(No Model.)

W. A. McCOOL.

METHOD OF MANUFACTURING COLD DRAWN STEEL TUBING.

No. 602,350. Patented Apr. 12, 1898.

Fig. 1.

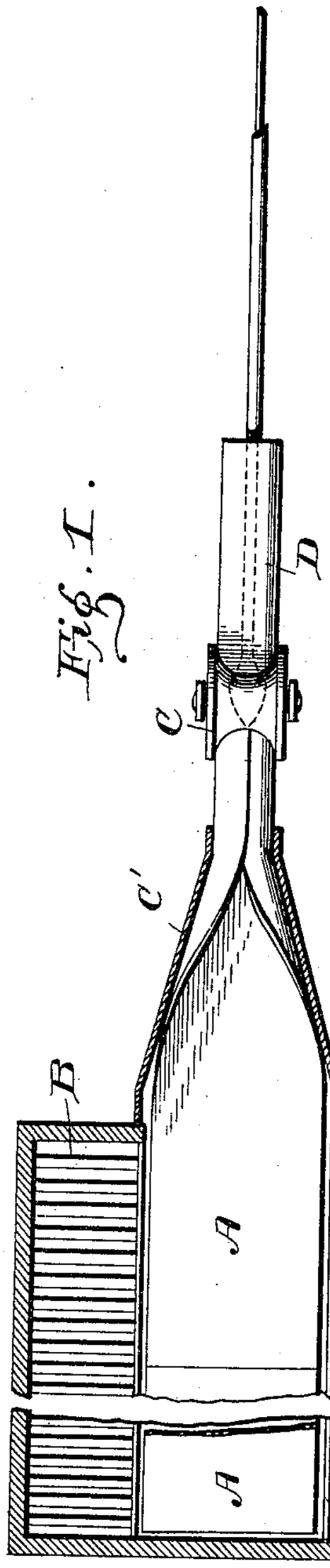

Fig. 2.

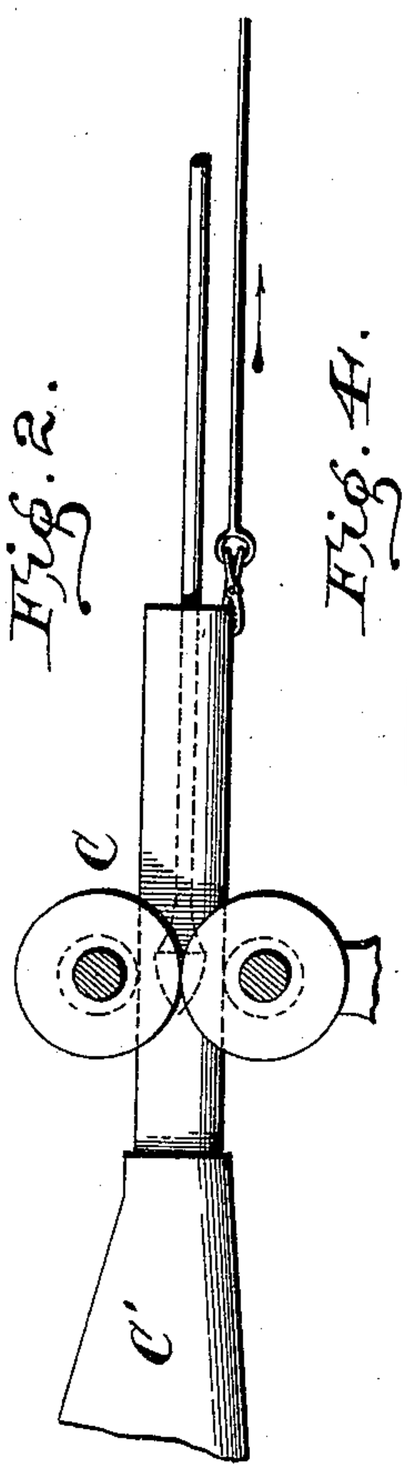

Fig. 4.

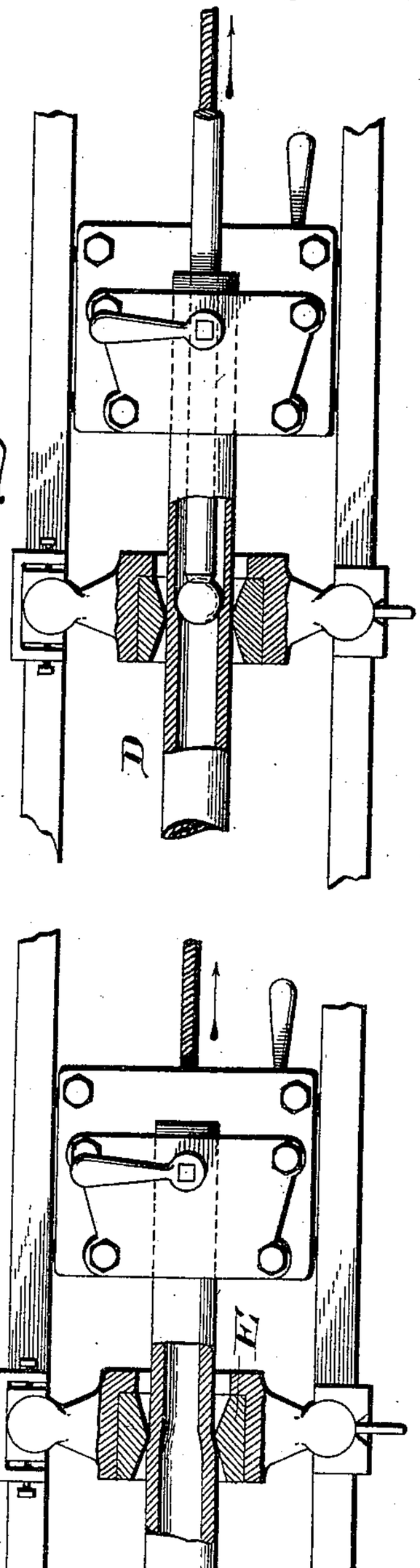

Fig. 5.

Fig. 3.

Witnesses
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UNITED STATES PATENT OFFICE.

WILLIAM A. McCOOL, OF BEAVER FALLS, PENNSYLVANIA.

METHOD OF MANUFACTURING COLD-DRAWN STEEL TUBING.

SPECIFICATION forming part of Letters Patent No. 602,350, dated April 12, 1898.

Application filed December 3, 1897. Serial No. 660,671. (No specimens.) Patented in England November 14, 1896, No. 25,686.

To all whom it may concern:

Be it known that I, WILLIAM A. McCOOL, a citizen of the United States, residing at Beaver Falls, in the county of Beaver and State of Pennsylvania, have invented certain new and useful Improvements in Methods of Manufacturing Cold-Drawn Steel Tubing, (for which there have been issued to me in the Kingdom of Great Britain and Ireland Letters Patent No. 25,686, dated November 14, 1896;) and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

Figure 1 is a sectional view, more or less conventional, illustrating a furnace wherein the metallic plates or blanks are heated from which the tubes are formed and the devices for forming such plates into tubes. Fig. 2 shows in side elevation a portion of the welding mechanism illustrated in Fig. 1. Fig. 3 illustrates the mechanism by which are removed the scale, silicates, &c., formed on the inner surface of the skelp or blank during the earlier stages of the treatment. Fig. 4 illustrates the mechanism by which the tubes are reduced in thickness after the interior has been cleansed. Fig. 5 illustrates the cross-sectional form of the tube as it leaves the welding mechanism.

The object of this invention is to provide an improved process for the production of thin-drawn steel tubing.

Heretofore according to the practice more generally followed it has been customary to commence with a solid bar or billet of steel, to form therein a longitudinal aperture by drilling, punching, or the like, and then subject the metal to the action of dies and mandrels for the purpose of reducing it in thickness until tubing of the desired character is obtained. It has been, however, long well known that this is a difficult and expensive process, and numerous attempts have been made for the production of a practically seamless drawn tubing from blanks of a cheaper sort than those obtained by perforating solid bars or billets. These attempts have included efforts to manufacture drawn tubing from welded blanks—that is to say, from tubular blanks formed by bringing together the edges of flat blanks or plates and welding said edges together either with butt-weld or lap-weld seams; but it has been found practically impossible with any of the methods heretofore followed to employ welded tubing for this purpose because of the character of the interior surface of the tubes. The ordinary mode of treatment by means of acids or pickling-baths has not been found available because of the fact that the scale or silicate has refused to yield to the action of the pickle until the pure steel beneath the scale has been attacked to such an extent that the tubing is practically ruined. It is imperative that this scale or silicate or other equivalent foreign material be entirely removed from the interior of the tube, as otherwise the cold-drawing thereof is absolutely prohibited because of the ruin which is caused to the dies or mandrels.

The object of this invention is to provide a method of manufacturing cold-drawn steel tubing which shall be greatly cheaper than any of those heretofore followed and which shall result in the production of a high grade of seamless tubing whose steel shall be free from attack by acids and similar reagents.

In manufacturing the tubing plates or flat blanks A A of steel are first employed. These are heated in a furnace B, in order to get them to the right condition for welding. This heating may be accomplished in a furnace of ordinary construction, and, as is well known, it contains or has present therein silicon in considerable quantities. This silicon comes into direct contact with the highly-heated skelp plates or blanks A and rapidly and very tenaciously unites therewith, forming silicates of the metal, which appear in the form of surface scale of intense hardness. The presence of the silicon is unavoidable and is largely present in the refractory materials used in the furnace.

The plates or blanks A are drawn from the furnace when sufficiently heated and are taken directly to the welding-machines. These may be of any suitable sort, the one

here selected being illustrated at C. As the heated plate passes through the shaping devices at C′ it is bent transversely, so as to bring its longitudinal edges together, and these slightly overlap and under powerful pressure are welded together. The blanks thus formed are not uniform around the center in cross-section, there being a well-defined seam or joint along the line of the weld, as shown at *d* in the tube or blank D. The metal of this tubular blank is relatively thick, and it is desirable to reduce it and to cause the weld-seam to disappear entirely, in order that the tube shall be uniformly thick at all points around the axis.

The above-described scale, silicates, and the like formed on the tube when in the furnace B is after the welding inclosed in the interior of the tube, and therefore these welded tubes have been practically prohibited from use in the manufacture of drawn tubing.

After the tubes have become cold I remove the scale as follows: E indicates a die having an aperture of a diameter slightly less than the exterior diameter of the tubes—say from a thirty-second to a sixteenth of an inch less. I pass the tube through this die, the interior being entirely unobstructed. As a result the metal is crowded toward the central longitudinal lines somewhat. As it is so crowded inward the flakes of scale and the particles of silicate, &c., are entirely loosened and displaced. The fibers of the metal will permit it to be condensed or contracted, while the particles of the scale refuse to be so treated and are therefore completely dislodged from the surface of the metal. The compression forces the metal inward uniformly around the axis, and in doing so breaks off the scale. In most cases a single passage of a tube through the die is sufficient to thoroughly cleanse it, and after it is withdrawn and is held in a vertical position the scale escapes from it, often in large quantities. After this cleansing step has been performed the interior can be still further purified by any suitable step. I have largely practiced the cleansing by means of mechanical abrasion, but the pickling or acid treatment can be applied, if desired. The removal of the scale mechanically by the crushing or condensing action above described obviates the necessity of exposing the interior of the tube for any length of time to pickle, whereas when the pickling is depended upon alone the time required is so long that the metal itself is largely destroyed before the scale can be dislodged.

After the complete cleansing by both the crushing and the abrasion or pickling the tubing is subjected to a reducing operation. It is passed through supplemental dies and its interior is drawn over mandrels or balls, and these steps are repeated until the seam at *d* entirely disappears and the fibers in the neighborhood of the weld become so thoroughly interwoven that the line of the weld entirely disappears and the mass is entirely homogeneous throughout.

By following the plan above described cold-drawn tubing can be produced at a cost very much lower than that incident to the earlier methods of manufacture, and, too, a tubing whose surfaces are practically intact and unaffected by acid and capable of either taking a high polish or of being enameled or japanned without liability of flaking or cracking.

It will be seen that it is unnecessary to follow all of the above steps immediately one after the other. The blank welded tubing can be made and provided as one article of manufacture and the cleansed cold-drawn tubing can be produced therefrom as another manufacture; but in making them in large quantities the entire process can be followed continuously in the production of the thin tubing from the initial flat sheets.

I do not herein claim any of the subjects-matter presented by either of the claims, respectively, in my other applications—one filed September 12, 1896, and the other filed October 24, 1896—for processes for drawing tubing, preferring to herein claim, broadly, the features incident to removing the interior scale and impurities by the action of inward compression, whether this is supplemented by acid, abrasion, or other cleansing treatment, and preferring to claim in said other applications novel features of a specific character, as therein set forth.

What I claim is—

1. The herein-described process of manufacturing seamless, drawn, steel tubing, which consists in first forming a plate of steel, heating said plate, bending it transversely, welding together its longitudinal edges, and then cold-drawing the tube thus produced through a die of a diameter slightly less than that of the tube and thereby mechanically dislodging the scale, silicates, &c., on the interior surface of the tube, subsequently cleansing the interior, and thereafter subjecting the tube to external and internal radial pressure to reduce it in thickness and obliterate the seam, substantially as set forth.

2. The herein-described process of forming cold-drawn steel tubing, which consists in subjecting a tubular blank having a weld extending along a longitudinal line, to the compressing action of a die slightly smaller in diameter than the tube, crushing or dislodging the scale and silicates from the interior surface by such die, and subsequently reducing the tube in thickness by external and internal compression, and obliterating the said weld, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM A. McCOOL.

Witnesses:
H. W. REEVES,
JAMES F. MERRIMAN.