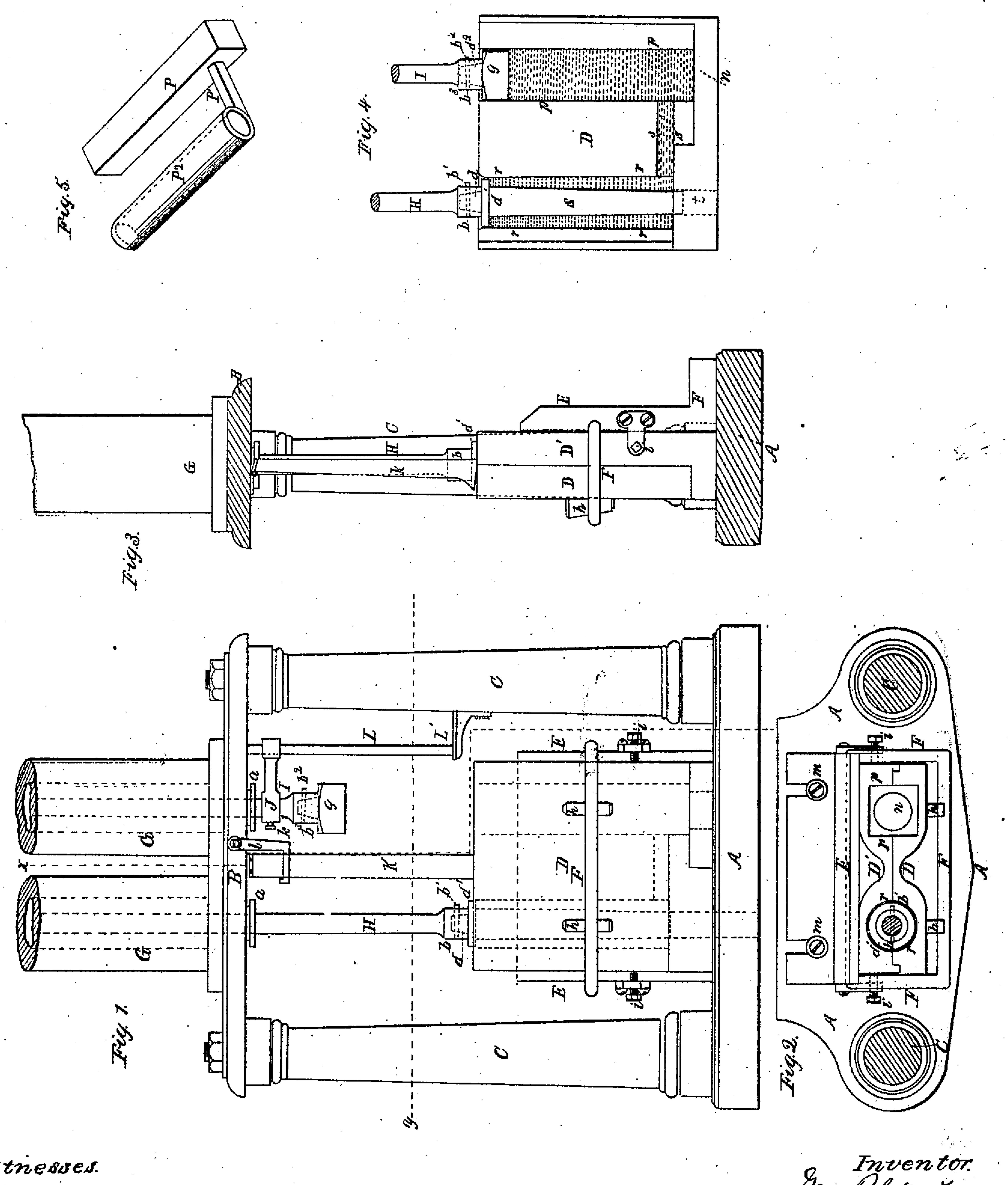
2 Sheets-Sheet 1.

J. B. Tarr,

Casting Ingots

No. 83,222. Patented Oct. 20, 1868.



Witnesses.
B. J. Campbell.
Edw. Schafer.

Inventor.
Jno. Blake Tarr.
by
Mason Fenwick Lawrence

2 Sheets-Sheet 2.

J. B. Tarr,

Casting Ingots.

No. 83,222. Patented Oct. 20, 1868.

Fig. 8

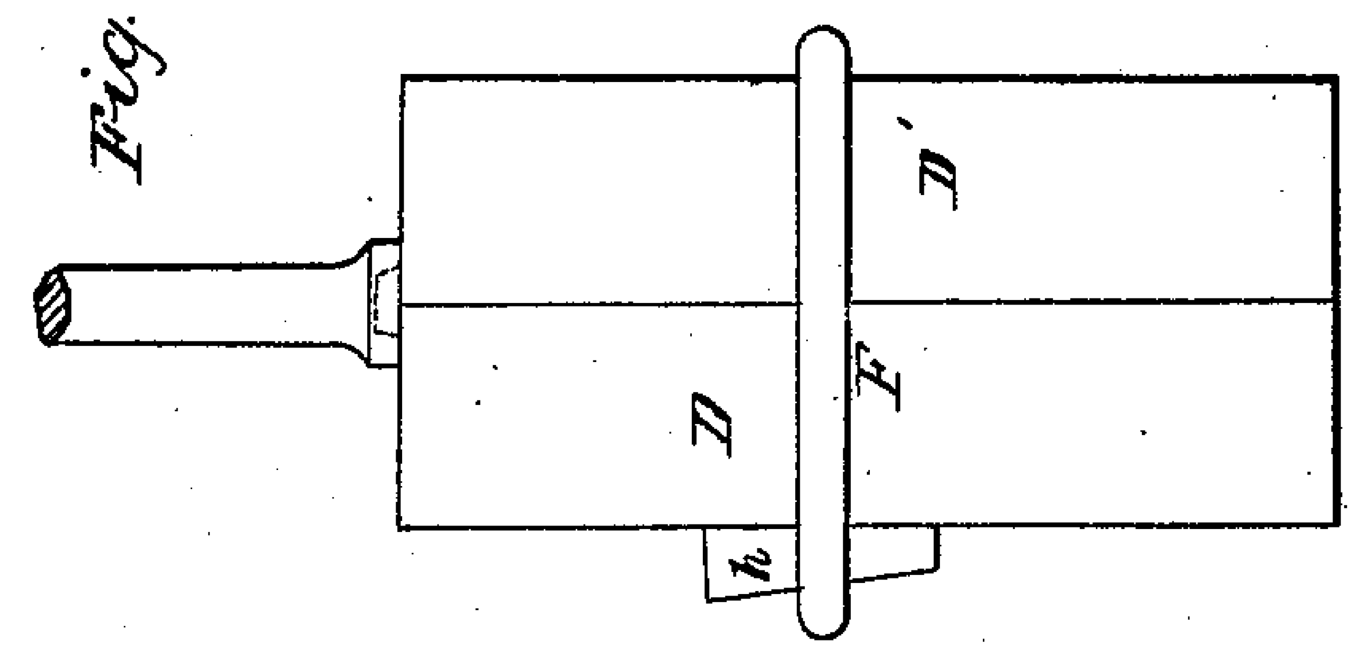
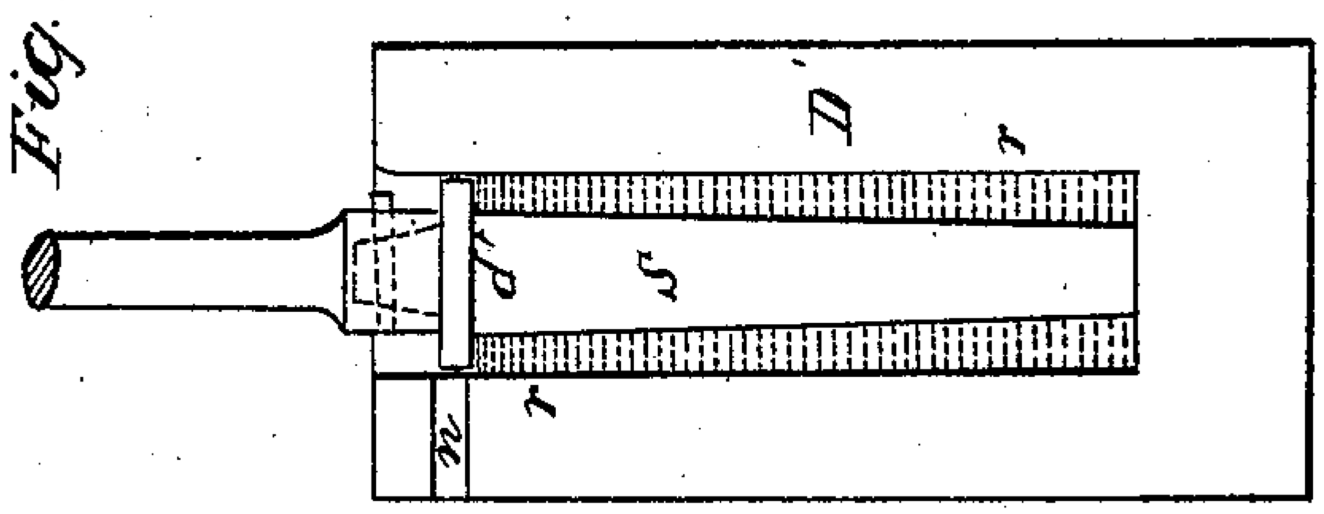


Fig. 7.



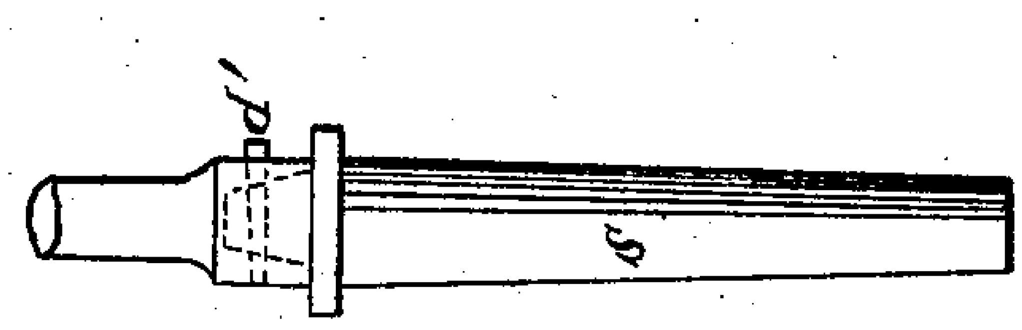
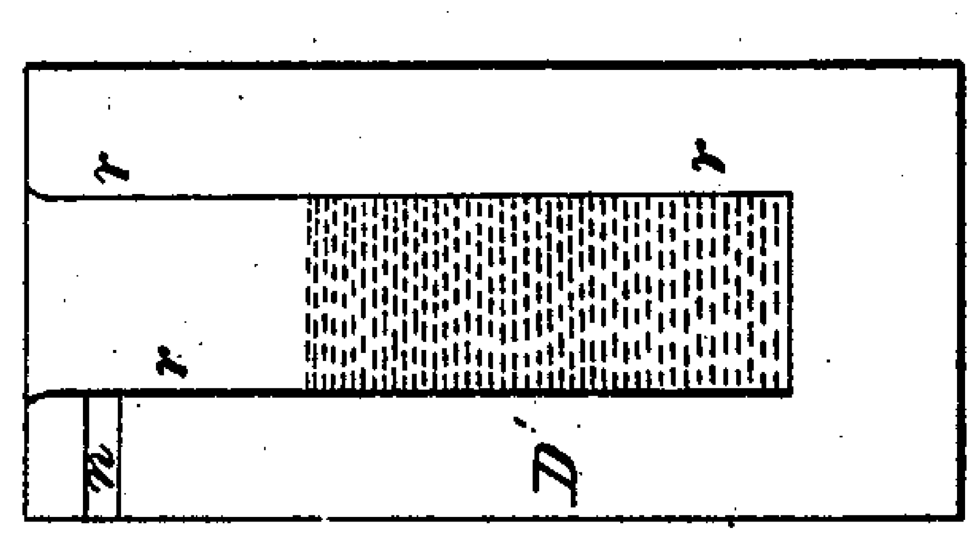


Fig. 6.



Witnesses.
B. J. Campbell.
Edw. Schafer.

Inventor.
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United States Patent Office.

JOHN BLAKE TARR, OF FAIR HAVEN, MASSACHUSETTS.

Letters Patent No. 83,222, *dated October* 20, 1868.

IMPROVEMENT IN MANUFACTURE OF STEEL INGOTS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, JOHN BLAKE TARR, of Fair Haven, in the county of Bristol, and State of Massachusetts, have invented a new and improved Steel Ingot; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a front elevation of a machine which is adapted for producing the ingots.

Figure 2 is a section, taken in the horizontal plane indicated by line *y* in fig. 1.

Figure 3 is a section, taken in the course indicated by line *x* in fig. 1.

Figure 4 is a view of the mould, the plunger, and the core, as seen by removing the front section of this mould.

Figure 5 is a perspective view of the improved ingot attached to a solid ingot.

Figure 6, sheet 2, is a view of a mould adapted for making only a tubular ingot, showing the core elevated.

Figure 7, sheet 2, is a similar view, showing the core depressed.

Figure 8 is an external edge view of the mould of figs. 6 and 7.

Similar letters of reference indicate corresponding parts in the several figures.

This invention relates to a new and improved mode of constructing steel ingots, or blanks, from which to make seamless tubes for the flues of steam-boilers, and for other purposes.

The nature of the invention consists in compressing and condensing the steel while in a liquid or plastic state, and confined within the mould, which will give to it the form of a hollow or tubular ingot, thereby not only improving the quality of the metal, as to density, toughness, and strength, but also depriving it of the porosity which has always been a great detriment to steel ingots hitherto used in the manufacture of seamless tubes, as will be hereinafter described.

To enable others skilled in the art to understand my invention, I will describe one practical mode of carrying it into effect.

In the accompanying drawings, A represents the foundation or bed-plate, forming part of a strong frame, consisting of pillars, C C, and a horizontal head-plate, B.

There is a sufficient space left between the two horizontal plates A B for receiving the moulds in which the ingots are cast, and also the devices used for pressing and condensing the metal forming the ingots.

On top of the head-plate B, and firmly bolted down thereon, are two strong cylinders, G G, in which pistons are designed to work up and down, which pistons have vertical rods, H I, attached to them, that pass through stuffing-boxes, *a a*, and carry followers upon their lower ends, as will be hereinafter described.

These cylinders should communicate in a suitable manner with a hydrostatic forcing-engine, constructed upon the well-known principle of the hydrostatic presses, so that the follower-rods can be caused to descend with great force.

If desirable, screw or other well-known mechanical power may be employed for moving the followers, but I prefer to adopt hydrostatic pressure, in the manner substantially as above described.

The moulds in which the ingots are cast are mounted upon the bed-plate A, and held in proper position by means of a perpendicular back plate, E, which is secured upon said bed-plate by means of clamping-screws *m m*. These screws pass through slots made through the right-angular foot of the plate E, and by loosening them, this plate can be adjusted forward or backward, as may be desired.

By means of the two horizontal set-screws *i i*, which pass through ears that project from the back plate E, the moulds can be adjusted laterally, and confined in place upon the bed-plate A. This provision for adjustment is made for the purpose of adapting the machine to receive and hold in place moulds of different sizes, and also for adjusting the receptacles for receiving the metal to a nicety beneath their respective followers H I.

The moulds consist of halves or vertical sections, D D′, nicely fitted together, and confined by means of a bail, F, and clamping-wedges, *h h*, or by any other suitable means.

There are two vertical receptacles, *r* and *p*, made in the sections D D′, which are designed for receiving the steel, and producing ingots, which receptacles communicate with each other by means of a horizontal passage, *s*, fig. 4. The circular receptacle is designed for producing the ingots from which seamless pipes are made, and the rectangular receptacle, *p*, which extends a short distance below the passage *s* and receptacle *r*, is designed for producing solid ingots for other purposes.

Within the circular chamber *r* is a tapering core, S, terminating at its upper end in a circular flange or follower, *d′*, which is slightly smaller in diameter than the diameter of that part of chamber *r* in which it works. The lower end of this conical or tapering core S terminates in a short cylindrical portion, which fits snugly into a vertical hole, *t*, coinciding with the centre of the said chamber, and forms a guide for keeping the core in its proper place during its descending stroke. Surrounding this core S is the annular space for receiving the steel and producing tubular or hollow ingots.

The upper end of the core S has a shank, *d*, projecting from it, which is fitted into a socket formed in the lower end of an enlargement, *b*, upon the piston-rod H. By means of the key *b′* the core is secured to the piston-rod, so as to rise and descend with it.

I make the core S tapering, for the purpose of having it part from the casting readily, as well as impart a lateral pressure to the metal during its descent; and I make the chamber r slightly larger at its base than it is at its upper end, so that in raising the core from the casting, the latter shall remain in its chamber.

I employ a solid plunger, g, for the chamber p, which is of the same shape as this chamber, but slightly smaller, and which is fitted to an enlarged head, b^3, on piston-rod I, by means of a shank, d^2, entering a socket in said head, and receiving the key b^2, as plainly indicated in fig. 4.

To prevent the piston-rod I from turning about its axis, an arm, J, is keyed to it, near the head b^3, which arm is guided by means of a fixed rod, L, that is secured to a bracket, L', at one end, and to the head-plate B at the other end, as shown in fig. 1.

Both piston-rods should coincide with the centre of their respective mould-chambers, so that the followers, or plunger and conical core, shall work truly therein.

The bar K, which is hinged to the bottom of head-plate B, between the two pistons H and I, is used for holding the mould-sections down firmly in place upon the bed-plate A, and the pivoted stirrup l, upon the head-plate, is used as a support for said bar when thrown up.

The operation of the machine is as follows:

The two sections D D' being firmly clamped together by means of the bail F and wedges h h, and then adjusted and secured firmly in place upon the bed-plate A, the core S is depressed until its flange or follower d^1 just enters the upper end of the chamber r. The plunger or follower g, being in an elevated position, as shown in fig. 1, melted steel is poured into the chamber p, at its upper end, until both chambers, p and r, are thus filled, or nearly filled. The plunger g is then brought down upon the surface of the metal in chamber p, and great pressure applied to it. At the same time pressure is applied upon the surface of the metal in the chamber r.

After compressing the steel in this manner, the plunger g and core S are raised free from the moulds and castings, the set-screws i i and bar K are released from the sections D D', and these sections removed from the bed A. The castings being removed from the moulds, the latter may be again confined together and adjusted in place upon the bed A, for a repetition of the operation.

By constructing the moulds as above described, it will be seen that I produce at one casting a solid ingot, P, and a tubular ingot, P^2, and that I am enabled to apply pressure at both ends of the steel confined in the mould.

As the object of my invention is to make a tubular steel ingot, compressed and condensed, the chambers p and s, and the parts acting in conjunction therewith, may be omitted, and the steel poured directly into the chamber r. In this case, the core S should be raised sufficiently high, during the operation of pouring, to allow the melted steel to run into said chamber r, beneath the annular flange or follower d^1.

In practice, the moulds may be made of cast-iron, of proper thickness to insure the strength required to resist the pressure to which they are subjected; and these moulds may be lined partly or wholly with plumbago, or any other substance of a sufficiently refractory nature to resist the intense heat of the melted steel.

In the operation of pressing and condensing the metal in the moulds, the first perceptible indication of the application of pressure will be a blue flame issuing from the joints around the followers. This flame will continue to escape until all the gas has been expelled from the moulds, and metal contained therein. When the flame ceases, the pressure can be removed from the followers, and the metal allowed to set.

Ingots produced in this manner will be free from holes and other imperfections, the metal will be homogeneous in texture and density, and it will also be much stronger, and better adapted for making seamless tubes than metal which is left to cool in the moulds without being subjected to pressure.

For the purpose of casting an ingot of a different size, a new mould, corresponding to the size desired, may be substituted in place of that shown; in which case, another core and follower may be substituted in place of those shown, adapted for the new mould.

In figs. 6 and 7, of sheet 2, I have shown a mode of producing a tubular ingot, compressed, wherein the core which leaves the bore through the ingot is removed from the mould until the steel is poured into this mould, after which the core is depressed, as shown in fig. 7, and the metal in the mould condensed. This plan would obviate all liability of the metal becoming chilled around the core S while pouring the metal into the mould-chamber r. Under this arrangement, a sufficient amount of metal is poured into the chamber r to form an ingot, and a hole, n, is made, to allow of the overflow of any surplus metal during the descent of the core S. If there is a surplus of metal in the mould-chamber r, it will run out through the hole n until the flange or follower d^1 on the core closes this hole, when the compression and condensation of the steel will commence.

To remove the condensed ingot, the bail F is loosened by driving out the wedges h, and the two mould-sections separated.

I will here state that it is important to raise the core S a short distance, as soon as possible after condensing the steel, to prevent the latter from shrinking around it and holding it fast.

I do not desire to be understood as making claim of invention to cast-steel ingots in the manufacture of seamless tubing, which ingots are bored out after they are cast, and which are not compressed, as this is not new.

Having described my invention,

What I claim as new, and desire to secure by Letters Patent, is—

Forming a hollow ingot under pressure, as herein described.

JOHN BLAKE TARR.

Witnesses:

R. T. CAMPBELL,
EDW. SCHAFER.