tion of this allegation, the puzzling experience related to me by Captain Shaler may be cited: "The window-glass of the officers' quarters, at the testing-grounds at Sandy Hook, situated some three to five hundred feet to the westward of the gun park shown in the picture, are liable to be shattered by the concussion of large pieces in practice, and it has been found that the glass is forced *outward* at one time, and *inward* at another." Regarding the drum-heads as window-glass under like conditions, we might find them ruptured by compression from without in one instance, and by distention of intra-tympanic air in another.

All of us are aware of the difficulty of ascertaining the source of sound in a sea-fog, where vapor-tension varies in a much greater degree than inland. Professor Henry described the reflections of sound which here take place as 'acoustic shadows,' — a picturesque comparison, recognizable by every one familiar with those similar phenomena, namely, the reverberatory detonations of thunder during a storm, where clouds or mountain-peaks intervene. It is to the unrecognizable 'vapor-peaks' that many unexplained and puzzling acoustic manifestations are due. In the case of Corporal Ingram, cited, the wave from the blast did not nearly so much affect the right ear, which was turned toward the shell, as the left one, the sound having been apparently deflected from its course by the heavy gun-carriage intervening.

Experiments are wanting to determine the windage [1] of balls. This must depend on their size and velocity, nearness of passage, and the force and direction of the wind. There seems to be no doubt but that the windage of a cannon-ball might rupture the drum-head of the ear. The compression of the air before and around the ball, I am informed by my friend Prof. A. M. Mayer, is considerable; and the *velocity* of the compression is equal to that of the ball, which velocity may even exceed that of wind itself. So an *aerial blow* of such a mass of air, at such high velocity, is probably quite sufficient to rupture the drum-head.

The size and force of modern military explosives having been greatly increased of late years, much more injury to the ear is likely to occur in future than has been recorded of the past, though the number of accidents from premature discharge, or from exposure to the blast in firing breech-loading pieces, must be less than when muzzle-loaders were in vogue.

It is the experience of many officers that the vibrations of great intensity which are given off from some field-pieces and bursting shells, charged with high explosives, are more disagreeable than the heavier sounds of great guns. The metal itself vibrates under these circumstances similarly to a tuning-fork.

A very disagreeable jar is imparted to the temporo-maxillary articulation when the individual is near a great gun being fired off. This is lessened, it is believed, by standing on the toes and leaning forward. Some simple precaution, to be employed by officers and men during artillery practice, would seem very much needed, since aural shock is not only painful and distressing, but orders cannot be well heard while the confusion lasts.

There is probably no better protection than a firm wad of cotton-wool well advanced into the external auditory canal. In suggesting this protection, it is believed that harm can seldom take place from pressure of air from within, since it is known that the violent introduction of air into the tympanum from the throat, by means of Politzer's method of inflation, seldom ruptures the drum-head; though, if such a volume of air were suddenly driven into the external auditory canal, the drum-head would in nearly all cases be ruptured.

The writer, in finishing this account of the aural injuries done by the explosion, would request that other observers having experience in this direction kindly communicate with him. Any knowledge that may thus be contributed would be of service to military surgeons, otologists, and others.

SAMUEL SEXTON, M.D.

[1] 'Windage', it should be said, is a technical term used in military parlance to indicate the difference in diameter between the bore of a gun and its projectile. The wo d has been, perhaps improperly, adopted by writers on military surgery, in which sense it refers to the impact of the condensed air surrounding a missile passing near any part of the body.

MINING INDUSTRIES AND MINERAL RESOURCES OF THE UNITED STATES.

Tenth census of the United States. Vol. XV.: Report on the mining industries of the United States (exclusive of the precious metals). By RAPHAEL PUMPELLY. Washington, Government. 4°.

THIS report supplements those previously issued on the precious metals, and on petroleum, coke, and building-materials; and these volumes together constitute a very complete account of the mining and quarrying industries of the country for the census-year.

The appearance of this volume, nearly two-thirds of a decade after the close of the census-year, is neither timely, nor creditable to those responsible for the delay; for the practical interest and usefulness of works of this class, except, perhaps, for students of economics, diminish rapidly

with the lapse of time. Fortunately, however, this volume also possesses features of more permanent value than mere statistics, to the students of American mining and geology. This is especially true of the extended section on the iron ores, which certainly is a boon to every student and teacher of economic geology. The treatment, both statistically and geologically, is well-nigh exhaustive. The geologist will find here a profusion of maps, sections, and diagrams, showing in all desirable detail the geographical and geological distribution of all the principal varieties of iron ore mined in this country; with an account of the extent, structural characteristics, and chemical composition of every important deposit, and, in most cases, of every important mine. The geological material, where not original, is collected from widely scattered and comparatively inaccessible sources; so that, even if regarded merely as a compilation, this treatise on the sources of our most valuable metal ranks, as a contribution to the popular knowledge, with the most important monographs of the national survey. Of the statistics of the production of iron ore in the census-year, it is sufficient to say, that, like the statistics of the tenth census generally, they are very full, and are presented in every interesting and instructive aspect.

The section on the iron ores is followed by that on the coals: and this part of the report is, for the eastern United States, very summary, and chiefly statistical; the statistics being illustrated, however, by a series of maps showing the general distribution of the coal-measures, and the production by counties. In his meagre description of the coal-fields of the eastern United States, Professor Pumpelly has evidently been influenced by the fact that very satisfactory accounts of most of them are now accessible to the public in various general works and state reports, and especially in the report of the second geological survey of Pennsylvania.

But any deficiency here is fully compensated in the very full report on the cretaceous coals and lignites of the north-west, especially on the line of the Northern Pacific railroad, in Montana and Washington Territory.

In short, Professor Pumpelly has made this volume a medium for the publication of some of the results of the northern transcontinental survey, carried on for two years (1881–83) under his charge. It is a substantial and timely contribution to our knowledge of the geology and resources of the most imperfectly known section of the country. The report is profusely illustrated by beautifully drawn maps and sections.

The remainder of the volume is devoted mainly to the usual statistics of the production of the base metals, — copper, lead, zinc, — and of the minor economic minerals, such as mica, asbestus, asphaltum, barytes, chromic iron, emery, graphite, kaolin, etc.; but it concludes with an extended and well-arranged directory of the mines and metallurgical establishments east of the 100th meridian, and of the mines of bituminous coal and lignite in the eastern states and territories.

Mineral resources of the United States, 1885. By DAVID T. DAY. Washington, Government. 8°.

This is the third of the series of annual octavo volumes on the development and production of the mines of the country, published by the U. S. geological survey; and since it represents the condition of the mining industries at the middle of the decade, it supplements in an important way the census volumes already referred to, bringing the statistical portions of these, especially, nearly up to date. These annual volumes cover the entire range of economic geology, including building-materials and fertilizers, and, besides the statistics of production, are replete with descriptions of new developments, and notes on the condition of allied industries, and on processes for utilizing materials which have no value at present.

SOME AGRICULTURAL REPORTS.

Report of the viticultural work during the seasons 1885 *and* 1886. (Univ. Cal. coll. agric. rept., 1886, Appendix No. 6.) By EUGENE W. HILGARD. Sacramento, State. 8°.

THIS report records the continuation and extension of Professor Hilgard's well-known viticultural work of former years, which has done so much towards developing the wine industry of California, and placing it upon a rational basis. The general scope and purpose of this work, as defined by Professor Hilgard, is to aid in "the establishment of more definite qualities and brands, resulting from a definite knowledge of the qualities of each of the prominent grape varieties, and of their influence upon the kind and quality of the wine in blending."

With this end in view, work has been done chiefly in three directions, — first, as a means of rectifying nomenclature and aiding in identifying varieties, a standard vine collection is being formed; second, a considerable number of samples of grapes have been made into wine on a small scale at the viticultural laboratory, and the course of the fermentations and aging of the wine and the quality of the product have been followed; third, representative samples of wine from different localities, and different varieties of grapes, have been analyzed. Some comparative experiments upon different methods of fermentation