

PATENT SPECIFICATION

1,119,363

DRAWINGS ATTACHED.

Inventor:—HERBERT JAMES ELLIOTT.

1,119,363



Date of filing Complete Specification: 7 July, 1965.

Application Date: 7 April, 1964. No. 14324/64.

Complete Specification Published: 10 July, 1968.

© Crown Copyright 1968.

Index at Acceptance:—C1 AK9B; B5 A1L.

Int. Cl.:—B 29 j 1/00.

COMPLETE SPECIFICATION

Improvements in or relating to the Treatment of Sulphur.

We, ELLIOTT ASSOCIATED DEVELOPMENTS LIMITED, a British Company of 22 Bishops-gate, London, E.C.2, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the treatment of sulphur. More particularly, but not exclusively, it is concerned with the conversion of sulphur into a physical form that is particularly convenient for subsequent storage and transport.

Sulphur mined or extracted from ores or other sulphur-bearing materials is commonly obtained in molten form and will solidify to a solid block or cake. If allowed to solidify the block sulphur must be cut up or remelted before it can be moved from store. Alternatively, the sulphur can be kept in the molten condition, but both these courses are inconvenient and costly.

In our prior patent Specification No. 1,001,486 there has been described a technique for the pelletisation or granulation of sulphur whereby these storage and handling difficulties can be overcome. It is an object of this invention to provide, as a development of this technique, a process and apparatus, for converting molten sulphur into pellets or granules, which is particularly suitable for continuous operation.

According to the present invention, a stream of molten sulphur is injected into a pelletising vessel by means that break the sulphur up into discrete globules as it enters, and the vessel contains a liquid with which the sulphur is immiscible, the arrangement being such that the sulphur globules are first received by said liquid in a region where the temperature thereof is substan-

tially the same as that of the molten sulphur and they travel continuously through regions of said liquid of progressively decreasing temperature until they solidify into pellets or granules after which they arrive at a point of discharge from the vessel. The liquid immiscible with the sulphur will ordinarily be hot water under pressure and will be supplied in greater quantity than the sulphur since the sulphur is to become, in effect, a dispersed phase therein.

In the preferred process, the molten sulphur is injected into the top of the vessel through relatively-rotating perforated plates, and the resultant globules descend continuously under gravity through the vessel in countercurrent to water under pressure rising therein, means being provided for heating the upper part of the vessel.

One layout of apparatus in accordance with the invention is shown, by way of example, in the accompanying drawing. A reservoir tank 11 of pure molten sulphur has a sulphur feed inlet 12 and an external steam coil heating system 13. This tank is maintained at atmospheric pressure and a temperature of about 138.5°C. Within the tank 11 is a submerged molten sulphur pump 14 which delivers the sulphur through a line 15 to a tall pelletising vessel 16.

The sulphur from the line 15, at a pressure of 60 to 80 p.s.i.g., enters a trunk 17 upstanding at the top of the vessel 16. The floor of the trunk 17, where it joins the main body of the vessel 16, comprises two perforated plates 31 one of which is fixed while the other is rotated by an overhead drive 18. As the rotating plate is driven the perforations in the two plates move into and out of register and a pulsating action takes place whereby the molten sulphur is injected downwardly into the main body of

[Price 4s. 6d.]

the vessel intermittently. The sulphur is therefore broken up into streams of individual globules.

5 The vessel 16 contains hot water under pressure which flows upward in counter-current to the descending sulphur globules. The water enters the lower part of the vessel, by way of a line 19, at a temperature, say, of 40°C and a pressure of about 30 p.s.i.g. and it rises to the upper portion of the vessel which is surrounded by a heating coil 20. The water leaves by way of an overflow pipe 21 at a temperature of about 138.5°C and a pressure of about 35 p.s.i.g. 10 The liquid in the upper part of the vessel is circulated by means of a truncated cone stirrer 22 rotated by a motor 23.

As the globules of sulphur descend through the water in the vessel 16 to the cooler regions thereof they solidify into pellets or granules. The vessel has a coned bottom 24 fitted with a rotating valve 25 through which the pellets, together with some water, are delivered on to a screen 26. 25 The screen underflow is pumped back to the vessel 16 through the line 19 together with fresh feed water introduced through a water inlet 40. The pellets retained on the screen discharge on to a conveyor 27.

30 The water in the vessel 16 can be topped up from a third vessel 29 through a line 28. The vessel 29 receives the water continuously overflowing from the vessel 16 and is maintained at a pressure of 30 p.s.i.g. A heating coil system 30 surrounds the vessel 29 to raise and/or hold the temperature of the water therein at about 138.5°C. Water continuously leaves the system from the top of the vessel 29 by way of the discharge line 41. 40

The aim of the upward water flow through the vessel 16 is to achieve a sufficient hold-up of the solidifying sulphur globules to ensure that they are really hard before they reach the bottom. It may be further assisted by providing two hollow truncated cones on the stirrer shaft with their larger ends facing each other, in order that the molten sulphur globules are met by mechanically induced cooling currents and thrown outwards towards the vessel sides whereby their descent is delayed.

The ratio of hot water to sulphur in the vessel 16 may be in the range of, say, 5:1 to 10:1 by weight or greater. There will be some loss of water with the pellets from the screen 26 but this will be made up by an excess of water entering the vessel 16 from the inlet 40 and through line 19.

60 Modifications of the particular arrangement described and illustrated are possible without departure from the scope of the invention. Thus, there are various ways of collecting the pellets from the bottom of the pelletising vessel; an alternative to the

rotary valve shown would be the fitting of a breeches piece, such as is often used on vertical evaporators, with control means for causing the pellets to discharge into the two legs of the breeches piece alternately. 70

While the pelletisation of pure molten sulphur has been described herein, the process is also applicable to the treatment of impure sulphur feed materials such as may be derived from sulphur ores or industrial filter cake. With these the sulphur may be initially refined by treatment in hot water under pressure, and the ratio of water to sulphur during this treatment may be, say, 2:1 to 4:1. 75 80

WHAT WE CLAIM IS:—

1. A process for the treatment of sulphur wherein a stream of molten sulphur is injected into a pelletising vessel by means that break the sulphur up into discrete globules as it enters, and the vessel contains a liquid with which the sulphur is immiscible, the arrangement being such that the sulphur globules are first received by said liquid in a region where the temperature thereof is substantially the same as that of the molten sulphur and they travel continuously through regions of said liquid of progressively decreasing temperature until they solidify into pellets or granules after which they arrive at a point of discharge from the vessel. 85 90 95

2. A process according to claim 1, wherein the liquid immiscible with sulphur is hot water under pressure. 100

3. A process according to claim 2, wherein the ratio of hot water to sulphur in the pelletising vessel is 5 to 1 by weight or greater.

4. A process according to claim 2 or claim 3, wherein the molten sulphur is injected into the top of the vessel through relatively-rotating perforated plates, and the resulting globules descend continuously under gravity through the vessel in counter-current to water under pressure rising therein. 105 110

5. A process according to claim 4, wherein means is provided for heating the upper part of the vessel. 115

6. A process according to claim 4 or claim 5, wherein the pellets are delivered at the bottom of the vessel through a rotating valve.

7. A process for the treatment of sulphur substantially as described herein. 120

For the Applicants:
LLOYD WISE, BOULY & HAIG,
Chartered Patent Agents,
Norman House,
105—109 Strand,
London, W.C.2.

the vessel intermittently. The sulphur is therefore broken up into streams of individual globules.

- 5 The vessel 16 contains hot water under pressure which flows upward in counter-current to the descending sulphur globules. The water enters the lower part of the vessel, by way of a line 19, at a temperature, say, of 40°C and a pressure of about 30 p.s.i.g. and it rises to the upper portion of the vessel which is surrounded by a heating coil 20. The water leaves by way of an overflow pipe 21 at a temperature of about 138.5°C and a pressure of about 35 p.s.i.g.
- 10 The liquid in the upper part of the vessel is circulated by means of a truncated cone stirrer 22 rotated by a motor 23.

- As the globules of sulphur descend through the water in the vessel 16 to the cooler regions thereof they solidify into pellets or granules. The vessel has a coned bottom 24 fitted with a rotating valve 25 through which the pellets, together with some water, are delivered on to a screen 26.
- 25 The screen underflow is pumped back to the vessel 16 through the line 19 together with fresh feed water introduced through a water inlet 40. The pellets retained on the screen discharge on to a conveyor 27.

- 30 The water in the vessel 16 can be topped up from a third vessel 29 through a line 28. The vessel 29 receives the water continuously overflowing from the vessel 16 and is maintained at a pressure of 30 p.s.i.g. A heating coil system 30 surrounds the vessel 29 to raise and/or hold the temperature of the water therein at about 138.5°C. Water continuously leaves the system from the top of the vessel 29 by way of the discharge line 41.

- 40 The aim of the upward water flow through the vessel 16 is to achieve a sufficient hold-up of the solidifying sulphur globules to ensure that they are really hard before they reach the bottom. It may be further assisted by providing two hollow truncated cones on the stirrer shaft with their larger ends facing each other, in order that the molten sulphur globules are met by mechanically induced cooling currents and thrown outwards towards the vessel sides whereby their descent is delayed.

- 50 The ratio of hot water to sulphur in the vessel 16 may be in the range of, say, 5:1 to 10:1 by weight or greater. There will be some loss of water with the pellets from the screen 26 but this will be made up by an excess of water entering the vessel 16 from the inlet 40 and through line 19.

- 60 Modifications of the particular arrangement described and illustrated are possible without departure from the scope of the invention. Thus, there are various ways of collecting the pellets from the bottom of the pelletising vessel; an alternative to the

rotary valve shown would be the fitting of a breeches piece, such as is often used on vertical evaporators, with control means for causing the pellets to discharge into the two legs of the breeches piece alternately.

While the pelletisation of pure molten sulphur has been described herein, the process is also applicable to the treatment of impure sulphur feed materials such as may be derived from sulphur ores or industrial filter cake. With these the sulphur may be initially refined by treatment in hot water under pressure, and the ratio of water to sulphur during this treatment may be, say, 2:1 to 4:1.

WHAT WE CLAIM IS:—

1. A process for the treatment of sulphur wherein a stream of molten sulphur is injected into a pelletising vessel by means that break the sulphur up into discrete globules as it enters, and the vessel contains a liquid with which the sulphur is immiscible, the arrangement being such that the sulphur globules are first received by said liquid in a region where the temperature thereof is substantially the same as that of the molten sulphur and they travel continuously through regions of said liquid of progressively decreasing temperature until they solidify into pellets or granules after which they arrive at a point of discharge from the vessel.
2. A process according to claim 1, wherein the liquid immiscible with sulphur is hot water under pressure.
3. A process according to claim 2, wherein the ratio of hot water to sulphur in the pelletising vessel is 5 to 1 by weight or greater.
4. A process according to claim 2 or claim 3, wherein the molten sulphur is injected into the top of the vessel through relatively-rotating perforated plates, and the resulting globules descend continuously under gravity through the vessel in counter-current to water under pressure rising therein.
5. A process according to claim 4, wherein means is provided for heating the upper part of the vessel.
6. A process according to claim 4 or claim 5, wherein the pellets are delivered at the bottom of the vessel through a rotating valve.
7. A process for the treatment of sulphur substantially as described herein.

For the Applicants:
LLOYD WISE, BOULY & HAIG,
 Chartered Patent Agents,
 Norman House,
 105—109 Strand,
 London, W.C.2.

