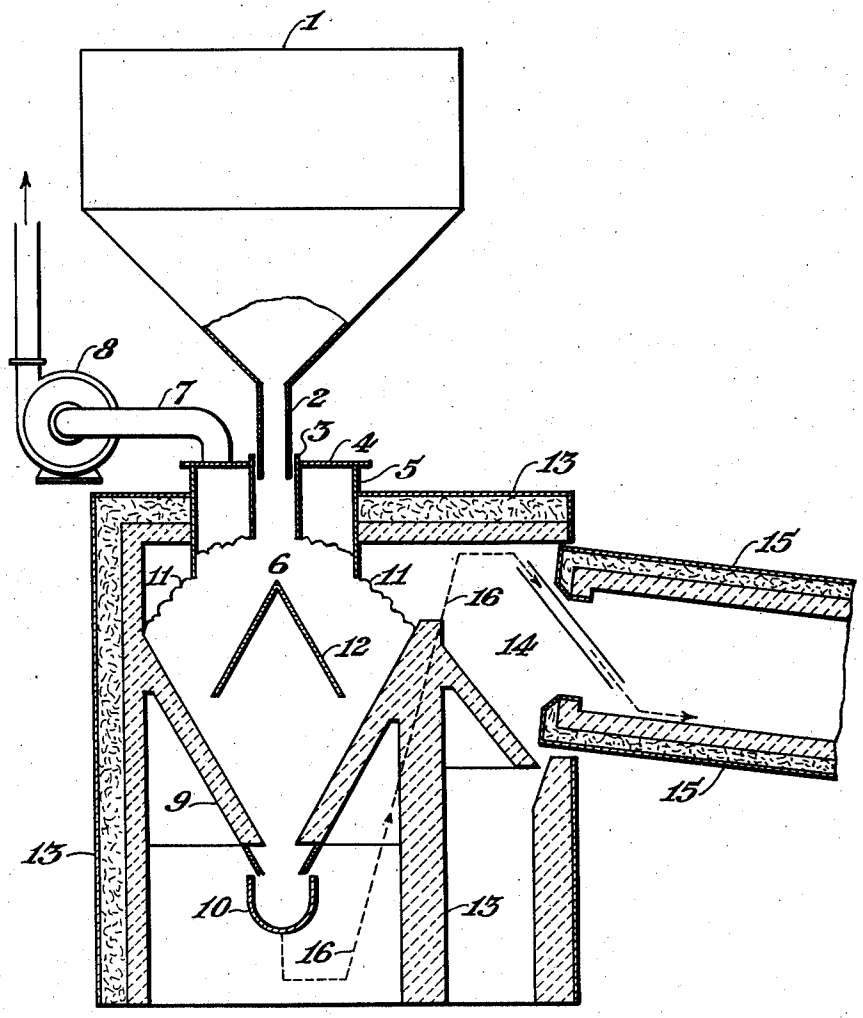
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TREATMENT OF LIMESTONE

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TREATMENT OF LIMESTONE

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4 Claims. (Cl. 263—53)

This invention relates to processes for the treatment of limestone to produce lime therefrom; and is more particularly concerned with a method and means for pretreating limestone before it is introduced into a burning kiln.

It is a primary object of this invention to provide a method for pretreating limestone whereby the normal capacity of a continuous rotary kiln operating on such pretreated stone is substantially increased.

It is among the objects of this invention to provide a novel apparatus for carrying out the hereinafter described process for the pretreatment of limestone.

Another object of the invention is to provide means wherein limestone can be pretreated wherein unusual heat economy is obtained.

To the accomplishment of the foregoing and related ends the invention, then, comprises the method and means hereinafter fully described and particularly pointed out in the claims, the annexed drawing, and the following description, setting forth in detail one mode and means for carrying out the invention, such disclosed mode and means illustrating, however, but one of the various ways in which the principle of the invention may be used.

In said annexed drawing, the single figure shows a side elevation, partly in section, of a preferred form of my apparatus wherein the method which I have invented for pretreating limestone can be carried out.

My method for the treatment of limestone prior to the introduction of the same into a burning zone comprises the steps of feeding the raw stone through a zone wherein it is intermingled with gas supplied at an elevated temperature to transfer heat from said gas to said stone, then holding the hot stone in a soaking zone for a suitable period of time, and thereafter feeding the hot stone into a burning zone.

The gas employed to heat the raw stone may be derived from any suitable source and should be supplied at a temperature above about 1000° F., and preferably about 1200°–1600° F., to yield the best results. I have found that in commercial practice substantially all of the sensible heat in the exhaust gas from a rotary lime-burning kiln can be recovered and utilized where such gas is fed into the raw stone in the pretreating apparatus at a temperature of approximately 1400° F. The rate of flow of stone through the heat exchange zone can be so controlled that the stone attains a temperature only slightly below that of the incoming hot gas, e. g. a differential of about 25°–100° F. From the heat exchange zone the heated stone is fed into a zone insulated to prevent heat loss, wherein it is allowed to remain for a suitable period of time, e. g. about one to two hours. From this soaking zone the stone, preferably while still hot, is led into the usual burning kiln, preferably of the rotary type. The hot stone may advantageously be introduced into the burning kiln through the hot gas leaving the same.

Referring now to the drawing:

In the single figure, a storage bin 1 for raw limestone is provided at the bottom thereof with an outlet pipe 2 which depends into an adjustable telescoping spout 3. Said spout 3 is mounted to slide vertically in a cover plate 4 which closes the top of a cylinder 5 constituting the upper part of the treating chamber 6. The upper part of the treating chamber 6 is provided with an offtake pipe 7 through the cover plate 4, leading to a fan 8 for exhausting the gases from said chamber 6. The lower part of the chamber 6 consists essentially of an inverted conical hopper 9 provided at the bottom thereof with an outlet for treated stone, and means to control the rate of withdrawal of stone from the chamber 6. Suitable means for such purpose is here shown diagrammatically as a vibrating conveyor 10.

The cylinder 5 and the inverted cone 9 have a common vertical axis, but are arranged so that the bottom of the cylinder is slightly above the base of the cone, and the diameter of the cylinder is somewhat less than the diameter of the base of the cone, thereby providing an annular opening 11 in said chamber 6 wherethrough the heating gas is admitted to the chamber. The relationship between the diameter of the cylinder 5, the diameter of the base of the inverted cone 9, and the vertical distance between the bottom of the cylinder and the cone base should be such that stone travelling downwardly through the chamber will not spill over the rim of the cone base, and is determined by the angle of flow of crushed limestone, which is approximately 30°–40°.

A suitable distributing element, here illustrated as a cone 12, having a common vertical axis with that of the aforesaid cylinder 5 and inverted cone 9, is placed within said chamber 6 to distribute the gravitational flow of limestone therethrough and to provide means to obtain more thorough intermingling of the crushed stone and hot gas led into the treating chamber. The entire chamber 6 is surrounded by well-insulated walls 13 arranged to provide an inlet path 14 for

the heating gases, to prevent substantial loss of heat, and to confine the hot gases so that they can only flow into the chamber 6 through the annular inlet 11 thereto. Said gas inlet path 14 may lead from the gas discharge end of a continuous rotary kiln 15 and may contain a part of the conveying means 16 for feeding the pretreated stone from the treating chamber 6 to the kiln 15.

To illustrate the practice of my invention in the type of apparatus just described, the following example is given:

Raw limestone, sized to pass through a one and one-quarter inch screen and be retained on a five-eighths inch screen, was fed at a substantially uniform rate from a storage bin into a treating chamber constituting a gas-stone contact zone and a soaking zone. The exhaust gases from a rotary kiln were led into the chamber at a temperature of about 1400° F. The kiln wherefrom such gases were obtained was an ordinary rotary lime burning kiln, having an internal diameter of six feet and a length of approximately one hundred feet, the normal rated capacity of such kiln being forty tons per day of finished lime. The temperature of the treated stone withdrawn from the chamber at the bottom of the soaking zone was approximately 1300° F. The gases exhausted from the top of the treating chamber had a temperature of approximately 300° F. The treated stone withdrawn from the bottom of said soaking zone was continuously conveyed into the rotary kiln, and a uniformly burned lime product obtained at the discharge end of the kiln. Approximately 75 tons per day of uniformly burned lime was obtained under the operating conditions described.

My process provides a way of pretreating limestone which utilizes the heat in the exhaust gases from rotary kilns, thereby lending to lime burning operations a high over-all efficiency; produces a uniform product by avoiding the simultaneous over- and under-burning of stone which is experienced in most rotary kilns; and substantially increases the normal capacity of rotary lime-burning kilns.

Other modes and means of applying the principle of my invention may be employed instead of those explained, change being made as regards the steps or apparatus herein disclosed, provided the steps or means stated by any of the following claims or the equivalent of any such stated steps or means be employed.

I, therefore particularly point out and distinctly claim as my invention:

1. In a method of treating limestone to prepare the same for burning in a kiln, the steps which consist in feeding the stone into a zone wherein it is intermingled with hot gas to transfer heat from said gas to said stone, then into a zone out of contact with said gas and permitting said stone to soak in said zone, and thereafter introducing the stone from said second zone into a burning kiln.

2. In a method of treating limestone to prepare the same for burning in a kiln, the steps which consist in feeding the stone into a zone wherein it is intermingled with gas supplied at a temperature above about 1000° F. to transfer heat from said gas to said stone, then into a zone out of contact with said gas and permitting said stone to soak in said zone, and thereafter introducing the stone from said second zone into a burning kiln.

3. In a method of treating limestone to prepare the same for burning in a kiln, the steps which consist in feeding the stone into a zone wherein it is intermingled with gas supplied at a temperature of between about 1200° F. and about 1600° F. to transfer heat from said gas to said stone, then into a zone out of contact with said gas and permitting said stone to soak in said zone, and thereafter introducing the stone from said second zone into a burning kiln.

4. In a method of treating limestone to prepare the same for burning in a kiln, the steps which consist in feeding the stone into a zone wherein it is intermingled with hot gas to transfer heat from said gas to said stone, then into a zone out of contact with said gas and permitting said stone to soak in said zone, and thereafter introducing the stone while still at an elevated temperature from said second zone into a burning kiln.

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