June 6, 1950 J. STADLER 2,510,764

LIQUID EXTRACTING PRESS FOR DRYING FIBROUS MATERIALS

Filed Sept. 14, 1945 2 Sheets-Sheet 1

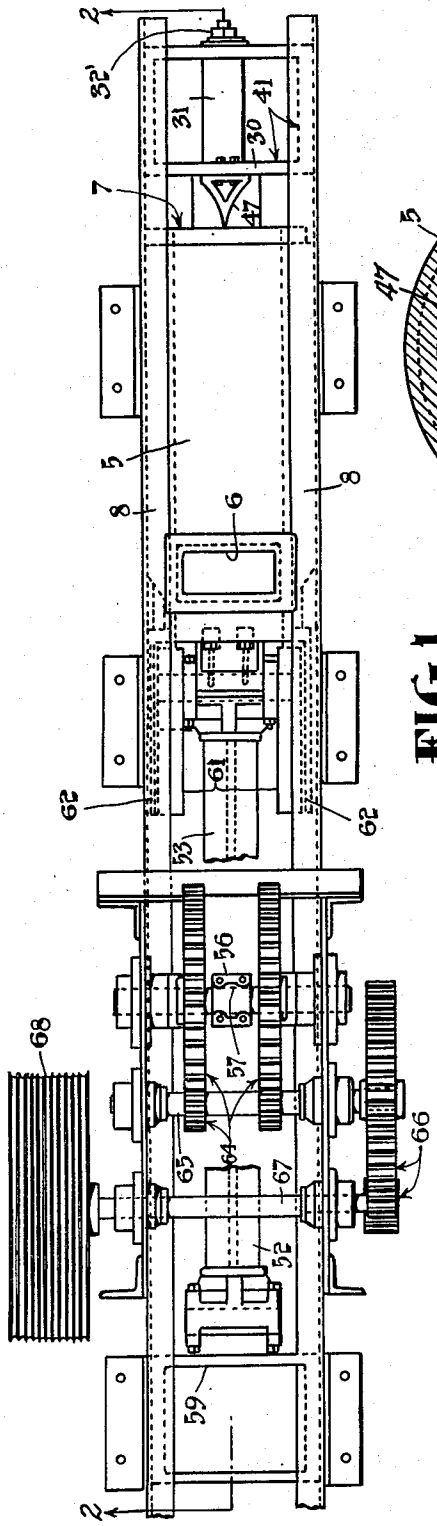


FIG. 1

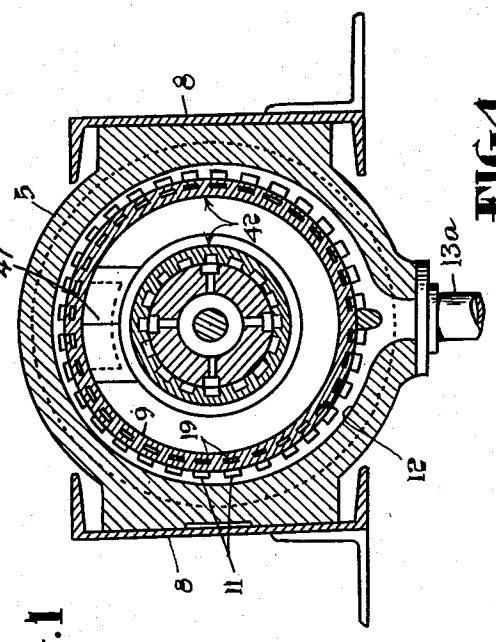


FIG. 4

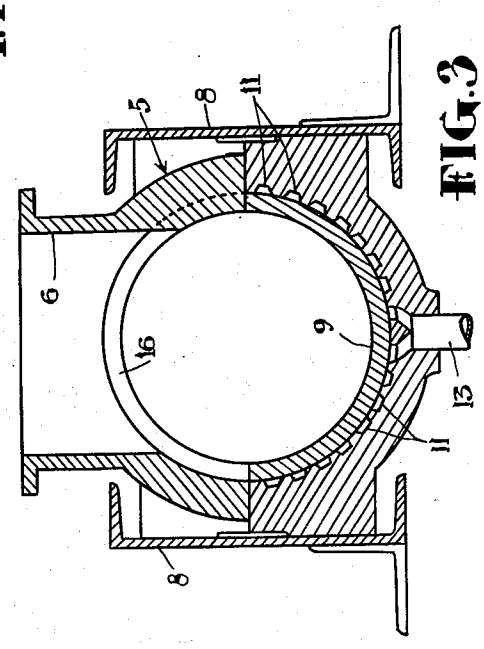


FIG. 3

INVENTOR
JOHN STADLER
BY Fetherstonhaugh & Co.
ATTORNEYS

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LIQUID EXTRACTING PRESS FOR DRYING FIBROUS MATERIALS

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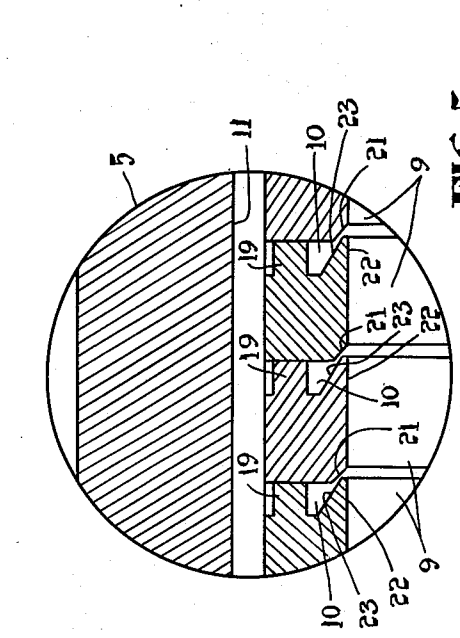


FIG.5

FIG.2

FIG.6

INVENTOR
JOHN STADLER
BY Fetherstonhaugh & Co.
ATTORNEYS

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LIQUID-EXTRACTING PRESS FOR DRYING FIBROUS MATERIALS

John Stadler, Montreal, Quebec, Canada

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In Canada June 29, 1945

1 Claim. (Cl. 100—45)

1

This invention relates to removal of liquid from solids by subjecting the latter to compression in a high pressure power press of the cylinder and piston type.

The object of the invention is to provide an improved liquid-extracting press of the above mentioned type in which the material is compressed in a more efficient manner resulting in the economical removal of a substantially greater amount of liquid than is possible with the best types of presses now in use.

According to this invention, the cylinder is equipped with a drainage lining which surrounds and is spaced from a pressure-intensifying drainage cone arranged with its smaller end directed toward but terminating short of the entrance end of the cylinder into which the material to be compressed is intermittently introduced through a suitable inlet. The cone and the surrounding cylinder lining conjointly provide an annular compression zone of gradually decreasing area toward the discharge end of the cylinder. The material is forced rearwardly through the annular compression zone under continuously increasing compression pressure by means of a high pressure power-actuated piston reciprocating in the portion of the cylinder located forwardly of said cone. The piston is operated by a power-actuated toggle or other force transmitting mechanism through which the force applied to the piston is increased to a maximum value as the piston nears the end of its working stroke. With this arrangement, the material is forced through the annular compression zone in the form of a cylindrical mass, the cylindrical wall of which is gradually decreased in thickness by continuously increasing radial compression thereof between the converging defining walls of said zone. This provides the optimum conditions for the most effective use of the compression pressure applied to the material to remove liquid therefrom since the length of the path which the liquid must travel through the material to reach the drainage openings of the cyinder and cone is reduced to a minimum at the point where the material is subjected to the maximum compression pressure during its passage through the compression zone.

Other objects, advantages and characteristic features of the invention will be more readily understood from the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a plan view of my improved liquid-extracting press with certain parts broken away

2

to disclose other parts that would otherwise be hidden from view.

Figure 2 is a vertical longitudinal sectional view taken substantially along the section line 2—2 of Figure 1.

Figure 3 is a transverse vertical sectional view taken substantially along the section line 3—3 of Figure 2.

Figure 4 is a composite transverse vertical sectional view which is taken partly along the section line B—B and partly along the section line C—C of Figure 2.

Figure 5 is an enlarged detail view of a portion of the press cylinder.

Figure 6 is an enlarged detail view of a portion of the drainage cone.

Referring more particularly to the drawings, 5 designates a horizontally arranged press cylinder provided near one end with a lateral inlet 6 for the admission of the material from which the liquid is to be removed. The other end of the cylinder is left open to provide an outlet 7 through which the material is discharged after the liquid has been extracted therefrom. In the present instance cylinder 5 is shown mounted in place between a pair of supporting channels 8 which also support other press elements hereinafter referred to.

That portion of cylinder 5 which lies between inlet 6 and outlet 7 is provided with a drainage lining consisting of rings 9 arranged in side by side relation to provide intervening drainage slots 10 communicating with longitudinally extending drainage channels 11 provided in the inner wall surface of the cylinder. The channels 11 are interconnected by a helical channel 12 (Figure 2) so that all the water which is forced into said channels through the drainage slots 10 is delivered to suitable drain connections 13 and 13a. Cylinder 5 is also equipped with a vent 14 which communicates with channels 11 through drain slots 10.

The rings 9 are clamped in place between a cutting ring 16 located immediately adjacent inlet 6 and a clamping ring 17 which is fastened to the cylinder at the discharge or outlet end 7. The body portion of each ring 9 is provided with laterally directed spacers 19 which are engaged with an adjacent ring to maintain the spacing of the ring necessary to provide the drainage slots 10. The spacers 19 of the ring nearest the outlet 17 engage the clamping ring 17 but the spacers of each of the remaining drainage rings 9 engage the body portion of an adjacent drainage ring.

With the exception of the drainage ring butted against the cutting ring 16, the inner corner of that side of each ring which is nearest inlet 6 is bevelled at an angle of approximately 45° to provide a corner surface 21 which slopes inwardly and rearwardly toward the discharge opening 7. At the side remote from inlet 6, the inner corner portion of each drainage ring 9 is extended to provide a lip 22 having its outer annular surface 23 bevelled so that it inclines inwardly and rearwardly toward the discharge opening 7. A portion of the bevelled lip surface 23 of each ring 9 is opposed to the bevelled corner surface 21 of the next succeeding ring 9 to provide a restricted entrance for the drainage slot 10 provided by and between said rings.

A pressure intensifying drainage cone 25 is arranged in cylinder 5 with the smaller end of the cone directed toward but terminating a substantial distance short of the inlet 6. Cone 25 comprises a hollow conical core member 26 mounted on a combined supporting and fastening rod 27 which is provided at its front end with a pointed enlargement 26 which constitutes the tip of the cone. A plurality of drainage rings 28 are mounted on the core member 26 and are clamped in place between the pointed enlargement 28 of rod 27 and a shoulder 29 of the core member. The rear end of the core member 26 is butted against a plate 30 formed integral with the front end of a tubular casting 31 which is in communication with the hollow interior of core member 26 and is provided with a drain connection 32. The rod 27 extends rearwardly through the casting 31 and is equipped with a clamping nut 32' which is tightened to clamp the drainage rings 28 against the shoulder 29 and to also clamp the rear end of the core member 26 tightly against the plate 30. The surface portion of core member 26 on which the drainage rings 28 are mounted is provided with longitudinally extending channels 33 communicating through radial openings 34 with the hollow of the core member. The drainage rings 28 associated with the core member 26 are constructed in substantially the same manner as the previously mentioned drainage rings 9. One outer corner portion of each ring 28 is extended to provide a lip 36 provided with a bevelled inner surface 37 which inclines outwardly and rearwardly toward the discharge orifice 7 and overlies a correspondingly inclined surface 38 formed by bevelling the adjacent outer corner portion of the next succeeding ring. This description applies to all the rings 28 with the exception of the end rings. In the case of the end ring abutting the cone tip 28, the sloping of the leading outer corner portion of the ring is omitted. In the case of the end ring abutting the shoulder 29, the lip formation 36 is omitted.

The tubular casting 31 forms part of a cast frame structure 41 which is positioned between and supported by the channels 8. As clearly shown in Fig. 2 the drainage lining of cylinder 5 and the drainage cone 25 conjointly provide an annular compression zone 42 of gradually decreasing area toward the discharge outlet 7.

The material introduced into the cylinder through the inlet 6 is forced rearwardly through its annular compression zone 42 by means of a high pressure piston 44 which reciprocates in the portion of the cylinder located forwardly of the cone 25.

When the piston is in the retracted position shown in Fig. 2 a charge of material is introduced into the entrance end of the cylinder through the inlet 6. During the working stroke of the piston a cutting ring 45 carried thereby cooperates with the previously mentioned cutting ring 16 to separate the inserted charge of material from excess material which is subsequently introduced into the cylinder when the piston is again retracted to the end of its return stroke. The repeated reciprocation of the piston causes the material to be forced rearwardly through the annular high compression zone 42 toward the discharge outlet 7. During its passage through zone 42, the material is formed into an annular mass, the wall thickness of which is constantly decreased by continuously increasing radial compression thereof between the converging defining walls of said zone. It will thus be seen that the annular mass of material being forced through the annular high compression zone is subjected to the greatest compression at that point in said zone where the wall thickness of the annular mass is reduced to a minimum to provide the shortest path for the flow of liquid through the mass to the drainage openings of the cylinder lining and the pressure intensifying cone. It will thus be seen that the invention provides the optimum conditions for the most effective use of the compression pressure applied to the material to expel the liquid therefrom.

The material, from which the liquid has been extracted, issues through the discharge opening 7 in the form of an annular ring which is forced against the cutting edge of a triangular cutting knife 47 fastened to the plate 30 with its cutting edge or apex opposed to the upper portion of said discharge opening. As the ring of material is cut by this knife, it collapses and falls downwardly through the space reserved between the discharge end of the cylinder and the plate 30.

Part of the water forced from the material during its passage through the cylinder 5 is forced outwardly through the drainage openings 10 between the cylinder lining rings 9 into the channels 11 and 12, from whence it is delivered to the drain connections 13 and 13a. Another part of the water expelled from the material by compression between the cylinder lining rings 9 and the cone 25 flows through the drainage spaces 28a between the cone rings 28 into the cone channels 33 from whence it passes through the openings 34 and hollow interior of the core member 26 to the drain casting 31 which, as previously stated, is equipped with a drain connection 32.

The piston 44 encounters the maximum resistance as it nears the end of each working stroke. In order to ensure a reasonable normal power consumption when the piston is working against the maximum resistance, I provide a toggle mechanism 50 through which power is applied to the piston from the main crank shaft 51 so that the maximum force is transmitted to the piston when the latter is nearing the end of its working stroke and is encountering the maximum resistance. This toggle mechanism comprises a pair of toggle members 52 and 53 having corresponding ends connected to a swinging shaft 54 carried at the lower end of a connecting rod 55 having its upper end 56 fastened to the crank 57 of the main crank shaft 51. The other end of toggle arm 52 is connected to a stationary shaft 58 carried by a shaft supporting bracket 59 supported in place between the channel members 8. The remaining end of toggle arm 53 is connected to a travelling crosshead shaft 60

which, together with the cross heads 61, is rigidly secured to piston 44 to travel therewith, the cross heads 61 being fitted in cross head guides 62 carried by the channel members 8. The crank shaft 51 is driven by gearing 64 from a slow speed countershaft 65 which, in turn, is driven by gearing 66 from a high speed countershaft 67 equipped with a pulley 68 or other means for driving it from a suitable prime mover. During rotation of the main crank shaft 51, the piston is operated by the toggle mechanism 50 so that the greatest power is applied to the piston through the toggle mechanism as the piston nears the end of its working stroke.

Liquid-extracting presses constructed in accordance with the invention described herein may be efficiently employed in all cases where high pressure power compression of moist or liquid-saturated bark or other fibrous material must be resorted to in order to extract a sufficient amount of liquid to permit economical use of the material for fuel or other industrial purposes. Owing to the efficient manner in which the material is compressed during its travel through the water-draining high-compression zone afforded by the water-draining cylinder lining and the opposing pressure-intensifying draining cone, the amount of water extracted from the material far exceeds the amount of water that can be extracted by any other press of comparable capacity and power consumption.

Having thus described the nature of my invention and what I now conceive to be the preferred mechanical embodiment, it will be understood that various modifications may be resorted to within the scope and spirit of the invention as defined by the appended claim.

Having thus described my invention, what I claim is:

A high-pressure liquid-extracting power press comprising a cylinder provided with a material inlet near one end and being open at the opposite end to provide a material discharge outlet,

a drainage lining extending around the inner wall portion of the cylinder located between the inlet and the outlet, said lining consisting of a plurality of drainage rings arranged in side by side relation to define intervening drainage slots communicating with drainage channels provided in the inner wall surface of the cylinder, a drainage cone arranged in said cylinder with the smaller end of the cone directed toward but terminating short of said inlet, said drainage cone comprising a conical core member provided with drainage channels and a plurality of drainage rings arranged on said core in side by side relation to define intervening drainage slots communicating with the drainage channels of said core, said latter drainage rings being of gradually larger diameter toward the base of the drainage cone, a triangular cutter arranged externally of but directly opposite said discharge outlet and having its apex directed toward said outlet, and a high-pressure power-actuated reciprocating piston working in the portion of the cylinder located forwardly of the tip of said drainage cone, said press being characterized in that the drainage rings of the cylinder and the drainage cone conjointly provide an annular high-pressure compression zone of gradually decreasing area toward said discharge outlet.

JOHN STADLER.

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