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The Month in Focus

INCREASE of production facilities since the beginning of the war has been tremendous. These facilities of course have not been limited to manufacturing but have included equipment and plants for the production of raw materials which are utilized in construction and manufacture. Everyone is conscious of the effort devoted to the expansion in the production of steel, aluminum, magnesium, and other materials.

Production of Magnesium

The growth of the magnesium industry is particularly interesting, and has given rise to much discussion of whether or not the construction of facilities for the production of magnesium has been overdone. The annual capacity of all magnesium metal plants in the country for 1943 was approximately 580,000,000 lbs., and in February of that year it was estimated that the annual requirement for this metal for aircraft purposes and for alloying with aluminum would be about 170,000,000 lbs. Whether or not this capacity is being or will be fully utilized will not be discussed here. That is a broad and general question of economics. However, this issue of *Engineering and Science* carries an excellent article by Dr. Paul D. V. Manning on magnesium and its production. Another chapter of the magnesium story, pertaining to the development and improvement of alloys, is yet to be written. However, before that story can be told, more research must be done. This will be an exceedingly interesting development to follow for there are some inherent difficulties related to the structure of magesium, and until these problems are solved the widespread engineering use of this interesting metal and its alloys may be subject to question.

The Electron Microscope

In the field of scientific instruments, the electron microscope has recently created wide interest. Its relative newness does not permit a statement of its ultimate range of usefulness. Dr. Charles S. Barrett presents, in this issue, a clear picture of the essential features and some of the uses of the electron microscope. Although several illustrations of its use are presented, the reader will also realize that there are certain limitations to the application of this instrument. At present it is not possible to interpret all that is seen in a photograph made on the electron microscope. The instrument is another tool which physics has made available to other fields of science and through which it may be possible to obtain a fuller knowledge of the properties of engineering materials.

Aircraft Plant Engineering

The vast amount of effort associated with constructing and equipping a large aircraft plant is presented by Frank Clayton in his article on the Fort Worth Plant of Consolidated Vultee. The coordination required in an undertaking of such magnitude requiring speed was remarkable and the project illustrates the combined use of the many branches of engineering involved in such an enterprise.

Is Engineering a Profession?

In discussing the ramifications of engineering, one frequently hears the plea that engineers should be designated as a professional group. There have been frequent attempts to place the engineer in a category comparable to that of the physician or lawyer. It is difficult, however, for engineers to form a unity because of the extensive scope covered by their various fields. This fact was presented by Herbert J. Gilkey in the March, 1944, issue of the "Journal of Engineering Education": "To be at all comparable in scope to engineering, medicine would have to embrace everything from the delivery of a baby to the disposal of a carcass, from the manufacture of drugs and instruments to the performance of a tonsillectomy on a giraffe." Engineering is not a unit since it comprises many diversified activities including electrical, mechanical, civil and chemical engineering. Engineers with a degree of common interest may belong to the technical society representing that field; but membership in one organization is not sufficient, for the individual engineer has interests in other societies covering overlapping fields. This diversification of interest is probably the principal deterrent to unity. For instance, one civil engineer may be concerned with construction, incorporating an interest in the properties of construction materials and the influence which various methods of utilizing these materials has on the strength of the structure. He is further concerned with the methods of testing component parts of the structures and must assist in the establishment of codes for construction in order

(Continued on Page 18)

education of the prospective magnesium user to overcome his fears of magnesium fires. Many years ago both gasoline and kerosene were thought to be so dangerous that neither would ever be commonly used. Today the inflammability of gasoline has been greatly increased and yet it plays a very important part throughout the entire daily lives of all of us. Dangerous? Yes, but only under certain conditions and certainly not when one knows how to handle it.

Most people do not realize that in every magnesium incendiary bomb is some thermite, a mixture of aluminum powder and iron rust. This mixture is first ignited and it is this that sets fire to the magnesium. Magnesium will burn but only if heated to 1,250 degrees Fahrenheit in the presence of air or an oxidizing material.

As to the fields where magnesium may be expected to make its first showing after the war, the following appear most worthwhile considering:

Lightweight household appliances, vacuum cleaners, sewing machines, refrigerators, furniture, folding tables, washing machines, ironers, dish washers and driers, clothes driers, ventilating and other fans, small motors, can all be made of greater usefulness with magnesium. Window shades, screens and frames for the windows themselves are possibilities.

In the field of transportation, by airplane, by automobile and by train, magnesium undoubtedly will fill a tremendous demand. Its use in airplane construction is increasing, and the per cent of the total weight of the plane that is magnesium continues to increase in present manufacturing practice. The advantages in airplane, rail and ship transportation obtained by use of light metals and alloys are quite obvious.

In the field of automobile manufacture, with continued high gasoline taxes it seems quite probable that the need for higher gasoline mileage to guarantee economical transportation will require lightweight cars.

In commenting on various possible uses for magnesium, Dr. Colin G. Fink suggests the use of magnesium for coins. Speaking of magnesium instead of copper pennies, Dr. Fink says, "There are approximately 1,000,000,000 copper pennies in circulation equivalent to 6,600,000 pounds of copper. The peacetime production cost of copper is six cents per pound as against about 14.5 cents for magnesium. For the same sized coin, the magnesium penny weighs but one-fifth the weight of the copper penny. In other words, 1,320,000 pounds of magnesium pennies at a base cost of $191,400 would replace 6,600,000 pounds of copper pennies at a base cost of $396,000. There is only enough copper in the world to last industry 40 years as against 10,000 years for magnesium."

In considering the possible future uses for magnesium and light metal alloys, it is difficult to find applications in which they cannot serve.

The Electron Microscope

(Continued from Page 13)

positive means of identifying the material. The microscope combined with the diffraction attachment becomes a research tool that is particularly advantageous for pigments, dusts, and various chemical preparations. Its usefulness in varied fields of research may lead in the future to an instrument in which individual particles only 50 atoms or so in diameter can be singled out of a sample of powder, photographed and then identified by "Submicroscopic chemical analysis," either by the diffraction method or by an analysis of the velocity of the electrons that emerge from the particle.

Windowless Factory

(Continued from Page 8)

volt equipment is supplied through 50 kilovolt-ampere, 440-120/208 volt, three-phase, air-cooled transformers installed at regular intervals throughout the plant. In general, each serves three multibreaker panel boards from which current is extended by conduit or through the underfloor duct system which is extended throughout most factory areas. Balance is maintained as closely as possible between phases.

CONCLUSION

To evaluate a "controlled conditions" plant properly in relation to traditional factory construction requires exhaustive analysis beyond the scope of this article. Certain advantages, however, are obvious. First, product quality and uniformity have a better chance of being maintained at a high level. Second, and especially in a severe climate, employee comfort and efficiency are greatly improved. Third, inaccuracies due to expansion and contraction can be held to a minimum. This is very important as assemblies of light metals get larger and larger, and for accurate machining of large light structures. Fourth, corrosion from both atmospheric conditions and handling is reduced.

The only serious disadvantage which has become apparent is that of increased investment and operating cost. This is a disadvantage only when full production is not maintained. In this respect it may be compared with a high-production special machine tool versus a less expensive but more common type.

For mass production, the special tool and the "controlled conditions" factory both have an outstanding place in the future of industrial development.

The Month in Focus

(Continued from Page 3)

that the public may be assured of safety. Another civil engineer may be concerned with the construction of channels, involving a knowledge of hydraulics as well as features of construction. Such differences may be cited in other branches of engineering. Thus it is apparent that the complete unification of engineers into a single professional group is difficult and that there are major barriers to the realization of this ideal. Some fields of engineering have been legally professionalized by several states in requiring licensing of those who wish to practice publicly. It is probable that more extensive developments will take place along these lines which will place the various fields of engineering on a professional basis in the eyes of the public.

Those who read "Mechanical Engineering" may have noted in the May issue the article by Hans Ernst on "High-Speed Milling with Negative Rake Angles." These developments originating on the Pacific Coast have led to greatly increased rates of production in milling operations. In this work, carbide-tipped cutters have been and are being operated at cutting speeds in excess of 500 feet per minute and with unusually high feeds. Some of the advantages obtained with these methods are higher production, improved finish, and less distortion of work due to heat. Naturally, these developments present many problems which require research to establish the soundest procedures. As a part of a program of studying milling operations under these new conditions, California Institute of Technology is conducting certain studies which will be interesting to watch. In his article in "Mechanical Engineering," Hans Ernst presents some interesting data in this connection.