

and refining necessary. But it is not fundamental. Colorado shales appear to contain more *pyridines* than do the Canadian and European shales.

The scientific problems being faced by the industry, who seek to establish a shale oil industry and to reach the final goal is going to fall into two groups.

(A) The method of extraction.

(B) The problems of refining.

*In the United States up to the present time, attention and effort have been directed almost entirely to the solution of (A). This has been due to the natural, but erroneous assumption that crude shale oil is like crude well petroleum, and may be successfully refined by the present refinery methods.*

*This assumption would be reasonably safe if oil shale were merely shale saturated with petroleum. True oil shales like those of Colorado contain no ready made oil, but are rich in the materials from which oil may be formed if the shales are properly treated, from extraction of the crude to the final phases of refining; thence will Colorado shale set off the biggest economic boom in the history of the United States.*

Inasmuch as I have reported all of the chemical engineering aspects of one of the world's greatest potential industries, in Phases I-II-III and IV, I will now conclude this report as briefly as possible so as to get on personally with the promoting and praying for the successful culmination of (A) under Scientific Problems.

(Steam)

After securing the Carl Belser patents #2,725,939—to extract the true hydrocarbons and gases thereto from the shales of Colorado, and the world, I engaged the services of one of the better known oil consultants, Mr. Kenneth Record of Denver, Colorado to examine the Belser patent for the removal of said hydrocarbons from the shale *in situ*, a copy of this report, your office has in its possession.

After engaging Mr. Record, a terrible tragedy occurred to my daughter, and the disintegration of my family; therefore, the long delay in completing this report.

When steam is used in retorting or extracting the hydrocarbon components from the shales the conditions in the earth or (retort if you please) will resemble those which are obtained in the manufacture of water gas, but the best temperature for the formation, of the oil vapors, will be too low to convert the carbon into carbon monoxide. If after the oil vapors are driven off, the shale is exposed to a much higher degree of temperature to get the maximum yield of ammonia, steam passing through this highly heated mass will not only aid in getting the ammonia, but will cause the formation of water gas by the union of the oxygen of the steam with the fixed carbon of the shale, and the freeing of the hydrogen. In this method the fuel value of the carbon may be saved and the full value of the hydrogen added. The temperature should be from 1000 degrees F. to 1300 degrees F. When super-heated steam is used under the Belser patent the desirable gases will be given off at lower temperatures.

The gases evolved at the lower temperatures are the best, the proportion of condensable gases are the largest, the percentage of paraffin gases is highest, and that if impurities will be the lowest. The oil obtained will be more easily refined and the proportion of light oils will be greatest.

Time must be given for the heat to penetrate the shale, and for the gases to form and escape. Under the Belser patent it will take approximately 21 to 28 days before the aforesaid will be accomplished and the hydrocarbons will begin to flow from the heated mass and thence to the surface for storage or transportation, via pipeline or transport to the refinery.

It is certain, that certain gases, are formed at low temperatures, others at intermediate temperatures and others at high temperatures. Therefore, the heat must be started at lower temperatures and applied slowly to give time for same to penetrate the shale, to heat the surrounding shale mass. The heat must then be increased to the higher temperature to gain the desired results. Too rapid application of the heat at higher temperatures causes sintering of the stone and will close the pores by which the condensable gases must escape.

Time is an important factor in all chemical reactions. Heating the shale mass at too high temperatures will result in the formation of considerable fixed gas, a low content of gasoline and kerosene in the crude oil, inferior lubricating oil a crude hard to refine. It would be called "burnt oil." To raise the tempera-