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Goodwin

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[54] **LATCHING SYSTEM**

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[73] Assignee: **McDonnell Douglas Corporation,** Santa Monica, Calif.

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[52] **U.S. Cl.** ..... **248/361 R**

[51] **Int. Cl.** **B65d 19/38**

[58] **Field of Search** ..... 248/361 R, 119 R; 292/DIG. 46, 280, 216, 210; 105/366 C, 366 D

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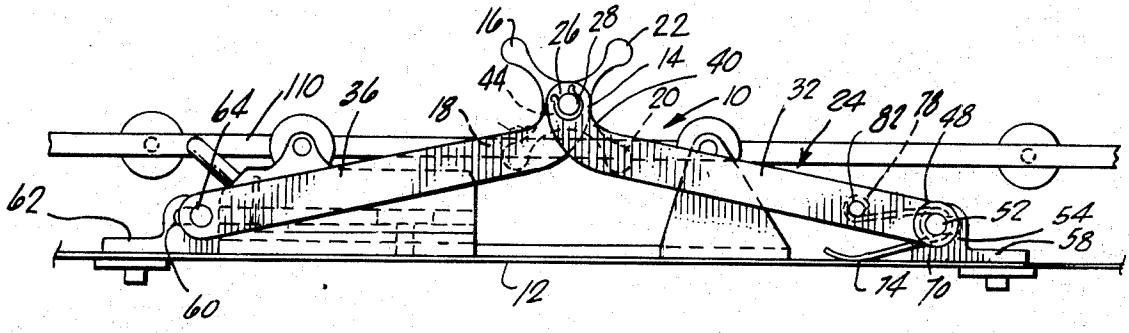
Primary Examiner—Edward C. Allen

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[57] **ABSTRACT**

An automatic latching system for pallets and the like including latching devices, each arranged so a pallet can move thereover to depress an upwardly biased star wheel until a pallet is positioned on one or both sides of the latching device, at which time the spokes of the upwardly extended star wheel hold and restrain the pallets from vertical and horizontal movement.

8 Claims, 6 Drawing Figures



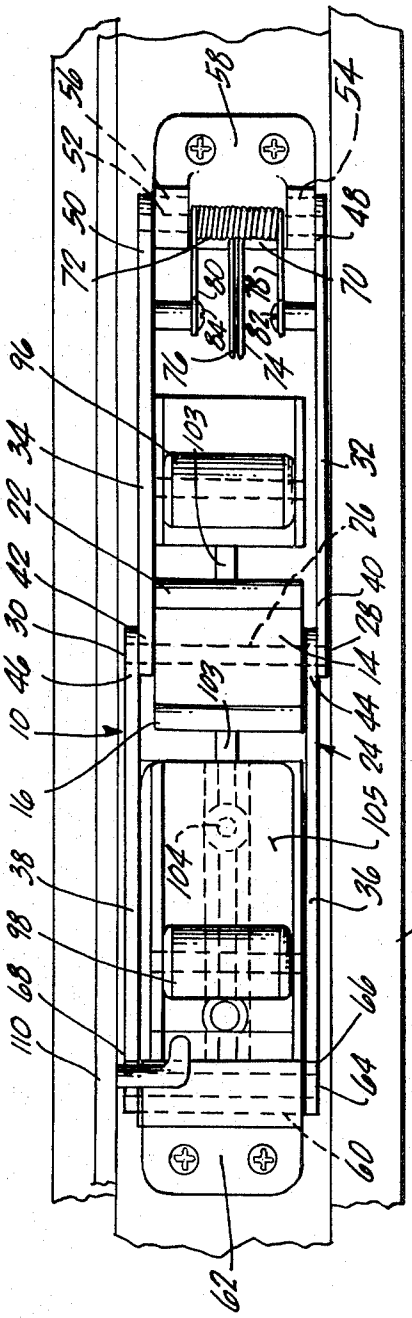


Fig. 1

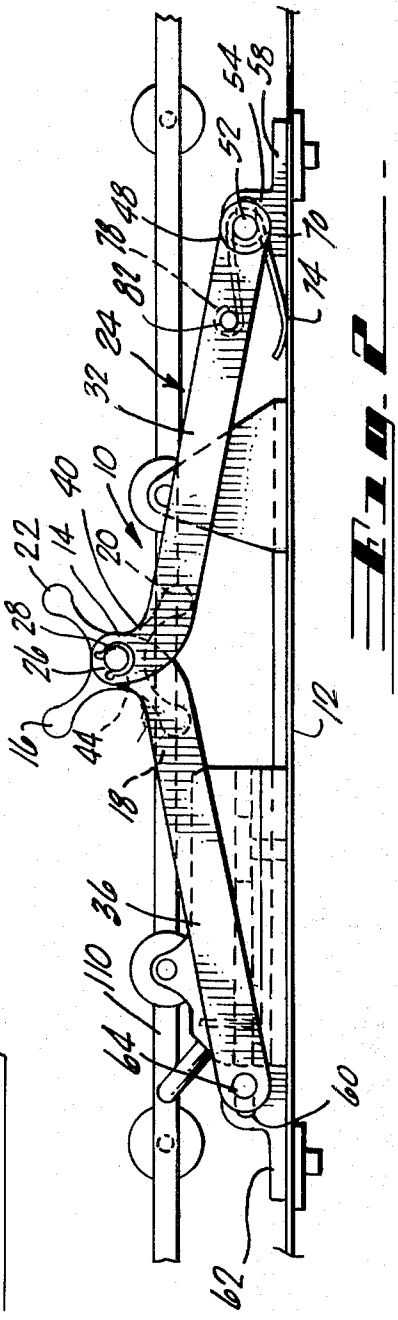


Fig. 2

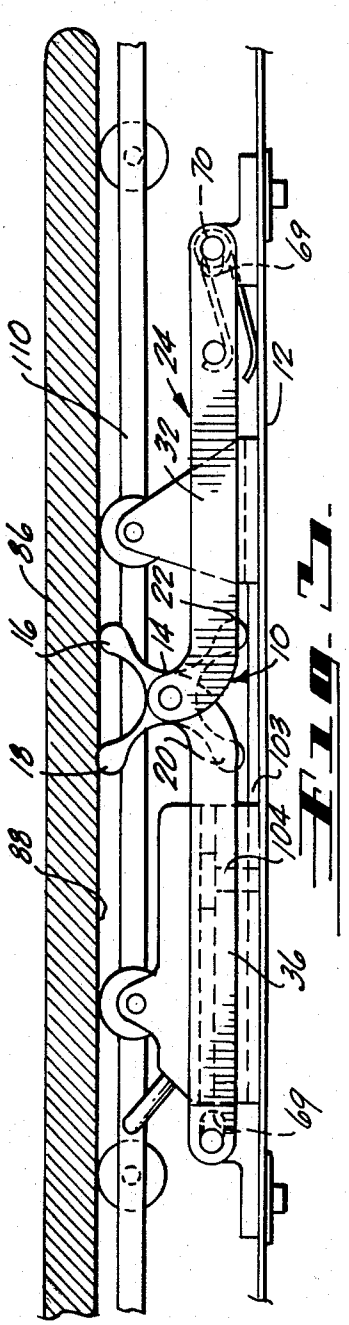


FIG. 5

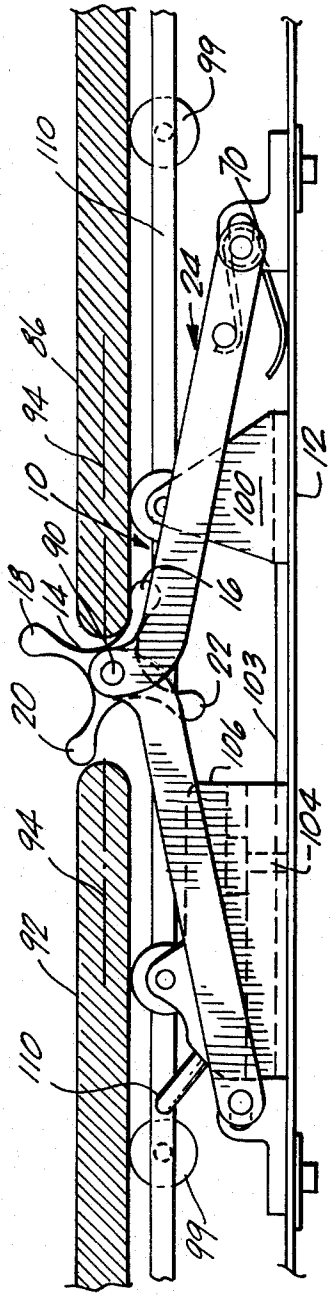


FIG. 6

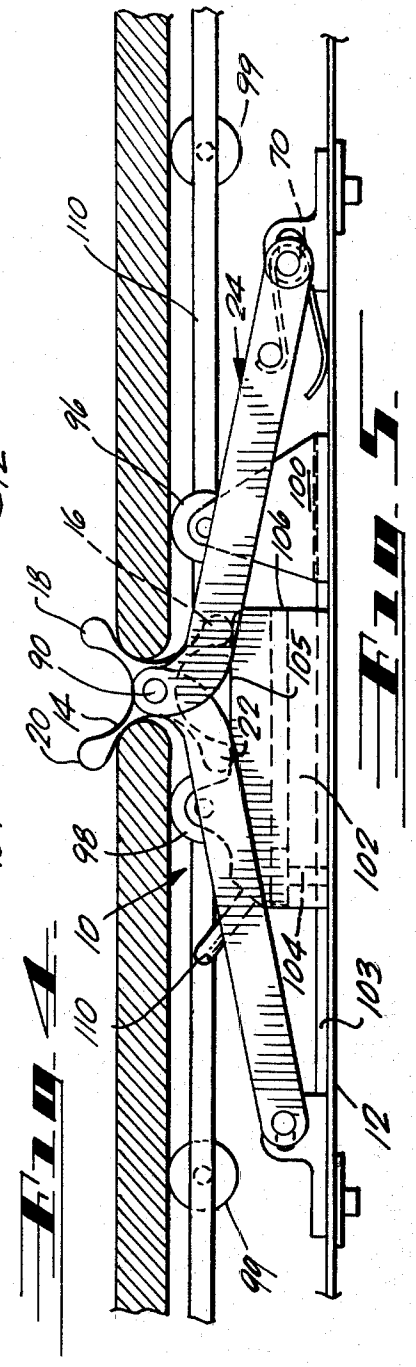


FIG. 7

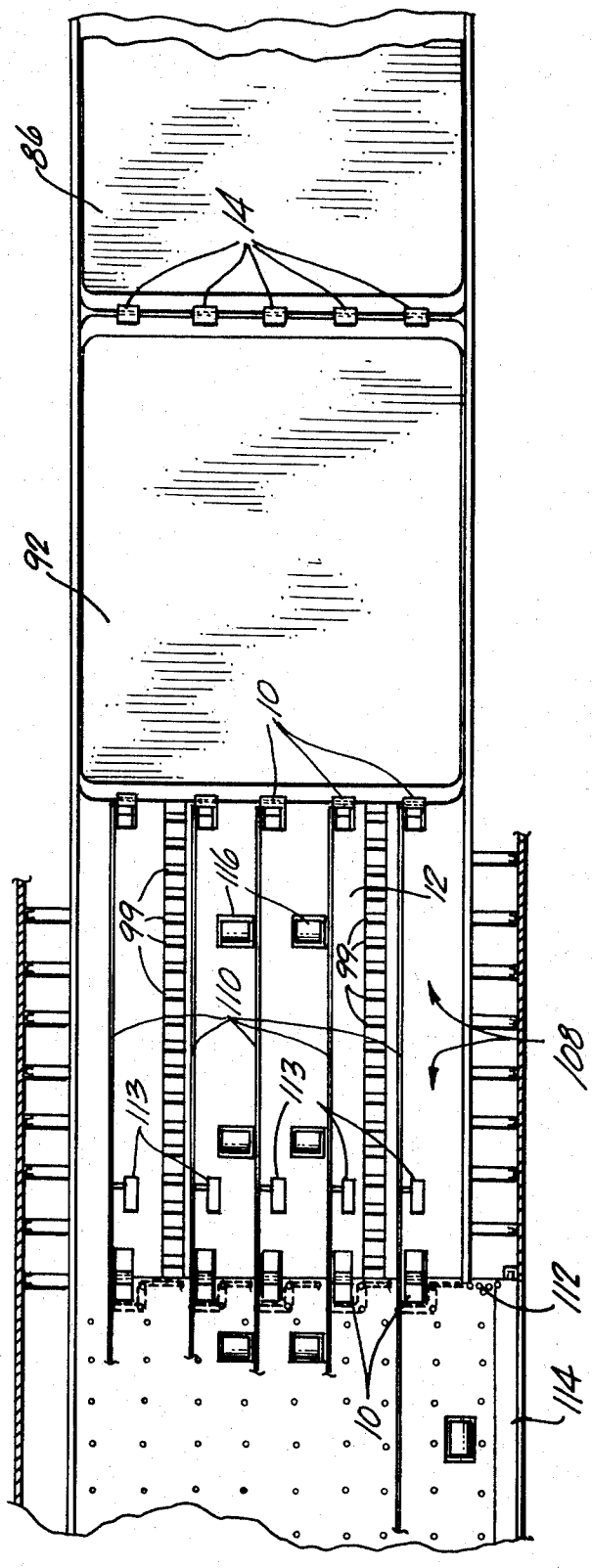


Fig. 6

LATCHING SYSTEM

BACKGROUND OF THE INVENTION

Most of the prior art pallet latches for restraining pallets from fore, aft, and vertical movement are not usable in automatic powered loading systems. This is because the prior art latches must be manually actuated to latch or unlatch the pallets in place. The few prior art automatic latches are complicated, heavy and expensive and include special spring and cam arms actuated by the pallet or other power actuated means to raise and lower retention means for the latch. In addition, such automatic latches have not proved to be fail indicative. Therefore, even though they are designed to work automatically, personnel must be present to assure that the latches are operating properly. This defeats one of the primary objects of such latches which is to reduce the manpower required to handle cargo. Also, it makes such latches unsuitable for use with automated systems for loading containers and pallets in a tunnel, such as the belly of an aircraft, where no space is available to allow a man to move past the loaded pallets for inspection of the latches in use.

SUMMARY OF THE INVENTION

The present invention solves the problems heretofore unsolved by the prior art latches by providing a system employing automatic latches which are lightweight, inexpensive and in the remote chance of failure, indicate such failure so that aircraft in which they are used are never endangered by loose pallets. The present latches provide vertical and horizontal restraint to a pallet, automatically lower as each pallet goes by and then rebound to raised positions that enable the restraint of pallets forward and/or aft of the latches.

Each latch includes a four spoke star wheel which is mounted for rotation on an upwardly biased linkage assembly. A pallet moving over the latch contacts a spoke of the star wheel, rotates it and pushes the star wheel beneath the pallet. Bias means associated with the star wheel supporting linkage assembly force two of the spokes up against the bottom of the pallet. As the trailing edge of the pallet travels over the latch, the bias means force the star wheel upward to pivot about the end of the pallet and regain its raised position. Once the star wheel has been pivoted to the raised position, it is in proper attitude to latch the forward and aft pallet or to again pivot out of the way as a pallet is moved thereover. When pallets are in position on both sides of the star wheel, it is fixed thereby to restrain the pallets. In addition, once one or two pallets have been positioned in engagement with the star wheel of the latch, a safety lock can be moved to assure that the star wheel is locked in its pallet restraining position. The safety lock can only be moved to its locking position when the star wheel is in its proper pallet restraining position. It is preferable that positive means are provided to connect the safety locks of associated latches together so the failure to latch of one or more of the latches is immediately discoverable through the impossibility of moving the positive lock connecting means to a predetermined locked position.

It is therefore an object of the present invention to provide an automatic latching system for pallet assemblies in aircraft.

Another object is to eliminate the need for manual manipulation or inspection of latches within an aircraft.

Another object is to provide an automatic latch which can be used to restrain pallet assemblies and the like within a tunnel configuration where access to the latch is limited once the loaded pallet assemblies have been positioned therein.

Another object is to provide an automatic latch which is fail indicating, economical, reliable and which is not substantially heavier than conventional manual latches for such pallets.

These and other objects and advantages of the present invention will become apparent after considering the following detailed specification which covers a particular embodiment of the present invention in conjunction with the accompanying drawings wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of the latching device of the present latch system invention;

FIG. 2 is a side view of the latching device of FIG. 1 in position to receive pallet assemblies;

FIG. 3 shows the latching device of FIG. 2 with a pallet assembly moving thereover;

FIG. 4 is a side view of the latching device of FIG. 2 with its star wheel in the worst possible condition during the latching of two adjacent pallet assemblies;

FIG. 5 is a side view of the latching device of FIG. 2 in a locked condition, restraining two adjacent pallet assemblies; and

FIG. 6 is a plan view of the floor of an aircraft fuselage with a latching system constructed according to the present invention installed therein.

DESCRIPTION OF THE PRESENT EMBODIMENT

Referring to the drawings more particularly by reference numbers, number **10** in FIGS. **1** and **2** denotes an automatic latching device constructed according to the present invention installed in the floor **12** of an aircraft. The latch **10** includes a star wheel **14** having spokes **16, 18, 20** and **22.** The star wheel **14** is mounted for rotation on an upwardly biased linkage assembly **24** by means of a shaft **26** which is held in place by means such as spring keepers **28** and **30.** The linkage assembly **24** includes link arms **32, 34, 36** and **38** which are connected together by the shaft **26** at their upper ends **40, 42, 44** and **46,** respectively. The ends **40, 42, 44** and **46** of the link arms **32, 34, 36** and **38** extend upwardly so that the arms cannot interfere with the action of the star wheel **14** to be described hereinafter. The opposite ends **48** and **50** of the link arms **32** and **34,** respectively, are connected together by means of a shaft **52** which extends therebetween and is partially restrained in horizontally slotted openings **54** and **56** in a bifurcated base member **58.** A horizontally slotted opening **60** in an opposite base member **62** partially restrains a shaft **64** connecting the opposite ends **66** and **68** of links **36** and **38** in a similar manner. The inboard ends **69** (FIG. **3**) of the slotted openings **54, 56** and **60** serve as stops to take all fore, aft and upward loads and to position the star wheel **14** at the correct locking height. The base members **58** and **62** are connected to the floor structure **12** and the slotted openings **54, 56** and **60,** provide clearance so the link arms, **32, 34, 36** and **38** along with their connected star wheel **14** can be depressed downwardly against the upward biasing action of a pair of springs **70** and **72** connected about the shaft **52.** Ends **74** and **76** of the springs **70** and **72** are restrained by the floor structure **12** while the other ends

thereof, 78 and 80, are connected to the link arms 32 and 34 by means of inwardly extending rods 82 and 84.

As shown in FIG. 3, the moving of a pallet 86 over the latch 10 causes engagement between the pallet 86 and one of the spokes 16. This causes the star wheel 14 to rotate away from the pallet 86 until the adjacent spoke 18 comes in contact with the bottom surface 88 thereof. The contact prevents the star wheel 14 from further rotation and the weight of the pallet 86 thereafter depresses the star wheel 14 and its connected linkage assembly 24 against the upward biasing action of the springs 70 and 72. Once the pallet 86 has moved past the star wheel 14 as shown in FIG. 4, the biasing action of the springs 70 and 72 causes the star wheel 14 to again assume its raised position as limited by the slotted openings 54, 56 and 60 and the linkage means 24. As the end of the pallet 86 passes the centerline 90 of the shaft 26, the spoke 16 is rotated under the pallet while the adjacent spoke 18 is rotated thereabove. If the pallet 86 is not restrained adjacent the star wheel 14 and is moved away from the latch 10, the next pallet 92 will cause the same action of the star wheel 14. However, when the pallet 86 is restrained adjacent the star wheel 14, as shown in FIG. 4, the next pallet 92 strikes the spoke 20 of the star wheel 14 causing it to rotate to the position shown in FIG. 5. The upward pointing spokes 18 and 20 thereafter restrain both pallets 86 and 92. The axial centerline 90 of the shaft 26 and star wheel 14 is always restrained below the centerlines 94 of the pallets so that the pallets always tend to move over the star wheel 14 and it is never possible for a pallet to "tuck under" the shaft 26 and cause a jammed condition.

Rollers 96 and 98 are provided on the opposite sides of the star wheel 14. In conjunction with the floor rollers 99, they support the pallets and further assure that the centerlines 94 of the pallets never drop below the centerline 90 of the star wheel 14 and shaft 26. The rollers 96 and 98 also prevent a heavy pallet from uplifting to depress a light pallet on the other side of star wheel 14. The roller 96 is mounted for rotation to a stationary member 100 while the roller 98 is mounted for rotation to a safety locking member 102. The locking member 102 is restrained to be slidable a predetermined distance by suitable means which are shown as a rail 103 and a stud 104. The locking member 102 has a relatively flat abutment surface 105 which can be slid under the star wheel 14 when it is in the *x* position shown in FIG. 5. The abutment surface 105 engages with the two downward pointing spokes 16 and 22 to prevent rotation and/or depression of the star wheel 14. This fixes the two opposite upward pointing spokes 18 and 20 to restrain adjacent pallets from longitudinal or upward motion no matter whether pallets are on one or both sides of the star wheel 14. The abutment surface 105 has only slight clearance with the spokes 16 and 22. If the star wheel 14 is in other than the proper *x* position, the end 106 of the locking member 102 engages the closest out of position spoke to restrict further motion of the locking member 102.

As shown in FIG. 6, a purality of latches 10 are installed on the floor 12 of the aircraft to form the latch system 108. The latches 10 are positioned along the floor 12 in lateral and longitudinal alignment. The safety locking members 102 of each set for longitudinally aligned latches 10 are preferably connected together by positive linkage means 110. The linkage means 110 are usually operated by means of levers 112 or position indicating solenoids 113 to enable the locking and unlocking of each longitudinal set of latches 10 separately or in unison. The levers 112 may be manually operated from any suitable location which is accessible with a full cargo load such as the doorway 114. In the alternative, the locking members 102 may be connected by lateral acting linkage (not shown) which allows a loading crew to leave spaces in the pallet string. The improper latching of the star wheel 14 of any of the latches 10 is immediately discoverable through the inability to move a lever 112 to the locking position or by the inability of a solenoid 113 to move the linkage means 110.

It is usual practice to provide three or more longitudinal sets of latches 10. Usually less than all of the longitudinal latch sets are sufficient to hold the pallets and therefore should one latch set fail to lock, the cargo pallets can still be secured by the latches 10 of the other sets and no unloading operation need take place.

Once the cargo pallets reach their destination, the latches 10 are unlocked by moving all of the locking members 102 back to the position shown in FIG. 1. The pallet in the doorway 114 is removed first. As the doorway pallet moves away from the spokes of the adjacent star wheels 14, the wheels 14 are free to rotate and therefore the next pallet is released and can also be removed by means such as the powered rollers 116. The latches 10 then release the pallets one at a time in order.

Thus there has been shown and described a novel latching system which fulfills all of the objects and advantages sought therefor. Many changes, alterations, modifications, and other uses and applications of the subject latching system will become apparent to those skilled in the art after considering this specification and the accompanying drawings. All such changes, modifications, variations and other uses and applications which do not depart from the spirit and scope of the invention are deemed to be covered by the invention which is limited only by the claims that follow.

What is claimed is:

1. A latching system for pallets and the like including:
at least one latch assembly, said latch assembly having a base, linkage means connected to said base, bias means, and a star wheel member connected for rotation about an axis to said linkage means, said star wheel being biased upwardly to a predetermined position by said bias means, said star wheel having spokes which extend radially outward from the axis at 90° intervals thereabout for engaging and latching pallets to said assembly and said linkage means being comprised of first and second pairs of links, said links having first and second end portions and being connected together and to said star wheel at said first ends thereof, said pairs of links extending away from said star wheel in generally opposite directions, said base including means to connect said link second ends for rotation and restricted translation to said base.

2. The latching system defined in claim 1 including:
means to support the pallets at a predetermined distance from said base, said predetermined support distance being related to said star wheel predetermined position so the centerline of the pallet edges is held further from said base than the axis of rotation of said star wheel.

3. The latching system defined in claim 2 wherein said star wheel is mounted for rotation substantially 90° from the loading and unloading direction of the pallets.

4. A latching system for pallets and the like including at least one latch assembly, said latch assembly having:

a base;

linkage means connected to said base;

bias means;

a star wheel member connected for rotation about an axis to said linkage means, said star wheel being biased upwardly to a predetermined position by said bias means, said star wheel having outwardly extending spokes for engaging and latching pallets to said assembly which extend radially outward from the axis of rotation of said star wheel at substantially 90° intervals thereabout;

means to support the pallets at a predetermined distance from said base, said predetermined support distance being related to said star wheel predetermined position so the centerline of the pallet edge is held further from said base than the axis of rotation of said star wheel, said star wheel being mounted for rotation substantially 90° from the loading and unloading direction of the pallets; and

a locking member movable along said base and including an upwardly facing abutment surface, said abut-ment surface being a predetermined distance above said base and being engagable with two of said spokes when said star wheel is in its predetermined position, said spokes are about 45° to said base and said locking member is moved between said base and said star wheel, to prevent substantial rotation and depression of said star wheel.

5. The latching system defined in claim 4 wherein said locking member includes an upward facing roller for engaging a pallet thereover to assure the pallet thereover is no closer than a predetermined distance to said base.

6. The latching system defined in claim 4 including:

means to positively connect locking members of selected latch assemblies so said locking members move in unison.

7. The latching system defined in claim 6 wherein said selected latch assemblies have the axes of rotation of said star wheels thereof in substantial alignment.

8. The latching system defined in claim 6 wherein said selected latch assemblies are substantially aligned in the direction of movement of the pallets.

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