blower fan journaled in said blower housing along the longitudinal drum axis for drawing lint-laden air into said air-cleansing space and cleansed air into said drum, baffle plate means forming an intermediate chamber between said fan and said drum which communicates with said blower housing and said air-cleansing space, a slinger blade mounted on said drum spaced apart from and in confronting relation to said baffle plate means to form a narrow channel communicating with said intermediate chamber thereby providing a labyrinth seal for preventing the passage of air from said air-cleansing space by passing said drum and flowing into said blower housing.


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