COMMISSIONER'S DECISION

Obviousness: Leaching of Subterranean Mineral Deposits

Explosive Fracturing of a deep rock ore body is known. Injection of the leaching solution in the less severely fractured zone and recovering it in the more severely fractured zone is not shown in the prior art.

Rejection: Reversed

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This decision deals with the refusal of claims C1 to C18 of patent application 205,542 (Class 166-23). The refusal appears in a letter dated April 7, 1978, issued as a result of a re-examination of the claims under Section 45(4) of the Patent Act, i.e. during conflict proceedings.

The application was filed on July 24, 1974 by E.I. Du Pont de Nemours and Company, and is entitled "Explosive Fracturing of Deep Rock." The Patent Appeal Board held a Hearing on October 25, 1978 at which Mr. R.E. Vernon and Mr. A. Brooks, the inventor Mr. Coursen, and Miss C. Asconci, the applicant's United States agent, represented the applicant.

The invention relates to the leaching of subterranean mineral deposits in the earth. A network of underground rock fractures produced by means of explosives prepares the ore bodies for in situ leaching. Figures 1 and 2 of the drawings indicate what the invention is about.

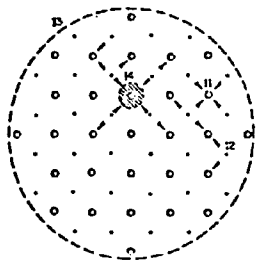

FIGURE 1

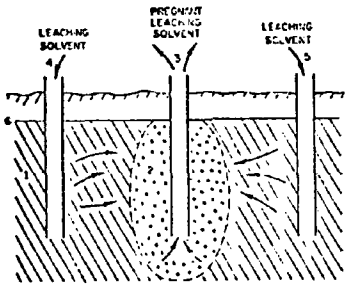

FIGURE 2

Claims C1 to C18 stand rejected in view of the following references:

United States

3,278,233	Oct. 11, 1966	Hurd et al
3,542,131	Nov. 24, 1970	Walton
3,574,599	Apr. 13, 1971	Ortloff et al
3,630,278	Dec. 28, 1971	Parker
3,640,579	Feb. 8, 1972	Lewis
3,647,261	Mar. 7, 1972	Stenger et al
3,666,014	May 30, 1972	Beard

In the rejection it was said, inter alia, that:

> The Beard patent shows the use of a high energy explosive device in the formation of a zone of high permeability, and the creation of a "chimney" or rubbled zone. A zone of permeability 17 within and around the fragmented formation is formed surrounding the chimney. When used throughout the specification (3,666,014), the terms "fragmented zone" and "fragmented zone of rubble" refer to the rubbled zone 15 or any other rubbled or fracture-permeated zone formed by any means well known in the art. The patent also teaches the injection of a gas (fluid) into the fragmented zone.
>
> The Stenger et al patent teaches solution mining of a metal. The patent teaches, in column 2 at line 6, that "Permeability may also be improved by underground fracturing techniques, such as are employed in the oil industry, although it is desirable that the brine pass through the ore itself rather than through cracks in the ore".
>
> The Ortloff et al patent teaches a recovery method for the in situ disintegration of a solid material comprising an in situ conversion of the solid material to a fluid solution by chemical conversion. In column 3 at lines 21 to 28 there is discussed a procedure if insufficient permeability exists to establish fluid permeability in the deposit and the residence time of the leach solution which can be controlled by the rates of injection and withdrawal of the solution.
>
> The Hurd et al patent teaches that the permeability may be increased by suitable means, such as hydraulic fracturing in the in situ leaching of deposits.
>
> The Lewis patent teaches the use of an oxidizing gas which is percolated through the broken ore and oxidizes the minerals to form an acid leach solution in the reaction.
>
> The Walton patent teaches the use of explosives to form cavities and to provide a fractured and cracked permeable zone.
>
> The Parker patent teaches the placing of the input well around the periphery of the fractures extending out from the fragmentation zone.

The Stenger et al patent teaches that techniques common in the oil industry can be used in the solution mining of minerals and hence, it must be concluded that such techniques would be considered to be obvious to one working in the mineral recovery art. It has been well established that a claim may be struck down on the ground of lack of an inventive step if it can be shown that it covers a variation of an individual prior proposal, which variation it would be obvious to make in the light of the relevant common general knowledge.

The patents to Ortloff et al, Stenger et al, Hurd et al, and Lewis can be classed as belonging to the mineral leaching aspect, whereas the Parker, Walton and Beard patents show techniques that are used in the oil industry which are applicable to the mineral recovery industry, and in particular the placing of the injection wells outside the rubblized zone which is taught in the Parker and Beard patents.

Therefore claims C1 to C18 are rejected on the Ortloff et al, Stenger et al, Hurd et al and Lewis patents when taken in view of what is taught in the Parker, Walton and Beard patents. The first group of patents teaches the leaching of minerals in situ and such variations as are being claimed are considered to be obvious variations when taken in the light of the relevant common general knowledge as exemplified by the patents to Parker, Walton and Beard.

...

In his response dated July 6, 1978 the applicant stated (in part):

...

In addition, Applicant does not agree with the assertion that the invention of claims C1 to C18 is an obvious variation of the techniques of solution recovery of mineral values as disclosed by Hurd et al in U.S. patent 3278233, Ortloff et al in U.S. patent 3574599, Lewis in U.S. patent 3640579 and Stenger et al in U.S. patent 3647261 in view of the teachings of Beard in U.S. patent 3666014, Walton and Parker.

In all of claims C1 to C18 a leach solution is injected into a less severely fractured zone in an ore body, which surrounds a more severely fractured zone in the ore body, and pregnant leach solution is recovered from the more severely fractured zone of the ore body.

It is respectfully submitted that none of the cited references teach or suggest the specific direction of flow of the leach solution from the less severely to the more severely fractured zone in accordance with the invention of claims C1 to C18.

The Hurd et al, the Stenger et al, and the Ortloff et al references indicate that permeability of the ore body may be increased by fracturing the ore body, but no indication is given that the presence or location of both more and less severely fractured zones is of any importance in relation to maintaining the flow of leach solution.

> The discussions by Ortloff et al and Stenger et al about increasing the permeability of natural subterranean formations is somewhat vague, giving no inkling of any benefits of particular fracture patterns or of particular flow directions of leach solution.
>
> It is clear that Hurd et al recognized the difficulties of maintaining the flow of mineral-pregnant solution resulting from the formation of impermeable precipitated plugs in the ore body. There is no indication, however, that increasing the permeability of the ore body by fracturing minimized these difficulties, or that any particular type of fracturing or direction of flow of leach solution was more beneficial than any other.
>
> It is not clear therefore, how the Hurd et al, Stenger et al, or the Ortloff et al disclosures taken singly, or in view of actual common general knowledge, provides any insight into the solution recovery process of the present invention.
>
> Lewis discloses percolation of a gas through the highly fractured zone of a so-called nuclear chimney which is flooded with water. In the invention of Lewis the gas is injected into a lower portion of the highly fractured zone and mineral-pregnant solution is withdrawn from the upper portion of the highly fractured zone i.e. both injection and recovery takes place within the highly fractured zone. It should be noted that the fractures in the highly fractured zone in a nuclear chimney is essentially uniform. This is quite different to the invention of present claims C1 to C18, which makes use of more and less severely fractured zones.
>
> ...

At the Hearing and in his response to the letter Mr. Vernon questioned the involvement of the Patent Appeal Board at this point in the conflict proceedings. In addition he also questioned the grounds of rejection and presented his interpretation on the manner in which art submitted during a Section 45(4) situation may be applied. However Section 45(4) of the Patent Act states that the Commissioner shall decide if the subject matter of conflict claims is patentable. If the Commissioner wishes to obtain the assistance of the Board in making that decision, he is fully entitled to do so (cf. Monsanto v Commissioner of Patents, F.C.A., June 24, 1977). Furthermore the applicant himself requested an oral hearing before the Board (letter of June 6, 1978),

and consequently estopped by his own deed from objecting to its involvement.

Claims C1 to C18 were rejected on prior art in the Commissioners letter dated April 7, 1978. As we have indicated earlier Section 45(4) states that the Commissioner shall decide if the subject matter of such claims is patentable and the question before us is whether or not the conflict claims are patentable over the art.

Mr. Coursen, the inventor, outlined the history of leaching subterranean deposits and the associated problems. This application increases the network of fractures in an ore body by detonating an explosive charge and the subsequent introduction of a lixiviant.

Initially the leaching process will cause the heavily shocked rock near the shot point to decrepitate to fines at a particularly high rate. In time the chemical attack on the rock by the leaching solution will generate further fines as well as slimes. The problem that this application is designated to overcome is the loss of fracture permeability and the plugging of fractures caused by the presence and production of these various kinds of fines and their movement during leaching. Accordingly this application directs the lixiviant flow from less severely fracture zone having small perforations to the more severely fractured zone with its larger perforations thereby preventing clogging by the fines and slimes.

Considering the prior art we find that Ortloff shows a method of leaching copper ore in situ. In this process a well extending from the earth's surface to the deposit allows a leach solution to be injected to react with the ore. A second well serves to recover the pregnant leachant. In this patent the ore is normally used in its natural condition although Ortloff recognized that

it may be necessary to increase permeability "... by means known to those skilled in the art of fracturing subterranean formations...." We find no further indication how permeability can be increased nor do we find any problem relating to the plugging of fractures with fines or the direction of fluid flow.

Stenger also leaches metal values from underground ores by injecting a brine in one well in the ore body and then collecting the reacted brine in another well in the ore body. As in Ortloff the ore is used in its natural condition (no detonation) and there is no mention of fines and slimes. He recognized that permeability may be improved "... by underground fracturing techniques such as employed in the oil industry although it is desirable that the brine pass through the ore itself rather than through the cracks of the ore...." There is no further description on how the techniques common to the oil industry can be applicable to increase permeability for leaching of minerals but it appears that Stenger recognizes that the brine flow for leaching should be through the ore itself rather than through the cracks as for oil recovery.

Hurd uses a gaseous leaching solvent for in situ mining of subterranean deposits. An acidic gas is passed into the ore deposit whereby the metallic ions are made soluble in previously-added water, wetting the ore. This solution is then recovered by water flooding. Here, as in Ortloff, and Stenger the ore is used in its natural state so there is no great alteration of fracture zones to contend with.

Lewis relates to a leaching method where a nuclear chimney located below water table in a primary ore deposit serves as an in situ pressure vessel. He introduces compressed oxidizing gas and lixiviant into the base of the rubble chimney and recovers pregnant solution at the top of the rubble chimney. Since both injection and recovery are in the rubble zone which is of infinite permeability there would be no problem with clogging by the fines.

Parker relates to the in situ production of oil from oil shale by pyrolysis with hot gases. Permeability of the shale around a nuclear produced chimney is increased before retorting by pyrolyzing and melting the surface of the fractures at a temperature of 1400 - 2000°F achieved by reverse combustion. Oxygen is injected in wells at the periphery of the fractures extending out from the fragmentation zone. This injected pressurized oxygen moves to the chimney where reverse combustion takes place. The surfaces of the fractures are melted to a slag which is left in place.

Walton discloses a method of recovering hydrocarbons from an oil shale formation by in situ retorting.

Beard is for a method of recovering oil from a subterranean oil shale formation by circulating a hot extractive fluid between two wells in an explosively produced chimney in an oil shale formation.

None of the citations before us,which relate to the in situ recovery of hydrocarbons from oil shale deposits,indicate any problem with flow restriction due to the formation of fines or slimes. We believe the type of physical reaction found in the recovery of oil from oil shale to be different from that of the solvent reaction in the leaching recovery for mineral deposits. It would appear that the reaction for leaching minerals will tend to produce fines and slimes which would restrict lixiviant flow whereas the recovery of oil from oil shale will not be subject to this additional factor of flow restriction.

In the cited leaching patents to Ortloff,Stenger and Hurd the ore is not fractured so they are not faced with the problem of fines restricting flow as is the case in this application. Further the Lewis citation only utilizes the highly rubblized zone of the nuclear chimney which will not cause any problem with respect of fine clogging.

The applicant produces a fracture network in a deep rock ore body and injects his leaching solution in the less severely fractured zone and recovers it in the more severely fractured zone. There is no doubt that this type of flow will tend to overcome the loss of fracture permeability caused by the formation of fines and slimes during their leaching movement. We are satisfied that there is present an indication of thought, design and a degree of ingenuity which in our view, constitutes a patentable advance in the art.

We will now consider the claims. Claim C9 is as follows:

> A process for the in situ leaching of an ore body which has been worked by detonating explosive charges in separate cavities therein to produce in the ore body immediately adjacent to the site of each detonation a fracture zone comprised of a most severely fractured core portion surrounded by a less severely fractured outer portion, comprising introducing lixiviant for the ore into the ore body through a plurality of injection holes in the less severely fractured portions and recovering pregnant leach solution from the ore body through a plurality of recovery holes in the most severely fractured portions.

The feature of introducing the lixiviant in the less severely fractured portion and recovering the leach solution in the most severely fractured portion is found in the claim. We consider this to define the scope of monopoly of the invention commensurate with what we find is the invention described in the specification taking into consideration what is taught by the cumulative effect of the cited art.

We also find these features in the remainder of the conflict claims and they too are considered allowable.

To summarize, we are satisfied that the conflict claims represent a patentable advance in the art and we recommend that the decision of the examiner to refuse claims C1 to C18 be withdrawn.

G. Asher
Chairman
Patent Appeal Board, Canada

S. Kot
Member

I concur with the findings of the Patent Appeal Board and return the application to the examiner for the resumption of prosecution.

J.H.A. Gariepy
Commissioner of Patents

Dated at Hull, Quebec

this 15th. day of January, 1979

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