

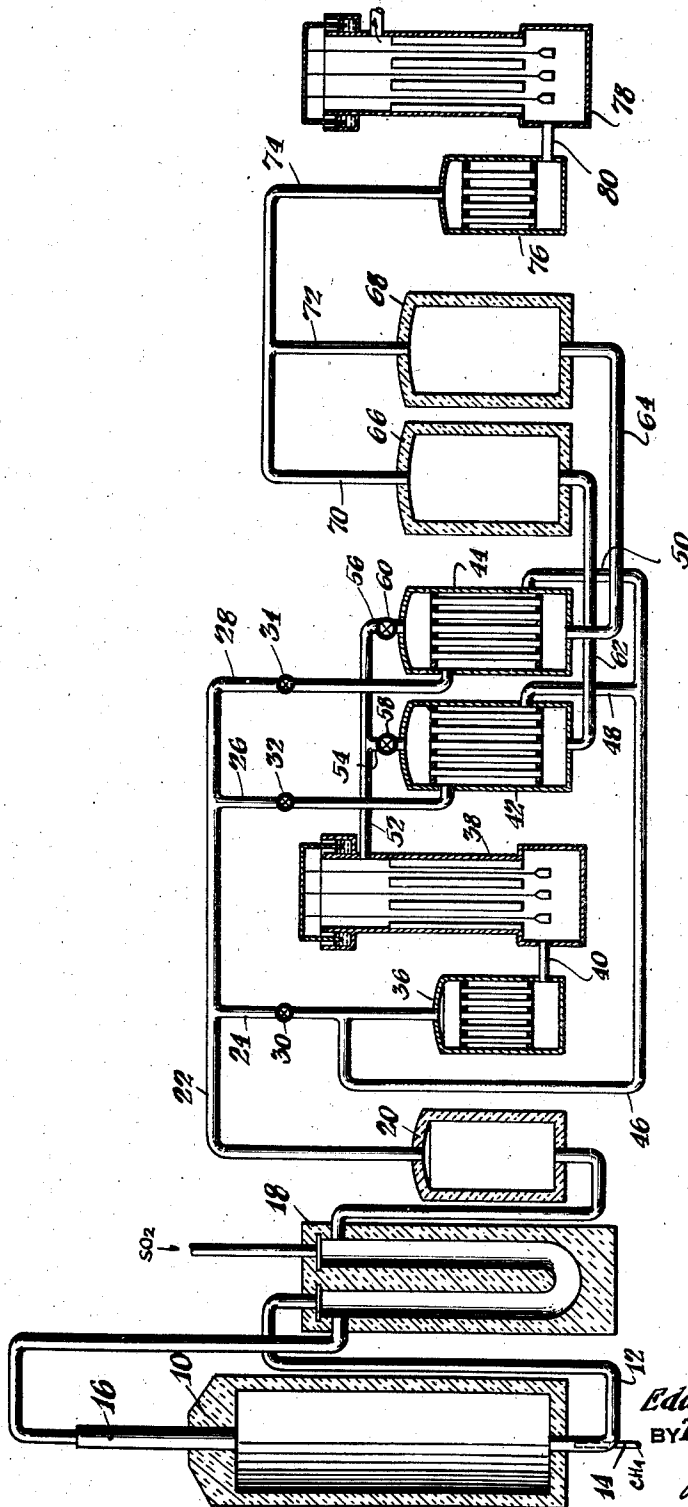
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SYSTEM FOR REDUCING SULPHUR DIOXIDE TO SULPHUR BY NATURAL GAS

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SYSTEM FOR REDUCING SULPHUR DIOXIDE
TO SULPHUR BY NATURAL GAS

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2 Claims. (Cl. 23-260)

This invention relates to the production of sulphur from gases comprising sulphur dioxide, such as those obtained in various metallurgical operations, employing natural gas as the reducing agent.

It is an object of the invention to provide a system that is economical in operation and capable of obtaining a high percentage of conversion of the sulphur content of the gases to elemental form.

Other objects and advantages will be apparent from the following description taken in conjunction with the accompanying drawing which is a diagrammatic section through a typical plant embodying the system of the invention.

Referring more particularly to the drawing, 10 indicates a reduction furnace provided with a sulphur dioxide inlet 12 and a natural gas inlet 14. The furnace 10 is provided with an outlet 16 which leads through heat exchanger 18 to a first catalyst chamber 20. The outlet 22 from the catalyst chamber 20 branches into pipes 24, 26 and 28 which are provided with valves 30, 32 and 34, respectively. Pipe 24 leads to cooler 36 which is in turn connected with a first precipitation unit 38 by pipe 40. The pipes 26 and 28 lead, respectively, to a pair of identical heat exchangers 42, 44 and thence through pipe 46 to cooler 36 via pipes 48 and 50, respectively. Outlet 52 of the first precipitating unit 38 branches into pipes 54 and 56 provided with valves 58 and 60, respectively. The said pipes 54, 56 lead through the heat exchangers 42, 44 through pipes 62, 64 into a pair of second catalyst chambers 66, 68, respectively, which, like heat exchangers 42, 44 are mounted in parallel. Outlet pipes 70, 72 from the catalyst chambers connect with the main outlet pipe 74 which enters a second cooler 76, which cooler is connected to a second precipitation unit 78 by pipe 80. All units in the system, beginning with the cooler 20 and ending with the final precipitation unit 78, are provided with conventional clean-outs or drains, not shown.

In one manner of operation, the gases comprising sulphur dioxide and a proper amount of air or other combustion-supporting gas, are preheated by passing through the heat exchanger 18 and thence introduced into the reduction furnace 10 through pipe 12. The correct proportion of natural gas is introduced into the reduction chamber 10 along with the sulphur dioxide bearing gases through pipe 14. Reduction is effected in the chamber 10 at a temperature substantially no less than 1250° C. and preferably

in the neighborhood of 1300° C., the reduction reaction products passing from the chamber 10 through the heat exchanger 18 into the first catalyst chamber 20.

This first catalyst chamber contains diatomaceous earth or diaspora and is operated at a temperature of not less than 450° C. and preferably not over 600° C. to effect conversion of any carbonyl sulphide to elemental sulphur vapor following which the sulphur vapors and other gases including hydrogen sulphide are delivered through pipes 22, 24 to cooler 36 and thence to electrostatic precipitator 38 which is operated in the neighborhood of 130° C.

From the precipitator 38, the relatively sulphur-free gases pass through pipes 52, 54 into heat exchanger 42 and thence into the second catalyst chamber 66 which like chamber 20 contains a suitable catalyst but is operated at a temperature below the dew point of sulphur vapor at the partial pressure employed and in which the hydrogen sulphide is converted to elemental sulphur. In time the accumulation of sulphur in the chamber 66 will cause back pressure to develop in the system at which time valve 32 is opened to permit a sufficient quantity of hot gas from chamber 20 to pass through exchanger 42 to raise the temperature of the gases entering chamber 66 from exchanger 42 above the dew point thereby carrying the sulphur out of chamber 66 through pipe 74 into electrostatic precipitator 78. The gases entering exchanger 42 through pipe 26 after giving up the requisite heat therein are conducted through pipe 46 to cooler 36.

While valve 32 is in its most open position for clearing chamber 66 as aforesaid, chamber 68 is operating below the dew point on gases supplied by line 64 from precipitator 38 through pipes 52, 56 and exchanger 44. When sufficient back pressure develops in catalyst chamber 68, it is cleared by opening valve 34 thereby supplying sufficient hot gas to exchanger 44 to raise the gases sweeping chamber 68 above the dew point. Chamber 66 having meanwhile been cleared, the opening of valve 32 is reduced to again put chamber 66 into operation below the dew point.

It will be observed that in the system above described, a plurality of sulphur precipitating units are provided so that in operation the great bulk of the sulphur vapors from the reduction furnace and from the first catalyst chamber wherein carbonyl sulphide is converted to sulphur, are removed prior to the entrance of the

gases into the catalyst chambers wherein conversion of the hydrogen sulphide is effected. Further, the provision of heat exchangers 42, 44 and catalyst chambers 66, 68, both in parallel, lends great flexibility of operation to the system. 5

The operation of the system as above described is highly efficient in conversion of sulphur dioxide to elemental sulphur both on relatively lean and richer gases. However, it will be understood that various modifications, substitutions 10 and additions may be made by those skilled in the art to adapt the invention to varying conditions and uses within the scope of the invention.

What is claimed is:

1. A system for reducing sulphur dioxide with 15 natural gas comprising a reduction furnace, a first catalyst chamber to which the gases pass from the reduction chamber, a first sulphur precipitating unit, a pair of second catalyst chambers in parallel, conduits and control valves for 20 supplying gases from the first catalyst chamber to the first precipitating unit and thence to said second catalyst chambers, a final sulphur precipitating unit to which gases are passed from said second catalyst chambers, means for heating 25 gases from the first precipitating unit prior to

their entrance into said second catalyst chambers by heat exchange with hot gases from said first catalyst chamber, and means for returning said last mentioned gases to said first precipitating unit.

2. A system for reducing sulphur dioxide with natural gas comprising a reduction furnace, a first catalyst chamber receiving the gases from the reduction furnace, a first sulphur precipitating unit, a plurality of second catalyst chambers in parallel, conduits and control valves for supplying gases from said first catalyst chamber to the first precipitating unit and thence to said second catalyst chambers, a final sulphur precipitating unit receiving gases from said second catalyst chambers, gas cooling means immediately preceding the respective precipitating units, means for heating the gases from the first precipitating unit prior to their entrance into said second catalyst chambers by heat exchange with hot gases from said first catalyst chamber, and means for returning said last-mentioned gases to the first precipitating unit via the cooler preceding same.

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