(No Model.)

B. C. TILGHMAN.

METHOD OF DRAWING METAL RODS.

No. 345,816. Patented July 20, 1886.

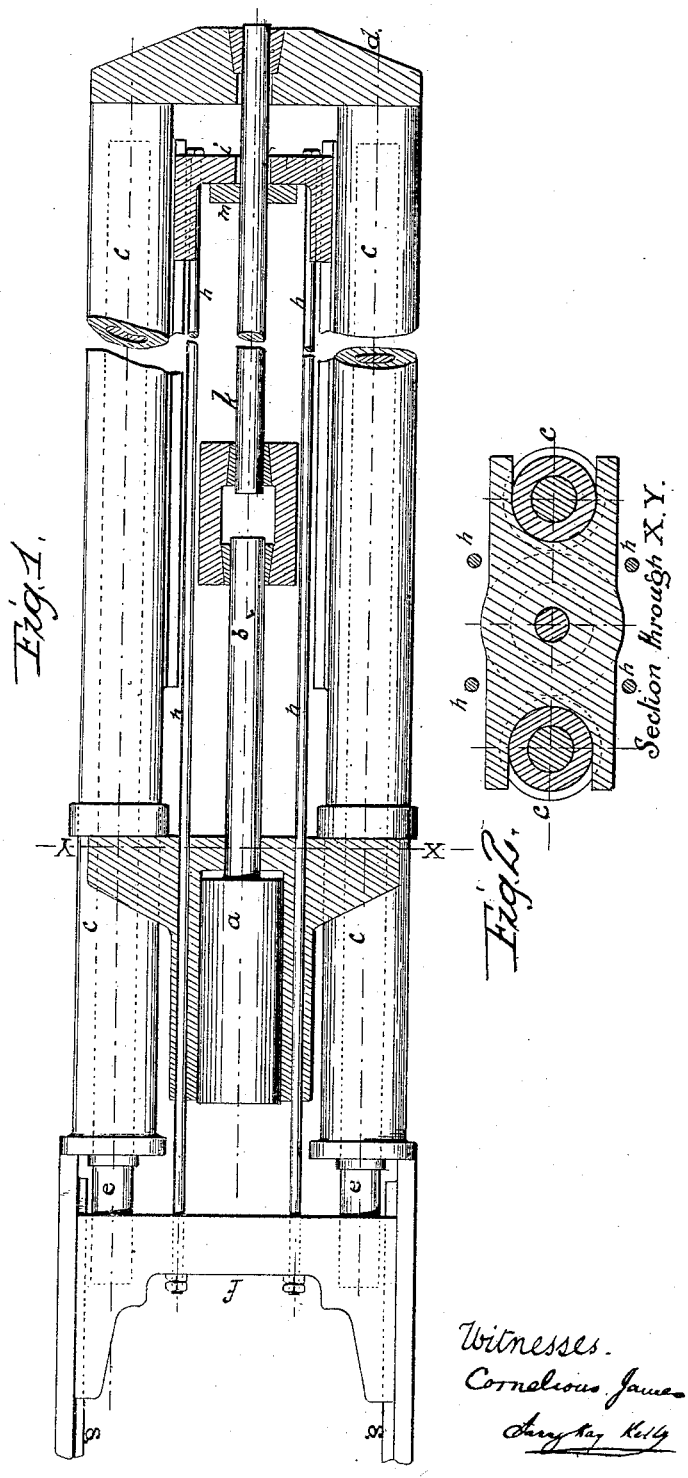

Fig. 2.

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METHOD OF DRAWING METAL RODS.

SPECIFICATION forming part of Letters Patent No. 345,816, dated July 20, 1886.

Application filed April 19, 1886. Serial No. 199,373. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN CHEW TILGHMAN, of Philadelphia, Pennsylvania, a citizen of the United States, now temporarily residing at Altrincham, Cheshire, in the Kingdom of Great Britain, have invented certain new and useful Improvements in the Process of Drawing Metal Rods; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to the process of drawing metal rods which are desired to be as straight as possible after having been drawn.

Heretofore, in the ordinary process of drawing metal rods, only that part of the rod which has passed through the die is subjected to tension, and the tension given is only sufficient to pull the rod through the die, the undrawn part of the rod being free from tension.

My invention consists in applying a powerful tension to the whole length of the rod before and during its passage through the die. This tension, which I will call the "initial tension," is independent of the tension which pulls the rod through the die, which I will call the "die-tension." The initial tension pulls all the curves and crooks of the rod into a straight line, and also brings the metal into a state of elastic elongation before it enters the die, so that when the die is drawn over it the flow of metal resulting in the reduction of diameter and permanent elongation of the rod takes place in the straight line of the elastic elongation, and consequently a rod drawn under this initial tension is straighter than one drawn without it. The initial tension should be continuous and persistent during the whole drawing process, so as to immediately take up the elongation as fast as it is produced by the passage of the die. It should be sufficiently powerful to pull straight all the curves and crooks of the rod, and may also permanently elongate it to some extent; but it should leave a large part of the final elongation to be effected by the passage through the die.

In the ordinary drawing process, as heretofore practiced without initial tension, the die-tension, acting through the convergent sides of the die-hole, does all the work of diminishing the diameter and increasing the length of the rod. This compressive action of the die brings the surface metal of the rod into a state of strain different from that of the interior. If any part of this compressed layer be afterward cut away—as in key-seating, for example—the rod will be apt to curve itself at that spot, and this is found to be an objection to rods as heretofore drawn.

When initial tension is used according to my invention it does part of the work, so that less die-tension is required, and the metal will be left in a more equable condition. The proper amount of initial tension to be given will vary with the cross-section of the rod and the nature of the metal, and can only be stated approximately and by indicating certain limits. It should be at least great enough to pull straight all the curves and crooks of the rod, and to stretch it nearly or about up to the elastic limit of the metal, and it should not be so great as to reduce the diameter of the rod in any place to the diameter of the small end of the die-hole.

In drawing under initial tension I find that to produce a good result as to straightness the metal of the rod should be of equal hardness and elasticity on all sides, and I find that rods made by the ordinary rolling process are generally deficient in this respect, and require to be carefully annealed before being drawn.

The usual practice in rolling-mills is to place the rolled rod on an iron floor and to straighten it while still red-hot, and then to let it lie on the floor until it is cold. The side next the floor cools faster than the rest, and becomes harder and more elastic and in a different state of strain. If the red-hot rod is kept rolling over and over on the floor while it cools, the difference of elasticity will to a great extent be avoided; but a careful annealing is more certain and preferable.

The following is a method of carrying my invention into effect, reference being had to the drawings, which illustrate a machine which I believe is well adapted for my process, and in which—

Figure 1 is a horizontal or plan view, partly in section; and Fig. 2, a vertical sectional view on the line *x y* of Fig. 1.

a is a hydraulic press constructed so as to

pull by the rod *b*, and having a stroke longer than the greatest elongation to be given to the rod drawn. *c c* are two long hydraulic presses, which also serve as columns to take the thrust between the press *a* and the cross-head *d*. The plungers *e e* have a stroke longer than the longest rod intended to be drawn. The cross-head *f*, rigidly connecting the plungers *e e*, runs in ways *g g*, and is connected by rods *h h* with the movable die-head *i*, which also runs in ways. All these ways and the lines of motion of the plungers of the three presses and of the cross-head *f* and the die-head *i* are parallel to the axis of the rod intended to be drawn. The rod *k*, having been previously annealed, is to have all scale removed in the usual way, and one end is to be reduced concentrically in diameter, so as to allow the die *m* to be slipped upon it. The die is adjusted in the movable die-head *i*, so that the axis of the die-hole will be in line with the axis of the rod *k*, one end of which is gripped to the cross-head *d* and the other end to the rod *b*. Tension is then applied by means of the press *a* until all the crooks and curves of the rod *k* are pulled straight—say up to the elastic limit of the metal, or thereabout. The plungers *e e* are then set in motion with equal speed and pressure, and the die *m* is drawn over the rod *k* to its farther end. The pressure in the press *a* is continuous during the stroke, so that the tension is kept constant on the rod *k*, notwithstanding its elongation by the drawing process. The press *a* is then drawn back a little, so as to remove the grip of the rod *b* to the end of the rod *k*, and the die is then pulled completely off from the rod *k*. If necessary, the power of the press *a* can be used to assist in this, its stroke being made long enough. The grip of the other end of the rod *k* to the cross-head *d* is then loosened, and the drawn rod is taken out and its irregular ends are cut off. The plungers of the presses and the die-head are drawn back to their original positions by suitable counter-weights, and the operation is repeated with another rod. Accumulators are convenient to give steady and regulated pressure and motion to the hydraulic presses. When the length of the rods drawn is considerable, their weight and that of the long plungers and connecting-rods may be supported by pivoted levers arranged so as to allow of the passage of the cross-heads, as is well understood.

I have described a hydraulic machine because I think it the most convenient, especially for drawing rods of considerable cross-section; but it is evident that the invention can be carried out by any machine operated by screws, drag-chains, or otherwise, and capable of giving the requisite initial tension to the rod and the pull to the die.

I do not claim or confine myself to the machinery herein described, or any particular form of machinery.

The invention may be applied to rods and bars of any shape or cross-section.

I have stated that the initial tension should be sufficient to pull straight all the crooks and curves of the rod, and this is what I recommend to produce the best results; but it is not necessary in all cases. A less degree of initial tension will produce proportionate results, and will make the drawn rod straighter than it would be without the tension, and may be practically sufficient in many cases.

I am aware that in the ordinary process of drawing wire a slight degree of tension is applied to that part of the wire which is moving toward the die and has not yet passed through it, so as to pull the wire steadily off the reel and keep it free from kinks. Such a tension is described in the patent for wire-drawing apparatus granted to I. M. Buisson, dated December 23, 1884, No. 309,688. It is evident that this slight tension cannot produce any straightening or elastic elongation similar to that produced by the initial tension herein described, and I do not claim the application of any such tension, and I disclaim everything described in said Patent No. 309,688.

What I claim as my invention is—

The process of drawing metal rods which consists of, first, subjecting the rod to a tensional strain sufficient to produce a straightening and elastic elongation, and while the rod is under such tensional strain die-drawing the rod, substantially as and for the purpose specified.

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