THE ROMANCE OF MATERIAL USE

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Materials obviously play a most important part in our engineering work. Without the light but strong alloys now so much in evidence we would not have today's perfection of the airplane or the automobile. Without tungsten whose uses have only been really known recently we would not have our electric illumination nor our radio. It is therefore interesting to reflect how much of our present-day civilization is due to a new use of materials.

One curious fact that shows up in an advertising light is that the work of our pioneer engineers was done with an exceedingly limited knowledge of materials. These early workers in the field had roughly some half dozen materials to draw from and no others. Let us count them—cast iron, cast steel, mild or low carbon steel, tool steel, bronze, brass, copper, lead, tin, and zinc.

Benz and Daimler built their early automobiles from these materials and no others. The Forth Bridge, the Brooklyn Bridge were built with only a knowledge of these; our big shipping industry, our railway industry also had their foundation in this little list. The metallurgical students of those days had simple metals and simple facts to study, but they were on the verge of great discoveries.

It is very remarkable that these discoveries and developments have practically all taken place in the last thirty years. In the engineering lifetime of many of our faculty members have come about tremendous increases in the knowledge of men regarding materials.

I remember the first piece of aluminum I saw, about 1902. It was exhibited as a curiosity. Its price, if I remember rightly, was about 200 dollars per pound. Contrast this with today's production of aluminum and its alloys which threatens to become commensurate with the tonnage of steel produced at a price of some 20 cents a pound.

Now comes a third remarkable thing and that is that our so-called new materials have been known for years, having been discovered by chemists perhaps as much as a century before. This fact clearly shows how necessary it is to have different types of mind to work on problems. The chemist is the discoverer, but experience shows he cannot develop his work commercially. It needs the vision of the metallurgist, the chemical engineer or the manufacturer to see the possible everyday uses.

Let us study some of the materials that have come into commercial use these last thirty years and trace their history.

Actually, the Romans had an inkling of the presence of this metal and called a derivative alumen. The matter lay at this stage till about 1800 when Sir Humphrey Davy almost discovered the metal but could not actually isolate it. Lavoisier, the famous French chemist, also visualized the metal but said that it could not be isolated by carbon reduction processes. Not until 1882 was the metal actually isolated, and to the brothers Cowles goes this credit, but still it was only a laboratory element—a matter of curiosity. In 1907 it was first produced on a commercial scale. The chemical engineer should distinctly get the credit for this wonderful commercial discovery. He has opened up the tremendous uses in the automobile and aircraft industries. Incidentally, aluminum no longer stands alone, but is combined with many other elements to form the most diversified series of alloys we know. We are even now experimenting with the alloying of aluminum with steel to form a material which will respond to nitride hardening.

Magnesium has a similar history. Davy again discovered this metal in 1808 but did not isolate it. For many years it was a plaything of the fireworks manufacturer and the photographer who used it for flashlight work. Metallurgists and chemical engineers then began to study it for possible use in the aeronautic and automotive industries and within the last few years the magnesium piston of great lightness, strength, and wear-resisting qualities has been adopted for gasoline engines. Alloyed with aluminum it has tremendous potentialities whose surface we are just scratching.

Now let's turn to tungsten, the basic metal of our incandescent bulbs and our radio tubes and now in this past year of 1930 found in its alloy with carbon to produce wonderful properties in tool materials. Tungsten Carbide or Carboloy tools bid fair to effect another revolution in the machine tool and manufacturing business. Higher speeds, greater feeds, longer life, less setting up delays will effect a great decrease in our costs of production. Yet tungsten was known in 1781 when K. W. Scheele the chemist discovered it. It was, however, not used commercially until about 1890 when Musket tool steels of great hardness and resistance qualities were introduced. Tungsten, long a rarity, now promises to be one of our most valuable metals.

Now let your fancy roam around the steels. Steel is no longer steel. It may be one of a hundred materials. Alloyed these last thirty years with chromium, nickel, manganese, aluminum, molybdenum, copper and silicon it becomes some material of great strength yet significant lightness. The history of steel alloys, altogether too long for this article, is one of the most romantic in engineering literature.

Finally, just a few words on our most recent gas, helium, which has rendered the transport of airships so safe.

Helium was discovered in 1868 in the sun but not until 1894 was it discovered to be present on the earth. Its quantities are still thought to be small and the expense of producing it great, but since the history of other materials has been similar, so we may hope, as fleets of dirigibles appear, that helium may become increasingly available.