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METHOD AND MACHINERY FOR DRAWING WIRE

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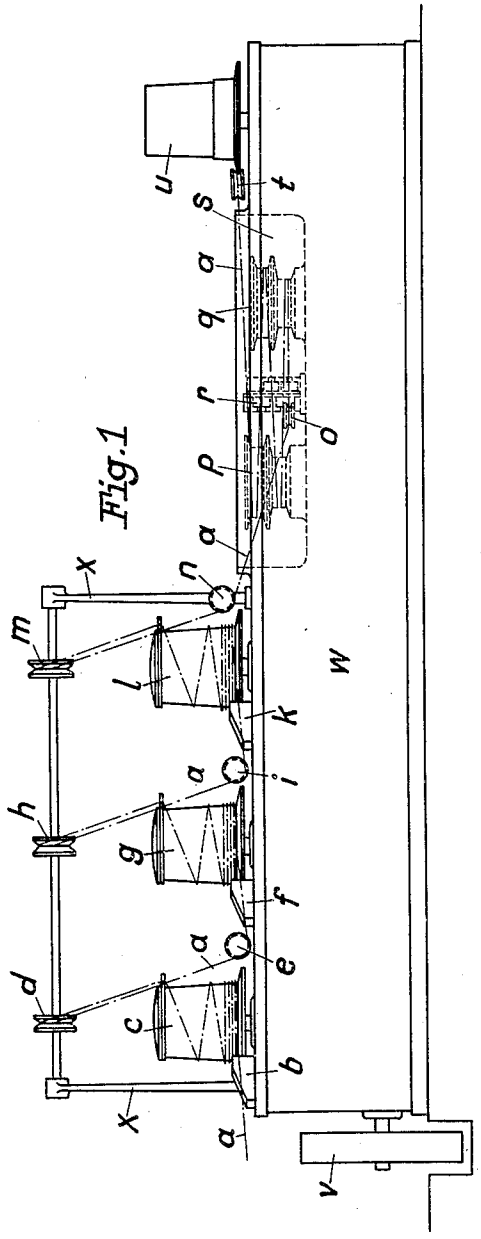


Fig. 1

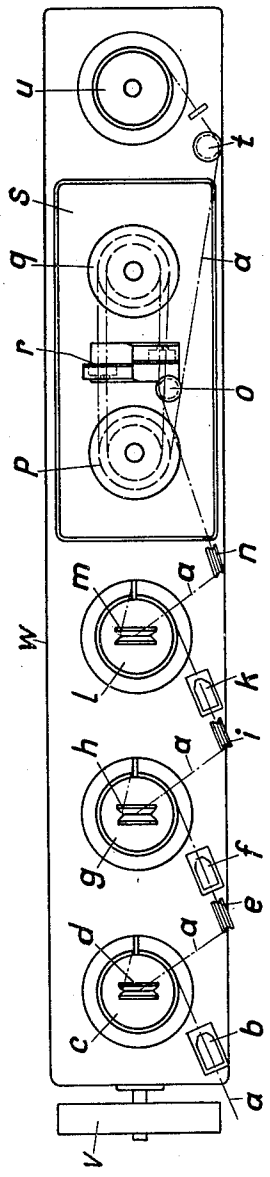


Fig. 2

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METHOD AND MACHINERY FOR DRAWING WIRE

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8 Claims. (Cl. 205—21)

My invention relates to improvements in methods and machinery for drawing wire, and more particularly in methods and machinery in which the wire is successively drawn through a series of dies for reducing the same from the original diameter to a very small diameter, and in which the wire is successively drawn through the said dies by means of drums frictionally engaging the same. The object of the improvements is to provide a method and machinery of increased efficiency, the energy needed for performing a certain work being considerably reduced, say by about 40%, more or less, or the amount of work performed by the same energy being considerably increased. With this object in view my invention consists in performing the first step or steps of the wire drawing operation and until a certain velocity of the wire is attained, by means of drawing implements such as drums which draw the wire positively and without any sliding or slip action, and thereafter continuing the drawing operation by means of drums which frictionally and slidingly engage the wire.

I have found that by my improved method the advantages of both drawing methods are availed of, while the disadvantages of each method are reduced to a minimum. As is known to those skilled in the art, the method of drawing wire in which the wire is in sliding or frictional engagement with the drawing drum has the drawback that a considerable part of the energy is lost by being transformed into friction work and heat, while in the method in which the wire is positively drawn by the drum the whole energy is transformed into drawing work. However, the last-named method in which the wire does not slide or slip on the drum has the drawback that it can be performed only at comparatively low drawing velocity, while the drawing velocity of the first-named method in which the wire is in sliding engagement with the drum is considerably higher. Therefore, if the drawing method consists of two steps the initial one comprising the drawing of the wire by the drum without sliding and friction, while the subsequent step comprises the drawing of the wire by means of drums which are in frictional or sliding engagement with the wire, and if, further, the first step of the operation is carried out until a certain high velocity has been attained, the energy needed for the first step of the operation is considerably reduced, because the loss caused by friction is obviated, and during the second step of the operation in which the drum or drums are in sliding engagement with the wire any desired high velocity may be attained, though there is a loss of energy by friction. Thus the output of the system may be as high as in machines in which all the steps are performed by drums which are in sliding engagement with the wire.

For the purpose of explaining the invention a machine suitable for putting the method into effect has been illustrated in the accompanying drawing, in which

Fig. 1 is a diagrammatical elevation showing the machine, and

Fig. 2 is a diagrammatical plan view of Fig. 1.

In the example shown in the figures the machine comprises a base *w* on which three drums *c*, *g*, *l* and two stepped drums *p* and *q* having vertical axes are mounted, the said drums being adapted to be rotated at successively increasing velocities, by suitable mechanism (not shown) from a pulley *v*. As shown in the figure, the drums *c*, *g* and *l* are mounted on the top of the base, while the stepped drums *p* and *q* are mounted in a trough-shaped portion *s* of the base, which may be filled with a suitable cooling medium. Further, at the rear of the drums *p* and *q* a drum *u* is rotatably mounted on which the finished wire is wound, the said drum being likewise rotated from the pulley *v*. In front of each of the drums *c*, *g* and *l* a die *b*, *f*, *k* respectively is secured to the base *w*, and between the stepped drums *p* and *q* pairs of dies *r* are provided. On a frame *x* mouted on the base *w*, guide rollers *d*, *h* and *m* are loosely mounted, and between the drums *c*, *g*, *l* and *p* guide rollers *e*, *i* and *n* are mounted on the base *w*. Similar guide rollers *o* and *t* are provided respectively at the receiving end of the drums *p* and *q* and in front of the drum *u*.

In the operation of the machine the wire *a* to be reduced in diameter is first passed through the die *b*, and thereafter it is wound on the drum *c*. The wire delivered from the said drum is trained on the guide rollers *d* and *e*, and thereafter it is passed through the die *f*, whereupon it is trained on the drum *g*. In a similar way the wire passes through the die *k*. The wire passing from the drums *c*, *g* and *l* to the guide rollers *e*, *i* and *n* is not under tension. After being delivered from the drum *l* and trained on the rollers *m* and *n* the wire *a* is passed into the trough-shaped portion or tank *s* and on the roller *o*, whereupon it is trained on the stepped drums *p* and *q* and passed through the dies *r* provided between the same. Finally the finished wire leaving the upper step

of the drum p is passed on the guide roller t and wound on the drum u.

The number of the turns of the wire a on the drums c, g and l is such that the wire is positively drawn by the said drums so that it does not slide thereon, while the drums p and q are in sliding engagement with the said wire. Accordingly, the drums c, g and l are rotated at comparatively low velocities, while the drums p and q are rotated at high velocity. Therefore, the loss of energy of the drawing operation of the drums c, g and l is reduced to to a minimum, and the output of the machine is high by reason of the high velocities of the drums p and q. In the operation of the machine the velocities of the drums c, g and l will be as high as possible in view of the non-sliding engagement of the drums with the wire, and the velocities of the drums p and q will be as high as in machines now in use, in which all the drums are in sliding engagement with the wire. By the high velocities of the wire trained on the drums p and q heat is developed, and for this reason it is preferred to dispose the said drums in a cooling liquid.

It will be understood that the number of the drums c, g and l may be varied according to the character of the metal, and also the number of the drawing operations performed by the drums p and q may be varied. For example a copper wire may be drawn say through six dies by means of drums which positively draw the same, and only after passing the wire through the said dies it will be necessary to continue drawing by means of drums which are in sliding engagement with the wire. In the drawing I have shown a machine in which all the drums are driven from the same source of power v, the velocities of the drums successively increasing from the intake end to the delivery end. But I wish it to be understood that my invention is not limited to the construction shown in the drawing and that separate drawing means may be provided for the drums or groups of drums. Further, it will be advisable in some cases to increase the number of the drawing operations in which the wire is in sliding engagement with the drums as compared to what is ordinarily needed, and to provide independent driving mechanisms for the said drums. Thereby a part of the machine may be used for other operations.

In order that my invention may be clearly understood I shall now describe an example.

A copper wire is to be reduced from a diameter of 8 millimeters to 1.5 millimeters, and it is desired to work an amount of wire per unit of time such that a wire of 1.5 millimeters is delivered from the machine at a velocity of 10 meters per second. In methods now in use eleven dies were needed, and the power needed for drawing was 115 hp. In my improved method six out of eleven steps of the drawing operations may be carried out by means of drums (such as those shown at c, g, l) on which the wire is trained without sliding, the said steps reducing the wire to say 2.5 millimeters. For further reducing the wire to 1.5 millimeters drums (such as those shown at p, q) are used which are in sliding engagement with the wire. The power needed for this operation is about 70 hp., which is a saving of about 37%. It will be understood that both the old method and the new method procedures compared in this paragraph were carried out with the same kind of wire, the same number of steps, the same type of dies, and the same final or delivery velocity of 10 meters per second.

If the same wire is to be reduced by means of the same machinery to a diameter of 2 millimeters, the final velocity of the wire being about 6 meters per second, six positively drawing drums are needed, and only two drums which are in sliding engagement with the wire. Thereby the saving of power is further increased.

If it is desired to reduce a copper wire from 6.3 millimeters to 1.4 millimeters five steps may be operated with positively drawing drums for reducing the wire to 2.4 millimeters, and immediately thereafter four steps are provided in which the drums are in sliding engagement with the wire, the wire being reduced thereby to 1.4 millimeters, and the end velocity being 10 meters per second. In this case the positive drawing requires about 30 hp., and the sliding drawing 35 hp., so that the whole power needed in the method is 65 hp. In methods heretofore in use 85 hp. were required.

If a copper wire of 6.3 millimeters is to be reduced to .8 millimeter, and the final velocity of the wire is to be 15 meters per second, I provide five positively drawing drums by means of which the wire is reduced to 2.4 millimeters and thereafter nine steps in which the wire is in sliding engagement with the drums whereby the wire is reduced to .8 millimeter. The positive drawing operation requires 15 hp., and the sliding drawing operation 48 hp., the whole power needed in the method being 55 hp. In methods heretofore in use fourteen steps were required to obtain this particular result, and the consumption of power was 75 hp.

I claim:

1. The method of drawing wire, which consists in imparting a continuous longitudinal movement to the wire and during such continuous movement subjecting the wire portion which has the original diameter to a positive drawing operation which reduces such diameter while said wire portion travels longitudinally at a relatively low speed, while at the same time another portion of the wire, the diameter of which portion has been reduced by said positive drawing operation, is subjected to a slip drawing operation which further reduces the diameter of the wire while said last-mentioned wire portion travels longitudinally at a relatively high speed.

2. The method of drawing wire, which consists in imparting a continuous longitudinal movement to the wire and during such continuous movement subjecting the wire portion which has the original diameter to a positive drawing operation which reduces such diameter progressively in a plurality of successive steps while said wire portion travels longitudinally at a relatively low speed, while at the same time another portion of the wire, the diameter of which portion has been reduced by said positive drawing operation, is subjected to a slip drawing operation which further reduces the diameter of the wire while said last-mentioned wire portion travels longitudinally at a relatively high speed.

3. The method of drawing wire, which consists in imparting a continuous longitudinal movement to the wire and during such continuous movement subjecting the wire portion which has the original diameter to a positive drawing operation which reduces such diameter while said wire portion travels longitudinally at a relatively low speed, while at the same time another portion of the wire, the diameter of which portion has been reduced by said positive drawing operation, is subjected to a slip drawing operation which fur-

ther reduces the diameter of the wire progressively in a plurality of successive steps while said last-mentioned wire portion travels longitudinally at a relatively high speed.

4. The method of drawing wire, which consists in imparting a continuous longitudinal movement to the wire and during such continuous movement subjecting the wire portion which has the original diameter to a positive drawing operation which reduces such diameter progressively in a plurality of successive steps while said wire portion travels longitudinally at a relatively low speed, while at the same time another portion of the wire, the diameter of which portion has been reduced by said positive drawing operation, is subjected to a slip drawing operation which further reduces the diameter of the wire progressively in a plurality of successive steps while said last-mentioned wire portion travels longitudinally at a relatively high speed.

5. Wire-drawing machinery comprising a positive drawing section of relatively low speed, a slip drawing section of relatively high speed, and means for causing the wire to pass in a longitudinal movement first through said positive drawing section and then through said slip drawing section, such movement being continuous so that at the same time that one portion of the wire is being drawn through one of said sections another portion of the wire is being drawn through the other section.

6. Wire-drawing machinery comprising a positive drawing section of relatively low speed, said section including a plurality of successive drawing means for reducing the initial thickness of the wire progressively, a slip drawing section of relatively high speed, and means for causing the wire to pass in a longitudinal movement first through said positive drawing section and then through said slip drawing section, such movement being continuous so that at the same time that one portion of the wire is being drawn through one of said sections another portion of the wire is being drawn through the other section.

7. Wire-drawing machinery comprising a positive drawing section of relatively low speed, a slip drawing section of relatively high speed, the said slip-drawing section including a plurality of successive drawing means for reducing the thickness of the wire progressively, and means for causing the wire to pass in a longitudinal movement first through said positive drawing section and then through said slip drawing section, such movement being continuous so that at the same time that one portion of the wire is being drawn through one of said sections another portion of the wire is being drawn through the other section.

8. Wire-drawing machinery comprising a positive drawing section of relatively low speed, said section including a plurality of successive drawing means for reducing the initial thickness of the wire progressively, a slip drawing section of relatively high speed, the said slip drawing section including a plurality of successive drawing means for further reducing the thickness of the wire progressively, and means for causing the wire to pass in a longitudinal movement first through said positive drawing section and then through said slip drawing section, such movement being continuous so that at the same time that one portion of the wire is being drawn through one of said sections another portion of the wire is being drawn through the other section.

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