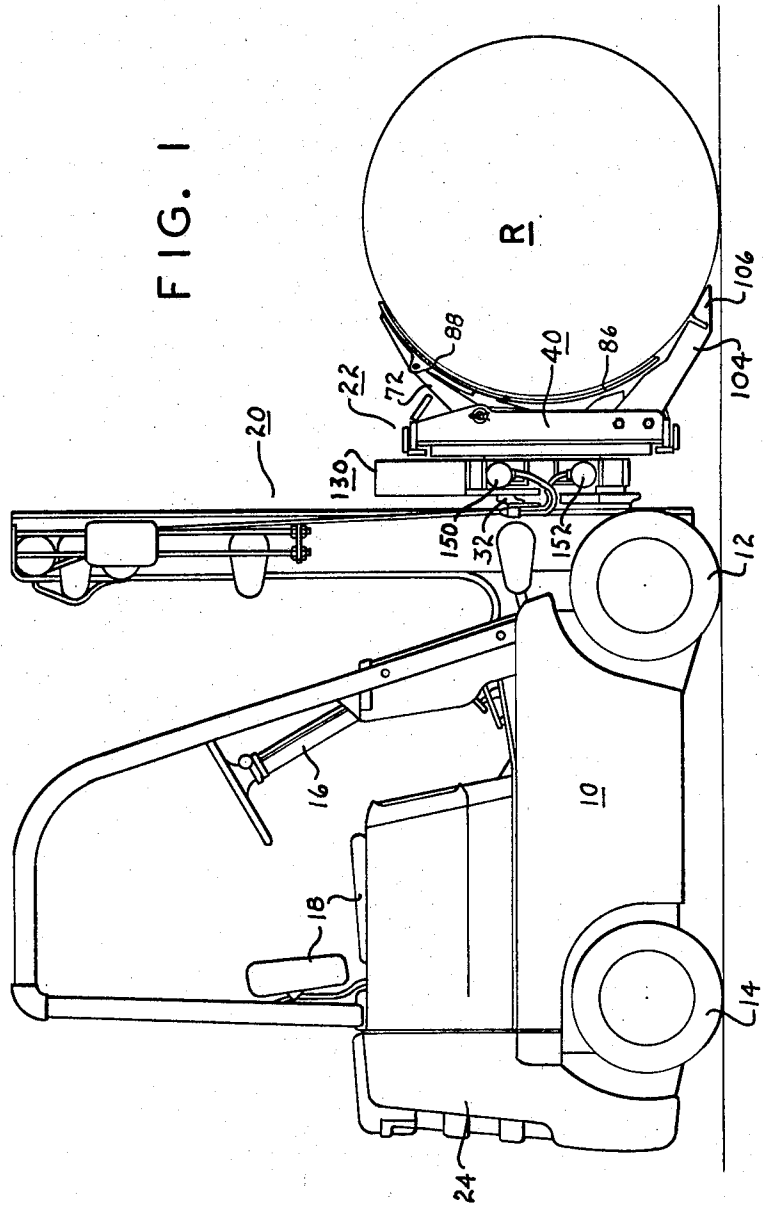
May 21, 1968 R. B. HICKMAN 3,384,255

LIFT ATTACHMENT FOR HANDLING CYLINDRICAL OBJECTS

Filed Oct. 22, 1965 4 Sheets-Sheet 1

FIG. 1




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LIFT ATTACHMENT FOR HANDLING CYLINDRICAL OBJECTS

Filed Oct. 22, 1965 4 Sheets-Sheet 2

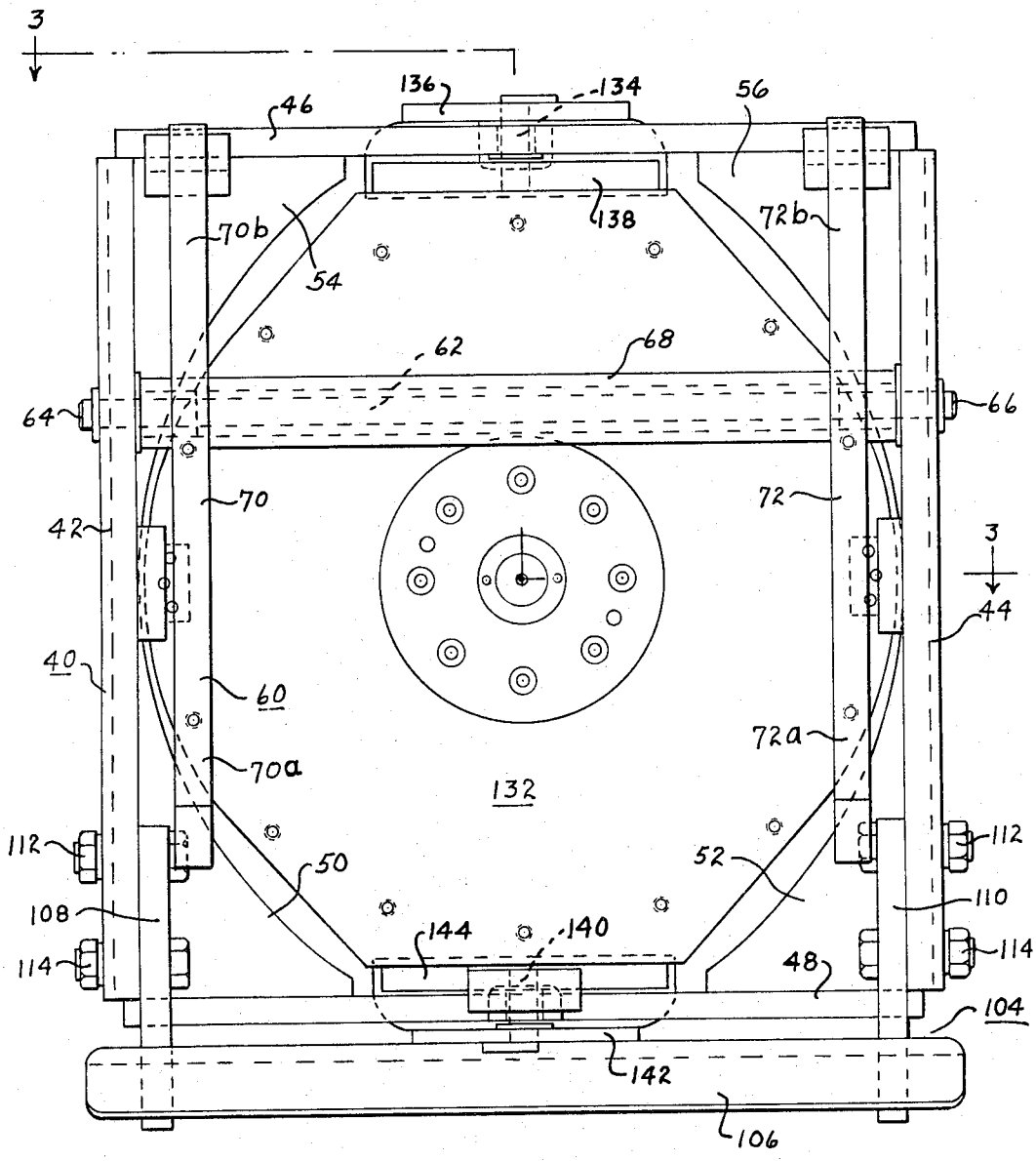



FIG. 2

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LIFT ATTACHMENT FOR HANDLING CYLINDRICAL OBJECTS

Filed Oct. 22, 1965 4 Sheets-Sheet 3

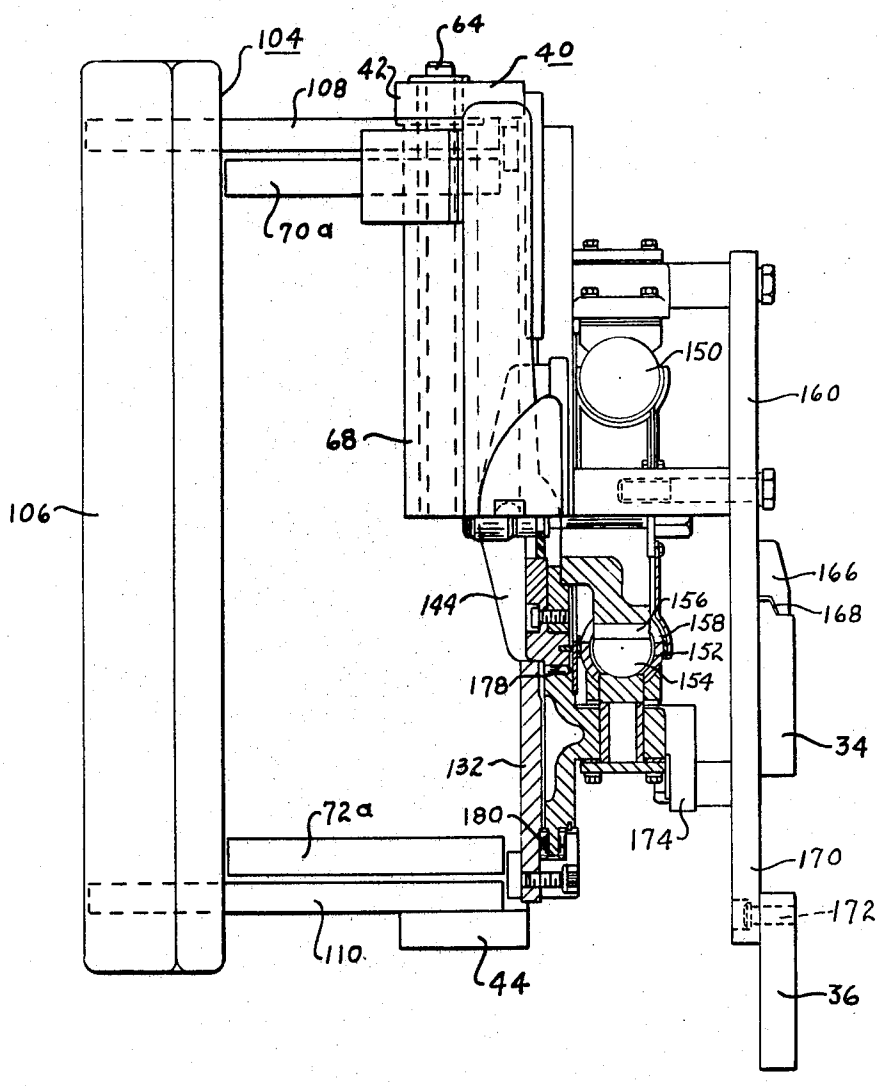



FIG. 3

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LIFT ATTACHMENT FOR HANDLING CYLINDRICAL OBJECTS

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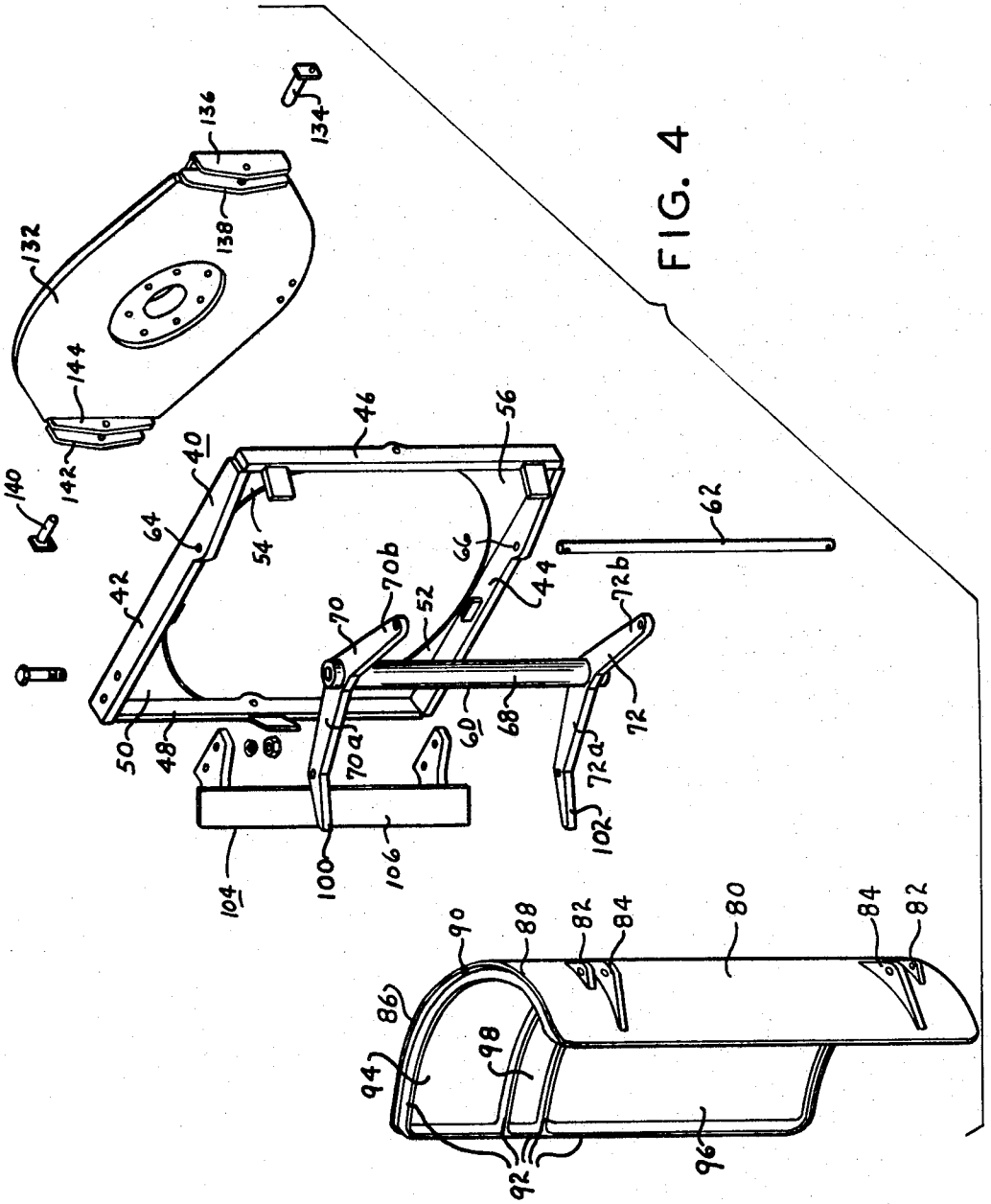



FIG. 4

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# LIFT ATTACHMENT FOR HANDLING CYLINDRICAL OBJECTS

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## ABSTRACT OF THE DISCLOSURE

A lift truck attachment having a support plate mounted for rotation about a central horizontal axis, a generally rectangular first frame pivotally mounted from the opposite sides of the rotatable support, a generally H-shaped second frame mounted from the first frame about a vertical axis offset from the horizontal axis, and gripper members, such as vacuum pads, mounted from the second frame for engaging and handling loads.

The present invention relates to a load handling attachment for vehicles, and more particularly to an articulated load handling attachment for industrial trucks, especially for handling paper rolls, such as printing paper rolls and other cylindrically shaped objects.

The conventional attachment used in conjunction with industrial trucks and the like for handling paper rolls consists of one or more pairs of jaws projecting forwardly from the upright on the front of the truck, and in lifting, transporting and stacking paper rolls, such as newspaper rolls, the jaws engage the cylindrical sides of a paper roll and positively clamp and hold the roll firmly while the roll is being lifted and moved. These attachments usually are constructed to rotate so that the roll can be shifted from a position lying on its side to an up-ended position. This type of manipulation often requires the roll to be gripped tightly by the jaws to prevent the roll from slipping end-wise while the roll is up-ended and is being lifted or removed from the upper tiers of stacked rolls. Further, in order to provide an effective gripping action on the larger rolls the jaws are necessarily relatively long, and hence project forwardly from the truck upright to an extent where they often interfere with the maneuverability of the truck, particularly in box cars and on loading platforms in the operation of loading and unloading the rolls.

The positive and firm gripping action required by the conventional paper roll attachments often results in damage to the roll, particularly to the external layers, by tearing, wrinkling, and scuffing, and occasionally to the entire roll by the compressing effect of the jaws. The compressing effect may distort the roll, making it out of round or otherwise rendering it unbalanced and hence unusable on the high speed reels of the standard printing presses. The damage to the external layers and distortion to the entire roll may not be discernible until the roll has been mounted on the reel and is ready to be fed into the press, thus resulting in substantial loss in transportation and handling of the defective and unusable roll, and materially increased downtime of the printing press required to replace the defective roll with a new roll.

In more recent developments, an attachment for industrial trucks having a vacuum pad for engaging and lifting the rolls has been used and found satisfactory in that the engaging pads do not distort the rolls and seriously damage the external layers of paper on the roll; however, some difficulty has been encountered with this type of attachment in holding the roll with the axis of the roll horizontally positioned, since the weight of



the suspended roll on the pads is not evenly distributed and tends to break the seal at the top of the pad and place excessive pressure on the seal at the bottom of the pad. Consequently, there is a tendency for the vacuum seal to accidentally release the roll, or fail to seat properly on the roll when it is initially engaged thereby. Various types of positive supports have been used in conjunction with the pressure pads, but those tried in the past have generally not been satisfactory.

It is therefore one of the principal objects of the present invention to provide a paper roll handling attachment for industrial trucks having a vacuum operated load engaging and lifting mechanism, by utilizing a reaction means which can lift and hold the rolls effectively and form a reliable seal on the surface of the roll when the roll is horizontal, i.e., the axis of the roll is parallel to the floor line.

Another object is to provide an attachment for a load handling and transporting vehicle, which can effectively engage and lift a load without accurate alignment between the load and the attachment load engaging elements, and which can be operated with less skill and care than similar conventional or standard attachments of the same general type.

Still another object of the present invention is to provide a compact vehicle of the industrial truck type for lifting and transporting paper rolls and similar cylindrically-shaped objects, which has greater maneuverability in limited areas than the conventional paper roll handling trucks with a jaw-type roll engaging mechanism, and will not compress or distort the roll or cut or tear or otherwise mar the outer layers of the roll, and which is not as sensitive to the position of the roll on the vacuum seal as the prior vacuum roll engaging mechanisms.

A further object of the invention is to provide an attachment for a paper roll handling and transporting vehicle, which is so constructed that it can adapt itself to a roll and the position of the roll without accurate alignment of the roll engaging mechanism with the side of the roll, and which ejects the roll away from the attachment when the roll is released.

Another object is to provide a highly versatile, easily controlled and operated attachment for industrial trucks and the like, which can be readily adapted to various types of standard truck uprights without substantial modification, and which will effectively adapt itself automatically to various size rolls of paper and similar cylindrical objects over a relatively wide range.

Additional objects and advantages of the invention will become apparent from the following description and accompanying drawings, wherein:

FIGURE 1 is a side elevational view of an industrial truck having the present paper roll handling attachment mounted on the upright thereof and showing the attachment prepared to lift a roll of paper or other cylindrical objects;

FIGURE 2 is a front elevational view of the articulated mechanism of the present attachment with the load engagement elements removed therefrom to better show the operating mechanism;

FIGURE 3 is an enlarged partial cross sectional view of the present articulated attachment for handling paper rolls and other objects, the section being taken on line 3—3 of FIGURE 2 with the paper roll engagement attachment elements shown positioned 90 degrees from the position shown in FIGURE 1; and

FIGURE 4 is an exploded perspective view of the present attachment removed from the truck.

Referring more specifically to the drawings and to FIGURE 1 in particular, numeral 10 designates an industrial truck having a pair of front wheels 12 and a

pair of rear wheels 14, a steering mechanism 16 for the rear wheels, seat 18 and an upright 20 on the front of the truck having mounted thereon the present load handling attachment 22. The truck is driven by a motor enclosed in housing 24 beneath the driver's seat 18. The industrial truck on which the present load handling attachment is mounted may be considered conventional for the purpose of the present description and may be of any one of a number of well known suitable types, including those powered by a battery driven electric motor or by gasoline engine. Hence, the details of the industrial truck will not be described herein.

The upright 20 mounted on the front of the truck likewise may be considered conventional for the purpose of the present description, the one shown briefly consisting of a vertical frame, in which an inner vertical frame reciprocates and a hydraulic cylinder moves the inner frame to various elevated positions in the outer frame. Mounted on the inner frame is a conventional carriage 32 which moves upwardly and downwardly relative to both the inner and outer frames and is provided with a pair of cross beams 34 and 36 for receiving and supporting the present paper roll attachment 22. Since the present upright is considered conventional and since a number of different types may be used satisfactorily for lifting and lowering the present attachment, the one shown in the drawings will not be further described herein.

The present articulated load handling attachment, which as illustrated in the drawings is adapted to handle paper rolls, consists of an outer frame 40 having side members 42, 44, 46 and 48 connected to one another and forming a rigid structure therewith. The side members are rigidly joined to one another by arcuate plates 50, 52, 54 and 56 at the left and right sides of the outer frame, as viewed in FIGURE 2. An inner frame 60 of generally H-shaped configuration is pivotally mounted in outer frame 40 on rod 62 which forms pivot means 64 and 66 on the left and right sides, respectively, of the outer frame, as viewed in FIGURE 2. The inner frame is of rigid construction consisting of a tubular cross member 68 and two end frame members 70 and 72 rigidly secured to the ends of tubular cross member 68. The pivot means 64 and 66 are offset from the center, as can be readily seen in FIGURES 2 and 4, for reasons which will be more fully explained hereinafter. Each end member 70 and 72 has arms *a* and *b* for supporting gripper pad 80, each arm of the upper and lower end members being pivotally connected to the gripper pad by brackets 82 and 84 which embrace opposite sides of the respective arms and are provided with holes for receiving a pin extending therethrough and through the respective arm.

The gripper pad consists of two lateral section 86 and 88 connected by a hinge means 90 which extends the full length of the gripper pad and permits the two sections to pivot cooperatively on the respective arms of frame 60. The gripper pad is contoured to approximate the external circumference of a standard paper roll and is provided with a gasket structure 92 which divides both sections of the gripper pad into upper, lower and intermediate vacuum chambers 94, 96 and 98, the vacuum chambers being connected to a suitable vacuum tank or pump by conventional lines and connections (not shown). Since the particular gripper pad is not important to the present invention, details of the vacuum operated means will not be described herein; however, normally a pressure pad has, in addition to the gaskets, a number of lugs or members on the internal surface of the pad within the vacuum chambers, for engaging and seating firmly on the roll while the gaskets seal the peripheral edge of the gripper pad and the respective chambers therein. Since the attachment is intended to be used in many operations in the position at which tubular member 62 is horizontal, extensions 100 and 102 are provided on the ends of arms 70*a* and 72*a* to give support to and to limit the movement of the gripper pad in the downward direction when the attachment is in the position illustrated in FIGURES 1 and 2.



The foregoing offset H-frame construction is used in conjunction with a reaction member 104 mounted on the lower part of outer frame 40, and projecting beyond the lower edge thereof. Blade 106 extends the full length of the edge of the outer frame and is supported by arms 108 and 110 bolted to side members 42 and 44, respectively, of the outer frame by two bolts 112 and 114 on each side, thereby rigidly supporting blade 106 in fixed position as an extension of the outer frame. The reaction member projects forwardly as well as downwardly from the outer frame into a position beneath the roll being carried by the attachment, and thereby gives substantial support to the roll. Since the pressure of the roll on the gripper pad tends to pull the roll away from the upper edge of the gripper pad and to apply excessive pressure to the lower edge of the pad, the offset arrangement of the H-frame 60 to a position above the center of the attachment and of the roll minimizes this pressure differential between the upper and lower edges of the pad with the reaction member 104 supporting a substantial portion of the weight of the roll, thereby eliminating or minimizing the tendency of the roll to become accidentally disengaged from the gripper pad. The reaction member also forms a scoop which assists in the proper engagement of the gripper pad and also as a ramp to assist in rolling the roll to its final position when the roll is intentionally released by the gripper pads. The primary function of the reaction member 104, however, is to give support to the roll while it is being lifted and transported in a horizontal position, and this member is conjunction with offset H-frame arrangement above the center of the attachment and lifted roll, provides effective and dependable gripping and holding action on the roll throughout the operation of the lifting and transporting of the rolls from one location to another.

In order to permit the operator to lift and rotate the roll between its horizontal and up-ended positions, a mechanism indicated by numeral 130 for rotating the apparatus through at least 180 degrees is interposed between outer frame 40 and upright 20. A suitable mechanism for performing the rotating operation consists of a rotatable front plate 132 to which outer frame 40 is pivoted by a pin 134 extending through brackets 136 and 138 on one edge of plate 132 and through frame member 46, and a pin 140 extending through brackets 142 and 144 on the opposite edge of plate 132 and through frame member 48. Plate 132 is rotated by a pair of operating cylinders 150 and 152, each having a piston 154 therein with a rack on the inner edge for engaging the teeth on pinion 156, the teeth on said pinion projecting through a longitudinal slot 158 in said cylinders to engage the rack. Movement of the piston in cylinder 150 in one direction and the piston in cylinder 152 in the opposite direction rotates pinion 156 which is rigidly secured to plate 132, and thus rotates the plate to the various angular positions required for positioning the paper roll. The cylinders are rigidly secured to backing plate 160, which in turn is mounted on and secured to cross beams 34 and 36 on carriage 32 of upright 20 by a plurality of lugs 166 secured to backing plate 160 and seating over a shoulder 168 on cross beam 34. The lower portion of the rotating mechanism is secured to the lower cross beam by an arm 170 secured to cross beam 36 by a bolt 172, arm 170 being rigidly joined to base plate 174, which in conjunction with backing plate 160, holds the cylinders firmly in place while the attachment is being rotated to various positions. Plate 132 is rotatably secured to base plate 174 by bearings 178 and 180 at the inner and outer edges, respectively, of the base plate. Plate 132 rotates around base plate 174 as pinion 156 is rotated by the pistons in cylinders 150 and 152, the pinion being rigidly secured to plate 132.

An effective articulated load engaging mechanism is created by the pivotal mounting of inner H-frame **60** on outer frame **40** and the pivotal mounting of outer frame **40** on plate **132** on an axis disposed at right angles to the axis of the pivotal mounting of the inner and outer frames. The pivotal mounting of the two frames and plate **132** permits the load engaging elements readily and effectively to adapt themselves to the load, such as a paper roll, regardless of any small misalignment between the load and load engaging elements.

In the operation of the present load handling apparatus, assuming that the paper roll is lying on its side, as illustrated in FIGURE 1, the attachment is operated to place blade **106** of the reaction member beneath the lower side of the roll and the gripping pads on the upper side of the roll in horizontal position. The operator then moves the truck forwardly until the gripper pads firmly engage the external surface of the roll and the reaction member is in contact with the underside of the roll. The vacuum chambers **94**, **96** and **98** are then connected to a source of vacuum, thereby causing gaskets **92** to seat firmly on the external surface of the roll. With the gripper pad in this position and the roll resting in part on reaction member **104**, the roll can be effectively maneuvered into various positions with little probability of the roll being accidentally displaced by uneven pressures on the gasket on the upper and lower edges of the gripper pad. When the roll has been moved to its new location, the roll is placed near the floor with reaction members spaced slightly thereabove and the vacuum within the gripper pad chambers is relieved, thereby permitting the roll to disengage itself from the gripper pad and to roll down the reaction member with sufficient momentum to carry the roll into the desired location on the floor of a truck, storehouse or railroad car. It is seen that the H-frame construction of the inner frame **60** and the offset relationship of the inner frame with relation to the center of the roll create an effective gripper pad arrangement which eliminates the excessive differential in pressure between the upper and lower edges of the gripper pad. This, in combination with the reaction member, permits the operator to maneuver the roll into various positions without the likelihood of the roll being unintentionally displaced.

While the present load handling attachment has been illustrated in connection with paper rolls, it may be used in handling other cylindrical objects of substantially the same size and shape of paper rolls. While only one embodiment of the present attachment has been described in detail herein, various other changes and modifications may be made without departing from the scope of the invention.

I claim:

**1.** In a lift truck attachment for handling cylindrical objects: a plate rotatable on a horizontal axis, a first rectangular frame pivoted at opposite sides to said plate and being on a plane substantially parallel with the plane of said plate, a second frame having a tubular cross-member pivoted at each end to said first frame on an axis perpendicular to the axis of the pivots of said first frame and offset from the axis of said plate, said second frame having arms extending outwardly from opposite sides thereof adjacent each of its pivot points, a vacuum gripper pad having two sections hinged to one another and being pivotally mounted on corresponding arms of said second frame, and a reaction member secured to said first frame and extending forwardly therefrom on the side of said first frame opposite to the offset of said second frame for supporting the object.

**2.** In a lift truck attachment for handling cylindrical objects: a plate rotatable on a horizontal axis, a base for rotatably supporting said plate on said carriage, means for mounting said base on said carriage, a power means on said base for rotating said plate, a first rectangular frame pivoted at opposite sides to said plate and being on a plane substantially parallel with the plane of said plate, a second frame having a tubular cross-member pivoted at each end to said first frame on an axis perpendicular to the axis of the pivots of said first frame and offset vertically from the axis of said plate, said second frame having arms extending outwardly from opposite sides thereof adjacent each of its pivot points, a vacuum gripper pad having two sections hinged to one another and being pivotally mounted on corresponding arms of said second frame, a reaction member secured to said first frame and extending forwardly therefrom on the side of said first frame opposite to the offset of said second frame for supporting the object, said reaction member having a blade for receiving and supporting the object, and movement limiting means for said pad on the ends of the two arms on said second frame extending toward said reaction member.

**3.** In a lift truck attachment for handling cylindrical objects: a plate rotatable on a horizontal axis, a first rectangular frame pivoted at opposite sides to said plate and being on a plane substantially parallel with the plane of said plate, a second frame having a tubular cross-member pivoted at each end to said first frame on an axis perpendicular to the axis of the pivots of said first frame and offset from the axis of said plate, said second frame having arms extending outwardly from opposite sides thereof adjacent each of its pivot points, a vacuum gripper pad having two sections hinged to one another, each section being pivotally mounted on corresponding arms of said second frame, and movement limiting means for said pad on the ends of the two arms of said second frame extending in the direction opposite said offset.

**4.** In a lift truck attachment for handling cylindrical objects: a plate rotatable on a horizontal axis, a first rectangular frame pivoted at opposite sides to said plate and being on a plane substantially parallel with the plane of said plate, a second frame having a tubular cross-member pivoted at each end to said first frame on an axis perpendicular to the axis of the pivots of said first frame and offset from the axis of said plate, said second frame having arms extending outwardly from opposite sides thereof adjacent each of its pivot points, and a vacuum gripper pad having two sections hinged to one another and being pivotally mounted on corresponding arms of said second frame.

**5.** In a lift truck attachment for handling cylindrical objects: a plate rotatable on a horizontal axis, a first frame pivoted at opposite sides to said plate and being on a plane substantially parallel with the plane of said plate, a second frame of H-configuration pivoted to said first frame on an axis perpendicular to the axis of the pivots of said first frame and offset from the axis of said plate, a vacuum gripper pad having two sections hinged to one another, each section being pivotally mounted on corresponding arms of said second frame, and a reaction member secured to said first frame and extending forwardly therefrom on the side of said first frame opposite to the offset of said second frame, said reaction member having a blade for receiving and supporting the object.

**6.** In a lift truck attachment for handling cylindrical objects: a plate rotatable on a horizontal axis, a base for rotatably supporting said plate on said carriage, means for mounting said base on said carriage, a power means on said base for rotating said plate, a first frame pivoted at opposite sides to said plate and being on a plane substantially parallel with the plane of said plate, a second frame of H-configuration pivoted to said first frame on an axis perpendicular to the axis of the pivots of said first frame and offset from the axis of said plate, and a vacuum gripper pad having two sections hinged to one another and being pivotally mounted on corresponding arms of said second frame.

**7.** In a lift truck having an upright, an attachment for handling cylindrical objects mounted on and forwardly

of the upright comprising a support means rotatable in a vertical plane about a central horizontal axis, a first frame pivoted at opposite sides to said rotatable support means on an axis substantially transverse to said horizontal axis and being mounted in a plane normally parallel with the plane of said support means, a second frame pivoted to said first frame on an axis substantially transverse to the axis of the pivots of said first frame and offset from the axis of said support means, and a vacuum gripper pad pivotally mounted on said second frame.

8. In a lift truck having an upright, an attachment for handling cylindrical objects mounted on and forwardly of the upright comprising a support means rotatable in a vertical plane about a central horizontal axis, a first frame pivoted at opposite sides to said rotatable support means on an axis substantially transverse to said horizontal axis and being mounted in a plane normally parallel with the plane of said support means, a second frame pivoted to said first frame on an axis substantially transverse to the axis of the pivots of said first frame and offset from the axis of said support means, and means on said second frame for engaging and lifting the object.



9. In a lift truck having an upright, an attachment for handling cylindrical objects mounted on and forwardly of the upright comprising a support means rotatable in a vertical plane about a central horizontal axis, a first frame pivoted at opposite sides to said rotatable support means on an axis substantially transverse to said horizontal axis and being mounted in a plane normally parrallel with the plane of said support means, and a second frame pivoted to said first frame on an axis substantially transverse to the axis of the pivots of said first frame and offset from the axis of said support means.

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