Jan. 16, 1934. G. R. LEWERS 1,943,976

PROCESS OF REVIVIFYING MINERAL ABSORBENTS

Original Filed Jan. 16, 1931 2 Sheets-Sheet 1

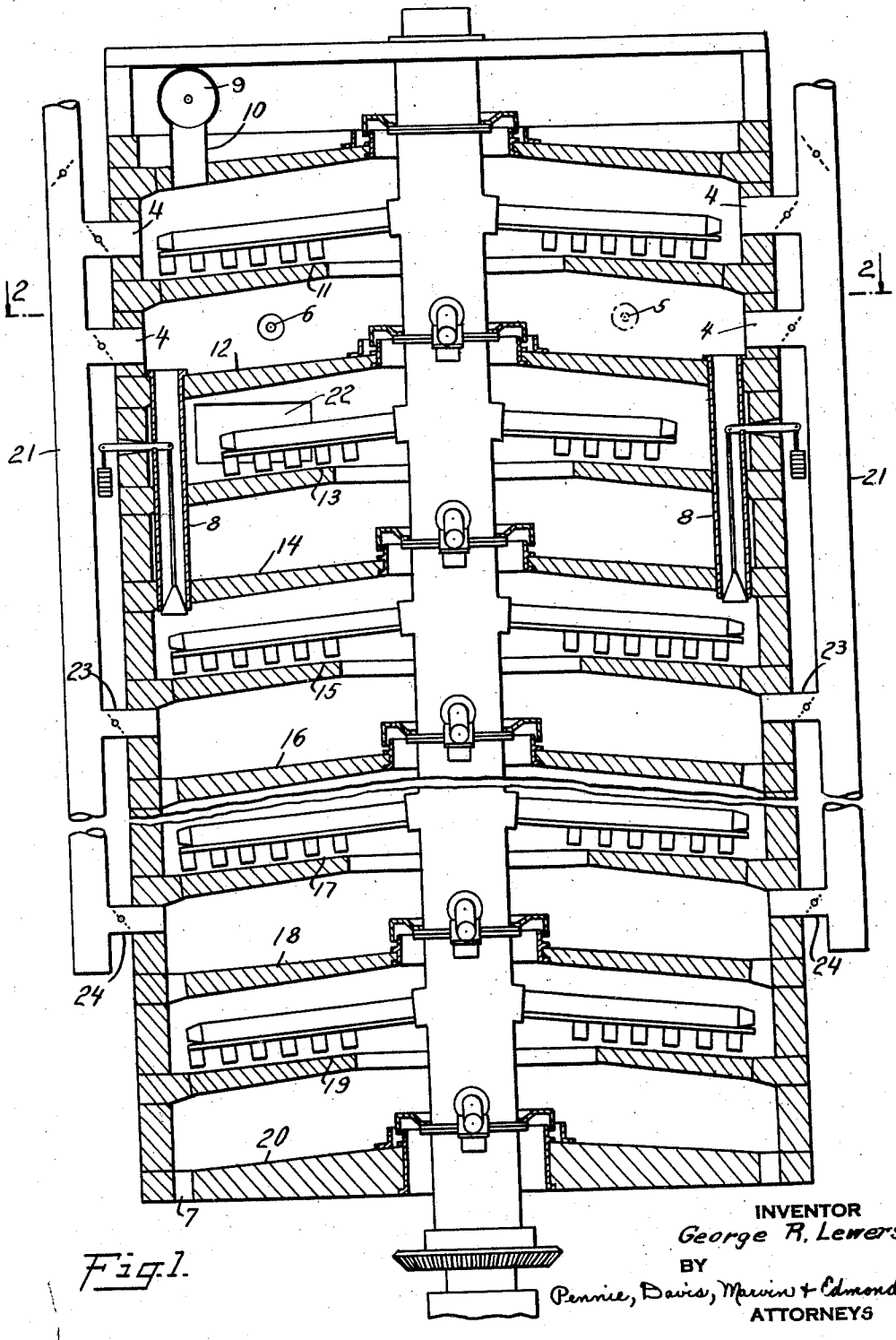


Fig. 1.

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Fig 2.

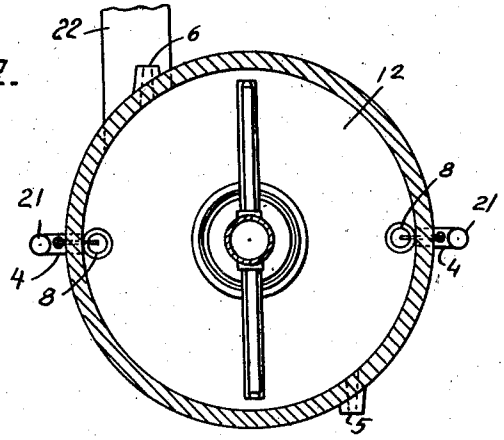
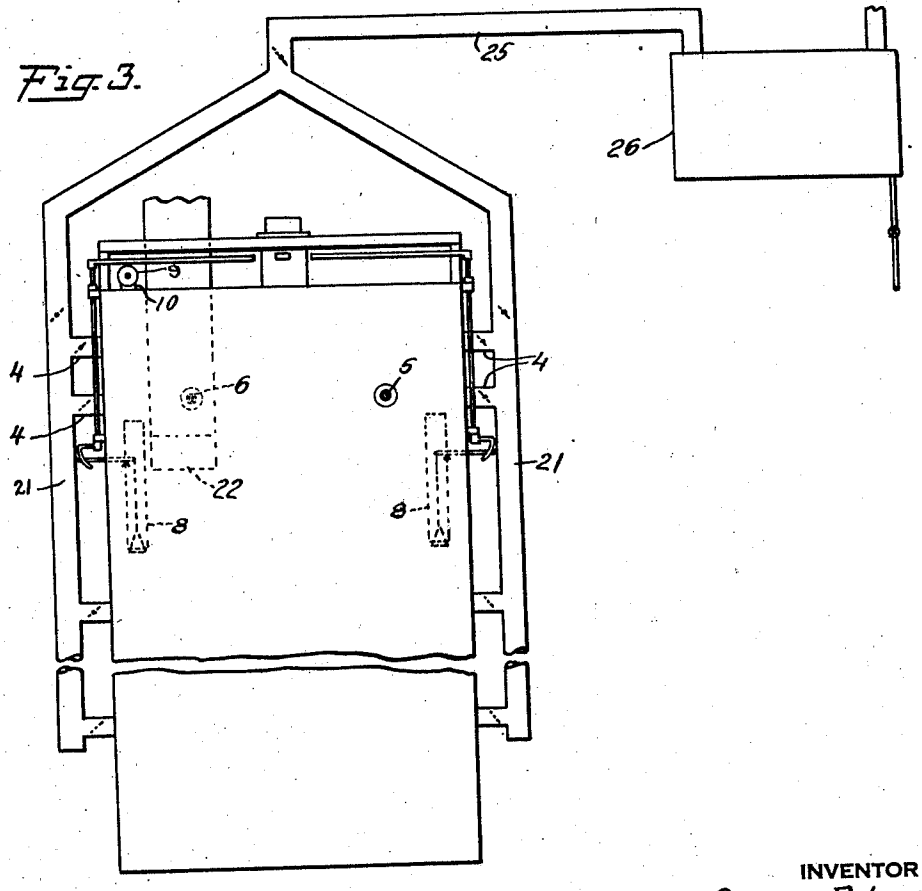


Fig. 3.



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UNITED STATES PATENT OFFICE

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PROCESS OF REVIVIFYING MINERAL ABSORBENTS

George R. Lewers, Elizabeth, N. J.

Original application January 16, 1931, Serial No. 509,101. Divided and this application October 28, 1931. Serial No. 571,507

4 Claims. (Cl. 252—2)

My invention relates to improvements in the burning or roasting of solids containing vaporizable combustible material, such as oil saturated mineral absorbents and sulphur bearing ores. My invention is of special value and application in connection with the burning of such mineral absorbents to recover them for reuse. It is also useful in the roasting of such ores, particularly for the elimination of sulphur. This application is a division of my prior application Serial No. 509,101, filed January 16, 1931.

Burning operations to recover oil saturated mineral absorbents such as fuller's earth, clays and like materials, to recover them for reuse are commonly carried out in tiered multiple hearth furnaces provided with rotary rabbles driven from a common shaft extending vertically through the several hearths, the oil saturated absorbent being supplied to the uppermost hearth, the oil content of the absorbent being utilized as fuel for the operation and the burned product being discharged from the lowermost hearth. This common practice frequently involves a loss of as much as 20% to 30% or more of the absorbent and, unfortunately, the lost material almost invariably includes a more than aliquot portion of more active components of the absorbent with the result that the recovered material is of reduced efficacy. In working on this problem I have found that this loss seems to be due to more or less uncontrolled combustion particularly on the first few hearths over which the oil saturated absorbent passes. My invention provides for control of combustion in the burning operation in an advantageous manner accomplishing a substantial improvement with respect to such losses without involving sacrifice of furnace capacity and without prejudice, but rather the contrary, to the efficacy of the burned product. My invention thus provides, in its broader aspect, an improved burning operation for the recovery of solids containing vaporizable, combustible material.

In carrying out my invention to recover such mineral absorbents I first pass the oil saturated mineral absorbent through a region, over the first hearth or the first several hearths of the burning furnace for example, in which combustion is controlled by limitation of the air available for combustion and in which, by such control of combustion, vaporization of a large part of the contained oil from the absorbent is effected without combustion of this part of such oil, and then pass the absorbent, thus partially freed from its original oil content, through a separate region, over successive hearths of the burning furnace for example, in which combustion is controlled by limitation of the fuel available for combustion, the oil vaporized from the absorbent in the first mentioned region for example, or by regulated distribution through this second region, through the several hearths of which it is comprised for example, of the fuel available for combustion. I maintain reducing conditions in the first region and oxidizing conditions in the second. I thus am able to carry out the burning operation so that combustion proceeds regularly and under definite control throughout the various stages of the operation and in this manner I avoid excessive losses of the absorbent and in particular losses of more active components of the absorbent. I have been able, by my invention, to accomplish recoveries of a burned product as high as 98% of the absorbent content of the oil saturated material charged to the operation and of a burned product improved as much as 50% or more in efficacy without sacrifice of furnace capacity in burning furnaces of the same size and same general construction as are commonly used for the purpose.

My invention will be further described in connection with the accompanying drawings which illustrate in a diagrammatic and conventional manner apparatus adapted for carrying out my invention. It is intended and will be understood that this further and more detailed description of particular embodiments of my invention is intended by way of exemplification only and that my invention is not limited to the specific operations described by way of example, or to operations carried out in the specific apparatus illustrated. In the accompanying drawings:

Fig. 1 is a fragmentary elevation in section with parts broken away of a furnace adapted for carrying out my invention.

Fig. 2 is a section on line 2—2 of Fig. 1, and

Fig. 3 is a fragmentary elevation with parts broken away showing further and varying details of the furnace.

The general construction of the hearths and shell and of the rabbles and the rabble driving mechanism of the furnace illustrated are conventional and therefore need not be described in detail here.

In carrying out my invention to recover such mineral absorbents in the furnace illustrated in Fig. 1, oil saturated mineral absorbent material is supplied to the uppermost hearth 11 through chute 10 by means of a conventional screw feed mechanism 9. The rotation of the rabbles carries this material across the hearth 11 to be

dropped to the hearth 12 and thence across the hearth 12 to be delivered through the chutes 8 to the hearth 15. The material delivered from the chutes 8 is carried successively across the hearths 15, 16, 17, 18, 19 and 20, etc., from the last of which it is discharged through chutes 7 to conventional collection means. Air for combustion on the hearths 15, 16, 17, 18, 19 and 20, etc., also enters through the chutes 7.

In the furnace illustrated a temperature sufficient to vaporize a large part of the oil content of the material supplied through the chute 10 is maintained by burners inserted through the apertures 6 and 5 (see Fig. 2) but the supply of air admitted is limited to avoid combustion in excess of that required to effect this vaporization. The vaporized oil escapes through the ducts 4 to the conduits 21. Instead of positioning the burner apertures 5 and 6 on the hearth 12 as in the apparatus illustrated, these burner apertures 5 and 6 may be positioned on the hearth 13 and the heat necessary for the vaporization then transferred to the hearth 12 by constructing this hearth of material of relatively high thermal conductivity such as silicon carbide. Extreme limitation of air available for combustion on the hearths 11 and 12 may thus be effected.

It will be noted that the conventional openings to permit material to be dropped to the next lower hearth are not present in the hearth 12. The hearth 12 completely divides the furnace except for the chutes 8. These conventional openings are present in the hearth 14. Gases escaping from the hearth 15 and the hearths below it pass through the openings in the hearth 14 and the central opening through the hearth 13 to the stack flue 22 through which they escape.

The separation of oil effected by vaporization on the hearths 11 and 12 avoids irregular or uncontrolled combustion on hearth 15, or the hearths below it, to which the material from which oil has been separated by vaporization on the hearths 11 and 12 is supplied through the chutes 8. On the hearth 15, and the hearths below it, the heat necessary to complete burning of the mineral absorbent is supplied by combustion of fuel the supply of which, being independent of the rate of supply of the absorbent to these hearths is readily susceptible to control. The oil vaporized from the absorbent on the hearths 11 and 12 and discharged through the ducts 4 to the conduits 21, or any required part of these oil vapors, are with advantage supplied from the conduits 21 to any one or more of the hearths 15, 16, 17, 18, 19, 20, etc., through the ducts 23 and 24 for example, as may be necessary or desirable in the particular operation. The utilization of these oil vapors, or part of them, as fuel on the hearths on which burning of the absorbent is completed is comprehended within my invention. Any excess of these oil vapors over that required for combustion on the hearths on which burning of the absorbent is completed may be conveyed from the conduits 21 through conduit 25 to the condenser 26.

Dampers are provided as illustrated in the ducts 4, 23, and 24 and the conduits 21 and 25 for control of the flow of the oil vaporized from the absorbent on the hearths 11 and 12.

The hearth chambers including hearths 14 and 13 constitute settling and collection chambers for the separation from escaping gases of entrained fines for return to the hearth 15. These hearths 14 and 13 are outside of any region of active combustion and, in conjunction with my invention, assist in elimination of loss of fines. Such fines frequently are a most efficacious component of mineral absorbents. The provision of such settling and collection chambers is not essential to secure many of the advantages of my invention but my invention comprehends the operation effected in such chambers in conjunction with the rest of the burning or roasting operation.

Passage of material through the chutes 8 to maintain a seal to prevent passage of gases from the hearth 15, or the hearths below it, or from the hearths 13 and 14, over the hearths 11 and 12 may be controlled in any conventional manner. In the apparatus illustrated in Figs. 1 and 2 counterpoised closure means adapted to maintain a predetermined weight of material in the chutes 8 are shown. In the apparatus illustrated in Fig. 3 closure means adapted to be opened periodically through linkages actuated by a cam positioned on the rabble shaft are shown.

It will be apparent that my improved burning operation for the recovery for reuse of mineral absorbents, saturated with combustible oil provides for control of combustion or rate of burning of the mineral absorbent. The elimination of contained oil from the absorbents is one of the functions of such recovery operations. In carrying out my invention this may be in part accomplished in the preliminary stages of the burning operation with or without combustion of part of the contained oil. In carrying out my invention as distinguished from conventional practice, however, uncontrolled or irregular combustion of this oil in the preliminary stages of the burning operation is avoided, and further more effective control of combustion in succeeding stages of the burning operation is attained by such elimination of uncontrolled or irregular combustion in the preliminary stages. This control of the later stages of the burning operation may be accomplished by control of the amount of heat supplied or by control of the distribution of the total heat supplied or by control in both of these respects. The thorough control of combustion throughout the burning operation thus provided by my invention affords equally thorough control of the temperature gradient throughout the burning operation.

Roasting operations to desulphurize ores, of zinc, antimony and lead for example, also are commonly carried out in such tiered multiple hearth furnaces, the ore being supplied to the uppermost hearth and the roasted product being discharged from the lowermost hearth. In the common practice it is difficult to maintain the temperature on the uppermost hearths below the required maximum and at the same time to maintain proper roasting conditions. Excessive temperatures on these hearths usually involve loss of fines and also undesirable nodulizing or sintering, inhibiting elimination of sulphur, of the ore. The sulphur content of such ores is frequently sufficient to support combustion at high temperatures, but uncontrolled combustion of the sulphur at such temperatures produces an unsatisfactory roasted product. The present invention provides an improved roasting operation for the desulphurization of ores.

In carrying out my invention to roast such ores I first pass the sulphur bearing ore through a region, over the first hearth or the first several hearths of the roasting furnace for example, the hearths 11 and 12 of the furnace illustrated, in which reducing conditions are maintained

by limitation of the air available for combustion and in which a temperature sufficient to vaporize sulphur from the ore is maintained, in the manner previously described, and then pass the ore, thus partially freed from its original sulphur content, through a separate region, over successive hearths of the roasting furnace for example, the hearths 15, 16, 17, etc., of the furnace illustrated, in which oxidizing conditions are maintained, usually by the combustion of extraneous fuel. Proper roasting conditions may thus be maintained without involving danger of excessive temperatures. The vaporized sulphur may be vented to the atmosphere or conveyed to apparatus appropriate for the manufacture of sulphuric acid, for example. The gases escaping from the region in which oxidizing conditions are maintained do not pass through the region in which the initial elimination of sulphur is effected.

It will be apparent that my invention provides for control of combustion, or the roasting conditions, throughout roasting operations for the desulphurization of ores. Uncontrolled or irregular combustion of the sulphur content of the ore is avoided and more effective control of the roasting operation is attained. Control of the several stages of the roasting operation may be accomplished by control of the amount of extraneous fuel supplied or by control of the distribution of combustion of extraneous fuel supplied or by control in both of these respects. The thorough control of combustion throughout the roasting operation thus provided by my invention affords equally thorough control of the temperature gradient throughout the roasting operation.

Having described my invention, I claim:

1. In the burning of oil saturated mineral absorbents to recover the mineral absorbent for reuse, the improvement which comprises passing the oil saturated absorbent through a region in which limited combustion occurs and in which vaporization of a part of the contained oil from the absorbent is effected without combustion of this part of the contained oil and limiting the air available for combustion in this region to avoid combustion of this part of the contained oil and then passing the absorbent thus partially freed from its original oil content through a separate region which is continuously maintained isolated from the region in which reducing conditions prevail and in which burning of the absorbent is completed and in which oxidizing conditions are maintained.

2. In the burning of oil saturated mineral absorbents to recover the mineral absorbent for reuse, the improvement which comprises passing the oil saturated absorbent through a region in which limited combustion occurs and in which vaporization of a part of the contained oil from the absorbent is effected without combustion of this part of the contained oil and limiting the air available for combustion in this region to avoid combustion of this part of the contained oil and then passing the absorbent thus partially freed from its original oil content through a separate region which is continuously maintained isolated from the region in which reducing conditions prevail and in which burning of the absorbent is completed and in which oxidizing conditions are maintained, and utilizing oil separated from the absorbent in the first mentioned region as fuel to complete burning of the absorbent in the second mentioned region.

3. In the burning of oil saturated mineral absorbents to recover the mineral absorbent for reuse, the improvement which comprises passing the oil saturated absorbent through a region in which limited combustion occurs and in which vaporization of a part of the contained oil from the absorbent is effected without combustion of this part of the contained oil and limiting the air available for combustion in this region to avoid combustion of this part of the contained oil and then passing the absorbent thus partially freed from its original oil content through a separate region which is continuously maintained isolated from the region in which reducing conditions prevail and in which burning of the absorbent is completed and in which oxidizing conditions are maintained, and supplying oil separated from the absorbent in the first mentioned region at a plurality of points along the path of passage of the absorbent through the second mentioned region to be utilized therein as fuel to complete burning of the absorbent.

4. In the burning of oil saturated mineral absorbents to recover the mineral absorbent for reuse, the improvement which comprises passing the oil saturated absorbent through a region in which limited combustion occurs and in which vaporization of a part of the contained oil from the absorbent is effected without combustion of this part of the contained oil and limiting the air available for combustion in this region to avoid combustion of this part of the contained oil and then passing the absorbent thus partially freed from its original oil content through a separate region which is continuously maintained isolated from the region in which reducing conditions prevail and in which burning of the absorbent is completed and in which oxidizing conditions are maintained, separating entrained absorbent from the gases escaping from the second mentioned region and returning this separated material to the second mentioned region.

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