United States Patent

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[54] RETRACTABLE LADDER

3 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **182/84,** 182/96
[51] **Int. Cl.** **E06c 5/22**
[50] **Field of Search** 182/96, 95, 84, 98

[56] **References Cited**

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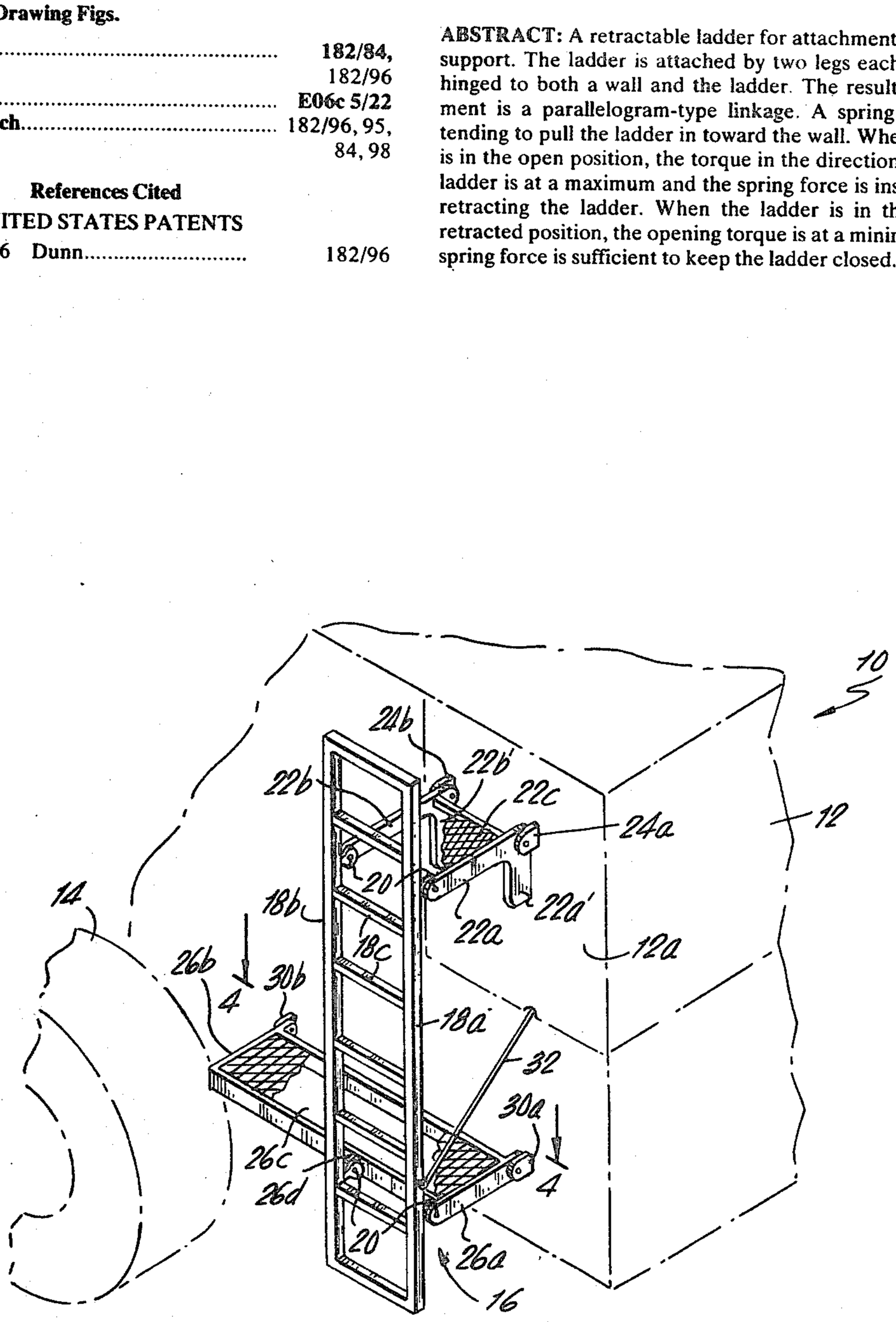
ABSTRACT: A retractable ladder for attachment to a vertical support. The ladder is attached by two legs each of which is hinged to both a wall and the ladder. The resulting arrangement is a parallelogram-type linkage. A spring is provided tending to pull the ladder in toward the wall. When the ladder is in the open position, the torque in the direction to open the ladder is at a maximum and the spring force is insufficient for retracting the ladder. When the ladder is in the closed or retracted position, the opening torque is at a minimum and the spring force is sufficient to keep the ladder closed.



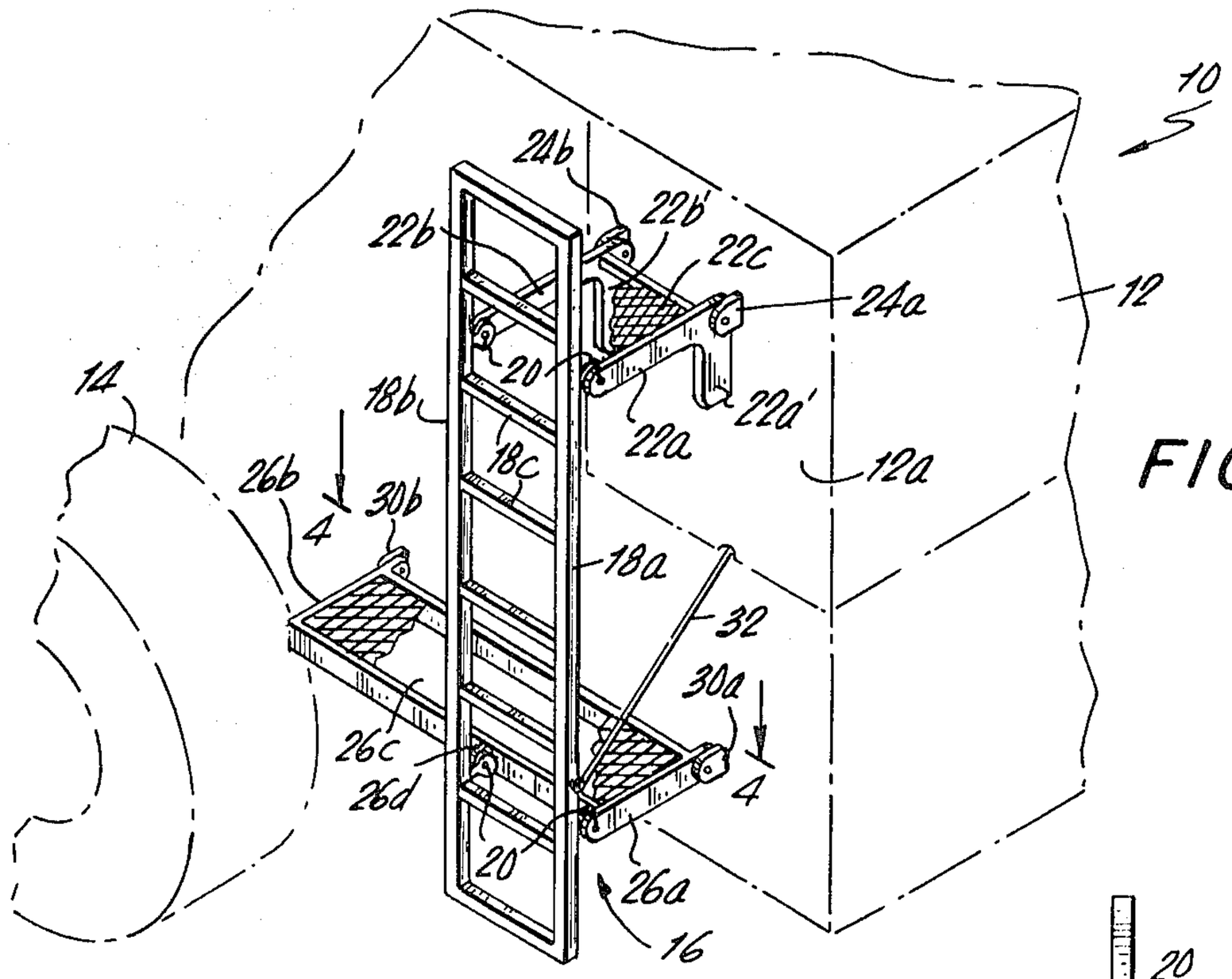


FIG. 1

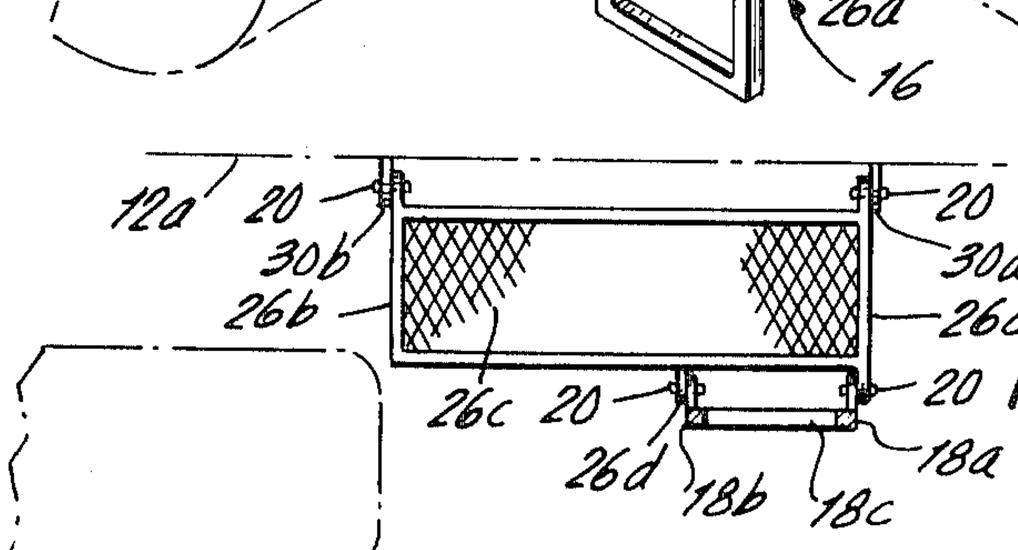


FIG. 4

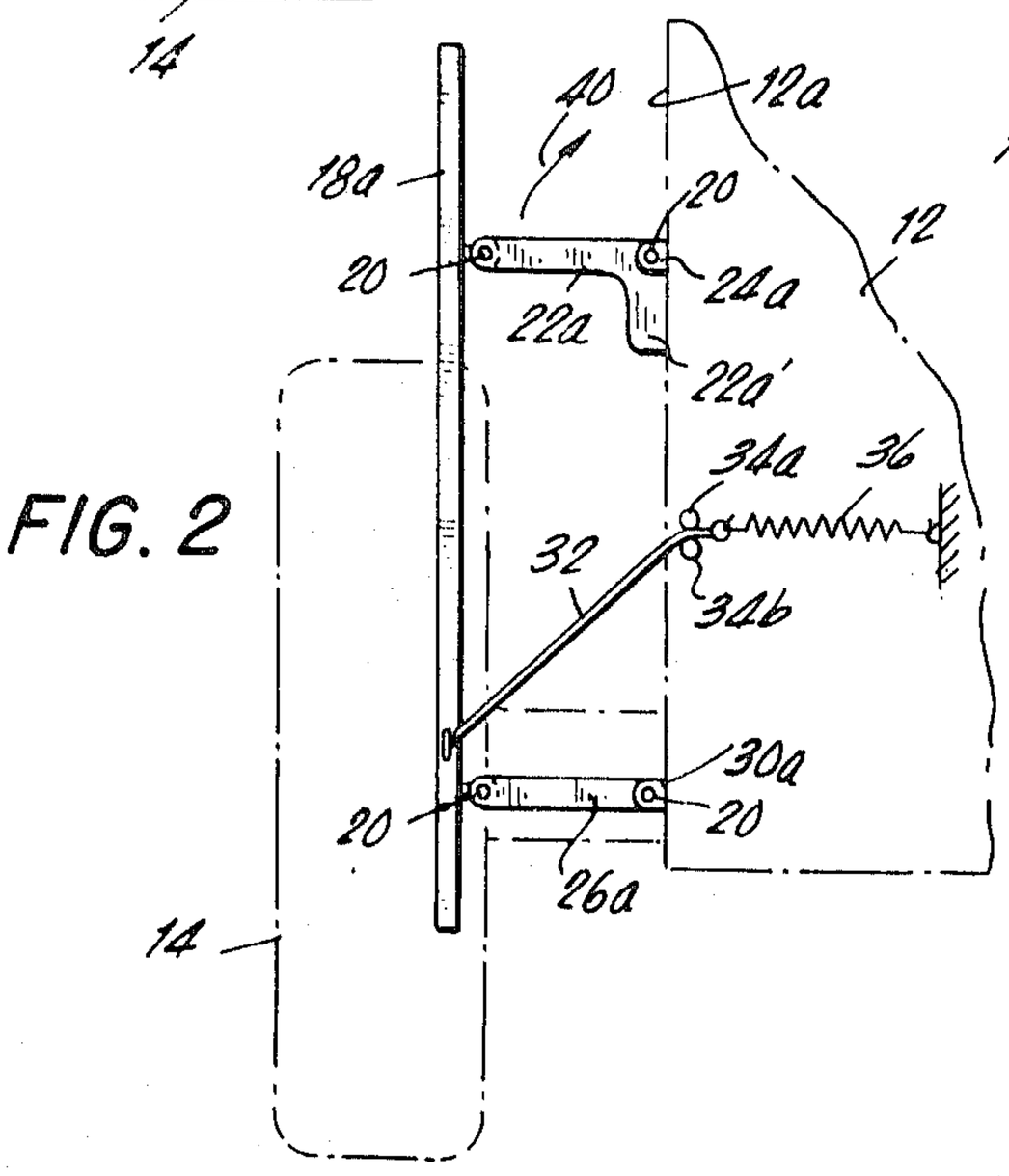


FIG. 2

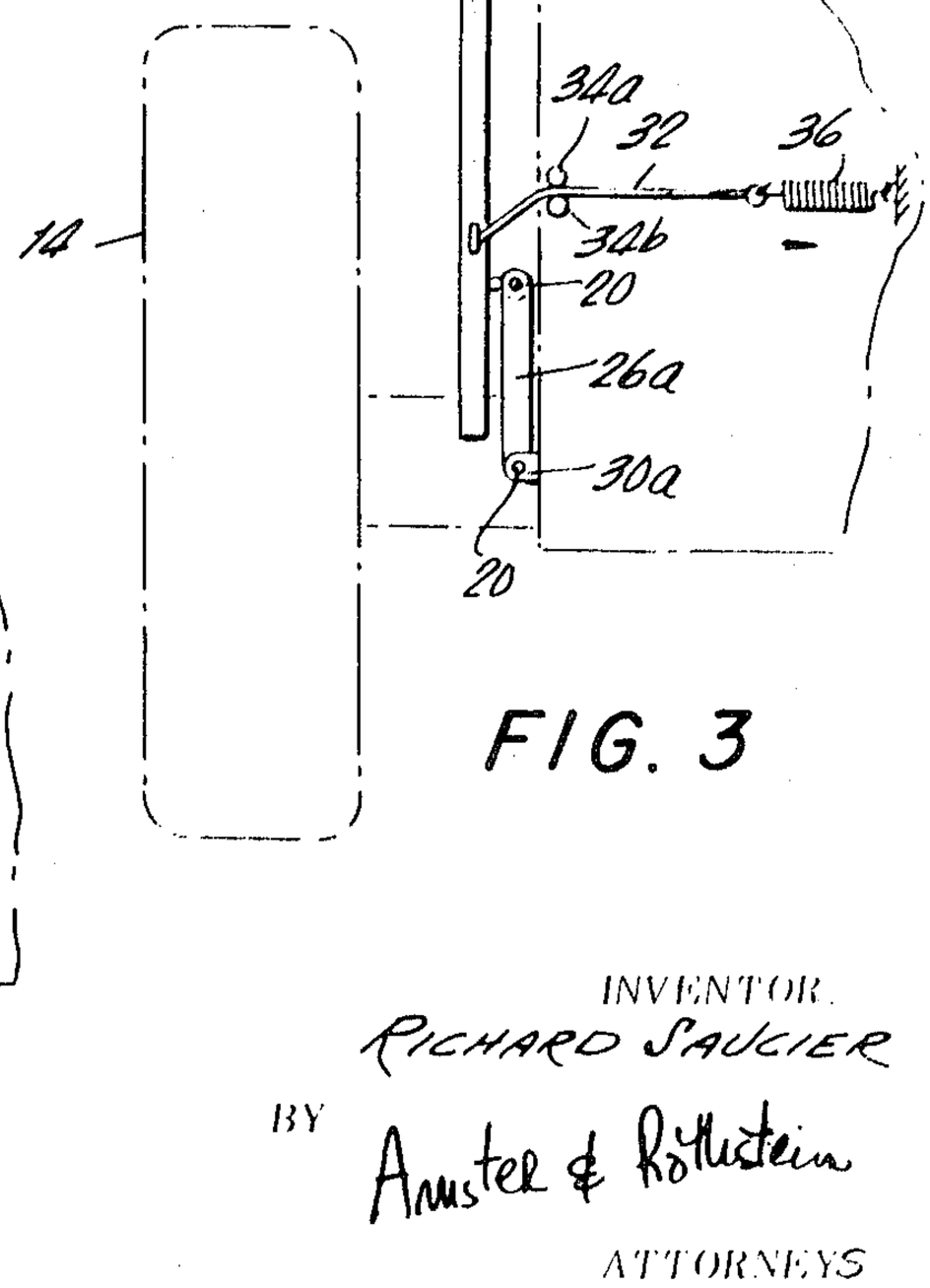


FIG. 3

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RETRACTABLE LADDER

This invention relates to ladders, and more particularly to a ladder which extends outward from a supporting vertical wall but which can be retracted against the wall when no longer needed.

It is often necessary to provide a ladder fixed to a vertical support. In many cases it would be highly advantageous to provide a mechanism by which the ladder could be retracted against the vertical support so that it does not jut out when not in use. An example of such a ladder is that found on heavy earth-moving equipment. When the ladder is not in use, it is desirable to have it retracted against the supporting vertical wall of the machine, rather than to have it extending outward from the machine where it could possibly cause damage to a workman standing near the moving vehicle.

There are prior art ladder systems which are fixed to a vertical wall for support and can be moved between open and closed positions. However, such systems do not generally provide for rapid switching between the two positions of the ladder. Moreover, it is often necessary to provide a cumbersome locking mechanism for maintaining the ladder in one or the other of the two positions.

It is a general object of my invention to provide a ladder fixed to a vertical wall having an open position in which it extends away from the wall and a closed position in which it is immediately adjacent to the wall, and which can be switched from one position to the other simply by applying a small force to it and then maintained in the new position without the need for any locking mechanism.

Briefly, in accordance with the principles of my invention, this is accomplished by providing a pair of horizontal legs extending between the supporting wall and the ladder. Each leg is pivoted at one end to the wall and at the other end to the ladder. The four pivots form corners of a parallelogram; as the ladder is raised from the open position, the projection of the two legs from the supporting wall decreases and the ladder is pulled toward the wall. At least one of the legs includes a stop so that, as the ladder is pulled down and away from the wall, a point is reached after which further downward motion is prevented.

A spring is provided for exerting a force upon the ladder both in the upward direction and toward the wall. When the ladder is in the open position, its weight is great enough to prevent the spring from pulling it up and in toward the wall. To move the ladder to the closed position it is pushed up, the parallelogram arrangement causing the ladder to be retracted in toward the wall at the same time. Once the ladder is adjacent to the wall, the spring maintains the ladder up against it; the weight of the ladder is no longer effective to overcome the force of the spring. Actually, the force resulting from the weight of the ladder is directed downward through the pivots which secure the two legs to the wall. There is thus no torque developed around the pivots. The spring serves to keep the ladder retracted against the wall even if the vertical support, e.g., an earth-moving machine, tilts and slight torque is developed.

It is a feature of my invention to provide a parallelogram linkage for securing a ladder to a wall, the linkage including a stop to prevent downward movement of the ladder past a predetermined point and further including pivots arranged such that when the ladder is in the closed or retracted position no torque is developed around the pivots tending to open the ladder.

It is another feature of my invention to provide a spring tending to pull the ladder in toward the wall, the spring force being insufficient to move the ladder from the open to the closed position without the application of an external force but being sufficient to maintain the ladder in the closed position after it is placed there even if a small torque develops around the pivots as a result of a tilting of the wall.

Further objects, features and advantages of my invention will become apparent upon consideration of the following detailed description in conjunction with the drawing, in which:

FIG. **1** depicts a perspective view of an illustrative embodiment of my invention, in which the retractable ladder is shown attached to an earth-moving machine;

FIG. **2** depicts a side view of the ladder in its open position;

FIG. **3** depicts a side view of the ladder in its closed position; and

FIG. **4** is a top view taken along the line **4—4** of FIG. **1**.

Earth-moving machine **10** in FIG. **1** includes a body portion **12** and a number of wheels **14** (only one of which is shown). These elements are shown in phantom because they do not comprise a feature of the invention. Although the retractable ladder mechanism **16** is shown attached to wall **12***a*, it is to be understood that it can be attached to any suitable vertical support.

The ladder itself includes two vertical supports **18***a*, **18***b* and a series of rungs **18***c*. The lower leg includes two side bars **26***a*, **26***b* and a platform **26***c*. The upper leg includes two side sections **22***a*, **22***b* and a bridge **22***b'*. The lower leg platform is provided in order to allow a person climbing the ladder to stand on the platform if desired.

The ladder is attached to the lower leg by two pivots **20**, which pivots may be of any conventional type. As shown in the drawing, the pivots consist of pins extending through lugs on both the ladder and the lower leg. One lug on the lower leg is simply an extension of side section **26***a*. The other lug **26***d* extends forward of platform **26***c*, as shown most clearly in FIG. **4**. A similar pivot attachment is made between the upper part of the ladder and the upper leg.

Two lugs **30***a*, **30***b* extend outward from wall **12***a*. A mating pair of lugs extends outward from the two ends of side sections **26***a*, **26***b*. The lugs are interconnected by a pair of pins which serve to allow the lower platform to rotate relative to lugs **30***a*, **30***b*. Similarly, two lugs **24***a*, **26***b* extend outward from the upper part of wall **12***a* for attachment to mating lugs extending rearwardly of the upper platform.

The four pairs of pivots form a parallelogram, one side of which (the wall) is fixed. As the ladder is pushed upward, it remains in a vertical orientation since it is at all times parallel with wall **12***a*. However, as the ladder is pushed upward, the two legs rotate in the direction of arrow **40** of FIG. **2**. This causes the ladder to be retracted in toward wall **12***a*. As the ladder is pushed upward from the open position in FIG. **2** to the closed position of FIG. **3**, it is seen that the pins (pivots **20**) which are fixed to the ladder move in arcs until they are directly above the pins (pivots **20**) attached to the wall. At such a time, the two long legs of the parallelogram are coincident.

When the ladder is in the open position of FIG. **2**, the weight of the ladder tends to rotate the two legs in the direction opposite to that shown by arrow **40**. Even when the ladder is pulled only slightly away from the wall, that is, slightly to the left of the position shown in FIG. **3**, the weight of the ladder results in the application to the two legs of a torque around the pivots attached to the wall. The torque is a maximum when the ladder is in the fully open position of FIG. **2**. Although the weight of the ladder would ordinarily tend to cause it to continue to rotate in the counterclockwise direction until it was once again up against the wall but in a lower position, it is seen that stops **22***a'* and **22***b'*, which are simply perpendicular extensions of side sections **22***a*, **22***b*, strike wall **12***a* and prevent further downward movement. The stops thus insure that the ladder falls no lower than the position shown in FIG. **2**.

It should be noted that stops **22***a'* and **22***b'* are in the same plane as legs **22***a* and **22***b*. Since the two legs are pivoted to the outside of the upper lugs on the ladder, it is apparent that when the ladder is moved to the closed position, stops **22***a'* and **22***b'* fall outside the bounds of the ladder, as shown in FIG. **3**. This arrangement insures that the ladder can be closed to the maximum extent in which position the downward forces produced by the weight of the ladder are directed through the pins passing through the wall lugs.

Since the force vectors resulting from the weight of the ladder thus extend downward through the pins attached to the wall, no torque is developed tending to rotate the ladder counterclockwise.

Although theoretically this arrangement would cause the ladder to remain in he closed position after it is first placed there, as a practical matter a slight jarring movement may cause the ladder to move to the open position. For example, if the ladder is attached to the wall of an earth-moving machine, it is apparent that as the machine tilts from one side to the other as it moves across rough terrain, when the machine is tilted to the left in FIG. 3 the downward forces will no longer pass through the pins attached to the wall. The torque may be sufficient to cause the ladder to open.

For this reason, a spring **36** is provided as shown in FIGS. 3 and 4. The right side of the spring is anchored and the left side is attached to cable **42**. Preferably (although not shown due to space limitations), the spring is long enough such that there is little difference between the forces applied in the open and closed positions of the ladder. The cable passes through guides **34***a*, **34***b* at that end attached to the spring, and the other end is attached to the lower part of the ladder.

When the ladder is in the open position of FIG. 4, the counterclockwise torque produced by the weight of the latter is at a maximum. The spring force is insufficient to pull the ladder to the closed position and the ladder remains open. However, when the ladder is in the closed position of FIG. 3, the counterclockwise torque produced by he weight of the ladder is at a minimum. Even if the wall tilts slightly, the counterclockwise torque is still very small. The force of the spring is sufficient to keep the ladder up against the wall in the absence of the application of an external force which moves the ladder from the closed position to the open position.

Although the invention has been described with reference to a particular embodiment, it is to be understood that this embodiment is merely illustrative of the application of the principles of the invention. Numerous modifications may be made therein and other arrangements may be devised without departing from he spirit and scope of the invention.

What is claimed is:

1. A retractable ladder and platform device to be mounted on a vehicle having pivotal mounts to receive such a device for movement between a closed clearance position and an open working position in which a person can climb on the ladder and stand on the platform, said device comprising: a vertically oriented ladder; upper and lower collapsible support means for mounting said ladder on pivotal mounts on a vehicle for said movement; one of said support means having a platform extension extending beyond the width of said ladder and moveable with said support means; each of said upper and lower collapsible support means including a pair of mounting arms pivoted at one end to said ladder and at the other end to pivotal mounts on a vehicle; all of said mounting arms being in parallel array and being substantially horizontal in said open position and substantially vertical in said closed position; stop means in operative engagement with said support arms defining said open working position; and spring bias means for maintaining said ladder and support arms in said closed position; said spring bias means being insufficient to raise said ladder and upper and lower collapsible support means out of said open position and the weight of said ladder and support means being substantially completely carried by the pivotal mounts on the vehicle in the closed position with said spring bias means maintaining he same in said closed position.

2. A device in accordance with claim **1** wherein said spring bias means includes an elongated tension spring and a flexible connector secured at one end to said ladder and at the other end to a rigid point on the vehicle on which said device is mounted.

3. A device in accordance with claim **1** wherein said spring bias means provides a continuous force tending to move said ladder and support means into the closed position.