I. *An Account of Observations made on Board the* Chatham-Yacht, *August 30th and 31st, and* September 1st, 1732, *in pursuance of an Order made by the Right Honourable the Lords Commissioners of the Admiralty, for the Trial of an Instrument for taking* Angles, *described in* Philosophical Transactions, *Numb,* 420. *By* John Hadley, *Esq; Vice-President of the* Royal Society.

IN *May,* 1731, I communicated to the *Society* the Description of a new Instrument for taking Angles, and produced a Specimen of an Instrument made accordingly. Several of the Gentlemen to whom it was shewn, as well then as at other times, entertained a favourable Opinion of the Probability of its Usefulness, particularly our worthy Vice-President Dr. *Edmund Halley,* Astr. Reg. and the Reverend Mr. *James Bradley,* Astr. Pr. S. not only expressed their Desire that Trial should be made of it at Sea, but promised the Favour of their Company and Assistance on that Occasion.

The Instrument produced at the *Society* was made of Wood, according to *Fig.* IV.*Transact.* N° 420. of the 'forementioned Description,and was intended chiefly for taking Altitudes of the Sun, Moon and Stars, from the visible Horizon, either forwards or backwards ; I therefore procured another to be made of Brass by Mr. *J.*

Z z   *Sisson,*

Siſſon, for taking the Diſtance of any kind of Ob-
jeⱴs. It is ſupported by a ſingle Stem ſkrewed on
to it on the under Side, the lower End of which
may reſt on the Ground, to eaſe the Obſerver of the
Weight of the Inſtrument. This Stem is alſo
made to lengthen or ſhorten, by which Means the
Inſtrument is brought to the proper Height, for
any Obſerver's Eye, either ſtanding or fitting. In-
ſtead of a Ball and Socket, it has two circular Arches
fixed on its Back, by which it is readily ſet to
any Poſition which the Situation of the Objeⱴs may
require.

The Right Honourable the Lords Commiſſioners of
the Admiralty having been pleaſed to order the
Chatham-Yacht for the Trial of the ſaid Inſtru-
ment, and to give Direⱴions to Mr. *James Young*,
Maſter Attendant at *Chatham*, a Gentleman well
ſkill'd in Navigation, to be preſent at the Trial, my
two Brothers and Self went on Board accordingly
Wedneſday, *Auguſt* the 30th, being favoured with
the Company (beſides the two 'forementioned Gen-
tlemen) of the Reverend Sir *Robert Pye*, Bart. and
Robert Ord, Eſq; Members of this *Society*. We
met Mr. *Young* at *Sheerneſs* the next Day, who ac-
companied us down about three Leagues below the
Nore, near the *Spile-Sand*, and was on Board on
Friday, *September* the 1ſt, when we lay by there,
and the ſeveral Altitudes of the Sun were taken as it
approached the Meridian from about Ten of the Clock
'till Noon.

The

The Obfervations were as follow.

Auguſt the 30th, near Midnight, Mr. *Bradley* obferved the Diſtance of *Lucida Iyræ* from *Cor Aquilæ* by the Brafs Inſtrument off *Gravef-end* in ſtill Water,   34° 13′ 30″
   The fame repeated was   34 13 15
   The Error of the Inſtrument in that Place is 23″ to be fubtra&ted.
   The Diſtance of thofe Stars, accord-ing to Mr. *Flamſteed*, is   34° 11′ 50
Which by the Refra&tion is reduced to 34 11 10

Auguſt the 31ſt, about 10ʰ 30′, Mr. *Bradley* obferved the Diſtance of *Capella* from the *North Pointer* in the *Great Bear's* Back, by the fame Inſtrument, while we lay at Anchor in the Mouth of the *Med-way* near *Sheerneſs*, the Wind blow-ing hard at North Eaſt,   49° 14′ 00″+
             Or   49 15 00
   Mr. *Bradley* and my felf making a ſmall Difference in numbring the Angle mark'd by the Index.
   The Error of the Diviſion of the Inſtrument there is 30″ to be added.
   The Diſtance of thofe Stars, accord-ing to Mr. *Flamſteed*, is   49° 16′ 00″
By the Refra&tion reduced to   49 14 20
   Clouds coming up prevented the repeating this Ob-fervation, nor had we any Opportunity of making any others of this kind.

Altitudes

Altitudes of the Sun obferved by Mr. *Bradley*, lying at Anchor in the Mouth of the *Medway*, *Auguſt* the 31ſt, Afternoon, the Wind at North-Eaſt, a freſh Gale, by the Wooden Inſtrument forwards. The Watch by the Mean of the Obſervations appeared to be about 8′ 45″ too ſlow ; the viſible Horizon being ſuppoſed 3′ 30″ depreſſed below the true by the Height of the Obſerver's Eye above the Surface of the Water, amounting to about 8 or 9 Feet.

Time by Watch.			True Time.			True Alt. of Sun's upper Limb from on, the viſible Horizon.		Re-fracti-on, add.	App.t Alt. of Sun's upper Limb from the viſible Horizon.			Alt. of the Sun's up-per Limb obſerved.			Errors of Di-viſion of the Inſtr. corrected. Subſtr.			Obſerved Alt. of the Sun's up-per Limb.			Errors of Obſervati-on.	
h	′	″	h	′	″	′	″	″	°	′	″	°	′	″	°	′	″	°	′	″	′	″
5	11	05	5	20	35.9	9	50	14	54.9	55	25.9	57	00	2	15.9	54	45	—	0	40		
	16	30		25	15	07	05	54.5	17	12	17	13	30	2	15	11	15	—	0	02		
	18	20		27	058	49	007	8	27	55	198	30	00	2	008	54	52	—	0	49		
	21	20		30	05	21	515	44	27	27	35	30	00	3	007	25	27	—	0	18		
	28	5		36	507	18	446	28	25	08	12.7	30	00	3	008	00	00	—	0	35		
	30	55		39	206	55	226	46	02	25	08.7	05	30	3	15	02	45	+	0	49		
	32	25		41	10	38	137	40	03	45	166	10	00	2	15.6	07	45	+	0	05		
	36	5		45	15	00	007	03.5	07	48	14.5	48	00	2	15	48	45	+	0	29		
	38	35		47	22.5	21	008	40	03	45	40	34	00	2	15	31	45	+	1	31		
	40	37		49	20	03	08	24	036	02	10	51	00	2	157	45	45	+	1	31		
	42	35		51	19	21	148	50	035	00	14	34	00	2	15.8	02	45	+	1	04		
	43	50		52	354	51	249	07	07	31	04	03	30	3	008	30	30	—	0	1		

Altitudes of the Sun, obferved *September* the 1ft, before Noon, under Sail from *Sheernefs* towards the *Spile-Sand*, with the Tide of Ebb, the Wind blowing hard at North-Eaft, by the Wooden Inftrument forward. The fecond Speculum being removed by fome Accident from its due Pofition, fo as to increafe the Angles obferv'd about one Degree three Minutes and a half, as appeared by the firft Obfervations of the Afternoon of the fame Day, made with the fame Inftrument, in the fame manner, while we continued lying-by near the *Spile* ; and that Degree and three Minutes and a half are added to the Errors of the Divifions of the Inftrument in the feventh Column. While thefe Obfervations were making, the Yacht fteered at firft chiefly Eaft, fometimes South-Eaft, afterwards ftood to the North-Eaft, towards the *Swin*. The Time of the Watch was regulated by fome of the later Obfervations made when we were moft Eaftward, and this was probably the Caufe why the firft Altitudes, which were taken while we were more Wefterly, fall fo much fhort of the Computations, the Difference decreafing gradually as we advanced towards the Eaft.

Altitudes

Altitudes observed by Mr. *Bradley*.

Time by Watch.			True Time.			True Alt. of the Sun's lower Limb from on, the visible Horizon. Refraction add.			Appt Alt. of the Sun's lower Limb, from the visible Horizon.			Altitude of the Sun's lower Limb observed.			Errors of the Instrument subtract.			Observed Altitude of the Sun's lower Limb corrected.			Errors of Observation.	
h.	'	"	h.	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'
7			7			15			15			15						15				
09	15		18	15		05	39	3	08	54	16	09	00	—	5	45	15	03	15	—	5	39
11	44		20	44		28	13	3	31	24		33	00	—	5	45	27	15	+	4	09
13	58		22	58		45	23	3	48	31		49	00	—	5	45	43	15	—	5	16
14	52		23	55		56	45	3	59	48	17	02	00	—	5	45	56	15	—	3	33
16	33		25	33	16	11	47	3	14	49		18	00	—	5	45	12	15	—	2	34 +
18	04		27	04		25	31	2	28	30		32	00	—	5	45	26	15	—	2	15
20	54	17	29	54		18	00	2	50	18		00	00	—	5	30	19	30	—	1	20
23	54		32	54		53	31	2	56	43		43	00	+	6	00	37	00	+	0	42 +
25	38		34	38		58	31	2	47	56		18	00	—	6	00	01	00	—	0	06 +
28	25		37	25		23	18	2	43	01		28	00	+	6	18	23	00	+	1	16
30	44		39	44	18	19	042		42	00	19	07	00	—	5	00	01	00	—	0	45
34	21		43	21		51	102		35	45	20	28	00	—	5	30	55	30	+	1	45
36	24		45	21		09	182		53	45		16	00	—	5	30 19	23	30	+	0	21
38	44		47	44		29	302		30	11		38	00	—	4	30	33	30	+	1	06 — uncertain
40	50		49	50		45	542		42	51		52	00	—	4	30	47	30	+	1	25 —
42	00		51	00		58	272		30	24		00	00	—	4	30	59	30	—	1	37 —
45	00		54	00		41	212		26 20	07	21	04	00	—	4	30	30	30	—	1	—
45	34		54	34 20		29	512		22	13		35	00	—	4	30 20	30	30	—	1	43

The

The fame continued by Mr. *John Hadley.*

Time by Watch.			True Time.			True Alt. of the Sun's lower Limb from the visible Horizon.			Re-fraction, add.		Appt Alt. of the Sun's lower Limb from the visible Horizon.			Altitude of the Sun's lower Limb observed.			Errors of the Instrument (substract.)			Observed Altitude of the Sun's lower Limb corrected.			Errors of Observation.	
h.	'	"		'	"	°	'	"	'	"	°	'	"	°	'	"	°	'	"	°	'	"	'	"
7	52	18	7	01	18	21	28	21	2	12	21	30	36	22	36	00	1	4	30	21	31	30	+0	54 —
	54	18		03	18		45	43	2	13		47	56		52	00	1	4	30		47	30	-0	26 —
	55	40		04	40		57	25	2	12		59	37	23	04	00	1	4	30		59	30	-0	07 —
	58	22		07	22	22	20	34	2	09	22	22	43	30	24	45	1	5	15	22	24	45	+2	02 uncertain.
8	02	51		11	51		58	46	2	06		00	52	24	58	45	1	5	15		58	45	-2	07 —
	09	19		18	19	23	53	26	2	00	23	55	26	25	00	00+	1	5	30	23	54	30+	-0	56 —
	13	10		22	10	24	25	35	1	57	24	27	32		32	00	1	5	30	24	26	30	-1	02 —
	14	45		23	45		38	43	1	56		40	39		45	00+	1	5	30		39	30+	-1	09 —
	16	55		25	55		56	24	1	55		58	19	26	03	00	1	5	30		57	30	-0	49 —
	19	05		28	05	25	14	34	1	53	25	16	27		22	00+	1	5	30	25	16	30+	+0	03 +
	22	57		31	57		46	14	1	51		48	05		52	00—	1	5	30		46	30	-1	35 +
	25	05		34	05	26	03	35	1	49	26	05	24	27	10	00+	1	5	30	26	04	30—	-0	54 +
	26	43		35	43		16	50	1	48		18	08		22	00+	1	5	30		16	30+	-1	38 —
	28	20		37	20		29	54	1	47		31	41		35	00	1	5	30		29	30	-2	11

Altitudes

Altitudes of the Sun, observed lying-by near the *Spile, September* the 1st, before Noon, with the Wooden Instrument backward, the Wind continuing to blow hard, as before, at North-East. The Instrument when used for the back Observation was so adjusted, as to allow for a Dip of the visible Horizon of two Minutes and a half; consequently that Dip being supposed, as before, three Minutes and a half; there remains only one Minute to be accounted for; in computing the Height of the Sun, which is accordingly subtracted in the third Column from the Altitudes found by Computation. The Watch now appeared to be 9′ 30″ too slow.

Altitudes observed by Mr. *John Hadley.*

Time by Watch.			True Time.			True Alt. of the Sun's upperLimb. on, add.		Refraction on, upperLimb.	Appt Alt. of the Sun's upperLimb.		Alt. of the Sun's upper Limb observed.		Errors in the Division. on. Subtr.		Observed Altitude of the Sun's upper Limb corrected.		Errors of Observation.	
h.	′	″	h.	′	″	°	′	′	°	′	°	′	°	′	°	′	′	″
9	52	55	10	02	25	36	52	11	36	54	36	46	1	00	36	45	00	−9	05
10	02	07	11	37	37	43	37	09	37	44	46	37	44	1	00	37	43	00	−1	46
06	00	15	30	38	04	01	08	37	38	05	08	38	04	1	00	38	03	00	−2	08
08	53	18	23	04	00	19	00	08	38	20	08	00	+	1	00	38	21	00	+	32
12	25	21	55	19	00	36	01	07	20	37	32	41	00	1	30	39	30	+	0	32
16	30	26	00	56	09	01	06	57	15	39	00	1	30	58	30	+1	58
18	50	28	00	07	01	06	08	06	00	1	30	05	30	+1	15
20	40	30	10	39	07	01	06	39	16	00	39	13	30	−2	43
							26	01	06	32	14	00	0	30	13	30	−3	02

The

The same continued by Mr. Bradley.

Time by Watch.	True Time.	True Alt. of the Sun's upper Limb.	Refraction, add.	Appt Alt. of the Sun's upper Limb.	Alt. of the Sun's upper Limb observed.	Errors in the Division, subtr.	Observed Altitude of the Sun's upper Limb corrected.	Errors of Observation.
h. ' "	h. ' "	° ' "	' "	° ' "	° ' "	' "	° ' "	' "
10 30 18	10 39 48	39 57 28	1	39 58 32	40 00 00	2 00	39 58 00	—0 32
33 23	42 53	40 10 02	1	40 11 06	12 00	2 00	40 10 00	—1 06
35 52	45 23	19 51	11	20 55	16 00	2 00	14 00	+6 55
37 48	47 18	27 15	31	28 16	32 00	2 30	29 30	+1 14
39 22	48 52	33 03	31	34 06	36 00	2 30	33 30	—0 36

Continued yb Mr. Henry Hadley.

Time by Watch.	True Time.	True Alt. of the Sun's upper Limb.	Refraction, add.	Appt Alt. of the Sun's upper Limb.	Alt. of the Sun's upper Limb observed.	Errors in the Division, subtr.	Observed Altitude of the Sun's upper Limb corrected.	Errors of Observation.
11 08 05	11 17 35	41 59 36	1 00	42 00 36	42 15 00	2 30	42 12 30	+11 54
16 20	25 50	42 16 36	1 00	17 36	20 00	2 30	17 30	—00 06
22 00	31 30	25 48	59	26 47	31 00	2 45	28 15	+01 28
24 20	33 50	29 35	59	30 54	34 00	2 45	31 15	+00 41
28 00	37 30	34 27	59	35 26	39 00	2 45	36 15	+00 49
33 45	43 15	40 32	58	41 30	45 00	3 00	42 00	+00 30
37 45	47 15	43 43	58	44 41	48 00	3 00	45 00	+00 19
40 50	50 00	45 25	58	46 23	49 00	3 00	46 00	+00 02
43 00	52 30	46 34	58	47 32	51 00	3 00	48 00	+00 23
47 00	56 30	47 42	58	48 40	52 00	3 00	49 00	+00 28
again 00 00		48 02	58	49 00	52 00	3 00	49 00	+00 20
again 1½ 00 00								00 00

Between each of the five laſt of theſe Obſervations the Index was removed ſo as to make them entirely independent of one another; and from their near Agreement among themſelves, and with good Part of the preceding, I conclude the true

Height of the Sun's Center above the real Horizon at Noon was exactly enough 42° 33' his Semidiameter being 16 Min. from which, and the Sun's Declination 4° 1' the Latitude of the Place will be 51° 28', which is accordingly used in all the Computations.

Altitudes of the Sun observed *September* 1, 1732, Afternoon, near the *Buoy of the Spile*, and under Sail Westward, by the Wooden Instrument forwards, the second Speculum remaining displaced as in the Morning.

Altitudes observed by Mr. *Bradley.*

Time by Watch			True Time			True Alt. of the Sun's lower Limb from the visible Horizon. Refraction to be add.			Appt Alt. of the Sun's lower Limb from the visible Horizon.			Altitude of the Sun's lower Limb observed.			Errors of the Instrument. Altitude of the Sun's lower Limb corrected.			Errors of Observation.	
h.	'	"	h.	'	"	°	'	"	°	'	"	°	'	"	°	'	"	'	"
07	30		12	17	09	30	42	12	13	42	13	20	42	13	45	42	14	00	+0	47
08	30			18	00		13	00		13	09		13	10		13	00		−0	51
12	00			21	30		18	00		08	18		08	24		07	00		−1	18
19	50			29	20	41	56	00	41	57	00	41	57	00	41	55	00	−2	00

The same continued by Mr. *Henry Hadley.*

	Time by Watch		True Time			True Alt. lower Limb			Appt Alt. lower Limb			Altitude observed			corrected			Errors	
1	00	00	1	09	30	40	03	40	40	03	24	40	04	13	40	07	00	−3	24	uncertain
2	00	35	11	05		04	01		04	10		04	10		04	00		−0	24	uncertain
3	01	02	12	32	39	04	39		04	59		04	04		58	00		−1	03	
4	02	21	13	51		52	57		54	59		02	04		56	00	59	+1	59	
5	03	14	15	44		51	52		54	01		52	04		46	00		+1	35	
6	04	30	17	00	40	45	31		46	35		52	04		45	00		+1	28	
7	06	14	18	15		40	28		41	32		49	04		43	00		−2	42	
8	07	30	19	30		35	37		36	42		40	04		34	00		+1	44	
9	08	45	20	59		31	33		31	38		01	04		32	00		+0	27	
10	10	00	23	20		28	28		25	28		13	06		28	00		+2	32	
11	11	29	24	22	1	05		25		24	06		01	06		24	00		52
14	14	25	23	53	1	46	06	1	12	52	18	06		12	00		52	

The firft and fixth Columns of the preceding Ta-
bles of Obfervations are copied from the Minutes as
they were fet down at the Time. The Divifions of
the Wooden Inftrument being not exact, I found it ne-
ceffary to make a Table to correct them by, which was
done partly by meafuring with Compaffes, and partly
by examining them againft thofe of another Inftrument.
The Corrections are every where to be fubftracted
from the Angles obferved, and the Errors of a Degree
and three Minutes and a half, occafioned by the mif-
placing the fecond Speculum in all the forward Obfer-
vations of *September* the 1ft, being of the fame kind,
are joined with them, in the feventh Column of the Ta-
bles of thofe Obfervations. The laft Column contains
the Differences between the obferved Altitudes, cor-
rected by the 'forementioned Table, and the Alti-
tudes as they ought to have appeared by the Com-
putations. Among them there are two or three which
fo much exceed any of the reft, that for that reafon
they feem to be rather owing to Miftakes, in counting
the Minutes on the Inftrument, or the Time by the
Watch, than to the Errors of the Obfervations.

The greateft Part of the Altitudes were taken by a
Horizon not clear of Land, and by that Means not al-
ways fo readily diftinguifhable. The Obfervers were
all Perfons quite unaccuftomed to the Motion of a Ship
at Sea, which in this Cafe was generally very great and
quick, the Veffel we were in being only of about 60
Tuns Burthen, as the Mafter informed us, the
fmallnefs of which made it alfo more liable to be lifted
up and let down again by the Waves: And if the
Difference of Height occafioned by that Means was
about four or five Feet, as we judged it to be, it

muft

muft neceffarily fink and raife the vifible Horizon by Turns near one Minute. The Computations of the Sun's Altitudes are all made for the Latitude of 51° 28', whereas a good Part of them were taken under Sail, and upon different Tacks, the Veffel fome-times ftanding North Eaft or North, and at other times South Eaft, for near a quarter of an Hour at a time.

Several of thefe Circumftances may probably have contributed to increafe the Inconfiftency of the Ob-fervations; but as no particular Notice was taken of them at the Time, I content my felf with barely mentioning them.

P O S T S C R I P T.

The Principle on which the Contrivance of this In-ftrument depends, was laid down in the before-men-tioned *Philof. Tranf.* Numb. 420. in one Propofition, and feveral *Corollaries*, the fifth of which contains the Grounds of an Approximation for correcting fome fmall Errors which will arife if the Plane of the Inftrument be fuffered to vary too much from the great Circle paffing through the two Objects, when the Obfervation is taken. There appears rea-fon to think, that there will be very little Occafion in Practice for that Correction; but it was neceffary to mention it, in order to explain the Nature of the In-ftrument; and as the manner of deducing that Co-rollary from the Propofition may not appear obvious to every Reader, I have here annexed the Demonftra-tion of it.

Let
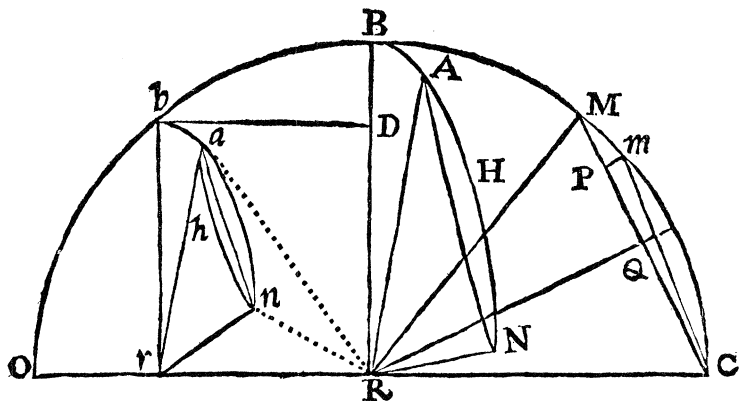
Let O B C in the annexed Figure reprefent an infinite
Sphere, at whofe Center R are placed the two Specula
inclined to one another in any given Angle, and let their
common Section coincide with the Diameter O R C.
Let B A N be the Circumference of a great Circle, to
the Plane of which the common Section of the Spe-
cula O R C is perpendicular, and B R its Radius:
Let *b a n* be the Circumference of a Circle parallel to
B A N, and at the Diftance from it B *b* : Draw
b D the Sine, and *b r* the Sine complement of the
Arch B *b* : B D is the verfed Sine of the fame. Let
A be a Point of an Object placed in the Circumfe-
rence of the great Circle B A N, and N the Point in
which its Image is formed by the two fucceffive Re-
flections, as before defcribed; and let *a* be a Point of
another Object placed any where in the Circumfe-
rence of the Parallel *b a n*, and *n* its Image; and let
a h n be an Arch of a great Circle paffing through
the Points *a* and *n*. The Point *a* is at the fame Di-
ftance from the great Circle B A N, as the Point *b*,
i. e.

i. e. at the Diftance B *b*. Draw A R, A N, R N, *a r*, *a n*, *r n*, *a* R and *n* R.

By the fourth Corollary the Figures A R N and *a r n* are fimilar, and confequently the Line A N is to the Line *a n* as A R or B R is to *a r* or *b r*, *i. e.* as the Radius is to the Sine complement of the Diftance B *b*. But A N is the Chord of the Arch A H N of the great Circle B A N equal to the Tranflation of the Point A, or double the Inclination of the Specula, and *a n* is the Chord of the Arch *a b n* of a great Circle, meafuring the Angle *a* R *n*, by which the Point *a* appears removed by the two Reflections, to an Eye placed in the Center R. Therefore the Tranflation, or apparent Change of Place of the Point *a* is meafured by an Arch of a great Circle, whofe Chord is to the Chord of the Arch A H N (equal to double the Inclination of the Specula) as the Sine complement of its Diftance from the great Circle B A N is to the Radius.

From any Point C of the Circumference O B C draw the Chords C M and C *m*, to the fame Side of the Point C, and equal to the Chords A N and *a n* refpectively, draw the Radius R M, and from R and *m* draw R Q and *m* P, both perpendicular to C M, and cutting it in Q and P. R Q is the Sine complement, and C M double the Sine of half the Angle M R C, or A R N, or of the Angle of Inclination of the Specula. The little Arch M *m* will reprefent the Difference of the apparent Tranflations of the Objects in A and *a* ; and if it be very fmall, may be looked on as a ftrait Line, and the little mix'd Triangle M *m* P as a rectilinear one, which will be fimilar to R M Q, becaufe R M is perpendicular to M *m* and
R Q

R Q to C M, and the Angles at Q and P right An-
gles. The Line C P may be taken as equal to
C *m*, and M P as the Difference of the Lines C M and
C *m*. Therefore the little Arch M *m* is to the Line
M P nearly as R M to R Q: But C M (*i. e.* A N)
was to C *m* (*i. e. a n*) as B R to *b r*, and the Dif-
ference M P of C M and C *m* to the Difference B D
of B R and *b r* as C M to B R. Therefore M *m*, the
Difference of the apparent Tranflations, is to B D,
the verfed Sine of the Diftance B *b*, or to an Arch
equal to it, in the compound Ratio of R M the Ra-
dius to R Q the Sine complement of the Angle of
Inclination of the Specula, and C M double the
Sine of the fame to B R the Radius, *i. e.* as C M
to R Q.

The Obfervation may be corrected by one eafy
Operation in Trigonometry, as will appear from the
firft Part of this Corollary, *viz.* by taking the half of
the Angle obferved, and then finding another Angle,
whofe Sine is to the Sine of that half, as the Sine
complement of the Diftance B*b* is to the Radius:
This Angle doubled, will be the true Diftance of the
Objects. But as this Operation, though eafy, will
require the ufe of Figures, I rather chofe the Method
of Approximation, becaufe by that the Obferver, re-
taining in his Memory the Proportions of the Sines of
a few particular Arches to the Radius, may eafily efti-
mate the Correction without Figures, when the Angle
is not great, and by a Line of artificial Numbers and
Sines, may always determine it with greater Exactnefs
than will ever be neceffary.

When the Angle obferved is very near 180 Degrees,
the Correction may be omitted; for then it will be
eafy

eafy to keep the Plane of the Inſtrument ſo near that
of the before-mentioned great Circle as not to want
any, if the Situation of that Circle be known: If it
be not, the Obſerver, when he ſees the two Objeдts
together, may turn the Inſtrument on the Axis of the
Teleſcope, 'till he finds that Poſition of it by which
he obtains the leaſt Angle; and this (if the Specula
are ſet truly perpendicular to the Plane of the In-
ſtrument), will always happen when the Objeдts ap-
pear to coincide in the Line g h, as expreſſed in the
third Fig. of *Tranſ.* No 420.

In Page 152 of the ſame, a Rule is given for find-
ing to which Hand of the Obſerver the Objeдt ſeen
by Refleдtion ought to lie, but is reſtrained to the par-
ticular Form of the Inſtrument there deſcribed. The
general Rule is, that when the Index is brought to the
beginning of the Scale (*i. e.* to o° when the Inſtru-
ment is deſigned for Angles under 90°, or to 90° when
it is deſigned for Angles from 90° to 180°) if then a
Line be imagined to be drawn on it parallel to the
Axis of the Teleſcope, or Line of Direдtion of the
Sight, ſo as to point towards the Objeдt ſeen direдtly ;
which ever way this Line is carried by the Motion of
the Index along the Arch from o° towards 90° in the
firſt Caſe, or from 90° towards 180° in the ſecond, the
ſame way the Objeдt ſeen by Refleдtion ought to lie
from that which is ſeen direдtly.

Erratum, Pag. 154. Line 24, read, *They may be
either of Metal, or Glaſs Plates foil'd, having their
two Surfaces,* &c.

II. Ephe-