UNITED STATES PATENT OFFICE.

LEWIS B. SKINNER, OF DENVER, COLORADO.

PROCESS OF PROTECTING METAL PIPES EXPOSED TO HIGH TEMPERATURES.

1,350,268. Specification of Letters Patent. Patented Aug. 17, 1920.

No Drawing. Application filed February 11, 1918, Serial No. 216,503. Renewed July 9, 1920. Serial No. 395,172.

To all whom it may concern:

Be it known that I, LEWIS B. SKINNER, a citizen of the United States, and a resident of Denver, State of Colorado, have invented a certain new and useful Improvement in Processes of Protecting Metal Pipes Exposed to High Temperatures, of which the following is a full, clear, and exact description.

My invention is a method of protecting metallic conduits exposed to high temperatures, especially such as are employed in transferring heat by the "double surface regenerative process" in metallurgical operations. The use of hot stoves in which the air entering to be preheated is passed through metal pipes (usually of iron), around which pipes escaping metallurgical gases are circulated for the purpose of transferring a portion of the heat held by such gases to the air, is old. But in such stoves as ordinarily employed the permissible maximum temperature of the heating gases is below that at which the iron would begin to soften or burn. The object of my invention is to provide a process of protecting such pipes whereby the heating gases may be considerably higher in temperature than the destructive temperature of the metal of which the pipes are made.

I have discovered that when highly heated fumes carrying volatile compounds of metals are brought into contact with metallic surfaces there is deposited on the metal a tenacious coating of condensed fume which coating is sufficient in thickness to protect the metal both from oxidation and, on account of its low conductivity, from excessive heating. This coating will tenaciously adhere to a thickness sufficient to thoroughly protect the metal but it will not build up sufficiently thick to materially retard heat transference due to the fact that the adhesion of the fume deposit to metal is much more tenacious than to previously deposited fume. Therefore in building up process proceeds until a certain thickness of fume has accumulated; beyond this point there is no material accretion because if fume is condensed on the surfaces it will flake off.

I will now describe a specific case to which my invention is applicable. Assume that an ore containing zinc together with certain non-volatile values is to be treated on the hearth of a reverberatory furnace, in the heating of which preheated air is employed. The metallurgical operations are so conducted that the zinc is reduced, volatilized, and converted to the oxid. This fume, together with the products of combustion, is passed through a regenerative stove in which the air conduits are iron pipes. In starting the furnace the heat is carefully controlled so as not to burn the iron pipes and a coating of zinc oxid is soon deposited on the pipes, completely covering all exposed surfaces. This coating will build up to a certain thickness but will not continue depositing because of the low adhesion between the fume and that previously deposited, and will permit the handling of gases which are heated far above the softening and burning point of the iron. This is on account of the relatively low conductivity of the fume as compared with that of the iron and the resulting fact that the iron abstracts and conveys to its contained air the heat at a faster rate than the inner lying portions of the coating can supply it—and this even though the outer layers of the coating be very highly heated.

With a regenerator whose pipes are protected by the method here disclosed I have been able to heat the air of combustion to a point above 500 degrees C. and to pass the furnace gases heated to around 1300 degrees C. through a regenerator having iron pipes. When it is considered that, for various reasons of clogging, leakage, etc., the metal pipe, double surface type of heat regenerator is the only one feasible of use in a metallurgical process in which values in the form of fumes are later to be recovered from the furnace gases, the value of my discovery will at once be apparent.

My invention is not limited to the deposition of zinc oxid fumes as the protective coating, that being merely the volatile constituent of the ore assumed in describing the invention. In certain cases the fumes deposited may contain lead oxid or lead sulfate, for instance; or other volatile compounds or compounds of volatile metals adherent to the pipe surfaces may be utilized. I do not, therefore, desire to be considered as limited to the specific case disclosed.

Since it is obvious that immaterial deviations from the precise treatment herein described may be made without departing from

my invention, I do not wish to be considered as limited to the precise details herein set forth further than is indicated by the scope of the appended claims. But having described my invention what I claim and desire to secure by Letters Patent is:

1. In the art of heat exchange by regeneration, a process of protecting the surfaces of metallic conduits exposed to the heating gases which consists in depositing on said surfaces a coating of zinc oxid bearing fume from said heating gases.

2. In the art of heat exchange by regeneration, a process of protecting the surfaces of metallic conduits exposed to the heating gases which consists in depositing on said surfaces a coating of fume from said heating gases, said coating being composed principally of zinc oxid.

3. In the art of heat exchange by regeneration of heat contained in metallurgical gases, a process of protecting the surfaces of metallic conduits exposed to the heating gases which consists in depositing on said surfaces a coating of fume from said heating gases, said coating being composed of compounds of volatile metallic constituents of the ore under treatment.

4. In the art of heat exchange by regeneration, the process which comprises preliminarily passing combustion gases carrying metalliferous fume from a metallurgical furnace into contact with metal regenerator pipes, while controlling the heat in such manner as to prevent substantial destructive action on said metal pipes, until an adherent protective coating of said fume is condensed thereon, and then operating the furnace in such manner that the gases passing in contact with the coated pipes are at a temperature sufficiently higher to be destructive to unprotected metal pipes, and passing air for combustion through said coated pipes.

5. In the art of heat exchange by regeneration, the process which comprises preliminarily passing combustion gases carrying metalliferous fume from a metallurgical furnace into contact with iron regenerator pipes, while controlling the heat in such manner as to substantially prevent burning said pipes, until an adherent protective coating of fume is condensed thereon, and then operating the furnace in such manner that the gases passing in contact with the coated pipes are at a temperature above about 1000° C., while passing air for combustion through said pipes.

6. In the art of heat exchange by regeneration, the process which comprises preliminarily passing combustion gases carrying zinciferous fume from a reverberatory furnace into contact with iron regenerator pipes, while controlling the heat in such manner as to substantially prevent burning said pipes, until an adherent coating of fume is condensed thereon, and then operating the furnace in such manner that the gases passing in contact with the coated pipes are at a temperature above about 1000° C., while passing air for combustion through said pipes.

In testimony whereof I have hereunto affixed my signature.

LEWIS B. SKINNER.

Correction in Letters Patent No. 1,350,268.

It is hereby certified that in Letters Patent No. 1,350,268, granted August 17, 1920, upon the application of Lewis B. Skinner, of Denver, Colorado, for an improvement in "Processes of Protecting Metal Pipes Exposed to High Temperatures," an error appears in the printed specification requiring correction as follows: Page 1, line 46, for the word "in" read *the;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 30th day of November, A. D., 1920.

[SEAL.]

L. B. MANN,
Acting Commissioner of Patents

Cl. 91—70.