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# E. STURM

## ROPE DRUM WITH REGULABLE HYDRAULIC DRIVE ESPECIALLY FOR LIFTS

Filed Nov. 16, 1939

Serial No.
304,820

2 Sheets-Sheet 1

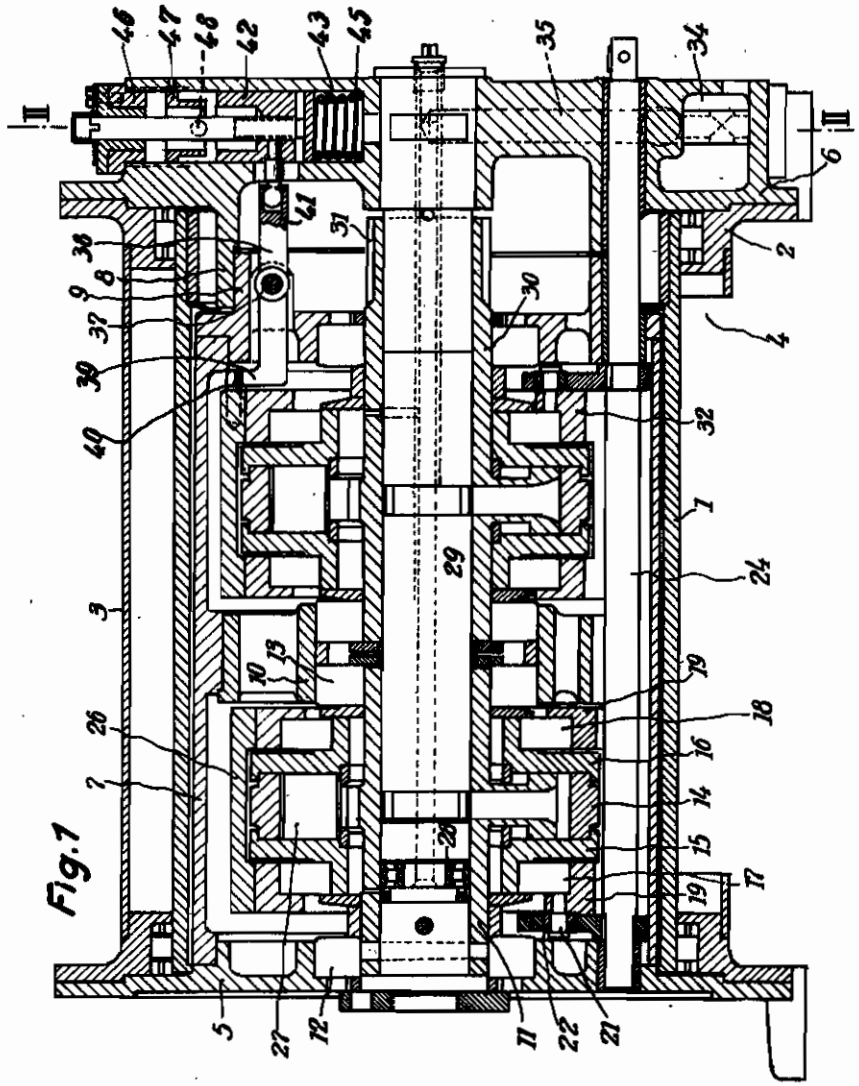


Fig. 1

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Fig.2

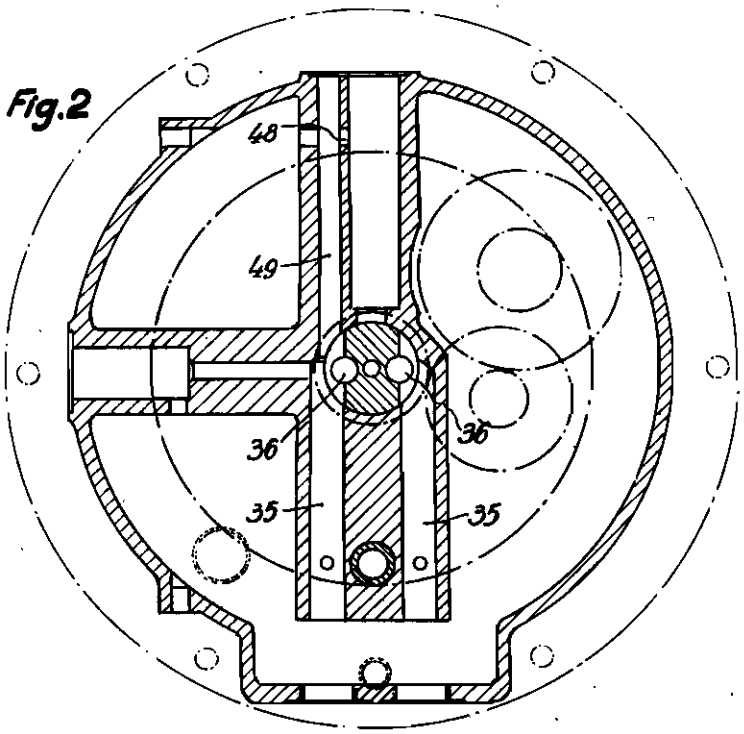



Fig.3

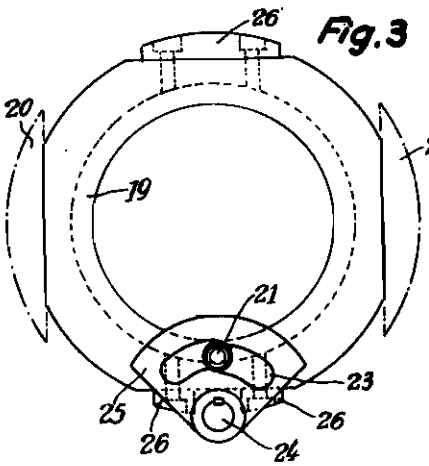
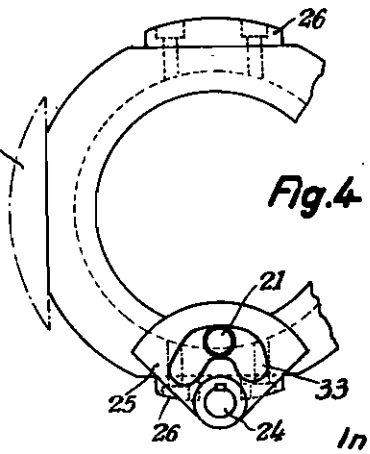



Fig.4

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# ALIEN PROPERTY CUSTODIAN

## ROPE DRUM WITH REGULABLE HYDRAULIC DRIVE ESPECIALLY FOR LIFTS

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Application filed November 16, 1939

This invention relates to a rope drum, especially for lifts having a regulable hydraulic drive. Regulable drives require in general additional implements to be attached especially outside of the rope drum. These arrangements necessitate, therefore, a comparatively large space for housing them and cannot, in consequence thereof, be employed in cases in which only a small place is available.

The present invention is based on the discovery that hydraulic drives comprising, with consideration to their comparatively easy regulableness, a pump and a motor are particularly suited to be placed into the interior of the rope drum in that this affords the possibility to arrange also the regulating device within said drum.

Besides this characteristic feature of the invention, another characteristic feature consists therein that the regulating device located within the rope drum is provided with a control shaft extending parallel to the axle of the driving gear, this shaft being coupled with the motor or with the pump or with both these parts by the intermediary of suitable control members, for instance cam disks or the like. Arranging the gearing, including the control device, within the rope drum renders it possible to attain certain further important advantages, as will appear from the detailed description of certain particular constructional forms dealt with hereinafter.

The invention comprises, however, also a particular design of the regulating device itself, in that in this device the maximum speed accommodates itself automatically to the load at the time being. For this purpose, the regulating device is, according to this invention, provided with either only one abutment member or with a plurality of such members by which the length of the transmission path is limited, preferably only one end abutment member is provided for limiting the eccentricity of the hydraulic motor in both direction of rotation.

The invention is illustrated diagrammatically and by way of example on the accompanying drawings on which Figure 1 shows a longitudinal section through a rope drum designed according to this invention. Figure 2 shows a transverse section in the plane II—II of Fig. 1, a few parts being omitted in this figure. Figure 3 is a plan of the control part of the gear pump, and Fig. 4 is a plan of the control part of the motor.

On the drawing, 1 (Fig. 1) denotes the rope drum which is supported in the usual manner in a casing 2, the shell 3 of which is provided with a longitudinal slot 4 for the passage of the rope. The casing 2 is closed at its frontal ends by means of flanged covers 5 and 6. The cover 5 constitutes a rigid bearing for the casing 7 of the hydraulic gearing, and the cover 6 is provided with a cylindrical collar 8 forming a bearing for a cylindrical extension 9 of the casing 7 and permitting an axial displacement of said extension. The casing 7 embraces with its middle portion an annular member 10 which may be integral with said casing. Said member 10 divides the casing into two parts, of which that on the left side serves for the reception of the pump and that on the right side serves for the reception of the motor.

The blade drum 11 of the pump which (the blade drum) is connected up to said motor across a clutch is supported in a race bearing 12 abutting on the cover 5 and in a race bearing 13 abutting on the annular member 10. The blade drum 11 is enclosed by a casing that is adjustable eccentrically with respect to the drum and consists of a ring 14 provided with lateral covers 15 and 16. These covers have rim flanges and abut on the supporting frame 19 by the intermediary of race bearings 17 and 18, which are displaceable radially with respect to the gearing axle in guides 20 (Fig. 3).

The supporting frame 19 shown in the left-hand half of Fig. 1 is provided with a pivot 21 engaging a curved slot 23 across a race socket 22 provided in a disk piece 25 keyed to the control shaft 24. The control shaft is supported in the covers 5 and 6 and can be adjusted by means of a hand wheel (not shown). The extent of the displacement of the supporting frames 19, which are rigidly connected with one another by webs 26, in dependency of the turning of the control shaft, is determined by the shape of the curved slots 23.

With the chamber formed by the casing surrounding the drum are arranged in known manner the blade pistons 27, of which one is visible in Fig. 1. Within the drum 11 is provided a guide axle 29 that abuts on a roller bearing and is rigidly supported at one of its ends in a flange 6.

The hydraulic motor shown in the right-hand half of Fig. 1 is designed similar to the pump so that no detailed description of its construction is necessary, but I mention, anyhow, separately that the projecting end of the drum 30 is provided with a toothing 31 meshing with gear wheels arranged in a chamber provided in the flange 6. The control means for the supporting frame 32 correspond, as regards their construction, substantially with those provided for the

supporting frame 19, there existing only that one difference that the shape of the curved slot 33 (Fig. 4) is accommodated to the motor. The control slots 23 and 33 are so designed that the control of the pump and of the motor can be effected with the aid of only one control shaft. With such an one-lever control there is, in general, provision made that the eccentricity of the motor has attained its maximum value when that of the pump is the smallest. Furthermore, the eccentricity of the motor maintains its maximum value substantially over the entire regulation range of the pump so that the regulation of the motor joins substantially the regulation of the pump. This condition is true, as a matter of course, for both directions of rotation.

The control slots might also be provided at the supporting frames whereas the pivots engaging said slots might be arranged at levers of the control shaft.

In order to attain a greater accuracy of adjustment, the control member may be formed by a pinion keyed to the shaft 24 and meshing with the toothing of a ring supported in the gear casing and acting on the supporting frame by the intermediary of a suitably shaped control slot and a pivot engaging this slot.

In order to obtain space for housing the requisite amount of the driving agent, the chamber 34 provided in the flanged cover 6 and containing the gear wheels is made use of for said purpose. This chamber communicates with the working spaces of the pump and the motor through vertical bores 35, as well as through bores 36 extending axially through the guide axle 29, on the suction side and on the pressure side respectively.

In the gear casing is provided a journal 37 for a two-armed lever 38, the end 39 of which co-operates with an abutment member 40 secured to the supporting frame of the hydraulic motor, whereby the extent of the eccentrical adjustment of the motor is determined. The other end (41) of said lever 38 engages across a ball clutch a piston 42 supported radially shiftable with respect to the gear axle in a bore 45 of the cover 6. The piston 6 abuts across a screw-threaded pin 44 that is adjustable from the outside on a compressive spring 45. The bore containing the piston 42 is closed by means of a screw-threaded cover 46. An externally screw-threaded sleeve 47 which can be fixed in its normal position serves as an end abutment for the piston 42. The space above this piston communicates through a hole 48 and a conduit 49 (Fig. 2) with that passage of the two conduits 38 which serves as pressure passage.

The manner of operation of the device is as described hereinafter, but I abstain from describing also the manner of operation of the gearing as this is known and does not form a part of the present invention.

By turning the control shaft 24 first the pump is caused to supply the driving agent to the motor so as to start same, but owing to the weight of the load to be lifted the driving agent is subjected to a pressure which is higher than the pressure existing at idle running. The thus increased pressure of the driving agent acts upon the piston 42 by which the two-armed lever 38 and, thus, also the limiting abutment members 39 are adjusted counter to the action of the spring 46, the adjustment corresponding with the weight of the load existing at the time being. When now the control shaft is further turned, first the pump is adjusted to its maximum eccentricity and thereafter the eccentricity of the motor is decreased by the limiting abutting member in dependency of the weight of the load allowed at the time being. As by the characteristic of the counter-acting compressive spring 45 for the limiting abutment member 39 this member determines, in the case of a load of great weight of the load allowed at the time being. As by the characteristic of the counteracting compressive spring 45 for the limiting abutment member 39 this member determines, in the case of a load of great weight, the appertaining ratio of transmission already at a low pressure of the driving agent, the performance will be smaller at low weight of the load and at the usual design of the control curve of the pump at which a constant feed over the entire range of the hydraulic motor is obtained.

In order to maintain the performance on a constant value over the entire range of the hydraulic motor, the sine curve of the motor is so designed that the pump gets an additional enlargement of the eccentricity during the regulation of the motor, in such a manner, that the product of the amount delivered and the pressure of the driving agent is constant over the entire regulation range of the motor.

ERWIN STURM.