

SPECIFICATION

A Drive Mechanism

This invention relates to a drive mechanism for transporting a load along an elongate flexible member.

According to the present invention there is provided a drive mechanism for transporting a load along a vertically hanging elongate flexible member the mechanism comprising a carrier supporting a wheel which has a peripheral circumferential groove for receiving the elongate flexible member, there being provided pressure applying means comprising a plurality of interlinked pressure elements for pressing the elongate flexible member radially inwardly of the groove over part of the circumferential extent of the groove to engage the elongate flexible member frictionally with the wheel, whereby rotation of the wheel causes travel of the mechanism along the elongate flexible member, one end of the pressure applying means being secured to the carrier and the other end being secured to a lever which is pivotably mounted on the carrier, the lever being adapted to support a load in such a way that the weight of the load places the pressure applying means under tension to press the pressure elements inwardly of the groove, the drive mechanism including a brake mechanism comprising a ratchet wheel mounted rotationally freely on a shaft which is drivably connected to the wheel, and a drivable gear wheel, which cooperates with a screwthreaded portion of the shaft whereby relative rotation between the gear wheel and the shaft causes the gear wheel to move axially along the shaft, such axial movement in one direction causing the ratchet wheel to be frictionally locked with respect to the shaft, pawl means being provided for permitting rotation of the ratchet wheel in one direction only.

For a better understanding of the present invention and to show how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 is a sectional view of a drive mechanism for a lifting cradle;

Figure 2 is a sectional view taken along the line II—II in Figure 1; and

Figure 3 shows part of Figure 2 on an enlarged scale.

The mechanism shown in the drawings is supported from an elongate flexible member constituted by a wire rope 2 which is suspended, in use, from a fixed member. The rope 2 passes around a wheel 4 which is mounted for rotation in a carrier 6. Pressure applying means in the form of a flexible element or chain 8 made up of linked rollers extends around the wheel 4 over an arc of approximately 180° and acts, in use, to press the rope 2 into a tapered groove 10 formed around the periphery of the wheel 4.

One end 8A of the chain 8 is secured to the carrier 6 by a pin 12, and the other end 8B is

connected to a shackle 14 by a lever 16. The lever 16 is pivotally mounted between two lugs 18 by a pin 19. A downward force applied to the shackle 14 causes the lever 16 to pivot about the pin 19 drawing the end 8B of the chain 8 towards the left as seen in Figure 1, so pressing the rollers of the chain 8 inwardly of the groove 10.

An electric drive motor, of which only an output pinion 20 is shown, is bolted to the carrier 6. The pinion 20 meshes with a gear wheel 22 mounted on a shaft 24 which also carries a pinion 26. At one end of the shaft 24 there is a square-section extension 28 by means of which the shaft 24 can be rotated manually to operate the drive mechanism, for example in the event of power failure. The pinion 26 meshes with a gear wheel 30 mounted on a shaft 31, on which a sun pinion 32 of a planetary gear arrangement is also mounted. This sun pinion 32 meshes with two planet gears 34 which are mounted for rotation on a planet carrier 36 which is fixed relatively to the carrier 6. The wheel 4 is supported for rotation on the planet carrier 36 by means of rolling element bearings 37, and has internal teeth 38 with which the planet gears 34 mesh. The gear train from the pinion 20 the wheel 4 constitutes a reduction gear.

The shaft 31, and some of the parts mounted on it, are shown in more detail in Figure 3.

The gear wheel 30 cooperates with a coarse screw-threaded portion 33 of the shaft 31. A ratchet wheel 29 and two friction discs 44 are mounted on the shaft 31, and are able to rotate relatively to the shaft 31. A sleeve 35 cooperates with a further screw-threaded portion of the shaft 31, and the sun pinion 32, which is not shown in Figure 3, is mounted on a portion 39 and is not rotatable relatively to the shaft 31.

A disc 46, having a projection 48, is mounted on a non-circular portion of the shaft 31. The projection 48 is positioned to obstruct a pin 50, fixed to the gear wheel 30, when the gear wheel 30 approaches the left-hand end of the shaft 31, as viewed in Figure 3. The parts to the left of the sleeve 35 are retained on the shaft 31 by a bolt 52. A spring washer 54 and a collar 56 are disposed between the head of the bolt 52 and the end of the shaft 31.

Two pawls 23, disposed on opposite sides of the shaft 31, engage the ratchet wheel 29 to allow rotation of the ratchet wheel 29 in one direction only. The pawls 23 are carried by bolts 58 which, with further bolts 60, serve to secure the planet carrier 36 to the carrier 6.

On the length of rope which, in use, falls below the mechanism, there is a stop member 40.

In use of the mechanism shown in Figures 1 and 2, a cradle, for example for receiving personnel, is connected to the shackle 14. The lifting mechanism is supported, preferably resiliently, on the cradle by means of a ring 42 fixed to the carrier 6. This measure provides a temporary support of the mechanism when it is not supported by the rope 2. Rotation of the wheel 4 in the appropriate direction by the motor

causes the mechanism to travel up the rope as will be described in more detail below, the rope being frictionally engaged within the groove 10. As the weight of the cradle connected to the shackle 14 is taken by the lifting mechanism, the chain 8 is tensioned through the lever 16 and forces the rope firmly between the tapered side walls of the groove 10, so increasing the frictional engagement between the wheel 4 and the rope 2.

10 Reversal of the motor causes the mechanism and the cradle to travel down the rope 2 at a controlled speed.

When the mechanism is to be raised, the gear wheel 30 is rotated in the direction to cause it to advance towards the ratchet wheel 29 along the screw-threaded portion 33. Eventually, the gear wheel 30 will compress the friction discs 44 and the rotation of the gear wheel 30 will be frictionally transmitted to the sleeve 35 and thence to the shaft 31 so causing the mechanism to climb the cable 2. At the same time, the ratchet wheel will also be rotated by virtue of the frictional engagement between it and the friction discs 44, this rotation being permitted by the pawls 23.

If the motor stops, the shaft 31 will be driven in the opposite direction by the weight of the lifting mechanism and the load attached to the shackle 14. However, the pawls 23 prevent the ratchet wheel from rotating in this direction, and, since the clamping pressure exerted by the gear wheel 30 is not released, the shaft 31 will be prevented from rotating because it is frictionally connected to the ratchet wheel 29. If there is any slip between the friction discs 44 and the adjacent parts, the resulting relative rotation between the shaft 31 and the gear wheel 30 will cause the gear wheel 30 to be forced even more firmly towards the sun pinion 32 to increase the clamping effect until the mechanism comes to a standstill. It will be appreciated that, while the motor must be braked strongly enough to prevent rotation of the gear wheel 30, the resistance to rotation of the shaft 31 is applied by the pawls 23.

If the motor is reversed, so as to cause the mechanism to move down the cable 2, the gear wheel 30 is rotated to release the clamping force applied to the friction discs 44. The shaft 31 can then slip relatively to the ratchet wheel 29, which is still held stationary by the pawls 23. The projection 48 on the disc 46 limits the travel of the gear wheel 30 to the left as seen in Figure 3. In the limit position, the projection 48 is engaged by the pin 50 and further rotation of the gear wheel 30 relative to the shaft 31 is prevented.

The stop member 40 prevents the mechanism from accidentally running off the lower end of the rope.

The mechanism described can be used as a travelling lifting mechanism, for example for goods in a warehouse, or for example, for supporting personnel during the exterior maintenance of buildings. Where a large cradle is used, it may be desirable to support it from two or

more lifting mechanisms on a corresponding number of ropes.

The drive mechanism disclosed herein is also disclosed and claimed in our Application No. 8212107 (Serial No. 2095202).

Claims

1. A drive mechanism for transporting a load along a vertically handling elongate flexible member, the mechanism comprising a carrier supporting a wheel which has a peripheral circumferential groove for receiving the elongate flexible member, there being provided pressure applying means comprising a plurality of interlinked pressure elements for pressing the elongate flexible member radially inwardly of the groove over part of the circumferential extent of the groove to engage the elongate flexible member frictionally with the wheel, whereby rotation of the wheel causes travel of the mechanism along the elongate flexible member, one end of the pressure applying means being secured to a lever which is pivotally mounted on the carrier, the lever being adapted to support a load in such a way that the weight of the load places the pressure applying means under tension to press the pressure elements inwardly of the groove, the drive mechanism including a brake mechanism comprising a ratchet wheel mounted rotationally freely on a shaft which is drivably connected to the wheel, and a drivable gear wheel, which cooperates with a screwthreaded portion of the shaft, whereby relative rotation between the gear wheel and the shaft causes the gear wheel to move axially along the shaft, such axial movement in one direction causing the ratchet wheel to be frictionally locked with respect to the shaft, pawl means being provided for permitting rotation of the ratchet wheel in one direction only.
2. A drive mechanism as claimed in claim 1, in which one arm of the lever is pivotally connected to the pressure applying means and the other arm of the lever is pivotally connected to attachment means for the load.
3. A drive mechanism as claimed in claim 1 or 2, in which the pressure applying means extends around the wheel over an arc of approximately 180°.
4. A drive mechanism as claimed in any one of claims 1 to 3, in which the pressure elements comprise rollers.
5. A drive mechanism as claimed in one of the preceding claims, in which a motor is provided for driving the wheel.
6. A drive mechanism as claimed in claim 5, in which the motor is connected to drive the wheel through reduction gearing.
7. A drive mechanism as claimed in any one of the preceding claims, in which two friction discs are provided, one being disposed between the gear wheel and the ratchet wheel, and the other being disposed between the ratchet wheel and a flange which is fixed with respect to the shaft.
8. A drive mechanism as claimed in any one of



causes the mechanism to travel up the rope as will be described in more detail below, the rope being frictionally engaged within the groove 10.

- As the weight of the cradle connected to the shackle 14 is taken by the lifting mechanism, the chain 8 is tensioned through the lever 16 and forces the rope firmly between the tapered side walls of the groove 10, so increasing the frictional engagement between the wheel 4 and the rope 2.
- Reversal of the motor causes the mechanism and the cradle to travel down the rope 2 at a controlled speed.

- When the mechanism is to be raised, the gear wheel 30 is rotated in the direction to cause it to advance towards the ratchet wheel 29 along the screw-threaded portion 33. Eventually, the gear wheel 30 will compress the friction discs 44 and the rotation of the gear wheel 30 will be frictionally transmitted to the sleeve 35 and thence to the shaft 31 so causing the mechanism to climb the cable 2. At the same time, the ratchet wheel will also be rotated by virtue of the frictional engagement between it and the friction discs 44, this rotation being permitted by the pawls 23.

- If the motor stops, the shaft 31 will be driven in the opposite direction by the weight of the lifting mechanism and the load attached to the shackle 14. However, the pawls 23 prevent the ratchet wheel from rotating in this direction, and, since the clamping pressure exerted by the gear wheel 30 is not released, the shaft 31 will be prevented from rotating because it is frictionally connected to the ratchet wheel 29. If there is any slip between the friction discs 44 and the adjacent parts, the resulting relative rotation between the shaft 31 and the gear wheel 30 will cause the gear wheel 30 to be forced even more firmly towards the sun pinion 32 to increase the clamping effect until the mechanism comes to a standstill. It will be appreciated that, while the motor must be braked strongly enough to prevent rotation of the gear wheel 30, the resistance to rotation of the shaft 31 is applied by the pawls 23.

- If the motor is reversed, so as to cause the mechanism to move down the cable 2, the gear wheel 30 is rotated to release the clamping force applied to the friction discs 44. The shaft 31 can then slip relatively to the ratchet wheel 29, which is still held stationary by the pawls 23. The projection 48 on the disc 46 limits the travel of the gear wheel 30 to the left as seen in Figure 3. In the limit position, the projection 48 is engaged by the pin 50 and further rotation of the gear wheel 30 relative to the shaft 31 is prevented.

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1. A drive mechanism for transporting a load along a vertically handling elongate flexible member, the mechanism comprising a carrier supporting a wheel which has a peripheral circumferential groove for receiving the elongate flexible member, there being provided pressure applying means comprising a plurality of interlinked pressure elements for pressing the elongate flexible member radially inwardly of the groove over part of the circumferential extent of the groove to engage the elongate flexible member frictionally with the wheel, whereby rotation of the wheel causes travel of the mechanism along the elongate flexible member, one end of the pressure applying means being secured to a lever which is pivotally mounted on the carrier, the lever being adapted to support a load in such a way that the weight of the load places the pressure applying means under tension to press the pressure elements inwardly of the groove, the drive mechanism including a brake mechanism comprising a ratchet wheel mounted rotationally freely on a shaft which is drivably connected to the wheel, and a drivable gear wheel, which cooperates with a screwthreaded portion of the shaft, whereby relative rotation between the gear wheel and the shaft causes the gear wheel to move axially along the shaft, such axial movement in one direction causing the ratchet wheel to be frictionally locked with respect to the shaft, pawl means being provided for permitting rotation of the ratchet wheel in one direction only.
2. A drive mechanism as claimed in claim 1, in which one arm of the lever is pivotally connected to the pressure applying means and the other arm of the lever is pivotally connected to attachment means for the load.
3. A drive mechanism as claimed in claim 1 or 2, in which the pressure applying means extends around the wheel over an arc of approximately 180°.
4. A drive mechanism as claimed in any one of claims 1 to 3, in which the pressure elements comprise rollers.
5. A drive mechanism as claimed in one of the preceding claims, in which a motor is provided for driving the wheel.
6. A drive mechanism as claimed in claim 5, in which the motor is connected to drive the wheel through reduction gearing.
7. A drive mechanism as claimed in any one of the preceding claims, in which two friction discs are provided, one being disposed between the gear wheel and the ratchet wheel, and the other being disposed between the ratchet wheel and a flange which is fixed with respect to the shaft.
8. A drive mechanism as claimed in any one of



the preceding claims, in which a sun gear is mounted on the shaft and connected to drive the wheel by means of planet gears which mesh with the sun gear and with internal teeth of the wheel and which are rotatable about axes which are fixed with respect to the carrier.

9. A drive mechanism as claimed in any one of the preceding claims, in which the load comprises

a personnel-carrying cradle.

10. A drive mechanism substantially as described herein with reference to the accompanying drawings.

11. A lifting arrangement comprising a vertically hanging elongate flexible member on which is supported a drive mechanism in accordance with any one of the preceding claims.