THE VALUE OF HELIUM-OXYGEN ATMOSPHERE IN DIVING AND CAISSON OPERATIONS.

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The Bureau of Mines is interested in the problem of the health hazards encountered by men who work in compressed air in tunnel construction and other engineering operations. This is also of interest to the Navy Department on account of the possibilities for extending the range of salvaging and marine-engineering operations. The most important hazards are oxygen poisoning, produced by breathing high partial pressures of oxygen, and caisson disease.

By controlling the amount of oxygen present at any pressure, ill-effects can be avoided. As an example, if the oxygen present is reduced to 5 per cent. at 1 atmosphere a pressure of slightly more than 4 atmospheres is needed to bring the equivalent partial pressure of oxygen to normal, 20.9 per cent., and the concentration produced by 10 or 12 atmospheres would cause no harmful effects due to oxygen.

Caisson illness is a condition resulting from too rapid decompression of an individual after having been exposed to atmosphere at high barometric pressure. Bubbles of nitrogen are found in the body tissue and fluids during decompression or ascent in diving. Any gas that has a lower coefficient of solubility or (and) a greater diffusivity than nitrogen would tend to reduce the danger of caisson disease, as well as reduce the period of decompression for a given condition of exposure, but such a gas in addition would have to be inert like nitrogen as regards physiological effects. Dr. J. H. Hildebrand called the authors' attention to the fact that the coefficient of solubility of helium had recently been determined to be less than that of nitrogen, and that it might possibly be of use in caisson illness. In addition to the advantage of lower solubility, it appeared to the authors that the greater diffusivity of helium would be an additional advantage, resulting in more rapid and easier escape from the tissues and body fluids during decompression.

Accordingly the authors, who had been considering the compressed air problems, included tests in helium on their studies. Comparative experiments were conducted on white rats and later on guinea pigs with synthetic atmospheres of nitrogen and oxygen and of helium and oxygen, the results of which give data as to their relative value.

From a comparative examination of all data as regards to decompression periods and symptomatic and pathological findings, it is
evident that, with similar exposure and decompression periods, the condition of the animals exposed to the helium-oxygen mixture is much better than that of those exposed to the nitrogen-oxygen mixture. It may be safely said that for similar effects the advantage of the lessened decompression time of helium over nitrogen is somewhere in the order of 1 to 3 or 4.

In order to ascertain whether any discomfort would be caused from breathing helium, the gas was inhaled by several of the investigators for periods up to two hours. There was no noticeable effect, except a temporary rise in the pitch of the voice. The gas was found to be as agreeable and pleasant as normal air.

The possibilities of the use of the helium-oxygen atmosphere may be for extended depth and time of submarine operations; also for the prevention of caisson disease in tunnel and caisson workers, and by using the mixture as a wash gas during decompression among tunnel workers.

THE ADRENALS AS DOMINANT FACTORS IN TISSUE RESPIRATION AND THEIR BEARING AS SUCH UPON ANÆSTHESIA.

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Recalling that the leading fundamental problem of medical science, the nature of tissue oxidation (including its corollaries fever, haemolysis, autolysis, etc.), is still unsolved, as indicated by Prof. Halliburton's statement (1921) among many others, that "our knowledge of tissue respiration is so scanty that we can say but little of its pathological bearing," Dr. Sajous submits that this obscurity, which retards correspondingly the study of the effects, normal and pathological, of anaesthetics, may be eliminated by advanced knowledge of the functions of the ductless glands.

He points out that the independent researches of many physiologists, biochemists, pharmacologists and clinicians, considered collectively, have sustained his own interpretation of the functions of the ductless glands and that several of these organs are the dominant fundamental factors in tissue respiration and thermogenesis.

According to Dr. Sajous, the adrenals carry on these functions by means of their three dominant constituents, one which he termed "adrenoxidase" in 1907, and the familiar lipoids, lecithin and cholesterol. (1) Adrenoxidase, the secretion of the adrenal medulla (the active principle of which is adrenalin) is a catalytic enzyme forming part of the haemoglobin which enables this pigment to become converted into oxyhaemoglobin on exposure to the pulmonary air, and to supply the tissues with activated oxygen; (2) Lecithin, a product of the adrenal cortex is a lipoid containing 3.88 per cent. of phosphorus, found in all tissues (in the brain as cephalin, in the heart as cuorin, etc.) which is oxidized catalytically by the adrenoxidase...