On a probable means of procuring plane and curved Specula of Great size, with a few remarks on fixed telescopes. by A. R. Wallace.

On considering the means of obtaining in the first place a perfect plane Reflecting surface, it appears that nature in certain instances produces one much superior to any thing the art of man can form. The surface of quiescent fluid mercury is perhaps the best of these and all we want is to fix it immoveably or obtain a perfect copy of it. There are many difficulties in the way of the latter but it is not unlikely that the Electrotype offers a means of overcoming them, and producing in solid metal a truly plane polished mirror. There appears no reason why the operation should not be successful; the vessel containing the metallic solution might have a stratum of mercury at the bottom and the moment the connection was made by the wire touching the mercury the operation would commence, an almost infinitely thin pellicle being first deposited the surface must be accurately copied, and in fact it has been shewn that a surface equally polished with the copy is produced. The difficulty of keeping the vessel perfectly free from vibration might doubtless be got over; the only question then remaining is a Chemical one: what metal can be deposited that would not in any degree combine with the mercury? Neither Gold nor Copper would do, perhaps Iron or Antimony might do better, but that which would answer must be determined by experiment. The writer much regrets that the circumstances in which he is placed have not permitted him either the time or expense necessary to ascertain these points. Should the metal deposited not reflect sufficient light he conceives a great advantage would still be obtained over performing the whole operation by hand as a thin pellicle of Gold or other metal might be deposited over it and that if necessary polished. Even should all efforts to deposit a metal on Mercury so as to produce a polished surface, fail, the principle might still perhaps be applied by obtaining some fluid which would consolidate with a polished surface. it might then be metallized in the manner usually employed for Electrotype operations and though perhaps a highly polished surface might not be thus obtained still it would be a great assistance to have a true homogenous plane surface requiring nothing but the last polish to render it fit for use. Trusting however that whatever difficulties may be presented will be overcome he will proceed to point out the advantages that may result from its success. We should then have a perfect plane mirror of any size to reflect the rays to the concave speculum and thus one great difficulty of using telescopes of large size fixed, would be got over.

Having however obtained a plane mirror it appears not impossible that we may also produce the concave one without going through the tedious, uncertain, and expensive operations of grinding and polishing. It is evident that a plane mirror produced as before described would be both perfectly uniform in its thickness and perfectly homogenous in its structure. The writer of this was much interested some time ago with Mr. Nasmyth's method of producing concave reflectors by extracting the air from a chamber behind a circular plate of glass and allowing the pressure of the atmosphere to produce the required curvature. He has not been able to learn why this has not succeeded or been brought into operation, but supposes it must be from the difficulty of procuring plates of glass sufficiently uniform in thickness, homogenous in structure, and truly plane in both surfaces without all of which it is evident a uniform curve would not be produced. Mr. Nasmyth conceives that the curve would be between a catenary and circle, but does it not appear more likely that it would be truly parabolic, the pressure of the atmosphere being similar to an infinite number of perpendicular pressures. If so it appears difficult to imagine how a perfectly plane homogenous body of uniform thickness, placed under such a pressure could take any other than a true parabolic form. If it did there would be a curved mirror formed superior probably to any yet made. It also seems probable that the metal after being exposed to the pressure, would on its being removed retain a portion of its curvature sufficient for a long focus and thus obviate the inconvenience of having to keep the atmospheric pressure perfectly uniform in order to preserve the same focal length.

In fixing a telescope for the purpose of using a moveable plane Speculum to reflect the objects to the curved one, it appears evident that that position must be best which requires the plane mirror to be of the least possible size. To effect this the tube must be directed to a point midway between the Pole and a few degrees above the Southern Horizon or in this Country about 20º South of the Zenith, (on the supposition that it is not required to view objects more than a few degrees below the Pole) the Great curved Speculum being at the top and the plane mirror and observer at the bottom; In this situation the plane mirror need be only 1/7th larger than the Speculum to reflect rays to the whole of its surface from objects least favourably situated, while if directed toward the Pole with the Speculum at the top the plane mirror must be nearly twice the diameter and with the speculum at bottom, no dimensions of plane mirror would reflect light from objects near the Pole to the whole surface of the Speculum.

The plane mirror might be made to keep an object in the field of view with great facility in whatever direction the telescope were placed, by fixing it in the manner of an equatorial so as to be elevated to the proper angle and moved round on a polar axis.

The writer has thus concisely expressed his ideas on these subjects in the hope that if they are at all novel, some one may be found to put them to the test of experiment and ascertain whether these methods of increasing the power of the Telescope are capable of practical application.