ing these structures with the exterior is mechanically adapted to relieve internal pressure readily.

The mechanical effects of atmospheric pressure change on gases enclosed within soft-walled structures, such as the gastrointestinal tract, are quantitatively different in the two ranges of pressure, in that the partial pressure of water enhances the volume change on decrease in pressure in inverse proportion to the absolute pressure. On increase of pressure there is no deleterious effect.

The effects of the partial pressure of oxygen with change in atmospheric pressure are qualitatively different in the two ranges of abnormal pressure. At increased pressures there is a tendency for "oxygen poisoning" to increase in proportion to the absolute pressure above a relatively low limiting value. At decreased atmospheric pressure there is, conversely, a progressive asphyxiation due to interference with the oxygen transport to the tissues and finally with the pressure-labile oxidative processes in the tissues.

The effects of the partial-pressure changes of inert gases are qualitatively similar in the two ranges of atmospheric pressure, in that reduction of pressure leads to supersaturation of the dissolved gases, with the consequent danger of the formation of bubbles within and without the vascular system. The causal relation between bubbles and the symptoms of decompression sickness is not wholly established, but the immediate relief of symptoms by recompression indicates a real relationship.

At high atmospheric pressures there is observed an additional effect on the central nervous system that has been attributed to the inert gases. A causal relation of carbon dioxide to it has been suggested in view of the lack of chemical activity of the inert gases, but neither approach can fully account for the observed effects. At low atmospheric pressures the biologically active gases produce such marked effects that no observations on the part played by inert gases, except as passive diluters of the oxygen, have been made.

At present, there are three extensive bibliographies of the literature in this field.[42,93,94] It is hoped that the references given here to reports of restricted circulation will aid the reader as an indication of the existence of the work and a subsequent search of the abstracting journals may reveal the ultimate place of publication.

[93] E. C. Hoff and J. F. Fulton, *A Bibliography of Aviation Medicine*. Thomas, Springfield, Ill., 1942, p. 237.

[94] E. C. Hoff and L. J. Greenbaum, Jr., *A Bibliographical Sourcebook of Compressed Air Diving and Submarine Medicine*, Vol. II. NAVMED-P-5033, Office of Naval Research and Bureau of Medicine and Surgery, Department of the Navy, Washington, D. C., November 1952.

CHAPTER XVIII

Industrial Noise and the Conservation of Hearing*

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Probably the best-known case of occupational loss of hearing is that of Quasimodo, the hunchback bellringer of Notre Dame. The events of this famous Victor Hugo novel took place in France in the year 1482. Centuries later during the industrial revolution medical science took note of the problem by coining the term "boilermaker's deafness." Only during the past few years, however, has society as a whole become aware of the harmful effects of extended exposure to intense noise. The recent widespread interest in the problem results from a combination of several factors.

The continued increase in the number of workers exposed to intense noise is probably the most important factor. From the time man first began to work metal he has produced sounds different from those of his natural environment. As civilization has developed man has found more and more ways of having machines do his work, and each new machine added to his exposure to noise. Since industrial development was quite gradual, the increase in noise was gradual and has, until recently, been endured by all concerned without much protest. So great is the number of people now affected and so intense are some of the new noise sources, that industry can no longer afford to overlook the problem.

Coupled with this increased number of severe noise exposures is a general transfer of the responsibility for an occupational disability from the worker to the employer. With the passage of modern workmen's compensation laws this transfer has been accomplished for most traumatic injuries and occupational diseases. The burden of the responsibility for occupational hearing impairment is now shifting and eventually will surely be placed entirely on industry.

This shift in responsibility would be impractical without certain technological advances in the fields of acoustics and audiometry. The electronic audiometer has made reliable and repeatable hearing measurements possible in clinical circumstances. Improvements in noise-measuring equipment, at last, make it feasible to express a man's noise exposure quantitatively; and the tremendous strides made recently in the field of noise reduction promise a satisfactory solution to the problem through engineering control.

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