(12) UK Patent Application (19) GB (11) 2 039 228 A

(21) Application No **7900002**
(22) Date of filing **2 Jan 1979**
(43) Application published
6 Aug 1980
(51) **INT CL³**
B01J 10/00 8/10
C22B 60/02
(52) Domestic classification
B1F 4F 4H1X 4L
B1Q 2
C1A G36 M7 N36 P22
(56) Documents cited
WO 7900025A
GB 1511104
GB 1467330
GB 1380060
GB 1379763
GB 1345599
GB 1242092
GB 1235150
GB 1081748
GB 1000107
GB 974211
GB 968708
GB 914473
GB 898796
(58) Field of search
B1F
B1Q
(71) Applicants
RTL Contactor Holding SA.,
Terrassenweg 1A, 6300 Zug, Switzerland
(72) Inventors
Lee Fisher Robinson
Maurice James Cahalan
(74) Agents
Batchellor, Kirk & Eyles

(54) **Contacting gases and liquids**

(57) A process for contacting substantially immiscible phases to transfer material from one phase to another comprises passing the phases through a contactor, while causing portions of at least one phase to be repeatedly passed through at least one other phase. One phase in the contactor is gaseous, and another liquid. A further phase can be liquid or solid. The process may be used for extracting impurities from china clay, or extracting uranium valves from one with oxygen gas acting to oxidise the uranium.

GB 2 039 228 A

SPECIFICATION

Contacting process

This invention relates to a process for contacting substantially immiscible phases so as to transfer material from one phase to another phase.

Contacting processes involving phase transfer of materials are well known and are used, for example, in extraction processes where an appropriate extractant is employed to remove desired values from phase to the extractant phase.

Suitable contactors which may be used for such contacting processes are described in Patent Specification Nos. 972035 and 1037573. Such contactors comprise elongated vessels through which streams of the phase to be contacted, for example two substantially immiscible liquids, are passed. During passage through the contactor portions of one phase are caused to pass through the other phase, for example, by the use of rotating buckets attached to discs dividing the contactor longitudinally into interconnected compartments. The continuous passing of one phase through another promotes the desired transfer of material between the phases. Conventionally, such contactors have been operated substantially completely filled with liquid or solid plus liquid phases in the absence of air or gas.

According to the present invention we provide a process for contacting substantially immiscible phases so as to transfer material from one phase to another phase, comprising continuously passing the phases through a contactor while causing portions of at least one phase to be repeatedly passed through at least one other phase, the contactor containing a gas and one or more liquid phases.

In one embodiment of the invention the contactor contains a head of air of other gas above at least two other phases, such as two substantially immiscible liquid phases or a liquid and a solid phase. One example is the acid leaching and solvent extraction of copper from copper oxide ores. A further example of a process in accordance with this embodiment is the leaching of carbonate based uranium-containing ores using an alkaline leaching agent as the extractant. When such an extraction is carried out continuously by passing a slurry of the ore and leaching agent through a contactor, considerable quantities of gas are generated and will form a gaseous phase above the liquid phase. A further example of such a process is the simultaneous leaching and extraction of phosphoric acid from phosphate rock in which there is a natural generation of gas. The presence of such a gaseous phase has not been found to impair the efficiency of such a contacting process and a steady interface between the extractant and slurry is maintained. In these examples of the invention, the gaseous phase is a product of the chemical reaction involved in the extraction process.

An alternative example of this embodiment involves the deliberate introduction of air or other gas into a contactor during an extraction process involving two further phases where a material is being transferred from one such phase to another. In this case the presence of air can assist in the emulsification of the extractant phase containing the extracted material, which may help in subsequent separation of the desired product, for example in a flotation unit. In some processes, the presence of air may assist in the formation of an intermediate layer at the interface between two liquid phases, in which intermediate layer impurities tend to collect. In the use of a contactor to separate fine minerals, the presence of a gaseous phase to effect partial oxidation or reduction of the mineral surfaces to be removed may serve to enhance the hydrophobic or hydrophilic properties thereof, thus improving the selectivity of the fine particles separation between the aqueous and organic phases present in the contactor for such a process.

A further example of use of the present process is the extraction of impurities from china clay which impurities themselves may be of some value, for example any uranium values present may be recovered. A further example of this embodiment is the use of an oxidising or reducing atmosphere above the liquid in the contactor, for example in a process for the extraction of uranium from uranium ore. Thus the introduction of air or oxygen serves to oxidise any iron present from ferric state and at the same time convert any U^{4+} ions into a U^{6+} state which is necessary to enable the solvent used to extract the uranium. Yet again, the use of certain gaseous atmospheres can promote crystallisation in a liquid phase of the contactor, which may be desirable for subsequent separation procedures.

In a further embodiment of the invention, the contactor contains a gaseous phase and one or more liquid phases. Such a process may be used to bubble gas through the liquid phase or phases, for example to aerate the liquid. In this embodiment portions of the gaseous material are thus transferred to the liquid phase. For such a process a modified contactor may be employed with the liquid phase or phases being introduced and withdrawn at or near the ends of the contactor, while the gaseous phase is introduced at a series of spaced points along the bottom length of the contactor. In addition, the contactor may be provided with discs to divide the interior into interconnected compartments with the discs engaging with seals in the upper region of the contactor to prevent passage of gas along the top of the contactor. Thus gas bubbled up through the liquid is forced down again through the liquid before it can pass from one compartment to the next. Advantageously, the contactor in such a process is arranged with its longitudinal axis at an angle for example 7° or more, to the horizontal, gas entering at the lowermost region of the contactor gradually passing to the highest region before withdrawal.

CLAIMS

1. A process for contacting substantially immiscible phases so as to transfer material from one phase to another phase, comprising continuously passing the phases through a contactor while causing portions of at least one phase to be repeatedly passed through at least one other phase, the contactor containing a gas and one or more liquid phases.

2. A process according to claim 1, wherein at

least two substantially immiscible non-gaseous phases are passed through the contactor.

3. A process according to claim 2, wherein the non-gaseous phases comprise an ore and a leaching agent for values contained in the ore and the gas has been generated by the reaction of the non-gaseous phases.

4. A process according to claim 2, wherein a gas is introduced to the contactor to assist the transfer of material from one non-gaseous phase to the other non-gaseous phase.

5. A process according to claim 4, wherein the non-gaseous phase comprise china clay and a liquid phase capable of extracting impurities therefrom.

6. A process according to claim 4, wherein the non-gaseous phases comprises uranium ore and an extractant for uranium values and the gas is capable of oxidising the uranium values to their higher oxidication state.

7. A process according to claim 1, wherein a gaseous phase and at least one liquid phase are passed through the contactor.

8. A process according to claims 4, 5, 6 and 7, wherein the gas is bubbled through the at least one liquid phase during passage through the contactor.

9. A process according to claim 8, wherein the gas is introduced at a series of spaced points along the bottom of the contactor.

10. A process according to any one of claims 4 to 9, wherein the contactor comprises discs dividing the interior into interconnected compartments and engaging with seals in the upper region of the contactor to prevent passage of gas therealong.

11. A process according to any one of claims 4 to 10, wherein the contactor is arranged with its longitudinal axis at an angle to the horizontal and the gas introduced at the lower most region of the contactor.

12. A process in accordance with claim 1, substantially as described herein.

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1980.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.