

Sept. 29, 1931.

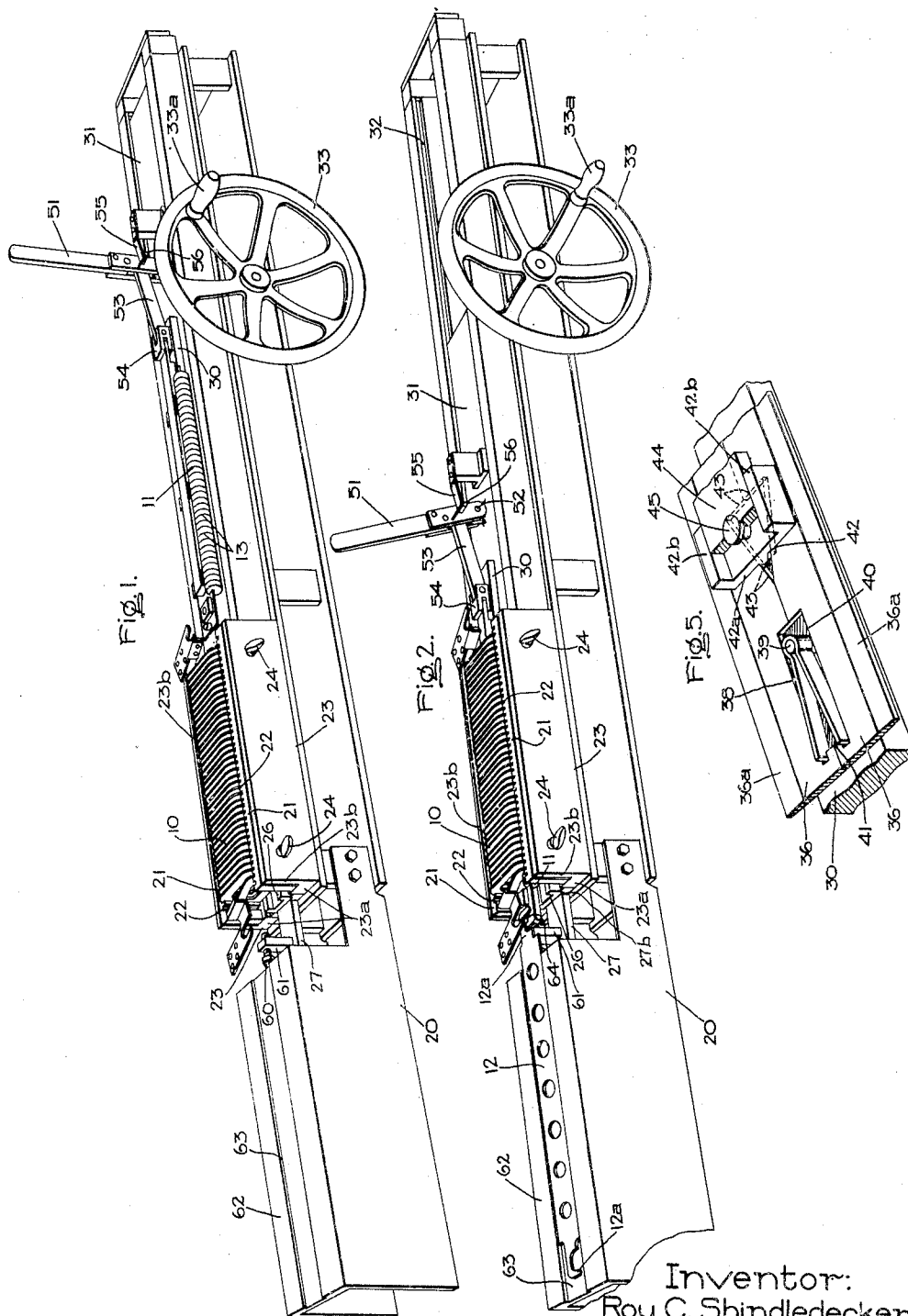
R. C. SHINDLEDECKER

1,825,481

METHOD OF AND MEANS FOR ASSEMBLING RESISTANCE UNITS

Filed Oct. 23, 1929

2 Sheets-Sheet 1



Inventor:
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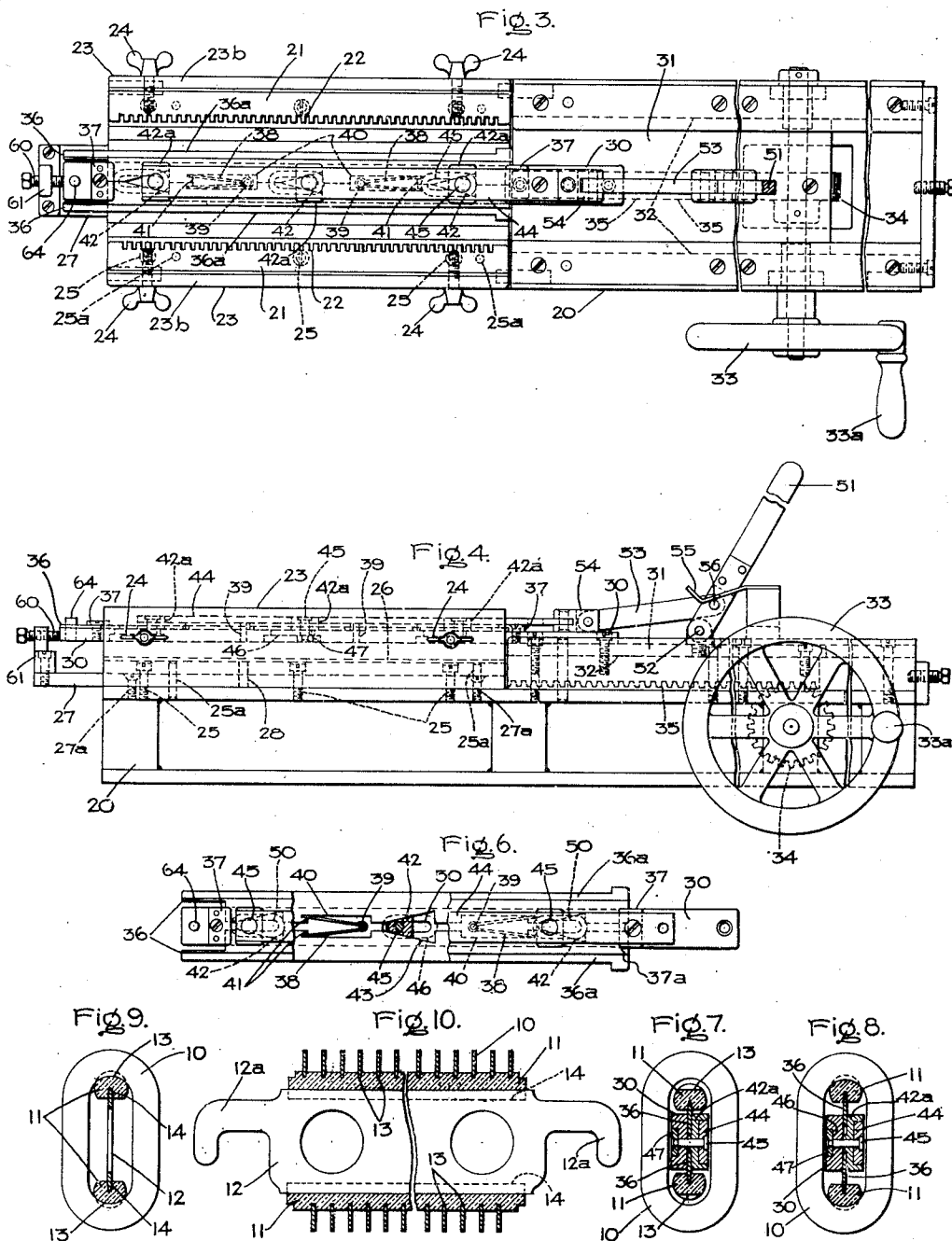
R. C. SHINDLEDECKER

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METHOD OF AND MEANS FOR ASSEMBLING RESISTANCE UNITS

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2 Sheets-Sheet 2



Inventor:
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UNITED STATES PATENT OFFICE

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METHOD OF AND MEANS FOR ASSEMBLING RESISTANCE UNITS

Application filed October 23, 1929. Serial No. 401,934.

My invention relates to the assembly of resistance units and the like and has for its object the provision of an improved method of and means for assembling a resistance unit.

My invention is directed especially to the assembly of resistance units of the edge-wound type, one common form of which comprises a ribbon or strip-like resistance element, wound edgewise into coil form, and supported upon a pair of spaced electrical insulators, these insulators being spaced and supported by means of a plate-like metallic member positioned between them. Usually each insulator is provided with notches or grooves for receiving the turns of the coil, and with a longitudinal recess for receiving an edge of the plate-like resistor support.

My invention in one of its aspects contemplates the provision of an improved method of and means for assembling a resistance unit of the above described character whereby the unit may be quickly and readily assembled with a minimum of labor and skill on the part of the operator.

In carrying my invention into effect in one form thereof, I secure the wound coil with its turns in the desired spaced relation and then insert the insulators within the coil to a position substantially coextensive with the coil and in which position the grooves, provided in the insulators, are aligned with their companionate turns of the coil. After the insulators are thus positioned, I move them outwardly to their assembled positions so that the turns of the coil are received in their respective retaining grooves. With the insulators secured in this position, I insert the plate-like resistor support in the coil so that its edges are received in the longitudinal grooves provided in the insulators. The insulators are thus locked in their respective assembled positions and are interlocked with the supporting plate.

In one form of apparatus for carrying out this method I provide suitable means for supporting the coil and for retaining its turns properly spaced. I further provide means for movably supporting the insulators so that they may be inserted longitudinally in the

coil to a position coextensive with the coil. In order to carry the insulators into their respective assembled positions with respect to the coil after they have been moved to coextend with the coil, I provide suitable means for separating the assembling insulator supports.

Means are also provided for supporting the plate-like resistor support so that the plate will be held in position to be received by the longitudinal grooves in the insulators when it is drawn into the coil. I prefer to mechanically connect the plate-like support with the insulator assembling supports so that when the latter are withdrawn from the insulators, the plate-like support will be inserted concurrently. By this arrangement the insulators will be held in their assembled positions by the insulator assembling supports while the resistor support is being inserted.

For a more complete understanding of my invention reference should be had to the accompanying drawings in which Fig. 1 is a perspective view of a resistance unit assembling machine embodying my invention and illustrating the elements of the machine in position for one step of the assembling operation; Fig. 2 is a view similar to Fig. 1 but illustrating the elements of the machine in position for another step of the assembling operation; Fig. 3 is a broken plan of the assembling machine of Fig. 1; Fig. 4 is a broken elevation of the assembling machine; Fig. 5 is a perspective view of a portion of the assembling machine illustrating certain structural details; Fig. 6 is a plan of a portion of the assembling machine illustrating certain structural details; Fig. 7 is an end view of the coiled resistance element together with the insulators and their assembling supports illustrating the positions the insulators occupy with respect to the resistance element when they have been inserted to coextend with the resistance coil; Fig. 8 is a view similar to Fig. 7 but illustrating the positions the insulators occupy after they have been separated and moved to their respective assembled positions; Fig. 9 is a view similar to Fig. 8 but with the assembling insulator sup-

ports withdrawn and the plate-like resistor support inserted and positioned between the insulators to complete the resistance unit; and Fig. 10 is a side elevation in section of the completed resistance unit of Fig. 9.

Referring to the drawings, I have shown my invention in one form in connection with an assembling machine for a resistance unit which in finished form comprises a ribbon or strip-like resistance element 10 wound edge-wise into substantially elliptical form and mounted on a pair of heat refractory electrical insulators 11. It will be understood that the edge-wound resistance element may be wound into any suitable form. Thus, for instance a coil circular in cross-section may be formed. However, the elliptical form is preferable in that the elliptical shaped unit conserves space and permits the use of a greater active portion of the resistance element.

The insulators 11, which preferably will be received in the ends of the ellipse on its major axis, are mounted upon a plate-like resistor support 12 positioned between the insulators so as to maintain them in assembled positions with respect to the coiled resistance element. Each insulator is provided in its outer surface with a plurality of grooves 13 suitably spaced to receive and to retain the turns of the resistance coil, and in its inner surface with a longitudinal groove 14 which serves to receive an edge of the plate-like support. It will be understood that the supporting plate 12 serves to force the insulators against the resiliency of the resistance element so that the assembled unit has considerable rigidity. Thus, when assembled the insulators will be interlocked securely both with the resistance element and the resistor support, the whole being a rigid, strong and compact assembly, one that will withstand extreme vibration and exposure to the elements, requisites of many of the industrial services such as mine and industrial haulage locomotive operations.

It will be understood that the completed units in service will be mounted on suitable frames comprising steel supporting rods. The supporting plate 12 is provided at its ends with arms or hooks 12a which in the assembled unit are fitted over the rods so as to support the unit with its major axis substantially vertical.

As has been pointed out, in accordance with my method of assembly, I first secure the finished resistance coil 10 with its turns properly spaced and then insert the insulators 11 longitudinally within the coil with their outer surfaces facing the opposite inner end surfaces of the turns of the coil (Fig. 7). The insulators will be positioned coextensively with the coil so that each groove 13 will be in alignment with its companionate turn. It will be observed that by so positioning the

insulators it is but necessary to separate them, i. e., move them in opposite directions transversely of the coil, to bring them into their assembled positions with respect to the coil, in which position the turns will be received by their respective grooves 13 (Fig. 8). Thus, as has been pointed out the next step of my method is to separate and move the insulators into their assembled positions. Then while maintaining the insulators in these positions, I insert the plate-like resistor support 12 within the coil so that its opposite edges will be received by the respective longitudinal grooves 14 provided in the insulators, (Figs. 9 and 10).

Referring to Figs. 1 to 8 inclusive, I have shown one form of apparatus for carrying out conveniently the above described method of assembling. Briefly, this apparatus comprises means for supporting the preformed coil with its turns properly spaced, means for inserting and separating the insulators and means for inserting and guiding the plate-like support into assembled position with respect to the separated insulators.

As shown, the machine comprises a framework supporting structure 20 between the ends of which is supported the coil supporting and turn spacing means. This means comprises a pair of separated spacer blocks 21. These blocks are positioned longitudinally upon the frame in substantially parallel relation with each other and are spaced sufficiently to receive the coil between them. Preferably these blocks will be spaced so that they will receive the major axis of the coil. Each spacer block is provided with a series of spaced notches or recesses 22 which serve to receive and space the various turns of the coiled element. It will be observed by reference to Figs. 1 and 2 that when the resistance coil is positioned between these blocks, it will be secured with its longitudinal axis midway of the spacer blocks and substantially coincident with the longitudinal axis of the machine frame.

Each spacer block is provided with suitable means for securing it to the frame. As shown (Figs. 1 to 4), each block is adjustably secured to a right angle member 23 with its bottom surface resting upon the leg portion 23a of the member and with its side adjacent the leg portion 23b and secured thereto by any suitable means such as screw fastening means 24. It will be observed that by reason of this construction the spacer blocks may be adjusted towards or away from each other to accommodate coils of different sizes. Moreover, it will be observed that the blocks may be removed readily and other blocks providing for a different turn spacing be readily substituted. The angle members 23 are secured to the frame 20 by any suitable means such as the screw fastening means 25 and the dowels 25a.

The coil when positioned between the spacer blocks is supported upon a suitable channel-like member 26, the upright portions of which serve to engage and support the coil in proper position with respect to the remaining elements of the mechanism. This channel member is removably secured to a plate member 27 which in turn is secured by any suitable means such as the screw fastening means 27a to the frame of the machine. Preferably, the channel member will be secured to its plate 27 by a suitable dowel 28 so that the channel member may be removed readily and another plate providing for a different vertical position of the coil be substituted therefor. It will be observed therefore that a coil having any size, within limits, may be properly positioned within the machine by substituting the appropriate channel member and by properly adjusting the position of the spacer blocks. The lower surface of the channel member preferably will rest in a recess 27b provided in the plate 27 and shaped so that the channel member when assembled with the plate will assume automatically its proper position with respect to the spacer blocks and the machine.

The means for inserting and separating the insulators 11 comprises a plate-like member 30 which is secured at one end to a slide member 31 in cantilever fashion (Fig. 4). In other words the slide functions to movably support the member 30 so that it may be projected into or withdrawn from the coil positioned between the spacer blocks 21, by giving the slide the proper motion. The slide 31 has a substantially T cross section, the end portions of the cross arm being received in longitudinal recesses or guides 32 provided on opposite sides of the frame 20 and extending longitudinally of the frame in parallel relation with each other and with the longitudinal axis of the frame. Thus, the guides 32 serve to reciprocally mount the slide 31 so that it may be moved longitudinally with respect to the frame 20 and consequently with respect to the resistance coil secured between the spacers 21. A suitable hand wheel 33 is provided to operate the slide 31, the hand wheel being provided with a suitable handle 33a. The hand wheel is mechanically connected to the slide member 31 by means of a gear and rack arrangement which comprises a gear 34 mounted on and secured against rotation on the hand wheel shaft and a rack 35 with which the gear 34 meshes formed on the lower surface of the upright portion of the T section. Thus, it is simply necessary to rotate the hand wheel in one direction or the other to move the plate 30 within or withdraw it from the resistance element coil.

Mounted upon the plate 30 are a pair of assembling supports 36 for the insulators 11 (Figs. 5 and 6). Each support is provided

with an edge 36a which is shaped to receive the longitudinal groove of its insulator. In other words each edge 36a will be given a shape substantially similar to the shape of the corresponding edge of the plate-like resistor support 12. The members 36 are mounted upon the plate 30 so that their edges 36a are substantially parallel with each other and the longitudinal axis of the machine and that of the resistance coil positioned between the blocks 21. Consequently, the insulators when positioned upon their assembling supports 36 will be secured in parallel relation with each other and to the longitudinal axis of the machine and that of the positioned resistance coil. Thus, the insulators after they have been positioned upon their supports 36 may be moved longitudinally within the coil simply by giving the hand wheel 33 the appropriate rotation.

In order that the insulators 11 may be moved outwardly into assembled position with the coil after they have been positioned within the coil as shown in Fig. 7, the plates 36 are mounted upon the plate 30 so that they may be moved transversely with respect to the plate, that is, so that they may be separated. As shown (Figs. 3, 4, and 6), these plates are mounted upon the plate 30 between the stop members 37 which are secured on opposite ends of the plate. It will be observed that each stop member has a portion 37a which projects over the adjacent ends of the plates 36. This construction serves to secure the plates. These plates are normally biased together as shown in Figs. 5 and 6 by means of hairpin shaped spring members 38 which are secured to the plate 30 by means of pins 39 and are positioned between the plates 36 in suitable recesses 40 provided in the plates. As shown, each recess 40 is provided at one end with an abutment 41 which serves to receive the free end of that portion of the spring which lies within the recess. It will be understood that the leg portions of each spring if free would align themselves, but in the assembled machine they are forced apart by the abutments 41 which will be sufficiently spaced so that the springs will exert a relatively large force on the members 36 to retain them together. It will be observed that the plates 36 are retained horizontally by means of the springs 38.

In order to separate the plates 36 against their spring bias, I provide suitable wedge or cam-like members 42 which are positioned between the plates 36 and are received in recesses 43 provided in the plates. Each of these recesses is of angular form and when the plates are together as shown in Figs. 3 and 5 the recesses taken together form an equilateral triangle between opposite sides of which the wedge-like member is positioned. It will be observed that when the

wedge-like member is moved toward the left, as viewed in Figs. 5 and 6, it will be co-operate with the opposite sides of the triangle and consequently move the plates apart. A number of these wedge-like members 42 will be provided along the longitudinal axis of the plates so that the plates will be moved apart with their edges 36a always in substantially parallel relation. As shown, I have provided three of these wedge-like members.

Each wedge 42 is carried upon the bottom surface of a channel member 43, the upright portions 43a of which serve to receive an operating plate 44. This plate has a length sufficient to secure all of the channel members provided with the wedges. Each channel member and consequently each wedge is secured to the plate 44 by means of a suitable pin 45. This pin as shown in Figs. 6, 7 and 8 extends from the upper surface of the plate 44 through the channel member and its wedge, through the plate 30 and projects into a recess 46 (Fig. 6) provided in the bottom of the plate. The lower end of the pin 45 is provided with a washer 47 which has a width substantially equal to that of the recess 46 and the upper end of the pin is provided with a head which rests in a counter-bore provided in the plate 44. It will be observed (Fig. 6) that the plate 30 is provided with elongated apertures 50 leading into the recesses 46 so as to permit the pins and consequently the channel members and their associated wedges and operating mechanism to move longitudinally with respect to the plates 36. Moreover, it will be observed that by reason of the above described construction a very rigid operating mechanism for the spreader or assembling supporting plates 36 is provided.

A suitable lever mechanism is provided for operating the plate 44. This mechanism comprises a manually operable lever 51 pivoted to the slide 31 by means of a suitable pin 52. This lever is mechanically connected with the plate 44 by means of a link 53 which is mechanically connected at one end to the lever and at its opposite end to a cross head-like member 54 which rides upon the plate 30 and is mechanically connected with the plate 44. It will be observed that by reason of this construction it is merely necessary to move the lever in a counterclockwise direction as viewed in the figures in order to separate the plates against their spring bias, and to move the lever in the opposite direction in order to withdraw the wedges and thus, permit the plates to move together under the influence of their spring bias. Preferably, suitable means will be provided to lock the lever in its wedge retracted position. As shown a spring 55 cooperating with a pin 56 on the lever is provided for this purpose.

It will be understood with the construction thus far described in mind that the plates 36 serve to receive the insulators 11, as shown in Fig. 1, and that with the operating lever 51 at its extreme right hand position, i. e., in a position in which the wedges are withdrawn, the plates 36 will be held together by means of their biasing springs 38. In order to insert the insulators longitudinally within the coil it is but necessary to turn the hand wheel 33 in a counterclockwise direction. This operation causes the slide 31, and consequently the assembling supports with the insulators mounted thereon, to move toward the left thereby projecting the supports and insulators into the coil. It will be understood that the plates 36 will be moved into the coil to a position in which the insulators 11 will be coextensive with the coil and the grooves in their outer surfaces will be in alignment with their companionate turns. In order to thus align the insulators, I provide a suitable stop member 60 for the plate 30. This stop is shown in the form of an adjustable screw mounted in a standard 61. This standard in turn is secured to the plate 27. It will be understood that the stop 60 provides a very fine adjustment for limiting the position of the plate 30 and consequently of the assembling supports 36 and the insulators 11 mounted thereon.

After the insulators have been brought into a position to coextend with the coil, it is but necessary to move the hand lever in a counterclockwise direction in order to separate the assembling supports 36 so as to carry the insulators into their respective assembled positions with respect to the coil. As long as the lever 51 remains in its left hand position the wedges will serve to secure the assembling supports and the insulators in their respective separated positions. Thus, the insulators will be maintained in their assembled positions as long as the lever 51 remains in its left hand position.

The assembly is then prepared for the insertion of the resistor plate-like support 12. In order to introduce the plate 12 so that its opposite edge will be received by the grooves in the respective spaced insulators, I provide suitable means for supporting the plate and guiding it into position. As shown (Figs. 1 and 2), I provide a suitable supporting and guiding block 62 for the spacer 12. This block is provided in its upper surface with a longitudinal recess 63 which serves to receive the spacer 12 and which is positioned with respect to the secured coil and the spread insulators so that the support 12 when inserted will be received by the longitudinal grooves provided in the insulators.

It will be understood that the support 12 will be inserted while the assembling supports 36 are being withdrawn so that the insulators 11 will never be free during the as-

sembling operation to move together, that is, to move away from the resistance coil. I prefer to introduce the supporting plate 12 concurrently with the withdrawal of the plates 36 by mechanically connecting the plate 12 with the plate 30 provided to support the plates 36. As shown, the plate 30 is provided at its end adjacent the support 63 with a pin 64. This pin is provided to engage the arm 12a provided on the end of the supporting plate 12 so that when the plate 30 together with the assembling supports 36 is being withdrawn by the operation of the hand wheel, the plate 12 will be inserted between the insulators so that its opposite edges will be received in the longitudinal grooves provided in the insulators.

In operation, it will be understood that the ribbon-like resistance element will be wound edgewise into a coil of the desired form and that the coil will be positioned in the machine between the spacer blocks with its turns secured in the desired spaced relation. The insulators will then be positioned upon their assembling supports 36 and with the hand lever 51 in its right hand position the hand wheel 33 will be operated to insert the insulators longitudinally within the secured coil. After the insulators have been positioned to coextend with the coil, the hand lever 51 will be moved to its left hand position so as to separate the plates 36 to carry the insulators 11 into their assembled positions with respect to the coil and to maintain them in these positions until the resistor support 12 has been assembled. The resistor support 12 which may have been placed within its recess 63 at any suitable time will then be connected with the plate 30 by means of the pin 64 after which the hand wheel 33 will be operated to withdraw the plates 36 and insert the plate 12. After the plate 12 has been inserted the unit will be completed and may be withdrawn from the machine. Other resistance units may be formed in the same manner.

If the resistance coil has a shape other than that of an ellipse, different spacer blocks 23 and a different channel member 20 may be provided to accommodate the coil.

It will be observed that I have provided an assembling machine which is extremely simple in construction and which is very simple to operate. With this machine very little effort and skill are required on the part of the operator to successively assemble the resistance units.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. An assembling machine for a resistance unit which has a coiled resistance element, electrical insulators upon which the resistance element is mounted and a member for supporting said insulators, said assembling machine comprising means for inserting said insulators within the coil formed by said re-

sistance element, means for moving said insulators into their respective supporting positions with respect to said coiled resistance element and means for positioning said supporting member with respect to said insulators so that said insulators are secured in their respective supporting positions.

2. Means for assembling a resistance unit which has an edge-wound coiled resistance element, a pair of electrical insulators positioned lengthwise within said resistance coil and upon which the coil is mounted, and a spacer member for supporting said insulators, comprising means for inserting said insulators longitudinally within the resistance coil, means for moving said insulators in opposite directions into engagement with said resistance element and means for inserting said spacer member longitudinally within said resistance coil and between said insulators so that said insulators are supported thereby.

3. An assembling machine for an edge-wound coiled resistance unit which has an edge-wound coiled resistance element, a pair of spaced electrical insulators positioned lengthwise within said resistance coil and upon which the coil is supported and each being provided with spaced grooves for receiving and spacing the turns of said coil, and a spacer member for supporting and securing said insulators, said assembling machine comprising means for securing said coil with its turns in the desired spaced relation, means for moving said insulators longitudinally within said coil and positioning them with respect to said coil so that said grooves are in alignment with their respective turns of said coil, means for separating said insulators so that they are moved into their assembled positions with respect to said coil in which positions, the turns of said coil are secured in their respective insulator grooves, and means for inserting said spacer member in said coil between said insulators so that said insulators are secured in their assembled positions.

4. An assembling machine for an edge-wound resistance unit which has a plate-like supporting member, a pair of electrical insulators mounted on the opposite edges of said supporting member, each insulator having a longitudinal groove to receive the corresponding edge of said member and each having spaced grooves on its outer surface, and an edge-wound coiled resistance element mounted on said insulators with its turns fitted within said grooves, said assembling machine comprising a pair of spacing blocks positioned in spaced relation with each other and each being provided with spaced notches so that when the coiled resistance element is positioned between said blocks its turns will be received by and spaced by said notches, a spreader comprising a pair of members each

of which is arranged to support one of said insulators, means for mounting said members so that they may be moved, together with the insulators mounted thereon, within the coil to a position in which the grooves in said insulators are aligned with corresponding notches in said blocks, and so that said members may be withdrawn from the coil, means for separating said members to move said insulators outwardly into assembled position with said coil, means for supporting said plate-like supporting member so that upon being drawn into said coil its opposite edges will be received by the longitudinal grooves provided in the respective separated insulators and means provided on said spreader for engaging said plate-like supporting member so that after said insulators have been moved outwardly to their respective assembled positions and said spreader is being withdrawn from the coil, the supporting member will be drawn into the coil and be received by the longitudinal grooves provided in said insulators.

5. An assembling machine for a resistance unit which has a support, a pair of insulators mounted on said support in spaced relation with each other and a coiled resistance element mounted on said spaced insulators and extending throughout substantially their full length, said assembling machine comprising means for inserting said insulators within said coil and for separating them so that they will be moved outwardly into supporting relation, with said coil, said means comprising a pair of spaced members each of which is arranged to support one of said insulators, means mounting said spaced members so that they may be moved, together with the insulators mounted thereon, within said coil to position said insulators coextensively with said coil, means biasing said spaced members toward each other and means for separating said members against said biasing means to move said insulators into supporting relation with said coil, and means for withdrawing said spaced members from said coil and for concurrently inserting said support so that as said members are withdrawn from said separated insulators, said support is drawn between them so as to hold them in their assembled positions.

6. An assembling machine for an edge-wound resistor which has a ribbon-like resistance element wound edgewise into a substantially elliptical coil, a pair of spaced heat refractory insulator members positioned lengthwise within said coil in the opposite end portions of said ellipse and each being provided with spaced grooves for receiving and spacing the turns of said coil, and a metallic spacer for spacing and supporting said insulators, said assembling machine comprising a support for each insulator mounted

for movement longitudinally with respect to the longitudinal axis of said coil and transversely with respect to said axis, said support serving to support said insulators longitudinally with respect to said longitudinal axis, operating means comprising a hand wheel for moving said supports, together with the insulators mounted thereon, longitudinally within said coil to a position in which said insulators are coextensive with said coil, means comprising a manually operable lever for imparting transverse motion to said supports so that each serves to carry its insulator into engagement with the opposite inner sides of said coil with the turns of the coil secured in their respective grooves, guiding means for supporting said metallic spacer so that upon being moved into said coil it will be positioned between said insulators so as to space and support them, said first operable means also serving to withdraw said supports after the insulators have been separated, and operable connections between said first operable means and said metallic spacer so that when said supports are withdrawn from said coil said spacers will be concurrently inserted.

7. An assembly machine for an edge-wound resistor which has a plate-like support provided with substantially parallel edges, a pair of insulators mounted on said edges in spaced relation with each other and coextensively with said support, each insulator having a longitudinal groove to receive the edge of its support and each having spaced grooves on its outer surface, and a ribbon-like resistor element edge-wound into a substantially elliptical coil mounted on said insulators coextensively therewith and with the turns of the coil fitted within said spaced grooves so as to be spaced thereby, said assembling machine comprising a frame, a pair of spacer blocks mounted on said frame in substantially parallel relation and each being provided with spaced notches so that when said coil is positioned between them its turns will be secured by and spaced by said notches, a spreader plate mounted on said frame for reciprocation on an axis substantially coaxial with the axis of said coil so that said plate may be inserted in or withdrawn from said coil, a pair of spreader members mounted on said plate so that they may be moved crosswise thereon in opposite directions, each member being provided to support one of said insulators and each being provided with an edge to receive the longitudinal groove in the insulator, means for biasing said spreader members toward each other, a plurality of wedge-like members positioned between said members and cooperating with said members so that when said wedge-like members are moved longitudinally with respect to said members they will be moved apart against their biasing means, lever mechanism for op-

erating said wedge members, means for operating said spreader plate so that it may be inserted, together with its spreader members and said insulators, within said coil to a position in which said insulators are coextensive with said coil with their grooves aligned with companionate notches in said spacer blocks whereby when said spacer members are separated the insulators will be moved into assembled relation with said coil, said operating means also serving to withdraw said spreader plate together with its spreader members from said coil, a guide on said frame for supporting and guiding said plate-like support so that upon being drawn into said coil its opposite edges will be received by the longitudinal grooves provided in the respective separated insulators, and means provided on said spreader plate for engaging said plate-like support so that after said insulators have been moved outwardly to their respective assembled positions and said spreader plate is being withdrawn from the coil, the plate-like support will be drawn within the coil and be received by the longitudinal grooves provided in said insulators.

8. The method of assembling a resistance unit which has a coiled resistance element, electrical insulators upon which the resistance element is mounted and a member for supporting said insulators which comprises inserting said insulators within the coil formed by said resistance element, then moving said insulators outwardly into assembled position with respect to said coil and then inserting said supporting member within said coil in assembled position with respect to said insulators so that the insulators are secured in their respective supporting positions with the resistance element.

9. The method of assembling a resistance unit which has an edge-wound coiled resistance element, a pair of spaced electrical insulators positioned lengthwise within said resistance coil and upon which the coil is supported and each being provided with spaced grooves for receiving and spacing the turns of said coil, and a spacer member for supporting and securing said insulators which comprises winding said resistance element into coil form, securing said coil with its turns in the desired spaced relation, inserting said insulators longitudinally within said coil and positioning them with respect to the coil so that each groove of each insulator is in alignment with its corresponding turn of said coil, then separating said insulators so that they are moved outwardly into assembled position with respect to said coil so that the turns are received in their respective grooves and then inserting said spacer member between said insulators while maintaining said insulators in their respective separated positions so that said insulators are secured in their assembled positions.

10. The method of assembling an edge-wound resistance unit, which has a plate-like support provided with substantially parallel edges, a pair of insulators mounted on said edges in spaced relation with each other and coextensively with said support each insulator having a longitudinal groove to receive the edge of said support and each having spaced grooves on its outer surface, and a ribbon-like resistor element edge-wound into a substantially elliptical coil mounted on said insulators coextensively therewith and with its turns fitted within said grooves so as to be spaced thereby, which comprises winding said resistance element into a substantially elliptical coil, securing said coil with its turns in the desired spaced relation, inserting said insulators longitudinally within said coil in parallel relation with each other and the longitudinal axis of said coil to a position coextensive with said coil and in which position its grooves are in alignment with their companionate turns of the coil, then separating said insulators so that they are moved into their assembled positions with said coil in which positions the turns of said coil are received in their respective insulator grooves and then inserting said plate-like support so that its opposite edges are received in the longitudinal grooves in said insulators while maintaining said insulators in their separated assembled positions.

In witness whereof, I have hereunto set my hand this 21st day of October, 1929.

ROY C. SHINDLEDECKER.