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Deaton

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[54] **EXCESS LINT INDICATOR FOR A CLOTHES DRYER**

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[52] **U.S. Cl.** **34/82,** 34/133, 55/215, 55/274, 55/511

[51] **Int. Cl.**.....**F26b 21/06**

[58] **Field of Search**.....34/51, 54, 55, 82, 133; 55/210, 214, 215, 274, 511

[56] **References Cited**

UNITED STATES PATENTS

2,022,250	11/1935	Lofgren	55/274
2,577,104	12/1951	Butler	34/55
3,639,998	2/1972	Mason	34/82
3,648,381	3/1972	Fox	34/82

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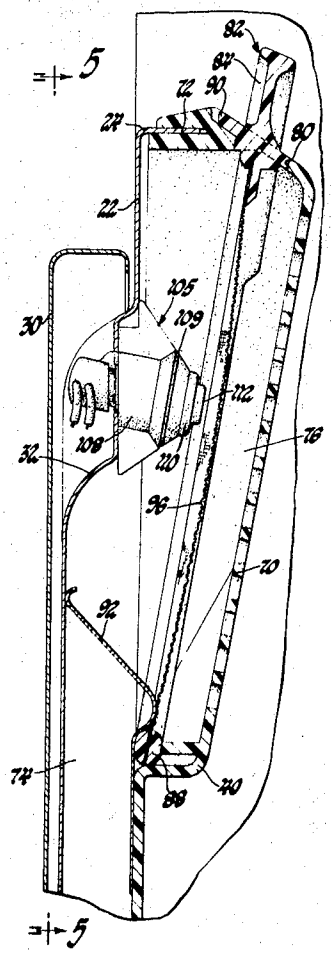
[57] **ABSTRACT**

A domestic clothes dryer has a circulating airflow duct system including a tumbling drum and a lint filter for filtering lint from air leaving the tumbling drum. An excess lint indicating system includes a visible signal light on the dryer and an operating switch therefor. The switch is operated by a pressure actuated surface which reposes against the cloth-like screen of the filter whereby the screen forces the switch as lint accumulates to energize the signal light.

4 Claims, 7 Drawing Figures



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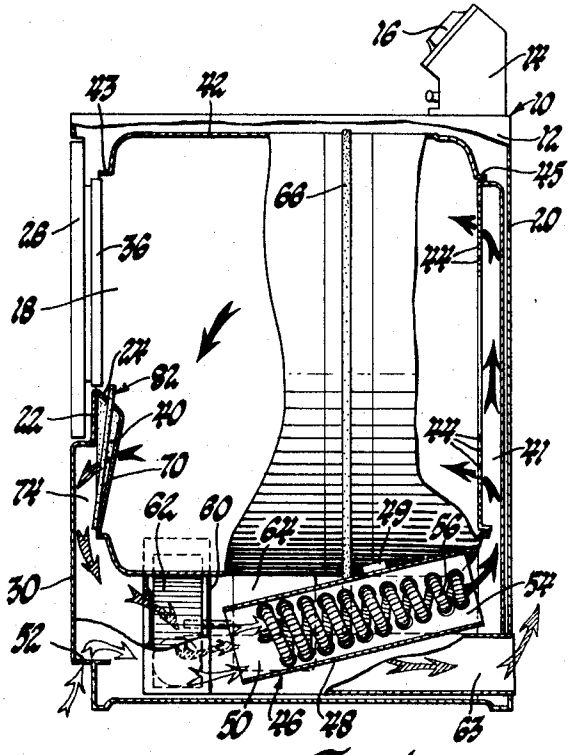

Fig. 1

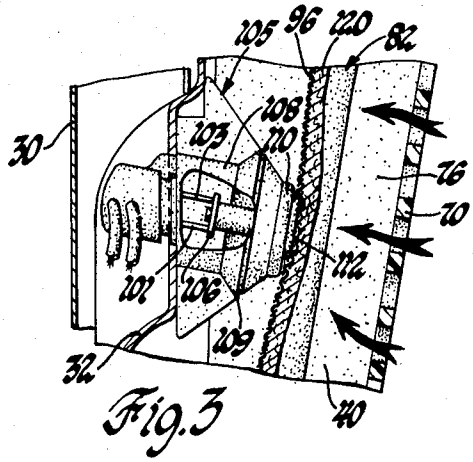

Fig. 3

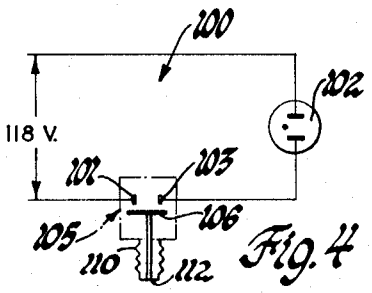

Fig. 4

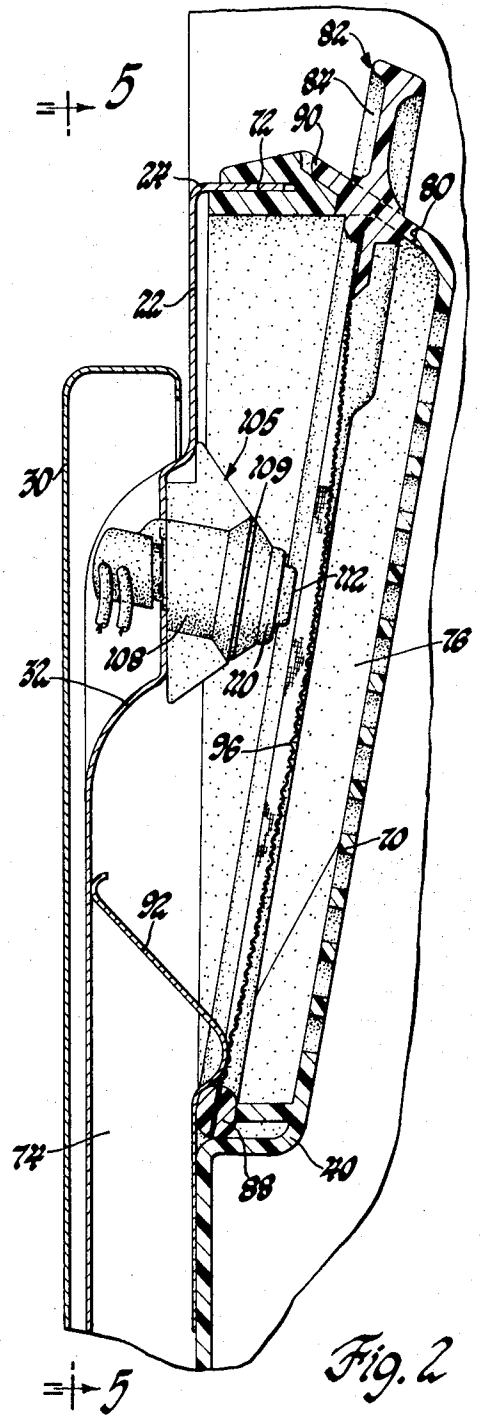

Fig. 2

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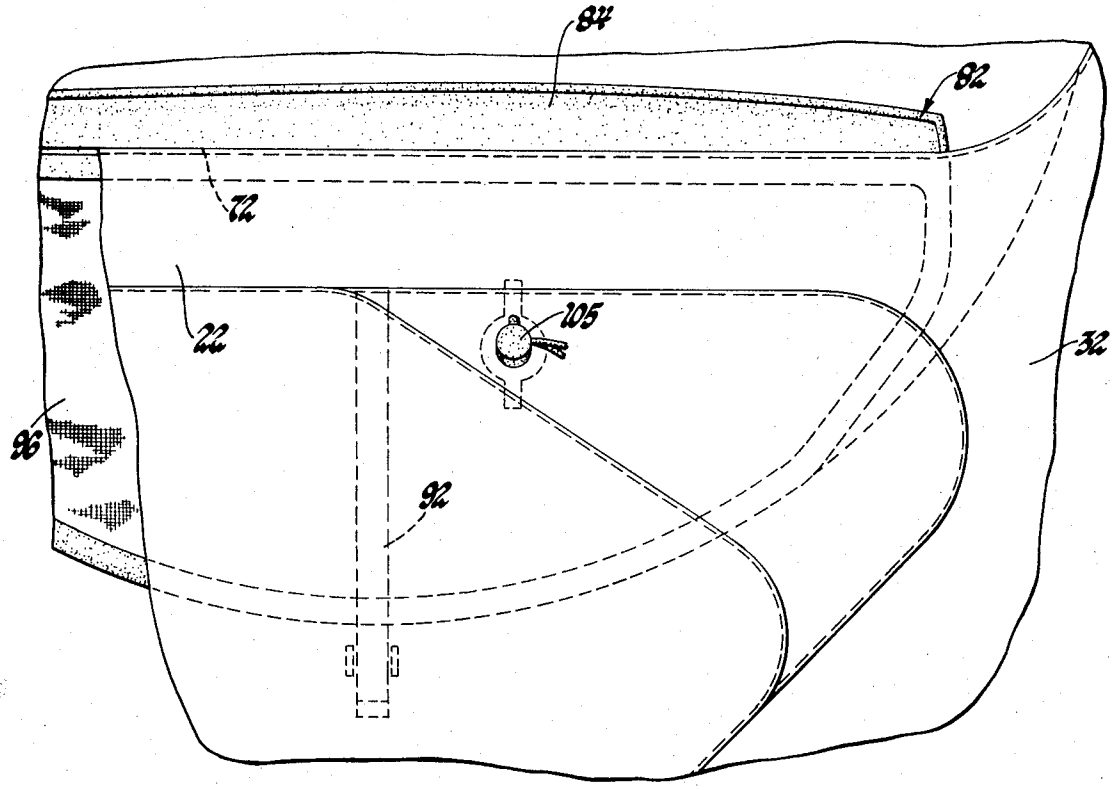

Fig. 5

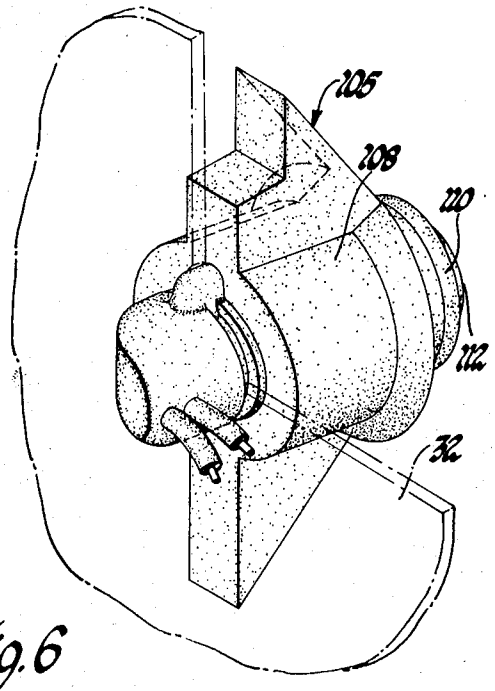

Fig. 6

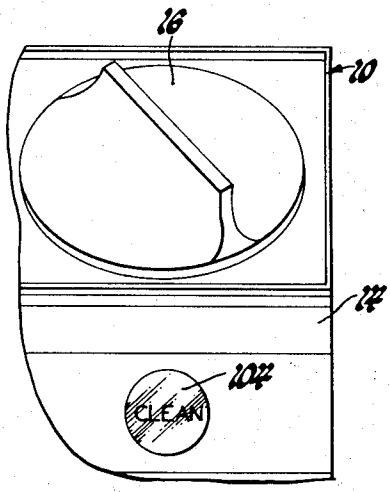

Fig. 7

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EXCESS LINT INDICATOR FOR A CLOTHES DRYER

This invention relates to a domestic clothes dryer and, more particularly, to an excess lint indicating arrangement therefor. The drying efficiency of clothes in domestic clothes dryers depends on air movement and air temperature. Decreasing air movement delays drying time. Moreover, as air flow decreases, the temperature thereof increases to the point where a safety limiter thermostat reduces the heat supplied. Decreased heat supply further delays drying time.

The prior art has recognized the desirability of maintaining airflow throughout a clothes drying cycle and has provided means for signalling or overcoming the effects of a clogged filter. Representative art of this type movably mount either an airflow switch downstream of a filter or a filter frame adjacent a movement-responsive switch so that such movement operates the switch. Movable filter frames have also been shown in a furnace. But movable devices may be noisy and tend to stick during the life of the product; and movement-responsive switches of the toggle-type require calibration. In other arts, differential pressure devices have been disclosed heretofore to measure dirt build-up in furnaces and vacuum cleaners. But differential pressure devices are complicated and expensive. This invention is directed to a simplified and inexpensive lint indicating system for a clothes dryer which utilizes the force of a filter screen itself directly on a pressure-sensitive switch to indicate the accumulation of excess lint on the screen.

Accordingly, it is an object of this invention to provide an improved lint indicating arrangement for a domestic clothes dryer.

A further object of this invention is the provision of a removable planar lint filter having a billowy cloth-like screen disposed crosswise in the exhaust airflow of a domestic clothes dryer in touching engagement with a pressure sensitive switch. More particularly, the switch is operated directly by the cloth-like screen fabric when an airflow-induced accumulation of lint on the screen fabric is reflected in a force of substantially 100 grams directly on a switch bellows of substantially 0.40 inch diameter.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

FIG. 1 is a generally schematic representation partly in elevation of a domestic clothes dryer suitable for use with this invention;

FIG. 2 is a fragmentary side sectional view of the lint indicating arrangement of this invention;

FIG. 3 is a fragmentary sectional view like FIG. 2 showing the accumulation of lint during a clothes drying cycle;

FIG. 4 is a schematic wiring diagram suitable for use with this invention;

FIG. 5 is a fragmentary front elevational view taken in the direction of line 5—5 in FIG. 2;

FIG. 6 is a perspective view of a lint indicator switch suitable for use with this invention; and

FIG. 7 is a fragmentary front elevational view of a domestic clothes dryer showing one form of lint indicating signal.

In accordance with this invention and with reference to FIGS. 1 and 2, a domestic clothes dryer 10 is shown. The dryer includes a cabinet 12 having disposed on the top thereof a control console 14 including a timer 16. The cabinet 12 generally surrounds a clothes treatment enclosure 18 and includes a back wall 20 and a front wall 22. The front wall is provided with an access opening 24 closed by an access door 26 hinged thereon and openable for placing wet clothes within the clothes treatment enclosure 18 and, after a drying cycle, for removing dry clothes therefrom. A service access panel 30 is removably supported on a lower portion 32 of the front wall of the dryer.

The clothes treatment enclosure 18 is part of an airflow duct system and extends between the front wall 22 and the rear wall 20. It is defined at the front by the inside surface of the dryer door or inner door panel 36 and by a stationary drum exhaust duct 40 subjacent to the access opening 24. Between the front and back walls the clothes treatment enclosure is defined by a seven cubic foot, horizontally rotatably mounted, open-ended cylinder 42 which is closed at the open back end by a stationary wall portion of the back wall 20. A rear supply duct 41 in the back wall is in communication with the clothes treatment enclosure 18 through a plurality of circumferentially arranged ports 44.

The clothes dryer is provided with a source of heat 46. In particular, it comprises a tubular heater housing 48 having its inlet end 50 in communication with the outside atmosphere by means of gaps or slots 52 in the clothes dryer cabinet. The outlet 54 from the heater housing is in airflow communication with the rear supply duct 41 in the back wall of the dryer. Heat may be provided by means of an open coil, electrical resistance element 56 within the housing 48. It should be understood, however, that a source of gas heat is equally adaptable for use with this invention.

All dryers are equipped with a temperature limiting switch 49 to prevent serious overheating in the event that a malfunction from a clogged lint screen, blocked exhaust, overloaded drum, etc., should occur. At a predetermined temperature the contacts in the limiter will open and disconnect the power from the heat source 46. The limiter switch is a snap action switch bimetal operated to respond to temperature change. The switch is mounted to the heater on burner housing 48. In the event that airflow is reduced or there is an inoperative drying temperature control thermostat, the limit switch operation is as follows: As the burner housing is heated to temperatures above normal the disc bimetal of the limit switch becomes heated to its operating temperature and it responds to open the heat source circuit. After the contacts have opened, the housing will begin to cool off. The limit switch bimetal disc will also cool until the disc again responds by snap action to close the heat control circuit. This cycle will repeat until the timer 16 completes the programmed time.

A prime mover means 60 is included for rotating the tumbling drum 42 and for impelling airflow at substantially 180 cubic feet per minute through the clothes treatment enclosure 18 and the airflow duct system. In particular, the prime mover means includes a blower 62 directly driven by a motor 64 which also serves to rotate the tumbling drum 42 by means of a poly V belt

66 wrapped around the tumbling drum and the motor shaft. Rollers (not shown) at the front and back of the cabinet respectively support the tumbling drum on front and back drum flanges 43, 45.

Filter housing 40 is part of a plastic drum exhaust duct structure at the front of the clothes dryer cabinet. The housing has a perforate panel portion 70 which connects at the top thereof with an in-turned flange or ledge 72 of the front wall 22 below the access opening. This connects the filter housing panel solidly to the clothes dryer cabinet. The filter housing is spaced from the front wall portion 32 to form an exhaust passageway 74 leading to the inlet side of the blower 62. The perforate panel portion 70 is also spaced from the front wall portion 32 to form a pocket 76 interposed in air intercepting relationship between the clothes treatment enclosure and the exhaust passageway 74. The pocket has a top opening 80. A planar lint filter 82 is insertable into said pocket 76 through said top opening 80. The lint filter 82 has a grip portion 84 projecting into the access opening 24 so that the lint filter can be manually removed for cleaning when the dryer door 26 is open.

The lint filter 82 has a filled polypropylene frame 88 which includes a hilt portion 90 for closing the top opening 80 when the filter is in its pocket. The lower portion of the frame 88 is snap-fastened within the pocket by a leaf spring 92 in a manner to force all of the air from the clothes treatment enclosure to flow through the lint filter. The lint filter 82 includes a fine mesh, polyester cloth-like screen 96 molded into the frame about its periphery. With the lint filter 82 in its pocket 76, the cloth-like screen 96 is disposed in generally parallel spaced relationship to the perforate panel portion 70 in the lint filter housing. The pocket 76 has a width to depth ratio greater than one in the area of the perforated panel portion 70 so that the cloth-like screen receives the maximum effect of pressures generated within the pocket by airflow exhausting from the clothes treatment enclosure.

The cloth-like screen 96 is supported in a rather loose or billowy fashion within the lint filter frame 88 for reasons to be described hereinafter. The screen should be of polyester fabric woven in a 68 × 72 mesh with a minimum burst strength of 55 pounds. The burst strength is determined by holding the screen, with rubber gaskets, in a fixture with a 2 inch circular opening. A 1 inch diameter ball is pressed into the 2 inch opening at a rate of 2 inches per minute, and the pressure necessary to cause the bursting is noted. Burst strength after aging the screen ten days at 300° F. in air should not decrease more than 20 percent.

Room air (white arrows) drawn into the cabinet shell under the access panel 30 passes through the housing 48 to be heated by the heating element 56. The heated air (black arrows) then passes upward through the rear duct assembly 41 forward through the drum 42 and picks up moisture from the drum contents which are tumbling in the air stream as the drum rotates. From the drum, the moisture laden air passes through the perforated front panel 70 of the drum exhaust duct below the door opening and through the fine mesh lint screen 96. Lint is filtered out of the air and the moist air (shaded arrows) then passes through the drum exhaust duct 74 and into the blower housing 62. This air is then blown through the blower housing outlet, through a metal duct 63 to be discharged through the exhaust opening.

The efficiency of the air circulation system requires proper sealing of the drum at its front and rear flanges 43, 45. The lint screen must be in place when dryer is in operation. It should be clean to maintain drying efficiency.

To assure a clean screen, the clothes dryer includes an excess lint indicating arrangement shown generally at 100 in FIG. 4. The arrangement includes a neon signal lamp 102. The lamp 102 may illuminate a red plastic lens 104 (FIG. 7) marked with the word CLEAN. The illumination of the lens signals the need for removing the filter 82 from its pocket to clean the lint from the screen 96. Included, also, is a lint indicator switch assembly 105 having a switch 106 in series with the lamp 102 and adapted by the closing thereof on two contacts 101, 103 to energize the lamp. The switch is enclosed in a case material 108 of rigid polyvinyl chloride — 105° C — 90 durometer. A resilient bellows 110 of buna N material is cemented and sealed at 109 to the case 108 and has a circular pressure sensing surface 112 of 0.40 inch diameter. The switch 106 within the case is normally open and must close when a force of 100 grams ± 15 grams is applied perpendicular to the bellows. A minimal movement of 0.035 inch in the bellows occurs before the switch 106 closes. The switch assembly 105 must withstand high humidity conditions and a maximum temperature of 200° F.

It is important that the pressure sensing surface 112 of the bellows be properly aligned with the screen 96 of the filter. This is achieved by mounting the indicator switch casing 108 on the front wall portion 32 angularly so that the screen 96 and bellows surface 112 are closely oriented and in parallel relationship. This relationship, in addition to the fabric construction of the screen 96 and the looseness thereof, facilitates rather a draping of the screen over the bellows surface 112 with airflow. It also assures a pressure application to the bellows when the screen billows which is a true reflection of lint accumulation on the screen.

In operation as lint 120 (FIG. 3) accumulates on the upstream side of screen 96, the normal quantity of airflow (180 CFM) through the clothes treatment enclosure 18 is reduced. As airflow decreases in a dryer with fixed heat output air temperature increases. If a predetermined temperature limit is exceeded, the limit thermostat device 49 deenergizes the heating element 56. The combination of reduced airflow and reduced heat supply slows down clothes drying heat and decreases dryer efficiency. Accordingly, it is a general purpose of this invention to alert the user to such a filter-clogged condition. With this invention the accumulation of lint on the screen delivered thereto by a normal 180 CFM airflow causes the screen to billow and exert a pressure on the bellows surface 112. The pressure builds until a force or press of approximately 100 grams is being applied to the bellows. Then the switch 106 closes and the clean lamp 102 is energized to illuminate the CLEAN signal on the dryer console. Upon this signal, the user should open the door 26, remove the filter 82 from its pocket and clean the lint from the screen 96.

It is important to note that deflection of the lint screen **96** is not important. The indicator switch assembly **105** is sensitive only to pressure - an advantage in that the switch need not be calibrated in terms of movement at the bellows surface **112**.

It should now be seen that an improved lint indicating arrangement has been provided for a domestic clothes dryer wherein a predetermined accumulation of lint on the lint screen causes the screen to force a pressure sensitive switch to signal a clogged filter condition. The signal may be visible or audible.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is:

1. In combination, a domestic clothes dryer having an enclosing outer cabinet including a stationary front wall having a front access opening and a stationary rear wall, a dryer door mounted on said front wall for closing said front access opening, an airflow duct system within said cabinet, said airflow duct system including a clothes treatment enclosure having a rotatably mounted cylinder extending between said front wall and said rear wall, prime mover means for rotating said cylinder and impelling air through said airflow duct system, a stationary filter housing panel adjacent to said access opening, said filter housing panel defining with said front wall a pocket having an opening, said pocket connecting with said prime mover means and forming with the inside surface of said front wall an exhaust passageway for said airflow duct system, said filter housing panel being perforated in the area of said pocket to provide airflow communication between said clothes treatment enclosure and said exhaust passageway, said rear wall having a portion thereof to provide airflow communication between said clothes treatment enclosure and a high-air-temperature-limited source of heat, said prime mover means including a blower, said blower being connected directly to said pocket forming said exhaust passageway thereby to impel air through said airflow duct system, a manually removable substantially planar lint filter insertable in said pocket through the opening thereof and having a billowy cloth-like screen located downstream of the perforations of said filter housing panel and upstream of said blower, said pocket having a configuration in the area of the perforations of said panel so that said cloth-like screen is located crosswise to said airflow, and an excess lint indicator for said clothes dryer, said indicator comprising a signal on said cabinet and a switch, said switch actuatable in response to a pressure actuated bellows in said pocket supported in a position adjacent said cloth-like mesh on the downstream side thereof and sufficiently closely oriented in parallel relation thereto so that the billowing of said cloth-like screen in the downstream direction in response to lint collecting thereon directly presses against said bellows to actuate said switch and operate said signal before said cloth-like screen is so laden with an excess collection of lint that airflow through said clothes treatment enclosure is restricted to the point where high air temperature is reached and the source of heat thereby limited, the operation of said signal indicating the need for manually removing said lint filter through the opening of said pocket for cleaning lint from said cloth-like screen.

2. In combination, a domestic clothes dryer having an enclosing outer cabinet including a stationary front wall having a front access opening and a stationary rear wall, a dryer door mounted on said front wall for closing said front access opening, an airflow duct system within said cabinet, said airflow duct system including a clothes treatment enclosure extending between said front wall and said rear wall, said clothes treatment enclosure defined by a portion of the inside surface of said dryer door, a stationary filter housing panel adjacent to said access opening and a rotatably mounted cylinder, prime mover means for rotating said cylinder and impelling air through said airflow duct system, said filter housing panel defining with said front wall a pocket having an opening, said pocket connecting with said prime mover means and forming with the inside surface of said front wall an exhaust passageway for said airflow duct system, said filter housing panel being perforated in the area of said pocket to provide airflow communication between said clothes treatment enclosure and said exhaust passageway, said rear wall having a portion thereof to provide airflow communication between said clothes treatment enclosure and a high-air-temperature-limited source of heat, said prime mover means including a blower, said blower being connected directly to said pocket forming said exhaust passageway thereby to impel air through said airflow duct system, a manually removable substantially planar lint filter insertable in said pocket through the opening thereof and having a billowy screen of plastic fabric located downstream of the perforations of said filter housing panel and upstream of said blower, said fabric having substantially a 68 × 72 mesh for filtering lint, said pocket having a width to depth ratio greater than one in the area of the perforations of said panel so that said screen is located crosswise to said airflow, and an excess lint indicator for said clothes dryer, said indicator comprising a signal on said cabinet and a switch, said switch actuatable in response to a resilient pressure actuated bellows in said pocket supported in a position adjacent said screen on the downstream side thereof and sufficiently closely oriented in parallel relation thereto so that the billowing of said screen in the downstream direction in response to lint collecting thereon directly presses against said bellows to actuate said switch to operate said signal before said screen is so laden with an excess collection of lint that airflow through said clothes treatment enclosure is restricted to the point where high air temperature is reached and the source of heat thereby limited, the operation of said signal indicating the need for manually removing said lint filter through the opening of said pocket for cleaning lint from said screen.

3. In combination, a domestic clothes dryer having an enclosing outer cabinet including a stationary front wall having a front access opening and a stationary rear wall, a dryer door mounted on said front wall for closing said front access opening, an airflow duct system within said cabinet, said airflow duct system including a clothes treatment enclosure extending between said front wall and said rear wall, said clothes treatment enclosure defined by a portion of the inside surface of said dryer door, a stationary filter housing panel adjacent to said access opening and a rotatably mounted cylinder, prime mover means for rotating said cylinder and impelling air through said airflow duct system, said

filter housing panel defining with said front wall a pocket having an opening, said pocket connecting with said prime mover means and forming with the inside surface of said front wall an exhaust passageway for said airflow duct system, said filter housing panel being perforated in the area of said pocket to provide airflow communication between said clothes treatment enclosure and said exhaust passageway, said rear wall having a portion thereof to provide airflow communication between said clothes treatment enclosure and a high-air-temperature-limited source of heat, said prime mover means including a blower, said blower being connected directly to said pocket forming said exhaust passageway and adapted to impel air through said airflow duct system at substantially 180 cubic feet per minute, a manually removable substantially planar lint filter insertable in said pocket through the opening thereof and having a billowy screen of plastic fabric located downstream of the perforations of said filter housing panel and upstream of said blower, said fabric having substantially a 68 × 72 mesh for filtering lint, said pocket having a width to depth ratio greater than one in the area of the perforations of said panel so that said screen is located crosswise to said airflow, and an excess lint indicator for said clothes dryer, said indicator comprising a signal on said cabinet and a switch, said switch actuatable in response to a resilient pressure actuated bellows in said pocket supported in a position adjacent said screen on the downstream side thereof and sufficiently closely oriented in parallel relation thereto so that the billowing of said screen in the downstream direction in response to lint collecting thereon directly presses against said bellows to actuate said switch to operate said signal before said screen is so laden with an excess collection of lint that airflow through said clothes treatment enclosure is restricted to the point where high air temperature is reached and the source of heat thereby limited, said bellows having a circular surface of substantially 0.40 inch diameter engaging said screen when said blower is impelling air through said airflow duct system at substantially 180 cubic feet per minute, the operation of said signal indicating the need for manually removing said lint filter through the opening of said pocket for cleaning lint from said screen.

4. In combination, a domestic clothes dryer having an enclosing outer cabinet including a stationary front wall having a front access opening and a stationary rear wall, a dryer door mounted on said front wall for closing said front access opening, an airflow duct system within said cabinet, said airflow duct system including a clothes treatment enclosure extending between said front wall and said rear wall, said clothes treatment enclosure defined by a portion of the inside surface of said dryer door, a stationary filter housing panel subjacent to said access opening, a horizontally rotatably mounted, open-ended cylinder and a portion of the inside surface of said rear wall, prime mover means in front of said rear wall for rotating said cylinder and impelling air through said airflow duct system, said filter housing panel defining with said front wall a top-opening pocket, said pocket connecting with said prime mover means and forming with the inside surface of said front wall an exhaust passageway for said airflow duct system, said filter housing panel being perforated in the area of said pocket to provide airflow communication between said clothes treatment enclosure and said exhaust passageway, said rear wall having a portion thereof perforated and adapted thereby to provide airflow communication between said clothes treatment enclosure and an air-temperature-limited source of heat, said prime mover means including a blower, said blower being connected directly to said pocket forming said exhaust passageway thereby to impel air through said airflow duct system, a manually removable substantially planar lint filter insertable in said pocket through the top opening thereof and having a billowy cloth-like screen of polyester fabric located downstream of the perforations of said filter housing panel and immediately upstream of said blower, said fabric having substantially a 68 × 72 mesh for filtering lint, said pocket having a width to depth ratio greater than one in the area of the perforations of said panel so that said cloth-like screen is located crosswise to said airflow, and an excess lint indicator for said clothes dryer, said indicator comprising a signal light exposed on said cabinet, a humidity-sealed, pressure-actuated switch on said front wall, said switch having a resilient, rubber-like actuator bellows in said pocket supported from said front wall in parallel relation with said cloth-like screen on the downstream side thereof so that the billowing of said cloth-like screen in the downstream direction in response to lint collecting thereon when air is being impelled through said airflow duct system causes said screen to directly press against said bellows to gradually close said switch to energize said signal light before said cloth-like screen is laden with such an excess collection of lint that airflow through said clothes treatment enclosure is restricted to the point where high air temperature is reached and the source of heat thereby limited, the energization of said signal light indicating the need for manually lifting said lint filter through the top opening of said pocket for cleaning lint from said cloth-like screen.

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