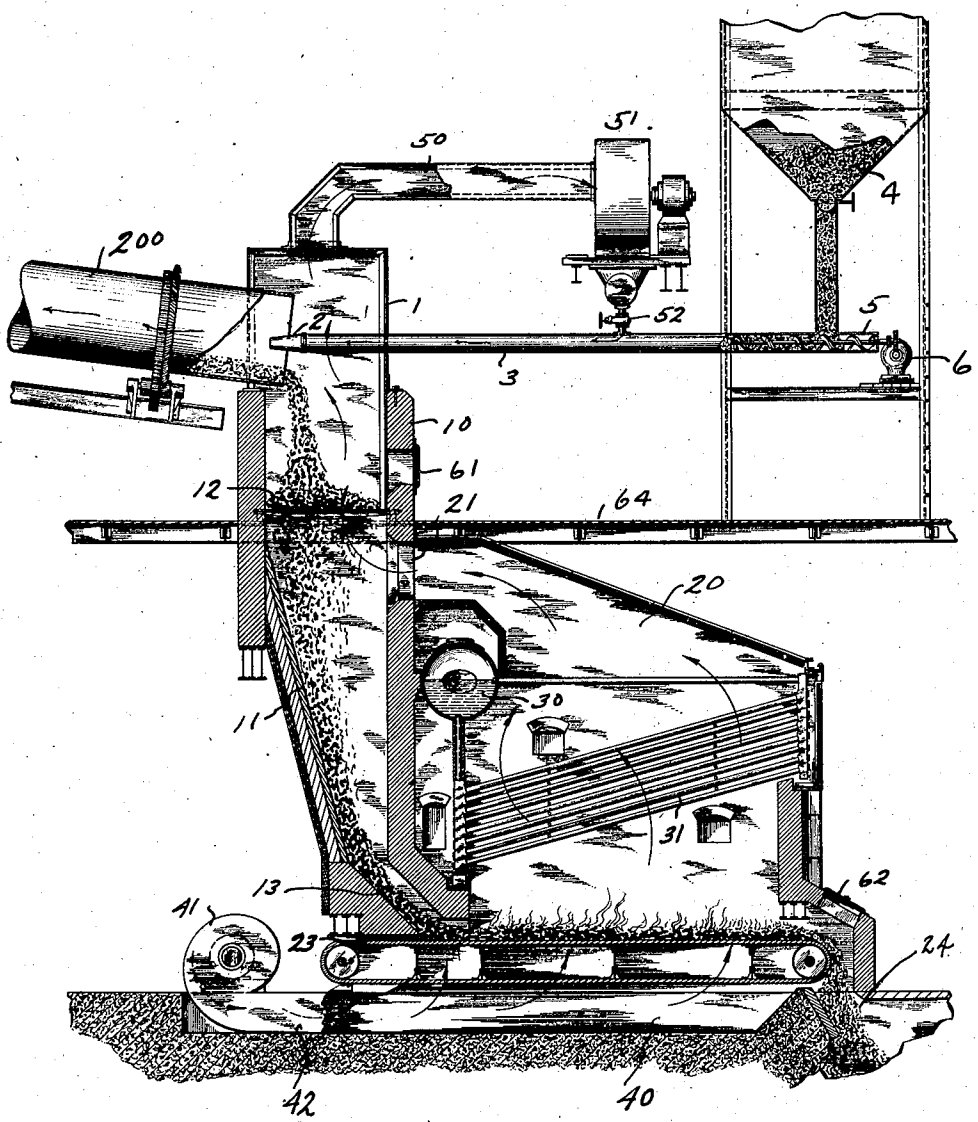
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D. S. JACOBUS ET AL

METHOD AND APPARATUS FOR UTILIZING HEAT

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INVENTORS
David S. Jacobus
Arthur D. Pratt
BY
Gifford, Bull & Gault
ATTORNEYS.

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DAVID S. JACOBUS, OF JERSEY CITY, AND ARTHUR D. PRATT, OF SHORT HILLS, NEW JERSEY, ASSIGNORS TO THE BABCOCK & WILCOX COMPANY, OF BAYONNE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

METHOD AND APPARATUS FOR UTILIZING HEAT.

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Our present invention relates to new and useful improvements in methods and apparatus for utilizing heat contained in preheated, divided, solid, non-combustible material, and more particularly for utilizing heat contained in cement clinker freshly discharged from a kiln.

The invention resides in the method and apparatus to be more fully described hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

The accompanying drawing illustrates, partly in section, a novel form of apparatus for carrying out our improved method.

In the drawing, a hood 1 has a substantially airtight fit over the end of a rotary kiln 200. Extending into the hood 1 is a nozzle 2 adapted to discharge into the end of the kiln finely divided fuel, fed thereto through pipe 3 from the hopper 4, the feeding of the fuel through the pipe 3 being conveniently accomplished by the screw-conveyor 5, driven by motor 6.

The hood 1 is a continuation of a shaft-like structure or chute 10, having an inclined portion 11. A grate 12 is advantageously located in the upper part of the conduit 10, the purpose of which will be apparent hereinafter. The inclined chute 11 terminates in a passage 13. A chain-grate stoker or conveyor 23 is arranged to receive clinker from the passage 13 and convey it to the discharge passage 24. Above the grate 23 is located a boiler 30 having water tubes 31 disposed above the stoker 23 so as to receive heat from the hot material thereon by radiation and convection. The boiler may be of conventional type in which the water undergoing evaporation is circulated in tubes 31, as is well understood. A single pass of the air across the tubes 31 is preferred. A flue 20 communicates with the top of the boiler and with the conduit 10 through an opening 21 beneath the grate 12.

Enclosing the sides and bottom of the stoker 23 is a casing 40, into which air is forced by means of blower 41 through the conduit 42.

In order to mix the heated air with fuel fed to nozzle 2, we provide conduit 50 to conduct heated air from the hood 1 through a blower 51 and valve 52 in tube 3.

The apparatus is conveniently provided with manholes 61, 62 to give access to the clinker on the grate 12 and on the stoker 23.

The method carried out in our illustrative device is as follows: The incandescent cement clinker from the rotary kiln 200 is allowed to fall through the conduit 10 and strikes the grate 12, which has the effect of retarding the passage of the clinker through the conduit. Should the clinker become clogged upon the grate 12, it may be poked or barred through the grate by an operator on the floor 64, the tool being passed through the man-hole 61. Passing through grate 12, the clinker strikes the inclined portions 11 and 13, which retard its fall somewhat and allow the clinker to be discharged upon the stoker 23, which conveys it beneath the boiler to the discharge 24. The boiler tubes are heated by the radiant heat from the clinker. Air is blown through the clinker by means of blower 41, and is heated thereby. This heated air flows over the boiler tubes 31, to which it imparts the heat acquired from the clinker. The air then passes through opening 21, through grate 12, and into the kiln 200, where it enters into combustion with the fuel supplied from nozzle 2. It will be seen that by permitting some accumulation of the intensely hot clinker upon the grate 12, opportunity is afforded for the reheating of this air cooled by its contact with boiler tubes 31, and that the heat abstracted from the clinker in this manner is returned to the kiln either directly or through the air passing through conduit 50 to the pipe 3.

It will be seen that we have thus provided a simple and effective method of and apparatus for recovering the waste heat in clinker or materials of a similar nature. It will be seen that by preheating the air by contacting it with the intensely hot clinker, we bring it to a state most favorable for high-combustion temperatures. Inasmuch as there is more waste heat available than would be needed for this purpose, it will be seen that we have provided an efficient means for utilizing that excess heat by operating a boiler therewith, the boiler being heated both by radiation from the hot clinker and by air heated by contact with the clinker.

It will be understood that the apparatus which we have described is merely illustrative and may be varied within wide limits.

We claim:

1. The method of utilizing heat contained in preheated, divided, solid, non-combustible material from a furnace, which consists in conveying the heated material from the furnace which produces it to a point beneath a boiler heating surface to heat the same by the radiant heat of the material, forcing air through the material beneath said heating surface and across said heating surface and then into contact with a portion of said material before it is carried beneath said heating surface and then utilizing the reheated air in the furnace producing said heated material to support combustion therein.

2. The method of recovering heat in hot clinker from a kiln, which consists in forcing air through a portion of the hot clinker and over a boiler heating surface, then into contact with another portion of the hot clinker and then into the kiln to support combustion therein.

3. The method of recovering heat in hot clinker from a kiln, which consists in forcing air through a portion of the hot clinker and over a boiler heating surface, then into contact with another portion of the hot clinker and then into the kiln to support a combustion therein, and carrying the said last-named portion into position to be contacted by the air passing to said heating surface.

4. The method of recovering heat in hot clinker from a kiln, which consists in passing air in contact with said clinker, thereby heating said air, passing the heated air into contact with a boiler heating surface, reheating said air by a second contact with the hot clinker, and utilizing the reheated air for combustion in the clinker-producing kiln.

5. The method of recovering heat in hot cement clinker from a kiln, which consists in passing the clinker through a conduit and onto a conveyor, passing air through said clinker while on said conveyor, thereby heating said air, passing the heated air into contact with a boiler heating surface, and thence into contact with clinker passing through said conduit, thereby reheating said air, and utilizing said reheated air for combustion in the clinker-producing kiln.

6. In combination with a kiln, an enclosed housing for receiving the hot clinker from the kiln, means for passing air into contact with said clinker at a first point in said housing, means for passing said air into contact with the clinker at a second point in said housing, a boiler in the path of said air between said points, and means to introduce into said kiln the air reheated by its contact at the said second point.

7. In combination with a kiln, a hood enclosing the delivery end of the kiln, a conduit communicating with said hood and adapted to receive hot clinker from the kiln, a housing provided with a lower and an upper passage connecting said conduit and said housing, means to receive clinker from the said lower passage and conduct it through the housing, means to force air into contact with the clinker while on said receiving and conducting means and thence through said upper passage to contact with the clinker passing through said conduit and thence into said kiln, and a boiler in said housing disposed in the path of said air.

8. In combination with a kiln, a hood enclosing the delivery end of the kiln, a conduit communicating with said hood and adapted to receive hot clinker from the kiln, a housing provided with a lower and an upper passage connecting said conduit and said housing, means to receive clinker from said lower passage and conduct it through the housing, means to force air into contact with the clinker while on said receiving and conducting means and thence through said upper passage to contact with the clinker passing through said conduit and thence into said kiln, a boiler in said housing disposed in the path of said air, and a grate in said conduit above said upper passage to retard the passage of clinker through the conduit.

DAVID S. JACOBUS.
ARTHUR D. PRATT.