(No Model.)

G. C. REESE.

ART OF DRAWING METAL.

No. 342,040. Patented May 18, 1886.

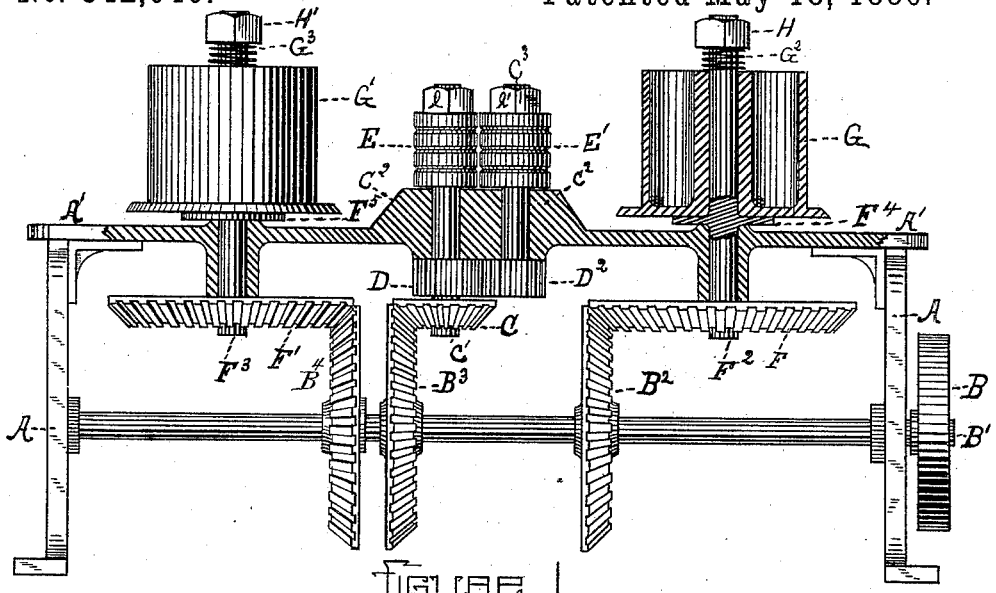

FIGURE 1

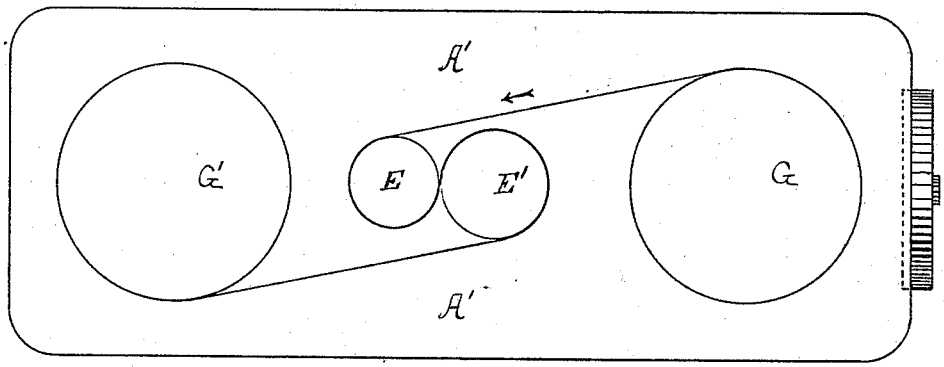

FIGURE 2

Witnesses—

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ART OF DRAWING METAL.

SPECIFICATION forming part of Letters Patent No. 342,040, dated May 18, 1886.

Application filed September 15, 1883. Serial No. 106,527. (No model.)

To all whom it may concern:

Be it known that I, GEORGE C. REESE, a citizen of the United States, residing at Woodvale, in the county of Cambria and State of Pennsylvania, have invented a certain new and useful Improvement in the Art of Drawing Metals; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 indicates a side elevation, partly in section, of an improved apparatus adapted to the use of my invention. Fig. 2 indicates a plan view of the same.

Like letters of reference indicate like parts wherever they occur.

My invention consists, first, in a new and useful process for drawing wire; and, secondly, in mechanism adapted to the use of said process.

The object of the invention is to substitute a simple, cheap, rapid, and efficient mode of drawing in place of the slow, tedious, laborious, and costly method heretofore in use.

In the manufacture of wire by the method heretofore in use, the material is subjected repeatedly to a series of reducing, annealing, and scaling operations before it can be brought down to the gage desired. The reducing operation is performed by pulling the metal through draw-plates, which generally effect a reduction of about two gages to each draw. This reducing action renders the material hard, brittle, highly elastic, and destroys its ductility; hence it must be annealed frequently between the reducing operations. In annealing a coating of scale forms upon the blank, and it is necessary to remove this by pickling the material in acid previous to subjecting it to the succeeding drawing operation. The scale is thicker, tougher, more tenacious, and more difficult to remove at some than at other portions of the blanks. Therefore the acid acts unequally, the metal is lost by undue oxidation by the acid, and the wire, after pickling, frequently retains in different places particles of hard tenacious scale. These particles of scale cut and score the draw-plate during the succeeding drawing operation, enlarging its aperture, so that less reduction takes place in the portion of the coil or hank drawn through after such enlargement has taken place. This difference in diameter causes serious trouble in the succeeding drawing operation, for the wire passes through the draw-plate readily until the part where such enlargement has taken place is reached, when the extra tension on the metal in the endeavor to draw the latter through the draw-plate frequently breaks the wire, or the friction and action of the metal upon the draw-plate becomes excessive and the latter cannot retain and properly exercise its functions; hence it follows that very frequent renewals and repairs of the draw-plates are necessary.

The first cost of the draw-plates and the cost of their repair, together with the cost of acid, time, labor, and loss of metal in pickling constitute a large portion of the expenses incident to the manufacture of wire, and I therefore purpose to dispense entirely with the draw-plate and pickling in the use of my invention; and I do this by subjecting the blank without compression to a traveling tension, which gradually passes from one to the other end of the wire-blank, and I also regulate this tension so that rupture of the wire cannot take place.

I shall now describe the best means known to me for carrying out my improvement, so that others skilled in the art may make and use the same.

In the drawings, Figs. 1 and 2 illustrate the machine I employ in carrying my improvement into practical use.

A A indicate the legs, and A′ indicates the top of the stand in which the drawing mechanism is mounted.

B indicates the power-pulley mounted on the driving-shaft B′, which is provided with three beveled gear-wheels, B^2, B^3, and B^4, and is suitably journaled in the legs A A of the drawing-table.

C indicates a small beveled gear-wheel, which meshes into the beveled gear-wheel B^3, and is mounted on the lower end of a vertical pulley-shaft, C′. This vertical pulley-shaft C′ is journaled in a heavy bearing, C^2, upon the upper part of the table, and is provided with a drawing-pulley, E, securely attached thereto, and held in position by means of a nut, *e*, which is screwed on the upper end of the pulley-shaft C′.

D indicates a small gear-wheel mounted upon the pulley-shaft C′, and meshes into and communicates motion to a similar gear-wheel, D^2, mounted upon the lower end of a supplemental pulley-driving shaft, which is also journaled

in the heavy bearing C^2, and is provided with a drawing-pulley, E', slightly larger in diameter than the pulley E on the shaft C'. This pulley E' is keyed into the shaft C^3, and is held into position by a nut, e', screwed upon the top of the latter.

F and F' indicate a set of beveled gear-wheels, which mesh, respectively, into the gear-wheels B^2 and B^4, and are mounted upon a set of vertical shafts, F^2 and F^3, which are suitably journaled in the top of the table. These vertical shafts F^2 and F^3 are provided with flanges F^4 and F^5, securely attached to them and extending out horizontally just above their journal-bearings in the top of the table.

G and G' indicate a set of coiling-drums, which slip down loosely over the shafts F^2 and F^3, and rest at their bases on the flanges F^4 and F^5.

G^2 and G^3 indicate a set of spiral springs inserted over the upper end of the shafts F^2 and F^3, and bearing, respectively, upon the upper ends or heads of the drums G and G', so as to press the latter down on the flanges F^4 and F^5. These springs are secured in position and their tension upon the drums is regulated by means of the nuts H and H', which are screwed on the ends of the shafts F^2 and F^3.

The operation of the mechanism is as follows: Power is applied to the pulley B, causing it, the main shaft B', and the beveled gear-wheels B^2, B^3, and B^4 to rotate in unison. The gear-wheel B^3 communicates a rapid motion to the small gear-wheel C and to its shaft and roll, and this rapid movement is transmitted through the gears D D^2 to the supplemental shaft and pulley, causing the latter (as it has a larger diameter) to travel at a slightly faster surface speed than that of the opposite pulley. The gear-wheels B^2 and B^4 communicate their motion to the vertical shafts F^3 and F^4 through the medium of the gears F' and F^2, and this rotary motion is also partaken of by the drums G and G' on account of the friction between their bases and faces of the flanges F and F', against which they are pressed by the action of the springs G^2 and G^3.

The operation of the improvement is as follows: The wire blank having been coiled up around the drum G, the latter is inserted on its shaft, and its spring is screwed down to force it with the desired pressure against the flange F. A portion of the wire is then wrapped first around the small pulley and then around the larger pulley, and the end is fastened to the opposite receiving-drum, as indicated in Fig. 2. Power is then applied to the machine and the drawing operation commences. The delivering-drum G, being held by its spring against the flange F, is caused to rotate by the friction, and delivers the wire to the small pulley E, which, by its rotary motion, delivers it to the larger pulley, E', but at a slower rate of speed than the surface of the latter is traveling, so that the wire is put under tension during its passage from the small to the large pulley, and is thereby reduced in diameter, for the large pulley draws the metal to it at a faster speed than it is delivered by the small pulley. The reduced metal then passes to the receiving-drum and coils up gradually until the first drawing operation is ended. As soon as all the wire is coiled up the drums or spools are removed from their shafts and exchanged, and the drawing operation is again continued.

It will be observed, first, that both the delivering and receiving drums are run by friction, and, second, that the shaft upon which the receiving-drum rests is geared to travel at a little faster speed than the shaft on which the delivering-drum rests. The objects of these arrangements are—

First, I want to deliver the wire with but little jar or shock to the first pulley, and therefore have geared the shaft upon which the delivering-drum rests so that in starting the wire will be delivered at about the speed that the receiving-pulley travels. Of course the tendency of the wire is to feed slower and slower as it unwinds and as the coil grows smaller in diameter, and as the drum is not attached to the shaft, but merely rests upon a frictional bearing, a slight strain upon the wire by the receiving-pulley gradually accelerates the speed of the drum and draws the wire to the receiving-pulley at a uniform rate of speed. The arrangement in this instance is merely to relieve the wire from jar in starting. Otherwise it is not necessary to gear the shaft F at all, as the receiving-pulley would unwind the wire from the drum by rotating the latter if the shaft were stationary.

Second. The receiving-drum G' rests upon a frictional bearing, which has a tendency to rotate the drum at the desired speed to take up the wire as it leaves the delivering-pulley; but as the wire is coiled on the drum the increased diameter thereof would result in increased tension on the wire were this not counteracted by the slip of the drum on its shaft.

From the foregoing description it will be observed that my method of drawing consists in reducing the diameter or cross-sectional area of the metal by subjecting it to tension without compression while passing from one pulley to the other. The method is not, strictly speaking, a mere wire-drawing operation, as it is apparent it might be applied to drawing heavier materials.

The rationale of the improvement is: I subject the metal while passing from one to another pulley to a tensile strain beyond its elastic limit. This causes a certain per centage of elongation, a permanent set is produced, and a reduction of the diameter is secured, and as all of the metal, except a short piece of each end, passes through during the operation, the strain is brought gradually upon it and travels over all portions, except those at the ends, which do not pass between the pulleys, so that a uniform reduction of diameter is secured.

From an analysis of the foregoing descrip-

tion it will be observed that the method embraces the following essentials: First, the metal must be made to bind on the first or slow roll or pulley, and this can be done either by means of a reel or equivalent device which will supply a moving tension between the feed and first roll or pulley, or by winding the metal around the roll sufficiently to obtain the drag or binding effect; secondly, the metal must be drawn while crossing the space between the rolls or pulleys, and this can be done by speeding up the second roll or pulley, or by increasing its diameter, so as to obtain a greater surface speed; finally, the metal must bind on the second roll or pulley, and this can be done, as in the first instance, by winding the metal several times around the second roll or pulley or by the use of a receiving-reel. The amount of reduction at each pass will depend upon the difference in the surface-speed of the pulleys and the character of the metal, and this difference in surface-speed may be greater or less, according to the greater or less degree of extension before rupture possessed by the different qualities of metal operated upon.

The different surface-speed of the pulleys required may be obtained in any of the well-known ways for producing the result—such as varying the relative sizes of the rolls or of their driving-gearing, or grooves of different diameters may be provided in the same pulley.

By an inspection of Fig. 1 of the drawings it will be noticed that I have shown two pulleys having three grooves of equal depth turned in upon their surfaces. The object of this is to enable me to draw three wires uniformly at the same time, the operation being the same as that I have previously described, except three coils of wire blank are coiled up around the drum G, or around it and a couple of similar spools or drums, (not shown,) then wrapped around the pulleys in their grooves, and attached at the ends to the receiving drum or drums. It will be readily understood without further description that the pulleys may be provided with any desired number of such grooves, that a corresponding number of wires may be wrapped therein, and that a corresponding number of sets of drums or spools being used all the wires may be drawn uniformly at one and the same time if such a mode of procedure is deemed advisable.

My improvement will be particularly adapted for the manufacture of fine wire, such as is largely in use for flour-bolts, &c. At present the manufacture of such wire is attended with great expense, and the drawing operations are extremely slow, numerous, and tedious. As before stated, when wire is drawn through dies it becomes hard, elastic, and highly brittle, and therefore requires frequent annealing to restore the metal to its normal condition previous to being subjected to some of the drawing operations. This is done, and the material is then pickled to remove the scale; but after the blank has become drawn down to about No. 18 or 20 wire-gage, the annealing and pickling must be dispensed with, because the acid used in the latter would corrode and weaken it. Consequently this fine wire cannot be annealed, and grows harder and harder and more and more brittle at each successive drawing operation, so that it must be drawn less and less at each time the operation is continued, and the final gage is obtained only after the expenditure of great time, care, labor, and expense. In the use of my invention, however, I can anneal the metal at any time, as I do not have to remove the scale, and consequently can work fast on fine wire and produce it at a very low cost.

In the use of my improvement I can dispense with pickling and thereby save the cost of acids, &c., and the waste of metal which takes place in such an operation.

My rolls may be driven at a very high rate of speed and a large increase of product obtained.

I do not herein claim a process of wire-drawing in which the metal is reduced by the combined compressing action of reducing-dies and a traveling tension beyond the elastic limit of the metal; but

What I do claim is—

1. The method of extending and reducing metal, which consists in drawing it progressively from and over one roll or pulley to and over another roll or pulley, the surface-speed of the second exceeding that of the first, and the metal being held or retarded in its passage over the rolls or pulleys so as to bind thereon, whereby the greater speed of the second shall elongate it and reduce its cross-sectional area as it crosses from one roll or pulley to the other, substantially as and for the purposes specified.

2. In a machine for drawing metals, the combination of two tension-pulleys geared to move at different surface-speed, and delivery and receiving drums with devices for regulating the speed of said drums to keep taut the portions of the metal between the tension-pulleys and their respective drums, substantially as and for the purposes specified.

3. A machine for drawing metal, provided with tension-pulleys arranged to run at different rates of surface-speed, and a coiling drum or spool mounted on a frictional bearing, substantially as and for the purposes specified.

4. A machine for drawing metal, having tension-pulleys arranged to travel at different rates of surface-speed, a coiling drum or spool mounted on a frictional bearing, and devices for regulating the friction between the drum and its bearing, substantially as and for the purposes specified.

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