H. I. Bailey.

Making Lead Pipe.

No. 86,347. Patented Feb. 2, 1869.

Fig. 2

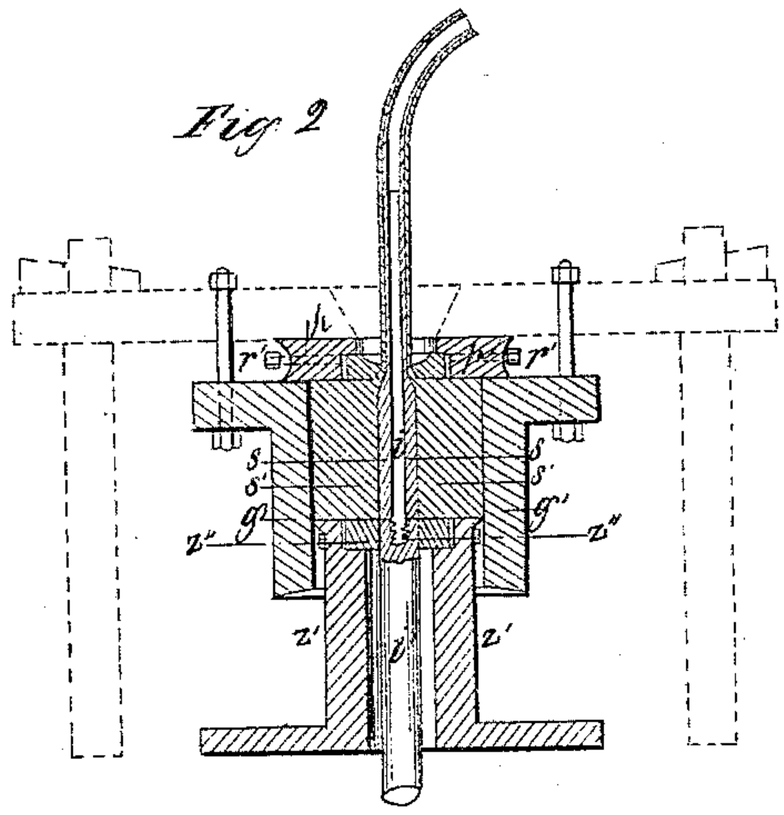
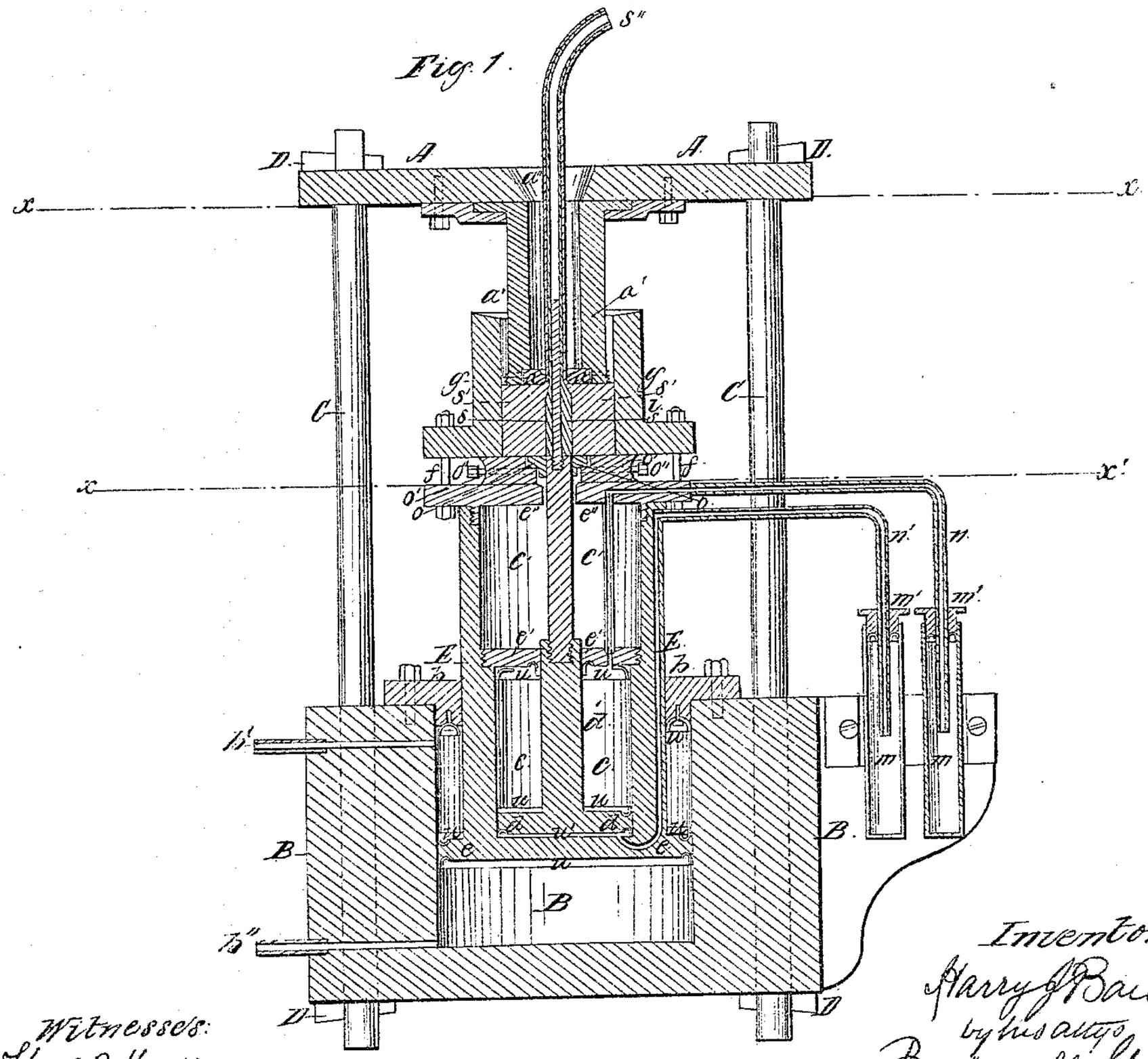


Fig. 1.



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HARRY J. BAILEY, OF PITTSBURG, PENNSYLVANIA.

IMPROVEMENT IN THE MANUFACTURE OF TIN-LINED LEAD PIPES.

Specification forming part of Letters Patent No. **86,347**, dated February 2, 1869.

To all whom it may concern:

Be it known that I, HARRY J. BAILEY, of the city of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in the Manufacture of Tin-Lined Lead Pipe; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the manufacture of tin-lined lead pipe, or lead pipe lined with tin or with such other metal or metallic alloy or composition as will, under pressure, unite with it, so that the two may in a solid state be forced through an orifice by hydraulic or other pressure, and, exuding around a core, may be formed into a pipe.

All or most of the modes of manufacturing tin-lined lead pipe heretofore in use are liable to objections more or less serious. Such objections arise from various causes. Among others, first, that tin is fusible at a lower temperature than lead, and if, as is often done in making the ingot, the lead is cast against the tin, the latter is fused too deeply, and tin lining of uniform thickness cannot be secured; second, that tin is harder than lead and is liable under pressure to draw or be pressed out of the cylinder containing the two metals more rapidly than the lead, giving as a result, first, a thicker and then a thinner lining than is desired, and perhaps in some places none at all; third, that with many of the devices now in use different cores are required in making the double ingot of tin and lead, and as the cores become heated to a high temperature it is difficult to change them, and considerable delay is thereby occasioned; and, fourth, that with many devices it is difficult, and with some impossible, to connect together in a continuous pipe two successive charges of tin and lead, and in such cases a thin flange or layer of lead and tin is left between the end of the plunger and the bottom of the cylinder, which, with so much of the pipe as is on the core, must be cut away or melted off, sometimes with injury to the core and always with difficulty, delay, and loss of metal. In short, nearly all the methods for manufacturing tin-lined lead pipe heretofore in use have proved slow, laborious, and expensive, and in some cases they have been complete failures.

In the manufacture of tin-lined lead pipe I obviate the above difficulties, as well as others, by my invention, the nature of which consists, first, in the construction and use of a double core attached to a piston and so arranged, relatively to the other devices, that the withdrawing from the ingot-cylinder of the larger core after the lead ingot is cast around it introduces into the ingot-cylinder the smaller core, around which to cast the tin ingot; second, in combining with such double core a collar, through which it works, and which is so adjustable as that the core may be accurately centered in or along the axial line of the ingot-cylinder, and which is also removable in order that cores and collars of different diameters may be substituted, so as to make pipe of different sizes; third, in combining with such double core an ingot-cylinder in which to cast the double ingot, and a die for shaping and forming the outer face of the pipe; fourth, in the construction of a double hydraulic press, in which the plunger of the main cylinder is itself a hydraulic cylinder, and is fitted with a piston for operating the double core, such plunger and piston being so made that they may be operated separately or together in either direction; fifth, in such construction of the hydraulic plunger and piston that the core may be changed at pleasure for making different sizes of pipes; sixth, in such construction of devices that the remainder of an ingot left at the completion of the pressing-stroke of the plunger may be removed from the ingot-cylinder, as well as the core around which the pipe is formed, and be united with the new ingot without the necessity of a change of machinery or devices, so that without delay, trouble, or expense the successive double ingots of tin and lead may be formed into a continuous pipe without joint, weld, or seam; and, seventh, in the construction and use, in such a machine, of extension water-pipe joints for supplying water to the movable hollow plunger.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and mode of operation, referring for that purpose to the accompanying drawings, making a part of this specification, in which—

Figure 1 is a vertical sectional elevation of

my improved devices for making tin-lined lead pipe, and Fig. 2 by a similar view illustrates the same mode of operation in its application to a somewhat different arrangement of devices.

Like letters of reference indicate like parts in each.

A is the top plate of my hydraulic press, and is connected to the main hydraulic cylinder B by uprights C, the latter being secured by keys D, or other equivalent device. Into the upper and lower parts of the cylinder B water is admitted by pipes *b' b''*. These in turn connect with force-pumps or other similar device, by means of which hydraulic pressure is applied in the cylinder B, as may be desired. In the hydraulic cylinder B is fitted, by a plunger-head, *e*, a hollow plunger, E, and the top of the cylinder B, around the plunger E, is made close by a collar, *b*. The cylindrical cavity of the plunger E is divided into two parts, *c c'*, by a partition, *e'*, and is closed at its upper end by a cap, *e''*. In the lower cavity, *c*, is fitted a piston, *d*, the stem *d'* of which passes upward through an opening in the partition *e'*. Into the upper end of the stem *d'* is screwed the larger core *i'*, which in turn passes through an opening in the cap *e''*, and a short distance above it, and to the upper end of which the smaller core *i* is attached in such way that when in use the one is an extension of the other and the two form a double core. On the top of the cap *e''* rests the collar-block *o'*, in which the collar *o* is carefully centered by set-screws *o''*. The aperture of the collar *o* is circular, with a diameter equal to that of the larger core *i'*. On the collar-block *o'*, and by bolts *f* tightly secured to the cap *e''*, is the ingot-cylinder *g*, which is made open at both ends and is bored to the size of the double ingot to be cast therein.

Attached to the top plate, A, of the press, in any convenient manner, and centrally placed with reference to the devices below, is a tubular die-holder, *a'*, of length equal to the depth of the ingot-cylinder *g*, and so made as to work closely therein. In its lower face is set an annular die, *a*, of a diameter equal to the exterior diameter of the pipe to be made. This die *a* is removable, so that dies of any other desirable diameter of aperture may be substituted. An opening, *a''*, is left in the top plate, A, right over the tubular cavity of the die-holder *a'*.

It will be observed that the cylinder B, plunger E, cores *i' i*, collar *o*, ingot-cylinder *g*, and die-holder *a'* all have a common axial line.

As already stated, water is admitted into the cylinder B by pipes *b' b''*, by the one, *b'*, above the plunger-head *e* and the other, *b''*, below. The cavity *c* of the plunger E is also furnished with water-pipes *n n'*, the one, *n*, discharging into the cavity *c* above the piston *d* and the other, *n'*, below it. These pipes at their outer ends enter reservoirs *m m* sufficiently far to play up and down therein through the packed heads *m' m'*, along with the up-and-down motion of the plunger E, as presently to be described. All the joints, not only those of the reservoirs *m m*, but also those of the cylinder B and cavity *c* in the plunger E, as well as those of the plunger-head *e* and piston *d*, are so secured or closed by packing *u* as to be water-tight.

The mode of operation is then as follows: The plunger-head *e* being at or near the bottom of the cavity of the main cylinder B, the ingot-cylinder *g* is thereby lowered so far that its upper end stands a little below the lower end of the die-holder *a'*. Water is then forced through the pipe *n'* into the cavity *c* below the piston-head *d*. By this the piston *d* is raised, and thereby the double core *i' i* is carried vertically upward till its larger part *i'* enters the ingot-cylinder *g* in the line of its axis. Melted lead is then teemed into the ingot-cylinder *g* at its open upper end till the space between the outer face of the larger core *i'* and the inner face of the ingot-cylinder *g* is filled with lead, which, becoming "set," forms the lead part of the double ingot, as shown at *s'*. As soon as this lead part *s'* has so far lost its fluidity as not to run, water is forced into the cavity *c*, above the piston *d*, through the pipe *n*. The piston *d* with its downward stroke then lowers the double core till it stands, as shown in Fig. 1, with the smaller part *i* in the cavity of the ingot-cylinder *g* along its axis. Melted tin is then teemed, as above described, into the space between the smaller core *i* and the inner face of the lead ingot *s'*, as at *s*. As soon as it is set sufficiently water is forced by the pipe *b''* into the main cylinder B below the plunger-head *e*, and the plunger E, with all the devices inside of it or attached to it, is carried vertically upward. By this the double ingot *s s'* is forced against the lower end of the die-holder *a'*, and the metals escape through the annular opening between the core *i* and die *a*, in the form of a pipe, *s''*, of lead body and tin lining. This pressing is continued till the double ingot *s s'*, or as much of it as possible or as much as is desirable, is pressed out of the ingot-cylinder *g* and formed into pipe. Fig. 1 shows the position of the machinery when the double ingot *s s'* is about half pressed out. Immediately on the completion of a pressing-stroke of the plunger E, and in order to charge the ingot-cylinder *g* anew, I force water, by the pipe *b'*, into the main cylinder B above the plunger-head *e*, and also at the same time, by the pipe *n'*, into the cavity *c* under the piston *d*. By this means the piston *d* and cores *i i'*, as also the remainder of the double ingot *s s'*, which, not being formed into pipe, rests partly on the upper end of the larger core *i'*, are kept stationary, and the downward stroke of the plunger E lowers the ingot-cylinder *g* until it surrounds the lower and larger core, *i'*. Melted lead is then teemed into the space between the two, as before, to form the lead part *s'* of a new double ingot. This being set, it is carried up by forcing water in under the plunger E until the lead ingot touches the remain-

der of the old ingot which has adhered to the die-holder *a'*. This remainder of the old ingot is thus held in place, while, by water forced in above the piston *d*, the smaller core *i* is stripped from the pipe *s''*. The ingot-cylinder *g*, with its newly-formed lead ingot *s'*, is then lowered to its former position, the cores *i i'* are lowered vertically till the smaller core *i* occupies the axial line of the ingot-cylinder *g*, when the new tin ingot *s* is cast in. The new double ingot now being complete, it is pressed up against the unpressed remainder of the old ingot, the two, under pressure, forming a perfect union, and the pressing of the pipe is continued.

For making pipe of different sizes, either in respect of weight or of interior or exterior diameter, no other changes are necessary in my machine than a change of cores *i i'*, collar *o*, and die *a*. These may be made of the required sizes relative to each other, and of the proper sizes for forming the pipe to be made and substituted for the cores, collar, and die shown.

By increasing or lessening the diameter of the annular die *a*, I increase or lessen the outer diameter of the pipe. The inner diameter of the pipe is likewise changed by substituting a larger or smaller core for the core *i*, and the thickness of the tin ingot is of course equal to one-half the difference between the diameter of the larger core *i'* and that of the smaller core *i*. The larger core *i'*, of whatever size, screws into or is otherwise connected with the stem *d'*, and is carefully centered by set-screws *o'' o''*, four in number, more or less, setting against the collar *o* on opposite sides. The die *a* is similarly adjusted, or it may be fixed in its die-holder *a'*, and the adjustments be made where the die-holder is attached to the top plate, A.

The devices described are superior to other devices already in use for like purposes in many important particulars:

First. By the use of a double core, one being an extension of the other, I avoid the necessity in casting the double ingot of removing one core from its head-block and inserting another. This, as already suggested, is, with the ordinary devices, a cause of considerable delay, since the cores become hot and when inserted must be adjusted in position with the greatest accuracy, and, also, since when one charge is pressed out the smaller core can be removed from the pipe only by cutting off and throwing away so much of the pipe as covers it and the remainder of the ingot adhering thereto. By my machine I avoid this waste of metal, and also avoid what often results, the bending and consequent spoiling of the core.

Second. During the time thus ordinarily spent in changing and adjusting cores the metal in the ingot-cylinder solidifies with great rapidity, and by the time the cores are changed and adjusted an immense pressure is required to cause the metals to exude. By the use of the devices described I waste no time, but as soon as the ingots *s s'* have so far set as to lose their fluidity I proceed with the pressing. Consequently less power is required, and wear and tear and danger of breakage are proportionately reduced. A single adjustment of the collar *o* and die *a* is all that is required.

Third. I unite together the successive ingots and produce a continuous pipe of any desired length without joint, weld, or seam.

Fourth. I make a machine easily adjustable for making pipe of different sizes.

Fifth. By my machine I make pipe continuously in a neat, rapid, workmanlike manner, without other interruption than what is required to strip the ingot-cylinder free from the remainder of the previous charge and teem in the metals, as described, giving each metal a few seconds to cool.

So much of my invention as appertains to the double core and double pressing apparatus I apply to other arrangements of devices for casting the ingots and shaping the pipe. One of these arrangements is shown in Fig. 2, which is a sectional view of so much of a somewhat different form of machine as would be included between the lines *x x x' x'*, Fig. 1, the devices below the line *x' x'* remaining the same. The machine, however, is inverted, the top plate, A, becoming the bottom and the main cylinder B being at the top. The tubular die-holder *a'* and the ingot-cylinder *g* then change places. The latter is bolted to the plate A, as at *g'*, Fig. 2, and between the two is the collar-block *o'* of Fig. 1, now become the die-block *p* of Fig. 2. The die *a* is taken from the die-holder *a'*, Fig. 1, and inserted, as at *r*, in the die-block *p*, Fig. 2, and made adjustable therein by set-screws *r' r'*. The tubular die holder *a'* becomes a collar-holder, *z'*, and is bolted directly to the upper end of the plunger E, and at its mouth it carries the collar *z*, which there performs the same functions as the collar *o* in Fig. 1, and is also similarly adjustable by set-screws *z'' z''*. The machine then being inverted, as already stated, the collar-holder *z'* is withdrawn from the ingot-cylinder *g'*, the larger core *i'* is lowered into the axial line of the cylinder *g'*, melted lead is teemed in around it, the smaller core *i* is substituted, and melted tin turned in around it, thus forming, substantially in the manner already described, the double ingot *s s'*, Fig. 2, and after the two metals are fairly set the pressing is done as before, with this difference, that in Fig. 1 the double ingot *s s'* moves along with its cylinder *g*, and in Fig. 2 the ingot-cylinder *g* is stationary, and the double ingot *s s'* is forced along through it, the two metals exuding through the annular die *r* into a pipe, *s''*, of lead body and tin lining.

The manner of operating the cores and double hydraulic apparatus is the same as that already described, and the collar *z*, die *r*, and cores *i' i* are removable in like manner, as and for the same purposes as before.

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

1. In a machine for making tin-lined lead pipe, a double core, *i' i*, constructed and op-

erated substantially in the manner hereinbefore set forth.

2. A double core, i' i, a piston or piston-stem, d', and guided by a collar, o, arranged with an ingot-cylinder, g or g', and an annular die, a or r, for forming the outside of the pipe, all constructed and operated substantially as and for the purposes hereinbefore set forth.

3. In a machine for making tin-lined lead pipe, the double hydraulic press consisting of the plunger E, the main cylinder B, a piston, d, for operating the core, and pipes for the admission of water, all constructed and arranged substantially as and for the purposes above set forth.

4. Adapting the machine herein described to the production of pipe of different size by constructing the cores i' i, collar o, and die a or r in the manner described, so that the same may be removed and others substituted therefor, all as set forth.

5. The double core i' i, the ingot cylinder, die-holder, and collar o, in its collar-block o', and die a or r, all arranged and operated so that at the end of a pressing-stroke a new double ingot may be made to unite with the remainder of the old ingot and the two be pressed into a continuous pipe, substantially as above set forth.

In testimony whereof I, the said HARRY J. BAILEY, have hereunto set my hand.

HARRY J. BAILEY.

Witnesses:
ELL TORRANCE,
G. H. CHRISTY.