The tubes were kept at 135°-140° for four and a half hours; no gas was over beyond that due to simple expansion, and not the slightest trace of either chlorine or ozone was found in any generator tube. No oxygen could be discovered. The mixtures upon testing were found to contain a considerable amount of chlorides. The temperature was raised to and kept at 150° for three hours and no chlorine or oxygen was produced. The quantity of chlorides seemed to be increased. At 173° all of the tubes began to evolve oxygen and so long as this temperature was maintained a steady but slow stream of oxygen was produced. No trace of chlorine, chlorine oxide or ozone was produced as high as 180°.

At this point the work was stopped for lack of time. Thus far a few conclusions may be provisionally advanced:

The conditions under which oxygen is ordinarily produced are not ideal, and the moisture always present materially influences the reactions. This moisture makes possible the production of oxygen at a lower temperature than in the case of dry materials, also the formation of chlorine or chlorine oxide, or both, as low as 125° and before oxygen is evolved. This may be due to hydrolysis of the potassium chlorate or chloride, thus allowing oxidation by the manganese dioxide. It is possible and even probable that no chlorine would be evolved at any temperature within the ordinary range of heating, if the materials were entirely free from moisture. In such a case, McLeod's explanation must fail, since if it be true, the formation of free chlorine is a necessary step in the evolution of oxygen.

This point, with others mentioned, will be more fully investigated by future work, and it is hoped that some facts of interest may be brought out during the investigation.

Action of Heat on Mixtures of Manganese Dioxide With Potassium Nitrate and With Potassium Bichromate.

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The fact that different metallic oxides mixed with potassium chlorate cause the latter to evolve oxygen at considerably lower temperatures than when heated alone has long been known, though the nature of the chemical action involved is not with certainty established. No work has been done, so far as I am aware, to see what the effect of these oxides might be on other substances decomposable by heat.

It seemed, therefore, of interest to investigate the subject, and especially the action of manganese dioxide on various substances, as the results might throw some light on the action between it and the chlorate.

The substances chosen for the preliminary work were potassium nitrate and potassium bichromate. When potassium nitrate is heated to a high temperature it loses one-third its oxygen and forms the nitrite. If molecular proportions of the nitrate and manganese dioxide are mixed and heated in a metal bath, little if any evolution of oxygen occurs below 285° C. Between that temperature and 350° C. there is a constant, though not rapid, evolution of a gas which gives the usual test for oxygen. The amount, however, is not large, and during the heating there are formed brown oxides of nitrogen. In the same bath was a tube containing the same weight of pure dried potassium nitrate but there was no evidence of any decomposition. During the heating some moisture collected in the colder part of the tube, but whether this had any effect in causing the decomposition of the mixture, as is found in the case of the chlorate, has not yet been determined.

When potassium bichromate is heated alone in a free bunsen flame little or no oxygen is evolved even at the highest temperature obtainable. When mixed with manganese dioxide, however, a steady stream of gas is evolved at a comparatively low temperature. The decomposition begins at 285° but does not increase greatly in rapidity up to 350°. The temperatures at which the nitrate and the bichromate decompose are so nearly the same that a similarity of action is suggested. Whether the oxygen comes from the oxide, the other substance or from both has not yet been determined. That the oxide has some effect in producing the evolution of oxygen is certain. The investigation will be continued along this and related lines and the nature of the actions will be thoroughly studied as soon as time permits. It will also be of interest to know whether such oxides as the one used will lower the temperature at which substances ordinarily decompose, but without the evolution of oxygen. Such a substance would be ammonium nitrate. This subject will also be inquired into. In the meantime I wish to reserve this field of investigation.