TELESCOPE MOUNT WOES

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After many years examining all sorts of telescopes and mounts (commercial and home made) I have decided there should be a better mount for reasonable size payloads. Nothing to my view is free from drawbacks. I would like to discuss the situation in detail and a formulation of a mount that may be the next step.

German Equatorial Mount.
Ubiquitous for small mounts. There are some good ones but wobble is a problem. Large payloads require great attention to detail and tuning in order to get things workable, but the mount tends to be very expensive to achieve stability. The problems are magnified with telescopes of large moments of inertia (long tube Newtonians or refractors) needing a large counterbalance. There is complete sky coverage but requires tube reversal near the Central Meridian. GOTOs can take two routes from the two hemispheres (east and west). The telescope overhangs the DEC bearings and the balanced DEC axis overhangs the RA bearings. Good designs have very little distance from the RA rotation axis to the telescope tube mounting.

Fork Mount.
This is a less common mount, usually seen on very large professional telescopes, but commercial ones of 24 inch aperture scopes have been made, and a new one was seen recently with a small refractor and a huge price tag.

The fork is ok if the large U shape of the fork is not put under undue stress. It is not easy for even a small telescope to be stable, except when in the Alt Azimuth orientation but that has its own problems. The advantage is there is no counterbalance but the disadvantage is that the fork must not flex when in any orientation. This can be done with 'A' frame arrangements to provide stability but the stresses are referred to the base which then must also be strengthened as the weight is hanging a long way from it. The centre of gravity has to be artificially moved towards the base with a very massive bottom end construction. The telescope is mounted within the DEC bearings which is good for stability but then the long fork arms and the telescope overhang the RA bearings by a good way.

Alt-Azimunth configuration.
This is the only configuration that can cope with large telescopes. Field rotation is the big problem and requires an additional layer of compensation and cost if it is in the Alt Azimuth arrangement. Photographic use requires the de-rotator. It is usually seen as a fork mount. For driven system there is no access to the zenith. At the zenith the RA drive speed increases to above the slew speed of the telescope, just in order to track the object so there is a hole in size equivalent to the RA slew time for 180 degrees traverse. Dobsonian telescopes are arranged like this and GOTO operation is available economically. The telescope is mounted within the Altitude bearings but then the long fork arms and the telescope are rotated in the azimuth plane quite a distance away. This is not a problem as the weight is all acting downwards so there is inherently no flexure in the mounting.

English Mount.
Seen on large telescopes in observatories as it requires a North pier and a South pier between which is slung the RA axis and the telescope tube. The disadvantage is there is no access to the polar regions. No counterbalance is required. It is not possible to make a portable version of this. The 200 inch Mount Palomar telescope is a modification of this where the northern pier is a horseshoe in shape through which the telescope can gain access to the pole. The telescope is mounted within the RA bearings with no counterbalance.

Modified English Mount.
Like the English mount there are two piers (N and S) but the telescope is mounted on a cross axis in the middle, tube one side, counterbalance the other side. There is now access to the complete sky. Tube reversal is generally not needed, this telescope can work under the polar axis. A good example of this is the 36 inch Yapp telescope at Herstmonceux.
The telescope overhangs the DEC bearings and the balanced DEC axis is mounted within the RA bearings.

A New Mount.
If you take the Modified English mount and bring the N and S support pillars close together then you retain the stability by having the load between the bearings. However the counterweight needs to move position or the support arms (N and S pillars) have to be unduly long. However with a stiff polar axle, the torque by the OTA can be counterbalanced by a torque at any other place on the same axle. So we arrive at a new form mounting where the main polar axle supports are on a 'C' shaped cradle. The telescope is mounted close in so the DEC axle is quite short. The counterbalance is on a long shaft above the North pier. Stiffness needs large section box and tubes, rather than solid cross sections

We call this a Portable English Mount (PEM) or more strictly a Portable Modified English Mount. It is a portable design because the North and South piers are tied together in a manageable lump.

AWR Technology in collaboration with ASTROMOUNT have taken this idea forward with mechanical design computations, models and engineering drawings to produce a workable prototype. The resultant will be tested with various large telescopes to check the performance. It is expected to be much more stable with no wobbles, smooth drive and good GOTO performance.

The prototype was first shown at Astrofest 2017.

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