Oct. 7, 1969 E. V. JUNG 3,470,815

PULP PRESS

Filed May 5, 1966 2 Sheets-Sheet 1

FIG.1

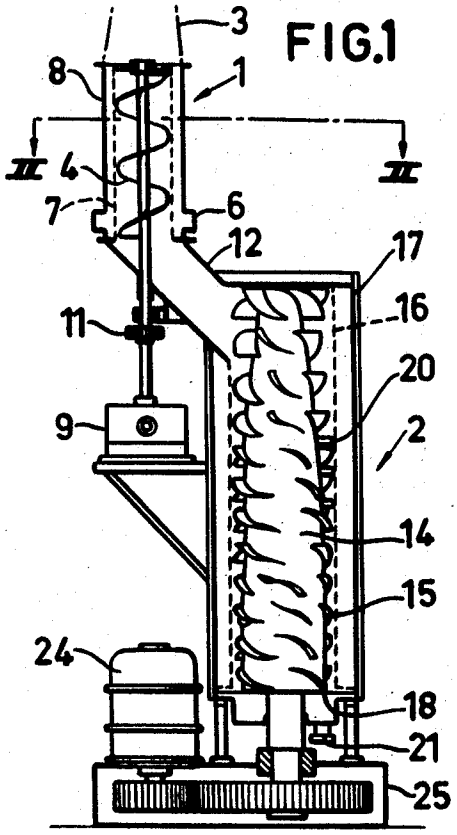


FIG.2

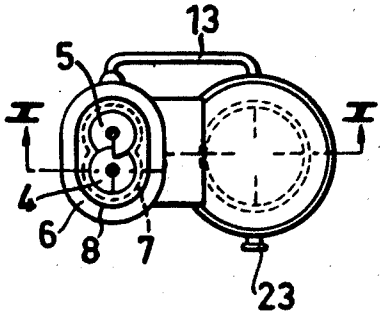


FIG.6

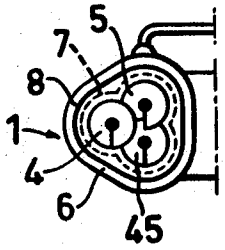
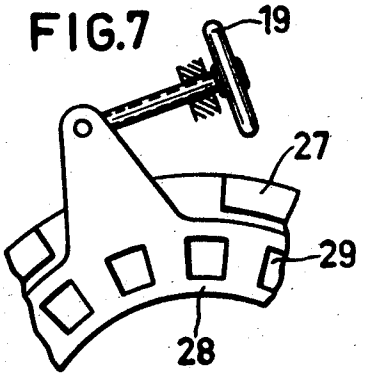


FIG.7



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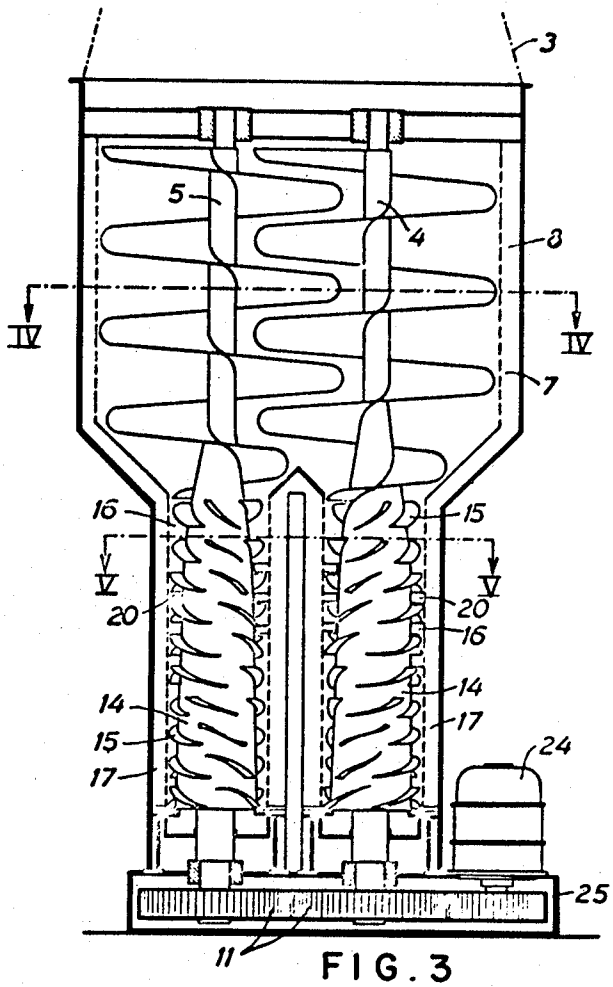


FIG. 3

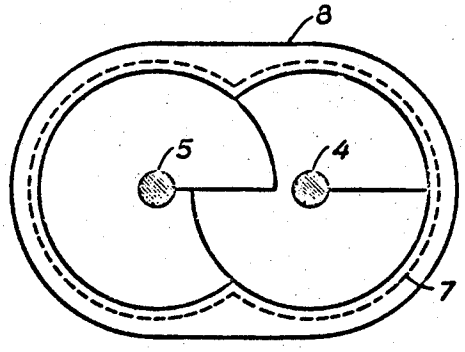


FIG. 4

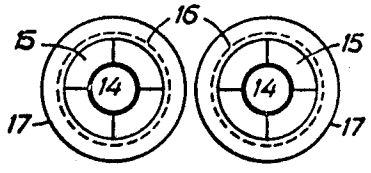


FIG. 5

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PULP PRESS

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U.S. Cl. 100—127 3 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus is disclosed for expressing liquids from vegetable substances such as beet pulp or cellulose pulp, wherein a high volumetric efficiency is economically attained, providing a high dry content of the pressed pulp. Efficiency is attained by employing, ahead of the main press, a pre-pressing stage preferably utilizing a plurality of meshing screw spindles rotatable on substantially vertical and parallel axes within a perforated strainer mantle, and the main press employing at least one screw spindle within a second perforated strainer mantel of substantially circular-cylindrical cross-section. Preferably, two screw spindles may be employed in the main press, each spindle being mounted on vertical axes within individual strainer mantles.

This invention relates to presses for pressing liquid out of pulp or vegetable substances, such as beet pulp and cellulose pulp.

The primary object of the invention is to provide a pulp press in which a high volumetric efficiency can be maintained throughout the entire pressing operation, particularly in the initial stage thereof, and in which a high end pressure and thus a high dry content of the pressed pulp can be attained.

A more particular object is to provide a press which can be erected at a comparatively low cost but yet permits attainment of the above-mentioned advantages.

With these and other objects in view the pulp press according to the invention includes firstly a pre-press or initial pressing stage which comprises an inlet hopper for pulp to be pressed, a plurality of screw spindles rotatable on substantially vertical and parallel axes and each having spirally arranged flight meshing between the flights of adjacent screw spindles, a perforated strainer mantle closely surrounding said screw spindles and their flights with a minute clearance between said flights and said strainer mantle, an outer housing surrounding said screw spindles and said perforated strainer mantle, and driving means for said screw spindles, and secondly at least one end-press or main pressing stage which is fed by the pre-press and comprises at least one screw spindle rotatable on a substantially vertical axes and having spirally arranged flights, a perforated strainer mantle having a substantially circular-cylindrical cross section and closely surrounding said screw spindle and its flights with a minute clearance between said flights and said strainer mantle, an outer housing surrounding said screw spindle and said perforated strainer mantle with an interspace therebetween, driving means for said screw spindle, a fluid outlet for fluid pressed out of said pulp and connected to said interspace between said strainer mantle and said outer housing, and a pressed pulp outlet connected to the interior of said perforated strainer mantle.

Other objects and advantages of the invention will become apparent from the following description and the accompanying drawings which diagrammatically and as nonlimiting examples illustrate some preferred embodiments.

FIGURE 1 is a vertical section taken substantially along the line I—I in FIG. 2 of a press according to one embodiment of the invention.

FIGURE 2 is a horizontal cross section taken substantially on the line II—II of FIGURE 1.

FIGURE 3 is a vertical sectional view of a second embodiment of the invention.

FIGURES 4 and 5 are horizontal cross sections taken substantially on the lines IV—IV and V—V of FIGURE 3 respectively.

FIGURE 6 is a fragmentary cross sectional view corresponding substantially to the left hand end of FIGURE 2 and disclosing a third embodiment of the invention.

FIGURE 7 illustrates a rotary valve.

In the figures and in the following description the same reference characters indicate same or like parts throughout.

Referring to FIGURES 1–2 of the drawings the press according to a first embodiment of the invention comprises a vertical pre-press or preliminary pressing stage **1** and a vertical end-press or final pressing stage **2**. The end-press is fed by the pre-press which means that the outlet end of the pre-press **1** is connected to and opens into the inlet end of the end-press **2**.

The pre-press **1** comprises an inlet hopper **3** to which wet pulp, e.g. beet pulp, is transported by a screw conveyor (not shown) or the like, a pair of interengaging feed screws or spindles **4** and **5** provided with vanes or flights, a perforated strainer mantle **7**, an outer housing **8**, a liquid collecting trough **6** and driving means for rotating the spindles **4** and **5**.

The driving means comprise a driving motor **9**, a gear box (not shown), in which the speed of the motor is reduced, and spur gears **11**. On account of these spur gears the spindles **4**, **5** rotate in opposite directions with respect to each other. The screw spindle **4** has right-hand and the screw spindle **5** has left-hand flights. The perforated strainer mantle **7** has approximately the shape of the numeral figure **8** as shown in FIGURE 2 and encloses the flights of the screw spindles **4**, **5** with a minute clearance. An interspace is formed between the perforated strainer mantle **7** and the outer housing **8**.

The wet pulp introduced into the pre-press in the cleft between the screw spindles **4**, **5** and the strainer mantle **7** through the inlet hopper **3** is advanced during moderate compression and simultaneous dewatering, by the screw spindles **4**, **5**. The liquid pressed out of the pulp through the perforated strainer mantle **7** is collected in the trough **6**. On account of the interengagement of the flights of the two screw spindles the pulp will become very well stirred and also prevented from taking part in the rotational movements of the screw spindles, which means that it will be given a favourable axial direction of motion. A comparatively rapid compression during the initial pressing stage and an effective filling of the press proper is hereby attained which ensures a high volumetric output. In addition to this an overpressure is created already at the inlet end of the end press **2** promoting the dewatering of the pulp.

The main or end press **2**, which is fed by the pre-press **1** and is also connected to the liquid collecting trough **6** by a pipe **13** (FIG. 2) comprises a single screw spindle **14** which preferably has an approximately parabolic contour and is provided with flights or vanes **15**, a perforated strainer mantle **16** which has a circular cross section throughout its entire length and is preferably cylindrical, a plurality of holders or resistors **20** located in the cleft between the screw spindle **14** and the strainer mantle **16**, an outer housing **17** surrounding the screw spindle **14** and spaced therefrom, a rotary valve or shutter **18** preferably of the rosette type and provided with a control hand wheel (not shown in FIGS. 1–2), an outlet **21** for the pressed pulp located in the outer housing **17** behind

the valve **18**, an outlet **23** from the lower end of the outer housing **17** for the liquid, and driving means for rotating the screw spindle **14** and comprising a motor **24** and a gear box **25** in which the speed of the motor is reduced.

The pre-compressed pulp from the vertical pre-press **1** is introduced laterally into the vertical end-press **2** in the cleft between its screw spindle **14** and strainer mantle **16** at the upper inlet end of the end-press **2**. In FIGURE 2 it should be noted that lower ends of the screw spindles **4, 5** of the pre-press **1** are located at the side of the axis of the screw spindle **14**, of the end-press **2** and are displaced in relation to each other in a direction which is substantially parallel to the axis of the screw spindle of the end-press. This ensures optimum feeding of the end-press. In the end-press **2** the pulp is further compressed and dewatered and also advanced by the screw spindle **14** and its flights **15**. The resistors **20** which are preferably arranged with an even pitch and only few of which are shown in FIGURE 1 operate to stir the pulp and prevent rotation thereof during its way along the screw spindle **14** to secure the most effective pressing and dewatering of the pulp.

The liquid pressed out of the pulp through the strainer mantle **16** is collected at the lower end of the outer housing **17**, into which the connecting pipe **13** from the trough **6** of the pre-press **1** opens, and the liquid mixture from the two press portions is subsequently carried off through the outlet **23**.

The strainer mantle **16**, on account of its round section, is very robust and will therefore preserve its shape for a long operating time. A close fit between the edges of the flights **15** and the strainer mantle **16** will thus be maintained, and the press will give a high pressing pressure and thus a high capacity throughout its entire life.

The edges of the screw spindles **4** and **5** as well as of the flights **15** of the screw spindle **14** are hardfaced. The other parts of the screw spindles **4** and **5** and likewise those of the flights **15** and the screw spindle **14** are stainless steel sprayed. All of these parts thus have a high resistance to both erosion and corrosion, also in this respect ensuring a long life without repairs of the press.

The total strainer surface of the press could be of the order 15 m.^{2} (161 sq. feet).

The pressure of the pulp in the press is regulated by the rotary shutter **18** which is of rosette-type and consists, as more clearly shown in FIGURE 7, of one fixed and one movable ring-shaped guide list **27** and **28** respectively provided with slotted holes **29**. The rotary guide list **27** of the shutter is controlled by means of the hand-wheel **19** to vary the cleft-opening for the pulp and in such a way to regulate the pressure. With this shutter design a high pressure can be obtained in the press, and this will give a high presswater run-off and a high dry matter content of the pressed pulp.

The ready-pressed pulp leaves the press through the outlet **21**.

It is also possible to provide three mutually interengaging screw spindles **4, 5, 45** in a common strainer mantle **7** comprised in the pre-press **1** as illustrated in FIGURE 6 which differs from the left-hand portion of FIGURE 2 only in this respect. In FIGURE 6 it should be particularly noted that the cross section of the strainer mantle is in strict conformity with the outer contour of the screw spindles **4, 5, 45**. This conforming between the outer contour of the screw spindles including their flights, and the cross section of the perforated strainer mantle, irrespective of its shape, can be maintained only thanks to the restricted over-pressure existing in the pre-press which is held within reasonable limits (1–1.5 kilos/cm.^{2}) due to the fact that the entire press is divided into a pre-press and an end-press.

In FIGURES 3–5 there is illustrated an embodiment in which a pre-press **1** comprising two interengaging screw spindles **4, 5** feeds two separate end-presses each having individual screw spindles **14** with flights **15**, strainer mantles **16** and outer housings **17**. In this embodiment too, the strainer mantles **7, 16** closely enclose their screw spindles **4, 5** and **14** respectively with a minute clearance between the flights of the screw spindles and the respective perforated strainer mantles. In this embodiment all screw spindles have a common drive motor **24** and a common speed reducing gear box **25**. Since the screw spindles **14** obviously rotate in opposite directions, they have oppositely directed flights **15**.

The embodiments described above and illustrated in the drawings are to be regarded merely as non-limiting examples and can be modified in several ways. Thus, not only the first but also the second one of the embodiments described may be modified as shown in FIGURE 6. Furthermore new embodiments may be created by combining details from the different embodiments described.

What I claim is:

1. A pulp press, comprising a pre-press operating at a relatively low pressure, and at least one end-press fed by said pre-press and operating at a relatively higher pressure than said pre-press; said pre-press comprising an inlet hopper for pulp to be pressed, a plurality of screw spindles rotatable on substantially vertical axes and each having spirally arranged flights meshing between the flights of adjacent screw spindles, a perforated strainer mantle closely surrounding said screw spindles and their flights with a minute clearance between said flights and said strainer mantle, an outer housing surrounding said screw spindles and said perforated strainer mantle, and driving means for said screw spindles; said end-press comprising two separate screw spindles with spirally arranged flights, each such spindle being separately enclosed in an individual perforated strainer mantle having a substantially circular-cylindrical cross section and closely surrounding said screw spindle and its flights with a minute clearance between said flights and said strainer mantle, an outer housing surrounding each said screw spindle and associated perforated strainer mantle with an interspace therebetween, driving means for each said screw spindle, a fluid outlet for fluid pressed out of said pulp and connected to said interspace between each of said strainer mantles and said outer housing, and a pressed pulp outlet connected to the interior of each of said perforated strainer mantles.

2. A pulp press, comprising a pre-press operating at a relatively low pressure, and at least one end-press fed by said pre-press and operating at a relatively higher pressure than said pre-press; said pre-press comprising an inlet hopper for pulp to be pressed, a perforated strainer mantle, three screw spindles enclosed within said perforated strainer mantle, each of said spindles being rotatable on substantially vertical axes and each having spirally arranged flights meshing between the flights of adjacent screw spindles, said perforated strainer mantle closely surrounding said screw spindles and their flights with a minute clearance between said flights and said strainer mantle, an outer housing surrounding said screw spindles and said perforated strainer mantle, and driving means for said screw spindles; said end-press comprising a rotatable screw spindle with spirally arranged flights, a perforated strainer mantle having a substantially circular-cylindrical cross section and closely surrounding said screw spindle and its flights with a minute clearance between said flights and said strainer mantle, an outer housing surrounding each said screw spindle and associated perforated strainer mantle with an interspace therebetween, driving means for each said screw spindle, a fluid outlet for fluid pressed out of said pulp and connected to said interspace between each of said strainer mantles and said outer housing, and a pressed pulp outlet connected to the interior of each of said perforated strainer mantles.

3. A pulp press, comprising a pre-press operating at a relatively low pressure, and at least one end-press fed by said pre-press and operating at a relatively higher pres-

sure than said pre-press; said pre-press comprising an inlet hopper for pulp to be pressed, a plurality of screw spindles rotatable on substantially vertical axes and each having spirally arranged flights meshing between the flights of adjacent screw spindles, a perforated strainer mantle closely surrounding said screw spindles and their flights with a minute clearance between said flights and said strainer mantle, an outer housing surrounding said screw spindles and said perforated strainer mantle, and driving means for said screw spindles; said end-press comprising a rotatable screw spindle with spirally arranged flights, a perforated strainer mantle having a substantially circular-cylindrical cross section and closely surrounding said screw spindle and its flights with a minute clearance between said flights and said strainer mantle, an outer housing surrounding said screw spindle and associated perforated strainer mantle with an interspace therebetween, driving means for said screw spindle, a fluid outlet for fluid pressed out of said pulp and connected to said interspace between said strainer mantles and said outer housing, and a pressed pulp outlet connected to the interior of said perforated strainer mantles; the lower ends of the screw spindles of said pre-press being located to the side of the axis of the screw spindle of

the end-press and are displaced in relation to each other in a direction substantially parallel to the axis of the screw spindle of said end-press.

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PETER FELDMAN, Primary Examiner

U.S. Cl. X.R.

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