(No Model.) 2 Sheets—Sheet 1.

C. KELLOGG.

PROCESS OF MANUFACTURING TUBING.

No. 324,118. Patented Aug. 11, 1885.

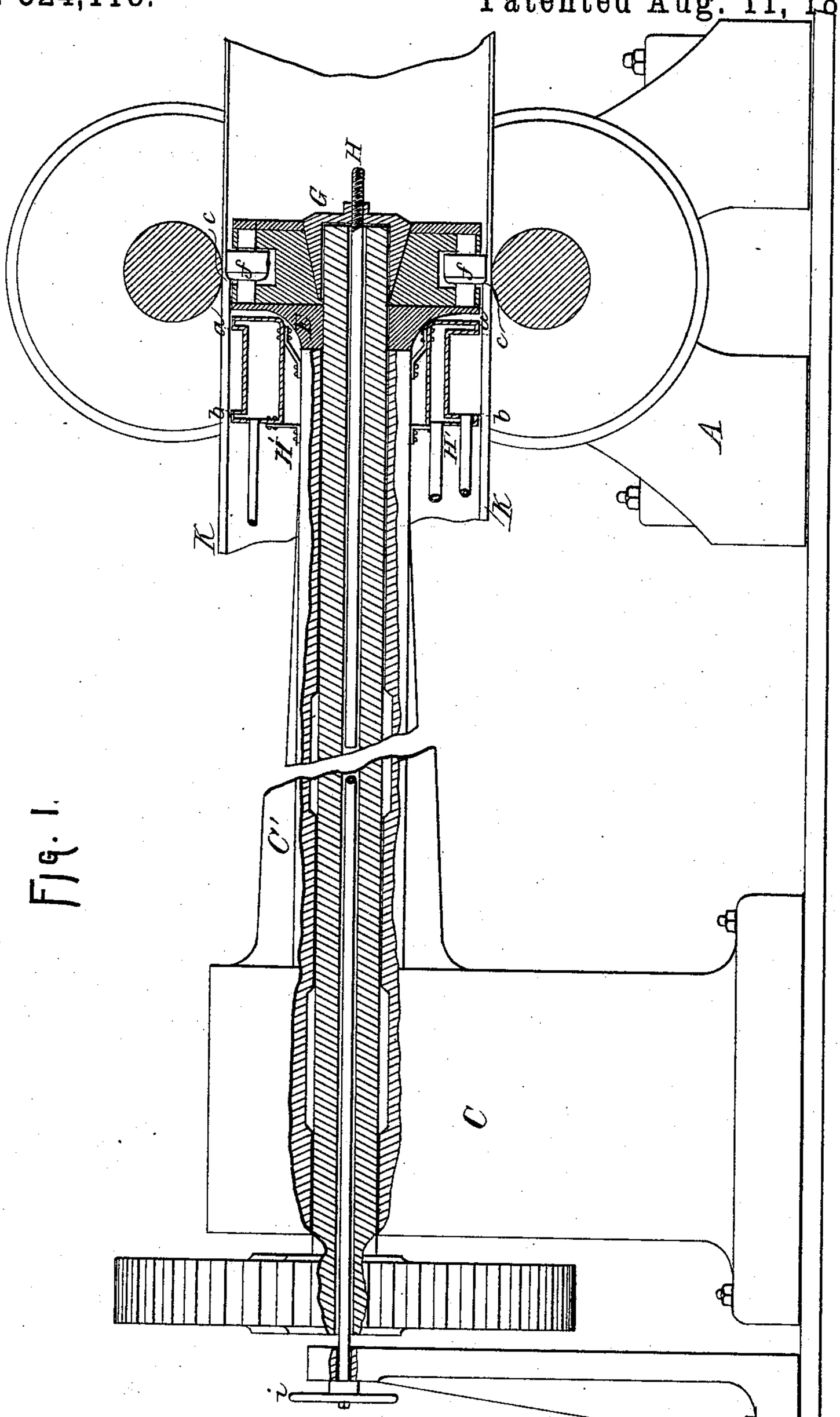

FIG. 1.

Witnesses:
A. B. Dodge.
E. B. Payne.

Inventor,
Charles Kellogg.
By W. C. Dowell
Attorney.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

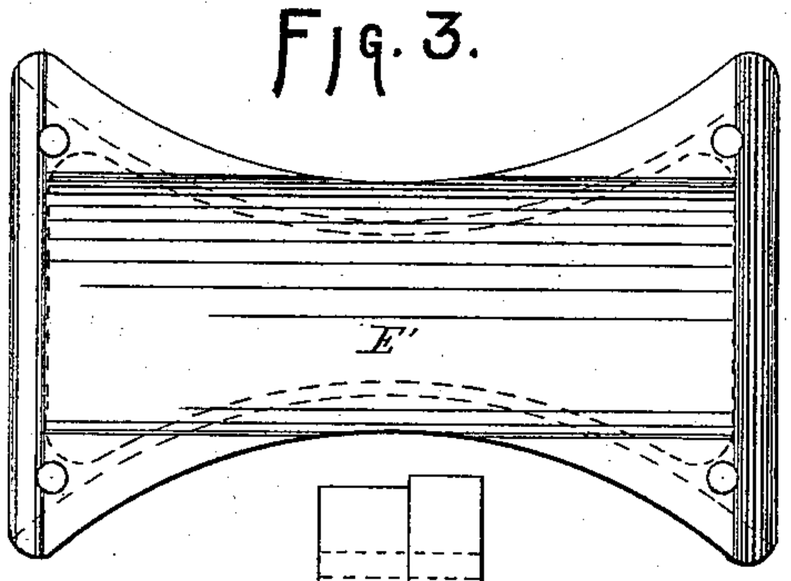


Fig. 3a

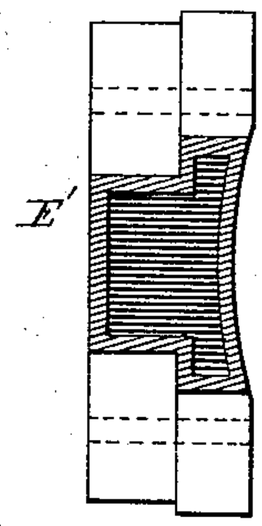
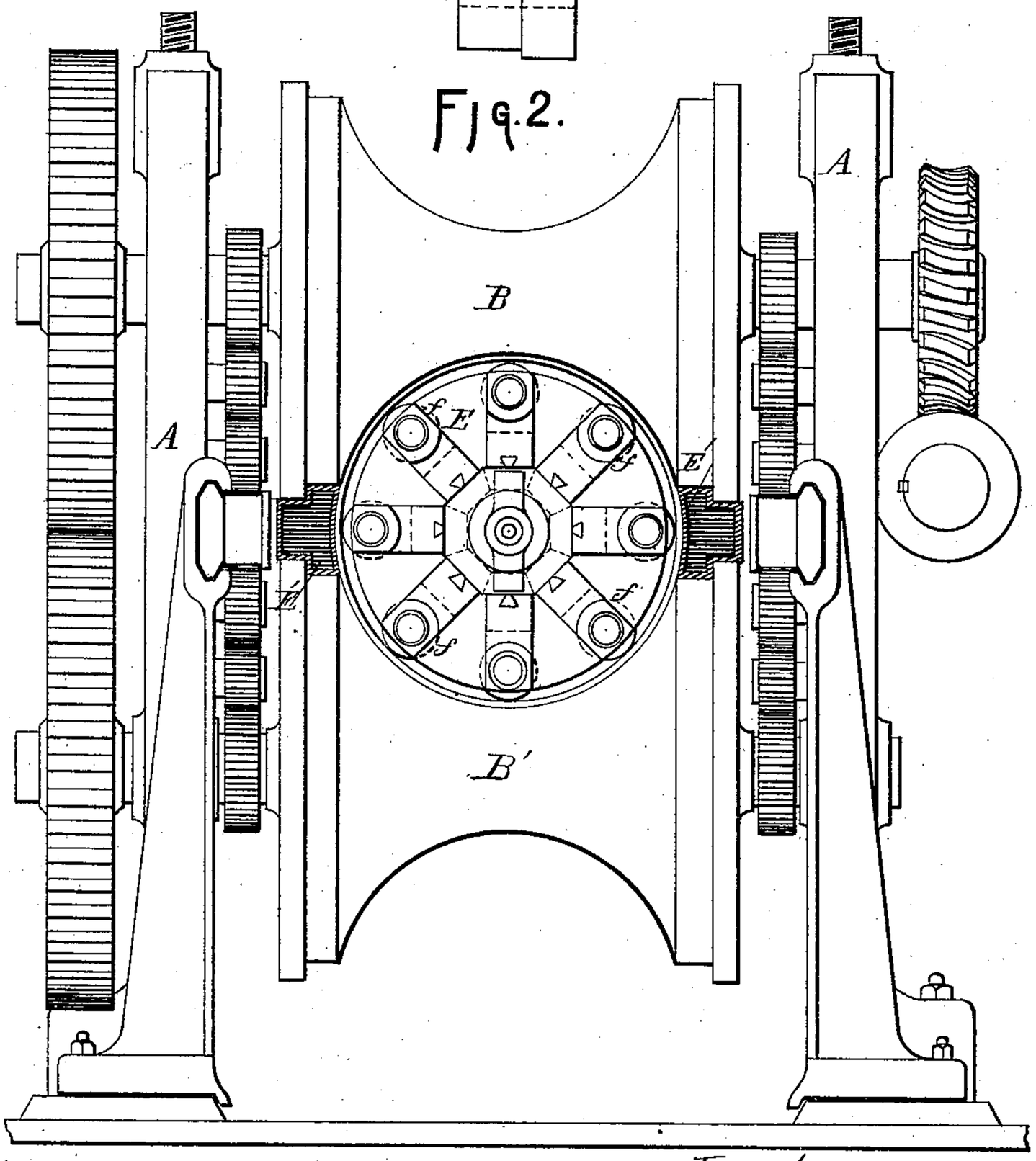


Fig. 2.



Witnesses:
A. P. Dodge.
E. B. Payne.

Inventor, Charles Kellogg.
By W. C. Dorn
Attorney.

UNITED STATES PATENT OFFICE.

CHARLES KELLOGG, OF BUFFALO, NEW YORK.

PROCESS OF MANUFACTURING TUBING.

SPECIFICATION forming part of Letters Patent No. 324,118, dated August 11, 1885.

Application filed February 27, 1885. (No model.)

To all whom it may concern:

Be it known that I, CHARLES KELLOGG, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented a new and useful Process of Manufacturing Seamless Tubing and other Hollow Cylindrical Articles, of which the following is a specification.

My invention relates to the manufacture of seamless steel tubing and other hollow cylindrical articles of steel.

Heretofore tubes, pipes, &c., have been made with a seam or joint either by lap or butt welding, or by riveting, or, if seamless, by casting. The lap and butt welding are not, however, applicable to the making of very large pipes—such as are used for water and gas mains, steam-heating, boiler-shells, &c.—as there is a limit beyond which the welding cannot be done successfully. Riveting is objectionable on account of the expense attending the manufacture, the liability to leakage, and the weakening of the shell by the presence of so many rivet-holes. Casting is objectionable on account of the greater weight of metal required to give the tubes the necessary strength, but chiefly because the tubing cannot be made sufficiently dense to resist corrosion and prevent leakage.

My invention has for its object to make tubing and other hollow cylindrical articles by rolling the same from hollow ingots of steel, &c., without seam or joint, and homogeneous throughout.

The invention consists, first, in forming an ingot of steel by casting, or in any other suitable manner, and then rolling the said ingot to condense the metal, and lengthen and true the ingot into a tube of the required diameter between external and internal rolls working at right angles to each other, and simultaneously on the outside and inside surfaces of the ingot, respectively; second, in heating the ingot, preparatory to rolling, immediately in front of the rolls, and as fast only as the rolling progresses.

The invention consists, third, in making seamless tubing by heating the ingot in sections and rolling the heated portion between external and internal rolls operating upon opposite surfaces of the ingot simultaneously and at right angles to each other.

The accompanying drawings illustrate machinery which may be used to carry into effect my process of making tubes, &c., Figure 1 representing a sectional side elevation of a machine for rolling the tubes, &c., the furnace for heating the ingot, and a longitudinal section of an ingot, and a partially-formed tube rolled from the same ingot; Fig. 2, an end elevation of the machine; and Figs. 3 3^a detached views of parts of the machine, enlarged, which are used in conjunction with the rollers to prevent the formation of a fin on the tube.

Referring to the drawings, A represents the housings of the rolls; B B′, the external rolls, which are the ordinary rolls of a two-high rolling-mill provided with concave semicircular cavities. C is the standard in which the mandrel-shaft has its bearings, and C′ is an extension thereof, which forms the housing for the mandrel-shaft, and is provided with bearings for the shaft, and by which the weight of the mandrel and its rolls is sustained, and the mandrel can be exactly centered and kept true. E is the mandrel-head, and *f* the mandrel-rolls by which the inside surface of the tube is rolled and reduced. The rolls *f* have a radial adjustment by means of the wedge G, rod H, and hand-wheel *i*. The furnace is designated by the letter H′. E′ E′ are the swage-blocks, which are placed between the flanges of the external rolls to prevent the formation of a fin on the sides of the tube.

No further description of the rolling machinery and heating-furnace is necessary here, as the same are to be found fully described in my application for Letters Patent for machinery for rolling tubes, &c., filed May 13, 1884.

The process of making the tubes and other hollow cylindrical articles from ingots of steel, &c., is as follows: The hollow ingot K is made by centrifugal casting—that is to say, the molten steel is delivered into a rapidly-revolving mold, and by centrifugal action it is thrown against the walls of the mold and sets into a hollow cylindrical ingot having the requisite external diameter, but a little thicker, and consequently a little less in internal diameter, than the finished tube is intended to be. The thickness of the casting should be about one and a half time greater than the finished tube. This proportion I consider the best, but it

can be varied to suit peculiar circumstances and conditions. The amount of reduction which such excess of thickness in the casting requires insures the proper condensation of the metal to give the requisite density to the walls of the tube and produce the proper smoothness and trueness of the same, and at the same time that amount of reduction will not present enough resistance to the action of the mandrel-rolls to interfere with the maintenance of the desired speed of rolling.

The ingot is heated preparatory to rolling, and as fast only as it is fed to the rolls. For this purpose a furnace is provided which heats that portion of the ingot only which is immediately in front of the rolls. This furnace H′, Fig. 1, may be placed inside the ingot, as shown in the drawings, so as to heat the ingot from the inside; or it may be placed outside and the ingot arranged to pass through it. The object of this is to heat only a section of the ingot, and that just previous to the rolling, and no faster than the rolling progresses. If the whole ingot were heated previous to rolling, there would be a liability of its cooling before it had passed through the rolls, as it is not possible to roll a tube as rapidly as bar-steel is rolled. In addition there is imminent danger in the case of large ingots of the walls collapsing or buckling. To prevent such accidents, the ingot should not be heated its entire length preparatory to rolling, but the heating should be confined to that portion which is about passing to the rolls, and it should not proceed more rapidly than the rolling. Thus in the drawings the section or part of the ingot exposed to the heat extends from *a* to *b*, over the heat-chamber of the furnace. Back of the point *b* the ingot is cold, and from *a* forward to the nip of the rolls at the point *c* the ingot is at the requisite heat for rolling. This distance from the heat-chamber of the furnace to the nip of the rolls is made as short as possible, so that in passing from the furnace to the rolls the ingot will not cool down below rolling heat. Thus the extent of surface of the ingot which is heated at any one time is limited, and the part which is heated is so short that there is no danger of its collapsing. At the same time the heating is continuous, a cold part of the ingot being constantly presented to the furnace, and the heating proceeds as rapidly as the rolling.

The furnace may be arranged in several compartments or sections, and a different degree of heat maintained in each one, that in the compartment next to the mandrel and rolls being greatest, and the others decreasing by regular gradations. In this way the ingot can be heated gradually throughout its length, and only arrive at the proper rolling heat when passing through the last compartment next to the mandrel and rolls; but the same degree of heat may be maintained in each compartment, if preferred.

The swage-blocks E′ E′ bear against the sides of the pipe at the nip of the rolls and at the points on both sides, where, if they were not employed, the metal would be forced out into the joints between the rolls and thereby form fins on each side of the tube; but the swage-blocks fill the spaces between the rolls, and by bearing uniformly against the sides of the ingot co-operate with the exterior rolls in forming and sustaining the external surface of the tube.

I do not limit myself to the mode of making the ingot by centrifugal casting, as the same may be made by other modes of casting, or in any other manner which may be preferred or better suited to the purpose of manufacturing tubes; neither do I limit myself to heating the ingot gradually, as the machinery, aside from the furnace, may be used in connection with other modes of heating the ingot.

I claim—

1. The process herein described of manufacturing seamless tubes and other hollow cylindrical articles, which consists in subjecting the ingot from which the tube is to be formed, to the simultaneous rolling action of external and internal rolls acting upon the outside and inside surfaces of the tube and at right angles to each other.

2. The process herein described of manufacturing seamless tubes, &c., which consists in forming a hollow ingot, and then rolling the said ingot into a tube by reducing the thickness of its walls by means of internal rolls acting opposite to and in line with external sustaining-rolls.

3. The process herein described of manufacturing tubes, &c., which consists in casting a hollow ingot of the required external diameter and less than the required internal diameter of the tube, and then forming the ingot into a tube by rolling its internal surface and reducing the same, and thereby increase the internal diameter.

4. The process herein described of manufacturing seamless tubes, &c., which consists in heating the ingot pile or billet of metal only so fast as the rolling progresses, and then subjecting the heated portion to the action of internal and external rolls acting opposite each other.

5. The process herein described of manufacturing seamless tubes and other hollow cylindrical articles, consisting in casting an ingot hollow, then heating the ingot gradually as it passes to the rolls, and then rolling the ingot into a tube by means of external and internal rolls acting against opposite surfaces of the ingot, substantially as specified.

CHARLES KELLOGG.

In presence of—
S. M. OSTRANDER,
A. B. DODGE.