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R. S. CHAPMAN
PRESSURE EXPANSION GUN

2,539,991

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2 Sheets-Sheet 1

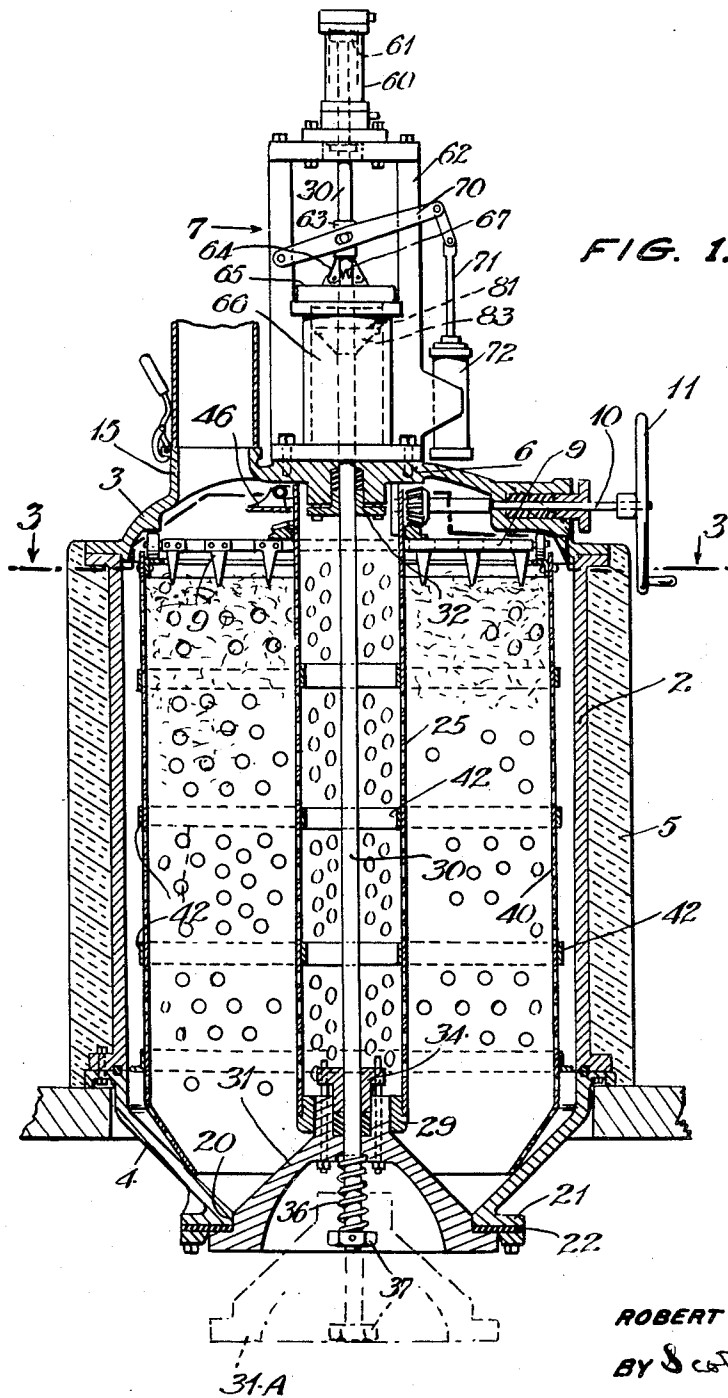


FIG. 1.

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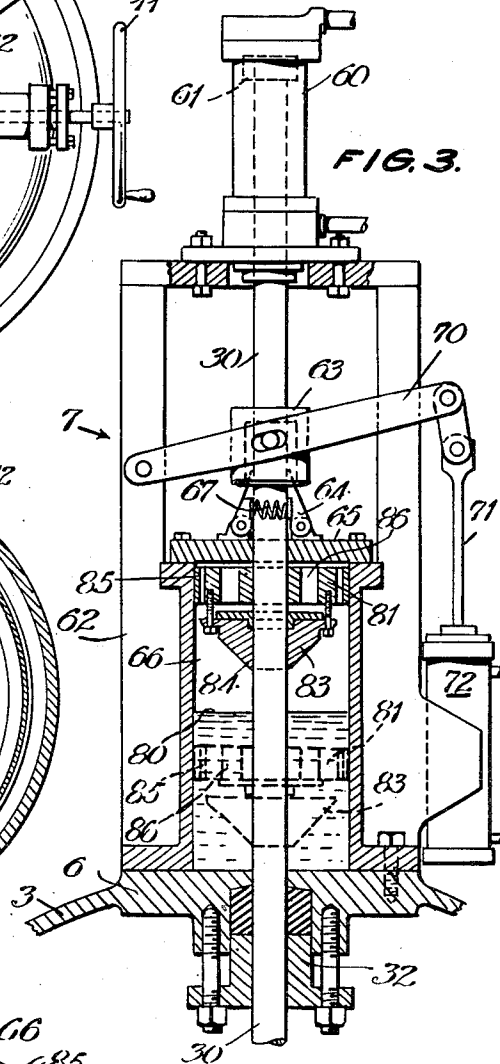
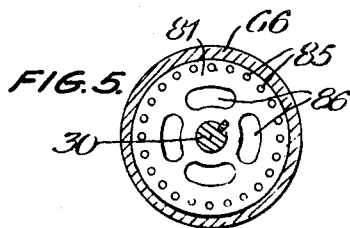
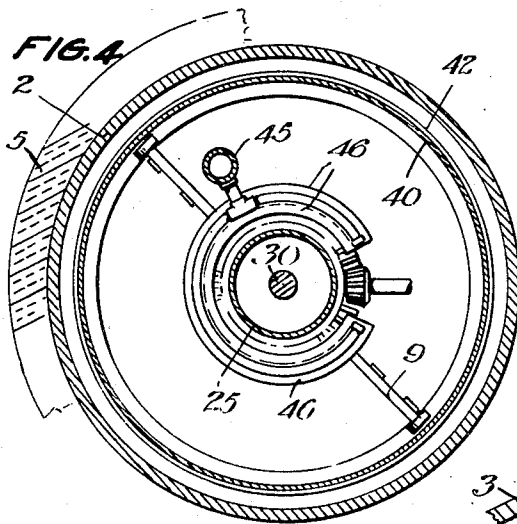
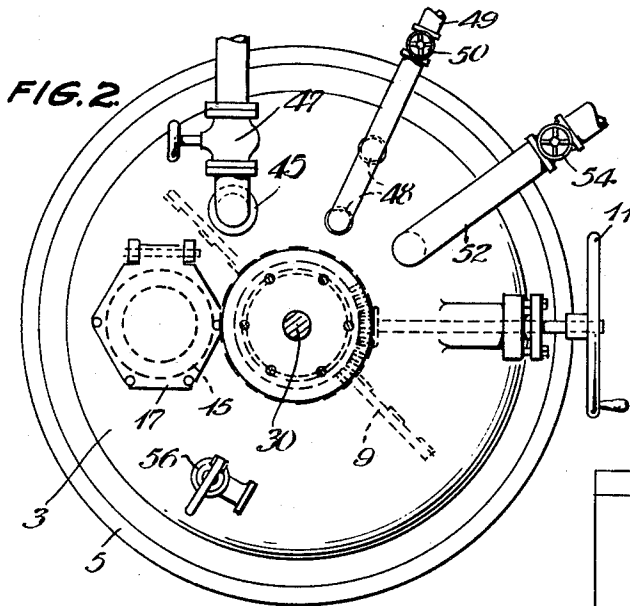
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PRESSURE EXPANSION GUN

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4 Claims. (Cl. 92-1)

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This invention pertains to pressure expansion guns for extracting fibre from fibrous bearing plants.

One of the objects of the invention is to provide an economical and efficient vessel into which fibre bearing plants may be placed and sealed, so that steam may be introduced to permeate all parts of the charge and at a desired time thereafter the contents may be discharged or expelled by the opening of the valve at the bottom of the vessel.

Another object is to provide an expansion vessel of the type mentioned which has means for loading and distributing the load within the vessel.

Another object is to provide an expansion vessel of the type mentioned in which means is provided for distributing steam or high pressure air evenly to all parts of the load.

Still another object is to provide mechanism for closing an expansion valve at the bottom of a cylindrical shaped vessel and for quickly opening it to permit the contents to expand therefrom. Other objects will appear hereinafter.

I attain the foregoing objects by means of the apparatus shown in the accompanying drawings in which

Figure 1 is a vertical sectional view of the expansion vessel, and attendant mechanism.

Figure 2 is a plan view of the vessel with the operation mechanism sectioned off and removed.

Figure 3 is a side elevation of the opening and closing mechanism, drawn on an enlarged scale.

Figure 4 is a horizontal section taken on lines 3-3 of Figure 1.

And Figure 5 is a plan view of the dash pot cylinder piston.

Similar numerals refer to similar parts in the several views.

The body of the vessel 2 is cylindrical. It is closed at the top by a dome shaped header 3 and at the bottom by an end piece 4. The entire perimeter of the vessel may be lagged as indicated by the numeral 5. The top header of the vessel includes a circular area 6 which forms a support for the valve operating mechanism indicated by numeral 7. The header also supports a rotary levelling rake 9 which is driven through gearing by a shaft 10 carrying a hand wheel 11. A loading door 15 is positioned eccentrically from the center of plate area 6, and provided with a hinged closing plate 17 which is arranged to be bolted in closed position.

The bottom closure 4 is somewhat funnel shaped and its opening 20 is provided with a flange 21 carrying a ring shaped packing 22.

Concentric with the axis of the vessel is a perforated steam distribution tube 25. This is attached to the inner surface of area 6 at its top, and has a thimble 29 at its bottom. Extending

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longitudinally through the center of the vessel is a shaft 30 which carries the expansion valve plug 31 at its bottom end. A gland thimble 32 seals shaft 30 in area 6 at the top of the vessel, and a gland thimble 34 seals the shaft 30 into the bottom of the central steam distribution tube 25. These thimbles also act as bearings. Valve plug 31 is resiliently attached to shaft 30 by means of a heavy spring 36 tensioned by a nut 37 at its bottom end.

Surrounding tube 25 and concentrically positioned is a cylindrical load holding basket 40. This is perforated throughout its perimeter and both this and tube 25 are provided with strengthening rings 42.

On the top of the vessel closure 3, a steam entrance inlet pipe 45 is positioned to direct steam into vessel 2 and over a conical distribution plate 46. A steam control valve is indicated by numeral 47. In addition to the steam entrance pipe there are compressed air inlets 48 connected to pipe 49 and closed by valve 50, and a vacuum pipe line 52 closed by valve 54, and lastly a safety valve 56.

Leaves or other fibre bearing plants and parts of plants are introduced into the chamber through entrance opening 15 after door 17 has been unlocked and opened. Prior to this, valve plug 31 has been closed on valve seat packing 22. The fibre bearing material fills basket 40, and as it reaches the top, hand wheel 11 is rotated in order to rotate the levelling rake 9 which operates above the top of basket 40. When the basket is filled and leveled, the cover 17 is closed and bolted shut. Steam is then introduced through pipe 45 until the proper pressure has been reached throughout the load. When this is done valve plug 31 is quickly released from seat 20 and the load expanded downward into a receiver where it is brought into contact with water spray and thoroughly washed and tumbled.

Thereafter the vacuum pipe line 52 may be opened to scavenge the interior of the vessel of water vapor etc., and make it ready for the next load. In certain instances after the introduction of steam as aforesaid compressed air is introduced through openings 48 at a higher pressure than the steam pressure within the chamber and expansion made thereafter.

Valve plug 31 is held on packing ring 22 of seat 20, and released from this seat by mechanism indicated generally at 7 but shown in detail in Figure 3.

The plug is primarily closed and held closed by a piston 60 operating in a valve operating cylinder 61 at the top of frame work 62, which is attached to area 6 on the cover header 3. Fluid introduced on the under side of piston 61 moves shaft 30 upward until plug 31 seats on packing 22. It is held and locked in this position (while

pressure is maintained on it) by the mechanism shown in Figure 3, and consisting of a number of angular wedges 64 surrounding shaft 30 and resting on the top face of plate 65, which is the cover of shock absorbing cylinder or dash pot 66. These frictional lock wedges are held normally in loose position by a circular spring 67, and are supported by loose hinges on the top of plate 65. While plug 31 is held closed, a slip sleeve or collar 63 is jammed down tightly over these wedges by means of lever 70 operated by piston rod 71 running in locking cylinder 72. The piston in this cylinder can be actuated either by hydraulic means or pneumatic means. By the action of slip sleeve 63, wedges 64 grip tightly against rod 30 so that valve plug 31 is held in closed position. After this, steam is introduced into vessel 2, as above explained. After steam has been introduced, the valve plug 31 is released by reversing movement of sleeve 63. Wedges 64 then release shaft 30 and the internal pressure of vessel 2 forces valve plug 31 to open position as shown by dotted line 31—A.

To stop the motion of shaft 30 and its attendant parts, when it has reached the limit of its travel, I provide the dash pot cylinder 66, which is partially filled with oil 80, and piston 81 on shaft 30. Piston 81 is perforated by a number of holes 85 arranged centrically near its perimeter. This allows the oil 80 to move from the bottom of this cylinder to its top as the piston is forced downward. The size and relation of these holes to the volume and size of piston 81 in cylinder 66 governs the speed with which the downward motion of the piston is stopped. A valve 83 seats on larger holes 86 and is positioned on shaft 30 below the bottom face of piston 81. It is slidably operative, a short distance, on shaft 30 so that it opens and stays open by its own weight when piston 81 is at the top of cylinder 66, and closes when its tapered nose 84 impinges on the top of oil 80. During the first part of its downward stroke air and oil flow through holes 85 and 86 until the surface of oil 80 is reached. Thereafter, the oil is forced through the holes, 85 only, and the motion of the piston is progressively retarded as it approaches the bottom of cylinder 66.

It is to be understood that before valve plug 31 has been opened by operation of cylinder 60, all hydraulic fluid is removed from the under side of the piston 61 operating in cylinder 60. Suitable oil pumps and control valves are connected to both the valve operating cylinder 60 and the collar operating or locking cylinder 72. These are of conventional structure and are therefore not shown in detail.

From the foregoing it will be seen that I have provided an expansion vessel, as herein concerned, which is easily constructed and assembled, and operatively and thermally efficient. The fibrous plant material may be forced through loading door or wilted by wet steam and fed by gravity. The load is evenly distributed by the leveling rake, and then, after closing and sealing the loading door, steam is evenly introduced throughout the whole load by the perforated center tube and the load holding basket. I have found that steam at high temperatures, often chars the plant fibers, therefore, I have provided means for the introduction of compressed air. Steam is first introduced to permeate and soften the plant material; high pressure air is then introduced to build up pressure to attain complete

expansion. The position of the loading door at the top, and the expansion valve at the bottom of the cylindrical vessel enhance the efficiency of the entire unit.

I claim:

1. A pressure expansion gun for extracting fiber from fiber bearing plants, including in combination a cylindrical vessel closed by a header at the top and by a funnel shaped end piece at the bottom terminating in a concentrically positioned valve seat; an axially extending concentrically positioned perforated steam distributing tube attached to the bottom face of said header at its top and positioned by a thimble at its bottom; an axially extending bottomless cylindrical perforated load holding basket concentrically positioned in spaced relation to said steam distributing tube; an eccentrically positioned loading door in said top header; a valve plug supported on a centrally positioned axially extending and operating valve shaft slidably bearing in and sealed into said top header, adapted to close on said valve seat and open by downward movement therefrom; means moving said valve shaft to closed position and instantly releasing it, when desired, including a piston mounted on the top of said valve shaft operative in a hydraulic cylinder mounted on said top header, a set of friction jaws surrounding said shaft and mounted on said top header, an axially operative collar surrounding said jaws adapted to clamp them onto said valve shaft; and hydraulic means for moving said collar from clamping position to released position; and means for introducing steam into the top of said cylindrical vessel so that it enters said perforated steam distributing tube and said perforated basket and permeates fiber bearing plants loaded into said basket.

2. A pressure expansion gun for extracting fiber from fiber bearing plants, including in combination a cylindrical vessel closed by a header at the top and by a funnel shaped end piece at the bottom terminating in a concentrically positioned valve seat; an axially extending concentrically positioned perforated steam distributing tube attached to the bottom face of said header at its top and positioned by a thimble at its bottom; an axially extending bottomless cylindrical perforated load holding basket concentrically positioned in spaced relation to said steam distributing tube; and eccentrically positioned loading door in said top header; a valve plug supported on a centrally positioned axially extending and operating valve shaft slidably bearing in and sealed into said top header, adapted to close on said valve seat and open by downward movement therefrom; means moving said valve shaft to closed position and instantly releasing it, when desired, including a piston mounted on the top of said valve shaft operative in a hydraulic cylinder mounted on said top header, a set of friction jaws surrounding said shaft and mounted on said top header, an axially operative collar surrounding said jaws adapted to clamp them onto said valve shaft; and hydraulic means for moving said collar from clamping position to released position; and a dash pot for stopping the opening movement of said valve shaft including a cylinder mounted on said top closure, a piston, keyed to said shaft, operative in said cylinder having a plurality of small holes near its perimeter, and large holes near its center closable by upward movement of a plate valve, and hydraulic fluid, half filling said cylinder, whereby it may be

forced into the upper portion of said cylinder through said holes and so that said plate valve may be closed on impact therewith; and means for introducing steam into the top of said cylindrical vessel so that it enters said perforated steam distributing tube and said perforated basket and permeates fiber bearing plants loaded into said basket; and means for introducing compressed air into said vessel independently of said steam.

3. A pressure expansion gun for extracting fiber from fiber bearing plants, including in combination a cylindrical vessel closed by a header at the top and by a funnel shaped end piece at the bottom terminating in a concentrically positioned valve seat; an axially extending concentrically positioned perforated steam distributing tube attached to the bottom face of said header at its top and positioned by a thimble at its bottom; an axially extending bottomless cylindrical perforated load holding basket concentrically positioned in spaced relation to said steam distributing tube; an eccentrically positioned loading door in said top header; a valve plug supported on a centrally positioned axially extending and operating valve shaft slidably bearing in and sealed into said top header, adapted to close on said valve seat and open by downward movement therefrom; means moving said valve shaft to closed position and instantly releasing it, when desired, including a piston mounted on the top of said valve shaft operative in a hydraulic cylinder mounted on said top header, a set of friction jaws surrounding said shaft and mounted on said top header, an axially operative collar surrounding said jaws adapted to clamp them onto said valve shaft; and hydraulic means for moving said collar from clamping position to released position; and means for leveling and distributing fiber bearing material introduced through said eccentrically disposed loading door, including a rotary leveling rake journaled around said valve shaft at the top of said vessel, and a radially extending drive shaft geared to turn said rake at its inner end, having a drive wheel at its outer end, passing radially outward through said vessel and sealed by a gland; and means for introducing steam into the top of said cylindrical vessel so that it enters said perforated steam distributing tube and said perforated basket and permeates fiber bearing plants loaded into said basket.

4. In a pressure vessel for expanding fiber bearing plants, having a centrally positioned vertically operating expansion valve, closing on a valve seat at the bottom thereof mechanism for operating said valve, including in combination; a vertical valve shaft carrying a valve plug on its lower end and a piston on its upper end, adapted

to extend through the upper part of said vessel; glands providing bearing surfaces and sealing means for said shaft in said vessel; a hydraulic cylinder operatively accepting said shaft piston, arranged to force said shaft upward to close said valve and, when desired, to permit rapid downward opening movement thereof; a dash pot for slackening and stopping downward movement of said valve shaft including a cylinder supported on the top of said vessel surrounding said shaft partially filled with oil, a piston keyed to said valve shaft operative in said cylinder, peripherally disposed holes in said piston forming a primary multiple passageway of predetermined size between the bottom of said cylinder and the top, a secondary larger passageway through said piston formed by holes formed adjacent the center thereof to permit rapid movement of oil from the upper end of said cylinder to the lower end thereof, a plate valve slidably operative on said shaft below said piston being normally in depressed open position, and adapted to be moved upward to a position closing said secondary passageway by impact of said valve with said oil in said dash pot cylinder; means for retaining said shaft in raised position to keep said valve closed including a plurality of gripping dogs surrounding said shaft and hinged to the top of said dash pot cylinder, said dogs being wedge shaped and having levelled outer faces tapering inward, a locking collar surrounding said dogs having an internal bore tapering inward and upward, and means for forcing said collar downward onto said dogs to clamp them onto said shaft, and for reverse movement to effect release, including a lever hinged to said cylinder and operative on said collar, and a hydraulic piston and cylinder adapted to move the unhinged end of said lever downward and upward and move said collar from clamping to released position.

ROBERT S. CHAPMAN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,279,517	Cretors	Sept. 24, 1918
1,692,575	Root	Nov. 20, 1928
1,824,221	Mason	Sept. 22, 1931
1,878,782	Kirn	Sept. 20, 1932
1,938,060	Wood	Dec. 5, 1933
2,027,698	Parks et al.	Jan. 14, 1936
2,086,266	Heue et al.	July 6, 1937
2,279,868	Hayden	Apr. 14, 1942
2,304,543	Chapman	Dec. 8, 1942
2,379,062	Brandes	June 26, 1945