May 5, 1925. 1,536,908

J. S. MORGAN

METHOD OF IMMERSING SUBDIVIDED SOLIDS OR LIQUIDS IN LIQUIDS

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Fig. 1.

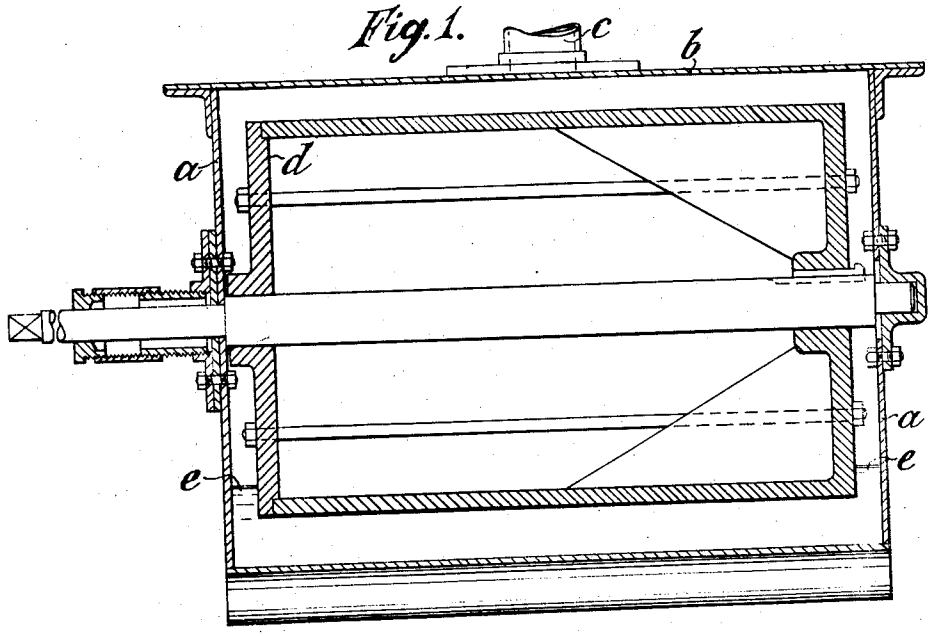

Fig. 3.

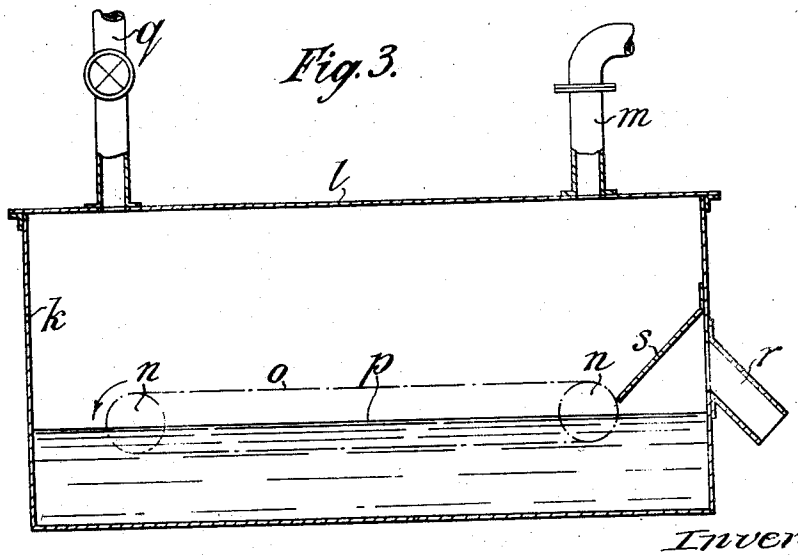

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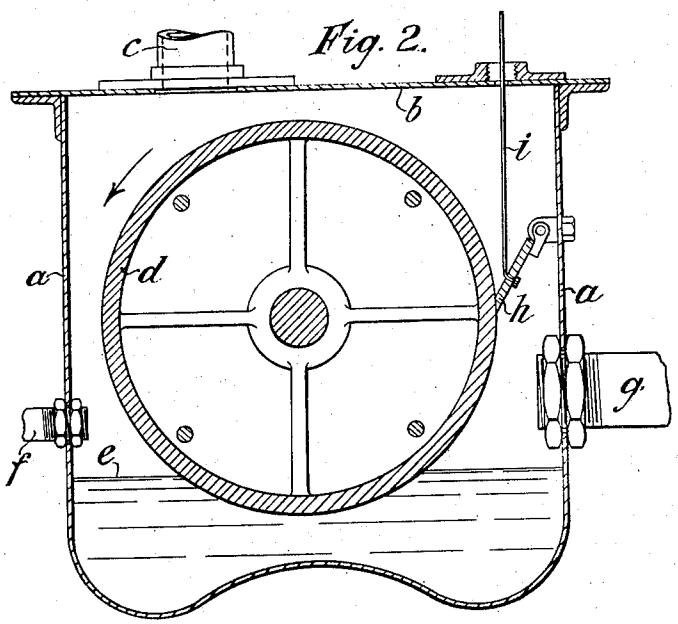
Fig. 2.



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UNITED STATES PATENT OFFICE.

JOHN STANLEY MORGAN, OF LONDON, ENGLAND, ASSIGNOR TO THERMAL INDUSTRIAL AND CHEMICAL (T. I. C.) RESEARCH COMPANY LIMITED, OF LONDON, ENGLAND, A BRITISH COMPANY.

METHOD OF IMMERSING SUBDIVIDED SOLIDS OR LIQUIDS IN LIQUIDS.

Application filed August 8, 1921. Serial No. 490,650.

To all whom it may concern:

Be it known that I, JOHN STANLEY MORGAN, a subject of the King of Great Britain, residing in London, England, have invented a new and useful Method of Immersing Subdivided Solids or Liquids in Liquids, of which the following is a specification.

According to the present invention the effective heating or cooling is applied to the material by causing it to enter the re-entrant angle formed at the junction of a surface of molten metal and a surface not wetted thereby and travelling into the molten metal through its surface. Under these conditions the material is carried by the travelling surface as a film or layer between this surface and the molten metal. In this manner the material is heated or cooled and in its changed condition leaves the travelling surface as this emerges from the molten metal or may be removed from the travelling surface while this is still submerged, or after it has emerged.

For instance, if a rod having a smooth surface is introduced vertically into a liquid which does not wet it, and has a material floating on its surface, the surface of the rod will, in passing into the liquid, become coated with material and will remain so coated until withdrawn from the liquid, when the material will usually leave the rod and remain on the surface of the liquid. In circumstances which would cause the material to adhere to the rod,—for example, if the material undergoes semifusion during its immersion,—the rod may remain coated with the material after its withdrawal from the liquid. By causing the rod to travel in the liquid the material with which it is coated can be conveyed beneath the normal surface of the liquid from one part of the mass to another and can be delivered on to the normal surface at this part by withdrawing or scraping the rod.

Generally it is more convenient to use a drum, or disc, having a surface incapable of being wetted by the molten metal and rotating on a horizontal or inclined axis while partly submerged in the molten metal. Or a travelling band having such a surface may have its lower run submerged while its upper run travels above the surface of the molten metal. The liquid or more or less finely subdivided solid to be treated is fed on to the surface of the molten metal on the descending side of the drum, disc or band; a baffle above the metal and extending to its surface in the axial plane of the drum or disc may serve to keep the material on the said descending side. In these circumstances the whole of the material is carried on the revolving surface between itself and the metal to be delivered or removed on the ascending side.

In the accompanying drawings, Fig. 1 is a longitudinal vertical section and Fig. 2 is a cross section through a still for dehydrating or distilling tar or oils by bringing the tar or oil beneath the normal surface of molten lead or lead alloy. Fig. 3 is a longitudinal vertical section through another form of still suitable for distilling saw-dust or other carbonaceous material.

Referring to Figs. 1 and 2 the still is a rectangular box *a* having a cover *b* provided with a vapour outlet *c*. The ends of the still carry bearings for the shaft of a hollow drum *d*, preferably of mild steel or machined cast-iron. The still contains molten lead to the level *e* and is kept hot by any suitable mode of heating. The hydrated tar enters the still, under the necessary head, through a pipe, such as *f*, and the dehydrated tar leaves by the single pipe *g*.

As the drum is revolved, at a speed which is varied with the content of water in the tar, in the direction of the arrow in Fig. 2, it carries the hydrated tar on its surface through the molten lead and delivers it on to the surface of the lead again as its own surface leaves the lead. To ensure complete removal of the tar from the ascending surface of the drum, it is useful to provide a scraper *h* to which a rod *i* may be attached so as to extend through a stuffing box in the cover for the purpose of putting the scraper into and out of action.

The modified form of still shown in Fig. 3 is a rectangular box *k* having a cover *l* provided with vapour outlet *m*. The ends of the still carry bearings for the shaft of drums or turnover wheels *n*. Round these drums travels an endless belt *o*, preferably of mild steel. The still contains molten metal to the level *p* and is kept hot by any

suitable mode of heating. The material for treatment enters the still through the feed *q* and after treatment leaves by the discharge *r*.

As the drums revolve the endless belt moves in the direction of the arrow carrying the material in a thin layer in contact with its surface through the molten metal and delivers it to the surface again as its own surface leaves the metal. To ensure complete removal of the material from the surface of the belt as it leaves the metal it is useful to provide a scraper *s*.

Other examples of the usefulness of this method as applied to the heat treatment of material by means of molten metal are—(1) the drying of powders or crystals such as chalk or sodium bicarbonate; (2) the distillation of calcium acetate; (3) the concentration or evaporation of liquids, especially such as contain dissolved solids. As in the case of the hydrated tar, the powder, crystals, solution or other material is fed into the vessel or still by any known device on the descending side of the moving body and removed on the ascending side.

It is not always the case that the material leaves the drum as the surface of this emerges from the molten lead, because one of the effects of the heat is sometimes to cause the material to adhere to the drum after the surface of the latter has emerged. In such cases scraping is generally necessary so that a cylindrical or conical drum is more convenient, though a polygonal cross section instead of circular is not excluded.

When the scraper is to be adjustable as described with reference to Fig. 2, it is often desirable to place the scraper below the surface to the lead thus providing a gas seal.

Having thus described the nature of the said invention and the best means I know of carrying the same into practical effect, I claim:—

1. A process of subjecting material to heat treatment by bringing it into contact with molten metal, which process consists in carrying the material in the form of a continuous layer on a continuous surface not capable of being wetted by said molten metal into and through the metal whereby the whole of the material to be treated is subjected to the said heat treatment, in the form of a film between the molten metal and that portion of the surface which is immersed in the molten metal.

2. A process of subjecting a material to heat treatment by causing it to travel through molten metal, which process consists in feeding the material on to the surface of the metal so that it comes into contact with an endless continuous surface which is travelling partly immersed in the molten metal whereby the whole of the material to be treated is subjected to the said heat treatment, in the form of a film between the molten metal and that portion of the surface which is immersed in the molten metal.

3. Apparatus for the heat treatment of materials as herein defined comprising a vessel containing molten metal, a continuous surface of revolution incapable of being wetted by the molten metal and so placed that a part of it is immersed in the molten metal, means for revolving the said surface on its axis, means for feeding the material to be treated on to the surface of the molten metal on the descending side of the said surface of revolution and means for removing the treated material from the surface of the molten metal on the ascending side of the said surface of revolution.

In testimony whereof I have signed my name to this specification.

JOHN STANLEY MORGAN.