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LOG GRAPPLE WITH GRIPPER MEANS

2 Sheets-Sheet 1



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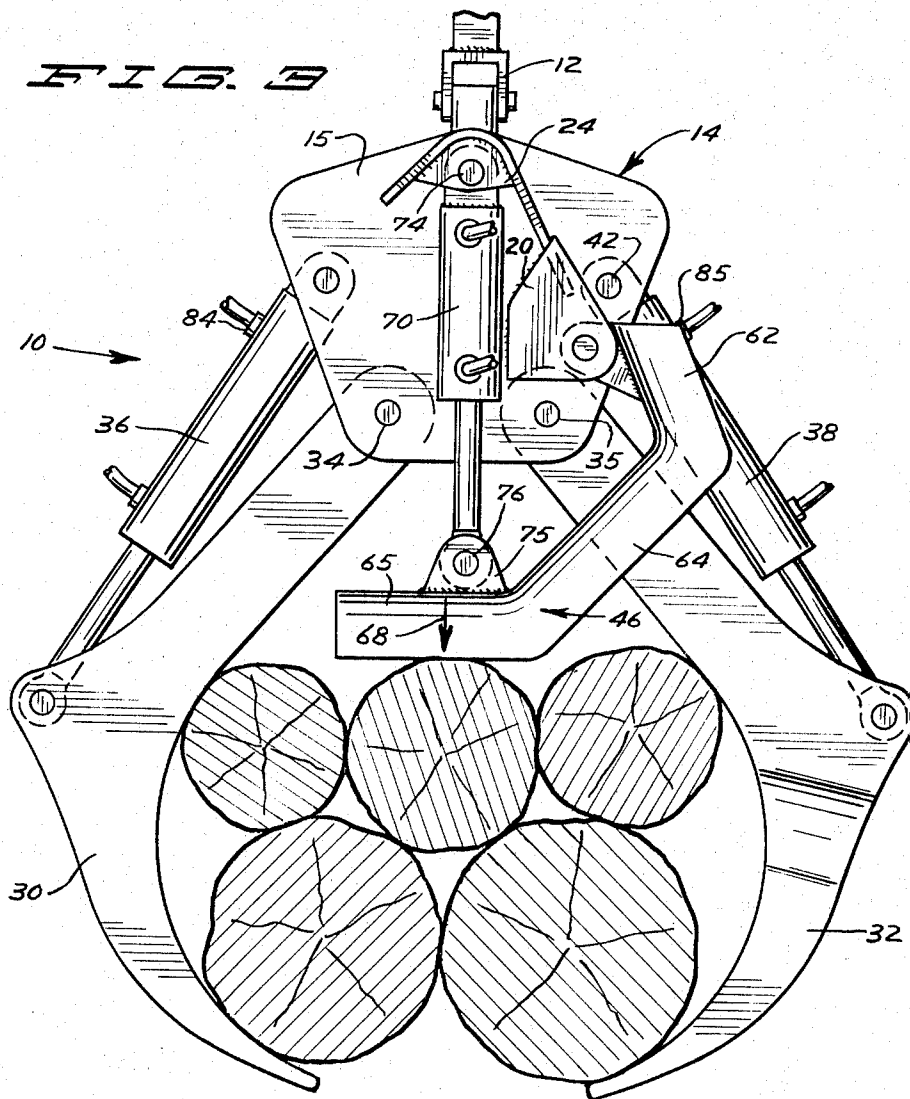
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2 Sheets-Sheet 2



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LOG GRAPPLE WITH GRIPPER MEANS

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ABSTRACT OF THE DISCLOSURE

Log grappling apparatus having a pair of cooperating jaws pivotally connected to a supporting head, and hydraulically actuated between a spread apart position and a log grapple position. A hydraulically actuated gripper arm is mounted on the head and has a pair of angled portions whereby a force is applied to the logs toward the opening end of the jaws regardless of the number of logs between the jaws. A hydraulic circuit actuates the gripper arm to apply a force to the logs after the jaws are in the log grapple position.

This invention relates to log handling apparatus and more particularly to a log grapple having improved structure for engaging and holding bunched logs.

Pulpwood or other log grapples ordinarily consist of a pair of hydraulically actuated jaws which can be brought into grasping relation to a bunch of logs. Occasionally, when the bunch is either too large or too small, the disposition of the logs within the jaws will be unstable and the logs will slip and even fall out of the grapple under some conditions. The operator must therefore be careful in operating the grapple to make sure that the bunches of logs are within the capacity of his equipment. If the bunch is too large, he must take only part of it, or if it is too small, he is obliged to have more logs moved onto the pile before they can be adequately handled.

It is an object of this invention to increase the handling capacity of a log grapple in the sense that greater variation is obtained in the size of the bunches of logs which can be handled. Stated somewhat differently, it is an object of this invention to provide a log grapple which is capable of handling different size bunches of logs with equal facility.

Another object of the invention is to provide a grapple structure for holding logs in a more positive manner than prior art grapples, so that the logs are clamped firmly in the grapple.

Still another object of the invention is to provide a hydraulically actuated log grapple structure for firmly holding a bunch of logs in which the gripping elements are sequentially operated to insure that the desired number of logs will be grasped by the device in a stable arrangement.

Briefly described, the invention resides in adding to generally conventional grapple structure an auxiliary gripping means which is oriented to move parallel to the general plane of the grapple jaws, effectively to vary the gripping area between the jaws of the grapple. Thus, this additional holding means can be moved into engagement with the logs in the grapple to hold them in place regardless of how full the grapple is, that is, regardless of how large the bunch of logs happens to be. The auxiliary gripping means is hydraulically actuated and is operated from the primary jaw closing circuit through a sequence or delayed-lift valve so that the auxiliary holding means is actuated after closure of the primary grapple jaws. This insures that the jaws will have closed on the bunch of logs, and also balances the forces which are applied in holding the logs.

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Other objects, advantages and new features of the invention will become apparent from the following detailed description when read in conjunction with the accompanying drawings wherein:

FIGURE 1 is a combination view including an elevational view of the grapple structure in its holding relation to a small bunch of logs and a diagrammatic showing of the hydraulic circuit which is employed for the various actuating motors of the grapple;

FIGURE 2 is a side view of the grapple as seen in FIGURE 1, the various hydraulic lines having been omitted from FIGURE 2 for purposes of clarity; and

FIGURE 3 is an elevational view of a grapple according to the invention showing the grapple in its relation to a larger bunch of logs than was shown in FIGURE 1.

The log grapple according to the illustrated embodiment of the invention is generally indicated at 10 throughout the several views of the drawing. It will be understood by those skilled in the art that the grapple is intended to be attached to a suitable boom or other manipulating structure so that it may be moved into position to engage and grapple a bunch of logs. The attachment of the grapple to the manipulating structure is suggested in the drawing by the universal joint 12 which permits the grapple to assume a vertical orientation regardless of the position of the boom to which the grapple is attached.

The grapple itself consists of a supporting head 14 which is attached to the universal joint 12. The supporting head 14 is made up of vertical side journal plates 15 and 16 which are held in spaced parallel relation by means of a transverse member 18. Other mounting portions of the supporting head 14 are the journal plates 20, 22, 24 and 25, which are mounted in spaced parallel relation to the side plates 15 and 16 by means of suitable supporting elements such as plates 26 and 28. The manner in which the various elements are journaled in these plates will be disclosed below.

Grapple jaws 30 and 32 are mounted on the head 14 for pivotal movement about the spaced axes defined by shafts 34 and 35, respectively. The jaws 30 and 32 are shaped in generally conventional manner so that they may be brought into encircling relation to a bunch of logs to be handled. For operating the jaws 30 and 32, a pair of double-acting hydraulic motors 36 and 38 are provided. The cylinders of these motors are pivotally attached to the supporting head 14, as by means of pins 40 and 42, and the extensible rams of the cylinders are pivotally connected to the jaws 30 and 32 by means of pivot shafts 44 and 45, all in generally conventional fashion.

The auxiliary gripping means in the illustrated embodiment of the invention are the two spaced gripper arms 46 and 48 which are pivotally attached to the supporting head 14 at the right side of the assembly as seen in FIGURE 1. As shown, the gripper arm 46 is pivotally mounted between the plates 15 and 20 by means of a lug 50 attached to the gripper arm and a pivot pin 52 extending between the plates 15 and 20. The gripper arm 48 is mounted in similar fashion between the plates 16 and 22 by means of a lug 54 and a pivot pin 56.

As will be apparent from an inspection of FIGURE 2, the gripper arms 46 and 48 are of triangular box-frame construction. This arrangement provides structural rigidity and strength while providing a wedge effect as the apex of the gripper arm cross section is brought into engagement with the logs which are held within the grapple. Thus, the gripper arms 46 and 48 will bite into the logs and hold them in place. Another aspect of the shape of the gripper arms is best illustrated in FIGURES 1 and 3, where it will be seen that the arm 46

has a generally vertically extending portion 62 and two angled portions 64 and 65 which together extend substantially transversely of the grapple jaws. The arrangement is such that the force exerted on the logs by the gripper arms is toward the opening ends of the jaws and generally aligned with the center line between the jaws regardless of the number of logs in the bunch. Thus, when the logs lie within the jaws in such a manner that a relatively short travel of the gripper arms is required to engage the logs, the surface of the portion 64 of gripper arm 46 and the corresponding portion of gripper arm 48 will engage the logs to impart a force generally in the direction of the arrow 66. On the other hand, where, as in FIGURE 3, the gripper arms must travel through a greater arc to come into contact with the logs, the surface of the portion 65 and the corresponding portion of gripper arm 48 will engage the logs to impart a force generally in the direction of the arrow 68, again directed predominantly along the center line between the jaws.

For moving the gripper arms, hydraulic motors 70 and 72 are provided. The motor 70 is anchored between the plates 15 and 24 by means of a pivot pin 74, the opposite end of the motor being connected to a suitable lug 75 on the gripper arm 46 by means of a pivot pin 76. It will be understood that the motor 72 is similarly connected on the opposite side of the supporting head 14.

In the hydraulic circuit of the present invention, as illustrated in FIGURE 1, hydraulic fluid is supplied to the various motors from a reservoir 78 by means of a suitable pump 80. Opening and closing of the grapple is under the control of a spool valve 82, which, in the position shown, supplies hydraulic fluid to the grapple closing ports 84 and 85 of the motors 36 and 38, respectively, over the line 86 through the T-connection 88 and then over the lines 90 and 92. As the rams are extended to close the jaws 30 and 32, fluid is returned to the reservoir from the retracting ports 94 and 95 of the motors 36 and 38 over lines 96 and 98 to the T-connection 100 and then over the line 102 to valve 82, and then over the line 104 to the reservoir. To open the jaws, the spool of the valve 82 is shifted so that the pressure side of the pump 80 is connected to the line 102 rather than to the line 86, that is, the pressure and return relationship of these two lines are reversed.

It is desirable to close or actuate the gripper arms 46 and 48 after the grapple jaws have closed, so that the logs will not be forced out of the grapple by the operation of the gripper arm. For this purpose, the extending ports 105 of the motor 70 is connected to the line 86 over a line 106 and through a delayed-lift or sequence valve 108 of conventional construction. It will be understood by those skilled in the art that the valve 108 permits fluid to enter the line 106 only after the pressure in the line 86 reaches a predetermined level. Thus, as the jaws 30 and 32 close, the pressure in the closing circuit will build up and when it reaches a predetermined value, fluid will be admitted to the line 106 to extend the motor 70 to cause the gripper arms 46 and 48 to come into forcible engagement with the logs. This sequential operation is not required in the opening action of the grapple, so that the retracting port 110 is simply connected to the return line 102 over a line 112 and a T-connection 114.

The operation of the grapple should be readily apparent from the above description. The following summary, however, should be of some aid in the understanding of the present invention. It will be understood that the boom structure is first manipulated to bring the grapple into position to pick up a bunch of logs. The valve 82 is then actuated to open the jaws to their wide open condition. The boom is then actuated to lower the grapple into straddling relation to the logs which are desired to be handled.

Upon lowering of the grapple, the valve 82 is changed to connect the closing side of the hydraulic circuit to the motors to close the jaws 30 and 32. As the jaws engage the logs, the resistance presented by the logs will cause the pressure to increase in the line 86 to the point where the delayed-lift valve 108 will permit fluid to enter the line 106. At this time, the gripper arms will be extended to engage the logs and to add their holding action to that of the grapple arms.

If the configuration of the bunch of logs is such as to permit only a short travel of the gripper arms, as in the case shown in FIGURE 1, the portion 64 of the gripper arm 46, for example, will engage the logs as has been described above. If, on the other hand, the configuration of the logs is relatively less in the vertical direction so that the gripper arms must travel further around their respective pivot pins in order to engage the logs, then the next angled section 65 will come into contact with the logs. In this manner, the forces exerted on the logs will always be predominantly directed along the center line between the grapple jaws.

Release of the logs is accomplished by moving the valve 82 to its other position, thus supplying hydraulic fluid to the retracting ports of the various motors to open the grapple jaws 30 and 32 and to withdraw the gripper arms from their operative position against the logs.

It should now be apparent that a grapple has been described which fully meets all of the objects of the invention set forth above. In particular, the bunches of logs are held rigidly and without danger of slipping out of the jaws regardless of the degree of fullness of the grapple. The operator is thus relieved of the necessity of watching to see that just the right number of logs is involved in the bunch that he is intending to handle and the overall efficiency of the handling operation is improved. The shape of the auxiliary gripping arms is such that the gripping action is maintained in the proper direction at all times and the sequencing action of the hydraulic circuit insures that the grapple jaws are closed before the auxiliary gripping means is actuated.

It will, of course, be understood that various changes may be made in the form, details, arrangements and proportions of the parts without departing from the scope of my invention as set forth in the appended claims.

I claim:

1. Log handling apparatus comprising a log grapple having a supporting head, a pair of cooperating grapple jaws movable between a spread apart position and a log grappling position, each of said jaws having an opening end portion and an opposite end portion, means for pivotally mounting said opposite end portion on said supporting head to permit the jaws moving between said positions, power means for moving said jaws toward each other to hold a bunch of logs therebetween, auxiliary gripping means mounted on said supporting head for movement relative thereto and having a portion thereof extending generally transversely of said jaws, and power means for moving said auxiliary gripping means into forcible contact with said logs to hold them firmly in said jaws.

2. Log handling apparatus as recited in claim 1, said auxiliary gripping means being arranged to move in a direction toward the opening ends of said jaws in the grapple position, effectively to reduce the gripping area between said jaws.

3. Log handling apparatus as defined in claim 1, said auxiliary gripping means comprising a gripper arm pivotally mounted on said supporting head for movement parallel to the general plane of movement of said jaws.

4. Log handling apparatus comprising a log grapple having a supporting head, a pair of grapple jaws pivotally mounted on said supporting head, power means for moving said jaws toward each other to hold a bunch of logs therebetween, auxiliary gripping means mounted on said supporting head and having a portion thereof extending generally transversely of said jaws, said auxiliary gripping means comprising a gripper arm pivotally mounted on

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said supporting head for movement parallel to the general plane of movement of said jaws, said gripper arm being shaped that a force is applied to said logs predominantly along the centerline between said jaws regardless of the amount of arcuate travel required to bring said gripper arm into engagement with said logs, and power means for moving said auxiliary gripping means into forcible contact with said logs to hold them firmly in said jaws.

5. Log handling apparatus as recited in claim 4, said gripper arm having a first portion thereof extending substantially normally to the centerline between said jaws when said gripper arm is displaced only a short distance into engagement with said logs and a second portion angled with respect to said first portion so that said second portion will extend substantially normally to the centerline between said jaws when a greater arcuate travel of said gripper arm is required to bring said gripper arm into engagement with said logs.

6. Log handling apparatus comprising a pair of cooperating grapple jaws movable between a spread apart first position and a log grappling second position, each jaw having an opening end portion and an opposite end portion, auxiliary gripping means movable from a retracted first position to a second position for cooperating with the grapple jaws in their second position to effectively reduce the gripping area between said jaws, first means connected to said jaw opposite end portions and to said gripping means for mounting said jaws for movement between said jaw positions and mounting said gripping means for movement between its positions, said first means including a supporting head and means for pivotally connecting said opposite end portions to said head, and said gripping means including a gripping arms that in a gripping means retracted position has at least a portion extending generally between said pivot means and the jaw opening end portions, and power means connected to the first means and the gripping means for moving said jaws from their first positions to their second positions and thereafter move the gripping means to its second position, said power means including means connected to said head and said arm for moving said arm portion in a direction generally toward the jaw opening end portions in the jaw second position.

7. Log handling apparatus comprising a log grapple having a supporting head, a pair of cooperating grapple jaws movable between a spread apart first position and a log grappling second position, each jaw having an opening end portion and an opposite end portion pivotally connected to said head, auxiliary gripping means movable from a retracted first position to a second position for cooperating with the jaws in their second position to effectively reduce the gripping area between said jaws, and power means connected to said jaws and to said gripping means for moving said jaws from their first position toward their second position and then moving the gripping means to its second position to firmly hold logs between said jaws.

8. The apparatus of claim 7 further characterized in that the gripping means has a portion extending generally between said jaws in their first position, and that said power means includes means connected to said gripping means for moving said gripping means to move said portion in a direction generally toward the jaw opening end portions in the jaw second position.

9. Log handling apparatus comprising head means, a

pair of cooperating grapple jaws mounted on said head means relatively movable between a spread apart first position and a log grappling second position determined by the number of logs being grappled, each jaw having an opening end portion and an opposite end portion, auxiliary gripping means mounted on said head means movable from a retracted first position to a second position for cooperating with the grapple jaws in their second position to effectively reduce the gripping area between said jaws, said gripping means having a portion extending generally transversely relative said jaws, first means connected to said jaw opposite end portions for mounting said jaws for relative movement between said jaw positions, and power means mounted on said head means connected to said jaws and gripping means for relatively moving said jaws from their first position toward their second relative position and said gripping means toward its second position, said power means including hydraulic means connected directly to said gripping means for moving the gripping means mechanically independently of said jaws and relative thereto so as to move said portion generally toward the jaw opening end portions in the jaw second position uninfluenced by the gripping area to be reduced to a position to abut against a log between said jaws in the jaws second relative position irrespective of the number of logs determining said second position to apply a force to the logs predominately along the centerline between the jaws and toward sections of said jaws near their said opening end portions.

10. Log handling apparatus comprising head means, a pair of curved cooperating grapple jaws movable between a spread apart position first position and a log grappling second position, each jaw having an opening end portion and an opposite end portion, said curved jaws forming a gripping area having an apex adjacent the opening end portions thereof when in said second position, auxiliary gripping means mounted on said head means movable from a retracted first position to a second position in the direction of said apex to effectively reduce the gripping area between said jaws, first means connected to said jaw opposite end portions for pivotally mounting said jaws on said head means for movement between said jaw positions, and power means mounted on said head means connected to said jaws and gripping means for moving said jaws from their first position toward their second position and then said gripping means toward its second position, said power means including a pair of double-acting hydraulic motors connected to the first means for moving the jaws between their positions, one of said motors being connected to one of said jaws and the other motor being connected to the other jaw.

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