

Patented Dec. 28, 1926.

1,612,453

UNITED STATES PATENT OFFICE.

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PROCESS FOR MINING SULPHUR.

No Drawing.

Application filed August 5, 1926. Serial No. 127,475.

Our invention relates to the process of recovery of elemental sulphur from sulphur bearing deposits by means of what is commonly known as the hot-water method. It has for its object the better control of the movement of the fluid heating medium (commonly water) used in this process.

In order that the operation of our invention may be made clear we will first describe the nature of the sulphur bearing formations commonly encountered in the United States and will also briefly describe the so-called hot-water method as now generally applied to sulphur mining.

By far the greater part of the sulphur known to exist in the elemental form on the American Continent occurs in the form of pure crystals of elemental sulphur interspersed with gypsum or lime rock or mixtures of these rocks. It occurs usually in what are known as "domes," which are found in considerable numbers along the coastal plane bordering on the Gulf of Mexico in the States of Texas and Louisiana. The sulphur bearing portion of these domes, or of such of them as are known to contain sulphur, lies at depths varying from a few hundred feet up to 1500 or 2000 feet. The sulphur bearing portions of these dome formations are usually more or less porous or spongy. They contain cavities of widely varying sizes, from minute pores to cavities of very great size, which may be aptly described as caverns. These cavities are more or less inter-connected by channels through which water may circulate with a greater or less degree of freedom depending upon the number and sizes both of the cavities or pores, and of the inter-connecting channels. Being at considerable depth in the ground and below the water table, these cavities, pores, channels and caverns are filled with water. This water being in contact with sulphur, limestone, gypsum and other rocks and earths, contains in solution considerable quantities of solid matter. In different sulphur bearing formations and also in different portions of the same sulphur bearing formation, there is often to be found a great degree of variation in what may be termed the permeability of the formation. This permeability is a function of and is affected by two variables. One variable is the size and number of the pores or cavities in the sulphur bearing formation

and the second variable is the number and size of the inter-connecting passages or channels between the cavities. Some of the effects of this difference in permeability will be described later.

The recovery of sulphur from these sulphur bearing formations situated at depths of several hundred feet under the surface of the ground is commonly accomplished by what is generally known as the hot water process. This process consists essentially in forcing water at a high temperature, usually above 300° F., and under a pressure usually above 100 lbs. per square inch, into the sulphur bearing formation, and raising to the surface of the ground the sulphur melted by the water.

In the carrying out of this process holes are drilled from the surface of the ground down into and through the sulphur producing horizon. In these holes or wells are placed a series of pipes of various diameters one within another in such a manner that hot water under the desired pressure and temperature conditions may be forced into the sulphur bearing strata through the water pipes, and also that fluid or melted sulphur may be simultaneously lifted to the surface through one of the inner pipes of the series.

The hot water so injected into the sulphur bearing formation moves through the pores and cavities of the formation and while so passing raises the temperature of the formation with which it comes into contact. This rise of temperature continues until those portions of the formation through which quantities of the hot water have passed reach a temperature approximately equal to that of the injected water. As pure sulphur melts at about 240° F., and as the hot water is injected at a considerably higher temperature, there results a melting of the sulphur contained in the formation. This melted sulphur, being much heavier than the water, finds its way downward through the heated portion of the porous formation surrounding the bottom and lower portion of the pipes and enters the pipes through perforations suitably placed and provided for the purpose. This molten sulphur is then lifted to the surface of the ground by means of compressed air, utilizing the well known device known as an "air lift."

As already stated, there is a wide difference between sulphur formations and also be-