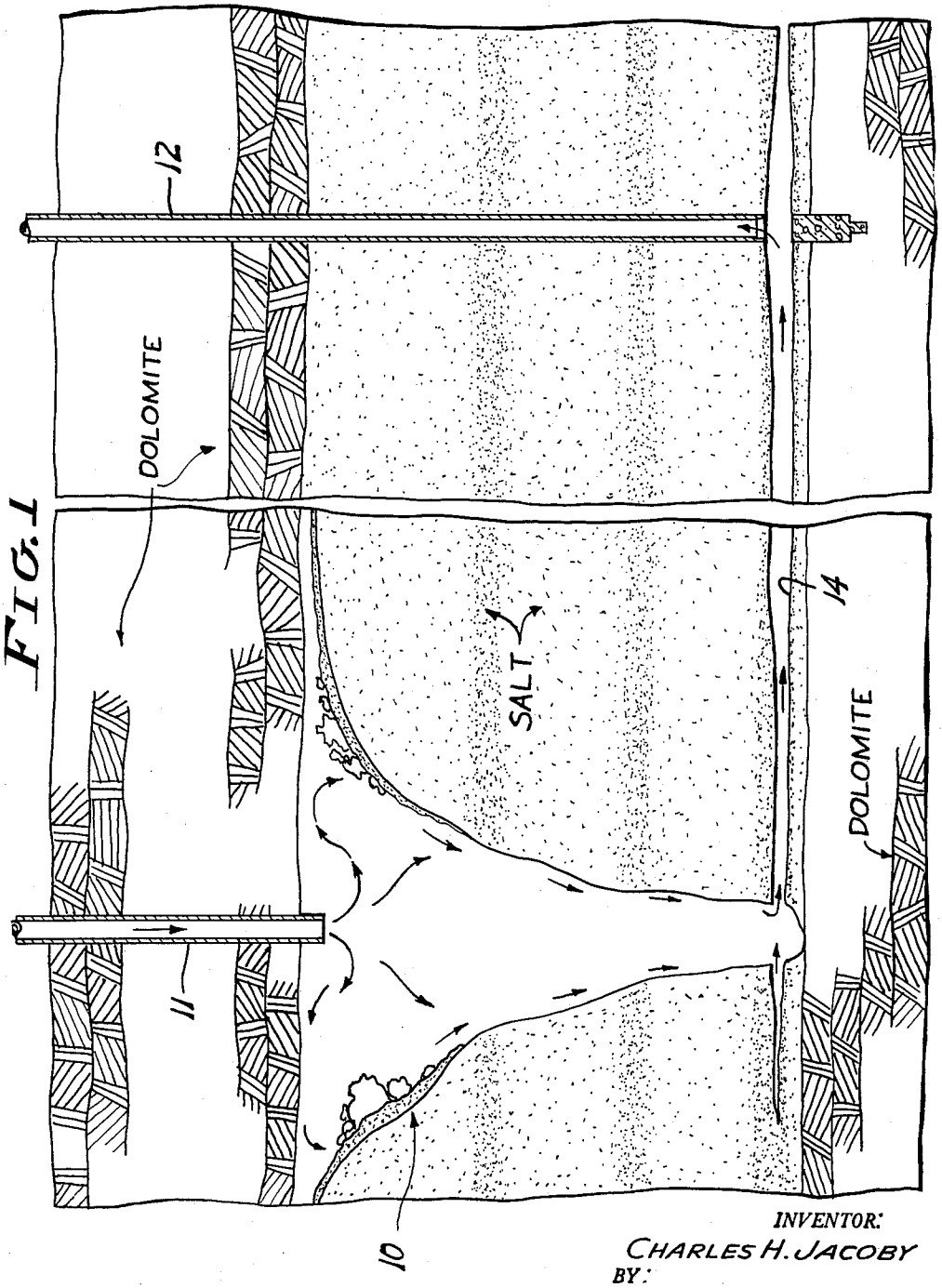
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METHOD FOR REVIVING BRINE FIELDS

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FIG. 1



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METHOD FOR REVIVING BRINE FIELDS

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This invention relates to the mining of liquid-soluble minerals from underground strata, and more particularly to the solution mining of salt. A number of salt fields have been mined by drilling into the salt deposits, pumping a dissolving fluid, such as water, into the hole to dissolve the salt, and pumping the resulting brine out of the hole to recover the salt. It is well known in the art that the solution mining of salt from a single cavity has particular difficulties due primarily to the fact that when water is pumped into a well drilled into a salt formation, the fresh water will tend to rise and the brine saturated water remains near the bottom of the cavity. Because of this, most of the dissolving action takes place in the upper section of the hole and as a result the cavity develops primarily upwardly and only secondarily laterally until it reaches over-lying insoluble rock, at which point the cavity spreads only laterally at the top. This condition is enhanced by reason of the insoluble impurities in the salt deposit falling out of the brine solution and forming a semi-porous insoluble blanket on the floor and to some degree, the walls of the cavity. The result of these conditions is a "morning glory" shaped cavity, and as the "petals" develop further and further outwardly, stoping of the unsupported roof rock results in accumulations of rock fragments around the well casing which impedes circulation of the brining fluid to the point that ultimately the well must be abandoned. This leaves a very large percentage of the salt bed untouched beneath the "petals" of the cavity.

Attempts to mine a salt area efficiently by drilling and mining a series of such cavities in close proximity to one another have been generally unsuccessful because of the collapse of roof rock and the general unstable rock stress condition adjacent a developed cavity.

A more recent and more efficient method of mining soluble mineral deposits, known as the "gallery" system, has been developed wherein two or more wells are driven into the salt strata, the strata is split, usually hydraulically, to open a passageway from one well to another, and a mineral solvent is circulated through the opened underground system. This method of mining is more fully described in my co-pending application Serial No. 807,449, filed April 20, 1959. In developing this method it has been found feasible to open passages in salt beds for distances of over 1000 feet between wells by hydraulic fracturing along the bedding planes of the salt.

Now I have developed a method for reviving previously abandoned salt fields, which includes using the old "morning glory" cavities and incorporating them into a "gallery," and have found that by using my method the old field may be reworked with nearly the same efficiency now obtained by the newer methods of salt field development.

Thus, the primary object of the present invention is to provide an improved method for reviving an old brine field previously mined by the method discussed and recovering the large percentage of salt in a given deposit not recoverable under the prior system of mining.

By using hydraulic fracturing to split the salt along a bedding plane, a new hole may be drilled far enough from an old cavity so that the rock formation immediately surrounding and above the old cavity will not be disturbed. The location of the new well is determined by the known geology of the area and the estimated outline of the old cavity, and the new well is drilled and completed in accordance with known methods, preferably those outlined in my co-pending application referred to hereinabove. The new well will be completed for the fracturing or splitting step at a level somewhat above the lowest point of the existing cavity to assure connection between the two wells but at the lowest point possible. The high pressure fracturing or splitting fluid will then be applied from the new well until the crevice reaches the target cavity, and dissolving fluid will then be circulated from the new well to the old cavity to wash through the crevice thereby enlarging it to the extent necessary to assure keeping the crevice open.

In pursuing the method of my invention, as soon as the channel opened by the fracture has been washed through to a sufficient degree to prevent convergence of the salt bed, the flow of dissolving fluid is reversed; and the newly established gallery is then mined by circulating fresh fluid into the old cavity and withdrawing the brine through the new well. For example in the accompanying drawing FIG. 1 is a cross section of a salt deposit showing an old "morning glory" cavity **10** which has been connected with a newly drilled well **12** by hydraulic fracturing. Thus, the old "morning glory" cavity is shown as being interconnected with the new well by a crevice **14** which has been produced by hydraulic splitting of the salt deposit. Whereas initially, following the fracturing step, water is pumped under pressure into well **12** and thence through the fracture to the glory hole **10** so as to "establish" the channel **14**; the fresh water is then pumped into the casing **11** of the glory hole, and the final mining operation is thus commenced by causing the water to travel in the direction of the arrows from the old cavity through the crevice **14** and out of the casing **12** as brine.

The rate of brine withdrawal from the gallery is then adjusted to assure maximum salt withdrawal from the area of the old cavity. In most cases the brine making capacity of the area surrounding the old cavity will be known from the previous mining operation, and by limiting the withdrawal rate to known production of the old area, only saturated fluid will be pulled through the new channel and well area. Therefore little or no salt will be removed from the new areas, except as the old cavity enlarges to include more of the channel area and eventually the area around the newer well. Thus, reversing the direction of flow and regulating the rate of brine withdrawal limits the amount of salt which is dissolved from around the new well, and thereby preserves the structural stability around the new well area while recovering all of the salt possible from the area of the old cavity. This will assure progressive enlargement of the old cavity and because the fluid outlet therefrom is at a low point thereof, a large percentage of the salt bed previously untapped may thus be recovered.

I claim:

1. A method for solution mining of underground deposits of salts in areas containing existing morning glory shaped cavities comprising, drilling a new well at a point removed from the base of an existing cavity, applying a salt deposit splitting force from the new well to open a crevice to the base of the existing cavity, washing a dissolving fluid through said crevice to create a permanent channel in the salt deposit, and then mining said salt bed by circulating a solvent through the existing cavity to the new well at such rate of solvent flow that the solvent becomes saturated with salt while still in the zone of the existing cavity, whereby salt in solution is withdrawn through the new well.

2. A method for solution mining of underground deposits of salts in areas containing abandoned morning glory shaped cavities comprising, drilling a new well to a point removed from an existing cavity, applying a salt deposit splitting force from the new well to open a crevice

to the lower portion of the existing cavity while washing a dissolving fluid through said crevice under pressure to create a permanent channel, and then mining said salt bed by circulating a solvent from the upper portion of the existing cavity through the channel to the new well, whereby salt in solution is withdrawn through the new well, the rate of withdrawal of salt in solution through the new well being limited to a rate at which the circulated solvent will become saturated with salt while still in the old cavity.

3. A method for solution mining of underground deposits of salts in areas containing abandoned morning glory shaped cavities comprising, drilling a new well to a point removed from an existing cavity, applying a salt deposit splitting force from the new well to open a crevice to the lower portion of the existing cavity while washing a dissolving fluid through said crevice under pressure to create a permanent channel, and then mining said salt bed by circulating a solvent from the upper portion of the existing cavity through the channel to the new well, whereby salt in solution is withdrawn through the new well, the rate of brine withdrawal through the new well being adjusted to assure maximum salt withdrawal from the area of the old cavity.

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