Nov. 17, 1964 H. P. BIRKEMEIER 3,157,358

SNOW MELTING CONTROL APPARATUS

Filed Oct. 8, 1962 4 Sheets-Sheet 1

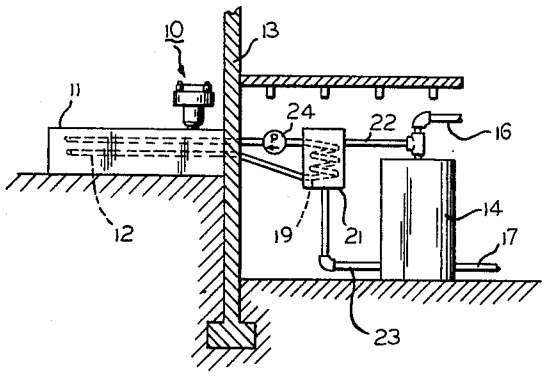


FIG. 1

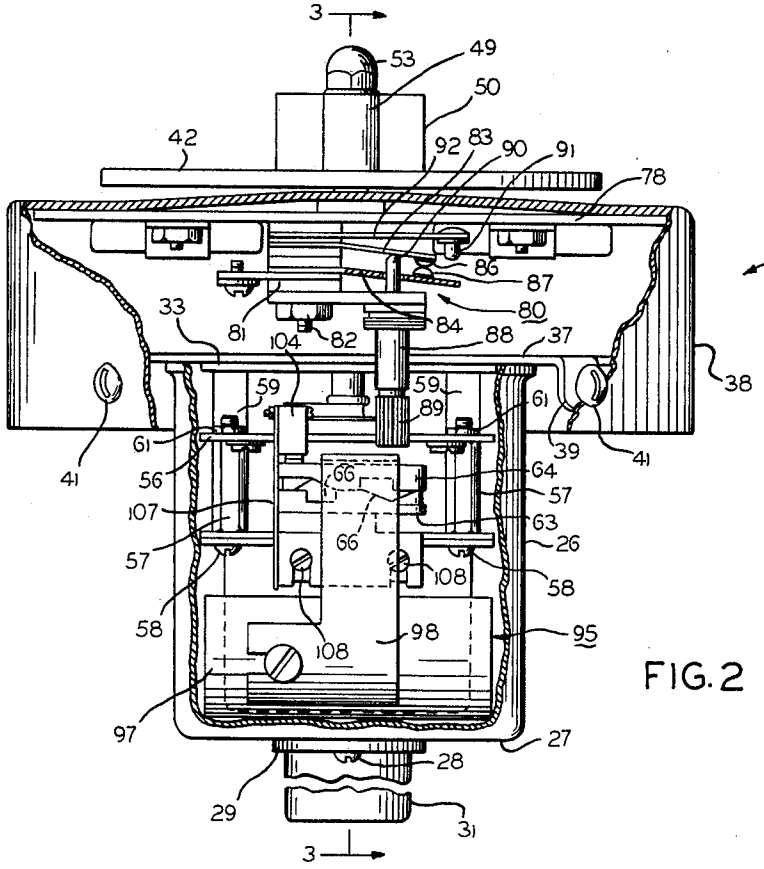


FIG. 2

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SNOW MELTING CONTROL APPARATUS

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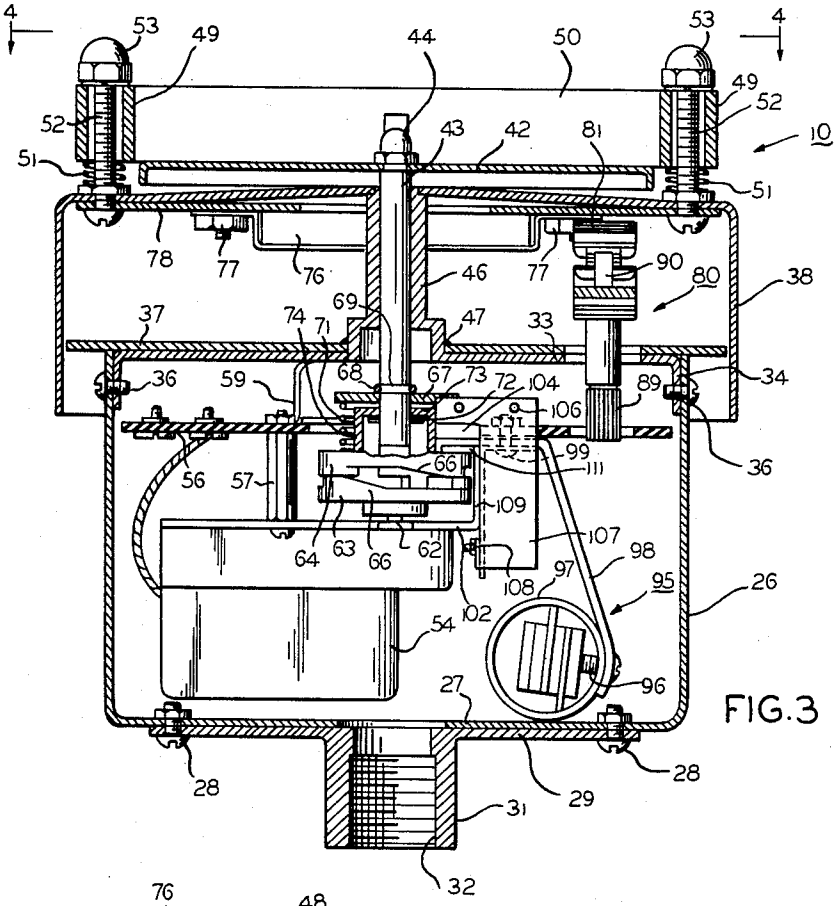


FIG. 3

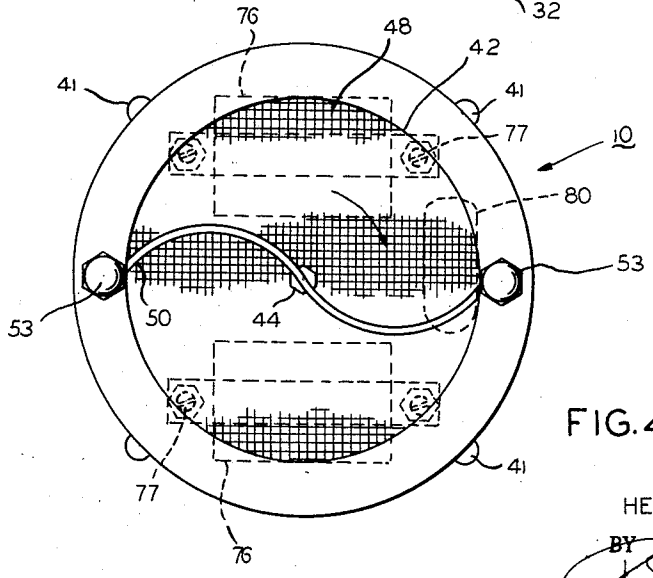


FIG. 4

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SNOW MELTING CONTROL APPARATUS

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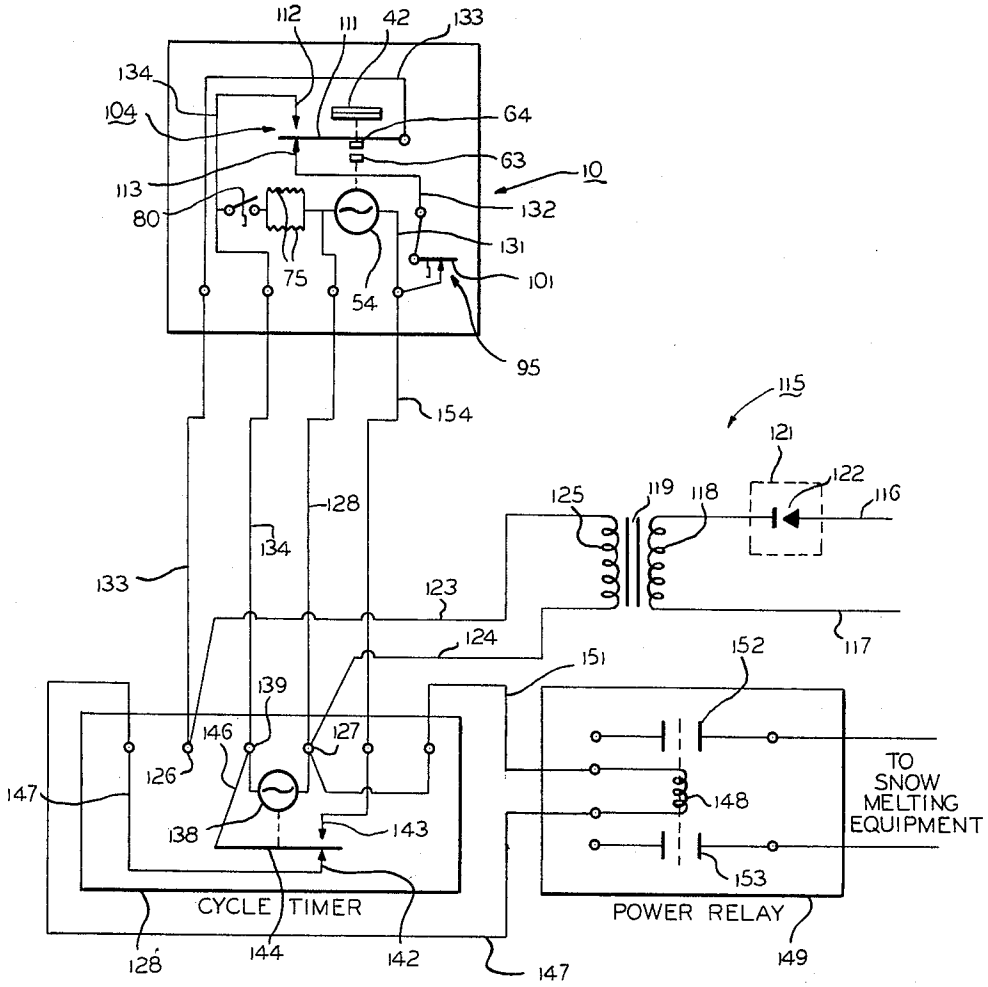


FIG. 5

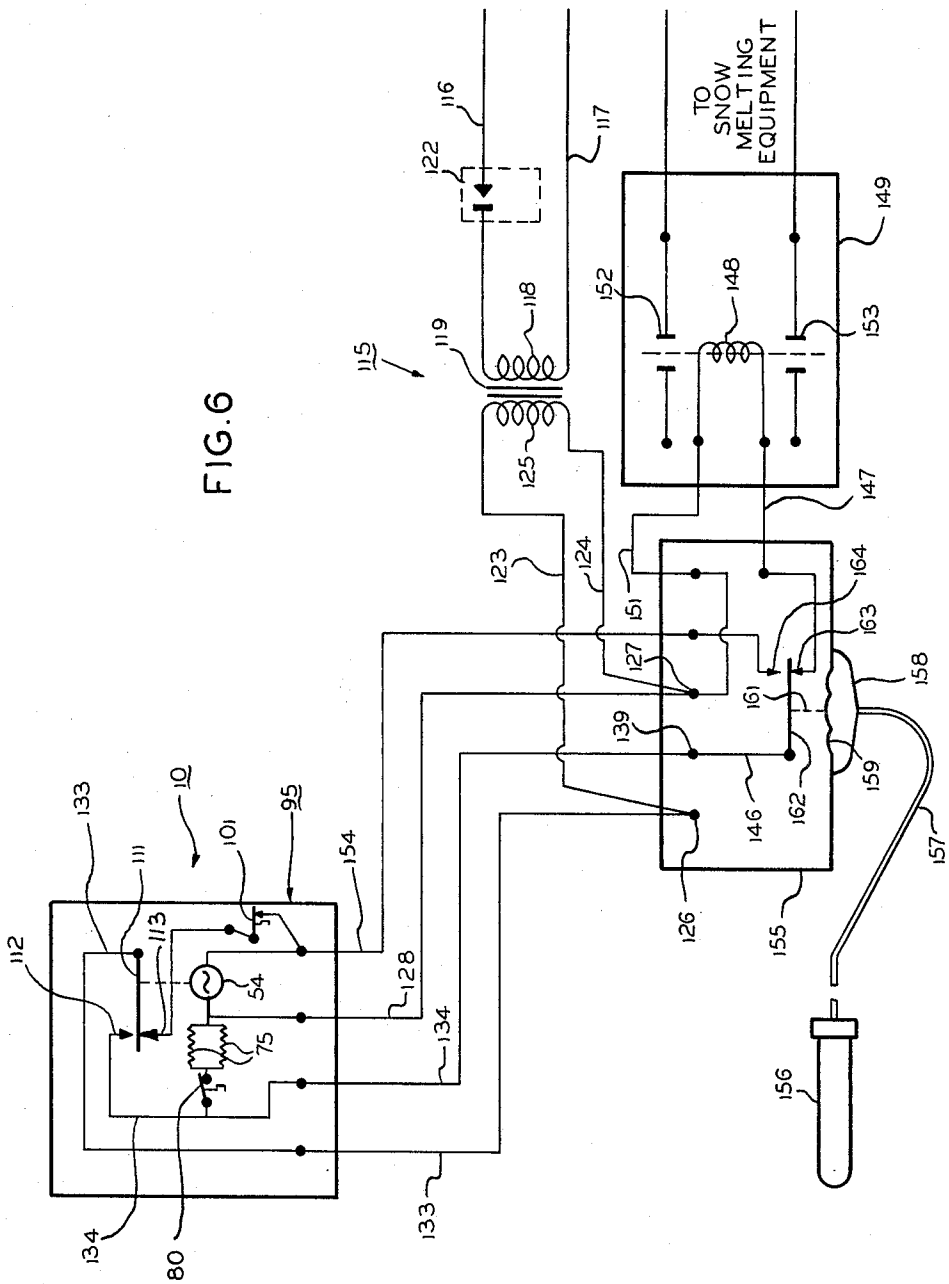
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SNOW MELTING CONTROL APPARATUS

Filed Oct. 8, 1962 4 Sheets-Sheet 4

FIG. 6



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United States Patent Office 3,157,358 Patented Nov. 17, 1964

3,157,358

SNOW MELTING CONTROL APPARATUS

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Filed Oct. 8, 1962, Ser. No. 228,975
11 Claims. (Cl. 237—1)

This invention relates generally to snow melting equipment, and particularly to improvements in control apparatus for such equipment.

In Birkemeier Patent No. 2,738,927, issued March 20, 1956, for "Snow Melting Control," there is shown apparatus for controlling the application of heat to a snow panel such as a driveway or sidewalk having heating elements placed therein. The invention herein constitutes an improvement over that shown in the aforesaid patent in that sudden extreme cold following a snowfall has no effect on the operation of the control.

The control apparatus according to the present invention is characterized by the provision of a single moving element exposed to falling snow or sleet, this element cooperating with a fixed element capable of building up a mass of snow or ice to restrain the single moving element and thereby activate circuitry controlling the application of heat to the snow panel.

With the foregoing considerations in mind, it is a principal object of this invention to provide apparatus for controlling the application of heat to a snow panel upon the occurrence of snow or sleet, said apparatus being characterized by a single moving element cooperating with a fixed element capable of building up a mass of snow or ice restraining the movement of the single moving element, such restraint initiating the movement of mechanism operating circuit elements controlling the application of heat to the snow panel.

Another object is to provide snow melting control apparatus having a single motor driven movable element cooperating with a fixed element which traps a quantity of snow or ice restraining the movement of the movable element, such restraint causing movement of a clutching mechanism in turn actuating switching elements connected in circuitry controlling the application of heat to a snow panel.

Other objects and important features of the invention will be apparent from a study of the following specification taken with the drawings, which together describe and illustrate a preferred embodiment of the invention, and what is now considered to be the best mode of practicing the principles thereof. Other embodiments may be suggested to those having the benefit of the teachings herein, and such other embodiments are intended to be reserved especially as they fall within the scope and spirit of the subjoined claims.

In the drawings:

FIG. 1 is a sectional elevation of a residence showing a panel heating system in heat exchange relationship with a heating system for the residence;

FIG. 2 is a side elevational view of control apparatus according to the present invention adapted to control the system seen in FIG. 1;

FIG. 3 is a vertical section taken along the line 3—3 of FIG. 2, looking in the direction of the arrows;

FIG. 4 is a plan view thereof;

FIG. 5 is a circuit diagram illustrating the manner in which the control apparatus of FIGS. 2, 3 and 4 is connected in a circuit for control of the application of heat to the snow panel seen in FIG. 1; and

FIG. 6 is a circuit diagram illustrating another manner in which the control apparatus of FIGS. 2, 3 and 4 is connected in a circuit for the control of the application of heat to the snow panel seen in FIG. 1.

Referring now to FIG. 1 of the drawings, there is shown an example in which the control apparatus according to the present invention regulates the application of heat through a snow panel system, such as a driveway apron for a residence. As seen in FIG. 1, the snow melting control apparatus according to the present invention is referred to generally by the reference numeral 10, and controls the application of heat to a snow panel 11 having a plurality of coils 12 embedded therein. The snow panel 11 is part of a driveway, sidewalk or the like, and is shown adjacent a residence 13 which is heated by means of a hot water system including a boiler 14 and supply and return pipes 16 and 17 for a heating system, not shown, for the residence 13.

The pipes 12 embedded in the panel 11 have a non-freezing type of liquid therein, and the pipes 12 are part of a closed loop including a coil 19 shown as being enclosed within a heat exchanger 21 supplied by a pipe 22 branching from the supply pipe 16 and connected to a return pipe 23 to the boiler 14. A pump 24 controls the flow of heating liquid to the embedded pipes 12 for the purpose of melting any snow or sleet which has fallen upon the panel 11.

Referring now to FIGS. 2, 3 and 4 of the drawings, the snow control device 10 according to the present invention includes a lower housing 26 essentially rectangular in cross section. The housing 26 has a lower wall 27 adapted to be held by bolts 28 to a flange 29 of a coupling member 31. Coupling member 31 is internally threaded as at 32 to receive a hollow standard, not shown, which also serves the purpose of housing various cables, not shown, for the control apparatus 10.

The lower housing 26 has an upper closure 33 provided with turned down securing ears 34, and screws 36 threaded into the securing ears 34 and housing 26 hold the upper closure 33 to the lower housing 26. The upper closure 33 is spot welded to a flat support 37 for an upper housing 38. A plurality of ears 39 bent down from the peripheral portions of the flat support 37 together with screws 41 hold the upper housing 38 to flat support 37.

Structure is provided for rotatably supporting a disc 42 which is positioned atop the upper housing 38 to receive snow falling thereon. The disc 42 is supported at the upper end of a driven shaft 43, and is secured to the shaft 42 by means of an acorn nut 44. Shaft 43 rotates in a stationary bushing 46 which is secured by welding or brazing as at 47 to the closure 33 and the flat support 37. As seen in FIG. 4, the rotating disc 42 has its upper surface knurled or striated as seen at 48 so as to tend to hold any falling snow or ice firmly thereto.

Rotating disc 42 cooperates with a stationary wiper blade 50, it being of a sinuous form as seen in FIG. 4. Stationary wiper blade 50 has each end secured to a sleeve 49, and the end sleeves 49 rest upon springs 51 guided by studs 52 extending upward from upper housing 38. The amount of spacing of the stationary wiper blade 50 with respect to the surface of the rotating disc 42 is adjusted by means of acorn nuts 53 threaded to each of the studs 52.

Shaft 43 is driven by a small clock motor 54 supported in spaced relationship to a fibre plate 56 by means of spacer posts 57 and mounting bolts 58. Fibre plate 56 in turn is supported from the upper closure 33 by means of ears 59 bent down therefrom, each of the mounting bolts 58 having a securing nut 61 securing the assembly together.

Structure is provided for affording a driving connection between the shaft 43 and the clock motor 54, and to this end the clock motor 54 has an output shaft 62

drivably connected to a lower cam coupling member 63. This coupling member 63 cooperates with a driven cam coupling member 64 secured to the driven shaft 43. Coupling cam members 63 and 64 have mating faces 66 which normally are in contact to afford a driving connection between coupling member 63 and coupling member 64, there being three such faces on each coupling member located 120° apart. Driven coupling member 64 has frictional engagement with the driven shaft 43 through the medium of a spring retainer disc 67 on the driven shaft 43 through the medium of an O-ring 68 held in a groove 69 on the driven shaft 43. A cylindrical compression spring 71 is interposed between the friction disc 67 and the driven cam member 64. The driven cam member 64 is retained in position on the driven shaft 43 by means of a roll pin 72 passing through the driven shaft 43 and bearing against a wall 73 of a cup-shaped hub 74 on the driven clutch member 64.

When no restraint is imposed upon the rotating disc 42 a driving connection is provided between motor shaft 62 and the driven shaft 43 through the medium of the clutching members 63 and 64, the faces 66 thereof being in contact at such time. However, when snow or ice falls upon the rotating disc 42 it tends to pack against the sinuous wiper blade 50, and when a sufficient amount of snow or ice has built up against the blade 50, the movement of the disc 42 will either be slowed greatly or completely stopped. Upon either condition of the disc 42, the clutching members 63 and 64 separate as seen in FIG. 3.

Structure is provided for applying heat to the rotating disc 42, so that the snow or ice can be melted therefrom to reinstitute a cycle controlling the application of heat to the snow panel 11 seen in FIG. 1. To this end there is provided a pair of heat sinks 76 containing heater elements 75, see also FIG. 5, heat sinks 76 being held by fastenings 77 to a heat sink plate 78 held against the underside of a housing 38 by means of the studs 52.

The application of heat through the heat sinks 76 is controlled by means of an adjustable thermostat indicated generally by the reference numeral 80 and including a stack 81 held by fastening means 82 to the heat sink plate 78, see FIG. 2. Thermostat 80 includes a pair of spaced contact arms 83 and 84 having respective contacts 86 and 87 thereon. The bias of contact arm 83 toward the contact arm 84 is adjusted by means of an adjusting device 88 having a knurled actuating member 89, which is threaded into or out of the device 88, and including a finger 90, bearing against the contact arm 83 so as to vary the position thereof.

The contacts 86 and 87 are opened by a finger 91 mounted at the end of a bimetal strip 92. It will be seen that the temperature at which the contacts 86 and 87 open is adjusted by means of the setting of the knurled member 89 and the action of the bimetal strip 92. The application of heat to the heat sinks 76 is thereby adjusted.

The structure thus far described also includes a thermostat responsive to the ambient temperature, and determining the operation of the control 10, said thermostat being indicated generally by the reference numeral 95 and including a stack 96 enclosed in a cylindrical housing 97. An arm 98 supports the housing 97 for the thermostat 95 and is secured to the fibre disc 56 by means of a securing bolt 99. As seen in FIG. 5, thermostat 95 includes contacts 101 which are adapted to close when the temperature falls below a desired value.

As seen in FIG. 3, arm 98 is also continuous with a horizontal portion 102 which forms a support arm for the motor 54.

The lower housing 26 also encloses a switch housing 104 which is held by screws 106 to a support bracket 107 in turn held by fastening means 108 to a vertical portion 109 of the arm 98. Switch 104 has an actuating arm 111 which is actuated by the driven cam member 64 when in the raised position as seen in FIG. 3. Switch

actuating arm 111 is arranged to actuate contacts 112 and 113, contact 112 being closed when cam member 64 is in the raised position, and contact 113 being closed when cam member 64 is in the lowered position, see also FIG. 5. Contacts 112 and 113 are connected in circuitry which controls the application of heat to the panel 11 seen in FIG. 1, as now will be described.

The snow control device 10 is connected in circuitry indicated generally by the reference numeral 115, see FIG. 5, and including a pair of main power leads 116 and 117 connected to a primary winding 118 of a transformer 119. A humidistat 121 is connected in series with the supply lead 116, and contains contacts 122 which are adapted to close when the relative humidity reaches a value greater than about 85%.

The transformer 119 has a secondary winding 125 and leads 123 and 124 are connected across the secondary winding 125 to terminal poles 126 and 127 respectively of a cycle timer indicated generally by the reference numeral 128.

Assuming now that the humidity condition is such as to satisfy the humidistat 122, and that the ambient temperature condition is such as to close the contacts 101 of thermostat 95 within the lower housing 26 of the control mechanism 10, a circuit is made including the secondary 125 of the transformer 119, which circuit includes a line 128 connected to the terminal 127, motor 54, a lead 131, closed thermostat contacts 101, a lead 132 connected to contact 113 of the switch 104, see also FIG. 3. The circuit is completed through the switch 104 by means of switch actuating arm 111, and thence by a lead 133 to the other terminal 126, the circuit being completed through the secondary 125 of transformer 119 by the lead 123.

Under conditions when there is no snow or ice on the rotating disc 42, it is free to rotate. However, when the wiper blade 50 has a sufficient amount of snow or ice backed thereagainst to impede the rotary motion of the disc 42, the coupling cam members 63 and 64 will separate as seen in FIG. 3, to close actuating switch arm 111 upon its other contact 112. The aforesaid movement of the actuating switch arm 111 will open the circuit through the motor 54 to stop the same. However, at the same time a circuit is made to apply heat from heat sink 76 to the rotating disc 42 and to energize the cycle timer 128 and apply heat to the snow panel 11.

When the switch actuating arm 111 closes upon its contact 112, a circuit will be made including secondary 125 of the transformer 119, lead 123 connected to the terminal 126, switch actuating arm 111, switch contact 112, a lead 134, and heater elements 75 of thermostat 80 connected between lead 134 and the lead 128 to the other side of the secondary winding 125. Heater elements 75 are associated with the heat sink 76 seen in FIG. 3 to apply heat thereto and melt the snow from the rotating disc 42.

As was previously described, the closing of the switch arm 111 upon the contact 112 also serves to energize the cycle timer 128. Cycle timer 128 includes a motor 138 connected between the line 134 connected to a terminal 139 and the lead 124 connected to the opposite side of the secondary winding 125. Motor 138 actuates a normally closed contact 142 and a normally opened contact 143, the motor 138 controlling the movement of a contact arm 144 cooperating with contacts 142 and 143 and connected by a lead 146 to the terminal 139.

At the time the motor 138 of the cycle timer 128 is energized, a circuit will be made to control the application of heat to the snow panel 11 seen in FIG. 1. Details of control equipment for the boiler 14, the pump 24 and other accessories controlling boiler 14 and pump 24 are not important to the invention herein. However, it is sufficient to say that when the switch arm 144 is closed upon the contact 142 at the start of operation of the cycle timer 128, and switch arm 111 is closed upon contact 112,

a circuit will be made including a lead 147 connected to a winding 148 of a power relay 149. The circuit is completed through the winding 148 by a lead 151 connected to the terminal 127.

Relay 149 has contacts 152 and 153 which are closed upon the energization of the winding 148 to control the application of heat to the snow panel 11 seen in FIG. 1.

At the time of energization of the cycle timer 128, the motor 54 of the snow control 10 is de-energized and the same will be maintained in a de-energized condition by reason of the open contact 113.

However, power can be re-applied to the motor 54 irrespective of the condition of the contact 113 at the conclusion of the application of heat to the snow panel 11 for a finite amount of time. For purposes of description at this point, the motor 138 of the cycle timer 128 is constructed to close the contact arm 144 upon the contact 142 for, say, 59 minutes of a one hour period. During this time it will be seen that the relay winding 148 is energized to control the application of heat to the snow panel 11. At the end of the 59 minute period, the switch arm 144 is adapted to close upon the contact 143 to close an additional circuit to energize the motor 54 of the snow control 10. At such time, a circuit will be made including the lead 146 connected to the terminal 139, switch arm 144, closed contact 143, a lead 154, lead 131, motor 54 and thence by lead 128 to the terminal 127 and thence to the other side of the secondary winding 125.

At this time the motor 54 is re-energized and the coupling members 63 and 64 will close on each other to cause the switch arm 111 to close on contact 113. If the ambient temperature and relative humidity is such as to satisfy the humidistat 121 and the thermostat 95, the circuit will continue to be completed through the motor 54. At the same time the cycle timer 128 will be de-energized by reason of the opening of the contact 112.

If the stationary blade 50 does not impede the rotation of the disc 42, the motor 54 will continue to operate, but if the ambient conditions are such as to cause snow or ice to be deposited upon the rotating disc 42, the rotation of the disc 42 will be impeded once more to apply heat to the snow panel 11 to remove snow and ice therefrom.

Referring now to FIG. 6 of the drawings, there is shown another manner in which the control unit 10 seen in FIGS. 2, 3 and 4 can be connected to circuitry controlling the application of heat to the snow panel 11 seen in FIG. 1. In this form of the invention the timer 128 is unnecessary, and the application of heat to panel 11 is under control of the unit 10 and a thermostat 155 located in proximity to the panel 11.

Thermostat 155 includes a vapor bulb 156 connected by a capillary tube 157 to a chamber 158 closed by a diaphragm 159. An actuator 161 extending from diaphragm 159 controls the operation of a snap-action switch member 162.

Vapor bulb 156 of thermostat 155 is preferably located in a well, not shown, of snow panel 11, particularly if the same is of the type which is heated by electrical resistance elements. If, and as is shown in FIG. 1, snow panel 11 is of the type which is heated by heated fluid circulating within the coils 12 embedded in such panel, the vapor bulb 156 is placed adjacent a return pipe from the coils 12 in a position so as to be subjected to the ambient temperature.

In either case, vapor bulb 156 operates to discontinue the supply of heat to panel 11 when the temperature at panel 11 or ambient is above a predetermined value. For purposes of description at this point, structural elements common to the embodiment seen in FIG. 5 are denoted by the same reference numerals in FIG. 6.

Snap action switch member 162 is adapted to close on a contact 163 when the temperature is below a predetermined value, and to close on a contact 164 when the temperature is above such predetermined value.

The operations controlled by the circuit seen in FIG. 6

are similar to those found in FIG. 5. Consider a set of ambient conditions satisfying the humidistat 122 and the thermostat 95 at control unit 10, and the impediment to rotation of disc 42 at control unit 10 by the incidence of snow or ice thereon. Consider also a temperature condition at snow panel 11 of a value as to close switch member 162 on contact 163. Under such given set of conditions, a circuit will be made including secondary winding 125, lead 123, terminal member 126, lead 133, switch actuating arm 111, contact 112, lead 134, terminal 139, lead 146, switch member 162, contact 163, lead 147, relay winding 148, lead 151, terminal 127 and lead 124.

Energization of coil 148 as described causes the snow panel 11 to be supplied with energy.

At the same time, heater elements 75 of heat sink 76 are energized through a parallel circuit including the aforesaid closed contact 112, thermostat 80, heater elements 75, lead 128 to terminal 127, and thence to the other side of transformer winding 125 by lead 124.

The energization of heater elements 75 will remove the ice or snow on rotating element 42, and at this time the closing of switch member 162 on contact 163 will keep motor 54 de-energized. However, when heat sink 76 applies enough heat to disc 42 to melt the ice on same, switch arm 111 will not close upon contact 113 until motor 54 is re-energized. This arises by reason of the cam elements 63 and 64 seen in FIG. 3 being forced apart.

So long as vapor bulb 156 is not satisfied by a high enough temperature, contact arm 162 will remain closed on contact 163. When the temperature is satisfied, contact arm closes upon contact 164. This will re-energize motor 54, and the circuit to energize motor 54 comprises winding 125, lead 123, terminal 126, lead 133, switch arm 111, contact 113, thermostat 161, motor 54, lead 128, terminal 127 and lead 124 to winding 125.

If thermostat 161 is not satisfied by an increase in ambient, motor 54 will not start.

From the description foregoing, it will be seen that there has been provided a snow control device which is operable only upon proper conditions of temperature and relative humidity of the ambient. It will be seen also that the heating cycle through the snow panel 11, once initiated, will continue through a time interval sufficient to remove snow or ice from the snow panel. If the ambient conditions are such that additional snow or ice is deposited upon the rotating disc 42, the operation will be repeated.

While the invention has been described in terms of a preferred embodiment thereof, it is to be understood that the scope of the invention is not to be limited by the precise embodiment herein shown, the scope thereof being intended to be limited only by the claims here appended.

I claim:

1. In apparatus for controlling the application of heat to a body exposed in an ambient of proper temperature and humidity, a first moving member located in a position to be subject to deposition thereon of snow and ice, a fixed member located with respect to said moving member and adapted to restrain the movement of said moving member when snow and ice have built up thereon, driving means for said moving member, a clutch interposed between said moving member and said driving means, said clutch being disengaged when restraint is imposed on said moving member, means regulating the period that heat is to be applied to said body, and circuit means operable upon actuation of said clutch for initiating the operation of said last named means.

2. In apparatus for controlling the application of heat to a body exposed in an ambient of proper temperature and humidity, a first moving member located in a position to be subject to deposition thereon of snow and ice, a fixed member located with respect to said moving member and adapted to restrain the movement of said moving member when snow and ice have built up thereon, driving means for said moving member, disconnect means interposed between said moving member and said driving

means, said disconnect means being disengaged when restraint is imposed on said moving member, means regulating the period that heat is to be applied to said body, and circuit means operable upon actuating of said disconnect means for initiating the operation of said regulating means.

3. In apparatus for controlling the application of heat to a body exposed in an ambient of proper temperature and humidity, a first moving member located in a position to be subject to deposition thereon of snow and ice, a fixed member located with respect to said moving member and adapted to restrain the movement of said moving member when snow and ice have built up thereon, driving means, said disconnect means being disengaged when reposed between said moving member and said driving means, said disconnect means being disengaged when restraint is imposed on said moving member, a timer adapted to regulate the period that heat is to be applied to said body, circuit means operable upon actuation of said clutch for initiating the operation of said timer, and a heat sink located in proximity to said moving member and adapted to be energized upon disengagement of said disconnect means to enable said moving member to reinstitute movement.

4. In apparatus for controlling the application of heat to an exposed body, a first moving member located in a position to be subject to deposition thereon of snow and ice, a fixed member located with respect to said moving member and adapted to restrain the movement of said moving member when snow and ice have built up thereon, driving means for said moving member, a clutch interposed between said moving member and said driving means, said clutch being disengaged when restraint is imposed on said moving member, a timer adapted to regulate the period that heat is to be applied to said body, circuit means operable upon actuation of clutch for initiating the operation of said timer, and means reinstituting the movement of said moving member at the end of the timer cycle to ascertain the necessity of a subsequent heating cycle.

5. In apparatus for controlling the application of heat to an exposed body, a first moving member located in a position to be subject to deposition thereon of snow and ice, a fixed member located with respect to said moving member and adapted to restrain the movement of said moving member when snow and ice have built up thereon, driving means for said moving member, a clutch interposed between said moving member and said driving means, said clutch being disengaged when restraint is imposed on said moving member, a timer adapted to regulate the period that heat is to be applied to said body, circuit means operable upon actuation of said clutch for initiating the operation of said timer, a heat sink located in proximity to said moving member and adapted to be energized upon disengagement of said clutch to enable said moving member to reinstitute movement, and means reinstituting the movement of said moving member at the end of the timer cycle to ascertain the necessity of a subsequent heating cycle.

6. In apparatus for controlling the application of heat to an exposed body, a first moving member located in a position to be subject to deposition thereon of snow and ice, a fixed member located with respect to said moving member and adapted to restrain the movement of said moving member when snow and ice have built up thereon, driving means for said moving member, a clutch interposed between said moving member and said driving means, said clutch being disengaged when restraint is imposed on said moving member, a timer adapted to regulate the period that heat is to be applied to said body, and circuit means operable upon actuation of said clutch for initiating the operation of said timer, including a first set of contacts operable during engagement of said clutch for energizing said driving means, and a second set of contacts operable to energize said timer.

7. The invention defined in claim 6 wherein a heat sink is energized by the closing of said second set of contacts during disengagement of said clutch to remove snow and ice from said moving member.

8. The invention as defined in claim 6 wherein said first set of contacts are reclosed by reinstituting the movement of said driving means at the end of a timer cycle to ascertain the necessity of a subsequent heating cycle.

9. In apparatus for controlling the application of heat to a body exposed in an ambient of proper temperature and humidity, a first moving member located in a position to be subject to deposition thereon of snow and ice, a fixed member located with respect to said moving member and adapted to restrain the movement of said moving member when snow and ice have built up thereon, driving means for said moving member, a clutch interposed between said moving member and said driving means, said clutch being disengaged when restraint is imposed on said moving member, means adapted to be responsive to the heated condition of said body for regulating the application of heat to said body, and circuit means operable upon actuation of said clutch for initiating the operation of said last named means.

10. In apparatus for controlling the application of heat to a body exposed in an ambient of proper temperature and humidity, a first moving member located in a position to be subject to deposition thereon of snow and ice, a fixed member located with respect to said moving member and adapted to restrain the movement of said moving member when snow and ice have built up thereon, driving means for said moving member, a clutch interposed between said moving member and said driving means, said clutch being disengaged when restraint is imposed on said moving member, means adapted to be responsive to the heated condition of said body for regulating the application of heat to said body, and circuit means operable upon actuation of said disconnect means for initiating the operation of said last named means.

11. The invention according to claim 10 wherein said means adapted to be responsive to the heated condition includes switching means adapted to control the application of heat to said body irrespective of the condition of restraint on said moving member.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,157,358 November 17, 1964

Henry P. Birkemeier

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 7, line 13, after "means", first occurrence, insert -- for said moving member, a disconnect means interposed between said moving member and said driving means --.

Signed and sealed this 13th day of April 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents

UNITED STATES PATENT OFFICE

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