

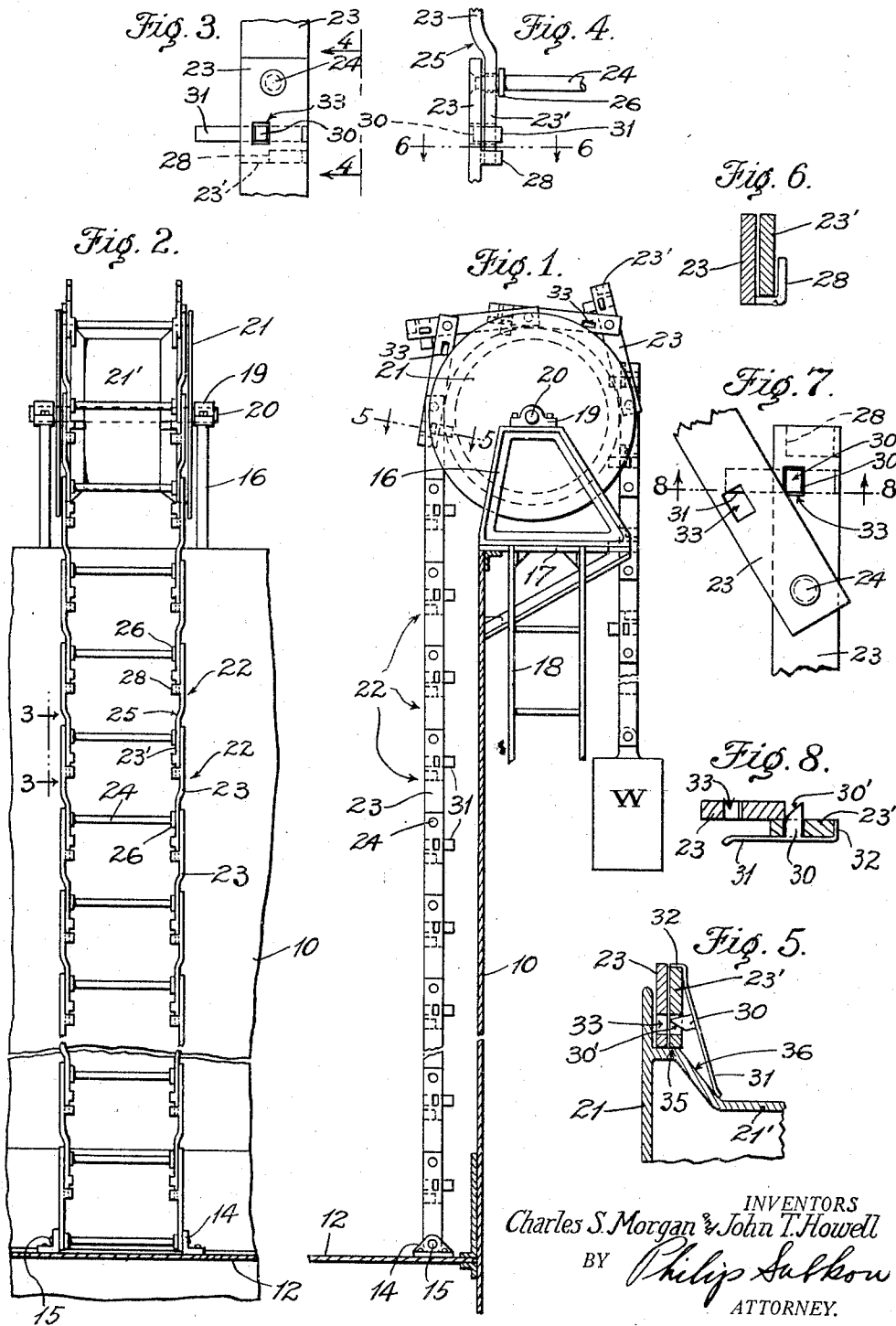
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SELF LOCKING LADDER FOR FLOATING ROOF TANKS

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SELF-LOCKING LADDER FOR FLOATING ROOF TANKS

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This invention relates to ladders and has been developed especially for use upon floating roof tanks which rise and fall with the liquid level, such type of tanks being in com-
mon use in the petroleum industry.

The object of this invention is to present a ladder construction of the character stated which will provide for the securing of the lower end of the ladder to a tank roof, for running the ladder into and out of the tank as the roof rises and falls in such manner that the surplus portion of the ladder may depend outside of the tank and be drawn back into the tank when the liquid level drops, for maintaining the service portion of the ladder (that part within the tank) rigid for use, and for automatically controlling the movement of all parts. It is also an object of the invention to provide a ladder of the type described which shall contain a minimum of parts and require minimum attention for maintenance.

Briefly stated, the invention comprises a plurality of flexibly connected sections, each of which sections is rigid in itself and includes a rung or tread and means for releasably locking adjacent sections in order that the useful portion of the ladder within the tank will be always rigid, and the surplus portions of the ladder may pass over the edge of the tank to the outside as the roof rises and may be drawn back into the tank as the roof falls. The invention also comprises a releasably locked sectional structure as above described in combination with a cooperating device, across which the surplus portion of the ladder passes having means for operating the releasable locking device. In a preferred embodiment, the cooperating means is in the form of a drum having annular ledges which the ladder sections engage and over which they pass and bevelled portions for engagement by and operation of the releasable means. Or more broadly stated, the invention comprises a flexible ladder whose lower end is adapted to be secured to a floating roof and having a plurality of rigid sections flexibly connected and provided with means for releasably locking certain sections into a rigid

portion in combination with means for automatically operating the locking means.

In the accompanying drawings wherein one desirable form of the invention is illustrated,

Fig. 1 is a side elevation of the ladder mounted in operative position upon a tank having a floating roof;

Fig. 2 is a front elevation showing particularly the service portion of the ladder disposed within the tank;

Fig. 3 is an elevational detail showing a joint and its locking means viewed from the side of the ladder as indicated by the line 3—3 of Fig. 2;

Fig. 4 is a view taken at right angles thereto from the line 4—4 of Fig. 3;

Fig. 5 is a cross sectional detail taken on the line 5—5 of Fig. 1 and indicating how the locking means is released by the drum over which the ladder sections roll;

Fig. 6 is a cross sectional detail taken on the line 6—6 of Fig. 4;

Fig. 7 is an elevational detail, and Fig. 8 is a cross sectional detail taken on line 8—8 of Fig. 7, these two figures indicating latch movement for return of sections to alignment.

In these drawings a ladder constructed according to the present invention is shown as mounted upon a petroleum storage tank 10 and its floating roof 12, said roof having secured thereto a pair of brackets 14 to which the lowermost section of the ladder is pivotally connected as at 15. The outer edge of the tank wall 10 carries a framework generally indicated at 16 and suitably braced, this framework conveniently comprising a platform 17 accessible by means of an ordinary steel ladder 18, and carrying journals 19 for the shaft 20 of a reel or drum 21 over which the surplus portion of the ladder passes.

The ladder proper comprises a plurality of sections each of which is generally indicated at 22 and comprises a pair of oppositely disposed links or spacers 23 between the upper ends of which a tread or rung 24 extends and to which upper ends said link is secured as best seen in Fig. 4. The lower ends of each

pair of links 23 are offset inwardly as indicated at 25 to form offset portions 23' in order that said lower ends may lie within and alongside of the upper ends of the adjacent links 23, the treads 24 passing through said offset lower ends just below the offsets 25 and acting as bearings about which the respective links may be prevented from moving inward from aligned position, collars 26 are fixed upon the treads 24 to retain said offset link ends against inward movement. The forward edges of the links 23 as viewed in Figs. 2 and 4 are provided with laterally offset and reversely turned retaining lugs 28 which serve to engage the lower extremities of the offset link portions when adjacent sections are in properly aligned or operative position to insure against doubling back beyond dead center. Thus the treads or rungs 24 serve to properly space the opposite links of each section and also to pivotally connect adjacent sections with each other.

In order that adjacent sections may be locked in longitudinal alignment to form a rigid operative ladder length, a locking device is provided at each joint, this device being in the form of a latch 30 mounted upon a spring arm 31 secured to the offset portion 23' of each link as indicated at 32. The latch 30 normally is received in apertures or pockets 33 formed in the adjacent portions of the links 23 and their offset portions 23', Figs. 3 and 5, thereby locking adjacent links against swinging motion about rungs 24.

The various spring arms 31 when in normal position are vertically aligned as indicated in Fig. 1 in order that they may be successively operated as the ladder sections pass over the drum 21. The peripheral portions of the heads of the drum 21 serve as annular flanges to position the links 23, and these links are adapted to engage and roll over horizontally disposed annular tracks 35 formed in the drum barrel 21' said drum barrel also being offset to provide annularly disposed bevelled walls 36 which are engageable by the extremities of the spring fingers 31 to withdraw the latches 30 from the recesses 33 as said links 23 roll over their annular tracks 35.

In operation, a number of the lower ladder sections 22 are usually vertically aligned with the latches 30 in locking position to form a rigid serviceable ladder length upon which an attendant may descend to the tank roof for inspection. As the tank roof rises upon elevation of the liquid level, the ends of the respective spring fingers 31 engage with the bevelled annular walls 36 of the drum barrel 21', thus withdrawing the latches 30 from the respective apertures 33 to permit the joints to break so that the ladder section next above will swing about run 24 as seen at the left of the Fig. 1. This permits the surplus portion of the ladder to roll over the drum 21 into ver-

tical position outside of the tank, a counterweight W being provided to insure proper movement. Incidentally the surplus portion outside of the tank also is locked in rigid position by the latches 30 and when the tank roof descends, these latches will be withdrawn to permit return of the ladder sections as just described.

At certain stages of the passage of the links over the drum 21, the offset ends 23' are moved outside of the range of the adjacent link portions 23 as indicated at the top of Fig. 1, so that the spring fingers 31 disengage the bevelled walls 36 and permit the latches 30 to re-enter the respective aperture 33. As these sections begin to approach alignment and before the extremities of the spring fingers 31 come into engagement with the bevelled walls 36, the respective latches 30 come into engagement with the outer edges of the adjacent links 23, and in order to withdraw each latch 30 it is necessary that the adjacent face of the outer portion thereof be bevelled as at 30' so that it will ride over the edge of the adjacent link 23 and thereby shift the latch.

From the foregoing it will be clear that depending portions of the ladder are locked in rigid relation with the sections properly aligned and that as the surplus portions pass over the drum 21 the latches will be properly released to permit such passage.

While we have disclosed one desirable embodiment of the invention, it is to be understood that this form is presented merely as an illustration, and is not to be considered as limiting the generic invention, since many modifications within the scope of the claims will be obvious to those skilled in the art.

We claim:

1. A ladder comprising a plurality of swingingly connected rigid sections, means carried by the sections for locking adjacent sections in alignment to form a rigid ladder portion, certain sections having treads, and means disposed adjacent said ladder and into engagement with which said ladder sections are adapted to be moved for automatic release of said locking means.

2. A ladder for floating roof tanks and the like comprising a plurality of hingedly connected rigid sections, means for locking adjacent sections in rigid relation when in longitudinal alignment, means over which said ladder sections are adapted to move, said sections being adapted to swing on said hinge connections in their movement over the last mentioned means, and means adjacent said last mentioned means for automatically releasing the locking means for such swinging movement.

3. A ladder for floating roof tanks and the like comprising a plurality of flexibly connected rigid sections, means for locking adjacent sections in rigid relation when in longitudinal alignment, means to receive said lad-

der sections for movement of said sections therearound, and means cooperating with the receiving means to automatically release said locking means to permit relative travel of the sections about said receiving means.

5 4. A construction according to claim 1 wherein each locking means comprises a latch movable into apertures in the respective ladder sections, movable means carrying said latch and actuable by the releasing means, one
10 face of such latch being bevelled to permit return of one section into alignment with an adjacent section, another face of said latch being perpendicular to the direction of swing to prevent swing in one direction and a retaining lug on one section to prevent swing in
15 the opposite direction.

5 5. A construction according to claim 3 wherein a counter-weight is secured to that end of the ladder which passes over and depends from the receiving means.

20 6. A ladder for floating roof tanks and the like comprising a plurality of hingedly connected rigid sections having treads, means for locking adjacent sections in rigid relation
25 when properly aligned, a drum having tracks over which upper sections are adapted to travel to depend on the other side thereof, a means working in cooperation with the tracks on said drum for releasing the locking means
30 on sections approaching the drum to permit the surplus sections to roll thereover.

7. A collapsible ladder comprising a plurality of flexibly connected rigid sections,
35 means for locking said sections in aligned position, means located at a predetermined point and with relation to which means said ladder sections are movable, the last named means cooperating with the ladder sections for automatically releasing respective locking means
40 to collapse respective ladder sections as they pass said point.

8. In combination a tank, a floating roof therein, a ladder secured to said roof and comprising a plurality of hingedly connected sections extending upward therefrom, means for releasably locking said sections in vertical alignment, and means at the top of the tank for releasing the respective locking means to
45 collapse respective sections as they pass the top of the tank.

9. A ladder comprising a plurality of flexibly connected rigid sections, each section including a tread, means for locking said sections in aligned position, means cooperating
55 with said locking means to automatically release said locking means, said locking means comprising a latch adapted to enter pockets in adjacent sections, an arm upon which said latch is carried and by movement of which
60 said latch is withdrawn.

In witness whereof we affix our signatures.

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