

[54] MATERIAL GRASPING CLAMP ASSEMBLY
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[56]

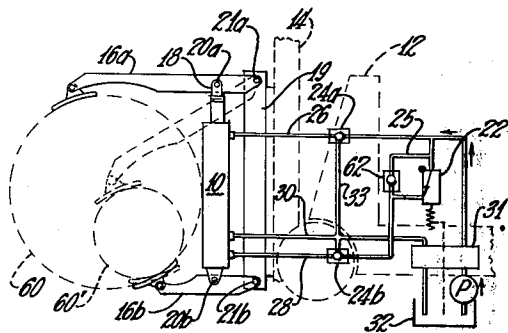
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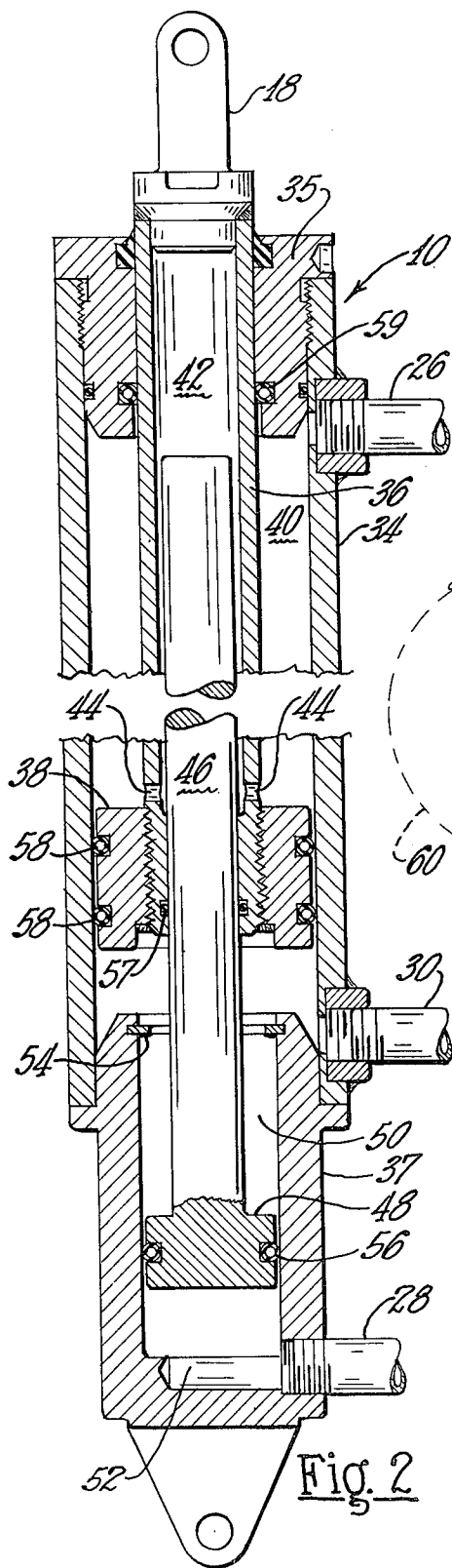
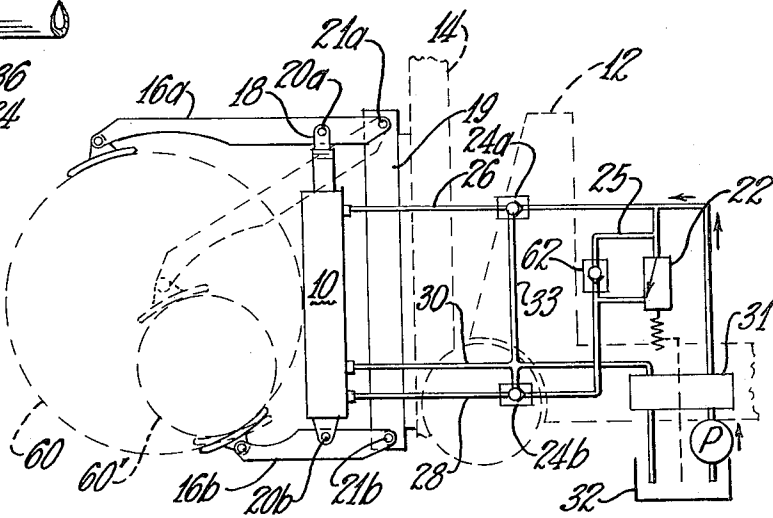
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[57] ABSTRACT

A clamp assembly for material handling vehicles includes a hydraulic system which provides a first pressure for moving the clamp assembly before material is grasped between the clamp members of the assembly and a second increased pressure to the clamp assembly once material is grasped therebetween. A main piston operating at the first pressure actuates closure of the clamp members until the material is grasped therebetween at which time a secondary piston operates at the first pressure to increase the pressure on the main piston to the second increased pressure to positively retain the material between the clamp members at the increased second pressure.

7 Claims, 2 Drawing Figures





MATERIAL GRASPING CLAMP ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to material handling vehicle grasping clamps generally and more particularly to clamp assemblies which operate at an increased clamping pressure upon material being grasped between the clamps.

2. Description of the Prior Art

In material grasping clamp assemblies the hydraulic cylinders actuating the clamp assemblies have heretofore been operable at a single pressure level. Since this necessitated that the pressure level be high enough to retain the grasped material between the clamp member of the clamp assembly, large piston areas requiring a large volume of fluid to be displaced were needed to effectively close the prior art clamp assemblies. This resulted in slow closure of the clamp members which was time consuming and costly from both a manpower and vehicle utilization standpoint.

SUMMARY OF THE INVENTION

The present invention solves the prior mentioned problems and others by providing a material grasping clamp assembly which is speedily closed to initially grasp material between clamp members and which retains the material between the clamp members once it is grasped.

To this end a pair of opposed clamp members are mounted to a material handling vehicle so as to allow at least one of the clamp members to retain variable size material between itself and the opposed clamp member. Means mounted between the pair of clamp members moves the clamp members relative to one another at a first pressure to speedily close the clamp assembly upon the material and thereafter provides an increased pressure to retain the material in the clamp assembly.

Since the initial closure of the clamp about the material requires little pressure, a smaller piston area is utilized which requires less working fluid displacement and allows for speedy closure of the clamp about the material. Once the clamp members engage the material, the pressure on the clamp is intensified by engaging more piston area with the working fluid and thereby the clamp provides increased pressure only when it is needed to positively retain the material between the clamp members.

Therefore, the primary object of the present invention is to provide a clamp assembly which will speedily close to grasp material and which will be able to positively retain the material between clamp members once it is grasped.

Another object of the present invention is to provide a clamp assembly operating at a decreased pressure while closing upon material to be grasped and operating at an increased pressure once material is grasped.

A further object of the present invention is to provide a clamp assembly which will operate at an increased pressure only when material is grasped, regardless of the amount of closure that the clamp has experienced.

These and other objects of the present invention will become more apparent from the figures and the description of the preferred embodiment which follow.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial schematic representation of a material handling vehicle utilizing the clamp assembly and its associated controls.

FIG. 2 is an enlarged cross sectional view of the pressure intensifier assembly shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, wherein the showings are for purposes of illustrating a preferred embodiment of the invention and not for purposes of limiting same, FIG. 1 depicts a material handling vehicle 12 having a mast 14 to which a clamp support base 19 is mounted to allow the base 19 to move laterally and rotationally with respect to the mast 14, as is well known to those skilled in the art and more specifically shown in U.S. Pat. No. 2,916,171.

A pair of opposed clamping members or jaws 16a, 16b are attached to the support base 19 at respective pivot points 21a and 21b with a pressure intensifier assembly 10 connecting the jaws at coupling points 20. It will be readily appreciated that although both clamping jaws are shown as pivoted the device would also operate if one jaw 16a were pivoted and the other jaw 16b were rigidly secured to the support base 19. The clamping jaw 16a is longer than the jaw 16b to provide a force which will direct any material 60 being grasped toward the support base 19 and thereby further secure it.

A series of hydraulic connections allow the pressure intensifier assembly 10 to be speedily closed upon the material 60 being grasped. A main piston pressure line 26 supplies pump P pressure to a main pressure chamber 40 through a clamp control valve 31 while a secondary piston pressure line 28 supplies pressure to a secondary pressure chamber 52. The clamp control valve 31 allows an exhaust line 30 to communicate fluid from the intensifier 10 to a reservoir 32 during any material clamping operation and provides pump P pressure to the line 30 during any material releasing operation. The main piston pressure is supplied along the pressure line 26 through a pilot check valve 24a by a pump P which communicates with the reservoir 32. The pump P also communicates its pressure to a sequence valve assembly 22 which transmits the pump P pressure to the pressure line 28 whenever the jaws 16 close sufficiently to grasp the material 60. A pilot check valve 24b is located in line 28 between the sequence valve assembly 22 and the pressure intensifier 10. The sequence valve 22 has a feedback line 25 with an in line check valve 62 and communicates with the reservoir 32.

Referring now to FIG. 2, the pressure intensifier assembly 10 has a cylindrical housing 34 with an end cap 35 sealing it at one end and an end cap 37 sealing the opposite end. A hollow main piston shaft 36 slidably extends through the end cap 35 and is joined to a main piston head 38 at one end and the rod 18 at the other end by means known to those skilled in the art. The volume formed between the end cap 35 and the piston head 38 forms a main pressure chamber 40 while the hollow portion of the main piston shaft 36 forms an intensified pressure chamber 42. The intensified pressure chamber 42 communicates with the main pressure chamber 40 by means of passageways 44. A secondary

piston shaft 46 having an enlarged piston head 48 is slidably mounted to allow the shaft 46 to sealably reciprocate within the intensified pressure chamber 42. Maximum extension of the secondary piston shaft 46 into the chamber 42 is limited by a stop 54, which can be in the form of a snap ring as shown, which interferes with the piston head 48. The integrity of the main pressure chamber 40 is maintained by seals 58 and 59. Similarly, seals 56 and 57 seal the chambers 52 and 42, respectively, from the exhaust chamber 50.

In operation, the material handling vehicle 12 is driven to a location where paper rolls of varying diameters comprise the material 60 to be transported. The clamp 16b is aligned with one of the paper rolls so as to engage it along the circumference. The pump P is activated to pressurize chamber 40 through line 26 and cause the intensifier assembly 10 to retract its rod 18 and pivot the clamp 16a until it engages the paper roll 60 along its circumference opposite the clamp 16b. The above pivoting occurs under the action of the pump P pressure being supplied only to line 26. This pivoting continues until the paper roll 60 is engaged regardless of the size of the roll. Once the paper roll 60 is engaged by the clamps, resistance to further clamp 16 pivoting is sensed by the sequence valve assembly 22 which then transmits the pump P pressure to line 28 of the pressure intensifier assembly 10. The intensifier 10 then causes an increased pressure, greater than that produced by the pump P, to act on the rod 18 and thereby assures positive retention of the paper roll 60 between the clamps 16.

When pump P is operated to draw fluid from the reservoir 32 to the chamber 40 and by way of the passages 44 to the chamber 42, the pressure of the fluid acts on the piston head 38 and shaft 46 to produce linear motion of the shaft 36 and coupled rod 18. As the piston head 38 moves, fluid is exhausted from the chamber 50 back to reservoir 32 by way of the exhaust line 30. This linear motion continues until rod 18, which couples the jaws 16, is prevented from further motion by engagement with the paper roll 60. This constraint on rod 18 motion will cause the full pump P pressure to be applied to chamber 40 by the pressure line 26. The sequence valve assembly 22 communicates with the line 26 and upon sensing full pump pressure opens to allow fluid to be communicated to the chamber 52 by way of line 28. Since the area of the piston head 48 is larger than the area of the shaft 46, the pump pressure will act on the area differential to linearly move the secondary piston shaft 46 into the chamber 42 until the pressure in chamber 42 increases sufficiently above the pump pressure to balance the area differential of the secondary piston. The increased pressure of the chamber 42 will be transmitted to the chamber 40 via the passages 44 where it will act on the main piston head 38 to provide an increased force on the rod 18 and on the clamps 16. This increased force ensures positive retention of the paper roll 60 retained by the jaws 16.

To release or unclamp the paper roll 60, the clamp control valve 31 is shifted to allow line 30 to communicate with pump P pressure. Pump P pressure is communicated from line 30 by line 33 to the pilot check valves 24a and 24b causing them to open. The pump P pressure is communicated by line 30 to the chamber 50 causing pistons 48 and 38 to move and release the paper roll 60. As the pistons 48 and 38 move, they exhaust the fluid from respective chambers 52 and 40

along respective lines 28 and 26 to the exhaust reservoir 32 due to the open pilot check valves 24a and 24b.

It may thus be seen that a new material grasping clamp assembly has been described wherein at least one clamp member of the assembly pivotably moves with respect to the opposite clamp member under a first pressure and at a speedy rate until material is grasped between the clamp assembly. Once the material is grasped, regardless of the extent of clamp member movement, the clamp assembly exerts a second increased pressure on the grasped material to positively retain the material in the clamp assembly.

Having described the preferred embodiment of this invention, certain modifications and improvements will become obvious to those skilled in the art upon the reading of this disclosure. It is the Applicant's intention that all such modifications and improvements be included within the scope of the present application and that it not be limited to the preferred specific embodiment as described.

What I claim as new and desire to secure by letters patent of the United States is:

1. A material grasping clamp assembly for a material handling vehicle comprising:

a pair of opposed clamp members with at least one of said clamp members being movable toward the other to retain variable size material matter between said pair of clamp members;

means for mounting said clamp members to said material handling vehicle;

means for moving said clamp members relatively toward one another at one pressure prior to retaining of material between said pair of clamp members to effect speedy closure of said clamp assembly and applying a second increased pressure to said clamp members thereafter to retain material therebetween;

said moving means further including a direct acting fluid motor having a main piston movable at one speed within a main cylinder cavity under the action of said first pressure, a secondary piston movable within a secondary cavity independent of the first cavity and having a shaft received within a cavity in said main piston upon application of said first pressure to said secondary piston, a pump communicating with said main cylinder cavity and said secondary cavity to produce said first pressure on said main piston and said secondary piston, and a sequence valve assembly connected between said pump and said secondary cavity to provide said first pressure to said secondary piston whenever said clamp members retain said material between them, the relationship of the working areas of said pistons being such as to produce said increased pressure on said main piston.

2. A material grasping clamp assembly as set forth in claim 1 including a passageway extending into the cavity of said main piston to communicate pressure from said cavity to said main piston.

3. A material grasping clamp assembly as set forth in claim 1 including a pilot check valve connected between said pump and said main piston to prevent said second pressure on said main piston from being transmitted to said pump.

4. A pressure device for actuating material handling jaws to close upon said material at a first pressure and to positively retain it at a second pressure comprising:

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a pressure source for providing said first pressure;
a main piston assembly providing linear motion to
close said jaws upon said material in response to
said first pressure;
means for intensifying the pressure on said main piston
assembly to said second pressure to positively
retain said material including a secondary piston
assembly movable by said first pressure to increase
the pressure to said main piston assembly to said
second pressure; and
means for actuating said intensifying means in re-
sponse to the closure of said jaws upon said mate-
rial including a sequence valve, connected between
said pressure source and said main and said sec-
ondary piston assemblies, to apply said first pres-
sure of said pressure source to said main piston as-
sembly while said material handling jaws are clos-
ing upon said material and to apply said first pres-
sure of said pressure source to said secondary pis-
ton assembly once said jaws close upon said mate-
rial.
5. A pressure device as set forth in claim 4 wherein:
said main piston assembly includes a housing with a
main piston sealably movable within a first cavity
of said housing and having a shaft portion sealably
extending from said housing;
said secondary piston assembly includes a secondary

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piston sealably movable within a second cavity of
said housing and having a shaft portion sealably ex-
tending into said first cavity of said housing to
maintain the pressure integrity of said first and sec-
ond cavity of said housing; and
said sequence valve connecting said pressure source
only to said first cavity while said jaws are closing
upon said material and connecting said pressure
source to said second cavity only when said jaws
close upon said material.
6. A pressure device as set forth in claim 5 wherein:
said shaft portion of said main piston assembly is
formed to have a hollow portion communicating
with said first cavity;
said main piston of said main piston assembly is
formed to sealably accept the shaft portion of said
secondary piston; and
said shaft portion of said secondary piston movably
extends through said main piston and into the hol-
low portion of said shaft portion of said main piston
assembly.
7. A pressure device as set forth in claim 6 wherein
said housing includes an exhaust chamber located be-
tween said first and said second cavity and communi-
cating with an exhaust reservoir.

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