No. 868,418. PATENTED OCT. 15, 1907.

T. E. DWYER.

METHOD OF MAKING COMPOSITE PIPE.

APPLICATION FILED JUNE 16, 1905.

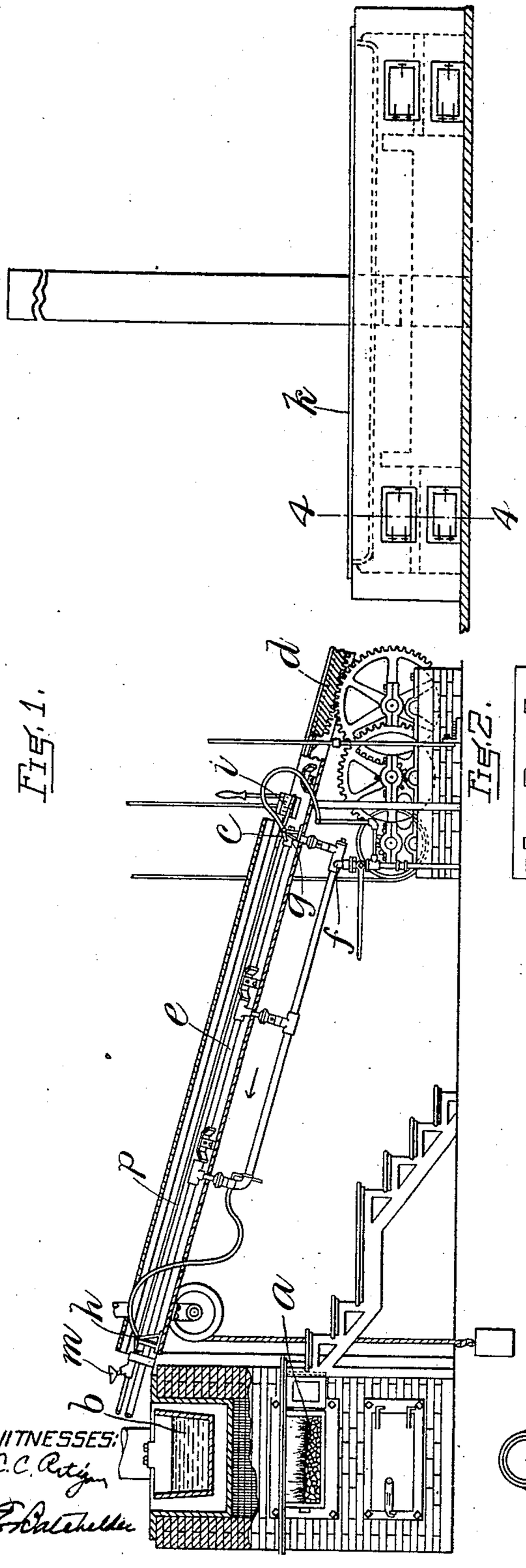

Fig. 1.

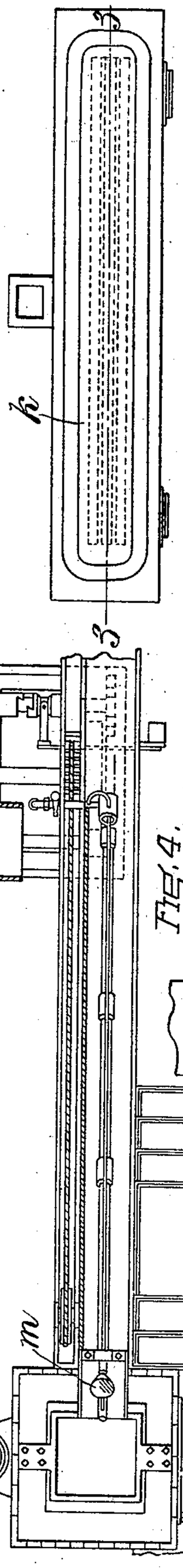

Fig. 2.

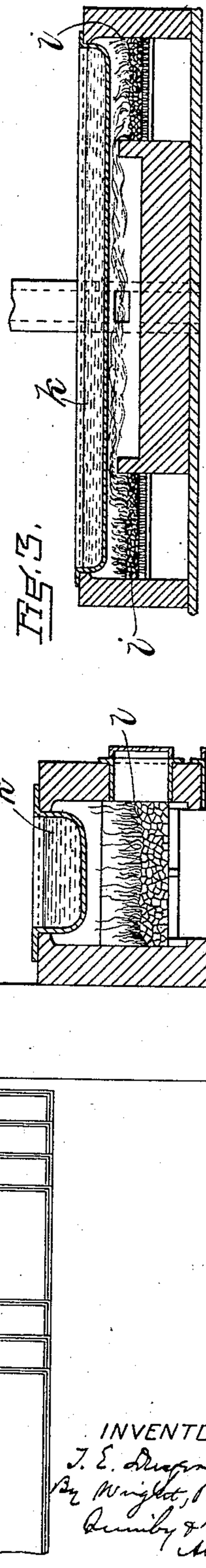

Fig. 3.

Fig. 4.

WITNESSES:
C. C. Retzer
E. Batchelder

INVENTOR:
T. E. Dwyer
By Wright, Brown
Quinby & May
Attys

UNITED STATES PATENT OFFICE.

THOMAS E. DWYER, OF WAKEFIELD, MASSACHUSETTS.

METHOD OF MAKING COMPOSITE PIPE.

No. 868,418. Specification of Letters Patent. Patented Oct. 15, 1907.

Application filed June 16, 1905. Serial No. 265,513.

To all whom it may concern:

Be it known that I, THOMAS E. DWYER, of Wakefield, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Methods of Making Composite Pipe, of which the following is a specification.

The present invention has for its object to improve on the previously known methods of manufacturing composite, non-corrodible pipe, consisting of an outer tube of corrodible material such as iron or steel, and an inner tube or lining of non-corrodible metal having a relatively lower melting point such as zinc, lead and the like, or their alloys.

Hitherto it has been the practice in making pipe of this character to first coat the interior of the iron pipe with tin or zinc, in order that the soft, easily fusible, non-corrodible metal, when poured therein in a melted condition, may form a close union therewith, and between the steps of coating the iron tube with tin and introducing the melted lead, it has been usual to allow the iron tube to become cool. Thereafter, in order for the lead to be enabled to flow into all parts of the iron tube to provide a continuous lining, it was necessary to heat the iron tube externally to a temperature higher than that of the melted lead before pouring in the lead, and this resulted in injury to the coating of tin which had previously been deposited in the iron tube. When this procedure is employed the reheating causes the tin coating either to separate and peel off from the iron tube, or to be oxidized, forming a tarnished and discolored surface which prevents close union with the melted lead.

By the present invention I have devised a method which obviates the difficulties above referred to, since the iron pipe is not allowed to become cooled to any great extent after being tin-coated, but is immediately provided with a lead lining.

The invention particularly consists in the steps which I will now proceed to describe and claim in detail and is practiced by means of the apparatus shown in the drawings forming a part of this application, in which—

Figure 1 represents a side elevation, partly in section, of such apparatus: Fig. 2 represents a plan view of the apparatus: Fig. 3 represents a sectional view of the bath of melted tin taken on the line 3—3: Fig. 4 represents a cross section of the same taken on the line 4—4 of Fig. 1.

The same reference characters indicate the same parts in all the figures.

This apparatus consists of a device for coating the iron pipe with tin and simultaneously heating the same, and a contrivance by which lead or similar non-corrodible metal may be applied to the interior thereof to form a non-corrodible lining.

The apparatus for forming the non-corrodible lining of easily fusible metal is substantially the same as that described in the patent granted to David A. Ritchie June 2, 1903, and numbered 729796. This consists of heater *a* and retort *b* in which molten metal having a low melting point, such as lead, zinc, etc, may be retained, a mandrel *c* adapted to be placed within a primary tube of corrodible and relatively hard and refractory material, as iron or steel, a carriage *d* for moving the tube in longitudinal direction relatively to the mandrel to separate it therefrom, a gas-tube *e* beneath the mandrel having burner outlets for heating the primary tube while the molten lead is being poured therein, a gas-conduit *f* for supplying gas to the burner *e* and to the auxiliary burners *g*, *h*, and a cooling device *i* for spraying water upon a portion of the primary tube adjacent the end of the mandrel, for cooling the lead at that point. These and other details of the mechanism for forming the non-corrodible lining in the tube are clearly set forth in the patent referred to and need no further explanation in this application.

In close proximity to the apparatus above referred to is the tank *k* containing tin or solder or a mixture of lead and tin, which is retained at a high temperature and in a molten condition, by the heat of furnaces *l l* beneath the tank. This tank is long enough to permit a section of iron tubing, which may be called the primary tube, to be immersed in the tin contained therein, and constitutes a tin bath.

In carrying out the method which forms my invention the primary tube is first placed in the tin bath and heated to a temperature approaching that of the melting point of lead approximately 500° Fahrenheit, and is at the same time provided with a coating of the tin which flows into it. The primary tube is then removed from the bath, and as it is of iron or steel and therefore refractory to heat, it is unchanged as to its physical characteristics, except that it is evenly coated with the tin. Thereupon the primary tube is immediately carried to the apparatus for providing the lining and is placed so as to surround the mandrel *e*, its end being attached to the carriage *d* in the manner described in the before-mentioned patent. As this apparatus is in close proximity to the tin bath the primary tube can be transferred and placed in position in the lining apparatus before it has had time to lose any considerable portion of the heat imparted to it by the molten tin. The burners *e g h*, being ignited, serve to maintain the temperature of the primary tube at such a point as will prevent the lead which is poured into the same and surrounds the mandrel, from solidifying. The subsequent steps of the process are the same as set forth in the patent referred to, melted lead being poured into the funnel *m* and filling the space between the interior of the primary tube and the mandrel *c* and rod *p* to which it is connected. The carriage *d* is set in motion and gradually draws the primary tube longitudinally away from the mandrel, bringing with it a lining layer

of lead which is cooled as it leaves the end of the mandrel and solidified by the cooling device *i*.

It will be seen that with the process above outlined there is practically no cooling of the primary tube between the time it leaves the tin and the time when it is heated again by the gas-burners, and that therefore there is no opportunity for the injury to the coating of tin which results from allowing the primary tube to become cooled and reheating it to a relatively high temperature. Thus the tin coating remains in firm union with the iron when the lead is poured in the primary tube, and also has a bright, clean surface.

While I have specified tin as the material of the coating applied to the primary tube, I wish it understood that solder, or a mixture of lead and tin may be used for said coating. It is obvious that the described method may be employed for coating primary tubes of brass and other relatively hard metals.

I claim:—

1. That improvement in the art of making composite non-corrodible pipe which consists in heating and coating a primary tube of corrodible refractory material by immersing the same in a bath of molten material, pouring into the tube while it is still hot a quantity of molten non-corrodible metal having a lower melting point than that of the pipe, and forming the molten metal around a mandrel into a lining for the tube.

2. The method of making composite non-corrodible pipe which consists in uniting a non-corrodible metallic lining to a primary tube of relatively-refractory corrodible material by coating and heating the primary tube in a bath of molten material, placing the primary tube over a mandrel, pouring molten non-corrodible metal having a lower melting point than that of the metal from which the primary tube is made into the space between the mandrel and tube while the primary tube is still hot, and cooling the tube.

3. The method of making composite non-corrodible pipe which consists in uniting a non-corrodible metallic lining to a primary tube of relatively-refractory corrodible material by coating and heating the primary tube in a bath of molten material, placing the primary tube over a mandrel, pouring molten non-corrodible metal into the space between the mandrel and walls of the tube before the tube has become cool, removing the mandrel and cooling the tube.

4. The method of making composite non-corrodible pipe which consists in uniting a non-corrodible metallic lining to a primary tube of relatively-refractory corrodible material by coating and heating the primary tube in a bath of molten material, placing the primary tube over a mandrel, pouring molten non-corrodible metal having a lower melting point than that of the material of which the primary tube is made into the tube while the latter retains a considerable portion of the heat imparted by the bath, maintaining by extraneous means the temperature of the tube at a point higher than the melting point of said non-corrodible metal, producing a relative longitudinal motion between the mandrel and tube to separate them, and cooling the portion of the tube adjacent the end of the mandrel.

5. The improvement in the method of making lead-lined iron or steel pipe which consists in simultaneously coating and heating to a high temperature a primary tube of iron or steel by immersing the tube in a bath of molten material, pouring melted lead into the tube before the latter has cooled to any considerable extent, forming the lead into a tubular lining, and cooling the tube.

6. The improvement in the method of making lead-lined iron or steel pipe which consists in simultaneously coating and heating to a high temperature, a primary tube of iron or steel by immersing the tube in a bath of molten material, placing a mandrel in the tube and pouring melted lead into the space surrounding the mandrel before the tube has cooled to any considerable extent, removing the mandrel by producing relative longitudinal movement between it and the tube, and cooling the portion of the tube adjacent the end of the mandrel.

7. The improvement in the art of lining corrodible pipe with an incorrodible metal, consisting in dipping the pipe in a bath of molten metal, which will adhere to the pipe, and thereby at the same time heating the pipe, inserting a mandrel into the pipe, further heating the pipe by an external heater before the first coating has become appreciably cooled, pouring molten non-corrodible metal into the space between the mandrel and inner walls of the pipe, and chilling the pipe and lining.

8. The improvement in the art of lining corrodible pipe with an incorrodible metal, consisting in simultaneously heating and coating the pipe with molten metal, maintaining the pipe at a sufficiently high temperature to prevent solidifying of the coating, pouring molten non-corrodible metal into the pipe to form a lining, and chilling the pipe and lining.

In testimony whereof I have affixed my signature, in presence of two witnesses.

THOMAS E. DWYER.

Witnesses:
C. F. BROWN,
A. C. RATIGAN.