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DOUBLE-ACTING PLUNGER PRESS

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2 SHEETS—SHEET 1

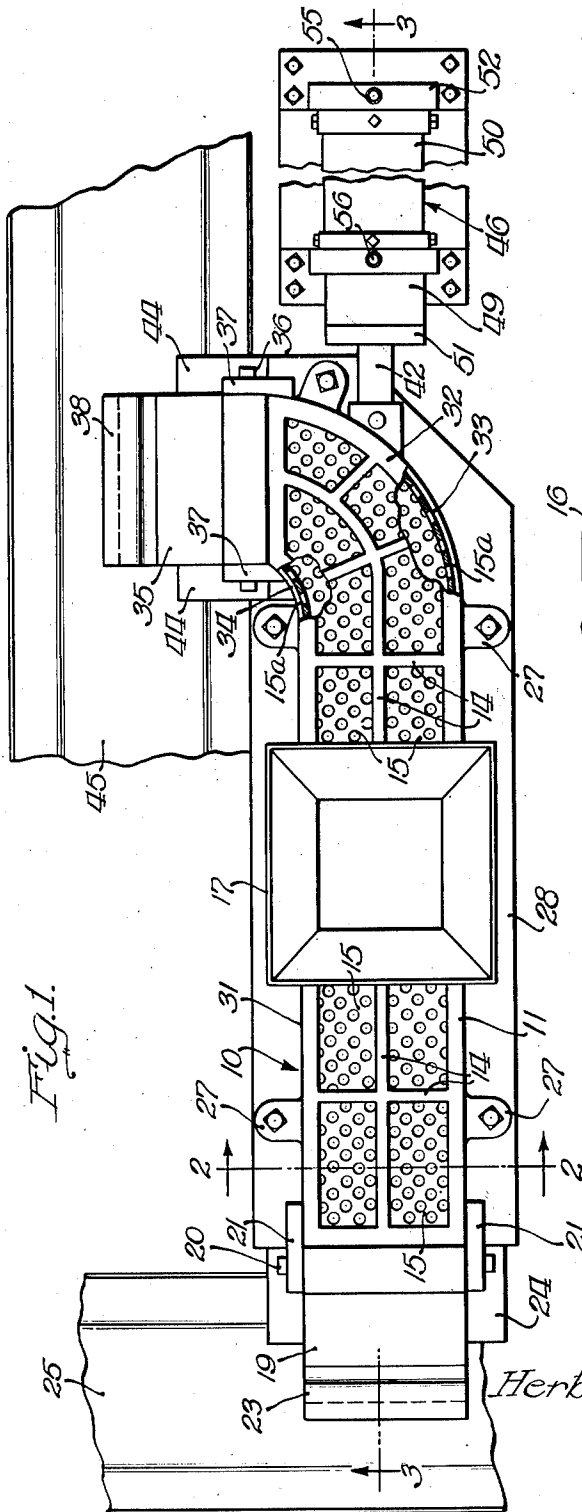


Fig. 1.

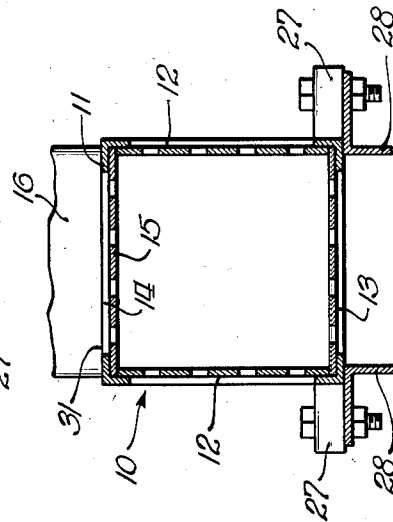


Fig. 2.

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DOUBLE-ACTING PLUNGER PRESS

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2 Claims. (Cl. 100—50)

1

2

This invention relates to presses, and has to do with presses of the plunger or follower type.

In various industrial processes waste materials are produced in large amount. Those materials, as produced, frequently contain considerable quantities of moisture which render them unfit for use. By reducing sufficiently the moisture content of such waste materials they may be rendered suitable for use for various purposes, for example, as fuel in the furnaces of the mills in which the materials are produced. For example, in paper mills large quantities of bark are removed from logs under treatment. This bark, as produced, contains water in such amount as to render it unsuitable for use as fuel. It is known to provide plunger presses for subjecting waste materials to pressure for removal in large part of the water content. The known plunger presses used for such purposes with which I am familiar are single acting presses in which the plunger is driven by a crank shaft or equivalent mechanical means. Such plunger presses have limited output and, in general, each press requires its own separate power plant. That is objectionable in requiring a multiplicity of power plants and as also requiring a large number of presses, due to the limited capacity of single acting plunger presses, to handle the bark produced in the operation of a paper mill.

My invention is directed to the provision of a plunger press which avoids the objections to the single acting plunger presses above referred to. To that end, I provide a double acting plunger press capable of substantially continuous operation and having comparatively large capacity for handling large volumes of waste materials such as above referred to. More particularly, I provide a press box provided intermediate its ends with a charging opening for introduction of the waste material, such as wet bark, and a follower or plunger operating in the box movable in alternately opposite directions across and beyond such charging opening, the box being open at its ends for discharge of the pressed bark. The press box comprises foraminous walls for escape of the water pressed out of the bark and is provided at one with a discharge opening located at one side of the box, at such end thereof, the means for operating the follower or plunger being located adjacent that end of the box and comprising an operating rod extending through an adjacent wall of the box into the latter. Preferably, I provide hydraulic means for operating the operating rod whereby the press plunger may be subjected to substan-

tially uniform pressure throughout the full extent of its stroke in either direction, which is conducive to increased speed in pressing the water out of the bark and corresponding increase in capacity of the press. Further objects and advantages of my invention will appear from the detailed description.

In the drawings:

Figure 1 is a plan view of a double acting press embodying my invention;

Figure 2 is a sectional view taken substantially on line 2—2 of Figure 1;

Figure 3 is a sectional view taken substantially on line 3—3 of Figure 1; and

Figure 4 is a diagrammatic view of the hydraulic means and the associated controls for reciprocating the operating rod of the press.

The press comprises an elongated press box 10, which may be of rectangular—square—cross section, and comprises a top wall 11, side walls 12 and bottom wall 13, all secured together in any suitable manner, conveniently by welding. The walls 11, 12 and 13 are of open work construction and are provided with appropriately disposed transverse and lengthwise reinforcing ribs 14, as shown, providing therebetween openings of substantial area. Perforated plates 15 are suitably secured, conveniently by welding, to the inner faces of the walls of the box providing a foraminous lining therefor.

A neck 16 extends upward from top wall 11 of box 10 defining a charging opening 16a through which the material to be pressed, such as wet bark, may be delivered downward into the press box 10. An upwardly flaring hopper 17 is bolted to and extends upward from the upper end of neck 16, to facilitate delivery to the latter of the wet bark, which may be delivered to the hopper 17 in any suitable manner.

The press box 10 is open at one end, at 18, for discharge of the pressed bark. A gate 19 is pivoted at its upper end, at 20, between brackets 21 secured to the sides of box 10 adjacent the discharge opening 18. This gate 19 is formed of iron or other suitable metal and is of considerable thickness, so as to be of substantial weight, and may have one or more weights 23 bolted or otherwise suitably secured to its lower portion at the outer face thereof. As will be understood, the gate 19 is urged toward closed position by gravity and presents considerable resistance to passage of the pressed bark through the discharge opening 18. A downwardly and outwardly inclined apron 24 extends from the end of box 10, below discharge opening 18, for di-

3

recting the discharged bark downward onto a suitable conveyor 25, such as an endless belt conveyor, by means of which the bark may be delivered to a storage pile, a bin, or to furnaces in which the bark is burned, as will appear more fully later.

The press box 10 is provided with lugs 27 extending outward from the sides of bottom wall 13 and bolted to the base frame 28, conveniently of channel beam construction, which is suitably anchored to a foundation 29 provided with a trough 30 for receiving water pressed from the bark and escaping through the foraminous walls of the box 10. The major or body portion 31 of box 10 is straight lengthwise, as shown in Figure 1. At its other end the box 10 is provided with an end portion 32 disposed at an angle to body portion 31 and toward one side thereof, this end portion 32 being connected to the body portion 31 by arcuate elements 33 and 34 at the inner surfaces of which are provided arcuate perforated plates 15a curved conformably to and secured to the corresponding arcuate portions of the side walls of the box, it being understood that the top and bottom arcuate plates at the areas of the plates 15a have their side edges curved conformably to the latter plates. The end portion 32 is provided with a discharge opening similar to the opening 18, which opens to one side of the press box 10. This opening is controlled by a gate 35 pivoted at its upper end, at 36, between brackets 37 secured to the side walls of end portion 32 of the box 10, this gate being provided with a weight 38 adjacent its lower end, the arrangement being similar to that at the other discharge opening of box 10.

As will be clear from the above, the end portion 32 of box 10 comprises an outer side wall 40 which extends at an inclination across one end of body 31 of box 10. A bearing sleeve 41, suitably mounted on wall 40, slidably receives an operating rod 42 extending therethrough and into box 10 substantially coaxially therewith. A follower or plunger 43, conforming to and fitting snugly the interior of box 10, is secured upon the inner end of rod 42. Suitable means, to be described presently, is provided for reciprocating rod 42 and thereby moving plunger 43 in alternately opposite directions across and beyond the charging opening 16a defined by the neck 16. As will be understood, at the start of the pressing operation, the gates 19 and 35 are held by gravity in closed position covering the discharge openings of the press. The wet bark is delivered to the press box through hopper 17 and neck 16. During the stroke of the plunger 43 in one direction the bark is displaced toward one end of the box 10 and, during the stroke of the plunger 43 in the other direction the bark is displaced toward the other end of the box. When the bark contacts with either one of the gates 19 or 35, its further travel through the press box is stopped. Thereafter the gates present considerable resistance to movement of the bark through the press box and the bark is then subjected to high pressure between the plunger 43 and the gate. In that connection, this increased pressure to which the bark is subjected also forces the bark outward into tight contact with the top and side walls of the box 10, thereby providing considerable frictional resistance to movement of the column of bark through the press box. Accordingly, high pressure is now exerted upon the bark by the plunger 43 in the stroke of the latter in either direction, effective for pressing the major portion of the water from the bark and thereby drying it sufficiently to render it suitable for

4

burning. In the continued operation of the press, the columns of pressed bark are gradually forced through the discharge openings of the press box 10, in opposition to the gates 19 and 35, which are now moved upward to open position, resting upon the upper portion of the bark columns. The gates thus direct the columns of pressed bark downward onto the aprons 24 and 44 extending downward and outward from the respective discharge openings of the press box. The bark discharge through the opening 18 is directed onto the conveyor 25, which carries it to a suitable point of discharge as previously noted. Likewise, the bark passing down the apron 44 is delivered onto a conveyor 45, which carries it to a suitable point of discharge, which may be the mill furnaces. It will be clear, from what has been said, that the press is double acting and substantially continuous in operation, having a capacity approximately twice that of a single acting plunger press of the known type previously referred to.

The operating rod 42 may, within the broader aspects of my invention, be reciprocated in any suitable manner. Preferably, however, I provide hydraulic means for reciprocating this rod. A cylinder 46 is suitably secured to a base frame 47 anchored to a portion 29a of the foundation 29, this cylinder 46 being disposed coaxially with the body 31 of press box 10. A piston 48, operating in cylinder 46, is secured to the outer end of rod 42, which is slidable through head 49 secured upon one end of the cylinder barrel 50, head 49 being provided with a stuffing box 51 of suitable known type providing a pressure resistant fluid tight seal about piston rod 42. A head 52 is appropriately secured on the other end of the cylinder barrel 50 and, like head 49, is provided with a base flange which is bolted to the base frame 47. Suitable means, to be described presently, is provided for admitting fluid under pressure to one end of the cylinder while exhausting fluid from the other end thereof, in alternate relation, for reciprocating the piston 48 within cylinder 46 and thereby reciprocating the follower or plunger 43 within the press box 10. The length of the stroke of piston 48 is such that the plunger 43 is moved across and beyond the charging opening 16a defined by neck 16, in alternately opposite directions, for pressing the water content, in major portion, out of the bark in the manner previously described.

The cylinder head 49 is provided with a duct 54 opening through its inner face, and the cylinder head 52 is provided with a duct 55 opening through its inner face. A conduit or pipe 56 secured in cylinder head 49 opens into duct 54 and a similar pipe 57 is secured in cylinder head 52 and opens into the duct 55. The pipes 56 and 57 extend to a multiple passage valve 58 and open into ports 59 and 60, respectively, thereof. The valve 58 is provided, between the ports 59 and 60, with a port 61 which communicates, through a pipe 62, with the discharge of a pump 63 of suitable known type. The intake of pump 63 is connected by a pipe 64 to a tank 65 containing a suitable liquid, such as oil, providing a source of supply for the pump. The valve 58 is provided, at the side thereof opposite to the ports 59, 60 and 61, with an outlet nipple 66 connected by a pipe 67 to tank 65 for returning the oil thereto. The valve 58 is provided with two passages 68 extending from opposite sides of nipple 66 to the ends of a web structure 70 having appropriately disposed ports, of known type.

The ports of the web structure 70 are controlled by a valve member or spool 72 at each end

5

of which is disposed a solenoid 73 whereby the spool 72 may be moved endwise to appropriate extent in either direction. When the spool 72 is in its position shown in Figure 4, pipe 56 communicates, through one of the passages 62 and the return pipe 67, with the oil tank or reservoir 65, at which time the piston 48 is in its outermost position shown in Figure 3. Also, when spool 72 is in its position shown in Figure 4, pipe 57 communicates, through ports 60 and 61 and pipe 62 with the discharge side of the pump 63, which then supplies oil under adequate pressure to the cylinder 46 at the outer side of piston 48. The piston 48 is thereby forced inward, toward the left as viewed in Figure 3, thereby moving the plunger 43 from its full line position to its dotted line position and subjecting the bark to the left of the plunger 43 to high pressure. When the piston 48 reaches the end of its stroke toward the left, the solenoid 73 at the other end of valve spool 72 is energized, as will be explained more fully presently, moving the spool 72 to its left hand position, as viewed in Figure 4, and thereby connecting duct 54 of cylinder head 49 to the discharge of pump 63, while connecting duct 55 of head 52 to the return pipe 67 and thence to the oil tank or reservoir 65. The piston 48 is then forced outward or toward the right, as viewed in Figure 3, thereby moving the plunger 43 from its dotted line position to its full line position. In that manner the plunger 43 is reciprocated and is subjected to substantially uniform pressure throughout the full extent of each stroke, which is conducive to increased capacity and corresponding output of the press.

One pole of each of the solenoids 73 is connected, by a short lead 75 to a main 76 connected to one side of a suitable source of electrical energy. The other pole of each of the solenoids 73 is connected by a lead 77 to a fixed contact member 78 of a rotary cam switch 79. The switch 79 is of known type and comprises a shaft 80 driven by a suitable electric motor 81, the speed of which may be varied for driving the shaft 80 at any desired predetermined speed, within limits. Two contact blades or segments 82 are mounted on shaft 80 for rotation therewith and have electrical connection thereto. The contact segments 82 cooperate with the respective contact members 78 and are so disposed that as one of the segments 82 passes out of contact with its cooperating contact member 78, the other segment 82 makes contact with its contact member 78. In Figure 4 the right hand contact segment 82 is in contact engagement with its contact member 78, the left hand 82 being disengaged from its contact member 78. The shaft 80 is connected electrically, by a brush or otherwise, to a main 83 connected to the other side of the source of electrical energy to which the main 76 is connected. It will be clear that when the right hand segment 82 is in contact engagement with its contact member 78, the solenoid 73 at the right hand end of spool 72 is energized thus moving the spool endwise to its position shown in Figure 4 and retaining it in that position, the solenoid 73 at the left hand end of spool 72 being then deenergized. As the piston 48 reaches the limit of its stroke to the left, as viewed in Figure 3, the right hand contact segment 82 of Figure 4 passes out of engagement with its contact member 78, and the left hand contact segment 82 engages its contact member 78. That opens the circuit of the right hand solenoid 73

6

and closes the circuit of the left hand solenoid 73, thus shifting the valve spool member 72 from its position shown in Figure 4 endwise toward the left. The piston 48 is then forced outward or toward the right, as viewed in Figure 3, as will be clear from what has been said. The valve 58 and the rotary cam switch 79 are both of known construction and operation and need not be described here in greater detail. As will be clear, by varying the speed of rotation of shaft 80 of the rotary cam switch 79, the extent of travel of the follower or plunger 43 in either direction may be varied as required, for any given setting of the pump 63, and by varying the pump speed the rate or speed of the stroke of plunger 43 in either direction may be adjusted to requirements. Within the broader aspects of my invention, the plunger 43 may be operated in any suitable manner, though preferably by the hydraulic means herein disclosed, which gives uniform pressure throughout each stroke of the plunger 43 in either direction which, as above noted, is conducive to increased output of the press. Further, a plurality of presses may be operated from a single hydraulic installation thus avoiding the necessity of providing a large number of power units such as is required where the presses are operated by crank shaft or analogous mechanical means.

It will be understood that changes in detail may be resorted to without departing from the field and scope of my invention, and I intend to include all such variations, as fall within the scope of the appended claims, in this application in which the preferred form only of my invention has been disclosed.

I claim:

1. In a press of the character described, a foraminous press box provided intermediate its ends with a feed opening in its top wall for introduction of material to be pressed, a plunger operative in said box, the latter comprising a continuous body portion straight lengthwise and an arcuate end portion extending from one end of said body portion substantially in the plane of the latter and opening toward one side thereof for discharge of pressed material, the other end of said body portion being open for discharge of pressed material, upwardly opening and downwardly closing weighted gates controlling said openings, an operating rod extending through said one end portion into said body portion substantially coaxial therewith and secured at its inner end to said plunger, said rod terminating at one end at said plunger and the interior of said box being unobstructed except for said rod and plunger, and means for reciprocating said rod effective for moving said plunger in alternately opposite directions across and beyond said feed opening.

2. In a press of the character described, a foraminous press box provided intermediate its ends with a feed opening for introduction of material to be pressed, a plunger operative in said box slidable therein in alternately opposite directions, said box comprising a continuous body portion straight lengthwise and an arcuate end portion extending from one end of said body portion substantially in the plane of the latter and opening toward one side thereof for discharge of pressed material, an operating rod slidable through said one end portion and extending into said body portion substantially coaxial therewith and secured at its inner end to said plunger, said rod terminating at one end at said

plunger and the interior of said box being unobstructed except for said rod and plunger, and means for reciprocating said rod effective for moving said plunger in alternately opposite directions across and beyond said feed opening, the latter being unobstructed in the normal operation of said press except by said plunger in its passage across said opening whereby material to be pressed may be delivered through said opening into said box at alternately opposite sides of said plunger during reciprocation of the latter.

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