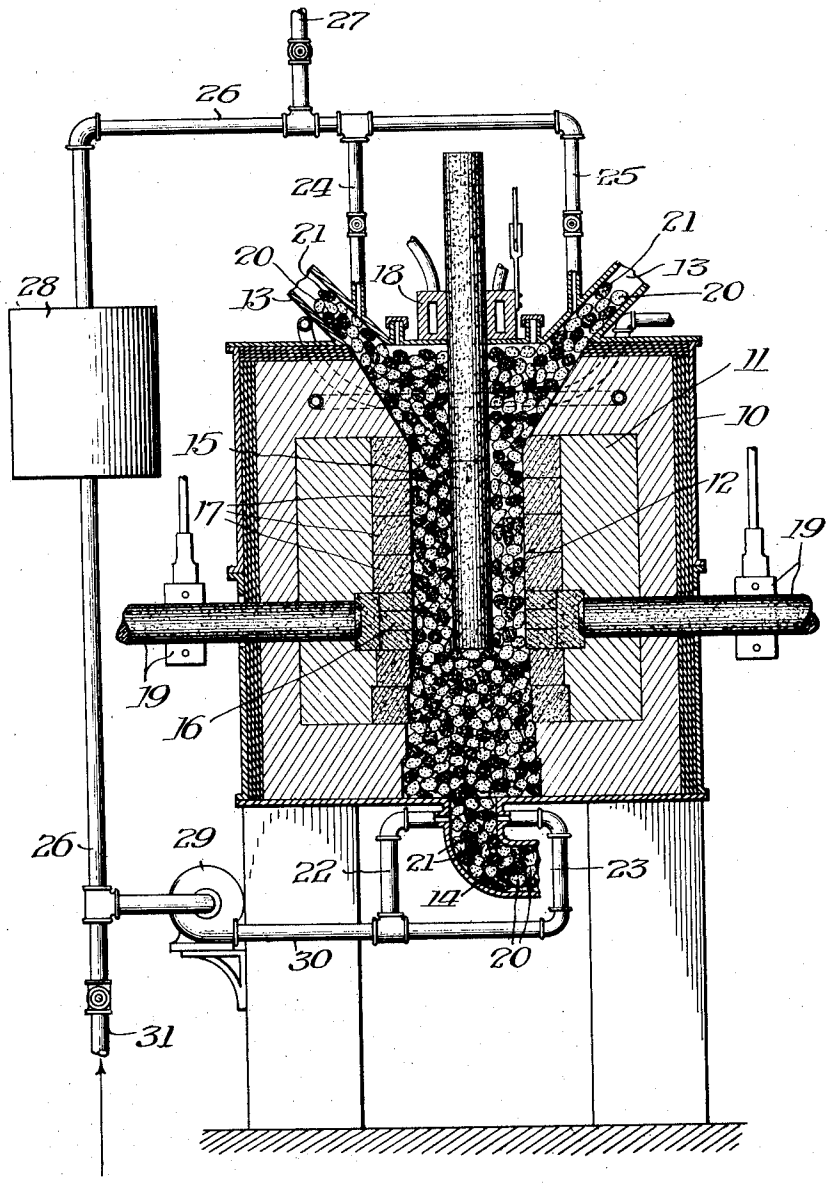
M. SHOELD.

GAS SUPPLY FOR COUNTER CURRENT FURNACES.

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1,317,327. Patented Sept. 30, 1919.



Witness:
Geo. C. Morrison

Inventor
Mark Shoeld
By Walter M. Fuller
Atty.

UNITED STATES PATENT OFFICE.

MARK SHOELD, OF CHICAGO, ILLINOIS, ASSIGNOR TO ARMOUR FERTILIZER WORKS, OF CHICAGO, ILLINOIS, A CORPORATION OF NEW JERSEY.

GAS-SUPPLY FOR COUNTER-CURRENT FURNACES.

1,317,327. Specification of Letters Patent. Patented Sept. 30, 1919.

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To all whom it may concern:

Be it known that I, MARK SHOELD, a subject of the King of Sweden, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Gas-Supplies for Counter-Current Furnaces, of which the following is a specification.

In a co-pending patent application, Serial No. 258,943 I have disclosed and claimed a process or method of heating a material in briquet form, for example, in an electric furnace by mechanically mixing therewith or uniformly distributing throughout the mass a number of bodies or pieces of substantially-infusible resistance material of greater conductivity than the briquets, whereby such resister-elements divert or deflect the electric current from the briquets to themselves and therefore become highly heated, transmitting their heat by conduction to the closely associated neighboring briquets, in this way shunting most of the current away from the more or less fusible briquets and hence eliminating the undesirable possibility of their melting or becoming welded together and upsetting or disarranging the substantially uniform heating necessary for the best results. With such an augmented body or mixture passing through the furnace, it is desirable to use an excess or surplus quantity of the incoming gas, nitrogen, for instance, over that actually required to enter into the chemical reaction, to cool the material effectually and fully before its discharge from the furnace, this greater body of gas, after being heated by passing through the heat zone of the furnace, also more adequately heating the comparatively cool entering mixture of briquets and resister members, preliminary to the arrival of such mixture at the heat zone. My invention contemplates the employment of such larger quantity of gas for the purposes indicated with their advantageous results. In order, however, to employ the cooled discharged gas to cool the heated solid material being delivered from the furnace, such gas is again and again or continuously circulated through the furnace and its contained mixture, after having had a portion of the more or less spent gas drawn off and a portion of fresh replenishing gas added to compensate for its gradual consumption, the gas being cooled if desired in any approved and convenient way before again passing into the furnace.

To enable those skilled in this industry to understand and appreciate the operation of an electric furnace on the principles of this invention and to comprehend the benefits accruing therefrom, in the accompanying drawing I have illustrated in central vertical section a structure of electric furnace adapted for the performance of this new process or method.

By reference to this drawing it will be seen that the electric-furnace 10 is suitably lined with any desirable and efficient refractory material 11 and is formed with a central vertical passage 12 to which the solid pieces of material have entrance through the opposed hopper spouts 13, 13, the treated or chemically modified material passing out of the lower end of the furnace at 14. This furnace has a central depending graphite electrode 15 and a ring electrode 16 concentrically spaced therefrom, the heat chamber proper being lined with infusible carbon blocks or bricks 17. In the usual way, by means of electric-terminals 18 and 19, 19, these associated electrodes are connected in an electric circuit so that the current passes through the intervening material between them and produces sufficient heat to carry out the chemical transformation.

The material fed to the furnace from the hoppers in case aluminum nitrid, for instance, is to be produced, comprises a mechanical mixture of briquets 20, composed of comminuted carbon, alumina, and a suitable binder, and resister-elements 21, which may be of carbon or other suitable comparatively non-fusible substance, these latter electrical resistance members being but slightly consumed, if at all, during the performance of the process. Such resistance elements, which are preferably of greater electrical-conductivity than the briquets, by contacting with one another, provide a number of paths in parallel for the passage of the electric current, each of such courses being composed of a collection of associated contacting resisters, which due to their internal resistance, or to the opposition to the current flow they provide by reason of their comparatively poor contact with one another, cause the development or generation of sufficient heat to effect its conduction to

the adjacent briquets, where it brings about the desired chemical result. Thus these resistance-elements divert, shift, or shunt the electric current away from the more or less fusible briquets, although a small portion of the current probably passes through the latter, insufficient, however, in amount to cause danger of fusing. These infusible, heating, resistance-bodies are, therefore, comparatively-uniformly distributed throughout the mixture and cause a satisfactory practically-even heating of the briquets without the attendant disadvantages of compelling the briquets to heat themselves by reason of their own electrical resistance.

Nitrogen gas, or gas rich in nitrogen, is caused to flow up through the furnace and its contained charge of the mixture entering through the branch pipes 22 and 23 at the lower portion of the apparatus. This cool gas, in passing upwardly through the hot mixture which has descended through the heat-zone, reduces the temperature of such material so that it may be discharged from the furnace in relatively cool condition, and is in this manner itself advantageously heated preliminary to its upward passage through the heat-zone between the electrodes. The hot more or less spent or exhausted gas, after having traversed the heat-chamber, during the continuance of its progressive upward travel, flows through the cool, incoming, descending mixture transmitting a large portion of its heat thereto, thus desirably initially raising the temperature of the mixture before it reaches the heat-zone, and also advantageously cooling the gas, which then passes out through the branch pipes 24 and 25 in the spouts of the hoppers which unite in the common pipe 26. From the latter a portion only of the somewhat spent gas is exhausted or discharged through a delivery pipe 27, the remainder of the gas passing through a scrubber 28 where it is additionally purified and cooled, then traversing a blower 29 and being conducted through a pipe 30 to the admission pipes 22 and 23, pipe 26 between the scrubber and blower having connected therewith an intake pipe 31 through which fresh cool gas is admited to replenish the supply and compensate for that consumed, chemically modified, or discharged in carrying out the process. Thus, the gas continuously traverses the circuit having a part subtracted therefrom and a part added thereto in the manner indicated. It is to be understood that the amount of gas fed through the material is in excess of that actually needed for the carrying out of the chemical reaction, the surplus being employed for its cooling function on the material which has passed through the heat chamber and its heating effect on the incoming material. The gas is used over and over, being strengthened and replenished in part during each cycle to compensate for losses.

It will be understood that the apparatus shown and described is merely presented by way of convenient example of an appliance adapted for the performance of this process or method and that the invention is not limited or restricted to any particular type and style of appliance in which it is used, the invention having the broad underlying principles clearly set forth in the appended claims.

I claim:

1. The method of treating a mechanical mixture of briquets to be chemically modified and substantially-infusible electrical resistance-elements consisting in feeding such mixture, heating an intermediate zone only of such traveling mixture by passing an electrical current therethrough, circulating gas through such mixture in quantity in excess of that required for the chemical reaction with the briquets and in a direction the opposite to that of the travel of such mixture, removing a portion of the gas after traversing the mixture, adding to the remaining gas a portion of fresh replenishing gas, and causing such replenished gas to traverse the mixture as before, substantially as described.

2. The method of treating a mechanical mixture of briquets to be chemically modified and substantially-infusible electrical resistance-elements consisting in feeding such mixture, heating an intermediate zone only of such traveling mixture by passing an electrical current therethrough, circulating gas through such mixture in quantity in excess of that required for the chemical reaction with the briquets and in a direction the opposite to that of the travel of such mixture, removing a portion of the gas after traversing the mixture, scrubbing the remaining gas, adding to the scrubbed gas a portion of fresh replenishing gas, and causing such replenished gas to traverse the mixture as before, substantially as described.

3. The method of treating a mechanical mixture of briquets to be chemically modified and substantially-infusible electrical resistance-elements consisting in feeding such mixture, heating an intermediate zone only of such traveling mixture by passing an electrical current therethrough, circulating gas through such mixture in quantity in excess of that required for the chemical reaction with the briquets and in a direction the opposite to that of the travel of such mixture, removing a portion of the gas after traversing the mixture, cooling the remaining gas, adding to the cooled gas a portion of fresh replenishing gas, and causing such replenished gas to traverse the mixture as before, substantially as described.

4. The method of treating a mechanical

mixture of briquets to be chemically modified and substantially-infusible electrical resistance-elements consisting in continuously feeding such mixture, heating an intermediate zone only of such traveling mixture by passing an electrical current therethrough, continuously circulating gas through such mixture in quantity in excess of that required for the chemical reaction with the briquets and in a direction the opposite to that of the travel of such mixture, continuously removing a portion of the gas after traversing the mixture, and continuously adding to the remaining gas a portion of fresh replenishing gas preliminary to its again traversing the mixture, substantially as described.

5. The method of treating a mechanical mixture of briquets to be chemically modified and substantially-infusible electrical resistance-elements consisting in continuously feeding such mixture, heating an intermediate zone only of such traveling mixture by passing an electrical current therethrough, continuously circulating gas through such mixture in quantity in excess of that required for the chemical reaction with the briquets and in a direction the opposite of that of the travel of such mixture, continuously removing a portion of the gas after traversing the mixture, continuously scrubbing the remaining gas, and continuously adding to the scrubbed gas a portion of fresh replenishing gas preliminary to its again traversing the mixture, substantially as claimed.

MARK SHOELD.