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METHOD OF COMMINUTING FUSIBLE SOLIDS

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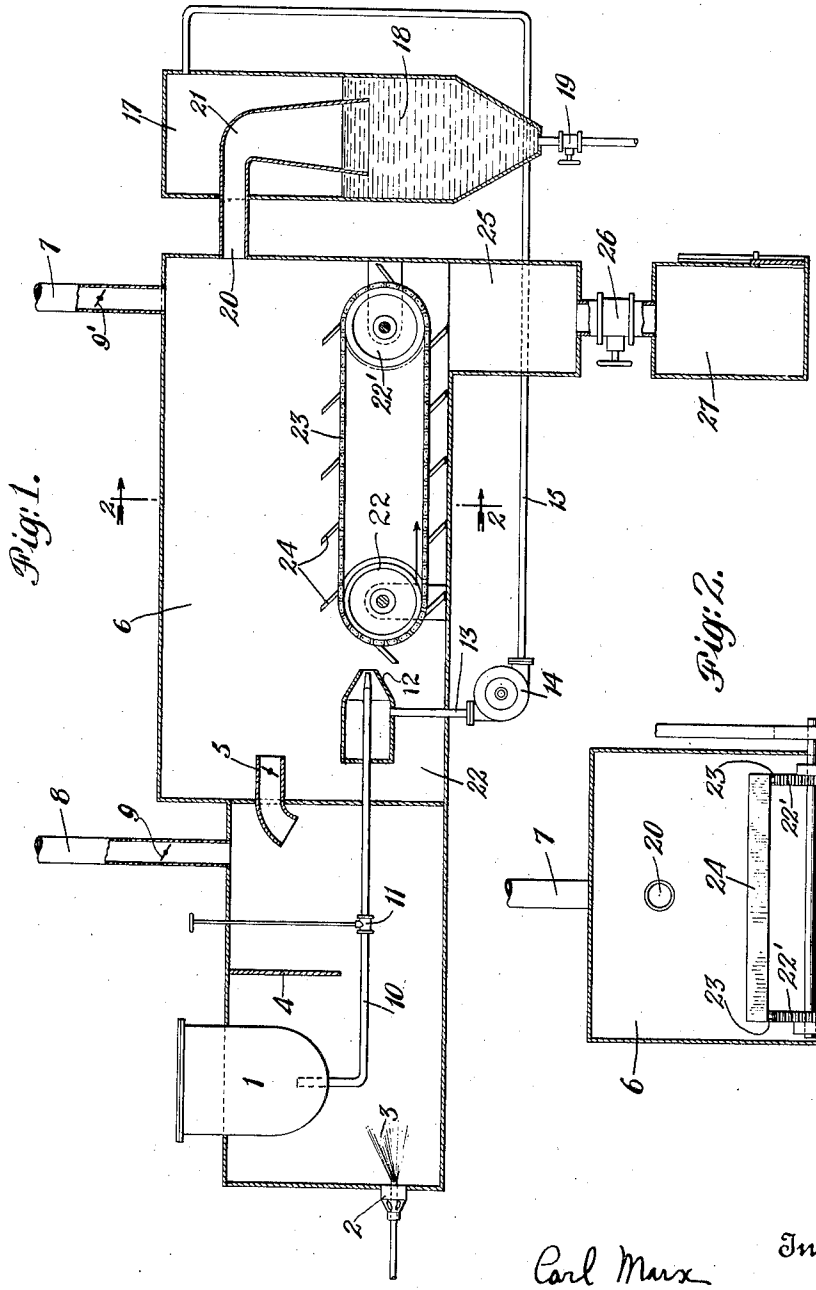


Fig. 1.

Fig. 2.

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METHOD OF COMMINUTING FUSIBLE SOLIDS.

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This invention comprises a process for obtaining a fusible solid in a finely divided form by the atomization thereof in the fluid state by a rapid current of a fluid or gas, which may or may not be entirely inert to the substance desired to be comminuted. More specifically, this invention concerns itself with the comminution of sulfur in passing from the liquid to the solid state.

As is well known, the grinding of sulfur is attended by considerable difficulty and danger, as the heat of the grinding surfaces induce sparks which have often been the cause of fires and explosions. The present method has to do with the subdivision of sulfur into a form and size as fine or finer than that obtained by ordinary grinding operations, and without the above mentioned dangers.

Novel features of my process lie in the relative arrangement of the parts of the apparatus employed, and in the method of recovery of the comminuted sulfur from the apparatus in a continuous manner without interruption of the process of production. The use of the gases of combustion from the source of heat for melting the sulfur prior to comminution and the exhausting thereof through suitable apparatus as hereinafter described, with partial re-use of the gases produced by the combustion of the fuel used as the source of heat in liquefying the sulfur, differentiate this invention from all other processes for comminution and partial purification of sulfur.

I am aware that A. Walter (U. S. P. 873,812; D. R. P. 177,281) has proposed to boil sulfur and conduct the vapors together with an inert gas into chambers, thus producing flowers of sulfur, and while the present method may appear to have certain similarities, it is specifically pointed out that the present method as developed by myself does not involve the boiling of sulfur, or the heating of sulfur up to the boiling point; hence the product obtained when operating according to the patented directions of Walter is called flowers of sulfur. The product obtained by my process as herein described consists of finely divided ordinary or carbon-bisulfide-soluble sulfur. Also, the temperatures employed by me for heating the sulfur are very much lower than is possible in any method of sulfur distillation under normal atmospheric conditions, being, in fact, in my process not over 130° C.

In one method, described and illustrated herein as one method of the application of my process and method employed, I may proceed as follows:—Sulfur is melted in a suitable container by means of a smokeless flame, the latter being so regulated that the products of combustion are practically devoid of oxygen, and hence a non-supporter of combustion. The gases from the burner are conducted in any suitable manner to a receiving chamber or a plurality of the same, and until said chamber or chambers are substantially filled with such gases. If the products of combustion are insufficiently inert towards sulfur, other inert gases as nitrogent or carbon dioxide may be mingled with the flue gases in any suitable manner. The introduction of gas inert to sulfur may be accomplished by means of natural draft to the chamber or chambers, or by means of suitable suction fans or pumps. When the apparatus has once been filled with inert gas or gases, and the sulfur has melted in the kettle, said sulfur is allowed to flow in a controllable fluid stream by means of a regulator, and through a pipe passing from the furnace itself to maintain the sulfur in the proper fluid condition, and to an atomizing arrangement, where it is atomized by a blast of gas inert to the sulfur, or substantially so. This inert gas may be taken from the chamber itself, and will not only atomize the sulfur but will serve to carry the atomized sulfur into the receiving chamber. The speed of atomization is so proportioned that the sulfur will be sufficiently chilled to at once return to the solid state, forming a very fine and uniform powder which settles in the chamber. The atomization may also be so adjusted as to produce sulfur of widely differing degrees of fineness, as will be apparent to those skilled

in the art. The sulfur still suspended in the current of gas may be passed through a dust trap charged with a liquid which is a non-solvent of the sulfur such as water, and there deposited, the inert gas passing thence to a pump which supplies the atomizer with gas. An excess of pressure in the receiving chamber may be avoided by means of the introduction of an exit pipe suitably valved, the furnace being likewise provided with a stack and valve so that the products of combustion of the material used to liquefy the sulfur, may either be sent up the stack or into the chamber at the operators will.

The finely divided sulfur may be removed from the receiving chamber either by shutting down the apparatus when sufficient sulfur has accumulated, or by providing the chamber with a scraping device which continually or periodically removes the sulfur to the end of the apparatus furthest removed from the heating chamber where it may fall into a depression in the chamber from which it is removable through a valve into containers for shipment or use.

In order to better describe one form of apparatus which I have employed, the attached figures are provided, it being distinctly understood, however, that these are merely diagrammatical, and merely for the further explanation of the process involved.

Sulfur is placed in a suitable kettle 1 heated by a burner 2 employing gas or oil. The products of combustion 3 pass under a baffle 4 to a pipe 5 into chamber 6, being allowed to escape if desired, into a stack 7, or they may be allowed to escape directly through stack 8. Both stacks 7 and 8 are provided with valves 9 and 9′ to control the flow of gases. The sulfur when molten in kettle 1 passes through pipe 10 controlled by valve 11 to the atomizer or nozzle 12. There it meets a current of gas coming through pipe 13 from pump or circulating fan 14, this pump in turn sucking the gas through pipe 15 from dust filter 17, in which dust filter the gas has been washed by liquid 18. This dust filter has a drain pipe and valve shown at 19. The sulfur dust settles in chamber 6, and the very finest particles pass out through duct 20 and the inverted conical elbow 21 into the liquid 18 in the dust collector 17. Chamber 6 is provided with two sprocket wheels 22 and 22′ over which travels a twin chain 23 spaced a distance apart equal to approximately the diameter of the receiver. Across these chains may be placed a series of iron or wooden paddles 24 or scrapers, which by suitable revolution of the sprocket wheels, and by scraping along the bottom of the chamber, transfer the sulfur which has settled there to the off-set or depression 25 in the chamber. This off-set, if provided with valve 26, permits of the dropping of the sulfur into a final receiver 27, from which it may periodically be removed.

The preliminary melting of the sulfur is a purification in that the insoluble and extraneous matter thereby settles to the bottom of the melting kettle. The sulfur obtained by the above described process is very finely divided, but never-the-less retains all of its natural properties, such as solubility in carbon bisulfide. Being made at a temperature above that of boiling water, it will be essentially anhydrous. Having been in the fluid state, the impurities will have settled out, thus resulting in a purified sulfur practically ash-free. Furthermore, certain hydrocarbonaceous and petroleum impurities will have been volatilized by the temperature to which the sulfur is subjected in the melting kettle and their removal effected.

For many purposes a form and condition of sulfur as above described, in which the inorganic solids, ash, and volatile hydrocarbonaceous impurities have been partially removed is highly desirable, as the flowers of sulfur of commerce is partially insoluble in carbon bisulfide and often contaminated with sulfur dioxide, sulfuric acid and other impurities not removed by ignition. On the other hand, the sulfur produced by my process is free from acid, readily soluble in carbon bisulfide, and may be produced in varying degrees of fineness, depending upon the will of the operator.

The fuel employed forms no part of the claim of this specification, as any form of gas, oil or hydrogen may be employed.

What is claimed as new and is desired to be protected by Letters Patent of the United States is:—

1. A process for producing finely divided sulphur which consists in establishing an inert atmosphere in a chamber, in applying the heat of burning fuel to melt a mass of sulphur, and in utilizing gaseous products of combustion of the fuel as a vehicle to spray the molten sulphur into said inert atmosphere.

2. A process for producing finely divided sulphur which consists in applying the heat of burning fuel to melt a mass of sulphur, in charging a chamber with gaseous products of combustion of the fuel, and in utilizing gaseous products of combustion of the fuel as a vehicle to spray the molten sulphur into the gas-charged chamber.

3. A process for producing finely divided sulfur soluble in carbon bisulfide, consisting in atomizing liquid sulfur at a temperature slightly above its melting point by means of inert gases derived directly from the products of combustion of the fuel used to melt the sulfur, spraying said sulfur by means of said inert gas into a settling chamber and removing the comminuted sulfur from said

settling chamber without permitting external gases to enter, substantially as described.

4. A process for producing finely divided sulphur which consists in applying the heat of burning fuel to melt a mass of sulphur, in charging a chamber with gaseous products of combustion of the fuel, in cleansing a portion of the gaseous products of combustion, and in utilizing the cleansed gases as a vehicle to spray the molten sulphur into the gas-charged chamber.

This specification signed this twenty-second day of October, A. D. 1923.

CARL MARX.