

W. E. GIBBS.
METHOD OF AND APPARATUS FOR PRODUCING COPPER WIRE.
APPLICATION FILED AUG. 30, 1910.

1,058,048.

Patented Apr. 8, 1913.

3 SHEETS—SHEET 1.

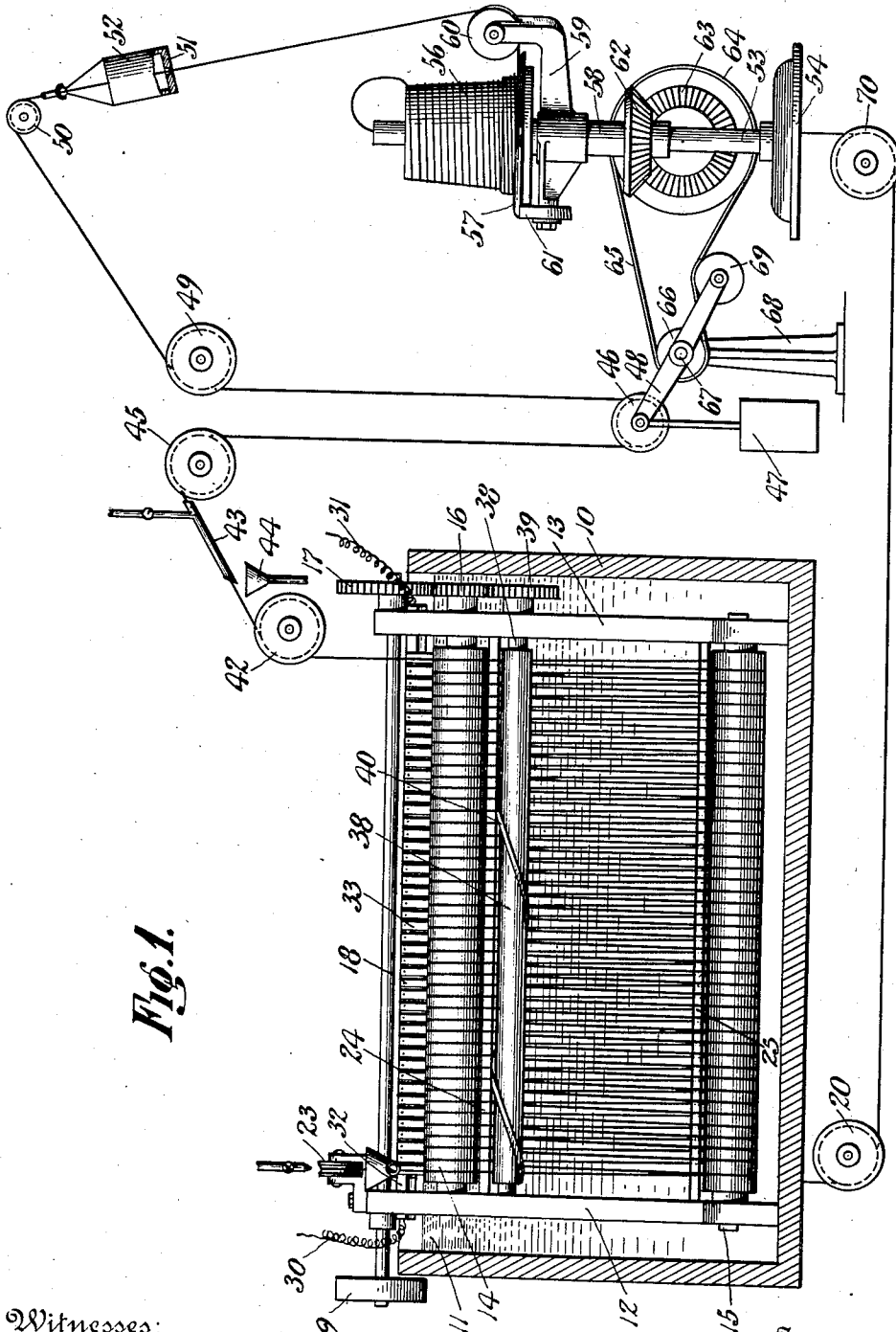


Fig. 1.

Witnesses:
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Ray J. Ernst.

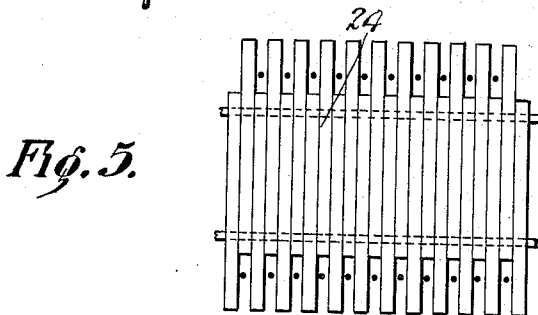
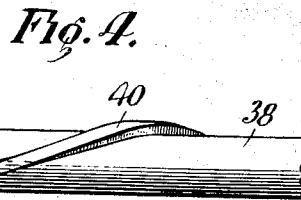
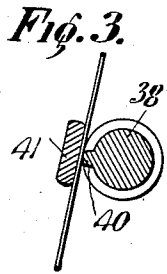
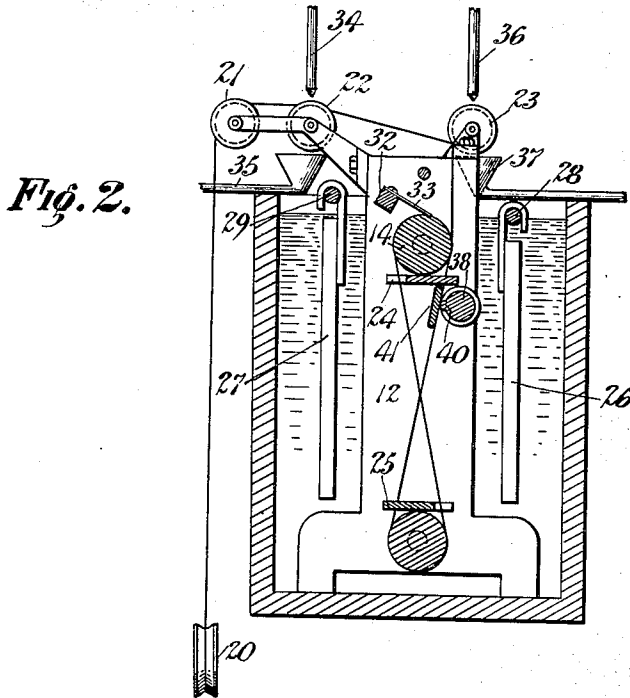
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 6.

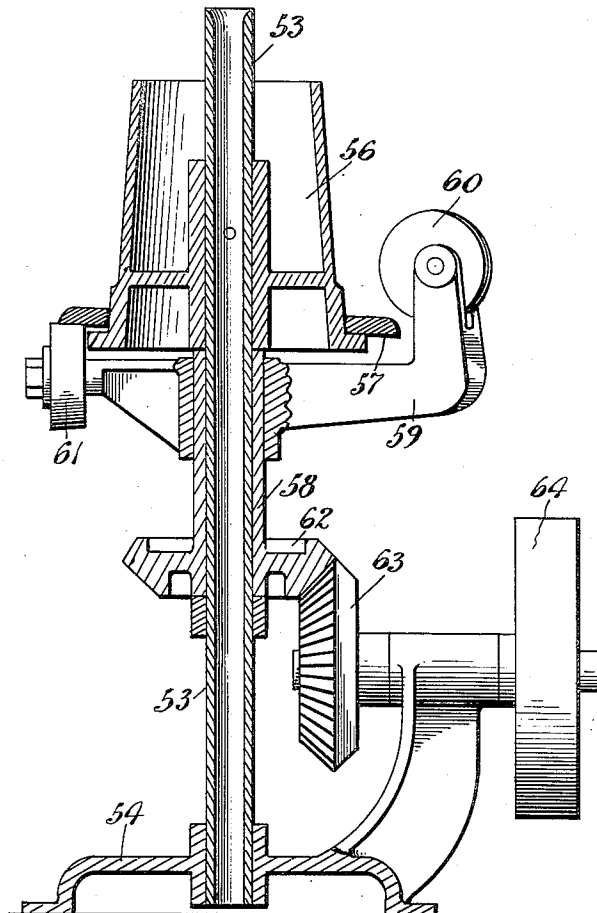


Fig. 7.

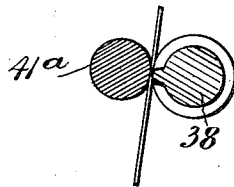
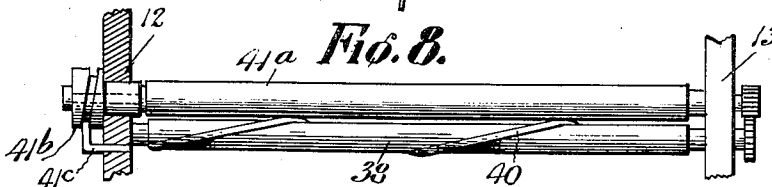


Fig. 8.



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UNITED STATES PATENT OFFICE.

WILLIAM EDWIN GIBBS, OF NEW YORK, N. Y., ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO GIBBS COMPANY, OF PLAINFIELD, NEW JERSEY, A CORPORATION OF NEW JERSEY.

METHOD OF AND APPARATUS FOR PRODUCING COPPER WIRE.

1,058,048.

Specification of Letters Patent.

Patented Apr. 8, 1913.

Application filed August 30, 1910. Serial No. 579,721.

To all whom it may concern:

Be it known that I, WILLIAM EDWIN GIBBS, a citizen of the United States, and a resident of the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Methods of and Apparatus for Producing Copper Wire, of which the following is a specification.

My invention relates to the production of copper wire by direct electrodeposition.

In a prior application filed on September 4, 1909, serially numbered 516,162, I have described a method and apparatus by which copper wire may be produced by electrodeposition, and the present invention constitutes an improvement in some of the features therein set forth.

For practical considerations it is desirable to lead the wire through the vat in continuous series of loops, upon a pair of rolls or cylinders one or each of which is power driven. In such an arrangement, it is necessary either to insure that the diameter of each roll be uniform at all points where the wire engages it, or otherwise to provide for the correction of uneven driving at different points. When it is considered that the vat may contain a mile of wire subdivided into a multitude of small turns, the multiplication of a slight excess or deficiency of the feed at a given point during the travel through the vat will be apparent. In accordance with my present invention I prefer to provide a correcting or equalizing device which does away with the necessity of having the diameter of the roll exactly uniform throughout.

Another difficulty which is met with in the electrodeposition of copper wire is the imperfect adhesion of the deposited layer, due to the presence of oxid upon the surface which is to be coated. I find that the employment of a suitable bath by which the layer of oxid is removed and the surface slightly etched just before the wire passes into the depositing vat makes it possible to obtain a firmly adhering deposit which is not separated during the subsequent drawing operation.

The drawing operation involves an elongation of the wire which comes from the vat, and as in the preferred form of my

process the drawn wire is returned to the depositing vat in cyclic manner, it is necessary to provide for taking up and retaining the increment, or in other words, the drawn wire must be coiled at a greater speed than it is delivered to the vat. The present invention provides a novel form of reeling apparatus by which the wire is taken up at one speed and given off at another, while at the same time permitting of a variation of the speed of reeling by which the tension upon the wire as it comes from the vat is automatically maintained within safe limits.

While the several features of my invention are adapted to cooperate with each other in the system which I shall describe by way of illustration, it will be recognized by those skilled in this art that many of the elements are adapted to more general application and their employment may extend to other uses and combinations where their individual functions may be employed to advantage.

In the accompanying drawings Figure 1 is an elevation, with parts in section, showing a system for producing copper wire by electrodeposition and drawing. Fig. 2 is a cross section through the depositing vat and associated parts. Fig. 3 is a detail cross section of the automatic correcting device by which the travel of the wire through the vat is equalized. Fig. 4 is a side view of one of the equalizing parts. Fig. 5 is a plan view of one of the guide combs by which adjacent turns of wire within the vat are spaced apart. Fig. 6 is a vertical section of the reeling device. Fig. 7 is a cross section, and Fig. 8 is a plan view of a modified form of equalizing device.

Referring now more specifically to said drawings, 10 indicates the vat and 11 the electrolytic bath contained therein. Suitably immersed in the electrolytic bath 11 is a frame comprising uprights 12 and 13 in which are journaled a driven roller 14 and a preferably idle roller 15, the latter having slight vertical play. The driven roller 14 receives power through gear 16 fixed upon its shaft which is in mesh with a gear 17 fixed on power shaft 18 which latter receives power through belt pulley or the like 19. The wire is guided into the vat under guide pulley 20, over guide pulley 21, over

and around guide pulley 22, and under and around guide pulley 23. From guide pulley 23 the wire passes downwardly at one side of the driven roller 14 and under the idle roller 15 at the other side, then diagonally upward over the driven roller and so on a suitable number of times until the desired length of wire is wound upon the supporting frame. In order to prevent the adjacent turns of the wire from coming into contact with each other a pair of spacing combs 24 and 25, preferably made up of staggered plates suitably perforated and bolted together as illustrated in Fig. 5, are employed, the separate turns of wire passing between the projecting ends of alternate plates as clearly shown.

The copper anodes 26 and 27 are hung upon contact rods or bars 28 and 29 which receive current by a suitably connected lead 30. The wire upon which copper is to be deposited forms the cathode and is connected with the lead 31 by means of a conducting rod or bar 32 upon which brushes 33 in contact with the individual turns of wire upon driven roller 14, are mounted.

It will be apparent from the apparatus thus far described that the electrical connections being made and the driven roller 14 being in operation, the wire will be caused to advance through the vat in a continuous series of endwise traveling loops, passing in at one end and out at the other and while in the vat will receive a uniform deposit of copper upon its surface, the crossing of the wire as it passes diagonally from one roll to the other serving to present first one side and then the other side of the wire to the depositing action.

In order that the deposited copper may adhere firmly to the surface of the copper wire to be coated, I preferably employ a suitable acid bath or wash such as indicated diagrammatically at 34, which drips upon the wire as it passes around the guide pulley 20 and drains off into receiving device 35 mounted beneath the pulley 22. The effect of the acid wash is to remove the thin layer of oxid which usually forms upon the surface of copper wire under exposure to the atmosphere, and to leave the surface of the wire in a slightly etched condition. From the acid bath the wire passes under and around the guide pulley 23 as already described and immediately above this is a water bath indicated diagrammatically at 36 by which the remaining acid is washed off and drains away through a suitable receiver 37 mounted beneath pulley 23.

Since the wire in its passage through the depositing vat is gradually increasing in diameter, and the rollers 14 and 15 may have slight irregularities or variations in their respective diameters at different lines

of engagement with the wire, due to minute imperfections in the construction thereof, it will be apparent that one portion of one of the rollers may be feeding the wire at a slightly greater speed than a preceding or succeeding portion of the same roller. Inasmuch as this is a constant variation every rotation of the roller will add to the discrepancy. While the discrepancy may be slight for each turn, the fact that the wire must travel a great distance in passing through the vat multiplies the discrepancy to serious proportions so that the tendency may be to finally create sufficient slack in one portion of the wire to enable it to project into the path of an adjacent turn and entangle the wire. On the other hand, the tendency may be to constantly increase the tension on a particular portion of the wire due to one part of the roller feeding off at a greater speed than a preceding portion of the roller delivers it so that eventually the wire will break. The labor of stringing the wire upon the rollers is necessarily long and tedious inasmuch as the vat may contain a mile or more of wire. The importance of preventing the fouling or rupture of the wire will therefore be apparent and one of the important features of my invention is to always maintain the wire in proper arrangement upon its supporting rollers so as to avoid the necessity of rewinding it.

According to my present invention an automatic equalizing device is employed which constantly tends preferably to retard and return the excess from that portion of the roller which feeds it at greater speed so that slack is being continually moved back toward the receiving end of the roller and thus relieving the frictional engagement of the wire at the larger portions of the roller. In this way the movement of the wire at the larger portions of the roller is automatically retarded until the continued operation of the smaller portions of the roller has taken up the slack. In order to effect this result, I find that the equalizing device must not engage all of the turns of wire simultaneously, as the wire preceding the slack turn should be free to loosen up and slip upon the roller. Preferably the equalizing device should engage the turns of wire successively toward the receiving end of the vat so that the slack will be continually passed back. This operation may be effected in numerous ways but by way of example, I may refer to a specific form which is herein shown and by which I have obtained good results. In this embodiment the equalizing device comprises a shaft 38 driven by a gear 39 in mesh with gear 16 above described, and upon the shaft is a helix 40 extending longitudinally of the shaft a sufficient distance to operate upon each turn of wire within the vat. A

stationary bar or plate 41 is suitably mounted in the uprights 12 and 13 so that the turns of wire pass between the plate 40 and the equalizing shaft 38. The distance between the shaft 38 and the plate 41 is sufficient to permit the wire to run free between them but the helix 40 projects into this space a sufficient distance to engage the wire at those portions of the helix which are at the moment in their innermost positions. The rotation of the shaft 40 causes the points of contact on the helix to move constantly toward the receiving end of the vat so that the turns of wire will be engaged successively in that direction and retarded or moved backward until the frictional engagement of the wire with the roller is relieved at the slack points and the rate of feed thus diminished until the slack has been taken up by the succeeding portions of the roller. The engagement of the helix 40 with the wire is so arranged that the desired amount of friction is maintained but its retarding influence may be overcome when engaging a turn of wire which is under sufficient tension and thus does not require correction.

Assuming that the wire has passed through the vat and received its deposit of copper, the resultant wire of increased diameter is led off over and around a guide pulley 42 through a water bath 43 which drains into a suitable receiver 44, whereby the remaining solution is washed off. From the tube 43 the wire passes over and around a guide pulley 45 down under a floating pulley 46, which is weighted as indicated at 47 and controls the movement of a lever 48 for a purpose which will presently be described. The wire then passes up over and around the guide pulley 49 and through the drawing device which is suitably mounted to have universal movement, and comprising for example, guide pulley 50 and drawing die 51, the latter being mounted in a universally pivoted hanger 52.

The "block" by which the wire is pulled through the drawing die 51 is illustrated in Figs. 1 and 6 and comprises a stationary stud or post 53, suitably secured in the base plate 54. A block or drum 56 is fixed upon the upper end of the post 53 which has tilting guide ring 57 suitably mounted upon its receiving end. Rotatably mounted upon post 53 below the block 56 is a sleeve 58 which has fixed thereto a revolving arm 59 carrying at one end a guide pulley 60 and at the other an idle roller 61. The function of the idle roller 61 is to tilt the guide ring 57 so as to raise it at the side opposite from the guide pulley 60 so that the wire is gradually pushed upon the block and a space is formed between the coil of wire on the block and the side of the guide ring adjacent to the guide pulley 60 in which the guide pulley 60

lays the wire as it comes from the drawing die 51. The revolving arm 59 is driven by a bevel gear 62 which is fixed upon the sleeve 58 and engages a bevel gear 63 suitably mounted and driven by belt pulley 64 over which a belt 65 travels. Belt 65 is driven from belt pulley 66 and power shaft 67 which latter is journaled in a suitable bearing 68.

The lever 48 above referred to, carries an idle roller 69 at the end opposite to the pulley 46, and upon movement of the lever 48, the idle roller 69 engages the belt 65 and varies the tension thereof. When the belt 65 is loose it slips upon the belt pulley 64 so that revolving arm 59 is retarded. It will be seen that by this construction any tendency of the block to pull the wire through the drawing die at too great a speed relatively to the travel of the wire through the electrolytic vat will raise the weighted end of this lever 48 and slacken belt 65, thereby retarding the revolving arm 59. As soon as the continued feed of wire through the vat enables the weight 47 to move the idle roller 69 into tightening engagement with the belt 65, the movement of the revolving arm 59 is resumed. It will thus be seen that the speed through the drawing die with the speed through the depositing vat are automatically maintained in the proper ratio. As the revolving arm 59 coils the wire upon the block 56 at the bottom the wire is crowded off toward the top and in order to make the method continuous and cyclic in its operation, the wire from the top of the coil is continuously led off and down through the hollow post 53 under a guide pulley 70 from which it is returned under guide pulley 20 already referred to, through the cycle of operations.

It will be understood by those skilled in this art that the materials of which the various parts of the apparatus are constructed must be selected in accordance with the conditions under which they must operate. For example, those parts which are to operate within the depositing vat must be of such character as not to contaminate the bath or to be destroyed thereby while the washing and etching bath of acid will necessitate the use of material which is impervious or inert to the acid of the bath.

It will be observed from Figs. 1 and 2 that the frame and feed rollers upon which the wire travels together with their various associated parts, are constructed as a unit which may be removed entire from the vat. By this construction the initial winding of the wire upon the rolls may take place outside of the vat and the entire feeding and supporting apparatus be then immersed to the desired depth in the bath.

In some instances it may be desirable to

substitute a rotary cylinder for the stationary plate 41 against which the spiral flange 40 operates to retard the wire. Such a construction is illustrated in Figs. 7 and

8. The roller is shown at 41^a and is geared to the roller 38 as shown in Fig. 8. At one end of the shaft of roller 41^a, a barrel cam 41^b is secured in which operates stationary finger 41^c so that the roller 41^a is continuously reciprocated longitudinally as it rotates and thus distributes the wear from the wire which engages it. The rollers 38 and 41^a may be driven either slower or faster than the wire so that the slack may be either retarded or advanced, as in either case it will effect the desired result of equalizing the feed in the individual loops of the wire.

I do not claim in this application the product obtained by the process and apparatus herein shown as the same is reserved for claiming in a separate application.

What I claim is:

1. The method of producing copper wire, electrolytically, which comprises passing a copper wire through a depositing vat, drawing and reeling the resultant product, and automatically maintaining the speed of the wire through the vat and the reeling speed in proper ratio.

2. The method of producing copper wire electrolytically, which comprises passing a copper wire through a depositing vat, drawing and reeling the resultant product, and automatically governing the reeling speed by the speed of the wire through the vat.

3. The method of depositing copper upon copper wire, which comprises leading the wire through an electrolytic bath in a series of loops, and automatically equalizing the speed of the several loops.

4. The method of depositing copper upon copper wire, which comprises leading the wire through an electrolytic bath in a plurality of loops, and locally correcting abnormal speed in individual loops.

5. The method of depositing copper upon copper wire, which comprises leading the wire through an electrolytic bath in a plurality of loops, and locally retarding excessive speed in individual loops.

6. The method of depositing copper upon copper wire, which comprises leading the wire through an electrolytic bath in a plurality of frictionally driven loops, and engaging the loops in sequence by a friction retarding device whereby loops moving at excessive speed are relieved of frictional engagement with their driving means.

7. The method of depositing copper upon copper wire, which comprises advancing the wire through an electrolytic bath in a plurality of loops upon suspending rollers, and automatically equalizing the rate of advance in the individual loops.

8. The method of depositing copper upon copper wire, which comprises advancing the wire through an electrolytic bath, in a plurality of loops by frictional engagement upon supporting rollers, and automatically reducing the frictional engagement of the loops advancing at excessive speed.

9. Apparatus for producing copper wire by direct deposition, comprising in combination a depositing vat, a drawing die, a reeling device, means for advancing the wire through the depositing vat, and means for maintaining the operation of the reeling device in proper relation to the advance of the wire through the depositing vat.

10. Apparatus for producing copper wire by direct deposition, comprising in combination a depositing vat, a plurality of rollers supporting and advancing the wire through the vat in a continuous series of loops, and means for maintaining the speed of the individual loops equal.

11. Apparatus for producing copper wire by direct deposition, comprising in combination a depositing vat, a plurality of rollers for supporting and advancing the wire through the vat in a continuous series of loops, and means for correcting inequalities of advance in individual loops.

12. Apparatus for producing copper wire by direct deposition, comprising in combination a depositing vat, a plurality of supporting rollers for advancing the wire through the vat in a continuous series of loops, and a friction device successively engaging the loops of wire and correcting inequalities in their advance.

13. Apparatus for producing copper wire by direct deposition, comprising in combination a depositing vat, a plurality of supporting rollers for advancing the wire through the vat in a continuous series of loops, and a rotary helix frictionally engaging successive loops to correct inequalities of advance.

14. Apparatus for producing copper wire, by direct deposition, comprising in combination a depositing vat, a plurality of supporting rollers for advancing the wire through the vat in a continuous series of loops, a stationary plate extending transversely of and in proximity to the loops of wire, and a rotary helix adapted to frictionally engage successive loops of wire in conjunction with said stationary plate and retard loops advancing at excessive speed.

15. Apparatus for producing copper wire by direct deposition, comprising in combination a depositing vat, a plurality of supporting rollers for advancing the wire through the vat in a continuous series of loops and a roller and rotary helix geared together and adapted to frictionally engage successive loops of wire and correct abnormal advance in individual loops.

16. Apparatus for producing copper wire by direct deposition, comprising in combination a depositing vat, a plurality of supporting rollers adapted to advance the wire
5 through the vat in a continuous series of loops, a roller and rotary helix adapted to frictionally engage successive loops and correct abnormal advance in individual loops, and means for reciprocating said roller to distribute the wear thereon.

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Witnesses:

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