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DOMESTIC APPLIANCE WITH CONTROL MEANS

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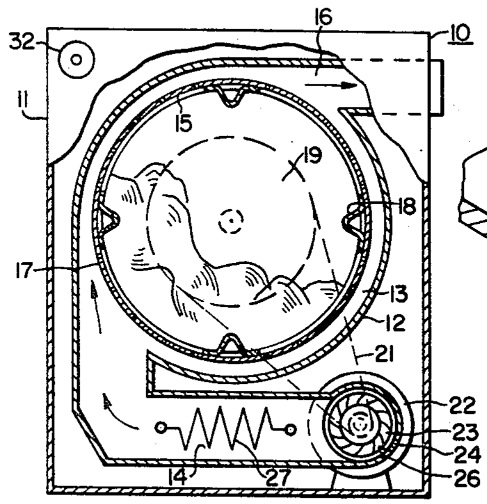

FIG.1.

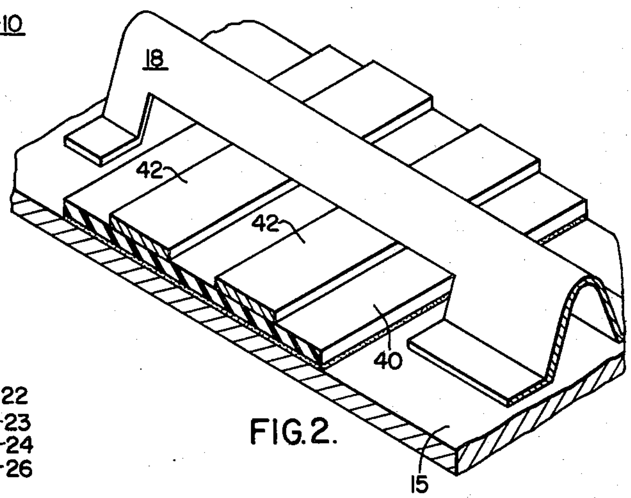

FIG.2.

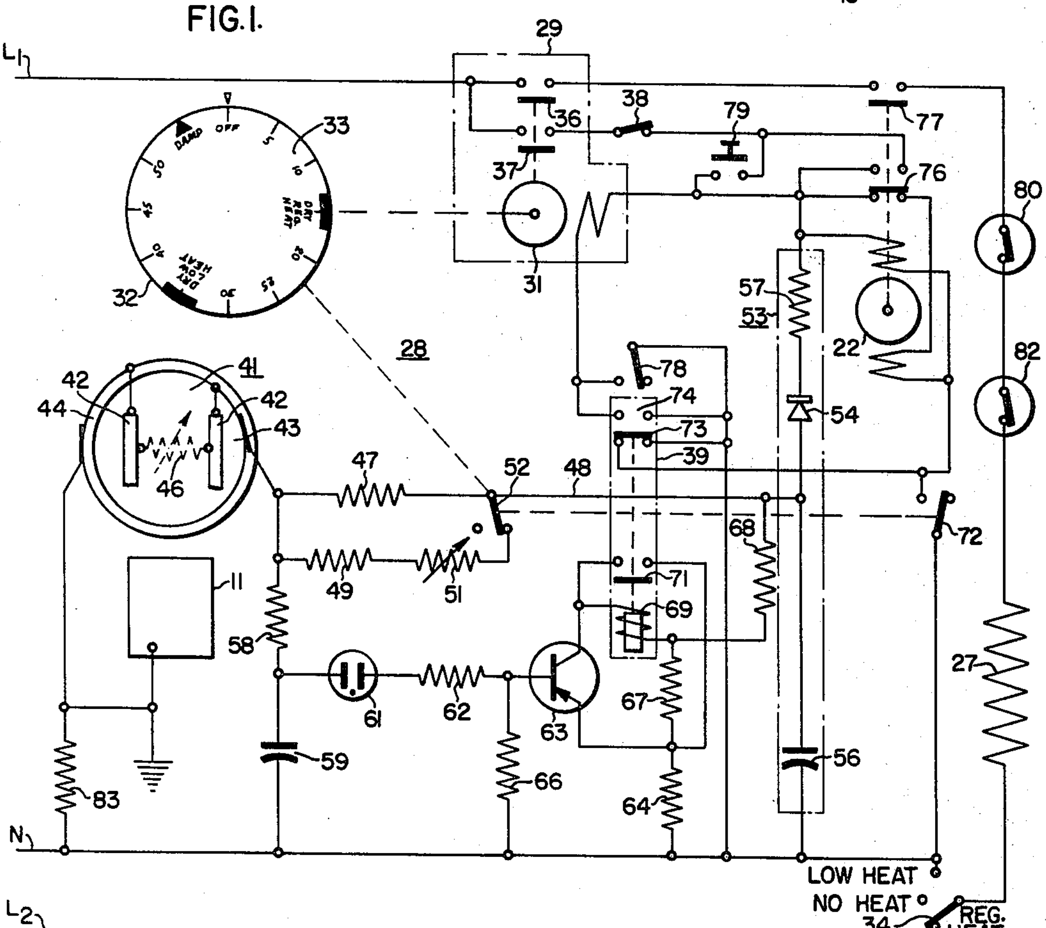

FIG.3.

WITNESSES

Theodore F. Wrobel

James F. Young

INVENTOR

Hans T. Thunander

BY B. B. Sklar, Jr.

AGENT

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1

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DOMESTIC APPLIANCE WITH CONTROL MEANS

Hans T. Thunander, Mansfield, Ohio, assignor to Westinghouse Electric Corporation, Pittsburgh, Pa., a corporation of Pennsylvania

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ABSTRACT OF THE DISCLOSURE

Clothes drying apparatus having a control including electrodes disposed in the rotating basket, which electrodes, together with the clothes, constitute a varying resistance which is measurable as a function of moisture content in the clothes. The control is more specifically characterized by the incorporation of means capable of producing various signals representative of moisture content which serve to either extend operation of the dryer or to terminate operation thereof, the extended operation including both a drying portion with heat and a cool-down portion without heat.

The invention relates, in general, to domestic clothes dryers and, more particularly, to electronic controls therefor.

Domestic clothes drying apparatus, at an early date, utilized a timer that could be manually set in order to establish the duration of the drying cycle so as to accommodate the drying of different size loads of clothes to different degrees of dryness as desired by the user.

While such an arrangement is reasonably satisfactory, the end result is dependent entirely upon the judgment of the operator with respect to his or her estimate as to the time required to dry the particular load of clothes to the desired degree of dryness. The use of many mechanical aids have been suggested and tried in order to better establish this estimate, the result being only to reduce limits of error of the unaided estimate.

As a solution to the guessing problem attendant with the clothes dryers of the type dicussed above, control means such as a thermostat was added, for automatically shutting down the dryer when the clothes are dry. The thermostat is so located within the dryer as to respond fairly well to a completely dry condition, however, it is not capable of automatically shutting off the dryer when the clothes are still damp enough for ironing. Such being a desirable feature, many attempts have been made to design such a control. Such controls, heretofore, attempted, have been based on the fact that, as the clothes dried below a certain moisture content, the rate of drying falls off, this being reflected in various phenomena in the dryer, such as exhaust temperature, heat utilized for vaporization, and humidity in the exhaust air, etc. A relatively large number of seemingly unrelated control schemes are based on this fundamental principle, i.e. rate of drying, and efforts have been directed at finding qualities such as temperature, time, etc., and combination of qualities, which respond as purely as possible to the rate of drying. Unfortunately, most of these qualities also respond to ambient temperature, line voltage, load size, air flow, initial amount of water present in the clothes, heating and cooling of dryer parts, etc. Such controls, although not infeasable tend to be either inadequate or cumbersome and expensive. Furthermore, the fundamental principle is not entirely correct. For instance, the correlation between rate of drying and moisture content is not the same for heavy fabrics as for light fabrics, nor for cotton as for rayon or nylon.

Accordingly, an entirely new approach, based on a principle which is independent of the drying process and

2

of the dryer, has been utilized in more recent dryer constructions. It is based on measurement of moisture content remaining in the clothes. As this measurement is independent of whether or not the clothes are drying, most of the variables that render the previously mentioned control schemes unsatisfactory are eliminated. One such arrangement for measuring the moisture content, utilizes the correlation between cooling effect of the clothes on a heated body and moisture content. In other words, clothes having a relatively high moisture content and, hence, high heat conductivity, will remove a greater amount of thermal energy from the heated body than clothes in the damp-dry or completely dry condition. The decreased heat removal by the clothes can be readily utilized directly or indirectly to effect termination of heated air supplied to the clothes.

Such an arrangement as just discussed has been used in a control which is intended primarily for clothes which are to be removed from the dryer with sufficient moisture retained therein to render them suitable for ironing. However, any commercially acceptable clothes dryer must also be able to dry clothes completely and automatically. A thermal arrangement similar to that discussed supra, cannot be relied upon to accurately sense moisture remaining which is less than, say, 20%, accordingly with such an arrangement it is necessary to extend the drying time beyond the control point of the thermal control. This can be done by providing a timer motor which can be started and stopped in response to a signal from the thermal control used in conjunction therewith. The timer normally may be started and will run for a predetermined period of time after a specific percentage of moisture, sensed by the thermal control, remains in the clothes.

The thermal type of sensing device used is usually located at a point on the basket and, therefore, makes contact with the clothes at the most, once during each rotation. Since the signal produced by such an arrangement is neither smooth nor continuous it is desirable from the standpoint of sensitivity, reliability, and repeatability, to provide a sensing device which contacts the clothes continuously. A continuous sensor not only produces a smoother signal but in the case of extremely small clothes loads or single items, a useable signal is available when anyone point in the basket might be missed for several revolutions. It will be understood by those skilled in the art that known thermal sensors are not suitable for continuous sensing and that the portions of the control used in conjunction with thermal sensors are not suitable for use with continuous sensors.

Accordingly, it is the general object of this invention to provide new and improved clothes drying apparatus.

It is a more particular object of this invention to provide new and improved electronically controlled clothes drying apparatus.

Another object of this invention is to provide a control system for clothes dryers suitable for damp drying and complete drying automatically.

Still another object of this invention is to provide a new and improved sensing and control system which measures moisture content as a function of electrical conductivity.

Briefly, the present invention accomplishes the above-cited objects by providing, in a domestic clothes dryer, an electronic control comprising a relay actuated timer motor, which relay is responsive to an electrical signal resulting from the electrical conductivity level of the clothes load, the level or degree of electrical conductivity of the clothes being a function of the moisture content thereof. The clothes therefore, act as a variable resistance which is connected in the circuitry of the control by means of a pair of spaced apart continuous electrodes extending the entire distance around the inside of the dryer basket and a pair of slip rings. It will be apparent to those skilled in the art that one or more point sensors, i.e. electrodes confined to small areas may be employed in lieu of continuous electrodes. The voltage across the clothes serves to fire a gas diode at a moisture level in the clothes determined by the resistance values in the voltage divider and by the parameters of a low-pass filter inserted between the voltage divider and the gas diode. The voltage divider is adjustable to effect firing of the gas diode at various moisture levels and the firing of the gas diode is used either to effect immediate termination of operation or extended operation, the extended operation including a period with heat and a period without heat.

Further objects and advantages of the invention will become apparent as the following description proceeds and features of novelty which characterize the invention will be pointed out in the claims annexed to and forming a part of this specification.

For a better understanding of the invention, reference may be had to the accompanying drawings, in which:

FIGURE 1 is a front elevational view of a clothes dryer, partly broken away, representing the invention;

FIG. 2 is an enlarged fragmentary section of the basket of the dryer, illustrated in FIG. 1 and portions of the electrodes carried thereby;

FIG. 3 is a schematic diagram of the dryer control.

Referring to the drawings, especially FIG. 1, reference character **10** designates generally a clothes drying machine comprising a casing structure **11** having a generally cylindrical baffle **12** supported therein and enclosing a drying chamber or receptacle **13**. The drying chamber is provided with an air inlet duct **14** for directing heated air thereto and an air discharge duct **16** for directing moisture laden air therefrom. A generally open end cylindrical basket **17** is supported within the drying chamber **12**. A cylindrical sidewall **15** of the basket **17** may be perforate substantially throughout its circumferential extent for the passage of air from the air inlet duct **14** through the clothes in the basket **17** to the discharge duct **16**. The basket **17** is preferably provided with a plurality of radially inwardly extending vanes **18** for the tumbling of the clothes during the drying operation. The casing **11** is provided with an opening (not shown) which is in registry with the open end (not shown) of the basket **17** for providing access to the interior of the basket through a door (not shown) for insertion and removal of clothes.

The basket **17** is suitably journaled in the casing **11** for rotation about a horizontal axis and is driven by a sheave **19** belted, as shown at **21**, to an electric motor **22** mounted on the bottom of the casing **11**. The motor **22** also serves to drive the rotor **23** of a blower **24**. The blower is provided with an air intake opening **26** communicating with the space within the casing **11**, which space receives air from the surrounding atmosphere through openings (not shown) formed in the casing sidewalls. The blower **24** discharges into the air inlet duct **14** and passes over an electric heater **27** provided for heating the air before it is circulated through the clothes in the basket **17**.

Consonant with conventional practice the heater **17** is connected to an Edison three-way single phase circuit having main conductors L1 and L2 and a neutral conductor N (see FIG. 3). It is understood that the potential between the main conductors L1 and the neutral conductor is 115 volts and the potential across L1 and L2 is 230 volts.

Referring to FIG. 3, there is shown schematically an electronic control generally indicated **28** which comprises a timing mechanism **29** having a timer motor **31** and provided with a manually adjustable knob **32** by which the user may set the timer **29** in an active range of operation designed to start the dryer motor **22** and to, itself, operate for a desired period of time, say 50 minutes after a predetermined delay, which will be hereinafter discussed in detail. The timer **29** is so constructed that when it reaches the end of the selected period, it will shut itself off by returning to its inactive position. Alternately the control knob **32** may be used to set the timer **29** to an inactive position designed to start the dryer motor **22** and in which the timer motor will not run at the end of a corresponding delay period. It will be apparent that the timer motor may be of any known type; for example, electric, hydraulic, pneumatic, or thermal, etc.

The knob **32**, as best shown in FIG. 3, is provided wtih an annular scale **33** comprising indicia indicating an "off" position, "damp," "dry," regular heat and "dry," low heat. A selector switch **34** (see FIG. 3) serves to connect conductor L1 to the neutral conductor N, for supplying 115 volts to the heater **27** or, alternately, to connect the conductor L1 to the conductor L2 to supply 230 volts to the heater **27**. To set the timer **29**, the control knob **32** is rotated counterclockwise, the degree of rotation determining the duration for which the timer motor **31** will run when actuated. As the timer runs, the control knob **32** gradually rotates in a clockwise direction, so that, by the time the selected period, represented by the setting of the knob, has nearly terminated, switch actuating means (not shown), serves to open a heater switch **36** for deenergizing the heater **27** and when the selected period has terminated, the switch actuating means serves to open a dryer motor switch **37** for stopping rotation of the motor **22**. The above outlined procedure will take place for all settings of the control knob **32**, with the exception of the "damp" dry setting the function of which will become apparent hereinafter.

A conventional door actuated safety switch **38** is connected in series with the motor switch **37**, thereby serving to stop the motor **22** and, consequently, deenergize the heater **27** at any time the dryer door (not shown) is open.

The control **28** is provided with means **41** for sensing the electrical conductivity of the clothes load within the basket **17**. The sensing means **41** comprises a pair of continuous electrodes **42** and **42'** made from any suitable material, for example, stainless steel, which are secured in a suitable manner within the interior of the basket **17** to insulating material **40** secured to the cylindrical sidewall **15** for the entire length thereof and pass under the vanes **18** (see FIG. 2). Under one of the vanes **18**, electrical conductors (not shown) are connected to one of the other of the electrodes. One of the conductors is, in turn, connected to the basket **17** while the other conductor is, in turn, connected to the sensing circuit via a conventional slip ring **43** shown schematically in FIG. 3. The conductor connected to the basket is connected to the casing **11** and the sensing circuit by means of a conventional slip ring **44**, also shown schematically in FIG. 3. The foregoing arrangement will be obvious to one skilled in the art. The wet clothes and the electrode **42** appear to the circuit as a variable resistor **46**, the electrical conductivity of which is a function of the moisture in the clothes. The resistance is low when the clothes are wet and increases to a very high value when the clothes are completely dry. Typical resistances are (approximate magnitude only): 100% water—1000 ohms, 25% water—0.5 megohm, 10% water—50–100 megohms, and 0% water—500–5000 megohms (including insulation leakage). The resistance represents a useable signal upon which there may be superimposed some very strong noise signals, ranging in frequency from a few cycles per hour to several thousand cycles per second. One important problem, the solution of which is accomplished by the present invention as will be apparent, is that of extracting the desired signal (i.e. those having frequencies ranging from one cycle per minute to a few cycles per day) from the background noise signals, the most troublesome of which occur when the clothes have a moisture suitable for ironing.

The sensing circuit **41** further comprises a fixed resistor **47** which together with the variable resistor **46** forms a voltage divider which has a very low output until there is a specific amount of moisture, say, 15–20% remaining in the clothes. With the value of the resistor **47** equal to 66 megohms and as long as the variable resistor **46** remains below 5 megohms, there is a very low voltage across the variable resistor **46**. At this point the voltage begins to rise rapidly and within a couple of minutes, it rises to half the supply voltage applied to conductor **48**. At this point the voltage is rising at its greatest speed and represents a detectable signal which is utilized to start the timer motor **31** to thereby extend drying time. Variations in supply voltage or the exact level of voltage across the resistor **46** when the circuit triggers has a nominal effect on the instant when the relay **39** closes. This is important in order to achieve good repeatability with wide tolerance components which may be used to minimize cost. The value of the fixed resistor **47** is, therefore, selected to be nearly equal to the resistance across variable resistor **46** when the moisture content in the clothes is at the desired level and when the relay **39** is to be triggered. Actually, the relay triggers somewhat later due to an unavoidable delay to be described later.

A fixed resistor **49** and a variable resistor **51** connected in series, may also be coupled with the variable resistor **46** by means of a selector switch **52** operable by the control knob **32** at the "damp" setting to form another voltage divider. The variable resistor **51** is preferably a rheostat having a logarithmic taper and a maximum resistance of at least two megohms. The variable resistor **51** may also be a selector switch having a number of fixed resistances. The resistor **51** may be adjusted by means of a control knob (not shown). The fixed resistor **49** may have a resistance in the range from 50,000 to 300,000 ohms and serves to prevent the resistance between the variable resistor **46** and the power supply across the variable resistor **51** from being set to zero. The resistance valves of resistors **49** and **51** are dependent on the specific electrode design and the desired latitude of settings. Since the resistance of the resistor **47** is much greater (66 megohms) than the resistors **49** and **51** (300,000 ohms max. plus 2 megohms max.) it need not be disconnected. When the resistance of the variable resistor **46** is equal to the resistance of the resistor **49** plus the resistor **51** approximately one half of the supply voltage will appear across the variable resistor **46**. Triggering of the relay **39** takes place at this point, however, instead of starting the timer motor **31** for extending drying time as in the case of the "dry" setting, the operation of the dryer **10** is terminated by stopping the dryer motor **22** as will be apparent hereinafter. Alternatively, a very short run-out time could be set on the timer motor.

The sensing circuit **41** is fed by a half-wave power supply **53**, which also supplies the rest of the control circuit **28**. The power supply **53** comprises a rectifier **54**, a filter capacitor **56** and a surge limiting resistor **57**. The sensing circuit **41** is therefore, supplied with about 150 volts negative voltage as will be understood by those skilled in the art. The half-wave power supply **53** permits utilization of high voltage in the sensing circuit and minimizes the effect of galvanic phenomena at the electrodes **42** which may be present to a lesser or greater extent, depending on a material from which the electrodes are made. Moreover, the effect of capacitive currents on alternating current is not a problem with this direct current type of arrangement.

A fixed resistor **58** and a fixed capacitor **59** having resistance and capacitance values, respectively, of 22 megohms and two microfarads, form a low-pass filter with a cut-off frequency of about 0.25 cycle per minute. This is a compromise between the desirability of even lower cut-off to more effectively eliminate background noise on damp settings and the nuavoidable longer delay, at the lower cut-off frequency. The delay is about 45 seconds on a steadily rising input signal which delay is

tolerable. Since the sensing circuit on the "damp" setting has a very low resistance compared to that of the resistor **58**, it has very little effect on the cut-off frequency of the filter. However, a much higher output impedance is produced, on "dry" settings, in the sensing circuit (i.e. between 20 to 40 megohms), which impedance effectively appears in series with the resistance across resistor **58** thereby lowering the cut-off frequency of the filter to one-tenth cycle per minute, the delay of the signal being increased by about one and two-thirds minutes. Both of these effects are beneficial since the lower cut-off frequency results in greater repeatability and the increased delay allow the selection of less running time of the timer motor **31**. The size of the capacitor **59** is determined by the pulse energy required by the circuitry following and the resistor **58** is chosen to give the frequency response described above for "damp" settings. It will be understood that a larger capacitor would give more of a pulse, larger delays on dry settings and would permit use of cheaper components down stream. The choice of a two microfarad capacitor may be changed if warranted by the cost savings.

An electrically actuated switch **61**, herein shown as a gas diode, in the form of a small neon lamp is adapted to be fired when the capacitor **59** has been charged to the breakdown voltage of the switch **61**. At this point a portion of the charge on the capacitor **59** is discharged through a resistor **62**, the base-emitter junction of a P-N-P, germanium transistor **63** and a resistor **64**. The resistor **62** serves to limit the amplitude of the pulse and also determines its duration. A resistor **66** serves to bypass any collector leakage around the base-emitter junction while the resistor **64** causes a reverse bias thereon. Together the resistors **66** and **64** prevent thermal runaway of the transistor **63**.

It will be apparent to those skilled in the art that the wider the differential is between the breakdown voltage of the gas diode **61** and its extinguishing voltage, the more of the charge on the capacitor **59** can be utilized. For example, the commercially available gas diode NE–83 has a relatively large differential compared to the NE–2 gas diode, consequently, a smaller capacity and a less sensitive relay may be used, a matter of considerable economy. Accordingly, numerous combinations of components can be employed, the selection of which may be governed by such variables as cost, reliability, etc.

The transistor **63** amplifies the pulse or signal so that a rather powerful relay **39** which can handle the motor current directly can be utilized thereby eliminating the need for a slave relay. The transistor has a current gain of about 50 in the grounded emitter configuration and a collector-emitter voltage rating of 25 volts. In the absence of a signal or a pulse a voltage divider comprising resistors **67** and **68** and the resistor **64** applies about 22 volts to the collector of the transistor. With the relay **39** having closing time of 14 milliamps or less, a coil resistance of about 1000 ohms and a pull-in time of about 20 milliseconds, the transistor should be maintained saturated for at least 20 milliseconds. In lieu of the transistor **63** a silicon-controlled rectifier (SCR) has been successfully utilized, resulting in significant advantages for example, a less sensitive relay may be used, less pulse is required from the gas diode, no contact is needed for "lock-in," and the relay and SCR operate on the full voltage of capacitor **56** without the need for a voltage divider.

The amplified signal or pulse fed to the coil **69** of the relay **39** causes the relay to close momentarily, but as soon as the relay switch **71** closes the transistor **63** is bypassed, however, the relay is locked in for as long as the power supply **53** delivers current. The moisture level or conductivity level at which this occurs of course, depends, on the setting of the switch **52** and the variable resistor **51**. For the "dry" setting, regular heat the switch **52** is opened and the relay **39** closes when about 10–15% moisture remains in the clothes. For the "damp" setting the switch **52** is closed and the moisture level of the clothes depends on the setting of the variable resistor **51** by means of a knob (not shown) which can be set by the user as desired.

As indicated above, the selector switch **52** is actuated by the control knob **32**, the switch **52** being operatively connected to a second two position selector switch **72** which is simultaneously actuated with the switch **52**. For example, when the control knob **32** is set to one of the "dry" settings the switch **52** is opened while the switch **72** is simultaneously closed and vice versa. The switch **72** by-passes a switch **73** of the relay **39** and the dryer motor **22** continues to run after the pulse from the transistor **63**. The relay switch **73**, which was open prior to the pulse, closes, thereby starting the timer motor **31**. The moisture in the clothes is removed to an extent determined by the timer setting which in the case of the "dry" setting, regular heat, is fifteen minutes. This works well, regardless of load size, at low moisture levels because diffusion rates, rather than available heat, determines the drying rate. When about five minutes are left on the timer the heater switch **36** opens, deenergizing the heater **27**. The air flow from the blower **24** continues thereby cooling the dryer. After five minutes the dryer motor switch **37** opens thereby deenergizing the dryer motor **22**.

When the knob **32** is set at "damp" dry, the switch **52** is closed and the switch **72** is open. Now the pulse from the transistor **63** causes the relay **39** to lock in as before, but when the relay switch **73** opens the dryer motor **22** is deenergized immediately opening centrifugally actuated switches **26** and **27** thereby deenergizing the dryer motor and the heater **27**. In this instance, therefore, there is no running-out of the timer motor **31** after the pulse as in the case of the "dry" setting.

The dryer **10** may be controlled by the timer **31** independently of the sensing circuit **41** and the relay **39**. To this end a manually operated selector switch **78** is provided which serves to by-pass the relay **39**. With the switch **78** in the closed position, the control knob **32** may be set anywhere in the "time range" and the dryer **10** will operate in the conventional manner under the control of the thermostat and timer contacts.

Contrarywise, when the selector switch **78** is opened, then, drying is accomplished "automatically" through the relay **39** as hereinabove discussed. If for any reason the operator, at the termination of a "damp" dry cycle, desires to run the dryer for a minute or two, he or she may do so by means of an override switch **79** in the form of a spring biased push-button. As long as the button is depressed by the user the dryer motor **22** and the heater **27** will be energized thereby serving to further dry the clothes load. This can be carried out with or without heat depending on the position of the switch **34**. By releasing the push-button the override switch **79** opens, however, the motor **32** continues to run momentarily until a pulse is generated by the sensing circuit **41** to open the relay switch **73**, at which time the motor **22** is immediately deenergized due to the switch **72** being in the opened position.

An outlet thermostat **80** is suitably mounted in the exhaust air stream in a conventional manner and serves to control the general air temperature in the dryer. As a safety precaution against dangerous overheating another thermostat **82** is mounted, also in a conventional manner, in the inlet air stream in the vicinity of the heater **27**.

Normally the electrical codes governing installations of dryers similar to that of dryer **10** allow grounding, thereof, through the neutral conductor or line wire N, which grounding may be accomplished by means of a conventional grounding strap (not shown). Where the electric codes do not allow grounding as discussed above, the grounding strap (not shown) may be replaced by a separate ground wire which, for example, may be attached in a well known manner to a water pipe. In the latter grounding arrangement, the sensing circuit **41** is completed

to the neutral line N by means of a resistor **83** having a suitable resistance value of, say 100,000 ohms, which resistor provides a potential difference between the neutral and ground thereby limiting the current flow to the rest of the circuit to a safe value.

It will be apparent that there has been disclosed a dryer and an electronic control therefor in which it is not necessary to guess which of a plurality of settings should be used in conjunction with the automatic drying operation, as is in the case of prior art constructions. In other words, the same setting is used for all load sizes and all fabrics, consequently, the necessity of having settings, which tell the control what kind of load it has to work with, are eliminated. Moreover, the control disclosed herein minimizes the harshness, stiffness and shrinkage caused by overheating of the clothes, commonly caused when an exhaust thermostat is used to determine end of drying. Furthermore, the dryer herein disclosed works very well on low or with restricted air flow, which operation is most unsatisfactoy with thermostatically controlled dryers, and gives satisfactory results on installations for 115 volts.

While there has been shown and described what is at present considered to be the preferred embodiment of the invention, modifications thereto will readily occur to those skilled in the art. It is not desired, therefore, that the invention be limited to the specific arrangements shown and described and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In a clothes dryer, in combination, a clothes receptacle, means including a motor for rotating said receptacle, a control and circuitry therefor adapted to be connected to a source of potential, said control circuit comprising means for sensing moisture in said clothes, means for initiating operation of said motor, means for extending operation of said motor and means for terminating operation of said motor, said moisture-sensing means being adapted to produce a first signal for actuating said extending means and a second signal for actuating said terminating means, said means for extending operation of said motor being effective to provide a cool-down period without heat and a drying period with heat.

2. In clothes drying apparatus, the combination comprising: a clothes receptacle; means including a motor for rotating said receptacle; an electronic control and circuitry therefor connected to a source of power; said control circuit comprising a pair of electrodes mounted in said receptacle and insulated therefrom, said electrodes being positioned so as to be continuously contacted by the clothes in said receptacle whereby said clothes and said electrodes comprise a moisture sensing element, manual means for initiating operation of said motor, means for terminating operation of said motor, and means for extending operation of said motor, said moisture sensing element being adapted to produce a first electrical signal for actuating said extending means and a second electrical signal for actuating said terminating means, said means for extending operation of said motor being effective to provide a cool-down period without heat and a drying period with heat.

3. Structure as specified in claim **1**, wherein said extending means comprises relay actuated timing mechanism operatively connected to said means for initiating operation of said motor.

4. Structure as specified in claim **3**, wherein said terminating means comprises relay actuated switch means operatively connected to switch means actuated by said initiating means.

5. Structure as specified in claim **4**, wherein said control includes means movable from an inoperative position to an operative position and operatively connected to said timing mechanism whereby operation of said motor may be discontinued independently of said terminating means.

6. In clothes drying apparatus having a clothes receptacle supported for rotation, means for circulating heated air through said receptacle for evaporating moisture from said clothes, and means including a motor for rotating said receptacle for tumbling the clothes therein, the combination consisting of an electronic control and circuitry therefor connected to a source of electrical power, said control comprising manually operable means for initiating operation of said motor, means in said receptacle for sensing the moisture content of the clothes, means for extending operation of said motor, first means cooperating with said moisture sensing means for producing a first signal of a predetermined magnitude and representative of the predetermined moisture content in said clothes, means responsive to said first signal for extending operation of said motor, second means cooperating with said sensing means for producing a second signal of a predetermined magnitude different from said first signal and representative of moisture content in the clothes, means responsive to said second signal for terminating operation of said motor.

7. Structure as specified in claim **6**, including means operatively connected to said first cooperating means for selectively varying the magnitude of said first signal.

8. In clothes drying apparatus having a clothes receptacle supported for rotation, means for circulating heated air through said receptacle and said clothes for evaporating moisture from said clothes, and means including a motor for rotating said receptacle for tumbling of the clothes therein, the combination consisting of an electronic control and circuitry therefor connected to a source of electrical energy, said control comprising manually operable means for initiating operation of said motor, means in said receptacle for sensing the moisture content of the clothes, means cooperating with said moisture sensing means for producing a first signal representing a predetermined moisture content remaining in said clothes, means operably connected to said signal producing means for extracting a desired portion of said signal thereby eliminating interfering signals superimposed upon the desired signal, means for extending operation of said motor, means interconnecting said signal extracting means and said extending means for transmitting desired signals from the former to the latter.

9. Structure as specified in claim **8** including means interconnecting said transmitting means and said extending means for amplifying the signal from said transmitting means.

10. Structure as specified in claim **9** wherein said signal extracting means comprises a resistance-capacitance filter, said transmitting means comprises a gas diode the firing of which takes place when the capacitor reaches the breakdown voltage of the gas diode and said amplifying means comprises a transistor.

11. Structure as specified in claim **10**, including means operatively connected to said amplifying means for terminating operation of said motor, means cooperating with said moisture sensing means for producing a second signal distinct from said first signal, said second signal being adapted to actuate said terminating means.

12. Structure as specified in claim **11**, including means operatively connected to said initiating means and operable between a first and a second position for effecting actuation of said extending means when in said first position and for actuation of said terminating means when in said second position.

13. Structure as specified in claim **7**, including means operatively connected to said manually operable means and movable between a first and a second position for effecting actuation of said extending means when in said first position and for effecting actuation of said terminating means when in said second position.

14. Mechanism for use in sensing and controlling the condition of the material after tumbling in a container, which condition effects the electrical conductivity characteristic of the material, a pair of continuous conductors in said container adapted to be contacted substantially continuously by the material, control means and electrical circuitry therefor operatively connected to said conductors and a source of potential, said material and said conductors serving to produce various signals representative of the conductivity of the material at different intervals of time, manual means for initiating tumbling of said container, means for extending tumbing of said container, means for terminating tumbling of said container, said material and said conductors being adapted to produce a first signal of a given magnitude adapted to actuate said extending means and a second signal of a given magnitude for actuating said terminating means.

15. Structure as specified in claim **14** including means operatively connected to said manual initiating means and movable between a first and a second position for effecting actuation of said extending means when in said first position and for effecting actuation of said terminating means when in said second position.

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JOHN J. CAMBY, *Acting Primary Examiner.*

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34—53