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ELECTRIC RESISTANCE ELEMENT MACHINE

Filed June 21, 1924

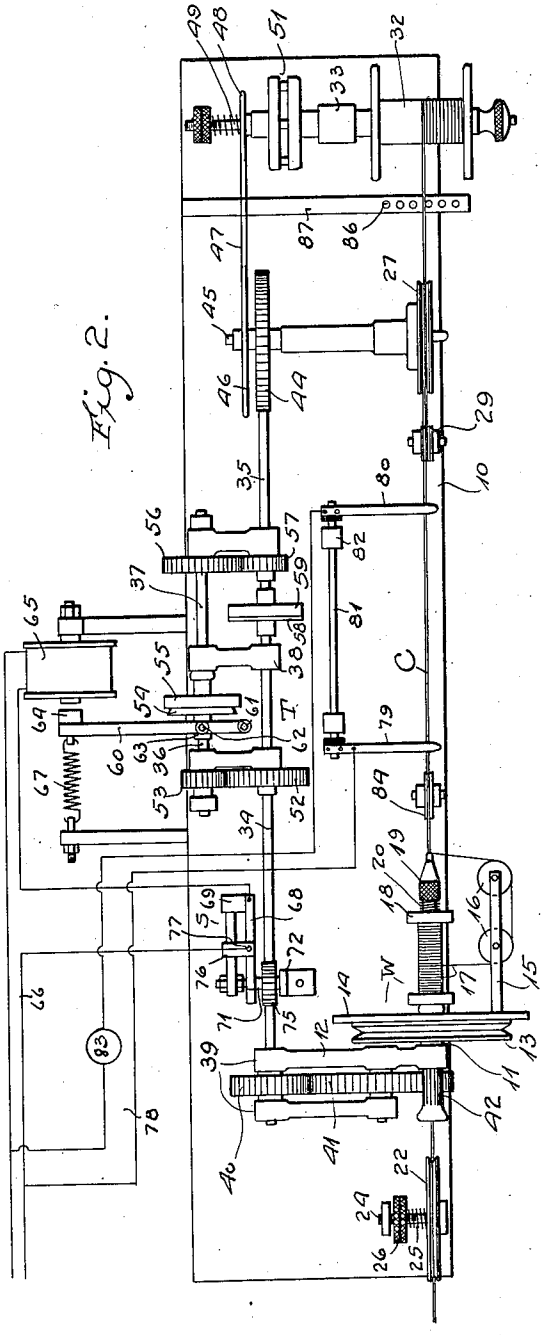


Fig. 2.

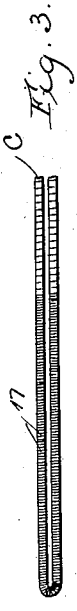


Fig. 3.

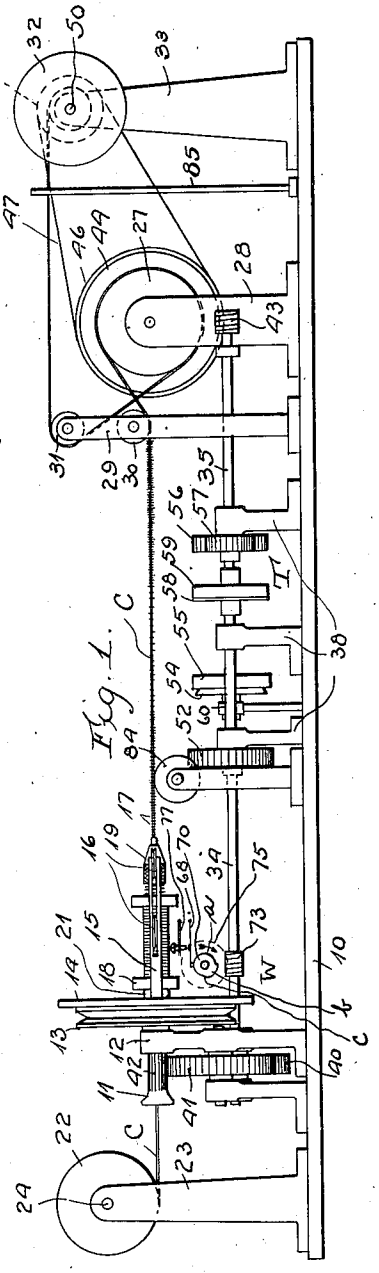


Fig. 1.

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UNITED STATES PATENT OFFICE.

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ELECTRIC-RESISTANCE-ELEMENT MACHINE.

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My invention relates to electric resistance element machines for automatically making the resistance elements for curling irons or other electric heat devices in which the element comprises resistance wire wound around a flexible core of insulating material such as asbestos cord. The resistance wire of such elements must have a certain resistance in order to restrict the current flow to a desired value under a certain electrical pressure. It is sometimes desirable to provide for greater heating by the element at certain localities, and less at others. For example, in curling irons, where the element extends through a tubular curling rod, it may be desirable to have the element produce more heat along the outer section, and less along the inner section and where the element enters the handle of the rod for connection with circuit connection members.

Control of the heat generation by the element along any section thereof can be readily accomplished by winding the wire on the core with its turns closer together or farther apart depending upon the apportionment of the heat desired. Thus, in the case of the curling iron, the turns would be close together along the outer section so that the outer section of the rod would receive most of the heat generated by the element, while along the inner end the turns would be less frequent and in some cases would act principally to conduct the supply current from the connection members to the concentrated winding section.

The object of my invention is to produce a simple, rapidly operating, and efficient machine for winding resistance wire on a traveling endless core of insulating material and for automatically controlling the relative speeds of travel of the core and wire winding apparatus at predetermined periods so that the core will receive alternately stretches of close winding and stretches of more open winding, and so that the wound core, after receiving a winding of insulating material, may then be cut into lengths each of which will be a resistance element with close and open winding sections for apportioning the heat as desired when the element is assembled in the device it is intended to heat.

The various features of my invention are incorporated in the machine shown on the accompanying drawing on which—

Figure 1 is a side elevational view,

Figure 2 is a plan view,

Figure 3 shows a resistance element for a curling iron.

The various machine parts are mounted on a base 10. At one end is the winding mechanism W which has the hollow spindle 11 journaled in the bearing frame 12 and rotated by means of the pulley 13 connected by belt with a suitable driving motor (not shown). On the spindle is secured the disk 14 from which extends the arm 15 on which are pivoted guide sheaves 16 for the resistance wire 17. This wire is drawn from the supply spool 18 which is held on the spindle between the disk and the nozzle 19 which detachably receives the spindle end. The spool may rotate on the spindle but it is braked by means of the spring 20 and the friction washer 21, the spring being inserted between the spool end and the nozzle.

Through the hollow spindle travels the core C which may be in the form of asbestos cord or strands. The core is fed from a suitable supply reel (not shown) and before entering the spindle it engages around the tension wheel 22 pivoted on the standard 23 on the stubshaft 24. A brake spring 25 between the tension wheel and the nut 26 on the shaft provides for adjustably fixing the retardation of the tension wheel and the tension on the cord. At the other end of the base 10 is journaled the propulsion pulley 27 on bearing standard 28. In front of the pulley is the rack 29 journaling the guide sheaves 30 and 31, the wound core traveling below the sheave 30, then around the propulsion pulley, and then around the sheave 31 to the takeup reel 32 mounted on the standard 33.

Interposed between the winding mechanism and the propulsion mechanism is the transmission mechanism designated as a whole T. This transmission mechanism has the two main co-axial shaft sections 34 and 35 and the two countershaft sections 36 and 37, the shaft sections being journaled in the various bearing frames 38, the outer end of the shaft section 34 being journaled in the bearing framework 39, and the outer end of

the shaft section 35 being journaled on the standard 28. At its outer end the shaft section 34 has the gear 40 mounted thereon which meshes with the intermediate gear 41 which is engaged by the pinion teeth 42 on the spindle 11 of the winding mechanism. The outer end of the shaft section 35 terminates in a worm 43 which meshes with the worm-wheel 44 secured on the shaft 45 which also carries the propulsion pulley 27. On the shaft 45 is also the sprocket wheel 46 connected by chains 47 with the sprocket pinion 48 on the shaft 49. Interposed between this shaft 49 and the shaft 50 on which is mounted the takeup reel is the slip-friction clutch mechanism 51, such clutch mechanism being well known in the art.

The shaft section 34 carries a gear 52 which meshes with the pinion 53 on the countershaft section 36. Interposed between the inner ends of the countershaft sections is cone clutch mechanism comprising the cone part 54 on the shaft section 36 and the socket part 55 on the shaft section 37. The outer end of the countershaft section 37 carries the gear 56 which meshes with the gear 57 at the inner end of the main shaft section 35. Between the inner ends of the main shaft section is interposed the automatic clutch mechanism comprising the members 58 and 59 frictionally connected together. When the cone clutch is released rotation is transmitted directly from the main shaft section 34 to the section 35 through the automatic clutch 58—59, and the speed will be comparatively slow. When the cone clutch members are coupled together the transmission between the main shaft sections will be from the gear 52 through the gears 53 and 56 on the countershaft, and through the gear 57 on section 35, and as the gears 53 and 57 are smaller than the gears 52 and 56 the speed will be correspondingly increased, the propulsion pulley 27 being thus rotatable at slow or increased speed to correspondingly draw the cord C through the spindle. When the machine is started the end of the resistance wire from the spool 18 is secured to the core and then as the spindle rapidly rotates and the arm 15 with the sheaves 16 is carried around the spindle, the resistance wire is guided from the spool around the sheave and wound transversely around the core. In the arrangement shown the spindle and the shaft section 34 will always have the same relative speed, but the speed of the shaft section 35 may be changed by means of the transmission mechanism. With this arrangement, when the core travels slowly through the field of the winding mechanism the turns of resistance wire will be closer together, and when the speed of travel of the core is increased the turns will correspondingly be farther apart, the core being thus alternately wound with the turns close together and comparatively widely separated depending upon the heat proportionment desired. In Figure 3 I show one of the resistance element units which has been bent at the middle point of the closely wound section to form a loop-shaped resistance element to be inserted in the tubular curling rod of a curling iron.

I provide means for automatically controlling the transmission mechanism and thereby the slow and fast travel periods of the insulation core for the resistance element. Such means may be mechanical, but I have shown electrical means. The clutch lever 60 is pivoted at 61 and at 62 engages in the clutch collar 63 slidable on the countershaft section 36 and connected with the clutch cone member 54. The outer end of the clutch lever carries an armature 64 opposed to which is supported the electro-magnet 65 which is supplied by the electrical circuit 66. A spring 67 tends to keep the clutch lever swung away from the electro-magnet and with the clutch cone member 54 withdrawn from the clutch socket member 55 so that normally the transmission to the propulsion pulley 27 is directly through the main shaft sections 34 and 35. Upon energization of the electro-magnet the clutch lever is swung inwardly and the cone clutch structure is actuated to connect in the countershafting and speed-increasing gearing trains so that the propulsion pulley will be rotated faster. Under such increased speed the automatic clutch mechanism 58 and 59 will release the driving connection between the main shaft members 34 and 35 in a well-known manner so that transmission through the countershaft will not be interfered with.

For controlling the electrical circuit of the electromagnet, I provide the switch S whose contact spring 68 is shown secured at one end to the supporting frame 69 and whose other end is associated with the cam 70 on the cam shaft 71 which is journaled in the framework 72. The cam shaft carries a worm wheel 73 engaged by the worm 75 on the main shaft section 34. Above the spring 68 is the supporting bracket 76 for the adjustable contact 77, the switch structure being connected serially in the electrical circuit 66. The spring end is normally in engagement with the cylindrical surface *a* of the cam and disconnected from contact 77 so that the electro-magnet is deenergized and the spring 67 permitted to swing the clutch lever to unclutch the members 54 and 55. The cam has the cam ridge *b* of increased radius which when engaging with the contact spring 68 will raise the spring into engagement with the contact 77 to close the electro-magnet circuit which results in engagement of the clutch members 54 and 55 and connection of the countershaft trans-

mission train to increase speed of rotation of the propulsion pulley 27. Thus the duration of opening or closure of the electromagnet circuit by the cam member determines the extent of the closely wound and less closely wound sections of wire on the core C.

It is very important that the total resistance of the wire of a resistance element, as for example that shown in Figure 3, be kept as closely as possible to the predetermined value which will insure proper and safe current flow through the element under the electrical pressure of the circuit with which it is to be connected. Stretches of the core C may vary slightly in its dimensions, which might increase or decrease the length of the wire turns thereon. I make provision for readily and accurately compensating for such variations. The approach *c* to the cam ridge *b* is made gradual, so that the spring 68 is gradually raised toward its contact 77. This contact 77, as before stated, is adjustable and such adjustment can readily be accomplished by making the contact in the form of a screw threading in the bracket 76 so that the contact is vertically adjustable toward or away from the spring 68. The distance between the spring and its contact is always less than the radial length of the cam ridge *b*, but by adjusting the contact 77 the engagement of the spring with the contact will either be advanced or delayed, which means that the higher speed travel of the propulsion pulley and consequently the core C will become effective either earlier or later. While the contact spring engages with the circular section *a* of the cam the core will be propelled slowly during which time the windings are close together thereon. The cam incline *c* will then reach the contact spring and raise it and if the contact 77 has been adjusted downwardly closure of the electro-magnet circuit will be advanced, and the resulting advanced connection of the transmission train through the countershaft will result in more turns on the core and decrease in the number of close turns. On the other hand if the contact 77 was adjusted upwardly and actuation of the transmission mechanism delayed there would be more close together turns and less separated turns. The resistance per unit length of wire on the core C can thus be nicely adjusted for, each unit length comprising a stretch of close together turns and a stretch of more widely separated turns.

To enable the operator of the machine to check up on the resistance, I provide a test circuit 78 whose ends terminate in contact fingers 79 and 80. These fingers are insulated from each other and mounted on the ends of the shaft 81 journaled in the bearing structure 82. In the circuit I include an ammeter 83. The operator determines what the resistance of an element unit should be in order that it may function properly when connected in service and by knowing the pressure of the circuit 78 and by consulting the ammeter 83 he can readily check up on the resistance, the fingers 79 and 80 being swung down against the cord and the wire thereon when a test is to be made. By adjusting the contact screw 77 conpensation can then be quickly and readily made to increase or decrease the number of close turns to thereby correct for any resistance variation. In order to prevent disturbance of the core during a test a supporting sheave 84 may be provided for the core adjacent the end of the spindle 11.

A guide rod 85 adjustably mounted in holes 86 of the plate 87 serves to guide the wound core from the propulsion pulley 27 to the take-up reel 32. The filled take-up reels are then transferred to another machine to have an insulating winding or covering applied to the core to cover the resistance wire thereon. After such covering the core is cut at proper intervals to produce the resistance element units. For a unit such as that shown in Figure 3, cutting occurs at the middle of the spaced-apart turn sections. These units are then bent at the middle of the closely wound sections to form the resistance element loop shown in Figure 3 which would then be used for insertion into the tubular rod of a curling iron or similar device, the closely wound turn section then causing a concentration of the generated heat along the corresponding section of the curling iron or other device to be heated.

I thus produce a simple and efficient machine for automatically rapidly and accurately applying turns of resistance wire to a traveling core in proper apportionments to produce the desired resistance. I do not desire to be limited to the exact construction, arrangement and operation shown and described as modifications can be made which will still come within the scope of the invention.

I claim:

1. In a machine of the class described, the combination of rotary winding mechanism, propulsion means for propelling a continuous core of insulating material through the field of said winding mechanism, said winding mechanism traveling at a uniform rate, a driving source, a high speed transmission train and a low speed transmission train between said source and said propulsion mechanism, electro-magnetic clutch mechanism for controlling the connections of said trains for service, an electrical circuit for said electro-magnetic mechanism, and cam mechanism for controlling said electrical circuit to cause operation of said electro-magnetic clutch mech-

anism to alternately connect said trains for service, whereby said core will be alternately wound with close turns and open turns.

2. In a machine of the class described, the combination of a rotary winding mechanism, propulsion means for propelling an object to be wound through the field of said winding mechanism, a driving source, a slow speed transmission train normally connected between said source and said propulsion mechanism, a high speed transmission train, electro-magnetic means for alternately substituting said high speed transmission train for said slow speed transmission train whereby the propulsion travel of said object will be accelerated and said object will receive more open winding, an electrical circuit for said electromagnetic clutch mechanism, contacts for said circuit, and a cam driven from said source for cooperating with said contacts to control said circuit to cause alternate operation of said clutch mechanism.

In witness whereof, I hereunto subscribe my name this 29th day of May A. D., 1924.

OTTO A. LANGOS.