United States Patent

Helle

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[54] APPARATUS FOR SPLITTING AND CHOPPING TIMBER

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[52] **U.S. Cl.** ..... **144/193 A**

[51] **Int. Cl.** **B27l 7/00**

[58] **Field of Search** ..... 143/193 A

[56] **References Cited**

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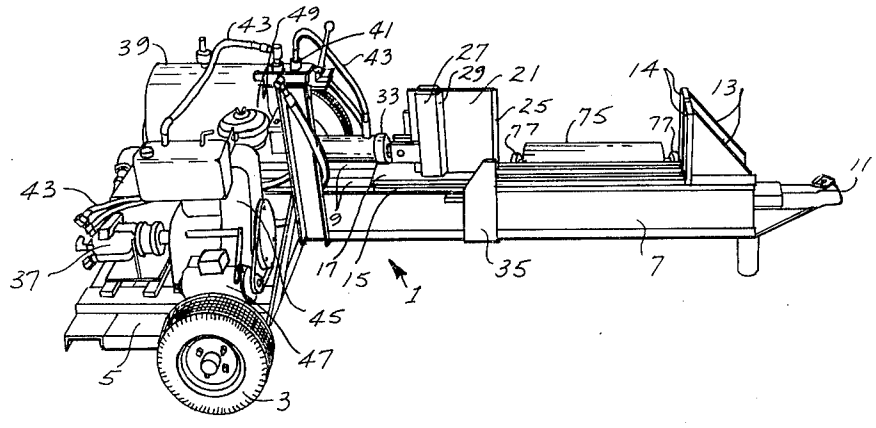
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[57] **ABSTRACT**

Apparatus for splitting and chopping timber having a blade adapted to chop as well as split timber actuated by a hydraulic cylinder supplied with fluid under pressure by a variable-displacement constant-pressure hydraulic pump adapted automatically to increase the force exerted on the blade in response to increased resistance to chopping or splitting while decreasing the speed of travel of the blade and vice versa over the normal operating range of the apparatus.

9 Claims, 4 Drawing Figures



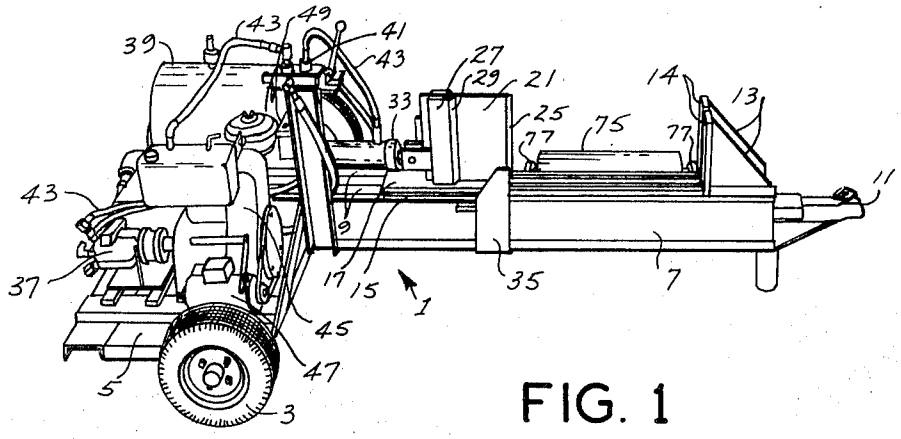


FIG. 1

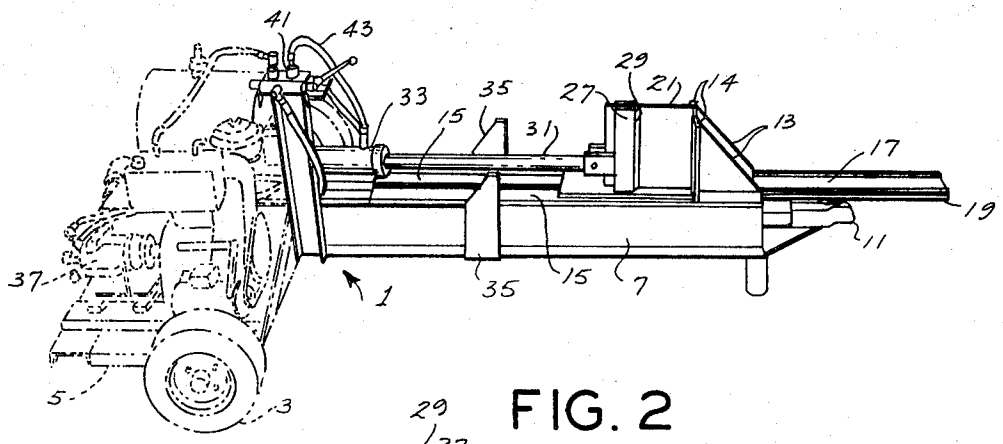


FIG. 2

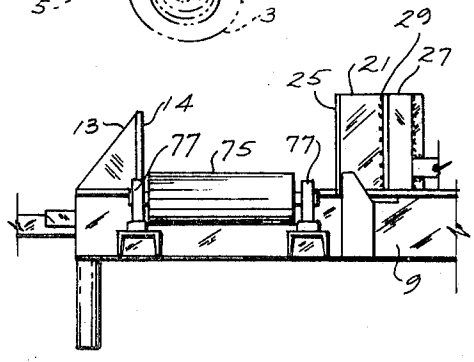


FIG. 3

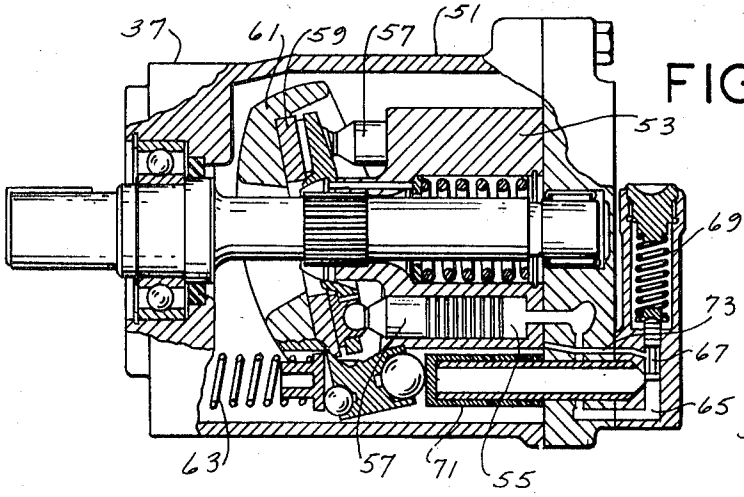


FIG. 4

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APPARATUS FOR SPLITTING AND CHOPPING TIMBER

BACKGROUND OF THE INVENTION

The invention relates to apparatus for splitting and chopping timber, and more particularly to hydraulically operated apparatus of this class.

Hydraulically operated apparatus for splitting timber has been developed, but has not been adapted to chop as well as to split timber. Reference may be made, for example, to U.S. Pat. Nos. 3,077,214 and 3,242,955. Several of the problems and disadvantages of prior hydraulically operated timber splitters are as follows. The hydraulic systems of such timber-splitting apparatus are normally operable at two speeds, a high speed developing lower force for easy splitting of timber and return of the blade and a low speed developing high force for hard splitting. While such a system may automatically switch from low to high and vice versa, it does not provide a system which automatically compensates to increase the force and reduce the speed over an infinitely variable range as the resistance of the timber changes. The hydraulic systems of such timber-splitting apparatus also normally have a constant-displacement pump requiring a relief valve which recirculates the fluid when the apparatus is operating at reduced loads, when idling and when loaded above its capacity. If allowed to idle for long periods of time, the hydraulic systems have the characteristic of overheating due to the energy supplied to the hydraulic fluid by the pump.

When splitting apparatus of the type heretofore developed encounters a piece of timber which is tough to split and exceeds the capacity of the apparatus, the blade is apt to become embedded in the timber so tightly that the timber must be chopped or sawed off the blade before operation can be continued.

It is often desired to split a length of timber in a predetermined plane or planes. For example, in the process of making barrel staves, the first split is normally made through a knot, since the stave adjacent the first split and those having knots are discarded. Therefore, aligning the blade and a knot is desirable if the operator is to obtain the maximum number of staves from the timber. Such operation requires rotation of the timber about a longitudinal axis, and heretofore has been difficult particularly in the case of heavy timbers.

SUMMARY OF THE INVENTION

Among the several objects of the invention may be noted the provision of apparatus for chopping as well as splitting timber; the provision of such apparatus which will automatically increase the force exerted on a blade as the resistance to splitting increases; the provision of such apparatus upon which timber placed to be split may be easily rotated so that the timber can be aligned with the blade along a plane predetermined to be advantageous for splitting; the provision of such apparatus which will disengage the blade from the timber when the blade is tightly embedded in the timber; and the provision of such apparatus which is convenient to use and reliable in operation. In general, apparatus made in accordance with this invention comprises a frame, a backup for the timber mounted on the frame, a blade movable toward and away from the backup and means for moving the blade toward and away from the backup comprising a hydraulic cylinder. Means for operating the hydraulic cylinder is provided comprising a hydraulic pump for delivering hydraulic fluid under pressure to the cylinder and a line interconnecting the pump outlet to the cylinder. The line has a control valve therein. The pump has means associated therewith for varying the displacement of the pump under load to maintain the outlet pressure of the pump substantially constant on variation of load, whereby in splitting a timber the force exerted on the blade to split the timber is automatically increased in response to increased resistance to splitting, with accompanying decrease in speed of travel of the blade and vice versa. The control valve is operable to effect reciprocation of the blade via the cylinder for chopping timber place crosswise between the blade and the backup. Other objects and features will be in part apparent and in part pointed out hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective of a splitting and chopping apparatus of this invention, showing the blade thereof in retracted position;

FIG. 2 is a perspective of part of the apparatus of FIG. 1, showing the blade extended;

FIG. 3 is a fragmentary view taken on line 3—3 of FIG. 1; and

FIG. 4 is a view in section of a pump of the apparatus.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, first more particularly to FIG. 1, apparatus made in accordance with this invention is shown to comprise a frame generally designated 1, having wheels 3 so that it may be towed from place to place. The frame comprises a transversely extending rear platform 5 and a tongue 7 extending longitudinally forward from the platform 5. The tongue comprises a pair of channels, each designated 9, arranged vertically in spaced relation with their webs facing one another, these channels having their rear ends mounted on the platform and being cantilevered forward from the platform. At the forward end of the tongue is a trailer hitch 11.

Mounted on each channel 9 extending upward therefrom adjacent its forward end is a backup member 13 backed by a gusset plate 14. The two members 13, which are transversely spaced apart, constitute a backup for a piece of timber which is to be split or chopped. Also mounted on top of the channels are side rails 15 which project inward from the channels. These rails serve as guides for an elongate slide 17, guiding the slide for longitudinal movement with respect to the channels, the slide having grooves 19 in the sides thereof receiving the rails. Extending vertically upwardly from the slide 17 and fixed thereto adjacent its rearward end is a blade 21 formed from a thin rectangular plate having a sharpened leading edge 25 which constitutes the chopping portion of the blade, and a pair of flat bars 27 parallel to the sharpened edge and disposed on opposite sides adjacent the trailing edge of the plate. The leading ends 29 of the bars 27 are angled to form an acute angle with the plate. The bars 27 constitute the splitting portion of the blade. A piston rod 31 of a double-acting hydraulic cylinder 33 is pivotally connected to the blade 21 and pivotally mounted to the rearward end of the tongue 7. The hydraulic cylinder, acting with the slide 17, constitutes means for moving the blade toward and away from the backup members 13 as the hydraulic cylinder strokes. The slide 17 is adapted to guide the blade and support the timber being split or chopped and, as shown in FIG. 2, passes under the members 13 and extends beyond the end of the tongue 7 as the blade 21 approaches the members 13.

As shown in FIG. 1, a pair of plates 35 are fixed to the legs of the channels 9 forming the tongue 7. The plates 35 extend upwardly adjacent the forward end of the blade 21 when the blade is in retracted position. Plates 35 are adapted to arrest the movement of the timber and resist the forces exerted by the double-acting cylinder on its return stroke, to disengage the blade from the timber if the blade should become tightly embedded in the timber during a splitting or chopping operation.

To operate the hydraulic cylinder 33, there is provided a hydraulic pump 37, a reservoir 39 holding a supply of hydraulic fluid, a control valve 41, and a plurality of lines 43 interconnecting these elements. Coupled to the hydraulic pump 37 is an internal combustion engine 45 having an electric starter 47. The pump 37 and engine 45 are mounted on the platform 5 on one side of the tongue. The reservoir 39 and a battery 49 for the electric starter 47 are mounted on the platform 5 on the other side of the tongue 7.

The pump 37 is of the variable-displacement constant-pressure type which has means for varying the displacement of the pump under load to maintain the output pressure of the pump substantially constant on variation in the load, such as a Vickers PB 15 variable-displacement constant-pressure pump manufactured by Vickers Division of Sperry Rand Corporation.

As shown in FIG. 4, the pump 37 comprises a housing 51, a cylinder block 53 rotatably mounted within the housing, the cylinder block having several cylinders 55 bored therein and a like number of pistons 57 adapted to pump hydraulic fluid when moved forward and backward in the cylinders, and a swash plate 59 mounted in a yoke 61 which is pivotally mounted in the housing so that the angle of the swash plate 59 may be varied with respect to the cylinder block. The free ends of the pistons ride on the swash plate so that as the cylinder block revolves the pistons move forward and backward, the length of their stroke depending on the angle of the swash plate with respect to the cylinder block. The closer to parallel the cylinder block and swash plate become, the shorter the stroke of the piston, which reduces the volume of fluid being pumped. Controlling the angle of the yoke 61 and thus the swash plate is a yoke return spring 63 which initially has the yoke advanced to a full delivery position. Pressure built up by the pump is constantly applied through a passage 65 to a compensator spool 67. An adjustment spring 69 acts on the opposite end of the compensator spool 67 to oppose the fluid pressure in passage 65. When the pressure in passage 65 is sufficient to overcome the bias of the adjustment spring 69, the spool 67 moves upwardly, allowing fluid from passage 65 to enter a yoke-actuating piston 71. The fluid form passage 65 forces the yoke-actuating piston against the yoke 61, decreasing the angle of the yoke with respect to the cylinder block 53, thereby decreasing the stroke of the pistons 57 and the volume of fluid being pumped. A decrease in the pressure built up by the pump causes the spring bias of the adjustment spring 69 to move the compensator spool 67 downwardly, closing off the passage 65 from the yoke-actuating piston and permitting the fluid in the yoke-actuating piston to drain into the pump housing cavity via passageway 73, the bias of the yoke return spring 63 then moving the yoke toward its full delivery position, increasing the stroke of the pistons to increase the volume of fluid pumped. Under normal operation, where the capacity of the pump and hydraulic cylinder exceeds the force required for splitting, the force exerted on the blade to split the timber is automatically increased in response to increased resistance to splitting with an accompanying decrease in speed of travel of the blade and vice versa. Thus a smaller engine 47 may be used to drive this pump because power varies directly with flow and pressure and this pump has the characteristic of varying the flow inversely to the pressure so that the product of flow and pressure, which is proportioned to the power required, will be lower than that produced by a constant-displacement pump having equal capacity.

Pump 37 also eliminates the need for a relief valve and does away with the problem of overheating the hydraulic fluid when the apparatus idles for long periods of time. Since the pump essentially stops pumping by destroking as the discharge pressure reaches a predetermined value, it stops adding energy to the hydraulic fluid, thereby eliminating overheating.

To control the movement of the blade 21, a control valve 41 is installed within the lines 43 connecting the reservoir 39, the pump 37 and the hydraulic cylinder 33. The control valve 41 is manually operated and is operable in three positions. The first position, being a central neutral position, delivers no fluid to the hydraulic cylinder 33 and imparts no movement to the blade. From the neutral position, the control valve 41 may be moved to a forward and to a rearward position. In the forward position, fluid under pressure is supplied by the pump 37 to a first chamber in the hydraulic cylinder 33 and fluid from a second chamber is drained to the reservoir 39, driving the piston rod 31 from the cylinder and causing the blade 21 to advance toward the backup 13. In the rearward position, the control valve 41 reverses the flow of fluid by draining the fluid in the first chamber to the reservoir 39 and supplying fluid under pressure to the second chamber, causing the piston rod 31 to be retracted and the blade 21 to move rearward way from the backup 13.

The control valve 41 is provided with spring means for returning the valve to the neutral position. Thus the control valve will automatically return to its neutral position and stop the movement of the blade when the operator removes his hand from the control valve, an important safety feature on such an apparatus.

By alternating the control valve between the forward and rearward position, the blade may be made to reciprocate.

As shown in FIG. 3, means for rotating the timber comprises a roller 75 journaled in a pair of pillow blocks 77 mounted on the outside of one of the channels 9, this roller extending parallel to the channels rearward of backup 13, 13 and with its top just above the plane of the top face of slide 17. The roller 75 is adapted to assist the operator to rotate the timber 5 placed on the slide 17 so that the timber may be aligned with the blade in order to split the timber along a plane predetermined to be advantageous; for example, a plane along which the timber will split easily, or a plane aligned with a knot when splitting timber to make barrel staves. The timber is rotated by rolling it over on the slide 17 into engagement with the roller, and then continuing the rotation of the timber until the desired splitting plane is vertical.

To operate the apparatus, the internal combustion engine 45 is started, driving the pump 37 to supply hydraulic fluid under pressure to the hydraulic system so that operating the control valve 41 will stroke the blade 21. The timber to be split is placed lengthwise on the slide 17 so that its grain parallels the blade. The control valve is moved forward, causing the blade to move rapidly toward the timber and the backup 13, 13. The sharpened leading edge 25 of the blade 21 engages the timber, forcing it against the backup and cuts through the timber. The blade continues cutting the timber until the bars 27 adjacent the trailing edge of the blade, constituting the splitting portion of the blade, enter the cut and then bars 27 spread apart the sections of the timber on opposite sides of the leading portion of the blade to split the timber along a plane coincident with the initial cutting. Then, the control valve is moved to its rearward position to retract the blade and prepare the apparatus for splitting the next timber.

Chopping the timber is accomplished by placing the timber crosswise on the slide 17 so that its grain is perpendicular to the blade, and then moving the control valve 41 to its forward position to cause the blade to move rapidly toward the timber and backup 13, 13. The blade 21 engages the timber, forcing it against the backup. However, the resistance to cutting is greater across the grain; therefore the blade will penetrate the timber a shorter distance. When the timber is relatively small, the blade may chop it in two with one pass. In chopping large timber, several passes of the blade may be required. Thus when the blade's forward progress is stopped by the resistance of the timber, the control valve is moved to its rearward position to retract the blade. The control valve is alternated between its forward and rearward positions, causing the blade to reciprocate and perform a chopping action on the timber. Such action, coupled with the thin sharp blade, is effective to chop a large timber in two in a short time.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. An apparatus for splitting and chopping timber comprising a frame, a backup for the timber mounted on the frame, a blade movable toward and away from the backup, means for

moving the blade toward and away from the backup comprising a hydraulic cylinder, and means for operating the cylinder comprising a hydraulic pump for delivering hydraulic fluid under pressure to the cylinder, and a line interconnecting the pump outlet to the cylinder, said line having a control valve therein, said pump being a variable-displacement pump having means associated therewith for varying the displacement of the pump under load to maintain the output pressure of the pump substantially constant on variation in the load, whereby, in splitting timber, the force exerted on the blade to split the timber is automatically increased in response to increased resistance to splitting with accompanying decrease in speed of travel of the blade and vice versa, said control valve being operable to effect reciprocation of the blade via said cylinder for chopping timber placed crossways between the blade and the backup for the timber.

2. An apparatus for splitting and chopping timber as set forth in claim 1 wherein the cylinder is a double-acting hydraulic cylinder having a piston rod connected to a slide slidably mounted on the frame, the blade being carried by the slide, the slide extending forward of the blade and being adapted to support the timber.

3. An apparatus for splitting and chopping timber as set forth in claim 2 having roller means mounted on the frame adjacent the backup for facilitating rotation of the timber relative to the blade to position the timber for being split along a predetermined advantageous plane.

4. An apparatus for splitting and chopping timber as set forth in claim 1 having means for disengaging the blade from the timber as the blade is retracted.

5. An apparatus for splitting and chopping timber as set forth in claim 4 wherein the means for disengaging the blade and the timber as the blade approaches the hydraulic cylinder comprises a pair of stops mounted on the frame on opposite sides of the blade and adapted to arrest the movement of the timber as the blade and timber move rearward.

6. An apparatus for splitting and chopping timber as set forth in claim 2 wherein the backup for the timber comprises a pair of members mounted on the frame adjacent its forward end, said frame being adapted to permit said slide to move forward beyond said members as the blade is moved forward, said members being adapted for engagement with the timber and to oppose the force exerted by the blade, said members being laterally spaced on the frame and the blade passing through the space between said members as the blade is moved forward.

7. An apparatus for splitting and chopping timber as set forth in claim 1 having a manually operable control valve for the hydraulic cylinder normally having a neutral position in which flow of fluid to the cylinder is blocked, a forward position for operation of the cylinder to move the blade forward and a rearward position for operating the cylinder to move the blade rearward, said valve being adapted for relatively rapid manual operation between its forward and rearward positions for chopping timber.

8. An apparatus for splitting and chopping timber as set forth in claim 7 wherein the blade comprises a splitting portion and a chopping portion, the chopping portion having a relatively thin cross section, and a sharp edge constituting the leading edge of the blade, the chopping portion being adapted to cut through the timber, and the splitting portion having a relatively thick cross section adjacent the trailing edge of the blade and adapted to spread apart the sections of the timber on opposite sides of the chopping portion, whereby the timber splits along a plane coincident with the initial cutting as the blade moves through the timber toward the backup.

9. An apparatus for splitting and chopping timber as set forth in claim 8 wherein the chopping portion of the blade comprises a rectangular plate having a sharp leading edge and the splitting portion of the blade comprises a pair of flat bars parallel to the leading edge of the plate disposed on opposite sides of the plate adjacent the trailing edge of the plate, the leading edge of the bars being angled to form an acute angle with the plate.

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