

Sept. 22, 1953

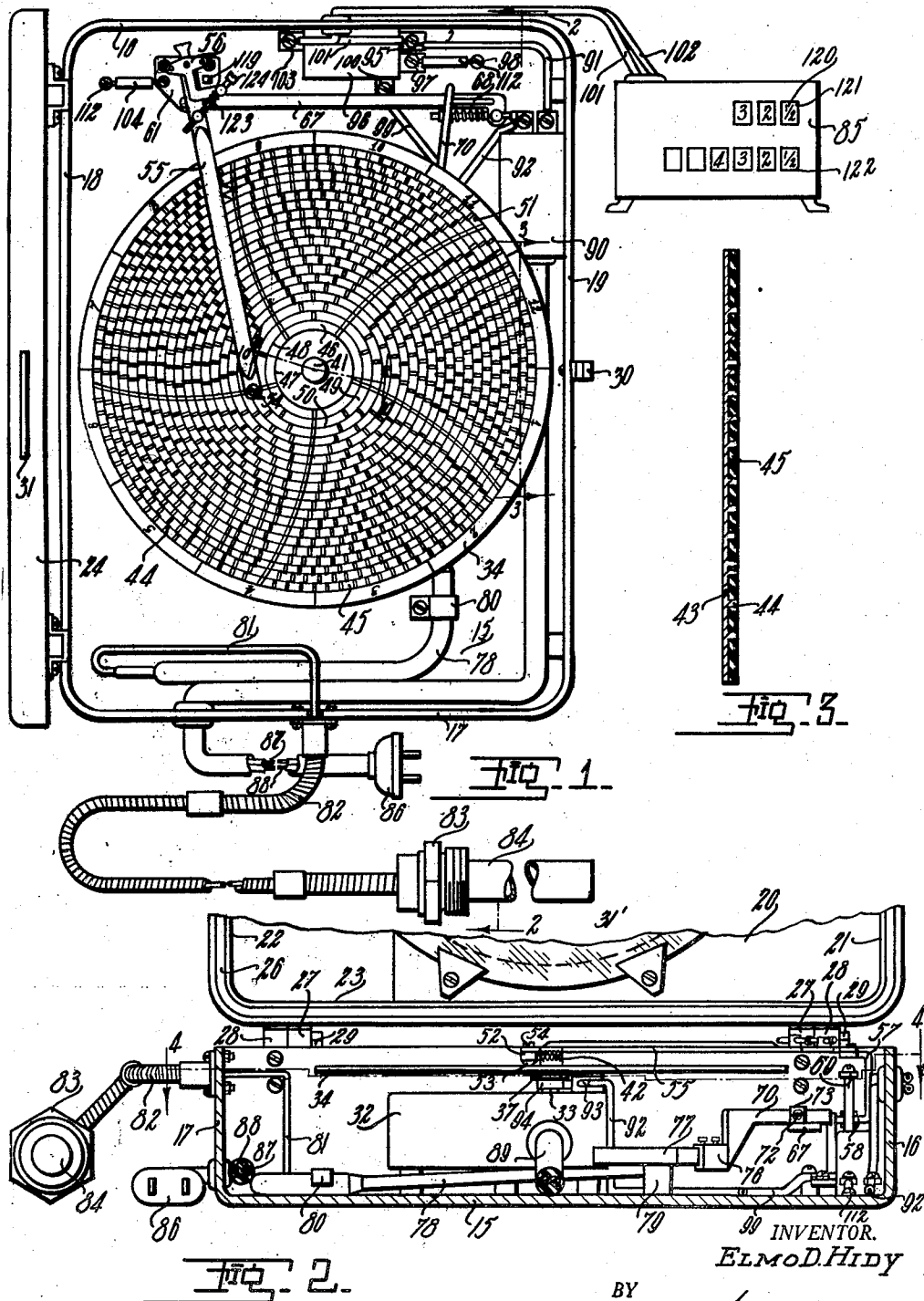
E. D. HIDY

2,652,724

DEGREE-DAY REGISTER

Filed Feb. 25, 1948

4 Sheets-Sheet 1



INVENTOR.
Elmo D. Hidy

BY

Joseph A. Rave
ATTY.

Sept. 22, 1953

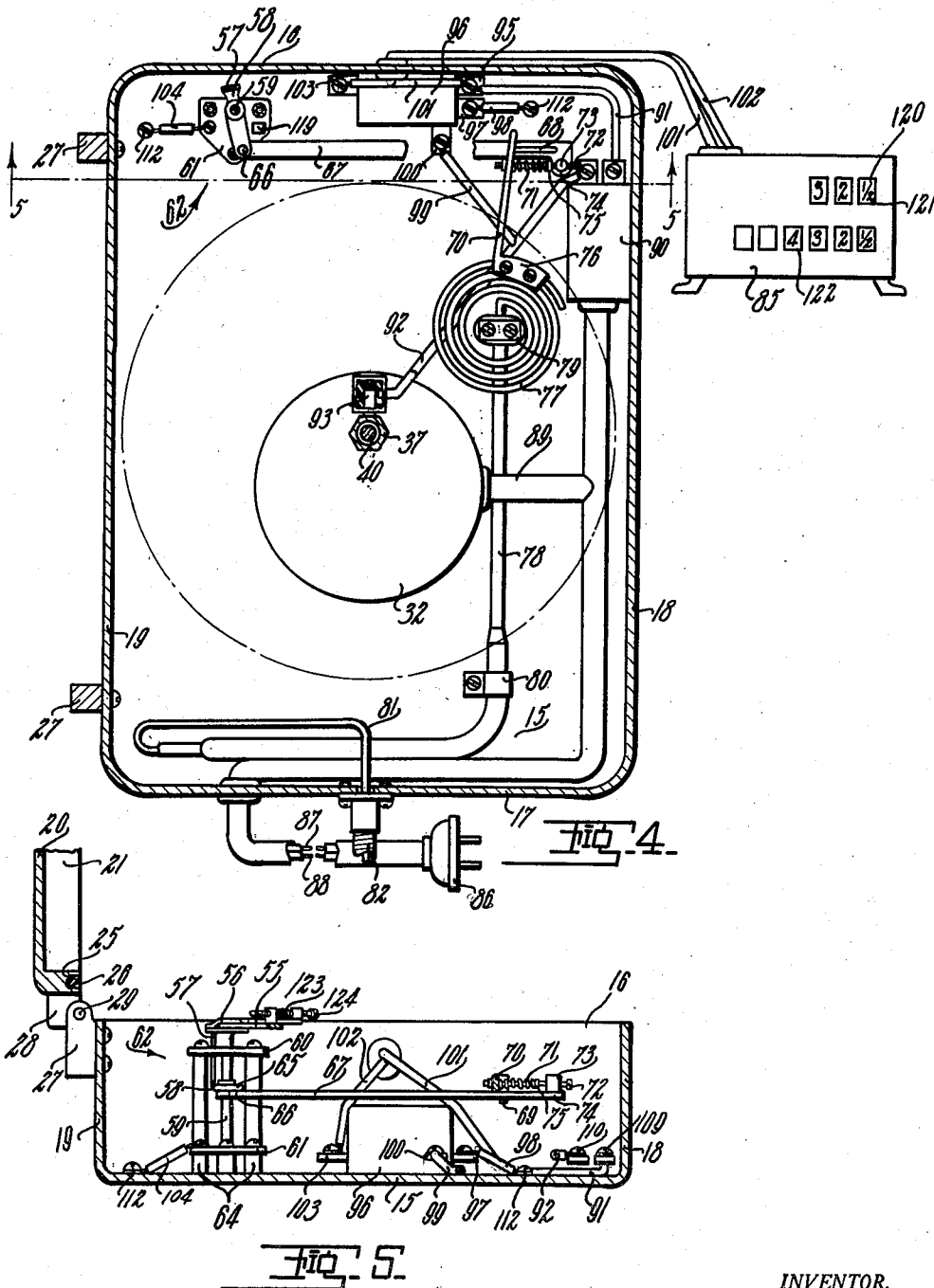
E. D. HIDY

2,652,724

DEGREE-DAY REGISTER

Filed Feb. 25, 1948

4 Sheets-Sheet 2



INVENTOR.
ELMO D. HIDY

BY

Joseph A. Rave
Att'y

Sept. 22, 1953

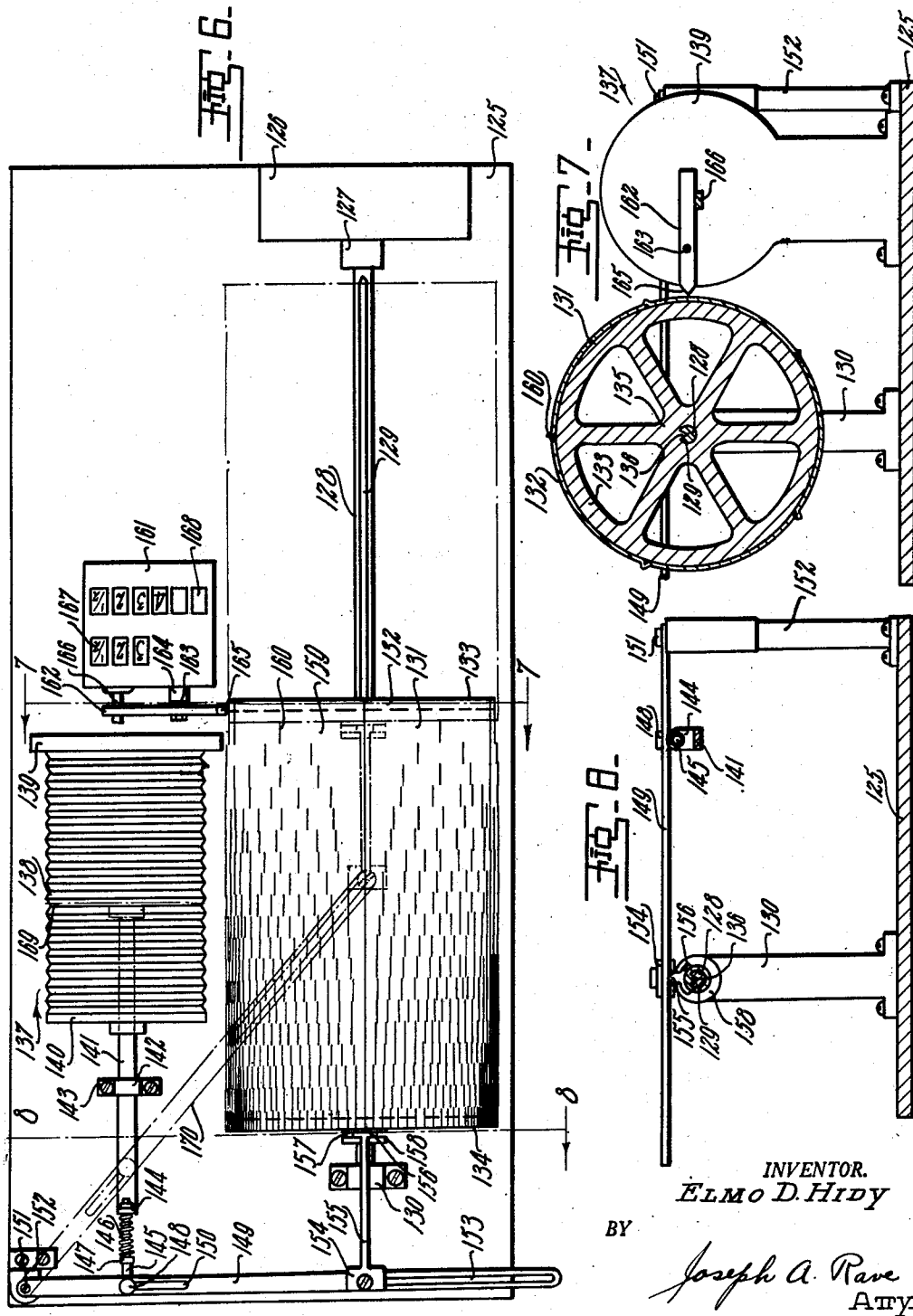
E. D. HIDY

2,652,724

DEGREE-DAY REGISTER

Filed Feb. 25, 1948

4 Sheets-Sheet 3



Sept. 22, 1953

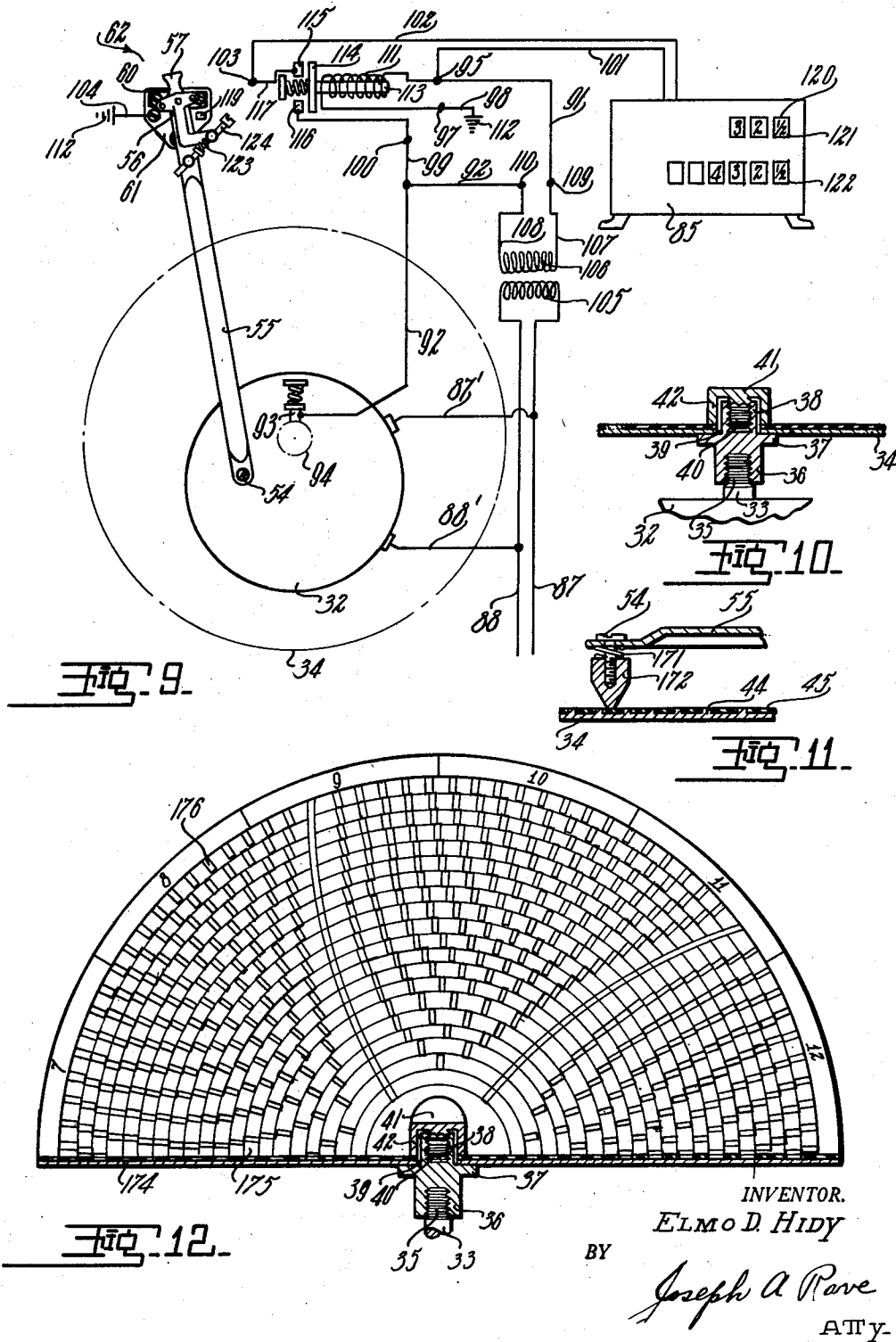
E. D. HIDY

2,652,724

DEGREE-DAY REGISTER

Filed Feb. 25, 1948

4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE

2,652,724

DEGREE-DAY REGISTER

Elmo D. Hidy, Cincinnati, Ohio

Application February 25, 1948, Serial No. 10,651

14 Claims. (Cl. 73-339)

1

2

This invention relates to improvements in a degree-day register device and particularly to a device of this character which automatically records and accumulates the degree days.

No reliable means are at present known for accumulating and recording the number of degrees the outside temperature is below a given standard or norm. In those instances where this information is needed or desired it is obtained manually by consulting with the authorities which compile the weather reports that include the high and low temperature for a given day and strike a mean from these factors and by subtracting the mean temperature from the established norm determine the degree days in the previous day period thereby making up a record which is utilized in obtaining a desired result, such as, the amount of oil utilized for heating purposes in said previous day.

The principal object, therefore, of this invention is the provision of a device which will automatically record the degree days and accumulate said degree days so that an accurate record is always available.

Another object of the present invention is the provision of a device for accomplishing the foregoing object that is extremely accurate and automatically operates as the change in temperature takes place instead of striking a mean which may or may not accurately indicate said degree days of a preceding time.

A further object of the present invention is the provision of a device that is of sturdy construction commensurate with the accuracy necessary to recording temperatures as they occur.

Other objects and advantages of the present invention should be readily apparent by reference to the following specification considered in conjunction with the accompanying drawings forming a part thereof and it is to be understood that any modifications may be made in the exact structural details there shown and described, within the scope of the appended claims, without departing from or exceeding the spirit of the invention.

In the drawings:

Fig. 1 is an elevational view of a degree-day recorder built into a suitable cabinet with the door of the cabinet open.

Fig. 2 is a sectional view through Fig. 1 as seen from line 2-2 on said Fig. 1.

Fig. 3 is an enlarged sectional view through the dial of the device which forms a detail of the invention, said section being taken on line 3-3 on Fig. 1.

Fig. 4 is a view similar to Fig. 1 except through

a plane below the top of the cabinet as seen from line 4-4 on Fig. 2.

Fig. 5 is a sectional view through the cabinet taken at right angles to Fig. 2 on line 5-5 on said Fig. 4.

Fig. 6 is a semi-diagrammatic plan view of a structure for accomplishing the results of the present invention mechanically instead of electrically.

Fig. 7 is a transverse sectional view of the mechanism of Fig. 6 as seen from line 7-7 on said Fig. 6.

Fig. 8 is a transverse sectional view of the mechanism of Fig. 6 taken through a plane ahead of that of Fig. 7 on line 8-8 on said Fig. 6.

Fig. 9 is a wiring diagram of the circuits employed with the degree-day recorder of Figs. 1 to 5.

Fig. 10 is an enlarged fragmentary sectional view through a portion of the mechanism as seen from line 10-10 on Fig. 1.

Fig. 11 is an enlarged fragmentary sectional view through the stylus showing a modification in the mounting thereof and forming a detail of the invention.

Fig. 12 is a fragmentary, sectional, perspective view of a dial and cover, showing a modification in the construction thereof and forming a detail of the invention.

Throughout the several views of the drawings similar reference characters are employed to denote the same or similar parts.

In the use of oil for heating homes and the like use is made of a storage tank from which the said oil is fed to the burners. The burners are controlled by valves operated automatically from a thermostat or gauge located within the area being heated. The thermostat or other control device is set to maintain a given degree of heat regardless of the temperature exteriorly of the space being controlled.

It has been found that beyond a certain temperature, exteriorly, the temperature in the space being heated must be raised in order to be comfortable. In other words with exterior temperatures down to 70° F. or 65° F. no inside heat need be generated but below these temperatures heat interiorly, or within the space being controlled, must be supplied and in the case of a heating unit utilizing oil as the fuel the burners will be automatically turned on upon reaching this said or minimum exterior temperature in order to maintain a predetermined or preestablished minimum interior temperature.

The exterior temperature which has been es-

established as the norm is 65° F. which will be used as the norm in describing the present application.

It has been established, each heating plant will utilize a definite amount of fuel oil to maintain a given interior temperature for a given time period, a twenty-four hour day, for example, for each degree of temperature drop exteriorly. This rate of fuel oil consumption is established for each heating plant by observing the user for a given period of time and noting the amount of fuel oil consumed and the number of degree-days for this period whereby it can be determined how many degree-days will pass between the time of filling his reserve or storage tank and the next filling required. It is the purpose of the present invention to automatically count and record these degree-days so that a supplier can maintain an accurate record of the passing degrees and thereby maintain a record as to when additional fuel oil supply is required.

Specifically, the device of the present invention comprises a housing or casing having a back 15 from which upstands a top 16, a bottom 17 and sides 18 and 19. The cabinet is adapted to be closed by a lid or cover comprising a panel 20 of an area substantially equal to the area of cabinet back 15 and having upstanding from the edges thereof flanges 21, 22, 23 and 24. The flanges 21-24 are channeled as at 25 in Fig. 5 to receive therein a rubber gasket 26 that is pressed in sealing engagement with the upper edges of the cabinet walls 16-19. For convenience the cabinet side wall 19 has projecting therefrom hinge lugs 27 for alignment with similar lugs 28 projecting from the cover flange 23 with said lugs having passing therethrough pivot bolts 29. In order to lock the lid or cover in its closed position the cabinet front wall 18 is provided with a latch 30 cooperating with an elongated latch 31 in the cover wall or flange 24. The lid or cover panel 20 is provided centrally thereof with an opening covered by a glass window 31' through which the interior of the cabinet may be observed.

Interiorly of the cabinet and carried by the back panel 15 is an electric clock 32 of the usual construction utilized in recording thermometers and having projecting therefrom a driven shaft 33. The clock 32 may be of a construction to make a single revolution of its shaft 33 in each twenty-four hours but preferably is so geared that the shaft 33 makes a complete revolution each twelve hours.

Secured to for rotation with the clock shaft 33 is a disc 34 and which connection may take any suitable or desirable construction. As shown in Fig. 10 this construction comprises the formation of screw threads 35 on the clock shaft 33 receiving a carrier 36 which has mid-way of its height a radially projecting flange 37, which flange in plan view is preferably formed as hexagonal in shape so that it can readily be screwed home on the clock shaft 33. Upstanding from the radial flange 37 the carrier 35 has a counter-bored post 38 of a diameter substantially equal to the diameter of a bore 39 substantially centrally of the disc 34. The post 38 is internally threaded to receive a lug 40 externally threaded and projecting from a cap member 41. The cap member 41 has a flange 42 for encircling the hollow post 38 whose free edge engages the disc 34 around the aperture 39 therein.

From the foregoing it should be noted that the

disc 34 makes a complete revolution with the clock shaft 33.

The disc 34 is adapted, as will presently be made clear, to form one side of an electrical circuit in recording degree-days and for this reason should have a surface that is normally non-conductive while permitting conduction through the disc at proper and desirable intervals. As shown in Figs. 1 and 3 the disc 34 has a back or body portion 43 from the forward face of which upstands a plurality of bars or contact strips 44. It is contemplated that the disc 34 will have its face etched between the bars 44 thereby providing for the major portion of the face of the disc to be recessed. After the said recesses are formed they are filled with insulating material 45 thereby making non-conductive areas between the upstanding bars or contact strips 44.

In practice the disc 34 is laid out in a series of theoretical concentric circular bands 46 from a point as near the center or aperture 39 as practical to the outer perimeter of the disc. Each circular band 46 radially from the center represents a drop of five degrees in temperature which is traversed by a stylus in the same manner that a recording thermometer traverses a recording dial. In other words the circle 47 on the inner edge of the band 46 and the circle 48 at the outer edge of the band 46 represents a drop in temperature from 65° F. to 60° F. In the same manner the next band 49 having its inner edge represented by the circle 48 and its outer edge by the circle 50 represents a further drop of five degrees temperature or a temperature of from 60° F. to 55° F. Each of the bands representing five degrees temperature drop is divided into segments by the bars or contact strips 44, the number of said segments in each said band corresponding to the maximum number of degrees that each said band is below the established norm. Since the band 46 represents a five degree drop in temperature below a norm of 65° F. it is provided with five bars or contact strips 44 with five insulating segments between said bars. The second band 49 representing a maximum of ten degrees drop below the norm of 65° F. is provided with ten bars or contact strips 44 and therefore ten segments of insulation. Each band of five degree temperature drop beyond the band indicated at 49 to the periphery of the disc is correspondingly divided wherefore the outermost band representing a temperature of between 25° F. and 30° F. below zero represents a maximum of 95° F. below the norm of 65° F. wherefore this band, indicated by the reference numeral 51 would be divided by ninety-five bars or contact strips 44 to establish ninety-five segments of insulating material therein. As will subsequently be made clear these bars or contact strips 44 are employed for recording the degree-days.

Cooperating with the dial 34 is a stylus comprising a head 52 having a ball point 53 and secured in any suitable or desirable manner as by a screw 54 to an arm 55. The arm 55 is formed as a spring member and biased to have a firm contact with the face of the dial 34. If desired, and to insure a firm contact between the stylus, ball end or point 53 and the face of the disc 34, the said stylus may be spring backed as disclosed in the modification in Fig. 11. As shown in said Fig. 11 the stylus 52 has an expansion spring 171 between its body portion 172 and the arm 55 which may be readily tensioned by the mounting and attaching screw 54.

The arm 55 is adapted to be swung away from

the center of the dial 34 upon a decline in temperature and swung toward the dial center when the temperature rises and for which purpose the arm is carried by a bracket 56 which in turn, see Fig. 2, has a depending arm 57 attached through a finger 58 to a pivot shaft 59, see Fig. 5. The pivot shaft 59 is mounted for oscillatory movement in the top plate 60 and bottom plate 61 of a supporting bracket indicated in general by the reference numeral 62. Any suitable or desirable means such as pillars 64 may be employed for securing the bracket 62 in operative position to the cabinet back panel 15. The chief purpose of this bracket 62 and the parts just described is to provide a sensitive pivoted mounting for the stylus arm 55.

The pivot shaft 59 is oscillated upon an increase and decrease in the outside temperature for which purpose it has secured to it intermediate its ends a lever 65 to the outer end of which is pivotally connected, as at 66, one end of a link 67. The link 67 at its other end is provided with an elongated aperture 68 through which projects a pin 69 of an operating arm 70.

The pin 69 is retained, yieldably, against the inner, left-hand, as seen in Fig. 4, end of the elongated aperture 68 by yielding means which may take any suitable or desirable form of construction for a purpose presently to be made clear. Specifically, this means comprises a spring 71 encircling an adjustable screw 72 threaded into a post 73 upstanding from an ear 74 projecting laterally at one end of the link 67. The spring 71 abuts on one end with a collar 75 on the screw 72 and abuts on the other end with the arm 70.

The arm 70 is secured through an enlargement 76, at its lower end, to a coil 77 which is a hollow tube-like member under coil spring tension and adapted to be uncoiled as pressure therein, due to reduction in outside temperature, is developed.

The coil 77 is formed at the end of a tube 78 which is secured or anchored in position by clamps 79 and 80 to the cabinet back 15. The tube 78 is illustrated as having at its inner end a very small diameter tube 81 which passes outwardly through the cabinet wall 17 into a sheath cable 82. The cable 82 and tube 81 may be of any desired length and terminate in a mounting coupling 83 which in turn carries the member 84 which is sensitive to temperature changes in the surrounding atmosphere and which member 84 is commercially known as a Mercury Bulb. The changing in density of the mercury in the mercury bulb sets up the pressure in the tubes 81 and 78 which uncoils the coil 77 or permits same to coil under spring tension inherent therein for thereby shifting the link 67.

The mechanism hereinbefore described for actuating the link 67 and the stylus arm 55 are known having been employed in substantially this form in recording thermometers.

In order to effect a recording and an accumulation of degree-days use is made of a counter 85 which is well known and operated by electrical impulses. The electric energy is obtained from any suitable commercial current outlet to which may be attached the pronged plug 86 which has extending therefrom wires 87 and 88 inclosed in the usual insulating sheath. As shown in Fig. 4, the wires 87 and 88 have branches extending therefrom within the sheath 89 for connection with the electric clock 32 for operating the same and the said wires 87 and 88 terminate in a transformer 90 mounted within the cabinet in any suitable or desirable space such as near the upper

end thereof. The transformer 90 provides a current of low voltage since that is all that is required for operating the counter 85.

The transformer 90 is shown as having extending therefrom wires 91 and 92 forming between them the low voltage circuit. The wire 92 terminates in a spring pressed shoe 93 that has electrical contact with a collar portion 94 of the disc carrier 36. The other transformer circuit or low voltage wire 91 terminates in a terminal 95 of a relay switch 96. The relay switch 96 is of the magnetic type for handling relatively low voltage and is not structurally illustrated in the drawings but merely diagrammatically in Fig. 9, to which reference will presently be made. The relay switch 96 has a second terminal 97 connected by a wire 98 to the cabinet back panel 15 which may be considered a ground connection utilizing the cabinet as a part of the low voltage electric circuit. The low voltage circuit wire 92 has a branch wire 99 extending therefrom which terminates in relay switch terminal 100. The relay switch terminal 95 has a second wire 101 attached thereto and extending therefrom which terminates in the counter 85. The second wire 102 from the counter 85 terminates in a terminal 103 of the relay switch 96. The oscillating shaft bracket 62 is preferably insulated from the cabinet by its mounting posts or pillars 64 although this may be a metal connection, but, if insulated the said bracket 62 is electrically connected with the cabinet by means of a wire 104.

Referring now to the wiring diagram in Fig. 9 it will be noted that the wires 87 and 88 terminate in the opposite ends of transformer primary coils 105 with said wires 87 and 88 having respectively extending therefrom branch wires 87' and 88' which are enclosed in the sheath 89 and terminate in the electric clock motor. The transformer secondary coil 106 has wires 107 and 108 extending therefrom which terminate at transformer terminals 109 and 110 from which respectively extend the low voltage circuit wires 91 and 92. The wire 91 terminates, as noted above, in the terminal 95 of the relay switch 96. Connected with the terminal 95 is, additionally, one end of a solenoid magnet coil 111 and which solenoid magnet coil has its other end connected with the relay switch terminal 97. As was noted above the relay switch terminal 97 is electrically connected by wire 98 to the cabinet back panel 15 or ground 112.

The solenoid magnet coil 111 has associated therewith a projectable core 113 carrying at its outer end a bridging switch contact 114 adapted to close or bridge switch contacts 115 and 116 located within the usual housing of the relay switch 96. The contact 115 is connected by a wire 117 with the relay switch terminal 103 with which, as noted above, is also connected the counter actuating wire 102. The other switch contact 116 is connected by a wire 118 with the switch terminal 100 which, as noted above, has also connected therewith the wire 99 from the low voltage circuit wire 92.

The operation of this device is as follows:

The cabinet is mounted in position so that the mercury bulb 84 will be subjected to the outside temperature or atmosphere preferably on the north wall of the building. The wires 87 and 88, through their plug 86, are connected with an electrical current source. The counter mechanism 85 is then positioned at any point desirable where it can be observed. The point of mounting of the counter 85 may be on a desk or other

support considerably removed from the operating mechanism and since the circuit which operates it is of a low voltage no appreciable problem of installation is encountered. It should be noted that any number of counters may be connected in parallel in the wires 101 and 102.

Rotation of the motor 32 causes a similar rotation of the dial 34 and changes in the atmosphere acting on the mercury bulb 84 causes the arm 55 to swing outwardly of the cabinet center, or to the left as seen in Fig. 1, upon a decline in said temperature. If the temperature is above 65° F. the arm 55 will be swung toward the center of the disc 34 inwardly of the circle 47 which forms the inner edge of temperature band 46. The said swinging of the arm 55 will occur until the oscillating arm 65 engages a stop 119 upstanding from the bottom plate 61 of the supporting bracket 62. The reason for this is that no purpose is gained by swinging the arm past center of the disc 34, or to the right thereof, as at this time the temperature is above that at which additional heat within the building is desired or needed. In order to permit of the holding of the arm 55 by the stop 119 the spring 71 is compressed thereby allowing the operating arm 70 to move its actuating pin 69 in the link elongated aperture 68.

Assuming that the temperature acting on the mercury bulb 84 is between 50° F. and 55° F. the arm stylus 52 will be in the temperature band outwardly of the band 49, illustrated in the drawing, and which temperature band 55—50 represents a maximum of fifteen degrees below the norm of 65° F. will have therein fifteen bars or contact points 44. As the dial 34 is rotated it successively passes the bars or contact points 44 below the stylus point 53 and thereby makes or completes an electrical circuit as follows: from one end of secondary coil 106 through wire 108, transformer terminal 110, control circuit wire 92, sliding contact or shoe 93, disc carrier collar 94, disc carrier 33, disc 34, stylus 52, arm 55, supporting bracket 62, wire 104, to the cabinet back panel 15 or ground 112, relay switch terminal 97, magnetic switch coil 111, relay switch terminal 95, wire 91, transformer terminal 109 and wire 107 to the other end of the secondary coil 106.

The completion of this circuit projects the core 113 to the position for bridging contacts 115 and 116 thereby completing the following electric circuit, from transformer secondary coil 106 through wire 108, transformer terminal 110, circuit wire 92, circuit branch wire 99, relay switch terminal 100, wire 118, fixed contact 116, bridging contact 114, fixed contact 115, wire 117, relay switch contact 103, wire 102, actuating mechanism within the counter 85 (not shown in the drawings), wire 101, relay switch terminal 95, circuit wire 91, transformer terminal 109 and wire 107 to the other end of the secondary coil 106. The closing of this circuit effects an adjustment of the counter mechanism to indicate or record a degree-day. This operation continues each time a bar or switch contact 44 on the disc 34 presents itself to the stylus 52.

It is to be understood that a degree-day is a drop of one degree below the established norm in twenty-four hours wherefore if the temperature were 50° F. for a twenty-four hour period there would be fifteen degree-days in said twenty-four hour period. By utilizing a clock and dial that make a complete revolution in twelve hours and with the dial marked off in divisions for each degree of drop the device would register twice for

each degree of temperature drop. For this reason the counter 85 is shown as utilizing one-half digits, wherefore, while each bar or contact 44 registers as it passes the stylus 52 it requires two contacts to register a single degree-day. The half degree-day mark is indicated in the drawings by the reference character 120.

The counter 85 is shown in Figs. 1 and 4 as having an upper set or series of windows 121 and a lower set or series of windows 122. The first set of windows 121 may be employed for indicating the number of degree-days in short periods of time such as daily or weekly while the second set of windows 122 would be employed for indicating the total number of degree-days in a normal heating season such as from the first of September to the last of the following June. It is understood that the digits or figures that appear in the windows 121 and 122 to the left of the one-half character accumulate in the same manner as any counter and it is further to be understood that the counter includes mechanism whereby the said indicating characters or digits may be returned to zero at the end of given periods, those in the windows 121, as noted above, at the end of each day or week while those in the windows 122, again as noted above, at the end of the heating season.

In those rare instances where something may happen or occur to prevent the oscillation of the arm 55 to the left, and in order to prevent springing or damaging to the link 67 and parts operated thereby, there is provided a yielding or cushioning connection comprising a spring 123 and an adjusting screw 124 which has sufficient tension thereon to effect normal operation but which will yield under undue force. This mechanism is substantially identical with the connection of the operating arm 70 with the link 67 at its other end and above fully described.

The foregoing mechanism is the preferred construction and operates by electric power. In Figs. 6, 7 and 8 a device for accomplishing the same result is disclosed which, however, is purely mechanical.

As shown in Figs. 6, 7 and 8 use is made of a base or support 125 having mounted thereon a clock 126 which may be of the mechanical or spring motor type although an electric motor clock may be employed. The clock 126 terminates in a driven shaft or member 127 to which is secured a shaft 128 having longitudinally thereof a spline 129. The shaft 128 is suitably journaled at its other end in a bearing 130 upstanding from the base 125. Mounted on the shaft 129 is a drum 131 consisting of a cylindrical body member 132 having heads 133 and 134, each similar to the head 133 shown in cross-section in Fig. 7. The heads 133 and 134 along with the cylindrical body portion 132 are made as light in weight and as durable as possible consistent with the work to be performed thereby and each of said heads, similar to head 133, has a hub 135 with an inward projecting key 136 received in the groove or spline 129 in the shaft 128.

Upstanding from the base 125 is a temperature responsive device, indicated in general by the reference numeral 137, which comprises an expandable and contractable bellows 138 secured to and projecting from a support 139 through which the device 137 is attached to the base. The bellows 137 has at its other end a head 140 carrying, substantially at the center thereof, a rod 141. The rod 141 serves as a support for the

outer end of the bellows 138 and is mounted for sliding movement through a bearing 142 at the upper end of a post 143 secured to and upstanding from the base 125. The rod 141 has its free end upturned, as at 144, and is provided with an aperture for a link 145. The link 145 has encircling it an expansion coil spring 146 which abuts on one end with the upturned portion or finger 144 of the rod 141 and which spring abuts on its other end with a collar 147 on the link 145. The link 145 is connected through a pin 148 with a lever 149, the connection of the link 145 through the pin 148 with the lever 149 being through an elongated aperture 150.

The lever 149 has its one end pivotally connected at 151 to the upper end of an upstanding pillar 152 conveniently located on the base 125 at the outer edge thereof. The lever 149 is provided at its outer end with a second elongated aperture 153 receiving therein for sliding movement a cross head 154 at the outer end of a link 155. The link 155 at its inner end has depending therefrom a shifter shoe 156 disposed in a circumferential groove 157 formed in collar 158 secured to and projecting forwardly of the drum head 131.

The drum cylinder body 132 is divided longitudinally thereof into temperature bands 159 which correspond to the temperature bands 46 and 49 of the dial 34 above described. Each of the temperature bands 159 on the drum cylinder or body 132 is transversely divided by projections 160 each extending transversely of its band and there being as many projections for each band as the said band represents degrees below the norm as above described in connection with the cross bars or contact bars 44 of the dial 34. The said temperature bands 159 are adapted to operate through their projections 160 a counter 161 which upstands from the base 125.

Any suitable or desirable means may be employed for actuating the counter 161, shown in the drawing consisting of a lever 162 pivoted at 163 intermediate its ends to a bracket or the like 164 carried by the counter 161. The lever 162, on one side of the pivot 163, is shaped as at 165 to be engaged by the projections 160 for thereby oscillating the lever about the pivot 163. The portion of the lever 162 on the other side of the pivot 163 is in contact with a trip arm 166 projecting from the counter 161 and held in engagement with the lever 162 by yieldable means acting thereon and located within the counter 161. The counter 161 similar to the counter 85 is provided with a series of windows 167 and 168 the former counting and accumulates degree-days for short periods while the latter counts and accumulates the degree-days for the entire heating season.

It is believed that the operation of the mechanical degree-day recorder and accumulator disclosed in Figs. 6, 7 and 8 is obvious but briefly is as follows:

Reduction or falling temperature acting on the bellows 138 causes same to contract from the full line position shown to the position shown by phantom line 169. This movement of the bellows 138, and particularly its head 140, carries with it the rod 141 which through the link 145 actuates or oscillates the arm 149 from its solid line position to the phantom line position 170 thereof. The movement of the arm 170 through this arc shifts the drum 131 on the shaft 128 through the link 155. The movement

of the drum 131 brings the various temperature bands 159 into alignment with the counter actuating lever 162 and since the shaft 128 is being constantly rotated by the clock 126 the projections 160 of each temperature band automatically operates the counter 161 for thereby counting and accumulating the degree-days as they occur.

It is understood that the bellows 138 of the temperature responsive device 137 will expand as the temperature rises above the norm. This expansion would, through the shaft or rod 141, tend to oscillate the arm 149 to the left of its solid line position in Fig. 6 but since no purpose would be served, insofar as recording or accumulating degree-days is concerned, by this outward oscillation of the arm 149, the bearing post 130 acts as a stop for the drum 131 upon coming into contact with the drum head collar 158. The expansion of the bellows 138 and the outward movement of the rod or shaft 141 is absorbed by the spring 146 or other suitable device provided for this purpose.

The description of the dial 34, above, in connection with the disclosure in Figs. 1 and 3 is the preferred construction but any suitable or desirable construction may be employed for this purpose which will effect an electrical circuit for each degree of temperature drop below the norm. A simple and inexpensive construction is disclosed in Fig. 12 wherein use is made of a dial 174 of electrical conducting material and on which is placed a cover 175 of insulating material. The cover 175 may conveniently be formed as a paper disc having slits or elongated apertures 176 punched therein to take the place of the bars or contact strips 44 of the above-described form. It will be understood that the ball point 53 of the stylus can readily extend through the said slits or elongated apertures 176 to have contact with the metal disc 174.

With this construction the same electrical circuits are completed so that the same operation of the degree-day recorder is obtained.

It will be noted that the disc of each modification has the rim or periphery thereof divided into hour segments 177 and which are conveniently marked with hour numerals 1 to 12 so that the time of checking the accumulator is readily noted and which time is observed through the glass observation window of the cabinet lid or cover 20.

It is believed now evident that there has been provided a degree-day recorder which accomplishes the objects initially set forth.

What is claimed is:

1. In a degree-day register and accumulator the combination of a rotatable disc, a clock mechanism for rotating the disc through a single revolution in a single day's time, said disc being divided between its center and outer periphery into temperature zones with each zone representative of a given number of degrees below a certain temperature degree; successive temperature zones from the center of the disc to the periphery thereof indicating the temperature next below the zone on one side thereof and the temperature next above the zone on the other side thereof, each temperature zone being subdivided into portions with each portion representative of a single degree-day, each single degree-day portion in each temperature zone having a contact bar at a corresponding point therein, and means co-operating with said disc and its contact bars movable relative to the disc upon temperature

changes from the certain temperature degree for engagement with said contact bars and to thereby indicate the number of separate degree days per single day below the said certain temperature degree that occurs, including a temperature sensitive device, an arm oscillatable by said temperature sensitive device to the different temperature zones, a contact member on said arm for engagement with the contact bars in said temperature zones, and an electrical circuit completable upon engagement of the oscillatable arm contact member and rotatable member contact bars for operating an electrical counter and accumulator.

2. In a degree-day register, the combination of a clock mechanism, a rotatable member rotatable by said mechanism through a single rotation in a given length of time, contact bars distributed over the surface of said rotatable member, said bars being spaced from each other and arranged in a plurality of contiguous zones defined by series of said bars extending along the path of rotation of said member with the number of bars in each zone varying progressively from each zone to the next contiguous zone, a contact member positioned relative to the movable member surface so as to make contact with said contact bars when said rotatable member rotates to contact effectively only one bar at a time, temperature responsive means for causing relative motion between said contact and rotatable members transversely to the path of rotation of the zoned surface of the rotatable member, the extent of said motion being proportional to the temperature to which said device is subject, and means actuated by contact of said contact member with said bars to register the number of contacts made when said rotatable member is rotated through a single rotation by the clock mechanism.

3. In a degree-day register, the combination of a clock mechanism, a rotatable member rotatable by said mechanism through a single rotation in a given length of time, contact bars distributed over the surface of said rotatable member, said bars being spaced from each other and arranged in a plurality of contiguous zones defined by series of said bars extending along the path of rotation of said member with the number of bars in each zone varying progressively from each zone to the next contiguous zone, a contact member positioned relative to the movable member surface so as to make contact with said contact bars when said rotatable member rotates to contact effectively only one bar at a time, temperature responsive means for causing relative motion between said contact and rotatable members transversely to the path of rotation of the zoned surface of the rotatable member, the extent of said motion being proportional to the temperature to which said device is subject, means actuated by contact of said contact member with said bars to register the number of contacts made when said rotatable member is rotated through a single rotation by the clock mechanism, and means accumulating the number of contacts that occur during successive rotations of said rotatable member.

4. In a degree-day register, the combination of a rotatable disc, contact bars distributed over the surface of said disc, said bars being spaced from each other and arranged in a plurality of contiguous zones defined by series of said bars extending along the path of rotation of said disc with the number of bars in each zone varying

progressively from each zone to the next contiguous zone, a clock mechanism for rotating the disc through a single revolution in a given period of time, a stylus engaging and adapted to cooperate with said disc surface and contact bars and of such size as to be able to contact only one bar at a time, an oscillatable arm for said stylus, said arm being oscillatable into the various paths of said contact bars, a temperature sensitive device, means connecting the temperature sensitive device with the oscillatable arm for effecting the oscillation of the arm upon temperature variation acting on said temperature sensitive device for moving the stylus into the paths of said contact bars, and means actuated by contact of said stylus with said bars to register the number of contacts made when said disc is rotated through a single rotation by the clock mechanism.

5. In a degree-day register, the combination of a rotatable disc, contact bars distributed over the surface of said disc, said bars being spaced from each other and arranged in a plurality of contiguous zones defined by series of said bars extending along the path of rotation of said disc with the number of bars in each zone varying progressively from each zone to the next contiguous zone, a clock mechanism for rotating the disc through a single revolution in a given period of time, a stylus engaging and adapted to cooperate with said disc surface and contact bars and of such size as to be able to contact only one bar at a time, an oscillatable arm for said stylus, said arm being oscillatable into the various paths of said contact bars, a temperature sensitive device, means connecting the temperature sensitive device with the oscillatable arm for effecting the oscillation of the arm upon temperature variation acting on said temperature sensitive device for moving the stylus into the paths of said contact bars, means actuated by contact of said stylus with said bars to register the number of contacts made when said disc is rotated through a single rotation by the clock mechanism, and means accumulating the number of contacts of the stylus and contact bars that occur during successive rotations of the disc.

6. In a degree-day register, the combination of a clock mechanism, a drum, contact bars distributed over the surface of the drum, said bars being spaced from each other and arranged in a plurality of contiguous zones defined by series of said contact bars extending around the drum with the number of bars in each zone varying progressively from each zone to the next zone, means supporting said drum for rotation and axial movement, the clock mechanism being connected with the last named means for rotating the same together with the drum through a single revolution in a given period of time, a temperature sensitive device capable of expansion and contraction upon temperature variations acting thereon, means connecting the temperature sensitive device with the drum for effecting axial movement of the drum upon the expansion and contraction of the temperature sensitive device, and means relative to which the drum is moved for engagement with the contact bars on the drum for indicating the number of such engagements that occurred during a single revolution of the drum.

7. In a degree-day register, the combination of a clock mechanism, a drum, contact bars distributed over the surface of the drum, said bars being spaced from each other and arranged

13

in a plurality of contiguous zones defined by series of said contact bars extending around the drum with the number of bars in each zone varying progressively from each zone to the next zone, means supporting said drum for rotation and axial movement, the clock mechanism being connected with the last named means for rotating the same together with the drum through a single revolution in a given period of time, a temperature sensitive device capable of expansion and contraction upon temperature variations acting thereon, means connecting the temperature sensitive device with the drum for effecting axial movement of the drum upon the expansion and contraction of the temperature sensitive device, and means relative to which the drum is moved for engagement with the contact bars on the drum for indicating the number of such engagements that occurred during a single revolution of the drum, comprising a pivotally mounted finger and a counter.

8. In a degree-day register, the combination of a drum, contact bars distributed over the surface of the drum, said bars being spaced from each other and arranged in a plurality of contiguous zones defined by series of said contact bars extending around the drum with the number of bars in each zone varying progressively from each zone to the next zone, a shaft supporting said drum for rotation and axial movement, a clock mechanism for rotating the shaft together with the drum through a single revolution in a given period of time, a temperature sensitive device capable of expansion and contraction upon temperature variations acting thereon, a system of levers connecting the temperature device with the drum for effecting axial movement of the drum during its rotation upon the expansion and contraction of the temperature sensitive device, a pivotally mounted finger relative to which the drum is axially moved and rotated for engagement with and oscillation of said finger by the contact bars on the drum, and a counter connected with and actuated by the finger for indicating the number of such engagements of the finger and contact bars that occurred during a single rotation of the drum.

9. In a degree-day register, the combination of a drum, contact bars distributed over the surface of the drum, said bars being spaced from each other and arranged in a plurality of contiguous zones defined by series of said contact bars extending around the drum with the number of bars in each zone varying progressively from each zone to the next zone, a shaft supporting said drum for rotation and axial movement, a clock mechanism for rotating the shaft together with the drum through a single revolution in a given period of time, a temperature sensitive device capable of expansion and contraction upon temperature variations acting thereon, a system of levers connecting the temperature device with the drum for effecting axial movement of the drum during its rotation upon the expansion and contraction of the temperature sensitive device, a pivotally mounted finger relative to which the drum is axially moved and rotated for engagement with and oscillation of said finger by the contact bars on the drum, a counter connected with and actuated by the finger for indicating the number of such engagements of the finger and contact bars that occurred during a single rotation of the drum, and means for accumulating the number of such engagements occurring during successive rotations of the drum.

14

10. In a degree-day register, the combination of a clock mechanism, a rotatable member rotatable by said clock mechanism through a single rotation in a given length of time, contact means having spaced contact portions distributed over the surface of said rotatable member along the path of rotation of said member, the number of said contact portions per given length of path of rotation of the rotatable member varying progressively transversely of the direction of rotation of the rotatable member, a contact member positioned relative to the rotatable member surface so as to make contact with said contact portions when said rotatable member rotates and of such size as to be able to contact only one contact portion at a time, temperature responsive means for causing relative motion transversely of said path of rotation between said contact and rotatable members, the extent of such motion being proportional to the temperature to which said device is subjected, and means actuated by contact of said contact member with said contact portions to register the number of contacts made when said rotatable member is rotated through a single rotation by the clock mechanism.

11. In a degree-day register, the combination of a clock mechanism, a rotatable member rotatable by said clock mechanism through a single rotation in a given length of time, contact means having spaced contact portions distributed over the surface of said rotatable member along the path of rotation of said member, the number of said contact portions per given length of path of rotation of the rotatable member varying progressively transversely of the direction of rotation of the rotatable member, a contact member positioned relative to the rotatable member surface so as to make contact with said contact portions when said rotatable member rotates and of such size as to be able to contact only one contact portion at a time, temperature responsive means for causing relative motion transversely of said path of rotation between said contact and rotatable members transversely of the path of rotation of the rotatable member, the extent of such motion being proportional to the temperature to which said device is subject, means actuated by contact of said contact member with said contact portions to register the number of contacts made when said rotatable member is rotated through a single rotation by the clock mechanism, and means accumulating the number of such contacts that occur during successive rotations of said rotatable member.

12. In a degree-day register, the combination of a clock mechanism, a rotatable disc rotatable by said clock mechanism through a single rotation in a given length of time, contact means having spaced contact portions distributed over the surface of said disc along the path of rotation of said disc, said spacing of the number of said contact portions per given length of path of rotation of the rotatable disc varying progressively transversely of the direction of rotation of the rotatable disc, a contact member positioned relative to the surface of the disc so as to make contact with said contact portions when said disc rotates and of such size as to be able to contact effectively only one contact portion at a time, temperature responsive means for causing relative motion between said contact member and disc transversely to the path of rotation of the surface of the disc, the extent of said motion being proportional to the temperature to which said device

15

is subject, and means actuated by contact of said contact member with said contact portions to register the number of contacts made when said disc is rotated through a single rotation by the clock mechanism.

13. In a degree-day register, the combination of a clock mechanism, a rotatable disc rotatable by said clock mechanism through a single rotation in a given length of time, contact means having spaced contact portions distributed over the surface of said disc along the path of rotation of said disc, the number of said contact portions per given length of path of rotation of the rotatable disc varying progressively transversely of the direction of rotation of the rotatable disc, a contact member positioned relative to the surface of the disc so as to make contact with said contact portions when said disc rotates and of such size as to be able to contact effectively only one contact portion at a time, temperature responsive means for causing relative motion between said contact member and disc transversely to the path of rotation of the surface of the disc, the extent of said motion being proportional to the temperature to which said device is subject, means actuated by contact of said contact member with said contact portions to register the number of contacts made when said disc is rotated through a single rotation by the clock mechanism, and means accumulating the number of such contacts that occur during successive rotations of the said disc.

14. In a degree-day register, the combination of a clock mechanism, a rotatable disc rotatable by said clock mechanism through a single rotation in a given length of time, contact means having spaced contact portions distributed over the sur-

16

face of said disc along the path of rotation of said disc, the number of said contact portions per given length of path of rotation of the rotatable disc varying progressively transversely of the direction of rotation of the rotatable disc, a contact member positioned relative to the rotatable disc surface so as to make contact with said contact portions when said rotatable disc rotates to contact effectively only one contact portion at a time, temperature responsive means for causing relative motion between said contact member and disc transversely to the path of rotation of the surface of the disc, the extent of said motion being proportional to the temperature to which said device is subject, an electrical circuit including the contact member and disc contact portions completable upon engagement of said contact member and disc contact portions, and means actuated upon completion of said electrical circuit to register the number of contacts made when said disc is rotated through a single rotation by the clock mechanism.

ELMO D. HIDY.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,131,573	Snediker	Sept. 27, 1938
2,377,860	Bickley	June 12, 1945

FOREIGN PATENTS

Number	Country	Date
266,677	Germany	Apr. 29, 1913
26,257	Great Britain	June 5, 1913
392,313	Germany	Mar. 18, 1924