

[54] LADDER WARNING DEVICE

[72] Inventors: **Leo Lawrence Garrett, deceased**, Orlando, Fla.; **The Florida National Bank at Orlando, administrator**, P.O. Box 3593, Orlando, Fla. 33112; **Walter L. Birdyshaw**, Box 301 Bay St., Ocoee, Fla. 32761

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[51] Int. Cl.**E06c 5/34, G08b 13/02**

[58] Field of Search**340/272; 200/86, 85, 61.58; 182/18**

[56] **References Cited**

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Primary Examiner—John W. Caldwell
Assistant Examiner—Scott F. Partridge

[57] **ABSTRACT**

A warning device involving a rigid section of ladder is pivotally suspended from a tank, tower, building or the like and adapted to move slightly upon an intruder placing weight upon the section of ladder. Means are provided for biasing the ladder section in one direction, with the arrangement being such that upon an intruder placing weight upon the ladder, it overcomes this bias and actuates a warning device. The warning device may take the form of a switch which, when actuated, operates an alarm at a remote location, thus alerting a guard or the police of the trespass by the intruder. Significantly, all aspects of this device are inconspicuous, the motion of the ladder is slight, and the intruder in almost all instances will be unaware of the fact that his presence has been detected. Also, the arrangement resets itself automatically, and cannot be actuated by an accumulation of snow and ice.

13 Claims, 5 Drawing Figures

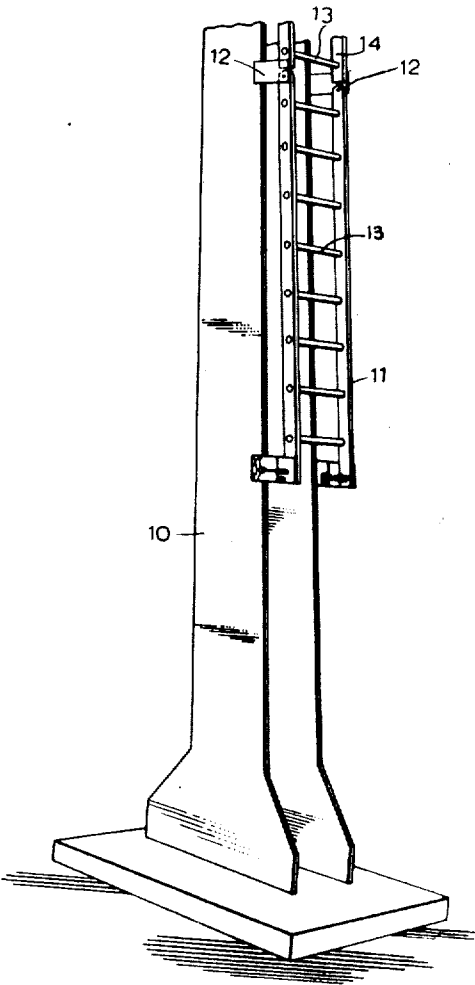
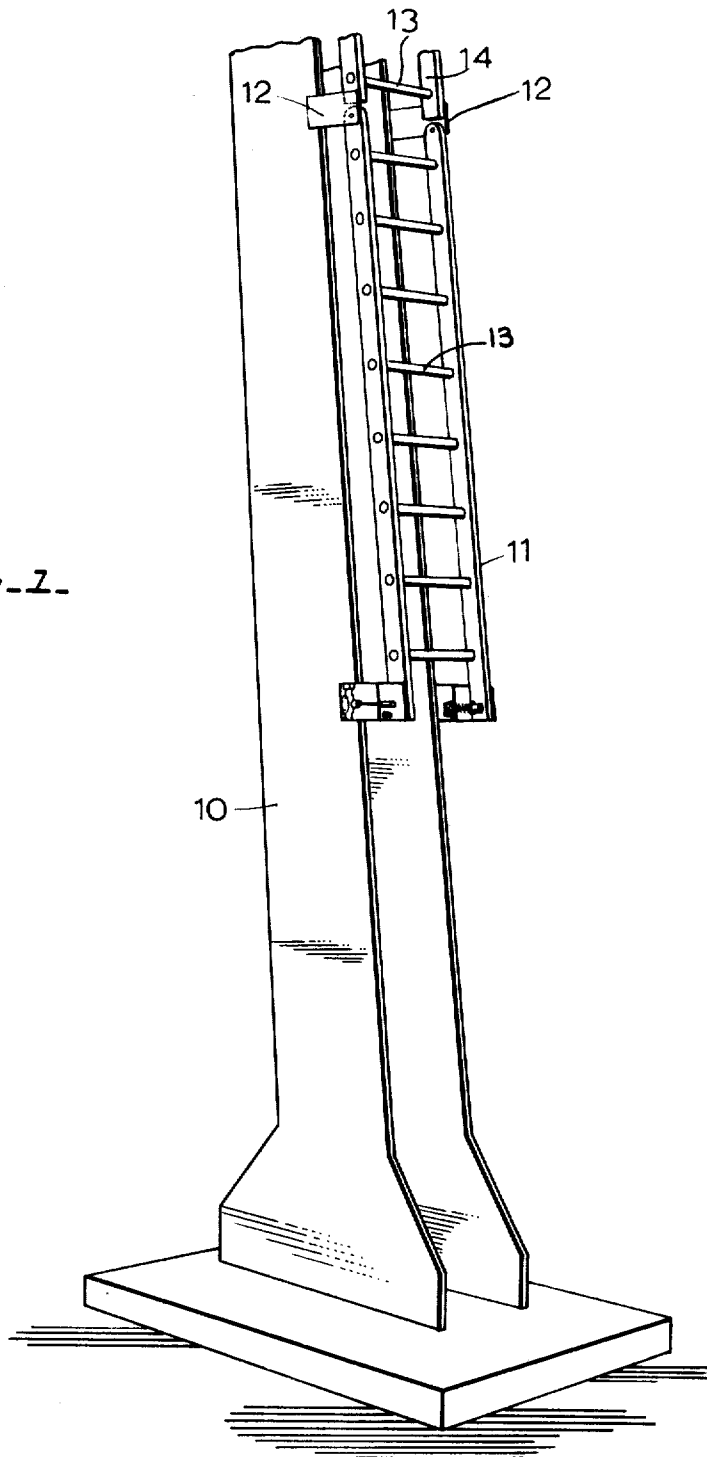


Fig-1-



INVENTORS

Leo L. Garrett

Walter L. Birdyshaw

By *Julian C. Denfro*

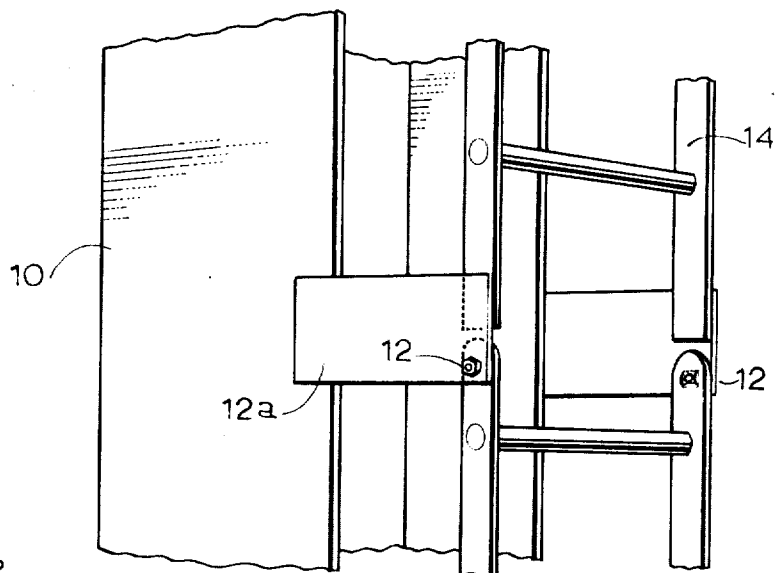
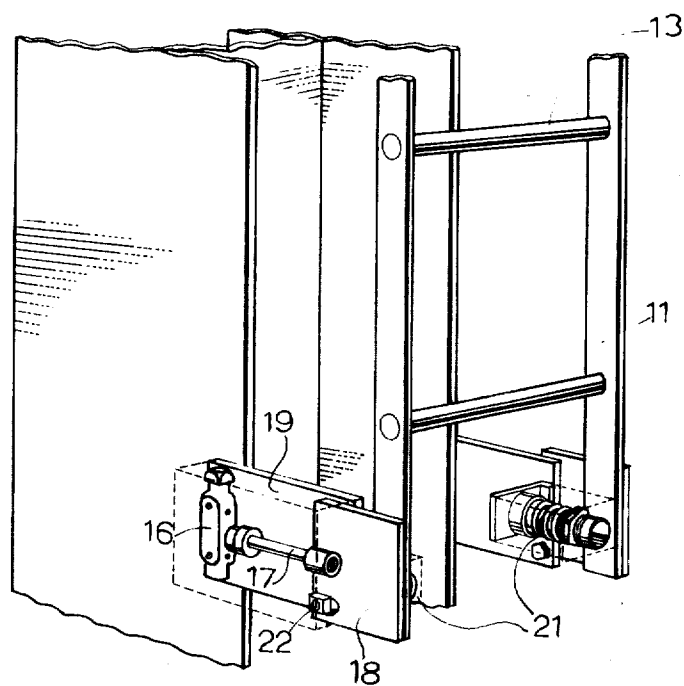


Fig-2-

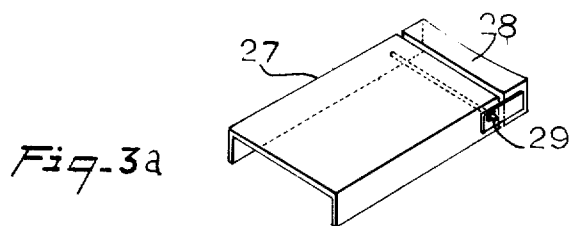
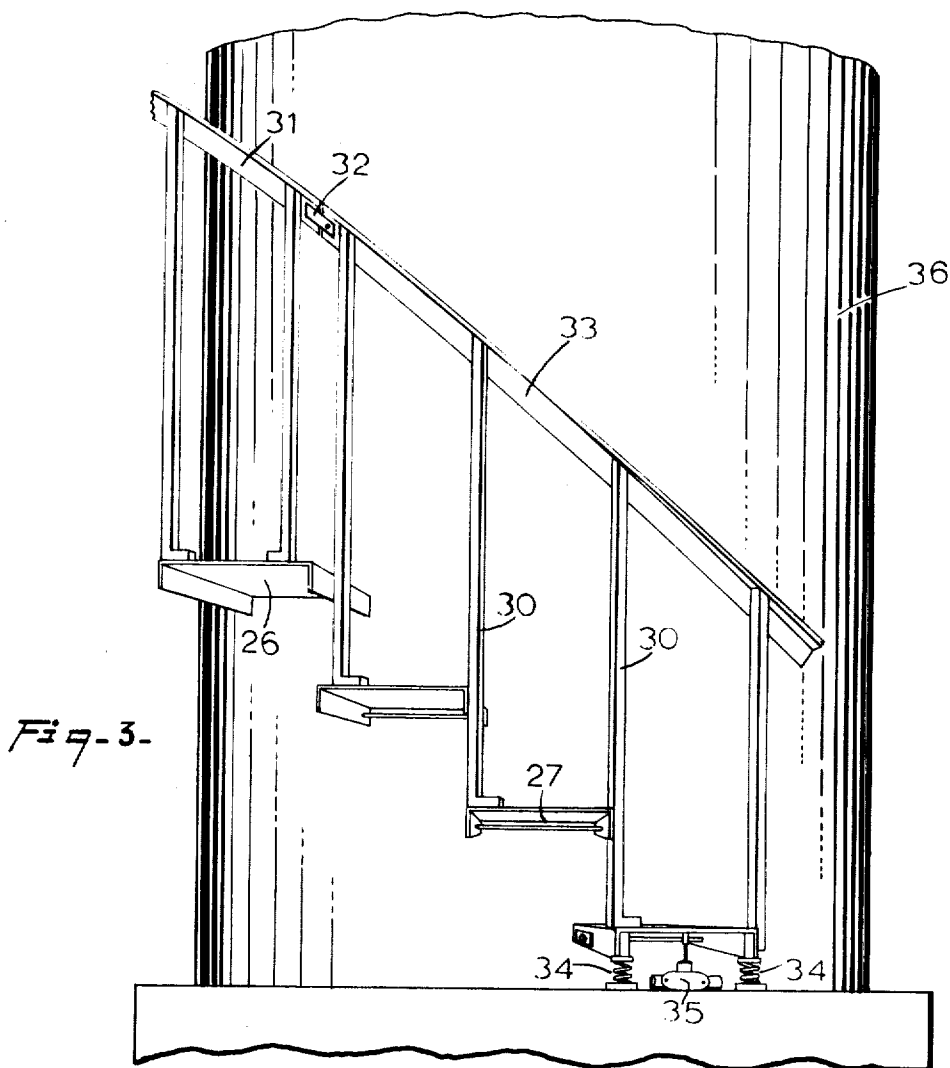


INVENTORS

Leo L. Garrett

Walter L. Birdyshaw

By *Julian C. Penfro*



INVENTORS
 Leo L. Garrett
 Walter L. Birdyshaw
 By *Julian E. Renfro*

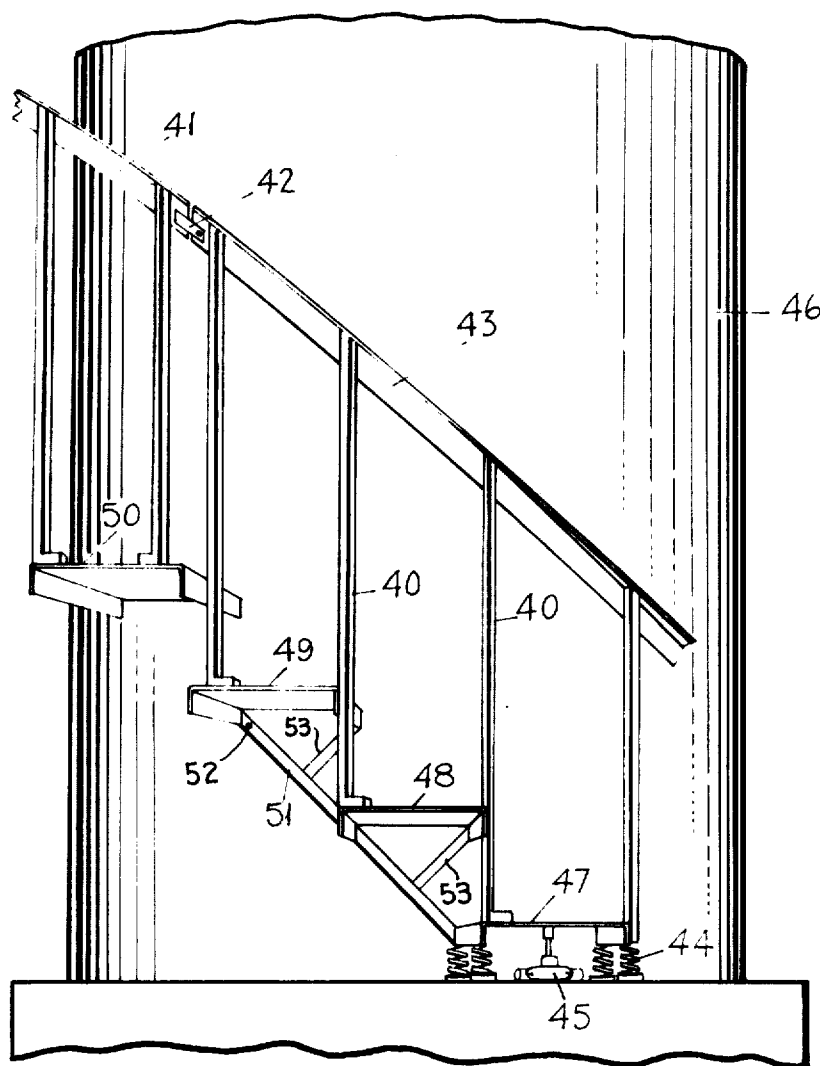


Fig. 4.

INVENTORS
 LEO L. GARRETT
 WALTER L. BIRDYSHAW
 BY *Julian C. Denfro*
 ATTORNEY

LADDER WARNING DEVICE

This application is a continuation of application 679,297, filed Oct. 27, 1967 and now abandoned.

This invention relates to a warning device adapted to prevent an intruder from climbing undetected upon a tank, tower, building or other type structure using a ladder or stair, and more particularly to an improved type of a ladder warning device in which a length or section of the ladder or stair on the side of such tank or structure is pivotally suspended in such a manner that it can move slightly to inconspicuously reveal the presence of an intruder, yet automatically reset itself for future operation subsequent to the removal of weight therefrom.

Ever since the turn of the century, various intruder detectors have been proposed for use with ladders or stairs, but these have been rudimentary type devices in which the intruder often became aware of the betrayal of his presence, not only by virtue of detectable movement of the stair or ladder, but also in many instances an alarm was sounded that was as audible to him as it was to the owner of the property.

A comparatively recently issued patent proposes a Ladder Warning Device for use with tall towers or the like, but it utilizes a slidable ladder section suspended by the use of springs and chains at a mid-portion of the ladder. That slidable section can move to reveal the presence of the intruder, and although that patentee asserts that the suspension arrangement could be made inconspicuous, it more likely than not could be sensed by the average prudent person, who might easily be able to disable the system. Furthermore, the slidable ladder section might well become loaded down with snow and ice or mud, thus causing a warning signal to be sent continuously, even though no unauthorized person were in the vicinity.

In contrast, the present invention provides in accordance with its principal embodiment, a pivotally suspended section of ladder several rungs or steps in length, which is arranged to move only very slightly at its lower portion in the event that an intruder places weight upon it. Because this arrangement comprehends a section of ladder of sturdy construction, suspended from comparatively massive pivot points disposed adjacent the uppermost portion of this novel ladder section, our invention is not susceptible to being actuated by a load of ice and snow or mud. Also, the motion detection arrangement used with this invention is quite inconspicuous, and only an intruder familiar with the system could detect the warning arrangement because of the unobvious construction of all components used therewith.

In this preferred embodiment, the base of the pivotal section of ladder is spring-biased away from the supporting structure of the tank or building, with the movement of the section toward the structure an extent of only $\frac{1}{8}$ of an inch or so being sufficient to set off an alarm in a remote location, which of course enables the guards or the police to apprehend the intruder in the act.

Another embodiment of our invention is designed for use with the curved type of ladder that may be used around the central column of a tank, such as a water tank, with a section of several steps or rungs of such ladder being pivotally supported at its upper end so that

the movement of the lower end can take place to a sufficient extent to warn of the presence of an intruder.

It is therefore a principal object of our invention to provide a low cost yet effective ladder warning device that is extremely difficult for the intruder to detect, which cannot be disabled by snow and ice or mud, and which resets itself automatically in a highly dependable manner despite many years of use.

These and other objects, features, and advantages will be more apparent from a study of the enclosed drawings in which:

FIG. 1 is a perspective view of the leg of a tank or the like, showing a section of ladder in accordance with one embodiment of this invention;

FIG. 2 is an enlarged perspective view of our invention, with certain portions removed, in which details of the suspension, motion detection means, and spring bias arrangements are revealed;

FIG. 3 illustrates a first embodiment of a curved stair arrangement, such as may be used in connection with the circular stairway about the central pipe of a large tank; and

FIG. 3a illustrates a connecting mechanism for securing the steps of FIG. 3.

FIG. 4 is another curved stair embodiment.

Referring now to FIG. 1, it will be noted that the structural leg 10 of a water tank or the like is provided with a comparatively rigid section of ladder 11 in accordance with our invention, in which comparatively massive pivotal support members 12 are provided at the top of the ladder section to support it effectively at all times. Because these support members 12 are in the form of pivots, the bottom end of the ladder can move slightly toward the leg 10 so as to give a warning signal at such time as an intruder places weight on one or more rungs 13 of the ladder, with no restraint to this motion being provided by the pivotal supports. As will be seen hereinafter, the bottom portion of the ladder is biased slightly away from the position in which a warning signal is given, so that only at such time as an intruder places his weight and utilizes climbing action on this section of the ladder will the bias be overcome, and the ladder move so as to cause a signal to be sent to the desired remote location.

As will be noted from this figure, the movable section of ladder may comprise only a fraction of the overall length of the ladder, and such section can be disposed at any of a variety of locations in a given ladder arrangement so as to make detection of its presence unlikely. In the present instance, the movable ladder portion is below fixed portion 14. By virtue of the fact that the comparatively movable section of ladder involves a number of rungs, it will be difficult, if not impossible, for the intruder to circumvent the section, even though he suspected the utilization of an intruder warning device.

The sturdy design of the pivotal support members and other components of our ladder warning arrangement is such that even an accumulation of snow and ice thereon will not interfere with proper operation. Also, our design is such that it will not interfere with the modern requirements of the use of various types of safety belts which are used to climb tanks. This latter is obviously a distinct safety advantage.

Referring to FIG. 2, it will be noted that the pivotal support means 12 includes in addition to a pair of bolts, a pair of plates 12a welded or otherwise secured to the tank leg 10. The lower end of the fixed upper ladder section 14 may also be secured to these plates.

At the lower end of the comparatively movable ladder section 11, plates 18 are secured such as by welding, these plates ordinarily being utilized in pairs. These plates 18 are preferably disposed so as to slightly overlap a pair of plates 19 that are welded or otherwise secured to leg 10, with the arrangement being such that as an intruder places weight on one or more of the rungs 13 of the ladder section 11, the plates 18 move so as to overlap the plates 19 to a greater extent. This relative motion is utilized in accordance with this embodiment of our invention to actuate the motion detection means now about to be described.

A switch unit 16, utilizing a micro-switch or a mercury switch, is mounted upon plate 19, such switch preferably being in a water-tight enclosure of the type shown. Extending outwardly from the switch unit 16 is a push rod 17, which is movable into and out of the switch unit. The end of the push rod remote from the switch unit is secured to plate 18, so as therefore will be understood, motion of the plate 18 toward the switch unit 16 as a result of climbing action on the movable section of ladder will bring about actuation of the switch, with preferably an alarm or warning light being actuated at a remote location. Damage to the switch as a result of too much motion can be prevented by the use of a stud and slot arrangement 22 utilized in the overlap portion of plates 18 and 19. A typical amount of motion permitted by this arrangement is $\frac{1}{8}$ inch, which is usually ample for proper switch operation.

In order to provide a positive resetting of the switch subsequent to the removal of weight from the movable section of ladder, we provide in accordance with this invention a bias in the form of a pair of spring units 21 whose bases are secured to the plates 19, and whose outer portions may be secured to the movable ladder portion 11. These springs serve to bias the movable ladder section to a sufficient extent about the pivotal support members that resetting of the switch 16 is assured. Adjustment means are provided so that the desired weight required to operate the ladder warning system can be preset. These springs are preferable enclosed in a weather-proof cover.

As will be apparent, upon an intruder placing weight upon the movable ladder section 11, the springs 21 are compressed to a sufficient extent that the push rod 17 will actuate the switch 16, and thus bring about a warning signal being given. For example, the switch 16 can be wired into a circuit arranged to provide a signal at either a local or a remote location, such as operating a light and/or warning bell on a switch board or control panel at a guard station. Such signal could be transmitted either by the use of wires or radio signals. Referring to FIG. 3, it will be noted that a fixed step 26 and a fixed railing 31 characterize the type of circular staircase utilized around the central column of one type of tank. Several movable steps 27 which together constitute a movable ladder section are also shown in this figure, with each of the moveable rungs or steps being suspended at their outer ends by means of rods 30 from a movable bannister or railing 33. The railing 33 is

pivotaly connected at 32 to the fixed portion 31 of the railing, with pivot 32 serving as a pivotal support means for this movable ladder section.

The inner portion 28 of each of the movable rungs or steps is secured to the central section 36 of the tank, with a connecting pin 29 or the like being utilized for securing the step portions 27 and 28 together in a proper manner; see FIG. 3a.

The lowermost movable step forms some support for the lower portion of the movable section of ladder in accordance with this embodiment, inasmuch as the outer end of the step is provided with a pair of compression springs 34 which serve to bias the outer end of the lower step, which unit is provided with a push rod 37 in contact with the underside of the step.

As will be apparent, upon an intruder placing weight on any part of the movable ladder section in accordance with this embodiment, the springs 34 are compressed to a sufficient extent that the push rod 37 will be moved downwardly to bring about actuation of the switch 35, and thus actuate a warning arrangement. For example, the switch 35 can be wired into a circuit arranged to provide a signal at a remote or local location, such as lighting a light and/or operating a warning bell or siren at the guard station or maintenance office. Such signal can be transmitted either by the use of wires or radio signals.

The design of the transmission device can vary as desired, for either a telephone system, a private wire, or radio system can be used for carrying the signal to a remote location. The switches are designed so that they can be installed in standard electrical fittings which will make it virtually impossible for an intruder to determine that an alarm system has been installed.

Turning now to FIG. 4, a curved ladder embodiment generally resembling the embodiment in accordance with FIG. 3 is illustrated, in which a modified form of pivotal support means is disposed adjacent a rigid ladder section. This section comprises steps or rungs 47, 48 and 49, with the outer ends of these three steps being supported by means of vertical bars 40 from a railing 43 that in turn is pivotally attached at 42 to the fixed railing 41.

The inner ends of steps 47 through 49 are maintained in the desired spaced relation by means of a bar 51 secured to each of these steps, with the upper end of this bar being pivotally supported at 52 from a lug or bolt extending outwardly from central section 46 of the tank. Short members 53 extend between the inner front edges of steps or rungs 48 and 49 and the bar 51, and the outer front edges of these steps are welded or otherwise secured to respective bars 40, thus keeping the front edges of these steps from tending to deflect undesirably.

A plurality of springs 44 are disposed beneath lowermost step 47, tending to bias this three-step section of ladder in one direction about pivot means 42 and 52, but of course this bias is overcome at such time as an intruder places weight upon any of these three steps. The railing 43 and bar 51 serve to hold these steps in a unit or section, which section can pivot about its pivot points upon weight being placed at virtually any location of the unit. Switch unit 45 is disposed adjacent or below step 47, which unit is caused to be actuated upon the springs 44 being compressed a small amount. The

operating of the switch unit of course is arranged as in the other embodiments to cause a signal to be given at a remote location.

As will now be apparent, we have provided an effective warning device for preventing an intruder from climbing undetected upon a ladder or the like that is utilized on a tank or building. In each embodiment, pivotal support means are disposed adjacent an upper end of a movable section of ladder, with bias means being used to bias the section of ladder in a given direction about the pivotal support means. The section of ladder tends to pivot about the pivotal support means in a direction opposite said given direction upon weight being placed upon said section of ladder, and motion detection means are disposed in cooperative relation with said section of ladder, to sense motion about said pivotal support means resulting from the placement of weight upon said section. Advantageously, the motion detection means resets itself automatically after the removal of weight from said section of ladder, with the result that little if any maintenance is necessary.

A cover is preferably provided over the switch unit and push rod assembly of FIG. 2, as indicated by the broken lines, this not only preventing an accumulation of dirt or snow, but also serving to render this assembly even more inconspicuous than it would otherwise be. The switch units of the other embodiments may likewise be provided with a cover, although the disposition of a switch unit below the lowermost step makes its detection highly unlikely.

It is claimed:

1. A warning device for preventing an intruder from climbing undetected upon a ladder comprising a comparatively rigid section of ladder equipped with a plurality of rungs and having an upper end and a lower end, stationary support means disposed adjacent the upper end of said section of ladder, for forming the principal support for said section of ladder, the upper end of said section of ladder being directly and pivotally attached to said support means for rotational deflection to a slight extent under the weight of a person stepping on the rungs, but not downward deflection, thus minimizing the extent of ladder travel and the conspicuousness of the motion, means biasing said section of ladder in a given direction about said pivotal support means, said section of ladder tending to pivot about said support means in a direction opposite said given direction upon weight being placed upon said section of ladder, and motion detection means disposed in cooperative relation with said section of ladder to sense the slight motion about said support means resulting from the placement of weight upon said section of ladder.

2. The warning device as defined in claim 1 in which said motion detection means resets itself automatically after the removal of weight from said section of ladder.

3. The warning device as defined in claim 1 in which said comparatively rigid section of ladder is substantially straight.

4. The warning device as defined in claim 1 in which said comparatively rigid section of ladder forms at least a portion of circular staircase.

5. The warning device as defined in claim 1 in which said motion detection means is arranged to actuate an

alarm in a remote location.

6. A warning device for preventing an intruder from climbing undetected upon a ladder, said ladder comprising a comparatively fixed section, adjacent which a comparatively movable section is supported as a continuation thereof, said comparatively movable section being rigid and having a plurality of rungs, and having an upper end and a lower end, stationary support means disposed adjacent the upper end of said comparatively movable section of ladder, for forming the principal support for latter section of ladder, said upper end of said comparatively movable section of ladder being pivotally attached to said support means such that said upper end can deflect rotationally to a slight extent under the weight of a person stepping on the rungs but not downwardly, thus minimizing the extent of ladder travel and the conspicuousness of the motion, means biasing said movable ladder section in a first direction about said pivotal support means, said movable ladder section being movable in a direction opposite said first direction as a result of the weight of an intruder thereon, and motion detection means arranged to be actuated at such time as said movable ladder section is moved in a direction opposite said first direction, whereby an alarm may be given.

7. The warning device as defined in claim 6 in which said motion detection means resets itself automatically after the removal of weight from said movable section of ladder.

8. The warning device as defined in claim 6 in which said fixed and movable ladder sections are substantially straight sections, disposed at a comparatively steep angle against a structure.

9. The warning device as defined in claim 6 in which said fixed and movable ladder sections together form at least a portion of a curved ladder.

10. The warning device as defined in claim 6 in which said motion detection means is arranged to actuate an alarm in a remote location.

11. A warning device for preventing an intruder from climbing undetected upon a ladder comprising a comparatively rigid section of ladder equipped with a plurality of steps, stationary support means disposed adjacent an upper end of said section of ladder, for forming the principal support for said section of ladder, the upper end of said section of ladder being pivotally attached to said support means, such that said upper end can deflect rotationally to a slight extent under the weight of a person stepping on the steps, but not downwardly, thus minimizing the extent of ladder travel and the conspicuousness of the motion, said section of ladder tending to pivot slightly about said support means upon weight being placed upon said section of ladder, and motion detection means disposed in cooperative relation with said section of ladder, to sense motion about said support means resulting from the placement of weight upon said section of ladder, and to give an alarm at a remote location.

12. The warning device as defined in claim 11 in which said comparatively rigid section of ladder is substantially vertically disposed.

13. The warning device as defined in claim 11 in which said comparatively rigid section of ladder forms at least a portion of a circular staircase.

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