Nov. 17, 1936. R. E. FRAHER ET AL 2,060,984

RECORDING INSTRUMENT

Filed May 18, 1932 4 Sheets-Sheet 1

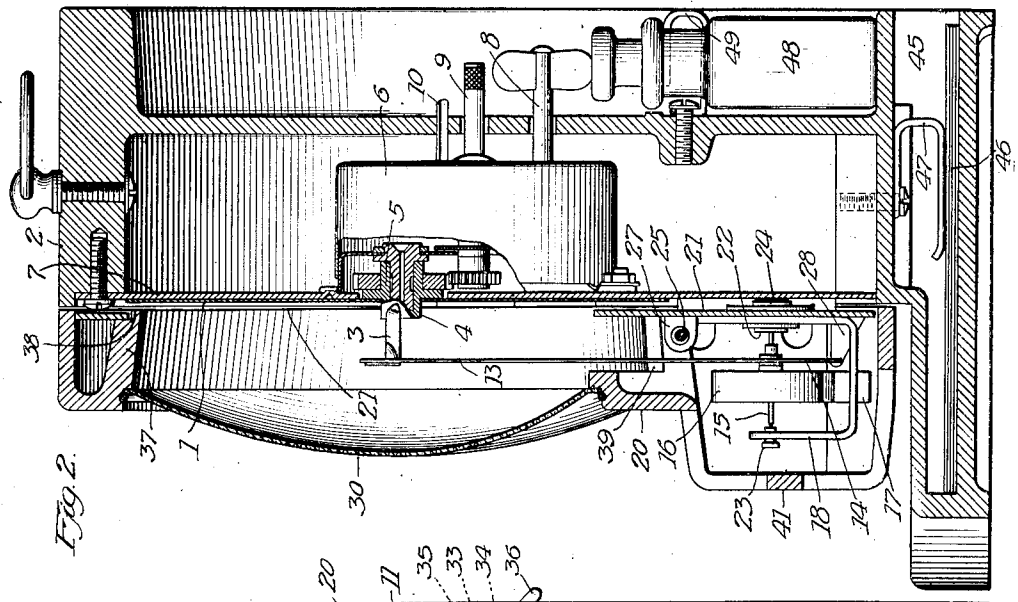


Fig. 2.

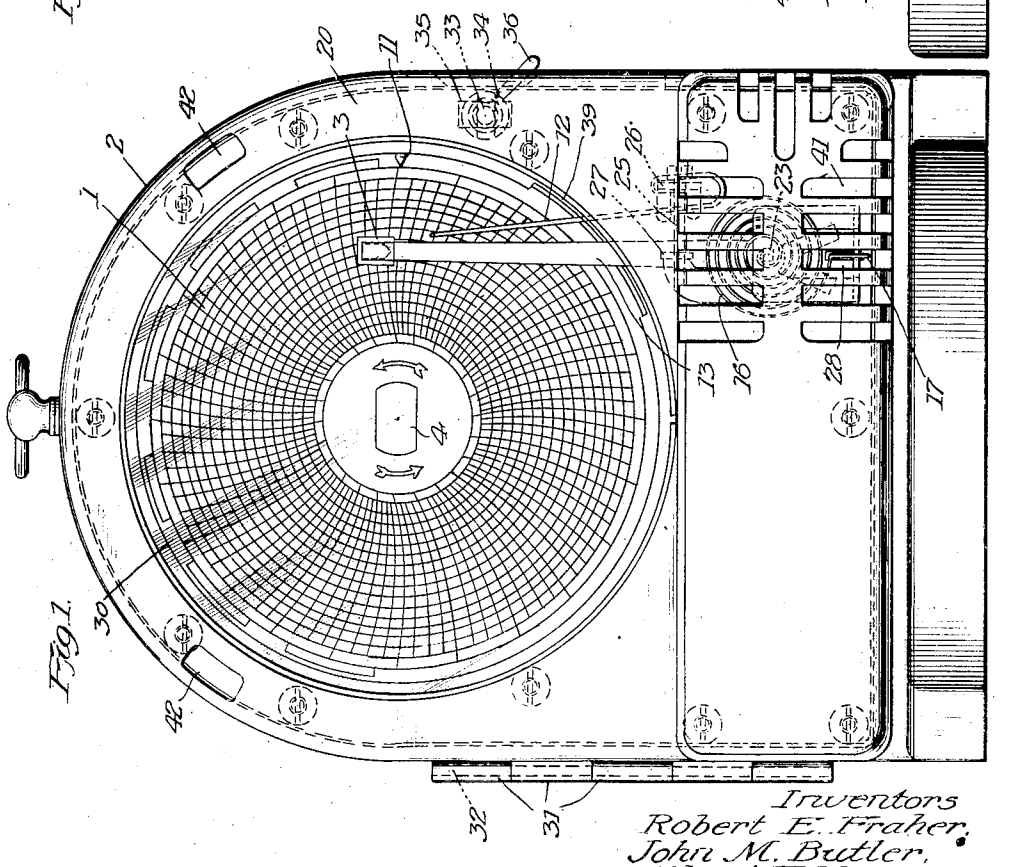


Fig. 1.

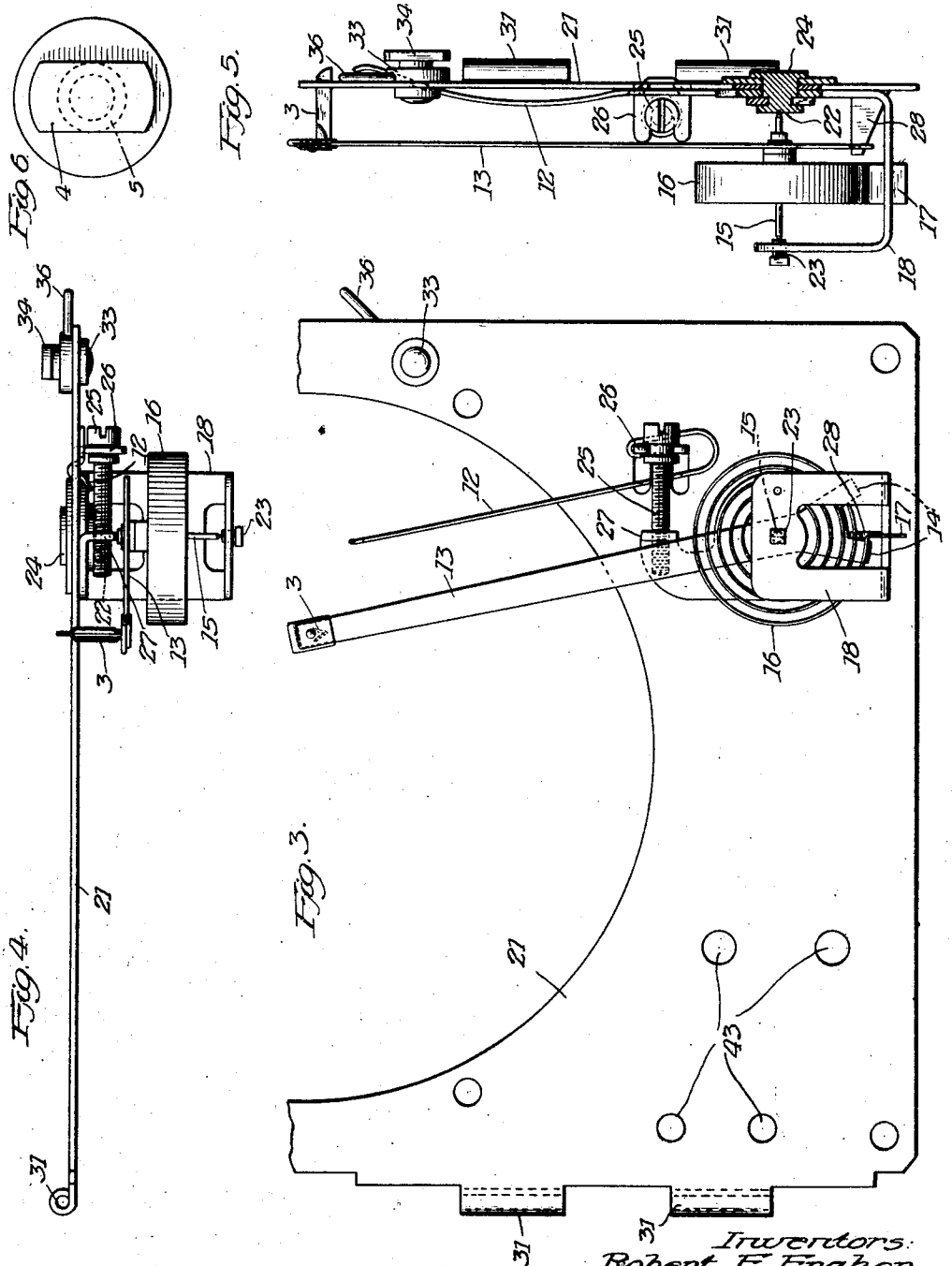
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RECORDING INSTRUMENT

Filed May 18, 1932 4 Sheets-Sheet 2



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RECORDING INSTRUMENT

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Fig. 7.

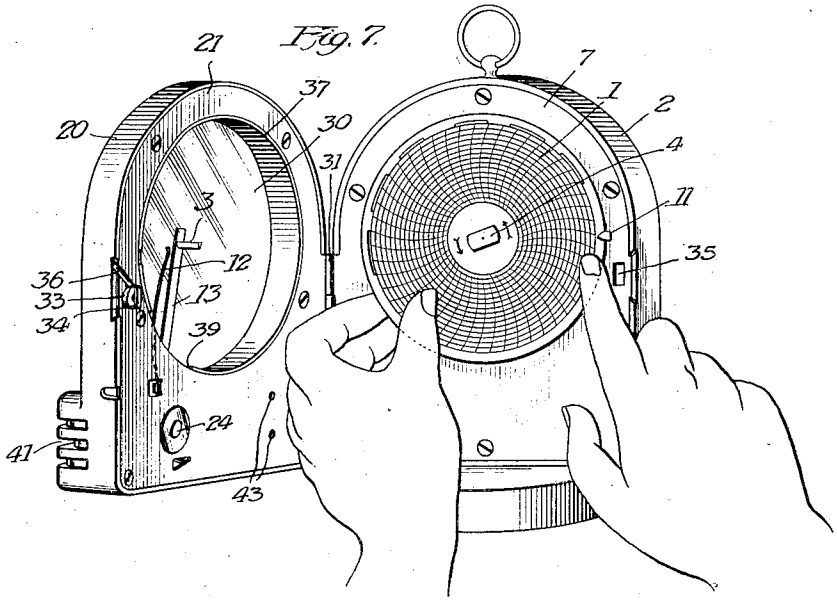


Fig. 8.

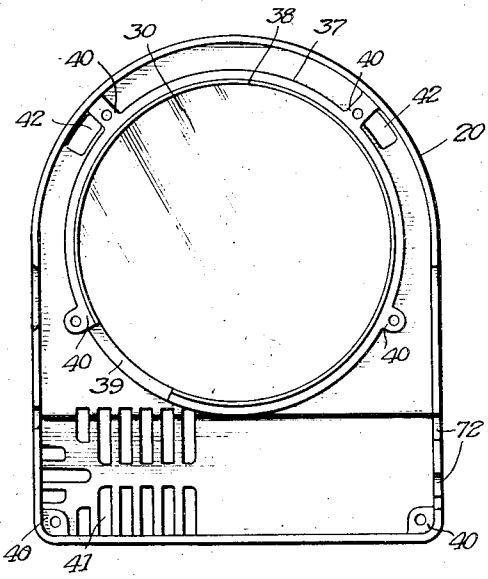
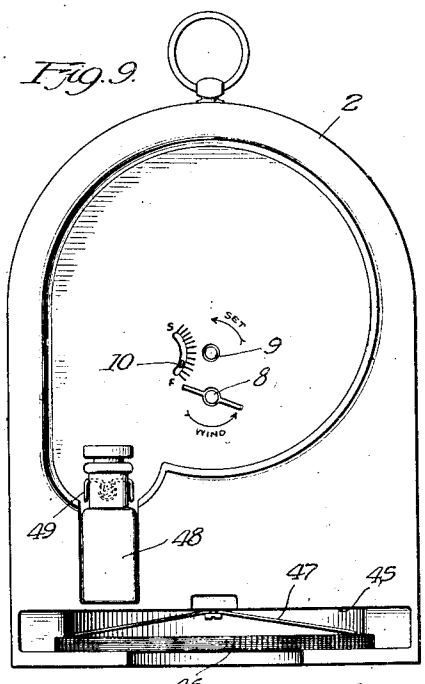


Fig. 9.



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RECORDING INSTRUMENT

Filed May 18, 1932 4 Sheets-Sheet 4

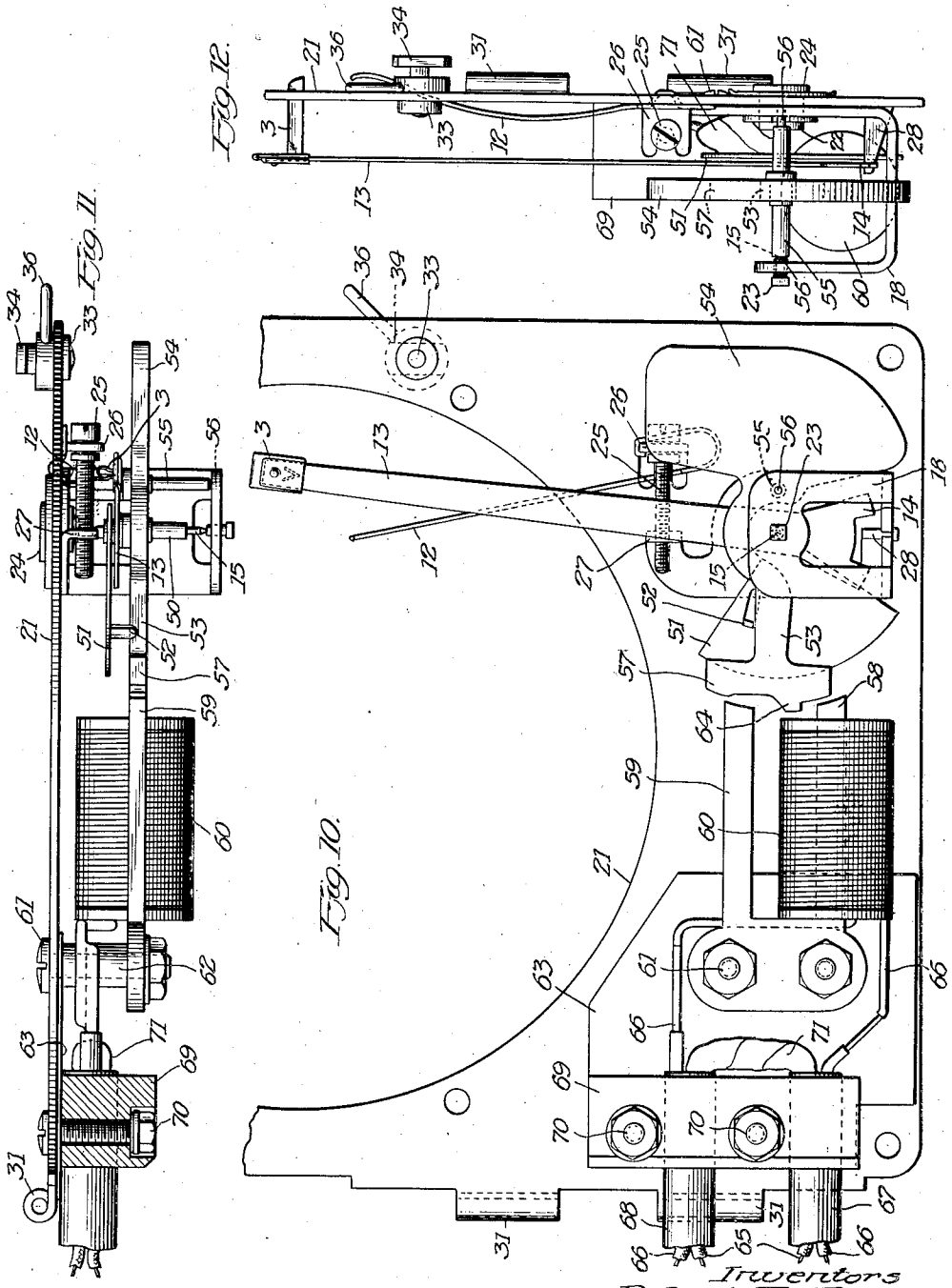


Fig. 12.

Fig. 11.

Fig. 10.

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UNITED STATES PATENT OFFICE

2,060,984

RECORDING INSTRUMENT

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Application May 18, 1932, Serial No. 612,100

6 Claims. (Cl. 234—1)

This invention relates to recording instruments including recording thermometers, operation recorders and other instruments of the type in which a chart moved by clockwork is traversed by a marker controlled by conditions to be recorded.

Among other objects the invention aims to improve such instruments with a view to facilitating replacement of charts and especially with a view to permitting such replacements without disturbing the marker. A further object is to improve such instruments with a view to increasing their practicability, efficiency and convenient serviceability, and more particularly to provide very practical, reliable and convenient instruments adapted for use by engineers in field work or for servicing purposes. Other objects are to provide an improved recording thermometer, and to provide an improved operation recorder.

These and other incidental objects and advantages of the invention will more fully appear from the following description with reference to the accompanying drawings in which are illustrated an improved recording thermometer and an improved operation recorder. The instruments so illustrated embody in common certain constructions and features comprehended in the invention, and respectively embody specific improvements comprehended in the invention.

In said drawings:

Fig. 1 is a front elevation of said recording thermometer.

Fig. 2 is a vertical sectional view thereof.

Fig. 3 is an enlarged detail view showing in front elevation a part of the back plate of the front door of the instrument and the pen or marker and its controlling means carried by said plate.

Fig. 4 is a top plan view of Fig. 3.

Fig. 5 is a right-hand end elevation of Fig. 3.

Fig. 6 is a detail front end view of the clock spindle.

Fig. 7 is a perspective view of the instrument showing the front door swung to open position and illustrating how the chart is by an easy manipulation mounted in place in the instrument.

Fig. 8 is an inner face view of the main front member of the front door.

Fig. 9 is a back view of the instrument.

Fig. 10 is a view like Fig. 3 of the corresponding part of an operation recorder which, except for the part illustrated in Fig. 10, is otherwise of the same construction as the instrument illustrated in the preceding figures.

Fig. 11 is a top plan view of Fig. 10.

Fig. 12 is a right-hand end view of Fig. 10.

A specific description of the illustrative instruments will now be made, it being understood that such description is not intended to limit the invention beyond the terms of the claims appended to this specification.

Recording thermometer

Referring first to the recording thermometer shown in Figs. 1 to 9 inclusive, it will be understood that the circular chart 1, which may be of conventional type, is rotated by a clock movement contained in the case 2, and that the face of the chart (on which the radiating curved lines represent consecutive time periods while the concentric circular divisions indicate different specific temperatures) is traversed by a pen 3 controlled to move toward or from the center of the chart in accordance with the temperature of the compartment, room or other place in which the instrument is used, so as to record the temperature at successive periods of time by the inked line drawn by the pen on the chart.

The chart, consisting of an appropriately marked paper record disk, is affixed on the front stub end 4 of the spindle 5 which is driven by the clock movement at such rate as to effect one complete revolution of the chart in twenty-four hours or other predetermined interval of time, and for this purpose there may be employed any conventional twenty-four hour clock movement or, if the instrument be intended for a twelve-hour chart or chart designed for an operation of other than twenty-four hours, there may be employed any conventional twelve-hour or other clock movement as the case may require. Such clock movements are so well known as to be unnecessary to illustrate in detail. In Fig. 2, the clock movement or mechanism of a conventional twenty-four hour clock is partially revealed, this mechanism being represented as mounted in a housing 6 which is affixed to the back of the face plate 7 of the clock case 2. Said face plate 7 is in this instance a sheet metal plate affixed to the front of the main body of the clock case by suitable fastening screws. As shown in Fig. 2 the clock case is rabbeted to receive said front plate. The clock winder stem 8, the setting stem 9, and the regulator 10, all of which are ordinary features of clock movements, are shown protruding through the back wall of the clock case. By manipulation of the setting stem 9, the clock spindle 5 can be turned to set the chart in any desired position relative to the index or pointer 11, just as the ordinary clock hands can be set by turning the

setting stem of an ordinary clock. This adjustment would be made at the beginning of the recording operation. That is to say, after mounting the chart in place and winding the clock, the setting stem will be turned to bring the initial time line or division of the chart into registration with the pointer 11, so that the recording will commence at that line. The pointer 11 may be a small projection struck up from the sheet metal face plate 7 and arranged to overlie the margin of the chart, assisting in keeping it in place.

It will be observed that the projecting stub end 4 of the clock spindle is of noncircular or squared shape, preferably of the oblong shape shown (Figs. 1 and 6), and the center opening in the chart is correspondingly shaped. This simple expedient obviates the need of fastening means to secure the chart fast to the clock spindle, and enables the chart to be easily affixed to the spindle by merely fitting it thereon, promoting expedition in the replacement of the charts. It is obviously much simpler merely to fit the chart on the noncircular stub end of the spindle, than to have to unfasten and replace a nut which in the ordinary recording instrument is used in conjunction with a circular threaded spindle end to secure the chart in place.

The pen 3, typifying any suitable marker, may be of the ordinary type adapted to hold a small supply of ink for feeding to the pen point. This pen carried by the sheet metal arm 13 bears lightly on the chart, being held thereagainst by the very slightly stressed arm. Said arm 13 is mounted on and fast to the spindle 15 of a thermostatic controlling means represented by a bimetallic strip in the form of a coil 16. The inner end of the coiled bimetallic strip is fast to the rotatably mounted spindle 15, while the outer end is attached at 17 to a fixture therefor provided in this instance by the bracket 18 in which the thermostatic controlling means is mounted. It will be understood that the coil 16 by expansive or contractive action turns the spindle carrying the arm 13, thereby moving the pen toward or away from the center of the chart, the direction of such movement depending upon whether the temperature is increasing or decreasing. As the turning movement of the spindle 15 is the differential result of the unequal expansion or contraction of the two metals at the opposite sides of the coiled strip, it follows that only a slight turning movement will be imparted to the spindle, while by reason of the length of the arm 13 a considerably greater movement will be imparted to the pen.

As clearly appears from Figs. 1, 2 and 7, the pen and its controlling mechanism are carried in a hinged front door, which is constructed to house said parts. The front door in this instance comprises the front housing member 20, having a window through which the chart is exposed, and a sheet metal back plate 21 secured to said front member by suitable attaching screws. In this connection it will be observed that the pen 3 is arranged between the chart and the transparent window pane 30, and that the bracket 18 carrying the thermostatic controlling means is arranged within the space provided by the bulging lower portion of the door member 20 and is attached to the back plate 21 of the door. Referring to Figs. 2, 3, 4 and 5, the said bracket 18 is represented as a U-shaped member one branch of which is affixed to the door plate 21 by a rivet connection in which is provided a bearing 22 for one end of the spindle 15 whose other end is mounted in the screw 23 carried by the other branch of said U-shaped bracket. Said rivet connection indicated at 24 secures the bracket substantially tightly to the door plate but nevertheless permits the bracket to be rocked on the rivet connection for adjustment, this being controlled by the calibrating screw 25 whose head is swiveled in a lug 26 on the door plate and whose threaded stem is in screwed engagement with a lug 27 on the bracket. By this means the bracket can be adjusted angularly to set the pen-holding arm 13 in exactly the right position, such calibration being made initially at the factory where the instrument is manufactured. A lug 28 struck up from the sheet metal door plate 21 projects forwardly between the prongs 14 of the bifurcated lower tail portion of the pen-holding arm 13 and functions as a motion-limiting stop for said arm. A wire spring 12 affixed to the door plate 21 as shown in Figs. 3 to 5 bears lightly on the chart and assists in holding it in place.

When the door is swung to open position as shown in Fig. 7, the pen and presser finger 12 automatically clear the chart, being swung with their associated parts out of the way, but without the slightest disturbance of the pen or its carrying arm 13 in relation to its controlling means. Upon closing the door, the pen is automatically restored to proper operative position in relation to the chart, as also the presser finger 12. This is a highly advantageous feature of the present invention. In ordinary recording instruments having the pen controlled by mechanism mounted in the clock case, the overlapping of the chart by the pen-holding arm interferes with easy insertion or removal of the chart. The replacement of charts in such ordinary instruments is a somewhat fussy operation since the operator must displace the pen with his fingers while installing or removing a chart. This is objectionable not only because of the trouble and inconvenience but also because the pen and its holding arm are delicate parts which ought not to be interfered with. Obviating this difficulty, the present invention provides a construction whereby the pen and associated controlling means are bodily displaced by the mere opening of the door, leaving the face of the clock case free, so that the chart can be readily removed and replaced by another, without any disturbance of the delicately adjusted pen. In mounting a chart in place, it is merely necessary to insert its margin under the pointer 11 while fitting the chart on the stub end 4 of the clock spindle, which may be very expeditiously and easily performed in a manner which will be readily apparent from Fig. 7.

The hinging of the door to the clock case is accomplished by constructing the confronting sheet metal plates 7 and 21 as hinge plates, or in other words forming these plates with integral interfitted hinge portions 31 sleeved to receive the vertical hinge pintle 32. This provides a very strong hinge whereby the door is prevented from sagging, and the proper relationship of the parts carried by the door to the clock case and chart mounted thereon is assumed. Also the expense of separate hinges is avoided.

The door when closed is fastened by a suitable latch which, for example, may be of the construction shown consisting of a pivoted member 33 mounted on the back face of the door plate 21 and formed with a lug 34 adapted to enter the hole 35 in the clock face plate 7 (Fig. 7) and to be turned thereon to engage the rear side of said plate 7. This latch is operated by the handle 36.

The window panel 30 in the door consists preferably of a circular disk of transparent celluloid, suitably mounted as shown in Fig. 2. Such celluloid window panel has the advantage of not being liable to breakage when the instrument is being transported or used in field work.

By reference to Figs. 1, 2 and 8, the latter being an inner face view of the front door member 20, it will be seen that this member is formed with a marginal flange and an annular wall 37 framing the transparent window panel, this annular wall being rabbeted to provide a reduced portion 38 which fits in the circular opening of the back door plate 21, while the marginal flange encloses said back plate, so that the parts are nicely interfitted. Said annular wall 37 is cut away at 39 to accommodate the movement of the pen-holding arm 13. Lugs indicated at 40 in Fig. 8 receive the attaching screws for the back plate 21. The bulging portion of the door member which houses the coil 16 is shown as of reticulated form at 41, providing a multiplicity of air passages for free circulation of air around the thermostatic controlling means. Other air openings are indicated at 42, and still others at 43 in the back plate 21, so that there may be a free circulation of air from the room through the entire door.

As shown in Figs. 2 and 9, the base of the clock case 2 is formed to provide a horizontal compartment or receptacle 45 open at the rear which receptacle contains a pile of charts 46 held in place on the bottom of the receptacle by the spring presser 47 attached to the top wall of said receptacle. Thus there is provided in the instrument case a convenient supply of charts for use when the instrument is employed in field tests. Also the back wall of the clock case is formed to provide a pocket for an ink bottle 48 secured in place by the spring clasp 49. The bottle stopper may be provided with a dropper, so that when the instrument is installed for use in the field the operator can conveniently supply a drop of ink to the pen.

This instrument, containing a supply of charts and bottle of ink, may be furnished by the manufacturer in a suitable case for convenient portability, and may be carried about and used for such purposes, for example, as obtaining twenty-four hour temperature records of automatic refrigerators. It can be installed for use in a refrigerator box or other place of use very easily and quickly, without any fussy or troublesome operations, search for lost parts or other annoying delays, and without the necessity of making adjustments of the instrument from time to time. When the front of the instrument is opened, the pen automatically clears the chart, and a new chart is easily slipped under the pointer and over the hub as previously explained. The setting stem of the clock in the rear is then turned to register the chart properly with the pointer, which indicates where the pen will touch the chart when the door is closed. It is then merely necessary to ink the pen, wind the clock and close the door, whereupon the instrument may be put into the refrigerator box, and the service man may go on his way. At the end of twenty-four hours, the record of the temperature for that period is on the chart, telling what service if any the refrigerator may require.

It will be understood that the charts used with the instrument will bear appropriate indicia indicating the time periods represented by the radial curved lines and the temperatures represented by the concentric circular lines. On account of the small size of such indicia, only a few of the time indicia have been shown on the chart in this instance. Attention is called to the fact that the pen 3 is arranged so that the pen point will register with the same time line that the pointer 11 registers with, and that the pen-holding arm 13 is of such length and so fulcrumed that the pen in moving to or from the the center of the disk will follow the curved time line with which the pointer registers. In starting the operation, the operator will adjust the chart to register the proper time line with the pointer. For instance, suppose the operation starts at four o'clock P. M. The operator will bring the four P. M. time line into registration with the pointer, and as the pen is positioned at that line the chart at the end of twenty-four hours will show the proper record commencing at the time at which the operation was actually started.

The instrument above described may be converted into one for recording conditions other than temperature by replacing the thermostatic controlling means with other appropriate controlling means according to the conditions to be recorded. In this connection, the front door member 20 is preferably designed to accommodate different controlling means, including that for the operating recorder now to be described.

Operation recorder

Figs. 10, 11 and 12 taken in conjunction with Figs. 1, 2, 7, 8 and 9 illustrate an operation recorder which is the same in construction as the instrument already described except that in the operation recorder the rear plate 21 of the front door carries the controlling mechanism shown in Figs. 10, 11 and 12 instead of the controlling mechanism shown in Figs. 3, 4 and 5.

This operation recorder is intended to record the "on" and "off" periods of operation of an electric motor, e. g. the motor of an electric refrigerator which, as is well understood, is thermostatically controlled to run only when the temperature in the refrigerator box rises above a predetermined limit.

In the case of the operation recorder, the pen is controlled to occupy one position when the motor is running and another position when the motor is not running, so that the "on" and "off" periods of the motor will be indicated on the chart by radially offset lines drawn by the pen.

In Figs. 10, 11 and 12 the parts which are identical with those of the first described instrument are indicated by the same reference symbols. These parts include the door plate 21, the bracket 18 attached thereto by a rivet connection, the spindle 15 mounted in said bracket, and the pen-holding arm 13. In this instance the pen-holding arm instead of being rigidly mounted or fast to the spindle 15 is attached to a sleeve 50 rotatably fitted on said spindle which functions as an axle for the sleeve. To the same sleeve 50 is attached a weighted arm in the form of a sector-shaped member 51 which actuates the pen-holding arm to move inwardly or to a position nearer the center of the chart than the normal position shown in Fig. 10. A projection 52 struck up from the sheet metal member 51 overlies a lever 53 which is normally held up in the position shown by its weighted or enlarged heavier end 54, thereby holding the pen-holding arm in the position shown. In this position the line drawn by the pen indicates that the motor is "off" or not running.

The lever 53 is pivotally mounted in the brack-

et 18, being attached to a sleeve 55 which is rotatably fitted on an axle 56 mounted in said bracket. Said lever 53 has a T-shaped end constituting an armature 57 adjacent to the ends of the legs 58 and 59 of the U-shaped soft iron core of an electromagnet, the coil 60 of which is shown on the lower leg of said core. This core is attached to but insulated from the door plate 21, being so attached by means of the bolts 61 and spacing sleeves 62, there being suitable insulation material 63 between the plate and sleeves. The coil 60 is adapted to be connected in series with the motor whose operations are to be recorded, so that, when the motor is running, the electromagnet being energized will attract the armature member 57 carried by the lever 53, rocking the lever downwardly, this motion being limited by the stop 64 adapted to engage the leg 58 of the core. When the lever is so depressed, the weight 51 will move the pen-holding arm inwardly or toward the left in Fig. 10, and the pen-holding arm will be held in this position so long as the motor is running. When the motor stops, the electromagnet being de-energized releases the armature, and under influence of the weight 54 the pen-holding arm will be returned to its normal position, so that the pen will record the "off" or nonrunning condition of the motor until it is again started.

The construction shown in Fig. 10, having the fulcrum of the weighted lever 53 located near the weight and behind the fulcrum of the pen-holding arm 13, has the advantage that downward movement of the weight 54 when the magnet is deenergized does not cause the pen-holding arm to be jerked outwardly so suddenly as to dislodge ink from the pen; and when the magnet is energized with the result of lowering the lever 53 the pen-holding arm is gently moved inwardly by the light weight provided by the sheet metal sector-shaped part 51 formed as an integral extension from the pen-holding arm.

In an electric refrigerator, the motor circuit usually has terminals at a socket in the refrigerator case, and connection between said terminals and the terminals of a house circuit is ordinarily made by a flexible extension cord comprising a pair of insulated wires whose terminals are connected to plugs at the ends of the cord, one plug adapted for connection with a wall socket in the room in which the refrigerator is used, and the other adapted for connection with the socket in the refrigerator case. In Figs. 10 and 11, such an extension cord is represented by the pair of insulated wires 65 and 66 and the rubber tubing 67 and 68 enclosing the same. This extension cord is so attached to the door plate 21 as to provide the two branches 67 or 68, the branch 67 being for connection with the wall socket of the room, and the branch 68 being for connection with the refrigerator. It will be understood that these two branches, which are in effect two extension cords, are respectively equipped with suitable plugs for making the respective electrical connections with the refrigerator and house circuit. As will be apparent from Fig. 10, the magnet coil 60 is included in one of the wires 66. The other wire 65 runs through the insulation indicated at 71. By means of the block 69 and bolts 70 the inner ends of the two branches 67 and 68 of the extension cord are firmly clamped to the door plate 21 and held in a parallel relationship. The front door member 20 is shown having notches 72 (Fig. 8) to accommodate these branches.

Thus the instrument is equipped for convenient installation in such manner that when the electrical connections are made the magnet coil 60 will be included in the motor circuit. Consequently, depending upon whether or not the motor runs (which in turn is controlled by a thermostatic switch in the refrigerator), the magnet will be energized or de-energized. Hence the pen will occupy one position while the motor is running and another while it is not running, and the "on" and "off" periods will accordingly be recorded on the chart.

What we claim and desire to secure by Letters Patent is:

1. A recording instrument having, in combination, a clock case having a face plate, a clock movement mounted therein behind said face plate and including a spindle protruding through said face plate, on the protruding end of which spindle a circular chart is adapted to be mounted, a marker arranged to engage the face of said chart, carrying means for said marker, mechanism controlling said marker to shift its position relative to the center of the chart in accordance with variations in the conditions to be recorded, and a hollow front door carrying the marker carrying means and in which the said controlling mechanism is mounted, said door having a back plate confronting said face plate, said front door having an opening in its back plate and a window in its front wall through which the chart is exposed to view, and said controlling mechanism and carrying means for the marker being mounted on the front side of said back plate within said door.

2. A recording instrument having, in combination, flat plates constructed as leaf hinge members, a clock movement mounted on one of said plates, said clock movement including a spindle protruding through said plate and adapted to have a chart affixed thereon, a marker adapted to engage such chart, means carrying said marker from the other plate, controlling mechanism for the marker mounted on said other plate, the said plates being hinged together and normally confronting and having the respective parts carried thereby arranged at the sides of the plates opposite their confronting faces, a case containing said clock movement and to which is separably affixed as a face plate the said plate carrying said clock movement, and a front housing section enclosing said controlling mechanism and marker and to which is separably affixed as a back plate the said plate carrying said controlling mechanism, the said front housing section having a window, and the said back plate of the front housing section having an opening in registration with said window, through which opening and window the chart is exposed to view.

3. A recording instrument having, in combination, a clock case comprising a recessed body having a separable face plate, the front side of the body being rabbeted to receive said face plate, a door hinged to said body, said door comprising a front housing member having a rearwardly extending marginal flange abutting the front side of said body and having a separable back plate fitted within said flange, said front housing member having a transparent window pane and said back plate having an opening in registration therewith, said front housing member having an annular wall framing said window pane and rabbeted to fit within the opening in said back plate, a clock movement mounted on the back side of said face plate, said clock movement including a spindle protruding through said face plate, on the

protruding end of which spindle a chart is adapted to be affixed and to be viewed through said opening and window pane, a marker arranged between said window pane and back plate adapted to engage the face of such chart, and mechanism mounted on the front side of the back plate of the door and enclosed by said door carrying said marker and controlling the same to shift its position in accordance with variations in conditions to be recorded.

4. In a recording instrument of the type in which a chart revolved by clockwork is traversed by a marker, a lever arm carrying said marker, a bracket in which the lever arm is pivotally mounted, means cooperating with the lever arm and bracket and controlled in accordance with variations in conditions to be recorded for actuating the lever arm, a support to which said bracket is pivotally attached concentrically with the pivot of the lever arm, and an adjusting screw connecting said support and bracket.

5. In a recording instrument of the type in which a chart revolved by clockwork is traversed by a marker, the combination with said clockwork, marker and carrier arm therefor and mechanism for controlling said arm to shift the position of the marker in accordance with variations in conditions to be recorded, of an instrument case comprising hinged housing sections, one of said sections containing said clockwork and the other containing said carrier arm and controlling mechanism therefor, said housing sections being provided with confronting plates constructed as hinge members by which the two sections are hinged together, said clock movement being mounted on one of said plates and the driven spindle thereof protruding through said plate to receive the chart, the said controlling mechanism being mounted on the other plate which is formed with an opening for exposure of the chart therethrough, and the section which contains said marker and controlling mechanism having a window in line with the chart and said opening.

6. In a recording instrument of the type wherein a revolving chart operated by clockwork is traversed by a marker, a housing element containing said clockwork, said element having a clock and chart carrying closure plate provided with a hinge part, and a recessed cover housing element having a marker-carrying plate provided with a hinge part, said hinge parts being pivotally jointed so that the plates may be positioned in substantially parallel adjacent planes, the housing elements being removably secured to said plates on their non-adjacent faces so that when the plates are in the parallel adjacent planes aforesaid the housing elements form a closed housing.

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