BORN at San Angelo, Texas, in 1895, Eugene Holman graduated as M.A. at the University of Texas in 1917 and entered the oil industry. For some years he was engaged mainly on geological investigations. In 1942, he was appointed a Vice-President of the Standard Oil Company (New Jersey), which, in terms of total assets, is the largest industrial corporation in U.S.A. today. At the age of 49, he became President.

Eugene Holman is a "working" director and is, by his own definition, a "professional manager." He combines knowledge, judgment and an unusual ability to take the long view, and he has, too, a disarming common touch.

Mr. Holman subscribes to the view stated in an organisation manual issued by his Company: "To maintain a business climate favourable to reasonable profit making, management must impose upon itself a proper concern with many social responsibilities. No business exists in economic isolation. It is part of the economic and social environment of its time. Its policies and actions affect many segments of that environment — and in turn are affected by them."

At our invitation this article was specially prepared by Mr. Holman for publication in "Review."

Enough for All Men's Needs

By EUGENE HOLMAN

President, Standard Oil Company (New Jersey)

THE peoples of the world are using up raw materials at a rate never equalled before. The expanding economy of the post-war years plus the present unhappy need for rearmament has resulted in the new high rate at which we are taking minerals from the earth. Perhaps it is no wonder, therefore, that some people fear we are in danger of exhausting our natural resources. But I am convinced that this fear is groundless. In fact, I believe that, under certain circumstances, the natural resources of the world may be considered inexhaustible. For the record of the past indicates that natural resources will always be available for our use as long as men have the freedom to acquire knowledge and the incentive to put their creative talents to work.

In prehistoric times, men used simple tools, such as axes and picks, made from stones that were readily available on the earth's surface. With these tools they were able to create societies, and within these societies they gathered knowledge of the natural world. As their knowledge accumulated, they used their tools to obtain some of the softer metals, especially copper and tin. They fashioned more and better tools. In time, they moved on to the Bronze age, and thence to the

threshold of the modern world, the age of Iron. Each step was characterised by an accumulation of knowledge and by the use of the minerals which that knowledge made available. When humanity stepped from the age of iron to the age of steel, it had already stored up a vast amount of information and analysis concerning the natural world. There was also a formidable array of important tools—levers, pulleys, wedges, hooks and gears. The age of steel was born with a far richer heritage of human knowledge and natural resources than any other previous age.

The steplike pattern of development from age to age is marked by two outstanding features. First, it proceeded at a geometric rate. Each successive age was shorter than the age before it. The stone age lasted tens of thousands of years. The steel age, in spite of its astonishing achievements, is not yet a hundred years old. And, second, each upward step was dependent upon the knowledge accumulated in the age before.

THE point is that in every age it was the *use* of all available materials that supported societies in which men could gather knowledge. Increased knowledge, in turn, has invariably led to an increase in the number and kinds of raw materials men have had to work with.

Thus we see that true conservation has never meant the hoarding of raw materials. On the contrary, the very use of raw materials stimulates the search for more sources and new kinds of materials. Conservation, therefore, is intelligent, efficient use. Not profligate waste, of course, but not hoarding either.

The picture becomes clearer as we look at present day developments. As far as natural resources are concerned, the twentieth century has, in an almost literal sense, inherited the earth. There are new metals and new sources of energy in the offing. There are new uses of familiar materials, and faster, more efficient ways of discovering new sources of familiar materials. And there are materials, produced by the synthesis of organic compounds, that have made their appearance for the first time.

In my own industry—oil—I have seen how constantly increasing knowledge, stimulated by growing use of petroleum products, has helped expand the sources of crude oil. When I was in the field as a geologist I often heard people predict that the world's supply of petroleum was rapidly running out. Back in the 'twenties, one man solemnly proclaimed that he had figured the last oil well in the United States would go dry in exactly ten years. I don't know where that prophet is today but I hope he is better informed. The proved reserves of oil deposits in the United States are now at an all-time high, despite the fact that since 1941, the consumption of petroleum, for war and peace, has been enormous. The same is true of proved reserves all over the world.

This expansion of oil reserves was made possible largely because the oil industry produced and used the oil at its disposal, and thereby developed the means, financial and technical, to find more oil. One new device that is helping find new oil fields today, for instance, is the airborne magnetometer. Improved drilling methods now permit deeper strata to be reached, and today's geologists have means of determining oil structures more accurately.

In addition, oil men are learning how to get more oil out of reservoirs already located. Repressuring, waterflooding, and other techniques of secondary recovery are adding greatly to the quantities of oil available for consumers' use.

IN many different parts of the world new sources of oil have been discovered in recent years. The great fields in Alberta, Canada, began to produce crude oil in commercial quantities only two years ago. In several fields in the United States, where oil exploration has been going on for years, discovery wells have come in within recent months. New sources of oil have also been opened up in recent years in central Sumatra, southern Iraq, and western Venezuela. Meanwhile, in other parts of the world, including Australia and Papua in the southwest Pacific region, geologists are making surveys and drillers are at work in the everlasting search for new oil deposits.

Moreover, should the supply of oil some day begin to dwindle, we know that we will be able to derive liquid hydrocarbons from oil shales, tar sands, coal and other sources.

Besides the mineral energy derived from coal and oil, we may soon enjoy the benefits of two great additional sources of energy. Recent developments in atomic research give promise that atomic energy may be available for constructive purposes, and scientists are giving serious attention to the likelihood of harnessing the vast energy of the sun. In fact, at present in the United States some houses are successfully utilizing solar energy in heating systems. Whatever their application, atomic energy and solar energy will play an important role when and if their use becomes economically feasible. The over-all effect will be to increase still more the total amount of energy available to humanity.

There, in outline, is the picture of our energy resources. It is plain that we are in no danger of exhausting them. Indeed, I am convinced that we can regard them as practically limitless.

LET us look now at metallic mineral resources to see if the concept of inexhaustability stands up as well for them as it does for energy resources. There are forty-five metallic elements and some 8,000 alloys of those metals now in commercial use. Iron and aluminium are the two metals most used today, and they occur in great abundance on the earth. Current explorations for new iron deposits range from the jungle of South America to the mountains of Labrador.

In connection with the search for new deposits of metals and the part human ingenuity plays in extending natural resources, a good example is the famous Broken Hill Proprietary Company, Limited, in New South Wales. I understand that the company was originally in the business of mining silver, lead and zinc. It wasn't until the problem of diminishing deposits arose that the Company turned to the business of mining iron ore and the production of steel. It was a wise decision. Today, the world knows Broken Hill, as one of the most modern steel mills in the world, and a producer of high quality steel at very low prices. As a company spokesman has aptly put it, "for over half a century the mine was to link the age of silver with the age of iron and steel."

AUSTRALIA'S rich deposits of high grade iron ore are, of course, in no immediate danger of depletion, but if the danger arises, it is quite likely that new sources will be uncovered as they were in the great Mesabi range in the United States. Not long ago it was feared that the Mesabi range was running out of its deposits of 50 per cent. iron ore. Today, companies are making large investments in Mesabi, in order to refine an ore called taconite, which treated by a new process produces 60 per cent. iron ore. The Mesabi range contains a taconite strip several miles broad and 100 miles long.

The search for more deposits of iron ore is an adventurous story of modern industry in many parts of the world. In Labrador, engineers are laying down tracks for a 338-mile railroad line through snow-covered mountains and bleak wastelands to haul iron ore from the Ungava area, on Labrador's northern tip, to a port on the Gulf of St. Lawrence. At Steep Rock Lake, Ontario, seven million tons of lake bed are being removed to get at the iron deposits underneath. In Venezuela, a railroad is being cut through the jungle to a river, where barges will carry iron ore out to the coast.

A new mineral resource that man's knowledge is just about to bring into usefulness is titanium, which although it is the fifth most abundant metal on earth, was hitherto impossible to process for commercial purposes. It is said that a new, inexpensive process is being worked out. Titanium should be ideal for modern high-speed aircraft, because it is lighter than steel, stronger than aluminium, and highly heat resistant.

Two other rigid materials are supplementing metals and we shall probably see their use expanded before very long. The first is glass, in use for centuries, but now taking on new importance in building materials, fabrics, and other uses. The other is plastics, which are used for everything, from childrens' toys to automobiles. One of the impressive things about plastics is that they can be made from corncobs, oat hulls, and other formerly useless waste materials. Both glass and plastics are doing much to extend our supply of metals.

So we see that the story of metal resources closely parallels the story of energy. Research and ingenuity are also making our supplies of needed metals inexhaustible.

THE picture of sufficiency for our material needs is bright indeed, but the concept of unlimited resources does not mean that progress is easy. Human effort and thought must be applied to natural resources before they have any value at all. In some parts of the world, rich in potential resources, people still live in poverty because they have not yet learned how to make use of them.

Often the progress that comes with use of natural resources is impeded by political and social conditions. In many parts of the world today these conditions hamper or paralyze the normal healthy growth of free science and industry. Extreme nationalism, government controls and monopolies, currency restrictions, abnormal tariffs, the denial of just rewards for effort, or threats of expropriation, wars and revolutions have caused valuable raw materials to remain useless in the earth, where no one benefits by them.

Where men are free to create their own goals and achieve them in their own way human progress, I am convinced, has no limits. The one great resource, without which all the natural resources in the world would be nothing, is the free creative spirit of the human individual. Therein lies the true secret of inexhaustible material resources.