

In regard to material equipment, the author holds views of a very advanced character. Necessity is not the mother of invention; knowledge and experiment are its parents. This is clearly seen in the case of many industrial discoveries; high-speed cutting tools were not a necessity which preceded, but an application which followed, the discovery of the properties of tungsten-chromium-iron alloys; so, too, the use of titanium in arc lamps and of vanadium in steel were sequels to the industrial preparation of these metals, and not discoveries made by sheer force of necessity. Much the same consideration applies to the equipment of an industrial laboratory, where the most useful tools were often acquired with no idea of the uses to which they would ultimately be put. "No good tool lives long for a single use alone. Many times we have questioned the advisability of installing some new apparatus—a vacuum furnace, a pair of metal rolls, some special galvanometer, some microscope, a hydraulic press, a power hammer, a steam digester, &c. Never, after it became a part of the equipment, has it seemed possible to proceed without it. In the single case of the electric vacuum furnace, for example, our laboratory has made almost continual use of from three to eight for the past five years. The laboratory, piped several years ago with high vacuum and with electrolytic hydrogen, besides steam, air, water, and gas, will probably never operate without them."

Similar considerations apply to a library. A library containing ten of the leading research journals of the world may be said to have in each volume about 100,000 brain-power hours, and it would be folly not to utilise a charged storage-battery of this immense capacity when it can so readily be installed.

SOME RECENT APPLICATIONS OF OZONE.

ALTHOUGH ozone has now been definitely known for nearly seventy years, its commercial production and exploitation is one of the many bye-products that have resulted from the modern development of electrical engineering. The "Ozonair" Company, of 96 Victoria Street, Westminster, has taken advantage of these developments to produce a series of compact and (in many cases) portable ozonisers which can be connected directly to the ordinary lighting circuits and set in operation by means of a couple of tumbler switches, one controlling a fan or blower, and the other a coil or transformer for energising the aluminium gauze in contact with which the ozone is produced. The simplicity of these arrangements should prove an important factor in securing the general utilisation of ozone in all those cases in which its usefulness has been conclusively demonstrated.

Most of the new designs are intended for the purification of air, and in the case of large buildings their utility and efficiency can scarcely be doubted. In a small room or in close proximity to a generator, the presence of an excess of ozone might well be disagreeable, as those who have worked with it have good reason to know, but in a crowded hall the atmosphere of a public meeting would stand to gain enormously by the freshening and purifying effects of one or two well-placed ozonisers. In cases such as the above it is difficult, and in many buildings impossible, during the winter to introduce enough air from outside to prevent the atmosphere from becoming "stuffy," but the most dangerous and unpleasant effects might well be got rid of by means of ozone.

This general idea has been worked out into a definite and novel scheme of ventilation, which is acquiring considerable popularity in Russia, where warmth and freshness have usually presented themselves as alternatives rather than as compatible qualities, and in the tropics, where the introduction of large volumes of air from the outside is sufficient to destroy whatever remnants of coolness may be retained by the use of verandahs and other devices for excluding the glare of the sun. In each of these widely differing circumstances the method used is to withdraw air from the room, purify it by screening, washing, and ozonising, cool or warm as the case may be, and return it to the room with a sufficient admixture of outside air to keep the proportion of carbon dioxide within reasonable limits. In this way a great economy of

heating or cooling is achieved, whilst the wholesomeness of the atmosphere is fully maintained.

The sterilisation of air by means of ozone has found a widespread application in brewing, where it replaces with great advantage the cumbrous and only partially effective systems of air-filtration that have been employed to protect the wort during fermentation, cooling, refrigerating, and bottling; it is also of service in protecting the yeast from contamination whilst it is being drained off from the wort.

An application of ozone of a more familiar type is in the bleaching of palm-oil for soap-making. This has usually been effected by means of bichromate and muriatic acid at a cost which may amount to as much as 30s. per ton. The bleaching of the oil by ozone is very effective, even in the case of specially bad samples, and costs little more than a tenth of this sum; in addition, the dark sediment that is thrown out during purification is much smaller in bulk, and the waste of oil is therefore greatly reduced.

It is claimed that the ozonised air produced by the new types of apparatus is entirely free from oxides of nitrogen, a point of considerable importance in many of its commercial applications.

AMERICAN ECONOMIC ENTOMOLOGY.

ACCORDING to the twenty-fifth report of the State Entomologist on the noxious and beneficial insects of Illinois, the scope of the work of the Entomological Department of that State has been very largely increased as the result of special legislative enactments, and the present report is the first to be drawn up under the new conditions. Its contents consist of three articles, one on experiments to check the corn-root aphid, a second on the habits of the corn-field ant (*Lasius niger americanus*), and a third on the insects infesting clover and alfalfa. Since all three have been already issued as Bulletins of the Agricultural Experiment Station of Illinois University, they need not be further noticed.

The mites of the group Oribatoidea form the subject of an article in vol. vii. of the Bulletin of the Illinois State Laboratory of Natural History. These mites, which are not much larger than the head of an average pin, are characterised by their hard, chitinous integument, on account of which they are commonly spoken of as beetle-mites, although they are not to be confounded with the mites infesting coprophagous beetles. They are generally found under decaying timber, beneath bark, under stones, in moss or grass, or on the twigs of trees, and do not appear to inflict any special damage on crops. In the present article Mr. H. E. Ewing describes a number of new species.

In article 2 of vol. viii. of the same publication Mr. J. D. Hood gives descriptions of new generic and specific types of thrips of the group Thysanoptera from Illinois.

Army-worms and cut-worms infesting sugar-cane in the Hawaiian Islands form the subject of Bulletin No. 7 of the Entomological Division of the Experiment Station of the Hawaiian Sugar-planters' Association, published at Honolulu. Of the various species of "army-worms," the widely spread *Cirphis unipuncta* is abundant in the islands, but the larvæ do not seem to assemble in the hordes which have given rise to the name of the group. They inflict, however, considerable damage on young sugar-cane, although, fortunately, there is an interval between the disappearance of one brood and the development of a second, which affords time for the plants to recuperate. The numbers of the grass army-worm—the caterpillars of the moth *Spodoptera mauritia*, a species indigenous to Mauritius, western Africa, and the Oriental and Australasian regions—have been kept in check in Hawaii, where they formerly did much damage, by the introduction of myna birds from India.

Since weevils are a group with which the economic entomologist has many dealings, reference may be made here to a paper on North American Curculionidae, by Mr. W. D. Price, published as No. 1708 of the Proceedings of the U.S. National Museum. A number of new species are named and described.