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PATENT SPECIFICATION

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(54) EXTRACTION OF OIL FROM OIL-CONTAINING ORGANIC MATERIAL

(71) We, ROSE, DOWNS & THOMPSON LIMITED, a British company of Old Foundry, Cannon Street, Kingston-upon-Hull, Yorkshire, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to a method of, and apparatus for, extracting oil from oil-containing organic material. The extractant used is conveniently water containing a detergent and particularly a hydrotrope.

According to a first aspect of the invention in a method of extracting oil from oil-containing organic material the material is passed along a conduit extending downwardly into a trough containing a liquid extractant for the oil and upwardly out of the trough, the material in the conduit being in contact with the liquid in the trough when the material is below the level of the surface of the liquid and during the upward movement out of the trough the material is screw-pressed to remove contained liquid and oil.

The liquid screw pressed from the material is preferably returned to the trough and liquid is withdrawn from the bath and the oil is separated from the extractant liquid.

Preferably the extractant is water containing a detergent, which may be a hydrotrope, such as an aqueous solution of sodium xylene sulphonate. It is preferred to in addition supply liquid extractant to the material when it is in the conduit.

According to a second aspect of the invention apparatus for extracting oil from oil-containing organic material by the method referred to above comprises a trough for the reception of a liquid extractant and oil extracted from the material, a conduit extending downwardly into the trough and upwardly out of the trough, the downwardly extending portion of the conduit including a feed mechanism for

feeding the material along the conduit, part of the downwardly extending portion of the conduit arranged to be below the level of the liquid in the trough being perforated to allow the liquid to enter into the conduit and the upwardly extending portion of the conduit including an extractor for feeding the material out of the trough and subjecting it to a screw-pressing action.

In order that the invention may be more readily understood it will now be described, by way of example only, with reference to the accompanying drawings in which:—

Figure 1 is a side view of the apparatus, and

Figure 2 is a flow diagram.

The apparatus consists basically of a trough 12 having inclined walls 15 and mounted on legs 16. The trough 12 is also secured in position by a framework 17 which also supports a conduit which is arranged to have the oil-containing organic material passed along it. The conduit comprises a portion 13 extending downwardly into the trough and a portion 14 extending upwardly from the trough. The material is passed along the portion 13 of the conduit by a feed mechanism in the conduit and the material is passed along the conduit 14 by an extractor in that portion of the conduit.

The feed mechanism consists of a screw working in an upper imperforate barrel section 27 and a lower perforated barrel section 28 of the conduit. Barrel section 27 has an upwardly directed branch 30 through which the material from which the oil is to be extracted is fed into the conduit. The lower barrel section 28 connects on to a hollow coupling section 31. The section 31 has a perforated wall 32 extending over the lower part of its periphery and is otherwise imperforate. It receives material from the feed portion of the conduit. The screw of the feed mechanism is driven by a motor 33 supported on the framework 17 and driving the screw through a gearbox 34.

The portion 14 of the conduit includes an extractor having the general form of a screw

press, the barrel 18 of which is bolted to a housing 20 pivotally mounted on a shaft 21. The housing 20 supports the drive motor 22, which drives the drive shaft 23 of the extractor screw through a gearbox 24, also mounted on housing 20. The barrel 18 is in three parts, the lowermost part 18A being perforated, the central part 18B being imperforate and the uppermost part 18C being perforated. The part 18A is bolted to the section 31 into which the screw 23 extends. The material is discharged from the barrel 18 to a restricted annular opening formed by a hydraulically-loaded pressure cone 25. The pressed material is then discharged through an outlet 26 from the housing 20. After the barrel section 28 has been removed from the section 31 and the barrel 18 released from its mounting brackets, the extractor can be pivoted about the shaft 21 from the inclined working position shown to the inoperative horizontal rest position outside of the trough indicated in phantom by reference 18'. In the latter position, the extractor is clear of the trough to facilitate maintenance. Thus the motor 22 and the gearbox 24 mounted on the housing 20 turn with the extractor and the pivotal movement is achieved without disconnecting the drive. The part 18C is surrounded by a shield 18D which directs liquid emerging through the perforations back into the trough.

In operation, the material to be extracted, mixed with a liquid extractant is fed into the feed portion 13 and, during its passage through the barrel section 28 is permeated by the liquid contained in the trough 12. The mixture of material and liquid then passes into the connecting section 31, where it is picked up by the extractor screw of extractor section 14 and moved upwardly. Little pressing action takes place within the barrel part 18A but pressing occurs in the parts 18B and 18C. Barrel part 18C is located outside the trough 12 and the liquid pressed from the material is removed through the perforated barrel 18C and is returned to the trough by the shield 18D.

Referring now to Figure 2 which represents the entire extraction process, the palm fruit or other oil-bearing material from which the oil is to be extracted is charged into a digester 40, which is supplied with hot fresh liquid extractant from tanks 41. From the digester 40, the fruit is fed to the feed portion 13 through the branch 30. The liquor from digester 40 is fed through line 42 to the trough 12, the level of liquid in which is indicated at 43. Extractant from the tanks 41 can also be supplied to the branch 30 through line 44, so that the fruit is fed through portion 13 as a slurry. The extractant is preferably a solution in water of sodium xylene sulphonate, as sold for

example under the Registered Trade Mark "Halvopon." The miscella in the trough 12 tends to settle into two layers, and the oil as an emulsion in the extractant is largely disposed at the top of the miscella. The level of liquid in the trough is kept constant by being withdrawn through line 45 by discharge pump 46 which is controlled by float switch 47. The mixture removed through line 45 is passed to a clarification station (not shown) where the oil layer is separated from the extractant, which may be returned to the system, and from the suspended fines which are released by the extractor into the trough. The liquid from the bottom of the trough itself can also be withdrawn through line 48 and pumped by means of circulation pump 49 to an input to the digester 40 and/or to the input to the trough 12. Circulation pump 49 serves to prevent fines from settling and accumulating at the bottom of trough 12, either by recycling them to the digester or by resuspending them in trough 12 from which they are removed through line 45.

Many variations in the process are possible according to requirements. For example, instead of, or in addition to, the supply of fresh extractant to branch 30, the extractant may be supplied through line 50 and fed under pressure into any one of a number of inlets 51 through the imperforate barrel 18B of the screw press. Also, the apparatus illustrated in Figure 1 is capable of modification. In some circumstances, for example, it is advantageous to use a twin-screw press for the extractor in portion 14 of the conduit and similarly twin screws may be used for feeding the material in portion 13 of the conduit.

WHAT WE CLAIM IS:—

1. A method of extracting oil from oil-containing organic material in which the material is passed along a conduit extending downwardly into a trough containing a liquid extractant for the oil and upwardly out of the trough, the material in the conduit being in contact with the liquid in the trough when the material is below the level of the surface of the liquid and during the upward movement out of the trough the material is screw-pressed to remove contained liquid and oil.

2. A method of extracting oil as claimed in claim 1 in which the liquid screw-pressed from the material is returned to the trough, liquid is withdrawn from the trough and the oil is separated from the extractant.

3. A method of extracting oil as claimed in claim 1 or 2, in which the oil-containing organic material is mixed with hot liquid extractant in a digester prior to being supplied to the conduit.

4. A method of extracting oil as claimed in any preceding claim in which additional



press, the barrel 18 of which is bolted to a housing 20 pivotally mounted on a shaft 21. The housing 20 supports the drive motor 22, which drives the drive shaft 23 of the extractor screw through a gearbox 24, also mounted on housing 20. The barrel 18 is in three parts, the lowermost part 18A being perforated, the central part 18B being imperforate and the uppermost part 18C being perforated. The part 18A is bolted to the section 31 into which the screw 23 extends. The material is discharged from the barrel 18 to a restricted annular opening formed by a hydraulically-loaded pressure cone 25. The pressed material is then discharged through an outlet 26 from the housing 20. After the barrel section 28 has been removed from the section 31 and the barrel 18 released from its mounting brackets, the extractor can be pivoted about the shaft 21 from the inclined working position shown to the inoperative horizontal rest position outside of the trough indicated in phantom by reference 18'. In the latter position, the extractor is clear of the trough to facilitate maintenance. Thus the motor 22 and the gearbox 24 mounted on the housing 20 turn with the extractor and the pivotal movement is achieved without disconnecting the drive. The part 18C is surrounded by a shield 18D which directs liquid emerging through the perforations back into the trough.

In operation, the material to be extracted, mixed with a liquid extractant is fed into the feed portion 13 and, during its passage through the barrel section 28 is permeated by the liquid contained in the trough 12. The mixture of material and liquid then passes into the connecting section 31, where it is picked up by the extractor screw of extractor section 14 and moved upwardly. Little pressing action takes place within the barrel part 18A but pressing occurs in the parts 18B and 18C. Barrel part 18C is located outside the trough 12 and the liquid pressed from the material is removed through the perforated barrel 18C and is returned to the trough by the shield 18D.

Referring now to Figure 2 which represents the entire extraction process, the palm fruit or other oil-bearing material from which the oil is to be extracted is charged into a digester 40, which is supplied with hot fresh liquid extractant from tanks 41. From the digester 40, the fruit is fed to the feed portion 13 through the branch 30. The liquor from digester 40 is fed through line 42 to the trough 12, the level of liquid in which is indicated at 43. Extractant from the tanks 41 can also be supplied to the branch 30 through line 44, so that the fruit is fed through portion 13 as a slurry. The extractant is preferably a solution in water of sodium xylene sulphonate, as sold for

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Many variations in the process are possible according to requirements. For example, instead of, or in addition to, the supply of fresh extractant to branch 30, the extractant may be supplied through line 50 and fed under pressure into any one of a number of inlets 51 through the imperforate barrel 18B of the screw press. Also, the apparatus illustrated in Figure 1 is capable of modification. In some circumstances, for example, it is advantageous to use a twin-screw press for the extractor in portion 14 of the conduit and similarly twin screws may be used for feeding the material in portion 13 of the conduit.

WHAT WE CLAIM IS:—

1. A method of extracting oil from oil-containing organic material in which the material is passed along a conduit extending downwardly into a trough containing a liquid extractant for the oil and upwardly out of the trough, the material in the conduit being in contact with the liquid in the trough when the material is below the level of the surface of the liquid and during the upward movement out of the trough the material is screw-pressed to remove contained liquid and oil.

2. A method of extracting oil as claimed in claim 1 in which the liquid screw-pressed from the material is returned to the trough, liquid is withdrawn from the trough and the oil is separated from the extractant.

3. A method of extracting oil as claimed in claim 1 or 2, in which the oil-containing organic material is mixed with hot liquid extractant in a digester prior to being supplied to the conduit.

4. A method of extracting oil as claimed in any preceding claim in which additional

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liquid extractant is supplied to the material when it is in the conduit prior to entering the trough.

5 5. A method of extracting oil as claimed in any preceding claim wherein the extractant is an aqueous solution of sodium xylene sulphonate.

10 6. Apparatus for extracting oil from oil-containing organic material by the method claimed in claim 1 comprising a trough for the reception of a liquid extractant and oil extracted from the material, a conduit extending downwardly into the trough and upwardly out of the trough, the downwardly extending portion of the conduit including a feed mechanism for feeding the material along the conduit, part of the downwardly extending portion of the conduit arranged to be below the level of the liquid in the trough
20 being perforated to allow the liquid to enter into the conduit and the upwardly extending portion of the conduit including an extractor for feeding the material out of the trough and subjecting it to a screw-pressing
25 action.

7. Apparatus as claimed in claim 6 in which the feed mechanism is a screw conveyor.

30 8. Apparatus as claimed in claim 6 or 7 in which at least that part of the upwardly extending portion of the conduit which is outside of the trough is perforated and a

shield is provided for diverting liquid emerging through the perforations back to the trough.

35 9. Apparatus as claimed in claim 6, 7 or 8 in which the lower ends of the downwardly extending and the upwardly extending portions of the conduit are connected together by a hollow coupling section
40 located in the trough.

10. Apparatus as claimed in claim 9 in which the upwardly extending portion of the conduit, the extractor and drive means therefor are pivotally supported outside of
45 the trough and after releasing the downwardly extending portion of the conduit from the coupling section they are pivotable to a position in which they are outside of the
50 trough.

11. Apparatus for extracting oil from oil-containing organic material substantially as hereinbefore described with reference to the accompanying drawings.

55 12. A method of extracting oil from oil-containing organic material substantially as hereinbefore described with reference to the accompanying drawings.

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