

MULTI-DRUM WINCHING APPARATUS

The present invention relates to multi-drum winching apparatus, more particularly to such apparatus for use in a high-mast lighting column.

5 A prior double-drum construction has been disclosed in our United Kingdom Patent No. 1,390,558; and a triple-drum version of this construction has been disclosed in our United Kingdom Patent No. 2,042,455.

10 The double-drum construction disclosed in GB 1,390,558 referred to above, includes two independently-rotatable drums, a first driving means, whereby the first rope drum can be driven in either direction of rotation independently of the second, a second driving means, whereby the second rope drum can be driven in
15 either direction of rotation independently of the first, and means for coupling the two driving means, so that they can be rotated dependently at the same speed, whereby equal lengths of rope can be either wound onto or wound off the two drums simultaneously.

20 As shown in Figures 1 and 2 of the accompanying drawings, which illustrate the apparatus disclosed in GB 1,390,558, each of the winch drums 14 is driven through a worm wheel 24 and worm 26. In reaction to tension in the two wire ropes 60 connected to the drums, the two
25 worms 26 are constantly thrust towards the right as viewed in Fig. 2. In this known construction, the thrust is carried on bronze thrust washers 34.

The friction which occurs at these thrust washers, either when the winch mechanism is stationary
30 or in motion, contributes substantially to the winch's self sustaining facility.

However, when the winching apparatus is in frequent use for service and maintenance purposes, excessive heat may be generated at the bronze thrust

washers, thereby necessitating a lower running speed. Also, it is believed that the friction provided by the bronze thrust washers is greatly in excess of what is necessary for safety requirements, so that the winch not
5 only becomes unnecessarily hot but also is slower in operation as a result, which means that over a given period of time fewer high-mast lighting columns can be serviced by the maintenance crew.

Although the problems of excessive friction, heat
10 and slow operation, referred to above, may be overcome by replacing the bronze thrust bearings with thrust ball bearings, the use of thrust ball bearings alone may reduce the self-sustaining capacity of the winching apparatus excessively.

15 It is therefore an object of the present invention to partially or wholly overcome the problems referred to above in connection with the known multi-drum winching apparatus.

According to the present invention there is
20 provided a multi-drum winching apparatus of the type having independently rotatable drums driven by worm gear arrangements, said apparatus including: at least one friction ratchet associated with one of the worms, said
25 or each said friction ratchet comprising a first annular member assembled with the worm and having a single tooth on its outer circumference, and a substantially U-shaped member pivotally mounted and having a pair of arms one of which acts as a pawl, the first annular member being
30 cradled for rotation within the arms of the pivotable U-shaped member, the eccentric motion of the peripheral surface of the first annular member causing the pawl to engage with the single tooth at the end of a lifting run of the multi-drum winching apparatus; and a thrust ball
35 bearing associated with the first annular member.

In a preferred embodiment, the friction ratchet.

further comprises a second annular member assembled with the first annular member and having a thrust bearing portion and a pivotal bearing portion. In this embodiment, the worm associated with the friction
5 ratchet is orientated preferably such that its broad end imparts thrust to the friction ratchet.

The other worms associated with respective drums, not provided with a friction ratchet, may simply be provided with a thrust ball bearing arrangement. The
10 other worms may be arranged in reverse relation to or in like arrangement with the worm associated with the friction ratchet.

Preferred embodiments of the present invention will now be described in detail, by way of example, with
15 reference to the accompanying drawings, in which:-

Figures 1 and 2 are, respectively, plan and sectional views of the prior art double-drum winching apparatus of GB 1,390,558, and have already been described;

20 Figure 3 is a side elevation view of a preferred form of double-drum winching apparatus in accordance with the invention, the side plate of the apparatus being removed for clarity;

Figure 4 is a sectional view on the line IV-IV of
25 Figure 3;

Figure 5 shows two views of the pawl constituting part of the friction ratchet;

Figure 6 shows two views of the first annular member constituting another part of the friction
30 ratchet;

Figure 7 shows two views of a second annular member, the first and second annular members as an assembly constituting another part of the friction ratchet;

35 Figures 8 and 9 illustrate the operation of the

friction ratchet.

Referring to Figures 3 to 9, the preferred double drum winching apparatus is generally of similar basic construction to that shown in Figures 1 and 2, and includes a pair of drums 14 (only one being shown) on which respective ropes 60 (only one being shown) are wound.

The drums 14 are mounted for rotation on an axle 20, respective worm wheels 24 being rigidly secured at inwardly facing ends of respective drums 14. Engaging with each worm wheel 24 is a respective worm 26 which is pinned to a respective shaft 28 to be rotatable therewith.

A particularly preferred friction ratchet which forms the novel feature of the multi-drum winching apparatus comprises, as shown in Figures 5, 6 and 7, a first annular member 70 having a single tooth 72 on its outer circumference, a second annular member 84,88 acting as both thrust and pivotal bearing to the first annular member 70, and a substantially U-shaped member 74, one arm 76 of which constitutes a pawl for engagement with the single tooth 72 of the first annular member 70. The arms 76 and 78 together provide a substantially semi-circular surface therebetween, whose diameter is just slightly larger than the external diameter of the first annular member 70 in the region of the single tooth 72. Thus, as shown in Figure 4, the first annular member 70 is effectively cradled within the substantially U-shaped member 74. The U-shaped member 74 is mounted on a pivot 80 and confined with working clearance between supporting plates 82.

The combination of first annular member 70 and second annular member 84,88 is positioned on the shaft 28 between the worm 26 and a thrust ball bearing 86, the thrust bearing portion 84 of the second annular member

being positioned between the worm 26 and the first annular member 70. The pivotal bearing portion 88 of the second annular member is of reduced outer diameter and is positioned within the bore of the first annular member 70. The length of the pivotal bearing portion 88 is, for example, approximately 0.5mm less than the thickness of the first annular member 70, so that no thrust can be applied to the extreme forward end of the pivotal bearing portion 88.

In an alternative construction of friction ratchet in accordance with the invention, there is no separate second annular member, but instead there is provided a boss 84 formed integrally with the worm 26, the end 88 of the boss being machined to accommodate the first annular member 70.

The operation of the preferred friction ratchet will now be explained with particular reference to Figures 8 and 9, except where otherwise stated.

During the lifting operation, the first annular member 70 is rotating clockwise in unison with the second annular member 84,88 (Figure 3) and the adjacent race of the thrust ball bearing 86 (Figure 3). Due to the eccentric motion of the first annular member 70, the substantially U-shaped member 74 is caused to rock to and fro about its pivot 80.

Thus, during the lifting operation, the thrust ball bearing 86 is effectively the sole thrust bearing and thrust friction is therefore minimized.

When the worm 26 (Figure 3) ends its clockwise lifting run the pawl 76 may already be positioned to engage the single tooth 72 of the friction ratchet when counter-clockwise rotation commences, for example as shown in Figure 9. If instead the single tooth 72 of the friction ratchet is situated anywhere below the pawl 76 which acts as a stop to counter-clockwise rotation, for

example as shown in Figure 8, then upon counter-clockwise rotation of the worm 26, the friction ratchet will initially rotate in unison with the worm 26 and deflect the pawl 76 to the right about the pivot 80 as in Figure 9. The pivoting movement causes the pawl 76 to engage with the single tooth 72 of the first annular member 70, thus preventing further rotation thereof.

The above described combination of friction ratchet and thrust ball bearing is designed to replace one of the bronze worm thrust bearings in the double-drum winching apparatus shown in GB 1,390,558, preferably the left hand one as viewed in Figure 1 of the drawings.

Thus, during the lowering operation, the first annular member 70 and the thrust ball bearing 86 are motionless and the thrust bearing portion 84 of the second annular member is effectively the sole thrust bearing.

During the subsequent lifting operation, the single tooth 72 of the friction ratchet will initially disengage clockwise from the pawl 76 and further operation will be as previously described above.

In the case of the right hand worm thrust bearing, it may be replaced by a thrust ball bearing only.

Alternatively both bronze worm thrust bearings may be replaced by both the novel friction ratchet and the thrust ball bearings.

It should be noted that in the case of a right hand worm thrust bearing arrangement, the friction ratchet would operate in the reverse direction.

In the case of the triple-drum winching apparatus shown in GB-A-2,042,455, one, two or three of the bronze worm thrust bearings may be replaced by both the novel friction ratchet and thrust ball bearings, and the other

bronze thrust bearings (if any) replaced by a thrust ball bearing only.

5 It will be appreciated that the novel friction ratchet does not depend on the use of a spring to ensure that the pawl is forced into the operative position to engage the single tooth. Conventional ratchets make use of a spring to bias the pawl into engagement with the teeth of the ratchet wheel. It is known that after lengthy use, springs are known to fail. In the case of a
10 winching apparatus for a high-mast lighting column, such failure could have disastrous consequences. Due to the specific construction of ratchet and pawl employed, this type of failure cannot occur.

15 Accordingly, the provision of the novel friction ratchet together with a thrust ball bearing in place of at least one of the bronze thrust washers in a multi-drum winching apparatus, ensures that less wear takes place, less heat is generated, and the lowering and raising operations can be performed in less time, yet
20 ensuring that adequate safety standards are maintained.



CLAIMS

1. A multi-drum winching apparatus of the type having independently rotatable drums driven by worm gear arrangements, said apparatus including: at least one
5 friction ratchet associated with one of the worms, said or each said friction ratchet comprising a first annular member assembled with the worm and having a single tooth on its outer circumference, and a substantially U-shaped member pivotally mounted and having a pair of
10 arms one of which acts as a pawl, the first annular member being cradled for rotation within the arms of the pivotable U-shaped member, the eccentric motion of the peripheral surface of the first annular member causing the pawl to engage with the single tooth at the end of a lifting run of
15 the multi-drum winching apparatus; and a thrust ball bearing associated with the first annular member.
2. A multi-drum winching apparatus according to claim 1, wherein the friction ratchet further comprises a second annular member assembled with the first annular
20 member and having a thrust bearing portion and a pivotal bearing portion.
3. A multi-drum winching apparatus according to claim 2, wherein the worm associated with the friction ratchet is oriented such that a broad end of the worm
25 imparts thrust to the friction ratchet.
4. A multi-drum winching apparatus according to claim 2 or claim 3, wherein the first and second annular members are positioned between the worm and the thrust ball bearing, the thrust bearing portion of the second
30 annular member being positioned between the worm and the first annular member, the pivotal bearing portion of the second annular member being of reduced outer diameter



and being positioned within the bore of the first annular member.

5. A multi-drum winching apparatus according to claim 4, wherein the length of the pivotal bearing portion of the second annular member is less than the thickness of the first annular member, whereby no thrust can be applied to the extreme forward end of the pivotal bearing portion of the second annular member.

6. A multi-drum winching apparatus according to claim 1, wherein a boss is formed integrally with the worm, the end of the boss being machined to accommodate the first annular member.

7. A multi-drum winching apparatus according to any preceding claim, said apparatus including two independently rotatable drums driven by respective worm gear arrangements, one or both of the worms having associated therewith at least one said friction ratchet and thrust ball bearing arrangement.

8. A multi-drum winching apparatus according to any preceding claim, said apparatus including three independently rotatable drums driven by respective worm gear arrangements, one, two or three of the worms having associated therewith at least one said friction ratchet and thrust ball bearing arrangement.

9. A multi-drum winching apparatus according to claim 7 or claim 8, wherein the other worm or worms associated with respective drums not provided with said friction ratchet, if any, have associated therewith respective thrust ball bearing arrangements only.



10. A multi-drum winching apparatus substantially as any of those described herein with reference to Figures 3 to 9 of the accompanying drawings.
