

Sept. 24, 1968

J. B. DAHMS ETAL
METHOD OF INCREASING INJECTION AND WITHDRAWAL
POINT IN A SOLUTION MINING CAVITY

3,402,965

Filed March 11, 1966

4 Sheets-Sheet 1

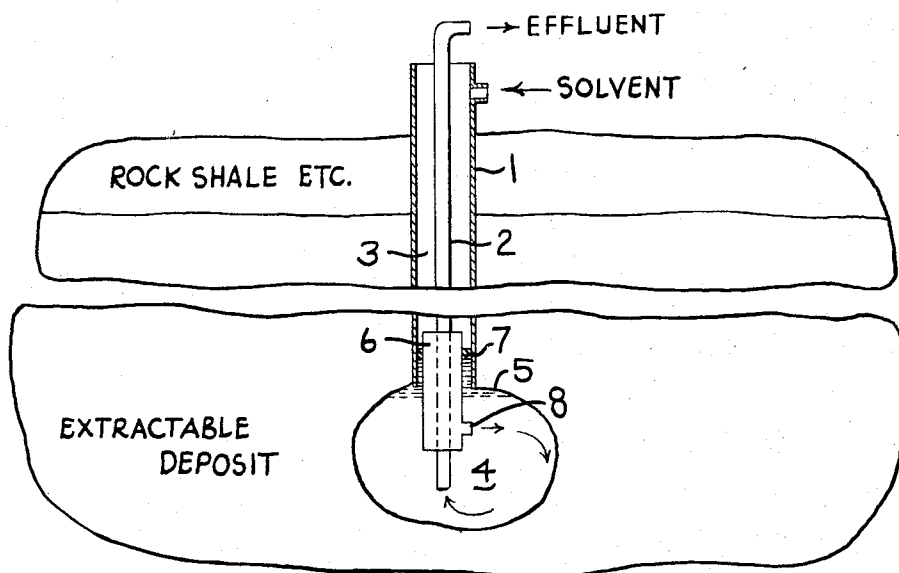


FIG. 1

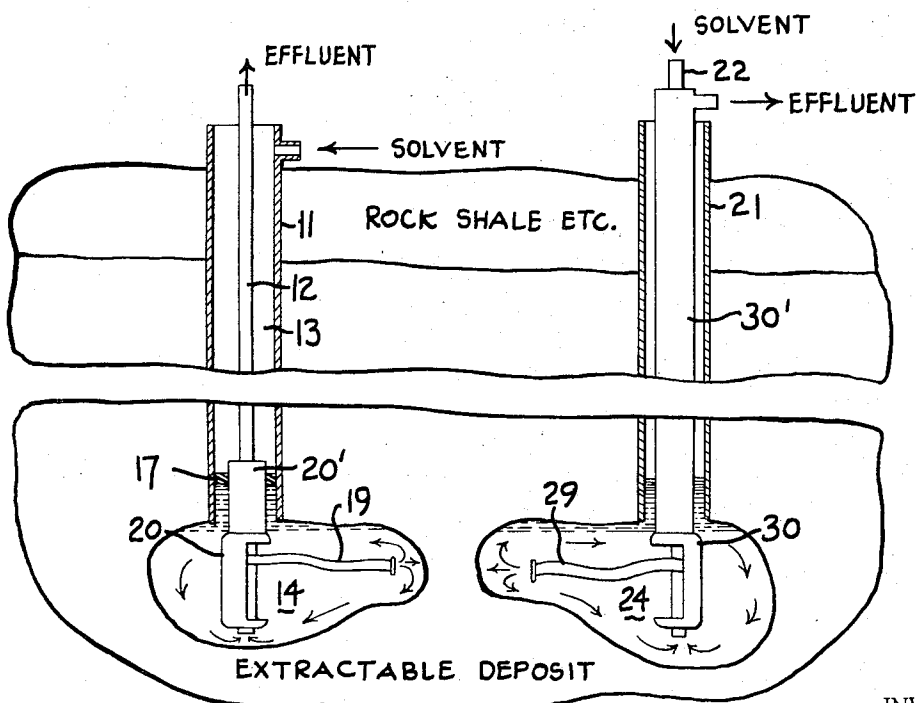


FIG. 2

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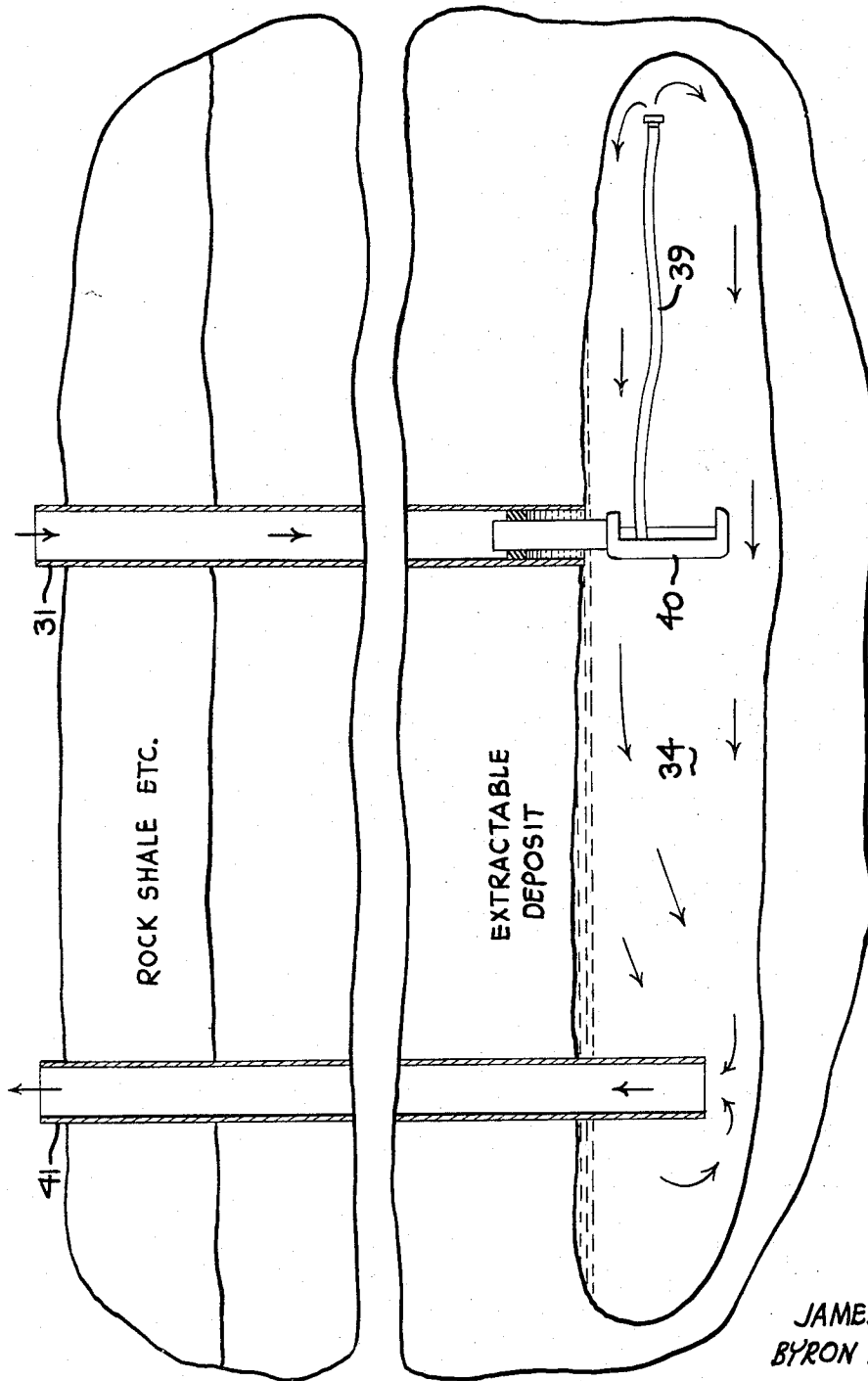


FIG. 3

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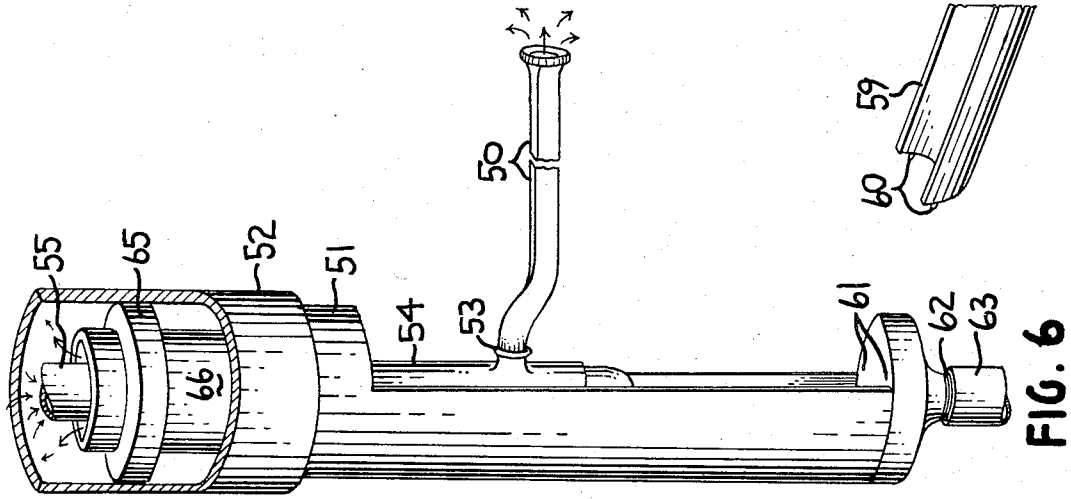


FIG. 6

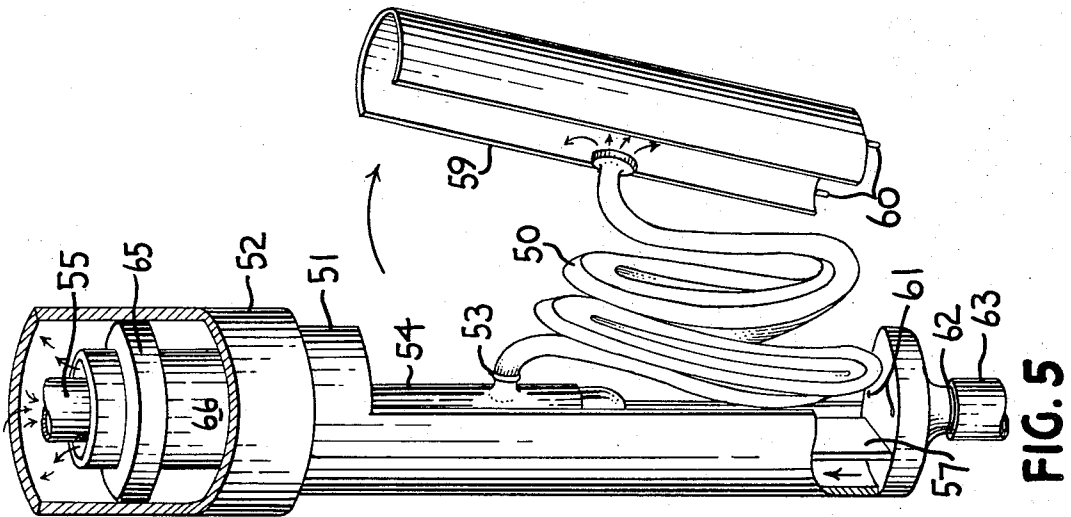


FIG. 5

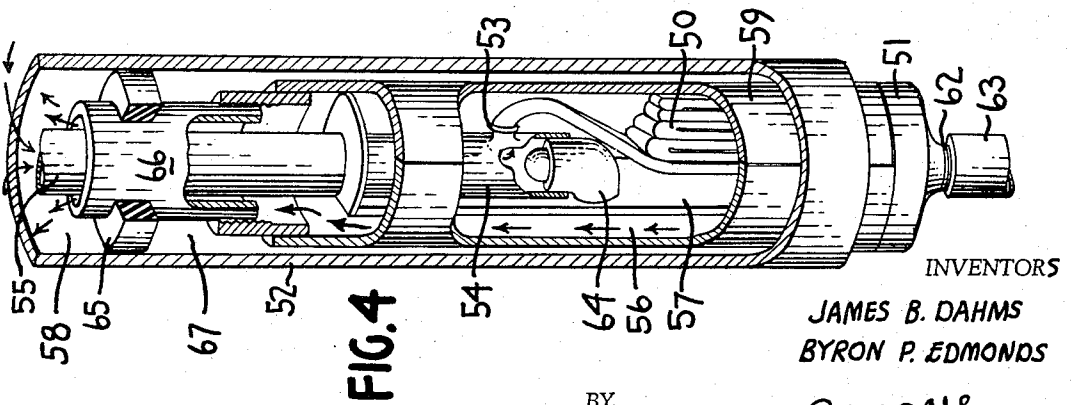


FIG. 4

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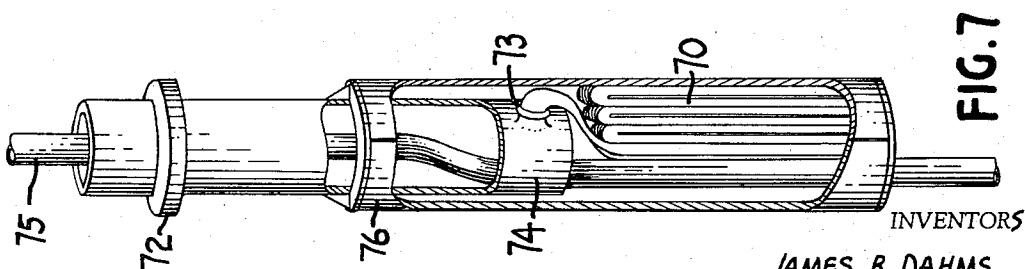
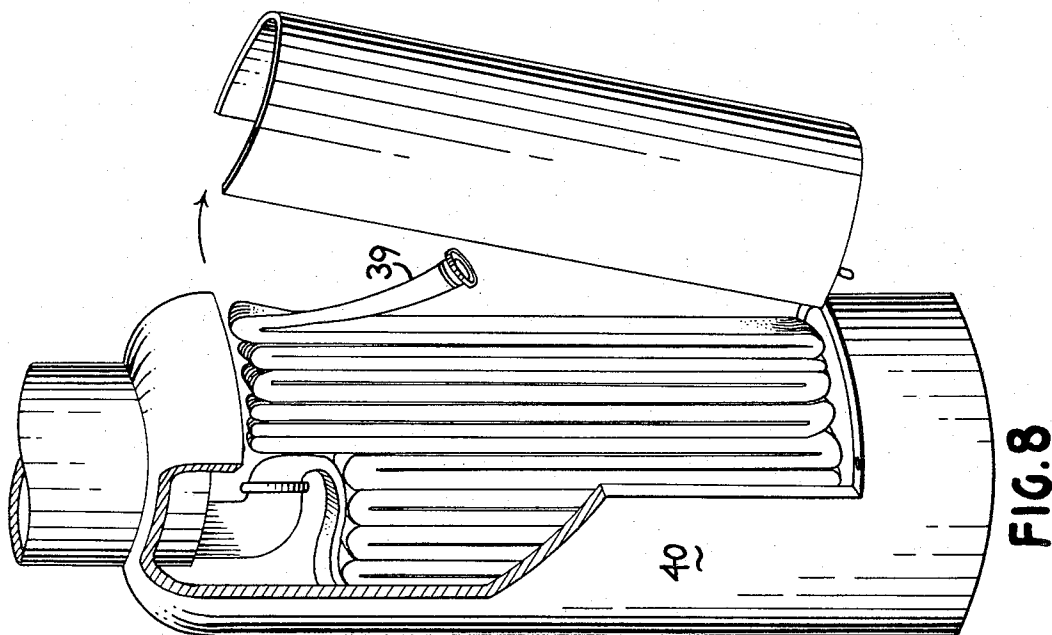
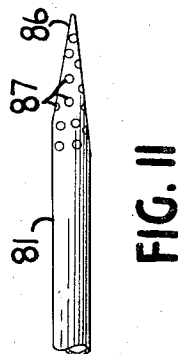
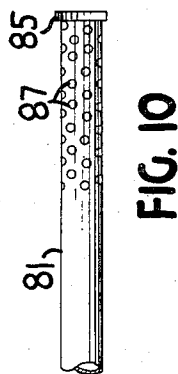
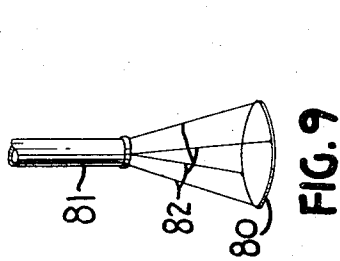
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3,402,965

METHOD OF INCREASING INJECTION AND WITHDRAWAL POINT IN A SOLUTION MINING CAVITY

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15 Claims. (Cl. 299—4)

ABSTRACT OF THE DISCLOSURE

A solution mining method is described in which a flexible tube is utilized to provide a large travel path for incoming solvent and outgoing effluent from a solution mining cavity. The flexible tube is attached to a solvent supply system and extended in the cavity a substantial distance by the introduction of solvent. The flexible tube is positioned in the solution of the cavity above the floor and below the ceiling and is positioned substantially horizontally to both the floor and ceiling.

This invention relates to solution mining. It more specifically relates to an improved method of introducing solvent to a desired location in a solution mining cavity.

In solution mining, one or more conduits are provided through a plurality of strata of varying composition to a subterranean deposit of product minerals. By "product mineral" is meant a mineral which it is commercially desirable to extract. These minerals are extractable with suitable solvents, typically aqueous media, e.g., water, acid, steam, or aqueous solutions unsaturated with respect to the product mineral.

In a typical commercial operation, a single cased bore hole is first established to communicate with a product deposit. A length of tubing of smaller diameter than the casing is then placed internal to the bore hole casing to communicate with the deposit. Solvent is introduced to the deposit through the annulus between the casing (including liners or equivalent extensions of the casing) and the tubing. As the solvent contacts the deposit, it extracts extractable material therefrom thereby forming a solution filled cavity. Additional solvent is introduced to the cavity and cavity solution is withdrawn through the tubing internal to the casing. The cavity is thereby caused to grow in size. If desired, the annular conduit may be used as the effluent conduit and the internally disposed conduit as the influent conduit. As cavities increase in size, they may be brought into communication with additional bore holes. In that event, one or more cased bore holes may function as the injection conduits while one or more separated bore holes function as withdrawal conduits.

It has long been appreciated that the economics and efficiency of a solution mining cavity are improved by increasing the fluid travel path within the cavity. This flow path is typically increased by increasing the separation between the point of solvent injection and the point of effluent withdrawal. In the cavity which communicates with a single cased bore hole, this separation has been limited to the vertical distance between the injection and withdrawal points. As a practical matter, this distance could not exceed the height of the cavity. In a cavity which communicates with a plurality of bore holes, separation of the injection and withdrawal points is greater but has nevertheless been limited by the fixed distances between bore holes. To increase the flow path further, additional bore holes have heretofore been required. Providing additional bore holes is expensive and time consuming.

The present invention provides a simple and inex-

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pensive method of greatly increasing the fluid travel path within a solution mining cavity. The fluid travel path is increased by increasing the separation of the solvent injection point from the effluent withdrawal point. In general, this increased separation is accomplished by providing a length of flexible tubing or conduit attached to the cavity end of the influent conduit. The flexible tubing is oriented in a direction with a substantial horizontal component. Thus, solvent is delivered to the cavity at a point quite remote from the axis of the influent conduit. To maximize separation of the injection and withdrawal points, the flexible tube is oriented away from the withdrawal conduit.

A noteworthy characteristic of this invention is that the flexible tubing taught by the instant invention can deliver relatively fresh solvent, i.e., solvent which is unconcentrated with respect to the extractable minerals of the deposit to the extraction surface of the formation. Thus, the dissolving power of the solvent in contact with the extractable material is enhanced. In a solution mining operation, it is often desired to maintain a gradation of concentrations of cavity solution, e.g., with the most concentrated solution at the bottom of the cavity. Horizontal separation of the inlet and outlet points contributes greatly to maintaining the optimum gradation of concentrations in a cavity. In addition, the capacity of a cavity to produce concentrated solution increases exponentially as this horizontal spacing is increased.

It is important to introduce the flexible tubes of this invention to the cavity in undamaged condition. A flexible tube can sometimes be satisfactorily introduced down a large, e.g., 10 inch, casing to a cavity only a few hundred feet beneath the surface of the earth by merely allowing it to dangle at the end of a liner or tubing run down the casing. The flexible tubing may be weighted with a soluble material, e.g., a salt core to facilitate its entry into the cavity. Alternatively a weight may be attached to the tube with cord or equivalent means adapted to weaken and break upon aging or upon prolonged contact with the cavity solution. Preferably, the flexible tube is protected by suitable means to prevent its being damaged as it is introduced down a bore hole. Illustrative of such means are the protective carrying devices disclosed in applicant's copending application, Ser. No. 533,558, filed Mar. 11, 1966 for Solution Mining Apparatus and Method and assigned to Kalium Chemicals Limited.

According to one embodiment, the tube is packed in a container or can of the type disclosed in the afore-mentioned copending application much as a fire hose is packed in a fire hose container. In the can is a nozzle or equivalent adapted to communicate with a supply conduit. The flexible tube is attached to this nozzle. In some embodiments, the can must also accommodate a withdrawal conduit. The can desirably includes means for equalizing pressure across the nozzle as the can is lowered into a cavity through a bore hole. There is a substantial opening in the can through which the flexible hose unfolds into the cavity. Usually the opening is provided with a hatch, typically a removable portion of the can. In that event, the can desirably includes means for automatically removing the hatch when the can emerges from the casing at the top of the cavity. The flexible tube is thereby freed from the can so that it can extend into the cavity. Other suitable tube-carrying devices and other methods of introducing the flexible tube to a cavity will suggest themselves to the skilled artisan.

The flexible conduit may be made of any suitable material. Various plastic, e.g., polyethylene and polyvinylchloride films, synthetic fabrics, such as nylon and rayon, natural fabrics such as cotton twill and canvas, rubber or rubberized fabrics, or similar materials suitable for mak-

ing flexible tubes or hoses may be employed. One particularly good material for making flexible conduits has been rubber impregnated nylon fabric.

Sometimes a flexible tube tends to meander in the cavity when solvent is introduced through it. A degree of meandering is generally acceptable but it is often desired to deliver solvent to a chosen extraction area. Meandering of the flexible tube is greatly reduced by constructing it from a material with a rough surface. Additional roughness can be built into the tube, e.g., by providing several joints at intervals along its length. The natural roughness of the tube together with the roughness of the joints helps encourage the conduit to straighten and remain straight when the fluid, e.g., solvent flows therethrough. Internal roughness of these tubes has been further increased by adhering rubber crumb to the inside of the tube. To further decrease the tendency of the flexible conduit to meander about the cavity, a means associated with the injection point, typically an end device, may be employed. The end device may take a variety of forms and is designed to establish a resultant force operating on the tube in the direction of solvent flow.

The length and diameter of the flexible tubes which may be employed depend on several factors, e.g., materials of construction, solvent flow velocity and cavity conditions, e.g., density of the cavity solution and flow currents in the cavity. In general, flow rates are rarely high enough to utilize satisfactorily tubes larger than 6 inches in diameter. Tubes less than 2 inches in diameter are generally structurally unstable and tend to meander unduly in the cavity. Tube lengths up to several hundred feet are possible. Three to four inch diameter tubes 30 to 100 feet in length are readily employed. The tube lengths and diameters herein disclosed are by way of illustration only and are not intended to limit the scope of the invention in any way.

The invention will be more readily understood with reference to the drawings of which FIGURES 1, 2 and 3 illustrate a typical sequence in the practice of the instant invention. FIGURES 4, 5 and 6 illustrate the operation of a preferred carrying means or can for introducing the flexible tubes of this invention to a cavity. FIGURE 7 illustrates an alternative can apparatus. FIGURE 8 illustrates a can employable in a bore hole which houses a single fluid-carrying conduit. FIGURES 9, 10 and 11 illustrate various end devices useful as aids to straighten out the flexible tube and reduce the tendency for the extended tube to meander.

Referring to FIGURE 1, a cased bore hole 1 is provided to communicate with an extractable deposit. Tubing 2 is disposed internal to the casing 1 to provide a second conduit through the bore hole. Solvent is introduced through the annular conduit 3 and effluent (solution laden with extracted material) is withdrawn through the internally disposed tubing 2. In this fashion, a cavity 4 is developed.

Mineral or petroleum oil is often provided to the cavity to form an insulating layer 5 at the top of the cavity as the cavity is developed. In this fashion, horizontal development of the cavity is encouraged. Rapid horizontal development of the cavity may be additionally encouraged, particularly when the cavity is small, e.g., less than about 50 feet in diameter, by providing a flow diverter at the base of the casing 1. The flow diverter imparts a horizontal component of velocity to the solvent entering the cavity. The flow diverter illustrated comprises a liner 6 attached to the tubing 2. The annulus between the liner and the casing is blocked with packing means 7. One or more holes, orifices or jets 8 are provided in the liner oriented in the desired direction. Often a single port 8 is provided and is oriented toward a second cavity remotely located in the same extractable deposit.

After a cavity has developed sufficiently in the desired direction to accommodate an extended length of flexible conduit, the flow diverter is removed from the

bore hole. Flexible tubing is then introduced to the cavity as an extension of the influent conduit (see 19, 29 and 39 of FIGURES 2 and 3). In this fashion, the injection point of the solvent is provided at a point remote from the withdrawal point. In addition, because fresh solvent is introduced at a selected point in the cavity, the cavity is caused to develop preferentially in a desired direction.

Referring to FIGURE 2, two separated cased bore holes 11 and 21 communicate with an extractable mineral deposit. Cavities 14 and 24 are then established at the base of the bore holes in accordance with well known solution mining techniques, such as those previously described herein. After each cavity has reached a suitable radius, for example, 50 feet, flexible tubes 29 and 19 are introduced down cased bore holes 11 and 21, respectively, by means of carrier assemblies 20 and 30. The flexible tubes 9 and 19 are oriented to develop the cavities toward each other. It is often desirable to withdraw the carrier assemblies from time to time to replace a flexible tube with a longer flexible tube. Best results are usually obtained when the solvent injection point is close to the extraction surface.

According to the embodiment of FIGURE 2, each carrier assembly has two fluid carrying conduits, one of which communicates with the withdrawal conduit and the other of which communicates with the input conduit of the cased bore hole in which it is positioned. In FIGURE 2, the withdrawal conduit of carrier assembly 20 communicates with tubing 12 and the annulus 13 with the input conduit (flexible tube 19) through liner 20' which forms a part of the carrier can. The annulus between liner 20' and casing 11 is blocked with packing means 17 to divert solvent to the carrier influent conduit. Carrier assembly 30 is of an alternative type wherein the withdrawal conduit communicates with the annulus between tubing 22 and tubing 30'. Internal tubing 22 communicates with the influent conduit of the can 30. Tubing 30' could alternatively extend only part way up the casing 21 and be packed off the same as liner 20' is packed to casing 11.

When a relatively large cavity communicates with a plurality of cased bore holes, the flexible tubes of this invention are useful in further developing the cavity. For example, referring to FIGURE 3, after two cavities have been brought into communication, the internal piping can be removed from one of the bore holes 41 communicating with the resulting cavity 34. This bore hole 41 then functions as the withdrawal conduit. Flexible tube 39 may be oriented in a direction away from the withdrawal bore hole 41 to develop the cavity further in that direction and to increase the separation between the inlet and withdrawal points in the cavity.

Flexible tube 39 may be the tube used to develop the cavity initially. Often this tube is ultimately replaced by a different tube in a can 40 adapted to communicate with the influence conduit only (see FIGURE 8). Of course, the flexible tubes may be removed from bore hole 31 and introduced down bore hole 41 if it is desired to develop the opposite end of the cavity. As the cavity increases in size, the carrier assembly can be brought to the surface of the earth from time to time to replace the flexible tube with a flexible tube of greater length. In removing the carrier assembly from the cavity, the flexible tube is sometimes sheared from the carrier assembly by the casing. The loss of this tube represents a negligible expense, however, in comparison to the economic advantages obtained by the practice of this invention.

Although many devices and methods for introducing the flexible tubes of this invention to a solution mining cavity will be suggested to the skilled art, FIGURES 4 through 6 and FIGURES 7 and 8 illustrate preferred devices.

Referring to FIGURE 4, a length of flexible tubing 50 is shown packed inside carrier can 51. The can assembly is contained inside a bore hole casing 52. The flexible

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tube is packed inside the can like a fire hose or in a snake-wise fashion. The flexible tube is attached to a nozzle 53 which communicates with a chamber 54 adapted to communicate with supply tubing 55. The fluid passage 56 for withdrawal from the cavity is provided by plate 57 placed as a chord in the back of the can. This fluid passage connects with the annulus 58 external of tubing 55. An opening is provided in the can. This opening is closed by hatch 59 which in this instance is a portion of the can adapted to be removable from the can when it enters a cavity. The hatch is removably fixed at the bottom of the can by pegs 60 which fit into holes 61. The hatch may be biased for removal by a spring or equivalent means (not shown) although the bias of the packed tube is often sufficient to remove the hatch (FIGURE 5). A threaded or equivalent portion 62 is provided at the bottom of the can in communication with fluid passage 56. An extension 63 of chosen length can be attached to this portion. The extension locates the withdrawal point at the desired depth in the cavity. This point can be relocated from time to time by replacing the extension with an extension of a different length. A ball valve 64 or equivalent pressure relief means is provided to allow equalization of pressure across nozzle 53 thereby avoiding rupturing of the flexible tube by transient pressures which may arise when the can is introduced down the casing. The annulus 67 between the can and the casing is blocked with packing means 65, e.g., packing cups, expandable or inflatable packers or equivalent means. Because the external diameter of the can 51 is only slightly smaller than the internal diameter of the casing 52 an end portion 66, sufficiently reduced in diameter to accommodate the packing means 65, is provided.

FIGURE 5 shows the operation of the release of the hatch 59. The carrier assembly has been dropped sufficiently below the casing to allow the hatch to fall free. Prior to being introduced to the top of the cavity, the biased hatch is held in contact with the can by casing 52. The frictional pressure of the casing holds the hatch over the flexible tube thereby protecting it. After the hatch has fallen free, fluid pressure, usually provided by the introduction of solvent, causes the flexible tube to extend horizontally as shown in FIGURE 6. Solvent is injected down tubing 55 into chamber 54 and through the nozzle 53 to the flexible tube 50. Effluent flow is into the extension 63 through the passage 56 in the carrier assembly to the annulus 58 (FIGURE 4).

FIGURE 7 shows a less preferred but highly satisfactory alternative design of a carrier assembly for the introduction of a flexible tube to a cavity. The flexible tubing 70 is packed in the same fashion as in the can illustrated in FIGURE 4 through 6. Nozzle 73 communicates with chamber 74 which extends beyond packing means 72. Tubing 75 extends through the entire can. This apparatus is introduced through a casing and hatch 76 is removed in a fashion similar to that described in connection with FIGURE 4 through 6. In this apparatus, however, solvent flow is from the annulus above the packing 72 through chamber 74 and the nozzle 73 into and through the flexible tube 70. Cavity solution is withdrawn through the tubing 75.

Transient pressures across the flexible tubing may be relieved during introduction of the apparatus shown in FIGURE 7 by any convenient valve means. Many such valves, e.g., sleeve valves, are known to the art. The valve (not shown) provides communication between the annulus or the chamber 74 and tubing 75 while the can is being introduced down a bore hole. When the can is in position, the valve is closed in response to mechanical manipulation or electrical impulse. The valve may also close in response to the removal of hatch 79. Pressure relief may also be accomplished by employing an expandable packer as the packing means 72. If the packer is left contracted until the can is in proper position, the transient

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pressures are often inconsequential thereby eliminating the need for a pressure relief valve.

Simpler carrier assemblies are employable in a well developed cavity communicating with a plurality of bore holes (FIGURE 3). When separate bore holes are used as introduction and withdrawal conduits, only one fluid-carrying conduit need be provided in association with the carrier assembly. The elimination of one of the conduits from the interior of the assembly makes it possible to pack a much longer tube of a given diameter in the can. An enlarged view of such a carrier assembly is illustrated in FIGURE 8. The can 40 of FIGURE 8 need not be attached to tubing when it is emplaced. It is preferably suspended from the interior of a casing by packing means (FIGURE 3). By eliminating the concentrically disposed tubing from a bore hole, the flow rate of fluids passed through the bore hole can be increased. This increased flow rate facilitates the extension of flexible tube 39.

It is, of course, recognized that the invention is operable with any number of equivalents to the introduction systems depicted in the several drawings. The drawings are for the purpose of illustrating preferred embodiments only and should not be taken as limiting the invention in any way.

According to certain preferred embodiments of this invention, steps are taken to encourage the flexible tube to assume a relatively stable orientation in the cavity. Sometimes it is acceptable for the tube to meander about the cavity provided solvent is injected at a point well removed from the withdrawal point. More often, it is desired that the tube straighten along its full length and remain oriented in a selected direction. A tapered flexible conduit having a smaller diameter at the terminal and (injection point) than at the supply nozzle has less tendency to meander than an equivalent untapered flexible tube.

FIGURES 9 through 11 show several end pieces designed to help maintain a desired orientation of a flexible tube. The device of FIGURE 9 is a rigid circular plate attached to flexible tube 81 by means of straps 82. Two types of enclosures 85, 86 for the flexible tube 81 are illustrated in FIGURES 10 and 11, respectively. These closures may be a part of the tube or they may be made from more rigid materials and attached to the tube. A plurality of small ports 87 are provided behind the closed tube end for solvent flow. A number of other devices will be suggested by this disclosure to the skilled artisan.

According to another embodiment of this invention, the flexible conduit is coated, prior to packing in the carrier assembly, with a pliable or flexible material which cures or hardens to a rigid condition after the flexible tube has been extended in the cavity. In this fashion, a rigid conduit is formed in situ in the cavity. Besides eliminating the tendency for the conduit to meander, this embodiment provides a method of introducing a lateral extension of the withdrawal conduit to a cavity. Thus, a properly treated flexible conduit can be introduced to the cavity and extended in the usual manner. After the coating or impregnating material has set to a rigid state, the lateral conduit is positioned to locate its terminus at the desired withdrawal point. By extending such a conduit in the opposite direction from the injection conduit, the operating efficiency and economy of a solution mining cavity are even further enhanced.

Suitable materials for impregnating a flexible tube in accordance with this embodiment include resinous materials such as polyester resins which can be gelled to a flexible state and which are subsequently cured to a rigid state. For example, an unsaturated polyester monomer, e.g., propylene maleate or propylene maleate phthalate is mixed with styrene and a peroxide catalyst, e.g., benzoyl peroxide, in standard proportions. An accelerator, e.g., stannous chloride is added to speed formation of a gel. The flexible tube is coated or impregnated with this gel and introduced to a solution mining cavity. The tube is extended in the usual manner as taught by this disclosure.

Upon aging, the partially polymerized (gelled) mixture continues to cure until the gel transforms into a rigid polymer thereby rendering the tube less flexible. As the tube becomes more rigid, it has less tendency to meander. The effective length of the tube may actually be extended in this fashion. The cure of the resin can be accelerated by pumping hot fluid, e.g., water through the extended tube. Eventually the tube becomes quite rigid and possesses adequate strength to remain extended even when the direction of fluid-flow is reversed therein.

Suitable coating or impregnating materials include those which remain pliable until exposed to aqueous media, e.g., polyurethanes. Organo polysiloxanes, which cure in the presence of water to become rigid, are highly desirable materials. Many other materials particularly polymerization systems will suggest themselves to the skilled art. Often, when a polymer with satisfactory cured strength properties is selected, the flexible tube may be constructed of materials with relatively less strength or durability than would otherwise be required.

According to one embodiment, resinous material such as gelled polyester or uncured epoxy resin is introduced to a can in which a flexible tube, such as a canvas or Fiberglass tube is packed. The can is introduced down a bore hole with the resin in contact with the fabric of the flexible tube. By the time the tube is extended in a cavity, it is well treated with the resin. Uncured epoxy resins are particularly useful in this embodiment. For example, approximately equal portions of an epoxy resin and a polyamide resin are introduced to a can packed with a flexible tube. The cure rate (pot life) of the mixture is selected to provide ample time for the tube to be extended before the resin sets.

To avoid premature hardening of the resins used to treat the flexible tubes of this invention, a plasticizer can be included in the formulation. A plasticizer which is readily extracted from the resin by the cavity solution is especially desired. As the plasticizer is extracted, the extended tube becomes more rigid. In other embodiments suitable coating or impregnating material is pumped to the extended flexible tube through the supply conduit.

Collapsible mechanical means, e.g., hinged splines, which pack with the folded tube in the can and lock into straightened position when the flexible tube is extended are also within contemplation.

According to some embodiments, a plurality of flexible tubes are provided at the base of a single bore hole attached either to individual or common supply conduits.

Although this invention has been described with particular reference to certain preferred embodiments, it is not intended to limit the invention to the details of these embodiments except to the extent that such details are incorporated in the appended claims.

We claim:

1. In a solution mining operation wherein solvent is introduced through a conduit to a cavity situated adjacent extractable minerals and cavity solution is withdrawn from the cavity through a second conduit the improvement comprising introducing a flexible tube attached at one end to one of said conduits, feeding fluid through said attached conduit and flexible tube to extend said flexible tube a substantial distance into said cavity from said one end, thereby increasing the separation of the introduction and withdrawal points in the cavity and maintaining said flexible tube substantially horizontal with respect to the cavity ceiling and the cavity floor and spaced between the ceiling and the floor in the cavity solution.

2. The improvement of claim 1 wherein the named conduits both extend through the same bore hole and the conduit to which the flexible tube is attached is used as an influent conduit while the other conduit is used as a withdrawal conduit.

3. The method of claim 1 wherein the flexible tube is adapted to become rigid after it is extended.

4. The method of claim 3 wherein after the flexible

tube becomes rigid it is employed as a withdrawal conduit.

5. The method of claim 1 wherein the flexible tube is adapted internally to offer frictional resistance to fluid passing therethrough so that the tube tends to straighten out when fluid is passed through it.

6. The method of claim 1 wherein means are provided in association with the injection point at the end of the flexible conduit to be contacted by the solvent thereby establishing a resultant force acting upon the tube in the direction of solvent flow.

7. The method of claim 1 wherein the flexible tube is oriented away from the second named conduit.

8. The method of claim 1 wherein a plurality of flexible tubes are provided in communication with the same conduit.

9. In a solution mining operation wherein solvent is injected through a conduit to a cavity situated adjacent extractable minerals and cavity solution is withdrawn from the cavity through a second conduit the improvement which comprises providing a flexible tube treated with a resinous substance in at least a partially uncured state and attached at one end to one of said conduits by means adapted to orient the flexible tube in a direction with a substantial horizontal component when the flexible tube is extended, feeding fluid through said attached conduit and said flexible tube to extend said flexible tube before the cure of said resinous substance is complete thereby increasing the separation of the injection and withdrawal points in the cavity and continuing the cure of said resinous substance thereby causing said flexible tube to become rigid.

10. A method of solution mining which comprises providing a cased bore hole through an extractable deposit, extracting said deposit to form a cavity, providing through the cased bore hole to the cavity a carrying means, said carrying means being operably associated with a supply conduit and containing a flexible tube attached to said supply conduit to allow flow from the supply conduit through said flexible tube, providing an effluent conduit in communication with said cavity, introducing solvent through said supply conduit and said flexible conduit to the cavity at a flow rate sufficient to cause said flexible conduit to extend a substantial distance into said cavity from said carrying means thereby increasing the separation of the introduction and withdrawal points in the cavity while maintaining in said flexible tube a substantially horizontal component with respect to the cavity ceiling and the cavity floor to thereby space said flexible tube in the cavity solution above the floor and below the ceiling thereof.

11. The method of claim 10 wherein the effluent conduit is provided through the same cased hole as the supply conduit and is operably associated with the carrying means.

12. The method of claim 10 wherein the flexible tube is adapted to become rigid after it is extended from the carrying means.

13. The method of claim 10 wherein a flexible tube is also provided in communication with the withdrawal conduit, said flexible tube being adapted to become rigid after it has been extended.

14. A method of solution mining which comprises providing a cased bore hole through an extractable deposit, extracting said deposit to form a cavity providing through the cased bore hole to the cavity a carrying means having a fixed portion in which there is provided in operable association a supply conduit and a flexible tube attached to said supply conduit to allow flow from the supply conduit through said flexible tube, a removable portion being provided for said carrying means and held in association with said fixed portion by frictional pressure of the cased bore hole while said carrying means is being introduced down said cased bore hole but biased to separate from said fixed portion when said carrying means

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emerges from the bore hole into the cavity thereby opening said carrying means to permit the flexible tube to be extended out from said carrying means, lowering said carrying means through said cased bore hole into said cavity providing a withdrawal conduit in said cavity, introducing solvent through said supply conduit and said flexible tube to the cavity at a flow rate sufficient to cause said flexible tube to extend from said carrying means in a direction with a substantial horizontal component and withdrawing effluent from the cavity through said withdrawal conduit.

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15. The method of claim 14 wherein the fixed portion of the container includes a withdrawal conduit.

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