May 19, 1970 N. MALARKEY, JR 3,512,474

PRESS FOR LIQUID-SOLID MIXTURES

Filed June 24, 1968 3 Sheets-Sheet 1

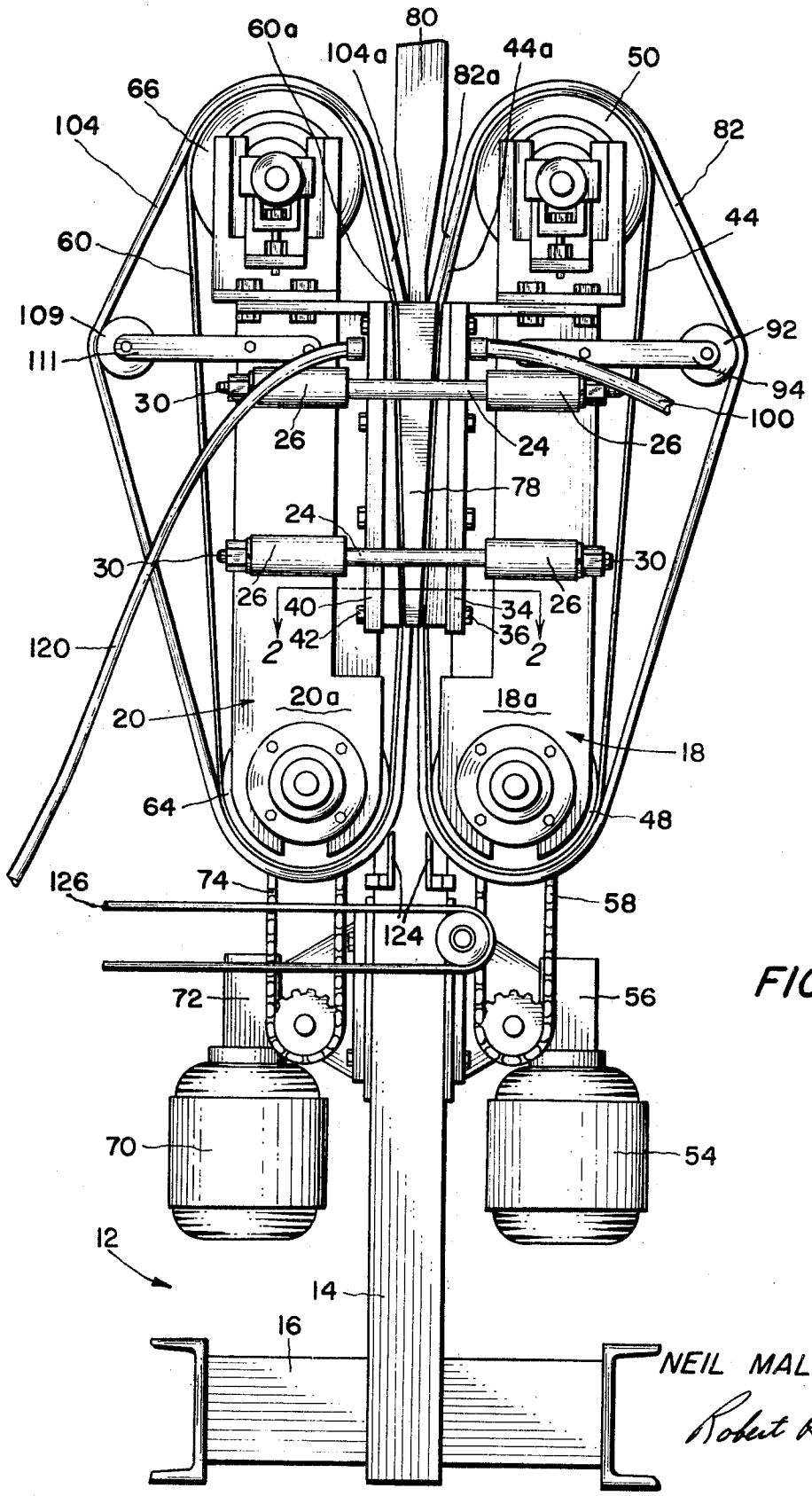


FIG. 1

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PRESS FOR LIQUID-SOLID MIXTURES

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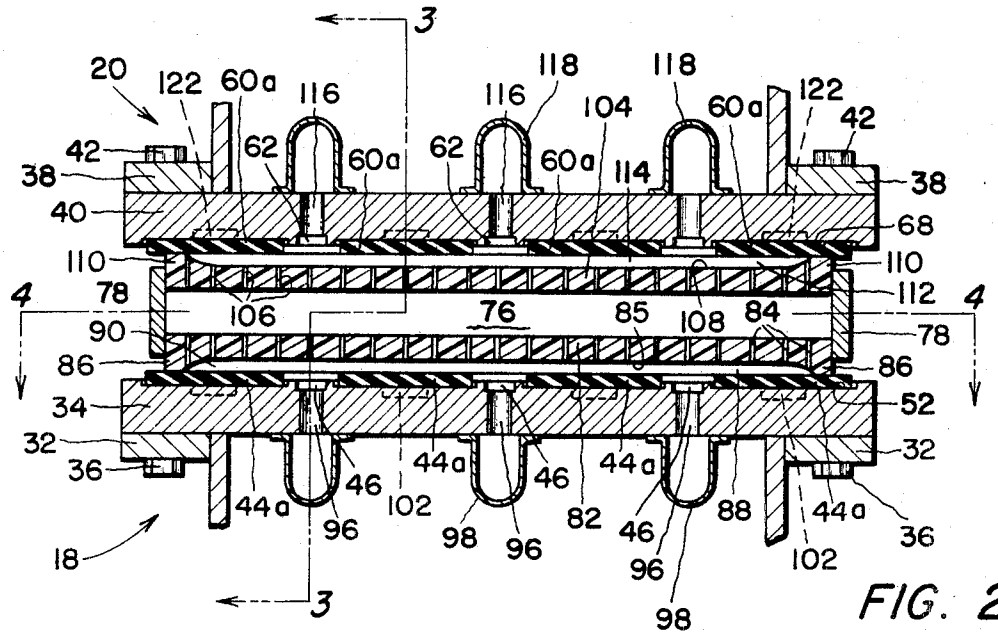


FIG. 2

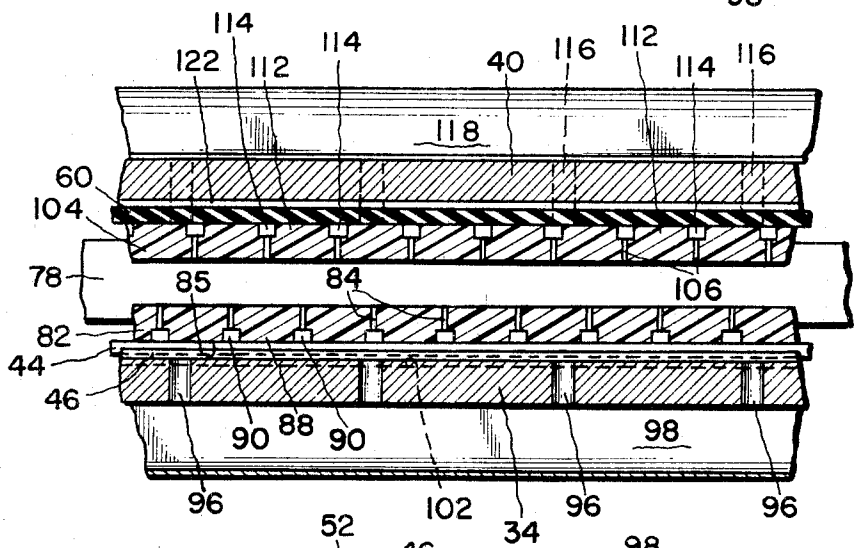


FIG. 3

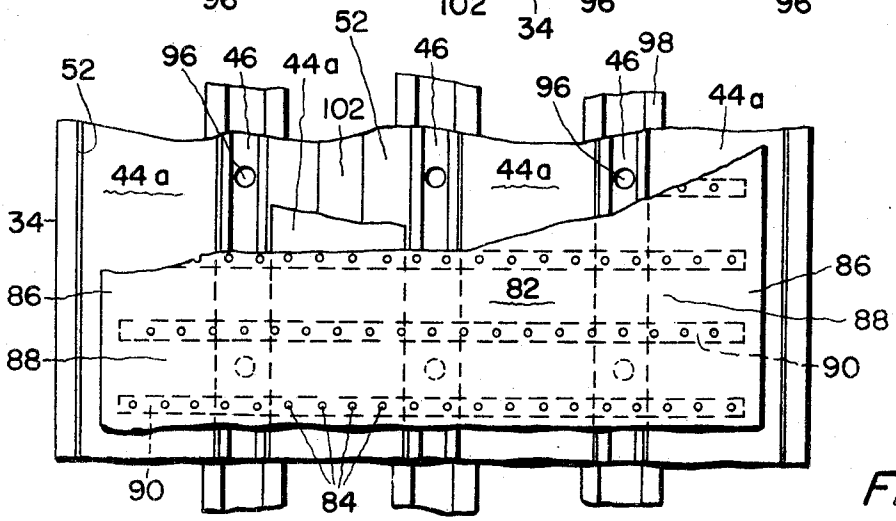


FIG. 4

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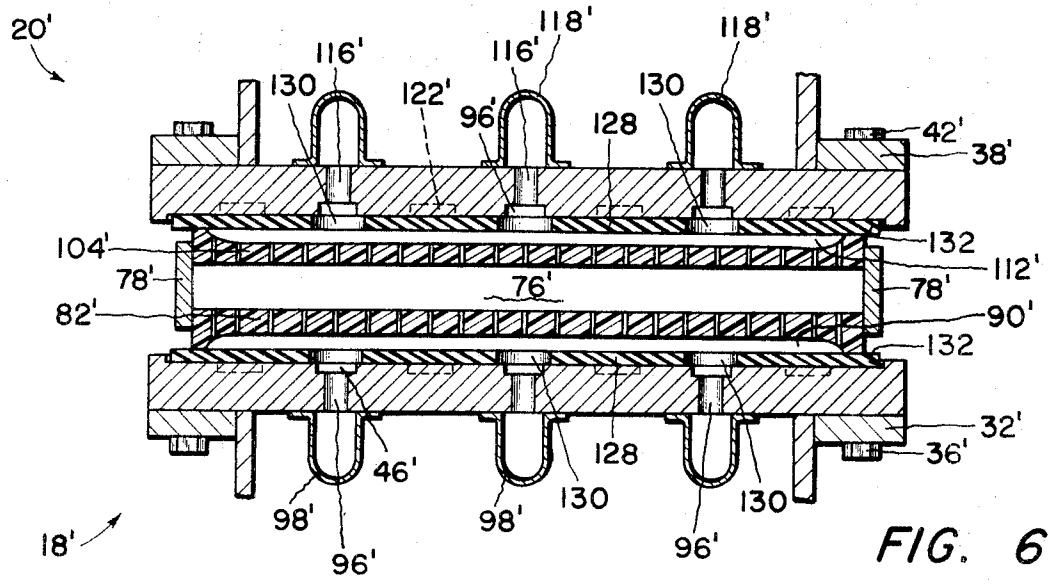


FIG. 6

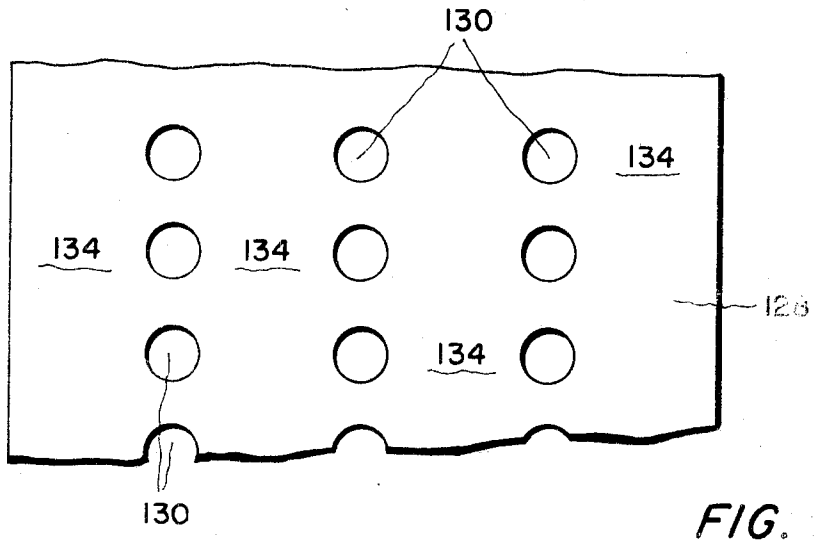


FIG. 5

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3,512,474

PRESS FOR LIQUID-SOLID MIXTURES

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Int. Cl. B30b 9/24, 5/04
U.S. Cl. 100—118 18 Claims

ABSTRACT OF THE DISCLOSURE

A press for separating liquid from liquid-solid mixtures, including a narrowing processing chamber bounded by conveyor belts adapted to permit fluid flow from the processing chamber. Porous filter belts overlay the conveyor belts and are driven thereby longitudinally through the processing chamber.

BACKGROUND OF THE INVENTION

The present invention relates to presses and more particularly to presses for separating liquid from a liquid-solid mixture such as, by way of specific example, the pulp slurries employed in the pulp and paper making processes.

Recently a new and improved press has been developed for separating liquid from a liquid-solid mixture. This press is disclosed in U.S. Pat. No. 3,381,609, entitled Filter Press, which was issued May 7, 1968. Although this press is believed to be a major advancement in the field of pressing equipment, it has been found that, as disclosed in said patent application, it is best suited for applications in which the processing chamber is of relatively narrow width.

SUMMARY OF THE INVENTION

The principal object of the present invention is to provide a new and improved press of this type which is particularly constructed and arranged for applications in which the processing chamber is of a width in excess of such relatively narrow width.

Another object of the invention is to provide a new and improved press of the type set forth which is particularly constructed and arranged for employment in applications in which the driving conveyor belts are lubricated by a fluid suitable for mixing with the filtrate or liquid separated from the liquid-solid mixture.

In accordance with the present invention, a press is provided with a plurality of walls forming opposing sides of a processing chamber of diminishing side-to-side dimension. At least one of these walls is movable to convey material through the processing chamber; and at least one of these walls includes a plurality of wall sections arranged side-by-side and having drainage passage means therebetween. A porous filter is positioned in the processing chamber and overlays the one of the walls including such wall sections whereby liquid accepted by the filter flows through the latter into the drainage passage means. In addition, passage means communicate with the drainage passage means for conveying liquid therefrom.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring to the drawings:

FIG. 1 is an elevational side view of a press constructed in accordance with the present invention;

FIG. 2 is an enlarged sectional view taken on line 2—2 of FIG. 1, looking in the direction of the arrows;

FIG. 3 is a sectional view taken on line 3—3 of FIG. 2, looking in the direction of the arrows;

FIG. 4 is a fragmentary sectional view taken on line 4—4 of FIG. 2, looking in the direction of the arrows, but with parts broken away for the purposes of illustration;

FIG. 5 is a fragmentary, elevational view of a drive conveyor or conveyor belt alternatively employable in the press illustrated in FIGS. 1 through 4; and

FIG. 6 is a view generally similar to FIG. 2, but showing a press provided with a pair of drive conveyors of the type shown in FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring more particularly to the drawings wherein similar reference characters designate corresponding parts throughout the several views, FIGS. 1 through 4 illustrate a press designated generally as **10** which comprises a supporting frame **12** including a substantially vertical supporting post **14** ground mounted by a base **16**. The supporting post **14** carries a pair of elongated, opposed, substantially upright frame sections **18, 20** which are connected to the supporting post **14** by suitable bracket structure (not shown) on the opposite side of the press **10** from that shown in FIG. 1. The frame sections **18, 20** each include a pair of spaced side plates **18***a*, **20***a*, respectively, connected by suitable conventional cross-bracing whereby each forms a rigid unit. The frame sections **18, 20** are interconnected on each side of the press **10** by a plurality of strain rods **24** which adjacent their opposing ends extend through sleeves **26** rigidly mounted on the side plates **18***a*, **20***a*. The frame sections **18, 20** are spaced a predetermined distance apart by spacers (not shown) and are held in this spaced relationship by lock nuts **30** threaded on the opposing ends of the strain rods **24**.

The frame section **18**, as shown in FIG. 2, rigidly carries a pair of laterally spaced supporting flanges **32** which are arranged to extend in a generally vertical direction. The supporting flanges **32** are connected to a first pressure platen **34** by mounting bolts **36** such that the frame section **18** rigidly supports the platen **34** in a generally upright position in the space between the frame sections **18, 20**. The frame section **20** rigidly carries a pair of laterally spaced supporting flanges **38** arranged to extend generally vertically. The supporting flanges **38** are connected to a second pressure platen **40** by mounting bolts **42** whereby the frame section **20** rigidly supports the platen **40** in a generally upright position in the space between the frame sections **18, 20**. The platens **34, 40** are directly opposed and, although spaced throughout their lengths, are each constructed of an upwardly narrowing cross-section such that they progressively converge as they extend downwardly.

A first plurality of imperforate, endless driving belts or drive conveyors **44** are arranged around the frame section **18** and each have a vertical reach **44***a* which extends between the platens **34, 40** and is slidably received in a belt groove **52** in the platen **34**. The drive conveyors **44**, as illustrated in FIG. 2 wherein they are shown as being four in number, are arranged in juxtaposed or side-by-side relationship and laterally spaced apart to provide a drainage passage or space **46** between the adjacent sides of the reaches **44***a* of adjacent ones thereof. The drive conveyors **44** are wound around rotatably mounted drums or rolls **48, 50** which are located, respectively, at the lower and upper ends of the frame section **18**. The drive conveyors **44** are suitably tensioned in a conventional manner such that their reaches **44***a* are caused by the platen **34** to extend towards the platen **40** as they extend downwardly. The drive conveyors **44** are longitudinally driven by a drive means in a counterclockwise direction, as viewed in FIG. 1, such that the reaches **44***a* move downwardly between the frame sections **18, 20**. This drive means, as illustrated, comprises

a drive motor 54, a gear reduction unit 56, and a drive chain 58 which is suitably connected to rotatably drive the roll 48.

A second plurality of imperforate, endless driving belts or drive conveyors 60 are arranged around the frame section 20 and have vertical reaches 60*a* which extend through the space between the platens 34, 40 and are slidably received in belt grooves 68 in the platen 40. The drive conveyors 60, as will be seen from FIG. 2 wherein they are shown as being four in number, are arranged in juxtaposed or side-by-side relationship and laterally spaced apart to provide a drainage passage or space 62 between the adjacent sides of the reaches 60*a* of adjacent ones thereof. The drive conveyors 60 extend around rotatably mounted drums or rolls 64, 66 and are suitably tensioned in a conventional manner such that their reaches 60*a* are caused by the platen 40 to extend towards the platen 34 as they extend downwardly between the platens 34, 40. The drive conveyors 60 are longitudinally driven by a drive means in a clockwise direction, as viewed in FIG. 1, such that the reaches 60*a* move downwardly between the frame sections 18, 20. This latter mentioned drive means, as illustrated, comprises a drive motor 70, a gear reduction unit 72, and a drive chain 74 suitably connected to rotatably drive the roll 64.

The aforedescribed arrangement of the drive conveyors 44, 60 positions their reaches 44*a*, 60*a* in opposed spaced relationship such that they form one set of opposing side walls of an elongated, substantially vertical, pressing or processing chamber 76 between the platens 34, 40. The processing chamber 76, due to the convergence of the reaches 44*a*, 60*a* caused by the platens 34, 40, is of diminishing side-to-side dimension in the direction of the convergence of the reaches 44*a*, 60*a* and thus narrows as it extends downwardly between the platens 34, 40. A pair of elongated flow barriers 78 are positioned at the other opposing sides of the processing chamber 76 and extend throughout the lengths of the platens 34, 40. A supply conduit or duct 80 extends downwardly towards the processing chamber 76 and serves to feed the liquid-solid mixture to be processed by the press 10 into the upper end of the processing chamber 76.

An endless, first porous filter belt 82, having filtering apertures or openings 84 therethrough, is longitudinally positioned around the drive conveyors 44 and connected to the latter to be longitudinally driven thereby in the aforesaid counterclockwise direction of the movement of the drive conveyors 44. The first filter belt 82 includes a vertical reach 82*a* which extends through the processing chamber 76 and overlays the reaches 44*a* of the drive conveyors 44, the opposing side edges of such reach 82*a* slidably engaging the flow barriers 78. The face 85 of the first filter belt 82 opposing the drive conveyors 44 is constructed to include flange portions 86 located at its opposing sides which are adapted to engage the outermost ones of the drive conveyors 44, such flange portions 86 extending continuously throughout the length of the filter belt 82. The face 85, moreover, also includes transversely extending ribs, one of which is shown as 88 in FIG. 2, which extend continuously between the flange portions 86 and are spaced by drainage cavities 90 communicating with the filtering apertures 84. The first filter belt 82 extends over the rolls 48, 50 and is tensioned by a roll 92 mounted upon an adjustable supporting bracket 94 whereby the flange portions 86 and transverse ribs 88 on the reach 82*a* are drawn into engagement with the reaches 44*a* of the drive conveyors 44.

Thus, it will be seen that fluid accepted by the filtering apertures 84 passes into the drainage cavities 90 and thence into the drainage passages 46 between the drive conveyors 44. The platen 34 includes a plurality of vertically spaced discharge passages 96 communicating each of the drainage passages 46 with one of several flow ducts 98 which extend generally vertically along the platen 34. A discharge hose or conduit 100, as shown in FIG. 1, is connected to the upper end of each of the flow ducts 98 for discharging liquid therefrom to a suitable receiver or place of disposal. In addition, a plurality of lubrication supply passages 102 are provided in the platen 34 in vertically spaced relationship beneath each of the reaches 44*a*. These lubrication supply passages 102, as will be understood, are suitably connected in a conventional manner to a source of a fluid lubricant, such as water, and supply the lubricant intermediate the reaches 44*a* and the platen 34, from whence the lubricant is discharged to the drainage passages 46 and intermixes with the liquid flowing therethrough.

An endless, second porous filter belt 104, having filtering openings or apertures 106 therethrough, is longitudinally positioned around the drive conveyors 60 and connected to the latter to be longitudinally driven thereby in the beforedescribed clockwise direction of the movement of the drive conveyors 60. The second filter belt 104 includes a vertical reach 104*a* extending through the processing chamber 76 and overlaying the reaches 60*a*, the opposing side edges of such reach 104*a* slidably engaging the flow barriers 78 whereby it cooperates with the reach 82*a* of the first perforate belt 82 and the flow barriers 78 to close such sides of the processing chamber 76. The face 108 of the second filter belt 104 is constructed identically to the face 85 of the first perforate belt 82 and hence includes flange portions 110, and transverse ribs 112 spaced by drainage cavities 114 communicating with the filtering apertures 106. The second filter belt 104 extends around the rolls 64, 66 and is tensioned by a roll 109 mounted on an adjustable supporting bracket 111 such that the flange portions 110 and transverse ribs 112 on the reach 104*a* are drawn into engagement with the reaches 60*a* of the drive conveyors 60.

The platen 40 includes a plurality of vertically spaced discharge passages 116 communicating with each of the drainage passages 62; and a flow duct 118 extends longitudinally along the platen 40 in communication with each of the drainage passages 62 through the discharge passages 116. A discharge hose or conduit 120 is connected to the upper end of each of the flow ducts 118 for discharging liquid therefrom. Also, similarly to the platen 34, the platen 40 contains a plurality of vertically spaced lubrication supply passages 122 beneath each of the reaches 60*a* of the drive conveyors 60 whereby water or other suitable lubricant is supplied beneath such reaches 60*a* and thence discharged through the discharge passages 62 with the liquid accepted by the second filter belt 104.

At the lower ends of the frame sections 18, 20, as illustrated in FIG. 1, a pair of scraper blades 124 are mounted on the frame 14 for scraping solid material from the filter belts 82, 104. The solid material thus dislodged from the filter belts 82, 104 falls by gravity onto an endless conveying belt 126 which transports it from the press 10.

In the operation of the press 10, the drive conveyors 44, 60 are continuously driven by the drive motors 54, 70 such that they, in turn, continuously drive the reaches 82*a*, 104*a* of the filter belts 82, 104 downwardly through the processing chamber 76. The liquid-solid mixture to be processed by the press 10 is continuously pumped through the supply conduit 80 into the upper end of the processing chamber 76 where the platens 34, 40 (and hence the drive conveyors 44, 60 and filter belts 82, 104) are spaced a substantial distance apart. As the reaches 82*a*, 104*a* of the filter belts 82, 104 move downwardly through the processing chamber 76, they carry this mixture with them. Thus, as they progressively converge in the processing chamber 76, liquid or filtrate is pressed out of the liquid-solid mixture and flows through the filtering apertures 84, 106 into the drainage cavities 90, 114 from whence it is discharged through the discharge passages 46, 62. This filtrate, and the lubricant flowing through the drainage passages 46, 62, then flows from

the press **10** through the platen drainage passages **96, 116,** flow ducts **98, 118,** and discharge hoses **100, 120.** The solids in the mixture, being rejected by the filtering apertures **84, 106,** remain entrapped between the filter belts **82, 104** and, after being so sightly compacted as to separate substantially all liquid therefrom, are carried downwardly below the processing chamber **76** thereby. These solids are removed from the filter belts **82, 104** by the scrapers **124** and fall by gravity upon the conveying belt **126** which transports them from the press **10.**

FIG. 5 fragmentarily illustrates a single, endless driving belt or drive conveyor **128** which may be substituted either for the plurality of drive conveyors **44** or for the plurality of drive conveyors **60.** The drive conveyor **128** is formed of a width greater than that of the filter belt to be disposed thereadjacent, and provided with wall sections **134** separated by columns of spaced drainage passages or openings **130,** the columns of the passages **130** each extending throughout the length of the drive conveyor **128** and being laterally spaced apart in accordance with the spacing of the drainage passages in the platen around which the drive conveyor **128** is to be entrained. Hence, although in FIG. 5 the columns of the passages **130** are illustrated as being three in number and equally spaced across the width of the drive conveyor **128,** it will be understood that this arrangement has been given by way of example only. Moreover, although the passages **130** are shown as being of circular configuration, it will be understood that alternatively they could be square, rectangular, oval, or of any other desired shape.

FIG. 6, wherein parts similar to those aforedescribed with reference to the press **10** illustrated in FIGS. 1 through 4 are designated by the reference character for their similar aforedescribed part followed by a prime, illustrates a press **10'** including a pair of the drive conveyors **128** each disposed in a belt groove **132.** The operation of the press **10'** is believed to be apparent from the aforegoing description of the drive conveyor **128** shown in FIG. 5 taken in connection with the preceding description of the press **10.**

Although the preceding description and the accompanying drawings only specifically describe two embodiments of the present invention, it will be understood that these embodiments have been given by way of illustration only and that the invention is not limited merely to these embodiments, but rather contemplates other embodiments and variations within the scope of these following claims.

What is claimed is:

1. A press for separating liquid from a liquid-solid mixture, comprising:

a plurality of walls forming opposing sides of a processing chamber of diminishing side-to-side dimension;

at least one of said walls being movable to convey material through the processing chamber;

one of said walls including a plurality of wall sections arranged side-by-side and having drainage passage means therebetween;

a porous filter in the processing chamber and overlaying the one of said walls including said wall sections whereby liquid accepted by said filter flows through the latter into said drainage passage means; and

passage means communicating with said drainage passage means for conveying liquid therefrom.

2. A press according to claim **1,** further comprising said wall sections being a plurality of laterally spaced apart elements.

3. A press according to claim **1,** further comprising said wall sections being portions of a single element separated by drainage passages through said element.

4. A press according to claim **1,** further comprising said wall sections each being a drive conveyor movable along the processing chamber, and said filter being a filter belt connected to said drive conveyors to be driven through the processing chamber by said drive conveyors.

5. A press according to claim **4,** further comprising said drive conveyors each extending around a pressure platen, and means for supplying lubricating fluid intermediate said drive conveyors and the pressure platen, such lubricating fluid being discharged therefrom to said drainage passage.

6. A press according to claim **4,** further comprising said drive conveyors being imperforate, and said drive conveyors and said filter belt defining therebetween a drainage cavity which communicates with said drainage passage for supplying liquid accepted by said filter belt to said drainage passage.

7. A press for separating liquid from a liquid-solid mixture, comprising:

a plurality of longitudinally driven, first drive conveyors arranged side-by-side and laterally spaced apart to provide a first drainage passage between said first drive conveyors;

a plurality of longitudinally driven, second drive conveyors arranged side-by-side and laterally spaced apart to provide a second drainage passage between said second drive conveyors;

said pluralities of drive conveyors being oppositely disposed in spaced relationship to form one set of opposing sides of a processing chamber and converging to cause the processing chamber to be of diminishing side-by-side dimension in the direction of the convergence of said pluralities of drive conveyors;

a first porous filter belt in the processing chamber and overlaying said first drive conveyors whereby liquid accepted by said first filter belt flows into said first drainage passage, said first filter belt being connected to said first drive conveyors to be driven by the latter longitudinally through the processing chamber;

a second porous filter belt in the processing chamber and overlaying said second drive conveyors whereby liquid accepted by said second filter belt flows into said second drainage passage, said second filter belt being connected to said second drive conveyors to be driven by the latter longitudinally through the processing chamber;

opposed elongated flow barriers at the other opposing sides of the processing chamber; and

passage means communicating with said first and second drainage passages for discharging liquid therefrom.

8. A press according to claim **7,** further comprising said drive conveyors extending slidably on pressure platens, and means for introducing lubricating fluid intermediate the drive conveyors and their respective pressure platen, such lubricating fluid being discharged therefrom to said drainage passages.

9. A press according to claim **8,** further comprising said first and second drive conveyors each being imperforate belts, said first filter belt and said first drive conveyors being constructed to provide therebetween a drainage cavity which communicates with said first drainage passage for supplying liquid accepted by said first filter belt to said first drainage passage, and said second filter belt and said second drive conveyors being constructed to provide therebetween a drainage cavity which communicates with said second drainage passage for supplying liquid accepted by said second filter belt to said second drainage passage.

10. A press according to claim **9,** further comprising said first and second filter belts cooperating with said flow barriers for closing the processing chamber at said other opposing sides thereof.

11. A press according to claim **10,** further comprising said passage means including discharge passages formed

in said pressure platens, and flow ducts communicating therewith.

12. A press for separating liquid from a liquid-solid mixture, comprising:

at least three juxtaposed, longitudinally driven, imperforate first drive conveyors laterally spaced to provide a drainage passage between the adjacent sides of each of the adjacent ones thereof;

at least three juxtaposed, longitudinally driven, imperforate second drive conveyors laterally spaced to provide a drainage passage between the adjacent sides of each of the adjacent ones thereof;

said first and second drive conveyors being oppositely disposed in spaced relationship to form one set of opposing sides of a processing chamber and converging to cause the processing chamber to be of diminishing side-to-side dimension in the direction of the convergence of the drive conveyors;

a first porous filter belt extending longitudinally through the processing chamber and overlaying said first drive conveyors whereby liquid accepted by said first filter belt flows into the drainage passages between said first drive conveyors, said first filter belt being connected to said first drive conveyors to be driven by the latter longitudinally through the processing chamber;

a second porous filter belt extending longitudinally through the processing chamber and overlaying said second drive conveyors whereby liquid accepted by said second filter belt flows into the drainage passages between said second drive conveyors, said second filter belt being connected to said second drive conveyors to be driven by the latter longitudinally through the processing chamber;

opposed elongated flow barriers at the other opposing sides of the processing chamber; and

passage means connected to said drainage passages for discharging liquid therefrom.

13. A press according to claim 12, further comprising said drive conveyors extending slidably on pressure platens, and means for introducing lubricating fluid intermediate the drive conveyors and their respective pressure platen, such lubricating fluid being discharged therefrom to said drainage passages.

14. A press according to claim 12, further comprising said first filter belt and said first drive conveyors being constructed to provide therebetween a drainage cavity which communicates with said first drainage passages for supplying liquid accepted by said first filter belt to said first drainage passages, and said second filter belt and said second drive conveyors being constructed to provide therebetween a drainage cavity which communicates with said second drainage passages for supplying liquid accepted by said second filter belt to said second drainage passages.

15. A press according to claim 13, further comprising said first and second filter belts cooperating with said flow barriers for closing the processing chamber at said other opposing sides thereof, and said passage means including discharge passages formed in said pressure platens, and flow ducts communicating therewith.

16. A press for separating liquid from a liquid-solid mixture, comprising:

a plurality of walls forming opposing sides of a processing chamber of diminishing side-to-side dimension;

one of said walls being a drive conveyor driven longitudinally along said processing chamber and including juxtaposed longitudinally extending sections separated by a column of spaced drainage passages;

a porous filter belt in the processing chamber and overlaying said drive conveyor whereby liquid accepted by said filter belt flows into said drainage passages, said filter belt being connected to said drive conveyor to be driven by the latter longitudinally through the processing chamber; and

passage means communicating with said drainage passages for discharging liquid therefrom.

17. A press according to claim 16, further comprising a wall of said processing chamber opposing said drive conveyor being a second drive conveyor longitudinally driven along the processing chamber and including juxtaposed longitudinally extending wall sections separated by a column of spaced drainage passages, a second porous filter belt in the processing chamber and overlaying said second drive conveyor whereby liquid accepted by said second filter belt flows into the drainage passages in said second drive conveyor, said second filter belt being connected to said second drive conveyor to be driven by the latter longitudinally through the processing chamber, and passage means communicating with the drainage passages in said second drive conveyor for discharging liquid therefrom.

18. A press according to claim 17, wherein the sections of each of said drive conveyors are at least three in number, and said drive conveyors each include at least two columns of spaced drainage passages.

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PETER FELDMAN, Primary Examiner

U.S. Cl. X.R.

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