

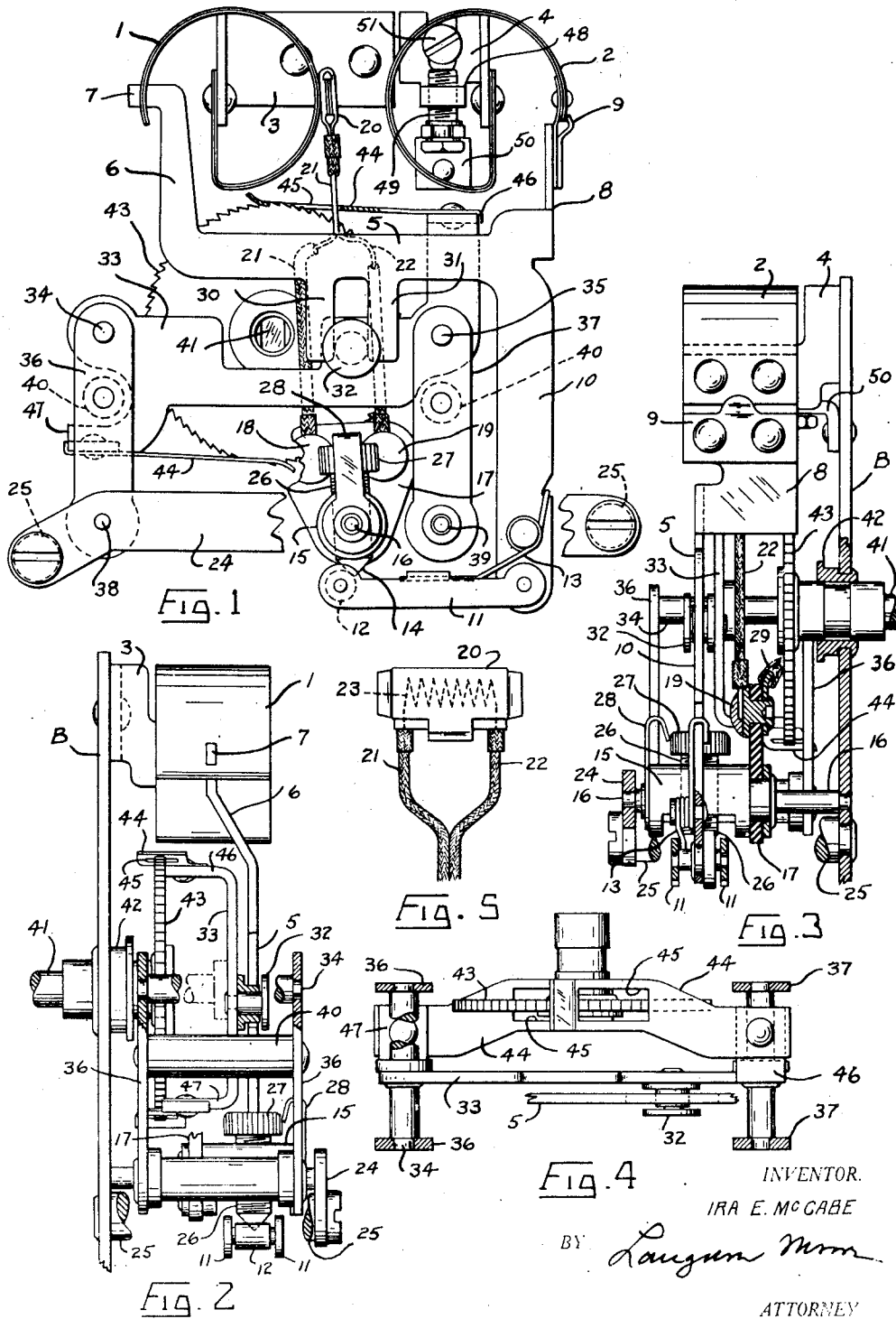
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ELECTRICALLY ACTUATED HEAT MOTOR

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ELECTRICALLY ACTUATED HEAT MOTOR

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5 Claims. (Cl. 172—126)

This invention relates to improvements in electrically operated heat motors, and more particularly to a motor of this type which may be substituted for a self-starting synchronous electric motor.

It is an object of this invention to employ one or more thermal members of bi-metallic metal which will expand and contract in response to the presence or absence of heat to impart movement to a driven member in combination with an electric resistance heater actuated by the movement of the thermal member to reciprocate the electrical heater toward and away from said member. It is a further object of this invention to employ two co-acting thermal members to be alternately subjected to the presence of heat and to transmit the cooling and heating movements of the two thermal elements through a transmission mechanism to the driving shaft of the heat motor.

One of the advantages of such a construction is that by providing two thermal members, the effect of ambient temperature is nullified and does not effect the operation of the heat motor. Another advantage is that a single heating element may be employed to actuate a plurality of thermal members. Another advantage is that the movement of the thermal members in response to the heating element is transmitted to automatically reciprocate a single heating element between the adjacent thermal members which simplifies the construction and eliminates the necessity of providing electrical contacts and switching apparatus, the operation of which would create interference with radio reception.

With these and other objects in view, reference is made to the accompanying sheet of drawings which illustrates a preferred form of this invention, with the understanding that detail changes may be made without departing from the scope thereof.

In the drawing:

Figure 1 is a view in front elevation of a heat motor constructed in accordance with this invention, with parts broken away and detached from the base or supporting plate.

Figure 2 is a view in side elevation of Figure 1 looking upon the lefthand side thereof.

Figure 3 is a view in side elevation of Figure 1 looking upon the right side.

Figure 4 is a top plan view of the driving mechanism with parts broken away and partly in section.

Figure 5 is a fragmentary detail view in elevation of the electrical resistance heating element.

In the embodiment of this invention, as illustrated in Figures 1, 2 and 3, cylindrical sections 1 and 2 of bi-metallic metal are each provided with a re-entrant portion at one end, each of which is mounted upon oppositely disposed angular end portions of brackets 3 and 4, respectively, said brackets mounted upon the upper portion of a base plate B so that the centers of the respective cylindrical sections lie in the same horizontal plane with their respective adjacent peripheries spaced apart from each other. A floating operating link 5 is provided with an upward projection 6 at one end terminating in an angular extension 7 which is passed through a slot provided therefor in the free end of the cylindrical section 1 and the opposite end of the link 5 is provided with an upward projection 8 adapted to be connected by a hinge 9 to the free end of the cylindrical section 2. The two projections 7 and 8 are so connected and arranged as to support the link 5 in a horizontal position. The link 5 is provided with a depending portion 10 extending below the projection 8, the lower extremity of which supports a heater actuator 11 pivoted at one end to the portion 10. The free end of the actuator 11 mounts a roller 12 and is normally urged in an upward direction by the spring 13, one end of which engages the actuator 11 with the other end anchored upon the portion 10 of the link 5. The roller 12 co-acts with an oscillator 14 carried upon an enlarged portion 15 of a shaft 16 mounted in a bearing therefor in the back plate B. An oscillating heater support plate 17 of insulating material is secured to the enlarged portion 15, which plate is provided with terminal posts 18 and 19 upon the upper side thereof. A flat rectangular electric resistance heater 20 with its flat surface positioned parallel to the surfaces of the cylindrical sections 1 and 2 is supported between the adjacent surfaces thereof by electrical conductors 21 and 22 connected to the opposite ends of the resistance wire 23 of the heater 20. The electrical conductors are preferably covered with insulation and their lower respective ends are connected to the terminal posts 18 and 19 upon the insulated heater actuator plate 17.

The outer end of the shaft 16 is mounted in a bearing therefor in a horizontal front plate 24 spaced apart from the base plate B by studs 25 to lie parallel therewith, as shown in Figures 2 and 3, so that the shaft 16 may be oscillated in the said bearings.

The oscillator 14 is preferably in the form of a threaded pin 26 terminating in a conical end

received in the enlarged portion 15 of the shaft 16 to provide for adjustment. The upper end of the pin 26 is provided with a knurled head 27 adapted to be engaged and locked in the adjusted position by the free end of a spring 28 secured to the outer end of the enlarged portion 15 of the shaft 16. The lower conical end of the actuator 14 is adjusted so that the roller 12 of the actuator 11 will normally engage one conical surface thereof and oscillate the shaft 16 and plate 17 to cause the heater 20 to engage the adjacent surface of one of the cylindrical bi-metallic sections of the thermal members. The terminal posts 18 and 19 pass through the plate 17 of insulating material and are connected to a source of electricity by conductors 29. When the current passes from the source through connectors 29, terminal posts 18 and 19, conductors 21 and 22 and resistance wire 23 of the heater 20, and the heater is in the position shown in Figure 1, it will cause the adjacent cylindrical section 1 of the thermal member to reduce in cylindrical form, thus moving the free end downwardly and inwardly, which will cause the floating lever 5 to be rotated about its hinge connection 9 with the other thermal member 2 and thereby cause the heat actuator 11 to move toward the right causing the roller 12 to travel down the conical termination of the oscillator pin 26 to ride over the apex thereof. The tension of the spring 13 as the roller rides over the apex will cause the roller to travel upwardly over the opposite conical side of the pin 26 which will impart a rotation to the shaft 16 causing the heater support plate 17 to oscillate the heater 20 and bring it into contact with the thermal member 2. When the heater 20 contacts the adjacent surface of the thermal member 2, the thermal member 2 will be heated to impart a reverse movement to the floating link 5 to cause the actuator 11 to travel in the opposite direction over the conical surface and apex of the oscillator 14 to impart a reverse oscillation to the heater 20. With the alternate heating of the thermal members one member when heated will be assisted by the other member while cooling whereby the combined moving force of both elements is applied to the floating lever 5 in moving it and an oscillating movement will be imparted to the heater 20 through the reciprocal movement of the floating link 5 as long as the resistance element 23 of the heater 20 is energized.

The floating link 5 is provided with two spaced apart depending similar operating members 30 and 31 adapted to receive in sliding engagement between them a stud 32 carried upon a reciprocating cradle 33. The opposite ends of the cradle 33 are pivotally mounted upon shafts 34 and 35, each of which shafts are supported by a pair of links 36 and 37, the lower ends of which are pivotally mounted upon studs 38 and 39, mounted between the base plate B and front plate 24; each pair of links being connected intermediate their length by spacing members 40. By this construction, when the oscillating heater causes the thermal members 1 and 2 to impart an oscillating movement to the floating link 5, this movement through the operating members 30 and 31 will transmit a reciprocating movement to the cradle 33.

A shaft 41 is received within a hub, mounted upon a ratchet wheel 43 in any desired manner to be rotatable therewith. The ratchet wheel 43 is located between the base plate B and cradle

33 with the hub passing through a bearing 42 provided therefor in the base plate. The reciprocating movement of the cradle 33 is transmitted to the ratchet wheel 43 to impart a rotation to the shaft 41 by pawls 44 in the form of flat springs each having slots 45 adjacent their free end adapted to cause the body of the spring adjacent the free end to form a pawl to engage the ratchet teeth of the ratchet wheel 43 on opposite sides of the shaft 41. The end of the upper spring pawl 44 opposite the slot 45 is secured to the upper end of a portion 46 of the cradle 33 extending upwardly therefrom above the pivot 35 and the corresponding portion of the lower spring pawl 44 is secured to a portion 47 of the cradle 33 depending below the pivot 34 and cut out to provide clearance for the spacer 40.

By this arrangement, the pawls 44 are always in engagement with the teeth of the ratchet wheel 43. Movement of the cradle to the right imparts a clockwise rotation to the ratchet wheel by the upper pawl 44 while movement of the cradle 33 to the left continues the clockwise rotation of the ratchet wheel by the movement of the lower pawl 44. While one pawl imparts movement to the ratchet wheel the other pawl travels over the ratchet teeth.

By providing the ratchet wheel 43 with fine teeth and synchronizing the movement of the elements 1 and 2, a continuous or substantially continuous rotation may be imparted to the shaft 41. In order to synchronize the movements of the free ends of the elements 1 and 2, it is preferable to provide an adjustment for one of the elements. As shown in Figure 1, the bracket 4 is made adjustable so that the thermal element 2 may be adjusted in a vertical direction. The bracket 4 is provided with a right angular extension 48 which receives an adjusting screw 49 mounted in a bracket 50 secured to the base plate B. The bracket 4 is also provided with a vertical slot through which a clamp screw 51 passes and by means of which the bracket may be secured in position after adjustment. Should the movement of the two thermal elements differ slightly when heated, the element 2 may be raised or lowered to adjust the relationship of the heater actuator roller 12 to the oscillator 14 for each element. Therefore, the heating effect of the heater on each element may be timed to cause each element, when heated, to apply the same degree of rotation to the ratchet wheel 43 and since the oscillator 14 is adjustable the heating periods may be determined to regulate the number of degree rotation which may be imparted by the thermal members for each cycle of operation thus providing a certain desired rotation of the wheel 43 over a desired period of time.

While this application of the heat or electro-thermal motor is described in connection with the timing mechanism disclosed in said Patent No. 2,139,454 as applied to an electrically operated and controlled stoker mechanism, it is obvious that the heat motor may be similarly operated by remote control devices other than a room thermostat and the opening and closing of the motor switch may be employed to control the operation of a motor for purposes other than the operation of a coal stoker mechanism.

What I claim is:

1. An electro-thermal motor including two spaced apart coils of thermal metal each having one end thereof fixed and arranged with the free ends thereof on opposite sides of and in substan-

tial alignment with the fixed ends, a movable electric heater arranged between the coils mounted to heat alternately the respective coils, a floating transmission link, means connecting the floating link to the free ends of the coils to cause the said ends to act in unison in reciprocating the link as one coil is heating and the other is cooling, means to reciprocate the electrical heater between the coils, and means carried by the floating link to actuate the heater reciprocating means at each reciprocation of the floating link.

2. The structure of claim 1 including a motor shaft, and means interposed between the floating link and shaft to impart a rotative movement thereto upon reciprocation of the link.

3. The structure of claim 1 wherein the means to reciprocate the electrical heater includes means for adjusting the operative relationship between the reciprocating means and actuating means therefore carried by the floating link, to control the duration of the periods for applying heat to said coils.

4. The structure of claim 1 wherein the means to reciprocate the electrical heater includes a

support for said heater mounted for oscillation and provided with an adjustable heater oscillator, and said floating link mounting a heater actuator coacting therewith to control the periods during which heat is applied to said coils.

5. The structure of claim 1 including a motor shaft and means interposed between the floating link and shaft to impart rotative movement thereto upon reciprocation of the link, said means comprising a ratchet wheel secured to the shaft with oppositely disposed pawls arranged to reciprocate in unison thereover, a reciprocating cradle mounting said pawls, and a sliding operating connection between the cradle and floating link to reciprocate said cradle, whereby the oscillation of the cradle in one direction causes one of the pawls to impart a rotation to the ratchet wheel while the other pawls travels over the teeth thereof and upon reverse movement the second pawl imparts a continuation of the rotative movement to the other ratchet wheel while the first pawl travels over the teeth thereof.

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