

TITLE"COLUMN HOISTS"FIELD OF THE INVENTION

THIS INVENTION relates to a column hoist particularly suitable for  
5 lifting vehicles or other heavy loads.

BACKGROUND OF THE INVENTION

There are many types of column hoists which have been developed over the years for elevation of motor vehicles for maintenance purposes.

10 One type of column hoist, described in Australian patent specification 26678/88, comprises a lifting carriage which moves along two vertical columns. A chain passes around spaced pulleys one located on the lifting carriage and the other located adjacent upper ends of the columns. This type of hoist is hereinafter referred to as a chain driven  
15 column hoist in which the chain engages a drive pulley, the rotation of which causes the lifting carriage to be raised or lowered.

Another type of column hoist is described in Australian Patent No. 470742. This comprises a steel cable, tethered at one end to the hoist frame and extending over a pulley to a carriage slidably movable on the  
20 hoist frame. The hoist is actuated by an hydraulic cylinder having the cable pulley mounted on the piston shaft.

Safety mechanisms are generally provided with chain driven column hoists in order to stop the lifting carriage dropping if the chain snaps or slips. Such safety mechanisms are described in Australian  
25 patent specification 26678/88 and Australian patent 470742 in which the safety mechanism is actuated by loss of chain tension. However, if the chain or cable snaps, the lifting carriage will drop down dragging the chain or cable with it. This can result in the chain or cable being temporarily tensioned causing a delay in safety mechanism functioning.

30 Other disadvantages of chain or cable driven column hoists are that the chain or cable may slip on the drive pulley and there are numerous components susceptible to wear and failure.

An alternative to chain or cable driven column hoists are shaft driven column hoists in which a shaft is rotatably mounted adjacent upper and lower ends of one or more support columns. The shaft is coupled to a motor which provides rotational movement of the shaft about its longitudinal axis. The shaft has a square shaped helical thread (commonly known as an acme thread) and operatively coupled to the shaft is a travelling nut which is coupled to a lifting carriage that is moveably mounted to the columns. Accordingly, rotation of the shaft in a selected direction moves the carriage up or down the columns.

Shaft driven column hoists have less components that are prone to wear or failure than chain driven column hoists. However, one problem which can occur with shaft driven column hoists is that the shaft may bend or bow due to lateral movement of the lifting carriage with respect to the rotational axis of the shaft.

The main problem with shaft driven column hoists is that the threads of the shaft and the travelling nut are prone to wear, deformation or even stripping. This is primarily due to inadequate distribution of forces on relatively small bearing surface areas when supporting lifting carriage loadings. This problem is exacerbated by the shaft generally being made of mild steel for ease of manufacture and is therefore highly susceptible to wear, deformation or stripping and thus for safety reasons necessitates frequent replacement of the shaft and assembly.

A major disadvantage of conventional travelling nut systems in vehicle hoists is that due to excessive friction between the nut and shaft, particularly when worn, a large high powered motor is required to drive the shaft to overcome frictional losses. Generally speaking such travelling nut systems have limited load capacities.

#### SUMMARY OF THE INVENTION

It is an object of the invention to provide a column hoist which overcomes or alleviates at least some of the problems with prior art column hoists.

According to one aspect of the invention there is provided a



column hoist including:

at least one upright column;

an upright threaded shaft rotatably supported adjacent one end thereof adjacent an upper end of the column;

5 drive means coupled to the shaft for selective rotation thereof;

a lifting carriage slidably mounted to the column to allow movement of the carriage therealong; and

at least one load bearing recirculating ball bearing assembly operatively coupled to the shaft for movement therealong, said lifting  
10 carriage being supported by said load bearing recirculating ball bearing assembly whereby selective rotation of the shaft causes selective movement of the carriage along an upright path.

Suitably, the threaded shaft and a housing of said load bearing recirculating ball bearing assembly each include aligned helical thread  
15 grooves, respective said helical thread grooves defining together a helical ball path between an upper and lower end of said housing, said housing including a return passage providing communication between respective upper and lower ends of said helical ball path to form a continuous ball path in use for recirculation of ball bearings.

20 If required, a further recirculating ball bearing assembly may be operatively coupled between said shaft and said carriage.

Preferably, the load bearing recirculating ball bearing assembly and said further recirculating ball bearing assembly are coupled to prevent relative rotation therebetween.

25 Preferably, the load bearing recirculating ball bearing assembly and the further recirculating ball bearing assembly are coupled such that in use the load bearing recirculating ball bearing assembly bears substantially all of the load of said carriage and any mass supported thereon.

30 If required, coupling means is provided between said load bearing recirculating ball bearing assembly and the further recirculating ball bearing assembly to permit, in use, transference of load to said further



recirculating ball bearing assembly upon failure of said load bearing recirculating ball bearing assembly.

Suitably said coupling means comprises two slidably engageable coupling members, each coupling member being associated with a  
5 respective one of said load bearing recirculating ball bearing assembly and said further recirculating ball bearing assembly.

Preferably, said hoist includes a sensing means adapted to provide a signal upon failure of said load bearing recirculating ball bearing assembly.

10 If required said signal may control said drive means such that rotation of said shaft is restricted to a single direction which effects lowering of said carriage.

The load bearing recirculating ball bearing assembly may be coupled to the lifting carriage by a self centering coupling means.

15 Preferably, the shaft is rotatably suspended adjacent an upper end of the column.

Suitably, the shaft is suspended from a self centering bearing mounted adjacent the upper end of the column.

20 If required, the shaft may be rotatably mounted adjacent both upper and lower ends of the column.

Preferably, the lifting carriage is slidably mounted on and cantilevered from said at least one column, said carriage including rollers locating on opposite surfaces of said at least one column.

25 If required, the column hoist may be mounted on wheels or rollers for mobile operation.

Preferably, the column hoist includes steerable wheels.

#### BRIEF DESCRIPTION OF DRAWINGS

30 In order that the invention may be readily understood and put into practical effect, reference will now be made to a preferred embodiment in which:

FIG 1 is a part cross sectioned front view of a hoist according to the invention;

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FIG 2 is a left side view of FIG 1;

FIG 3 is a cross sectional plan view of FIG 1 when viewed in the direction BB;

FIG 4 is a detailed cross sectional view of an upper portion of the rotatable shaft mounting CC;

FIG 5 is a cross sectional view of part of FIG 1 when viewed in the direction AA; and

FIG 6 is a detailed view of a shaft and bearing assembly of FIG 1.

#### DETAILED DESCRIPTION

Referring to FIGS 1, 2 and 3 there is illustrated a column hoist 10 having a pair of upright spaced columns 11, 12 interconnected at their upper ends by a plate 13. For aesthetic reasons cover plates 13a, 13b are mounted to upper ends of columns 11, 12. The lower ends of columns 11, 12 are connected to a base 14 comprising a pair of parallel extending feet 15, 16 attached to a respective end of a connecting member 17. Further, rollers 18 are rotatably mounted at the free ends of feet 15, 16.

Two pneumatic wheels 19 are rotatably mounted to a wheel mounting 20 which is pivotally attached to a support frame 21 to allow for steering of wheels 19. The support frame 21 is attached adjacent the lower ends of columns 11, 12 and a handle 22 is used to steer hoist 10 when it is being transported on rollers 18 and wheels 19.

As shown specifically in FIG 2, wheels 19 are pressurised such that when hoist 10 supports a load, wheels 19 are slightly flattened resulting in two underside plates 22 associated with base 14 contacting a ground surface 23 to stabilize hoist 10 under load.

A lifting carriage 24 is slidably cantilevered on columns 11, 12 to allow vertical movement of carriage 24 along columns 11, 12. Lifting carriage 24 includes a pair of parallel spaced lifting arms 25 mounted to opposite ends of a transverse member 26. A pair of spaced arms 27 incline upwardly from member 26 between columns 11, 12 to a support strut 26a bridging the upper ends of arms 25.



Rotatably mounted to lifting carriage 24 is a first pair of rollers 28 each of which abut a respective first bearing plate pair 29 mounted on opposite surfaces of column 11. Similarly there is a second pair of rollers 30 which abut a respective second bearing plate pair 31 mounted on opposite surfaces of column 12. Each roller of pairs 28, 30 has a  
5       respective annular shoulder 28a, 30a which abuts a corresponding edge of plates 29 or 31.

Also mounted to lifting carriage 24 are two abutment members 32 which are in sliding contact with a respective one of inwardly facing  
10       opposed surfaces 33, 34 of columns 11, 12.

Mounted to the upper end of hoist 10 is a drive means in the form of a gearbox 42 and motor 43 operatively coupled to drive shaft 37.

Referring to FIG 4 there is illustrated a mounting for shaft 37 having a thrust bearing 35 with an annular convex seat to allow bearing  
15       35 to be mounted to plate 13 to allow self centering of bearing 35 in an annular concave recess 36. Accordingly, convex seat and concave recess 36 are complementary in shape and size.

Shaft 37 is rotatably mounted to bearing 35 and is suspended in tension from bearing 35 by an arrangement of a washer 38, cover 39 and  
20       lock nut 40 which engages a threaded portion 41 of shaft 37. A further cover 39a mounted to plate 13 assists in protecting and covering bearing 35. Gearbox 42 and motor 43 assembly (not shown in FIG 4) are coupled to shaft 37 by keyway 44 and associated key 45 in a manner which is apparent to a person skilled in the art.

25       The lower end of shaft 37 has no associated bearing or mounting and therefore shaft 37 is in constant tension when under load. However, if desired the lower end can be loosely journalled or even mounted to hoist 10 by another bearing.

Referring to FIGS 5 and 6 shaft 37 has a threaded portion 46  
30       comprising a helical thread groove 47 having a particular cross section.

A pair of identical shaft engagement means in the form a load bearing of recirculating ball bearing assembly 48a and a further



recirculating ball bearing assembly 48b (one of which is partially shown in cross section in FIG 6) are operatively coupled to shaft 37. Each bearing assembly 48a and 48b has a housing 49 having a helical passage 49a with a continuous line of ball bearings 50 held captive therein to maximise the surface area contact between the shaft and the bearing assembly.

Helical passage 49a provides operative coupling to shaft 37 in which protruding portions of ball bearings 50 engage aligned groove 47 to define a helical ball path between an upper and lower end of housing 49. A return passage 49b in housing 49 provides communication between upper and lower ends of helical passage 49a thereby allowing ball bearings 50 to recirculate during rotation of shaft 37.

Bearing assembly 48a is mounted on an upper collar 51 which has an arcuately tapered annular seat 51a. Bearing assembly 48b is mounted on lower collar 52. Collars 51 and 52 are coupled together by connecting pin 53 to prevent relative rotation between bearing assemblies 48a and 48b. Pin 53 is slidably located in an operative in collar 52. Seat 51a engages an annular recess 53 of complementary shape in a thrust plate 54 bridging spaced arms 27.

Accordingly, shaft 37 supports lifting carriage 24 via bearing assembly 48a, and there is a self centering coupling between assemblies 48a, 48b and lifting carriage 24.

A threaded pin 51b is screwed into a threaded aperture in collar 51, the free end of which pin engages in an apertured plate 54a extending from thrust plate 54. This pin 51b restricts rotation of assembly 48a during rotation of shaft 37. Further, relative rotation between assemblies 48a and 48b is restricted due to the coupling collars 51, 52 by pin 53.

A sensing means in the form of a switch 60 having an activation arm 61 is mounted to collar 51. A tab 62 protrudes from collar 52 and is positioned to activate arm 61 if the distance between collars 51 and 52 decreases. Switch 60 is normally closed and upon activation becomes open circuit. Switch 60 is electrically coupled to central circuitry of motor 43 such that upon switch 60 becoming open circuit, motor 60 can only



rotate shaft 37 in a direction which effects lowering of carriage 24.

In use, when power is supplied to motor 43, shaft 31 rotates and causes lifting carriage 24 to be raised or lowered. During raising or lowering ball bearings 50 continuously circulate around passage 49a of a  
5 respective assemblies 48a or 48b. The ball bearings 50 operatively couple assemblies 48a or 48b to shaft 37 and due to the complementary shape of the ball bearings 50 and grooves 47, there is a substantial and even distribution of forces resulting from loads supported on lifting carriage 24. The use of recirculating ball bearings rather than travelling  
10 nuts provides a more even wear pattern on the shaft, the bearing housing and the balls and to a large degree alleviates the problem of thread deformation or thread stripping with prior art travelling nuts.

More importantly, the use of recirculating ball bearing assemblies permits the use of a drive motor having a substantially lower power  
15 requirement than a travelling nut assembly due to the substantially reduced frictional engagement between the shaft and the bearing assembly. Moreover a greatly increased life with reduced maintenance will be obtained compared with conventional travelling nut mechanisms.

In the embodiment described two bearing assemblies 48a and 48b  
20 are used for safety reasons. For example, if assembly 48a fails due to loss of ball bearings 50, assembly 48b drops down towards assembly 48b until collars 51 and 52 abut. Accordingly support of lifting carriage 24 is transferred to assembly 48b therefore stopping lifting carriage 24 from dropping. As a result, switch 60 is activated and movement of carriage 24  
25 is limited to lowering only. Once carriage 24 is lowered, hoist 10 can then be repaired.

Shaft 37 is supported in tension which alleviates the problems associated with bowing of the shaft under load. To further reduce or alleviate the likelihood of shaft 37 bowing, bearing 37 is self centering  
30 and rollers 28, 30 and abutment members 32 restrict lifting carriage 24 from moving laterally with respect to the rotational axis of shaft 37. In addition, the self centering coupling between assembly 48a and lifting



carriage 24 further alleviates or reduces the likelihood of bowing under load.

Although the invention has been described with reference to a preferred embodiment, it is to be understood that the invention is not  
5 limited to the embodiment described herein.

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CLAIMS

1. A column hoist including:  
at least one upright column;  
an upright threaded shaft rotatably supported adjacent one end  
5 thereof adjacent an upper end of the column;  
drive means coupled to the shaft for selective rotation thereof;  
a lifting carriage slidably mounted to the column to allow movement  
of the carriage therealong; and  
at least one load bearing recirculating ball bearing assembly  
10 operatively coupled to the shaft for movement therealong, said lifting  
carriage being supported by said load bearing recirculating ball bearing  
assembly whereby selective rotation of the shaft causes selective  
movement of the carriage along an upright path.
2. A column hoist as claimed in claim 1 wherein the threaded shaft  
15 and a housing of said load bearing recirculating ball bearing assembly  
each include aligned helical thread grooves, respective said helical  
thread grooves defining together a helical ball path between an upper and  
lower end of said housing, said housing including a return passage  
providing communication between respective upper and lower ends of  
20 said helical ball path to form a continuous ball path in use for recirculation  
of ball bearings.
3. A column hoist as claimed in claim 1 or claim 2 wherein a further  
recirculating ball bearing assembly may be operatively coupled between  
said shaft and said carriage.
- 25 4. A column hoist as claimed in claim 3 wherein the load bearing  
recirculating ball bearing assembly and said further recirculating ball  
bearing assembly are coupled to prevent relative rotation therebetween.
5. A column hoist as claimed in claim 3 or claim 4 wherein the load  
bearing recirculating ball bearing assembly and the further recirculating  
30 ball bearing assembly are coupled such that in use the load bearing  
recirculating ball bearing assembly bears substantially all of the load of  
said carriage and any mass supported thereon.





6. A column hoist as claimed in any one of claims 3 to 5 wherein said coupling means is provided between said load bearing recirculating ball bearing assembly and the further recirculating ball bearing assembly to permit, in use, transference of load to said further recirculating ball bearing assembly upon failure of said load bearing recirculating ball bearing assembly.
7. A column hoist as claimed in any one of claims 3 to 6 wherein said coupling means comprises two slidably engageable coupling members, each coupling member being associated with a respective one of said load bearing recirculating ball bearing assembly and said further recirculating ball bearing assembly.
8. A column hoist as claimed in any preceding claim wherein said hoist includes a sensing means adapted to provide a signal upon failure of said load bearing recirculating ball bearing assembly.
9. A column hoist as claimed in claim 8 wherein said signal may control said drive means such that rotation of said shaft is restricted to a single direction which effects lowering of said carriage.
10. A column hoist as claimed in any preceding claim wherein the load bearing recirculating ball bearing assembly may be coupled to the lifting carriage by a self centering coupling means.
11. A column hoist as claimed in any preceding claim wherein the shaft is rotatably suspended adjacent an upper end of the column.
12. A column hoist as claimed in claim 11 wherein the shaft is suspended from a self centering bearing mounted adjacent the upper end of the column.
13. A column hoist as claimed in claim 11 or claim 12 wherein the shaft may be rotatably mounted adjacent both upper and lower ends of the column.
14. A column hoist as claimed in any preceding claim wherein the lifting carriage is slidably mounted on and cantilevered from said at least one column, said carriage including rollers locating on opposite surfaces of said at least one column.



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15. A column hoist as claimed in any preceding claim wherein the column hoist may be mounted on wheels or rollers for mobile operation.

16. A column hoist substantially as hereinbefore described with reference to the accompanying drawings.

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