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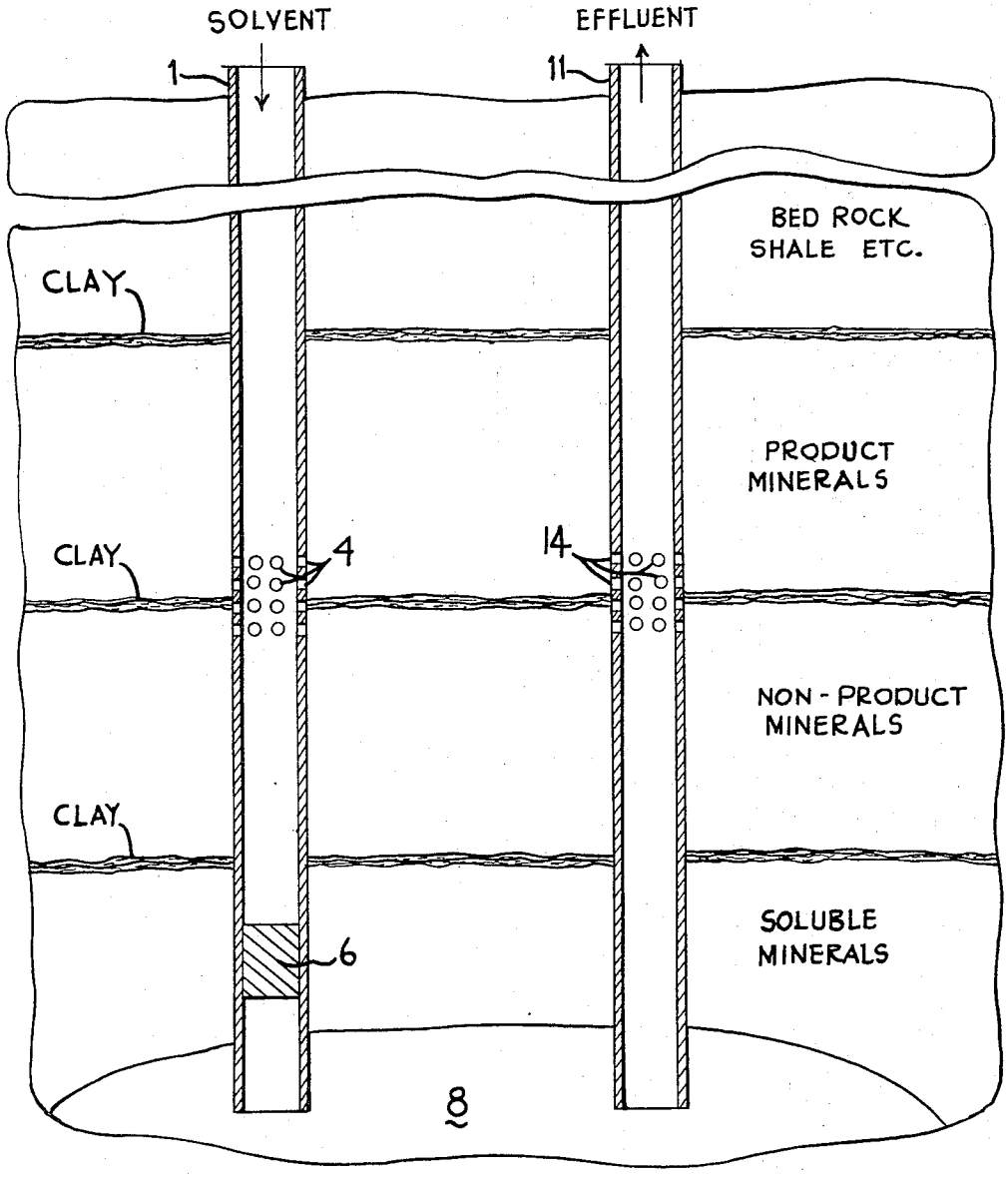


FIG. 1

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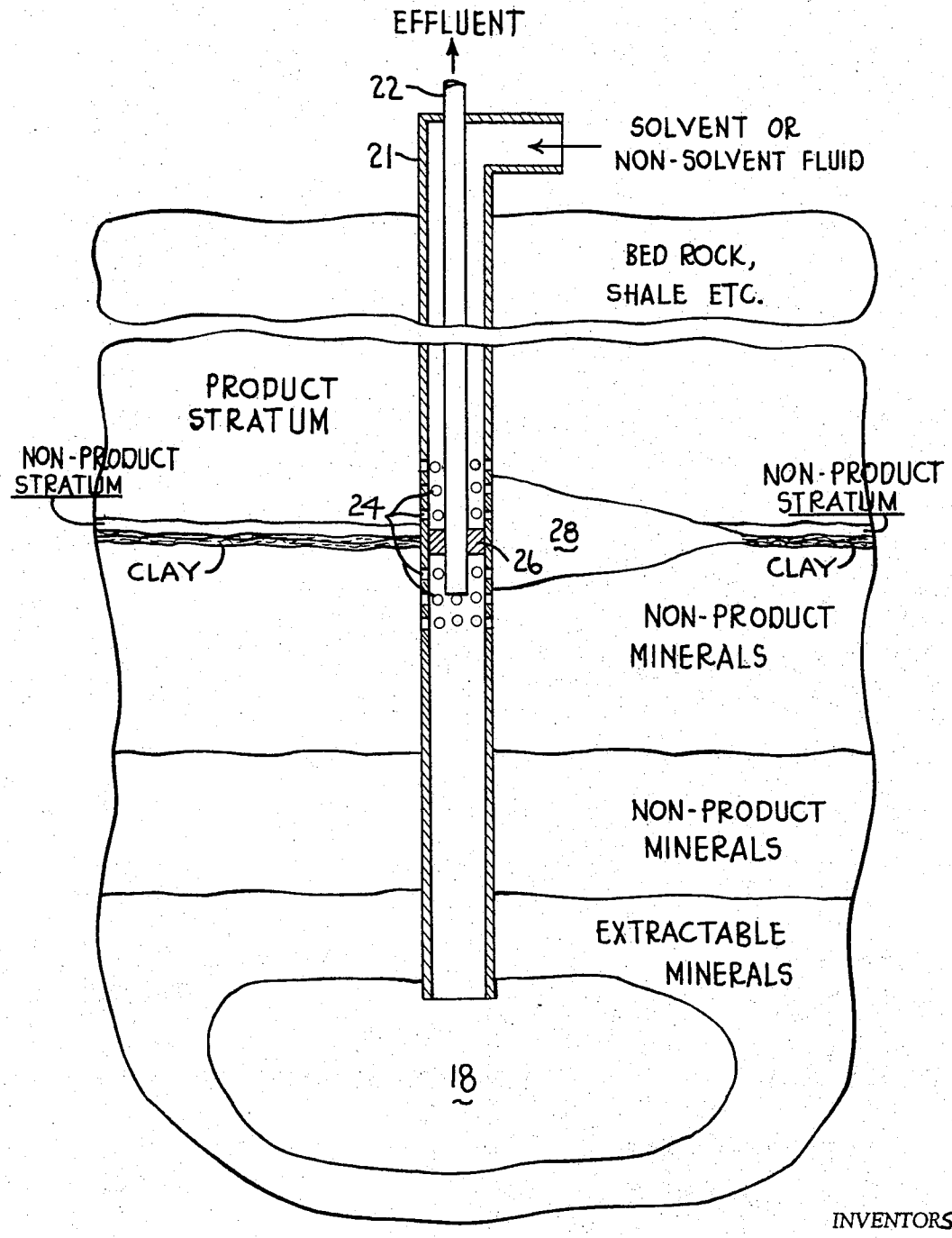


FIG. 2

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FORMING SOLUTION MINING SURFACE AT INTERFACE ABOVE CAVERN

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Continuation of application Ser. No. 570,362, Aug. 4, 1966. This application June 9, 1967, Ser. No. 645,060

24 Claims. (Cl. 299—4)

ABSTRACT OF THE DISCLOSURE

A plurality of conduits are provided in communication with an interface above a substantial subterranean cavity. Fluid is introduced through one such conduit at low pressures to establish communication along the interface between a pair of conduits. In this fashion, substantial extraction surface is provided in a very short time.

This invention is a continuation of U.S. patent application Ser. No. 570,362, filed Aug. 4, 1966, now abandoned, which is a continuation-in-part of U.S. patent application Ser. No. 337,387, filed Jan. 13, 1964, now abandoned.

This invention relates to mining a soluble. It more particularly relates to providing an extraction surface for solution mining a soluble. It is still more particularly directed to providing such a surface rapidly along a seam of clay-like material disposed above a substantial subterranean cavity.

In a typical solution mining operation, one or more bore holes are established through a plurality of strata of varying composition to a lower deposit of product minerals. By as "product strata." Sometimes these deposits contain incially desirable to extract. These minerals are extractable with suitable solvents, typically with aqueous media including mineral acids, steam, salt solutions, substantially pure water etc. The bore holes are normally fitted with suitable casings which communicate with a cavity in the mineable (product) deposit. Substantial surface areas of product minerals are typically exposed along the interior surface of the cavity. The solvent is pumped into the cavity through one or more cased holes to extract product minerals from this "extraction surface." The product bearing solvent is removed from the cavity through one or more cased bore holes to the surface of the earth.

Often, some of the strata located above a solution mining cavity contain appreciable amounts of product minerals. Such strata are referred to herein and in the claims as "product strata." Sometimes these deposits contain insufficient quantities of product minerals to justify on economic grounds, development of an independent solution mining cavity or other extraction surface for their recovery. Even in a deposit containing sufficient product minerals to justify development of an extraction surface in accordance with standard procedures, it is desirable to extract the product minerals at an economic rate as soon as possible after operations have commenced in these deposits. Development of an extraction surface by standard procedures has typically been time consuming.

One suggested method of extracting the upper deposits of mineable material is to perforate adjacent extractable material in the vicinity of the upper product deposit one or more of the casings which communicate with the lower cavity. Solvent is thereby caused to contact the upper strata through the perforations to extract the mineable materials contained therein. In this way a suitable extraction surface may be eventually be developed in the upper deposit.

Most solubles can be extracted at economically significant rates only when contacted with solvent over a considerably larger surface area that exists immediately adjacent the casing. Many solubles, e.g., KCl bearing minerals, are slow to dissolve in the extracting solvents typically employed. Thus, an inordinate amount of time is required to establish a large cavity in the upper deposit by this technique. Solutions of sufficient concentration to be processed for product recovery can normally be obtained only after a very large cavity has been developed. The low concentration solutions produced during the development of the upper cavity are frequently sewered as waste. Cavity development costs are typically very high in comparison to the cost of operating a solution mining system after a suitable extraction surface has been developed.

One technique for providing sufficient surface area for commercial extraction of product minerals involves fracturing the subterranean mineral formation, usually adjacent the bottom of the product deposit. The fracture is typically induced by hydraulic pressures applied through a bore hole to the fracture area. Typically, high pressures, i.e., up to about 2 p.s.i.g. per foot of depth to the fracture area, are necessary to produce a satisfactory fracture.

Most deposits extracted by solution mining methods are sedimentary in nature. Often these deposits are evaporites. It is normally difficult to maintain a fracture in such a deposit. These deposits exhibit plastic behavior at the depths at which they are normally found. Thus, unless high hydraulic pressure is maintained at the fracture point, the fracture tends to close. A typical fracturing operation requires the extended application of pressures, measured at the surface of the earth, from about 0.8 to 1.2 p.s.i. per foot of depth to the fracture in excess of normal hydrostatic pressure. Maintaining these pressures is expensive.

The hydrostatic pressure referred to herein is the pressure exerted at the point of fracture by a static column of fluid, typically in a bore hole, open to the atmosphere and extending to the surface of the earth. Hydrostatic pressure varies with the density of the fluid in the bore hole. Fluids used in fracturing operations are usually heavier than water. Brines with densities of up to about 1.6 times the density of water are often employed, for example.

This invention provides a rapid and economical method whereby an adequate dissolving (extraction) surface is provided in a mineable (product) deposit above a solution mining cavity. According to this invention, it has been found that a fissure can be rapidly induced in the vicinity of a strata of product minerals in a simple and surprising manner. This fissure provides a fluid pathway though which solvent is flowed thereby developing the necessary surface area to extract the product deposit. Thus, it has been found that a fluid pathway can be induced along an interface between strata in the formation above a substantial solution mining cavity. This fluid pathway is induced by introducing fluid such as solvent or cavity effluent to the vicinity of the interface. The energy required to produce a fissure or fluid travel path in accordance with this invention is generally about one or two, rarely in excess of about ten percent of the energy heretofore required to fracture a formation at a given depth.

Although the precise mechanism of this phenomenon is not understood, it is presumed that a small parting occurs or can be induced along the interface due to sagging of the underlying strata into the cavity below. This phenomenon is more apparent above cavities of large cross sectional area. When the cross section of the cavity exceeds 10,000 square feet, this phenomenon often occurs to a significant extent. The initial partings are apparently very shallow, i.e., not more than a few millimeters, probably less than about two to five millimeters.

It appears that a parting is most likely to occur along an interface between deposits of minerals significantly

different in physical characteristics. An example of such an interface is that which exists between a band (seam) of clay, shale, or other water insoluble material and an evaporite deposit such as a mixture of sodium chloride and potassium chloride. It is thought to be unnecessary that a parting actually exists along the interface. The tendency for the formation to part along this interface or plane of weakness, i.e., a plane of relatively low cohesiveness within the formation, appears to be sufficient for the practice of this invention.

Although this invention has some application to a solution mining system in which a single bore hole communicates with the subterranean cavity, it is most useful in a system which includes a plurality of bore holes. According to a preferred embodiment of this invention, two bore holes are perforated in the vicinity of a clay band or other suitable plane of weakness in the formation above a substantial cavity. An aqueous medium is introduced to the clay band through the perforations of one or both casings. A fissure is thereby induced between these bore holes along the plane of weakness. Solvent is then introduced down one bore hole, caused to flow through the fissure, and withdrawn up the other bore hole. Because fluid communication is established between the holes very quickly, in some cases in a few minutes, an economic rate of extraction of product minerals is obtainable significantly more expeditiously and economically than would otherwise be expected.

In the practice of this invention preferably at least two casings are perforated in the vicinity of the interface along which it is desired to induce a fissure. Fluid is introduced to at least one such casing. The time required to establish fluid communication between the casings may be significantly reduced by sealing the casing or casings to which fluid is introduced below the perforations. The seal in the casing (or casings) prevents or reduces the transfer of fluid pressure to the cavity. In this fashion, the fluid introduced through the casing (casings) to the perforations provides fluid pressure at the interface in excess of the pressure at the top of the cavity. Sometimes, fluid communication cannot be obtained within an acceptable time period without taking steps to produce such a pressure differential between the interface and the cavity roof.

Usually, casings in the system which are not sealed openly communicate with the cavity and the atmosphere. Thus, the static fluid pressure at the top of the cavity is readily determined from the density of the fluids in the casings and the height above the cavity roof of the fluid columns in the casings. The plane of weakness is usually very much closer to the cavity roof than it is to the surface of the earth. Thus, the static pressure adjacent the perforations of the unplugged casing may be considered without substantial error to approximately equal the pressure at the cavity roof.

The fluid pressure applied to the region of the interface is also readily determined by those skilled in the art. Typically, this fluid pressure is the sum of the hydrostatic pressure at the level of the fissure site (due to the column of fluid in the casing above the perforations) and any other pressure, e.g., pump pressure which may be applied to the fluid column.

Sometimes a fissure can be induced between two bore holes by establishing only a few, e.g., up to ten, p.s.i. more pressure at the plane of weakness than exists at the top of the cavity. Usually a fissure will occur when this pressure differential is held below 600 p.s.i., typically 50 to 500 p.s.i. The exact pressure differentials required for the practice of this invention obviously vary depending on the strength of the formation, the cross section of the cavity, the depth of the plane of weakness, the distance between the interface and the cavity roof, the nature of the interface, the thickness of the clay band or other seams, and several other factors. Consistently good results are obtained, however, with pressure differentials below 1,000 p.s.i.

It is readily apparent that the pressure differentials contemplated by this invention are obtainable by applying substantially lower pressure to the interface (plane of weakness), i.e., to the perforations in the casing than would be required in a typical fracturing operation in a similar deposit. Thus, while the present invention typically requires a pump pressure of much less than 1,000 p.s.i. over hydrostatic pressure to cause communication between two bore holes at a depth of 2,000 to 8,000 feet, a typical fracturing operation in a similar formation requires a pump pressure of at least 1,600 p.s.i. at depths of 2,000 feet to up to 9,600 p.s.i. or more at 8,000 feet.

The pressure differentials required by this invention are sometimes established without adding pressure to the fluid column in the sealed cavity. Frequently, in a solution mining system the density of the solvent fed to the cavity differs substantially from the density of the effluent. Normally, the effluent is more dense than the feed. Thus, according to one embodiment of this invention, both a feed casing and an effluent casing are preforated at the depth of a plane of weakness. The effluent casing is sealed (e.g., plugged) below the level of the perforations. The feed casing is not plugged and remains open to the cavity. In this manner a pressure differential, often up to 500 p.s.i. is established between the perforations of the two casings at depths of about 5,000 feet.

This invention contemplates embodiments which establish the required pressure differentials by procedures other than those specifically discussed herein. Thus, it is recognized that this invention might be practiced in part by pumping fluid from the cavity to reduce the pressure exerted against its roof. It is also understood that the fluid pressures in one or more of the casings can be altered considerably by introducing thereto fluids of differing densities. According to some embodiments, the casings to which fluid is introduced to the plane of weakness openly communicate with the cavity. In these embodiments, the pressure at the top of the cavity may actually exceed the pressure at the plane of weakness. According to other embodiments, fluid flow into the cavity is partially restricted below the perforations in a casing. In these embodiments, the pressure differential between the plane of weakness and the cavity roof may be substantial, e.g., 50 to 500 p.s.i. but significantly less than the pressure differential across the plane of weakness between the casings.

FIGURE 1 illustrates a typical embodiment in which a deposit of product materials is disposed above a solution mining cavity and a clay seam is disposed adjacent the bottom of the product deposit. FIGURE 2 illustrates an embodiment in which two conduits are disposed through a single bore hole.

According to FIGURE 1, two casings, 1 and 11, communicate with a cavity 8. The cavity floor is typically about 2,000 to about 8,000 feet beneath the surface of the earth. A well developed cavity is normally at least 100 feet in diameter and may measure several hundred feet in at least one horizontal direction. Typical cavities in solution mining sodium chloride, for example, are about 20 to about 400 feet in diameter and from about 10 to about 100 feet high. The casing usually extend through several strata of varying compositions. A deposit of product minerals is disposed above the cavity. Nonproduct mineral deposits typically separate the cavity roof from the upper stratum of product minerals. A clay seam typically about 0.01 to about 12 inches thick is disposed near, often immediately adjacent the product mineral strata. The location of the clay seam may be determined from core samples, typically taken prior to development of the subterranean cavity, or in accordance with well known logging techniques.

Perforations 4 and 14 are made in casings 1 and 11, respectively, in the vicinity of the clay seam. It is suffi-

cient that the perforations be reasonably close, e.g., within a few inches of the clay seam. Preferably, sufficient length of the casing is perforated that at least, some perforations are adjacent the clay seam. A plug **6** is inserted in casing **1** below the area of the perforations therein.

Fluid is introduced to casing **1** at about 10 to about 600 p.s.i. above atmospheric pressure measured at the surface of the earth. Thus, the pressure of the aqueous medium entering the clay seam through the perforations is about 10 to about 600 p.s.i. above normal hydrostatic pressure in the introduction casing **1**. The pressure against the cavity roof is approximately equal to the hydrostatic pressure exerted by the fluid column in casing **11**. Typically, sufficient pressure is applied to casing **1** to establish a pressure differential of about 10 to about 1,000 preferably less than about 500 p.s.i. between the perforations in casing **1** and the cavity roof.

According to an alternative embodiment, casings **1** and **11** are perforated to provide perforations **4** and **14**, respectively, in the vicinity of the clay seam. Both casings are left in open communication with cavity **8**. Solvent is introduced through casing **1** to cavity **8** and effluent is withdrawn from cavity **8** through casing **11**. Thus, the fluid pressure applied to perforations **4** is also applied to cavity **8**. Because of the normal pressure losses of the system, the fluid pressure applied through perforations **4** is slightly higher than the fluid pressure applied through perforations **14**. Fluid communication between perforations **4** and **14** is often established within a short period, e.g., within a few minutes to several hours. If fluid communication is not established within this period, plug **6** may be inserted. A pressure differential is thereby established between the clay seam adjacent perforations **4** and the cavity roof. In this way, fluid communication between perforations **4** and **14** is further encouraged.

Any gaseous or liquid fluid may be used to apply pressure through the perforations. It is preferred to use a nonsolvent of the minerals adjacent the plane of weakness to induce the fissure. Saturated aqueous solution of these minerals is a good nonsolvent fluid. After the fissure is established, solvent of the product minerals is introduced to the fissure to extract product minerals, thereby developing an extraction surface.

Dissolving rates of product minerals, e.g., sodium chloride, potassium chloride, etc., are known. The time expected to elapse before solvent would normally communicate between the perforations in area **4** and the perforations in area **14** can be calculated from these rates. The experience of the art has provided practical estimates which are in substantial agreement with these calculated times. Thus, the time required for fluid communication between two casings can be predicted within acceptable bounds of accuracy. It is surprising and unexpected, therefore, that fluid communication is observed between the casings in a fraction, typically between about ½ percent and about 5 percent of the time expected.

One specific example in which this invention was practiced with good results was in solution mining potassium chloride ore. The solution mining system in use was similar to that shown on the drawing. Two perforated casings were about 50 feet apart. The perforations were adjacent a clay seam about 5,200 feet beneath the surface of the earth. Previous experience on similar formations established about 3,000 to about 4,000 p.s.i. above hydrostatic pressure as the minimum practical fracture pressure for that depth. It was also known from previous experience and calculations, based on the dissolving rate of the ore in the solvent being used, that at least 30 days would be required for the solvent to communicate between the perforations of the two casings. It was found that by practicing this invention, solvent introduced to the clay seam through the perforations of one casing at a pressure of less than 200 p.s.i. over hydrostatic pressure flowed to the perforations of the other casing in less than 1 hour.

Although the precise mechanism of this improvement is not completely understood and while applicants do not desire to be held to a particular theory for their invention, the rapid communication of the liquid along the clay band is thought to be accomplished as a result of one or a combination of several factors. It is thought that the clay band tends to part from the mineable material above it due to sagging of the formation disposed below the clay seam into the cavity below. Wetting of the clay seam probably results in added pressure on the formation below the seam due to swelling of the wetted clay. There is also thought to be a decrease in the adhesiveness and the cohesiveness in the clay due to the wetting of the clay. Fluid pressure applied to the clay band through the perforations is thought to increase the tendency of the formation below the clay band to deflect. Sealing or restricting a casing against fluid flow to prevent or reduce the transfer of fluid pressure to the cavity solution additionally encourages this diaphragm of material to deflect.

This invention is useful for rapidly inducing fluid communication along seams other than clay seams, e.g., bands of shale, slate, limestone, dolomite, carnallite, anhydrite sand, and like minerals. Fissures may be induced, but with significantly greater difficulty, along the interface between immediately adjacent sedimentary strata of substantial thickness. The results of this invention are most dramatic when the fissue is induced adjacent a clay seam. In addition to the aforementioned characteristics of a clay seam, clay appears to disperse in water to a much greater extent than bands of material more closely resembling rock, e.g., shale or slate. Thus, in the preferred embodiment of this invention, an aqueous medium is forced into the vicinity of a clay seam.

The advantage of rapid communication along a seam adjacent the bottom of a product stratum is readily apparent. After such communication is established, an adequate extraction surface can be readily developed. Thus, solutions with a commercially acceptable degree of saturation can be recovered at satisfactory rates with a comparatively small expenditure of time in developing a suitable extraction surface. Minor deposits which heretofore have been uneconomical to extract may now be economically recovered.

It will be apparent to one skilled in the art that this invention is useful in many situations. For example, the pressure may be increased in the fissure to cause the formation below the fissure to cave into the cavity below. In this way, product minerals are exposed to the action of the solvent within the cavity.

This invention often makes it possible to select particular high grade strata within a formation to extract. Thus, low grade material can be left in place in the formation. This procedure offers a significant economic advantage in formations where high grade ore is disposed in well defined strata. The location of these strata and closely disposed clay or other suitable bands of minerals can be determined in accordance with well known logging techniques.

Although the invention has particular application in solution mining systems in which a plurality of laterally spaced conduits (casings or cased bore holes) communicate with a deposit in the vicinity of a plane of weakness (interface), it is often of use in a system in which a plurality of conduits are provided through a single bore hole. Such an embodiment is illustrated by FIGURE 2.

Referring to FIGURE 2, a subterranean cavity **18** is disposed beneath a product deposit. A cased bore hole **21** communicates with cavity **18**. An interface between dissimilar strata is disposed near a product stratum. Often the most suitable interface available for the practice of this invention is separated from the product stratum by a relatively narrow band of extractable nonproduct minerals as shown on the drawing. Perforations **24** are provided along a few feet of the length of casing **21** in the vicinity of the interface. Tubing **22** is disposed internal

to casing 21, preferably terminating below the level of the interface. A plug 26 is desirably provided to seal the annulus between conduit 22 and casing 21 at a level between the uppermost and lowermost perforations 24. Fluid is introduced down the conduit provided by the annulus and through perforations 24 to contact the deposit in the vicinity of the interface. A fluid travel path 28 is thereby formed which communicates with both the conduit provided by the annulus and the internal conduit 22 through perforations 24. For purposes of illustration, the travel path 28 is shown only in part on the drawing so that the original position of the interface can also be seen. In practice, the fluid travel path is believed to circumscribe the casing. The travel path 28 quickly increases in size thereby providing a substantial surface area, e.g., 100 to several thousand square feet, in contact with extractable minerals. Solvent is introduced down the annulus to extract minerals. Mineral bearing effluent is withdrawn through tubing 22. In this fashion, a substantial extraction surface is rapidly brought into contact with the lower portion of the product stratum.

Plug 26 serves to provide a pressure differential between the roof of cavity 28 and the interface when fluid is provided through the annulus. The plug also serves to divert solvent to the upper portion of fluid travel path 28 and effluent through the lower perforations to conduit 22. The invention is often operable in the absence of plug 26, however. As explained hereinbefore, a pressure differential between the lower cavity and the interface is not always needed. In addition, the effluent is normally more dense than the solvent and tends to flow to the bottom of the fluid travel path 28. Even without a plug 26, solvent tends to float on the effluent through the upper perforations. Normally, the use of a plug is preferred.

It is not essential to the invention that the product mineral stratum to be extracted be located above a productive solution mining cavity. Economic considerations may make it desirable to extract rapidly nonproduct soluble material beneath a product deposit for the purpose of establishing a large cavity beneath the product stratum. This technique is useful, for example, when the nonproduct material below the mineable deposit can be dissolved at a significantly faster rate than the product minerals. It is often cheaper in that event to first develop a cavity in the more soluble stratum. An extraction surface adjacent the product deposit may then be established in accordance with this invention.

Although the present invention has been described with reference to specific details and certain embodiments thereof, it is not intended that such details be regarded as limitations upon the scope of the invention except insofar as they are included in the accompanying claims.

We claim:

1. The method of solution mining a product stratum of minerals located above an interface between strata of dissimilar materials in a subterranean deposit, said interface being located above a subterranean cavity, which comprises providing a plurality of spaced casings in open communication with the deposit in the vicinity of the said interface above said cavity, providing fluid to the deposit under pressure in the vicinity of the interface through said casing and at below normal fracturing pressure, continuing the introduction of fluid to the deposit in the vicinity of said interface until there is established a fluid travel path through said deposit between said casings in the vicinity of said interface, introducing solvent to said fluid travel path to extract minerals adjacent said fluid travel path thereby developing an extraction surface adjacent the lower portion of the product stratum, and thereafter introducing solvent to said extraction surface to extract product minerals from said product stratum.

2. The method of claim 1 wherein the casings which openly communicate with the deposit in the vicinity of the interface also openly communicate with the subterranean cavity and fluid is simultaneously introduced through a casing to the deposit in the vicinity of the interface and to the cavity.

3. The method of claim 1 wherein the said fluid is an aqueous medium and is introduced to the vicinity of the interface at a pressure below about 1,000 p.s.i. above its hydrostatic pressure at that vicinity.

4. In a formation above a subterranean cavity, said formation including strata of both product and nonproduct minerals and wherein a plane of weakness is disposed near the bottom of a product stratum, a method of rapidly providing a fluid path near the bottom of said product stratum, which comprises providing a first casing in open communication with the formation in the vicinity of said plane of weakness and above said cavity, providing a second casing in open communication with the formation in the vicinity of said plane of weakness and above said cavity, introducing through said first main casing to the formation in the vicinity of said plane of weakness fluid under pressure and at a pressure below normal fracturing pressure, continuing the introduction of fluid in the vicinity of said plane of weakness until there is established a fluid communication between said casings in the vicinity of said plane of weakness.

5. In a solution mining system wherein a plurality of casings is disposed in bore holes extending through strata of product and nonproduct minerals to a cavity situated below said strata and a plane of weakness is disposed near the bottom of said product stratum the method which comprises perforating a plurality of said casings substantially adjacent said plane of weakness, introducing fluid to a said perforated casing, said casing being sealed to prevent flow of fluid into the cavity and said fluid being introduced at a pressure up to 1,000 p.s.i. above the pressure at the top of said cavity, thereby inducing a fissure along the plane of weakness to establish fluid communication between a plurality of said perforated casings, introducing solvent to said fissure, and extracting with said solvent product minerals from said product stratum thereby developing an extraction surface adjacent the bottom of said stratum.

6. The method of claim 5 wherein the plane of weakness is a narrow band of water insoluble minerals.

7. The method of claim 5 wherein the plane of weakness is a narrow seam of clay and the fluid introduced to induce the fissure is a nonsolvent of the minerals adjacent the plane of weakness.

8. The method of providing an extraction surface for solution mining a stratum of product minerals adjacently disposed above a seam of clay which comprises establishing a plurality of cased bore holes through said stratum and said seam to a deposit of soluble materials disposed therebelow, extracting with a solvent a substantial cavity in said soluble deposit, perforating a plurality of said casings in the vicinity of said clay seam, sealing a said casing below the lowest perforation therein, introducing at pressure up to 1,000 p.s.i. above the hydrostatic pressure at the top of the cavity fluid to the perforations in said sealed casing thereby to induce a fluid travel path between said casings in the vicinity of said clay seam, feeding solvent to said fluid travel path to extract product minerals adjacent said travel path and withdrawing mineral bearing solvent from said travel path thereby establishing a cavity adjacent said stratum.

9. The method of claim 8 wherein the fluid introduced to induce said fluid travel path is introduced at a pressure below about 500 p.s.i. in excess of the pressure against the cavity roof.

10. The method of claim 8 wherein the fluid introduced to induce the fluid travel path is introduced at a pressure between about 10 to about 600 p.s.i. in excess of its hydrostatic pressure.

11. In a solution mining system wherein a plurality of casings are disposed in bore holes extending through strata of product and nonproduct minerals to a cavity situated below said strata and a clay seam is disposed adjacent the bottom of a product stratum, the method of providing an

extraction surface to solution mine said product stratum which comprises perforating a plurality of said casings substantially adjacent said clay seam, sealing said system against fluid flow through the cavity, introducing to at least one of said casings fluid at superatmospheric pressure below 1,000 p.s.i. gauge to induce a fissure in the vicinity of said clay seam said fissure communicating with a plurality of said casings, feeding solvent to said fissure through at least one of said casings and withdrawing effluent from at least one of said casings thereby enlarging the fissure.

12. The method of claim **11**, wherein the pressure within the fissure is increased to cause collapse of the underlying formation into the cavity below.

13. In establishing an extraction surface adjacent the lower portion of a stratum of product minerals located above an interface between strata of dissimilar materials and a subterranean deposit, said interface being located above a subterranean cavity, the method which comprises providing a casing in open communication with the deposit in the vicinity of the interface and above said cavity but out of open communication with said cavity, providing a second casing spaced from said first named casing and in open communication with the deposit in the vicinity of the interface and above said cavity, providing fluid under pressure to the deposit in the vicinity of the interface through the first named casing and at a pressure at least equal to the pressure existing at the top of the cavity but below the pressure normally required to fracture a similar deposit at the depth of said interface thereby to induce a fissure along said interface in open communication with said first named casing, and continuing to provide fluid through said first named casing at said pressure thereby extending the fissure until said fissure openly communicates with said second named casing.

14. The method of claim **13** wherein the fluid employed to induce said fissure is a solvent of the product minerals.

15. The method of claim **13** wherein the pressure within the fissure is increased to cause collapse of the underlying formation into said cavity.

16. The method of claim **13** wherein solvent is introduced into said fissure to extract minerals adjacent said fissure thereby to develop an extraction surface adjacent the lower portion of the product stratum.

17. The method of claim **13** wherein non-product minerals located beneath said interface are first extracted to develop said subterranean cavity and thereafter fluid is introduced to said interface to induce said fissure.

18. The method of solution mining a stratum of product minerals located above an interface between strata of dissimilar materials and a subterranean deposit said interface being located above a subterranean cavity, which comprises providing a plurality of conduits in open communication with the deposit in the vicinity of the interface and above said cavity, providing fluid under pressure to the deposit in the vicinity of the interface through a said conduit and at below normal fracturing pressure, continuing the introduction of fluid in the vicinity of the said interface until there is established a fluid travel path with a substantial surface area in the vicinity of said interface and in open communication with said conduit and introducing solvent to said fluid travel path to extract minerals adjacent said fluid travel path thereby developing an extraction surface adjacent the lower portion of said product strata.

19. The method of claim **18** wherein the plurality of conduits comprises a tubing concentrically disposed in a cased bore hole.

20. The method of claim **19** wherein the casing of the bore hole is perforated in the vicinity of the interface and the annulus between the tubing and the casing is plugged below the uppermost perforations and above the lowermost perforations.

21. The method of establishing a parting in a subterranean formation which comprises selecting an interface located between strata of said formation and above a subterranean cavity, bringing a conduit into open communication with the formation in the vicinity of said selected interface and above said cavity and introducing fluid into the vicinity of said selected interface through said conduit under pressure and at below normal fracturing pressure, continuing the introduction of fluid in the vicinity of said selected interface until there is established in said formation a parting with substantial surface area in open communication with said conduit in the vicinity of said selected interface.

22. The method of claim **21** wherein fluid is introduced to the parting in the formation to extend the parting until it openly communicates in the vicinity of the interface with a second conduit laterally spaced from the first named conduit.

23. The method of claim **21** wherein the relative pressures in the cavity and in the parting are adjusted to cause collapse of the formation between the parting and the cavity.

24. The method of providing an extraction surface for solution mining a stratum of product minerals adjacently disposed above a seam of clay which comprises establishing a plurality of cased bore holes through said stratum and said seam to a deposit of soluble materials disposed below, extracting with a solvent a substantial cavity in said soluble deposit, perforating casings in the vicinity of said clay seam, providing fluid through the perforations of one of said casing in the vicinity of said clay seam under pressure but below normal fracturing pressure, continuing to introduce fluid under pressure but at below normal fracturing pressure to thereby induce a fluid travel path between said perforated casings in the vicinity of said clay seam, feeding solvent to said fluid travel path to extract product minerals adjacent said travel path and withdrawing mineral bearing solvent from said travel path thereby establishing a cavity adjacent to said stratum.

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