Oct. 10, 1939. H. E. DOW 2,175,381

EXTENSION TOWER AND ACTUATING MEANS THEREFOR

Filed March 9, 1938 2 Sheets-Sheet 1

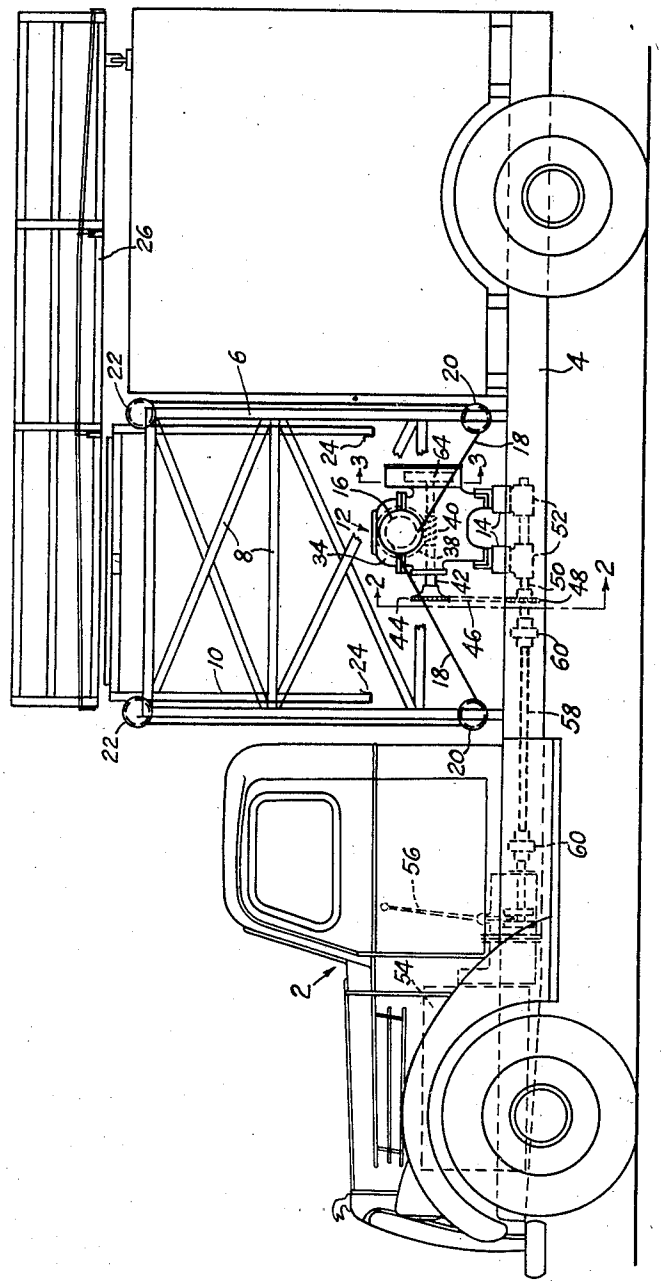


Fig. 1.

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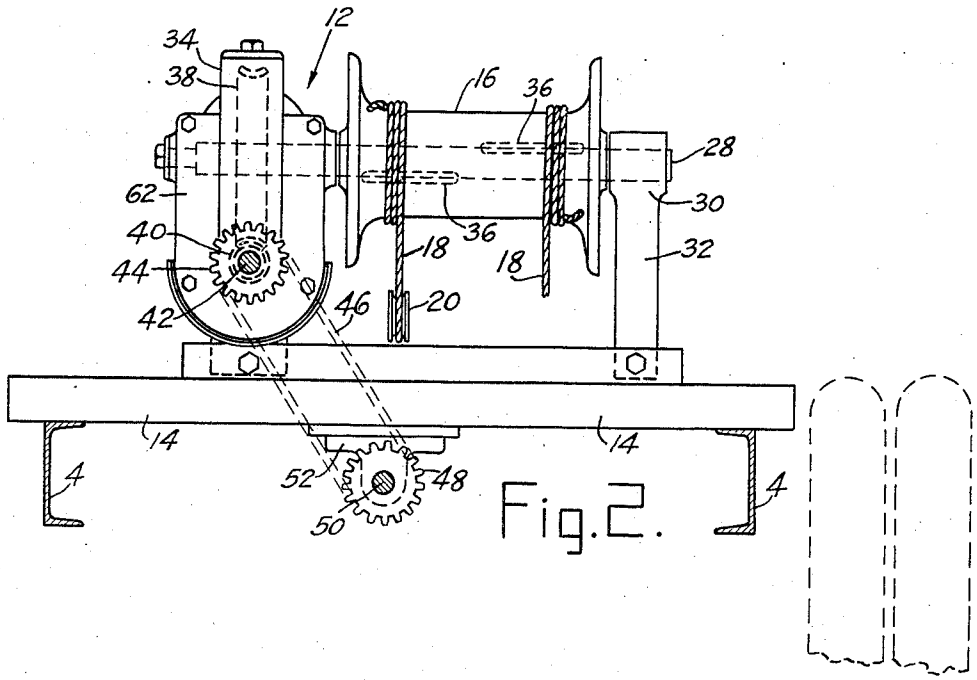


Fig. 2.

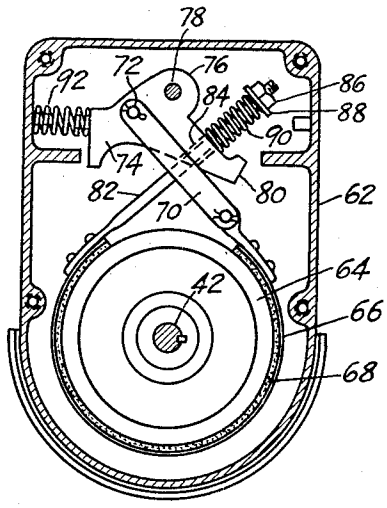


Fig. 3.

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EXTENSION TOWER AND ACTUATING MEANS THEREFOR

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2 Claims. (Cl. 304—9)

This invention relates to constructions such as extension towers and the like carried by trucks or other vehicles and to actuating mechanism therefor whereby a platform or other structure may be raised and lowered from time to time.

The platforms on extension towers are designed to be raised so that workmen can repair overhead wires, lights and the like or perform other operations in elevated positions. Such towers are ordinarily raised by means of a pair of cables which are wound on a rotatable drum. The cables pass over sheaves on the upper portion of a lower section of the tower and the ends of the cables are secured to the lower portion of a movable upper section or sections of the tower. With this construction rotation of the drum in one direction causes both cables to be wound up on the drum uniformly and as the ends of the cables are drawn upward towards the sheaves, the movable tower section is raised. Similarly rotation of the drum in the opposite direction allows the tower to be lowered by gravity.

In order to actuate the drum it is usual to provide the shaft by which the drum is carried with a worm gear which meshes with a spiral gear or worm driven by the motor of the truck or some other suitable source of power.

In using such constructions it is found that if the pitch of the spiral gear or worm is low the tower can be raised and lowered only very slowly. On the other hand if the pitch of the worm is comparatively steep, as is generally desired, there is a tendency for the worm gear to drive the worm through slippage and to allow the tower to fall or settle after being raised. When used on extension towers this tendency is greatly increased by the vibrations and strains imposed on the cables due to movement and swaying of the tower as the workmen move about in performing their duties and as the platform on the top of the tower is moved from one position to another.

In accordance with the present invention these objections to constructions of the prior art are overcome and actuating mechanism is provided whereby extension towers or the like may be raised and lowered quickly whereas the danger of the tower settling or falling after being raised is eliminated. Moreover slipping of the gears of the actuating mechanism is prevented even when the cables are subjected to severe vibrations and wear upon the gears and their bearings are greatly reduced so that the life of the actuating mechanism is increased. While this result may be accomplished in various ways the invention, in its preferred form, embodies means operating as a one-way brake to permit rotation of the gears of the actuating mechanism in one direction, to raise the tower, without material resistance thereto but serving to impose sufficient resistance to rotation of the gears in the opposite direction to sustain the tower against the force of gravity in any position to which it may be raised. In lowering the tower the application of power to the gears together with the weight of the tower acting upon the drum is sufficient to rotate the gears against the action of the brake and the tower may be lowered smoothly and without strain upon the gears or the bearings therefor.

One of the objects of the present invention is to provide novel actuating mechanism for extension towers and the like adapted to raise and lower the tower quickly and smoothly while preventing the tower from falling or settling after being raised.

Another object of the invention is to reduce the strain and wear upon the gears of operating mechanism for extension towers and to insure smooth operation thereof.

These and other objects and features of the invention will appear from the following description thereof in which reference is made to the accompanying figures of the drawings.

In the drawings:

Fig. 1 is a side elevation of a typical extension tower construction embodying the present invention.

Fig. 2 is a vertical sectional view taken on the line 2—2 of Fig. 1 illustrating the actuating mechanism for the extension tower in elevation, and

Fig. 3 is an enlarged vertical sectional view taken on the line 3—3 of Fig. 1 showing the brake mechanism employed for holding the tower in any position to which it may be raised.

In that form of the invention illustrated in the drawings a truck 2 having a chassis 4 is provided with a lower tower section 6 which is fixedly mounted on the chassis 4. The lower tower section is provided with the usual struts and braces 8 and is provided at suitable points with means (not shown) for guiding an upper tower section 10 in its movement to raised and lowered positions. The upper section 10 is telescopically arranged with respect to the lower tower section 6 so that when lowered it nests within the lower tower section.

The actuating mechanism by which the upper tower section is raised and lowered is indicated generally at 12 and is supported on cross beams

14 carried by the chassis 4 of the truck. The mechanism includes a drum 16 to which two cables 18 are secured and on which the cables are wound. The cables pass beneath sheaves 20 mounted on the lower portion of the lower tower section and pass upwardly over sheaves 22 mounted on the upper portion of the lower tower section. The cables pass downward from sheaves 22 and have the ends 24 thereof secured to the lower portions of the upper tower section 10. Thus on rotation of the drum 16 in one direction the ends 24 of the cables are raised toward the sheaves 22 and the upper tower section 10 is raised, whereas on rotation of the drum 16 in the opposite direction the upper section is lowered by gravity. A platform 26 is shown located on the upper portion of the upper tower section and preferably is rotatable with respect thereto by suitable means, not shown.

As shown in Fig. 2 the drum 16 is mounted on a shaft 28, one end of which is mounted in a bearing 30 on a support 32 and the other end of which is mounted in a suitable bearing within the gear housing 34. The drum 16 is secured to shaft 28 by keys 36 so as to rotate with the shaft. A worm gear 38 is located in the housing 34 and is fixedly secured to the shaft 28 to rotate with the drum 16. The worm gear 38 meshes with a spiral gear or worm 40 secured to shaft 42 one end of which projects from the gear housing. A sprocket 44 is secured to the projecting end of shaft 42 and is driven by a chain 46 from a sprocket 48 carried by a shaft 50 which is supported by hangers 52 suspended from the cross beams 14 on the truck chassis.

The shaft 50 may be driven by any suitable source of power such as the usual power take-off of the motor 54 by which the truck is driven. Transmission means actuated by a lever 56 serve to connect and disconnect the power take-off to a shaft 58 provided with universal joints 60 and connected to the shaft 50 to drive the same. The transmission means is movable to drive the shaft 50 in either direction as desired to raise or lower the upper section 10 of the tower.

With this construction when it is desired to raise the tower, the lever 56 is moved in one direction to drive shafts 58 and 50 and cause shaft 42 and worm 40 to rotate in a clockwise direction, as seen in Figs. 2 and 3 of the drawings, and to rotate the drum 16 and worm gear 38 in a clockwise direction as seen in Fig. 1. In this way the cables 18 are wound upon the drum and the upper tower section or sections are raised. When it is desired to lower the tower the lever 56 is moved to a new position in which the shafts 50 and 42 and worm 40 are driven in a counterclockwise direction as seen in Figs. 2 and 3 to rotate the worm gear 38 and drum 16 in a counterclockwise direction as seen in Fig. 1. The cables 18 are thus unwound from the drum and the tower is lowered by gravity.

In order to prevent the tower from falling or settling due to vibrations of the tower and slippage of the worm gear 38 on the worm 40, the shaft 42 by which the worm is carried is provided with a one way brake or similar means for imposing sufficient resistance to movement of shaft 42 in a counterclockwise direction as seen in Figs. 2 and 3 to insure retention of the tower in any position to which it may be raised. The brake is located in a housing 62 connected to the gear housing 34 and includes a brake drum 64 secured to the inner end of the shaft 42. A brake band 66 extends about the brake drum and is provided with frictional brake lining 68 for engaging the outer surface of the brake drum 64. One end of the brake band 66 is connected to a link 70 which is pivotally secured at 72 to the arm 74 of a bell crank 76. The bell crank is pivotally mounted at 78 within the housing 62 and is provided with an arm 80 to which the opposite end of the brake band 66 is connected. The latter connection is effected by means of a link 82 which extends through an opening 84 in the arm 80 of the bell crank and is provided on its end with an adjusting nut 86 and washer 88 against which spring 90 bears. The opposite end of the spring 90 bears against the arm 80 of the bell crank and tends to rotate the bell crank in a clockwise direction as seen in Fig. 3. A spring 92 bears aaginst the inner surface of the housing 62 and against the arm 74 of the bell crank tending to rotate the bell crank in a counterclockwise direction as seen in Fig. 3. The links 70 and 82 to which the ends of the brake band are connected are thus held in balanced relation by the springs 90 and 92.

The point 72 on the arm 74 to which the link 70 is secured is located closer to the pivot 78 about which the bell crank is movable than is the point at which the spring 90 bears against the arm 80 of the bell crank. The effective length of arm 74 of the bell crank is therefore less than the effective length of the arm 80. Thus on rotation of the brake drum 64 with the shaft 42 and worm gear 40 in a counterclockwise direction as seen in Figs. 2 and 3 in raising the tower, the brake band 66 tends to move with the brake drum in a counterclockwise direction. This movement of the brake band pulls the link 82 toward the left compressing the spring 90 and moving the bell crank in a clockwise direction about its pivot 78. However, because of the unequal effective lengths of the arms 74 and 80 of the bell crank, the movement thereof when the bell crank rotates in a clockwise direction causes the link 82 to move to the left a greater distance than the link 70 is moved to the left. The brake band therefore falls away from the brake drum releasing the shaft 42 and allowing substantially free rotation thereof in a counterclockwise direction. The tower is therefore raised easily and smoothly by the driving means.

Immediately upon termination of counter clockwise movement of the shaft 42 and brake drum 64 the frictional brake lining is again brought into forceful engagement with the brake drum 66 to prevent retrograde movement of the brake drum and shaft 42 so that the tower is held in its raised position. Moreover, on movement of the shaft 42 in a clockwise direction, as seen in Fig. 3, to lower the upper tower section the brake drum 64 is rotated in a clockwise direction and tends to carry the brake band with it due to the action of the brake lining 68. The brake band then pulls upon the link 70 moving the bell crank 76 in a counter clockwise direction about its pivot 78. The arm 80 of the bell crank then compresses spring 90 and moves the link 82 to the right to tighten the brake band. Since the link 82 moves a greater distance than does the link 70 the brake band is tightened about the brake drum and resists further clockwise movement of the shaft 42 and worm gear 40.

The size of the brake drum and brake band and the difference in position of the points at which the links 70 and 82 are connected to the bell crank 76 as well as the tension on spring 90 are so proportioned that the resistance to clockwise

movement of the shaft 42 is sufficient to overcome the force of gravity tending to rotate the brake drum and the worm gear 40 in a counter clockwise direction and is thus sufficient to prevent the tower from falling or settling due to vibration and unequal strains on the cables 18. However, the friction thus imposed on the brake drum is not sufficiently greater than that required to hold the tower in its raised position to place a material load on the motor when the shaft 42 and the worm 40 are driven in a clockwise direction to lower the tower. Therefore the motor has only to overcome the slight excess resistance to clockwise rotation of the worm, and strain upon the gears and bearings in lowering the tower are relieved. The tower therefore may be lowered smoothly and quickly whereas the danger of the tower settling or falling is eliminated and the life of the mechanism is increased.

While the one-way brake means described may be applied to any suitable element of the actuating mechanism it is preferred to apply it directly to the shaft 42 which carries the worm 40. It is then possible to use relatively small braking surfaces and elements which are light in weight and simple in construction due to the reduction in torque applied to the shaft 42 effected by the transmission of the forces tending to rotate the shaft in a clockwise direction through the worm gear 38. Moreover by applying the brake directly to shaft 42 it serves to reduce any jerking in the movement of shaft 42 due to the use of a driving chain between the sprockets 44 and 48. Further the brake serves to take up any shocks on the shaft 42 resulting from jerking in the drive between the worm 40 and worm gear 38 which result from faulty lubrication under the heavy load carried by the worm gear. In this way smooth operation of the gears is assured under all conditions of use and when either raising or lowering the tower.

It will be apparent from the foregoing description of the invention that the form of brake mechanism herein shown and described is not the only type that may be used for preventing retrograde movement of the worm gear but instead is typical of various brake mechanisms and one-way driving connections that may be employed. Moreover, it will be evident that the brake mechanism may be employed in other relations than that shown and other types of driving mechanism may be used for raising and lowering the tower. It will also be evident that the tower may be formed with any number of sections desired, and the mechanism may be employed on apparatus other than that herein described without departing from the spirit and scope of the invention. In view thereof it should be understood that the form of the invention herein described and the various elements thereof are intended to be illustrative of the invention and are not intended to limit the scope thereof.

I claim:

1. In a construction including an extension tower, cables for raising and lowering the tower, a drum on which said cables are wound, a power actuated shaft, a worm driven by said shaft and a worm gear meshing with said worm and operable to drive said drum, the combination of means for preventing said tower from falling or settling from a raised position comprising a one-way brake acting upon said shaft and operable to release said shaft when said shaft is rotated in a direction to raise said tower and to resist rotation of said shaft in a direction to lower said tower, said brake being formed to impose only substantially sufficient resistance to movement of said shaft and worm in a direction to lower said tower to overcome the action of gravity on said tower and applied to said shaft through said worm gear and worm.

2. In a construction including an extension tower, cables for raising and lowering the tower, a drum on which said cables are wound, a power actuated shaft, a worm driven by said shaft and a worm gear meshing with said worm and operable to drive said drum, the combination of means for preventing said tower from falling or settling from a raised position comprising a brake drum rotatable with said worm, a brake band engaging said brake drum and means operable on movement of said worm in a direction to raise said tower for releasing said brake band from said drum and operable on movement of said worm in a direction to lower said tower to tighten said brake band on said brake drum, said brake being formed to impose only substantially sufficient resistance to movement of said shaft and worm in a direction to lower said tower to overcome the action of gravity on said tower and applied to said shaft through said worm gear and worm.

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