Oct. 12, 1971 J. E. MOORE 3,611,542

SYSTEM FOR HOT DE-OILING AND HOT BRIQUETTING

Original Filed April 15, 1968 2 Sheets-Sheet 1

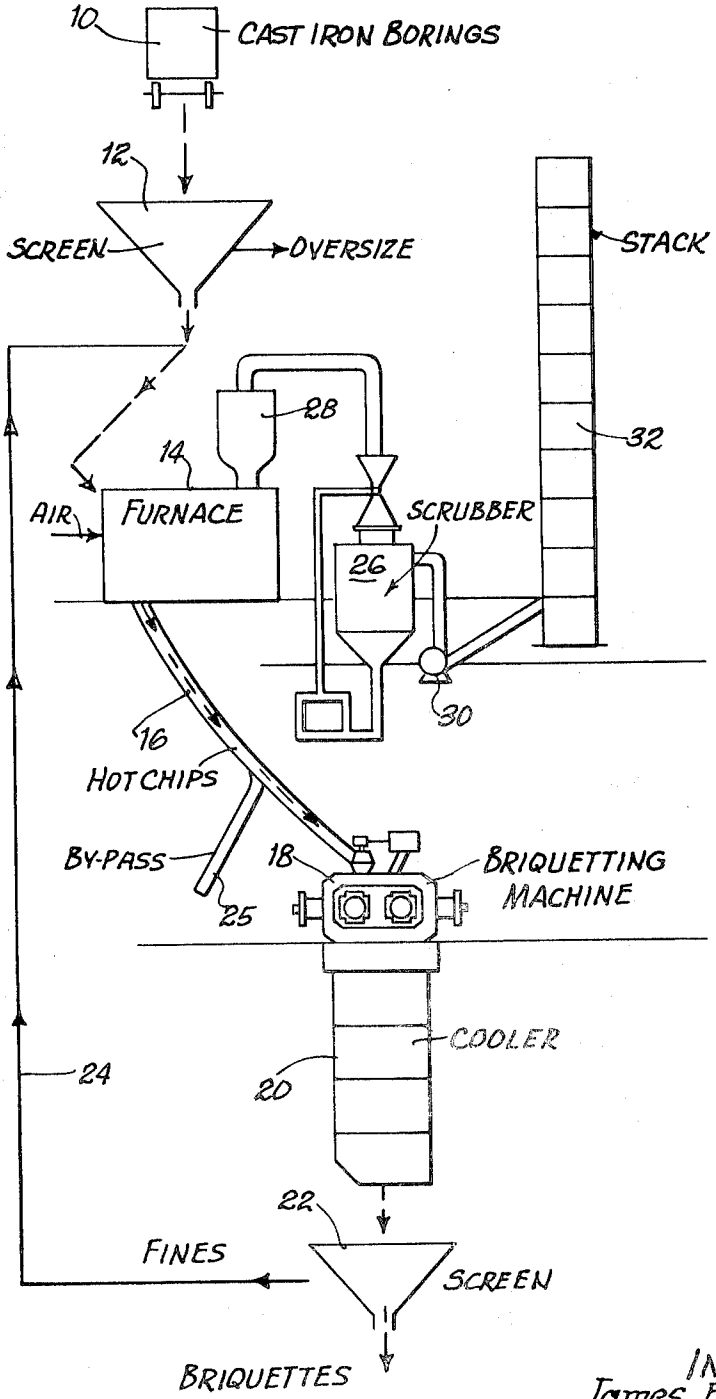


FIG. 1

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SYSTEM FOR HOT DE-OILING AND HOT BRIQUETTING

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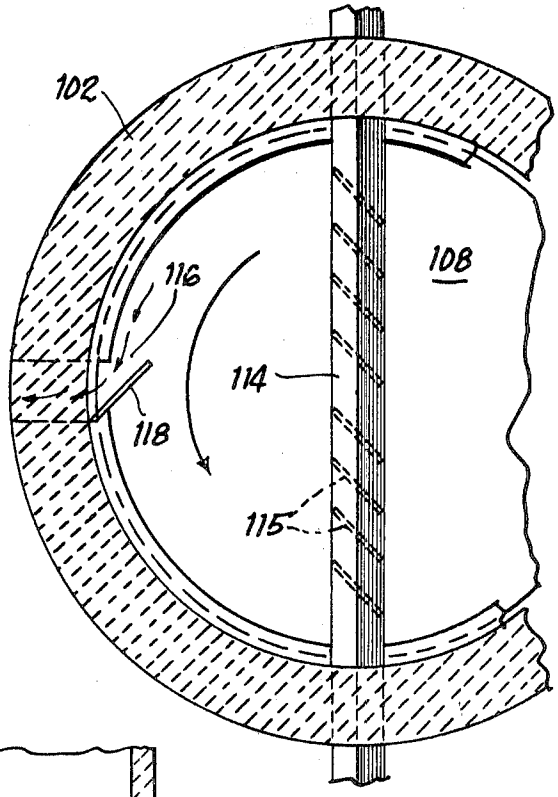


FIG. 3

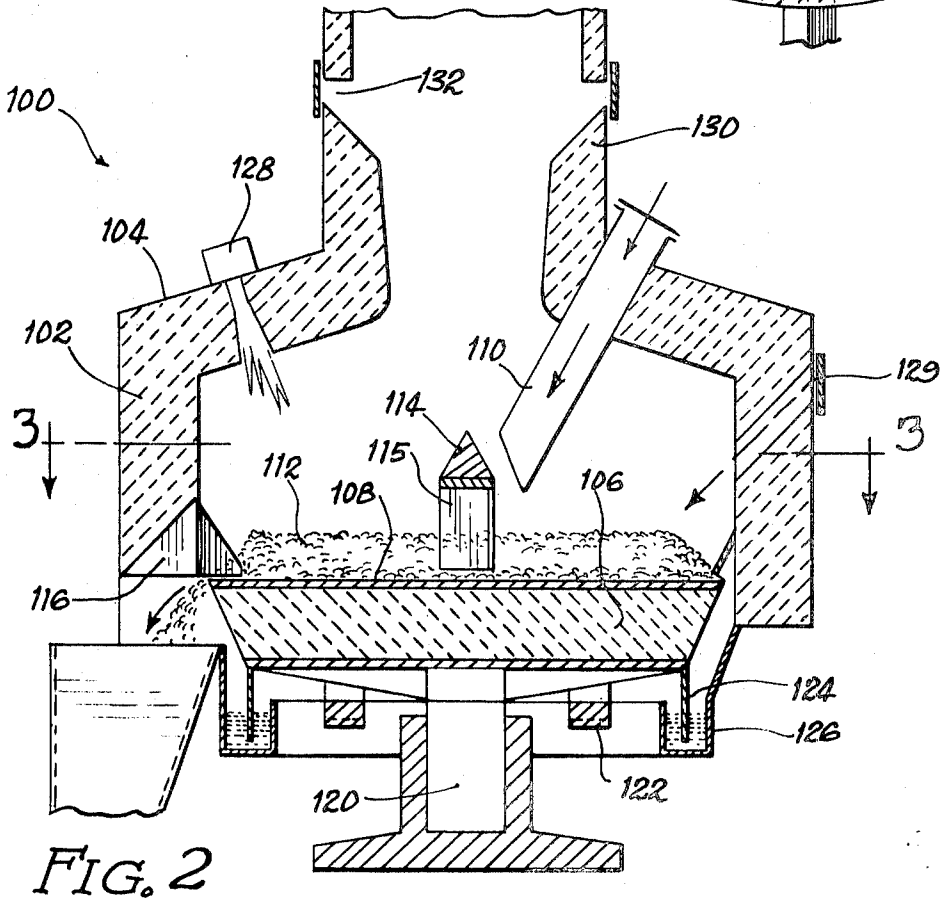


FIG. 2

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3,611,542

SYSTEM FOR HOT DE-OILING AND HOT BRIQUETTING

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Original application Apr. 15, 1968, Ser. No. 721,474, now Patent No. 3,497,190, dated Feb. 24, 1970. Divided and this application Dec. 18, 1969, Ser. No. 886,158
Int. Cl. B23q 17/00; C21b 11/00
U.S. Cl. 29—403 5 Claims

ABSTRACT OF THE DISCLOSURE

A system for hot de-oiling and hot briquetting material wherein the material is heated to burn off or vaporize foreign substances and is then transported to a briquetting machine for forming of the material into briquets. The improvements of the invention relate to a furnace construction and method of operation for heating the material. The furnace construction includes a single rotating hearth providing a combustion zone whereby the material can be fed to the combustion zone from an inlet designed to deliver the material to the center of the hearth. An outlet is defined in the side of the furnace construction, and stationary rake means are provided for moving the materials over the hearth surface to the outlet for thereby delivering the materials to briquetting equipment.

This application is a division of copending application Ser. No. 721,474, filed Apr. 15, 1968, and now Pat. No. 3,497,190.

This invention relates to a system for hot de-oiling and hot briquetting. The invention is particularly concerned with the processing of materials such as crushed turnings, chips, boring, and other metal scrapd, for example, those materials consumed in melting shops.

The briquetting of scrap materials such as turnings and borings has been recognized as a highly economical and efficient procedure. Turnings and borings have a composition which makes them highly suitable for use in charging operations in a foundry. These materials are readily available at low cost and, to add to the efficiency, they are often produced in a machine shop near a melting shop.

The turnings and borings have certain drawbacks, however, due to the fact that they are very small dimensionally and are usually coated with oil and water. These characteristics make them highly undesirable as additives in a cupola or in an electric furnace.

By hot de-oiling and hot briquetting the turnings and borings, the drawbacks referred to can be overcome. The briquets produced are of satisfactory size and density so that the original size of the turnings and borings is of no consequence when briquets are formed for addition to a melting furnace. Similarly, the oil and water on the turnings and borings is vaporized off as a regular step in the briquetting procedure so that the briquetted product will be virtually free of any oil and water traces.

The presence of oil on the turnings and borings presents another distinct advantage during hot briquetting. Thus, the oil serves as a fuel which is consumed as the oil is removed. This provides an ideal means for controlling temperature and non-oxidizing conditions in the combustion zone of a furnace employed for removing the oil. The air-to-fuel ratio within the furnace can be maintained at a desired level to provide a temperature of desired magnitude.

The system of this invention is also designed to eliminate adverse conditions which can arise due to the burning of the oil. Specifically, cxeses oil vapors and smoke

can cause highly undesirable air pollution, and afterburner means are provided for burning the excess oil to eliminate this problem. In addition, the discharge from the system can be scrubbed by suitable mechanisms to further reduce the introduction of contaminants into the air.

It is a general object of this invention to provide improvements in hot briquetting and hot de-oiling, particularly with respect to improvements in furnace constructions employed for removing foreign substances such as oil and water from the surfaces of the materials and simultaneously preheating the materials for briquetting or other use.

It is a more particular object of this invention to provide a furnace construction of the type described which are relatively low in cost and which operates with a high degree of efficiency, dependability and economy.

It is a still further object of this invention to provide a furnace design which is particularly suitable for the treatment of discharge from the furnace for purposes of burning excess oil vapor and for avoiding the entrainment of dust in off-gases whereby little or no dust is carried from the furnace to the afterburner, scrubber and/or atmosphere.

These and other objects of this invention will appear hereinafter and for purposes of illustration, but not of limitation, specific embodiments of the invention are shown in the accompanying drawings in which:

FIG. 1 is a schematic illustration of a hot briquetting system of the type contemplated by this invention;

FIG. 2 is a vertical sectional view of the furnace construction used in the briquetting system of the type shown in FIG. 1; and,

FIG. 3 is a horizontal sectional view taken about the line 3—3 of FIG. 2.

The system of this invention is specifically designed for the processing of material such as turnings and borings. In accordance with prior practice, the turnings and borings are placed in a furnace construction for purposes of burning off foreign substances such as oil from the surfaces of the turnings and borings. The hot materials are then transported to a briquetting machine for forming into briquets or utilized for other purposes. Although the invention will be described with reference to the treatment of metal, other materials can also be advantageously handled in these systems. For example, ores which have a fuel associated with the material when it is introduced into the furnace can be treated in accordance with the principles to be described.

In prior constructions employed for heating of the turnings and borings, it was thought necessary to provide a carefully constructed furnace which included different zones characterized by distinct operations. Thus, a central zone of such furnaces provided a primary combustion zone into which material to be briquetted was introduced. Means were provided for blowing the material into the furnace to scatter the particles since this was thought necessary to provide sufficient heat transfer.

A supplemental heating zone equipped with burners was located beneath the primary zone. Rakes were provided for gradually moving the material so that the material would eventually drop through the two heating zones.

Above the primary zone, an afterburner was provided. By the introduction of air into this afterburner zone, unburned oil vapors would be burned in the afterburner thereby reducing contamination of the atmosphere. Rakes were utilized in this zone for returning settled dust which collected on the floor of the afterburner chamber.

The instant invention provides a system for accomplishing hot processing of metal pieces in a more economical and efficient manner when compared with prior

systems. It has been found that furnaces having a single hearth can be utilized for purposes of heating of turnings and borings to the extent that these materials can be briquetted for use as charge materials or otherwise processed. Costs are materially reduced by eliminating the extra zones since the furnace size will be considerably less. Furthermore, the blowing means and additional raking means can be eliminated.

The single hearth arrangement is particularly suitable in systems where the inlet and outlet openings for the materials are located to provide maximum production rates, minimum installation costs and minimum operational costs. Additional improvements are available where the flow of gases is related to the feed and raking direction to provide maximum efficiency. Finally, the arrangement permits relatively low operating temperatures, low gas velocity, minimum agitation of dust on the hearth and minimum entrainment of dust in the exhaust.

FIG. 1 comprises a schematic illustration of a system for hot briquetting. In this system, cast iron borings are transported, as shown at **10**, to a sizing screen **12**. The screen **12** removes over-sized material whereby the material fed to the furnace **14** and the product of the furnace will be of relatively uniform dimension.

The hot chips are delivered from the furnace through line **16** to a briquetting machine **18**. The briquets produced by the briquetting machine are transported through a cooler **20** and are then passed across a screen **22**. The fines comprising particles which are separate from the briquets are fed back as shown at **24** for re-cycling through the furnace. In the event that the discharge from the furnace is not to be briquetted, a by-pass **25** is provided in line **16**.

A scrubber **26** is provided for collecting the gases issuing from the furnace through afterburner **28**. A pump **30** withdraws the gases from the scrubber for passage through a stack **32** into the atmosphere.

FIGS. 2 and 3 illustrate the furnace construction **100** of this invention. This construction defines a side wall **102**, top wall **104** and a bottom wall **106** which defines the hearth **108**. Material is introduced through the chute **110** which extends through an opening in the top wall, and which terminates adjacent the center of the hearth. The material builds up on the hearth as shown at **112** and is driven outwardly toward the side of the furnace by means of the rake structure **114** which includes blades **115**. As the material enters, it contacts material previously introduced, and this serves to ignite the new material.

An outlet **116** is defined in the side wall **102**. A baffle plate **118** serves to direct material on the extreme outer edge of the hearth through this outlet opening. The hearth itself is mounted on a shaft **120** and is rotated through gear **122** attached to the bottom of the hearth. A skirt **124** extends downwardly from the bottom of the hearth, and this skirt is received within a trough **126**. This arrangement provides a seal whereby gases cannot be passed into the furnace from beneath the hearth, and also to avoid passage of the gases out of the furnace.

Inlets **110** and **129** are provided for introducing gases into the furnace to support combustion. An auxiliary burner **128** is used for ignition and for sustaining temperature. An upper section **130** of the furnace defines an outlet for gases resulting from burning. An air inlet **132** is provided in this passage whereby additional air will be supplied to provide an afterburner arrangement to enable complete combustion of the gases. This afterburner arrangement greatly reduces the possibility of contamination of the surrounding atmosphere, and an arrangement of this type is preferably employed in this system.

The construction is designed to provide air flow which keeps disturbance of the materials in the furnace at a minimum. This is highly important from the standpoint of reducing the amount of dust entrained in the exhaust gases. Thus, the introduction of air at several points around the periphery may be resorted to to reduce the need for high pressure and high velocity air streams so that substantial dust will not be raised. The air flow may be regulated to provide temperature control and the material inlets may also be regulated and varied in number.

In the system described, the aim is to provide a high furnace capacity in the sense that the tonnage per hour of production is high relative to the size of the furnace. Rates of 30 tons per hour are obtainable without difficulty in such constructions.

The high capacity is possible due to the fact that the oil associated with the particles will ignite immediately adjacent the particle surfaces. This provides for high heat transfer, and thus rapid heating of the particles so that the particles can be moved through the construction at a high rate.

These results can be accomplished without the need for introducing the particles of material in a stream of air under high pressure. The materials are introduced through an inlet under the influence of gravity, and they simply drop on to the surface of the hearth. Since there is no agitation of the materials, the stirring up of dust can be kept to a minimum so that there will be a low incidence of dust entrainment in the exhaust gases.

The unit described can be readily provided with afterburner constructions, scrubbers, and other pollution control means. The ease with which these facilitates can be applied is an extremely important feature from the standpoint of installation costs.

An additional benefit arises from the fact that a reducing atmosphere or an atmosphere low in oxidizing ingredients is provided in all instances. Thus, the air which is introduced into the combustion zone is controlled to provide only enough air to support combustion. The hot particles are thereafter only exposed to the combustion gases which contain little or no oxygen whereby oxidation of the particles can be virtually eliminated. Excess air is only introduced in the afterburner zone of the various constructions.

It will be understood that various changes and modifications may be made in the above described systems which provide the characteristics of this invention without departing from the spirit thereof.

I claim:

1. In a system for heating a mass of small, individual metallic pieces carrying foreign substances at least part of which are combustible whereby the burning of said substances assists in the heating of the metallic pieces, and for forming the hot metallic pieces into briquets, the improvement comprising a furnace construction for heating the metallic pieces, said furnace construction including a single hearth, means for rotating said hearth, at least one inlet opening defined above said hearth adjacent the center thereof whereby said pieces and air can be placed directly onto the hearth where combustion occurs, a first outlet defined by the furnace construction in the side wall thereof, stationary rake means for moving said pieces over the surface of said hearth to said first outlet, said pieces being spread over substantially the entire surface of the hearth during operation of the construction, said rake means defining blades operating to progressively drive the individual pieces from adjacent the center of the furnace construction across said hearth to said first outlet at the side of the hearth, and a second outlet defined by said furnace construction, the gases resulting from said combustion passing out of said furnace through said second outlet, said second outlet being disposed above said inlet whereby said gases flow across material on said hearth to said second outlet, a briquetting machine, and including means connected to said construction for delivering said metallic pieces from said first outlet directly to said briquetting machine for thereby forming briquets made up of large numbers of said pieces.

2. A system in accordance with claim **1** including an afterburner communicating with said second outlet, said

gases passing into said afterburner, and means for introducting air into the afterburner for burning of uncombusted portions of said gases.

3. A method for heating a mass of small, individual metallic pieces in a furnace construction wherein the pieces carry foreign substances at least part of which are combustible whereby the burning of said substances assists in the heating of the pieces, the improvement comprising the steps of continuously introducing said pieces through inlet means located adjacent the center of the furnace construction directly into a combustion zone adjacent the inlet means whereby the combustible substances in the material are ignited by hot pieces previously introduced in the combustion zone, providing a first outlet for said pieces at the side of the furnace construction and progressively moving the pieces introduced toward said outlet, providing a second outlet for the combustion gases, said second outlet being located at the center of the construction whereby at least some of the combustion gases move across and in contact with said pieces as they progress toward said second outlet, providing a briquetting machine in direct association with said first outlet, delivering hot pieces to said briquetting machine, and forming said hot pieces into briquets made up of a plurality of such pieces.

4. A method in accordance with claim 3 including the step of providing an afterburner in association with said

second outlet for burning uncombusted portions of said combustible substances.

5. A method in accordance with claim 3 wherein air is introduced into the combustion zone along with said pieces, the amount of air introduced being controlled to provide approximately the amount necessary to support combustion whereby oxidizing conditions in the area of the combustion zone are minimal.

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