July 5, 1949. F. J. AVERY 2,475,367

CLAMP FOR LIFT TRUCKS

Filed May 28, 1947 4 Sheets-Sheet 1

Fig. 1

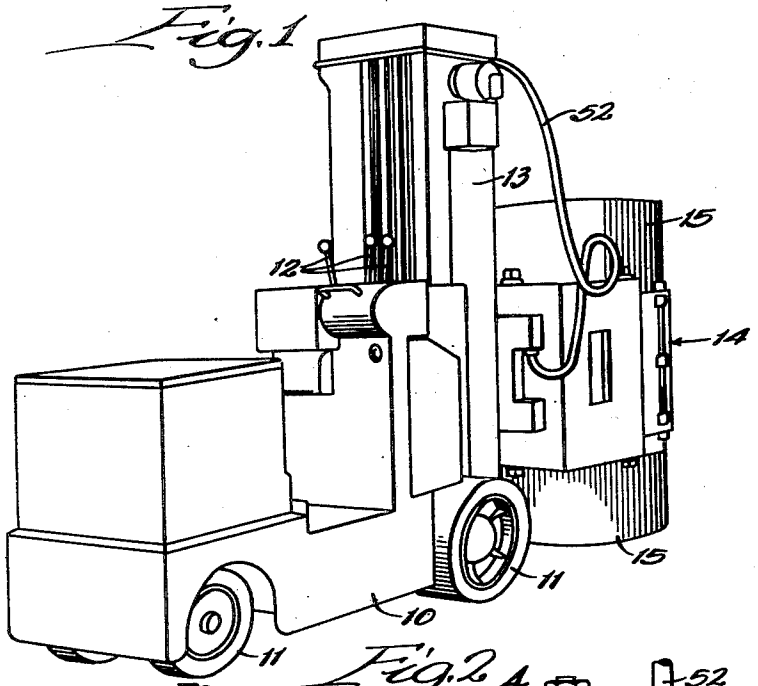
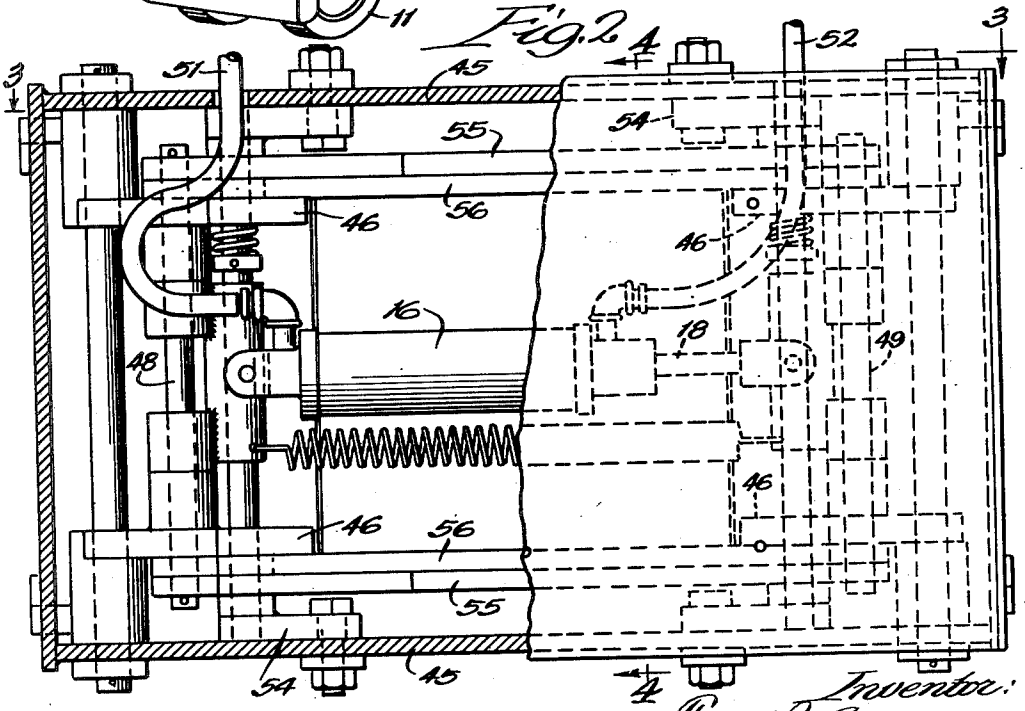


Fig. 2



Inventor:
Fred J. Avery,
By Dawson, Brittingham & Langenberg,
Attorneys.

July 5, 1949. F. J. AVERY 2,475,367

CLAMP FOR LIFT TRUCKS

Filed May 28, 1947 4 Sheets-Sheet 2

Fig. 3

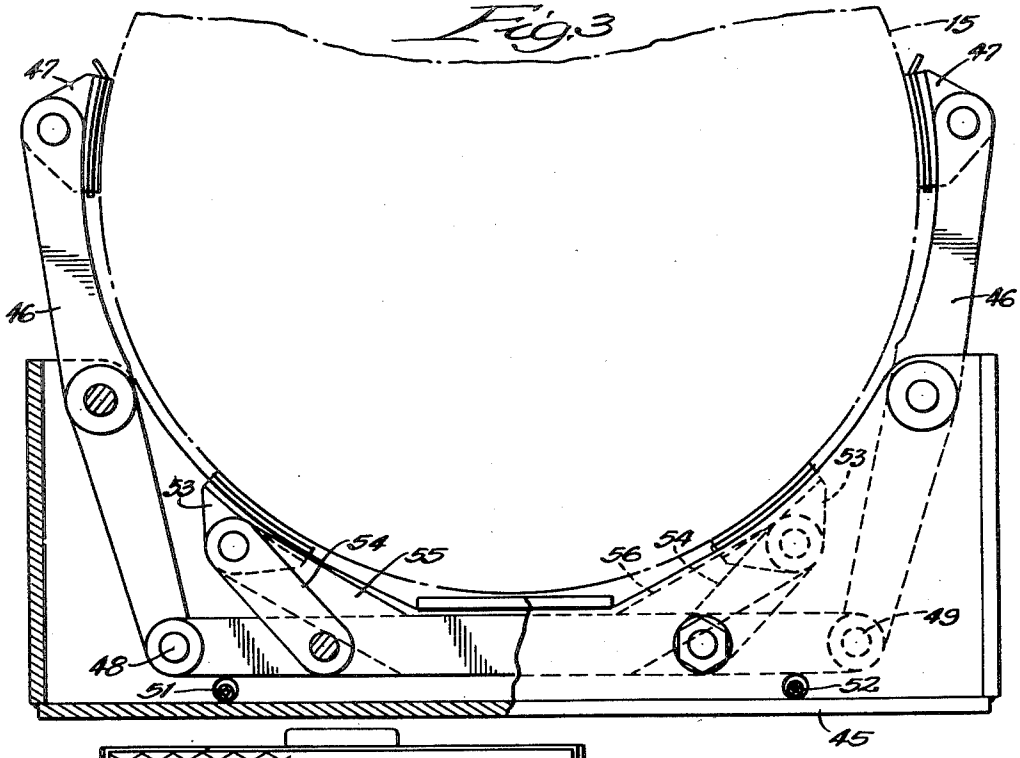
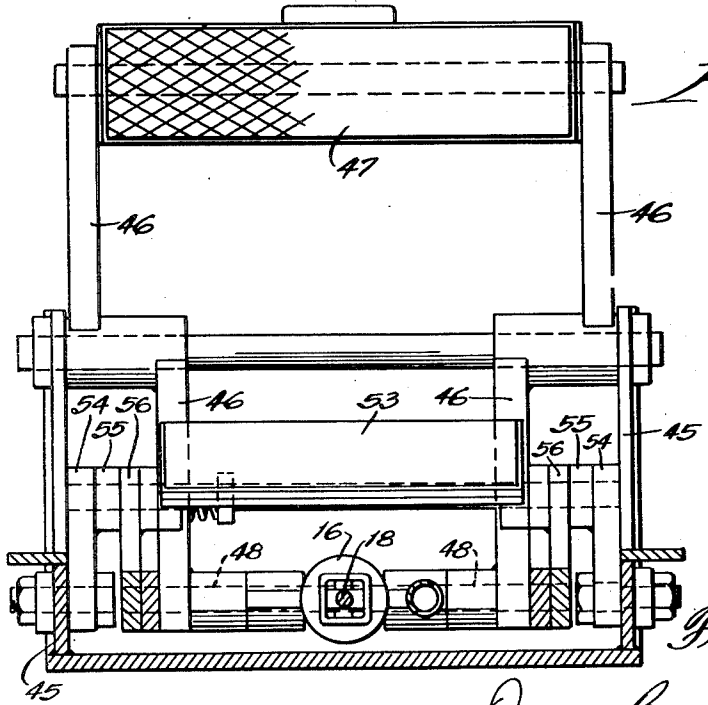


Fig. 4



Inventor:
Fred J. Avery,

By Dawson, Brittingham, Spangenberg,
Attorneys.

July 5, 1949. F. J. AVERY 2,475,367

CLAMP FOR LIFT TRUCKS

Filed May 28, 1947 4 Sheets-Sheet 3

Fig. 5

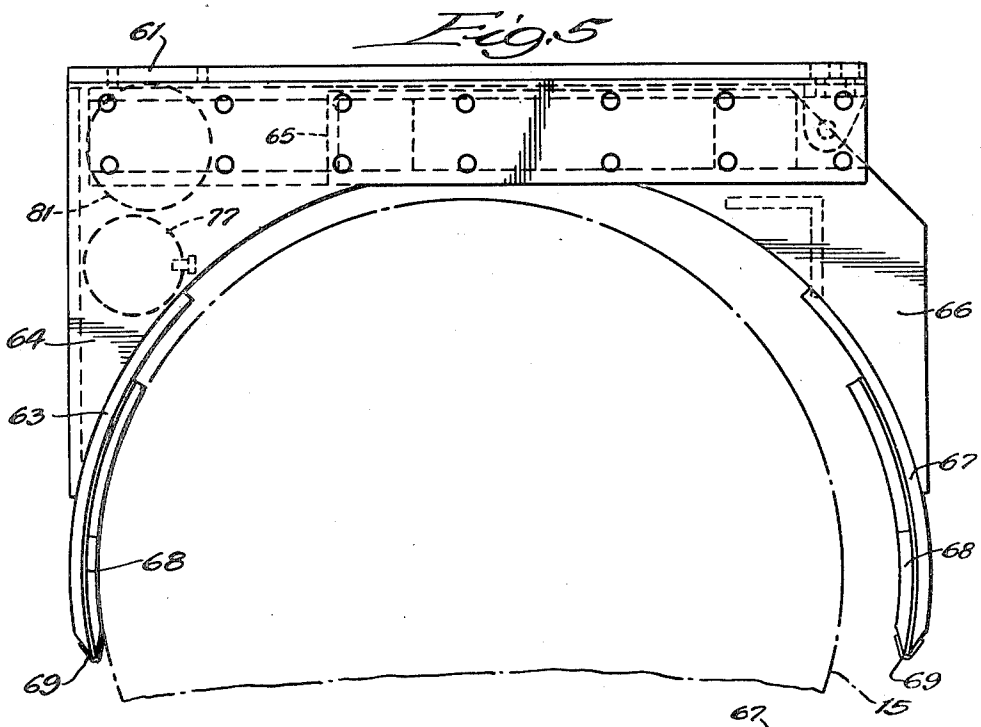
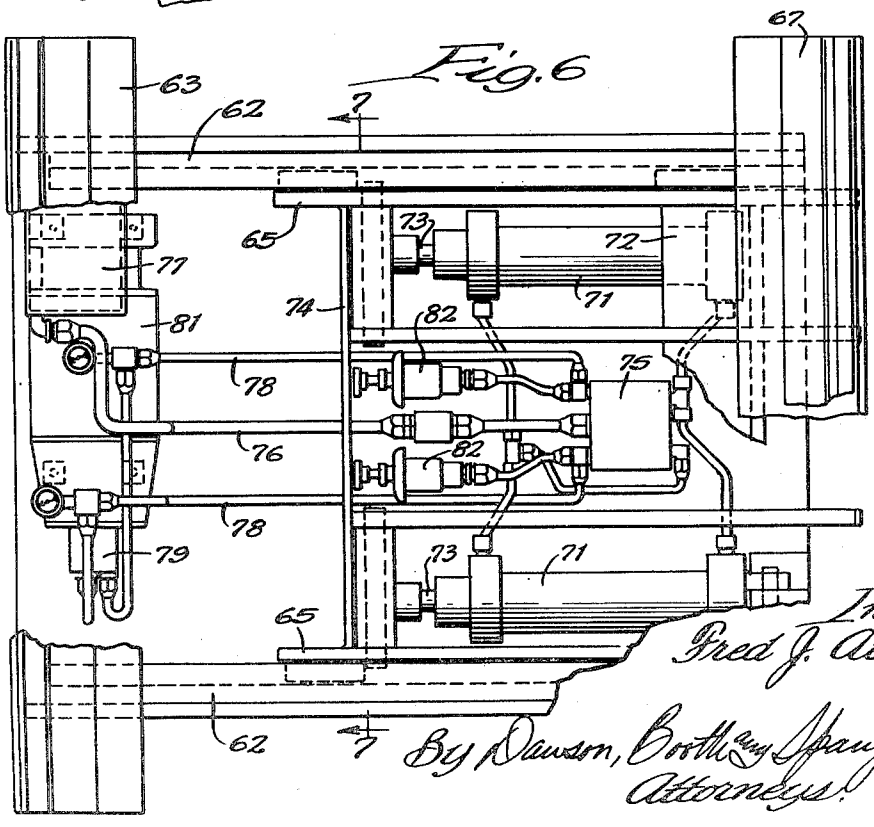


Fig. 6



Inventor:
Fred J. Avery,
By Dawson, Booth, Spangenberg,
Attorneys.

July 5, 1949. F. J. AVERY 2,475,367

CLAMP FOR LIFT TRUCKS

Filed May 28, 1947 4 Sheets-Sheet 4

Fig. 7

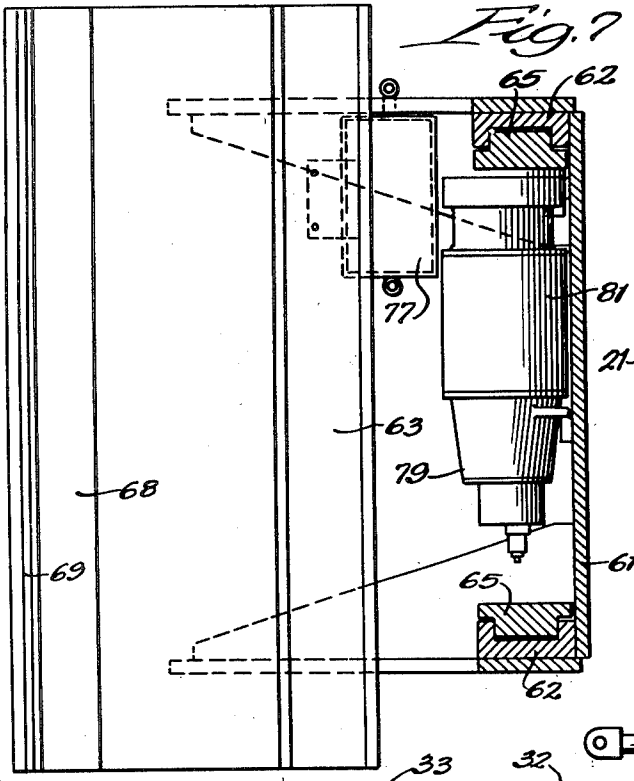


Fig. 8

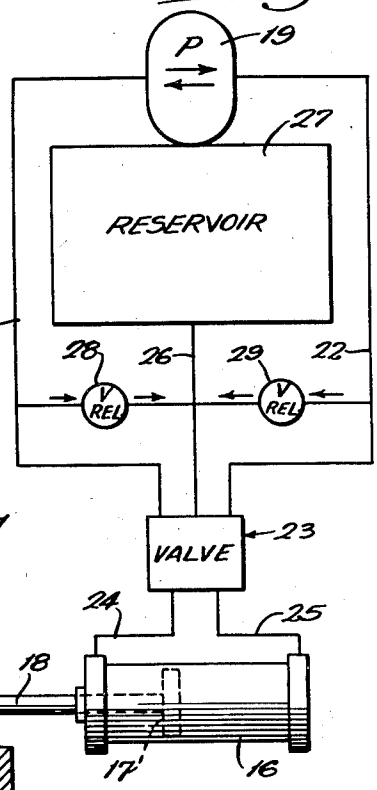
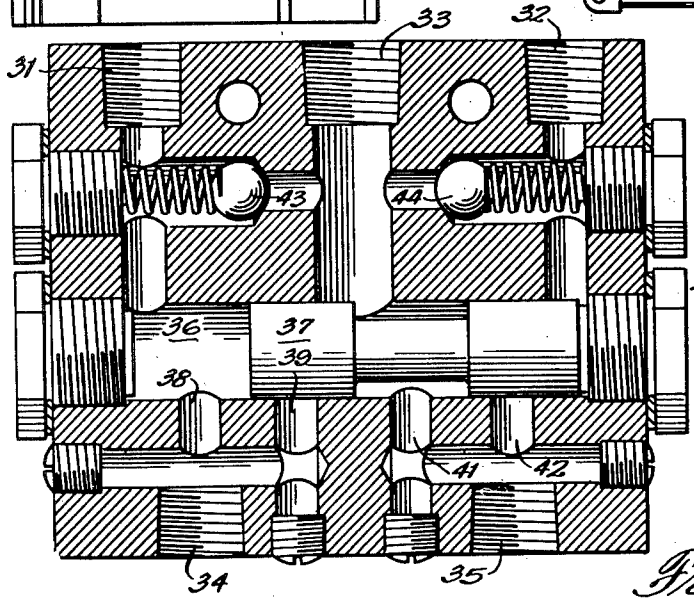


Fig. 9



Inventor:
Fred J. Avery,

By Dawson, Brittingham & Langenberg,
Attorneys.

Patented July 5, 1949 2,475,367

UNITED STATES PATENT OFFICE

2,475,367

CLAMP FOR LIFT TRUCKS

Fred J. Avery, Chicago, Ill.

Application May 28, 1947, Serial No. 750,916

2 Claims. (Cl. 214—115)

1

This invention relates to clamps and more particularly to clamps of the type adapted to be mounted on industrial trucks for handling rolls of paper or the like.

One of the objects of the invention is to provide a clamp which is operated hydraulically to grip and release an object to be held and in which reversal of a hydraulic motor operating the clamp is effected by reversing the supply pump for the motor.

Another object is to provide a clamp in which reversing of the supply pump automatically operates a reversing valve to reverse the direction of operation of the motor which operates the clamp. According to one feature of the invention the valve is so constructed as to compensate for varying displacement on opposite sides of the motor piston resulting from the piston rod being at one side of the piston.

Still another object is to provide a clamp which is mounted on an industrial truck for vertical movement thereon and which carries operating means flexibly connected to the truck. In one desired construction the clamp may carry a pump, a valve and a fluid motor for operating the clamp so that only flexible power leads between the truck and the clamp are required.

Still another object is to provide a clamp in which the object to be held is gripped by a plurality of spaced main and auxiliary jaws and in which the main and auxiliary jaws are connected for simultaneously operation in such a manner that the pressures exerted thereby are properly proportioned and equalized.

A further object is to provide a clamp in which the gripping surfaces are faced with a yielding gripping material.

A still further object is to provide a clamp in which the jaws are relatively rigid and one of the jaws is mounted for sliding movement on the clamp frame.

The above and other objects and advantages of the invention will be more readily apparent from the following description when read in connection with the accompanying drawings, in which—

Figure 1 is a perspective view of an industrial truck carrying a clamp embodying the invention;

Figure 2 is a back view with parts broken away and in section of the clamp of Figure 1;

Figure 3 is a top plan view of the clamp with parts broken away and in section;

Figure 4 is a section on the line 4—4 of Figure 2;

2

Figure 5 is a top plan view of an alternative clamp construction;

Figure 6 is a back view of the clamp of Figure 5 with parts broken away;

Figure 7 is a section on the line 7—7 of Figure 6;

Figure 8 is a diagrammatic view of the hydraulic circuit for operating the clamps; and

Figure 9 is an enlarged section of the automatic control valve.

The clamp of the present invention is particularly adapted for use in combination with relatively heavy industrial trucks for handling large rolls of paper or the like. As best seen in Figure 1, the truck comprises a chassis 10 supported on wheels 11 and adapted to be controlled by an operator through control levers 12. At one end the truck carries a vertical truck frame 13 on which a clamp as indicated generally at 14 may be mounted for vertical sliding movement. The clamp includes a frame which is slidably mounted on the truck frame 13 to be moved vertically thereon by the usual elevating mechanism provided on such truck frames and which carries movable jaws to grip an object such as a relatively large roll of paper 15. It will be noted that the roll is handled in a vertical position and that the clamp jaws are adapted to engage its opposite sides to hold it.

The clamp according to the present invention is adapted to be operated hydraulically through a hydraulic system as shown diagrammatically in Figure 8. The system includes a hydraulic motor formed by a cylinder 16 having a piston 17 therein connected with a piston rod 18 which extends through one end of the cylinder. The cylinder is supplied with operating fluid by a reversible pump 19 which is preferably of the constantially running type and which is driven by a reversible electrode motor. The opposite sides of the pump 19 are connected through pipes 21 and 22 to pump ports in a valve indicated generally at 23. The valve is connected through pipes 24 and 25 to the opposite ends of the cylinder 16 and through a pipe 26 to a liquid reservoir 27 which may be closed. The pipes 21 and 22 are connected to the pipe 26 through pressure relief valves 28 and 29 which may be adjusted to open at different pressures to provide a higher effective force in the clamping direction than in the release direction. For example, the valve 29 may be set to open at one thousand pounds per square inch to provide a high clamping pressure and the valve 28 may be set to open

at two hundred pounds per square inch to provide a relatively low release pressure.

The valve 23 is illustrated in detail in Figure 9 and as shown therein comprises a body formed with inlet ports 31 and 32 connected respectively to the pipes 21 and 22. The reservoir port 33 in the valve body connects to a reservoir pipe 26. Cylinder ports 34 and 35 in the body connect respectively to the pipes 24 and 25. All of the ports as so far described communicate directly with a cross bore 36 in the body in which a valve spool 37 is slidable. As shown, the valve spool has enlarged end portions fitting closely in the bore 36 and a reduced central portion around which fluid may flow. The cylinder ports 34 and 35 communicate with the bore 36 through spaced ports 38, 39, 41 and 42 for a purpose to appear later. The reservoir port 33 communicates with each of the ports 31 and 32 through outwardly opening check valves 43 and 44 so that fluid can flow from the reservoir port to the pump ports but not in the reverse direction.

In operation assuming the pump is delivering to the pipe 21 and that the pipe 22 is serving as the pump intake, the valve will occupy the position shown. At this time fluid entering the port 31 will act on the left end of the valve spool 37 to move the valve to the right so that direct communication is established between ports 31 and 34 through the port 38. At this time the reservoir port 33 communicates with the cylinder port 35 through the port 41. As the pump rotates, it will deliver liquid through the port 34 and pipe 24 to the left end of the cylinder to displace liquid from the right end of the cylinder into the port 35. Liquid entering the port 35 will flow directly into the reservoir port 33 and will pass the check valve 44 to flow out of the port 32 into the pipe 22. It will be noted that a greater volume of liquid will be displaced from the right end of the cylinder than enters the left end of the cylinder by an amount equal to the displacement of the piston rod 18. This excessive liquid may flow into the reservoir 27, but since a relatively small volume of liquid is involved, the reservoir may be closed, if desired.

Upon reversing the direction of the pump fluid under pressure will enter the port 32 and will act on the right end of the valve spool 37 to shift it to the left. This will reverse the valve connections so that operating fluid will be supplied to the right end of the cylinder and will be exhausted from the left end of the cylinder into the reservoir port. Since the quantity of fluid supplied to the pump from the left end of the cylinder is insufficient to supply the liquid required at the right end of the cylinder, liquid will at this time flow from the reservoir past the check valve 43 to the pump inlet. It will be seen that with this construction the clamp can easily be controlled simply by reversing the motor which drives the pump 19 without requiring any manual operation of the reversing valve.

One form of clamp embodying the invention is illustrated in detail in Figures 2 to 4 and as shown includes a frame 45 which is adapted to be mounted for vertical sliding on the truck frame 13. It will be understood that the clamp frame 45 may be moved on the truck frame by screws or other desired type of operating mechanism which is not shown in detail. The frame 45 has a pair of clamp levers 46 pivoted intermediate their ends adjacent the opposite sides of the frame. At their outer ends the clamp levers carry pivoted clamp shoes 47 which extend vertically and which may be curved on their inner surfaces to fit

against and grip a roll of paper as shown at 15. The inner ends of the clamp levers are adapted to be spread to move the clamp members 47 together by means of the cylinder 16 and its associated piston and piston rod. As best seen in Figure 2, one end of the cylinder 16 is connected to a cross bar 48 which connects the inner ends of the clamp levers 46 at one end of the clamp frame. The piston rod 18 is similarly connected to a cross bar 49 which connects the inner ends of the clamp levers 46 at the opposite end of the frame. The opposite ends of the cylinder are connected to pipes 51 and 52 which are in the form of flexible hoses leading to valve and pump mechanism as described above which is carried on the truck. Thus when fluid is supplied through the pipe 51 to the left side of the cylinder 16, it tends to spread the inner ends of the clamp levers 46 so that the jaw members 47 thereon will be moved together to grip a roll of paper between them. The jaw members are so spaced and the arms 46 are of such a length that the jaw members will extend slightly beyond a diameter through the roll, as shown in Figure 3.

Intermediate the clamp arms 46 the frame carries a pair of auxiliary clamps 53 which are pivoted on arms 54 pivotally connected to the frame. The jaws 53 are adapted to engage the roll at spaced points between the clamp jaws 47 so that the roll will be firmly gripped over a relatively large area and can be handled without tearing or without clamping pressure which might be sufficiently high to crush it. The auxiliary jaws are adapted to be operated simultaneously with the main jaws and for this purpose are linked to the main jaws. As shown, the jaw 53 at the left is connected through links 55 to the cross bar 49 so that when the cross bar 49 moves outward the jaw 54 will be moved away from the frame toward the object to be clamped. Similarly, the jaw 53 at the right is connected through links 56 to the cross bar 48. This linkage equalizes the movements of the main and auxiliary jaws and proportions the force exerted thereby so that a uniform gripping effect may be produced at all times.

In operation to move an object such as a roll of paper the truck may be driven toward the roll with the clamp jaws separated so that the jaws will span the opposite sides of the roll. The clamp is preferably lowered at this time substantially to the position shown in Figure 1. When properly in position the motor driving the pump 19 will be reversed to move the jaws together against the roll. The grippers 47 will engage the opposite sides of the roll and at the same time the jaw members 53 will move into engagement with the roll so that it will be firmly gripped at spaced points and over a relatively large area. In this way a relatively low jaw pressure can be used so that crushing will be avoided while slipping of the jaws over the surface of the roll which might result in tearing the roll will be eliminated. The clamping pressure can be determined by the size of the cylinder 16 and the setting of the relief valve 29 so that proper pressure will be exerted. When the jaws come together on the roll, liquid supplied by the pump will by bypassed through the relief valve 29, the pump continuing to operate to hold the jaws against the roll with uniform pressure. With the roll firmly gripped, the clamp may be raised on the truck frame 13 to elevate the roll so that it can be moved to any desired location.

Figures 5 to 7 illustrate an alternative clamp construction which can be used in place of the

clamp of Figures 2 to 4 in the same manner. This clamp construction comprises a frame 61 which is adapted to be mounted on the truck frame 13 for vertical movement thereon. The frame includes a back plate or cross piece connecting a pair of spaced parallel side rails 62 which extend completely across the frame. At one end the frame has rigidly secured thereto a curved clamping jaw 63 which follows approximately the same curvature as a roll to be picked up and which is rigidly connected to the frame by angle plates 64.

The side rails 62 are internally grooved, as shown in Figure 7, slidably to receive inner rails 65 which carry a second clamping jaw 66. The jaw 66 is substantially similar to the jaw 63 and includes an arcuate plate 67 following substantially the same degree of curvature as the roll to be picked up. The inner surfaces of both jaws are faced with a layer of yielding material 68 to facilitate gripping the roll and to insure that a substantially uniform pressure will be exerted on the roll over the entire jaw area. The tip ends of the jaws may be covered with metal angles 69 to prevent stripping the facings from the jaws when moving them beside or between stacked rolls. The jaws terminate substantially on a diameter of a roll of the maximum size to be picked up as shown in Figure 5 so that they can grip the roll to remove it from a stack.

The jaws are adapted to be moved together by a pair of hydraulic motors each including a cylinder 71 connected to a cross piece 72 on the frame and having pistons therein whose piston rods 73 are connected to a cross piece 74 joining the ends of the bars 65.

The opposite ends of the cylinders are connected in parallel to a control valve 75 similar to the valve 23 of Figure 8. The reservoir port of the control valve is connected through a pipe 76 to a reservoir 77 mounted on the frame and which is preferably closed. The pump ports of the control valve are connected through pipes 78 to the opposite sides of a pump 79 which is driven by an electric motor 81. Relief valves 82 corresponding to the relief valves 28 and 29 of Figure 8 are provided in the connections 78.

The motor 81 is controlled from the truck through a suitable reversing switch mounted on the truck so that the only connection required between the truck and the clamp are flexible electrical connections from the reversing switch to the motor. When the motor is running in a direction to supply liquid to the left ends of the cylinders 71, the clamp 67 will be moved to the right to the position shown so that the clamp is open and can be moved over a roll as indicated in Figure 5. Upon reversing the pump, fluid will be supplied to the right ends of the cylinders 72 to move the clamp jaws relatively together to grip the roll so that it can be raised and transported. The rubber facings on the clamp jaws insure uniform gripping so that the roll will be held securely without requiring the use of pressures high enough to crush it.

While two embodiments of the invention have been shown and described in detail herein, it will be understood that they are illustrative only and are not to be taken as a definition of the scope of the invention, reference being had for that purpose to the appended claims.

What is claimed is:

1. A clamp for use on a lift truck for handling vertically arranged cylindrical rolls comprising a vertical frame adapted to be mounted on a lift truck, a pair of vertically spaced horizontal parallel rails on the frame, a pair of thin rigid curved jaws projecting from the frame in facing relationship and having elongated vertical parallel edge portions transverse to the rails and terminating substantially on a diameter of a circle having the same radius as the curved jaws, said elongated edge portions gripping a roll throughout their lengths at opposite sides of the roll, one of the jaws being rigidly mounted on the frame adjacent one end of the rails, means slidably mounting the other jaw on the rails for linear horizontal movement therealong, and a fluid cylinder and piston unit on the frame connected to said other jaw to move it.

2. A clamp for use on a lift truck comprising a frame adapted to be mounted on a lift truck, a pair of spaced parallel rails on the frame, a pair of thin rigid curved jaws projecting from the frame in facing relationship and having elongated parallel edge portions transverse to the rails and terminating substantially on a diameter of a circle having the same radius as the curved jaws, one of the jaws being rigidly mounted on the frame adjacent one end of the rails, means slidably mounting the other jaw on the rails for linear movement therealong, a fluid cylinder and piston unit on the frame connected to said other jaw to move it, a pump on the frame to supply fluid to the cylinder, a control valve on the frame to control the supply of fluid, and a motor on the frame to drive the pump.

FRED J. AVERY.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,379,472	Morgan	May 24, 1921
1,437,547	Pope	Dec. 5, 1922
1,490,235	Smith et al.	Apr. 15, 1924
1,807,360	Wehr	May 26, 1931
1,812,587	Ellis	June 30, 1931
1,872,810	Raymond	Aug. 23, 1932
1,900,569	Lederer	Mar. 7, 1933
2,203,799	Shaffer	June 11, 1940
2,222,941	Freeman	Nov. 26, 1940
2,317,688	McDonald	Apr. 27, 1943
2,370,528	Fontaine	Feb. 27, 1945

FOREIGN PATENTS

Number	Country	Date
702,625	France	Jan. 26, 1931