June 14, 1966 F. F. MUELLER 3,255,535

ELECTRODE CONSTRUCTION FOR A LAUNDRY DRYER

Filed Dec. 10, 1962 2 Sheets-Sheet 1

Fig. 2.

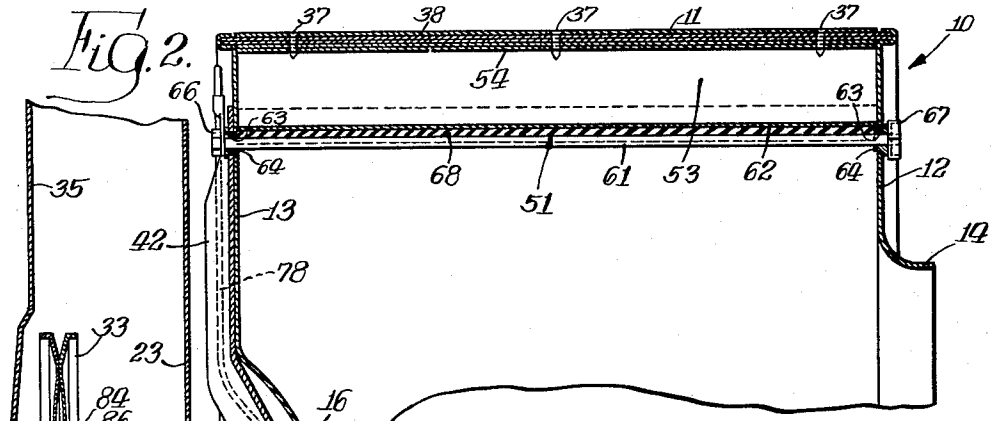
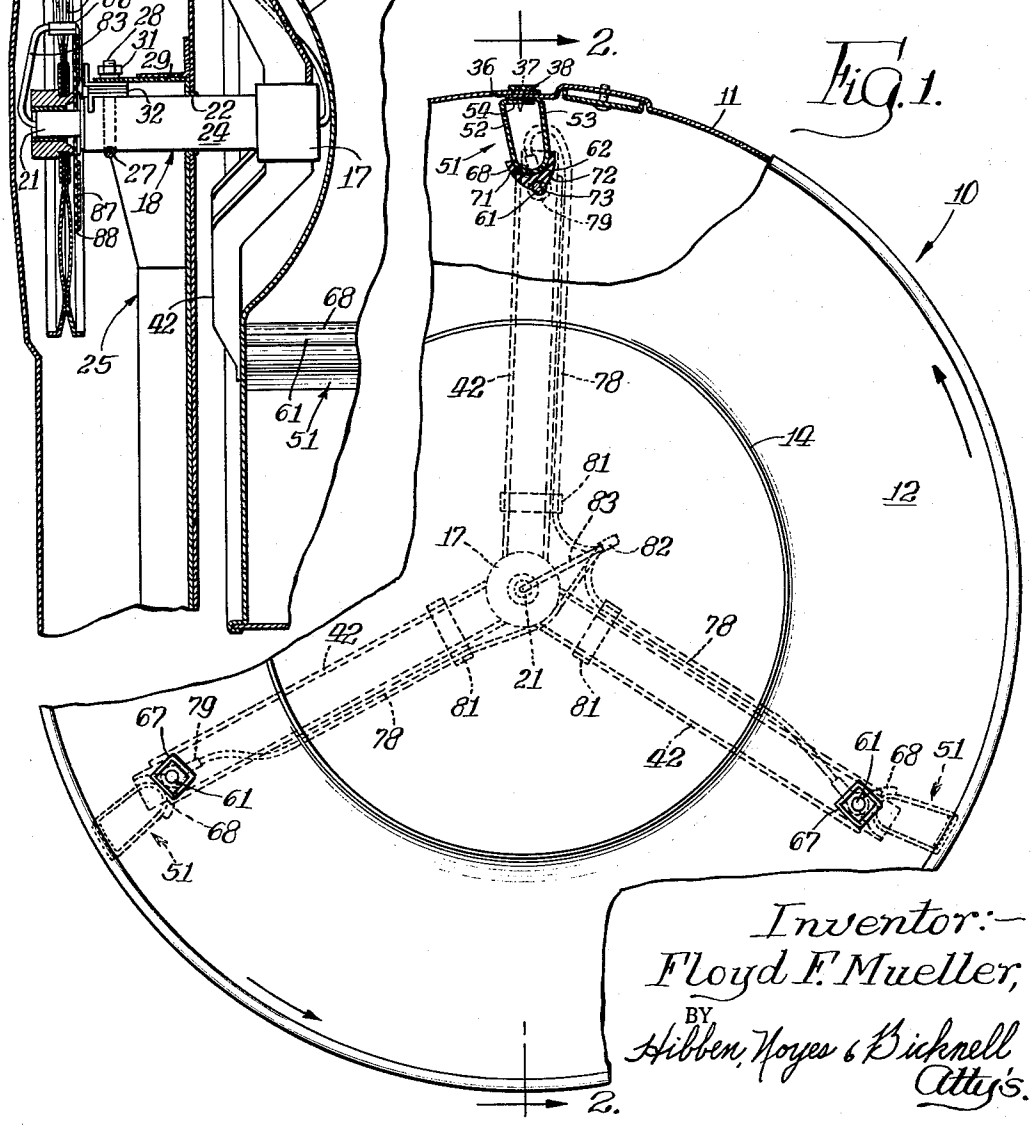


Fig. 1.

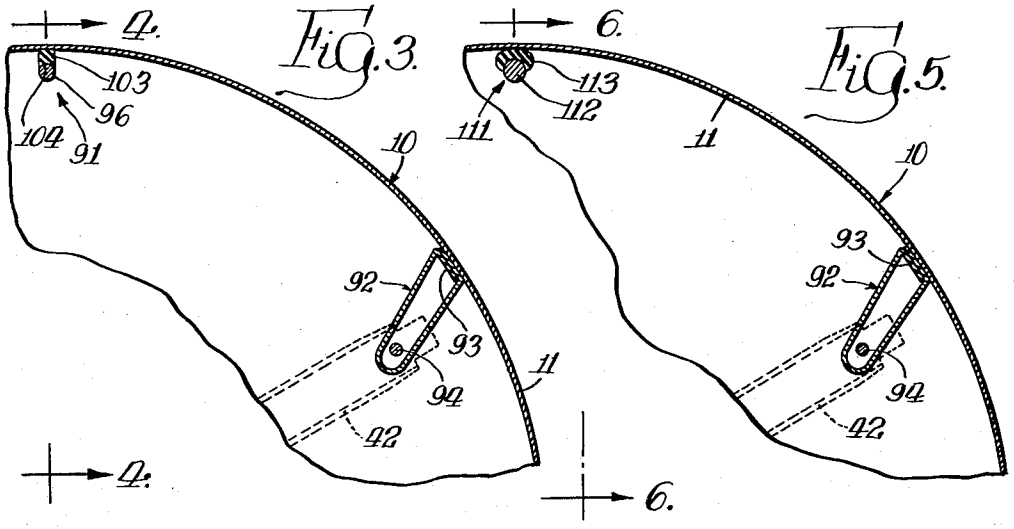


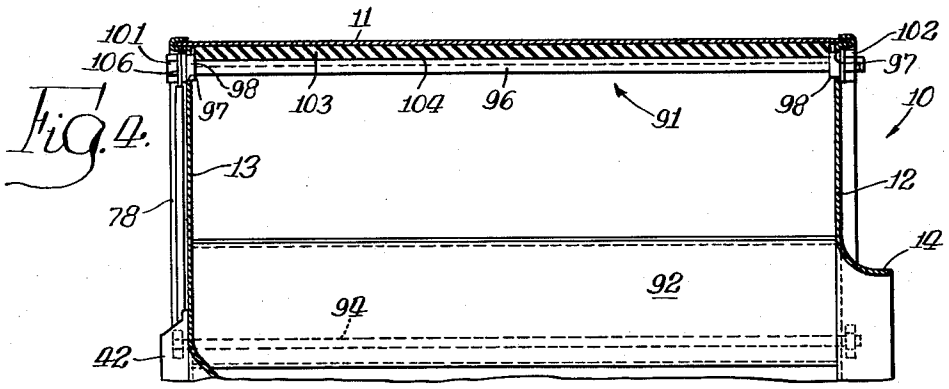
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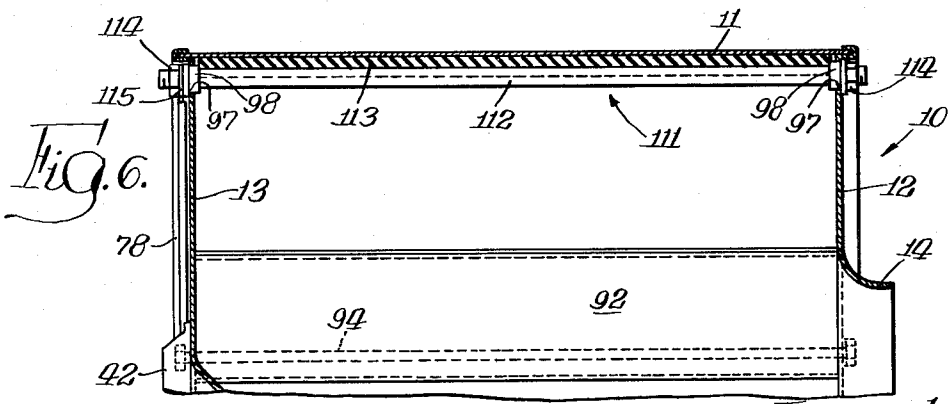
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ELECTRODE CONSTRUCTION FOR A LAUNDRY DRYER

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ELECTRODE CONSTRUCTION FOR A LAUNDRY DRYER

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7 Claims. (Cl. 34—45)

This invention relates to laundry dryers, and more particularly to an electrode construction for use in a dryer having an electronic dryness control system directly responsive to the moisture content of the laundry.

Various types of control systems have been developed for laundry dryers for controlling the period in which the heaters are energized and for terminating the drying operation. Some of these utilize various types of timing mechanisms for controlling the time during which the heaters are energized as well as the total cycle of operation. Other systems employ temperature sensitive devices in the exhaust air stream from the dryer as the sole control means or as an additional control to a timer. However, precise control of the final shut-off as well as the intermittent periods of deenergization of the heaters may vary with different types of laundry being dried. Consequently, for a given dryness setting, considerable variance of the degree of dryness between different loads of laundry may occur.

More recently, dryer control systems have been developed which respond directly to the moisture content of the laundry being dried for controlling the operation of the dryer. One such system utilizes the increasing electrical resistance characteristic of the laundry as it dries out to decrease the magnitude of an electric current that is passed through the laundry. The circuit carrying such current is connected to a control system which responds to a decrease in such current to shut down the dryer. It thus becomes apparent that effective operation of a dryer employing the foregoing type of control system requires an electrode arrangement which at all times assures contact between the laundry and the electrode during the drying operation. Other control systems may require a similar electrode arrangement.

Accordingly, it is a general object of the invention to provide a novel electrode arrangement for a dryer employing an electrical control system directly responsive to the moisture content of the laundry.

A more particular object is to provide a novel electrode construction for the drum of a laundry dryer employing a dryness control system, the electrode construction at all times providing an electrical contact with some portion of the laundry being dried and further providing structural support to the drum.

Other objects and advantages will become apparent from the following detailed description and accompanying sheets of drawings, in which:

FIG. 1 is a front elevation view of the rotatable drum of a laundry dryer employing an electrode construction embodying the features of the present invention;

FIG. 2 is a fragmentary vertical sectional view taken on the line 2—2 of FIG. 1;

FIG. 3 is a fragmentary sectional view showing another electrode construction embodying the features of the invention;

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 3;

FIG. 5 is a fragmentary sectional view, similar to FIG. 3, and showing still another electrode construction embodying the features of the invention; and

FIG. 6 is a sectional view taken along the line 6—6 of FIG. 5.

Laundry dryers of the type herein contemplated are

adapted for use in the home and generally include an outer cabinet or housing which serves to enclose a rotatable drum and the other parts of the dryer. The drum comprises a cylindrical housing having a peripheral side wall and end walls. The drum is disposed with its longitudinal axis horizontal, and the rear wall of the drum includes a hub secured to a shaft which is rotatably mounted on a support in the rear of the cabinet and through which the drum is driven. The front wall of the drum is provided with a central opening, and the front wall of the cabinet has a door providing access to the opening in the drum to permit loading and unloading of the dryer. Such a dryer also includes a plurality of baffles secured to the inner surface of the peripheral side wall of the drum and extending radially inwardly therefrom. The baffles are adapted to engage laundry in the drum and tumble it within the drum during rotation thereof.

A dryer as herein contemplated also employs a control system that is directly responsive to the moisture content of the laundry. Such a control system is mounted in the dryer cabinet externally of the drum and utilizes the varying electrical resistance of the laundry, as it becomes progressively dried, to control the operation of the dryer. To do this, the control system is grounded to the dryer and supplies through a circuit an electric current to the laundry which is in contact with the drum, the latter being grounded. Thus, as the electrical conductivity of the laundry is reduced because of the drying, an increased voltage through the laundry is obtained, and such increased voltage results in a shut down of the dryer. The shut down point is adjustable for varying the degree of dryness of the laundry as desired.

With the foregoing arrangement, a suitable electrode construction is provided within the drum to transmit the current from the control system to the laundry being dried. In addition, a circuit is provided for conducting the current from the control system external of the drum to the electrode construction within the drum.

A laundry dryer embodying the features of the present invention includes an electrode construction mounted in the drum adjacent the inner surface of the peripheral side wall of the drum for transmitting current from the control system to the laundry and thence to the grounded drum. The electrode construction is generally of rod-like form, and specifically is in the form of a tie-rod which maintains the end walls of the drum in assembled relation with the peripheral side wall thereof. In one embodiment of the invention, the tie-rod, which comprises the electrode construction, is disposed closely adjacent to and radially inwardly of the baffle, and an elongated piece of insulating material shaped to conform to the adjacent surfaces of the baffle and tie-rod may be interposed therebetween. In another embodiment, the tie-rod is circumferentially spaced from the baffle and disposed closely adjacent the inner side of the peripheral wall of the drum and an elongated piece of insulating material may be interposed between the tie-rod and the inner side of the peripheral wall. In still another embodiment, the tie-rod is mounted in the drum in the same manner as the previous embodiment, the tie-rod being enclosed in a layer of insulating material of which a portion thereof is removed throughout at least the major portion of the length of the tie-rod to permit contact with the laundry in the drum. In each of the embodiments, the tie-rod is insulated from the drum to permit current from the control system to be transmitted to the tie-rod and thence to the laundry in the drum.

In FIGS. 1 and 2, a rotatable drum 10 of a dryer of the type herein contemplated is illustrated. Such a drum is made of sheet metal and is mounted with its axis horizontal and includes a cylindrical or peripheral side wall

11 and front and rear walls 12 and 13, respectively. The front wall 12 is provided with a central loading opening defined by an annular axially outwardly extending flange 14. The rear wall 13 may be provided with an inwardly dished portion 16 (FIG. 2) within the concavity of which a hub 17 is located. A shaft assembly 18 is connected at its inner end to the hub 17 to support the left or rear end of the drum as viewed in FIG. 2. The shaft assembly 18 thus includes a tubular shaft 21 having its inner end extending into and secured to the hub 17. The shaft assembly 18 is sufficiently long so as to extend axially outwardly through an opening 22 in a partition 23 in the cabinet at the rear of the drum 10. The shaft 21 is rotatably mounted in bearings enclosed by a tubular sleeve 24, the outer end of the shaft 21 extending rearwardly beyond the sleeve 24. The opening 22 has a diameter substantially equal to the outside diameter of the sleeve 24 so that the latter, and consequently the shaft 21, is supported by the partition 23 and a support structure 25.

The sleeve 24 may be secured to the support structure 25 by a U-bolt or shackle 27 having its arms 28 extending upwardly around the sleeve 24 and through a horizontal plate 29 which forms a part of the support structure 25. The upper ends of the arms 28 are threaded to receive nuts 31 which engage the plate 29. Shims or spacers 32 may be inserted between the sleeve 24 and the plate 29 to adjust the position of the drum 10.

Rotation of the drum 10 is achieved by a pulley 33 secured to the rear or outer end of the shaft 21. The pulley 33 is driven by a belt (not shown) which passes around the pulley 33 and another pulley, the latter being driven by an electric motor. The drum 10, support structure 25, and the other components of the dryer are enclosed in a cabinet, a portion of the rear wall of which is indicated fragmentarily at 35 in FIG. 2.

As shown in FIGS. 1 and 2, the peripheral sidewall 11 of the drum in this instance is formed from a piece of sheet metal which is bent into a cylinder with its end edges overlapped as at 36 (FIG. 1) and so retained by means of a plurality of metal screws 37 passing through a tie-bar 38 and the overlapped end edges. The end walls 12 and 13 of the drum 10 may also be formed of sheet metal to the diameter of the cylindrical wall 11 and are secured thereto.

The rear wall 13 of the drum is supported by a spider which includes the hub 17 and a plurality of radially extending arms 42 disposed on the outer side of the rear wall 13. Each arm 42 is rigidly secured at its outer end to the rear wall 13 of the drum. The arms 42 extend substantially radially for the major portion of their length and then extend angularly inwardly toward a connection with the hub 17 within the concavity 16 of the rear wall 13.

In order to impart a tumbling action to the laundry being dried in the drum 10, baffle means is provided. Such baffle means, in the present instance, comprises three circumferentially spaced axially extending U-shaped baffles 51 (FIG. 1) made of sheet metal and having front and rear sidewalls 52 and 53, the marginal edges of which are folded inwardly and overlap to provide a double thickness base wall 54. The baffles 51 are secured at their base walls 54 to the inner side of the cylindrical side wall 11 as by sheet metal screws, one of the baffles preferably being located at the point where the end edges of the peripheral wall 11 are secured to each other. As will be apparent from FIG. 1, the sidewalls 52 and 53 of the baffles are inclined in a direction opposite to that of the rotation of the drum 10, which is indicated by arrows in FIG. 1. Such inclination permits the laundry to slide off the baffle as the latter approaches its uppermost position during rotation of the drum. The laundry will thus be caused to fall across the diameter of the drum and thereby obtain maximum exposure to the drying air currents in the drum.

A dryer with which the present invention is utilized is provided with a dryness control system which is directly responsive to the moisture content of the laundry and which controls the final shutdown of the dryer when the laundry reaches a predetermined degree of dryness. Such a system, which forms no part of the present invention, contemplates the provision of an electrode construction which will at all times assure contact with the laundry.

In FIGS. 1 and 2, one structural arrangement of an electrode construction for use with the foregoing type of dryness control system and embodying the features of the present invention is illustrated. Such electrode construction or means, in this instance, comprises an elongated member of electrically conductive material and of rod-like form mounted in the drum 10, such electrode means extending axially of the drum between the front and real walls thereof. Specifically, the electrode means illustrated in FIGS. 1 and 2 is in the form of a tie-bolt or rod 61 having its ends mounted in the front and rear end walls 12 and 13, respectively, with the rod spaced radially inwardly from the inner radial edge, indicated at 62, of each baffle 51. For mounting the tie-rod 61 in the front and rear end walls 12 and 13, respectively, the latter are provided with aligned openings 63 in which insulating bushings 64 are mounted and through which the ends of the tie-rod 61 extend. Each tie-rod 61 is provided with an enlarged head 66 at one end thereof, in this instance the left end as shown in FIG. 2, for engaging the outer end face of the bushing 64, and the opposite end of the rod 61 is threaded to receive a nut 67 which engages the outer face of the bushing 64 mounted in the front wall 12. The openings 63 are in axial alignment with the ends of the arms 42 and the latter are provided with openings through which the bushings 64 and the ends of the tie-rods 61 extend. Thus, in addition to their current transmitting function, to be described more fully hereinafter, the tie-rods 61 serve to hold the front and rear walls 12 and 13, respectively, in assembled relation with the peripheral wall 11 and to connect the ends of the arms 42 to the rear wall 13.

In order to support each tie-rod 61 along its length and to prevent laundry from becoming tangled between the tie-rod and the baffle, an elongated insulating member 68 may be interposed between the inner radial edge 62 of each baffle 51 and the adjacent surface of the tie-rod 61 in the manner illustrated in FIGS. 1 and 2. Preferably, the insulating member 68 is shaped to conform to the contours of the baffle 51 and thus is arcuate in cross-section and has an inner side 71 shaped to conform to the rounded radial edge 62 of the baffle 51. The outer side, indicated at 72, of the member 68 may be provided with an axially extending groove 73 which is adapted to partially receive a portion of the tie-rod 61 in nested engagement. The tie-rod 61 with the insulating member 68 thus further serves to give support to the baffle 51.

In order to provide a path for the flow of current from the control system to the tie-rods or electrodes 61, an electrical circuit is provided. Such circuit in the present instance, comprises three radially extending wires 78 disposed at the rear of the drum 10. Each wire 78 is provided with a terminal 79 (FIGS. 1 and 2) at the outer end thereof secured to the tie-rod 61 between the head 66 of the tie-rod and the bushing 64. From its terminal 79, each wire extends radially inwardly along an adjacent arm 42 of the spider toward the hub 17 and is held in close proximity to the side of the arm 42 as by heat resistant tape 81 (FIG. 1) which is wrapped around the wire 78 and arm 42 preferably at a point closely adjacent the hub 17.

Adjacent the hub 17, the inner ends of the wires 78 are joined together by a connector 82 and to another or common wire 83 which extends into the open inner end of the tubular shaft 21. The wire 83 extends axially outwardly through the shaft 21, then radially along the outer face of the pulley 33, and thence axially through an opening 84 (FIG. 2) in the pulley 33. The end of the wire

83 is provided with a connector 86 secured to a metal plate 87 mounted on one side of an insulating plate member 88. The metal plate 87 and insulating plate 88 are fixedly mounted on the shaft 21 for rotation therewith.

Current from the control system is transmitted to the plate 87 by a brush assembly (not shown) which is mounted on the support structure 25 and connected to the control system. The brush assembly and plate 87 thus comprise a commutator for supplying current from the dryness control system to the wire 83 and thence to the electrodes 61. The current then passes through the laundry, so long as it is moist, and is grounded through the drum 10.

In FIGS. 3 and 4, another electrode construction or means 91 for transmitting current to laundry in the drum 10 is illustrated. The drum 10 illustrated in FIGS. 3 and 4 is similar to the previous embodiment in that a plurality of circumferentially spaced baffles 92 are mounted therein and secured at their base walls 93 to the inner side of the peripheral wall 11 for tumbling the laundry. Only one baffle 92 and one electrode means 91 are illustrated in FIGS. 3 and 4, it being understood, however, that three circumferentially spaced baffles 92 may be provided and at least one and preferably three circumferentially spaced electrode means 91 are provided, the latter being circumferentially spaced from the baffles 92. An axially extending tie-rod 94 may be mounted in the interior of each baffle 92 for holding the baffle in assembled relation with the front and rear end walls 12 and 13, respectively, and for holding the end walls in assembled relation with the peripheral wall 11. The tie-rods 94 also extend through and rigidly secure the outer ends of the radial arms 42 to the rear wall 13.

Each electrode means 91 comprises an elongated rod-like member in the form of an axially extending tie-rod 96 mounted in the drum 10 in circumferentially spaced relation to the baffles 92 and radially spaced relation from the inner side of the peripheral wall 11. Each tie-rod 96 has a length somewhat greater than the axial spacing between the front and rear walls 12 and 13, and the latter are provided with openings 97 adjacent the inner side of the wall 11 to receive the ends of the tie-rods. The openings 97 are sufficiently large to accommodate insulating bushings 98 mounted on the tie-rods 96, which insulate the tie-rods 96 from the front and rear end walls 12 and 13. One end of each tie-rod 96 may be provided with an enlarged head 101 for engaging the bushing 98 in one of the end walls, such as the rear wall 13, and the other end of the tie-rod may be threaded to receive a nut 102 for engaging the bushing 98 in the opposite end wall, in this instance, the front wall 12. The tie-rods 96 thus serve to hold the front and rear walls 12 and 13 in assembled relation with the peripheral wall 11, in addition to the tie rods 94.

In order to support each tie-rod 96 along its length and to prevent laundry from becoming tangled between the tie-rod and the inner side of the peripheral wall 11, an elongated insulating member 103 may be interposed between each tie-rod 96 and the adjacent inner surface of the wall 11. The insulating member 103 is preferably generally rectangular in cross-section and the inner side thereof, indicated at 104, may be axially grooved to support and partially enclose a portion of the tie-rod 96. The insulating member 103 may be held in place by screws extending through the peripheral wall 11.

Current from the control system is supplied to each tie-rod or electrode 96 by a conductor or wire 78 in the manner of the previous embodiment. The outer radial end of each wire 78 is provided with a terminal 106 connected to the tie-rod and disposed between the head 101 and bushing 98.

In FIGS. 5 and 6, another electrode construction or means 111 for transmitting current to laundry in the drum 10 is illustrated. The drum 10 is similar to the drum of FIGS. 3 and 4 and includes a plurality of circumferentially spaced baffles 92, only one of which is shown in FIGS. 5 and 6, and at least one and preferably three electrodes means 111 are provided. Each electrode means 111 comprises an elongated member in the form of a tie-rod 112 extending axially of the drum 10 and having its ends mounted in but insulated from the front and rear end walls 12 and 13, respectively. Thus, a pair of insulating bushings 98 may be mounted on each tie-rod 112 in the manner of the previous embodiment, the bushings 98 being disposed in openings 97 in the end walls 12 and 13. The tie-rods 112 are also radially spaced from the inner side of the peripheral wall 11 and circumferentially spaced from the baffles 92.

In order to support each tie-rod 112 along its length and to prevent laundry from becoming tangled between the tie-rod and the peripheral wall 11, a layer of insulating material 113, such as rubber or plastic, may be provided on the tie-rod, such layer having a radial thickness substantially equal to the spacing between the tie-rod and the wall 11. The insulating layer 113 may be formed covering the tie-rod with the insulating material throughout its entire circumference and length and then removing part of the insulating material for a major portion of the length of the tie rod to expose a portion of the circumference of the tie rod, as illustrated in FIG. 5. The insulating material may be completely removed from the end portions of the tie-rod so that it may extend through the bushings 98. Such end portions may also be threaded to receive nuts 114, a terminal 115 being secured to the tie-rod outside of the rear wall 13 to connect the tie-rod to a wire 78 forming part of the electrical circuit connecting the tie-rod to the control system.

In all embodiments of the invention, the laundry will contact one or more of the electrodes during tumbling, and, so long as the laundry is moist, current will be carried from the electrodes through the laundry to the drum. As the laundry dries, the current decreases and at a predetermined point of dryness, the control system functions to shut off the dryer.

I claim:

1. In a laundry dryer including a rotatable drum having a peripheral side wall and front and rear end walls, and a control system directly responsive to the moisture content of laundry being dried for controlling the operation of the dryer, at least one baffle mounted on the inner side of said peripheral wall for tumbling the laundry as the drum rotates, electrode means comprising an elongated member of rod-like form mounted in said drum and extending axially thereof adjacent said peripheral wall, means mounting the ends of said member on said end walls and insulating the same therefrom, one end of said member having a conductor connected thereto, and an electrical circuit connected to said conductor for conducting a flow of current from said control system to said member for passage through the laundry and return to the control system so long as the laundry contains moisture.

2. The combination of claim 1, in which said elongated member comprises a tie-rod extending axially between said front and rear end walls and operable to hold the latter in assembled relation with said peripheral wall.

3. In a laundry dryer including a rotatable drum having a peripheral side wall and front and rear end walls engaging said side wall, and a control system directly responsive to the moisture content of laundry being dried for controlling the operation of the dryer, baffle means mounted in said drum on the inner side of said peripheral side wall for engaging laundry in said drum during rotation thereof, electrode means comprising an elongated member of rod-like form and of electrically conductive material mounted in said drum adjacent said baffle means and extending between said front and rear end walls for engaging said laundry, means mounting the ends of said member on said front and rear walls and insulating the same therefrom, an elongated insulating member dis-

posed between said baffle means and said conductive member, and an electrical circuit for conducting a flow of current from said control system to said electrode means for passage through the laundry and return to the control system.

4. The combination of claim 3, in which said insulating member comprises a piece of insulating material shaped to conform to the inner contour of said baffle means, said insulating material having an axially extending groove for receiving said elongated member.

5. The combination of claim 4, in which a plurality of circumferentially spaced baffle means are provided in said drum and at least an equal number of electrode means are provided.

6. In a laundry dryer including a rotatable drum having a peripheral side wall and front and rear end walls, and a control system directly responsive to the moisture content of laundry being dried for controlling the operation of the dryer, electrode means comprising an elongated conductive member of rod-like form and means mounting the same on and insulated from the front and rear walls of said drum in radially spaced relation from the inner side of said peripheral wall, said member holding said end walls in assembled relation with said peripheral wall, said member also having a conductor connected to one end thereof outside said drum, an elongated insulating member of generally rectanuglar cross section interposed between said conductive member and the inner side of said peripheral wall, the inner radial edge of said insulating member being grooved to partially enclose said electrode, and an electrical circuit connected to said conductor for conducting a flow of current from said control system to said conductive member for passage through the laundry and return to the control system so long as the laundry contains moisture.

7. In a laundry dryer including a rotatable drum having a peripheral side wall and front and rear end walls, and a control system directly responsive to the moisture content of laundry being dried for controlling the operation of the dryer, electrode means comprising an elongated member of rod-like form and means mounting the same on and insulated from the front and rear walls of said drum in radially spaced relation from the inner side of said peripheral wall, said elongated member being enclosed by a layer of insulating material except for a portion along the inner radial side of said member to expose the latter for contacting laundry in said drum, said member holding said end walls in assembled relation with said peripheral wall and having a conductor connected to one end of said member outside said drum for supplying current from said control system to said member for passage through the laundry and return to the control system so long as the laundry contains moisture.

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