United States Patent

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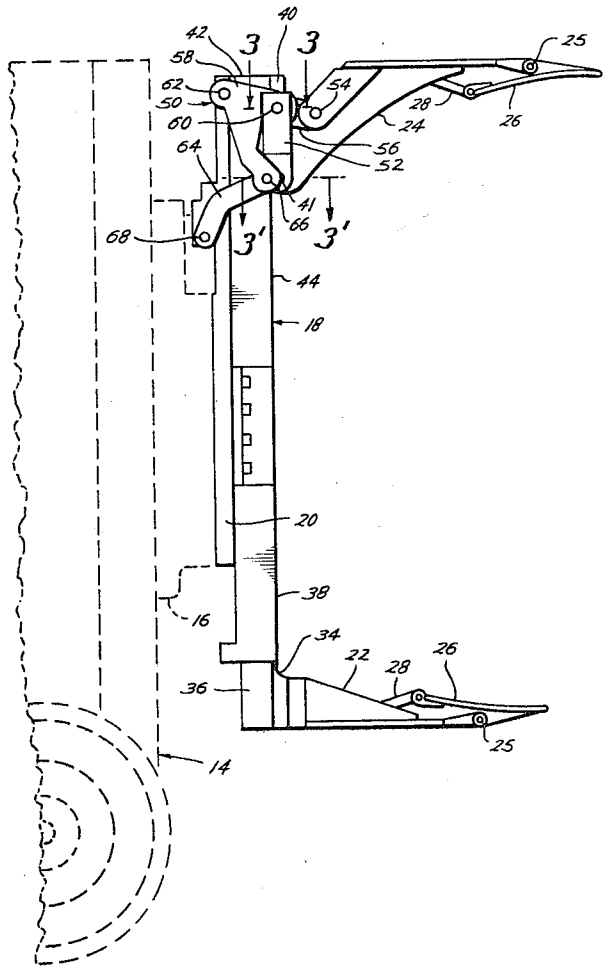
[54] **TOGGLE ARM CLAMP FOR LIFT TRUCKS**
5 Claims, 5 Drawing Figs.

[52] U.S. Cl. **294/88,** 214/653, 294/104
[51] **Int. Cl.** **B66f 9/18**
[50] **Field of Search** 214/653; 294/104, 88

[56] **References Cited**
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ABSTRACT: A lift truck clamp for paper rolls, or similar objects, having one swinging arm to increase the range of diameters which can be handled. A toggle linkage is used to control the movement of the swinging arm. The pivot point is so placed as to allow a much shorter swinging arm.



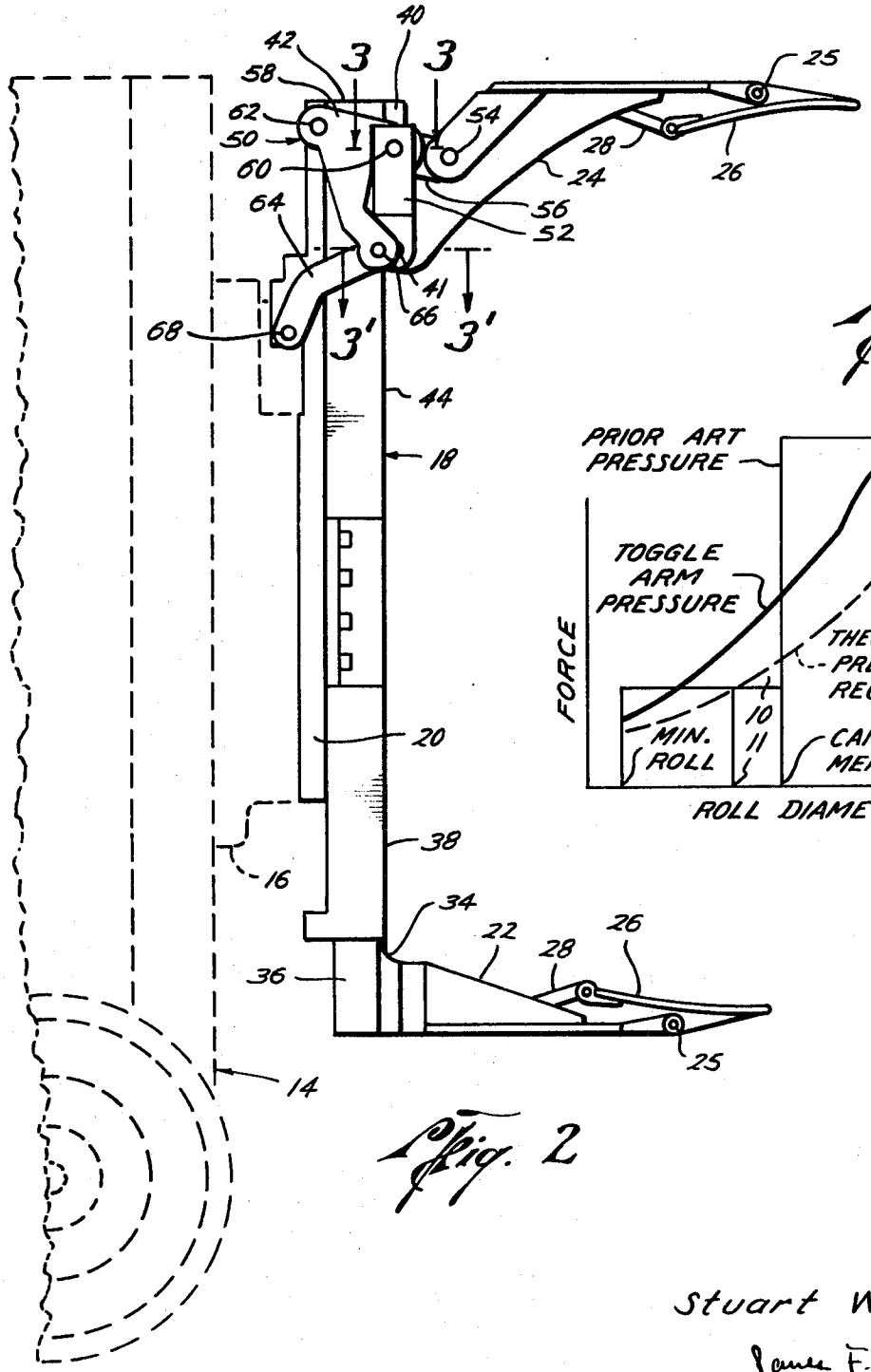


Fig. 2

Fig. 1

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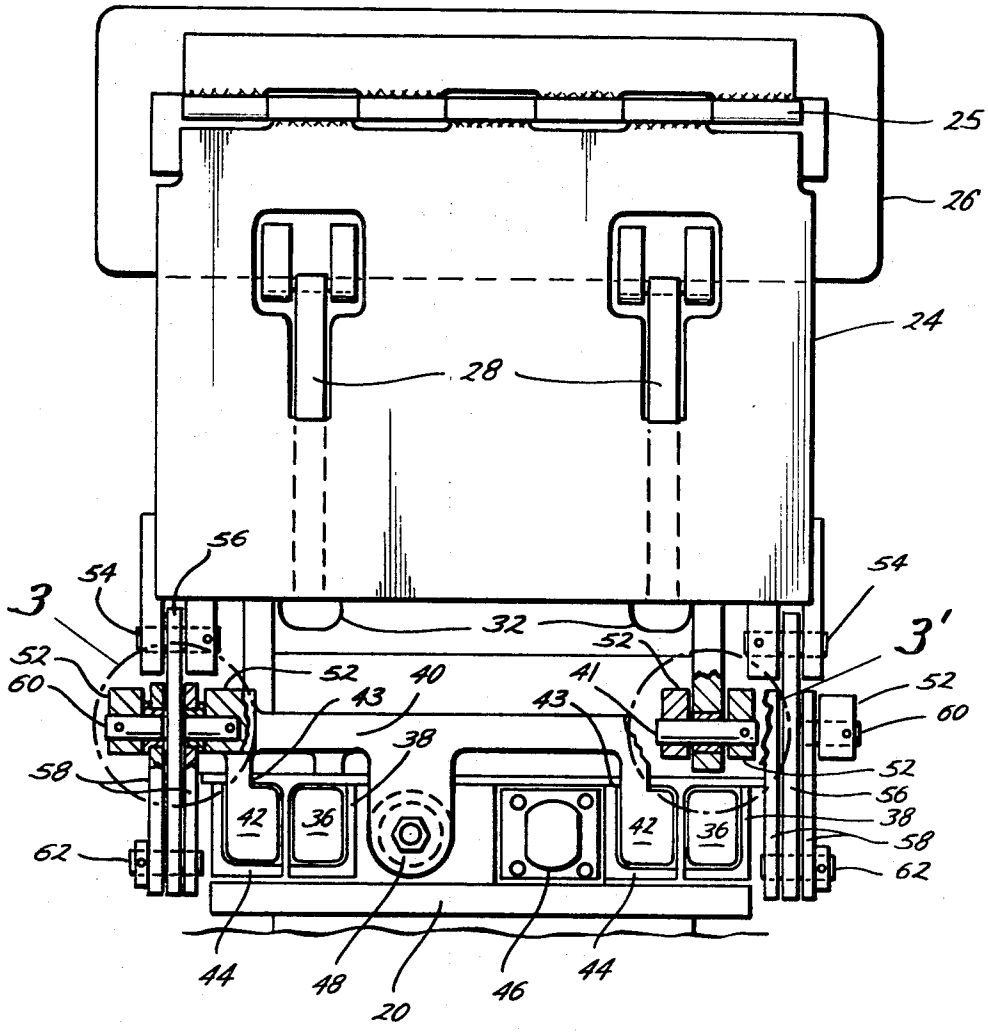


Fig. 3

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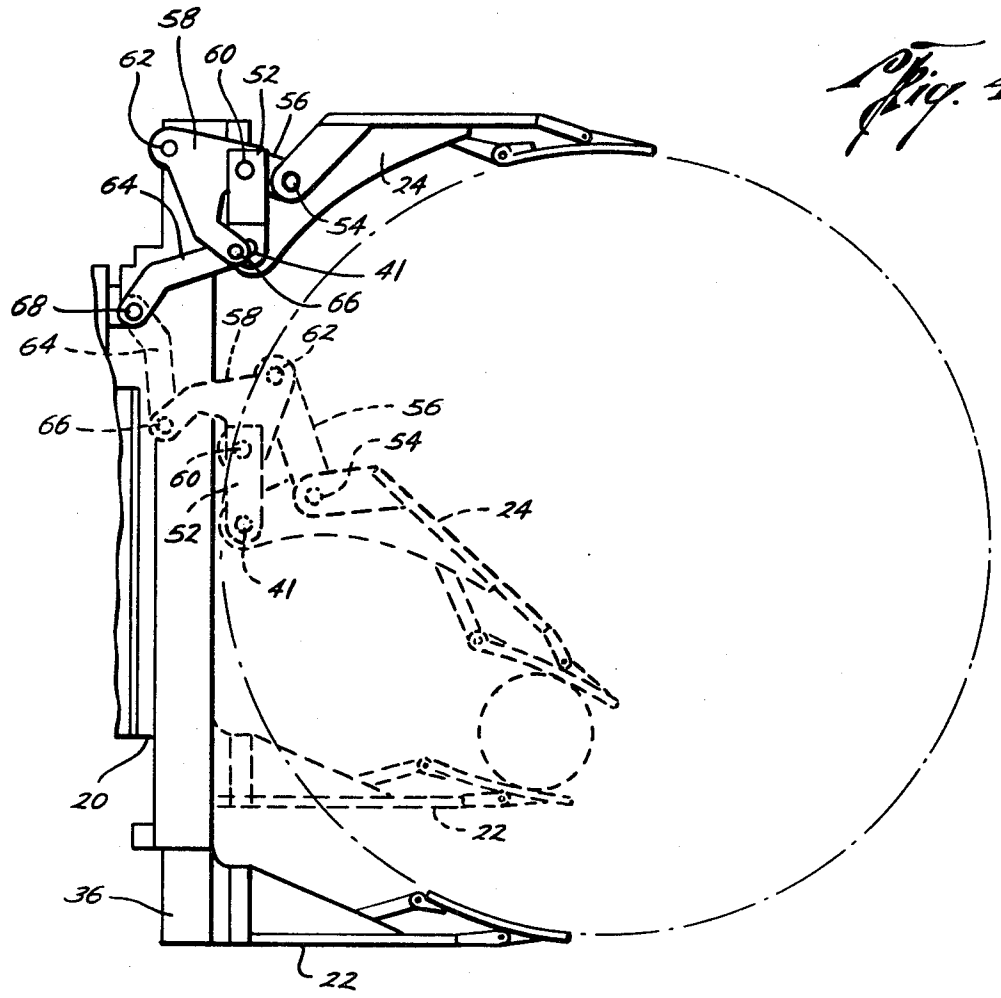


Fig. 4

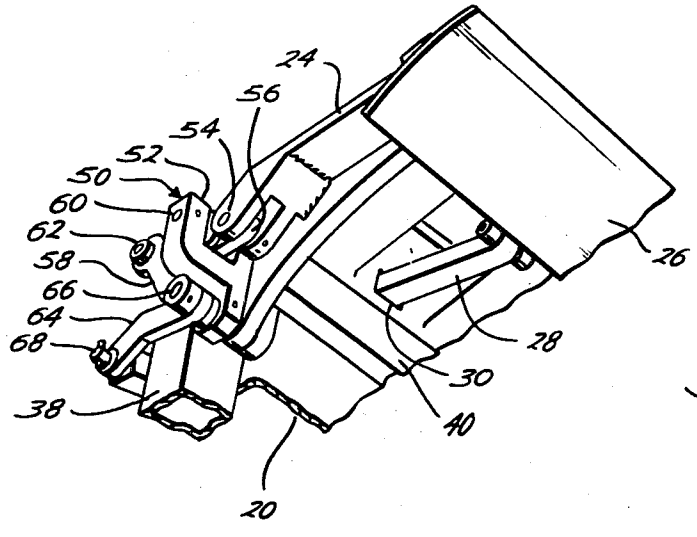


Fig. 5

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TOGGLE ARM CLAMP FOR LIFT TRUCKS

BACKGROUND OF THE INVENTION

The present invention relates to a clamp for lift trucks and the like, and more particularly to a clamp having a swinging arm, particularly suited for use with and manipulation of cylindrical loads, such as rolls of paper, in a variety of diameters.

Clamping mechanisms of the general type are illustrated in the patents to Farmer, U.S. Pat. No. 2,874,862, Faust, U.S. Pat. No. 3,127,209 and Bjorklund, U.S. Pat. No. 3,180,672. These prior structures all utilize a clamp having one pivoted arm, which arm pivots only after the two load-engaging arms have moved to a predetermined spacing. Thus, the prior devices utilize arms which move in a parallel fashion for approximately one-half of their scope, and then the pivoted arm begins to pivot so as to pick up small paper rolls, with an immediate decrease in mechanical advantage from the moment of pivoting onward.

In clamp designs for picking up paper rolls, the length of the short arm is determined when a roll of maximum diameter is lying on its axis on the floor and butts against the front plate of the clamp. The long arm length must be such as to reach across a diameter, drawn from the tangent of the short arm through the center of the roll. In most instances, the long arm can be a little shorter, and in this case, the manufacturer depends upon friction to keep the roll from squirting out. With the foregoing information, the parameters for maximum rolls are established. However, for small rolls the problem is to reach across the roll and still pick it up off the floor. The sort arm must, of course, stay next to the floor. Consequently, the long arm has to travel the entire distance across the clamp, which is the difference in diameters between the maximum roll and the smallest roll. For a variety of mechanical reasons, pivoting long arms are used so that a wider range of rolls can be handled. The pivoting mechanism itself must also clear both the large and small rolls.

On the other hand, when breaking paper rolls out of railroad cars or trucks, the rolls are generally set on end. Consequently, the long arm must not be too much longer than the short arm, or it is impossible to maneuver into the railroad car and to break fashion, one roll from other closely spaced rolls. Further, if the long arm is too long, it will cause paper damage or require too much space to encircle the roll or it may not be able to grip the roll at all because of maneuvering problems.

Finally, the theoretical pressure required to lift, and otherwise handle a paper roll, rises in a smooth curve dependent upon the roll diameter. With the usual pivoting arm, the pressure supplied by the clamp is at its maximum when the two arms are moving in a parallel fashion, but drops sharply when the cam-operated pivot engages. That is to say, the force supplied by these devices is not proportional to the weight of the rolls handled. These deficiencies are solved with the present invention.

SUMMARY

In general, the present invention provides a clamp having a short and a long swinging arm, wherein the swinging arm is continuously and positively actuated by a toggle linkage so that the force supplied by the clamp is substantially proportional to the weight of the roll being handled. Further, the pivot point of the swinging arm is located closer to the short arm, resulting in substantially reducing the required length of the swinging arm.

By the use of the toggle linkage mechanism of the present invention, the swinging arm moves substantially parallel to the short arm for the first portion of the clamping action, then begins to pivot at an increasing rate. However, the force supplied by the toggle mechanism results in a curve which is substantially proportional to the weight of whatever diameter roll of paper is being handled. Thus, the present invention eliminates a sudden change in mechanical advantage which on occasion with prior devices, has resulted in an inability to handle certain intermediate size rolls.

Further, the present invention allows pivot point of the swinging arm to be located closer to the short arm and to the front plate of the clamp. This location of the pivot point allows a substantial reduction in the required length of the swinging arm with several attendant advantages. First, it makes possible the use of a swinging arm which is no longer than the long arm in a nonpivoting type clamp of the long and short arm variety. This results in a much more maneuverable clamp, with its ability to break out rolls of paper with minimum clearances. Further, since the pivot point of the swinging arm is located closer to the short arm, the pads at the ends of the arms need not be pivotal through the large angular range heretofore required.

Advantageously, the present invention, through the use of the toggle linkage, provides a swinging arm which is positively actuated, and does not depend upon cams, springs or torsion bars for determining the position of the swinging arm at any given moment.

Thus, it is an object of the present invention to provide a swinging arm clamp wherein the pressure applied to the load by the clamp wherein the pressure applied to the load by the clamp varies in proportion to the diameter of the roll being handled, as well as to provide a swinging arm clamp wherein the length of the swinging arm is substantially reduced over the length of pivoting arm clamps heretofore utilized.

Other and further objects, features and advantages will be apparent from the following description of the presently preferred embodiment of the invention, given for the purpose of disclosure when taken into conjunction with the following drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Like character references designate like parts throughout the several views of the drawings, which are:

FIG. **1** is a graph diagrammatically illustrating the relationship between applied force and roll diameter,

FIG. **2** is a side view of the present invention shown attached to a partially illustrated lift truck,

FIG. **3** is a top view, with partial sections, taken along the lines 3—3 and 3'—3' of FIG. 2,

FIG. **4** is a view similar to FIG. **2**, showing the clamp of the present invention in position for maximum roll diameters in full lines, and for minimum roll diameters in broken lines, and

FIG. **5** is partial perspective view of the toggle linkage assembly seen in FIGS. 2 and 4.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, and particularly FIG. **1**, a plot of force versus roll diameter is diagrammatically illustrated. It is to be noted that between the limits of a minimum and maximum roll diameter, the theoretical pressure required to clamp and lift a paper roll gradually increases in a smooth curve from a low force level to a higher force level. This theoretical pressure required is, of course dependent upon a number of factors, including the length of the roll, as well as the coefficient of friction, and consequently is given only diagrammatically. Also diagrammatically illustrated is the pressure curve which results from the use of the ordinary pivoting arm paper roll clamp, such as is illustrated in the three patents previously mentioned. Note that while a large force is available for maximum roll diameters, the force available drops instantaneously to a much lower level upon the engagement of the cam to begin the pivoting arm movement shown by the prior art. Notice also that the maximum pressures and the point of cam engagement are critical if the prior art devices are to avoid the area illustrated at **10** on the chart. This area **10** shows that the available pressure is less than the theoretical pressure required, and consequently, the usual pivoting device is unable to effectively handle a roll in this intermediate diameter range between points **11** and **12**.

On the other hand, the available pressure from the toggle arm arrangement of the present invention is represented by the curve labeled toggle arm pressure. NOte that this available

pressure is always above the theoretical pressure required, and that the toggle arm pressure substantially tracks the theoretical pressure required over the entire curve. Said another way, the toggle arm pressure available from the present invention varies continuously in proportion to the diameter of the roll being handled.

Referring now to FIG. 2, a lift truck 14 is diagrammatically illustrated, having mounted thereon a conventional carriage 16 which may include rotating, tilting, elevating and side shifting functions. Suitably attached to the carriage 16 by the frame 20 is the toggle arm clamp 18 of the present invention. Extending from the frame are the lower or short arm 22 and the swinging arm 24. Pivotally attached to the ends of both the short and swinging arms, as by hinges 25, are load engaging pads 26 which are curved to generally mate with the periphery of the maximum diameter roll to be handled. Pivotally attached to the inner edges of the pads 26 are pad limiting links 28 which function to prevent the pads 26 from pivoting beyond a predetermined point with respect to the arms 22 and 24 when the pads are tip loaded. Referring briefly to FIG. 5, it is noted that the pad limiting links 28 extend from a pivotal connection with the pad 26 through an opening 30 within the arm 24, and as is seen in FIG. 3, the extension ends in a T-head 32 on the link 28. By this simple expedient, the load engaging pads 26 are limited in their pivotal movement.

Referring again to FIG. 2, it is to be noted that the short arm 22 is attached to a mounting bracket 34 whose extension forms a slide 36 which extends within the frame 20 of the clamp 18. The slide 36 more particularly slides within a guide 38 which forms a part of the frame 20, best seen in FIG. 3.

The swinging arm 24 is pivotally attached to the upper mounting bracket 40 by the pivot 41 which is barely discernible in FIG. 2 because it is covered by pivot 66 to be hereinafter described. However, pivot 41 is seen in section 3'—3' of FIG. 3 and in broken lines in FIG. 4. Forming a part of the upper mounting bracket 40 are slides 42 which slide within guides 44 in the upper part of the frame 20. Referring now to FIG. 3, a top view of the bracket 40, slides 42 and guides 44 are seen.

As seen in FIG. 3, the particular embodiment illustrated herein utilizes guides 44 on either side of the frame 20 for the upper slides 42, as well as a pair of guides 38 for the lower arm slides 36. The guides have slots on the front to allow the brackets entry to the slides, as seen at 43. Mounted vertically along the frame 20 is a hydraulic motor 46, one end of which is attached to the frame 20 and the other end attached to the slide or bracket 34. In a similar manner, a second hydraulic motor 48 is attached to the frame 20 and to the upper bracket 40. Upon actuation of hydraulic motor 48, in a conventional manner, the slides 42, and thus the mount 40, may be made to move upwardly and downwardly in the guide 44 and thus the frame 20. By the same token, upon actuation of the motor 46, the slides 36 and thus the mount 34 and lower arm 22 may be moved upwardly and downwardly in the guides 38 and thus the frame 20.

Illustrated generally as 50 and best seen in FIG. 5, is the toggle linkage which interconnects the frame 20, bracket 40 and the swinging arm 24. The function of the toggle linkage 50 is to control all of the movement of the swinging arm 24 as the hydraulic motor 48 pulls the mount 40 toward the short arm 22, so as to grasp a load therebetween.

Extending from and mounted on the upper bracket 40 is the heel 52. Pivotally attached to the inward lower end of the heel 52, as by pivot 41, is the swinging arm 24. Notice that the pivot 41 is adjacent the front of the frame 20. By comparing FIGS. 4 and 5, it is thus seen that actuation of the motor 48 results in reciprocation of slide 42 and thus the frame 40 and heel 50, which moves the pivot 41 and inward end of the swinging arm 24 along the frame 20 toward and away from the short arm 22. The remainder of the toggle linkage 50 is utilized through pivot 54 to control the angularity and displacement of the swinging arm 24 with regard to the frame 20. The pivot 54 pivotally interconnects the outer upper portion of swinging arm 24 and link 56, which is best seen in broken lines in FIGS. 4 and in full lines in FIG. 3.

Pivotally attached to the heel 52 is the rocker crank 58 by pivot 60. Also pivotally connected to the rocker crank 58 is the link 56 at pivot 62, seen in FIG. 4. Finally, the rocking lever 64, seen in FIGS. 4 and 5 is also pivotally connected to the rocker crank 58 at pivot 66, while the opposite end of rocking lever 64 is pivotally connected to the frame 20 at pivot 68. Notice that pivot 66 is substantially coincident with pivot 41 when the swinging arm 24 is widest open, and remains so for approximately one-third of the travel of the bracket 40.

In operation, it is thus seen that as the motor 48 is actuated and assuming that the swinging arm 24 is in its upward position, the upper mount 40 is pulled downwardly and is guided by the slides 42 in the guides 44. Since the heel 52 is attached to the upper mount 40, it similarly moves downwardly, along the front of the frame 20. This action also moves the pivot 41 and therefore the innermost portion of the arm 24 along the frame 20. At the same time, the rocking lever 64 being pivoted to the frame 20 at pivot 68 causes the rocking crank 58 to pivot about the pivot 60 resulting in pushing the link 56 about the pivot 62 as well as about the pivot 54, causing the upper part of the swinging arm 24 to move outwardly with respect to the frame 20, thus swinging the swinging arm 24 about the pivot 41 and toward the short arm 22.

Notice particularly that the pivot 66 is substantially coincident with the main pivot 41 of the swinging arm 24. So long as these two pivots remain in substantial coincidence, the swinging arm 24 remains substantially perpendicular to the frame 20. It is only when the pivots 66 and 41 move out of coincidence that the rocker crank 58 begins to cause the swinging arm 24 to pivot about the pivot 41. This does not occur until after approximately one-third of the total downward movement of the bracket 40 or heel 52. Then, as the two pivots move out of coincidence, the swinging arm begins to pivot about the pivot 41 toward the short arm 22, while at the same time the pivot 41 is moved downwardly as the mount 40 and heel 52 move downwardly. As can be seen by referring again to FIG. 1, so long as the pivots 66 and 41 are in substantial coincidence, the full force of the hydraulic motor 48 is available to act upon the load being handled. However, as the two pivots go out of coincidence, the mechanical advantage begins to vary in proportion to the diameter of the load to be handled. Thus, the present invention provides pressure between the clamping arms in proportion to the pressure actually required to handle the load involved.

As shown in FIG. 4, the short arm 22 moves upwardly upon actuation of the hydraulic motor 46 which moves the slide 36, mount 34 and thus the short arm 22, all as shown in broken lines. This feature allows rolls of even smaller diameter to be handled by the present clamp.

As was previously mentioned, the carriage 16 may include such conventional functions to allow rotating the clamp 18; tilting the clamp 18 so that the short arm 22, even when raised as shown by the broken lines in FIG. 4, is adjacent to the floor; elevating the clamp 18 on the mast of the truck; and shifting the clamp sideways. Obviously, the clamp 18 must be capable of most of these functions if it is to be useful in taking paper rolls out of a boxcar or warehouse space.

Although the invention has been described with particular reference to paper rolls, it is now felt to be apparent that this particular clamp may also be used with other cylindrical loads, and with a suitable change in pads, with other types of loads.

The present invention, therefore, in well adapted to carry out the objects and obtain the ends and advantages mentioned, as well as others inherent therein. While the presently preferred embodiment of the invention has been given for the purpose of disclosure, numerous changes in the details of construction and the combination, shape, size and arrangement of parts may be resulted to without departing from the spirit and scope of the invention.

What is claimed is:

1. In a clamping attachment for lift trucks and the like:
a frame,
a first load-engaging arm extending from the frame,
a second load-engaging arm extending in the same general direction as the first arm,
bracket means,
guide means slideably mounting the bracket means on the frame for movement toward and away from the first arm,
the second arm pivotally attached at its inner end to the bracket means,
a toggle linkage pivotally attached to the second arm adjacent the inner end and to the frame, and
actuating means for sliding the bracket means in the guide means,
thereby causing the load-engaging arms to move toward each other in a predetermined path.

2. The invention of claim 1 including:
mounting means holding the first arm,
guide means slideably mounting the mounting means, and
actuating means for sliding the mounting means and first arm toward the second arm.

3. A lift truck clamp including:
a frame,
vertically extending guides in the frame,
slides slideably mounted in the guides,
a bracket attached to the slides,
a first load-engaging arm extending from the front of the frame,
a second load-engaging arm pivotally mounted at its inner end on the bracket adjacent the front of the frame,
a toggle linkage pivotally interconnecting the frame and upper portion of the inner end of the second arm,
the toggle linkage maintaining the second arm substantially perpendicular to the front of the frame during a first portion of the sliding movement of the bracket, and causing the second arm to pivot about the bracket during the remaining portion of the sliding movement of the bracket, and
means for moving the slides within the guides.

4. The invention of claim 3 wherein the toggle linkage includes:
a crank pivotally attached to the bracket,
a rocking lever pivotally interconnecting the frame and crank, and
a link pivotally interconnecting the crank and second arm,
the pivotal interconnection between the rocking lever and crank being substantially coincident with the pivotal mounting of the second arm and bracket during the first portion of the sliding movement.

5. The invention of claim 3 including the first arm being slideably mounted on the frame and means for sliding the first arm.