The invention described herein may be manufactured and used by or for the Government of the United States for governmental purposes without the payment to us of any royalty thereon in accordance with the provisions of the act of April 30, 1928 (Ch. 460, 45 Stat. L. 467).

This invention relates to the production of metallic oxides, and more particularly to the production of such oxides by the thermal decomposition of metallic nitrates. In the production of metallic oxides by the thermal decomposition of metallic nitrates, such as manganese nitrate, the customary way of accomplishing the decomposition is to heat a body of the metallic nitrate until it is fused and thereupon to continue the heating until nitrogen oxides are liberated and the metallic oxide remains as a residue. However, the heating of metallic nitrates by direct combustion gases is impractical for large scale commercial operations since the success of such operations depends economically upon the recovery of the nitrogen oxides evolved. Obviously, dilution of the evolved nitrogen oxides with large quantities of flue gases renders their recovery impractical. Furthermore, if a body of metallic nitrate, such as manganese nitrate, is heated indirectly by means of steam coils or application of heat to the container in which the body of nitrates is held, the liberated metallic oxide forms a hard, impervious coating upon the interior of the container which soon insulates the main body of molten nitrate from the heat source, and the deposit is also very difficult to remove.

It is accordingly the object of this invention that the decomposition of such nitrates can be carried out without forming scaling or dilution of the evolved gases. Other objects will be apparent or will appear hereinafter as the description proceeds.

In accordance with this invention, metallic nitrates, such as manganese nitrate, are thermally decomposed by heating such nitrates with a portion of the gases liberated from a previous decomposition, said gases having been heated at an intermediate stage of the process. During operation, the evolved gases from the decomposition of the manganese nitrate or other metallic nitrates are collected, a portion of such gases are heated to a temperature at least as high as the decomposition temperature of the nitrate being treated, and then the heated gases are passed over additional metallic nitrate undergoing decomposition.

In the foregoing fashion, the decomposition of suitable metallic nitrates is carried out in a simple fashion without diluting the evolved gases and without a formation of scaly deposits and excessive foam.

Suitable metallic nitrates for decomposition in accordance with this invention include the nitrates of manganese, cobalt, aluminum, and many others too numerous to mention. Manganese nitrate, either in the hydrated or anhydrous form, constitutes a preferred metallic nitrate for decomposition in accordance with this invention.

The thermal decomposition of manganese nitrate, suitably in the form of its hexahydrate, liberates manganese dioxide, nitric oxides, and water. Manganese nitrate hexahydrate melts or fuses at 33° C. and is completely decomposed at 160° C.

The liberated reaction gases and vapors, herein called "gases," are withdrawn from the reaction zone and a portion of them is heated to a temperature at least as high as the decomposition temperature of the nitrate being treated. For example, in the case of manganese nitrate, the withdrawn portion of the evolved gases is heated to a temperature of at least 160° C., and preferably to about 400° C. to 500° C. After heating, the gases are brought into contact with additional quantities of metallic nitrate being decomposed. Thus, the process lends itself particularly well to operation in a cyclic continuous manner.

In operation, we have found that a desirable rate of decomposition is achieved when the reheated or superheated gaseous products of decomposition are passed over a shallow pool of molten manganese or other metallic nitrate. In this case the liberated manganese or other oxide forms a fine suspension in the pool of molten material, and no foaming or frothing has been observed.

It will be apparent from the foregoing that there has been provided a desirable and efficient method for decomposing molten metallic nitrates. Various changes may be made in the invention by those skilled in the art without departing from the spirit and scope of the invention.

What we claim is:

1. In a process for the production of manganese dioxide by the thermal decomposition of manganese nitrate, the improvement which comprises collecting the evolved gases from such a decomposition, heating a portion of such gases to a temperature at least as high as the decomposition temperature of manganese nitrate, and passing said heated gases into contact with ad-
additional manganese nitrate undergoing decomposition.

2. In a process for the production of manganese dioxide by the thermal decomposition of manganese nitrate, the improvement which comprises collecting the evolved gases from such a decomposition, heating a portion of such gases to a temperature at least 160° C., and passing said heated gases into contact with additional manganese nitrate undergoing decomposition.

3. In a process for the production of manganese dioxide by the thermal decomposition of manganese nitrate, the improvement which comprises collecting the evolved gases from such a decomposition, heating a portion of such gases to a temperature of about 400° C. to 500° C., and passing said heated gases into contact with additional manganese nitrate undergoing decomposition.

ABRAHAM L. FOX,
CARL JULIUS CHINDGREN.