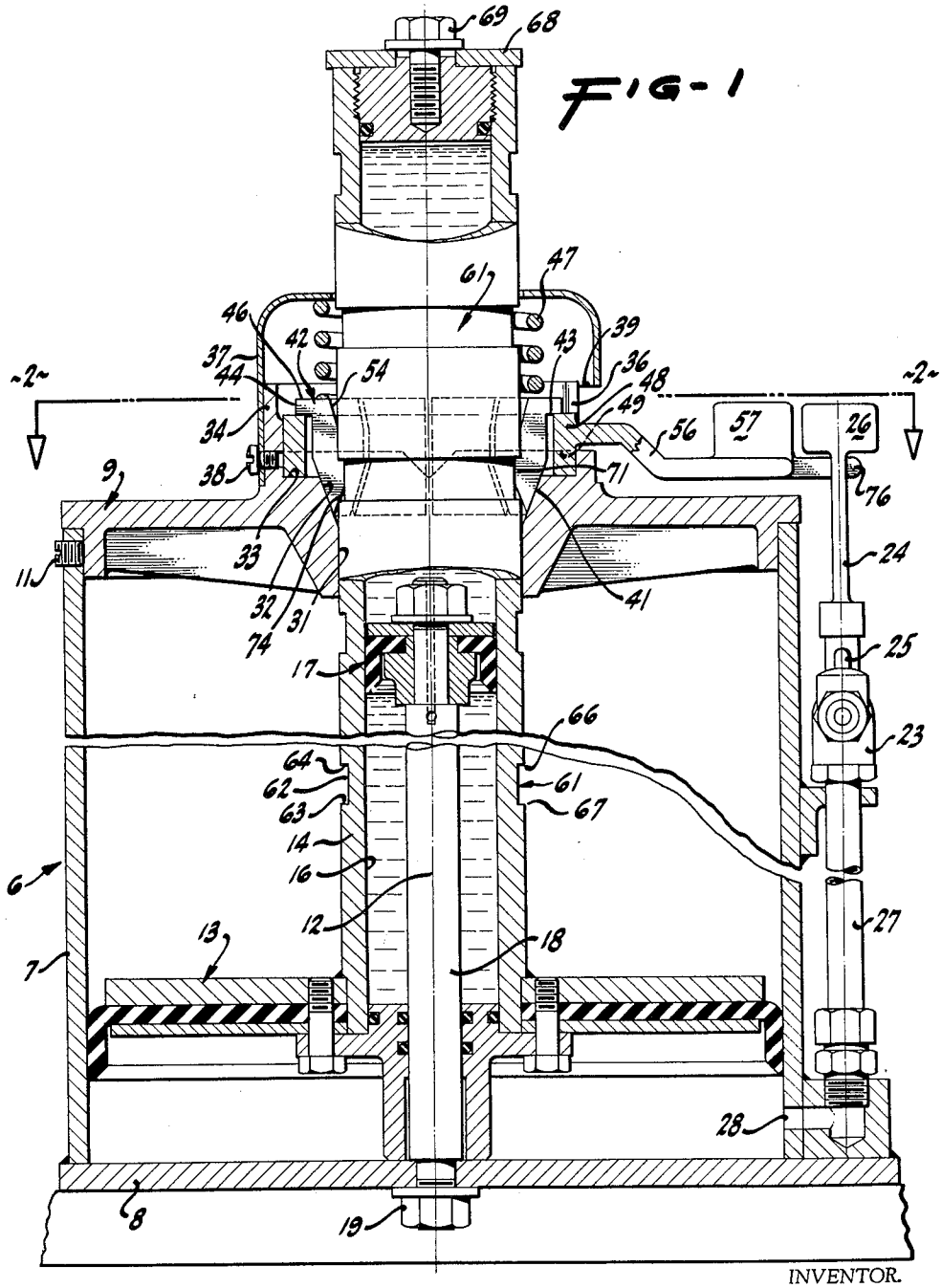
March 16, 1965 G. T. HEMMETER 3,173,659

SAFETY LIFT

Filed April 29, 1963 2 Sheets-Sheet 1

FIG-1



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SAFETY LIFT

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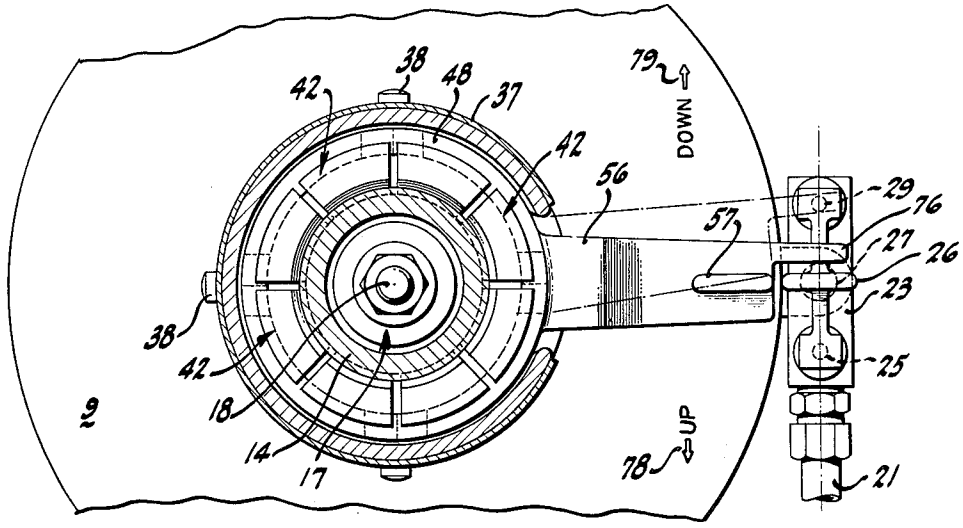


FIG-2

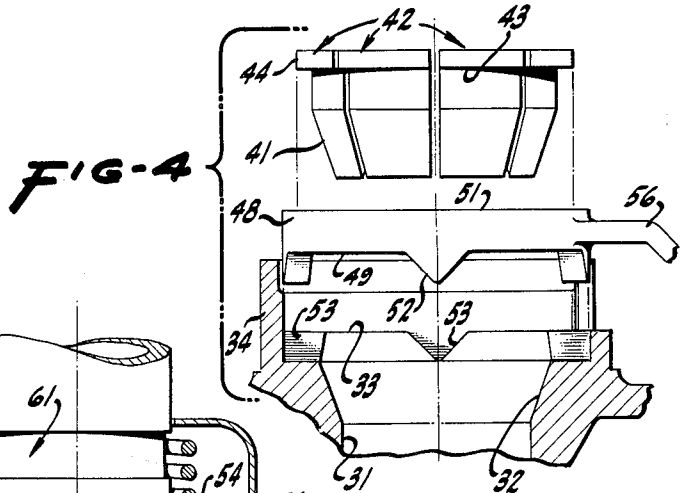


FIG-4

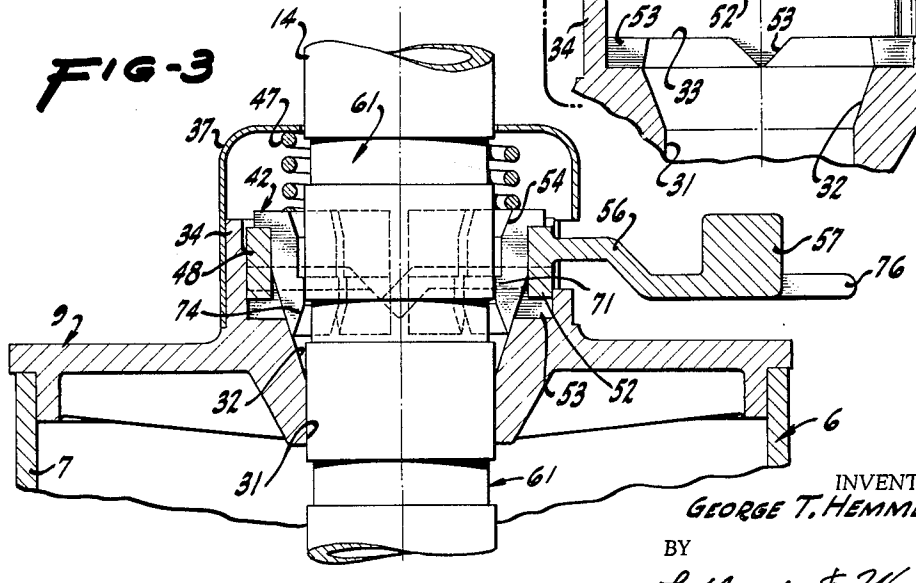


FIG-3

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United States Patent Office 3,173,659 Patented Mar. 16, 1965

3,173,659

SAFETY LIFT

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Filed Apr. 29, 1963, Ser. No. 276,231
10 Claims. (Cl. 254—93)

My invention relates to means especially utilized for lifting one end or the other of a vehicle from the ground and is especially concerned with such a structure employing an extensible jack actuated by pneumatic pressure. Lifts of this sort are well known and are generally useful except that they are prone to sudden failure by reason of loss of air pressure. Various safety devices are utilized to prevent injury when pressure fails or for some other reason the lift becomes quickly inoperative. The difficulties usually stem from random operation of a piston rod projecting from the pneumatic cylinder. To afford better control over the piston and cylinder arrangement, I have devised a structure entitled "Controlled Pneumatic Jack," disclosed in my copending application filed April 29, 1963, with Serial No. 276,290. The problem is more extensive, however, and it is desired to provide some simple, straightforward, readily operated means which will afford a mechanical lock of the jack mechanism so that when it is extended it cannot quickly collapse or contract.

It is therefore an object of the invention to provide a safety lift having means which are readily actuated so that the jack or lift piston rod will be mechanically held in its extended poistion or in any one of several extended positions.

Another object of the invention is to provide a safety lift in which the safety mechanism cannot be accidentally disengaged.

A still further object of the invention is to provide a safety lift in which the safety mechanism can readily be incorporated in and form a part of the normally provided pneumatic jack structure.

A still further object of the invention is to provide a safety lift in which the structure can be collapsed under load, but only after preliminary safety precautions.

Another object of the invention is to provide a safety lift which can readily be incorporated with devices of the sort shown in my copending application.

A still further object of the invention is to provide an improved safety lift.

Other objects together with the foregoing are attained in the embodiment of the invention described in the accompanying description and illustrated in the accompanying drawings, in which:

FIGURE 1 is a cross section through a safety lift constructed in accordance with my invention, the lift being shown with a middle section removed in order to reduce the size of the figure;

FIGURE 2 is a cross section, the plane of which is indicated by the line 2—2 of FIGURE 1;

FIGURE 3 is a detail view similar to a portion of FIGURE 1, but showing part of the safety mechanism in disengaged relationship; and

FIGURE 4 is an exploded view showing various parts of the safety mechanism in their adjacent but disconnected positions.

The safety lift pursuant to the invention can be embodied in a number of different ways, but has been embodied with commercial success in the present form. Some of the structure is similar to that in my copending application to which reference is made for further discussion of details.

In this embodiment, there is provided a jack structure 6 including a cylinder 7 mounted on and closed by a base

head 8 which itself rests on any suitable support, such as the floor, not shown. The cylinder 7 is likewise closed by a guide head 9 which is removably secured in position by a set screw 11.

Disposed within and reciprocable within the cylinder 7 along a vertical axis 12 is a composite piston 13 secured to a piston rod 14. While the term "rod" is utilized in its generic sense, it actually in this instance is preferably a tube having an interior cylinder 16 within which a hydraulic piston 17 is situated. A strut 18 extends from the hydraulic piston 17 to a fastening 19 in the base head 8.

Air from a suitable source 21 (FIGURE 2) is furnished to a multiple valve 23 mounted alongside the cylinder 7. The valve has a manual control lever 24 with a finger pad 26 thereon. The lever is centrally pivoted and when actuated in one direction opens communication from the pressure air supply tube 21 into an air tube 27 extending through a passageway 28 into the cylinder 7 beneath the piston 13. When the valve lever 24 is actuated in the opposite direction, the valve 25 affording communication with the air supply 21 is closed and then a similar valve 29 interconnects the air pipe 27 to the atmosphere and pressure within the cylinder 7 beneath the piston 13 approaches atmospheric.

By rocking the lever 24 in either direction from neutral shut-off, the jack piston 13 can either be forced upwardly along the axis 12, or can be permitted to drop along that axis under load. Oil within the rod 14 serves as a damper as set forth in the identified patent application. When the lever 24 is in its neutral or intermediate position, the pressure conditions within the cylinder 7 remain static. In this fashion the piston 13 can be raised or lowered and carries the piston rod 14 with it.

The piston rod extends through the cylinder 7 and projects therefrom through an opening 31 provided in the center of the guide head 9. In part, the opening 31 is circular cylindrical and serves as a bearing and guide for the piston rod. In addition, the opening 31 has a surface 32 which is conical or is a frustum of a cone. This surface 32 merges with a horizontal or flat surface 33 normal to the axis 12. A partial wall 34 surrounds the piston rod 14 except for an interrupted section 36. Upstanding from the wall 34 is a closure hood 37 removably held in place by fastenings 38 and substantially continuous except for a cut-away portion 39 corresponding with the cut-away portion of the wall 34.

Designed to rest upon the conical surface 32 are comparable conical segment surfaces 41 partially defining one of a number of detent members 42. As particularly shown in FIGURE 2, the structure includes a plurality of the detent members 42, each of which is exactly like the others. There can be any number of detent members from one up, and in the present instance eight are utilized. Each of the detent members 42 not only has a conical segment surface 41, but likewise is provided with a lower planar surface 43 normal to the axis 12 beneath a peripheral flange 44. The segment likewise has an upper flat surface 46 normal to the axis 12. A coil spring 47 encompasses the piston rod and is interposed between the upper flat surface 46 of all of the segments and the lower part of the hood 37 so that all eight of the segments are urged downwardly. The spring 47 acts substantially equally on all of the various detent members. The detent members are urged downwardly until there is mutual contact of the conical surfaces 41 and 32. The detent members under many circumstances can rest with their lower surfaces 43 on a ring 48. This bears freely within the wall 34 and has a flat lower surface 49 facing the surface 33 and a flat upper surface 51. The flat bottom surface 49 is interrupted at equal intervals by a plurality of tri-

angular cams **52**. These preferably are spaced ninety degrees apart and are arranged to interfit with complementary notches **53** cut in the upper surface **33** of the guide head **9** at appropriate intervals.

Extending from the ring **48** is a lever **56** having a finger pad **57** near one extremity thereof, so that when the finger pad **57** is moved in a rotary fashion in one direction or the other, the ring **48** is similarly rotated. When the surface **49** of the ring is in engagement with the surface **33** of the guide head and the triangular cams **52** are all in the notches **53**, the structure is axially compact. When, however, the lever **56** is rocked or rotated either one way or the other, the triangular cams **52** ride out of the notches **53** and cause the ring **48** to rise axially. The rising movement of the ring causes a similar rising movement of all of the detent members **42** against the urgency of the spring **47** if the detent members are otherwise unrestrained.

Advantage is taken of the detent members to provide a suitable mechanical interlock with the piston rod **14**. At appropriate intervals along its length, the piston rod is provided with a number of circumferential grooves **61**, each of which has an axial surface **62**, an upper surface **63** and a nether surface **64**, the latter two being normal to the axis **12**, i.e. substantially horizontal. The surfaces **63** and **64** merge with the outer surface of the piston rod to provide an upper shoulder **66** and a lower shoulder **67**.

At its upper end, the piston rod has a mechanism **68** held on by a cap screw **69**, the mechanism representing a connection to a load which is to be lifted. The connection **68** takes various forms in practice, but for present purposes can be assumed to engage with or to retain a heavy load acting downwardly along the axis **12**.

To cooperate with the piston rod **14**, each of the detent members **42** is especially contoured. Each of the members **42** is provided (FIGURE 3) with an inwardly projecting detent **71** in the form of an inwardly extending ledge having a substantially horizontal flat upper surface. The detent **71** in its upper portion is substantially of the same configuration as the upper portion of the groove **61** and the nether surface **64** so that the two readily interfit. The detent member **42** is also provided with a cam **74** which is inclined inwardly as it extends upwardly, the cam usually being a conical surface or a segment of a frustum of a cone, and is of substantially the same extent as the detent **71**.

In operation, as the parts are illustrated in FIGURE 1, the spring **47** urges the detent members **42** downwardly. If desired, the spring can be omitted and gravity alone provides a downward force. These members are urged against the conical surface **41** and are in secured position with the detents **71** underlying the upper shoulder **66** and in engagement with the nether surface **64**. Thus, downward loads on the piston rod are not transmitted to the piston **13**, but are mechanically transferred through the detent members **42** to the guide head **9** and through the cylinder **7** to the floor. The air pressure beneath the piston **13** under these conditions is immaterial since the rod is axially and radially clamped and the load is entirely transmitted through the detent members.

When it is desired to raise the load, the valve lever **24** is actuated in the direction of the indicator arrow **78** in FIGURE 2 to connect the source of air **21** to the air pipe **27**. The resulting increase of air pressure beneath the piston **13** is eventually sufficient to overcome the downward force of the load and the piston **13** begins to ascend. In so doing, the upper shoulder **66** rises above the detents **71** and the rising lower shoulder **67** rides against the cams **74**, thus tending to displace the detent members **42**. The force component against each of the detent members has not only a radially outward direction, but also an axially upward direction. Upward movement is substantially resisted by the spring **47**, so that the detent members **42** do not themselves rise axially, but rather are displaced radially outwardly until such time as the lower shoulder has cammed them to a radially outer position remote from the piston rod.

During the outward movement of the detent members, they move with the surface **43** sliding on the surface **51** and against the frictional resistance of the end surface spring **47**. The spring thus acts somewhat as a friction brake on the lateral movements of the detent members **42**. The piston rod is thus entirely free and ascends until such time as the supply of compressed air is interrupted by return of the lever **24** to its central position. When the piston rod is in an upper position and is still free, if a failure of air pressure or other accident occurs and the piston rod starts to descend, it cannot travel very far. The spring-pressed detent segments, being always urged downwardly and inwardly by pressure of the spring **47** (see FIGURE 3), as promptly as possible interengage with the next descending groove **61** and reassume or occupy the locked position shown in FIGURE 1, thus preventing any further downward rod movement.

While the motion of the detent members is conveniently resolved into radial and axial components, there is often some rotation of each individual detent member about a horizontal axis. The center of gravity of each detent member (and in most cases the effective line of downward thrust of the spring **47**, as well) with respect to the support by the flange **44** on the ring **48** is such that the detent members tend when otherwise unrestrained to rock inwardly at the top and spread outwardly at the bottom. Because of this and to prevent interference, the detent members are provided with a chamfer **54**.

Should it be desired to lower the free piston rod **14** under control and without having the displaced detent members automatically interengage with the next, successively lowered groove, the lever **24** is rotated in the direction of the indicator arrow **79**, as seen in FIGURE 2. The ring **48** is rotated and is cammed axially upward. This then brings the ring and the flanges **44** into abutment and precludes the downward movement of the detent members, as shown in FIGURE 3. Under these circumstances, the piston rod **14** can descend until it hits the bottom. At any time, however, that the lever **56** is restored to its neutral position, as shown in FIGURE 1, then the ring lowers and the lowering detent members can engage the piston rod to lock it.

The arrangement is such that when the piston rod **14** ascends with the lever **56** in neutral position, the detent members **42** will click into and be cammed out of each successive one of the grooves **61**. On downward motion with the lever **56** in neutral position, the detent members will click into the first groove encountered and will permit no further downward movement of the piston rod. In the event it is undesirable to have the detent members click into each successive groove on the upward movement, the lever **56** can be moved clockwise as shown in FIGURE 2 and thus will hold the detent members out of the path of movement of the piston rod so that the various grooves are passed without interengagement with the detent members. Unless the rod is already moving upwardly, the lever **56** cannot manually be operated when the piston rod load is borne by the detent members. A previous operation of the lever **24** to raise the rod and relieve the detent load then permits the lever **56** to move the ring **48** upwardly.

An interlock is a convenience in operating the air lever **24** and the ring lever **56**. For that reason, the lever **56** has an extension **76** thereon which is adjacent the stem of the lever **24** when the lever **24** is in its central location. When the piston rod **14** is to be moved upwardly, the lever **24** can first be moved by itself to add air. After initial air has been added and the piston rod has started upwardly so as to disengage the detent members, then, since the finger pieces **26** and **57** are close together, the lever **56** can easily be swung in a comparable direction and will hold the disengaged detent members out of engage-

ment with the ascending rod. The levers are finally released and the device is then locked.

When the extended rod is to be lowered, immediate manual movement of the lever **56** is impossible since a person has not sufficient strength to lift the loaded detent members. It is first necessary for the operator to operate the lever **24** to add sufficient air to lift the load to disengage the detent members. Once this is done, the lever **56** can then easily be rotated in a counterclockwise direction (FIGURE 2), thus rotating the lifting ring **48** and raising it to hold the detent members disengaged. Following that, the projection **76** projecting from the lever **56** is out of the way of the lever **24**, which can then be rocked into its "down" position to discharge the air from beneath the piston **13**.

What is claimed is:

1. A safety lift comprising a cylinder, a base head at one end of said cylinder, a guide head at the other end of said cylinder, an air piston reciprocable in said cylinder between said heads, a piston tube on said air piston and projecting from said cylinder through said guide head, said piston tube having a circumferential groove therein defined by an upper shoulder and a lower shoulder, means on said guide head forming a conical base, an arcuate detent member having an exterior conical face slidable on said conical base, a detent on the interior of said detent member and receivable in said groove beneath said upper shoulder, means on said detent member forming a cam in the lifting path of said lower shoulder, means axially movable on said guide head and engaging said detent member for moving said detent member axially, and a spring interposed between said guide head and said detent member for urging said detent member against said axially movable means and for frictionally restraining said detent member.

2. A safety lift comprising a guide head having a first conical surface thereon, a piston rod projecting through said guide head centrally of said first conical surface and adapted to rise and fall axially relative thereto, means forming a nether supporting surface on said piston rod, a detent member having a second conical surface adapted to engage said first conical surface on said guide head and movable along said first conical surface in radial and axial directions between an inner position near said piston rod and an outer position away from said piston rod, means for yieldingly urging said detent member axially and radially toward said piston rod, a detent on said detent member adapted to underlie said nether supporting surface when said detent member is in said inner position, and interengaging means on said piston rod and said detent member for overcoming said urging means and moving said detent member axially and radially from said inner position to said outer position when said piston rod rises.

3. A safety lift comprising a device as in claim 2 in which said urging means is a spring acting axially on said detent member.

4. A safety lift comprising a device as in claim 2 in which said nether supporting surface is part of the boundary of a groove in which piston rod and there is a plurality of said detent members arranged around said piston rod for axial and radial movement on said first conical surface between their respective inner positions and outer positions.

5. A safety lift comprising a guide head having an opening therethrough at least in part defined by a conical surface, a piston rod extending through said opening and axially movable relative to said guide head, means forming a groove in said piston rod defining a nether supporting surface and a lower shoulder, a plurality of detent members surrounding said piston rod, means on said

detent members defining conical segment surfaces adapted to abut said conical surface, a detent on each of said detent members adapted to underlie said nether surface, means forming a cam on each of said detent members adapted to overlie said lower shoulder, means on each of said detent members forming a supporting surface normal to said axis, a ring on said guide head surrounding said piston rod, means on said ring forming an engaging surface abutting said supporting surface, means for yieldingly urging said supporting surfaces and said engaging surface together, and means for lifting and lowering said ring on said guide head.

6. A safety lift comprising a cylinder head having an opening therethrough at least a part defined by a conical surface, a piston rod extending through said opening and movable along an axis relative to said cylinder head, a plurality of circumferential grooves in said piston rod each defining an upper shoulder and a lower shoulder, a plurality of segmental detent members surrounding said piston rod, each having a conical segment surface adapted to abut said conical surface, a detent on each of said detent members adapted in one position of said detent members to lie in one of said grooves, means forming a cam surface on each of said detent members arranged to be engaged by said lower shoulder and contoured to move said detent members away from said piston rod as said piston rod moves upwardly, a rotatable collar surrounding said piston rod, means forming interengaging cam faces on said collar and on said cylinder head to displace said collar axially when said collar is rotated relative to said cylinder head, means forming an engaging surface on said collar normal to said axis, means forming a supporting surface normal to said axis on each of said detent members, said engaging surface being adapted to rest on said supporting surface, a spring surrounding said piston rod and at its lower end abutting said detent members, and means on said cylinder head abutting the upper end of said spring.

7. A safety lift comprising a cylinder, a guide head on said cylinder, a piston rod projecting through said guide head and adapted to rise and fall relative thereto, means forming a circumferential groove in said piston rod, means forming a conical surface on said guide head coaxially with said piston rod, a detent member having a segment surface thereon engaging said conical surface and movable therealong, said detent member having means thereon movable into and out of said circumferential groove, and means for holding said detent member out of said groove.

8. A safety lift as in claim 7 in which there is a plurality of detent members for restraining said piston rod axially.

9. A safety lift as in claim 7 in which said means for holding includes a rotary ring having an operating lever projecting therefrom.

10. A safety lift as in claim 9 in which there is provided an air supply to said cylinder, an air valve for controlling said air supply, and a control lever projecting from said air valve and disposed in the path of movement of said operating lever.

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