LVIII. *Obſervations of the Tranſit of* Venus *over the* Sun, *on* June 3, 1769; *and the Eclipſe of the* Sun *the next Morning; made at* Eaſt Dereham, *in* Norfolk, *by the Rev.* Francis Wollaſton, *F. R. S. Extracted from ſome Letters addreſſed to the Rev.* Nevil Maſkelyne, *F. R. S. and Aſtronomer Royal.*

Read Dec. 21, 1769.

THE teleſcope I uſed was a reflector of Short's, of 12 inches focus, with a power that magnifies about 55 times. My clock was made by Holmes. It escapes dead ſeconds, has a pendulum with a wooden rod, and is firmly faſtened to a ſtack of chimnies in the room where I obſerve. I had lately received it from London, and regulated it by tranſits of the Sun and ſtars, taken with a tranſit inſtrument of a peculiar kind (deſcribed at the end of this account); and alſo by equal altitudes of the Sun, taken with another inſtrument of my own make. By ſeveral tranſits of the Sun and fixed ſtars, obſerved in the latter end of May and the beginning of June, I found I had brought it to go at the rate of mean ſolar time very nearly, *i. e.* loſing but 1″ in 14 days; and by tranſits of the Sun, it appeared to be 1″,5 too ſlow for mean time, on the third of June. But by a mean

of

of 8 days obfervations of equal altitudes, taken in June and the beginning of July, the clock appeared 5″,2 flower than was found by the tranfit-telefcope, which was not perfectly adjufted; though, as its error continued always the fame, it was very fufficient for determining the rate of the going of the clock. Hence, on the day of the tranfit, the clock was 6″,7 or 7″ too flow for mean time; and the obfervations that follow are corrected accordingly.

In watching for the firft contact of Venus, I kept my eye on the Sun's edge where the contact was expected; keeping that point nearly in the center of my field; and the firft impreffion which I faw (without any penumbra or atmofphere that I could perceive) was at 7ʰ 12′ 32″ by my clock, or 7ʰ 12′ 39″ mean folar time. I looked particularly to fee whether the reft of the Planet were vifible while only part was on. If I faw that, it appeared as a portion of a larger circle: but I think I fhould not have obferved it at all, if I had not looked for it. The dark part on the Sun did not appear to me with a fmooth edge; and yet I could not difcern any undulation in it: but the clouds obliged me to flide my fmoaked glaffes fo often, it interrupted me much. I then tried my ftrongeft magnifying power of 110, but to no purpofe; for there was an undulation on the Sun's edge, by that time, fo great, that I thought it beft to return to the former power of 55. Before the internal contact, at about 7ʰ 24′, I loft the Sun entirely, and, though there were a few breaks in the clouds, he never appeared more that evening.

As to the eclipfe the next morning, I faw that more perfectly; though at firft there were many
flying
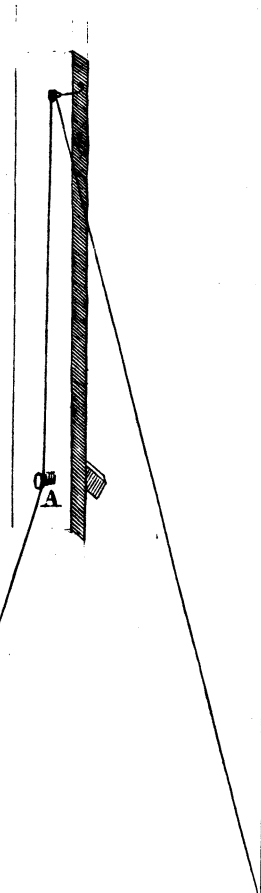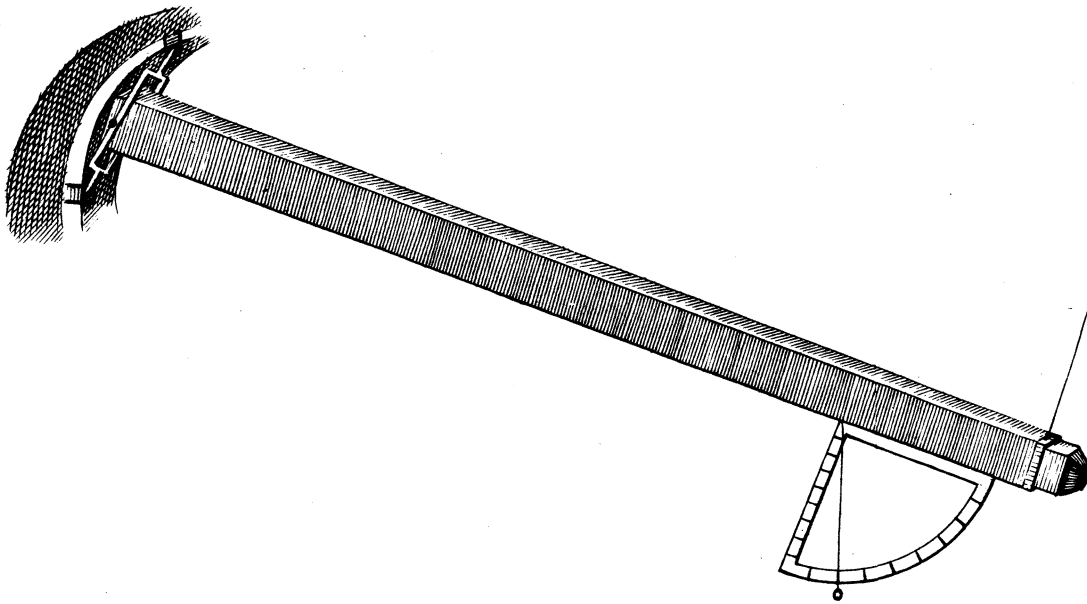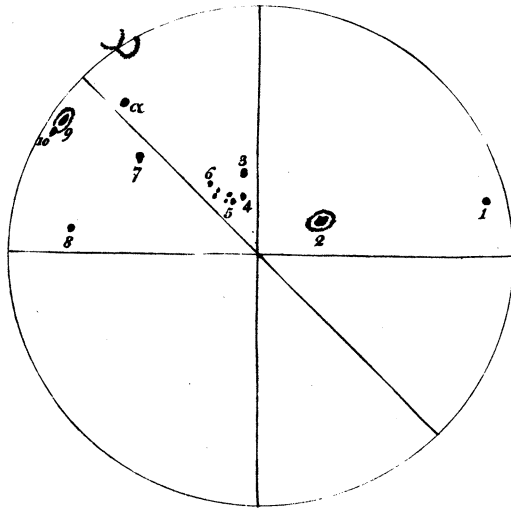
flying clouds; which, however, did not deprive me of any obfervation I was capable of making. It began here at 18^h 42′ 17″ by the clock, or 18^h 42′ 24″ mean time (a cloud had juft paffed; but I can be fure it was not vifible 2″ or 3″ before); and it ended at 20^h 28′ 1″ by the clock, or 20^h 28′ 8″ mean time. I ufed the magnifying power 55, as I had done for the tranfit. As I have no micrometer, the beft method I thought I could take to obferve the phafes of the eclipfe, was by the immerfions and emerfions of the fpots; which, if there were comparative obfervations in other places, might meafure them better than any inftruments I have. The fcheme annexed fhews the fituation of the fpots, as I judged of them by my eye; and the obfervations that follow refer to the numbers in the drawing, TAB. XVII. fig. 1.

Mean time.

h	′	″	
18	42	24	Beginning of the eclipfe.
	44	37	Spot 1 immerges.
19	3	17	The nebula of fpot 2 begins to immerge.
	4	47	Spot 2 quite immerged, but not the nebula.
	14	56	Spot 3 immerges.
	16	44	Spot 4 immerges.
	18	50	Spot 5 immerges,
	19	29	Spot 6 immerges.
	24	56	Spot 7 begins to immerge.
	25	22	Spot 7 immerges entirely.
	30	21::	Spot 1 immerges.

Mean time.

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19 33 50 Nebula of ſpot 9 begins to immerge.
34 14 Spot 9 begins to immerge.
34 51 Spot 9 immerges entirely.
35 3 Spot 10 immerges.
42 31 Spot 8 immerges.
45 8 Nebula of ſpot 2 begins to emerge.
45 52 Spot 2 emerges entirely.
46 57 Nebula of ſpot 2 emerges entirely.
59 22 Spot 4 emerges.
20 0 10 Spot 5 emerges.
 1 38 Spot 3 emerges.
 4 50 Spot 6 emerges.
11 35 Spot 8 emerges.
24 53 Spot 9 emerges.
26 22 Spot 10 emerges.
28 8 The eclipſe ends.

The ſpots α and N° 8 were not viſible (or over-looked) on the Saturday morning, when I took a drawing of the others; but I think I may be ſure were both ſeen that evening. The ſpot α certainly was not viſible the next morning, though N° 8 and all the reſt were: and, as far as I can recollect, that was its true ſituation. But, as the Sun did not break out till a few minutes before 7, and was quite gone before the internal contact, I had no opportunity to watch it. The roundneſs and blackneſs of that ſpot, at firſt ſuggeſted a ſuſpicion of its being a ſatellite of Venus: but as this is not corroborated by any other accounts, it is probably a miſtake. The two wires at right

right angles to each other, exprefs a horary circle, and a parallel of the equator (the telefcope moving in the plane of the equator); and ferve to fhew the fituation of the fpots in general. The other is an oblique wire, the correfponding one having been taken out a few days before, in order to leave the field more clear.

As to my latitude, I have tried it different ways with fuch inftruments as I have; but what I trufted to moft, were the zenith diftances I took of α Cephei and α Cygni at one time; and η and ξ Urfæ Majoris at another (for fome nights fuccef-fively) with my tranfit telefcope; from which I fufpend a plummet, at a certain diftance from the quadrant underneath, one of whofe radii becomes thereby a tangent; which being graduated, I cal-culate by it the diftance of ftars near the zenith, and correct the errors of collimation by taking them both ways. I have likewife taken ftars both ways, with my equal altitude quadrant, which in-deed is a very imperfect inftrument for that purpofe: but, by calculating the mean, it turns out much the fame as by the other method, viz. 52° $40'$ $20''$ north.

The other figure (2) is a fketch of my tranfit-te-lefcope, which you enquired after. The principle it goes upon is this: the center of the object-glafs remains immoveable, while the telefcope (by crofs-axes at right angles to each other, which interfect at that center) hangs as it were from thence, and has a free motion every way; and particularly its motion eaft and weft is freed, as much as poffible, from friction. At the focus, where the crofs wires are,

it

it is fufpended by a fmooth even catgut, by which that end is let down to the altitude required. This catgut bears conftantly againft a deep angular groove that is cut round the end of the fcrew marked A; by which means that end hangs always from the fame point at all altitudes; from whence, the centre of gravity of the telefcope keeps it conftantly in the fame plane. This fcrew runs eaft and weft; and therefore, when the telefcope is drawn up to a horizontal pofition, ferves to adjuft it to the meridian, by directing the wires to a diftant mark. The fettling of that meridian mark is certainly the fame in this as in other tranfit-inftruments; and perhaps mine is not exactly right. But I fufpect my inftrument errs in another particular; that the line of collimation does not run parallel to the interfection of crofs axes and the center of gravity; which it ought to do. This is owing to bad workmanfhip, which a fkilful operator could eafily fet right; and, when adjufted, I fhould think would not be apt to vary, but would always continue to defcribe a true vertical, as indeed it has proved upon trial; having always, in this rude form, kept to the fame errors at the fame altitudes.

The reft of the drawing, I believe, explains itfelf: excepting the two curved pieces of pafteboard between which the telefcope is directed; which are defigned to keep off the air that would make it vibrate; and do in effect take off alfo a great deal of falfe light in the day time, and anfwer the purpofe of an illuminator at night.

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The thought occurred to me while I was ufing Lord Charles Cavendifh's meridian line; to which you fee I thus adapt a telefcope; and there being fewer particulars neceffary to be attended to, when once rectified, I thought it would be more ferviceable in a common building, than thofe tranfit-inftruments which require fo very fteady a foundation.

Eaft-Dereham,
June and July, 1769.

Francis Wollafton.