

L. KEBLER.
ENAMELING RESISTANCE UNITS.
APPLICATION FILED MAR. 4, 1919.

Patented Dec. 14, 1920.
3 SHEETS—SHEET 1.

1,361,869.

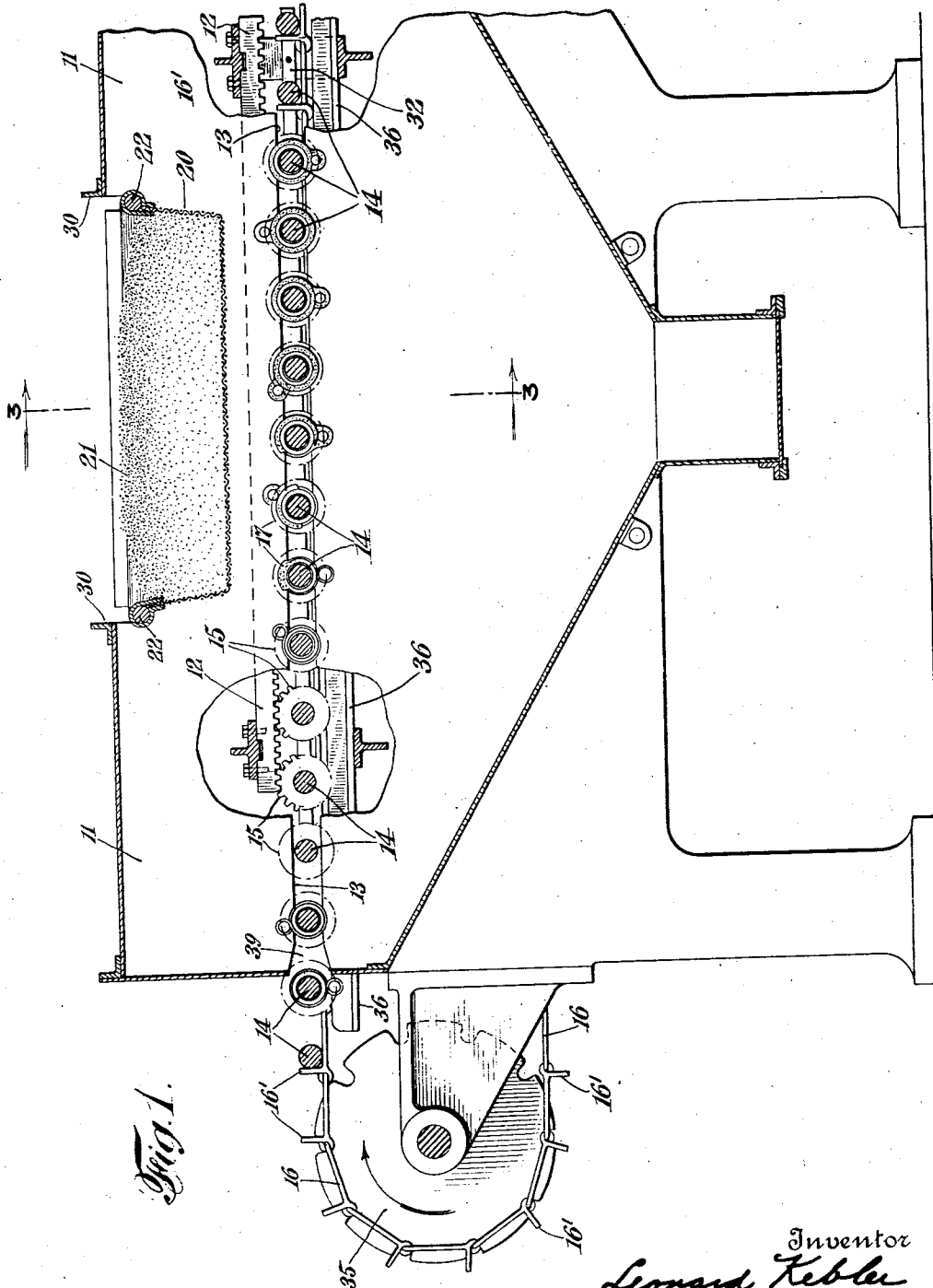


Fig. 1.

Inventor
Leonard Kebler
By *his* Attorneys
Edwards Page & Richmond

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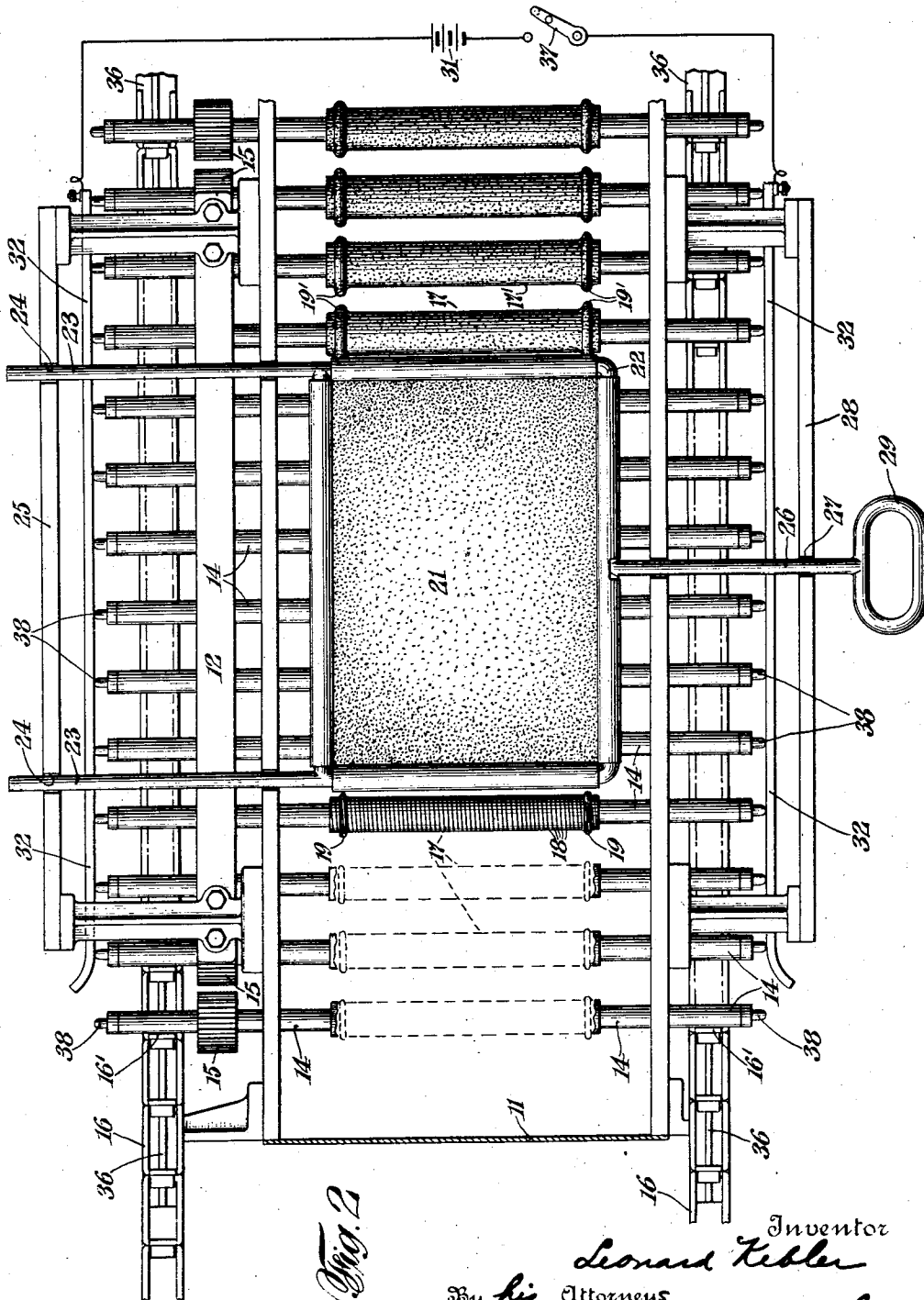


Fig. 2

Inventor
Leonard Kebler
By his Attorneys
Edward Sage & Richmond

1,361,869.

3 SHEETS—SHEET 3.



Fig. 3.

Inventor
Leonard Keble
By his Attorneys
Edwards, Rogers & Richmond

UNITED STATES PATENT OFFICE.

LEONARD KEBLER, OF BRONXVILLE, NEW YORK, ASSIGNOR TO WARD LEONARD
ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ENAMELING RESISTANCE UNITS.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, LEONARD KEBLER, a citizen of the United States, residing at Bronxville, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Enameling Resistance Units, of which the following is a specification.

The principal objects of my invention are to provide a new and improved method for enameling elongated resistance units and to provide certain suitable apparatus to be used in that connection. Another object is to provide for enameling such units by a continuous process. These and other objects of my invention will become apparent on consideration of the disclosure of specific procedure and apparatus in the following specification and the accompanying drawings. It will be understood that modifications may be made within the scope of my invention.

Referring to the drawings, which are diagrammatic,

Figure 1 is a sectional elevation of apparatus which may be employed in connection with my invention.

Fig. 2 is a sectional plan of the same apparatus,

Fig. 3 is an enlarged cross section on the line 3—3 of Fig. 1, and

Fig. 4 is a detail cross section of one of the resistance units and its associated supporting element.

Prior to my invention resistance units have been prepared by taking a hollow earthenware cylinder, winding the resistance wire upon it in helical course, providing terminals or taps, and applying a coat of enamel to cover the wire and insulate it and hold it in definite relation upon the cylinder. The common way of enameling the tubes has been to mix up powdered glass in the form of a paste, which is coated upon the tubes after they have been wound with the wire as by dipping them in the paste. Then the tubes are dried and then fired in a muffle furnace, which transforms the paste into a hard impervious adherent vitreous coating. By my invention I have provided for enameling the tubes by what may be called a continuous process without any necessity for intermediate drying.

The chamber 11 has horizontal slots 13 on its sides extending from an end opening 39 and beside each such slot 13 on the outside

of the chamber there travels a chain 16 running along the track 36 and around the sprocket wheel 35. The rods 14 are adapted to be laid across in the chamber 11 with their ends projecting through the slots 13 and engaged by the projections 16' on the chain 16. Each rod 14 carries the gear wheel 15 adapted to engage with the rack 12 so that while the rod 14 is traversed by the chains 16 it will be rotated by reason of the engagement of the gear wheel 15 with the rack 12.

Upon each rod there is mounted an earthenware tube 17 with the resistance conductor 18 wound thereon and its ends secured to the terminal bands 19.

In an opening 30 in the top of the chamber 11, there is positioned a sieve 20 containing powdered glass 21. The frame 22 of this sieve has extensions 23 on one side, which rests in notches 24 in the support 25. On the other side there is an extension 26 resting in the notch 27 in the support 28 and terminating in the handle 29.

A source of electric current 31 is provided with conductors therefrom to the electrodes 32. The interior of each rod 14 is equipped with a high resistance heating conductor 33 wound within the shell 34 and with its ends carried out to the respective terminals 38 which are in engagement with the respective electrodes 32. A switch 37 is provided to control the application of the current.

The earthenware tubes 17 having been wound with the conductor 18 and the terminal members 19, an attendant slips them on the rods 14, one or more on each such rod. As the chain 16 goes slowly around the sprocket wheel 35, the attendant drops the rods and tubes thus combined in front of the projections 16' and the chain 16 carries the ends of the rods 14 into the slots 13 and slowly across to the right as viewed in Figs. 1 and 2. The gear 15 on each rod 14 engaging the rack 12 causes the rod to rotate while it is being traversed. The terminals 38 engage the electrodes 32 and the heating coil 33 within the rod 14 is energized. Since the tube 17 completely surrounds the heating coil 33, none of the heat generated can escape except through the walls of the tube 17. In this way the tube 17 is quickly heated to the proper temperature. Since the heat comes from the inside toward the outside, the expansion of the tube 17 is some-

what in advance of the expansion of the wire 18 wound thereon so that the wire is kept tight all the time and there is no danger that the turns of the wire will become loosened and displaced and touch one another.

As the tubes 17 move transversely to the right as viewed in Figs. 1 and 2 they become hotter and hotter until they pass under the basket sieve 20. This is reciprocated meanwhile, sifting the powdered glass down upon the heated tubes 17 passing thereunder. All this time the tubes are being rotated, and their heat is sufficient to sinter the glass and make it adhere to the tubes and to fuse this adherent coating of glass into a clear vitreous enamel. Then as the tubes pass on to the right, the terminals 38 leave the ends of the electrodes 32 cutting off the current from within the tubes. They pass on to the right and the rods 14 can be removed by an attendant and the tubes taken off from them at a convenient stage all completely enameled. The coating of enamel on a tube 17 is designated 17' in Fig. 2 and the enamel over the terminal 19 is marked 19'.

Instead of heating the tubes electrically from within as described above, I may apply heat within the chamber 11 from any suitable source to heat the tubes on their outsides as they pass from the entrance opening 39 to the right toward the sieve 20.

The foregoing disclosure is specific by way of example, but it will be understood that many modifications departing widely therefrom will fall within the scope of my invention.

I claim:—

1. The method of enameling tubular units which consists in applying enamel material on them, and heating them electrically from within.

2. The method of enameling tubular units which consists in heating them electrically from within, rotating them, and applying enamel material on them by causing the material to fall on them while the units are being rotated and heated.

3. The method of enameling tubular units, which consists in heating them electrically from within, rotating them, applying enamel material on them while being rotated and heated, and continuing the heating after the enamel material has been applied.

4. The method of enameling tubular resistance units which consists in mounting them on rods, rotating these rods, heating the tubular units, applying enamel material on them while hot and being rotated, and fusing said material by the heat of the tubular units and thus forming an enamel coat on them.

5. The method of enameling hollow resistance units which consists in heating them electrically from within, rotating them, ap-

plying enamel material on them and fusing it by the heat of the units and thus forming an enamel coat on them.

6. The method of enameling resistance units which consists in heating them, rotating them, traversing them in a direction transverse to their length, meanwhile applying enamel material on them, and fusing it by the heat of the units and thus forming an enamel coat on them.

7. The method of enameling resistance units which consists in arranging them side by side in parallel relation, heating them, moving them alike in a direction transverse to their lengths, rotating them meanwhile, at the same time applying enamel material on them, and fusing it by the heat of the units to form an adherent coat of enamel.

8. The method of enameling tubular resistance units which consists in mounting them on parallel rods side by side, traversing these rods in a direction transverse to their length, rotating them and heating them meanwhile, continuing the rotation and application of heat until they have reached a suitable temperature and then applying enamel material on them, and fusing it by the heat of the units and thus forming an enamel coat on them.

9. The method of enameling tubular resistance units which consists in arranging them side by side in parallel relation on rods equipped with electric heating elements, moving them alike in a direction transverse to their lengths, rotating them meanwhile, sending electric current through the electric heating elements in the rods suitably to heat the units, applying enamel material on them and fusing it by the heat of the units to form an adherent coat of enamel.

10. In combination, means to support a series of resistance units arranged side by side, means to rotate them, means to heat them, a container for finely divided enamel material and means to apply this material gradually and evenly upon the units while they are heated.

11. In combination, a series of rods to support respective resistance units thereon, electric heating elements in said rods, means to traverse said rods, means to rotate them meanwhile, means to apply electric current to the heating elements therein, a container for finely divided enamel material and means to apply this material gradually and evenly upon the units while they are heated.

12. Apparatus for enameling a tubular unit comprising a central element passing through the unit, means for passing electric current through said element, and means for applying enamel material to said unit.

13. Apparatus for enameling a tubular unit, comprising a central element passing through the unit, means for passing electric

current through said element, means for causing the unit to be rotated, and means for applying enamel material to said unit.

14. Apparatus for enameling a tubular unit, comprising a central support passed through said unit, means for electrically heating said support, and means for applying enamel material to said unit.

15. Apparatus for enameling a tubular unit comprising a central support passing through said unit, means for electrically heating said support, means for rotating said support, and means for applying enamel material to said unit.

16. Apparatus for enameling a tubular unit, comprising a central support passing through said unit, means for electrically heating said support, means for rotating said support and moving said support in a direction transverse to its length, and means for applying enamel material to said unit.

17. Apparatus for enameling a tubular unit comprising a central support passing through said unit, means for moving said

support in a direction transverse to its length and for rotating said support, and means for applying enamel material to said unit during such movement.

18. Apparatus for enameling a tubular unit, comprising a central support passing through said unit, means for moving said support in a direction transverse to its length, means engaged during such movement for electrically heating said support, and means for applying enamel material to said unit during such movement.

19. Apparatus for enameling a tubular unit comprising a central support passing through said unit, means for moving said support in a direction transverse to its length, means engaged during such movement for electrically heating said support, means engaged during said movement for rotating said support, and means for applying enamel material to said unit during such movement.

LEONARD KEBLER.