hot solvents to extract oil from the shale. With it, they have obtained more oil out of the shale than the assay estimated was in the shale. The Bureau's oil shale demonstration plant near Rifle, Colo., will be put in operation during the next two or three months. Coal, however, is this country's real future source of fuel. Excluding atomic energy materials, coal comprises 98.8% of our mineral-fuel energy reserves, whereas oil shale amounts to only 0.8%, petroleum to 0.2%, and natural gas to 0.2%.

Bureau of Mines research findings and patents will be made available to all industry, large and small, and to any interested citizen. A technical advisory committee composed of some of industry's leading coal and petroleum experts has been named to assist the Bureau and is kept abreast of all plans and developments.

We are not waiting until a crisis and the Nation's economy and security are in jeopardy. When we are spending more than 10 billion dollars a year to maintain an army and navy, it does not appear unreasonable to spend at least one two-thousandth of that sum —or $5,000,000—to make sure that the planes, tanks, and ships will be able to move.

Science News Letter, March 29, 1947

PSYCHOLOGY

Problems from Brain Maps

Frustration or too much motivation may narrow brain maps, formed in learning, causing psychological difficulties of men and nations.

➤ INADEQUATE "brain maps," narrowed in the learning process by too intense motivation or too much frustration, may be the key to the psychological difficulties of men and nations, Dr. Edward C. Tolman, University of California psychologist and expert on animal behavior, declared in the annual Faculty Research Lecture in Berkeley.

Both rats and men, Dr. Tolman said, form in their brains what he calls "cognitive maps" of the environment during learning. On a simplified scale, for example, a rat running through a maze to a goal such as food or water forms in its brain a "cognitive map" of the maze environment.

If the rat is permitted to roam the maze when well fed and with plenty to drink, it appears to learn nothing. But if later placed in the maze when hungry, the rat readily proves it has learned by going to the goal. Under these optimum conditions the rat has been able to form a broad cognitive map of the environment.

If, on the other hand, the rat learns the maze when hungry and thirsty, its cognitive map is narrowed by intense motivation. The correct route to the goal is fixated in the brain and if this is blocked, the strain of intense motivation and frustration makes it difficult for the rat to learn a new route.

This mechanism of too strong motivation and too much frustration is seen at the human as well as the animal level, Dr. Tolman declared. The "cognitive maps" of children may be narrowed by an overintense striving for material wealth. When this is not forthcoming, the individual takes out his frustration on "out-groups."

"Over and over again," he said, "men are blinded by too intense motivations into blind and unintelligent and, in the end, desperately dangerous hates of outsiders. The expression of these displaced hates ranges from discrimination against minorities to world conflagrations."

"We dare not let ourselves or others become so over-emotional, so hungry, so ill-clad, so over-motivated that only narrow strip maps are developed. We must subject our children and ourselves to the optimal conditions of moderate motivation and to the absence of unnecessary frustration whenever we put them and ourselves before the great God-given maze which is our human world."

Science News Letter, March 29, 1947

In territory formerly German but now Polish, there is an estimated reserve of nearly 15,000,000,000 tons of brown *coal;* this coal cannot be stored over ground for periods of time because it has up to 50% water content.

ENGINEERING

Metals for Jet Engines Tested in Special Dugout

➤ SPINNING, RED-HOT metal disks in a special dugout at the Westinghouse Research Laboratories in Pittsburgh are going to help develop parts for future jet engines.

Heated to temperatures above 1,400 degrees Fahrenheit, the disks will spin at speeds of 1,200 miles per hour until they fly apart. The disks, made of specially developed alloys, will reveal the maximum strength of the materials to help engineers plan new alloys for engines.

The "metal torture" tests will be made in a dugout sunk 10 feet below floor level and lined with sandbags.

Metals to be tested are used in the rotors of present gas-turbine engines where they stand up under terrific stress and temperature. In the tests, actual operating conditions will be exceeded to find out how much heat and stress is needed to break up the metal.

From the tests in the dugout, Westinghouse engineers hope to devise principles from which they can predict the behavior of metals at any speed or temperature.

The disks, which will whirl at 35,000 revolutions per second, are one foot in diameter and one inch thick.

Science News Letter, March 29, 1947

SANDBAG DUGOUT—To measure the strength of jet engine alloys, Westinghouse scientists use a high-speed motor to whirl the metal disks being tested.