

Oct. 1, 1957

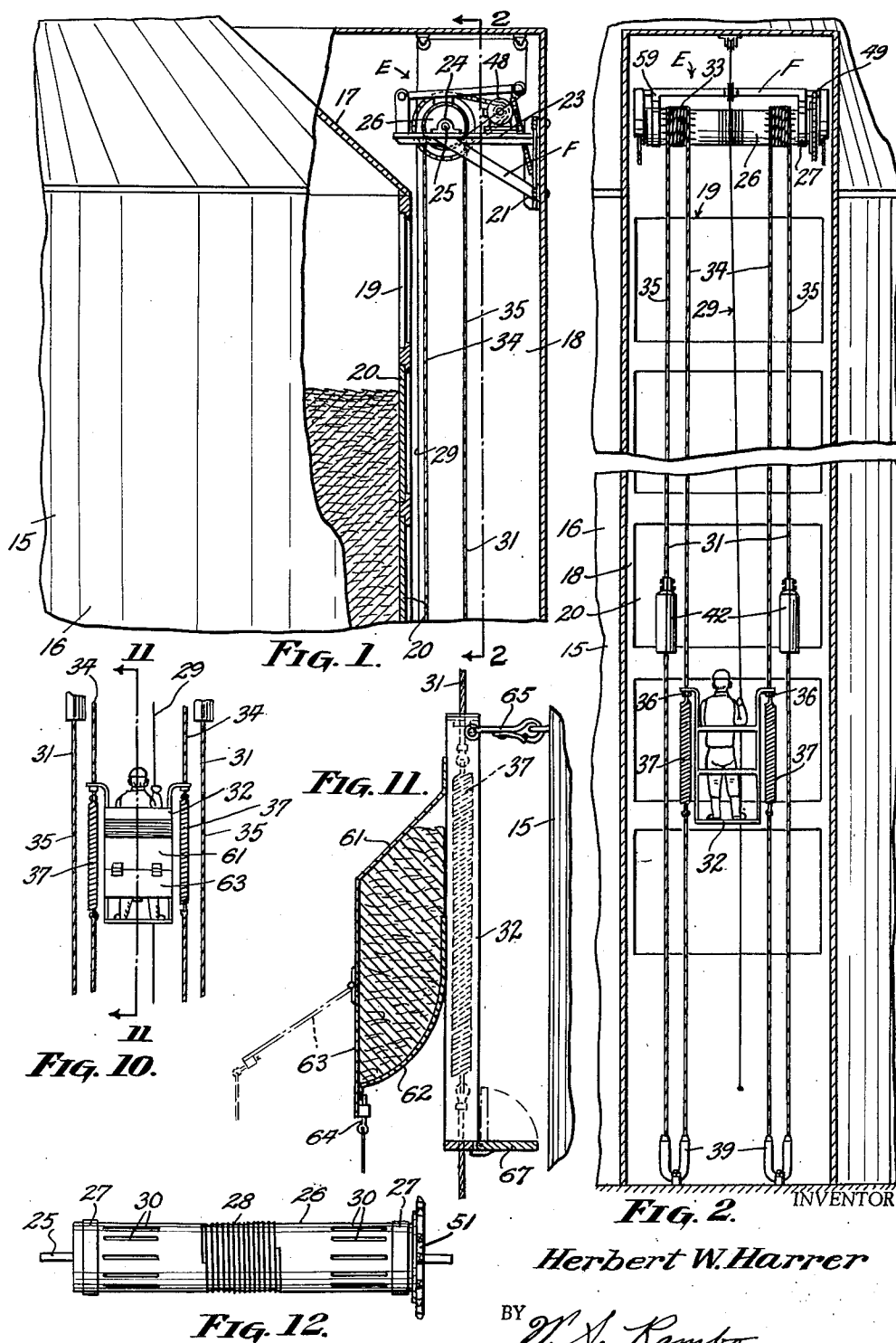
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2,808,126

MAN-LIFTING APPARATUS FOR SILOS AND THE LIKE

Filed March 26, 1956

2 Sheets-Sheet 1



BY *W. A. Rambo*

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2 Sheets-Sheet 2

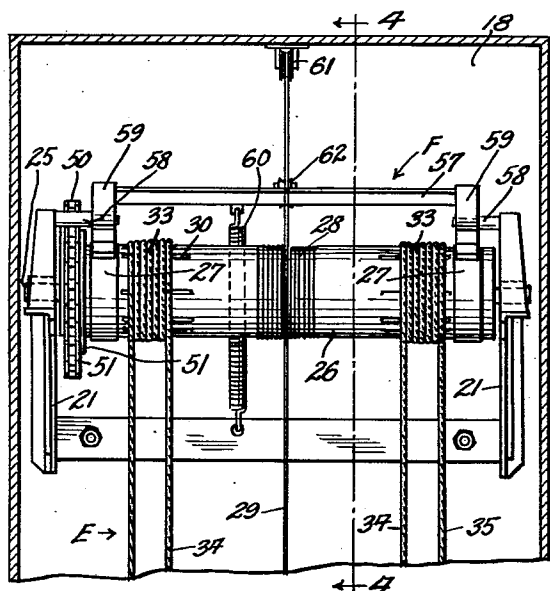


Fig. 3.

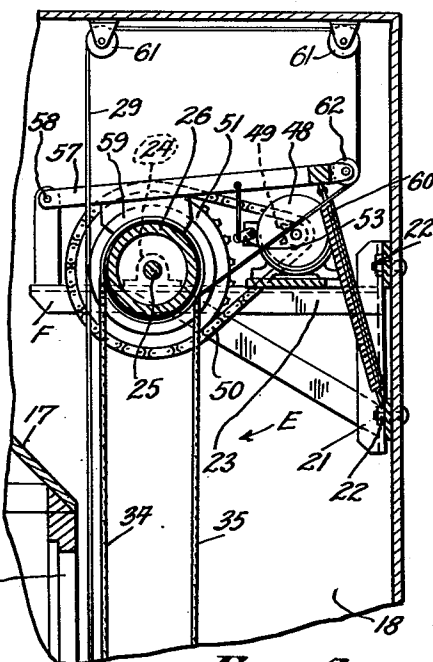


Fig. 4.

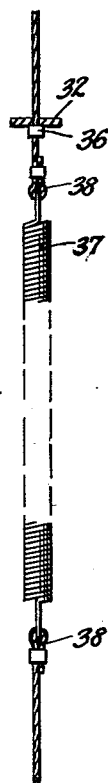


Fig. 5.

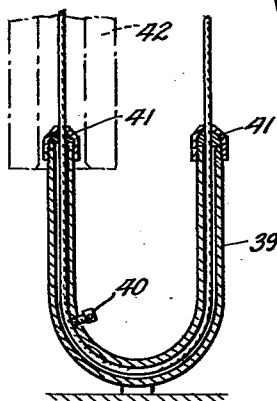


Fig. 6.

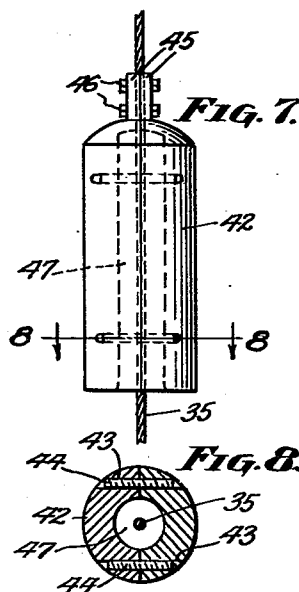


Fig. 7.

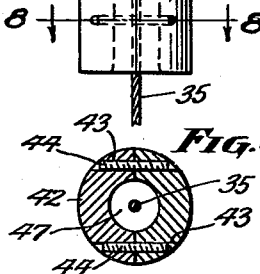


Fig. 8.

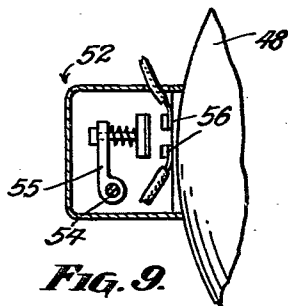


Fig. 9.

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## MAN-LIFTING APPARATUS FOR SILOS AND THE LIKE

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4 Claims. (Cl. 187—6)

This invention relates to an improved passenger elevator or man lift for farm silos and other relatively tall agricultural or industrial buildings.

A general object of the invention is to provide such a man lift or elevator designed for the reception of a single passenger, which is simple yet efficient for its intended purposes, of low cost, convenient to install and operate, safe and reliable in its functioning and of compact design so that the same will be disposed in close adjacency to an associated silo or other building wall.

Another object is to provide an elevator of this kind wherein a vertically movable passenger car or carrier is employed which is supported at the sides and laterally stabilized by being connected with a pair of vertically extending cables, the latter having their upper lengths wrapped about a rotatable winding drum and their lower lengths trained through stationary guides at the foot of the elevator, the outer lengths of both cables being equipped with counterweights for at least partially balancing, or, in certain instances, over-balancing, the weight of a passenger and the carrier, the dual cables imparting safe and smooth motion to the carrier during its ascent or descent and eliminating the use of fixed guide rails for confining the carrier, the inner lengths of the cable having spaced ends joined by contractile coil springs, maintaining the cables taut at all times.

A further object is to provide an elevator of the character indicated wherein improved motor and counterbalancing means are employed in a preferred form of the invention to produce elevation of the passenger-carrier, reliance being placed on the counterbalancing means, supplemented with an improved brake mechanism, in providing for controlled descent of the frame without the necessity of motor operation; and in an alternative form of the invention the motor drive is eliminated and reliance placed on an improved brake-governed counterweighting system for effecting, in a readily controlled manner, both ascent and descent of the passenger carrier.

A still further object is to provide a man lift for farm silos which is compactly designed for installation in door-closed drop chutes formed at the sides of such silos and adapted for the guided vertical descent of ensilage deposited therein from the upper levels of the ensilage beds stored in the silos, the construction of my improved man lift being such as to prevent the same from obstructing or otherwise interfering with the free gravitational fall of ensilage through chutes or the normal uses thereof, and to maintain the chute open ad unimpeded.

Additional objects, advantages and constructional details of the elevator apparatus forming the present invention will be obtained by reference to the following description and the accompanying drawings in which similar characters of reference are employed throughout the several views to indicate like and corresponding parts.

In said drawings:

Fig. 1 is a side elevational view, partly in vertical section, of a farm silo equipped with the passenger-carrying elevator of the present invention;

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Fig. 2 is a vertical sectional view on the line 2—2 of Fig. 1;

Fig. 3 is an enlarged fragmentary front elevational view of the hoisting drum and its associated driving and braking mechanisms of the present invention;

Fig. 4 is a vertical sectional view on the line 4—4 of Fig. 3 of the construction disclosed in Fig. 3;

Fig. 5 is an enlarged detail view in side elevation disclosing the spring means of the inner cable length;

Fig. 6 is a detail vertical sectional view disclosing one of the lubricated cable-guiding devices mounted at the base of the elevator structure;

Fig. 7 is a detail side elevational view, partly in vertical section, of one of the counterbalancing weights mounted on the outer length of an associated cable;

Fig. 8 is a detail horizontal cross-sectional view taken through the weight on the line 8—8 of Fig. 7;

Fig. 9 is a detail vertical sectional view showing the motor switch;

Fig. 10 is a front elevational view of a modified type of carrier;

Fig. 11 is a vertical sectional view on the line 11—11 of Fig. 10;

Fig. 12 is a detail front elevational view of the cable drum.

Referring to the drawings in greater detail, a conventional farm silo is shown at 15. The silo includes a right circular cylindrical wall 16 having a roof dome 17. The wall 16 is formed with a rectangular silage drop chute 18, said wall forming a part of the chute being provided with vertically aligned spaced openings 19 having a series of removable doors 20. As silage stored in the silo is removed from the top thereof, the appropriate door, or doors, in the wall opening is removed, whereby to enable the silage to be discharged through the opening for gravitational descent in the chute and subsequent removal from the base thereof. Usually the silo wall is provided in the chute with ladder-forming steps which are dangerous and difficult to climb and descend, and in lieu of such steps the present invention offers a simple, safe, and easily controlled elevator mechanism, which has been indicated generally at E in the drawings.

In a presently preferred form of my invention, as shown in Figs. 1 through 8, the mechanism E employs at the upper end of the chute 18 a frame structure F which embodies a pair of vertical back members 21 suitably secured at 22 to the wall of the chute 18. The frame further includes horizontally disposed, brace-held arm 23 carrying horizontally aligned bearings 24 for the reception of the end trunnions 25 of a rotatable cable and brake-receiving drum 26. This drum, as shown in Fig. 12, is formed at its ends with circular bands 27 of brake lining and in its central region with helical grooves 28 for the reception of a brake-controlling rope 29.

Between the grooves 28 and band 27 the drum is formed preferably with a plurality of spaced, parallel, longitudinally extending slots 30 of short length around which the cables or equivalent, substantially continuous, flexible members 31, controlling the operation of a passenger car or carrier 32, are wrapped, the slots allowing foreign matter to work out from under the cables 31 and also prevent slipping of the cables while in contact with the outer surfaces of the drum.

The cables 31, after being wrapped around the drum at longitudinally spaced positions thereon, as shown at 33, each includes vertically depending inner and outer parallel lengths 34 and 35, respectively, the flat, frame-like passenger carrier 32 being disposed between the inner cable lengths and rigidly fastened thereto at 36. As shown in Fig. 5, an elongated coil spring 37 is connected with spaced end portions 38 of the inner length 34 of each cable 31 and arranged at the sides of the carrier,

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the springs serving to maintain the cables taut and under tension at all times.

The lower ends of said cables are trained through stationary base-anchored, substantially U-shaped guide devices 39. These devices are provided with lubricant-receiving fittings 40 for the forced introduction therein of a lubricating grease under pressure. Also, the upper ends of the guide devices are preferably equipped with packing glands 41, the devices being thus formed to maintain the cable lengths engaged thereby lubricated and, also, to admit of their free and easy flexing movement through the U-shaped cable passages provided thereby.

The outer lengths 35 of the cables 31 are, as shown in Figs. 7 and 8, equipped with counterbalancing weights 42. Each of these weights is composed of two semi-cylindrical sections having flat meeting faces, the sections being formed with threaded openings 43 for the reception of screws 44 employed in holding the sections together. At their upper ends the weight sections are formed with clamping extensions 45 between which the outer cable lengths 35 are positioned and securely gripped upon tightening of the bolts 46, whereby to maintain the positions of the weight on said cables. Each weight further includes an interior axial chamber 47 which may receive the upper end of an associated guide device 39 when the weight is cable lowered to an extent requiring such interfitting between the parts defined, as shown in Fig. 6.

The weight of the carrier 32 and a passenger therein is at least partly counterbalanced by the weights 42. When the elevator mechanism is motor operated, as in the form of the construction here being described, the total weight of the two counterbalancing weights 42 must not be more than the weight of the carrier and passenger and should be considerably less, so that reversal in the direction of motor operation will not be needed. Such counterbalancing makes possible the use of an electric motor of lower horsepower than would be the case if the weights were not used and, in addition, their use contributes substantially to the safety of the apparatus.

To drive the drum 26, use is made preferably of an electric motor 48 mounted on the frame structure F. The armature shaft of the motor is equipped in this instance with a sprocket 49 which drives an endless roller-type chain 50, the latter being also trained over a larger sprocket 51 fixed at one end of the drum 26, as shown in Figs. 3 and 4. The motor includes an operating circuit, not shown, in which is arranged a starting switch 52 having a movable actuating arm 53. Mounted on a shaft 54 within the switch casing is a contact arm 55 normally spaced from stationary circuit terminals 56.

A brake yoke or stirrup 57 of the drum-braking mechanism is carried by the frame F. In this instance, the outer end of the stirrup is hinged at 58 to the frame structure F, the stirrup carrying a pair of arcuate brake shoes 59 disposed normally in braking engagement with the lining bands 27 of the drum 26. A coil spring 60 is connected at its upper end with the stirrup 57 and at its lower end with the supporting frame structure, the contraction of the spring serving to maintain the shoes 59 in such engagement with the bands 27 as to preclude drum rotation. To release the drum for rotation, the rope 29 is actuated by the passenger in the carrier 32 so that upward swinging movement is imparted to the stirrup 57 to lift the shoes 59 from the bands 27. In accomplishing this operation, it will be noted that the upper portion of the control rope 29 is trained over guide sheaves 61 and thence downwardly around a guide pulley 62 on the inner free end of the stirrup 57. From the pulley 62 the rope extends to and is wound around the drum by being positioned in the helical grooves 28, the upper end of the rope, after the groove wrappings, being suitably anchored to the drum. The rope extends downwardly from the sheaves 61 and has its lower end

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suitably attached to the carrier 32. Thus, the rope winds up on the center part of the drum when the drum is revolved to raise the carrier 32, and unwinds on downward movement of the latter. This feature makes the length of the control rope to the carrier constant.

When it is desired to raise the carrier, the control rope is pulled by the passenger occupying the carrier in order, first, to release the brake mechanism. After this has been done, a continued pull on the control rope raises the brake yoke or stirrup 57 to a position bringing the switch arm 55 into contact with the terminals 56 of the switch 52. This action results in the operation of the motor and consequent energizing of the motor and rotation of the drum 26 in a direction elevating the carrier. When the desired elevation of the carrier is reached, the passenger releases the control rope, so that the yoke or stirrup 57 may respond to the action of the spring 60 to cause the motor circuit to be broken and the brake shoes applied to arrest drum rotation, thus bringing the carrier to a stop. When the passenger desires to descend, the control rope is merely pulled sufficiently to release the brake but not to energize the motor. Then, as a result of the combined weight of the carrier and the passenger therein, the carrier descends gravitationally, lifting the counterbalancing weights 42. The speed of descent may be checked by releasing the control rope and applying the drum brakes as required. In this operation, the pull initially applied to the control rope 29 is less than that required to operate the motor switch. It will be noted that by virtue of this construction, fixed, rigid guides are unnecessary for the proper operation of the car or carrier 32, reliance being placed on the positions of the taut cables 31 at the sides of the carrier to maintain the latter's steady ascent and descent. The construction is thus adapted for easy and convenient installation, with relatively low-cost manufacture. The car or carrier may be stopped at any position in the full height of the silo or its drop chute through simple brake application, enabling a passenger to enter a silo at the desired level. The flat, open construction of the elevator is such that it will not interfere with the fall of silage unloaded from the silo through the chute.

The elevator is also adapted to motorless operation by providing the car or carrier 32, as shown in Fig. 10, with a ballast-receiving receptacle 61, having an open top and a downwardly and outwardly inclined bottom wall 62. The front wall of the receptacle is provided toward the bottom wall with a ballast-discharge opening which is normally closed by a swinging door 63. This door may be released for opening movement through the actuation of a pull-cord released latch 64. By this arrangement the counterweights 42 are sufficiently heavy to overbalance the weight of the carrier and its passenger, so that when the drum brakes are released, the carrier will ascend. When the passenger desires to descend, silage or other ballast is deposited in the receptacle 61 in an amount sufficient, when taken in connection with the weight of the carrier and the passenger, to overbalance the counterweights 42, thus providing for downward movement of the carrier under brake regulation if needed. When the carrier reaches the bottom of the chute shaft, the door 63 is opened so that the weighting ballast may be discharged. Silo-engaging latching devices 65 may be provided on the carrier to retain the same in any of its positions of stop.

While I have described my improved elevator apparatus in its adaptation to farm silos, it will be understood that the same may be employed in connection with any structure where a simple and low cost man lift may be needed.

The apparatus lies in close adjacency to the silo wall 16 and takes up but little room in the drop chute so that it will not interfere with the normal dropping of silage therethrough. The car or passenger frame 32 may, as shown in Fig. 11, be provided with a hinged spring-actuated step 67 which assumes a horizontal position,

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as shown in full lines in Fig. 11, when a man is standing on the same, but when the car or frame is unoccupied the step will be caused to swing to an upright position, as indicated in broken lines, to minimize ensilage deposit thereon.

I claim:

1. Man-lifting apparatus comprising, a rotatable horizontally disposed drum; frame means attachable to a building wall supporting said drum for rotation about its longitudinal axis; a vertically movable passenger-carrier; a pair of vertically disposed substantially continuous, flexible members each presenting inner and outer lengths arranged at each side of the carrier and connected therewith; guide devices stationarily mounted at the bottom of the wall and around which the lower portions of said flexible members are trained, the upper portions of said flexible members being reaved about said drum; coil springs cooperative with the inner lengths of said flexible members to maintain the latter under tensioning forces; counterbalancing weights fixed to the outer lengths of said flexible members; spring-pressed brake means normally engaged with said drum to restrain the same against rotation; and manually operated control means accessible to a passenger occupying said carrier for moving said brake means to a drum-releasing position.

2. A silo elevator comprising: a frame attachable to the wall of an associated silo contiguous to the top thereof; a drum rotatably mounted on said frame; movable spring-pressed brake means normally engaging said drum to restrain the same against rotation; a pair of vertically extending transversely spaced cables having inner and outer lengths, said cables having their upper portions engaged with said drum to raise and lower said lengths upon drum rotation; counterweights carried by the outer lengths of said cables; guide devices disposed at the base of the silo around which the lower portions of said cables are trained; a passenger carrier arranged between and joined with the inner lengths of said cables, said carrier being movable vertically and in close adjacency to the side

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wall of the silo; spring means cooperative with said inner cable lengths for maintaining both lengths of each cable under tension; and manually operated means accessible from said carrier for moving said brake means to a drum-releasing position.

3. A silo elevator comprising: a frame attachable to the wall of an associated silo contiguous to the top thereof; a drum rotatably mounted on said frame; movable spring-pressed brake means normally engaging said drum to restrain the same against rotation; a pair of vertically extending transversely spaced cables having inner and outer lengths, said cables having their upper portions engaged with said drum to raise and lower said lengths upon drum rotation; counterweights carried by the outer lengths of said cables; guide devices disposed at the base of the silo around which the lower portions of said cables are trained; a passenger carrier arranged between and joined with the inner lengths of said cables, said carrier being movable vertically and in close adjacency to the side wall of the silo; spring means cooperative with said inner cable lengths for maintaining both lengths of each cable under tension; manually operated means accessible from said carrier for moving said brake means to a drum-releasing position; an electric motor having an operating circuit mounted on said frame; a normally open control switch for said circuit including a movable actuating element arranged for engagement with said brake means upon determinate releasing movement thereof to close said motor circuit; and power-transmitting means driven by said motor for rotating said drum.

4. A silo elevator as defined in claim 2, and wherein said carrier is formed with a counterweighting ballast-receiving compartment; and movable door means normally closing said compartment, said door means being releasable to assume an open position discharging counterweighting ballast contained therein.

No references cited.