

March 24, 1936.

P. E. BRUNBERG

2,034,794

WIRE COATING MACHINE

Filed Jan. 19, 1934

3 Sheets-Sheet 1

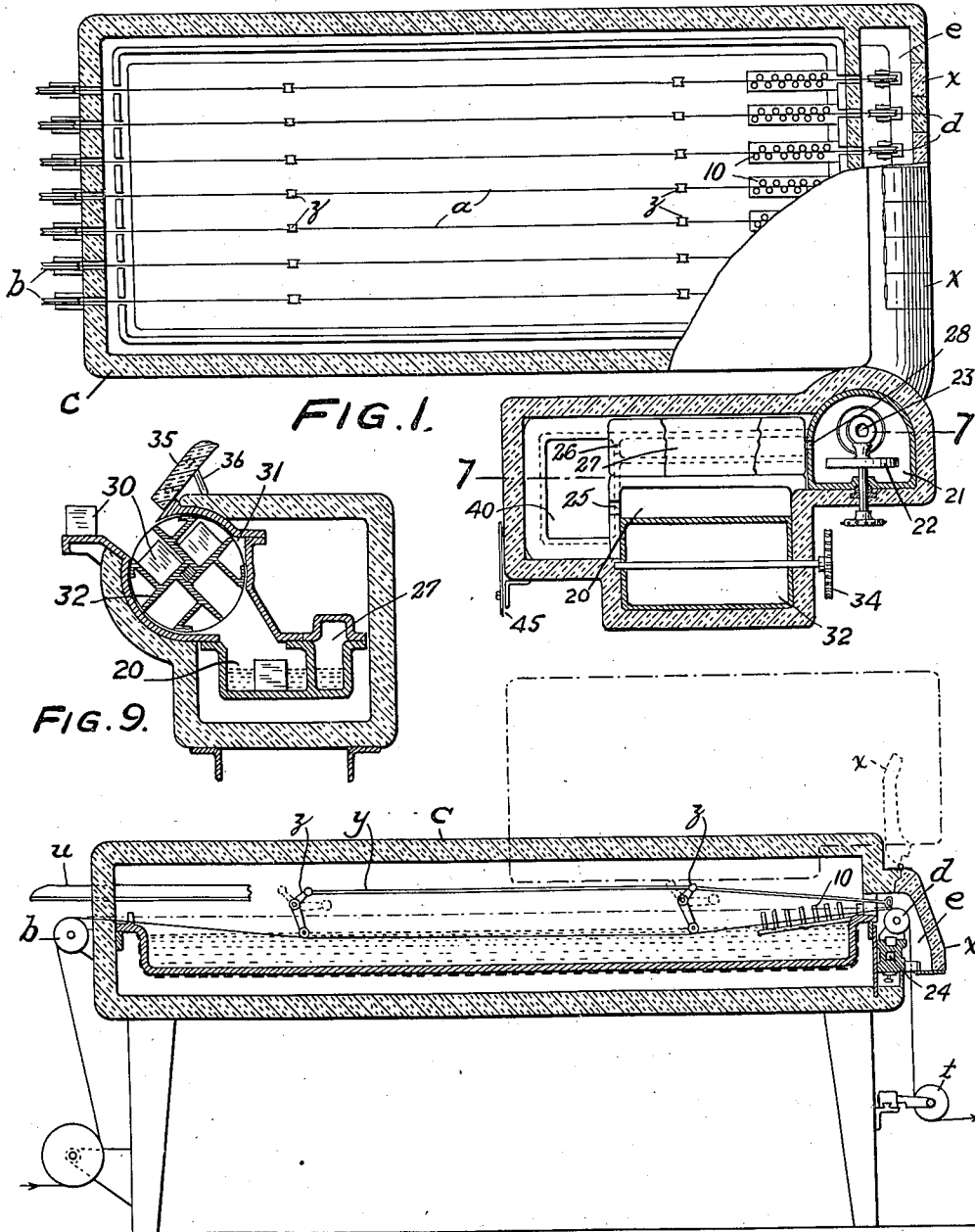


FIG. 2.

INVENTOR

WITNESS:

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Paul E. Brunberg

BY
Brosius and Hordening
ATTORNEYS.

March 24, 1936.

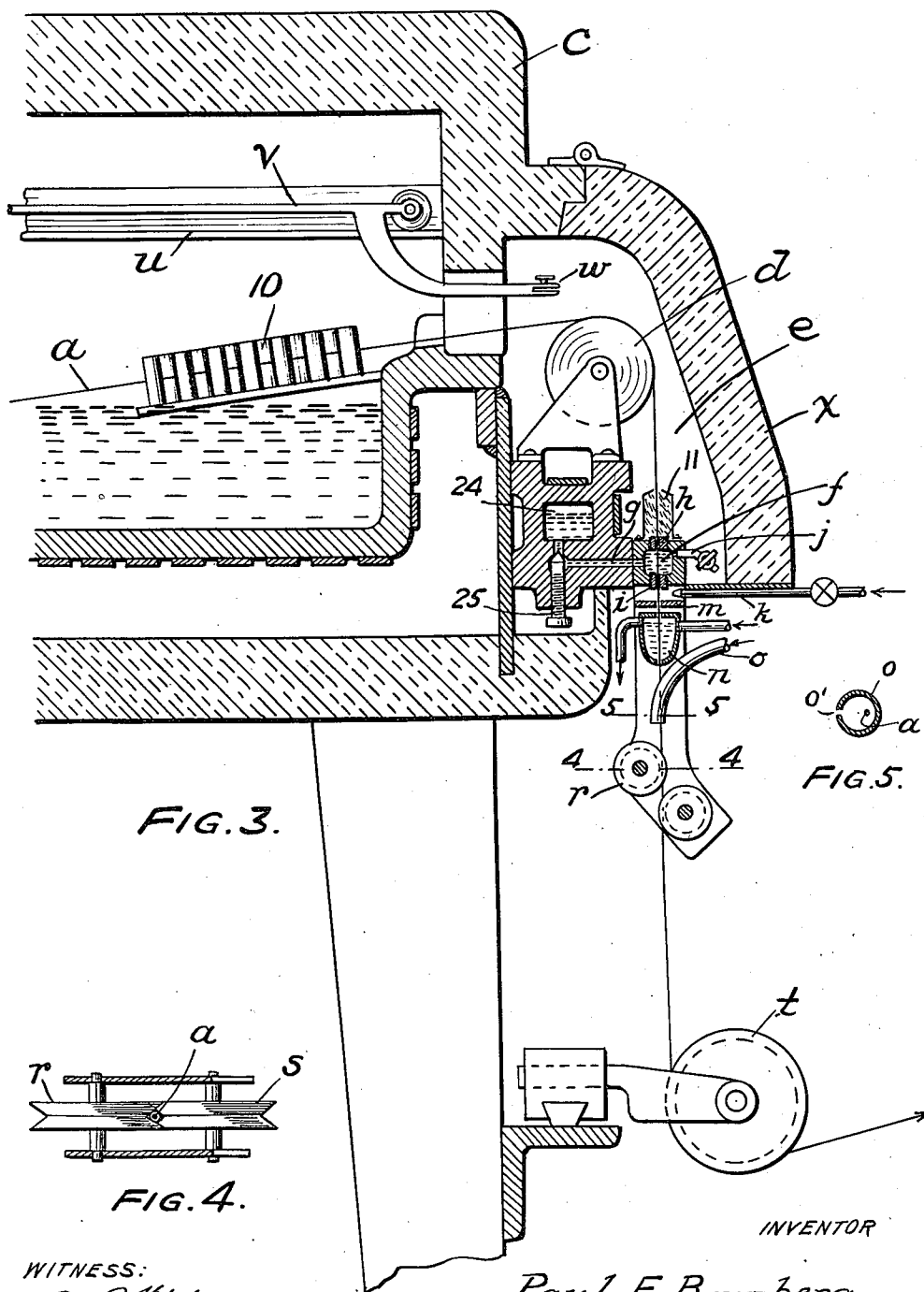
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Filed Jan. 19, 1934

3 Sheets-Sheet 2



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3 Sheets-Sheet 3

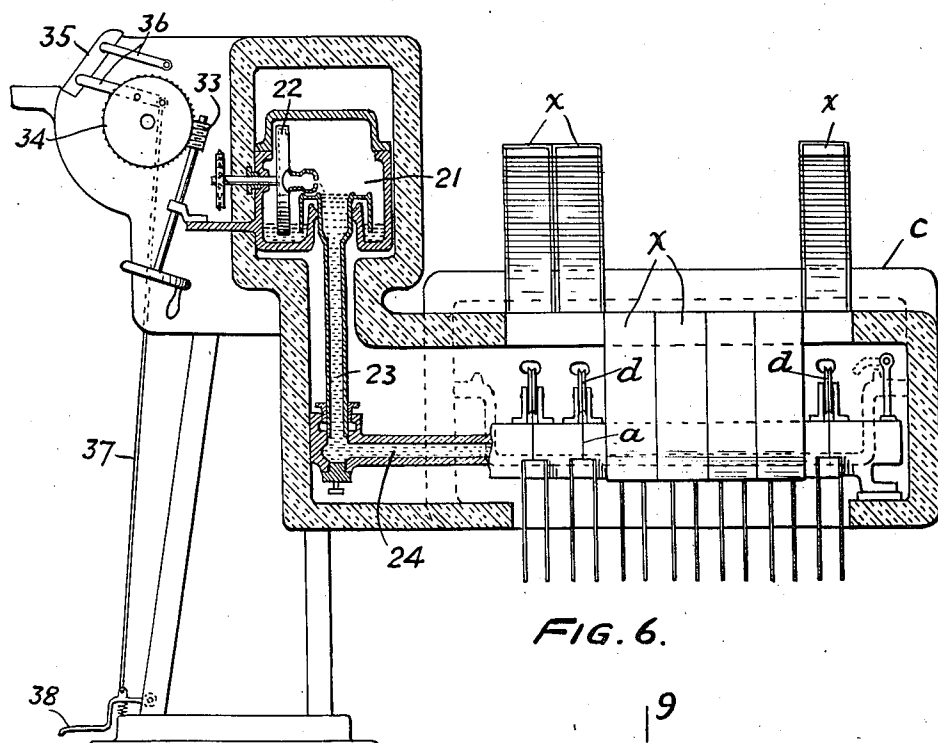


FIG. 6.

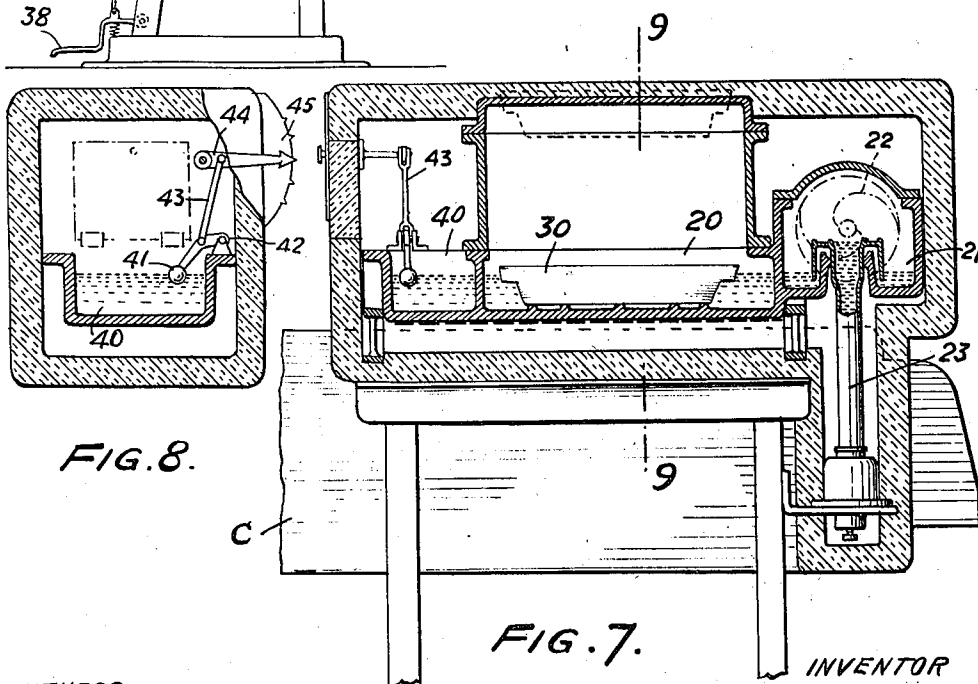


FIG. 7.

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UNITED STATES PATENT OFFICE

2,034,794

WIRE COATING MACHINE

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mesne assignments, to George E. Graff, Wil-
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Application January 19, 1934, Serial No. 707,368

9 Claims. (Cl. 91—12.5)

In an application filed by me November 10, 1932, Serial No. 642,040, I disclose a process for metal-coating wire or any other elongated metal article and also disclose a machine for carrying out such process. Herein I disclose an improved machine for carrying out said process, said machine comprising the novel features of the original machine together with substantial improvements thereon that have been found valuable or necessary in the commercial execution of the process.

In the drawings:

Fig. 1 is a plan view, partly broken away, of the machine. Fig. 2 is a longitudinal section through the machine with parts omitted for clearness. Fig. 3 is an enlarged sectional view of part of the machine. Figs. 4 and 5 are enlarged sections on lines 4—4 and 5—5 of Fig. 3. Fig. 6 is a front view, partly broken away, of the machine. Fig. 7 is a section on the line 7—7 of Fig. 1. Fig. 8 is an end view, partly in section, of Fig. 7. Fig. 9 is a section on the line 9—9 of Fig. 7.

The machine herein shown and described is especially designed to effect the coating of copper wire with lead, although it will be understood that elongated metal articles other than wire may be coated and that the elongated articles may be of metal other than copper and that the coating may be of metal other than lead.

The copper wire *a* to be coated is fed continuously from a pulley *b* into, through and out of a metal bath in a container *c*. The bath is composed of a mixture of lead and tin of permissively variable proportions but preferably about 70% lead and 30% tin. Beyond the container *c* the wire extends over a pulley *d* in an enclosure *e* and thence through a chamber *f* containing the molten coating metal—in this example lead.

The chamber *f* is completely enclosed except for the openings hereinafter described. It is provided with an inlet communicating with a channel *g* through which the coating metal is supplied. The chamber is closed at the top by means of a removable plug *h* having an orifice of a diameter barely exceeding the diameter of the uncoated wire. The chamber is closed at the bottom by a removable plug *i* having an orifice whose diameter exceeds that of the uncoated wire by an amount that predetermines the thickness of the coating. The chamber is provided with a small vent or air bleeder *j* through which the air is expelled by the coating metal as it enters and fills the chamber. The vent may be provided with a check valve or a hand operated valve.

Beneath the chamber *f* and spaced from it a slight distance is a plate *m*, which may be of metal, but is preferably of refractory material, having an orifice of a diameter at least equal to that of the orifice in plug *i*, the centers of the two orifices being in vertical alignment. One or more burners *k* direct their flame against plug *i* to maintain it at the desired temperature. Below plate *m* is a cup *n* into and from which water, oil, or other cooling and solidifying liquid continuously flows. Some of the outflowing water escapes at the bottom of the cup around the coated wire and the remainder overflows. Beneath the cup the coated wire travels through the lower end of a pipe *o*, which is slotted at *o'* to allow the wire to enter it. Oil, water or other cooling and solidifying liquid is continuously discharged from the pipe.

Below the pipe *o* are two wheels *r* and *s* between which the coated wire travels. Below these wheels is a larger wheel *t* about which the coated wire travels to a reel (not shown). The reel should be of that known type which will pull the wire through the machine at a uniform rate.

The wheels *r* and *s* are carefully adjusted because their adjustment is or may be exclusively relied upon to maintain the copper wire in the exact center of the wire outlet orifice in chamber *f*. The wheels are positioned so that their peripheries are on opposite sides of and equidistant from a vertical line coincident with the exact center of said wire outlet and they are spaced apart so that their peripheries are separated by a distance equal to the diameter of said wire outlet.

At that end of container *c* into which the wire is fed is a track *u*, which projects beyond the container at the said end. A wheeled shuttle *v* is adapted to run on this track. The shuttle is provided with a jaw *w* into which is adapted to be inserted the end of the wire to be coated. By moving the shuttle longitudinally the end of the wire may be pulled through the container into the enclosure *e*. The enclosure has a hinged wall *x*, which may be swung out to allow access to the enclosure. The wire is pulled by the operator around pulley *d* and is thence pushed and pulled down through the top and bottom orifices in chamber *f*, plate *m*, cup *n*, pipe *o*, between pulleys *r* and *s*, and around pulley *t* to the reel.

Extending longitudinally through the container *c* is a rod *y* which is manipulable by hand to move bell crank levers *z* into position to cause their feet to engage the wire and press it down below the level of the lead-tin bath in the con-

tainer. 10 are wipers, of asbestos or other suitable material, between which the wire travels on its way out of the lead-tin bath. These wipers remove all molten metal from the wire except a very thin film.

Mounted on chamber *f* is a chamber 11, which is so packed with asbestos or other suitable packing material 12 as to allow the wire to travel therethrough on its way to chamber *f*.

I have found it feasible to simultaneously coat a multiplicity of wires. The drawings show a machine adapted to handle seven separate wires. So far, however, as the machine has been described, the mechanism for handling a plurality of wires involves merely a multiplication of most of the described structural elements.

The molten lead is supplied from a vessel 20 wherein, if desired, pig lead may be melted, as hereinafter described. The molten lead flows from vessel 20 into a chamber 21; either directly or by way of a crossing chamber 40 hereinafter described. Within chamber 21 is a pump 22, which lifts the lead and discharges it into the upper end of a conduit 23 at a rate exceeding its rate of outflow from the conduit, the excess overflowing and dropping down into the pool of molten lead in chamber 21. Conduit 23 extends downward into a horizontally extending manifold 24, which, through channels *g*, communicates with the several lead coating chambers *f*. In each channel is a valve 25, which controls the rate of flow of molten lead into the corresponding chambers *f*. The height of the column of liquid in conduit 23 determines the pressure of the lead in chamber *f*.

Above vessel 20 is a cylindrical chamber 31 within which turns a conveyer 32 comprising a hub and radial partitions. Lead pigs 30 are adapted to be placed in the compartments, between the partitions, and the conveyer is adapted to be given quarter turns to allow the pigs to be successively discharged therefrom into the vessel 20, which is subjected to sufficient heat to melt the same. The conveyer may be turned by means of a worm 33 operating a worm wheel 34 on the shaft of the conveyer. The chamber 31 is normally closed by a sliding door 35 which may be opened at intervals to allow a fresh pig to be inserted. The door may be supported on the ends of parallel pivoted levers 36, one of which, by means of a connecting rod 37, may be operated, to open the door, from a foot treadle 38.

Adjacent the melting vessel 20 is a crossing chamber 40 into which melted lead flows from chamber 20, through an opening 25 (Fig. 1). From the crossing chamber 40 the melted lead flows through the opening 26 into the covered channel 27, through the opening 28, into the chamber 21 (Figs. 1 and 9). A float 41 is carried on the end of a lever 42, which is connected, by a link 43, with a lever 44 cooperating with a scale 45. Thereby the level of liquid in chamber 40 and vessel 20 is indicated, so that the operator may know when it is necessary to supply a fresh pig of lead.

Within vessel 20 and all enclosures communicating therewith is maintained a non-oxidizing atmosphere; and such an atmosphere, as far as possible, is maintained in container *c* and enclosure *e*.

By means of the described machine, wire of many different diameters may be uniformly covered with a coating of many different thicknesses. For example, copper wire having a diameter of

.025 inch may be coated with a preliminary lead-tin film of about .0005 or .001 inch and then given a final lead coating of a thickness of about .012 inch; the final product having a thickness of about .05 inch. Each wire may be run through the machine at the rate of about 35000 feet per hour. In a multiple machine adapted to simultaneously coat eight wires, it is thus possible to commercially coat such wires at the rate of about 6½ miles per hour.

With a given size of annular outlet orifice in chamber *f*, the higher the speed of the wire the greater must be the pressure upon the molten lead, or the greater the pressure the greater is the permissive speed. The greater the size of the orifice, the greater the necessary pressure with a given speed, or the slower the necessary speed with a given pressure. Since it is desired to provide for coatings of variable thickness, the size of the outlet orifice is a necessarily variable factor, and therefore speed of travel and/or the pressure must be adjusted accordingly. It is most convenient, as described, to provide a head of lead which is constant and to vary the speed in accordance with the size of the orifice. The size of the orifice is most conveniently varied by providing plugs *i* containing orifices of the desired different diameters. I also provide plugs *h* containing orifices of diameters corresponding to different diameters of uncoated wires.

What I claim and desire to protect by Letters Patent is:

1. In a machine for coating wire, the combination of a container for molten metal having a die in the body thereof through the center of which the wire to be coated is adapted to travel, of wire-positioning guide wheels so positioned as to maintain the wire in the center of the die.

2. In a machine for coating wire, the combination with an enclosed chamber provided with an inlet for molten coating metal, a wire-entering orifice at the top and an orifice containing a die at the bottom the die having an orifice therethrough larger than the wire to be coated by an amount equal to the thickness of the coating through which the wire and its coating metal is adapted to leave the chamber, of wire-positioning guide wheels below said chamber to maintain the wire central in the die, a container for cooling fluid below the chamber and above the guide wheels and through which the coated wire is adapted to travel, said chamber having openings through which the wire enters and leaves the chamber, and a pipe positioned to discharge cooling fluid upon the coated wire below said container.

3. In a machine for coating wire, the combination with an enclosed chamber provided with an inlet for molten coating metal, a wire-entering orifice at the top and an orifice at the bottom through which the wire and its coating metal is adapted to leave the chamber, of wire-positioning guide wheels below said chamber, a burner directed toward said bottom orifice, a sheet of refractory material provided with an orifice through which the heated coated wire is adapted to travel, and means below said sheet to subject the coated wire to a solidifying and cooling fluid.

4. In a machine for coating wire, the combination with a chamber through which the wire to be coated is adapted to travel and provided with an orifice through which the wire and the coating metal leave the chamber, of a vessel adapted to contain molten coating metal, pas-

sages through which the molten metal is conveyed from said vessel to said chamber, said passages including an upright conduit the upper and inlet end of which extends above the level of the molten metal in said vessel and the lower end of which is in constant open communication with the chamber, and a pump adapted to elevate said molten metal and discharge it into the inlet end of said conduit at a rate sufficient to maintain a definite head of molten metal in said passages and said chamber.

5. In a machine for coating wire, the combination with a chamber through which the wire to be coated is adapted to travel and provided with an orifice through which the wire and the coating metal leave the chamber, of a vessel adapted to contain molten coating metal, passages through which the molten metal is conveyed from said vessel to said chamber, said passages including an upright conduit the upper and inlet end of which extends above the level of the molten metal in said vessel and the lower end of which is in constant open communication with the chamber, a pump adapted to elevate said molten metal and discharge it into the inlet end of said conduit at a rate sufficient to maintain a definite head of molten metal in said passages and said chamber, and a valve in one of said passages to regulate the rate of flow of molten metal into said chamber.

6. In a machine for coating wire, the combination with a container adapted to hold a bath of preliminary filming metal, a chamber adapted to contain molten coating metal, the wire to be coated being adapted to travel successively through said container and chamber, and guide pulleys at the wire inlet end of said container, between said container and chamber, and beyond said chamber; a track in said container, and a shuttle movable longitudinally of said track and provided with wire-holding means, whereby the end of the wire to be covered may be secured to the shuttle and the shuttle moved through the container to allow the wire to be drawn through and beyond the chamber preparatory to the coating operation.

7. In a machine for coating wire, the combination

of a chamber having an inlet for the coating metal and an outlet for the coating metal; a die in the outlet through which the wire to be coated may pass, the die having its orifice larger than the wire by an amount equal to the thickness of the desired coating, guide wheels arranged to direct the wire centrally through the die, and means for cooling the coating metal, whereby the wire is coated with a covering of uniform thickness.

8. In a machine for coating wire with a protective alloying coating, the combination of a container for the alloying metal having an inlet and an outlet for the coating metal, a die in the outlet having an opening therein of a size larger than the wire to be coated by an amount equal to the thickness of the alloying coating, means for maintaining in the container a head of the coating metal which will be insufficient to force the coating metal through the die when the wire is relatively motionless but sufficient to enable the wire when moving at the proper speed to draw the molten metal through the die, means for continuously propelling the wire through the alloying metal in the container and out through the center of the die, and means for solidifying the coating metal as it passes through the die.

9. In a machine for coating wire with a protective alloying coating, the combination of a container for the alloying metal having an inlet and an outlet for the coating metal, a die in the outlet having an opening therein of a size larger than the wire to be coated by an amount equal to the thickness of the alloying coating, means for maintaining in the container a head of the alloying coating, which will be insufficient to force the coating metal through the die when the wire is relatively motionless but sufficient to enable the wire when moving at the proper speed to draw the molten metal through the die, means for regulating the flow of the molten alloying metal to the container, means for continuously propelling wire through the alloying metal in the container and out through the center of the die, and means for solidifying the coating metal as it passes through the die.

PAUL E. BRUNBERG.