

June 25, 1957

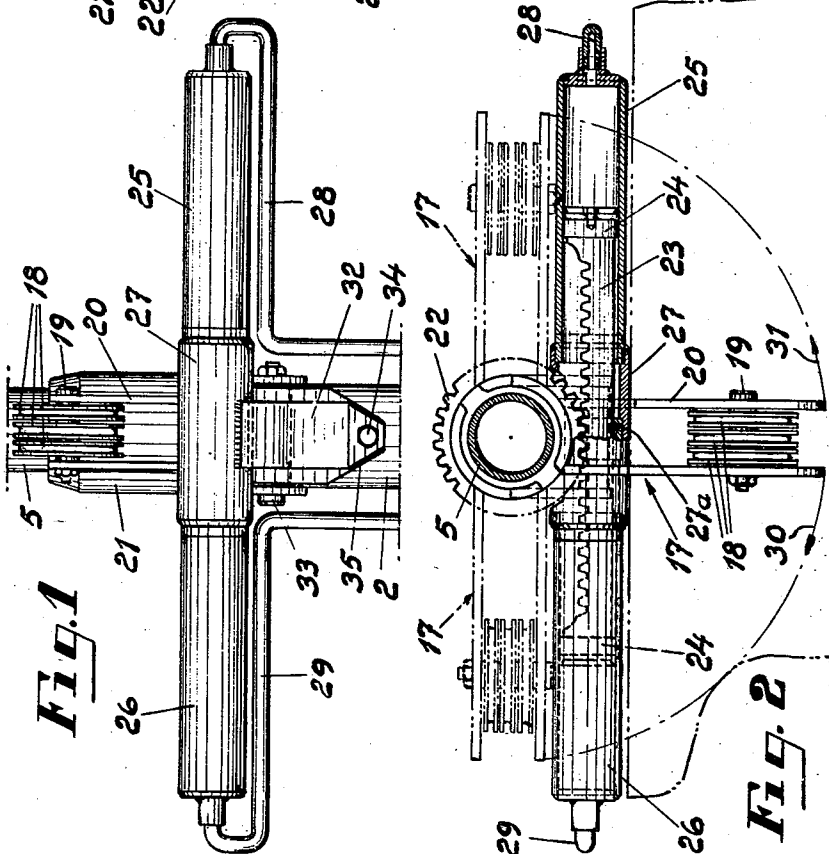
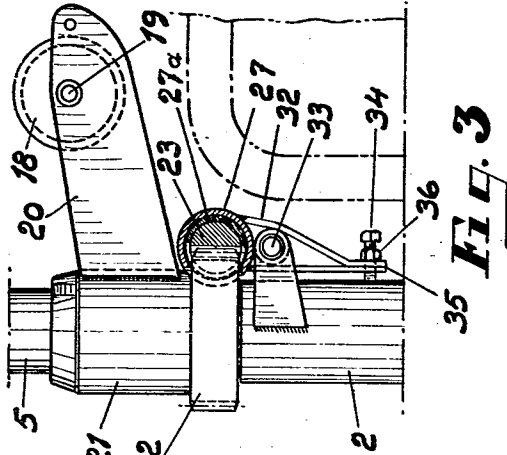
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2,796,998

DEVICE FOR SWINGING THE BOOM OF A HYDRAULIC ELEVATING APPARATUS

Filed Aug. 5, 1953

3 Sheets-Sheet 1



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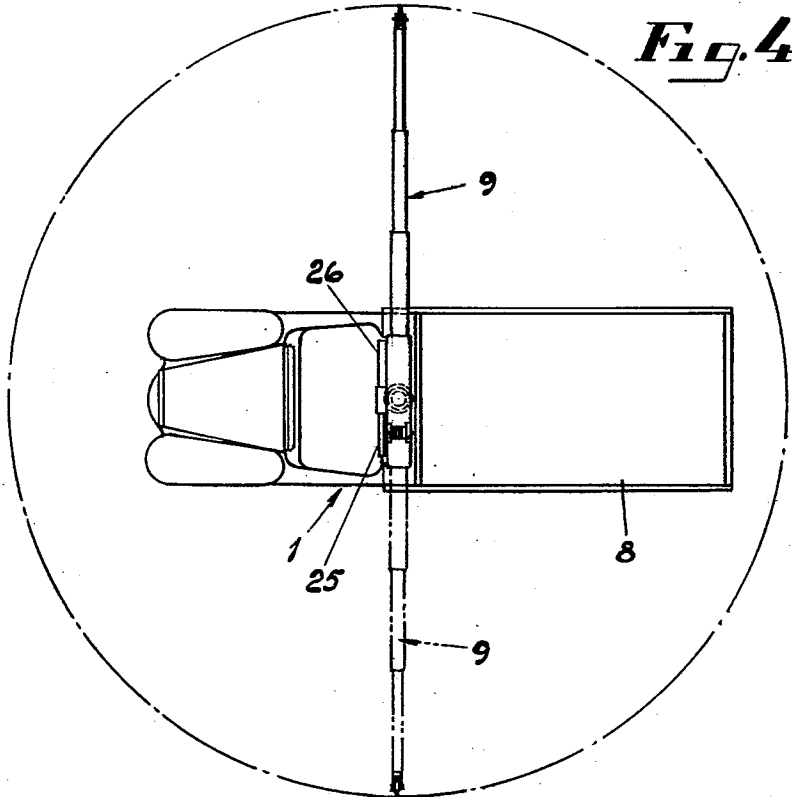
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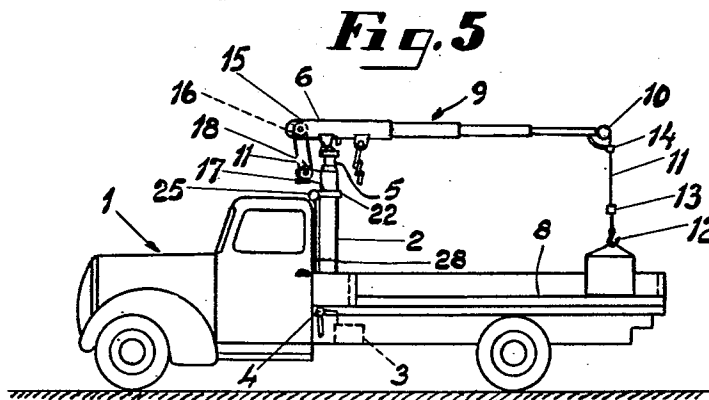
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**Fig. 4**



**Fig. 5**

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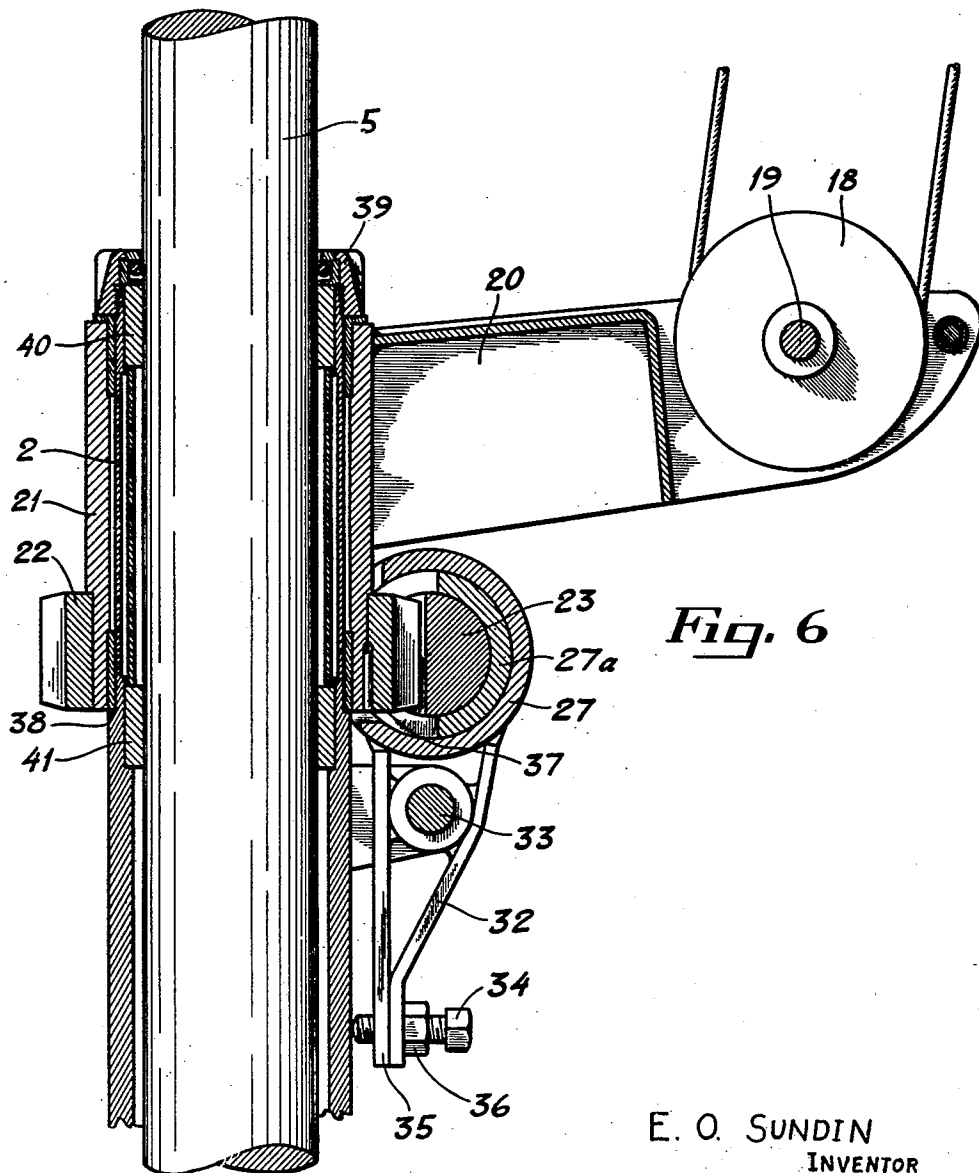


Fig. 6

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2,796,998

**DEVICE FOR SWINGING THE BOOM OF A HYDRAULIC ELEVATING APPARATUS**

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Application August 5, 1953, Serial No. 372,493

Claims priority, application Sweden December 6, 1952

2 Claims. (Cl. 212—66)

This invention relates to hydraulic elevating apparatus of that kind, which is especially adapted to be mounted on self-propelled trucks and which comprise an elevating cylinder vertically mounted on the truck, this cylinder having a piston rotatably and axially movable therein said piston supporting at its upper end, respectively at the upper end of its piston rod, a boom mounted for swinging movement, said boom having two arms of different lengths the longer arm of which at its outer end carries a pulley for a cable which at its outer end is provided with a hook or like lifting implement, while the shorter arm of said boom is provided at its outer end with a number of pulleys for the same cable this cable being besides passed around a number of similar pulleys corresponding to the number of pulleys of the shorter arm, these pulleys being located on a pulley bracket rotatably mounted on the elevating cylinder, the outer end of said cable being secured to this pulley bracket or to the boom besides which the bracket is adapted to be swung in a horizontal plane about the elevating cylinder by means of plungers hydraulically driven in swinging cylinders. Previously the swinging cylinders in this type of elevating apparatus have been arranged with their outer end swingably mounted on the outer ends of a supporting member at the upper end of the vertical elevating cylinder, and the outer end of a plunger axially movable in the respective swinging cylinder has been hingedly connected with an arm of the pulley bracket which arm carries the pulleys and which projects from a hub which is journaled at the upper end of the elevating cylinder.

By this construction it has not been possible to swing the pulley bracket through more than approximately 90°, i. e. approximately 45° in both directions from the vertical longitudinal plane of the truck. As a consequence, the swinging movement of the boom in a horizontal plane has been limited too.

The purpose of this invention is to provide an elevating apparatus without this drawback. According to the invention the pulley bracket is provided with a horizontal cog-ring, the cogs of which gear into the cog-gap of a rack adapted to be moved in the one or in the other direction by means of the medium forced into the one or into the other of the swinging cylinders. The invention makes it possible to swing the pulley bracket and consequently also the boom with good effect through 180° and, if desired, the cog-ring and the rack can be so dimensioned that the swinging movement will be up to 360°.

In the following reference is had to the accompanying drawings, in which

Fig. 1 is a side view of the upper end of the elevating cylinder with the pulley bracket and the swinging cylinders viewed from the driver's cabin.

Fig. 2 is a horizontal view, partly in section.

Fig. 3 is a side view of the device according to Fig. 1, partly in section.

Fig. 4 shows in a reduced scale a plane view of a self-propelled truck with an elevating apparatus provided

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with a device according to the invention for swinging the boom of the apparatus.

Fig. 5 shows the truck and the elevating apparatus in a side view.

Fig. 6 is a detailed cross sectional view of the device as seen in Figure 3.

The hydraulic elevating apparatus is generally of that type described in my Patent No. 2,672,990.

Behind the driver's cabin of a self-propelled truck is mounted a vertical elevating cylinder 2. A hydraulic medium is led under pressure into the elevating cylinder 2 from a pump 3, driven by the truck engine, via a control device 4. In the cylinder 2 is a piston 5 vertically movable and rotatable about its own axis. This piston supports at its upper end a horizontal shaft 6 about which the boom 9 which has arms of different lengths is swingably mounted. Thus, the boom 9 can be swung in a horizontal plane as well as in a vertical plane in relation to the body 8 of the truck. At the outer end of the longer arm of said boom 9 a pulley 10 is journaled around which a cable 11 is passed. At its outer end this cable carries a hook 12 and is besides provided with a stop member 13 for co-operation with an abutment 14 on the free end of the boom below the pulley 10. The shorter arm 15 of the boom 9 is provided with two or more pulleys 16 and on a pulley bracket 17 swingably mounted on the upper end of the cylinder 2 there is journaled a corresponding number of pulleys 18. The cable 11 is passed around all of these pulleys 10, 16, 18, and with that end which is opposite the hook 12 it is secured either to the pulley bracket 17 or to the boom 9. When a pressure medium is forced into the cylinder 2 the piston 5 is moved upwardly and the boom 9 is lifted in a horizontal position until the stop member 13 on the cable 11, which latter during the elevating movement runs around the pulleys 10, 16 and 18, abuts against the abutment 14, whereupon the boom 11 with its longer arm swings upwardly. For swinging the boom 9 in a horizontal plane, the device set forth below is used which device is subject of the invention.

The pulleys 18 are journaled on a shaft 19 at the outer end of an arm 20 which projects substantially radially from the hub 21 of the pulley bracket. This hub is rotatably mounted about the upper end of the elevating cylinder 2. Below the arm 20, the hub 21 is provided with a cog-ring 22 the cogs of which mesh with the cogs on a rack on a plunger rod 23 which mutually connects two plungers of two co-axial cylinders 25 and 26. The cog ring 22 is fixed by means of pins 37 to the hub 21 of the pulley bracket 20. The hub 21 is rotatably mounted on the top of the elevating cylinder 2 between a shoulder 38 on the same and a screw nut 39 threaded on the top of the elevating cylinder. The piston 5 is guided in bearing bushings 40, 41 in a way to allow the piston 5 to be axially and rotatably displaced in the elevating cylinder 2. The cylinders 25, 26 which are arranged for causing the swinging movement of the pulley bracket are in the following called "swinging cylinders." These cylinders 25, 26 are mutually connected with an intermediate member 27 in the middle of which is mounted a bushing 27a which serves as a bearing for the plunger rod 23. To the outer end of the two swinging cylinders 25, 26 are connected conduits 28 and 29 which carry a pressure medium and which are at the other end connected to a control valve 4 which is arranged in such a manner that when pressure medium is lead through the conduit 28 to the cylinder 25 pressure medium is at the same time carried away from the cylinder 26 through the conduit 29, and vice versa.

When a pressure medium is pressed into the cylinder 25 the plunger 24 and the rack 23 are pressed to the left according to Fig. 2 which causes the pulley bracket

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17 to be swung in the direction of the arrow 30, for example to the left hand position of Fig. 2 shown in dash and dot lines. The pulley bracket 17 is swung in a similar manner, if pressure medium is lead into the cylinder 26 in the direction of the arrow 31, for example to the right hand position of Fig. 2 shown in dash and dot lines. As a consequence of the swinging of the pulley bracket 17 in the manner shown in Fig. 2 the boom 9 is also swung due to the pull in the cable parts between the pulleys 16 and 18 to the two end positions shown in Fig. 4.

It is obvious that if the cog-ring 22 is formed like a full cog-wheel and the rack 23 is given a length which corresponds to the periphery of the cog-wheel it will be possible to obtain a swinging movement of the boom 9 in substantially a complete revolution as indicated in Fig. 4 by the arc. The swinging movement of the bracket 20 can be performed without difficulty through an angle of 180° and even through an angle of 360°. The turning force will be the same at all angles whether the boom 9 takes the position shown with full lines or dotted lines in Fig. 4 or along the length of the vehicle.

As it may occur that considerable forces are to be transmitted from the rack 23 to the cog-ring 22, it is of importance that the cog mesh between the cogs is always as good as possible. According to the invention an adjustment of the cog mesh is possible after the cogs have been worn. For this purpose the intermediate part 27 is positioned on the upper end of a cradle 32 which is pivoted on a horizontal shaft 33 and which at the lower end is provided with a set-screw 34 which is threaded in the lower shank 35 of the cradle and which may be secured by means of a nut 36. When the set-screw 34 which rests with its inner end on the elevating cylinder 2 is turned inwards, the cradle 32 is swung counter-clockwise according to Fig. 3, which causes the rack 23 to move towards the cog-ring 22 so that the free motion between the cogs is reduced.

The embodiment shown and described is to be regarded only as an example and the various parts of the swinging device may be varied in different ways within the scope of the invention.

What I claim is:

1. In combination, a hydraulic elevating apparatus adapted to be mounted on a vehicle, comprising a hydraulically extensible support having a fixed and an extensible portion mounted in a vertical position on said vehicle, an extensible boom pivoted for movement in a vertical plane on the upper end of the extensible portion of said support, a single pulley mounted on the outer end of said boom, a plurality of pulleys mounted on the other end of said boom, a plurality of pulleys rotatably mounted on the fixed portion of said support, a cable having a stop thereon passed over the pulley on the outer end of said boom, over one of the pulleys on the other end of the boom and alternately around the plurality of pulleys on the fixed portion of the support and the other end of the boom and fixed to one of said plurality of pulleys, such that on extension of said support said boom will be tilted up when the stop engages the pulley on

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the outer end, means for swinging said boom in a lateral direction comprising a plurality of swinging cylinders having pistons therein mounted on the fixed portion of said support, a pulley bracket on which the pulleys on the fixed portion of the support are mounted journaled about the upper end of said fixed portion and having an arm thereon carrying said pulleys, an intermediate member connecting said cylinders and serving as a guide for said bracket, a cog ring on said bracket below said arm, a rack engaged with said cog ring with its ends attached to said pistons in said swinging cylinders, and hydraulic means to move said pistons.

2. In combination, a hydraulic elevating apparatus adapted to be mounted on a vehicle, comprising a hydraulically extensible support having a fixed and an extensible portion mounted in a vertical position on said vehicle, an extensible boom pivoted for movement in a vertical plane on the upper end of the extensible portion of said support, a single pulley mounted on the outer end of said boom, a plurality of pulleys mounted on the other end of said boom, a plurality of pulleys rotatably mounted on the fixed portion of said support, a cable having a stop thereon passed over the pulley on the outer end of said boom, over one of the pulleys on the other end of the boom and alternately around the plurality of pulleys on the fixed portion of the support and the other end of the boom and fixed to one of said plurality of pulleys, such that on extension of said support said boom will be tilted up when the stop engages the pulley on the outer end, means for swinging said boom in a lateral direction comprising a plurality of swinging cylinders having pistons therein mounted on the fixed portion of said support, a pulley bracket on which the pulleys on the fixed portion of the support are mounted journaled about the upper end of said fixed portion, a cog ring on said bracket, a rack engaged with said cog ring with its ends attached to said pistons in said swinging cylinders, hydraulic means to move said pistons, a cradle pivotally supported on the fixed portion of said extensible support in which cradle said swinging cylinders, pistons and rack are carried, and a set screw on said cradle on the opposite side of said pivotal support from said swinging cylinders adapted to bear against the fixed portion of said extensible support, whereby said cradle can be adjusted about said pivotal support to more firmly engage said rack and said cog ring.

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