Short Communication

A simple plate clutch for solar concentrators

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Abstract

Design and constructional aspects of a simple plate clutch used for solar concentrators are described.

Key words : Plate clutch, solar concentrators, programmed mechanical systems, tracking.

1. Introduction

Solar concentrators are used to increase the intensity of solar radiation on the energy absorbing surface. Unlike the flat plate collectors, the solar concentrators can use only the direct radiation from the sun. Hence they must be oriented in varying degrees to 'track' the sun so that beam radiations will be directed to the absorbing surface. Programmed mechanical systems[1] are normally used for tracking the sun. They cause the concentrators to be moved at the rate of 15° per hour about the polar axis. (Polar axis is the axis of rotation of the earth).

For this, a synchronous motor with a suitable gear reduction unit is directly coupled to the shaft of the concentrators. Initial adjustment of the concentrators (perhaps every morning) can be done only by decoupling the reduction unit from the concentrator shaft. The plate clutch is a valuable intermediate unit between the concentrator shaft and the speed reduction unit. This has been designed, fabricated and used in the parabolic cylindrical trough concentrator developed at our laboratory.

2. Description

As shown in Fig. 1, it consists of a worm wheel (2) (the final component of speed reduction unit) which is free to rotate on the concentrator shaft (1). The worm wheel is coupled to the speed reduction unit through the worm (3). On either side of the worm wheel, fiber discs of 150 mm diameter and 4 mm thickness are provided. These fiber discs have a coefficient of friction of about 0·3 to 0·4 when in contact with the worm wheel. The fiber discs are screwed to input disc (4) and output discs (5). The

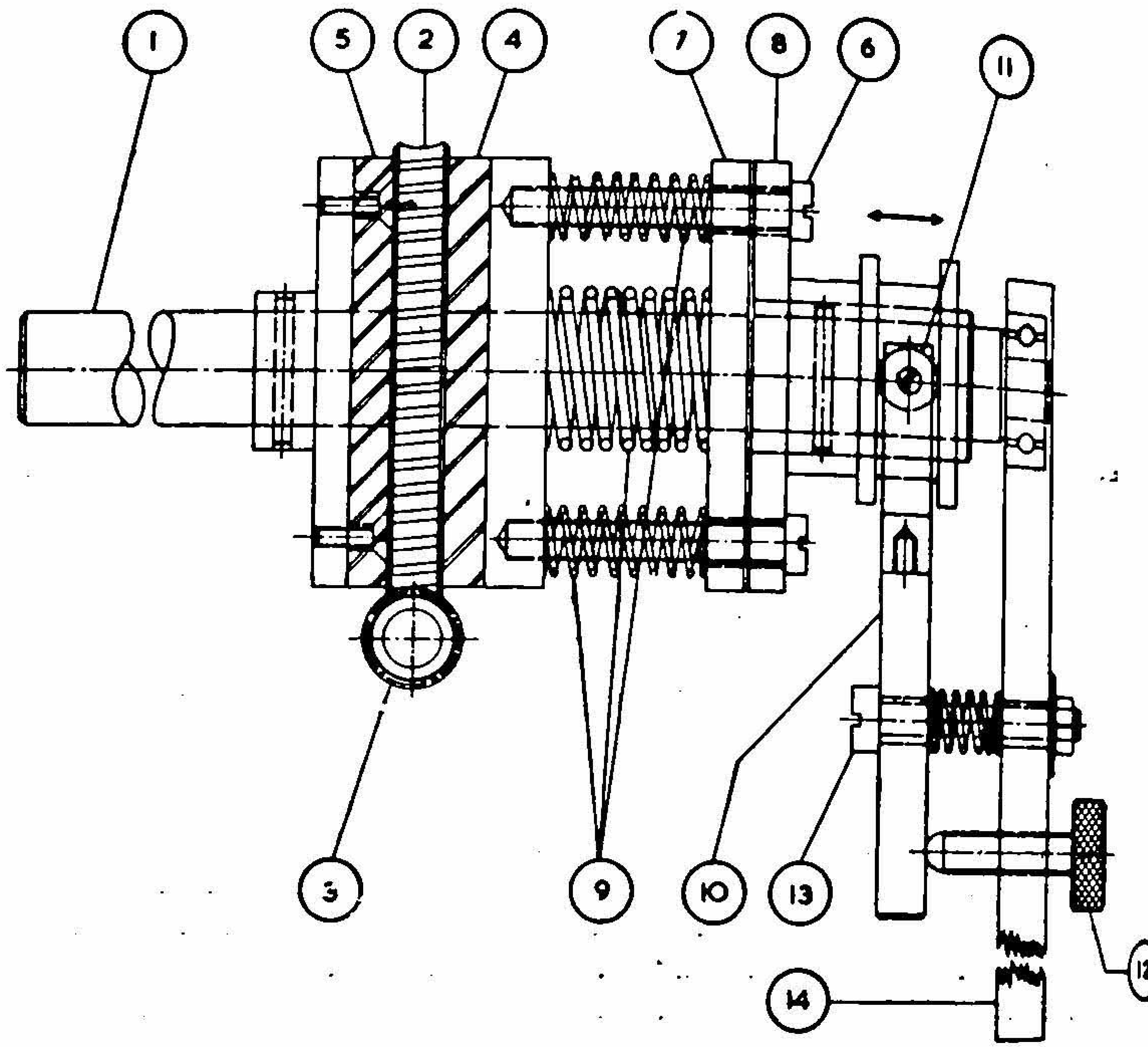

FIG. 1. Plate clutch for solar concentrators

1. Shaft. 2. Worm wheel. 3. Worm. 4. Input disc. 5. Output Disc. 6. Retaining bolts 7. Intermediate plate. 8. Retaining disc with collar. 9. Retaining springs. 10. 'U' bracket. 11. Bearings. 12. Adjusting screw. 13. Pivoting bolt. 14. Fixed plate.

output disc which is free to slide on the concentrator shaft is provided with three bolts (6) as shown in Fig. 1. The bolts pass through the free holes in the intermediate disc (7) as well as in the retaining disc (8). The intermediate disc is provided with a sleeve which is also pinned to the concentrator shaft. The retaining disc (5) provided with a collar at one end slides over the sleeve of the retaining disc and is loosely coupled to the output disc through the three bolts and the retaining springs (9). Thus the output disc is capable of sliding along the concentrator shaft and is also capable of rotating along with the shaft. A U-bracket (10) provided with ball bearings (11) engages in the collar of the retaining disc.

The torque that can be transmitted will depend upon the frictional force developed between the input fiber disc and the worm wheel, which in turn depends, among other factors, upon the axial force developed between them. By movement of the input disc, axial force is applied to the worm wheel through the retairing springs. In order to provide the axial movement an adjusting screw (12) having multiple threads activates the U-bracket about the pivoting bolt (13). The movement of the U-bracket is transferred to the retaining disc and thus to the input disc. The adjusting screw is held by the fixed plate (14) mounted on the concentrator frame.

3. Performance

The performance of this plate clutch has been tested by fitting in on an 8′ × 3′ para-cylindrical trough collector frame. It was found that it is capable of taking a load of about 50 kg. It can work continuously for about 8 hours without slipping. The primary advantage of this type of clutch is that there is very little shock on the reduction unit during engagement.

4. Conclusion

The plate clutch described in this paper is simple in design, easy to fabricate and very effective in use. In addition, it is cheap and costs about Rs. 300.

Reference

1. JOHN, A. DUFFIE AND WILLIAM A. BECKMAN — *Solar Energy Thermal Processes,* John Wiley and Sons Publications.