United States Patent [19]

Creskoff

[11] **3,833,251**

[45] **Sept. 3, 1974**

[54] **LONGITUDINALLY STIFFENED FLEXIBLE LIFTER FOR ARCUATE OBJECTS**

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[73] Assignee: **Aerovac Corporation,** Bala-Cynwyd, Pa.

[22] Filed: **Oct. 6, 1972**

[21] Appl. No.: **295,634**

[52] **U.S. Cl.** ..... **294/64 R,** 294/65

[51] **Int. Cl.** **B66c 1/02**

[58] **Field of Search**..... 294/64 R, 65; 214/650 SG, 214/8.5 D; 248/206, 362, 363

[56] **References Cited**

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Attorney, Agent, or Firm—Caesar, Rivise, Bernstein & Cohen

[57] **ABSTRACT**

A vacuum lifter is provided for arcuately shaped objects which includes a flexible sheet having opposed parallel surfaces. A supporting member is connected to one surface of the sheet and a resilient sealing gasket is connected to the opposing surface of the sheet about the periphery thereof. A source of vacuum is provided and the sheet has a port through which the vacuum source communicates. Stiffening means are connected to the flexible sheet to prevent bending of the sheet about a line extending at an angle transverse to the longitudinal extent of the plate. The lifter is secured to an arcuate object by placing the gasket against the outer surface of the object so that a partial vacuum is formed in the compartment formed between the outer surface of the object, the sheet and the gasket. The sheet accomodates a range of diameters of arcuate objects by bending around its longitudinal axis to conform to the diameter of the objects.

7 Claims, 5 Drawing Figures

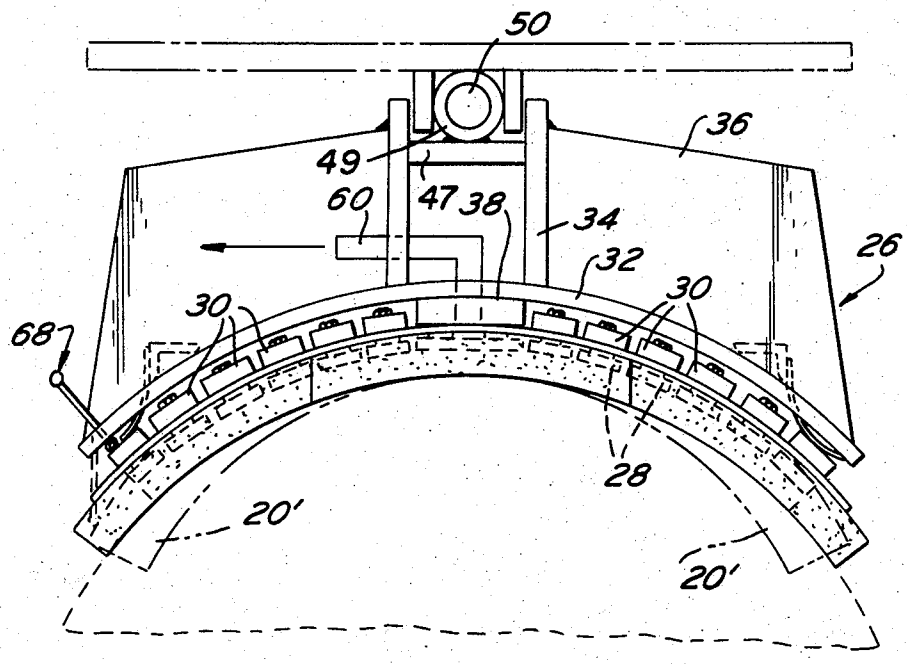


FIG. 1

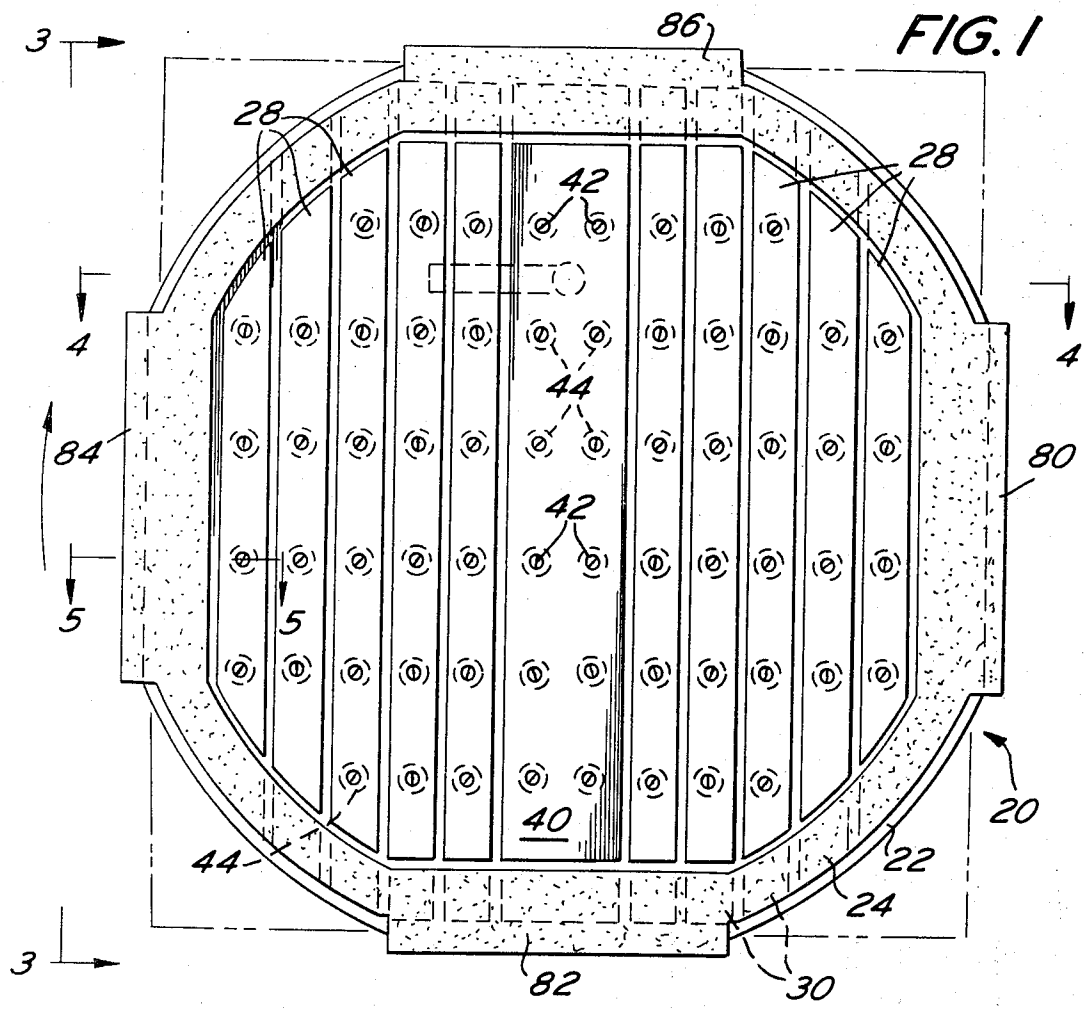

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FIG. 2

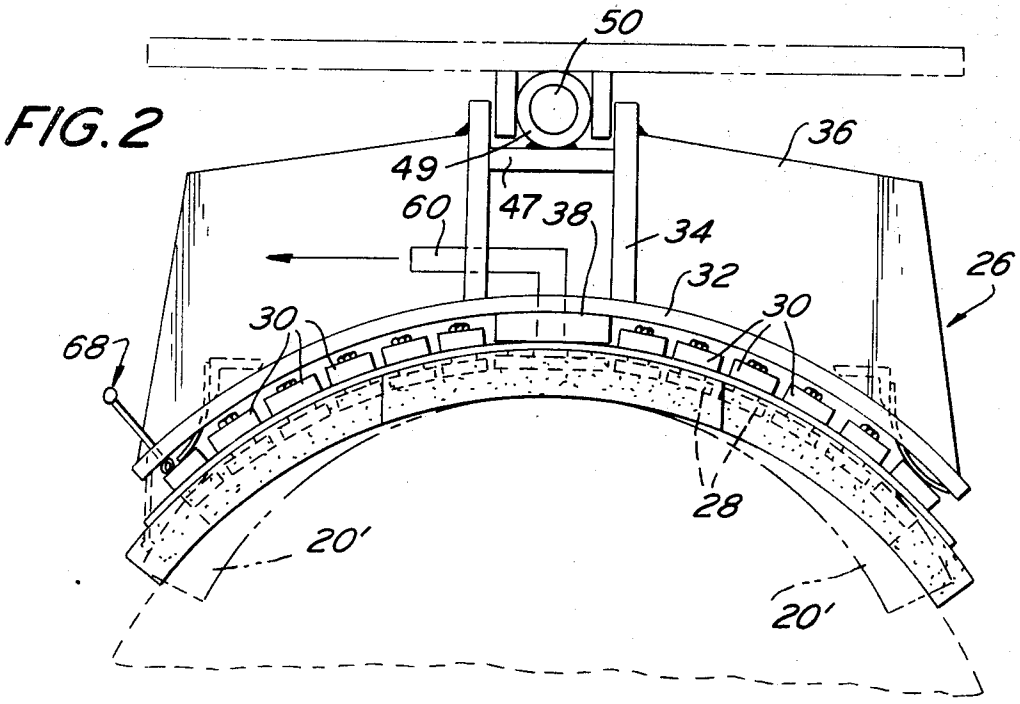
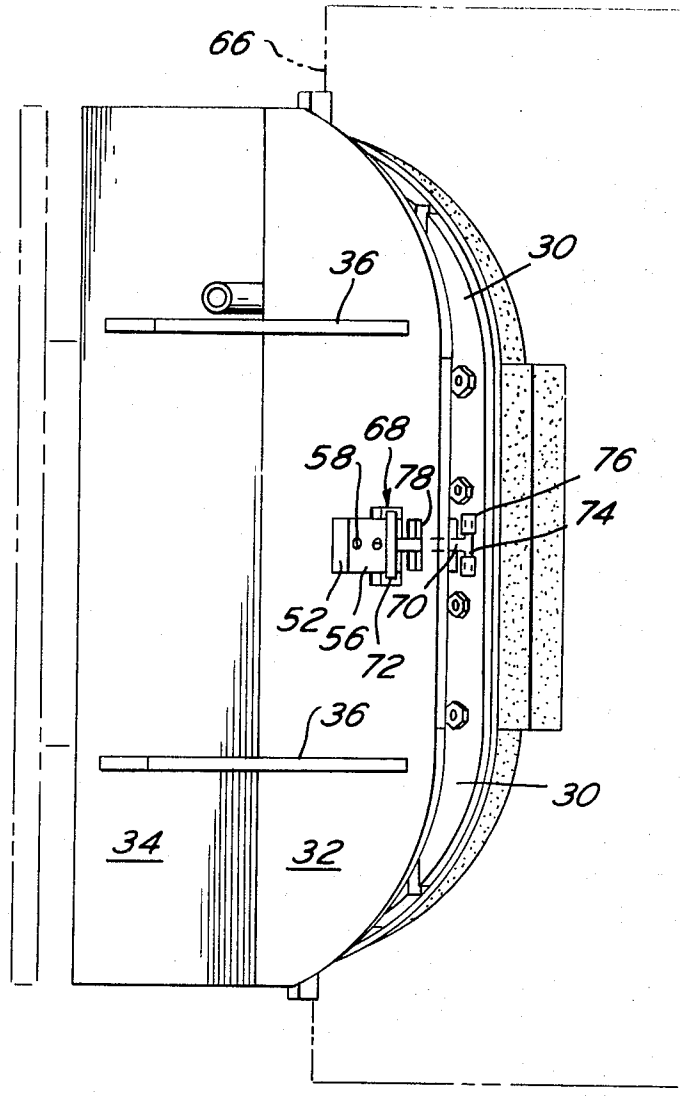

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FIG. 3



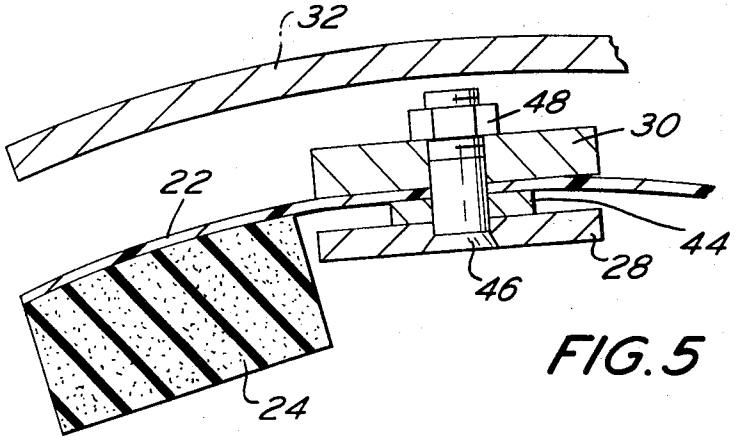


FIG. 5

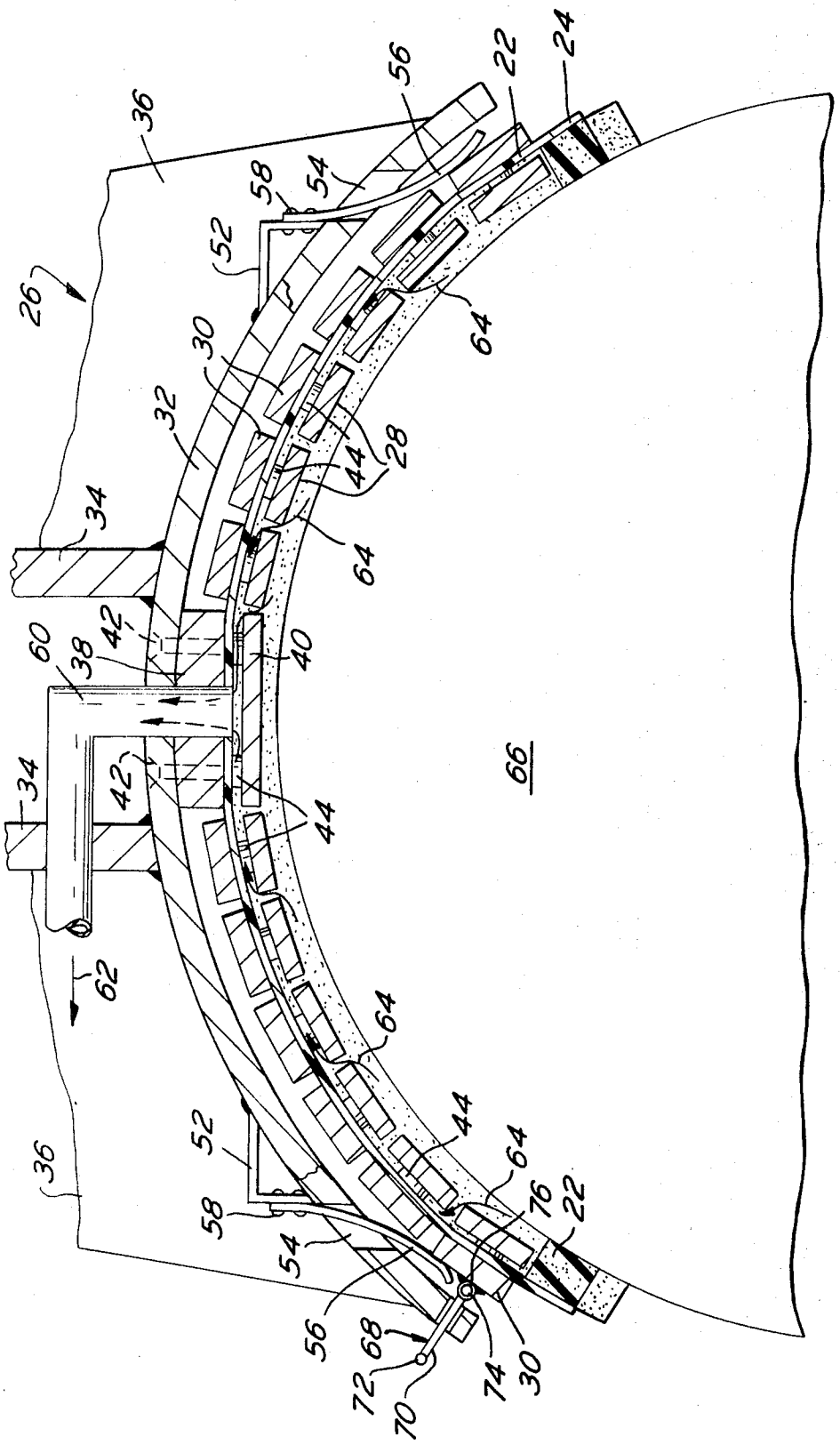

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FIG. 4

LONGITUDINALLY STIFFENED FLEXIBLE LIFTER FOR ARCUATE OBJECTS

This invention relates generally to vacuum lifters and more particularly to a flexible lifter which is longitudinally stiffened to enable its use for cylindrical or arcuate objects such as newsprint rolls.

One of the most difficult handling problems for stevedores in loading and unloading cargo ships, trailers and other formes of conveyance are newsprint rolls which are generally in a weight range of 1,000 pounds to 3,000 pounds and are cylindrically shaped having a diameter ranging from approximately 36 inches to 44 inches. At present, newsprint rolls are normally loaded and unloaded by use of fork lift trucks having clamping devices which embrace the newspaper roll and are then clamped tightly against the outer surface to frictionally engage the roll while lifting the roll and moving it from one place to another. In order to frictionally engage the newsprint roll the clamping surfaces are of necessity abrasive to permit slippage of the newsprint roll when the roll is lifted and lowered. The lifting and lowering stresses as well as the abrasive surface of the lifters often causes damage to the newsprint roll. In addition, unless the roll is standing on one of its planar edges, it is difficult for the clamping device to get underneath the roll in order to embrace and carry the roll.

It is therefore an object of the invention to overcome the aforementioned disadvantages of the prior lifting devices.

Another object of the invention is to provide a new and improved lifting attachment for use on fork lifting trucks which will enable newsprint rolls to be easily handled and which will withstand the operational shocks and prevent damage to the newsprint rolls.

Yet another object of the invention is to provide a new and improved lifting attachement for use on fork lift trucks which will facilitate the handling of newprint rolls whether the newsprint roll is standing on its planar or cylindrical surface.

Still another object of the invention is to provide a new and improved flexible lifter which is stiffened longitudinally to enable securement of the flexible lifter to the object to be lifted from a lateral disposition.

Still another object of the invention is to provide a new and improved flexible lifter attachment which can be utilized by fork lift trucks and other conveyance devices which are secured to an object from a lateral position.

These an other objects of the invention are achieved by providing a new and improved vacuum lifter for arcuately shaped objects which comprises a flexible sheet having opposed parallel surfaces.

The sheet has a supporting member connected to one surface of the sheet and a resilient gasket connected to the opposing surface of the sheet about its periphery thereof. A source of vacuum is provided which is connected through a port in the sheet. A stiffening means is provided which is connected to the flexible sheet to prevent bending of the sheet about a line extending at an angle transverse to the longitudinal extent of the sheet. The lifter is secured to an arcuate object by placing the gasket against the outer surface of the object so that a partial vacuum is formed in the compartment formed between the outer surface of the object, the sheet and the gasket. The sheet accomodates a range of diameters of arcuate objects by bending around the longitudinal axis to conform to the diameter of the object.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein;

FIG. **1** is a front elevational view facing the gasket side of the vacuum lifter;

FIG. **2** is a top plan view of the lifter;

FIG. **3** is a side elevational view of the lifter;

FIG. **4** is an enlarged sectional view taken along the line **4—4** in FIG. **1**; and

FIG. **5** is an enlarged fragmentary sectional view taken along the line **5—5** in FIG. **1.**

Referring now in greater detail to the various figures of the drawing wherein like reference numerals refer to like parts, a flexible vacuum lifter embodying the invention is shown generally at **20** in FIG. **1.**

As seen therein, the flexible lifter **20** basically comprises a flexible sheet **22** having a pair of opposed parallel surfaces a sealing gasket **24,** a supporting member **26** (FIG. **2**) and longitudinal stiffening means comprising a plurality of narrow longitudinally extending plates **28** connected to the front surface of sheet **22** and similar plates **30** connected to the rear surface of the sheet **22.**

The sealing gasket **24** is connected about the periphery of the front surface of the sheet **22** and is preferably comprised of a resilient deformable closed cell material such as neoprene. The flexible sheet **22** preferably comprises a thin sheet of polyurethane but may also be formed of other suitable high tensile strength flexible materials such as neoprene or metal.

The supporting member **26** as best seen in FIG. **4** basically comprises a cylindrically arcuate supporting plate **32,** a pair of transversely extending lifting bars **34,** which are suitably welded to the supporting plate **32,** and a plurality of integrally formed planar ribs **36** which extend transversely to the plane of arcuate lifting plate **32** and lifting bars **34.** A supporting bar **38** is interposed between the supporting plate **32** and the flexible sheet **22.** A similar supporting bar **40** disposed adjacent the front surface of the flexible sheet aligned with the supporting bar **38** and centrally of the flexible sheet **22** is also provided. A plurality of suitable fastening elements **42** extend through the supporting plate **32,** supporting bars **38,** sheet **22** and bar **40** to secure a sheet to the supporting member **26.**

As best seen in FIG. **1,** the stiffening plates **28** extend longitudinally of the flexible lifter and are transversely spaced along the transverse extent of the front surface of the sheet **22.** As best seen in FIG. **2,** the longitudinally extending plates **30** extend parallel to and are aligned with corresponding plates **28** on the opposing surface of sheet **22.** The plates **30** also extend longitudinally and parallel to a supporting bar **38.**

As best seen in FIG. **5,** each of the plates **28** includes a plurality of washers **44** which are spaced along the length of the plate **29.** Each of the washers **44** are preferably welded to the plates **28** and are aligned with an opening through which a suitable threaded fastener **46** extends. A similar plurality of openings are provided in plate **30** which are aligned with plates **28** so that fastener **46** can be telescoped through the plate **28,** the washer **44,** the plate **30** and then suitable secured to a nut **48** on the opposite side of plate **30.** The head of the

fastener **46** is preferably countersunk so that the front surfaces of plates **28** are completely flush and do not provide an abrasive surface which can abut the newsprint rolls.

Referring to FIG. **2**, it should be noted that supporting member **26** further includes a bridging plate **47** which is integrally connected between lifting bars **34** and is integrally welded to a collar **49** which is journalled over a lifting pin **50** of a fork lift truck (not shown).

The support mechanism for supporting the lifter **20** is shown in phantom in FIGS. **1** and **2**. The supporting mechanism is preferably of the type that rotates 90° about the horizontal axis extending longitudinally of the truck and centrally through the center of the support mechanism. The support mechanism of the truck may also rotate 360° about the same axis.

As best seen in FIG. **4** a pair of L-shaped brackets **52** are secured to the rear of the support plate **32** preferably by welding. The brackets **52** are mounted adjacent a pair of longitudinally extending slots **54** which extend through the supporting plate **32**. Both of the brackets **52** support a leaf spring **56** which extend through openings **54** and are secured to the brackets **52** by suitable fasteners **58**. The leaf springs **56** act to urge the flexible lifter to its smallest diameter which is shown in phantom at **20'** in FIG. **2**.

Referring to FIG. **4**, it can be seen that plates **40, 38** and **32** as well as the sheet **22** includes an opening through which one leg of an L-shaped pipe **60** extends. Pipe **60** is connected to a suitable source of vacuum as indicated by arrow **62** in FIG. **4**. The preferred source of vacuum is reservoir tank which is in turn connected to a suitable vacuum pump.

The plates **28** which act as stiffening members also act in combination with washers **44** to distribute the vacuum uniformly through the entire front surface area of the flexible lifter **20**. That is, the washers **44** space the major portion of plates **28** from the front surface of sheet **22**. Accordingly, as is indicated by arrows **64** in FIG. **4**, air can readily pass beneath the plates **28** past the washers **44** even when the resilient gasket **24** is deformed so that the plates **28** rest against the outer surface of an object being lifted.

As best seen in FIG. **4**, a suitable cylindrical object such as a newsprint roll **66** can be secured to the lifter **20** by disposing the gasket **24** against the outer periphery of the roll **66**. Suitable valves are then opened to connect the port provided in the sheet **22** by pipe **60** to the source of vacuum and thereby cause a reduced pressure within the compartment formed between the outer surface of the roll **66**, the gasket **24**, and the front surface of sheet **22**. Once the gasket **24** has been properly seated, a partial vacuum is formed very quickly within this compartment and thereby enables the flexible lifter to be so secured to the roll **66** as to easily enable the lifting of the newsprint roll **66**.

As best seen in FIGS. **3** and **4**, a limiting member **68** is provided on the leftmost (as seen in FIG. **4**) stiffening plate **30** of the flexible lifter. The limiting member **68** basically comprises a pin **70** having a pair of transversely extending end pins **72** and **74** which are integrally secured at the ends of pin **70**. Pin **70** is connected centrally of the end pins **72** and **74**.

The end pin **74** is suitably journalled in a pair of annular collars **76** which are preferably welded to plate **30**. Pin **70** extends through a slot **78** in the plate **32**. The pin **70** is thus pivotable around an axis through pin **74** which is journalled in collars **76**. The maximum separation of the plate **30** from plate **32** is limited by pin **72** which abuts the rear surface of plate **32** when plate **30** is moved with the flexible lifter **20** to the position shown in phantom at **20'** in FIG. **2**. The limiting member **68** is provided so that the flexible lifter **20** may be used not only as shown in FIGS. **1** through **5** where the longitudinal plates **28** and **30** extend vertically but also when the lift truck rotates the flexible lifter to a position where the longitudinal plates **28** and **30** extend horizontally.

When the plates **28** and **30** extend horizontally, the limiting member **68** is at the uppermost end of the flexible lifter and prevents the weight of plates **28** and **30** from causing the upper portion of the flexible sheet to be bent to a diameter which is too small to fit over a cylindrical object. That is, the weight of the plates could cause the flexible sheet to curl over which prevents the gasket from being properly seated without the limiting member **68**.

As best seen in FIG. **1**, the sealing gasket **24** has four enlarged portions **80, 82, 84** and **86**. The portions **80, 82, 84** and **86** which extend outwardly of the periphery of the remaining portion of the gasket **24** are not adhesively secured to the front surface of the sheet **22** as is the remaining portion of the gasket. The enlarged portions **80, 82, 84** and **86** are provided where the vacuum lifter **20** can be rotated 360° about an axis extending horizontally and transversely to the center plate **40**. In most lift trucks where there is only 90° of rotation, only two enlarged portions of the gasket need be provided. For example, in FIG. **1** only portions **84** and **86** would be required since these would be the portions of the gasket which are in the uppermost position when the flexible lifter is seated against the outer surface of an object to be lifted.

The enlarged portions of the gasket are therefore provided because as the arcuate object is picked up off the ground, the maximum unseating stress comes at the uppermost portion of the gasket and the extra portion of the gasket acts to prevent the unseating at its most vulnerable spot.

It can therefore be seen that a new and improved flexible lifter has been provided for lifting arcuate objects. The stiffening members comprised of plates **28** and **30** act to enable the flexible sheet **22** to be arcuately bent only about a longitudinally extending line. Similarly, the stiffening members prevent the bending of the flexible sheet about a line transverse to the longitudinal extent of the lifter.

In operation the flexible lifter **20** is used in combination with a truck having a supporting system which is capable of raising and lowering as well as rotating the flexible lifter **20**. In its typical utilization the flexible lifter is urged laterally towards an object which is to be lifted and as soon as the gasket is substantially seated the source of vacuum is connected to the vacuum compartment formed between the gasket and the flexible sheet **22**. As soon as the gasket is seated, the compartment is closed by the outermost surface of the object.

As set forth above, a newspaper roll may be attached to the flexible lifter when the roll is either in a vertical or horizontal position. When the roll is in a vertical position the flexible lifter is laterally moved to substantially the center of the roll and laterally engages the roll as set forth above.

Similarly, when the roll is on its side, the lifter **20** is rotated to a position 90° from the position shown in FIG. **1** and is lowered so that the lifter plate **40** is substantially aligned with the center of the roll. The lifter **20** is moved laterally towards the roll and as soon as the gasket is substantially aligned with the roll the source of vacuum is connected to the compartment formed between the gasket **24,** the outer surface of the roll and the front surface of sheet **22.** As soon as the partial vacuum is formed in this compartment, the newspaper roll can be lifted and transported as desired. To remove the roll from the lifter, a suitable valve is opened to restore atmosphere pressure to the lifter compartment.

Without further elaboration, the foregoing will so fully illustrate my invention that others may, by applying current or future knowledge, readily adapt the same for use under various conditions of service.

What is claimed as the invention is:

1. A vacuum lifter for arcuately shaped objects comprising a flexible sheet which is formed of a flexible material and has opposed parallel surfaces and a source of vacuum, said sheet having a port through which said vacuum source communicates, a supporting member connected to one surface of said sheet, a resilient sealing gasket connected to the opposing surface of said sheet about the periphery thereof, and stiffening means connected to said flexible sheet to prevent bending of said sheet about a line extending at an angle transverse to the longitudinal extent of said sheet, said stiffening means comprising a plurality of closely spaced longitudinally extending plates provided along the entire transverse extent of said flexible sheet, said lifter being secured to an arcuate object by placing said gasket against the outer surface of said object so that a partial vacuum is formed in the compartment formed between the outer surface of said object, said sheet and said gasket, said sheet accommodating a range of diameters of arcuate objects by bending around its longitudinal axis to conform to the diameter of said object.

2. The vacuum lifter of claim **1** wherein said closely spaced longitudinally extending plates are connected to the front and rear surfaces of the flexible sheet.

3. The vacuum lifter of claim **2** wherein the longitudinally extending plates connected to the side of said sheet that said gasket is connected each have spacing means connected between the plates and said sheet, said spacing means enabling a uniform distribution of the partial vacuum in the compartment formed between an object to be lifted, the gasket and said flexible sheet.

4. The vacuum lifter of claim **1** wherein said gasket includes an enlarged portion on one side of said lifter, said enlarged portion being provided on the uppermost edge of said lifter when said lifter engages an object to be lifted, said enlarged portion being integral with said gasket and movable with respect to said sheet so that said portion provides a fortified sealing area when said object is lifted.

5. A vacuum lifter for arcuately shaped objects comprising a flexible sheet having opposed parallel surfaces and a source of vacuum, said sheet having a port through which said vacuum source communicates, a supporting member connected to one surface of said sheet, a resilient sealing gasket connected to the opposing surface of said sheet about the periphery thereof, and stiffening means connected to said flexible sheet to prevent bending of said sheet about a line extending at an angle transverse to the longitudinal extent of said sheet, said lifter being secured to an arcuate object by placing said gasket against the outer surface of said object so that a partial vacuum is formed in the compartment formed between the outer surface of said object, said sheet and said gasket, said sheet accommodating a range of diameters of arcuate objects by bending around its longitudinal axis to conform to the diameter of said object, said supporting member including an arcuate plate which is connected centrally to said flexible sheet, said arcuate plate including means for urging the transverse ends of said lifter in an arcuate shape to facilitate seating of the gasket against an arcuate object.

6. The vacuum lifter of claim **5** wherein said means for urging includes a pair of leaf springs which extend through said arcuate plate and urge the outermost edges of said flexible sheet inwardly, said springs enabling said transverse ends of said lifter to be resiliently flexible when said edges engage an object to be lifted.

7. The vacuum lifter of claim **1** and further including limiting means provided on at least one of said transverse edges of said lifter, said limiting means acting to prevent more than a predetermined spacing between said flexible lifter and said support means.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,833,251 Dated September 3, 1974

Jacob J. Creskoff

It is certified that errors appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

(1) Column 1, line 21: "premit" should be --prevent--.

(2) Column 2,line 60: "plate 29" should be--plate 28--.

(3) Column 3,line 33: "is reservior" should be--is a reservior--.

Signed and sealed this 5th day of November 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents