pensable, and that the results obtained by the use of chemical fertilizers will be in direct proportion to the amount of organic matter with which these fertilizers have been associated.—*L'Engrais*.

SEPARATION OF OXYGEN FROM THE ATMOSPHERE.

By H. N. WARREN.

THE diffusion or osmotic properties of a gas, when compared with another of opposed density, have been pointed out from an early date, perhaps one of the simplest means of observing the same being the swift passage of hydrogen gas when in admixture with one of greater density, through the pores of a moist membrane. So perfect, however, is this peculiar separation in the case of hydrogen when in admixture with an equal bulk of oxygen, the operation being performed in a caoutchouc bag kept weighted, that on examining the same after an hour's duration a sufficiency of hydrogen will be observed to have escaped, so as to totally destroy the explosive nature of the mixture.

By taking advantage of the peculiarity of caoutchouc to condense gases upon its surface, an apparatus has been lately constructed, and intended for the parting or partial separation of oxygen gas from the atmosphere as explained by the accompanying figure. It is composed of two somewhat powerfully exhausting syringes, A and B, the top extremity of each being provided with a cock, and connected to the same two small gas bags, the bottom or further extremity of each syringe being connected with a porous pot, D, provided internally with two disks of compressed charcoal, and charged with a preparation of finely divided caoutchouc, obtained by immersing the same, before using, in a solution of caoutchouc in naphtha. The outer wall of the porous cylinder is also provided with a tightly fitting jacket of very thin rubber, the pipe, E, in connection with the cork, C, being pierced with two small orifices, and terminating at the commencement of the second disk, and intended to remove the nitrogenous atmosphere remaining in the cylinder after the separation of the oxygen by means of the syringe, A. The piston rod of the syringe, A, being now raised upward, a vacuum is naturally produced within the porous cylinder, D, and being surrounded by the atmosphere, an inward pressure is at once experienced, the result being that the cylinder is partially filled with an atmosphere extremely rich in oxygen, and also with one in which nitrogen predominated largely, which, by

working the piston on either side of the cylinder with due care, may be collected in their respective bags, namely, O and N, intended for the reception of the same. On submitting both portions of these separated gases to examination, that portion obtained from the syringe, A, was found to be sufficiently rich in oxygen to readily rekindle a glowing splint, and even support the combustion of iron wire, results of several analyses proving an existence of 50 per cent. of oxygen, while the nitrogenous atmosphere collected by the opposite cylinder readily extinguished a lighted match when introduced into the same. By a slight alteration in the arrangement of the apparatus a mixture of hydrogen and oxygen was separated so effectively as to produce only the minutest quantity of water when separately made to ignite. Carbonic anhydride and various other gases in admixture with one another were experimented upon with a like result.—*Chemical News*.

NICKEL AND COBALT.

DR. KRUSS, of Munich, has recently reported that, from his examination of the behavior of the salts of nickel and cobalt, he has been able to demonstrate that neither of these bodies are elementary substances. The atomic weights of nickel and cobalt are, as is well known, almost identical, and Dr. Kruss considered that a redetermination of these constants might throw some light on the very close relationship which exists between these two bodies. Dr. Kruss has been engaged on a long and laborious investigation on the atomic weight of gold, and the important work which he has published on this subject has shown that his careful methods of procedure, and accurate work, could not be better employed than in an investigation such as the one he has undertaken.

The method suggested by Winkler for attacking this problem is based on the decomposition of gold chloride by nickel and cobalt, and thus the previous work of Dr. Kruss rendered him particularly suited for undertaking the investigation. He found that the gold separated in the reaction contained some substance which gave a green color in acid solutions, and a white precipitate on the addition of alkalis. By fusing oxide of nickel or cobalt with potash, and treating the melted mass with water, Dr. Kruss has obtained a solution which contained some of this hitherto unknown material, while the pure oxide of nickel or cobalt remains undissolved. The oxide of the common element present in nickel and cobalt oxides is of a white color, and readily soluble in hydrochloric acid. It can be reduced by charcoal to a brown metallic powder, and ammonium sulphide precipitates from its solutions a brown sulphide. It also appears that a small quantity of the chloride of this substance added to a solution of cobalt chloride changes its color from red to green, and the author is therefore of opinion that what has hitherto been considered nickel in solution is a mixture of the salts of cobalt and this new element. The quan-

tity of the new substance at present isolated has been so small that a further description of its properties and a determination of its atomic weight are postponed until the author is able to obtain larger quantities of the oxide.

At the last meeting of the Chemical Society, in London, Dr. W. J. Russell, F.R.S., gave a resume of the work which he has recently been engaged upon, and which contributes to the discussion on the constitution of these two elements. Dr. Russell has been studying the absorption spectra of solutions of the chlorides of nickel, cobalt, and iron, and has found that when the solutions are very concentrated and saturated with hydrochloric acid a very marked resemblance between the absorption spectra of iron and cobalt chlorides is noticed. The concentration of the solution appears to determine the breaking up of the general absorption, and bands of absorption make their appearance. Several of the bands characteristic of the cobalt chloride solution coincide in position with those obtained with a solution of ferric chloride, and this coincidence led the author to examine various samples of iron from different sources, in order to determine whether cobalt might not be present in some of the usual iron ores. He has found, however, that the spectra is given by all the samples that he has examined, and consequently his experiments indicate that iron and cobalt are, therefore, very nearly related. It may be that further investigation will show that iron contains the same element as the experiments of Kruss go far to prove is common to both nickel and cobalt. All three of these elements have atomic weights which are very close to one another, and their general chemical behavior is such as to tend to support such a hypothesis. It is well known that Prof. Crookes has on several occasions advanced views which give a complex nature to what have hitherto been supposed to be elementary atoms, and the periodic law has afforded little explanation of the closeness of the atomic weights of the elements which appear in the eighth group, to which these three elements belong.

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