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METHOD OF UTILIZING WASTE HEAT IN KILNS.

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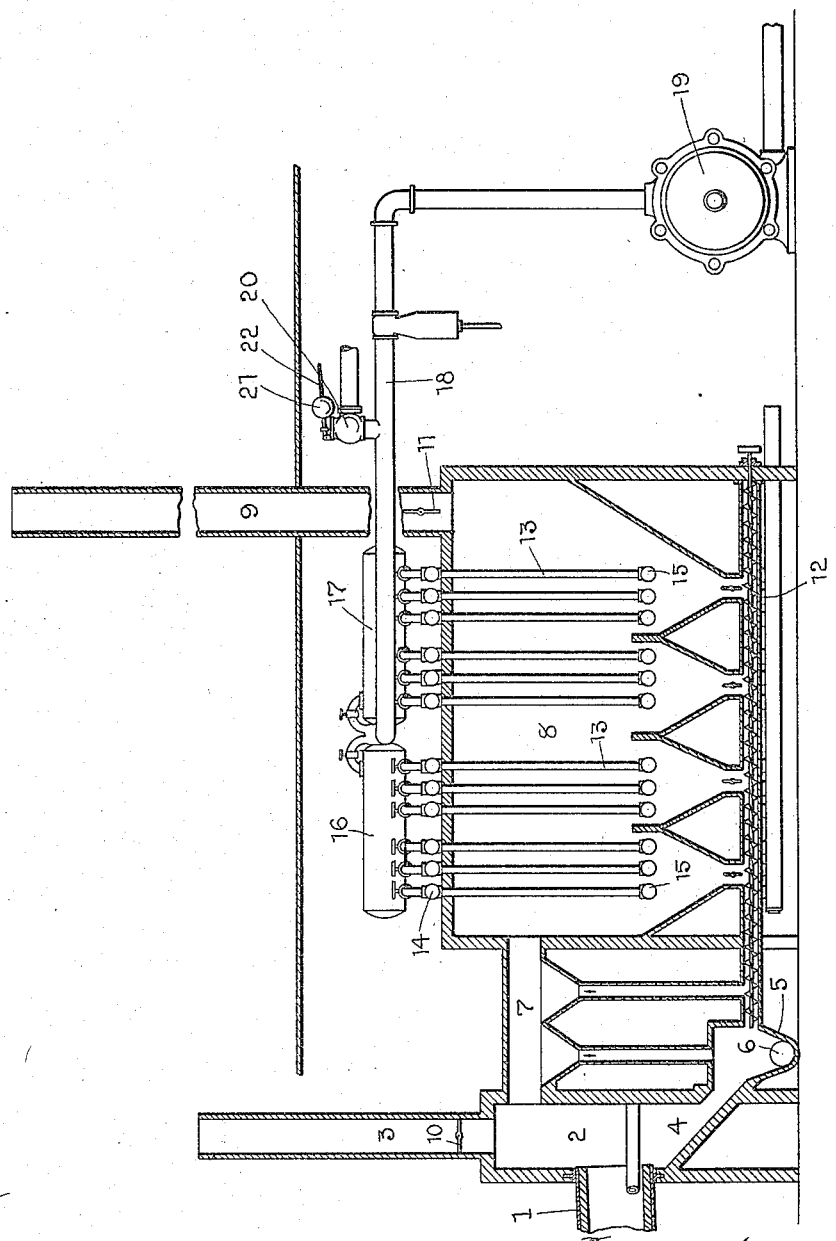
1,167,637. Patented Jan. 11, 1916.



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METHOD OF UTILIZING WASTE HEAT IN KILNS.

1,167,637. Specification of Letters Patent. Patented Jan. 11, 1916.

Application filed July 7, 1910. Serial No. 570,913.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, and a resident of Llewellyn Park, West Orange, Essex county, New Jersey, have made a certain new and useful Invention in Methods of Utilizing Waste Heat in Kilns, of which the following is a description.

This invention relates to rotary cement kilns and is an improvement upon the invention described and claimed by me in my application Serial No. 464,410, filed November 25, 1908, entitled Means for utilizing the waste heat in kilns, on which Patent No. 1,148,832 was granted on August 3, 1915. In the above entitled application, a settling chamber was provided in the path of the waste hot gases escaping from the kiln on their way to the stack. A steam generator was provided in the settling chamber for utilizing the heat of the waste gases without interfering with the draft of the kiln. The steam generated in the pipes constituting the generator was utilized for running a steam engine or engines, the water in the pipes of the generator being evaporated at a constant rate, the volume and temperature of the waste gases passing around the pipes being approximately constant. The constant quantity of steam thus generated was somewhat greater than the maximum amount to be used by the engine, the balance of the steam generated escaping through a safety valve or equivalent device. By this means heat was abstracted by the steam pipes from the waste kiln gases at a constant rate, and accordingly, the draft for the kiln, caused by the passage of the gases up the stack was not interfered with, as would be the case if steam were generated in the pipes at a variable rate in accordance with the quantity of steam called for by the consumption of the engine, with a consequent variation of the amount of heat abstracted from the waste gases by the generating pipes.

My present invention consists in an improvement upon the process and apparatus just described, consisting in the use of a low pressure condensing steam turbine in place of the steam engine described and broadly claimed in my previous application. I have found that when an ordinary steam engine is used, the same requires steam of such high pressure as to cause trouble from leaks in the joints of the tubes composing the boiler or steam generator in the dust settling chamber of the kiln. Accordingly, I propose to generate steam in the tubes at a constant rate and to furnish as much of the same as is required to a low pressure turbine, while allowing the remainder of the total amount of steam generated to escape, as through a safety valve, which is set to allow the steam to escape therethrough whenever the pressure rises above the maximum pressure of the steam to be used by the turbine. Low pressure condensing steam turbines are now manufactured to operate upon exceedingly low pressure steam and at the same time to generate an amount of power which would be out of the question in the case of a reciprocating steam engine, because of the enormous size of cylinder which would be required for the latter. Thus, I am enabled to use steam of only two or three pounds above the atmospheric pressure, avoiding the trouble due to leaks in the joints of the tubes above noted. Such a result would be impossible in the case of reciprocating steam engines, and my present invention is specific to the use of low pressure condensing steam turbines, as described.

The object of my invention, accordingly, is to provide an improved process and apparatus comprising the above described functions.

For a clearer comprehension of my invention, attention is directed to the accompanying drawing, forming part of this specification, and showing a vertical cross section through one end of the kiln and dust settling chamber, the steam generating devices, safety valve, and turbine being shown in side elevation.

Referring to the drawings, 1 represents a rotary cement kiln, such as is used in modern practice, and preferably one of large capacity, such as is described in my Letters Patent No. 802,631, granted October 24, 1905. The hot gases, the products of combustion of the kiln, pass from the upper or right-hand end of the kiln into the chamber 2 which is furnished with a stack 3. Chamber 2 is furnished with a slanting bottom plate 4, so that the chalk or dust which settles in this chamber falls on the slanting plate and slides into the boot 5, at the bottom of which is located a continuously operating conveying means, represented by the screw conveyer 6. In the normal operation of the

device, the waste hot gases pass from chamber 2 into the hot air pipe 7 through which they pass into the large dust settling chamber 8, through which in turn they pass and escape by means of the stack 9. The stacks 3 and 9 are equipped respectively with valves 10 and 11, by means of which either stack may be closed, the stack 9 being open as shown. The large dust chamber 8 is provided throughout its length with conveying means, such as the screw conveyer 12, for transporting all dust deposited in the chamber to the boot 5 and the main conveyer 6 therein.

The dust settling chamber 8 is provided with a series of vertical pipes 13 forming part of the steam generating apparatus for utilizing the waste heat of the hot gases passing through chamber 8. A number of these vertical pipes 13 may be connected together at their upper ends to a single horizontal head or drum 14, and at the bottom to similar heads or drums 15. Each pair of heads 14 and 15 with the connected gang of pipes, constitutes a single unit or grid. The various grids are connected with steam drums as 16 and 17, which are connected to the main steam pipe 18 by which steam is conveyed to the low pressure condensing steam turbine shown diagrammatically in the drawing at 19. The supply of steam in the steam pipe 18 is approximately constant in volume and temperature, since the quantity and temperature of the gases entering chamber 8 through hot air pipe 7 are approximately constant, and an approximately constant quantity of water is evaporated thereby during each unit of time in the steam pipes 13. This steam supply is designed to be slightly in excess of the requirements of the turbine 19. The remainder of the steam furnished to pipe 18 is allowed to exhaust through valve 20, which is of the safety valve type. This valve may be adjusted as by setting the weight 21 thereof on the lever arm 22 for whatever pressure of steam it is desired to take in the turbine 19. Since the steam supply in pipe 18 is always in excess of the requirements of the turbine, there will be a constant exhaust of steam through valve 20. When the turbine 19 is stopped, the whole flow of steam in pipe 18 will escape through valve 20.

Since the turbine runs on very low pressure steam, there is almost no tendency to leakage in the joints of the pipes constituting the steam generating system, while at the same time, the draft furnished by stack 9 is not interfered with.

Having now described my invention, what I claim and desire to protect by Letters Patent is:—

1. The method of utilizing the waste hot gases from a kiln without varying the draft of the kiln thereby, which consists in causing said gases of an approximately constant volume and temperature to pass around a plurality of steam pipes connected together to thereby generate steam at a definite rate, greater than the maximum rate of consumption thereof, using as much of said steam as desired in a low pressure condensing steam turbine, and allowing the remainder of the total amount of steam generated to escape, the pressure of the steam in the system being kept sufficiently low to largely obviate leakage in the joints of said steam pipes, substantially as described.

2. The method of utilizing the waste hot gases from a kiln without varying the draft of the kiln thereby, which consists in causing said gases of an approximately constant volume and temperature to pass around a plurality of steam pipes connected together to thereby generate steam at a low pressure and at a definite rate, greater than the maximum rate of consumption of the engine or engines using said steam, using as much of said steam as desired in a low pressure condensing steam turbine or turbines, and allowing the remainder of the total amount of said steam to escape, substantially as described.

3. The method of utilizing the waste hot gases from a kiln without varying the draft of the kiln thereby, which consists in causing said gases to generate steam at a definite rate, greater than the maximum rate of consumption thereof, using as much of said steam as desired in a low pressure condensing turbine or turbines, and allowing the remainder of the total amount of said steam to escape, substantially as described.

This specification signed and witnessed this 2d day of July, 1910.

THOS. A. EDISON.

Witnesses:
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