SECTIONIS TERTIAE.

CAPVT III.

DE ALTERA TERTII GENERIS TELESCOPIORVM SPECIE PRINCIPALI, EORVMQVE PERFECTIONE.

Definitio.

349.

Ad alteram hanc ſpeciem referimus ea teleſcopia, quae ſupra §. 310. et quidem ſpeciatim in ſubnexo Corollario 2. §. 314. ſunt explicata, in quibus ſcilicet lens ſecunda adhuc ante primam imaginem realem collocatur; tertia vero lens poſt hanc imaginem in eo loco, vbi lentis primae inſtar obiecti conſideratae imago per ſecundam lentem projiceretur, qui locus cum ante imaginem ſecundam cadat, lens quarta ocularis in debito loco conſtituitur. Speciatim autem ſi primae lentis diſtantia focalis ponatur $= \alpha$, ſecunda lens ita ſtatuitur, vt ſit $b = -\frac{\alpha}{\sqrt{m}}$ ſiue interuallum primae et ſecundae lentis $= \alpha(1 - \frac{1}{\sqrt{m}})$.

Coroll. 1.

350. Cum igitur haec telescopia quatuor constent lentibus, pro iis elementa ita se habebunt:

$$b = \frac{-\alpha}{\sqrt{m}};\ \beta = \frac{\sqrt{m}-1}{2m}\alpha;\ c = \frac{\sqrt{m}-1}{2m}.\alpha;$$

$$\gamma = \frac{\sqrt{m}-1}{2m}C\alpha;\ d = \frac{\sqrt{m}-1}{2m\sqrt{m}}.C\alpha;$$

ita, vt sit $B = \frac{1-\sqrt{m}}{2\sqrt{m}}$; $\mathfrak{B} = \frac{1-\sqrt{m}}{1+\sqrt{m}}$; et C arbitrio nostro relinquatur.

Coroll. 2.

351. Ex his elementis erunt lentium distantiae focales

$$p = \alpha;\ q = \frac{\sqrt{m}-1}{(1+\sqrt{m})\sqrt{m}}.\alpha;\ r = \frac{\sqrt{m}-1}{2m}\mathfrak{C}\alpha;$$

et $s = \frac{\sqrt{m}-1}{2m\sqrt{m}}.C\alpha$. et lentium interualla

$$\alpha + b = \left(1 - \frac{1}{\sqrt{m}}\right)\alpha;\ \beta + c = \frac{\sqrt{m}-1}{m}.\alpha;\ \gamma + d = \frac{m-1}{2m\sqrt{m}}C\alpha$$

et distantia oculi $O = \frac{m-1}{2mm}.\alpha$; ita, vt tota longitudo futura sit $= \frac{m-1}{m}\left(1 + \frac{1+\sqrt{m}.C}{2m}\right).\alpha$ vbi tantum monendum est, pro C numerum positiuum accipi debere.

Coroll. 3.

352. Litterae autem maiusculae P, Q, R pro hac specie fient $P = \sqrt{m}$; $Q = -1$ et $R = -\sqrt{m}$ ita, vt hinc prodeat $PQR = m$, vti rei natura postulat.

Scho-

Scholion.

353. Hic autem inprimis rationem reddere oportet conditionis in definitione commemoratae, qua diximus, lentem tertiam ibi esse collocandam, vbi primae lentis instar obiecti consideratae imago per secundam lentem proiecta esset casura. Cum enim secundae lentis distantia focalis sit $q = \frac{\sqrt{m}-1}{(1+\sqrt{m})\sqrt{m}} \cdot \alpha$, eius autem distantia a prima lente $= (1 - \frac{1}{\sqrt{m}})\alpha$, quae vocetur y, si prima lens vti obiectum consideretur, eius imago post secundam lentem cadet ad distantiam $\zeta = \frac{yq}{y-q}$; est vero $y - q = \frac{\sqrt{m}-1}{\sqrt{m}+1}\alpha$ hincque $\zeta = \frac{\sqrt{m}-1}{m}\alpha$, cui praecise distantia tertiae lentis a secunda aequatur. Hanc autem conditionem ideo in definitionem introduximus, quoniam eius ope locus tertiae lentis facillime per praxin assignatur. Ceterum supra iam notauimus, semidiametrum campi apparentis fore $\Phi = \frac{859}{m+\sqrt{m}}$ min. qui vtique augmentatione indiget, cum has lentes perficere conabimur. Denique ibidem quoque est ostensum, semidiametrum aperturae tertiae lentis statui debere $= \frac{\sqrt{m}}{50}$ dig.

Pro secunda autem lente, quia posuimus, $\pi = \omega\xi$ et $\omega = -\zeta = -\frac{1}{\sqrt{m}}$, semidiameter eius aperturae esse debet $= \frac{q}{4\sqrt{m}} = \frac{\sqrt{m}-1}{4m(1+\sqrt{m})} \cdot \alpha$.

Problema I.

354. Inter binas postremas lentes huius telescopiorum speciei nouam lentem inserere, qua campus apparens magis amplificetur.

 Solutio.

Solutio.

Cum igitur hic occurrant quinque lentes statuantur nostrae quaternae fractiones:

$$\frac{\alpha}{b} = -P; \quad \frac{\beta}{c} = -Q; \quad \frac{\gamma}{d} = -R; \quad \frac{\delta}{e} = -S.$$

quarum litterarum duae debent esse negatiuae, quarum prior erit Q statuaturque $Q = -k$; altera vero erit R vel S; vtram autem negatiuam statui conueniat, nondum definiamus. Hinc igitur elementa nostra erunt

$$b = \frac{-\alpha}{P}; \quad c = \frac{-B\alpha}{Pk}; \quad d = \frac{BC\alpha}{PkR}; \quad e = \frac{-BCD\alpha}{PkRS};$$

$$\beta = \frac{-B\alpha}{P}; \quad \gamma = \frac{-BC\alpha}{Pk}; \quad \delta = \frac{BCD\alpha}{PkR};$$

distantiae autem focales:

$$p = \alpha; \quad q = \frac{-\mathfrak{B}\alpha}{P}; \quad r = \frac{-B\mathfrak{C}\alpha}{Pk}; \quad s = \frac{BC\mathfrak{D}\alpha}{PkR}; \quad t = \frac{-BCD\alpha}{PkRS};$$

hincque lentium interualla

$$\alpha + b = \alpha\left(1 - \frac{1}{P}\right); \quad \beta + c = \frac{-B\alpha}{P}\left(1 + \frac{1}{k}\right)$$

$$\gamma + d = \frac{-BC\alpha}{Pk}\left(1 - \frac{1}{R}\right); \quad \delta + e = \frac{+BCD\alpha}{PkR}\left(1 - \frac{1}{S}\right)$$

quae cum esse debeant positiua et α iam sit positiuum, necesse est, vt sit 1°. $P > 1$; 2°. $B < 0$; 3°. quod ad bina reliqua interualla attinet, duos casus distingui conuenit.

Casus prior, quo $R > 0$ et $S = -k'$, hocque casu debet esse $C\left(1 - \frac{1}{R}\right) > 0$ et $CD < 0$; quo ipso etiam sit e positiuum.

Casus posterior, quo $R < 0$ seu $R = -k'$ et $S > 0$. Hoc ergo casu esse debet $C > 0$ ideoque etiam

$\mathfrak{C} > 0$

$\mathfrak{C} > 0$, at < 1 et $D(1 - \frac{1}{S}) > 0$. Vt autem etiam fiat $e > 0$, debet esse $D < 0$, ideoque $S < 1$.

Nunc igitur consideremus campum apparentem, cuius semidiameter est $\Phi = \frac{-\pi + \pi' - \pi'' + \pi'''}{m - 1}$ ac statuamus, vt hactenus, $\pi = -\omega\xi$; $\pi' = 0$ ex natura huius speciei; $\pi'' = -\xi$; et $\pi''' = \xi$ vt fiat

$$\Phi = \frac{\omega + 2}{m - 1}\xi = M\xi, \text{ existente } M = \frac{\omega + 2}{m - 1};$$

atque hinc iam statim pro loco oculi prodit

$$O = \frac{e}{Mm} = \frac{(m-1)e}{m(\omega + 2)}.$$

Aequationes porro fundamentales erunt:

1°. $\frac{\mathfrak{B}\pi}{\Phi} = 1 - P$; seu $\mathfrak{B}\omega = -(1 - P)M$

2°. $0 = -(1 + Pk)M - \omega$

3°. $\mathfrak{D} = -(1 + PkR)M - \omega$

vbi cum ex prima fit $\omega = \frac{-(-P)M}{\mathfrak{B}}$ hic valor in secunda substitutus dat $0 = (1 + Pk)\mathfrak{B} + P - 1$; vnde sequitur $\mathfrak{B} = -\frac{(P-1)}{1+Pk}$; ita, vt $\mathfrak{B}$ ac proinde etiam B fit numerus negatiuus; fit autem $B = \frac{-(P-1)}{P(1+k)}$ et $\omega = -(1 + Pk)M$; tum vero ex tertia erit $\mathfrak{D} = Pk(1 - R)M$, litterae vero C et $\mathfrak{C}$ arbitrio nostro manent relictae. Pro binis ergo casibus memoratis erit

Pro priore, quo $S = -k'$, $\mathfrak{D} = Pk(1 - R)M$. Si ergo *fuerit* $R > 1$ debet esse $C > 0$ et $D < 0$ at cum fiat $\mathfrak{D} < 0$, sponte illa conditio $D < 0$ impletur. *Sin autem fit* $R < 1$ erit $\mathfrak{D} > 0$; debet

debet autem esse $C < 0$ et $D > 0$, consequenter $\mathfrak{D} < 1$, ideoque $Pk(1-R)M < 1$.

Pro posteriore casu, quo $R = -k'$, erit $\mathfrak{D} = Pk(1+k')M$ ideoque $\mathfrak{D} > 0$ ante autem vidimus, hoc casu esse debere $C > 0$ adeoque $\mathfrak{C} > 0$ et $\mathfrak{C} < 1$. Tum vero $D(1-\frac{1}{S}) > 0$. Quare cum esse debeat $S < 1$, erit $D < 0$ vnde ob $\mathfrak{D} > 0$ colligitur $\mathfrak{D} > 1$.

Nunc pro tollendo margine colorato habebitur haec aequatio:

$$0 = \frac{\omega}{P} - \frac{1}{PkR} - \frac{1}{PkRS},$$

ex qua colligitur

$$0 = \omega kRS - S - 1; \text{ seu } 0 = kRS(1+Pk)M + S + 1$$

vbi ergo binos nostros casus distingui oportet.

I. Si $S = -k'$, habebitur $0 = -kk'.R(1+Pk)M - k' + 1$ vnde fit $R = \frac{1-k'}{kk'(1+Pk)M}$; vnde patet, esse debere $k' < 1$. vnde si prodeat $R > 1$, debet esse $C > 0$ et $D < 0$. Sin autem prodeat $R < 1$ debet esse $D > 0$, $C < 0$, $\mathfrak{D} > 0$ et $\mathfrak{D} < 1$. adeoque $Pk(1-R)M < 1$.

II. Si $R = -k'$, erit $0 = -kk'S(1+Pk)M + S + 1$ vnde colligitur $k' = \frac{S+1}{kS(1+Pk)M}$ quae expressio per se est positiua. Hoc autem casu supra vidimus esse debere $C > 0$ adeoque $\mathfrak{C} < 0$ et $\mathfrak{C} < 1$ et $D < 0$, ita, vt hoc casu sumendum sit $S < 1$.

Deni-

Denique hic meminisse oportet, esse $PkRS = -m$, quae conditio secundum binos casus considerari debet.

I. casu, quo $S = -k'$, ob $R = \frac{m}{Pkk'}$ nostra aequatio dat $o = -\frac{m}{P}(1 + Pk)M - k' + 1$ vnde colligitur $k' = 1 - \frac{m}{P}(1 + Pk)M$; ita, vt esse debeat $m(1 + Pk)M < P$ vbi notetur, si prodeat $R > 1$, esse debere $C > o$ et $D < o$; si autem prodeat $R < 1$, debere esse $\mathfrak{C} < o$ et $D > o$, $\mathfrak{D} > o$ et $\mathfrak{D} < 1$.

II. casu, si $R = -k'$, vt sit $m = Pkk'S$, nostra aequatio dat $o = -\frac{m}{P}(1 + Pk)M + S + 1$; vnde colligitur $S = \frac{m}{P}(1 + Pk)M - 1$ ita, vt esse debeat $m(1 + Pk)M > P$. Cum autem debeat esse $S < 1$, etiam esse debet $m(1 + Pk)M < 2P$; praeterea recordemur, esse debere $C > o$, adeoque $\mathfrak{C} > o$ et $\mathfrak{C} < 1$, et $D < o$.

Tandem circa has formulas probe obseruandum est ob valorem ω inuentum litteram M per reliqua elementa commode exprimi posse. Cum enim sit

$$\omega = -(1 + Pk)M, \text{ aequatio } \frac{\omega + 2}{m - 1} = M \text{ dabit}$$

$$M = \frac{2}{m + Pk} \text{ et } \omega = \frac{-2(1 + Pk)}{m + Pk}$$

ita, vt pro campo apparente prodeat

$$\Phi = \frac{2}{m + Pk} \cdot \xi \text{ seu } \Phi = \frac{859}{m + Pk} \text{ min.}$$

 Tum

Tum vero etiam pro loco oculi $O = \frac{e(m+Pk)}{2m}$. Quibus obseruatis binos casus seorsim euoluamus.

I. Euolutio casus, quo $S = -k'$.

355. Hoc ergo casu elementa nostra ita se habebunt:

$$b = -\frac{\alpha}{P};\ c = \frac{-B\alpha}{Pk};\ d = \frac{BC\alpha}{PkR};\ e = \frac{BCD\alpha}{m};$$

$$\beta = \frac{-B\alpha}{P};\ \gamma = \frac{-BC\alpha}{Pk};\ \delta = \frac{BCD\alpha}{PkR};$$

hincque interualla

$$\alpha + b = \alpha(1 - \tfrac{1}{P});\ \beta + c = -\frac{B\alpha}{P}(1 + \tfrac{1}{k})$$

$$\gamma + d = -\frac{BC\alpha}{Pk}(1 - \tfrac{1}{R});\ \delta + e = \frac{BCD\alpha}{PkR}(1 + \tfrac{1}{k'})$$

vbi ergo esse debet $P > 1$, et $\mathfrak{B} = \frac{-(P-1)}{1+Pk}$ hincque $B = \frac{-(P-1)}{P(1+k)}$.

Tertium vero interuallum dat hanc conditionem $C(1 - \frac{1}{R}) > 0$ et vltimum $CD < 0$; est autem $\mathfrak{D} = Pk(1-R)M = \frac{2Pk(1-R)}{m+Pk}$ et $D = \frac{2Pk(1-R)}{m-Pk+2PkR}$.

Destructio autem marginis colorati postulat, vt sit

$$k' = 1 - \frac{m}{P}(1+Pk)M = 1 - \frac{2m(1+Pk)}{P(m+Pk)}$$ et

$$R = \frac{m(m+Pk)}{k(P(m+Pk) - 2m(1+Pk))};$$

quamobrem debet esse $P(m+Pk) > 2m(1+Pk)$ ideoque $k < \frac{m(P-2)}{P(2m-P)}$; quare cum illa quantitas maior debeat esse, quam k, ob $2m > P$, debet esse $P > 2$; ex qua etiam conditione patet, semper esse debere

$R > 1$

$R > 1$ adeoque $C > 0$ et $D < 0$, vti ex valore ipſius D manifeſtum eſt. Quo his conditionibus ſatisfiat formulaeque euadant ſimpliciores, ſtatuamus $Pk = \sqrt{m}$ vt fiat $M = \frac{2}{m + \sqrt{m}}$ ideoque $\Phi = \frac{2}{m + \sqrt{m}} \cdot \xi = \frac{1718}{m + \sqrt{m}}$ min. qui valor duplo maior eſt, quam ante. Tum vero erit $\omega = \frac{-2(1 + \sqrt{m})}{m + \sqrt{m}}$; porro ſi capiatur $P = 4\sqrt{m}$, prodit $k = \frac{1}{4}$; $R = 2\sqrt{m}$ et $k' = \frac{1}{2}$ hincque $\mathfrak{D} = \frac{2(1 - 2\sqrt{m})}{1 + \sqrt{m}}$ et $D = \frac{2(1 - 2\sqrt{m})}{5\sqrt{m} - 1}$. Praeterea vero $\mathfrak{B} = -\frac{(4\sqrt{m} - 1)}{1 + \sqrt{m}}$ et $B = -\frac{(4\sqrt{m} - 1)}{5\sqrt{m}}$; vnde omnia interualla prodibunt poſitiua, dummodo pro C ſumatur quantitas poſitiua.

II. Euolutio caſus, quo $R = -k'$.

356. Pro hoc ergo caſu deſtructio marginis colorati praebet

$$0 = -\frac{2m(1 + Pk)}{P(m + Pk)} + S + 1$$

vnde concluditur

$$S = \frac{2m(1 + Pk)}{P(m + Pk)} - 1$$

ita, vt eſſe debeat

$$2m(1 + Pk) > P(m + Pk)$$

tum vero ob $S < 1$, debet eſſe

$$2m(1 + Pk) < 2P(m + Pk)$$

ſtatuamus nunc iterum, vt ante, $Pk = \sqrt{m}$ fietque $S = \frac{2\sqrt{m}}{P} - 1$, ita, vt nunc capi debeat $P < 2\sqrt{m}$ et $P > \sqrt{m}$; littera autem k cadet intra limites 1 et $\frac{1}{2}$.

 Tum

Tum vero ob $S = \frac{2\sqrt{m}}{P} - 1$ erit $k' = \frac{m}{S\sqrt{m}} = \frac{P.\sqrt{m}}{2\sqrt{m} - P}$. Definito autem P erit

$$\mathfrak{B} = -\frac{(P-1)}{1+\sqrt{m}} \text{ et } B = -\frac{(P-1)}{P+\sqrt{m}} \text{ et}$$

$$\mathfrak{D} = \frac{2(1+k')}{1+\sqrt{m}} \text{ et } D = \frac{2(1+k')}{\sqrt{m} - 2k' - 1} \text{ siue}$$

$$\mathfrak{D} = \frac{2(2\sqrt{m} - P + P\sqrt{m})}{(1+\sqrt{m})(2\sqrt{m} - P)};$$

qui valor cum sit positiuus et vnitate maior, littera D sponte fit negatiua, quemadmodum conditiones postulant, dummodo C capiatur positiuum. Quo autem omnia plene determinentur, statuamus insuper $P = \frac{3}{2}\sqrt{m}$ ac fiet $k = \frac{2}{3}$; $k' = 3\sqrt{m}$, et $S = \frac{1}{3}$,

$$\mathfrak{B} = -\frac{(3\sqrt{m} - 2)}{2(1+\sqrt{m})} \text{ et } B = -\frac{(3\sqrt{m} - 2)}{5\sqrt{m}}$$

$$\mathfrak{D} = \frac{2(3\sqrt{m} + 1)}{\sqrt{m} + 1} \text{ et } D = \frac{-2(3\sqrt{m} + 1)}{5\sqrt{m} + 1}$$

quibus valoribus omnibus conditionibus satisfit.

Scholion.

357. En ergo duos casus huiusmodi telescopiorum penitus determinatos pro data multiplicatione m, quorum effectus in praxi idem esse debet. Cum autem posteriore casu longitudo instrumenti minor euadat, quam priore, eum merito hic praeferimus; quam obrem operae pretium erit, in constructionem istorum Telescopiorum adcuratius inquirere. Notatis igitur praecipuarum litterarum valoribus, scilicet

$$P = \tfrac{3}{2}\sqrt{m};\ k = \tfrac{2}{3};\ k' = 3\sqrt{m} = -R;\ S = \tfrac{1}{3};$$

$\mathfrak{B} =$

$$\mathfrak{B} = -\frac{(3\sqrt{m}-2)}{2(1+\sqrt{m})}; \quad B = -\frac{(3\sqrt{m}-2)}{5\sqrt{m}}$$

$$\mathfrak{D} = \frac{2(3\sqrt{m}+1)}{\sqrt{m}+1}; \quad D = -\frac{2(3\sqrt{m}+1)}{5\sqrt{m}+1};$$

et quia C debet eſſe poſitiuum, ponatur

I. $C = \vartheta$ vt ſit $\mathfrak{C} = \frac{\theta}{1+\theta}$;

elementa noſtra ita erunt expreſſa:

$$b = -\frac{2\alpha}{3\sqrt{m}}; \quad \beta = \frac{2(3\sqrt{m}-2)\alpha}{15m};$$

$$c = \frac{3\sqrt{m}-2}{5m}; \quad \gamma = \frac{\theta(3\sqrt{m}-2)}{5m};$$

$$d = \frac{\theta(3\sqrt{m}-2)}{15m\sqrt{m}}; \quad \delta = \frac{-2\theta(3\sqrt{m}-2)(3\sqrt{m}+1)}{15(5\sqrt{m}+1)m\sqrt{m}}\alpha;$$

$$e = \frac{2\theta(3\sqrt{m}-2)(3\sqrt{m}+1)}{5(5\sqrt{m}+1)m\sqrt{m}}\alpha;$$

hinc diſtantiae focales

$$p = \alpha; \quad q = \frac{3\sqrt{m}-2}{3(1+\sqrt{m})\sqrt{m}}\alpha; \quad r = \frac{\theta}{1+\theta}\cdot\frac{3\sqrt{m}-2}{5m}\alpha;$$

$$s = \frac{2\theta(3\sqrt{m}-2)(3\sqrt{m}+1)}{15(\sqrt{m}+1)m\sqrt{m}}\alpha \text{ et}$$

$$t = \frac{2\theta(3\sqrt{m}-2)(3\sqrt{m}+1)}{5(5\sqrt{m}+1)m\sqrt{m}};$$

et lentium interualla

$$\alpha + b = \alpha\left(1 - \frac{2}{3\sqrt{m}}\right); \quad \beta + c = \frac{3\sqrt{m}-2}{3m}\alpha;$$

$$\gamma + d = \frac{\theta(3\sqrt{m}-2)(3\sqrt{m}+1)}{15m\sqrt{m}}\alpha;$$

$$\delta + e = \frac{4\theta(3\sqrt{m}-2)(3\sqrt{m}+1)}{15(5\sqrt{m}+1)m\sqrt{m}}\alpha;$$

et diſtantia oculi

$$O = \frac{e(1+\sqrt{m})}{2\sqrt{m}} = \frac{\theta(1+\sqrt{m})(3\sqrt{m}-2)(3\sqrt{m}+1)}{5m^2(5\sqrt{m}+1)}\cdot\alpha$$

vnde tota oritur longitudo teleſcopii

$$= \alpha\frac{(3\sqrt{m}-2)(1+\sqrt{m})}{3m} + \frac{\theta(\sqrt{m}+1)(3\sqrt{m}+1)(3\sqrt{m}-2)(5\sqrt{m}+3)}{15m^2(5\sqrt{m}+1)}$$

 ita,

ita, vt ſi m ſit numerus praemagnus, haec longitudo fiat $(1 + \frac{1}{8\sqrt{m}} + \frac{3\theta}{5\sqrt{m}})\alpha$ et quia hoc caſu fit $e = \frac{18\theta.\alpha}{25m}$, ſi liceret capere $\alpha = \frac{m}{7}$ dig.; ſtatui conueniret $\vartheta = 5$, vt vltimae lentis diſtantia focalis fieret circiter $\frac{1}{2}$ dig.; quando autem α multo maiorem obtinet valorem, facile capi poterit $\vartheta = 1$.

II. Adcuratius etiam inquirere debemus, quantam aperturam cuique lenti tribui oporteat, ac pro prima quidem lente ſemper ſumi ſolet ſemidiameter aperturae $x = \frac{m}{50}$ dig. pro reliquis lentibus ex formulis ſupra expoſitis colligitur:

Semidiameter aperturae ſecundae lentis

$$= \pi q \pm \frac{qx}{\mathfrak{B}P} = \frac{1}{4}\omega q + \frac{qx}{\mathfrak{B}\alpha}$$

$$= \frac{1}{4} q \left(\frac{2}{\sqrt{m}} + \frac{8(1+\sqrt{m})}{3\sqrt{m}-2} \cdot \frac{x}{\alpha}\right)$$

Semidiameter aperturae tertiae lentis

$$= \frac{rx}{B\mathfrak{C}P} = \frac{x}{\sqrt{m}} = \frac{\sqrt{m}}{50} \text{ dig.}$$

Quarta autem et quinta lens maximam aperturam capere debent; vnde eas vtrinque conuexas effici oportet.

III. Quod nunc ad litteras λ attinet, pro prima lente ſemper ſumi conuenit $\lambda = 1$, qui valor etiam pro ſecunda lente ſumi poſſe videtur, ſiquidem numerus m non ſit admodum paruus, de quo autem quouis caſu ſeorſim erit diſpiciendum. Pro tertia enim lente ob minimam aperturam nullum eſt dubium,

um, quin fumi poffit $\lambda'' = 1$. Quoniam vero quar-
ta lens debet effe vtrinque aequaliter conuexa, pro ea
fumi debet

$$\lambda''' = 1 + \left(\frac{\sigma-\varrho}{2T}\right)^2 (1 + 2\mathfrak{D})^2$$
$$= 1 + \left(\frac{\sigma-\varrho}{2T}\right)^2 \left(\frac{11\sqrt{m}+3}{\sqrt{m}+1}\right)^2.$$

Pro quinta autem lente erit $\lambda'''' = 1 + \left(\frac{\sigma-\varrho}{2T}\right)^2$.

IV. His igitur valoribus pro $\lambda, \lambda' \ldots$ ftabili-
tis quantitas α ex fequente formula definiri debet:

$$\alpha = kx\sqrt[3]{\mu m}\left\{\begin{array}{l}\lambda - \frac{1}{\mathfrak{B}P}\left(\frac{\lambda'}{\mathfrak{B}^2} + \frac{\nu}{B}\right) - \frac{1}{B^3\mathfrak{C}Pk}\left(\frac{\lambda''}{\mathfrak{C}^2} + \frac{\nu}{C}\right) \\ - \frac{1}{B^3C^3\mathfrak{D}Pkk'}\left(\frac{\lambda'''}{\mathfrak{D}^2} + \frac{\nu}{D}\right) + \frac{\lambda''''}{B^3C^3D^3.m}\end{array}\right\}$$

vbi meminiffe iuvabit fumi folere $x = \frac{m}{50}$ et $k = 50$,
vt fit $kx = m$. Interim tamen fi vel maiore clari-
tatis vel diftinctionis gradu contenti effe velimus, pro
kx fumi poterit $\frac{1}{2}m$. Deinde etiam hinc euidens eft,
ob illum praegrandem valorem ipfius λ''', qui fcili-
cet quadratum $(2\mathfrak{D} - 1)^2$ inuoluebat, terminum in-
de hic oriundum iterum fatis fieri paruum, cum is
diuifus fit per $\mathfrak{D}^3$; praeterquam quod eius denomina-
tor ob $Pkk' = 3m$ per fe fit fatis magnus. Deni-
que adhuc notari debet, numerum λ'' multiplicari per
quantitatem fatis notabilem, cum fit $-\frac{1}{B^3}$ propemo-
dum $\frac{125}{27}$ et $\frac{1}{\mathfrak{C}^3} > 1$; ideoque $-\frac{1}{B^3\mathfrak{C}^3}$ vltra 5 affurgat
atque adeo ad 40 vsque, fi fumeretur $\theta = 1$; ita vt
$Pk = \sqrt{m}$ in denominatore, hunc terminum vix in-
fra

ſta vnitatem diminuere poſſit. Cui incommodo remedium afferri poſſet, hanc lentem ſecundum praecepta in Libr. I. de lentibus compoſitis tradita duplicando. Hoc autem neceſſe non erit, quando ipſam lentem obiectiuam ita duplicabimus, vt omnis confuſio a reliquis etiam lentibus oriunda tollatur.

Exemplum.

358. Sumto $m = 25$, conſtructionem huiusmodi teleſcopii deſcribere.

I. Cum ſit $m = 25$, erit $\sqrt{m} = 5$, indeque

$$P = \tfrac{15}{2};\; k = \tfrac{2}{3};\; k' = 15;\; S = \tfrac{1}{3};$$

$$\mathfrak{B} = -\tfrac{13}{12};\; B = -\tfrac{13}{25};\; \mathfrak{D} = \tfrac{16}{3};\; D = -\tfrac{16}{15};$$

vnde elementa noſtra erunt

$$b = -\tfrac{2\alpha}{15};\; \beta = \tfrac{26\alpha}{375};\; c = \tfrac{13\alpha}{125};\; \gamma = \tfrac{13\theta\alpha}{125};$$

$$d = \tfrac{13\theta\alpha}{1875};\; \delta = \tfrac{-16\theta}{1875}\alpha;\; e = \tfrac{16\theta\alpha}{625};$$

et diſtantiae focales

$$p = \alpha;\; q = \tfrac{13}{90}\cdot\alpha;\; r = \tfrac{\theta}{1+\theta}\cdot\tfrac{13}{125}\cdot\alpha;$$

$$s = \tfrac{208}{5625}\alpha \text{ et } t = \tfrac{16\theta}{625}\cdot\alpha;$$

et interualla lentium

$$\alpha + b = \tfrac{13}{15}\alpha;\; \beta + c = \tfrac{13}{75}\alpha;$$

$$\gamma + d = \tfrac{208\theta}{1875}\alpha;\; \delta + e = \tfrac{32\theta}{1875}\cdot\alpha;$$

ac diſtantia oculi $O = \tfrac{48\theta}{3125}\cdot\alpha$;

ita, vt tota longitudo futura ſit $\alpha\left(\tfrac{26}{25} + \tfrac{448\theta}{3125}\right)$

Campi

Campi autem apparentis ſemidiameter erit
$\frac{1718}{30}$ min. $= 57' \, 16''$.

II. Semidiameter aperturae lentis primae $= \frac{1}{2}$ dig.
- - - - ſecundae $= \frac{1}{4} q \left(\frac{2}{5} + \frac{48}{13} \cdot \frac{x}{\alpha}\right)$, vnde colligere licet, pro hac lente dimidiam aperturam ſufficere.
- - - - tertiae $= \frac{1}{10}$ dig.

III. Deinde porro erit $\lambda = 1$; $\lambda' = 1$ fortaſſe; $\lambda'' = 1$; $\lambda''' = 1 + \frac{841}{9}\left(\frac{\sigma - \varrho}{2\tau}\right)^2$, vbi notandum, ſi vitrum commune adhibeatur, quo $n = 1,55$ fore $\lambda''' = 1, + 0,6299 \cdot \frac{841}{9} = 59,702$ et $\lambda'''' = 1,6299$.

Ex aequatione pro α colligere licet, numerum ſub ſigno radicali contentum circiter vltra $2 \mu m$. excreſcere, vnde eius loco tuto ſcribere poſſumus 64 ſicque obtinebimus $\alpha = 100$. dig. $= 8\frac{1}{3}$ ped.

Pro maioribus autem multiplicationibus haec quantitas in ratione $m \sqrt[3]{m}$ creſcet neque haec longitudo ſatis magna imminui poterit, niſi formulam pro ſemidiametro confuſionis ad nihilum redigamus, id quod vti ex ſuperioribus liquet, facile praeſtabitur, ſi his quinque lentibus adhuc lentem concauam praefigamus, ſiue ex eodem ſiue ex vitro chryſtallino parandam.

Problema 2.

359. Hanc teleſcopiorum ſpeciem ante primam lentem praefigendo lentem concauam ita perficere, vt confu-

confuſio penitus tollatur ſicque haec teleſcopia breuiſſima reddantur, ſeruato campo ante inuento.

Solutio.

Cum igitur nunc ſex habeamus lentes, quinque litterae erunt conſiderandae P, Q, R, S, T, ad lentium interualla relatae, quarum prima P debet dare interuallium minimum, quod ob α negatiuum ſtatuamus $= -\frac{1}{50}. \alpha$, vt fiat $P = \frac{50}{51}$. Deinde cum ſequentia interualla reſpondeant litteris Q, R, S, T, quae ante erant P, Q, R, S, nunc ponamus $R = -k$ et $S = -k'$, eruntque elementa

$$b = -\frac{\alpha}{P};\ c = \frac{B\alpha}{PQ};\ d = +\frac{BC\alpha}{PQk};\ e = \frac{BCD\alpha}{PQkk'};$$

$$\beta = -\frac{B\alpha}{P};\ \gamma = \frac{BC\alpha}{PQ};\ \delta = \frac{BCD\alpha}{PQk};\ \varepsilon = \frac{BCDE\alpha}{PQkk'}$$

$$\text{et } f = \frac{-BCDE\alpha}{PQkk'T} = \frac{-BCDE\alpha}{m};$$

vnde interualla colliguntur

1°. $\alpha + b = \alpha(1 - \frac{1}{P})$; quod fit ſumto $P = \frac{50}{51}$.

2°. $\beta + c = -\frac{B\alpha}{P}(1 - \frac{1}{Q})$; vnde cum Q capi debeat > 1, debet eſſe B poſitiuum, ideoque $\mathfrak{B} > 0$ et < 1.

3°. $\gamma + d = \frac{BC\alpha}{PQ}(1 + \frac{1}{k})$; vnde C debet eſſe negatiuum.

4°. $\delta + e = \frac{BCD\alpha}{PQk}(1 + \frac{1}{k'})$; vnde D debet eſſe poſitiuum, ideoque $\mathfrak{D} > 0$ et $\mathfrak{D} < 1$.

5°. $\varepsilon +$

5°. $\varepsilon + f = \frac{BCDE\alpha}{PQkk'}(1 - \frac{1}{T})$; vnde debet esse $\varepsilon(1 - \frac{1}{T})$ positiuum, sed cum et f debeat esse maius nihilo, debet esse E negatiuum, ergo $T < 1$.

Iam pro campo apparente ponamus

$\pi = -v\xi$; $\pi' = \omega\xi$; $\pi'' = 0$; $\pi''' = \xi$ et $\pi'''' = -\xi$

vt fiat $\Phi = \frac{v+\omega+2}{m-1}.\ \xi = M\xi$, existente $M = \frac{v+\omega+2}{m-1}$; vnde pro loco oculi fit $O = \frac{f}{Mm}$. Ex his autem formabuntur sequentes aequationes fundamentales:

1°. $\mathfrak{B}v = -(1-P)M$.

2°. $\mathfrak{C}\omega = -(1-PQ)M - v$.

3°. $\mathfrak{D}.0 = -(1+PQk)M - v - \omega$.

4°. $\mathfrak{E} = -(1-PQkk')M - v - \omega$.

Ex quarum tertia statim habemus

$v + \omega = -(1+PQk)M$ est vero etiam

$v + \omega = (m-1)M - 2$; vnde

$M = \frac{2}{m+PQk}$ sicque vicissim $v + \omega = \frac{-2(1+PQk)}{m+PQk}$.

Quia nunc prima aequatio dat

$v = \frac{-2(1-P)}{\mathfrak{B}(m+PQk)}$; secunda praebebit

$\mathfrak{C}\omega = \frac{-2(1-PQ)}{m+PQk} + \frac{2(1-P)}{\mathfrak{B}(m+PQk)}$

quare nunc fiet

$v + \omega = \frac{2(1-P)}{\mathfrak{BC}(m+PQk)} - \frac{2(1-PQ)}{\mathfrak{C}(m+PQk)} = \frac{-2(1+PQk)}{m+PQk}$

quae aequatio reducta dabit

$$(1-\mathfrak{B})(1-\mathfrak{C})-(1-\mathfrak{C})P+\mathfrak{B}PQ+\mathfrak{B}\mathfrak{C}PQk=0$$

quae ad formam hanc reducitur:

$$\frac{1-P}{BC}-\frac{P(1-Q)}{C}+PQ(1+k)=0$$

quae aequatio inferuit relationi inter litteras B et C definiendae. Littera autem D arbitrio nostro manet relicta, dummodo capiatur positiua. Tandem vero quarta aequatio dat

$$\mathfrak{C}=-\frac{2(1-PQkk')}{m+PQk}+\frac{2(1+PQk)}{m+PQk}=\frac{2PQk(1+k')}{m+PQk},$$

qui valor cum sit positiuus, debet esse

$$2PQk(1+k')>m+PQk \text{ siue } PQk(1+2k')>m$$

Denique destructio marginis colorati postulat hanc aequationem:

$$0=\frac{v}{P}+\frac{\omega}{PQ}-\frac{v}{PQk}+\frac{1}{PQkk'}+\frac{1}{PQkk'T}$$

quae substitutis pro v et ω valoribus abit in hanc:

$$0=\frac{-2(1-P)}{\mathfrak{B}(m+PQk)}-\frac{2(1-PQ)}{\mathfrak{C}(m+PQk)Q}+\frac{2(1-P)}{\mathfrak{B}\mathfrak{C}(m+PQk)Q}$$
$$+\frac{1}{Qkk'}+\frac{1}{Qkk'T}.$$

siue

$$0=\frac{2}{Q(m+PQk)}\left(\frac{(1-P)(1-Q)}{\mathfrak{B}}-1-PQk\right)$$
$$+\frac{1}{Qkk'}+\frac{1}{Qkk'T}$$

Vt huic aequationi commodissime satisfaciamus primo terminos factore $(1-P)$ adfectos ob summam paruitatem reiiciamus, quandoquidem non opus est, vt in hac

hac resolutione summum rigorem sequamur, et habebimus

$$\frac{2(1+PQk)}{m+PQk} = \frac{1}{kk'}(1+\frac{1}{T})$$

vbi statim secundum naturam huius speciei telescopiorum supra stabilitam statuamus $PQk = \sqrt{m}$ et $T = \frac{1}{2}$; vnde fiet $\frac{4}{\sqrt{m}} = \frac{3}{kk'}$; hinc $kk' = \frac{3\sqrt{m}}{4}$. Quia nunc erit $kk'T = \frac{3\sqrt{m}}{8} = \frac{m}{PQ}$ ita, vt sit $PQ = \frac{8}{3}.\sqrt{m}$, ob P datum etiam Q definietur. Quia porro est $PQk = \sqrt{m}$, erit $k = \frac{3}{8}$, hincque $k' = 2\sqrt{m}$, sicque valores harum litterarum ita se habebunt:

$P = \frac{50}{51}$; $PQ = \frac{8}{3}\sqrt{m}$; $k = \frac{3}{8}$; $k' = 2\sqrt{m}$ et
$T = \frac{1}{2}$; hincque $PQk = \sqrt{m}$;
$PQkk' = 2m$ et $PQkk'T = m$.

Quod nunc ad reliquas litteras B, C. &c. attinet, aequatio supra data, si etiam factor $1 - P$ reiiciatur, dabit:

$$-\frac{1+PQ}{C} + PQ(1+k) = 0$$

vnde inuenitur

$$C = \frac{1+PQ}{PQ(1+k)} = \frac{3+4\sqrt{m}}{7\sqrt{m}} \text{ et } \mathfrak{C} = \frac{3+4\sqrt{m}}{3(1+\sqrt{m})}.$$

Litterae autem B et $\mathfrak{B}$ arbitrio nostro permittuntur, ita, vt si prima lens concaua ex vitro chrystallino paretur, vt supra vidimus, poni conueniat $\mathfrak{B} = \frac{5}{7}$; porro vero litterae $\mathfrak{D}$ et D hinc plane non determinantur, nisi quod vtramque positiuam esse oporteat,

 ex

ex quo ſtatuamus $D = \vartheta$, hincque $\mathfrak{D} = \frac{\theta}{1+\theta}$; denique vero erit

$$\mathfrak{E} = \frac{2(1+2\sqrt{m})}{1+\sqrt{m}}; \text{ hincque } E = \frac{-2(1+2\sqrt{m})}{1+3\sqrt{m}};$$

qui valores vni conſpectui ita repraeſentantur:

$$\mathfrak{B} = \tfrac{5}{7};\ \mathfrak{C} = \frac{3-4\sqrt{m}}{3(1+\sqrt{m})};$$

$$\mathfrak{D} = \frac{\theta}{1+\theta} \text{ et } \mathfrak{E} = \frac{2(1+2\sqrt{m})}{1+\sqrt{m}};$$

$$B = \tfrac{5}{2};\ C = \frac{3-4\sqrt{m}}{7\sqrt{m}};\ D = \mathfrak{D} \text{ et } E = \frac{-2(1+2\sqrt{m})}{1+3\sqrt{m}};$$

hincque

$$BC = \frac{5(3-4\sqrt{m})}{14\sqrt{m}};\ BCD = \frac{5\theta(3-4\sqrt{m})}{14\sqrt{m}};$$

$$BCDE = \frac{5\theta(4\sqrt{m}-3)(1+2\sqrt{m})}{7\sqrt{m}(1+3\sqrt{m})};$$

ex quibus elementa noſtra penitus determinantur. Nihil igitur aliud ſupereſt, niſi vt ſemidiameter confuſionis ad nihilum redigatur, id quod fit ſequente aequatione:

$$\lambda = \frac{1}{P}\left(\frac{\lambda'}{\mathfrak{B}^3} + \frac{\nu}{B\mathfrak{B}}\right) - \frac{1}{B^3PQ}\left(\frac{\lambda''}{\mathfrak{C}^3} + \frac{\nu}{C\mathfrak{C}}\right)$$
$$- \frac{1}{B^3C^3.PQk}\left(\frac{\lambda'''}{\mathfrak{D}^3} + \frac{\nu}{D\mathfrak{D}}\right)$$
$$- \frac{1}{B^3C^3D^3PQkk'}\left(\frac{\lambda''''}{\mathfrak{E}^3} + \frac{\nu}{E\mathfrak{E}}\right) + \frac{\lambda'''''}{B^3C^3D^3E^3.m};$$

ſi ſcilicet omnes lentes ex eodem vitro ſint factae. Sin autem prima lens ſit chryſtallina; reliquae vero coronariae, valor ipſius λ hinc inuentus inſuper multiplicari debet per $\frac{9875}{8724}$, quae fractio eſt fere $\frac{17}{15}$, propius vero $\frac{163}{144}$.

Circa

Circa hanc vero aequationem obferuandum eft, fumi debere $\lambda' = 1$; $\lambda'' = 1$; $\lambda''' = 1$. Pro quinta autem lente, vt vtrinque fiat aeque conuexa, fumi debet

$$\lambda'''' = 1, + 0,60006.(1-2\mathfrak{C})^2 = 1 + \frac{0,60006(3+7\sqrt{m})^2}{(1+\sqrt{m})^2}$$

Pro fexta vero $\lambda''''' = 1,60006$.

Coroll. 1.

360. Pro his igitur telefcopiis cum fiat $M = \frac{2}{m+\sqrt{m}}$ erit femidiameter campi apparentis $\Phi = \frac{1718}{m+\sqrt{m}}$. min.

Coroll. 2.

361. Semidiametri autem aperturae fingularum lentium ita definiuntur: ex §. 21.

Pro prima $= x$.

Pro fecunda $= \frac{x}{P}$.

Pro tertia $= \frac{r}{2\sqrt{m}} + \frac{x}{PQ}$.

Pro quarta $= os + \frac{x}{PQk}$.

Pro quinta $= \frac{t}{4} + \frac{x}{PQkk'}$.

Pro fexta $= \frac{u}{4} + \frac{x}{PQkk'T} = \frac{u}{4} + \frac{x}{m}$.

Coroll. 3.

362. Si in locis imaginum realium velimus diaphragmata conftituere, reperitur

Pro

Pro priori ſemidiameter aperturae $= \frac{2BC}{m+\sqrt{m}} \cdot \frac{\alpha}{4}$.

Pro poſteriore vero $= \frac{2BCD}{m+\sqrt{m}} \cdot \frac{\alpha}{4}$.

Scholion.

363. En ergo duplicem perfectionem huius generis teleſcopiorum; altera ſcilicet ſpectat ad campum apparentem; quem fere duplo maiorem reddidimus; altera vero conſiſtit in deſtructione confuſionis, qua efficitur, vt non opus ſit, quantitatem α maiorem accipere, quam apertura lentis obiectiuae ad claritatem requiſita poſtulat, ſicque longitudo teleſcopii tantopere contrahatur, quantum quidem fieri licet. Cum hic duae lentes poſt vltimam imaginem reperiantur, quibus campus duplo maior eſt factus, ita, ſi tres pluresue lentes adhibere velimus, campum, quousque voluerimus, amplificare licebit. Quod cum vix maiorem calculum poſtulet, quam praecedens problema, operae pretium vtique erit, hanc inueſtigationem generatim ad quotcunque lentes extendere.

Problema 3.

364. Praefixa, vt ante, lente concaua, plures lentes poſt vltimam imaginem realem ita diſponere, vt campus apparens quantum libuerit amplificetur.

Solutio.

Hic omnia prorſus manent vt in problemate antecedente, quod ſcilicet ad elementa, diſtantias focales et et interualla lentium attinet, hoc tantum discrimine, vt ambae series litterarum B, C, D etc. et P, Q, k, k', T etc. vlterius continuari debeant. Deinde littera M, qua campus apparens definitur, alium nancifcetur valorem a numero lentium post vltimam imaginem inserendarum. Sit igitur harum lentium numerus $= i$ eritque $M = \frac{v + \omega + i}{m - 1}$ tum vero aequationes fundamentales se habebunt, vt ante, nisi quod vlterius progrediantur, post tertiam autem, quamlibet sequentium ope tertiae definiamus, vti sequitur

1°. $\mathfrak{B}\, v = -(1 - P)\, M$

2°. $\mathfrak{C}\, \omega = -(1 - PQ)\, M - v$

3°. $0 = -(1 + PQk)\, M - v - \omega$ siue
$v + \omega = -(1 + PQk)\, M$ vnde
$M(m - 1) = -(1 + PQk)\, M + i$ et
$M = \frac{i}{m + PQk}$.

4°. $\mathfrak{E} = PQk(1 + k')\, M$

5°. $\mathfrak{F} = PQk(1 + k'T)\, M - 1$

6°. $\mathfrak{G} = PQk(1 + k'TU)\, M - 2$

7°. $\mathfrak{H} = PQk(1 + k'TUV)\, M - 3$

etc.

ex primis autem formulis colligetur, vt ante,

$$\frac{1 - P}{BC} - \frac{P(1 - Q)}{C} + PQ(1 + k) = 0$$

vnde quia P proxime $= 1$, ideoque v pro nihilo haberi potest, erit satis exacte

 $\omega =$

$$\omega = -(1 + PQk) M = -\frac{(1-PQ)M}{\mathfrak{C}}$$

vnde colligimus

$$\mathfrak{C} = \frac{1-PQ}{1+PQk} \text{ et } C = \frac{1-PQ}{PQ(1+k)}.$$

Hic autem sufficit hunc valorem vero proxime definiuisse, quia aperturae lentium, vnde litterae v, ω etc. pendent, summam praecisionem respuunt. Quod cum etiam valeat in aequatione, qua margo coloratus destruitur, habebitur, loco M substituto valore,

$$\frac{i(1+PQk)}{m+PQk} = \frac{1}{kk'}\left(1 + \frac{1}{T} + \frac{1}{TU} + \frac{1}{TUV} \text{ etc.}\right)$$

quorum terminorum numerus cum sit i et singulae litterae T, U, V vnitate debeant esse minores, statuamus tam concinnitatis gratia, quam vt lentes postremae aequis fere interuallis distent,

$$T = \tfrac{1}{2};\ U = \tfrac{2}{3};\ V = \tfrac{3}{4};\ W = \tfrac{4}{5} \text{ etc.}$$

vt factor ipsius $\frac{1}{kk'}$ fiat

$$1 + 2 + 3 + 4 \ldots i = \frac{(1+i)i}{2}$$

deinde etiam, vt ante, ponamus $PQk = \sqrt{m}$, vt prodeat ista aequatio

$$\frac{i}{\sqrt{m}} = \frac{1}{kk'} \cdot \frac{i(1+i)}{2} \text{ vnde elicitur } kk' = \frac{(1+i)\sqrt{m}}{2}.$$

Productum vero reliquarum litterarum

$$TUV \ldots = \frac{1}{i}, \text{ erit } kk'\,TUV \ldots$$

$$= \frac{(1+i)\sqrt{m}}{2i} = \frac{m}{PQ}; \text{ hincque ergo deducitur}$$

$PQ = \frac{2i\sqrt{m}}{1+i}$, et quia P per se datur, hinc Q definietur.

Deni-

Denique ob $PQk = \sqrt{m}$; elicitur $k = \frac{1+i}{2i}$ et $k' = i\sqrt{m}$; hic ergo valores omnes sequenti modo se habent:

$$PQ = \frac{2i\sqrt{m}}{1+i};\ k = \frac{1+i}{2i};\ k' = i\sqrt{m};$$

$$T = \tfrac{1}{2};\ U = \tfrac{2}{3};\ V = \tfrac{3}{4};\ W = \tfrac{4}{5} \text{ etc.}$$

$$PQk = \sqrt{m};\ PQkk' = im;$$

$$PQkk'T = \tfrac{im}{2};\ PQkk'TU = \tfrac{im}{3}; \text{ et}$$

$$PQkk'TUV \ldots = \tfrac{im}{i} = m.$$

Circa litteras B C D etc. prima B cum tertia D hinc non definitur; iam vero ostendimus esse,

$$C = \frac{1-PQ}{PQ(1+k)} = \frac{1+i-2i\sqrt{m}}{(1+3i)\sqrt{m}} \text{ et}$$

$$\mathfrak{C} = \frac{1-PQ}{1+PQk} = \frac{1+i-2i\sqrt{m}}{(1+i)(1+\sqrt{m})}.$$

Ponamus igitur, vt ante, $D = \vartheta$ et $\mathfrak{D} = \frac{\vartheta}{1+\vartheta}$ sequentes vero erunt

$$\mathfrak{E} = \frac{i(1+1\sqrt{m})}{1+\sqrt{m}};\ \mathfrak{F} = \frac{i(2+i\sqrt{m})}{2(1+\sqrt{m})} - 1;$$

$$\mathfrak{G} = \frac{i(3+i\sqrt{m})}{3(1+\sqrt{m})} - 2;\ \mathfrak{H} = \frac{i(4+1\sqrt{m})}{4(1+\sqrt{m})} - 3;$$

quarum litterarum penultima erit

$$\frac{2(i-1)+(3i-2)\sqrt{m}}{(i-1)(1+\sqrt{m})} \text{ et vltima} = 1.$$

Has igitur quoque litteras hic coniunctim aspectui exponamus:

$\mathfrak{B} =$

$\mathfrak{B} = \frac{5}{7}$ circiter

$\mathfrak{C} = \frac{-(2i\sqrt{m} - i - 1)}{(1+i)(1+\sqrt{m})}$

$\mathfrak{D} = \frac{\theta}{1+\theta}$

$\mathfrak{E} = \frac{i + ii\sqrt{m}}{1+\sqrt{m}}$

$\mathfrak{F} = \frac{2(i-1) + (ii - 2.1)\sqrt{m}}{2(1+\sqrt{m})}$

$\mathfrak{G} = \frac{3(i-2) + (ii - 2.3)\sqrt{m}}{3(1+\sqrt{m})}$

$\mathfrak{H} = \frac{4(i-3) + (ii - 3.4)\sqrt{m}}{4(1+\sqrt{m})}$

$B = \frac{5}{2}$ vel circiter

$C = \frac{-(2i\sqrt{m} - i - 1)}{(1+3i)\sqrt{m}}$

$D = \vartheta$

$E = \frac{-(i + ii\sqrt{m})}{(i-1)(1+(i+1)\sqrt{m})}$

$F = \frac{-(2(i-1) + (ii - 1.2)\sqrt{m})}{(i-2)(2+(i+2)\sqrt{m})}$

$G = \frac{-(3(i-2) + (ii - 2.3)\sqrt{m})}{(i-3)(3+(i+3)\sqrt{m})}$

$H = \frac{-(4(i-3) + (ii - 3.4)\sqrt{m})}{(i-4)(4+(i+4)\sqrt{m})}$

ex quibus valoribus omnia elementa ſecundum formulas ſatis cognitas definiri poſſunt. Deinde vero vt omnis confuſio tollatur, haec aequatio erit adimplenda:

$$\lambda = \frac{1}{P}\left(\frac{\lambda''}{\mathfrak{B}^3} + \frac{\nu}{B\mathfrak{B}}\right) - \frac{1}{B^3PQ}\left(\frac{\lambda'''}{\mathfrak{C}^3} + \frac{\nu}{C\mathfrak{C}}\right)$$
$$- \frac{1}{B^3C^3PQk}\left(\frac{\lambda''''}{\mathfrak{D}^3} + \frac{\nu}{D\mathfrak{D}}\right)$$
$$- \frac{1}{B^3C^3D^3PQkk'}\left(\frac{\lambda'''''}{\mathfrak{E}^3} + \frac{\nu}{E\mathfrak{E}}\right)$$
$$+ \frac{1}{B^3C^3D^3E^3PQkk'T}\left(\frac{\lambda''''''}{\mathfrak{F}^3} + \frac{\nu}{F\mathfrak{F}}\right)$$
$$- \frac{1}{B^3C^3D^3E^3F^3PQkk'TU}\left(\frac{\lambda'''''''}{\mathfrak{G}^3} + \frac{\nu}{G\mathfrak{G}}\right)$$
$$+ \text{etc.}$$

vbi, vt ante, notandum eſt, ſi lens prima concaua ex vitro chryſtallino paretur, reliquae autem omnes ex coronario; tum valorem hinc pro λ inuentum inſuper multiplicari debere per fractionem $\frac{9875}{8724}$; quo caſu ſiquidem ſtatuatur $\mathfrak{B} = \frac{5}{7}$, etiam omnis confuſio a diuerſa refrangibilitate radiorum oriunda tolli deberet,

ſcili-

ſcilicet ſecundum Dollondi experimenta. Ceterum, vt iam monuimus, pro litteris λ', λ'' et λ''' vnitas poni poterit. Pro ſequentibus vero lentibus, quae omnes vtrinque aeque conuexae eſſe debent, ſtatui debet

$$\lambda'''' = 1 + 0,60006\,(2\,\mathfrak{E} - 1)^2;$$
$$\lambda''''' = 1 + 0,60006\,(2\,\mathfrak{F} - 1)^2;$$
$$\lambda'''''' = 1 + 0,60006\,(2\,\mathfrak{G} - 1)^2 \text{ etc.}$$

Coroll. 1.

365. Hoc igitur modo campi apparentis ſemidiameter erit

$$\Phi = \frac{i\xi}{m + \sqrt{m}} \text{ ſiue } \Phi = \frac{859.i}{m + \sqrt{m}} \text{ minut.}$$

ac ſi pro lente vltima fuerit diſtantia focalis $= \zeta$, pro loco oculi habebimus

$$O = \frac{\zeta}{Mm} = \frac{\zeta(m + \sqrt{m})}{im} = \frac{\zeta(1 + \sqrt{m})}{i\sqrt{m}}$$

vnde ſi multiplicatio fuerit praemagna erit $O = \frac{\zeta}{i}$.

Coroll. 2.

366. Semidiametri aperturae ſingularum lentium ita definientur:

Pro Ima $= x$; IIda $= \frac{x}{P}$;

IIItia $= \frac{i}{\sqrt{m}} \cdot \frac{r}{4} \pm \frac{x(1 + i)}{2i\sqrt{m}}$

IVta $= 0\,\frac{s}{4} \pm \frac{x}{\sqrt{m}}$

Vta $= \frac{t}{4} \pm \frac{1}{im} \cdot x$

VIta $= \frac{u}{4} \pm \frac{2}{im} \cdot x$

VIIta $= \frac{v}{4} \pm \frac{3}{im}\, x.$

 Coroll.

Coroll. 3.

367. Circa diaphragmata eadem eſt ratio, vt in problemate praecedente: ſcilicet pro diaphragmate in loco prioris imaginis collocando debet eſſe radius foraminis $= \frac{iBC}{m+\sqrt{m}} \cdot \frac{\alpha}{4}$; pro altero autem diaphragmate $= \frac{iBCD}{m+\sqrt{m}} \cdot \frac{\alpha}{4}$ vnde patet, haec foramina eo maiora fieri debere, quo magis campus amplificetur.

Scholion.

368. Hoc igitur problemate totum huncce de teleſcopiis tractatum finimus, quoniam cuncta praecepta pro illorum conſtructione ſatis ſunt expoſita, neque hic conſtructiones generales commode exhiberi queant, propterea quod hic non ſolum quantitates duplicis generis, vt ante, vbi ſcilicet vel numeri abſoluti vel per multiplicationem m diuiſi occurrebant, ſed triplicis adeo generis ſcilicet praeter numeros abſolutos quantitates primo per $\sqrt{m}$, vel etiam per m diuiſae in computum ſunt ducendae, ita, vt ex comparatione duorum caſuum nulla concluſio generalis colligi queat. Nihil igitur aliud hic reſtat, niſi vt pro qualibet multiplicatione, quam quis poſtulat, atque etiam pro quantitate campi, ſeu valore numeri i calculus ab initio inſtituatur, quem pro quouis caſu oblato ſuſcepiſſe ob rei dignitatem ſine dubio operae erit pretium: In quo quidem negotio etiam littera ϑ, quae arbitrio noſtro hactenus eſt permiſſa, determinari debet,

debet, quam commode vnitati aequalem vel maiorem assumere licet. Videtur autem aptissime poni posse $\vartheta = 2$; vnde posteriora instrumenti interualla non nimis augentur, simul vero valor pro λ notabiliter minor prodit, quam si esset $\vartheta = 1$. Quo autem totus iste calculus facilius suscipi et absolui queat, aliquot exempla hic subiungamus.

Exemplum I.

369. Si $m = 49$, vt sit $\sqrt{m} = 7$ et pro campo apparente $i = 2$, ita, vt telescopium ex sex lentibus sit componendum et sumatur praeterea $\vartheta = 2$. Primo colligantur litterae P, Q etc. vt sequitur

$$P = \tfrac{50}{51};\ PQ = \tfrac{28}{3};\ k = \tfrac{5}{4};\ k' = 14;\ T = \tfrac{1}{2};$$

$$\text{Log.}\ \tfrac{1}{P} = 0{,}0086002;\quad \text{Log.}\ \tfrac{1}{PQ} = 9.0299632;$$

$$\text{Log.}\ \tfrac{1}{PQk} = 9.1549019;\quad \text{Log.}\ \tfrac{1}{PQkk'} = 8.0087738;$$

$$\text{Log.}\ \tfrac{1}{PQkk'T} = 8.3098038.$$

$\mathfrak{B} = \frac{5}{7}$; $l.\mathfrak{B} = 9{,}8538719$	$B = \frac{5}{2}$; $l.B = 0{,}3979399$
$\mathfrak{C} = -\frac{25}{24}$; $l.\mathfrak{C} = 0{,}0177287(-)$	$C = -\frac{25}{49}$; $l.C = 9{,}7077438(-)$
$\mathfrak{D} = \frac{2}{3}$; $l.\mathfrak{D} = 9{,}8239086$	$D = 2$; $l.D = 0{,}3010300$
$\mathfrak{E} = \frac{15}{4}$; $l.\mathfrak{E} = 0{,}5740313$	$E = -\frac{15}{11}$; $l.E = 0{,}1346984(-)$

ex his logarithmis formantur sequentes:

$l.BC = 0{,}1056837(-)$; $l.BCD = 0{,}4067137(-)$

$l.BCDE = 0{,}5414121\ (+)$ $l.B\mathfrak{B} = 0{,}2518118(+)$

$l.C\mathfrak{C} = 9{,}7254725\ (+)$; $l.D\mathfrak{D} = 0{,}1249386\ (+)$

$l.E\mathfrak{E} = 0{,}7087297(-)$.

Hoc

Hoc quasi primo labore confecto colligamus nostra elementa, quae ita se habebunt:

$b = -1,02\alpha.$	$\beta = -2,55.\alpha$	$q = -0,72857.\alpha$
		$\text{Log.}\,q = 9,8624713(-)$
$c = +0,26785\alpha$	$\gamma = -0,13666.\alpha$	$r = -0,27901.\alpha$
		$\text{Log.}\,r = 9,4456318(-)$
$d = -0,18221\alpha$	$\delta = -0,36443.\alpha$	$s = -0,12148.\alpha$
		$\text{Log.}\,s = 9,0844942(-)$
$e = -0,02603\alpha$	$\varepsilon = 0,03549.\alpha$	$t = -0,09762\,\alpha$
		$\text{Log.}\,t = 8,9895188(-)$
$f = -0,07099\alpha$		$u = -0,07099.\alpha.$

Pro oculo autem erit $O = \frac{4u}{7} = -0,04057.\alpha$

III. Hinc iam lentium interualla cognoscuntur:

1°. $\alpha + b = -0,02000.\alpha$
2°. $\beta + c = -2,28215.\alpha$
3°. $\gamma + d = -0,31887.\alpha$
4°. $\delta + e = -0,39046.\alpha$
5°. $\varepsilon + f = -0,03550.\alpha$
6°. $O = -0,04057.\alpha$

Tota longitudo $= -3,08755.\alpha$

Deinde etiam diaphragmata ita definiuntur:

Prius post lentem tertiam ad distantiam

$\gamma = -0,13666.\alpha.$ ponitur,

Eius semidiameter foraminis $= 0,0569.\alpha$

Poste-

Posterius ponitur post quartam lentem ad distantian
$\delta = -0,36443.\alpha$

Eius semidiameter foraminis $= 0,1138.\alpha$

Porro vero semidiameter campi apparentis erit $30\frac{2}{3}$ min.

IV. Nunc singulas lentes examinari conueniet, quarum non solum constructio, sed etiam momentum confusionis, quod quaelibet ad valorem λ confert; est definiendum, vbi quidem prima lens vltimo loco, postquam scilicet valor λ fuerit inuentus, tractari debebit. Quoniam igitur sequentes lentes omnes ex vitro coronario fieri sumuntur, valores eo pertinentes erunt:

$$\nu = 0,2196;\ \text{Log.}\ \nu = 9.3416323$$
$$\varpi = 1,6601$$
$$\varrho = 0,2267$$

$$\varpi - \varrho = 1,4334;\ \text{Log.}\ \sigma - \varrho = 0,1563674$$
$$\tau = 0,9252;$$

Nunc igitur singulas lentes post primam ordine percurramus:

Pro lente secunda

$$1^{\circ}.\ \text{radius} \begin{cases} \text{anter.} & \frac{q}{\sigma - \mathfrak{B}(\sigma-\varrho) + \tau\sqrt{(\lambda'-1)}} \\ \text{poster.} & \frac{q}{\varrho + \mathfrak{B}(\sigma-\varrho) - \tau\sqrt{(\lambda'-1)}} \end{cases}$$

quae formulae ex superioribus facile eliciuntur. Hic vero est $\lambda' = 1$ et calculus ita instituatur

$l.\,\sigma - \varrho = 0,1563674$	$\sigma = 1,6601$
$L.\,\mathfrak{B} = 9,8538719$	subtr. $1,0239$
$0,0102393$	$0,6362$ den. rad. ant.
	$\varrho = 0,2267$
$\mathfrak{B}(\sigma - \varrho) = 1,02386$	add. $1,0239$
	$1,2506$ den. rad. post.

log. $q = 9,8624713\ (-)$	$9,8624713\ (-)$
log. den. $= 9,8035937$	$0,0971184$
$0,0588776\ (-)$	$9,7653529\ (-)$
rad. anter. $= -1,14519.\alpha$	rad. post. $= -0,58257.\alpha$

2°. Semidiameter aperturae requiritur $= \frac{51}{50}x = \frac{51}{50}\cdot\frac{m}{50}$ dig.

3°. Calculus pro momento confusionis:

$l.\frac{1}{p} = 0,0086002$	$l.\lambda' = 0,0000000$	$l.\,\nu = 9,3416323$
	$l.\,\mathfrak{B}^3 = 9,5616157$	$l.\,B\mathfrak{B} = 0,2518118$
	$0,4383843$	$9,0898205$
adde log. coëffic. $=$	$0,0086002$	$0,0086002$
	$0,4469845$	$9,0984207$

Ergo pars prior $= 2,79888$
posterior $= 0,12543$

Momentum confusionis $= 2,92431$

Pro lente tertia

1°. radius ant. $= \frac{r}{\sigma - \mathfrak{C}(\sigma - \varrho) + \tau\sqrt{(\lambda'' - 1)}}$

. . . poster. $= \frac{r}{\varrho + \mathfrak{C}(\sigma - \varrho) - \tau\sqrt{(\lambda'' - 1)}}$

vbi

vbi notetur, esse $\lambda'' = 1$.

$l. \sigma - \varrho = 0,1563674$	$\sigma = 1,6601$	$\varrho = 0,2267$
$l. - \mathfrak{C} = 0,0177287$	$+ 1,4931$	$- 1,4931$
$0,1740961$	$3,1532$	$- 1,2664$
$\mathfrak{C}(\sigma - \varrho) = - 1,49313$	denom. anter.	denom. poster.

Log. $r = 9,4456318\ (-)$	$9,4456318\ (-)$
log. den. $= 0,4987515\ (+)$	$0,1025709\ (-)$
$8,9468803\ (-)$	$9,3430609\ (+)$

Ergo

radius anter. $= - 0,08848 . \alpha$;

radius poster. $= + 0,22032 . \alpha$.

2°. Semidiameter aperturae requisita $= \frac{2}{7} . \frac{r}{4} + \frac{3}{28} . x$. siue $= 0,02\ \alpha + \frac{3}{28}\ x$. quam aperturam haec lens vtique sustinere potest.

3°. Calculus pro momento confusionis:

$l. \frac{1}{PQ} = 9,0299632$	$l. \lambda'' = 0,0000000$	$l. \nu = 9,3416323$
$3 l. \mathfrak{B} = 1,1938197$	$3 l. \mathfrak{C} = 0,0531861\ (-)$	$l. C\mathfrak{C} = 9,7254725$
$7,8361435$	$9,9468139$	$9,6161598$
	$7,8361435$	$7,8361435$
	$7,7829574\ (-)$	$7,4523033$

Ergo pars prior $+ 0,00606$
poster. $- 0,00283$

Momentum confus. $= 0,00323$

 Pro

Pro lente quarta

$$1^\circ.\ \text{radius anter.} = \frac{s}{\sigma - \mathfrak{D}(\sigma-\varrho) + \tau\surd(\lambda'''-1)}$$

$$\text{poster.} = \frac{s}{\varrho + \mathfrak{D}(\sigma-\varrho) - \tau\surd(\lambda'''-1)}$$

vbi iterum sumatur $\lambda''' = 1$.

$l.\sigma-\varrho = 0,1563674$	$\sigma = 1,6601$	$\varrho = 0,2267$
$l.\mathfrak{D} = 9,8239086$	$0,9556$	$0,9556$
$l.\mathfrak{D}(\sigma-\varrho) = 9,9802760$	$0,7045$	$1,1823$
$\mathfrak{D}(\sigma-\varrho) = 0,95560$	denom. anter.	denom. poster.

log. $s = 9,0844942\ (-)$;	$9,0844942\ (-)$
log. den. $= 9,8478810$	$0,0727277$
$9,2366132\ (-)$	$9,0117665\ (-)$

radius anter. $= -0,17243\ \alpha$;
radius poster. $= -0,10273.\ \alpha$;

2°. Semidiameter aperturae requisitus $= \frac{1}{7}.\ x$. quam aperturam lens commode sustinebit, si enim minor radius lentis secundae, qui est $0,58257.\ \alpha$, sustinet aperturam x; hic radius minor, qui est $0,10273.\alpha$, commode sustinebit aperturam $\frac{1}{7}\ x$.

3°. Calculus pro momento confusionis:

$l.\frac{1}{PQk} = 9,1549019$	$l.\lambda''' = 0,0000000$	$l.\ \nu = 9,3416323$
$3l.BC = 0,3170511(-)$	$3l.\mathfrak{D} = 9,4717258$	$l.\mathfrak{D}D = 0,1249386$
$8,8378508$	$0,5282742$	$9,2166937$
	$8,8378508$	$8,8378508$
	$9,3661250$	$8,0545445$

Ergo

Ergo pars prior 0, 23234
poster. 0, 01133

Mom. confus. = 0, 24367

Pro lente quinta

1°. Quia haec lens vtrinque debet esse aeque convexa, ob eius distantiam focalem $t = -0,09762.\alpha$ erit radius vtriusque faciei $= 1,06.t = -0,10348.\alpha$ nunc vero erit $\lambda'''' = 1 + 0,60006(2\mathfrak{E}-1)^2$ at est $2\mathfrak{E}-1 = 6,5$; ergo

$\log(2\mathfrak{E}-1) = 0,8129134$; et
$\log.(2\mathfrak{E}-1)^2 = 1,6258268$
$\log. 0,60006 = 9,7781947$

$1,4040215$

adeoque $\lambda'''' = 26,352$.

2°. Semidiameter aperturae hic per hypothesin est $\frac{1}{4}t. = -0,02440.\alpha$; altera enim pars $\frac{1}{98}x$, quam haec lens facillime patitur.

3°. Calculus pro momento confusionis:

$l.\frac{1}{PQkk'} = 8,0087738$	$l.\lambda'''' = 1,4208136$	$l.\nu = 9,3416323$
$3l.BCD = 1,2201411$	$3l.\mathfrak{E} = 1,7220939$	$l.E\mathfrak{E} = 0,7087297$
6,7886327	9,6987197	8,6329026
	6,7886327	6,7886327
	6,4873524	5,4215353

Ergo pars prior 0, 00031
posterior. − 0, 00002

Momentum confus. = 0, 00029

Pro lente sexta

1°. Quia per hypothesin haec lens vtrinque debet esse aeque conuexa, ob eius distantiam focalem
$u = -0,07099.\alpha$, erit
radius vtriusque faciei $= 1,06.u = -0,07525.\alpha$
tum vero erit $\lambda'''''= 1,60006$.

2°. Semidiameter aperturae $= \frac{1}{4}u = -0,01775.\alpha$

3°. Calculus pro momento confusionis:

$l.\frac{1}{PQkk'T}$	$= 8,3098038$	$l.\lambda''''''$	$0,2041363$
$3.l.BCDE$	$= 1,6242363$		$6,6855675$
	$6,6855675$		$6,8897038$

Ergo momentum confus. = 0, 00077.

His inuentis, colligantur omnia momenta confusionis in vnam summam, quae erit 3, 17227. Nunc autem duo casus sunt considerandi, prout primam lentem concauam vel ex vitro coronario vel ex chrystallino parare voluerimus, quos seorsim euolui oportet.

I. Pro prima lente concaua ex vitro coronario paranda.

Pro hac ergo lente erit

$\lambda = 3,17227$ vnde $\lambda - 1 = 2,17227$;

hinc-

hincque fiat sequens calculus.

$\text{Log.}(\lambda-1) = 0,3369138$	
$\text{Log.}\sqrt{(\lambda-1)} = 0,1684569$	ergo
$\text{Log.}\,\tau = 9,9662356$	$\tau\sqrt{(\lambda-1)} = 1,3636$
$0,1346925$	

Nunc cum sit pro hac lente

rad. anter. $= \frac{\alpha}{\sigma-\tau\sqrt{\lambda-1}}$; rad. poster. $= \frac{\alpha}{\varrho+\tau\sqrt{\lambda-1}}$

calculus ita se habebit:

$$\sigma = 1,6601; \quad \varrho = 0,2267$$
$$\tau\sqrt{(\lambda-1)} = 1,3636 \quad\quad 1,3636$$
$$0,2965 \quad\quad 1,5903$$

l. $0,2965 = 9,4720247$	l. $1,5903 = 0,2014791$
compl. $= 0,5279753$	compl. $= 9,7985208$

sicque prodit

radius anter. $= 3,37268.\alpha$; poster. $= 0,62881.\alpha$

semidiametro aperturae existente $x = \frac{m}{50}$ dig. $= 1$ dig.

II. Pro prima lente concaua ex vitro chrystallino paranda.

Pro hac igitur lente erit $\lambda = \frac{5875}{8724}.3,17227$ seu $\lambda = 3,59080$; et quia pro vitro chrystallino est

$$\varrho = 0,1414; \ \sigma = 1,5827; \ \tau = 0,8775;$$

calculus ita se habebit.

Log.

Log. $(\lambda-1) = 0,4134339$	
Log. $\sqrt{(\lambda-1)} = 0,2067169$	ergo
Log. $\tau = 9,9432471$	$\tau\sqrt{(\lambda-1)} = 1,41242$
$0,1499640$	

$\sigma = 1,5827$;	$\varrho = 0,1414$
subtr. $1,4124$	add. $1,4124$
$0,1703$	$1,5538$
log. $9,2312146$	log. $0,1913951$
compl. $0,7687853$	compl. $9,8086048$

sicque prodit

rad. anter. $= 5,87199.\alpha$; rad. post. $= 0,64358.\alpha$ semidiametro aperturae existente $x = \frac{m}{50} = 1$ dig.

VI. Quia binae priores lentes coniunctim lentem obiectiuam constituunt, cuius semidiameter aperturae $= 1$ dig.; statuatur earum minimus radius, qui est $-0,58257.\alpha > 4$ dig. hincque concludetur, sumi debere $-\alpha > \frac{4}{0,58257}$ dig. hoc est $-\alpha > 7$ dig. vel saltim non minus, ita, vt, si optimus successus sperari posset, accipere liceret $-\alpha = 7$ dig. Sin autem aberratio quaedam sit pertimescenda, tantum opus erit mensuram vnius digiti augere. Commoditatis autem gratia sumamus $\alpha = -10$ dig.; vnde sequens prodit.

Con-

Constructio huius telescopii determinata, pro multiplicatione $m = 49$.

I. Pro lente obiectiua,

quatenus ex vitro coronario paratur.

rad. fac. $\begin{cases} \text{anter.} = -33,73 \text{ dig.} \\ \text{poster.} = -6,29 \text{ dig.} \end{cases}$ Crown Glass.

(I) Pro lente obiectiua,

quatenus ex vitro chrystallino paratur.

rad. fac. $\begin{cases} \text{anter.} = -58,72 \text{ dig.} \\ \text{poster.} = -6,43 \text{ dig.} \end{cases}$ Flint Glass.

cuius distantia focalis pro vtroque casu $= -10$ dig.
semidiameter aperturae $= 1$ dig.
Interuallum ad secundam $= 0,2 = \frac{1}{5}$ dig.

II. Pro lente secunda

rad. fac. $\begin{cases} \text{anter.} = 11,45 \text{ dig.} \\ \text{poster.} = 5,82 \text{ dig.} \end{cases}$ Crown Glass.

cuius distantia focalis $= 7,28$ dig.
semidiameter aperturae $= 1$ dig.
Interuallum ad tertiam $= 22,82$ dig.

III. Pro lente tertia

rad. fac. $\begin{cases} \text{anter.} = 0,884 \text{ dig.} \\ \text{poster.} = -2,20 \text{ dig.} \end{cases}$ Crown Glass.

cuius distantia focalis $= 2,79$. dig.
semidiameter aperturae $= 0,3$ dig.
Interuallum ad quartam $= 3,19$. dig.

IV. Pro lente quarta

rad. fac. $\left\{ \begin{array}{l} \text{anter.} = 1,72 \text{ dig.} \\ \text{poster.} = 1,03 \text{ dig.} \end{array} \right\}$ Crown Glaſſ.

cuius diſtantia focalis 1, 21 dig.
ſemidiameter aperturae $= \frac{1}{7}$ dig.
Interuallum ad quintam $= 3, 90$ dig.

V. Pro lente quinta

radius vtriusque faciei $= 1, 03$ dig. Crown Glaſſ.
cuius diſtantia focalis eſt 0, 97 dig.
ſemidiameter aperturae $= \frac{1}{4}$ dig.
Interuallum ad ſextam $= 0, 35$ dig.

VI. Pro lente ſexta

radius faciei vtriusque $= 0, 75$ dig. Crown Glaſſ.
cuius diſtantia focalis $= 0, 70$ dig.
ſemidiameter aperturae $= 0, 18 = \frac{1}{6}$ dig.
Diſtantia ad oculum vsque $= 0, 40$ dig.

Huius igitur teleſcopii longitudo tota fiet
$= 30, 87$ dig. $= 2\frac{1}{2}$ ped.
et ſemidiameter campi apparentis $= 30\frac{2}{3}$ min.

APPEN-