J D Pope
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4.2 METRE WILLIAM HERSCHEL TELESCOPE

THE ROTATING TOP END RING - ITS DESIGN AND FUNCTION

Design Philosophy

The Rotating Top End Ring, which might be more accurately called the Reversing Top End Ring, was incorporated in the design of the 4.2m telescope primarily to permit the interchange of the secondary mirror and the prime focus assembly without the need for changing complete top end rings as is done for example on the Anglo-Australian telescope. This latter activity involves the use of an overhead travelling crane or large motorised handling trolleys, both of which occupy a great deal of space and would require a larger dome and building than is planned for the 4.2m telescope.

In the case of the AAT the need to cater for three secondary mirrors of F ratios 8, 15 and 35 as well as a prime focus assembly virtually dictated the use of completely interchangeable top end rings. The 4.2m telescope situation is simpler for it is only necessary to replace one secondary mirror with the PF assembly. This could have been achieved by having a fixed end ring with spider vanes and a central hollow cylinder into which either the secondary mirror or the prime focus assembly could be inserted, but in addition to other drawbacks it would have caused a larger central obstruction of the light beam than occurs with the chosen system which is able to take advantage of the fact that in an altazimuth-mounted telescope the tube does not rotate about its optical axis when tracking a star.

The rotating end ring feature is considered to have the following advantages:

1. Small space and simple handling equipment required for interchange.

2. One common permanently installed focussing mechanism for both F/11 secondary and the P.F. assembly.

3. Easy access to the secondary mirror for removal of cover and inspection of mirror surface.

4. Provision for installing another secondary mirror of smaller size, say of F ratio 30 or 40, behind the F/11 secondary

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(back to back) so that either can be brought into operation by rotating the top end. This feature could be important if infrared operation of the telescope is ever considered.

5. Provision for replacement, with minimum cost and effort, of the F/11 mirror with one of different F ratio or surface coating.

General Description

The telescope tube trusses which are of the conventional serrurier truss form terminate in a fixed end ring. Inside this ring there is a second ring which pivots about its horizontal diameter. A geared motor mechanism can rotate it through an angle of 180° and motor-driven latches lock it securely to the fixed ring in either of its two positions.

At the centre of the rotating ring tensioned vanes hold a drum housing the focussing mechanism which carries the mounting flange to which either the secondary mirror cell or the prime focus assembly is bolted. It is important to note that the operating position of this focussing flange is facing inwards (towards the primary) for the secondary mirror, and facing outwards for the prime focus assembly. Consequently, focussing movements are in opposite directions for the two situations and it is necessary for sign reversal to be incorporated in the focus control system.

The vanes supporting the central drum are at 90° but are offset from the ring centreline by 100 mm to provide torsional stiffness for the whole assembly. The vanes are arranged to be symmetrical about the axis of rotation so that in either of the two 180° positions the vanes are in line with those supporting the Nasmyth 45° flat mirror.

The central drum structure is arranged to be symmetrical about the axis of rotation of the ring and focussing movement of the secondary mirror is countered by a weight moving in the opposite direction so that the rotating end ring is normally maintained in balance. However, when the prime focus assembly is attached the ring is no longer in balance but rotation is then not needed and is in fact prevented by an interlock circuit.

The F/11 Secondary Mirror Assembly

The 1 metre diameter mirror is held in its cell by six cemented pads linked to

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form a three point axial support system, and a set of six lever weights provides edge support. The cell is attached to a back plate by motorised screws allowing remote collimating adjustment, and the back plate is in turn bolted to the focussing flange.

Clipped to the front of the cell is a fibre glass mirror cover intended for removal and replacement by hand.

Surrounding the mirror cell but not attached to it is a lightweight sky baffle of 1.22 metres diameter.

The Prime Focus Assembly

This consists of a conical shell which bolts onto the focussing flange. The shell carries the instrument mounting turntable with its servo-motor drive, and surrounding this there is a cable wrap carrying signal and power cables to and from the rotating instrument. Housed within the conical shell is the three-element prime focus corrector lens.

Operation of the Rotating End Ring

As the top end ring is only required to rotate for access or interchange purposes when there is human involvement it has been arranged that rotation can only be initiated by means of push buttons situated on the fixed end ring. These push buttons can be reached from the Nasmyth gallery when the telescope has been driven to a position at 19^{o} elevation known as Access Park 1.

After rotation of the top end ring at this position the telescope can be brought down by control from the Nasmyth gallery to Access Park 2 at 5^{o} elevation. Assuming that the secondary mirror is in place and that rotation of the top end has now made it face outwards, away from the primary mirror, the mirror cover can be removed or replaced. If however, a change to prime focus operation is required then the telescope must be brought down to Access Park 3 at 1^{o} elevation and clamped to the Nasmyth gallery. At this position the sky baffle can be removed by quick-release clamps and then the secondary mirror cell unbolted, transferred to its handling trolley and taken away.

The prime focus assembly on its own trolley is then brought up to the Nasmyth gallery by crane, placed in position and bolted to the focussing flange. As soon as the prime focus assembly is bolted in place it is in the operating position and rotation of the ring is not required and indeed is prevented by an interlock circuit.

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