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MATERIAL FOR CHARGING FURNACES

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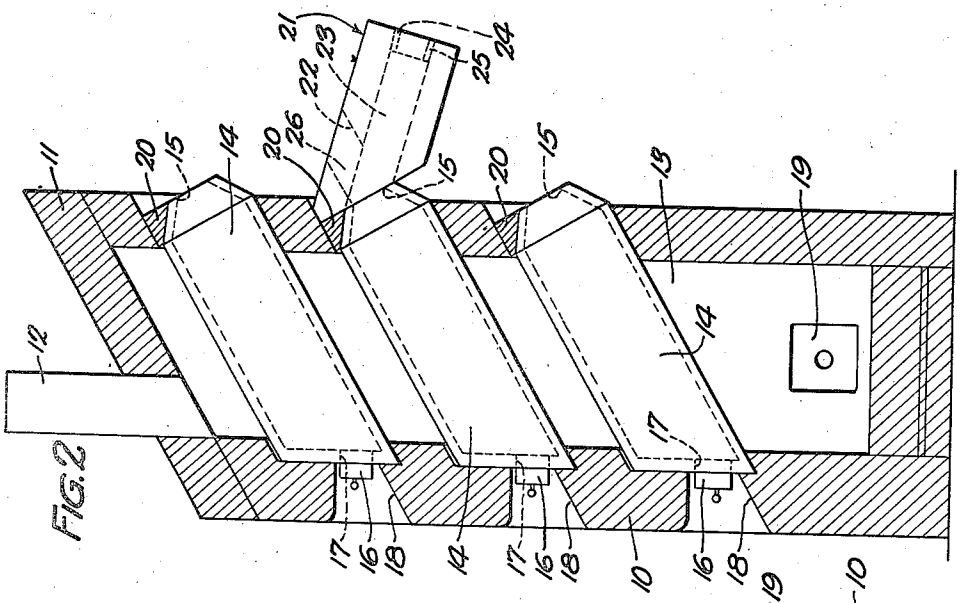


FIG. 2

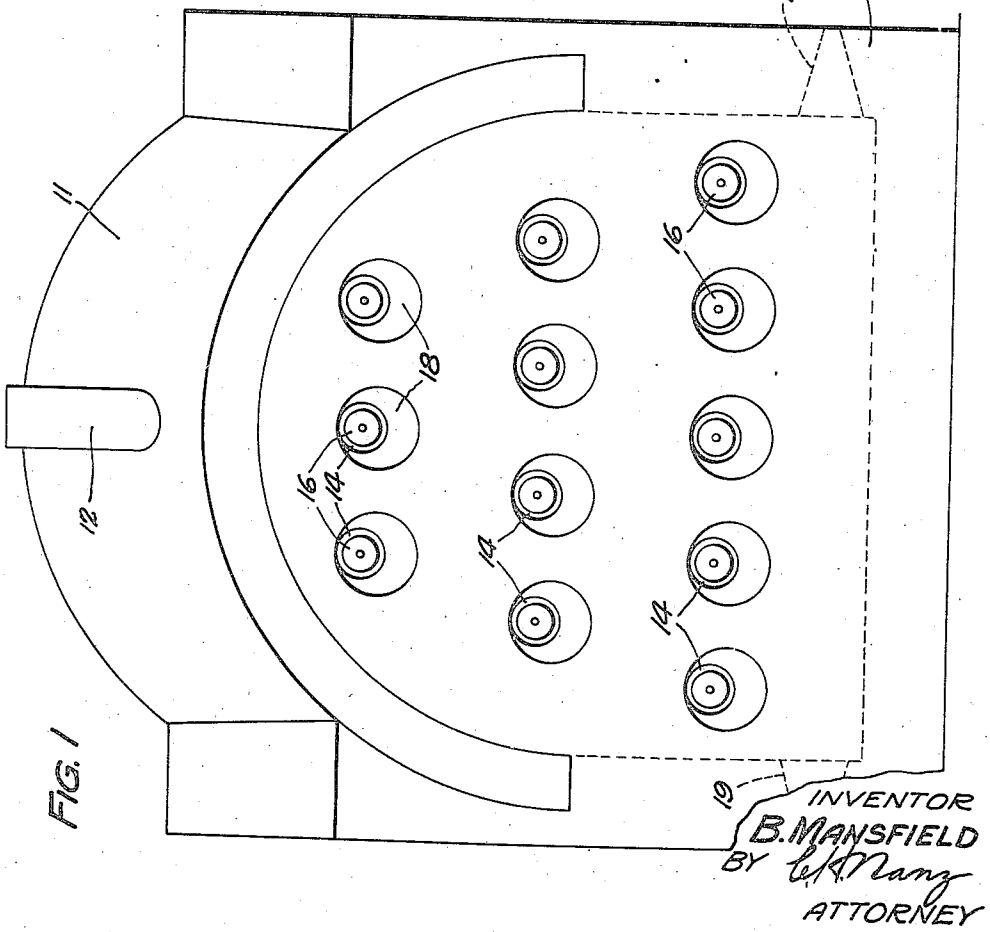


FIG. 1

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MATERIAL FOR CHARGING FURNACES

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8 Claims. (Cl. 75—86)

This invention relates to materials for charging furnaces, and more particularly to materials for charging furnaces for distilling zinc.

Due to the present metal shortage, it is now desirable to utilize zinc bearing by-products, such as zinc ashes, zinc skimmings, sal skimmings, zinc oxide, die casting skimmings, etc., to produce zinc slab spelter, which would be obtained during normal times from sources having more easily obtainable metallic values. Such products may be treated satisfactorily in accordance with this invention in inclined, indirectly heated zinc distilling furnaces to recover the zinc contained therein. It has been the common practice to charge retorts with a charge containing a mixture of zinc material and a reducing agent, such as coal, both of which are finer than ¼" mesh. The percentage of fines is such that the charge has little porosity and the zinc vapor and reducing gases do not pass freely through the charge, thus slowing up the distillation rate and requiring a high temperature to drive out the zinc vapor. Also when zinc bearing material of the type above described is treated in this manner, the amount of zinc remaining in the residual matter left in the furnace at the end of the distillation process usually is high enough to make such a process economically unfeasible.

The finely divided nature of the charge causes packing of the charge, which prevents the reducing gases formed in the furnace from flowing freely through the charge and reducing all of the zinc oxide and other zinc compounds to the metallic state. The gases and zinc vapor also have a tendency to channel and cause certain areas to be more completely reduced than other areas. The finely ground charges generally employed in furnaces for distilling zinc are wetted before being packed in the retorts, and not only require considerable time to become heated to the operating temperature of the furnace, but, of course, cannot be preheated before being fed into the furnace. Perhaps the most serious drawback, however, to these finely ground charges is that they tend to clinker and adhere to the walls of the retorts in which they are heated. For this reason, it is frequently necessary to manually remove the residue by scraping or sharply pounding the retort.

An object of this invention is to provide new and improved charging materials for furnaces, and more particularly to provide new and improved charging materials for zinc distilling furnaces.

A charge material for an inclined, indirectly heated furnace for distilling zinc which is illustrative of the present invention consists of a mixture composed of crushed zinc bearing material, coal screenings, and lumps of coke in sizes varying from about 2 inches to about 6 inches in diameter.

Other features and advantages of the invention will become apparent from the following detailed description of one embodiment thereof, when read in conjunction with the accompanying drawing, in which

Fig. 1 is a front elevation of an inclined, indirectly heated furnace for distilling zinc, and

Fig. 2 is a vertical sectional view of the furnace shown in Fig. 1.

The furnace shown somewhat schematically in the accompanying drawing comprises a body 10 constructed of a suitable refractory material such as fire brick of a type usually employed in similar furnaces. An arched roof 11 is provided for the body 10 and a flue 12 formed therein permits gases to escape from a combustion chamber 13, formed by the body 10 and the roof 11. A number of retorts 14—14 made of clay or graphite are supported by the body 10 at an angle of about 30° to 45° and are arranged in three rows. Each of the retorts shown in the particular furnace disclosed in the accompanying drawing is capable of refining about 500 pounds of charge materials during each cycle of operation, although the particular shape, size and number of the retorts 14—14 may, of course, be varied considerably without departing from the invention. Each retort 14 has a charging opening 15 in its upper end, and a smaller discharging opening 17 in its lower end normally closed by means of a plug 16, which may be removed to allow the charge material within the retorts 14—14 to slide out of the furnace through openings 18—18 formed in the body 10. Oil burners (not shown) are associated with openings 19—19 disposed at the sides of the furnace to heat the combustion chamber 13, and thus indirectly heat the charge material within the retorts 14—14.

A condenser 21 is placed over the end of each retort 14 to collect the zinc as it is distilled from the charge in the retorts and air tight joints between the condensers and the retorts are effected by fire clay seals 20—20. The particular construction of the condensers 21—21 does not form part of the present invention and the condensers may be of any conventional type. Hence, it is sufficient to say that each condenser includes a feed hole 22, a collecting chamber 23,

a vent hole 24, and a tap hole 25. The feed hole 22 is normally closed with a block 26 made of a suitable refractory material luted in place and the tap hole 25 is also normally closed with a plug of fire clay.

In operation, the furnace is heated by the oil burners to a temperature of approximately 2000° F., at which time the charge is fed through the feed holes 22—22 in the condensers 21—21 into the retorts 14—14 through the charging openings 15—15. The charge fed to each retort may weigh as much as 500 pounds and may be preheated, if desired. After the retorts have been filled with the charge, the feed holes 22—22 are closed by inserting therein the blocks 26—26 of refractory material and luting them in place. The temperature in the combustion chamber 13 is gradually raised during a period of about 2 hours to between about 2400° F. and 2500° F., at which temperature the metallic zinc formed by the reduction of the zinc compounds in the charging materials begins to distill into the condenser 21 and the carbon monoxide gas that is formed escapes through the vent hole 24, where it is ignited and burned as it passes into the atmosphere.

The distillation of the zinc is continued for about 20 hours, so that one complete cycle of operation requires about 24 hours. During the distillation of the zinc it is necessary to withdraw the molten zinc that condenses in the bottom of the collecting chamber 23 in each of the condensers 21—21 through the tap hole 25 approximately every 8 hours. When the distillation process has ended, the oil burners are shut off and the plugs 16—16 are removed from the retorts 14—14 to permit the residual material from the charge to slide out of the retorts through the openings 17—17 and through the openings 18—18 in the furnace body 10 into a suitable receptacle. The plugs 16—16 are then reinserted in the lower ends of the retorts 14—14, and a second charge is fed into charging openings 15—15 in the retorts through the feed holes 22—22 in the condensers 21—21 to commence the following cycle of operation. As an alternative procedure, the charge may be fed directly into the retorts 14—14 through the openings 15—15, in which case condensers which may have no feed holes are sealed to the retorts after the charge has been fed into the retorts and are removed from the retorts when another charge is to be fed thereto.

The type of charge generally employed in furnaces somewhat similar to that shown in the accompanying drawing consisted of zinciferous materials, usually in the form of oxides, and suitable reducing material, such as coal or coke. These ingredients were usually ground to approximately ¼ inch mesh or finer. Since the ingredients of the charge were fairly uniform in size and quite small, they tended to become packed, thus preventing free movement through the charge of the reducing gases formed during the heating of the retorts. As a result of the non-uniformity of the reduction and the distillation and the packing of the charge, the time and temperature required for distilling the zinc therefrom were increased considerably, which was undesirable both because it consumed valuable time and because it increased the amount of fuel required to distill a given quantity of zinc.

Perhaps the most undesirable effect resulting from the above mentioned type of charge was the clinkering of the charge in the retorts. Normally, the charge should flow by gravity out through the opening in the bottom of the retorts, but when clinkers were formed in the charge, the ejection of the residual charge left after the distillation of the zinc was greatly hindered. As a result, considerable time and effort were required to remove the residual charge from the retorts by mechanical means such as pounding and scraping, and the life of the retorts was shortened.

A charge, which illustrates an embodiment of the present invention and which has proven highly satisfactory when used in a furnace such as that shown in the accompanying drawing, consists of a mixture of zinc bearing materials, coal and coke. The zinc bearing materials, in this particular illustration, may consist of zinc ashes, zinc skimmings, zinc oxide, sal skimmings, die casting skimmings and other by-products containing relatively low percentages of zinc. Both the zinc bearing materials and the coal are ground sufficiently fine to pass through a 10 mesh screen. The coal used may be what is known in the art as "screenings," which are generally composed of coal particles that will pass through a 10 mesh screen.

The coke, in the form of lumps of from about 2 inches to about 6 inches in diameter, is mixed with the ground zinc bearing materials and coal screenings in the proportion of about 5% coke, about 25% coal, and about 70% zinc bearing materials. These proportions, of course, will vary somewhat with the particular zinc bearing material or materials used.

The charge is then thoroughly mixed and preheated, if desired, before it is introduced into the retorts 14—14 in order to considerably shorten the cycle of operation of the furnace and increase its output. After the charge has been fed into the retorts 14—14, the furnace is operated as above described.

Due to the uniform mixing of the zinc containing material with the other ingredients of the charge, sufficient reducing materials are intermixed with the zinc containing ingredients to reduce all of the readily available zinc in the zinc containing materials to metallic zinc which distills into the condenser. The large coke particles make the mix quite porous and permit free movement of the reducing gases through the entire charge. As a result, the cycle of operation of the furnace is further shortened, less fuel is required for a given quantity of zinc distilled and only a small amount of zinc, generally less than 5%, is left in the residual charge. The large coke lumps also prevent clinkering of the charge and permit the removal of the charge by gravity alone at the bottom of the retorts, thus lengthening considerably the life of the retorts and shortening the time required to remove the charges.

The use of a charge like that described makes the above outlined process economically feasible by increasing the amount of zinc obtained from the zinc containing materials, by shortening the cycle of operation of the furnace, by reducing the amount of fuel required to distill a given amount of zinc, and by facilitating the discharge of the residual charge material, thus lengthening the life of the equipment considerably.

What is claimed is:

1. A charge for an inclined, indirectly heated

furnace for the distillation of zinc, which consists of a uniform mixture composed of crushed zinc bearing materials, coal screenings, and coke divided into lumps having a diameter of at least 2 inches but not substantially more than 6 inches.

2. A charge for an inclined, indirectly heated furnace for the distillation of zinc, which consists of a uniform mixture composed of crushed zinc bearing materials, coal particles capable of passing through a screen of approximately 10 mesh, and lumps of coke in sizes varying from about 2 inches to about 6 inches in diameter.

3. A charge for an inclined, indirectly heated furnace for the distillation of zinc, consisting of a uniform mixture composed of crushed zinc bearing materials ground to at least about 10 mesh fineness, coal ground to at least 10 mesh fineness, and about 5% coke in the form of lumps varying in size from about 2 inches to about 6 inches in diameter.

4. A charge for an inclined, indirectly heated furnace for the distillation of zinc having inclined retorts, which consists of a uniform mixture composed of about 70% crushed zinc bearing materials, about 25% coal screenings, and about 5% coke in the form of lumps varying in size from about 2 inches to about 6 inches in diameter.

5. A charge for an inclined, indirectly heated furnace for the distillation of zinc, which consists of a uniform mixture composed of about 70% crushed zinc bearing materials, about 25% coal of at least about 10 mesh fineness, and about 5% coke in the form of lumps varying in size from about 2 inches to about 6 inches in diameter.

6. A charge for an inclined, indirectly heated furnace for the distillation of zinc, which consists of a uniform mixture composed of about 70% crushed zinc bearing materials of at least about 10 mesh fineness, about 25% coal of at least about 10 mesh fineness, and about 5% coke in the form of lumps varying in size from about 2 inches to about 6 inches in diameter.

7. A charge for an inclined, indirectly heated furnace for the distillation of zinc, which consists of a uniform mixture composed of about 70% of crushed materials which have been passed through a screen of approximately 10 mesh fineness and which contain a low percentage of zinc, approximately 25% coal which has been passed through a screen of approximately 10 mesh fineness, and about 5% coke in the form of lumps varying in size from about 2 inches to about 6 inches in diameter.

8. A charge for an inclined, indirectly heated furnace for the distillation of zinc, which consists of a uniform mixture of crushed materials containing a low percentage of zinc, coal screenings, and lumps of coke varying in size from about 2 inches to about 6 inches in diameter.

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