

fare. It collaborated with the National Research Council, the universities and other bodies, as also with individuals. When in June 1918 the Chemical Warfare Service of the National Army was formed and the War Department took charge of the work which the Bureau of Mines had been doing in connection with gas warfare the Bureau was able to turn over to the Department a complete organization with a personnel numbering 1,800. This included a corps of 700 chemists.

The Bureau of Mines conducts investigations on metallurgical problems, on lignites, on the composition of coal and on its utilization. It studies in fact everything connected with mining. It has for instance done a great deal of experimental work on the flotation process for treating ores. It does work on the technology of petroleum and natural gas. The methods employed in obtaining oil have been very wasteful. For example, in Oklahoma oil has been obtained under circumstances which would mean a loss of \$75,000 worth of natural fuel gas for \$25,000 worth of oil recovered. In one field of Oklahoma, it has been estimated, that the waste of fuel gas in one year was equivalent to 5,500,000 tons of coal. A very large proportion of this waste can be eliminated, as the Bureau of Mines has shown, by employing what is called the mud laden fluid method. A very large proportion of the oil too, from 30% to 90%, is left in the ground. If it is able to cause the adoption of practices whereby the production is increased 10% the Bureau of Mines estimates that the ultimate aggregate saving to the country will be \$450,000,000.

It would appear that the time is not so remote when the United States will have to look to its shales as a source of supply for oil. The Bureau of Mines has been studying processes for recovering oil from this source.

The Bureau of Mines has been instrumental in effecting a great saving in the by-products of coke. The United States had been wasting \$50,000,000 a year by using the beehive oven instead of the by-product oven in the coking of coal. A great change, due to the war, came about in 1917 during which year 22,600,000 tons of coke came from by-product ovens. This amount was greatly increased in 1918. During the latter year according to the Director of the Bureau of Mines the by-product ovens in operation were expected to produce 5,000,000 more tons of coke than if the coal had been coked by the beehive process. Furthermore he estimated that these ovens in full operation would produce 315,000,000 gallons of tar which could be used in the arts or which as a fuel would have the same efficiency as fuel oil. He also pointed out that they are capable of yielding 168,000,000 feet of gas or sufficient to melt 12,000,000 tons of steel in open-hearth furnaces. The by-products here in question have been of immense importance in the production of explosives for the war. They have made it possible too to establish the great American dyestuffs industry.

As a result of the war the American Government developed temporarily into the greatest manufacturer of chemicals in the world. Its appropriations for nitrate and sulphuric acid plants have run into the hundreds of millions. It has been suggested that the products of some of these plants be now utilized for the manufacture of fertilizers. In this connection one might remark that it has been stated on good authority that a reduction of the cost of soluble nitrogen compounds to a price comparable with that prevailing in Germany before the war would add \$1,000,000,000 to the annual value of the crops of the United States.