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PROCESS AND APPARATUS FOR FEEDING SULPHUR TO BURNERS

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FIG. 1

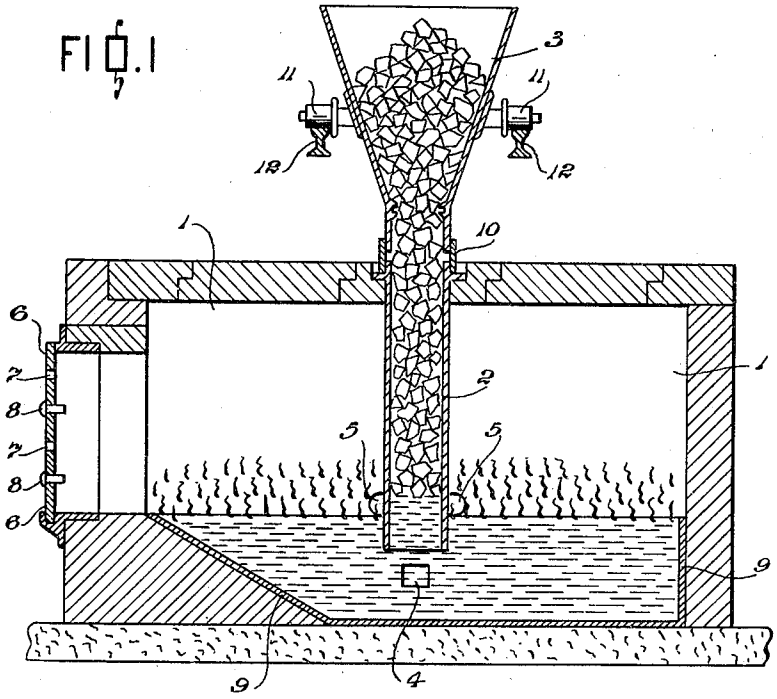
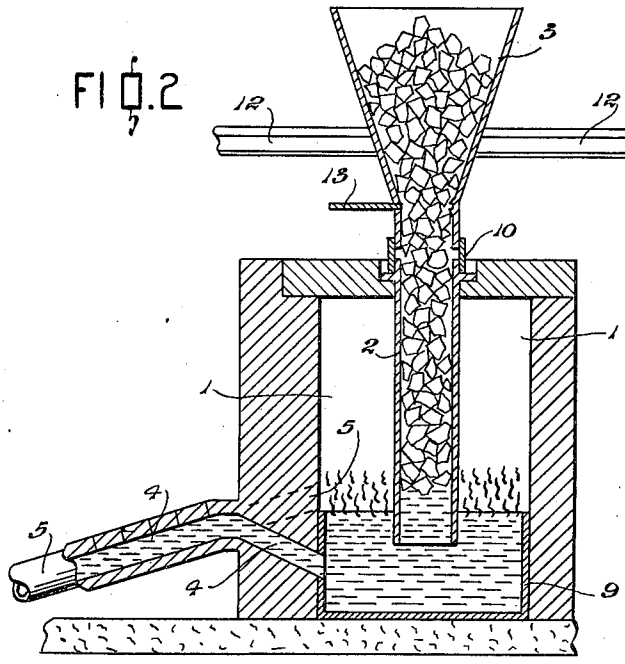


FIG. 2



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PROCESS AND APPARATUS FOR FEEDING SULPHUR TO BURNERS.

Application filed January 20, 1923. Serial No. 613,969.

To all whom it may concern:

Be it known that I, HERBERT DUGLASS KERR, a subject of the King of Great Britain, residing at Riccarton, Christchurch, in the Dominion of New Zealand, have invented new and useful Improvements in Processes and Apparatus for Feeding Sulphur to Burners, of which the following is a specification.

This invention relates to the feeding of sulphur to any existing burner, used for the purpose of producing sulphur di-oxide.

In practice it is found that irregular arrivals of solid sulphur to the burner, even although delivered to a bath of liquid sulphur in this burner, will result in an irregular production of sulphur di-oxide. This irregularity has far reaching effects on the ultimate production of sulphuric acid from this gas, both as regards production of a given plant, and recovery of sulphur in the form of sulphuric acid, and in chamber plants on the amount of nitric acid used.

The mechanical means most generally used is a screw conveyor carrying crushed sulphur. The weakness of this system is that mechanical defects arise, and also the amount of sulphur carried depends upon the degree of fineness of same with a corresponding variation in the grade of gas produced. Feeding by manual means requires the opening and shutting of feed doors, and is also objectionable from the point of view that the sulphur feed arrives intermittently.

Power and plant are also necessary to the running of any mechanical feed, also any foreign matter contained in the sulphur is delivered to the burner and gradually fills this burner with ash; also constant attention is required to see that the mechanical feed works properly, and also the sulphur fed through the mechanical screw has to be of an appropriate degree of fineness, and during the crushing to this state, there is always a risk of fire and explosion, due to the presence of foreign matter which produces sparks when subjected to friction in the crushing.

It is the object of the present invention, however, to provide a process and apparatus therefor, whereby the defects in working abovementioned may be eliminated or reduced to a very considerable extent.

In order that the nature of the invention may be clearly understood it will now be explained with reference to the accompanying drawings showing a preferred form of the apparatus employed and in which:—

Fig. 1 is a sectional elevation, and,

Fig. 2 is a cross-section of such apparatus.

According hereto 1 is a chamber the lower portion of which is adapted to constitute a bath to contain liquid sulphur while its upper portion is adapted to constitute a combustion-chamber.

Projecting downwardly into the chamber 1 and disposed vertically or approximately so is a pipe 2 or a plurality of such connecting at its upper end, at a point above the chamber 1, with a hopper 3 into which is adapted to be fed sulphur in solid form from a bin or other appropriate source, the arrangement being such that the sulphur will travel by gravity from the hopper downward through the pipe 2 into the chamber 1.

The said pipe 2 extends for a required distance towards the bottom or floor of the chamber 1 and such chamber is provided at its upper portion with means for the admission of air thereto such air-admission being controllable at the will of the operator.

The chamber 1 is first heated to the necessary degree of temperature to ignite the sulphur which is then permitted to run into such chamber through the feed-pipe 2 and air is admitted to the chamber in order to cause ignition of the sulphur.

This ignition serves to heat the pipe 2 thereby causing the melting of the sulphur inside the latter, which sulphur flows down and collects in the form of a pool or bath at the bottom of the chamber. The arrangement is such that the amount of sulphur so melted and delivered to the chamber is dependent upon the amount of heat resulting from the ignition, which is in turn dependent upon the volume of air admitted to the chamber. Thus it will be understood that by regulating the air admitted any desired rate of delivery of sulphur to the chamber may be obtained, such variation in the rate of admission being of course within limits of the capacity of the said apparatus.

The liquid sulphur is allowed to accumulate within the chamber to a predetermined height which is somewhat above the lower end of the said pipe 2 in order to seal the latter from the air and so prevent ignition of the sulphur in the interior of the pipe.

Upon reaching the said predetermined level, the liquid sulphur is permitted to overflow from the chamber 1 into a duct or pipe 4 or a plurality of such and by means of which such sulphur is delivered in liquid form to the burners. The said overflow is so arranged that the sulphur will be drawn from a point beneath the surface of the bath, thereby permitting the ash and scum, consisting of burnt and foreign matter, to remain in the chamber. By this means, therefore, the liquid sulphur delivered to the burners will be practically purified.

The sulphur di-oxide resulting from the combustion of sulphur within the chamber is led off and deliverd to the burning hearth or other desired portion of the plant by means of one or more pipes or ducts 5 which communicate with the chamber 1 at a point above the surface of the liquid sulphur bath.

In the preferred form of the construction the pipe or pipes 5 is (are) so arranged as to constitute a heating jacket for the pipe 4 which conveys the liquid sulphur to the burners.

If found necessary or desirable, means will also be provided for admitting air to the interior of the duct 4 in order that the stream of liquid sulphur as it flows therethrough may ignite and so provide additional heat to guard against the danger of the sulphur solidifying before reaching the burners, such air admission being controllable at the will of the operator.

This air admission may be conveniently provided as here shown by forming the upper side of the duct of a series of tiles any of which may be removed when so desired.

One or more suitable doors 6 will be provided in the upper portion of the chamber 1 to permit of the insertion of an appropriate implement by means of which the scum may be broken from time to time as required in order that the surface of the liquid sulphur may be in free communication with the air as essential for maintaining the combustion and through which door or doors the accumulated ash can be removed from the chamber.

The ash and waste material can also be removed at intervals from the chamber without interruption to the production of acid or interfering with the control of the process.

The aforementioned air admission to the chamber may conveniently take the form of holes or perforations 7 formed through the door 6 and in which holes are adapted to be inserted removable plugs 8, thus by removing or inserting the said plugs the volume of air admitted will thereby be increased or diminished at the will of the operator.

In practice the chamber 1 will preferably be composed of brick or other non-conducting material to conserve the heat, while a liner 9 of cast-iron or other suitable material will preferably be provided to contain the bath of liquid sulphur, or again the same purpose may be effected by making the whole chamber of cast-iron and if necessary furnishing it with an external lagging of insulating material.

The vertical supply pipe or pipes 2, or at all events the portion of the same within the chamber, should be of cast-iron or other acid-resisting and heat-conducting material in order that the heat may be conveyed to the sulphur in the interior.

As previously mentioned the supply of sulphur to the said feed pipe or pipes 2 is preferably provided by means of a hopper 3 arranged above such pipe and which hopper in turn is supplied from a storage bin or other source.

In order to provide access to the pipe 2 when required the said pipe is detachably connected with the hopper 3 by means of a collar or sleeve 10 slidable thereon and the hopper and bin are so arranged as to be movable in a horizontal direction.

This purpose, in the case of the hopper, is preferably effected as here shown by providing the hopper with wheels 11 adapted to travel upon rails 12 and a similar construction may be employed in mounting the storage bin. A damper 13 or other device is also provided in the hopper 3 for the purpose of intercepting the run of sulphur to the pipe 2 when required and a similar device is installed between the hopper and the storage bin.

The arrangement is such that by raising the collar 10 to clear the upper end of the pipe 2 the latter will be disconnected from the hopper, thereby permitting of the hopper being moved to one side and so exposing the upper end of the pipe 2 which can then be removed or replaced.

From the foregoing description it will be seen that by a suitable adjustment of the air admission to the chamber 1 a regular and constant delivery of sulphur in the required quantity may be obtained and which in turn provides a constant and regular overflow of liquid sulphur to the burners.

It will be understood also that on account of the fact that the impurities are wholly, or to a large extent, retained in the chamber, the sulphur delivered to the burners by this means will be practically pure and consequently the formation of ash in the burners will be to a large extent eliminated by the present invention.

Again, by the present invention, sulphur

of any size to that which will freely run down the pipe 2 may be used, thus dispensing to a large extent with the risk attendant upon finer crushing.

In a modified form of the invention the delivery of liquid sulphur to the chamber is dispensed with and the feed pipe 2 is arranged to receive dry sulphur and deliver it in liquid form to the burners direct. In this case the said feed pipe will be perforated to allow a portion of sulphur passing into an annular combustion chamber surrounding such pipe, such combustion chamber being provided with a controllable air admission in order that the combustion of sulphur may occur in the said combustion chamber for the purpose of supplying the necessary heat to the pipe to melt the sulphur contained therein. The said combustion-chamber will also be preferably provided with ducts or pipes to carry the sulphur di-oxide produced by the combustion to the burners or other portion of the plant. In this form of the invention the plant is somewhat simplified but it possesses the disadvantage in that it affords no means for purification of the sulphur.

I claim:—

1. Apparatus for feeding sulphur to burners comprising a pipe down which sulphur is adapted to travel by gravity, means for delivering sulphur in solid form into the upper end of said pipe, a combustion chamber surrounding a portion of said pipe and in which chamber sulphur is burnt to provide the required degree of temperature to melt the sulphur passing down said pipe, means for admitting air to said chamber to maintain combustion, and a duct for delivering such molten sulphur by gravity to the burners.

2. Apparatus for feeding sulphur to burners as defined in claim 1 characterised in that the duct delivering the liquid sulphur to the burners is provided with an air admission to permit combustion of the stream of liquid sulphur flowing therethrough.

3. An apparatus as set forth in claim 1, the duct for delivering the molten sulphur being provided with an air admission to permit combustion of the stream of sulphur flowing therethrough, said air admission being controllable at the will of the operator.

4. Apparatus for feeding sulphur to burners as defined in claim 1 characterised in that the said air admission to the combustion chamber is controllable by the operator.

5. Apparatus for feeding sulphur to burners as defined in claim 1 characterised in that a pipe or plurality of pipes is provided for leading the sulphur di-oxide produced by the combustion of sulphur in the chamber to the burners or other desired portion of the plant.

6. Apparatus for feeding sulphur to burners, as defined in claim 4 characterised in that the amount of sulphur melted is controllable within limits by regulating the amount of air admitted to the chamber.

7. Apparatus for feeding sulphur to burners as defined in claim 5 characterised in that the pipe or pipes employed for leading the sulphur di-oxide from the chamber is (are) so arranged as to constitute a heating jacket for the duct conveying the liquid sulphur.

8. Apparatus for feeding sulphur to burners comprising a combustion-chamber the lower portion of which is adapted to contain liquid sulphur, a pipe projecting downwardly into said chamber to a point near the bottom thereof, means for feeding sulphur in solid form into the upper end of the said pipe, means for admitting air to said chamber to promote combustion therein of sulphur delivered by said pipe, a duct communicating with said chamber and through which duct sulphur melted by said combustion is permitted to flow by gravity to the burners.

9. Apparatus for feeding sulphur to burners as defined in claim 8 characterised in that the lower orifice of the downwardly extending pipe communicates with the chamber at a point beneath the surface of the liquid sulphur contained in said chamber.

10. Apparatus for feeding sulphur to burners as defined in claim 8 characterised in that the said duct is arranged to communicate with the chamber at a point beneath the surface of the liquid sulphur contained therein.

11. Apparatus for feeding sulphur to burners as defined in claim 8 characterised in that the chamber is composed of non-metallic material and is provided with an internal lining of cast-iron to contain the liquid sulphur.

12. An apparatus for feeding sulphur to a combustion chamber the lower portion of which is adapted to contain liquid sulphur, comprising a pipe projecting downwardly into said chamber to a point near the bottom thereof, a hopper connected with the upper end of said pipe for feeding solid sulphur thereinto, means for admitting air to said combustion chamber to promote combustion, and a duct communicating with said chamber and adapted to conduct the molten sulphur from said chamber by gravity.

13. An apparatus as set forth in claim 12, the hopper being detachably connected to the pipe and removable horizontally to permit free access to the upper end of the pipe.

14. An apparatus as set forth in claim 12, including a slidable collar engaging adjacent portions of the hopper and pipe, whereby

said hopper is detachably connected to the pipe.

15. The process for feeding sulphur to burners which consists of first melting the sulphur by subjecting it to heat produced by the combustion of sulphur in a chamber the air admission to which is controllable to regulate the amount of sulphur melted thereby and then permitting the molten sulphur so produced to flow by gravity in liquid form to the burners.

16. The process for feeding sulphur to burners which consists of causing sulphur in solid form to pass by gravity down a pipe, melting such sulphur by heat derived from the combustion of a portion of such sulphur in a chamber surrounding the said pipe, and permitting the liquid sulphur so obtained to flow by gravity to the burners.

17. The process for feeding sulphur to burners which consists of causing sulphur in solid form to pass by gravity down a pipe, melting such sulphur during transit through such pipe by the combustion of sulphur in a chamber surrounding a portion of said pipe, permitting the molten sulphur to flow from said pipe and to accumulate in the bottom of said chamber, and permitting the said accumulation of liquid sulphur to flow by gravity to the burners.

18. The process for feeding sulphur to burners which consists of causing sulphur in solid form to pass by gravity down a pipe, melting such sulphur by the combustion of sulphur in a chamber into which said pipe enters, allowing the molten sulphur so produced to accumulate at the bottom of said chamber, and permitting said molten sulphur to flow by gravity to the burners from a point in the chamber beneath the surface of said accumulation of liquid sulphur in said chamber.

In witness whereof I have hereunto set my hand this 18th day of December, 1922, in the presence of two subscribing witnesses.

HERBERT DUGLASS KERR.

Witnesses:
SIDNEY JAMES TRELEAVEA,
H. P. BRIDGE.