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H. J. KAUTH

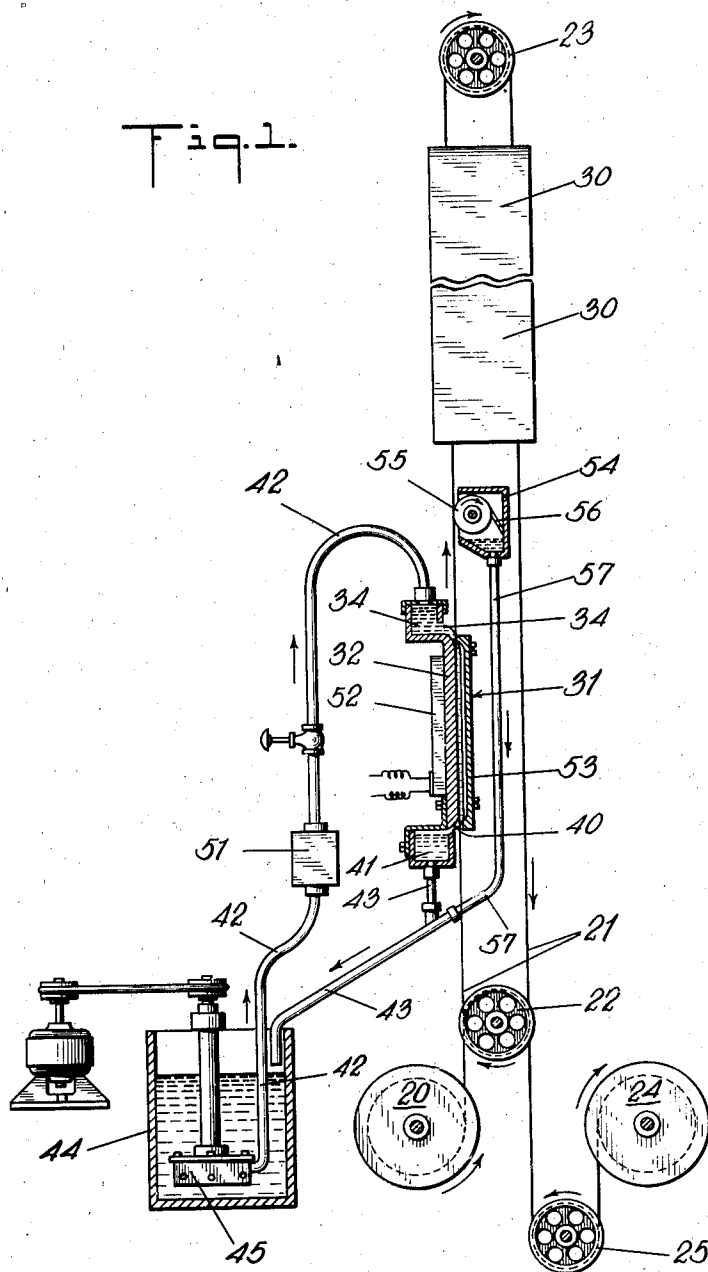
2,394,066

APPARATUS FOR COATING WIRE

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Fig. 1.



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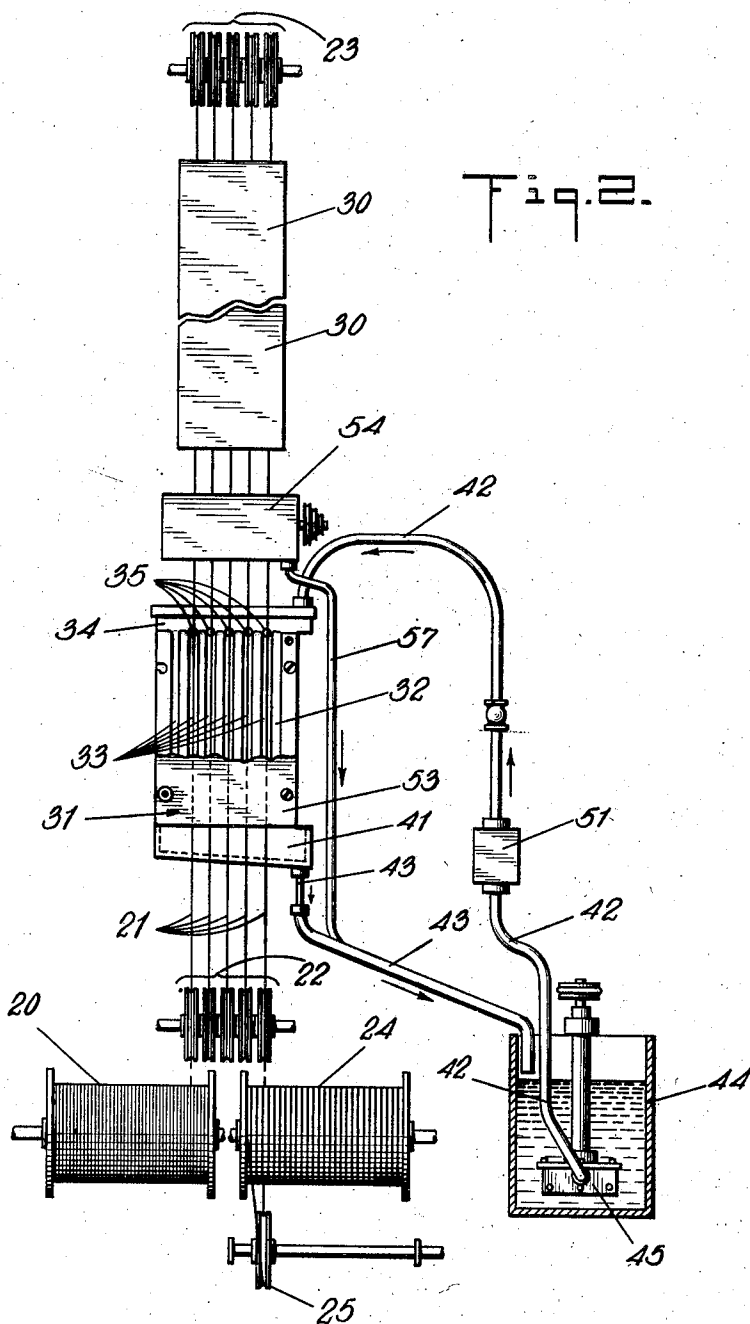
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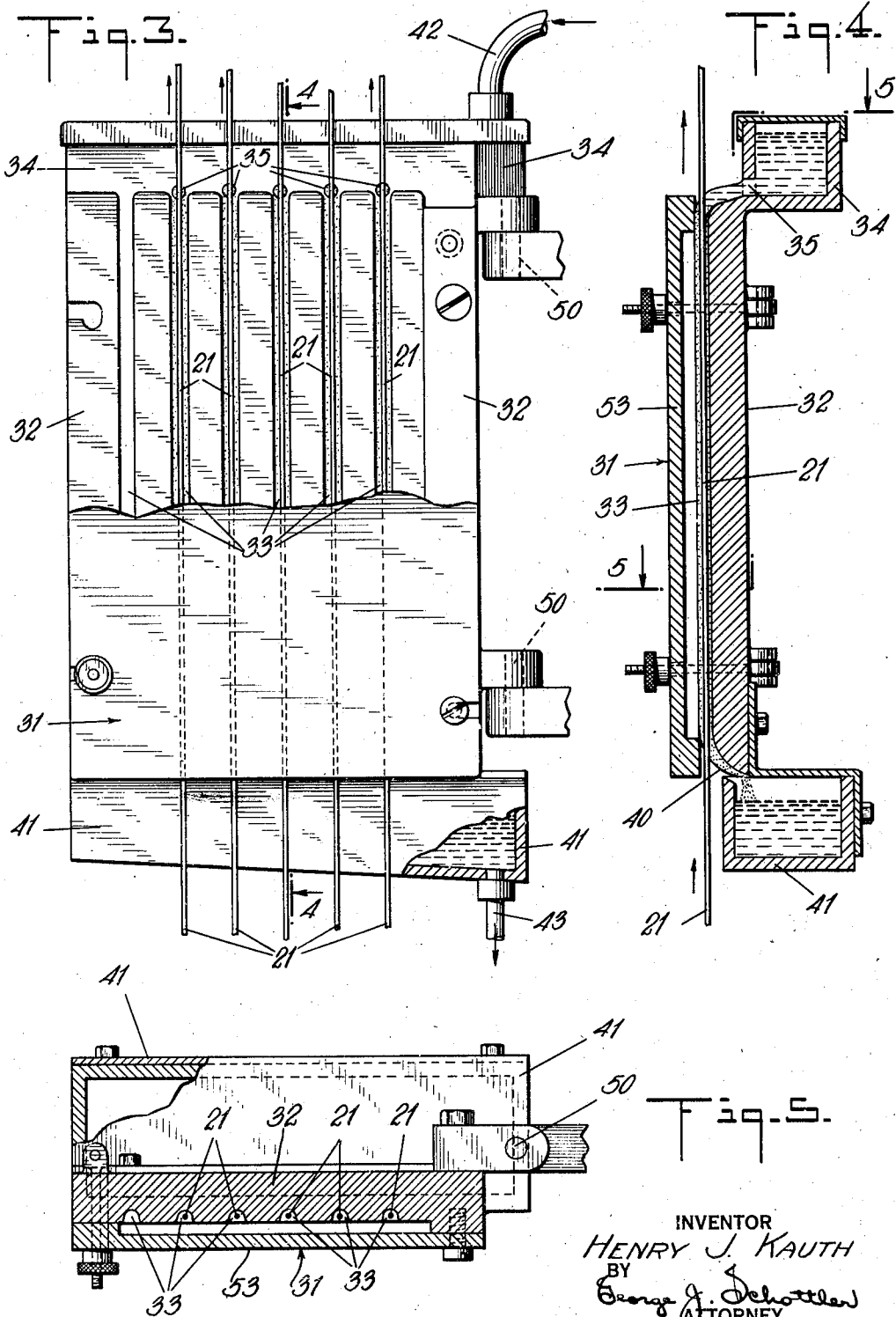
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APPARATUS FOR COATING WIRE

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7 Claims. (Cl. 91—29)

This invention relates to apparatus for coating wire, particularly with enamel, and has for an object the provision of improvements in this art.

The method of enameling wire which is commonly employed throughout the industry at present consists in passing the wire a number of times around two sets of vertically spaced sheaves, the lower set being disposed in a pan of enamel; applying a coating of enamel to the wire each time it passes around a lower sheave; and baking the enamel in successive layers as the wire passes vertically upward from the lower sheaves through a baking oven to the upper sheaves.

There are a number of disadvantages in the conventional method and apparatus.

One disadvantage is that the rotation of the lower sheaves in the bath of enamel draws air into the bath and reduces the quality of the enamel coating on the wire. When this trouble is suppressed by completely immersing the lower sheaves in the bath, the large amount of enamel required proves troublesome. The sheaves need to be relatively large to keep the wire immersed long enough to coat it properly and to avoid bending the wire too sharply.

Another disadvantage is that the large quantity of enamel which must be maintained in the bath, often amounting to as much as fifty gallons, constitutes a serious fire hazard. Certain components of the enamel are very volatile and inflammable and the bath of enamel is located under and near the baking oven.

Another disadvantage is that the bath presents a large surface area to contamination by air and loss by evaporation.

Another disadvantage is that the speed of movement of the wire is restricted because, if the lower sheaves rotate too rapidly, they will increase the turbulence and air entrapment in the bath of enamel.

Another disadvantage is that the bath of enamel normally becomes contaminated, as by metal dust or flakes from the base wire, and these particles of electrically conductive material are likely to be incorporated in each layer of enamel, thus reducing the insulating value of the coating. With a large bath, it is not easy to filter out these harmful suspended particles before they become incorporated in the enamel coating on the wire.

Another disadvantage is that the coatings of enamel may be improperly applied due to pressure of the sheaves on one side of the wire as

it passes therearound to pick up a fresh coat of enamel. Even one or more previous layers may be softened during passage through the bath and injured by pressure from the sheaves.

And yet another disadvantage is that it is unhandy, untidy, unsanitary, and possibly unhealthy to string up the wires in the conventional apparatus. The operator is required to put his hands in the enamel bath to thread the wire around the lower sheaves, and, in addition to soiling the hands, the enamel may injure them by reason of the harmful chemicals contained in the enamel.

According to the present invention, apparatus is provided in which the wire is passed a number of times around two sets of spaced sheaves, but both sets of sheaves are run dry, i. e. free of enamel, and the enamel is applied to the wire on the straight spans between sheaves as it advances to the baking oven.

By this arrangement and by the use of a specially designed enamel applicator, the enumerated and other disadvantages of the prior practice are avoided.

A construction in which both sets of sheaves are run dry permits easy and rapid stringing of the wire and avoids soiling or injuring the hands.

The enamel applicator provided by this invention furnishes adequate length of contact for proper wetting and adhesion, but requires only a very small amount of enamel—one quart being entirely adequate—and reduces the enamel surface exposed to air to a negligible area. The fire hazard is thus greatly reduced because there is not a large open pan with a heavy vapor output beneath the oven; and, if a fire should develop, the amount of material is so small as to cause no serious damage.

There is no mechanical contact at all between the wire and related parts while it is being coated and prior to baking; hence the layer is smooth and the previous layers are uninjured. Moreover, there are no factors which limit the speed of wire travel, and when high speeds are desired they may be utilized.

There is no undue turbulence in the enamel during application; hence the entrapment of air in the enamel coatings is avoided.

The enamel during application to the wire is caused to flow in a direction opposite to the direction of travel of the wire, and washes the metal dust from the base wire at the lower portion of the applicator and allows the wire to pass through freshly filtered enamel at its last point

of contact with the enamel. This provides positive elimination of any contamination of the enamel film by electrically conducting metal particles.

The objects and advantages of the invention may be better understood from the consideration of an exemplary embodiment which is shown in the accompanying drawings, wherein:

Fig. 1 is a side elevation and section, somewhat diagrammatic in nature, of enameling apparatus embodying the invention;

Fig. 2 is a similar front elevation;

Fig. 3 is a front elevation of the enamel applicator device;

Fig. 4 is a vertical section taken on the line 4—4 of Fig. 3; and

Fig. 5 is a horizontal section taken on the line 5—5 of Fig. 4.

Referring to the drawings, a wire is drawn from a supply or pay-off spool 20 and passes in a plurality of free vertical strands 21 between a lower set of sheaves 22 and an upper set of sheaves 23, thence to a take-up spool 24. A traversing device 25 of any approved type guides the wire to the take-up spool. Both sets of sheaves are dry-running, as distinguished from the conventional apparatus in which the lower set runs immersed in a pan of enamel.

According to the present invention, the enamel is applied to the free strands or spans of wire as they move toward the oven 30 by a novel form of applicator generally indicated at 31. The enamel is both applied and baked while the wire is moving in a free span between sheaves.

The applicator illustrated herein comprises a plate 32 provided with a plurality of vertical grooves 33 which are larger than the wire. At the upper end of the plate there is provided a supply trough or manifold 34 having channel ducts 35 leading to the upper ends of the vertical face grooves 33. For fine sizes of wire no grooves are needed in the plate since the enamel film flowing on a smooth plate is thicker than the diameter of the wire in such cases.

Enamel flows down the grooves 33 and coats the wire strands when disposed therein. The lower end of the applicator plate is curved laterally away from the strands, as shown at 40, to lead off excess enamel which does not adhere to the strands. A collection trough 41 takes the excess material which runs off the bottom edge of the plate.

A supply pipe 42 carries enamel to the upper trough 34 and a return pipe 43 carries the excess enamel to a reservoir or sump 44 of a pump 45. The pump is preferably disposed within the sump 44 and the latter is removable for refilling. The sump may be of any desired size but preferably is of small capacity, say about a quart, it being a feature of this invention that the apparatus may be operated satisfactorily with a very small amount of enamel.

A filter 51 desirably is provided for cleaning the enamel pumped to the applicator plate. The enamel may be kept at any desired temperature by appropriate means, such as a heater at the sump or a heater 52 on the back of the applicator plate.

The pipes 42 and 43 preferably have flexible sections or joints at the applicator plate to permit the latter to be swung on its hinges 50. When the strands have been properly positioned adjacent the applicator plate, the exposed side may be closed by a cover 53 to keep down evapo-

ration and exclude contamination. Hinge bolt and slot connections facilitate rapid opening and closing of the cover. The cover may be opened at any time to permit inspection; or it may be partly or wholly transparent to permit inspection without opening it. With this construction the threading of the wire is very easy.

The applicator plate is sufficiently long to permit the strands to be adequately wetted and coated. A length of from six to twelve inches has been found to work well for all normal conditions and speeds of wire travel. The width of the plate is adequate to embrace all strands in the group.

Excess coating material which adheres to the strands may be removed by a wiper 54, though in some instances, as for example when the viscosity and surface tension of the enamel are low, this wiper is not necessary. The wiper is preferably of the positively driven roll type in which the roll 55 travels in the direction of movement of the wire and picks up excess material without contact with the wire. Preferably also the roll runs faster than the wire travels, but its speed is adjustable to suit various conditions. A scraper 56 may be employed for removing enamel from the roll and directing it to a return pipe 57 leading to the sump. The wiper is adjustable in position so as to be moved nearer the applicator or nearer the oven, as may be desired. This provides additional control of coating thickness and also a means of eliminating waviness of the film when the surface tension of the enamel is high. The length of time between application of the enamel and application of heat to the enamel is important in preventing waviness of the film.

The applicator operates satisfactorily for either direction of wire movement, either against or with the direction of flow of enamel on the plate. This permits the use of the applicator for strands entering the oven from either direction or from both directions at once. However, the wire preferably travels through the applicator in a direction opposite to the direction of flow of enamel therethrough, as described hereinabove, in order that the freshly coated strand may emerge from clean enamel, and that all metal dust in the fresh coat is avoided.

It is thus seen that the present apparatus provides an improvement in the application of enamel to wires which avoids a great many of the serious objections to existing practices, and in addition provide advantages in speed, safety, and sanitary conditions which could not be attained under the existing practices.

The novel method of coating wire disclosed herein is the subject matter of a divisional application filed January 18, 1944, Serial No. 518,679.

While one embodiment of the invention has been illustrated and described, it is to be understood that the invention may be variously embodied within the limits of the prior art and the scope of the subjoined claims.

I claim as my invention:

1. Wire coating apparatus comprising in combination, a plate provided with a shallow open longitudinal passage in one face thereof larger than the wire to be coated, means for supplying liquid coating material at one end of the passage to flow to the other end, means for moving a wire through the coating material in the passage to coat the wire, and means for hardening the coating on the wire.

2. Wire coating apparatus comprising in com-

bination, a plate having in one face thereof a plurality of vertically disposed open longitudinal passages larger than the wire to be coated, said passages being defined solely by the said plate, means for supplying liquid coating material to the upper ends of the passages to flow downward to the lower ends, means for moving a plurality of wire strands through the coating material in said passages to coat the strands, and means for hardening the coating material on the wire.

3. Wire coating apparatus comprising in combination, spaced sheaves supporting a wire strand freely between them, means for applying an excess of a coating of liquid material to said free strand as it travels between the sheaves in such manner that the strand moves out of the coating zone through fresh clean material whereby the coat on the wire is kept free from metal dust or the like which may be accumulated in the material from the wire, means for withdrawing the excess coating material from the wire, means for continuously filtering the excess coating material which carries the suspended metal dust and returning it to the coating zone, and means for hardening the coating material on the strand between sheaves.

4. Wire coating apparatus comprising in combination, upper and lower sets of sheaves supporting a plurality of upwardly moving wire strands freely between them, a plate provided with a like number of shallow vertical grooves larger than the wire in which said strands move, means for supplying coating material to the upper ends of the grooves in excess of that which the wires will take as a coating, means for removing from the lower ends of the grooves the excess coating material which is not taken up by the strands, and means for hardening the coating material on the strands before they reach the upper sheaves.

5. Wire coating apparatus comprising an applicator plate provided in one face thereof with a shallow strand groove larger than the wire, one end of said groove being higher than the other end, a trough for supplying coating material to the upper end of said groove, said plate being

curved away from the path of the wire at its lower end to draw off excess coating material which does not adhere to the wire as a coating, and a trough to take away said excess coating material.

6. A wire coating apparatus comprising an applicator plate provided in one face thereof with shallow strand grooves larger than the wire, a manifold provided with a duct leading to each groove for supplying coating material to the upper end thereof, said plate being curved away from the path of the wire strands at its lower end to draw off excess coating material which does not adhere to the wire strands as a coating, and means to remove and return the excess coating material to the manifold.

7. Wire coating apparatus comprising in combination, upper and lower sets of dry-running sheaves supporting a plurality of wire strands freely between them, an applicator plate mounted adjacent said strands by a hinge connection permitting it to be swung away from the strands, said plate being provided with a plurality of oversized vertical grooves, a trough at the upper end of said plate provided with holes leading to each vertical groove to supply coating material thereto, a supply pipe for said trough at the hinge line of the plate, said plate being curved away from the strands at its lower end to draw off excess coating material, a trough to receive said excess coating material, a cover for enclosing said strands when in said grooves, a wiper roll near the strands running in the direction of their movement for removing excess coating material adhering to said strands, means for removing and collecting excess coating material from said roll, an oven for baking the remaining coating on said free strands, means for returning all excess coating material to a sump, a pump for forcing coating material back to the upper trough, means including a cup embracing the pump for supplying make-up coating material to the system, and a filter in the circulatory system for continuously cleaning the coating material before it is returned to the upper trough.

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