(No Model.)

J. C. BAYLES.

MANUFACTURE OF COMPOSITE METALLIC PIPES.

No. 418,154. Patented Dec. 31, 1889.

Fig. 1.

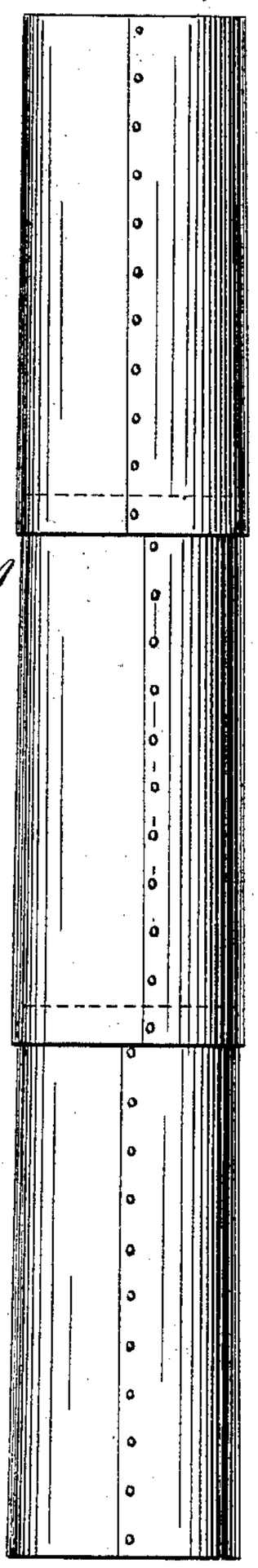


Fig. 2.

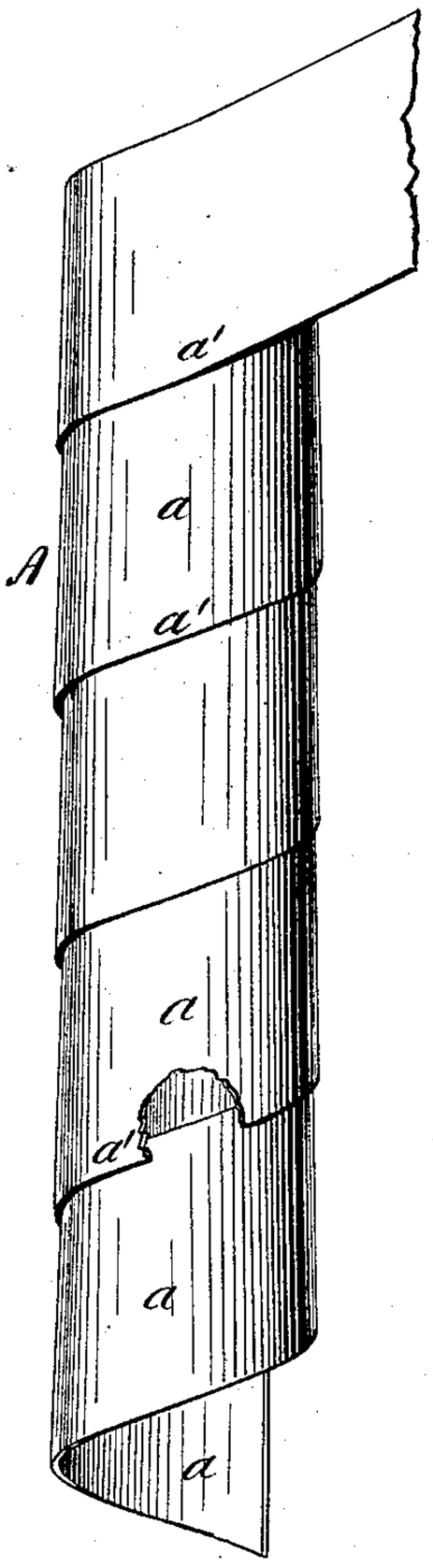


Fig. 3.

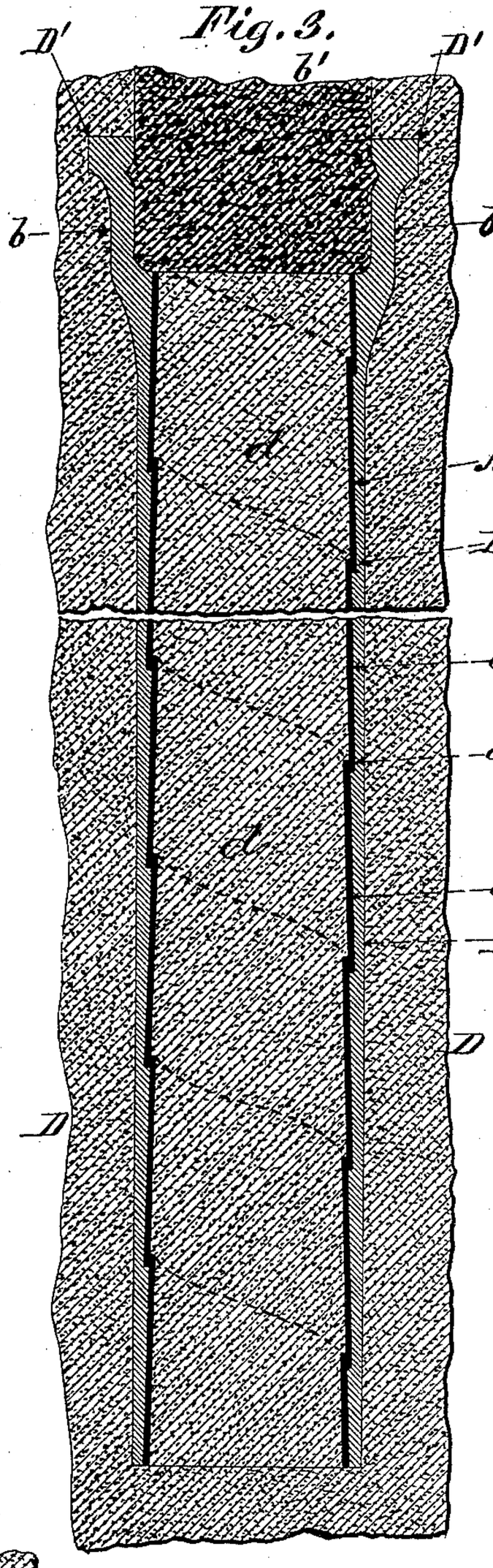
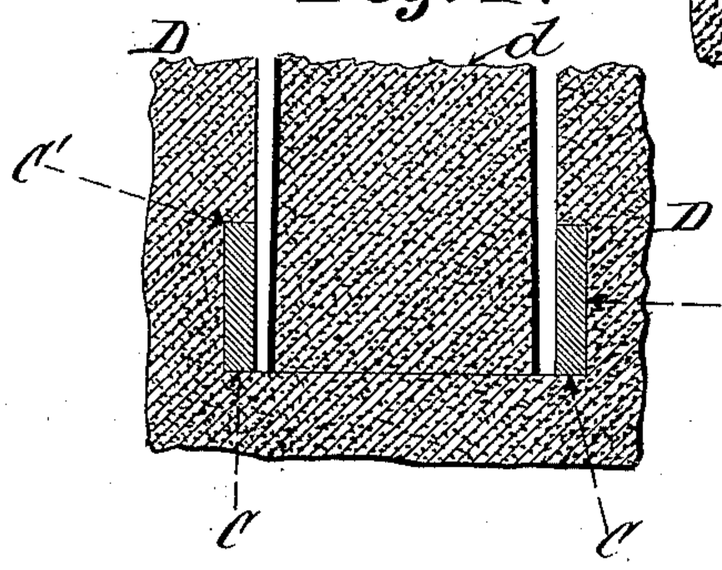


Fig. 4.



Witnesses:
Leo. H. Miatt
D. V. Gardner

Inventor:
James C. Bayles,
Per Edw. E. Lunny,
Atty.

UNITED STATES PATENT OFFICE.

JAMES C. BAYLES, OF EAST ORANGE, NEW JERSEY.

MANUFACTURE OF COMPOSITE METALLIC PIPE.

SPECIFICATION forming part of Letters Patent No. 418,154, dated December 31, 1889.

Application filed October 7, 1889. Serial No. 326,268. (No model.)

To all whom it may concern:

Be it known that I, JAMES C. BAYLES, of East Orange, New Jersey, have invented certain Improvements in the Manufacture of Composite Metallic Pipe, of which the following is a specification.

This invention relates to a composite metallic pipe which consists of an external shell of cast-iron and an adhering internal shell of comparatively thin sheet-steel or wrought-iron. The adherence of the cast-iron to the sheet-steel or wrought-iron is effected by first forming the sheet-steel or wrought-iron into a tube, then introducing such tube into a pipe-mold and filling it with sand, and employing it as a core around which the external shell is cast. The internal shell may be made, like ordinary stove-pipe, in short sections, having their longitudinal joints either riveted or seamed, and having sufficient longitudinal taper to permit the insertion for a short distance of the smaller end of one section into the larger end of the next adjoining section; but it is preferred to make the interior shell from a ribbon of steel or wrought-iron wound spirally with overlapping edges. The cast-iron shell may be re-enforced by a steel collar set in the mold, or by being made thicker at any place where it is desired to have a screw-thread cut upon its exterior surface, and it may be enlarged in diameter and flared at the end to form the usual hub for the pipe. By thus incasing a tube or pipe of steel or wrought-iron of light gage in a shell of cast-iron the inside retains the strength and impermeability of steel or wrought-iron, while the outside is given the ability of resisting destructive oxidation, which is possessed in a peculiarly high degree by cast-iron.

The accompanying drawings, illustrating the invention, are as follows: Figure 1 is an elevation of a sheet-steel or wrought-iron tube made, like an ordinary stove-pipe, in short sections with slip-joints. Fig. 2 is an elevation showing the manner of constructing the internal tube from a ribbon of steel wound spirally with overlapping edges. Fig. 3 is a central longitudinal section of an ordinary pipe-mold, showing the steel tube filled with sand and used as a core-barrel around which the cast-iron shell is cast. Fig. 4 is a central longitudinal section of a portion of a pipe-mold and the adjoining portion of the steel-covered core-barrel, showing a recess formed in the wall of the mold to provide for a greater thickness of the casting at that point, or to provide room for the reception of the re-enforcing collar of malleable metal, which in the subsequent operation of casting thus becomes attached to the part of the pipe requiring to be provided with an exterior screw-thread.

The essential characteristics of the improved composite pipe illustrated in the drawings are the interior tube A, made of comparatively thin sheet-steel or wrought-iron, and the exterior cast-iron shell B, adhering to the outside of the interior tube A. The exterior shell may, if desired, be provided at either end with a laterally enlarged and flanged extension or hub *b*, or may be otherwise so formed as to adapt it for employment in connection with either of the common methods of coupling pipe-sections to each other.

If desired, the place where an external screw-thread is to be cut on the cast-iron shell B may be re-enforced by the steel or wrought-iron collar C, which can be effectively fastened to the cast-iron shell by depositing it in a suitable recess C′, formed in the pipe-mold D, preparatory to the casting of the shell after the introduction into the mold of the core-barrel composed of the sheet-steel or wrought-iron tube A, filled interiorly with sand *d*.

If the composite pipe is to be provided with a hub, the mold is provided with the usual annular recess D′ at the top, and the hub-core *b*′, prepared in the ordinary way from straw rope and loam, is placed upon the upper end of the core-barrel, as shown in Fig. 3.

The operation of casting is performed in the usual manner by pouring the molten iron into the mold and thereby filling the space in the mold outside the core-barrel. In the construction of the inner tube for the purposes of this invention thin sheet-steel and wrought-iron may be regarded as equivalents; but steel is preferred, and preferably

the interior tube is made of a ribbon *a* of steel wound spirally with overlapping edges *a'*, as illustrated in Fig. 2. This winding may be done cold. There is no need of uniting the overlapping edges by welding, riveting, brazing, or other means, the contact of the edges being sufficient for the purposes of the invention, whether the overlapping edges are or are not fastened together. The steel tube filled with sand becomes the core around which the cast-iron is poured. The objects of filling it with sand, rammed to the degree of hardness which may be necessary in the judgment of the founder, are to sustain the steel shell and prevent its collapsing when the hot iron is poured around it, and also to enable it to be brought nearly to the temperature of the melted metal. The tube of steel filled with sand thus becomes the core-barrel around which the pipe is cast, and obviates the necessity for any other core-barrel, except when the pipe is to be provided with a hub *b*, as has been explained. When the molten iron is poured into the mold, it fills any seam which it can penetrate in the shell and closely adheres to the surface of the steel core. When the metal has cooled sufficiently, the sand is removed, and the resulting composite pipe is prepared for market in the usual way. It will of course be understood that the outside of the steel shell may be coated with a flux, if desired; but it will usually be found that the cast-iron shell adheres to the steel sufficiently without the use of the flux.

The composite pipe thus made is very much stronger than the same-sized pipe made of cast-iron alone and may be made very much lighter. The construction insures absolute tightness, which, in a light cast-iron pipe, is frequently prevented by the presence of blow-holes, sand-holes, or other defects in the casting. The density and imperviousness of the steel are not in any way impaired nor its high tensile strength reduced by its contact with melted iron in the mold. With a core of steel .035 inch, .049 inch, or .065 inch thick, (Nos. 20, 18, or 16, Birmingham wire-gage,) and external shells as light as can be run—from one-eighth inch to one-fourth inch thick—it is possible to secure strengths greater than are usual in heavy cast-iron pipes. The saving in weight of material is from fifty to seventy-five per cent., (more or less,) according to diameter cast and the strength desired. Slight defects in the casting, which would render a cast-iron pipe incapable of withstanding pressure, are of no consequence in the composite pipe described, for the reason that such defects are usually the result of bubbles in the iron, formed by steam or gases suddenly generated and finding no means of escape, and these never occur in practice opposite a seam in the inner steel shell, because any steam or gases generated at that point escape through the seam and into the sand filling of the core, and are immediately followed by the iron, which seals the seam tightly in cooling. The protecting value of the cast-iron casing is not impaired by any ordinary imperfections in the casting, because such imperfections can be filled with asphaltum or other plastic substances which resist decomposition in the ground.

The composite pipe described has great value for uses involving considerable pressures. Cast-iron, as is well known, is a brittle material, and the grades of pig-iron which are especially suitable for pipe-making because of their fluidity when melted, are, as a rule, especially brittle. Cast-iron pipes are also unsuitable for use as conduits for fluids or gases under high pressure, for the reason that cast-iron, even if free from defects, is to a greater or less degree porous; hence cast-iron pipes are not usually considered suitable conduits for natural gas and are not employed for the conveyance of compressed air or steam or of water under a greater pressure than one hundred and fifty pounds per square inch, to carry which pressure with safety they are made excessively heavy.

In the present invention no dependence for strength is placed upon the cast-iron. The value of the pipe as a conduit lies chiefly in the steel shell. For illustration, a shell of soft steel twenty inches in diameter, made of metal .049 inch thick, (No. 18, Birmingham wire-gage,) has an ultimate strength of three hundred and nineteen pounds per square inch. Re-enforced with the lightest shell of iron which can be cast around it—say one-fourth inch thick—such a pipe will be safe and tight under a working-pressure of two hundred and fifty pounds per square inch. It will weigh 61.78 pounds per lineal foot. A twenty-inch cast-iron pipe as now made, to safely carry a pressure of one hundred and fifty pounds, would need to be not less than one inch thick and would weigh, if of that thickness, about two hundred and six pounds per lineal foot.

The spirally-wound shell of steel is preferred to any other form, for the reason that it gives the greatest strength with the least weight. The effect of internal pressure is not to open the spiral seam, but to close it. The spiral cannot expand unless the edges can slip, which is impossible when they are held in place by a casing of cast-iron, and as no form of internal pressure circumferentially exerted has any tendency to separate the edges, as in the case of a longitudinal seam, a spirally-wound core will be found to possess a strength equal to the ultimate strength of the metal. This form of pipe is safe under pressure, even when tested to rupture. It will not fly apart, like burst cast-iron, but will tear slowly and only so far as is needed to relieve the strain upon it. Owing to superior lightness, as well as strength, it can be manufactured, transported, handled, and laid very much more cheaply than correspondingly-strong cast-iron pipes.

The external collar C, of soft steel, affords

a body of malleable metal into which to cut threads for a screw-joint, and hence may be applied when it is desired to adapt the composite pipes for the use of the screw-couplings employed in connecting wrought-iron pipes. If the thread is deeper than the thickness of the steel collar, it will still make a good screw-joint. The cast-iron will furnish the broad base of the pyramidal thread, and the steel the more slender apex for which cast iron would be too brittle.

What is claimed as the invention is—

1. The composite metal pipe herein described, which consists of a tube composed of comparatively thin sheet-steel or wrought-iron exteriorly incased by an adherent shell of iron cast thereon.

2. In a composite metal pipe, the combination, as herein set forth, of a tube composed of a ribbon of steel or wrought-iron wound spirally with overlapping edges, and an iron shell cast upon the exterior of the said tube.

3. A composite metal pipe consisting of a tube composed of comparatively thin sheet-steel or wrought-iron contained within and adhering to the interior of the barrel of a cast-iron pipe cast upon it provided at one end with a laterally-enlarged extension to serve as a hub.

4. A composite metal pipe consisting of a cast-iron cylindrical shell re-enforced by an adherent exterior collar of malleable metal provided with a screw-thread, and an interior lining composed of comparatively thin sheet-steel or wrought-iron.

5. The improvement in the art of manufacturing composite metal pipe herein described, which consists in casting in a suitable mold a cast-iron pipe around the exterior of a sheet-steel or wrought-iron tube filled with sand and supported within said mold.

JAMES C. BAYLES.

Witnesses:
A. M. JONES,
EDW. E. QUIMBY.