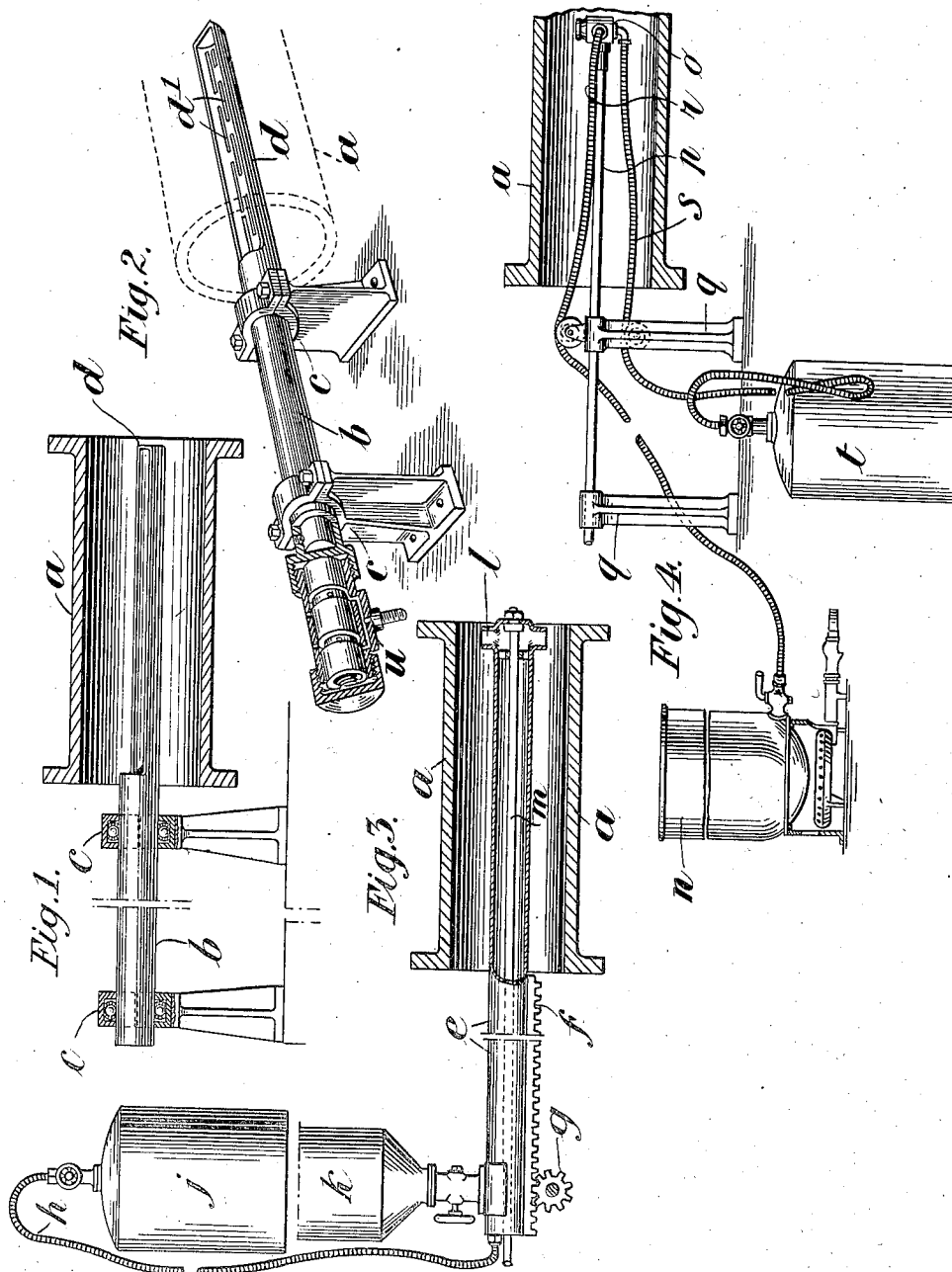


March 23, 1926.

1,577,531

W. LAMBERT ET AL
METHOD OF ENAMELING PIPES

Filed May 29, 1925



Inventors:
Wesley Lambert,
Albert Alfred Mead,
By *Wesley Lambert* atty.

UNITED STATES PATENT OFFICE.

WESLEY LAMBERT AND ALBERT ALFRED MEAD, OF LONDON, ENGLAND, ASSIGNORS
TO J. STONE & COMPANY LIMITED, OF DEPTFORD, ENGLAND, A CORPORATION OF
GREAT BRITAIN.

METHOD OF ENAMELING PIPES.

Application filed May 29, 1925. Serial No. 33,846.

To all whom it may concern:

Be it known that we, WESLEY LAMBERT, metallurgist, of No. 41 Bromley Road, London, S. E. 6, England, a subject of the King
5 of Great Britain, and ALBERT ALFRED MEAD, of Aldersyde, No. 1 Handen Road, Lee, London, S. E. 12, England, a subject of the King of Great Britain, have invented certain new and useful Improvements in
10 Methods of Enameling Pipes (for which we have filed an application in Great Britain, May 20, 1924, No. 12394/24), of which the following is a specification.

This invention comprises improvements
15 in and connected with the coating of metal surfaces with vitreous coatings of enamel, glaze, glass or the like, the invention being particularly concerned with the internal coating of hollow objects such as pipes,
20 tubes and the like.

The principal object of the invention is to enable coatings of the nature indicated to be applied to the objects or surfaces in question without the necessity for re-heating the same as a part of the process of hot
25 enameling, glazing or the like. A further object is to enable a permanent and lasting coating to be applied and to avoid the danger of such coating scaling off due to the presence of oxide or other impurities on the sur-
30 faces coated. The coating process will be hereinafter referred to as a hot enameling process, this term having reference to all enameling, glazing or similar coating processes requiring the application of heat for
35 vitrifying, indurating or burning on the applied coating.

According to the principal feature of this invention, the hot enameling process is carried out whilst there is still in the objects
40 to be coated sufficient residual heat remaining from a previous heat treatment (as for example, from the heat required for their formation) for effecting the complete vitrification or finishing treatment of the coating, care being taken to prevent the forma-
45 tion of oxide or other impurity on the surface, or to reduce any such oxide formation, prior to or during the application of the
50 coating.

As a general rule, the heat remaining in the object to be coated will be a residuum of the heat which was required for melting the metal prior to its formation into the desired

objects. The advantages of the invention 55 are attained in what may now be given as the principal example of the mode of carrying out the invention. It is well-known that pipes or tubes can be successfully manu-
60 factured by a process of centrifugal casting and according to these improvements the enamel or vitreous coating material is applied for distribution to the surface to be coated whilst the pipe or tube is still spin-
65 ning after solidification and whilst it still retains sufficient heat for the vitrification aforesaid. However, the invention is also applicable to articles made to finished shape from hot metal by a process other than that
70 of centrifugal casting provided that the residual heat in the article when formed is sufficient to cause complete vitrification of the coating material. Also, articles made by non-centrifugal methods may be revolved
75 whilst still hot for this hot enameling process to be performed.

In hot enameling the surfaces of the bore, barrel and belly of cast iron or other metal pipes and tubes, for example, the article is generally allowed to cool after formation
80 and is then scaled and cleaned and subjected to heat treatment as part of the hot enameling process. This process can be simplified and cheapened and a strongly adherent coating obtained by this improved process par-
85 ticularly when care is taken to avoid or remove or reduce oxide or other coatings or scale on the surface to be coated in accordance with these improvements. Spinning
90 of the object to be coated lends itself very advantageously to this step for the following reasons: While the formed pipe or tube is spinning in the hot condition, the air with-
95 in and about the same is rarefied due to the heat and to the centrifugal action, so that the volume of oxygen having access to the surfaces is minimized. Moreover, a reducing agent or component introduced into or in company with the vitreous material will be distributed over the surface and ensure the
100 intimate attachment of the material to the surface. This procedure will ensure the attachment of the coating to the metal without the possibility of any scale or the like intervening and although intimate or inte-
105 gral coatings, such as the blue oxide coating of steel, may not be prevented or reduced these will have no appreciable deteriorating

effect on the adherence of the vitreous coating. The introduction of the reducing agent may be effected by using such agent as a constituent or ingredient in the coating material or by the admission of such agent in the form of a gas or liquid into the vicinity of the surface to be coated, the employment of a reducing gas for projecting the coating material being a very advantageous example of this procedure.

In apparatus employed in carrying out the process in accordance with this invention, advantage may be taken of the underlying principles made use of in such known apparatus as is employed for the spraying of metals upon surfaces or for the spraying of pigments, scents and so on. In fact spraying, projecting or extrusion devices such as are employed in sand blasting, sifting, conveying and corestick making machines or centrifugal distributing apparatus may be employed. A simple device, however, comprises a trough or channel fashioned in such manner that a supply of the enameling material may be delivered upon the surface to be enameled by tipping over the trough or channel. Such trough or channel may be fitted, if desired, with a lid or with distributing devices so that the coating material opens such lid or passes through or over the distributing devices when the charged trough or channel is tilted or inverted.

This invention therefore provides a process of hot enameling under the conditions before mentioned and comprises the employment of suitable distributing apparatus whereby either an enamel, glass or glass in the form of powder, or the necessary ingredients to form a suitable enamel, glaze or glass is or are deposited in the predetermined or uniform quantity upon the surface to be coated. In the case of enameling the bore of pipes or tubes, the material may be fed to the position required by means of suitable lengths of trough, channel or hollow mandrils. For example, a length of hollow mandril or of an open topped trough or channel carrying the enameling material may be inserted into the bore and the distribution of the material over the surface of the bore may be effected by a sifting action through perforations, the sifting operation being performed either by hand or power. Or a length of trough or channel may be inserted and simply overturned to deliver its charge.

The carrying out of the invention by the aid of mandril devices will be further described with reference to the accompanying drawing illustrating three examples in more or less diagrammatic fashion, in which drawing:—

Figure 1 is an example of a hollow mandril device which is discharged by tipping,

the latter operation being performed by imparting a revolving motion to the mandril.

Figure 2 is a perspective view of an apparatus comprising a slotted trough from which the discharge takes place by a vibrator producing a sifting action.

Figure 3 is an example of a hollow mandril device to which an enamel powder is supplied and is carried to a distributor device by means of a gaseous propellant.

Figure 4 is an example of a mandril device carrying a sprayer to which molten material is supplied and discharged by means of a gas delivered through suitable nozzles or cones.

Referring to Figure 1, *a* is a pipe to be vitreously enameled over its interior, this pipe being supported so as to be capable of constant revolution. *b* is a hollow mandril supported so as to be capable of axial sliding and also of revolution and for this purpose the mandril *b* may be cylindrical and supported in ball bearing rings *c*. Over a suitable portion of its length a segment of the cylinder is cut away, as at *d*. The pipe *a* whilst still hot from centrifugal casting or previous heat treatment is revolved and the mandril *b* is charged in its portion *d* with an enamel mixture or composition. The mandril is inserted into the pipe *a* in the condition seen in Figure 1, and when properly inserted is given a half revolution so as to invert the portion *d* and discharge the contents thereof uniformly along the length of the revolving pipe *a*. The heat of the pipe melts the enamel and the revolution thereof distributes the enamel, so that the interior of the pipe becomes uniformly coated with the enamel which is strongly adherent for the reasons hereinbefore explained. Naturally, any suitable feeding devices may be employed within the mandril, as for example, the well-known Archimedian screw feed. Also, instead of cutting away the cylindrical wall of the mandril, the latter may be formed with perforations for the delivery of the enamel powder.

In the modification illustrated in Figure 2 the mandril *b* need not be revolvably mounted as in Figure 1 but it may be only axially slidable in its supports. The trough portion *d* is formed with narrow openings or slits *d'* and is charged with enamel or glass powder. After insertion of the trough *d* into the pipe *a* which is to be coated internally, a vibrator, which may consist of a known form of pneumatic hammer or vibrator *u* connected in any suitable manner to the outer end of the mandril *b* is operated the vibrations produced thereby to the trough *d* causing the powder to be delivered through the slits *d'* and to be uniformly delivered on to the interior of the revolving pipe *a*.

Referring to Figure 3, a hollow mandril

device is mounted so that it can be fed axially into or out of a pipe *a* to be coated interiorly. For example, the hollow mandril *e* may be formed or fitted with rack teeth *f* so that it can be fed along by means of a feed pinion *g*. A flexible connection *h* is made between the outer closed end of the mandril *e* and a gas container *j* and a container *k* of enamel or glaze powder is supported upon the mandril *e* and its hopper bottom is arranged to deliver the powder through a port into the interior of the mandril *e*. Naturally any suitable agitator or feed devices can be fitted within the container *k*. Upon admission of the powder from the container *k* and gas from *j* through the pipe *h* to the interior of the mandril *e* the powder is carried along by the gas to the delivery end of the mandril *e*. At the said delivery end there may be a centrifugal device, as for example, the centrifugal nozzle device *l* on a suitably driven spindle *m*, for the delivery and distribution of the enamel powder supplied as aforesaid. During this delivery, the mandril *e* is given an axial feed by the gearing *f g* or other feed means, as will be readily understood.

According to the further modification seen in Figure 4 the enamel glaze or glass is contained in a vessel *n* which is suitably heated for melting the enamel and maintaining it in a molten condition. A sprayer nozzle device *o* is mounted on the end of a rod *p* slidably carried on supports *q* so that the sprayer *o* can be fed along the axis of the pipe *a*. The sprayer *o* is connected by flexible piping *r* with the container *n* and by flexible piping *s* with a gas container *t*. The gas supplied to the sprayer effects an atomization of the enamel supplied to the sprayer by the pipe *r* and forcible projection of the same on to the interior of the pipe *a*, a suitable feed being imparted to the rod *p* meanwhile.

When hollow mandrils are employed, provision may be made for heating them by electric current or otherwise, the object being to furnish a means of pre-heating solid or fluid matter passing along or contained in the mandril.

When a gaseous propellant is employed for the vitreous coating material, as in Figures 3 and 4, the said propellant may be (a) of a combustible character which, when ignited, will afford a local heating effect of the nature of a blow pipe, or (b) of a non-oxidizing or neutral character, or (c) of reducing character with the specific object of reducing any undesirable oxides on the

surfaces to be coated. Any of the methods herein described may include the pre-heating of both the enameling material and the gaseous propellant before actually impinging the same upon the surfaces to be coated.

Any of the devices herein described, when employed for the enameling of pipes or tubes, can be advanced through the bore for the delivery of the enameling material, and then withdrawn, the whole operation being capable of performance by hand or automatically by suitable mechanism if desired.

The various methods and forms of apparatus hereinbefore described, although more particularly related to the operation of enameling pipes or tubes formed by the centrifugal casting method wherein advantage can be taken of the hot pipe continuing to spin in the moulding machine and thereby aiding in ensuring a uniform distribution of the enameling material, are nevertheless not restricted in their application to castings made by the centrifugal process.

Reducing or other agents having an effect on the surface to be coated as hereinbefore referred to, may, in some cases, have the effect of fluxing off scale, oxide or impurities from the surface, the molten matter then entering into harmless admixture with the coating material and forming a constituent of the actual vitrified coating.

We claim:—

1. Method of enameling a preformed metal pipe, comprising rotating said pipe while it still retains sufficient residual heat from a previous heat treatment, evenly distributing enamel onto a surface of such rotating hot pipe and holding the same thereon by centrifugal action, and simultaneously distributing over said surface a medium having the capacity of preventing and removing oxide formations thereon, substantially as and for the purpose set forth.

2. Method of enameling a preformed metal pipe, comprising rotating said pipe while it still retains sufficient residual heat from a previous heat treatment, delivering onto the interior of said pipe and by the aid of a distributor nozzle a reducing gas having the capacity for preventing and removing oxide formations on said pipe, introducing enamel through said nozzle and utilizing said gas as a propellant for delivering said enamel onto said interior, and feeding said nozzle along the pipe, substantially as and for the purpose set forth.

WESLEY LAMBERT.

ALBERT ALFRED MEAD.