

CYCLOPAEDIA OF TELESCOPE MAKERS

Part 7 (T-Z)

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INTRODUCTION

When we commenced the *Cyclopaedia* in 1991, the task of preparing even the working list of names of telescope makers scanning four centuries seemed an arduous and almost endless one. Our compilation of names associated with the private construction and commercial manufacture of optical mirrors and lenses, included not only the optical and scientific instrument trade but also a very large number of 17C-19C natural philosophers and astronomers, many of whom would be termed dillitantes or amateur scientists today. The optical and mechanical quality of instruments was not the determining factor. Clearly, the quality of many small terrestrial and marine telescopes differed from that in large astronomical instruments, or in the high-precision professional measuring instruments, for example, geodetic theodolites, astronomical transit telescopes etc. However, it seemed particularly appropriate to include names of all those involved in the early development of the refracting and reflecting telescope, both makers and designers, and to extend this to those amateur and professional scientists who either encouraged their development or owned such instruments. This freedom allows, or actually necessitates, frequent cross-referencing between name entries, from amateur astronomers who were spending the profits of breweries, from men with a single, large telescope or small, but historically important telescope; this broadened our search from those interested in telescopes, microscopes and scientific research, to rich patrons of science, to institutions of engineers, opticians and craftsmen, and to both lesser and greater commercial enterprises.

Apart from the final list of names we have accumulated more than 400 illustrations of optical instruments which demonstrate the diversity and ingenious development of the telescope in many different countries over the four centuries. We anticipate that more names will be forthcoming, especially from historians outside the United Kingdom and Ireland. An appendix of additional names is given at the end of the *Cyclopaedia*. In the case of the astronomical telescope there was a race to construct larger and larger professional instruments in which the technical demands, both in optical performance and the engineering, were highly expensive and beyond the capabilities of the amateur or the smaller company. It should be emphasised, however, that the amateur telescope-maker played an important role in the development of the instrument through many innovative ideas.

Early professional astronomers required high mechanical precision but had to be satisfied with relatively small-aperture telescopes. Even though well-within the technical capabilities of opticians and engineers of the 18th century, an achromatic objective larger than 7 inches (180 mm) was impossible until large quantities of flint glass of high quality could be produced. Even so, remarkable innovations took place, e.g. in the heliometer (Fig. 309) with its split objective lens. It is remarkable that the accurate equatorial mountings were still set only on wooden stands. We should also remember that the tubes for large professional, early 19th century refractors were also made largely in wood to cut down on the weight of the mammoth instruments. The mid-19th century, 72-inch Rosse reflecting telescope at Birr Castle possessed a wooden tube strapped like a beer barrel with iron rings. Iron castings for the bases of telescope mounts, and for sectional tubes too, however, soon became available even in quite small instruments (Fig. 310). Nevertheless, many disastrous examples can be seen throughout the *Cyclopaedia* where sheer weight would have excluded any kind of optical or mechanical stability. The pinnacle of awkwardness, though, probably occurred in the mid-17th century with the aerial telescopes! Whilst the early 19th century, German equatorial mounting was extremely ingenious and successful, it did involve doubling the weight carried by the axes and mounting due to the necessity of counterweights. Unnecessarily long declination axes are a common fault, and vibrations amounting to resonances are present in many instruments. See very poor examples in Fig. 311, *Blain*, and Fig. 312, top. With regard to weight, the English double-yoke mounting won four-fold. Many additional ingenious mountings will be seen throughout the *Cyclopaedia*. See especially the telescopes constructed by Zeiss in the present issue. The contribution to the excellence of late-Victorian astronomical observations from such mirror-makers as Calver (see Fig. 313) can never be over emphasised. Today, methods and designs have changed radically, and the commercial explosion seen in telescopes for the amateur astronomer, particularly, poses a daunting challenge when selecting an instrument. It is hoped that the illustrations from the present *Cyclopaedia* go some way towards explaining the wonders of the telescope and recording some of the makers and their instruments on the historical pathway to the present New Technology Telescopes.

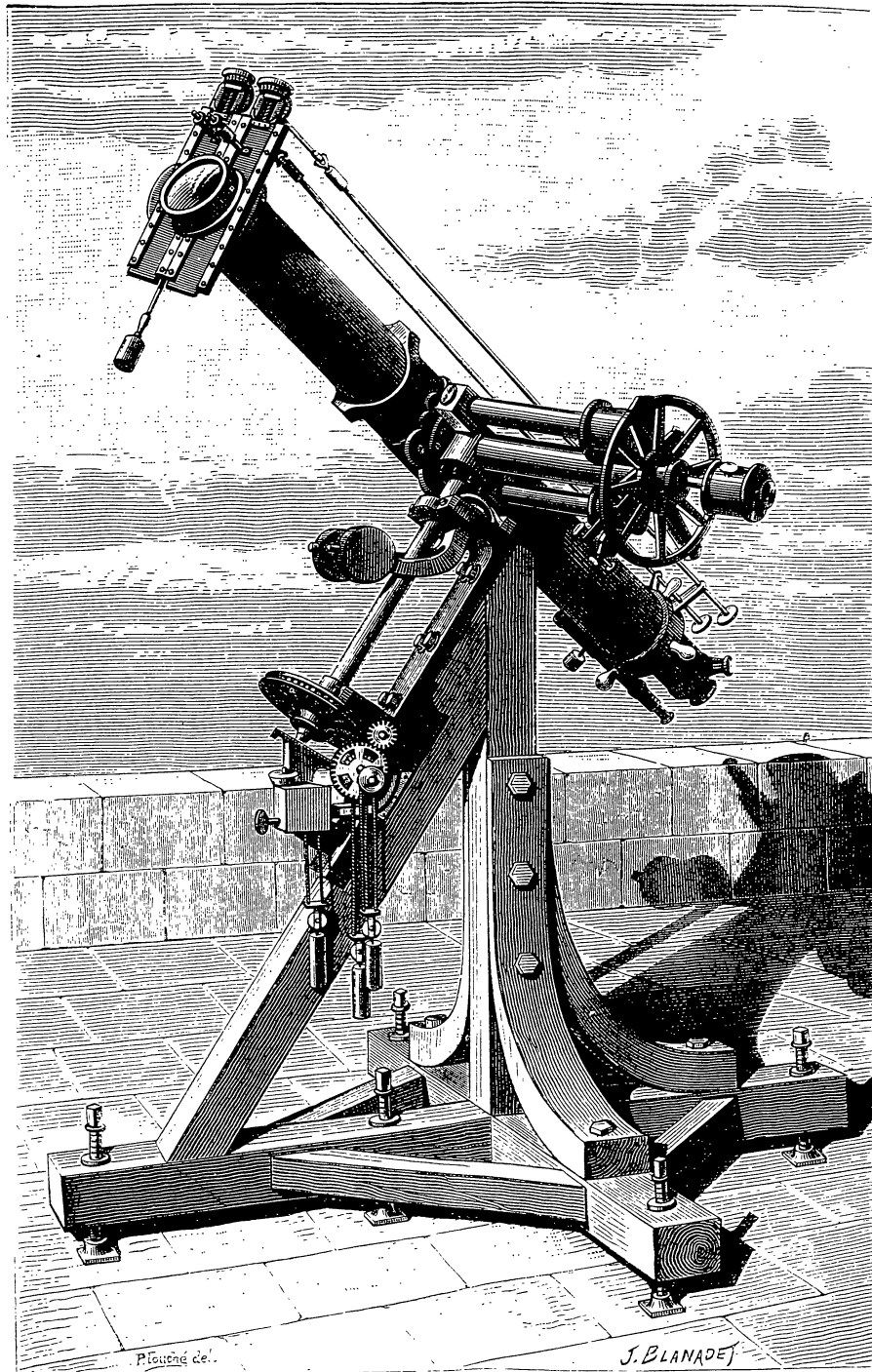


Fig. 309. The REPSOLD heliometer used by the famous German astronomer, F. W. Bessel. See *Cyclopaedia of Telescope Makers*, Part 5, Fig. 243. c.f. REPSOLD and MERZ/REPSOLD heliometers in Part 1, Fig. 48; Part 3, Figs. 157, 158 and 160.

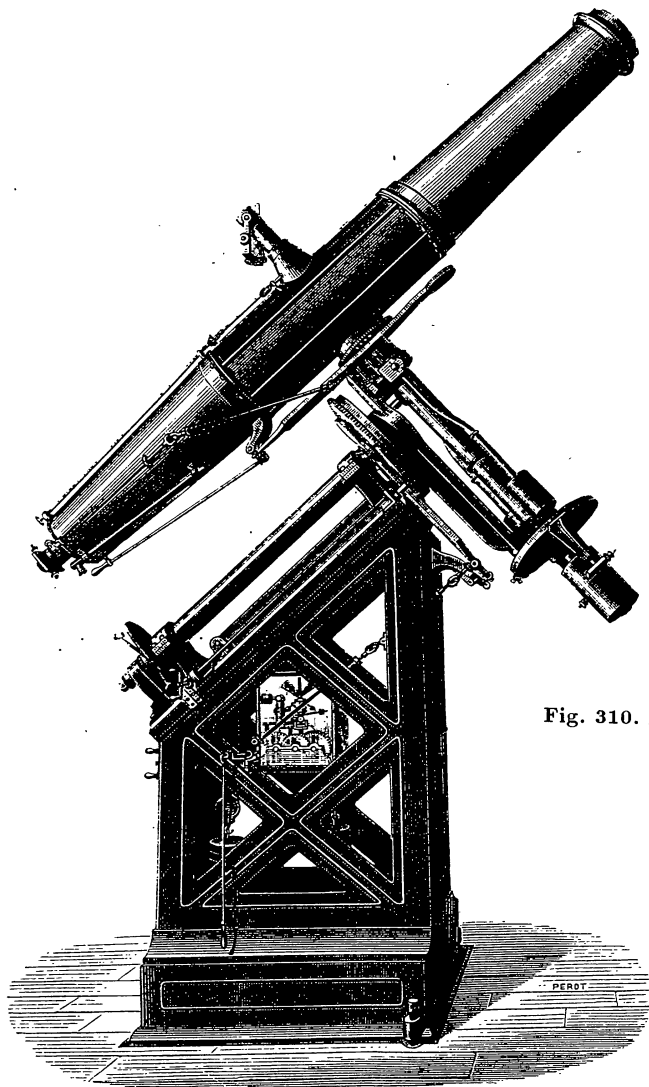
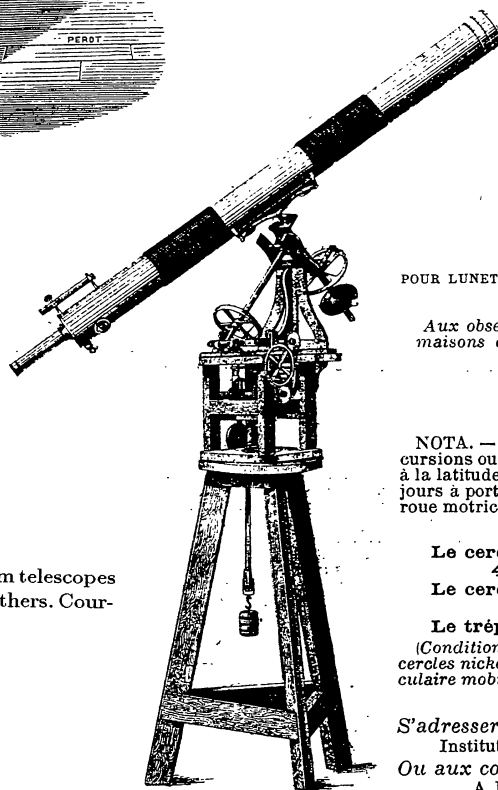


Fig. 310. An equatorial refracting telescope (maker unknown to the author).

Fig. 311. An advertisement for 75mm, 95mm and 108mm telescopes designed by BLAIN and constructed by LUSSAULT brothers. Courtesy *Revue d'Astronomie* 1885.



« L'AMATEUR »
MODÈLE BLAIN-LUSSAULT (POITIERS.)

MÉDAILLE D'ARGENT — PARIS, PALAIS
DE L'INDUSTRIE, NOVEMBRE 1885.

NOUVEAU PIED D'ÉQUATORIAL
BREVETÉ S.G.D.G.

Portatif, à latitude variable,
avec mouvement d'horlogerie facultatif
POUR LUNETTES ASTRONOMIQUES DE 75^{mm}, 95^{mm}, 108^{mm}
DESTINÉ

Aux observatoires populaires, facultés, lycées,
maisons d'éducation, cabinets d'amateurs, etc.

Prix : 475 francs.

NOTA. — Cette monture équatoriale portée en excursions ou en villégiature se règle instantanément à la latitude du lieu, la vis tangente demeurant toujours à portée d'engrenage du cercle horaire et de la roue motrice du mouvement d'horlogerie.

Le cercle horaire (0^h,15) est divisé de
4 en 4 minutes de temps.

Le cercle de déclinaison (0^m,19) porte
720 divisions.

Le trépied est armé de vis calantes.

(Conditions spéciales pour montures avec arbres,
cercles nickelés, et trépied de fonte à plateforme, circulaire mobile, pour rectification de la méridienne.)

S'adresser à l'inventeur, M. l'abbé Blain,
Institution des Sourds-Muets de Poitiers.

Ou aux constructeurs, MM. Lussault frères,
A. Marçay, par Vivonne (Vienne).

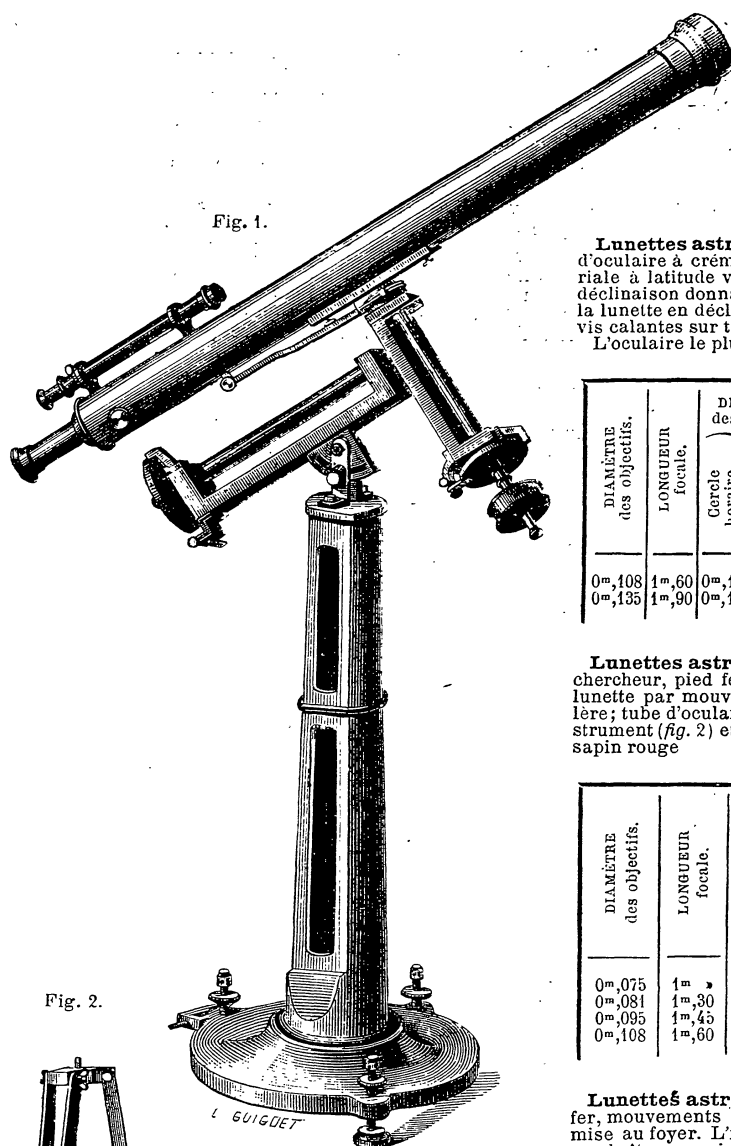


Fig. 1.

A. BARDOU

CONSTRUCTEUR D'INSTRUMENTS D'OPTIQUE

FOURNISSEUR DU MINISTÈRE DE LA GUERRE

Circular ministérielle du 29 Juillet 1872.

55, rue de Chabrol, à Paris.

Lunettes astronomiques, corps cuivre avec chercheur, tube d'oculaire à crémaillère pour la mise au foyer. Monture équatoriale à latitude variable de 0° à 90°, cercle horaire et cercle de déclinaison donnant la minute par les verniers; pince pour fixer la lunette en déclinaison. Pied en fonte de fer reposant par trois vis calantes sur trois crapaudines (fig. 1).

L'oculaire le plus faible est muni d'un réticule.

DIAMÈTRE des objectifs.	LONGUEUR focale.	DIAMÈTRE des cercles.		OCULAIRES.				PRIX.
		Cercle horaire.	Cercle de déclinaison.	Terres- tres.		Célestes.		
				Nombre.	Grossis- sements.	Nombre.	Grossissements.	
0 ^m ,108	1 ^m ,60	0 ^m ,15	0 ^m ,18	1	80	3	100, 160 et 270	1450
0 ^m ,135	1 ^m ,90	0 ^m ,15	0 ^m ,18	1	90	4	100, 150, 200 et 450	2500

Lunettes astronomiques et terrestres, corps cuivre avec chercheur, pied fer et soutien de stabilité servant à diriger la lunette par mouvement vertical lent au moyen d'une crémaillère; tube d'oculaire à crémaillère pour la mise au foyer. L'instrument (fig. 2) et ses accessoires sont calés dans une boîte en sapin rouge.

DIAMÈTRE des objectifs.	LONGUEUR focale.	OCULAIRES.				prix.	Augmentation pour pied de rechange en chêne permettant d'observer debout.
		Terres- tres.		Célestes.			
		Nombre.	Grossis- sements.	Nombre.	Grossissements.		
0 ^m ,075	1 ^m ,30	1	50	2	80 et 150	275	25
0 ^m ,081	1 ^m ,30	1	55	3	75, 120 et 200	360	35
0 ^m ,095	1 ^m ,45	1	60	3	85, 130 et 240	465	35
0 ^m ,108	1 ^m ,60	1	80	3	100, 160 et 270	650	35

Lunettes astronomiques et terrestres, corps cuivre, pied fer, mouvements prompts, tube d'oculaire à crémaillère pour la mise au foyer. L'instrument et ses accessoires sont calés dans une boîte en sapin rouge.

DIAMÈTRE des objectifs.	LONGUEUR focale.	OCULAIRES.				PRIX.		Augmentation pour pied de rechange en chêne permettant d'observer debout.
		Terres- tres.		Célestes.		Sans chercheur.	Avec chercheur.	
		Nombre.	Grossis- sements.	Nombre.	Grossis- sements.			
0 ^m ,057	0 ^m ,85	1	35	1	90	100	135	25
0 ^m ,061	0 ^m ,90	1	40	1	100	140	175	25
0 ^m ,075	1 ^m ,30	1	50	2	80 et 150	190	225	25

On peut ajouter et l'on ajoute généralement à ces divers modèles :

Monture à prisme pour observer facilement au zénith. Prix..... 35 fr.
Ecran pour examiner les taches du Soleil. Prix..... 15 fr.

Fig. 312. Advertisement for 108mm and 135mm (4.25-inch and 5.3-inch) astronomical refractors, and 57mm to 108mm (2.25-inch and 4.25-inch) refractors from BARDOU Paris. This firm was also an agent for well-known instrument makers such as WATSON and ZEISS. Courtesy of *Revue d'Astronomie* 1885.

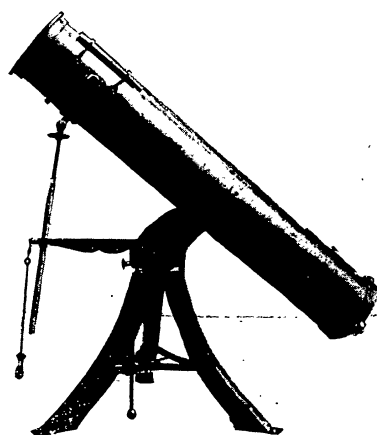
TÉLESCOPES

A MONTURE SIMPLE OU ÉQUATORIALE
pour AMATEURS et OBSERVATOIRES

G. CALVER

Membre de la Société Astronomique de France

THE MANSE, WALPOLE, HALESWORTH, ANGLETERRE



TÉLESCOPES modèle de la figure ci-contre, construits pour plusieurs des membres de la Société Astronomique de France; diamètre du miroir 12 1/2 pouces (32 cent.), foyer 2^m,35, mouvements lents verticaux et horizontaux; grande stabilité, poids aussi réduit que possible.

Ces instruments sont de la meilleure qualité optique (voir les observations de Saturne, Bulletin de Mars). La disposition de la monture permet de faire avec toute facilité les observations de l'horizon au zénith (*les coupoles sont inutiles*).

Les Prix sont établis ainsi qu'il suit :

6 ½	pouces,	foyer	6	pieds,	3	oculaires....	925 fr.
8 ½	—	—	6	—	—	1.175 fr.
10	—	—	7	—	—	1.700 fr.
12 ½	—	—	7	—	—	2.150 fr.

On traite de gré à gré pour les dimensions supérieures.

Montés équatorialement.....	2.250 fr. à 5.000 fr.
Avec mouvements d'horlogerie.....	3.860 fr. à 7.700 fr.

Fig. 313. Advertisement for CALVER 6.5-, 8.5-, 10- and 12.5-inch reflectors, either altazimuth or equatorial mountings, with or without lockdrive (from latter half of 19C). This range of apertures in high-quality mirrors rivalled the refractors of the same price, and were widely purchased by amateur astronomers. Both CALVER and BROWNING in England kept alive the interest in the relatively powerful and achromatic) parabolic reflecting telescopes.

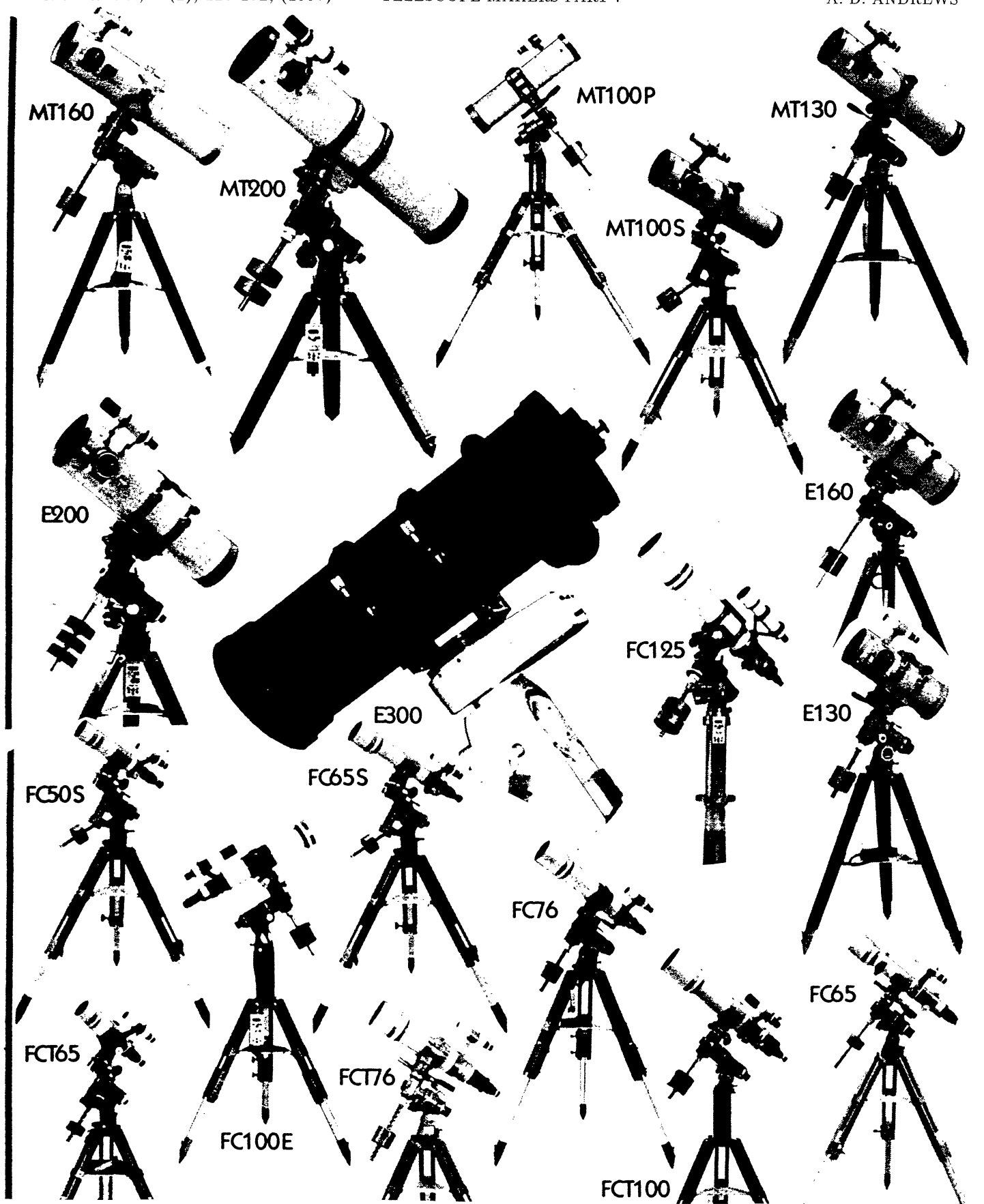


Fig. 314. Examples of late 20C instruments from the firm of TAKAHASHI ranging from 4-inch to 8-inch Newtonian reflectors (MT100, 130, 160 and 200 series, and E130, 160, 200 and 300 series), and from 2-inch to 4-inch short-focus refractors (FC and FCT 50S, 65, 65S, 76 and 100 series, and the FC100E) are shown.

T

TAGLIABUE Angelo and Anthoni - early 19C, Italian barometer makers, recorded at *11 Brook Street, Holborn, London* (1829-31).¹

TAGLIABUE Caesar - 1767-1844, born near Como, Italy, Italian instrument maker, optician, in *London*. Known especially as a maker of barometers and thermometers, although a few telescopes by him and his family exist, TAGLIABUE is recorded at *294 Holborn* (1795-1800), *26 Holborn* (1807-09), *11 Brook Street, Holborn* (1816-?), *28 Cross St, Hatton Garden* (1822-29), *23 Hatton Garden* (1829-1839). Partnerships are recorded (1801-05, 1806-14). TAGLIABUE & Co is also found at *26 High Holborn* (1806-14).²

TAGLIABUE John (II) - b.1801/02, outside British Isles, barometer and thermometer maker, recorded at *44 Leather Lane, Holborn, London* (1826-28), *38 Eyre Street Hill, Hatton Garden* (1828-34), *23 Hatton Garden* (1829-30), *25 Eyre Street Hill* (1833-38), *11 Brook Street* (1839-46).³

TAKAHASHI - present day, Japanese maker, producing a wide range of telescopes.⁴

TASCO - present day maker, mostly beginner's telescopes.

TAYLOR H. Dennis - English optician with COOKE and Sons, and later with take-over firm of GRUBB PARSONS. He was an important figure in English lens designing, well known for a photo-visual triplet, three separate achromatic doublets, and later, three spaced single lenses, used in GRUBB's 12.5-inch SHEEPSHANKS polar coude telescope at Cambridge University Observatory. TAYLOR was a collaborator with BRASHEAR in the design of astrographic lenses, and can claim some pride in being associated, therefore, with the FRANKLIN - ADAMS southern star charts which used a 10inch f/4.5 lens developed from these designs.⁵

TAYLOR LEE - 20C, maker/retailer, *Phoenix Works, Bailey Street, Pendleton, Salford*.⁶

TECTRON - U.S. present day, recorded at *2111 Whitfield Park Avenue, Sarasota, Florida*.

TELE-VUE OPTICS - U.S. present day, recorded at *20 Dexter Plaza, Pearl River, New York*, and *100 Route 59, Suffern, New York*.

TELOPTICS - present day.

TELRAD - present day.

TEMME - after 1700, optician at *Kassel*, maker of microscope optics.⁷

THOMPSON J.V - see COX, HARGREAVES, THOMPSON.

THOMSON Elihu - English amateur, recorded as purchasing a rare CLARK photographic Petzval doublet. He possibly devised a method of mirror grinding principles for two equal optical blanks (1878).⁸

THORNTHWAITE William Henry - fl.1845-78. See HORNE partnership. He is recorded at *123 Newgate St. London* (1846) and *416 Strand, London* (1878). He wrote a "History of the Reflecting Telescope" (6th edition 1895).⁹

THOUSAND OAKS OPTICAL - U.S. present day, recorded at *3228 Rikkard Drive, Thousand Oaks, California* and *Farmington, Michigan*. They often specialise (producing filters, Dobsonian telescopes etc.), and produced the 'Starsplitter'.

TILLOCH Alexander - English editor (see AYSCOUGH) 1759-1805.

TOEPFER - 17C, optician known to have devised a method for testing objectives (examining e.g. striae in the glass).¹⁰

TOLLES Robert B - 19C, optician, well known as designer of a solid eyepiece, c.1880. He is recorded at *Canastota, New York* and was in charge of the *Boston Optical Works, Mass* (1867-83).¹¹

TOMKINS H.G - 20C, d.1934, English astronomer, constructed a 24-inch Cassegrain reflector.¹²

TOMPSON Anthony - fl. mid-1660s, mathematical instrument maker, *Hosier Lane, Smithfield*.¹³

¹See Project SIMON, *British Scientific Instruments 1550-1850* by G.Clifton (under direction of G. L'E. Turner).

²See SIMON.

³See SIMON. Probably took ZAMBRA as partner. Other well known Italian makers in London were CASELLA and NEGRETTE (in partnership with ZAMBRA).

⁴See BG 22, a 2-element (Ross) corrector and parabolic mirror.

⁵See Bell 89, 125, and MNRAS 51, 77; apochromat 54, 67; 54, 328. Also see King 302. See the anastigmatic triplet (1893) and RUDOLF.

⁶See Sidgewick 530.

⁷See Turner Mic 91.

⁸See D.Warner 109, and King 424.

⁹See SIMON.

¹⁰D and C 689.

¹¹See Bell 85, 141.

¹²See King 417

¹³See Daumas 95. Alternative spelling THOMPSON.

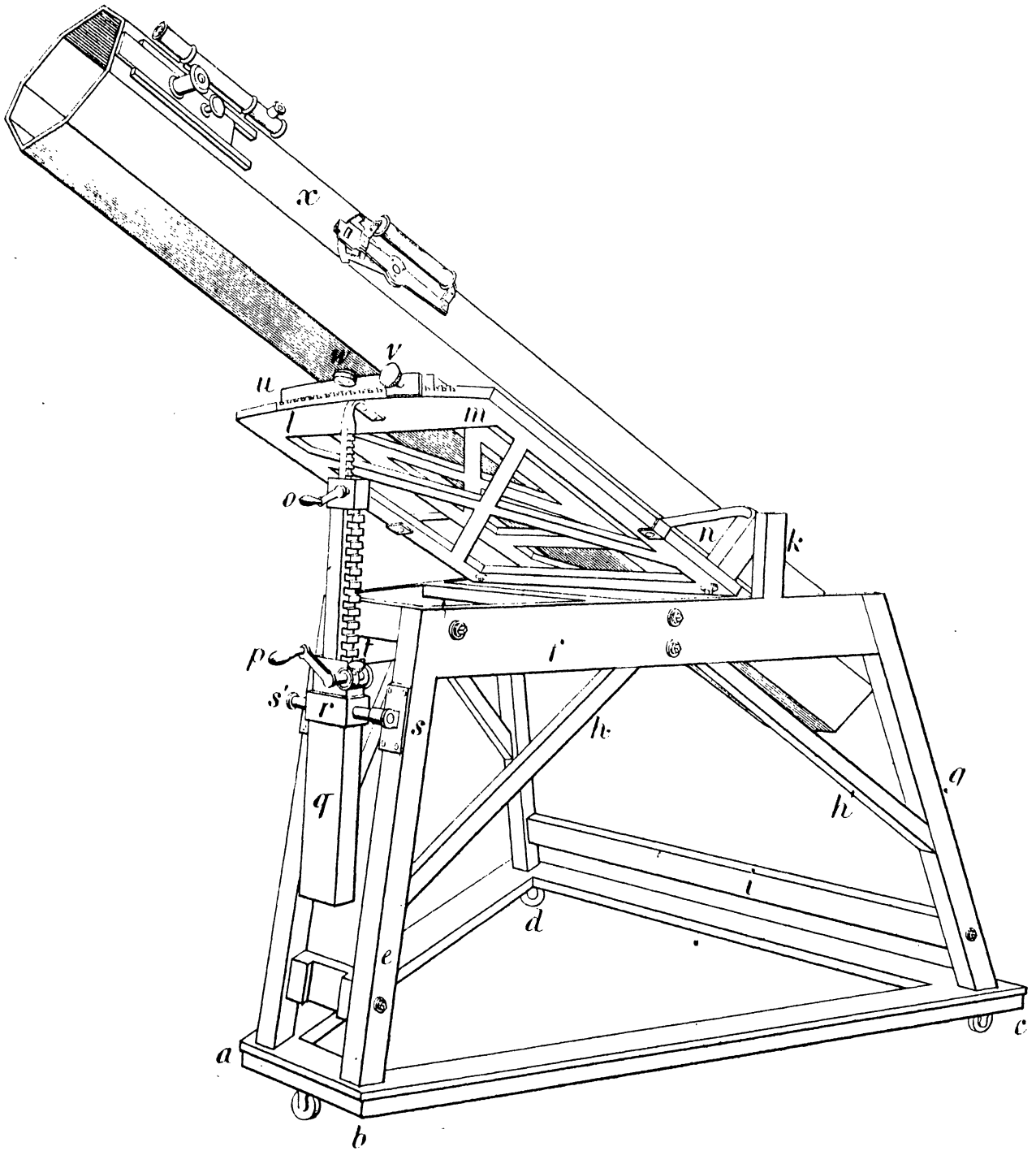


Fig. 315. An altazimuth stand for a Newtonian reflector by TULLEY (from Pearson 1829). The mounting allows limited slewing in altitude and azimuth (c.f. HADLEY's mount in Part 2, Fig.67, and HERSCHEL's in Part 1, Fig.14 and Part 2, Fig.81, and SCHRÖTER's in Part 5, Fig.242).

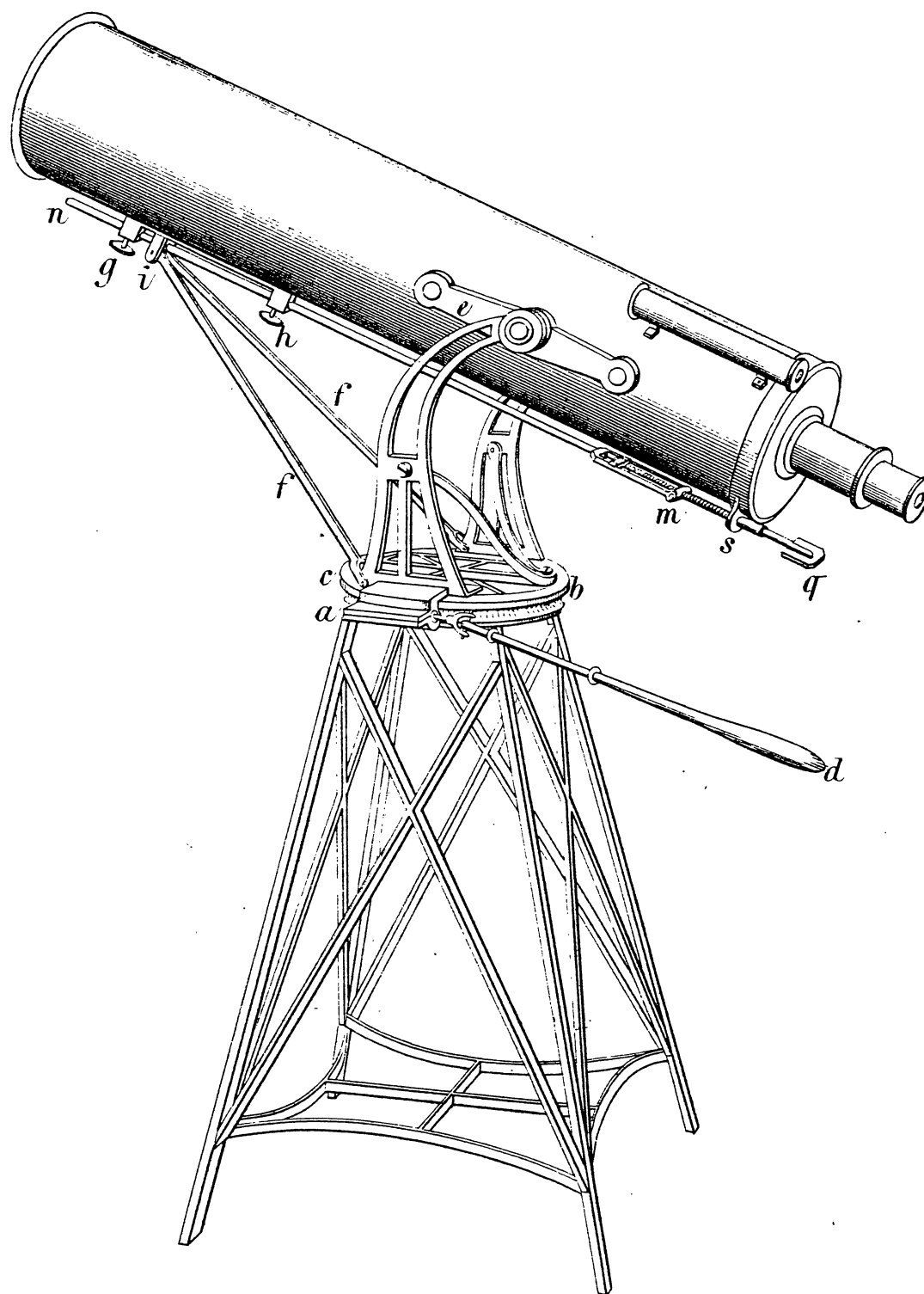


Fig. 316. The TULLY mounting for the popular Gregorian reflector (from Pearson 1829). See Part 2, Figs.53b and 53c.

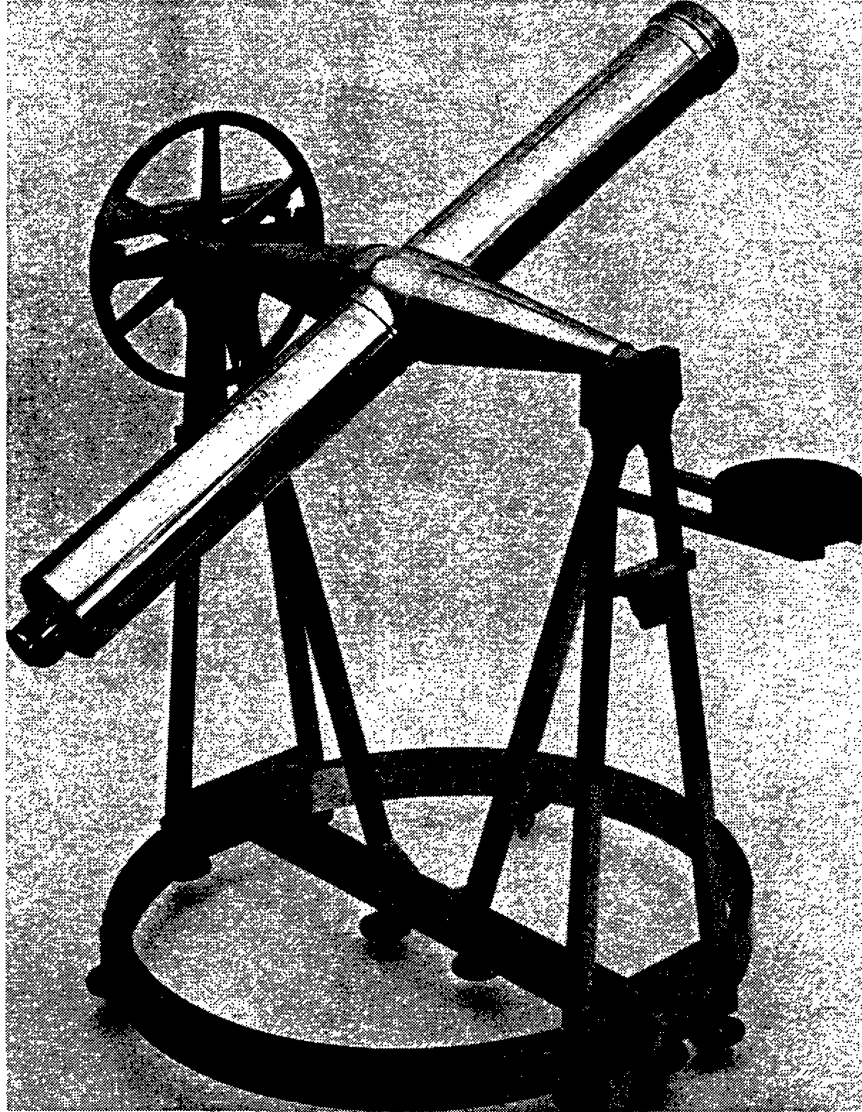


Fig. 317. A typical early TROUGHTON transit instrument (Courtesy Moscow Historical Museum).

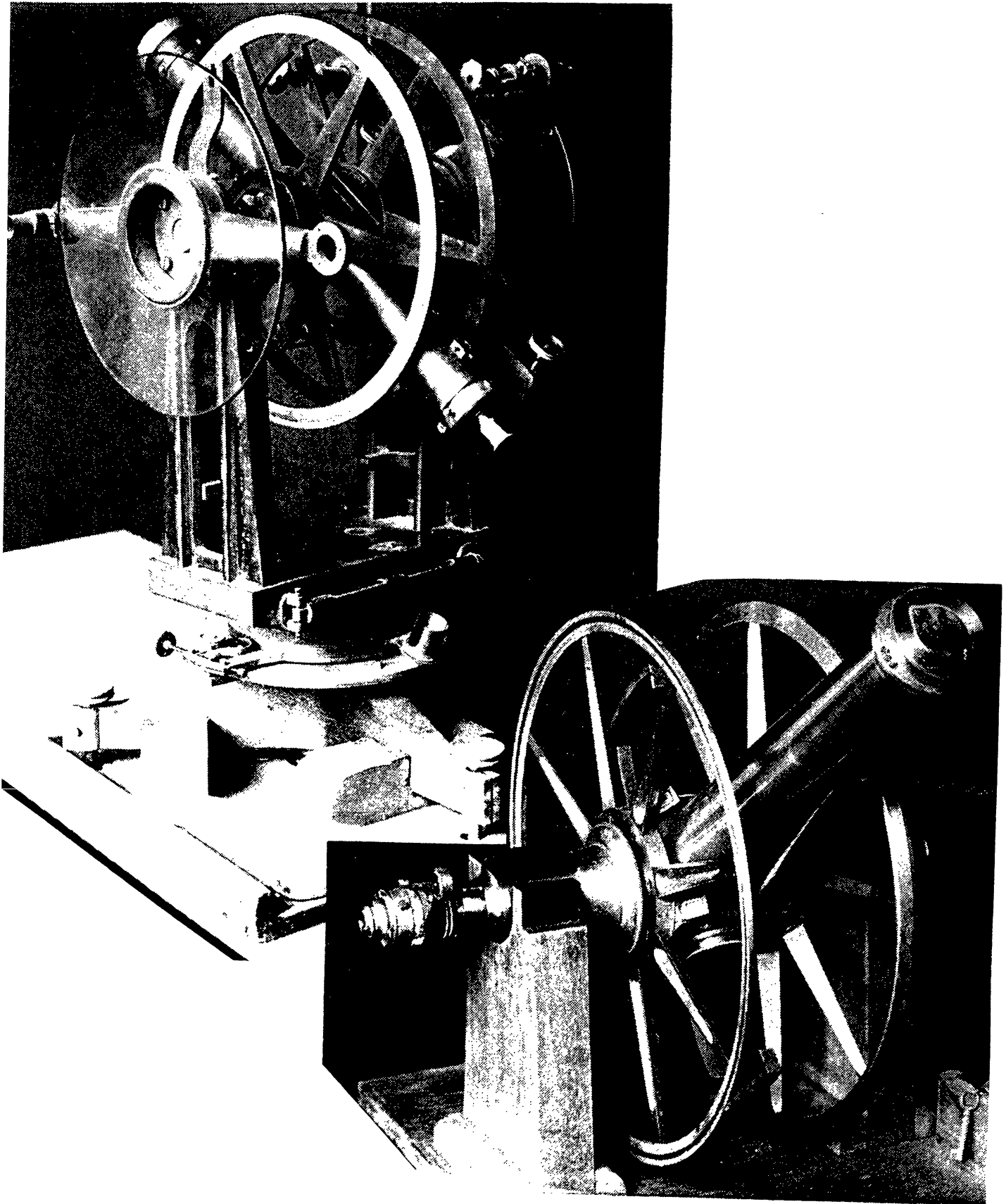


Fig. 318. Two TROUGHTON circles used in land surveys in New Zealand.

ALTITUDE AND AZIMUTH CIRCLE BY TROUGHTON.

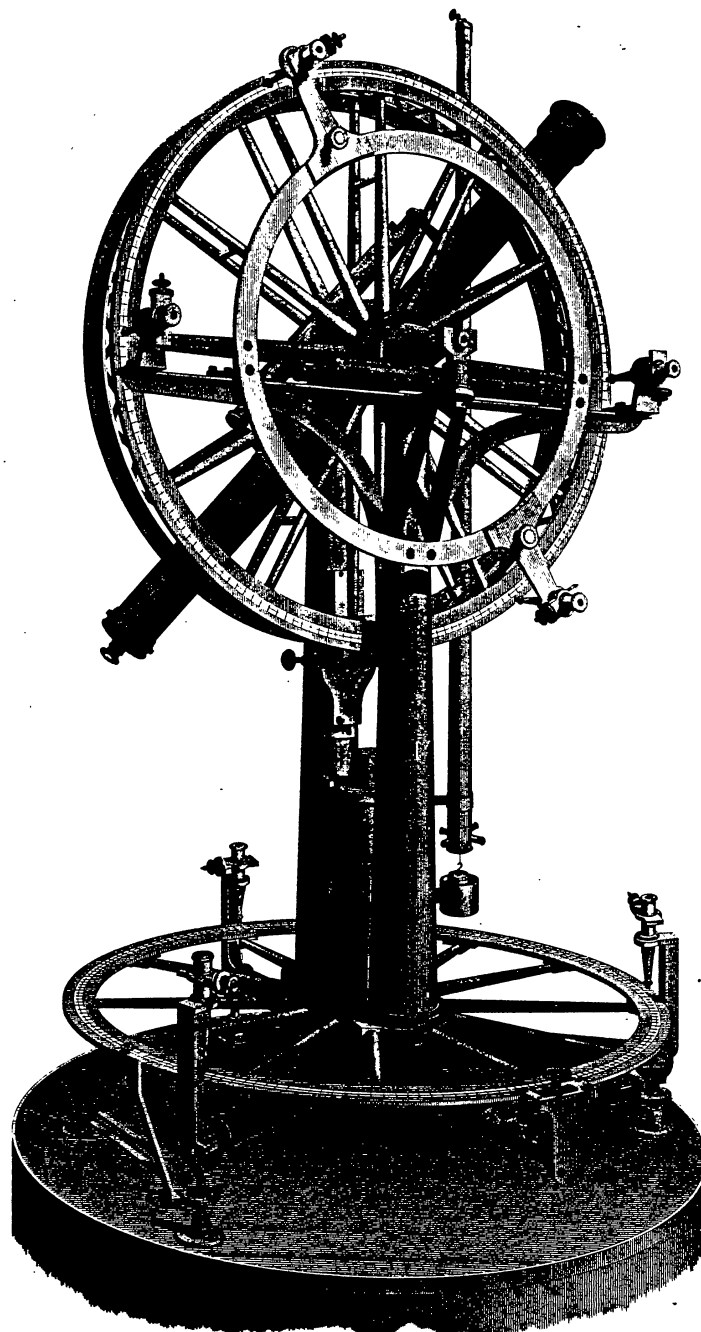
*J. Farcy, del.**London, Published for the Author Nov. 7th 1828.**E. Turrell, sc.*

Fig. 319. Altitude and Azimuth circle by TROUGHTON (*The Coimbra* shown in Pearson 1829). See also Thomas JONES' instrument in Part 2, Fig. 110.

TRANSIT CIRCLE BY TROUGHTON.

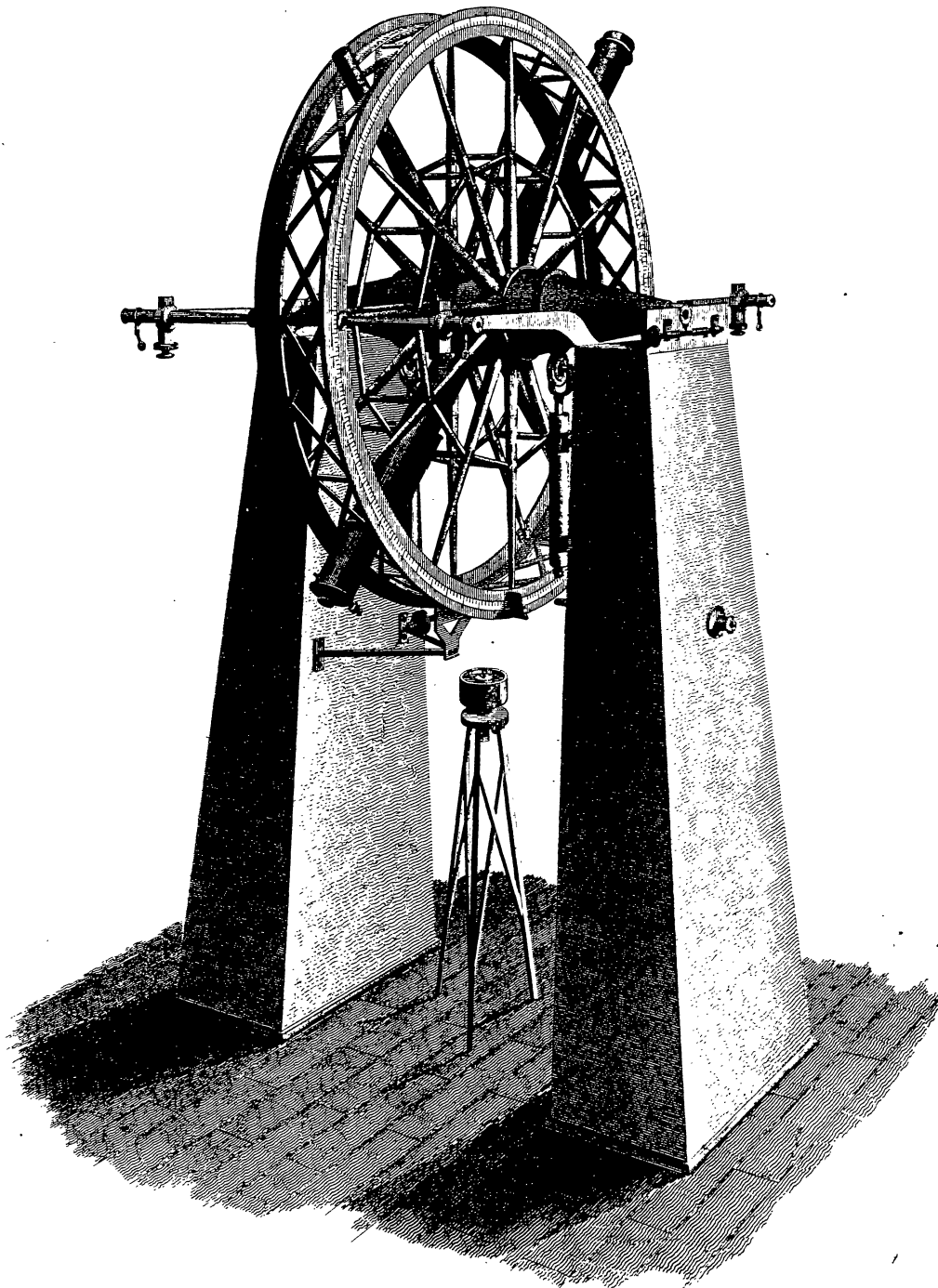
*J. Farey. del.**London. Published for the Author. Nov. 7. 1828.**E. Turrell*

Fig. 320. A transit circle by TROUGHTON (from Pearson 1829). This utilises the full-circle and pairs of micrometer eyepieces (c.f. RAMSDEN's in Part 4, Fig.204).

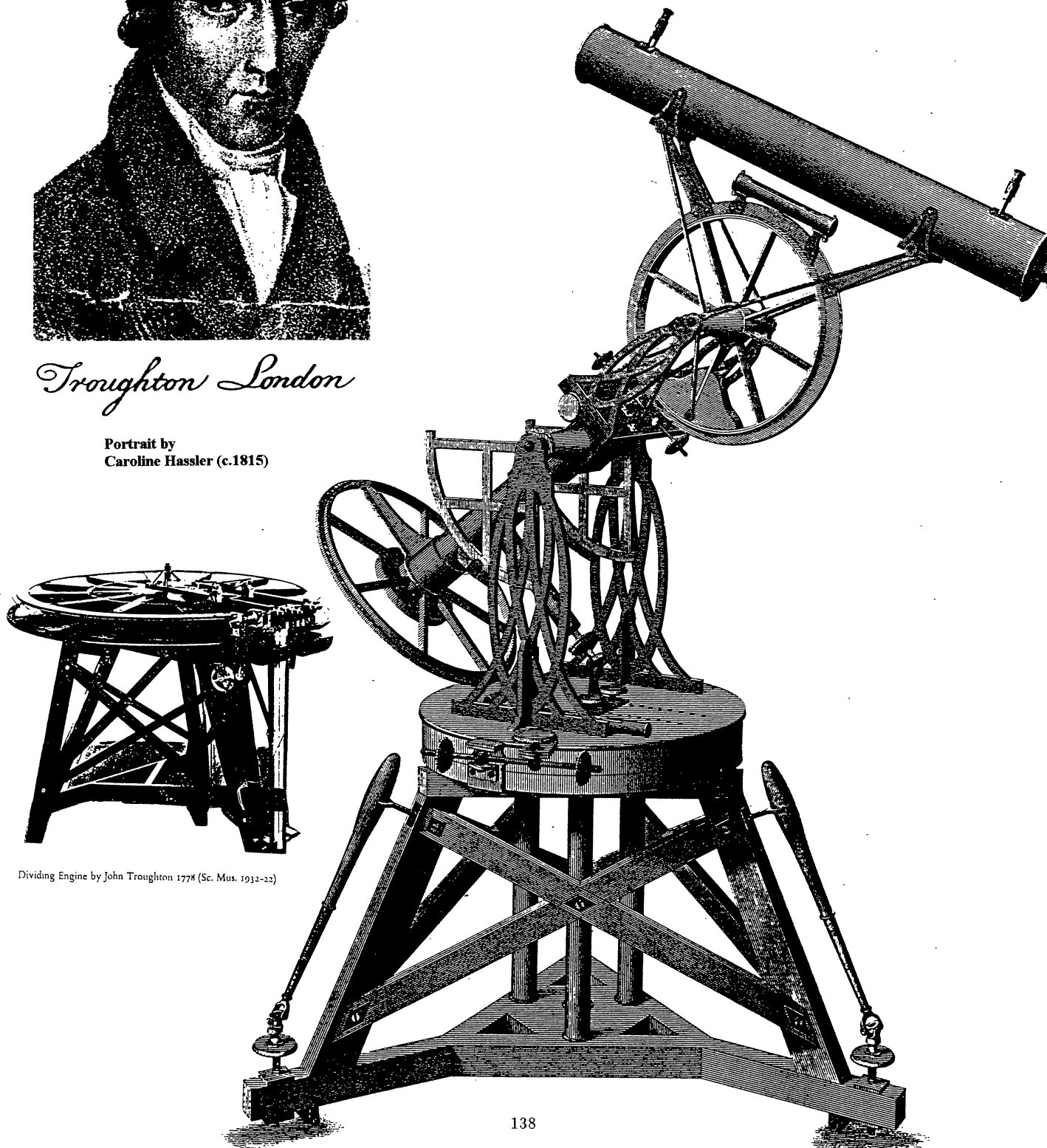
Edward TROUGHTON.



Troughton London

Portrait by
Caroline Hassler (c.1815)

Fig. 321. An elegant equatorial instrument by TROUGHTON (from Pearson 1829). See other variations by SHORT, ADAMS, RAMSDEN, DOLLOND, NAIRNE and BLUNT, in Part 3, Figs.166 to 171.



Dividing Engine by John Troughton 1778 (Sc. Mus. 1932-22)

Fig. 322. (a) The machine for graduating circles used by SIMMS, presumably similar to that used by TROUGHTON (c.f. RAMSDEN's earlier machine, in Part 4, Figs.205 to 208).

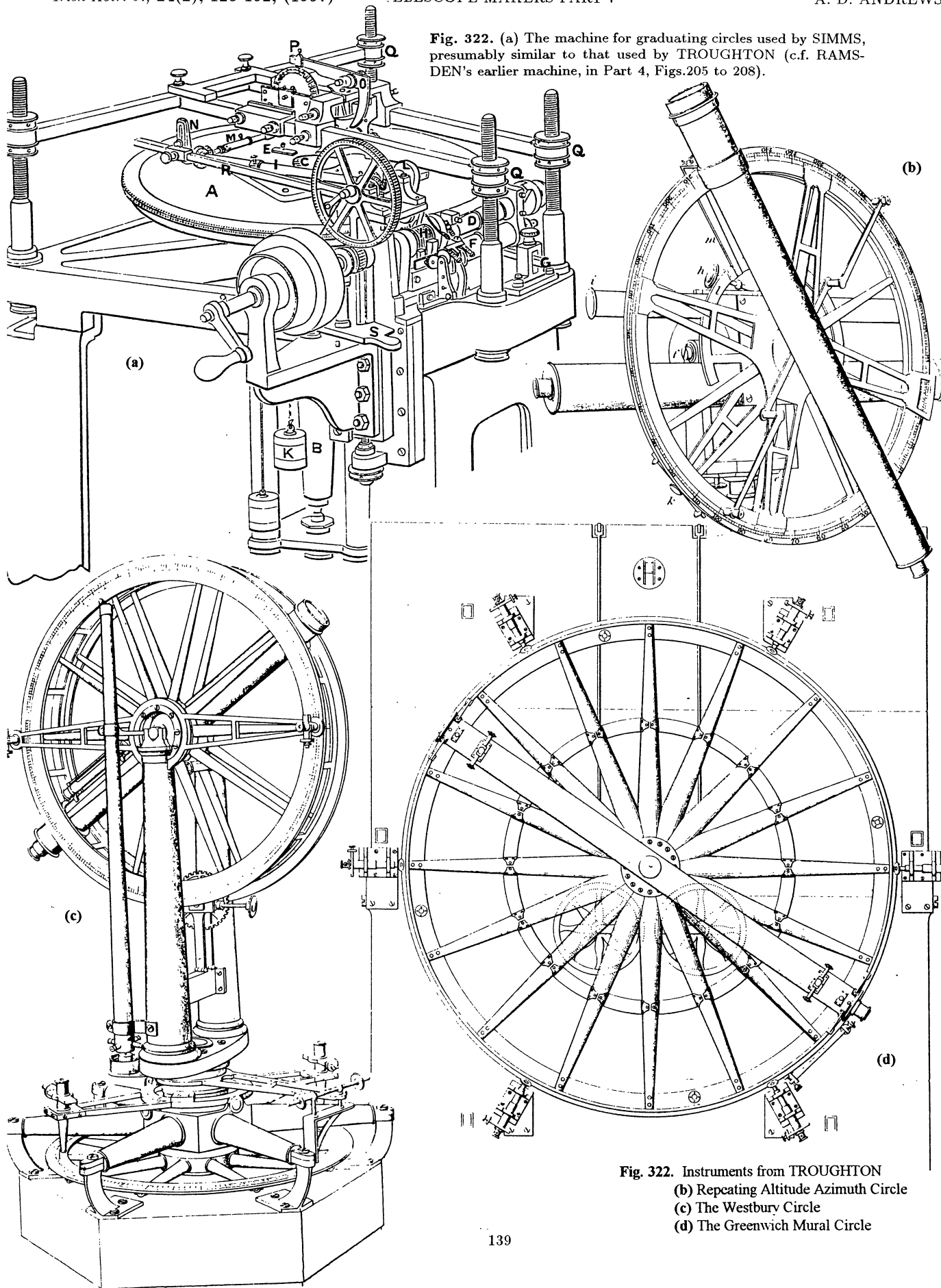


Fig. 322. Instruments from TROUGHTON
 (b) Repeating Altitude Azimuth Circle
 (c) The Westbury Circle
 (d) The Greenwich Mural Circle

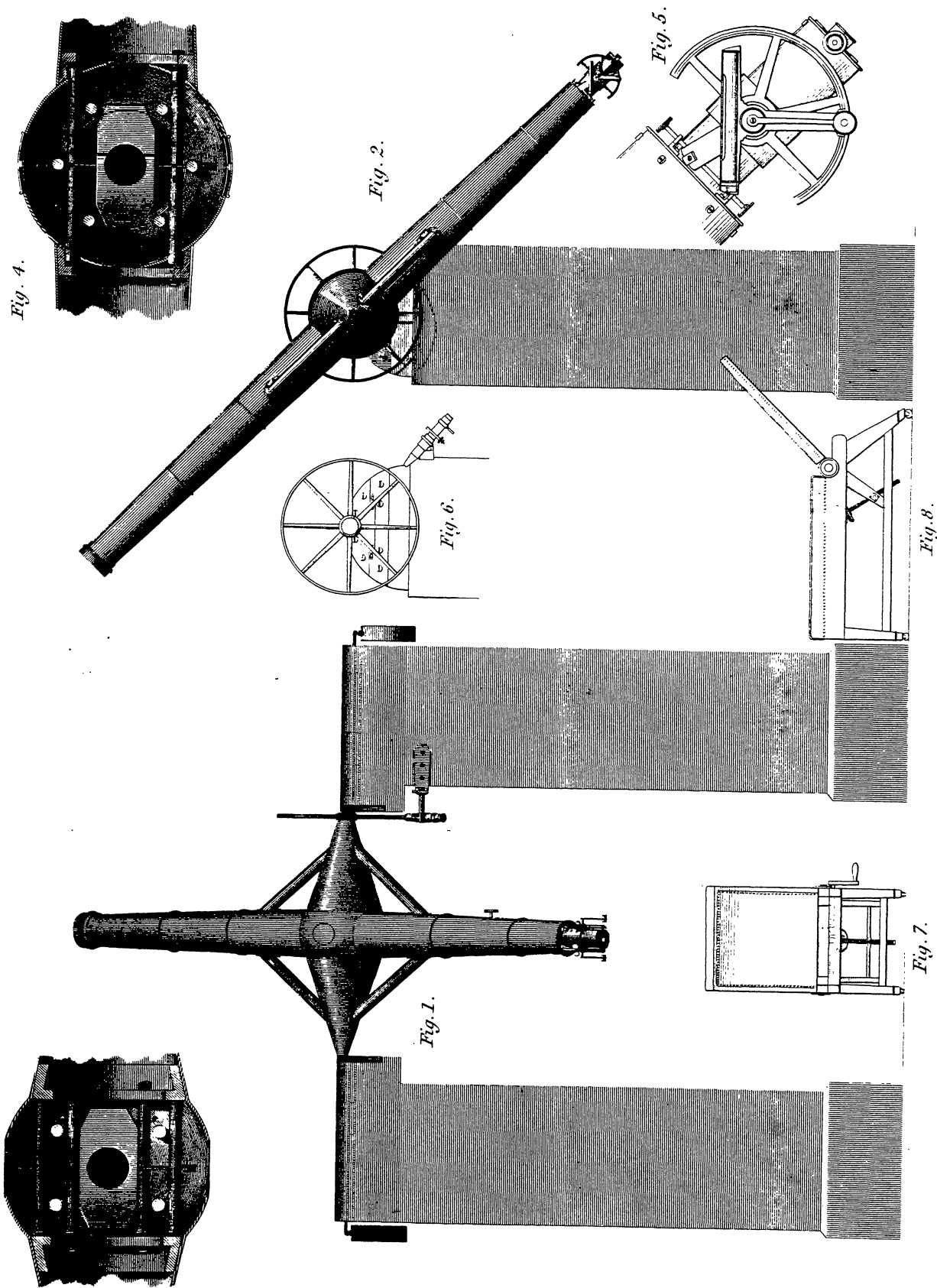


Fig. 322. (e) The Greenwich Transit Instrument by TROUGHTON

J. Farey, del.^t

London. Published for the Author, No. 7, 1828.

T. Brudley, sc.

TORRICELLI Evangelista - 1608-1647, Italian natural philosopher, instrument maker and experimenter. He invented the barometer. MONCONYS bought telescopes from TORRICELLI.¹⁴

TOURNANT Alexandre - c.1730-92, French glass worker.¹⁵

TOWA - present day.

TOWNLEY Richard - 1629-1707, known for his improvement of GASCOIGNE's moving-wire micrometer.¹⁶

TRAMBOUZE P - 20C, telescopes and microscopes, 92 rue de Rennes, Paris.

TROUGHTON Edward (I) - b.1753/56, retired 1831, d.1835, eminent English instrument maker. He was apprenticed to his brother John TROUGHTON (II) in 1773, and received the Copley Medal in 1809. Edward (I) is recorded at *The Orery, 136 Fleet St, London* (1805-22). There is a well preserved TROUGHTON equatorial telescope at Armagh Observatory in the west dome.¹⁷

TROUGHTON John (I) - b.c.1716, d.1788, English mathematical instrument maker, at *Standgate Lane, Lambeth* (1752), *Surrey St, Strand* (1755-77), *Strand Lane, near Surrey St* (1764-74), and resided at *Lewisham, London* (1788).¹⁸

TROUGHTON John (II) - b.c.1739, d.1807, eminent English instrument maker. He was apprenticed to his uncle, John TROUGHTON (I), and in partnership with his brother, Edward TROUGHTON (I). He is recorded at *Surrey St, London* (1764), *Crown Court, Fleet St* (1768-71), *17 Dean St, Fetter Lane* (1771-78), *1 Queen's Square, Bartholomew Close, London* (1778-82), *136 Fleet St* (1782-88). See under SIMMS, and also COOKE.¹⁹

TROUGHTON Joseph - brother to John TROUGHTON (II), also apprenticed to his uncle in 1765.²⁰

TROUGHTON AND SIMMS - famous English instrument making partnership. See under SIMMS, and also under COOKE.²¹

TUDER J.G - English surveying instrument maker.²²

TULLEY Charles - d.1830, notable English instrument maker.²³ He is recorded at *11 Pierpoint Row, Islington, London* (1805), and *Goswell Street Rd, London*.²⁴ TULLEY (Snr) and son is recorded (c.1825).²⁵ We find a TULLEY 5-inch objective used at the Helwan Observatory on the 30-inch reflector, a 5.9-inch at the Science Museum, London, a 5-inch objective (called SOUTH's object glass) and a 6.8-inch objective is mentioned by PEARSON.²⁶

TULLEY Thomas - d.1846, optician, instrument maker, optical turner, brass tube maker, at *4 Terretts Court, Upper St, Islington, London* (1835-39).

TULLEY William - d.1835, English optician, optical turner.²⁷

TURNER Joseph - mid 18C, English mathematical instrument maker, at *Quadrant and Dial, Hatton Garden, London* (1740), and *8 Red Lion Court, Clerkenwell, London* (1745).²⁸

TURRELL Edmund - notable engraver, e.g. see astronomical instruments in *Practical Astronomy* (1829) by Rev. William PEARSON of South Kilworth.

TWYMAN Frank - 1876-1959, theoretical optician and instrument designer, managing director at Adam HILGER's.²⁹

TYCHO BRAHE - see BRAHE.

¹⁴See Daumas 87. Examples at Firenze museum.

¹⁵See Tayl 65.

¹⁶See A.Turner ESI 133.

¹⁷See Bennett, *Church, State and Astronomy in Ireland*. See Chapman, *Dividing the Circle* (1995), McConnell (1992), Menim's biography of William SIMMS, and Skempton & Brown (1973), and Dict.Nat.Biogr.

¹⁸See SIMON and Dict.Sci.Biogr.

¹⁹TROUGHTON AND SIMMS (c.1826-1909), and COOKE, TROUGHTON AND SIMMS (from 1922). See Notes Roy.Soc 27, 2, John and Edward TROUGHTON as partners. Also Dict.Nat.Biogr.

²⁰See SIMON. There is no evidence that Joseph TROUGHTON was in partnership with his brother, John.

²¹See [CHrApr88] illustr (with others), CHrSep89, [CHrDec89] and [CHrJun89] (tripod).

²²TUDER constructed an early SISSON-type instrument, early 19C. See Bennett 196.

²³Alternative spelling TULLY. See King 191, 193 (illustr) and 196.

²⁴The TULLEYS supplied triple achromats for micrometer reading telescopes on Thomas JONES' mural circle at Armagh Observatory 1831. Also, we read of a 3.75-inch clear aperture (f=60 inches) telescope by TULLEY (Snr), with oculars magnifying x20 to x800, with equatorial mounting and slow motions which was given to LEE by SMYTH. See Aed Hartw 226, and SIMON.

²⁵See Handlist. Note also TULLEY and Sons (William and Thomas TULLEY, see below) fl.1782-1846. See under LISTER.

²⁶See Howse 54, McConnell 12, and Fig.316..

²⁷Same address as Thomas TULLY (see SIMON). We find a TULLEY-type 19C instrument (CHrMar89). There is a short obituary to William TULLEY in Mem. RAS 5, 240 (and 386) 1833.

²⁸See SIMON.

²⁹See McConnell 76.

Fig. 323. An early 19C refracting telescope (maker unknown), an equal-altitude instrument with spirit level, and an eyepiece with crosswires (from Pearson 1829).

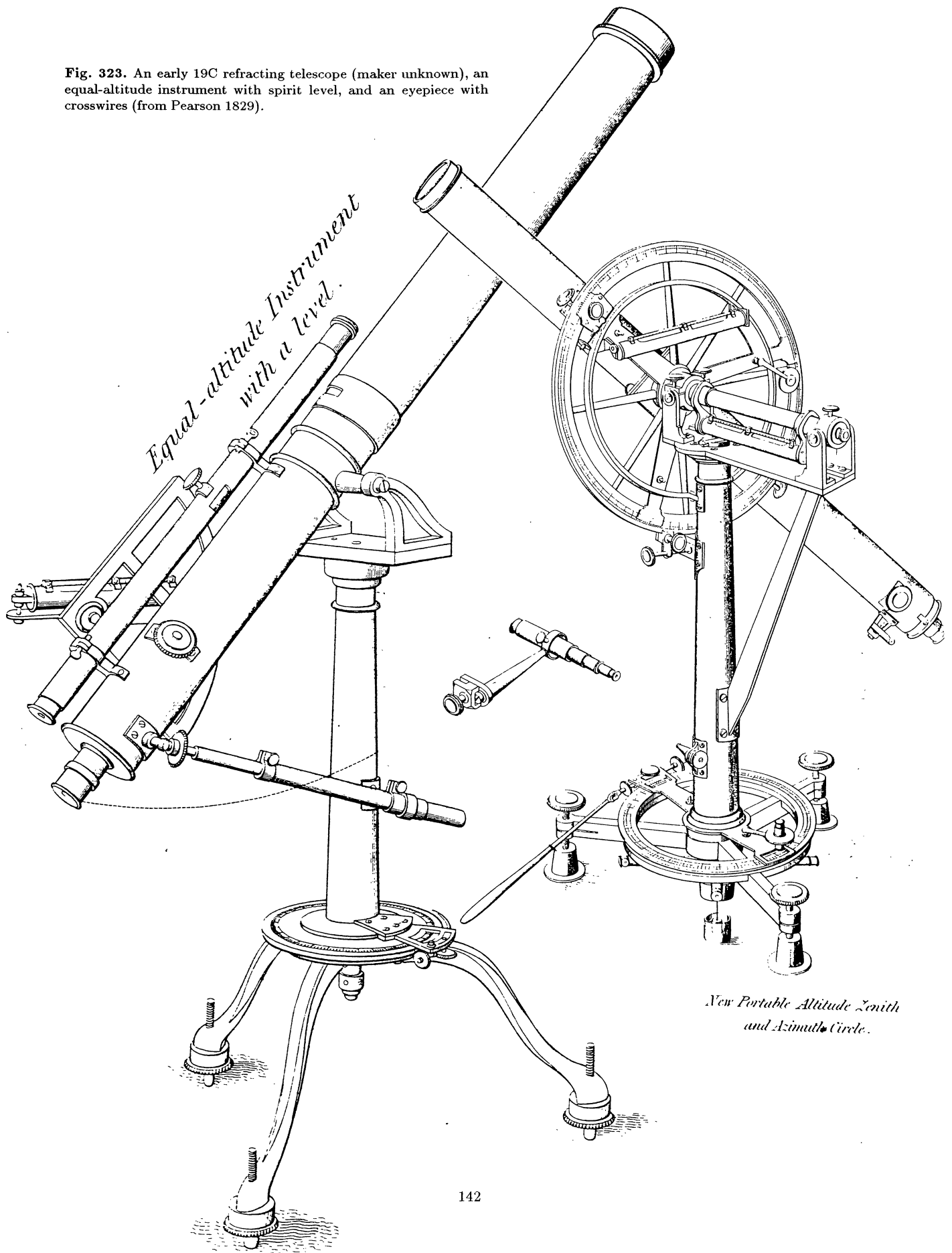
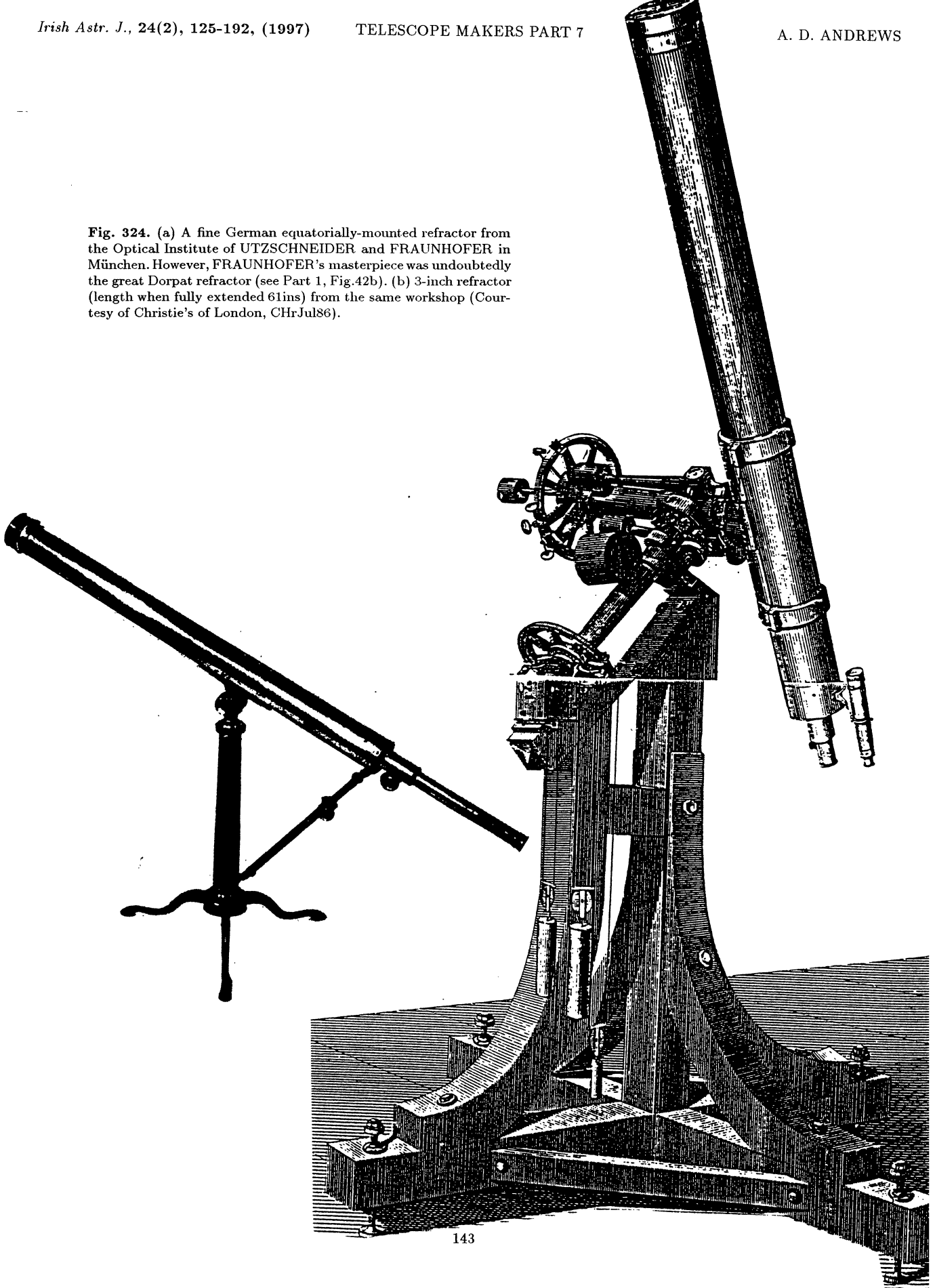


Fig. 324. (a) A fine German equatorially-mounted refractor from the Optical Institute of UTZSCHNEIDER and FRAUNHOFER in München. However, FRAUNHOFER's masterpiece was undoubtedly the great Dorpat refractor (see Part 1, Fig.42b). (b) 3-inch refractor (length when fully extended 61ins) from the same workshop (Courtesy of Christie's of London, CHrJul86).



LUNETTE ASTRONOMIQUE ET TERRESTRE

Corps cylindrique cuivre augmenté de deux tirages, développement 92 c. montée sur un petit pied bois à trois branches, avec genouillère cuivre permettant les mouvements en tous sens à frottement doux. La partie optique de premier choix comprend : un objectif achromatique de 45 millim.; un oculaire terrestre grossissant 40 fois; un oculaire astronomique grossissant 60 fois; une bonnette verre noir pour observer le soleil; un bouchon d'objectif. Le tout enfermé dans une boîte à compartiments. On peut, avec cet instrument, voir les détails de la surface lunaire: cirques, montagnes, rainures, etc.; les taches solaires, les satellites de Jupiter, l'anneau de Saturne; les phases de Vénus. On verra les principales curiosités du ciel: la crèche, l'amas de Persée, les nébuleuses d'Andromède et d'Orion, etc., etc.

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Construite sur les indications de
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MODELE N° 1: Objectif de 43mm, corps cuivre, 1 oc. terrestre et 1 oc. céleste, gross. max. 50 fois, permettant de faire les principales observations célestes..... **43 fr.**

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INSTRUMENTS D'OPTIQUE ET DE PRÉCISION
E. VION, Constructeur, 38, Rue de Turenne, PARIS
Fournisseur des Ministères de la Guerre, de la Marine, des Colonies et des Observatoires
Spécialités de Boussoles, d'Instruments d'Arpentage, de Nivellement et de Géodésie
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Série spéciale de Lunettes astronomiques, avec objectifs marque "ERIA", spécialement construits avec des nouvelles matières extra-lumineuses.
Ces objectifs étant parfaitement corrigés, donnent le maximum de rendement optique et permettent de faire, avec précision, les observations indiquées dans les ouvrages de M. FLAMMARION.

Lunette de 75 mm d'objectif sur pied de biche en cuivre avec chercheur, 3 oculaires grossissant 50, 75, 155 fois, boîte noyer. Prix..... 245 fr.

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Nouvelles JUMELLES à PRISMES, grand champ, grande luminosité



Fig. 325. (a) A simple French 45mm refractor on tripod as advertised by TRAMBOUZE. (b) The same telescope model advertised by BALLOT, offered as 43mm, 50mm and 56mm instruments and designed according to the contemporary eminent gentleman astronomer and writer, FLAMMARION (1842-1925). BALLOT also sold refracting telescopes by WATSON and Son, and Carl ZEISS. (c) Advertisement from VION for 75mm, 81mm and 108mm refractors.

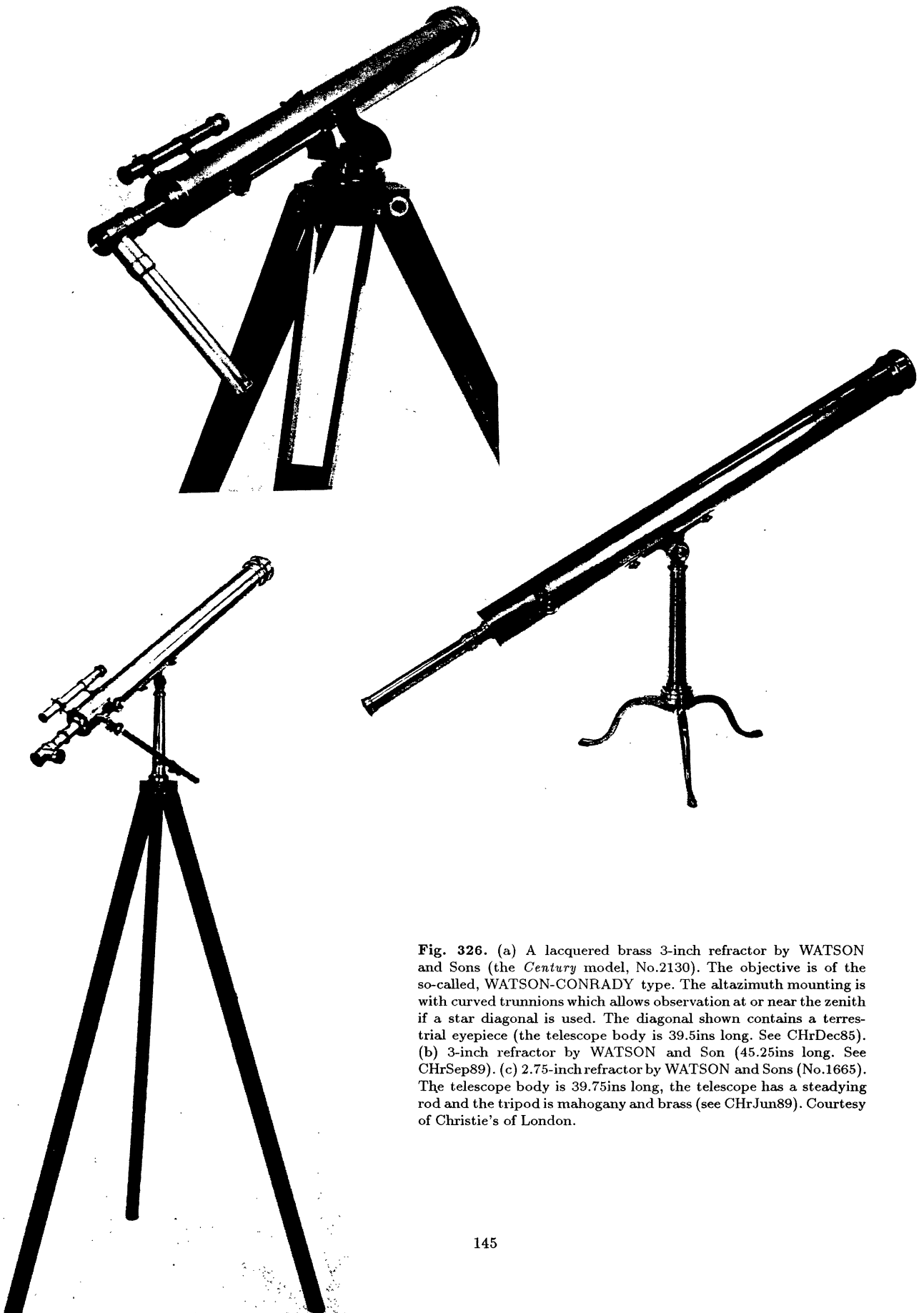


Fig. 326. (a) A lacquered brass 3-inch refractor by WATSON and Sons (the *Century* model, No.2130). The objective is of the so-called, WATSON-CONRADY type. The altazimuth mounting is with curved trunnions which allows observation at or near the zenith if a star diagonal is used. The diagonal shown contains a terrestrial eyepiece (the telescope body is 39.5ins long. See CHrDec85). (b) 3-inch refractor by WATSON and Son (45.25ins long. See CHrSep89). (c) 2.75-inch refractor by WATSON and Sons (No.1665). The telescope body is 39.75ins long, the telescope has a steadying rod and the tripod is mahogany and brass (see CHrJun89). Courtesy of Christie's of London.

WATSON'S ASTRONOMICAL TELESCOPES

W. WATSON & SONS, LTD., are prepared to quote for all types of
Astronomical Telescopes.

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List of second-hand instruments post free.

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Established 1837. Works: Bells Hill, High Barnet.

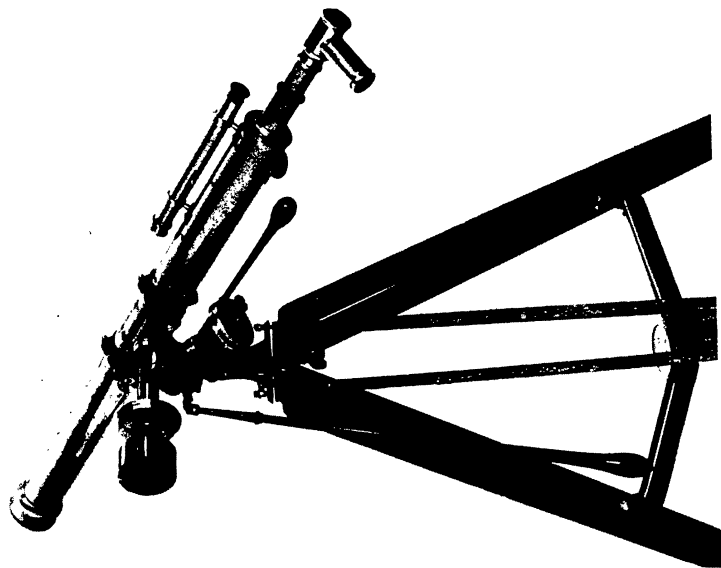
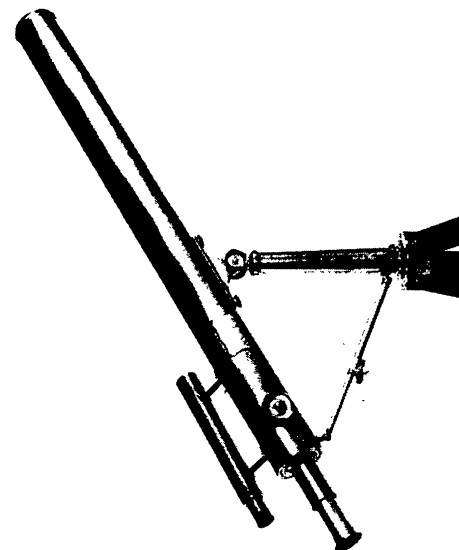


Fig. 328. (a) 2.75-inch refracting telescope by WOOD (late ABRAHAM, LIVERPOOL). The steady rod includes the altitude adjustment rack and pinion. This particular telescope belonged to R. Hamilton FRCS (Liverpool 1888). See CHrDec85. Courtesy of Christie's of London. (b) An extremely fine, lacquered brass 3-inch refractor by WRAY. The body tube is 39.5ins long, the mounting is equatorial with levelling screws, the scales are with verniers. See CHrSep86. Courtesy of Christie's of London.



W. WATSON & FILS

313, High. Holborn, LONDON (England)

*Fabricants de Lunettes en gros et au détail
Fournisseurs de l'Amirauté Britannique,
du Bureau de la Guerre et de plusieurs gou-
vernements étrangers. Maison fondée en 1837.
42 Médailles d'Or, etc.*

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Munies d'Objectifs Watson-Conrady (3 types différents)

Type I. — Triple objectif apochromatique ou photo-visuel.

Type II. — Double objectif apochromatique ou photo-visuel.

Type III. — Objectif holoscopique, qualité très supérieure.

Les Lunettes "CENTURY", munies d'Objectifs Watson

Type III constituent des appareils d'optique d'une qualité sans égale!! Ces instruments sont recommandés aux amateurs qui désirent obtenir le meilleur effet possible avec un objectif d'un diamètre déterminé.

PAS BESOIN D'OBSERVATOIRE !!

Les Lunettes astronomiques "CENTURY" sont montées sur un pied en acajou massif avec berceau en cuivre, mouvements universels; cette lunette possède un chercheur, trois oculaires et est livrée en boîte.

PRIX DES APPAREILS COMPLETS:

Ouverture de l'objectif	Prix
76 millimètres.....	437 fr. 50
89 millimètres.....	625 francs
102 millimètres.....	900 francs
127 millimètres.....	1.250 francs
152 millimètres.....	1.940 francs

Demandez le Catalogue n° 6 F contenant des renseignements sur tous ces appareils, et, en outre, sur des instruments plus grands et d'autres de construction plus simple.

Dépositaire à Paris: **M. BALLOT, 25, rue Serpente, Paris (VI.)**

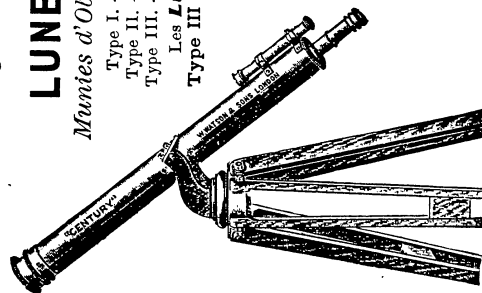


Fig. 327. Two advertisements for WATSON and Sons astronomical telescopes. The firm, founded in 1837, offers to make achromatic object glasses of 3- to 6-inch (and larger).

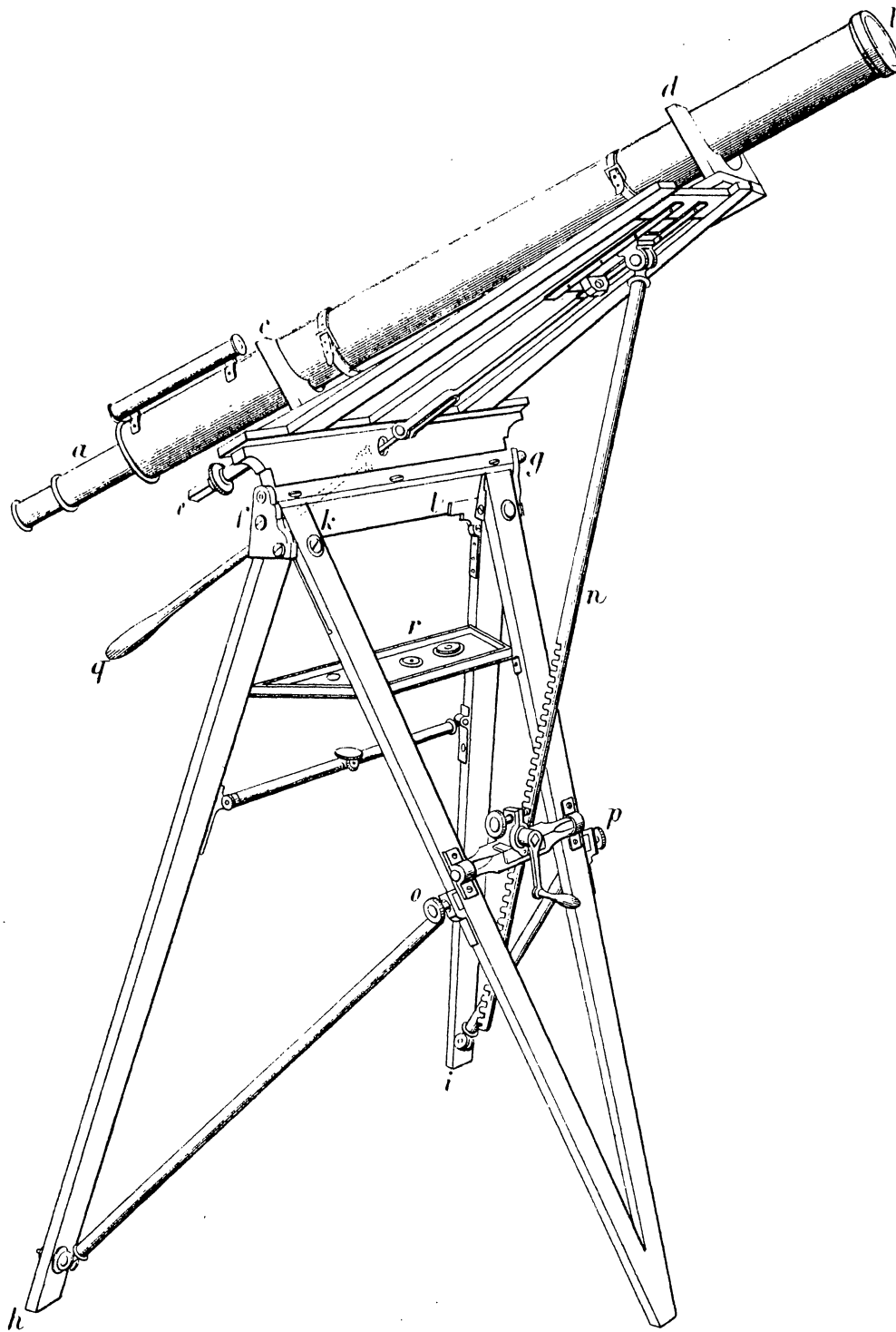


Fig. 329. VARLEY's *Improved Stand* for a refracting telescope (Pearson 1829). Brought up by his uncle, Samuel, a watch maker and scientific instrument maker, Cornelius VARLEY became not only an instrument designer himself, but also a proficient artist. His brother, John (1778-1842) was a founder member in 1804 of the Society of Painters of Water Colours, and John VARLEY taught such men as Turner, Hunt, Linnell and Cox. Cornelius VARLEY made practical use of the so-called *camera lucida* which interested him as both artist and natural philosopher (see Fig 330). John HERSCHEL was also particularly interested in this device during the 1830s.



Fig. 330. (a) A sketch by Cornelius VARLEY of the eminent English painter, J.M.W. Turner, made using a *graphic telescope* which threw an outline on the artist's paper. (b) The *camera lucida* of WOLLASTON (left) and AMICI (right). W.H.WOLLASTON patented this device c. 1805. It consists of a small prism which is used to effectively divide the pupil - one half then views the object (scenery or a specimen), the other half the drawing being made. AMICI designed a variation in which the head of the drawing pencil was seen projected against the field of view using an additional semi-transparent glass slip.

U

UNGARISCHE OPTISCHE WERKE A.G - *Budapest* (World War II binocular code gug).

UNITRON - present day, US telescopes and binoculars, recorded at *170 Wilbur Place, PO Box 469, Bohemia, New York 11716*.

URINGS John (I) - fl.1709-1751, mathematical instrument maker, at *East Smithfield, London* (1737-51).³⁰

URINGS John (II) - fl.1738, d.1773, ship chandler, mathematical instrument maker, at *Minories, London*, and *Hermitage St, St Catherine's, Tower Hill, London* (1759-68), and *174 Fenchurch St, London* (1773).³¹

UTZSCHNEIDER Joseph von - 1763-1840, joined the Mathematical and Mechanical Institute in *München* in 1804 founded by REICHENBACH and LEIBHERR. The great FRAUNHOFER also joined in 1806. The second Optical and Mechanical Institute of *Benediktbeuern* was founded in 1809 by these gifted men. MERZ and MAHLER later took over control in 1838 continuing the great German tradition of instrument making.³²

V

VALENTINE John - journeyman, instrument maker, on the staff of James SIMMS at *Fleet St, London* after William SIMMS' death.³³

VARLEY Cornelius - 1781-1873, founder member of the Microscopical Society of London, and also a Telegraph Instrument manufacturer, with interest in painting (watercolours), and in our context, astronomical instruments. VARLEY is recorded at *22 Charlotte St, Fitzroy Square, London*, and *228 Tottenham Court Rd*, and also *Junction Place, Paddington* (1811), *1 Charles St, Clarendon Square* (1811-56), *42 Newman St* (1815), *51 Upper Thornhough St, Tottenham Court Rd* (1825), *7 York Place, Kentish Town* (1857-63), and *337 Kentish Town Rd, NW London* (1864-73).³⁴

VAUCANSON - engineer, inventor of the 'endless' screw (the 'worm').³⁵

VEITCH James - 1771-1838, Scots inspector of weights and measures, amateur telescope maker, *Inchbonny, Jedburgh, Scotland*. He made lenses for Sir David Brewster.³⁶

VEITCH William - brother to James. He is known largely on account of his description of a visit to Charles TULLEY in *Islington* c.1813.³⁷

VERNIER Pierre - 1580-1637, French instrument maker, *Ornans, Burgundy*. He is particularly well known for his improvement of TYCHO's method of reading the circle.³⁸ VERNIER devised a new quadrant (1631) with a 'vernier' scale. HEVELIUS was probably the first major astronomer to make use of the 'vernier' scale.³⁹

VILLARCEAU Yvon - French engineer. He worked on telescope driving clocks and governors.⁴⁰

VINCE Samuel - fl.1781-1822, English mathematician and author of '*Treatise on Practical Astronomy*' (Cambridge 1790).

VIVIANI Vincenzo - 1622-1703, Italian instrument maker and experimenter in *Venice*. He was contemporary with CAMPANI.⁴¹

VIXEN - present day, well known maker of optics and equatorial mounts.

VOIGTLÄNDER Johan Christoph - 1732-1790, German optician, the forerunner in a great tradition of German designers, e.g. S. STAMPFER and J.J.PRECHTL and G.S.PLOSSL.

VOIGTLÄNDER and Son - 20C, eminent German optical works, *Brunswick* (World War II binocular code ddx). Earlier recorded at *12 Charterhouse St, Holborn Circus, London EC* (1910), and also *New York* (1908). Well known for photographic objectives.⁴²

VONÉCHE - early 19C, French glass manufacturer, producing flint glass.⁴³

³⁰See SIMON. Alternative spelling URING. There is a signed Gregorian telescope at Leyden.

³¹See SIMON.

³²See Handlist. See [CHrJul86], and also Bennett.

³³He is to be compared with other dedicated, long-serving craftsmen like today's Ernest Elliott in BROADHURST, CLARKSON and FULLER.

³⁴See Turner G (1989) 319, King 198 and 200, and SIMON. Also, Figs.329 and 330.

³⁵See D and C Figs.58/59.

³⁶See Edinburgh collection NMS, BG 17 and 20, and King 198. It is believed he supplied Sir Walter Scott, the poet, with a telescope.

³⁷See BG 23 and SIMON

³⁸See King 94, D and C 622.

³⁹Previous instrumental circles had been fairly accurately read by 'transversals' due to DIGGES' ideas, and were much used by BRAHE. In fact, the 'vernier' scale was re-invented by HEBRAEUS (1643), and had been anticipated by CLAVIUS (1537-1612). Note the work of Pedro Nunez (Nonius, *De Crepulis* 1542, on subdividing the scale. We record also A.VERNIER (c.1607-30). See Daumas 97. SMEATON advocated an alternative device, the micrometer (1786).

⁴⁰See Lockyer 324.

⁴¹See A Turner ESI 122, and King 60.

⁴²See DRAPER's instrument in *Cyclop. Part 1*.

⁴³See also SAINT-LOUIS and LE CREUSOT.



Fig. 331. Worcester R. WARNER, eminent U.S. maker in Cleveland, Ohio (firm fl.c.1880 onwards; WARNER d.1929).



40-INCH AUTOMATIC GRADUATING ENGINE
MADE AND IN USE

AT THE WORKS OF
WARNER & SWASEY

Fig. 332. WARNER and SWASEY's automatic graduating machine capable of inscribing on setting circles 40ins in diameter.

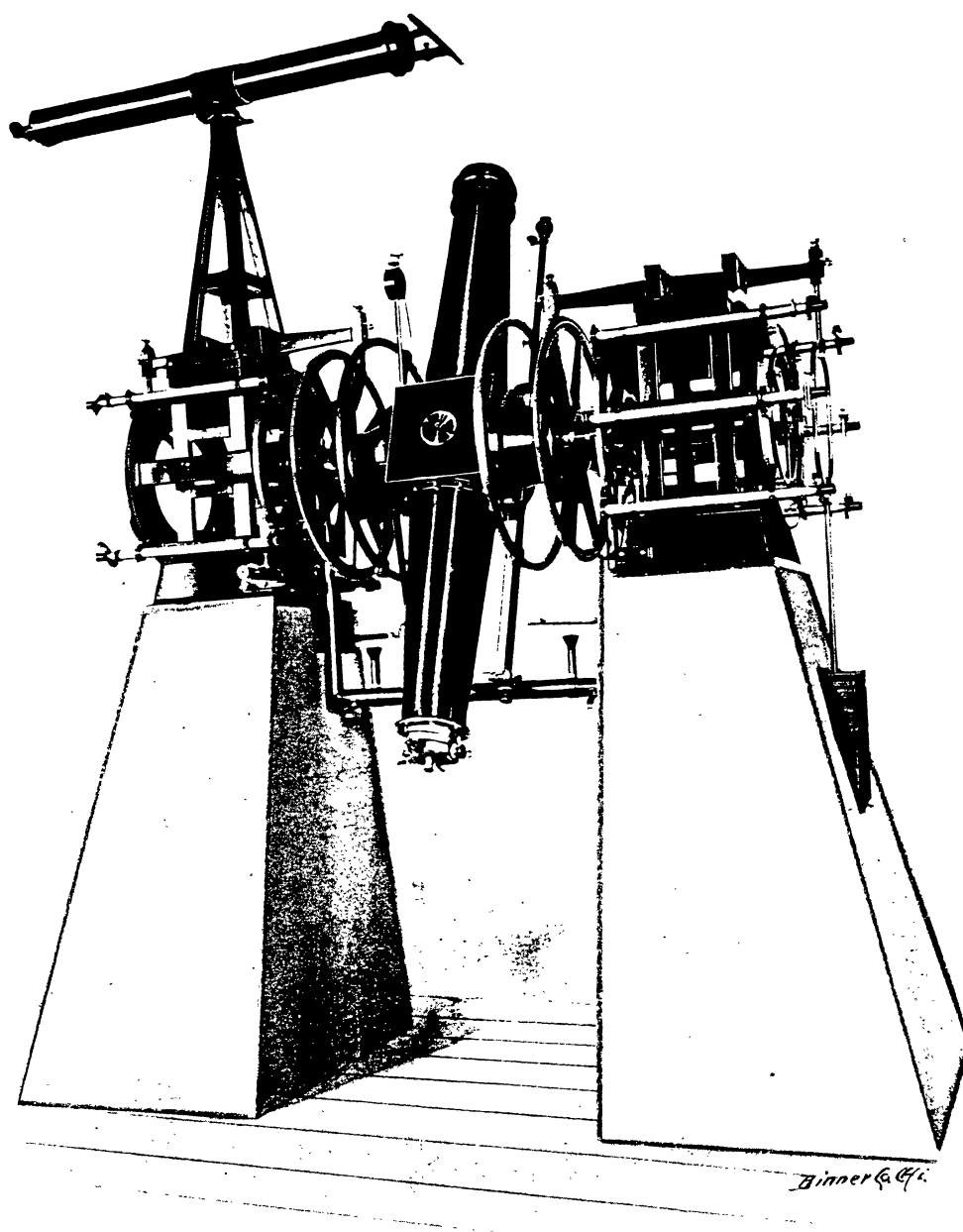


Fig. 333. WARNER and SWASEY's 6-inch meridian circle constructed for the U.S.Naval Observatory.

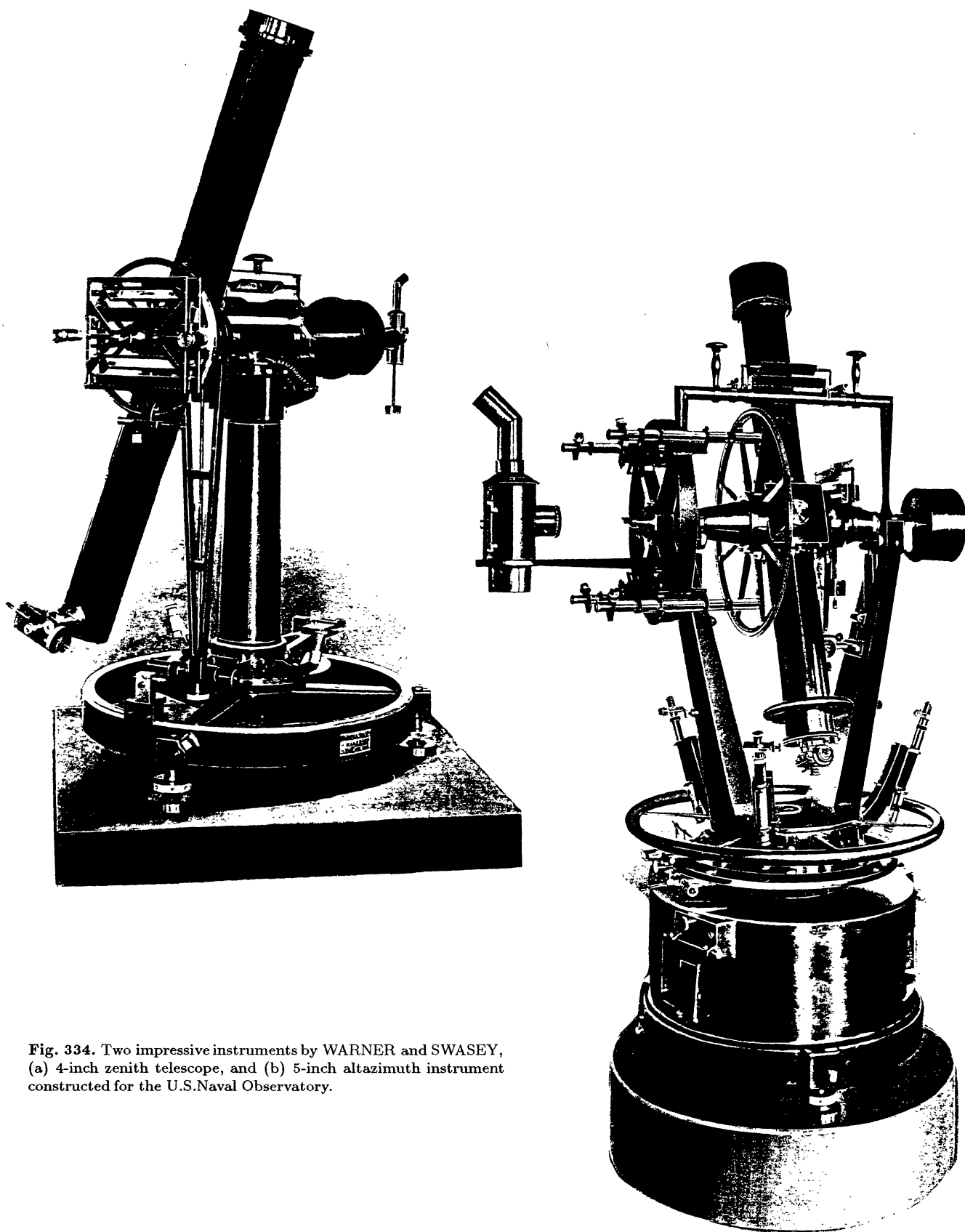


Fig. 334. Two impressive instruments by WARNER and SWASEY, (a) 4-inch zenith telescope, and (b) 5-inch altazimuth instrument constructed for the U.S. Naval Observatory.

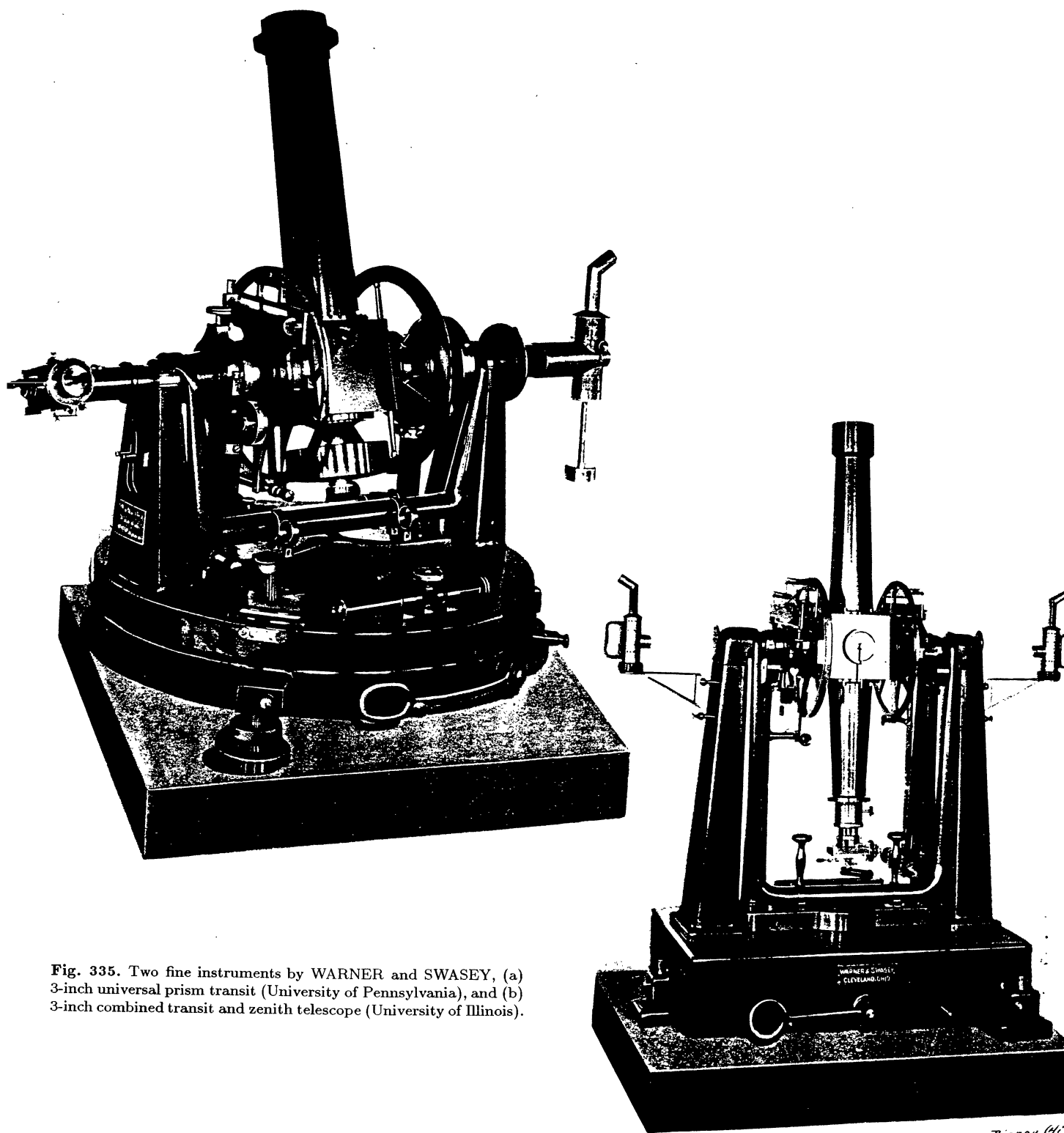
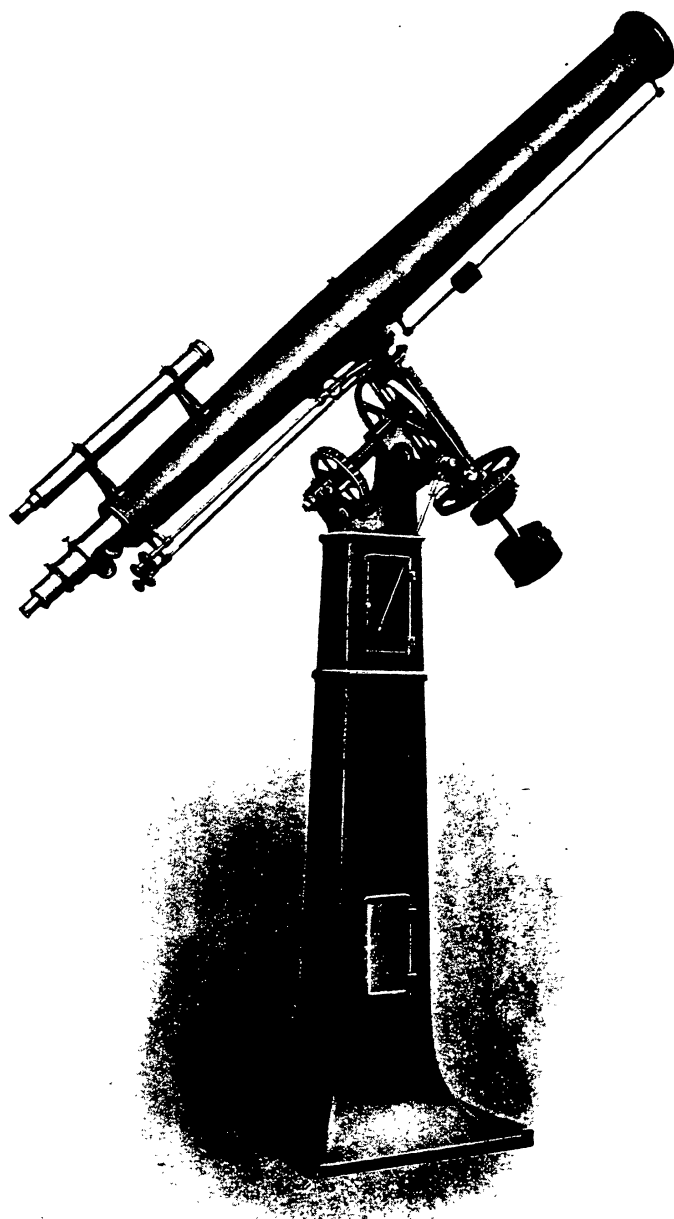


Fig. 335. Two fine instruments by WARNER and SWASEY, (a) 3-inch universal prism transit (University of Pennsylvania), and (b) 3-inch combined transit and zenith telescope (University of Illinois).

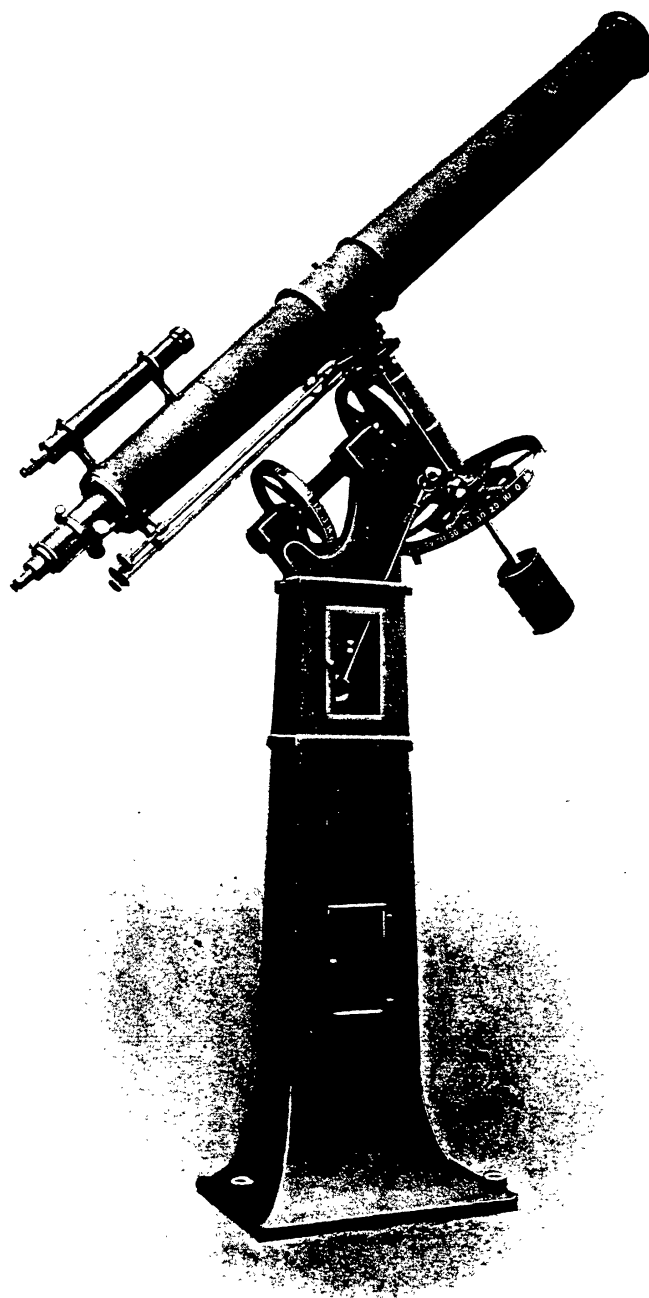
Binner 64.



Fig. 336. Ambrose SWASEY (d.1937), collaborator of W. R. WARNER in the highly successful instrument-making partnership.



6-INCH TELESCOPE



8-INCH TELESCOPE

FROM THE WORKS OF
WARNER & SWASEY

Fig. 337. Two refracting telescopes by WARNER and SWASEY, (a) 6-inch telescope, and (b) 8-inch telescope fundamentally identical but with strengthening of the tube and larger setting circles.

W

WAKE Charles - b.1806, optical, mathematical and philosophical instrument maker, at 11 *Silver St, Golden Square, London*.⁴⁴

WAKE Francis Henry - 1817-1883, mathematical instrument maker, at 4 *William St, Manchester Square, London* (1851-55), 9 *Silver St, Golden Square, London* (1861), 4 *St Martin's Court, St Martin's Lane* (1871), and *Ruby St, Camberwell, London* (1883). He was brother of Charles WAKE.⁴⁵

WALAND R.L - English mechanical /optical engineer at *St Andrew's University Observatory*. He was engaged on the Schmidt - Cassegrain project (1946) at St Andrews.⁴⁶ He improved on the early MAKUTOV system, and discussed the difficulties of the simple lens corrector, suggesting other fast, flat-field systems (c.1961).

WALKER Ezekiel - fl.1771-1816, English amateur optician.

WARD - English amateur astronomer.⁴⁷

WARNER Worcester R and SWASEY Ambrose - d.1929 and d.1937, respectively. From c.1880 onwards, as partners in the notable U.S. optical /engineering firm, *Cleveland, Ohio*, they constructed some of the world's most important telescopes. The firm of WARNER and SWASEY is noted for the mounting of the Lick Observatory 36-inch refractor and, later, the highly successful Yerkes Observatory 40-inch refractor (with the largest object glass in use in the world), and also the 82-inch McDonald Observatory reflector in Texas.⁴⁸

WARNER Samuel - fl.1735-50, English mathematics teacher and surveyor.⁴⁹

WATKINS Francis (I) - c.1723-82, English instrument maker, *Sir Isaac Newton's Head, 4/5 Charing Cross, London*, business fl. latter half 18C. Nathaniel ADAMS took WATKINS as apprentice in 1737. WATKINS trained PYEFINCH and Addison SMITH, who was later his partner.⁵⁰ It is suggested that WATKINS supplied Capt COOKE with some of his instruments, e.g. a telescope of 15 inches focal length to observe the solar eclipse in 1774. In 1805 the firm became WATKINS and HILL *London*, fl. c.1828-45.⁵¹

WATKINS Jeremiah and Walter - fl.1780-1817, optical, mathematical and philosophical instrument makers, at 5 *Charing Cross, London* (1784-98). Walter WATKINS died in 1798.⁵²

WATKINS and HILL - instrument makers, mostly demonstration apparatus.⁵³

WATSON James - b.1746, fl.1771-1824, English telescope maker, *London* (supplied BATE and SIMMS).⁵⁴

WATSON William - drew many of HERSCHEL's telescopes.⁵⁵

WATSON William - eminent English optician, *Clerkenwell, London* (1837), and 313 *High Holborn, two doors from Chancery Lane, London* (1862-65). We record a probable WATSON Bros (c.1894), 31 *Cockspur St, SW*.⁵⁶

WATTS Edward Richard and SON - late 19C, mathematical instrument maker, 123 *Camberwell Rd, London SE* (c.1894).⁵⁷ See under HILGER.

WATTS J - Irish instrument retailer /maker, 29 *Eden Quay, Dublin*.⁵⁸

WAUGH James - c.1793, English instrument maker. There is a 2-inch transit instrument at *Armagh*.⁵⁹

WEBB John - 1760-1846, optical instrument maker, 192 *Tottenham Court Road, London*, and also 408 *Oxford Street* and 28 *Francis Street*.⁶⁰

WEBB T.W (Rev) - well known English amateur astronomer /writer, *Hardwicke*. Author of '*Celestial Objects for Common Telescopes*' (1859). He owned a 5.5-inch CLARK refractor which passed on to Stonyhurst College.

WEDDERBURN John - c.1610, Scots mathematician. He wrote on GALILEO's 'microscope'.⁶¹

WELDON Edward - telescope maker, *Tunbridge Wells, Kent*.⁶²

⁵²See SIMON, and Daumas 302.

⁵³See Turner 19C 151.

⁵⁴See SIMON. Association with KATER. Possibly at 4 *Saville Place, Lambeth*. See King 198.

⁵⁵See JHA vii, 75, 1976. Uncertain whether he is the 19C optician.

⁵⁶See R.P. There was a connection of the WATSON firm in *Barnet*, and an *Edinburgh* branch at 16 *Forrest Rd* in 1899. See also [CHrSep89], [CHrDec85], CHrJun89. The firm served as agent for GRUBB 1888 (Handlist), and fl. c.1884 onwards (Handlist). WATSON's made McCLEAN's 'sun and star spectroscope'. See also WATSON and sons c.1926, and WATSON-CONRADY. Note the WATSON Centenary History (JAC), and G.Turner (1989). See Figs.326 and 327.

⁵⁷See R.P. where the name Edwin is given.

⁵⁸Note a telescope signed WATTS J in the Andrews collection.

⁵⁹See JMcF 176.

⁶⁰Tayl. 274.

⁶¹A.Turner ESI 93.

⁶²See CHrNov86. a 2.25-inch refracting telescope with rack and pinion focusing, on brass and wood tripod.

⁴⁴See SIMON.

⁴⁵See SIMON.

⁴⁶See King 374.

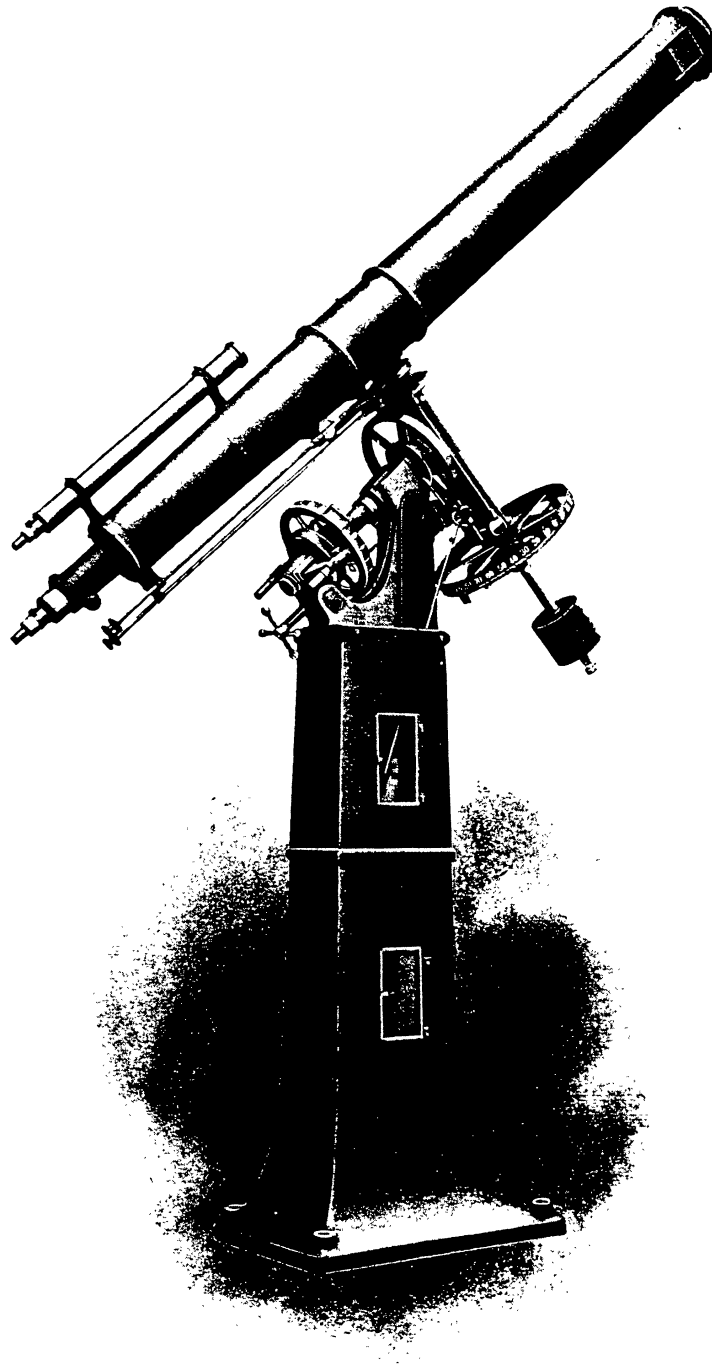
⁴⁷See King 259. Association with WRAY.

⁴⁸See King 399. See Figs.21, 225, 232, 240, 331-350.

⁴⁹See Tayl.

⁵⁰See Tayl 220.

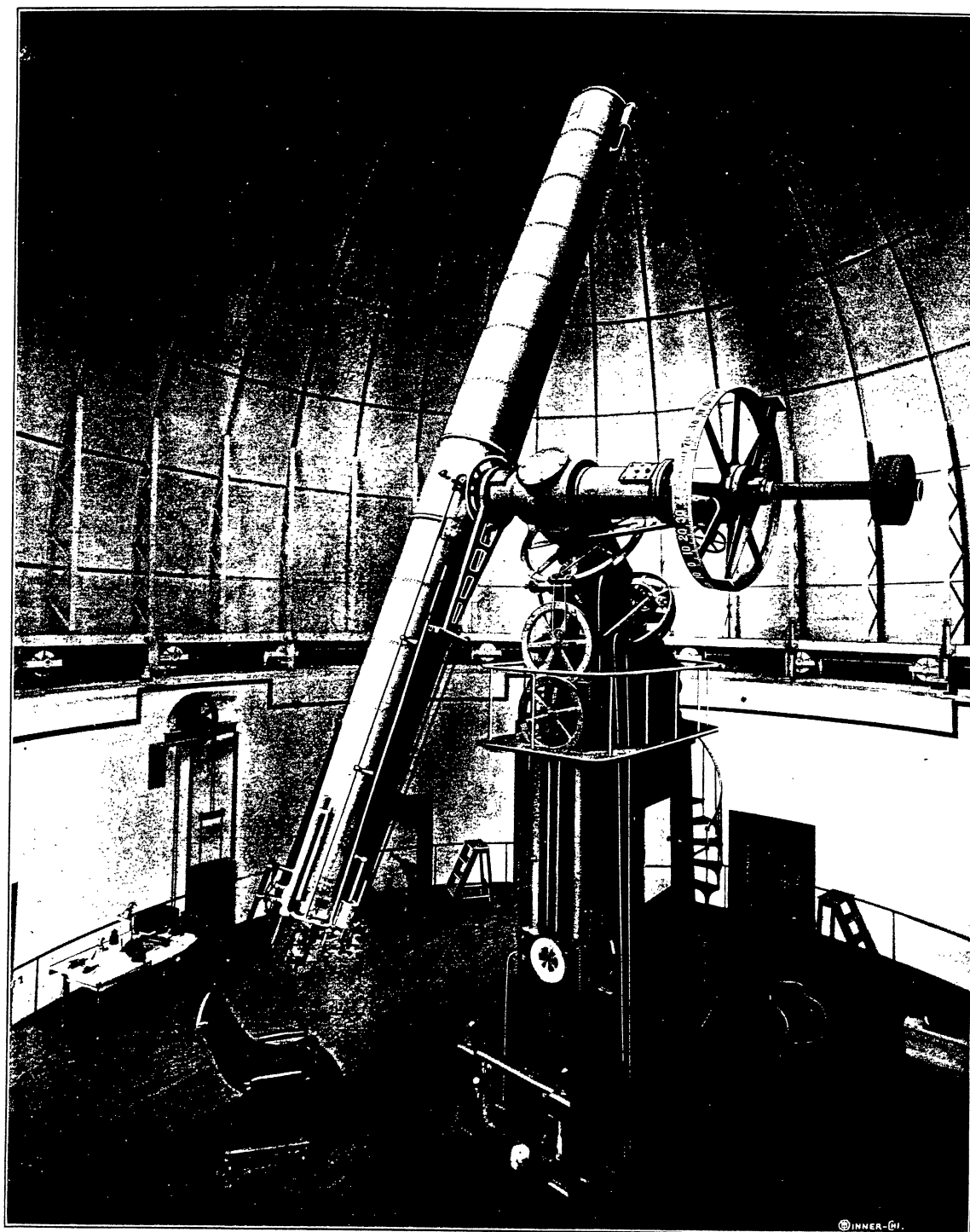
⁵¹An electrical firm in Handlist. See under ELLIOTT, and also in Howse 83 (a 2.5-inch triplet refractor 1781). Also a WATKINS and HILL 'primitive' surveying level (Bennett 201). See Daumas 302.



12-INCH TELESCOPE

FROM THE WORKS OF
WARNER & SWASEY

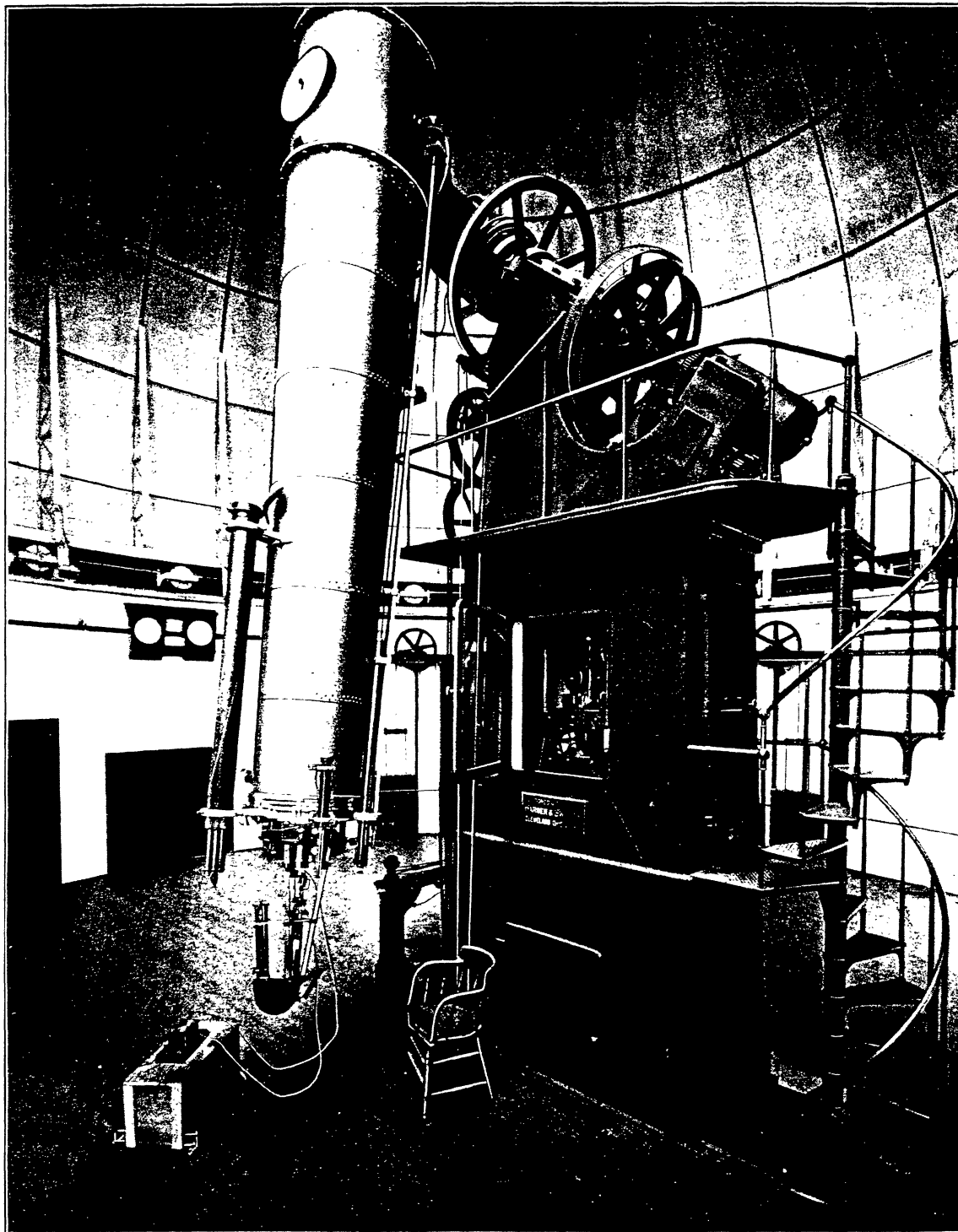
Fig. 338. The 12-inch version of the WARNER and SWASEY telescope design.



26-INCH TELESCOPE OF THE U. S. NAVAL OBSERVATORY

FROM THE WORKS OF
WARNER & SWASEY

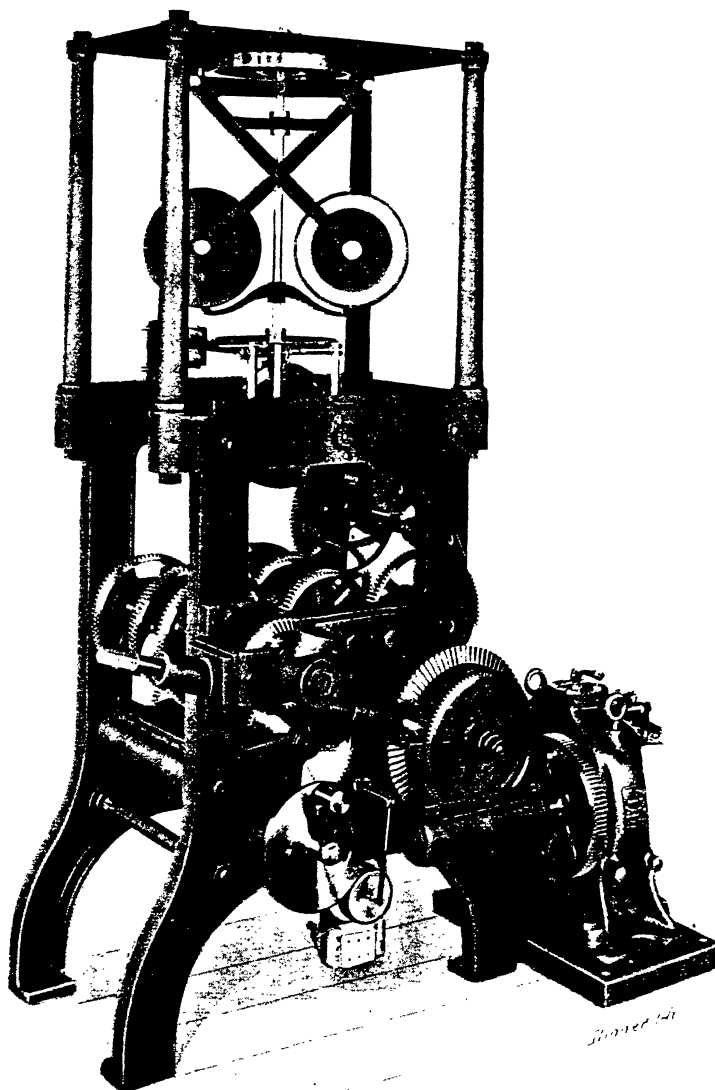
Fig. 339. The 26-inch telescope by WARNER and SWASEY (U.S. Naval Observatory). The telescope body required six sections above and below the central axial section, excluding the dew cap. Large setting circles could be read from the observer's reclining chair.



26-INCH TELESCOPE OF THE U. S. NAVAL OBSERVATORY

FROM THE WORKS OF
WARNER & SWASEY

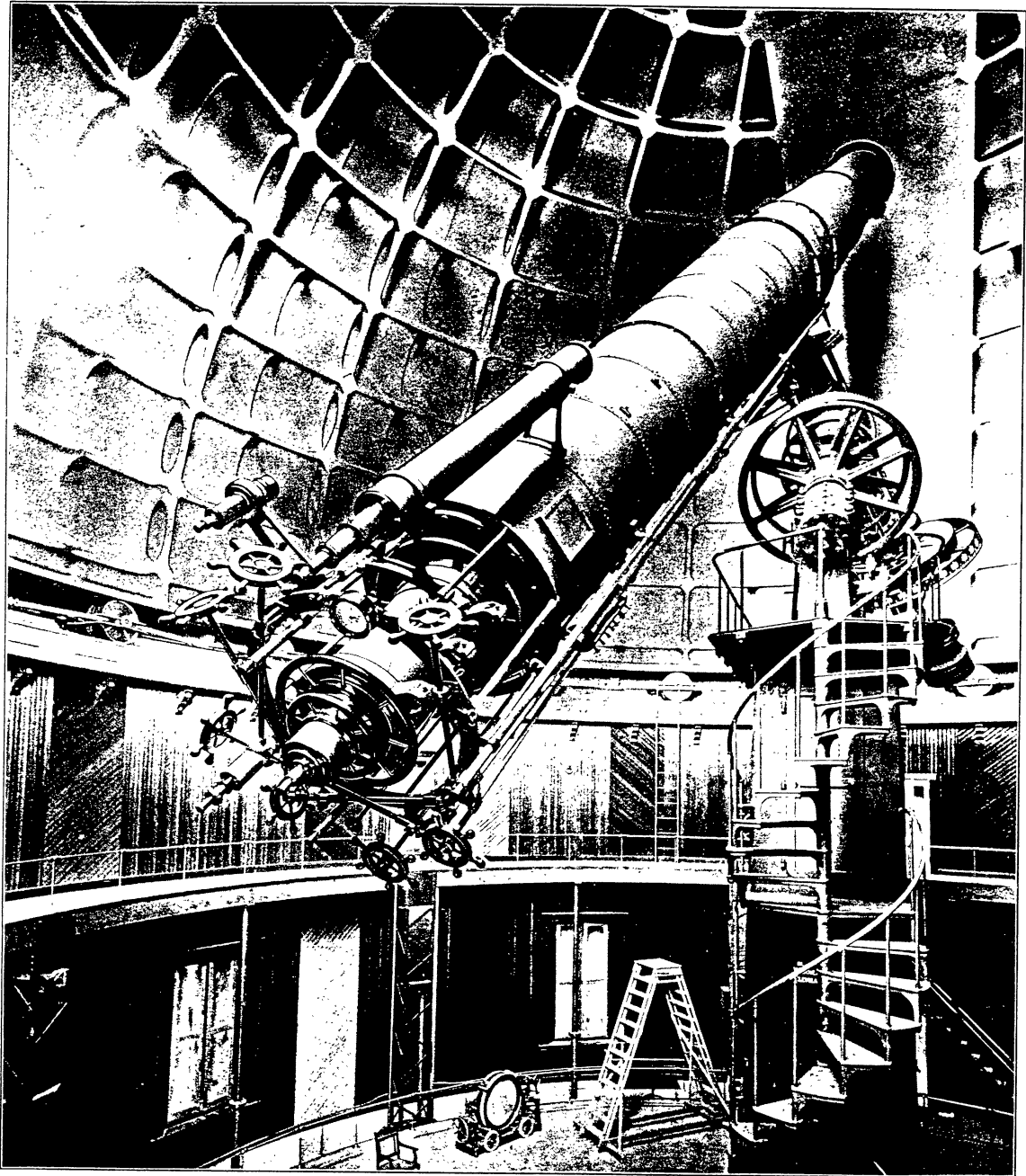
Fig. 340. Detail of the 26-inch showing the driving mechanism (see also Fig.341). There is a spectroscope attached to the eye-tube.



DRIVING CLOCK OF THE 26-INCH TELESCOPE OF THE
U. S. NAVAL OBSERVATORY

FROM THE WORKS OF
WARNER & SWASEY

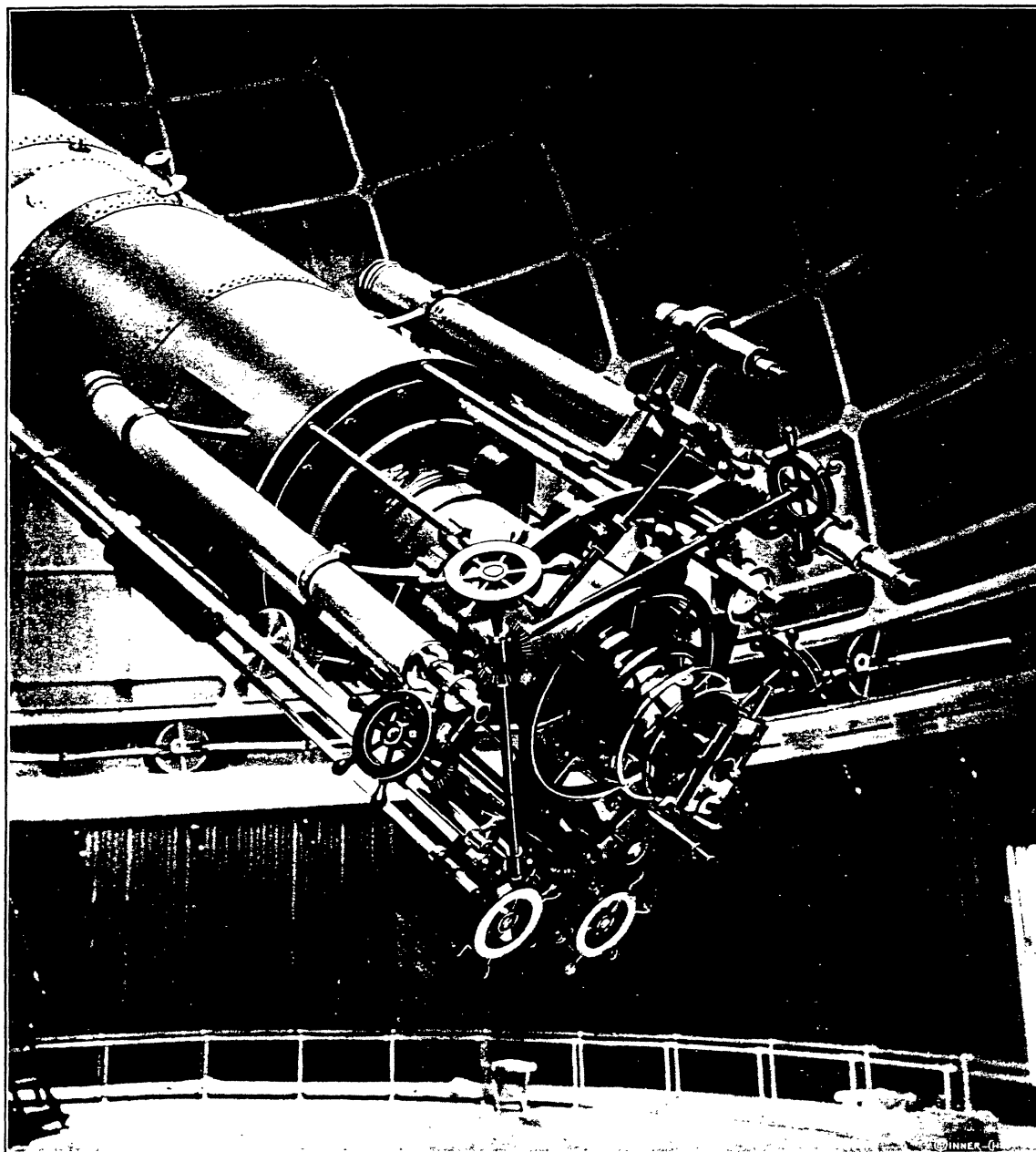
Fig. 341. The driving clock of the U.S.Naval Observatory's 26-inch telescope.



36-INCH LICK TELESCOPE

FROM THE WORKS OF
WARNER & SWASEY

Fig. 342. A giant stride forward for the workshops of WARNER and SWASEY, the 36-inch at the Lick Observatory. The object glass is by CLARK, the mounting by WARNER and SWASEY and the hydraulically-operated floor by Howard GRUBB.



EYE END OF THE 36-INCH LICK TELESCOPE

FROM THE WORKS OF
WARNER & SWASEY

Fig. 343. Detail of the observer's manual controls on the 36-inch telescope.

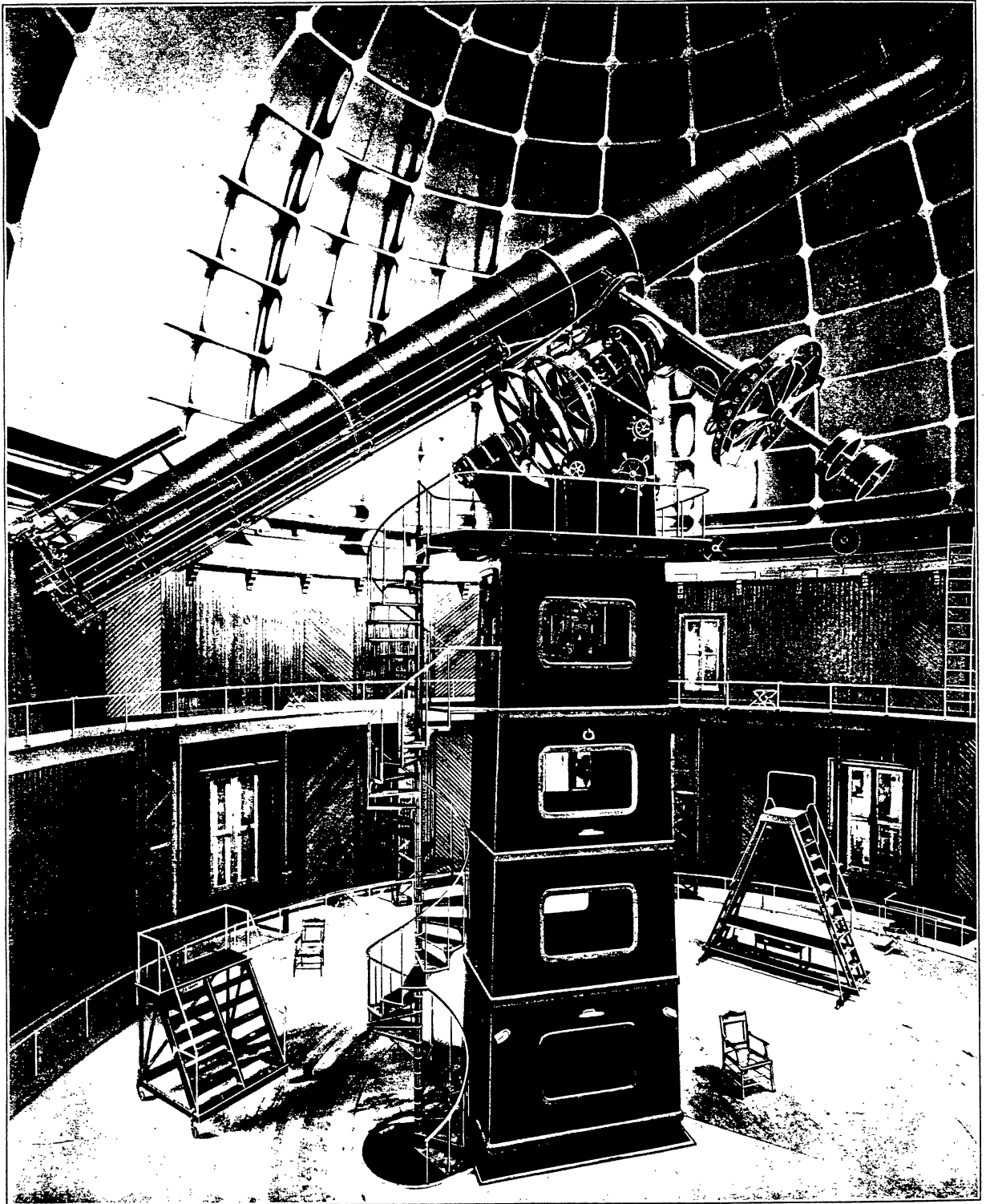
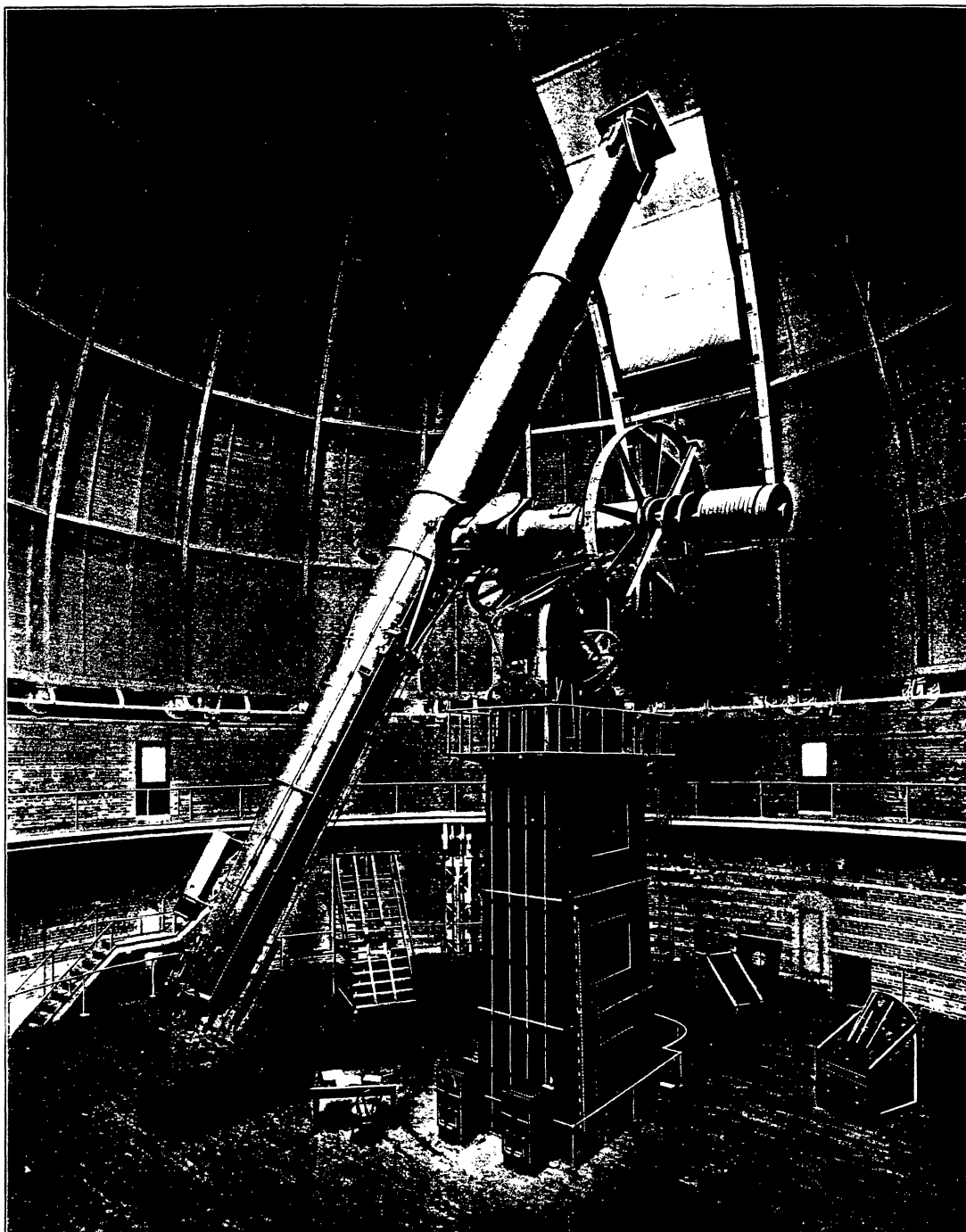


Fig. 344. Another view of Lick Observatory's 36-inch refractor.



40-INCH TELESCOPE OF THE YERKES OBSERVATORY

FROM THE WORKS OF
WARNER & SWASEY

Fig. 345. The giant 40-inch refractor by WARNER and SWASEY at Yerkes Observatory.

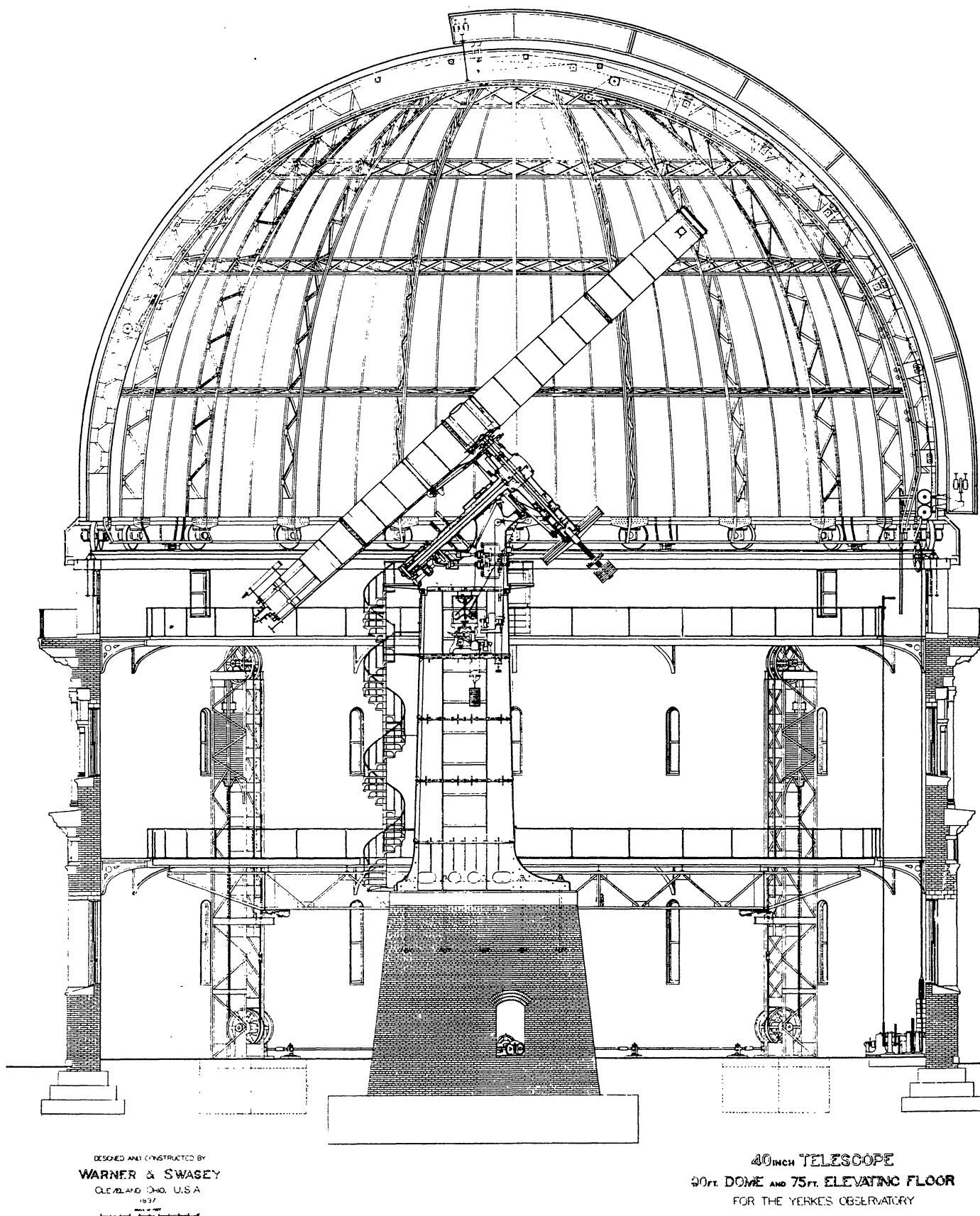


Fig. 346. WARNER and SWASEY's design drawing for the 40-inch telescope. The dome is 90 feet in diameter and the elevating floor is 75 feet in diameter.

WELLS William Harvey - c.1848, American amateur astronomer, noted as the 'first customer' of CLARKs (a 5-inch refractor).⁶³

WERNICKE - German optician, experimenting with glass/ liquid prism combinations.

WEST Charles Robert - early 19C, English optician and manufacturer, 23 Plough Court, Fetter Lane, London (1801), 1 St James St, London (1805-08), Cursitor St, London (1813), 5 Cursitor St, Chancery Lane (1817-22), Searle's Passage, Searle St, London (1817), 83 St James St (1822), End of St James St, Pall Mall, (shop) Gateway of Lincoln's Inn, London (1824). He patented achromatic telescopes with Wm. BRUCE with addresses given as 78 Cornhill and Fetter Lane, London and Gateway of Lincoln's Inn, and St James', Pall Mall, London.⁶⁴

WHISTON William - 1667-1752, mathematics teacher.⁶⁵

WHITE James - 1824-1884, Scots optical, mathematical and philosophical instrument maker, 24 Renfield St, Glasgow (1850-52), 14 Renfield St (1853-56), 1 Renfield St (1860-63), 60 Gordon St (1860-63), 95 Buchanan St (1864-68), 78 Union St (1869-75), 241 Sauchiehall St (1876-83), 209 Sauchiehall St (1884-90), and 16, 18, 20 Cambridge St, Glasgow (1884-1900). He sold instruments to Lord KELVIN (1884, 1900).⁶⁶

WHYTE James - fl.1864-1873, Scots nautical instrument and chronometer maker, Glasgow.⁶⁷

WIESEL Johann - 17C, German optician, known for commercial telescopes in Ausburg (c.1645).⁶⁸

WILCOX - see under BABCOCK.

WILLDEY George - early 18C, b.c.1681, d.1737, toy shop owner, selling maps, and optical instrument maker, next the Dog Tavern, corner of Ludgate St, near St Paul's, London, and The Great Toy, Spectacle and Print Shop (ditto), and Archimedes and Globe, Ludgate St, London.⁶⁹ WILLDEY was apprenticed to John YARWELL, and was journeyman to John MARSHALL.⁷⁰ WILLDEY took Edward WATKINS as apprentice (1717), and was in business with Timothy BRANDETH (c.1706-1712) at the Archimedes and Globe.

WILDEY Henry - present day, notable English mirror, lens and optical-flat maker, amateur astronomer, born at Cressy Rd, Hampstead, London, moving to Roderick Rd, Hampstead, and working at Savernake Rd. WILDEY 'retired' in 1988 to 34 Warner's Ave, Hoddeston, Herts, but was soon making short-focus object glasses (e.g. 5.25-inch f/5.7). In his early years WILDEY made complete telescopes, but worked later mainly on the optics of telescopes, sometimes supplying optics to H.N.IRVING and D.FULLER. He became demonstrator at the Hampstead Astronomical Society's 6-inch telescope, and a leading member of the British Astronomical Association (Instrument Curator for 28 years). He was also engaged in specialized projects involving satellite optics, including laser optics. Notable amateur astronomers like F.M. HOLBORN, A.C.CURTIS and P.MOORE purchased WILDEY mirrors which were of the highest quality. Observatories came to the great optician of Hampstead, too, e.g. for a 6-inch objective (London) and for a large secondary mirror (Cambridge).⁷¹

WILLIAMS Brian - present day, optician. He has constructed, together with his able partner, a highly successful public observatory near Knighton, Powys, Wales, after a similar attempt at Trelech. WILLIAMS' instrumentation includes a 13.4-inch f/10 apochromatic triplet (a crown BK7 front element, a rare borate flint, KzF5N-4, middle element, and a flint, BaFN-10, rear element). The observatory has a spectacular camera obscura made by WILLIAMS also of 13.4-inch aperture, being WILLIAMS' early attempt at a large diameter lens.

WILSON Henry - 1673-1741, mathematics teacher.⁷²

WILSON Jac. - 17C- early 18C, English instrument maker, London. There is a 1.6-inch refractor known by WILSON with an erecting eyepiece. The body is square, wooden, and 5.5 feet long.⁷³

WILSON William E - 1851-1908, Irish gentleman astronomer, Dromona Observatory, Streete, Co. Westmeath.⁷⁴

WINDRED - associated with MOSS.

WING Tycho (Snr) - 1696-1750, English mathematics teacher.⁷⁵

WING Tycho (Jnr) - 1726-c.1781, mathematical instrument maker, near Exeter Exchange, Strand, London (1751). He was in partnership (1751-73). WING was a petitioner against DOLLOND's patent for the achromatic combination (1764).⁷⁶

⁶³D. Warner 107.

⁶⁴WEST appears to have been associated with another Charles WEST (Tayl 409). and given as successor to ADAMS (Handlist, Tayl. 378).

⁶⁵Tayl.

⁶⁶See BG 252.

⁶⁷See BG 281. Association with HERON, WHYTE-THOMPSON. Note CHApr88 lot 200.

⁶⁸See A. Turner ESI 91.

⁶⁹See SIMON. Alternative spellings, WILDEY, WELLDY. There is a small 4-draw telescope by him in the Nat. Marit. Mus. See Thomas WILLDEY, died 1776. See also Tayl.

⁷⁰See Turner Mic. 89 and 107/108.

⁷¹See Fig.351.

⁷²See Tayl. There was a certain 19C WILSON of Glasgow who made a 4-inch dialytic telescope, unaware of ROGER's (c.1828) design. See King 191. There was also an Alexander WILSON, a frequent caller on William HERSCHEL. See King 134.

⁷³See A. Turner ESI 240.

⁷⁴See JHA xix, 146, 1988.

⁷⁵See Tayl.

⁷⁶See SIMON. Associated with Thomas HEATH (c.1760).

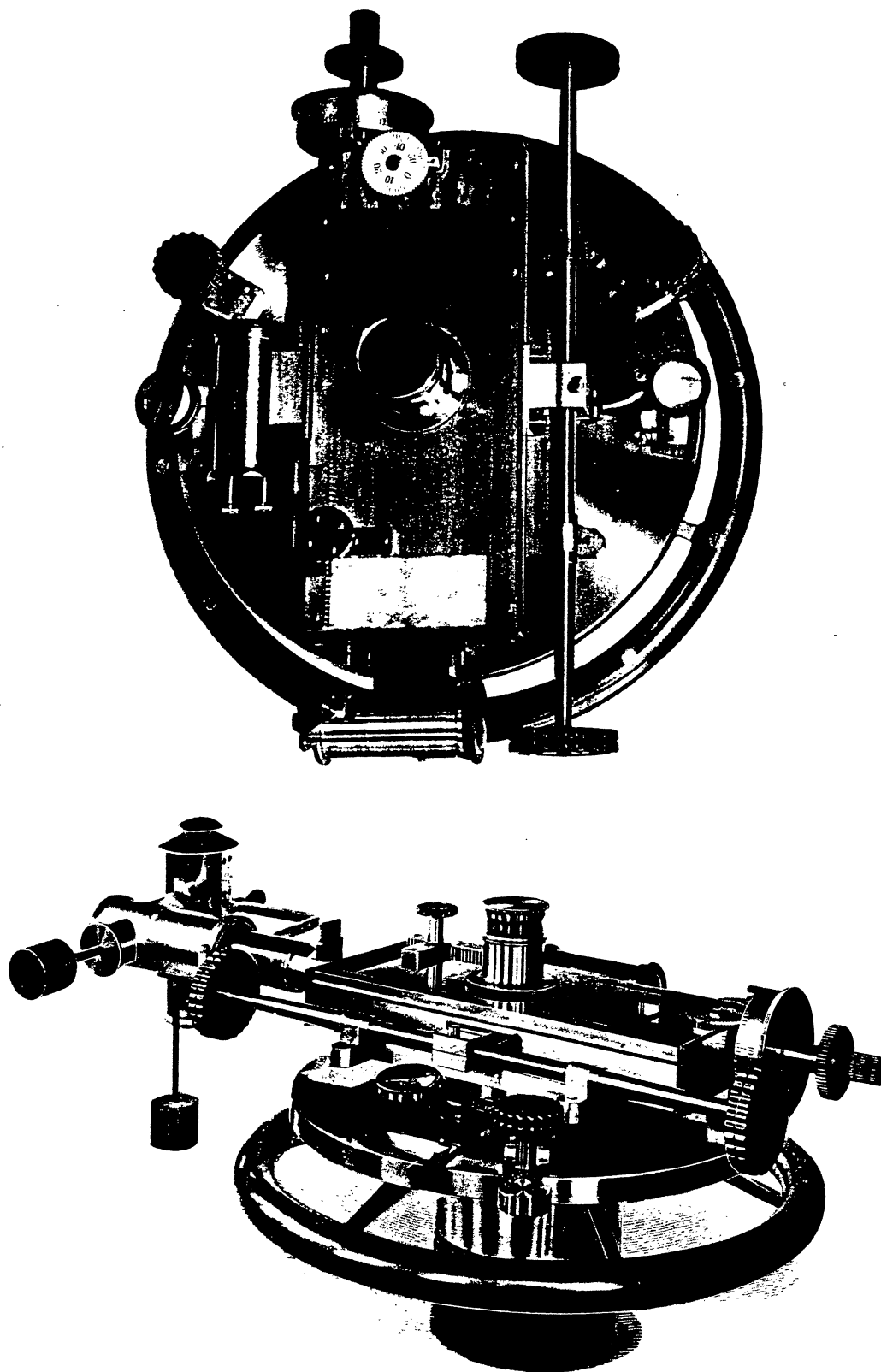
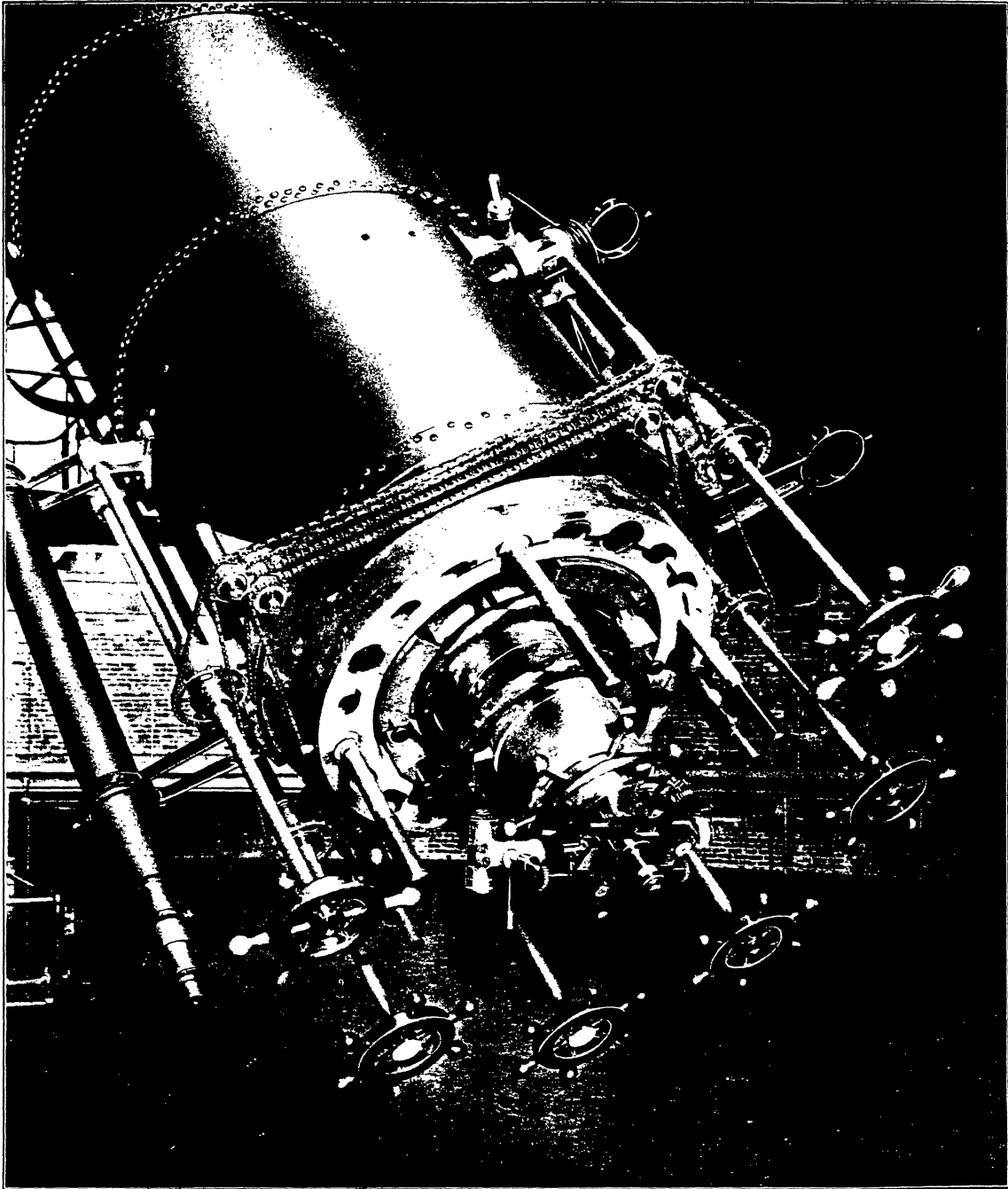
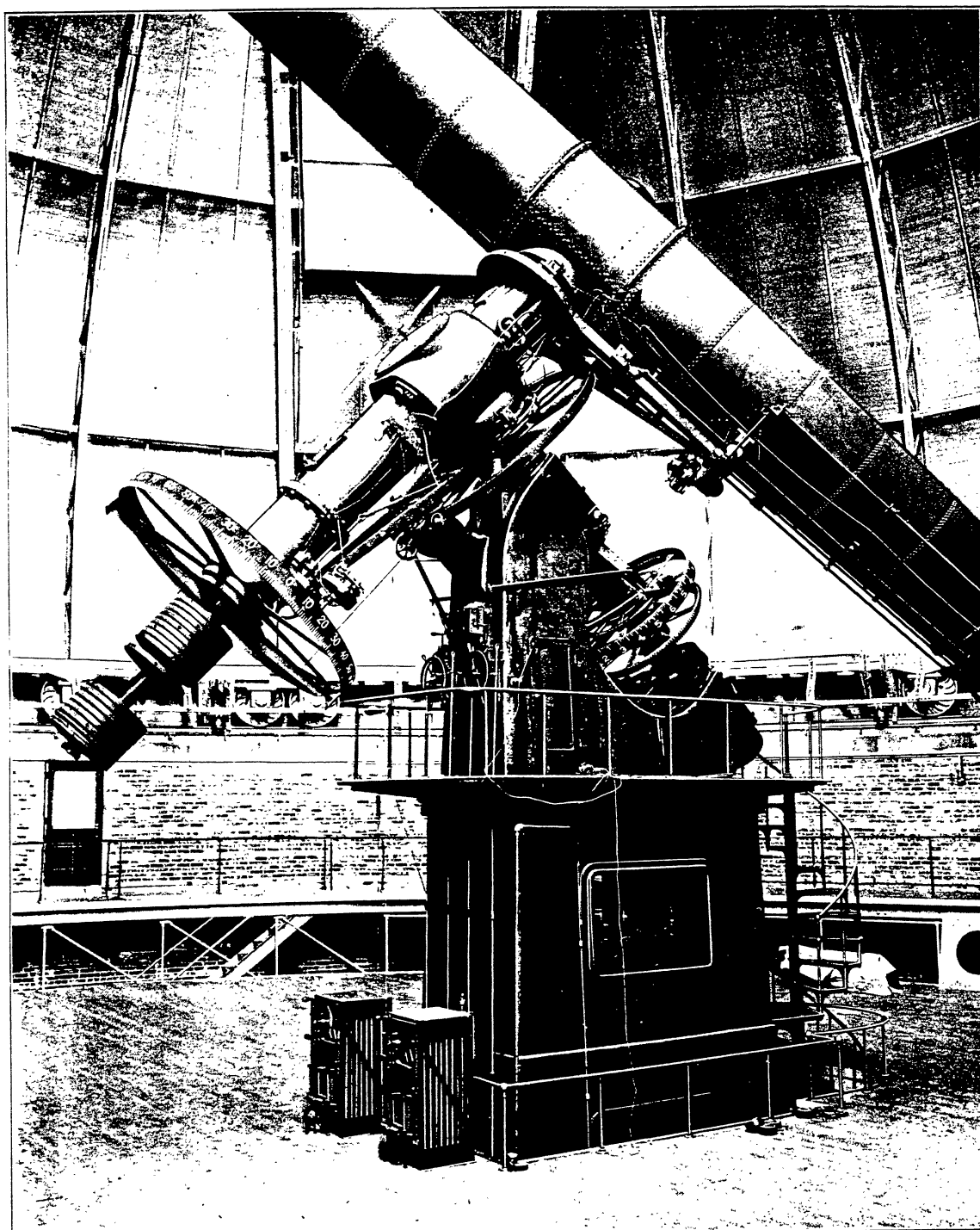


Fig. 347. Two views of the micrometer of the Yerkes Observatory's 40-inch telescope.



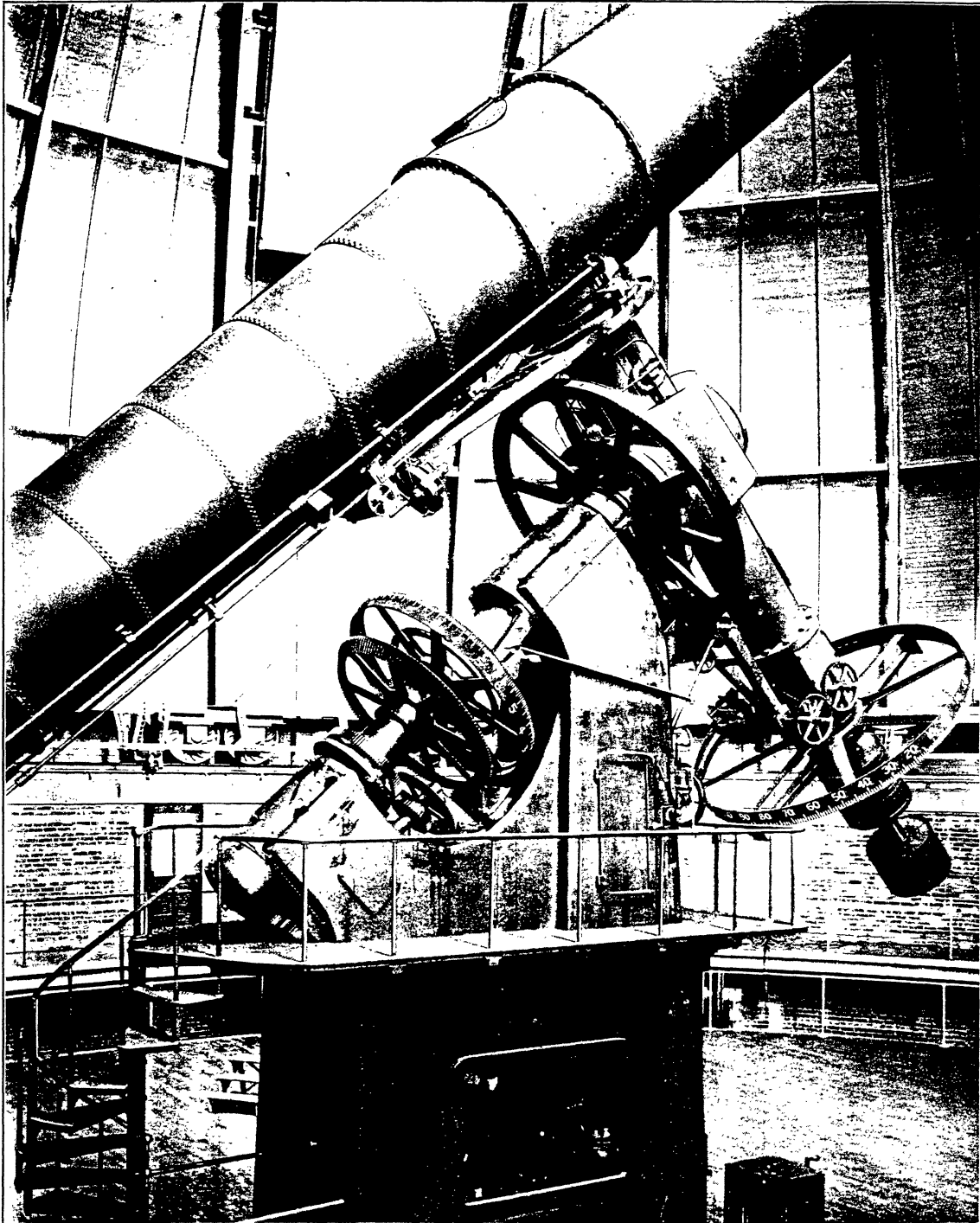
FROM THE WORKS OF
WARNER & SWASEY

Fig. 348. The eye end of the 40-inch telescope.



FROM THE WORKS OF
WARNER & SWASEY

Fig. 349. A detail of the equatorial head of the 40-inch telescope from the northwest.



FROM THE WORKS OF
WARNER & SWASEY

Fig. 350. A close-up view of the equatorial head of the 40-inch from the southeast.

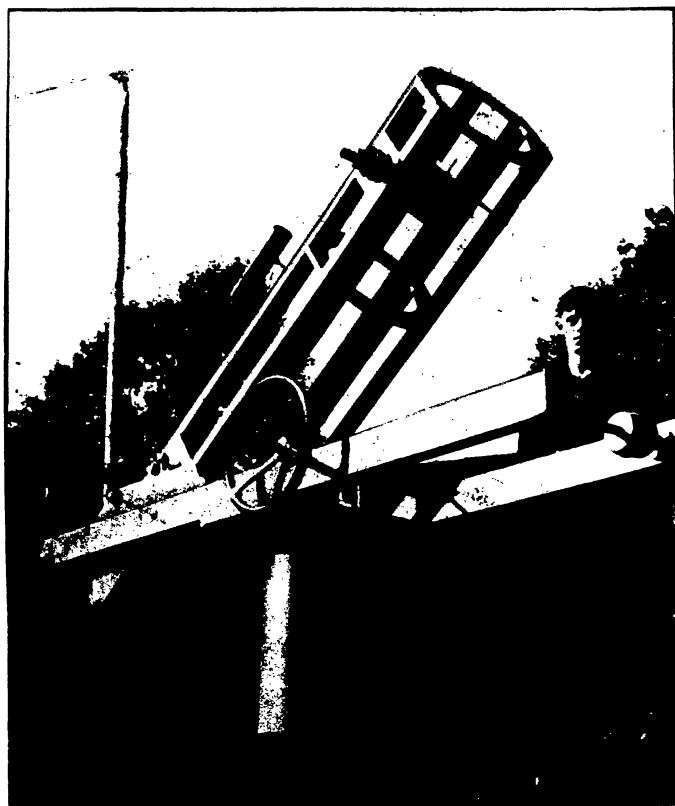


Fig. 351. (a) Henry WILDEY's first telescope on its Newtonian altazimuth mounting, and (b) A recent short-focus refractor with its maker, the well-known English mirror maker and telescope builder, Henry WILDEY.

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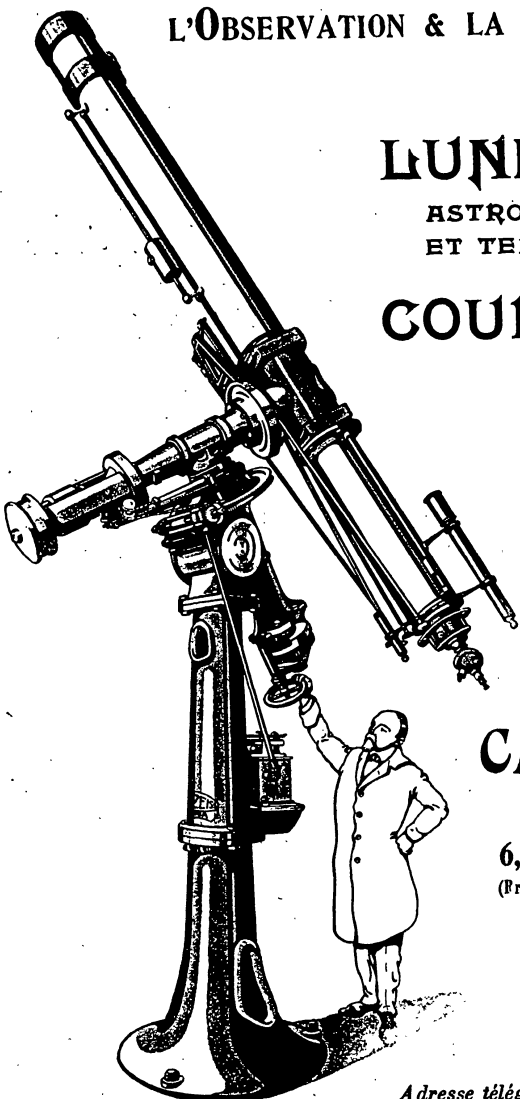
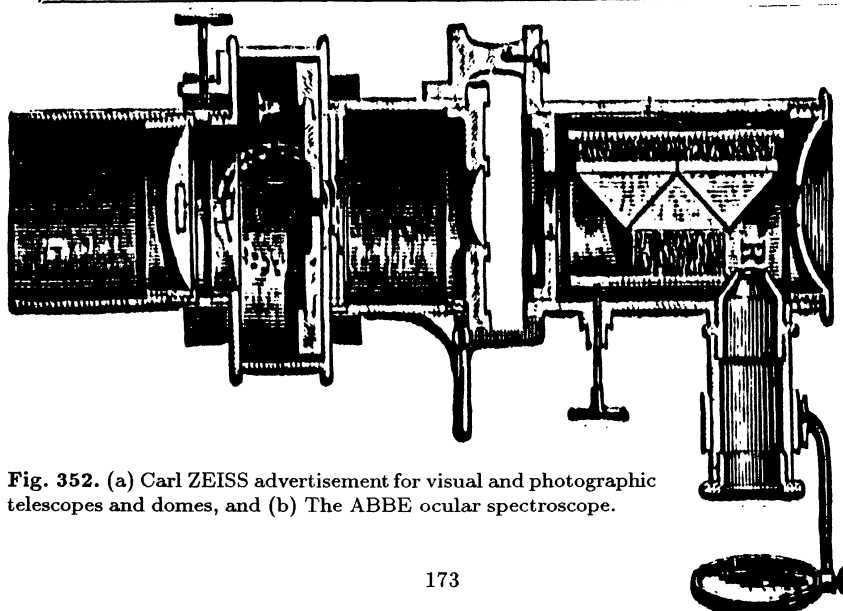



Fig. 352. (a) Carl ZEISS advertisement for visual and photographic telescopes and domes, and (b) The ABBE ocular spectroscope.

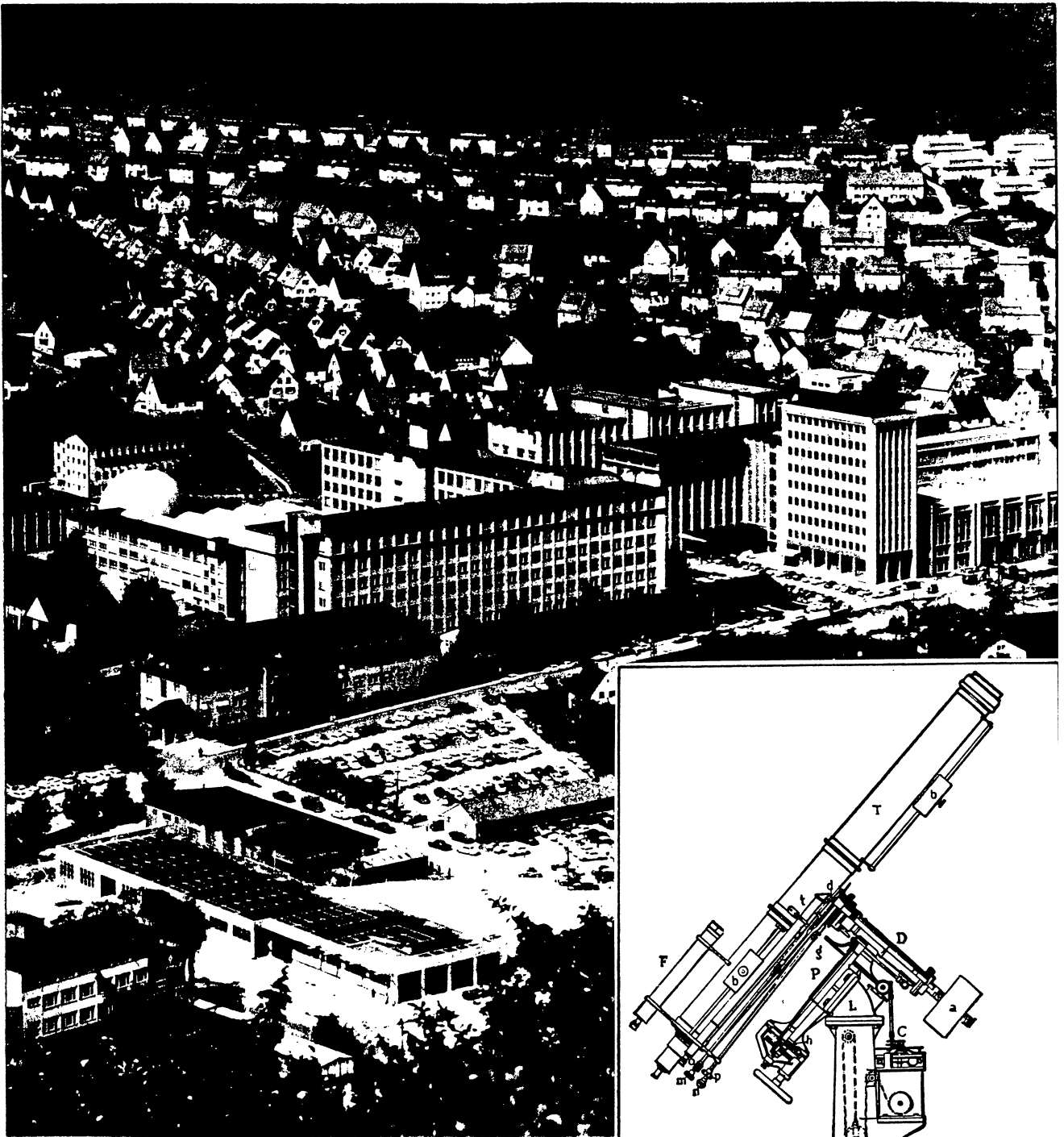
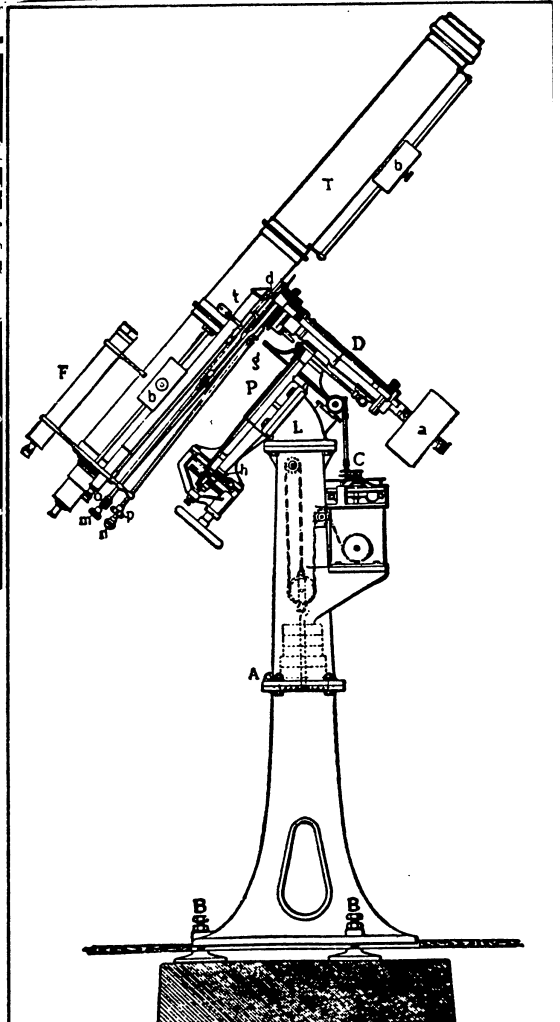


Fig. 353. (a) Carl ZEISS works at Oberkochen/Wuerttemberg, and
(b) A schematic plan of an early ZEISS equatorial refractor.



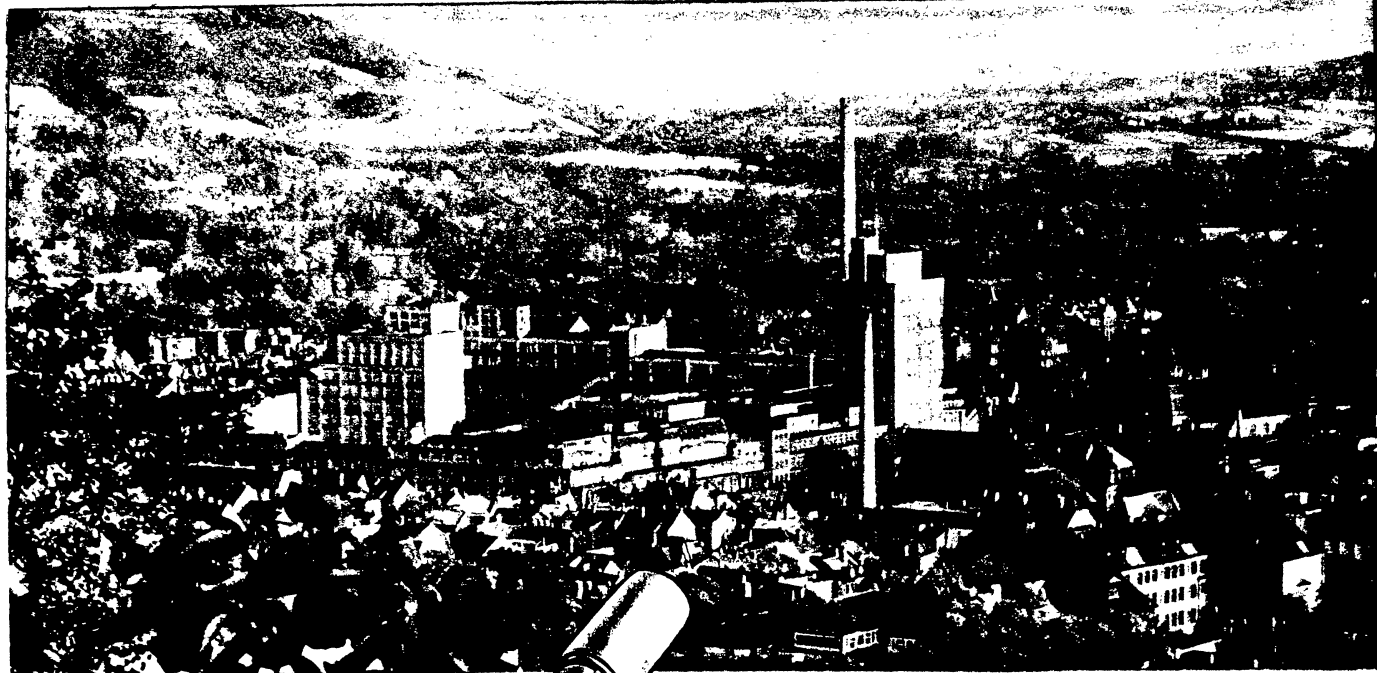
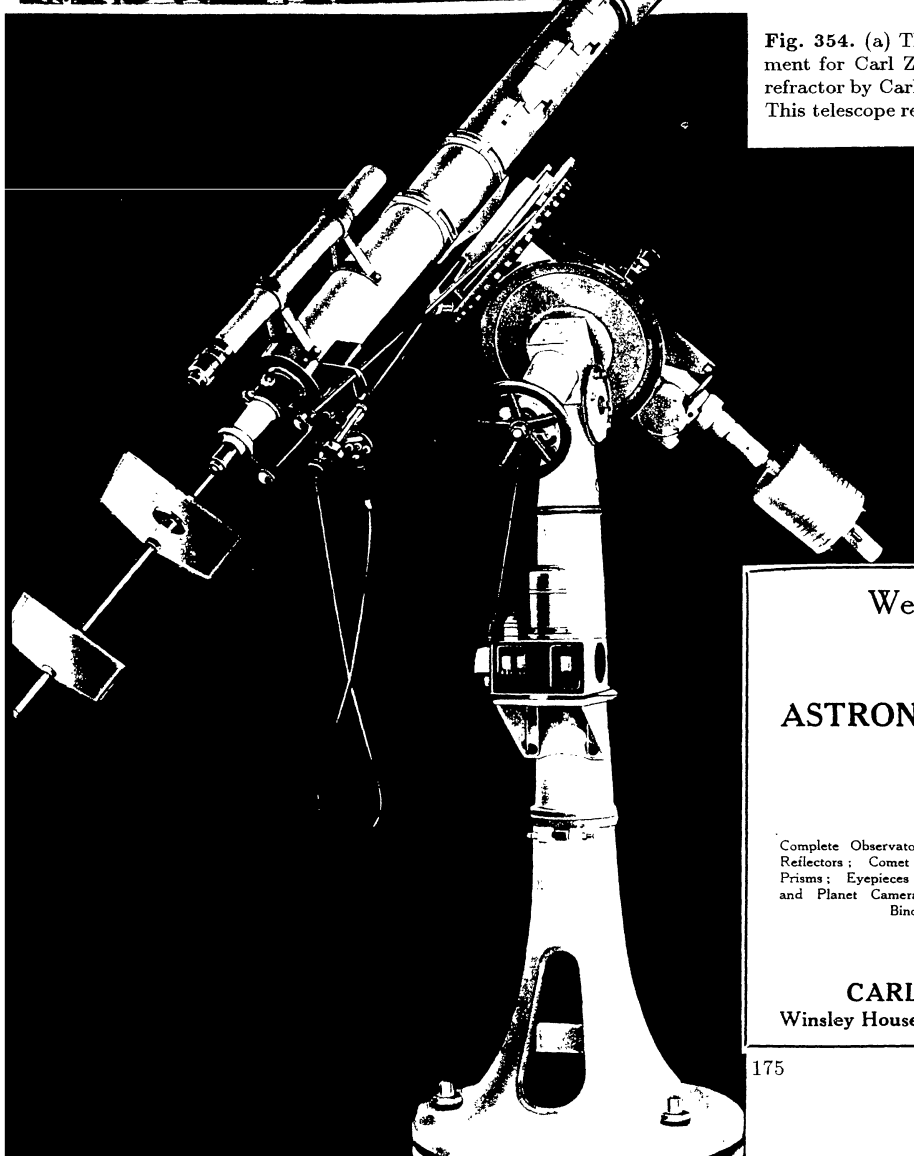


Fig. 354. (a) The factory of VEB Carl ZEISS Jena, (b) Advertisement for Carl ZEISS Jena, and (c) 130mm (5.1-inch) visual $f/15$ refractor by Carl ZEISS Jena shown with a solar projection device. This telescope required a 5 metre dome.



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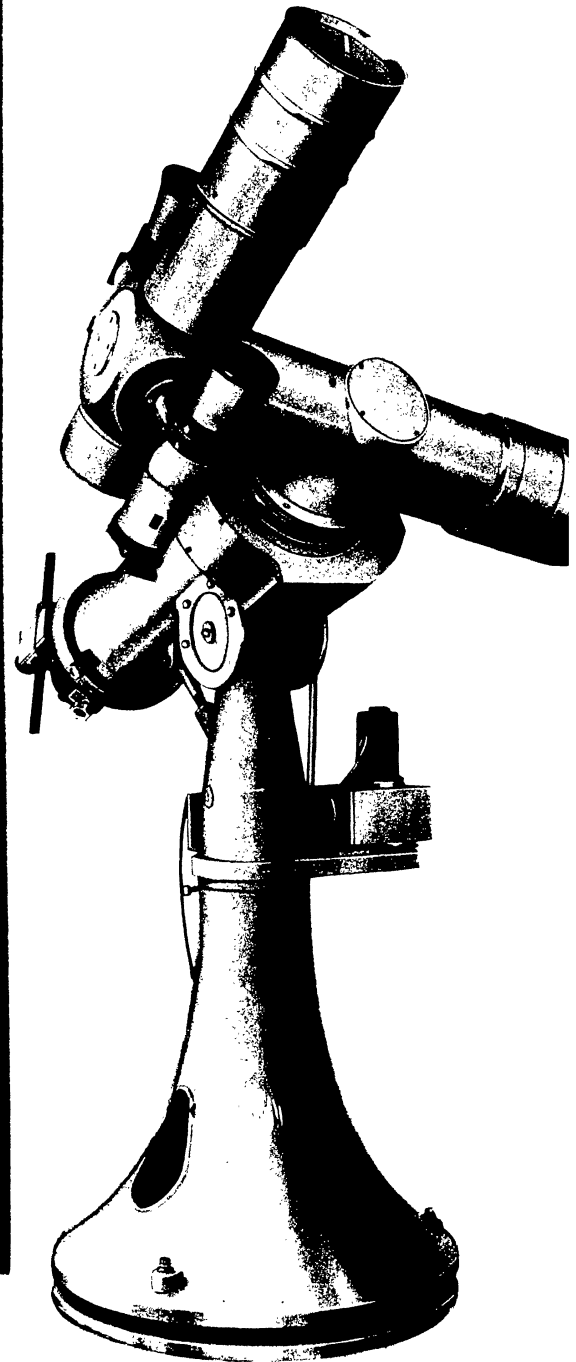
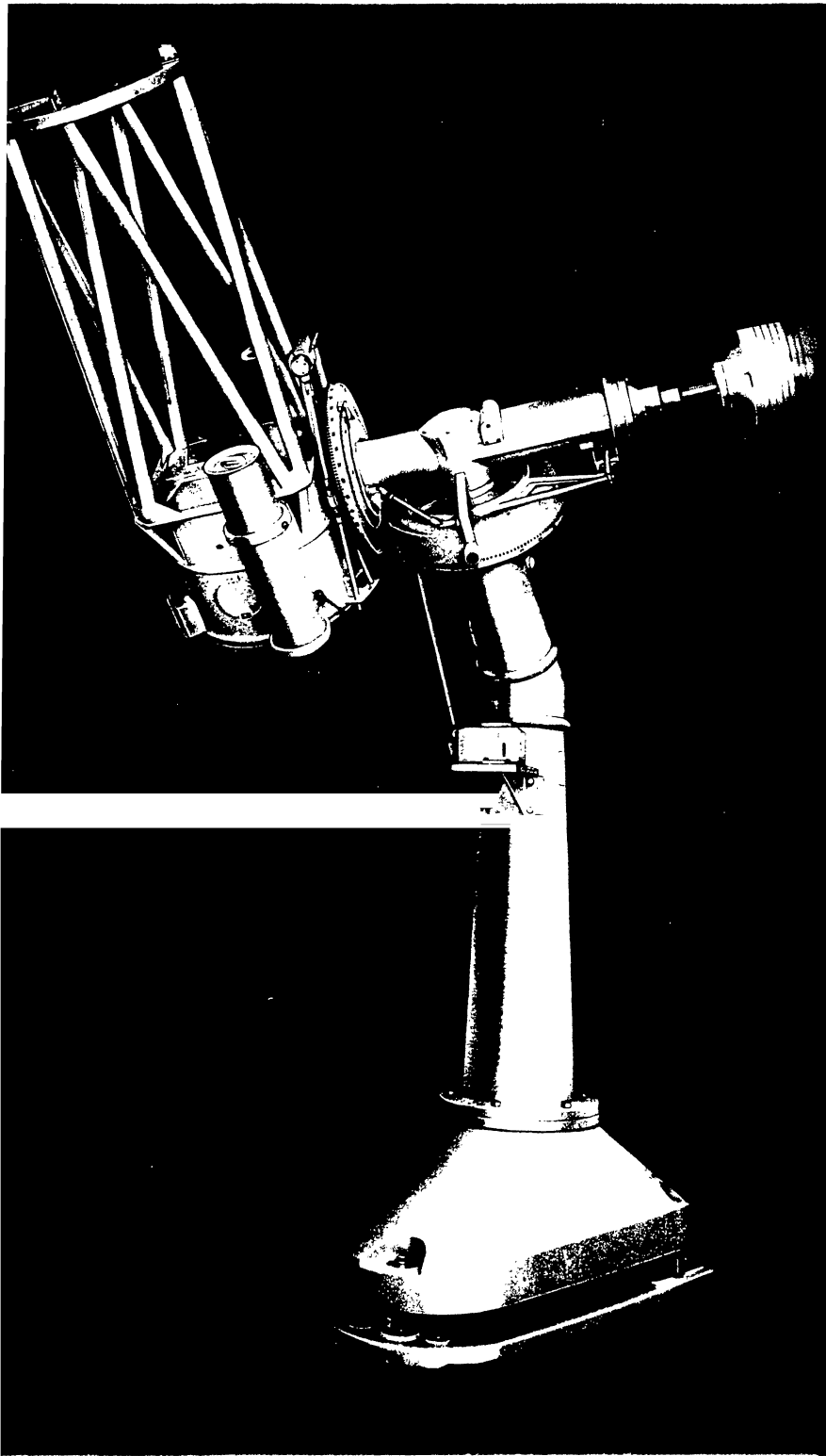


Fig. 355. (a) 500mm (19.7-inch) reflector in skeleton tube for Bukarest Observatory by Carl ZEISS Jena. This telescope is a two-mirror coudé arrangement for observation at the lower end of the RA/hour axis. (b) 150/2250mm (5.9-inch) coudé refractor for Karachi Observatory by Carl ZEISS Jena.

WITH George Henry - late 19C, d.1904, eminent English mirror maker, *Hereford*. Associated with BROWNING who supplied many mountings for WITH's excellent mirrors. WITH's largest mirror was probably an 18-inch (1877). Henry Cooper KEY, of *Stretton Sugwas, near Hereford*, worked with WITH on this 18-inch.⁷⁷

WOLFIUS - early 18C. He suggested placing a concave lens between telescope objective and eyepiece to increase the focal length and hence the magnification.⁷⁸

WOLLASTON Francis (Rev) - 1731-1815, English natural philosopher and gentleman astronomer, *Chiselhurst, Kent*, eldest son of Francis WOLLASTON (Snr), 1694-1774. He owned a 3.75-inch Peter DOLLOND refractor (1771) and a CARY transit circle (1792), and with his wide interest in instruments, he was associated with names like RAMSDEN and TROUGHTON.⁷⁹ The refractor was probably a triple achromat which passed on to his son. One of WOLLASTON's telescopes was moved to *Biggleswade* to Thomas McCLEAR's observatory, and then to *Altona*.⁸⁰ His son, William Hyde WOLLASTON, became the well known scientist.

WOLLASTON William Hyde - 1766-1828, eminent chemist, physiologist, physicist and astronomer. He was the third son of Francis WOLLASTON. His brother, the eldest son, Francis John Hyde (1762-1823) was a friend of the naturalist Charles DARWIN.⁸¹ There is also a camera lucida patented by WOLLASTON, used by Sir John HERSCHEL.⁸² His method for the measurement of the refractive index of a liquid is used in the Pulfrich refractometer,⁸³ and he was the designer of the so-called WOLLASTON prism.

WOOD Edward George - early 19C, English optical, mathematical and philosophical instrument maker, *15 King St, Clerkenwell, London* (1833), *7 Shepperton St, New North Rd, London* (1839).⁸⁴ He took over part of ABRAHAM's firm.⁸⁵

WOODWARD Charles - 19C, president of the Islington Science Society (c.1860), and known for his demonstration apparatus for wave interference.

WOODWARD J J - microscopist, known for his high-powered microscope objective.⁸⁶

WOODWARD W - 19C, English instrument maker, associated with John BROWNING (c.1869-75), leaving the firm at the same time as HILGER.⁸⁷

WORTHINGTON - 19C, English optician, *196 Piccadilly, London* (1835-1851), successor of Matthew BERGE. He had RAMSDEN's dividing machine.⁸⁸

WRAY William - eminent English optical instrument maker and retailer, *43 Havering St, Commercial Rd East, London* (1851), and later at *Ashgrove Rd, Bromley, Kent*.⁸⁹

⁷⁷See King, and Chambers vol.2, 9, showing WITH 12.25-inch telescope from 1874. See e.g. Elliott MERLIN's observatory at *Ealing* (JBAA 53,162 picture) and the 9-inch WITH mirror (mounted by BROWNING) owned by Mjr John TENNANT (1868). George CALVER was another highly successful 19C mirror maker, credited with probably 2000-4000 mirrors made or re-figured. See *Astronomy Now* Feb.1991, by Marriott. Early mirror makers did not use the FOUCAULT test but used artificial stars or distant objects (a watch at 100 feet !). Other owners of WITH mirrors were eminent observers like Thomas WEBB, George SEABROKE (Temple Observatory, Rugby), William DENNING (a 10-inch WITH-BROWNING) and the Oxford University Observatory (a 10-inch and 15-inch). An 18-inch WITH mirror was purchased by Rev. Jevon Muschamp PERRY (1879), and subsequently passed to Nathaniel GREEN, and then to the BAA (1899). This famous WITH mirror was later used by Rev. Theodore PHILLIPS at *Headley, Surrey*. This mirror passed to Denis BUCZYNSKI.

⁷⁸See Lockyer 89, King 197. Also, c.f. BARLOW and DOLLOND who made an 'achromatic' negative lens to perform similar task to be attached to the inner tube of the ocular.

⁷⁹See Repsold Fig.131.

⁸⁰See Howse 68.

⁸¹WOLLASTON discovered the dark lines in the solar spectrum (see e.g. Lockyer). It was left to FRAUNHOFER to identify and measure these solar absorption lines. See Shad Tel 17.

⁸²See Ganot 611. The camera lucida is a device consisting of a small prism which is used to effectively divide the pupil (one half views the specimen, or scenery, the other half the drawing being made). AMICI designed a variation in which the head of the drawing pencil was seen projected against the field of view using a semi-transparent glass slip.

⁸³See Ditchburn 461.

⁸⁴Also *74 Cheapside, London*.

⁸⁵We record also WOOD, *Liverpool* (1884). See Handlist. See WOOD (late ABRAHAM), late 19C, CHrDec85 (illustr) and WOOD E.G *Cheapside*, late-19C CHrDec85, CHrSep86 and Fig.328a.

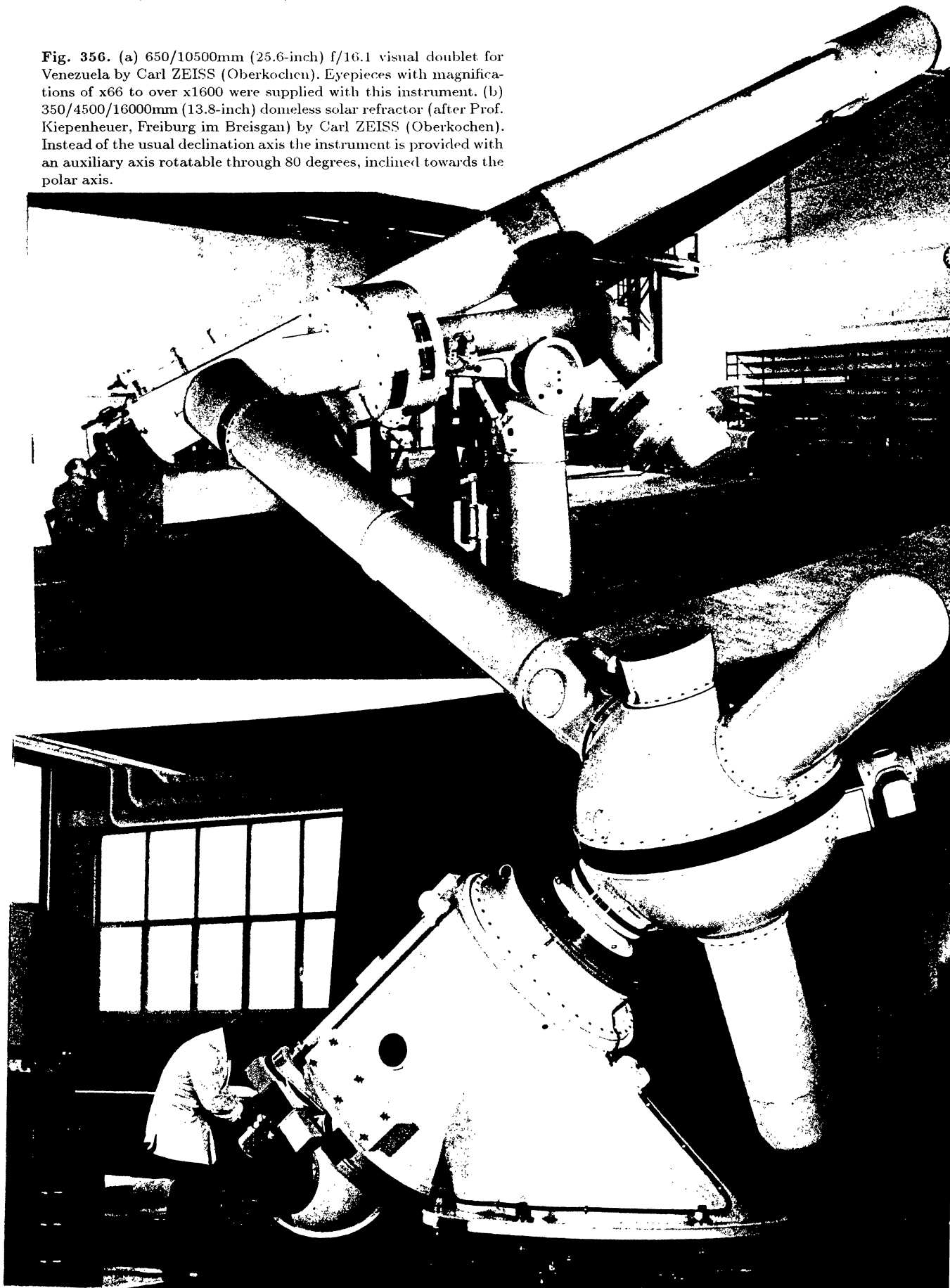
⁸⁶See Turner Mic. 46.

⁸⁷It is not known to the present author as to what WOODWARD did afterwards, but at least he wrote a short obituary to BROWNING.

⁸⁸See SIMON and Stimson (1985).

⁸⁹See [CHrSep86] illustr. c.1881 (Handlist). Also, see Sedgewick for WRAY's optical design of objectives. A 4.3-inch WRAY refractor belonging to WARD purportedly could show Uranus' two outer satellites (King 259). See also Sedgewick 102 describing some of WRAY's photographic objectives. See Fig.328b.

Fig. 356. (a) 650/10500mm (25.6-inch) f/16.1 visual doublet for Venezuela by Carl ZEISS (Oberkochen). Eyepieces with magnifications of x66 to over x1600 were supplied with this instrument. (b) 350/4500/16000mm (13.8-inch) domeless solar refractor (after Prof. Kiepenheuer, Freiburg im Breisgau) by Carl ZEISS (Oberkochen). Instead of the usual declination axis the instrument is provided with an auxiliary axis rotatable through 80 degrees, inclined towards the polar axis.



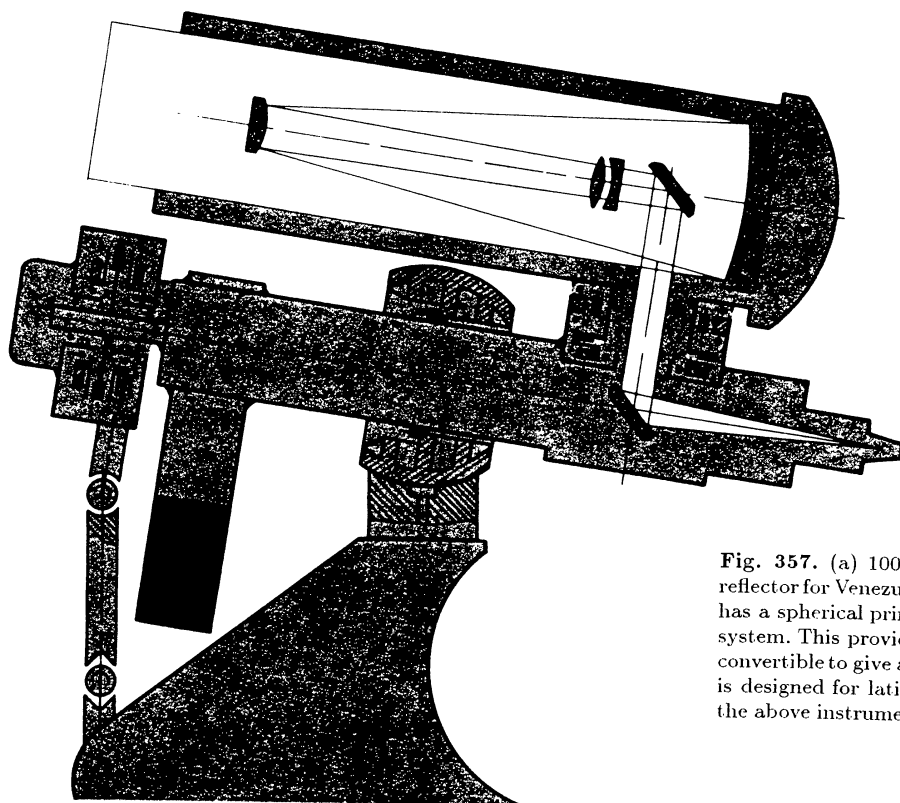
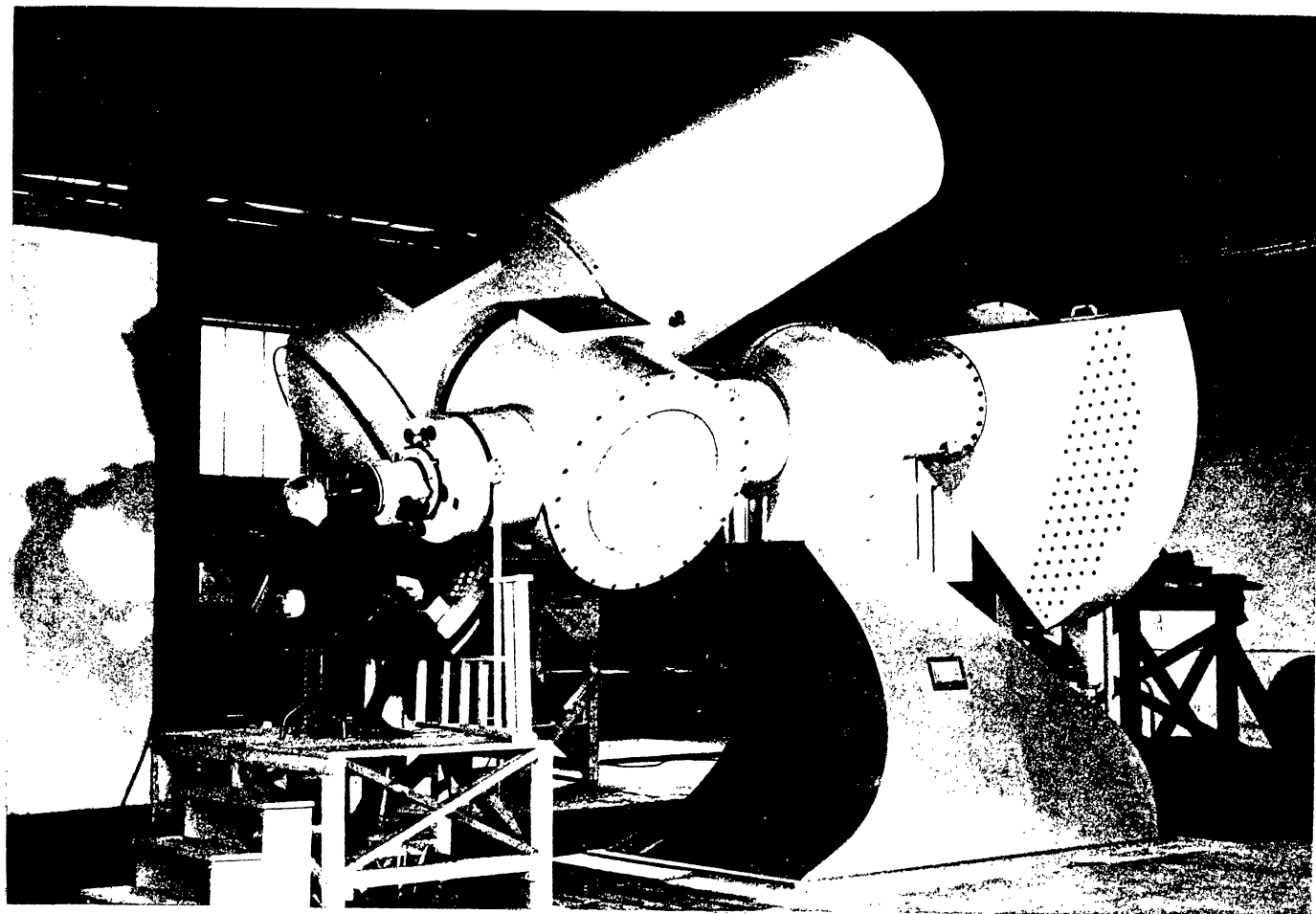


Fig. 357. (a) 1000/21000mm (39.4-inch) f/21 cassegrain coudé reflector for Venezuela by Carl ZEISS (Oberkochen). The instrument has a spherical primary, aspheric secondary and a 2-element afocal system. This provides an extended field of 23 arcmins, and is easily convertible to give a 2.6 degree visual field. This particular mounting is designed for latitudes of 0 to 30 degrees. (b) Schematic plan of the above instrument.

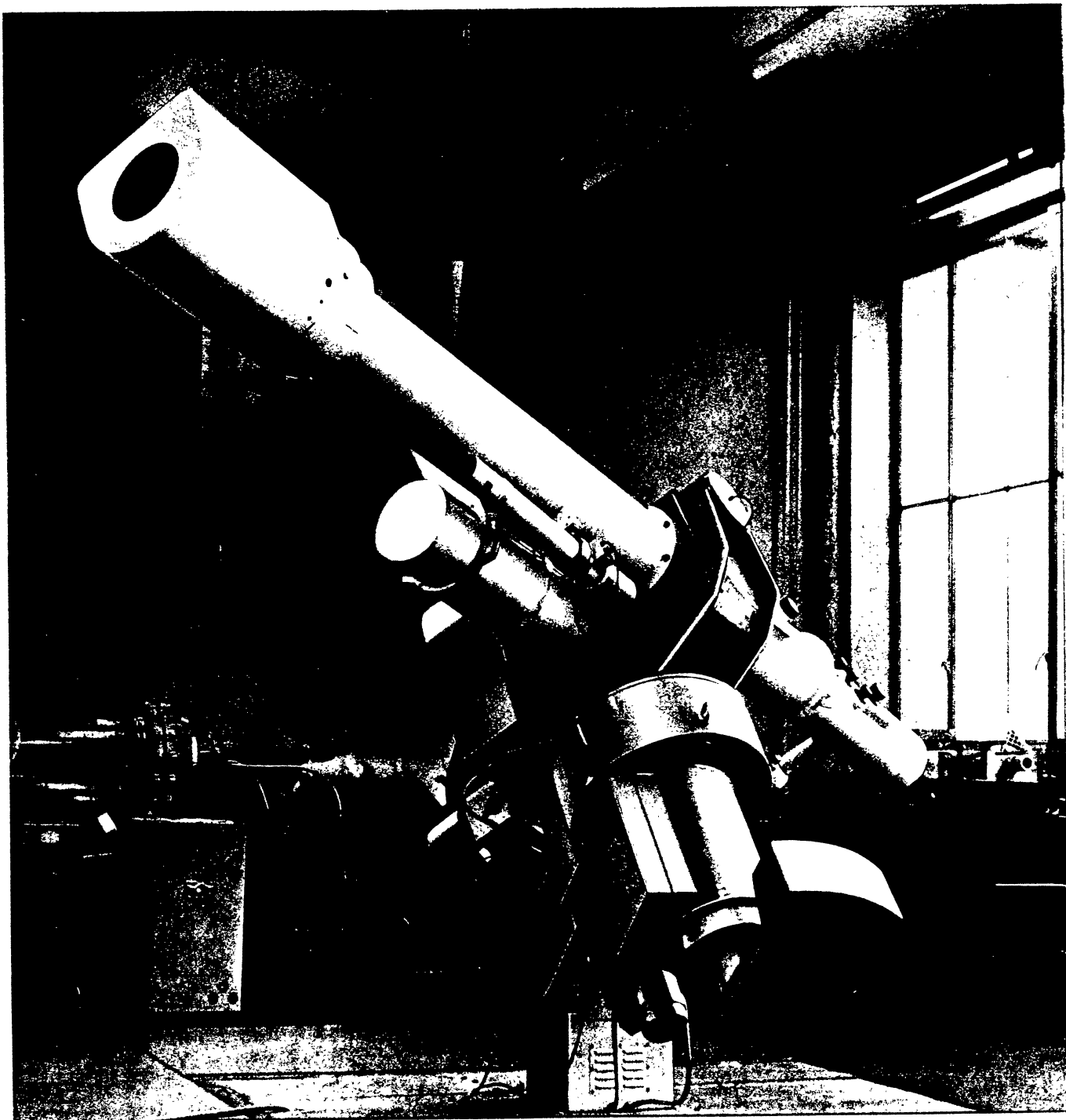


Fig. 358. 200/2250mm (7.9-inch) f/11.25 coronagraph by Carl ZEISS (Oberkochen).

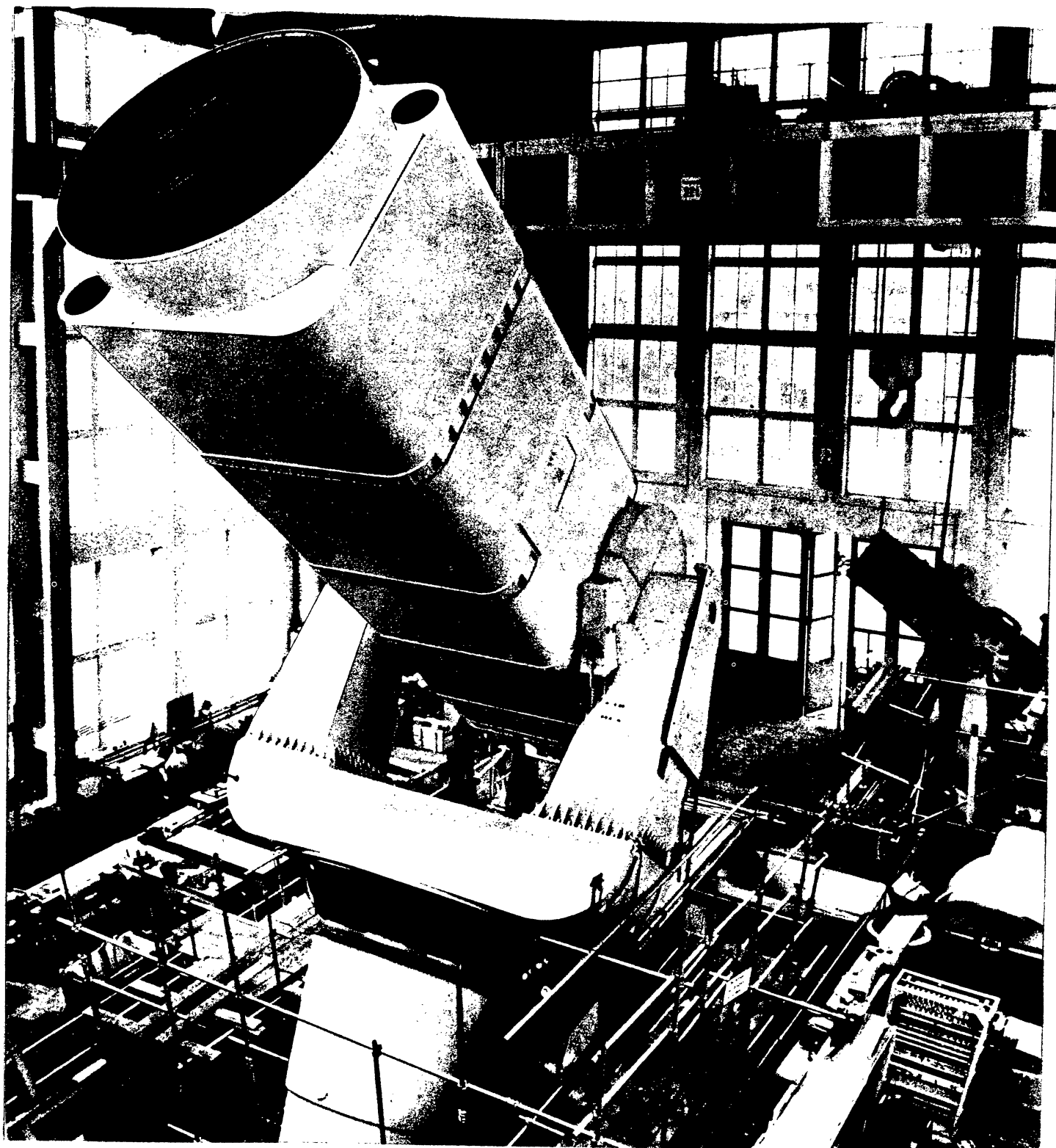


Fig. 359. 2-metre universal reflector (German Academy of Sciences Berlin) by Carl ZEISS Jena. This instrument combines a Schmidt 1340/2000/4000mm (78.7-inch) system for 24x24cm photographic plates (3.4x3.4 degrees), and a coudé 2000/4000/92000mm (78.7-inch f/46) system. Two 300/4750mm (11.8-inch f/15.8) finders are incorporated in the telescope body.

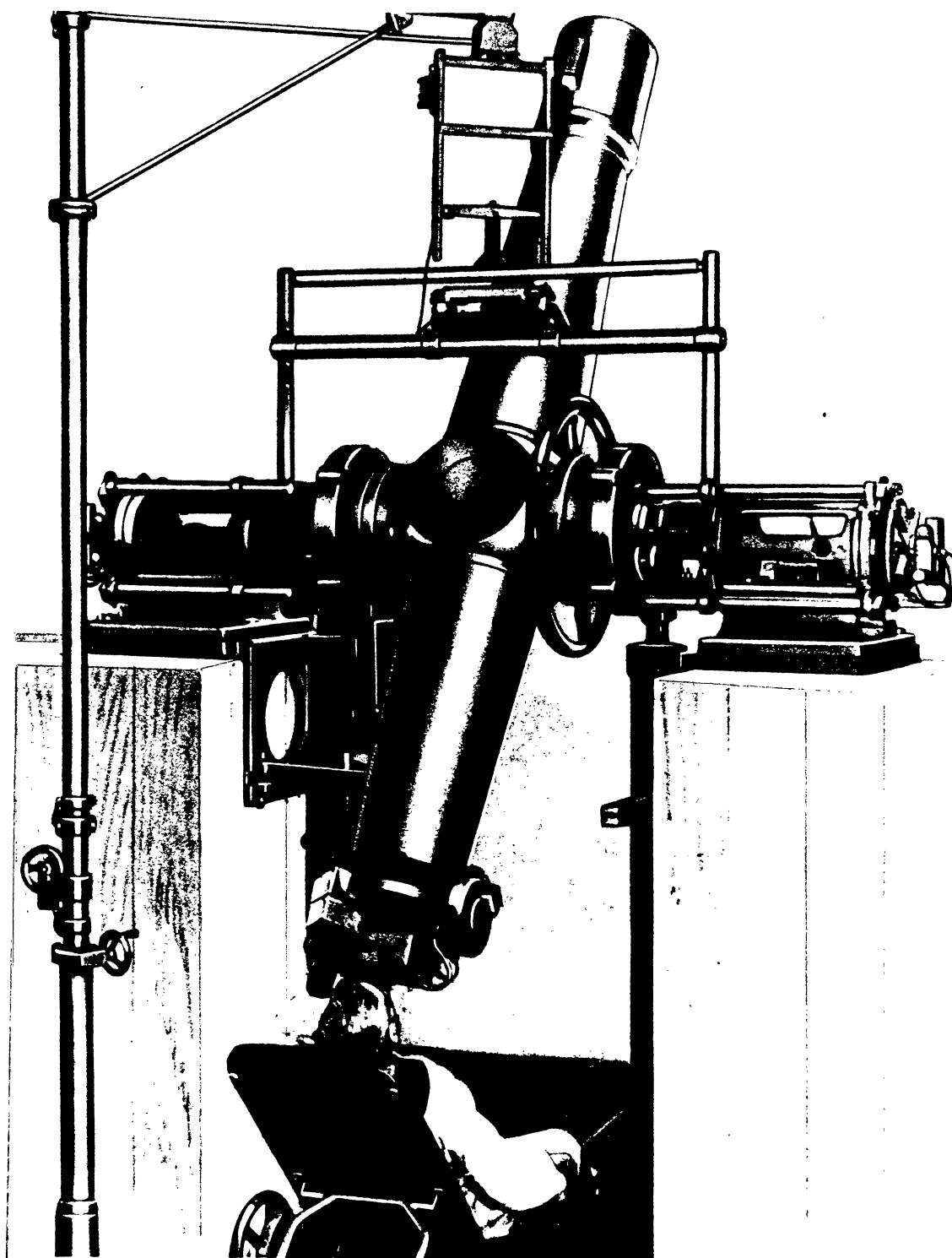


Fig. 360. Carl ZEISS (Oberkochen) 190/2578mm (7.5-inch) meridian circle. This is an ASKANIA-type instrument, with counter-balanced vee-type bearings (with only 3kg loading).

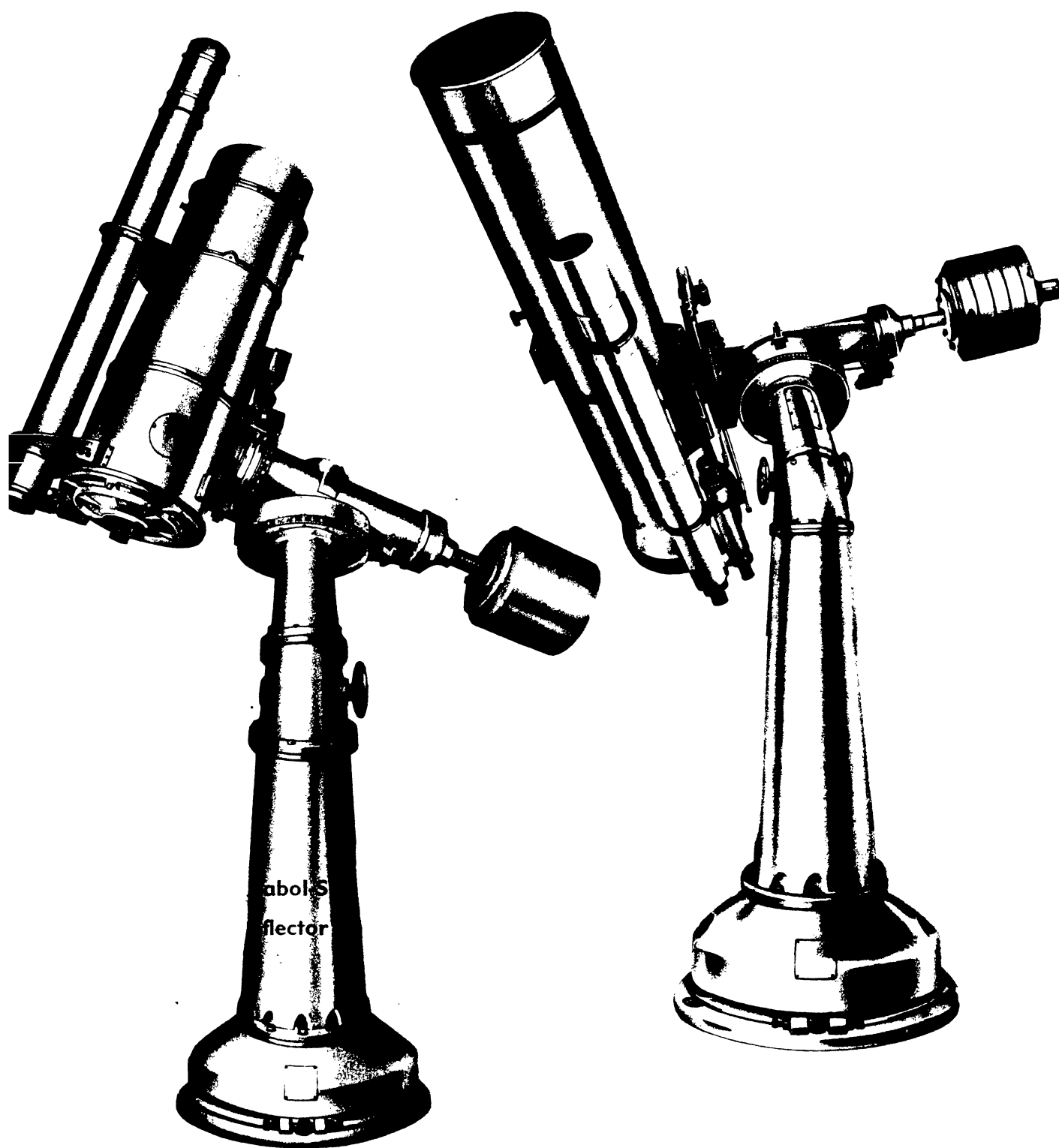


Fig. 361. (a) 600mm (23.6-inch) $f/7.5$ and cassegrain $f/30$ reflector of Sonneberg Observatory by Carl ZEISS Jena. N.B. The elbow mounting. (b) 500/700/1750mm (27.6-inch) Schmidt telescope as at Sonneberg and Potsdam Observatories by Carl ZEISS Jena. Square 16x16cm photographic plates are used giving fields of 5.24 degrees with a plate scale of 117.9 arcsec/mm.

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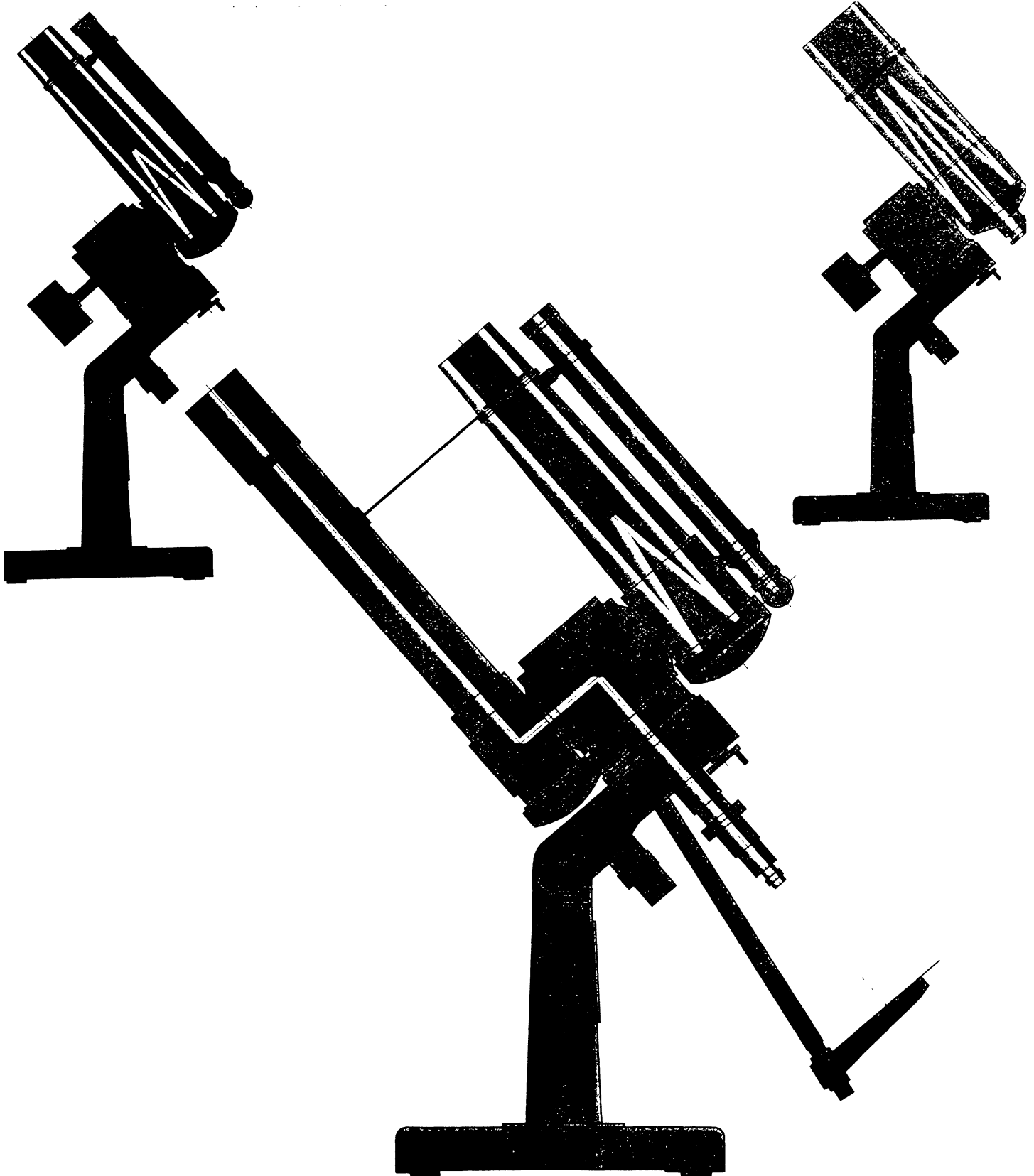


Fig. 362. Schematic plans from Carl ZEISS (Oberkochen) for (a) 200/300/600mm (11.8-inch) Schmidt, (b) 300/1200/3600mm (11.8-inch) cassegrain refractor, and (c) The pole-universal mounting in which the polar axis is a single spherical oil-pressure bearing (ball-joint).

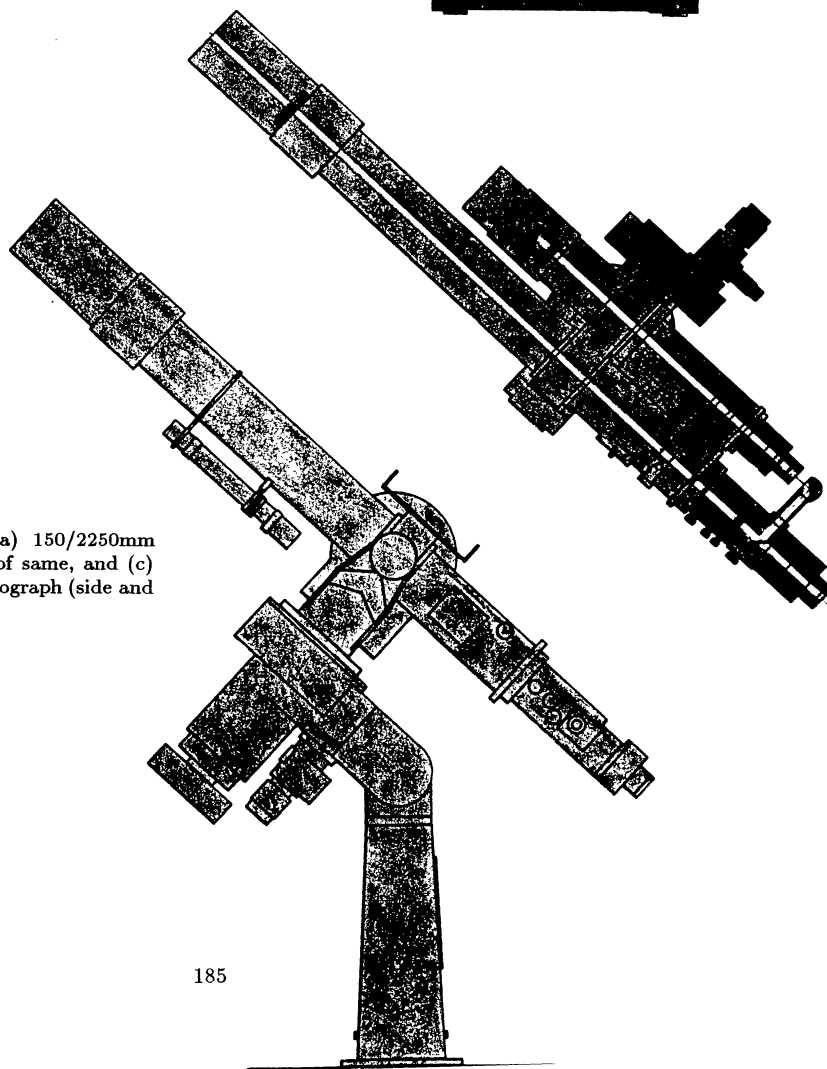
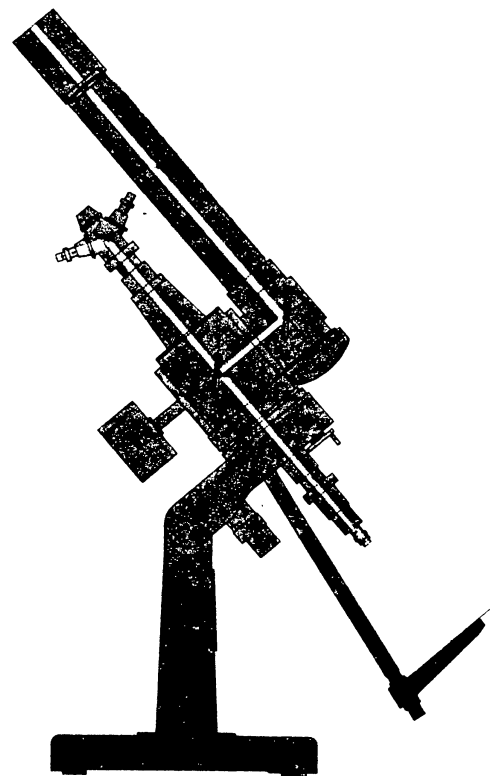
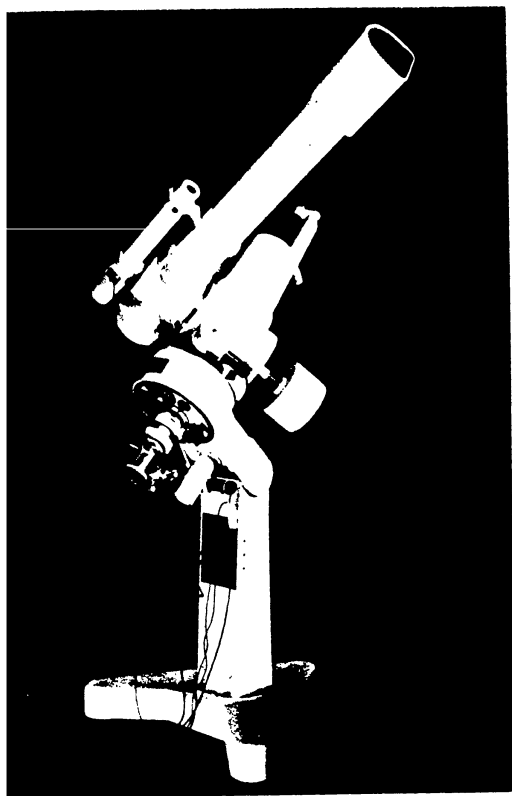


Fig. 363. From Carl ZEISS (Oberkochen), (a) 150/2250mm (5.9-inch) coudé refractor, (b) Schematic plan of same, and (c) A schematic plan of 200/2250mm (7.9-inch) coronagraph (side and top views).

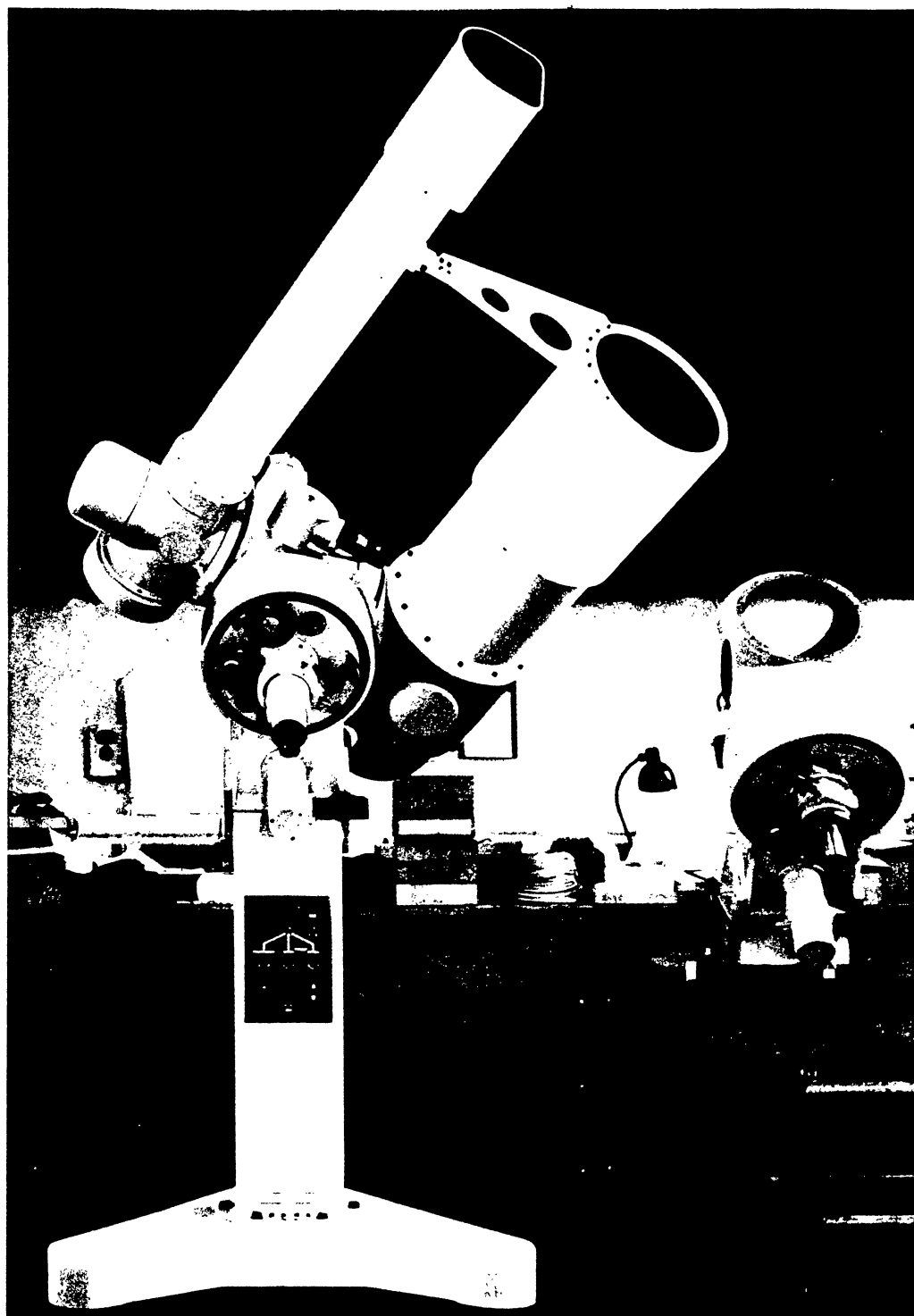


Fig. 364. From Carl ZEISS (Oberkochen), a double coudé refractor, 150/2250 (5.9-inch) and cassegrain coudé 300/1000/5000mm (11.8-inch).

WREN Christopher (Sir) - 1632-1723, well known English architect /mathematician and natural philosopher. He was involved in the foundation of the Royal Society, was professor of astronomy at Oxford, professor of mathematics at Gresham College, London, and was engaged with HOOKE and others on an abortive attempt to plan the re-building of London after the Great Fire in 1666 (he managed St Paul's and other churches, colleges and libraries).⁹⁰ In our context, WREN experimented with aspheric lenses.⁹¹

WRIGHT Thomas (I) - c.1686-1767, retired 1747/48, English mathematical instrument maker, toyman, *Orrery and Globe, near Salisbury Court, Fleet St, London* (1720), *The Orrery and Globe, near Water Lane, Fleet St* (1734), *The Orrery, ditto* (1738), *The Orrery and Globe, next the Globe and Marlborough Head Tavern in Fleet* (1747). He resided in *Hoddesdon, Herts* in retirement. A partnership is recorded in 1740-41.⁹²

WRIGHT Thomas (II) - 1711-1786, English mathematical instrument maker, teacher and inventor, *at the Sign of the Creation, Sunderland* (1730-34), *St James's, London* (1735-48), *Byers Green, Brancepeth* (1762). He worked for HEATH and SISSON. COLE (Snr)'s shop in *Fleet St* was on one of the WRIGHT's old premises.⁹³

WRIGHT F.B - 20C, theoretical optician. He modified the SCHMIDT camera, and discussed many SCHMIDT-type systems. He designed an ellipsoidal primary with a modified corrector plate just behind the focus, with a plate holder attached to the rear face of the corrector.⁹⁴

WROTTESELEY John (Lord) - 19C, English gentleman astronomer, at *Blackheath* (active until c.1840), and then at *Wrottersley Hall, Staffordshire* (up to c.1856). He was a contemporary of BISHOP and LEE. At his private observatory, he owned a 3.75-inch aperture JONES transit instrument, and a 7.75-inch aperture DOLLOND /GUINAND refractor, and a 2-inch TROUGHTON transit circle.⁹⁵

WYETH William - fl.1715-41, mathematical instrument maker, land surveyor, *The Orrery, Fleet St, London* (1741). In partnership with COGGS (c.1733-40), and with WRIGHT (c.1740-41).⁹⁶

WYKSEN J - Optische und Feinmaschin werke, *Katowitz* (German World War II binocular code byg).

WYNNE Charles G - present day English theoretical optician, involved with many of the world's largest telescopes along with other notables like LINFOOT. He designed an excellent 3-element focal plane corrector.⁹⁷

Y

YARWELL John - c.1662-1709, leading English microscope maker, *Archimedes and Spectacles, St Paul's Churchyard, London*, and later at *Archimedes and 3 Golden Prospects*. A 6-draw telescope is known (Nichol's private collection, London), and it appears that YARWELL made telescopes up to 8-feet long, and also microscopes.⁹⁸

YEATES Andrew - 1800-1876, born in *Dublin*, joined TROUGHTON (1821). Later assistant at *Greenwich Observatory*. There is YEATES of 2 *Grafton St, Dublin*, recorded from 1877, as instrument maker (including optics).⁹⁹

Z

ZAMBRA Joseph Cesare - barometer maker, father of Joseph Warren ZAMBRA, b.1796 at *Careno, Como, Italy*, and recorded at *Saffron Walden, Essex* (1821-40), and 23 *Brook St, Holborn, London* (1840-41).

ZAMBRA Joseph Warren - 1822-1897, barometer and meteorological instrument maker, in partnership also throughout his life with NEGRETTI. The partnership is remembered for many fine telescopes.

ZEISS - the eminent family noted for some of the world's finest telescopes, and high quality scientific instruments. Amongst the early observatory instruments, we note the 32-inch f/15 photographic refractor and 20-inch f/25 visual refractor at Potsdam (1899), the 28-inch reflector at Heidelberg (1905), the 39.4-inch reflector at Bergedorf, Hamburg (1913), the 23.6-inch photo-visual refractor at Lembang (Bosscha), Java, the 49-inch reflector at Berlin-Babelsberg (1927) and three famous 25.5-inch refractors at Berlin-Babelsberg (1912), Belgrade (c.1929) and Tokyo (1930).¹⁰⁰ Apart from large observatory instruments and diverse scientific instruments, the firm of ZEISS, of course, produced fine small telescopes and accessories in 19C/20C. See also under ABBE, RUDOLF and SCHOTT.

⁹⁶See SIMON and Tayl. Alternative spelling WYERTH.

⁹⁷See Proc.Phys.Soc. London (1949) 62, 772, and Appl.Optics (1965) 4, 1185, and (1967) 6, 1227. See also King 368. We note also Henry WYNNE (c.1710-21). See Daumas 310.

⁹⁸YARWELL advertised microscopes etc. in MOLYNEUX's *Treatise of Dioptricks* (1709). See Whipple Mus.Hist.Sci. (tradecard), and Turner Mic.98 and 106.

⁹⁹See Handlist.

¹⁰⁰See Figs. 352 to 368. Also, Czapski in Ap.J. (1905) 21, 379.

⁹⁰See Simpson in Vistas 28.

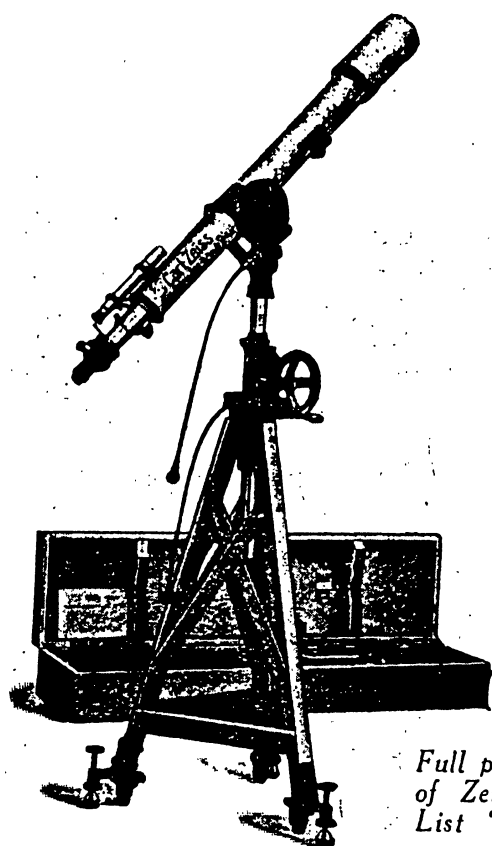
⁹¹See King 61.

⁹²See SIMON.

⁹³See SIMON and Tayl 114. Also, Ann.Science 1 (1951). Taylor lists seven WRIGHTS, including David (o.i.m. fl.1830), Thomas (m, ph. and oim, fl.1830), John (quadrants, fl.1740-61), George (globes, fl.1780) but we have been unable to confirm these.

⁹⁴See King 358 and 359.

⁹⁵Probably designed by himself, used in measuring accurate stellar positions. See Vistas 28, 157. This instrument is now in the Museum for the History of Science and known as the 'LEE circle'. John HARTNUP, director of Liverpool Observatory, was WROTTESELEY's chief assistant. See Dewhirst 157 and Dict.Nat.Biog.



ZEISS

110 mm. ($4\frac{1}{4}$ ")

ALTAZIMUTH TELESCOPE "ASESTEN"

With new AS type semi-apochromatic objective of 65" focus ; 1 Kellner eyepiece ; 2 Huygens eyepieces and 2 orthoscopic eyepieces, giving magnifications $\times 33$, $\times 66$, $\times 132$, $\times 184$ and $\times 275$; revolving eyepiece changer ; finder telescope $\times 10$; set of erecting prisms. Price, complete with fitted case and rigid wooden pyramid stand . . . **£163**

As above, with unrestricted slow motions **£211**

This telescope can be supplied alternatively with a folding tubular steel tripod at the same prices.

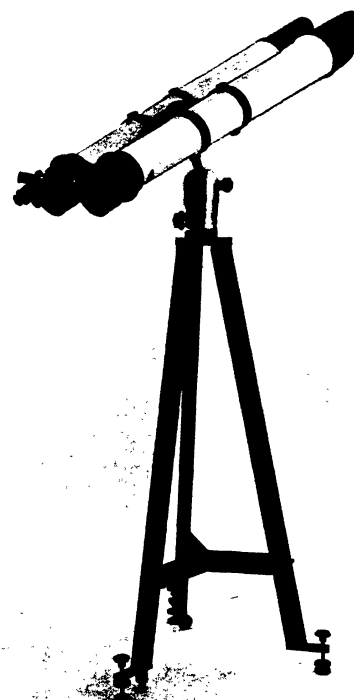
Full particulars of the above and a comprehensive range of Zeiss Astronomical Telescopes and Accessories in List "A. 28," from the British Representatives :—



CARL ZEISS (LONDON) LTD.
Winsley House, Wells St., Oxford St., London, W.1.



Fig. 365. (a) Advertisement from Carl ZEISS Jena for a 110mm (4.25-inch) altazimuth refractor, the so-called *Asesten*. (b) 4.5-inch binocular telescope by Carl ZEISS Jena (Courtesy of Christie's of London). This instrument could be used by one person or two.

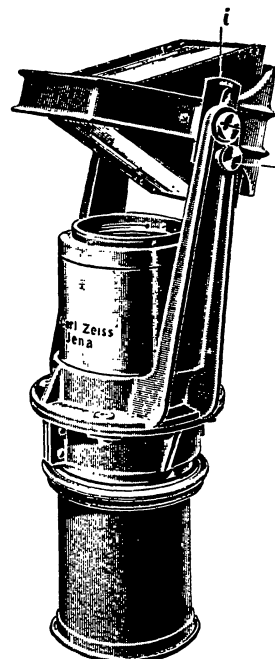
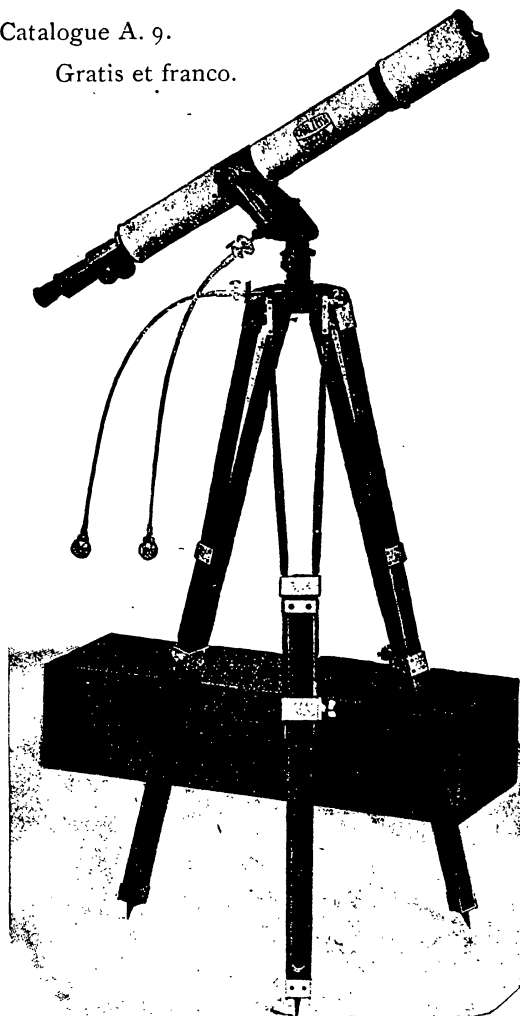


ZEISS

LUNETTES ASTRONOMIQUES ET TERRESTRES

Catalogue A. 9.

Gratis et franco.

CARL ZEISS
JENACARL ZEISS
JENALunettes
de voyageLunettes
d'Approche
monoculaires
et binoculairesLunettes
à monture
azimutaleLunettes
à monture
parallactique

Réfracteurs

Objectifs
astronomiquesOculaires
astronomiquesMiroirs
concaves,
Prismes,
Verres plansAppareils
auxiliaires

COUPOLES

Dépôt pour la France chez :
(M. BALLOT, PARIS)
25, rue Serpente, 25

Berlin
Francfort
s-l.-M.-
HambourgCARL ZEISS
JENALONDRES
Saint-
PÉTERSBOURG
VIENNE

Fig. 366. (a) Advertisement from Carl ZEISS Jena for a small portable refracting telescope. The agent is BALLOT of Paris. (b) An early, simple objective prism by Carl ZEISS Jena. (c) A small monocular, a French-made ZEISS-pattern telemeter by J.G.HOFMANN Paris.

1997IrAJ...24...125A

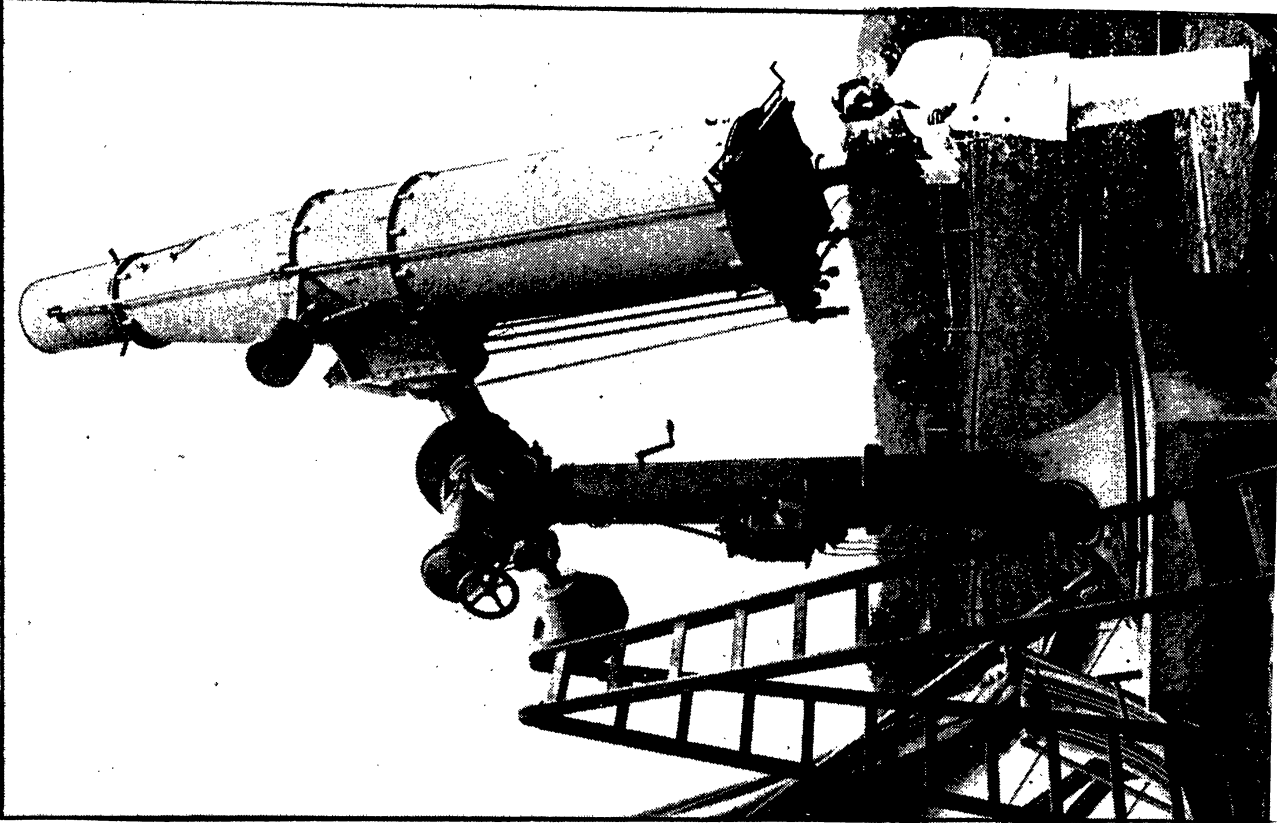


Fig. 368. An unusual 200mm (7.9-inch) $f/17.1$ ZEISS astrograph used by Potsdam astronomers at the 1929 total solar eclipse. The extremely large field (7.5×7.5 sq.degs.) was utilised to photograph stars in the vicinity of the sun to test Einstein's theory of relativity (the photographic plates were 45×45 cm!).

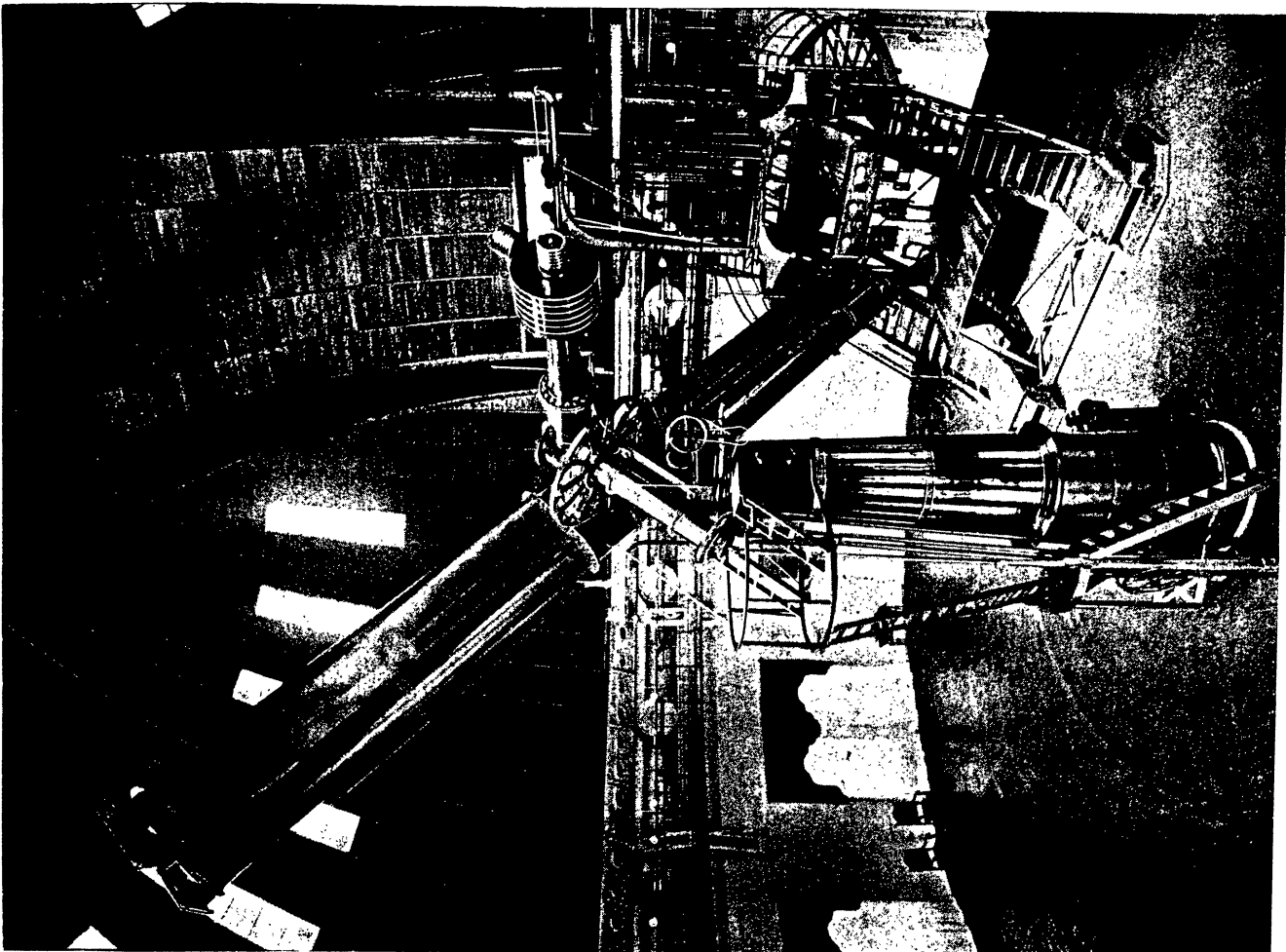


Fig. 367. The double refractor, 32-inch (81cm) $f/15$ photographic and 20-inch (50cm) $f/25$ visual telescopes, at Astrophysikalisches Observatorium at Potsdam Germany (ZEISS 1899).

ZEISS Carl - 1816-88. Originally a toymaker, he started the famous firm of instrument makers in 1846, *Oberkochen/Württemberg, Germany*. The early success of the firm depended heavily on the contributions of the great optician, ABBE, and the glass manufacturer, SCHOTT.¹⁰¹

ZEISS Jena - *Jena, East Germany* (WWII binocular code emq). Known as C.Z. SCIENTIFIC INSTRUMENTS (from c.1865) the firm produced especially fine microscopes and binoculars (WWII binocular code lmg). We record also ZEISS IKON AG, *Dresden* (WWII binocular code dpw).¹⁰² Also, *Stuttgart* (WWII binocular code dpx), ZEISS IKON GOERZWERKE, *Zehlendorf, Berlin* (WWII binocular code dpw), ZEISS Militarabteilung *Jena* (WWII binocular code lmg).

ZEISS Heinrich - *Gastingen* (WWII binocular code lae).

ZENGER - made glass /liquid prism combination. See also WERNICKE.

ZENONE John - carver, gilder and looking glass maker, associate of Louis Joseph BUTTI¹⁰³ He is recorded at 5 *Carlton St, Edinburgh* (1825), 7 *Carlton St* (1827), 5 and 6 *Carlton St* (1830), 77 *Princes St, Edinburgh* (1830), and 10 *Carlton St* (1832).

ZÖLLNER Johann Karl Friedrich - designed direct vision spectroscopy, and a photometer, 1834-82 (Bell 195, Shad Tel 96). There is a spectroscopy at *Buda*.

ZSHOKKE Paul - bought MERZ in 1903.

ZUCCHI Niccolo - natural philosopher, *Collegio Romano*, considered in 1616 a concave reflecting telescope which was, however, never constructed by him (King 71).

APPENDIX TO CYCLOPAEDIA including Corrigenda to Part 1

(to be continued in forthcoming IAJ)

ABBE Ernst - 1840-1905. Mis-spelling (no accent) in *Cyclop. Part 1* in IAJ 20(3), 1992.

ABRAHAM - See *Cyclop. Part 1*. There is no Josiah (nor Abraham DANCER).

ALMENT John - optician, *Ye Sign of Ye Spectacles, Marys Abbey, Dublin*.

BAILEY Salon I - fl. end of 19C, US astronomer, *Harvard and Boyden Station, Arequipa, Peru*, discoverer of several variable stars in stellar clusters. He worked with the 13-inch pg/vis CLARK refractor, the 8-inch (the famous Henry Draper star catalogue instrument, the "Bache") and the 24-inch CLARK photographic refractor (the "Bruce"). We record, also, the astronomer, Jean Sylvain BAILLY (1736-1793).

BAMBERG Paul and Th.Ludewig - early 20C, optical instrument makers in *Berlin*, sons of C.J.W. BAMBERG who had worked for ZEISS. Paul and Th.Ludewig continued the famous firm (which had been established in 1871) from c.1890 onwards. The firm, Carl BAMBERG, *Friedenau*, is associated with Otto TOPFER und Sohn (1919), Hermann WANSCHAFF (1922), Hans HEELE (1923), and in the 1930s became ASKANIA-WERKE A.G., *Kaiserallee 87/88, Berlin-Friedenau*. See *Cyclop. Part 1, Fig.2*.

BARCLAY J.G. - English amateur astronomer, *Barclay Estate, nr The Nower, Westcott Rd, Dorking*. He built an observatory & was interested in double stars.

BARROW Henry - 1790-1870, journeyman to TROUGHTON. George EVEREST (1790-1866) also employed him in India.

BATE Robert Brettell - d.1843. See *Cyclop. Part 1*, & Howse, JBAA 1993.

BAUDRY - 19C, optician, pupil of CAUCHOIX, *du Dépôt de la Marine, Paris*. See CHrJun92, lot 95, a 2.25-inch silver-mounted ebonised mahogany, single-draw telescope with tapered body.

BECK Conrad - The connection was with James SMITH (English). See *Cyclop. Part 1*.

BECKER Christopher - 1806-1890. See *Cyclop. Part 1*. We record also F.E. BECKER & Co., instrument suppliers, *Hatton Wall, London*, and also *Dublin* (1903), *Birmingham, Glasgow and Melbourne*. Successors W & J GEORGE Ltd. See CHrSep91 lot 229, and Handlist.

BIDSTRUP - mis-spelling in *Cyclop. Part 1*.

BLAIR Robert - late 18C, Scots naval surgeon, later Prof. of Astronomy, *Edinburgh*. He was interested in fluid lenses. See King 189/190.

BLANCHINUS - associated with aerial telescopes.

BORDA Jean Charles - 1733-1799. See *Cyclop. Part 1*.

BOUGUER Pierre - 1698-1758, author of treatise on optics (1729, 1760).



Finis

¹⁰¹ See King 346, and numerous ZEISS catalogues.

¹⁰² See e.g. [CHrMar89]

¹⁰³ See BG 102. A telescopes with his inscription is known, but he may not have constructed it.

BRÄNDER Georg Frederick - 1713-1783. See *Part 1*.

BROWN J - 1871-1912, 76 *St Vincent Street, Glasgow*.

CARTER G - English instrument maker, *Exeter*. See Miller's Antiq. Price Guide 1993, p.421.

CASELLA C.F. & Co. - instrument maker, *Fitzroy St, London*. See BAA Handbook 1948.

CASTILLO Roberto - present day, Chilean amateur astronomer & telescope maker.

CHAPOTOT brothers - early 18C, instrument makers, *Paris*. Their quadrant (1722) was used by DELISLE at *Palais du Luxembourg*.

CLAIRAUT Alexis-Claude - 1713-1765, notable French mathematician and astronomer (See mis-spelling in *Part 1*. Author of *Théorie du mouvement des comètes* (1757) and *Théorie de la lune* (1752, 1756). See C.Wilson, JHA 24, 1, 1993.

CLARKE Edward Montague - fl.1804-1846, optical, philosophical and mathematical instrument maker, *London*, employed by WATKINS and HILL (1833).

CODDINGTON Henry - d.1845, teacher of mathematics & optics, *Trinity College, Cambridge*. He publicised BREWSTER's idea of a solid eyepiece. He was author of *A Treatise on the Eye and on Optical Instruments*, and also *Improvement of the Microscope* (1830).

COLBERT Jean Baptiste - 1619-1683, eminent minister to Louis XIV, encouraged French research into optical glass. See *Cyclop.Part 1*, & *Part 5*.

COMBS Oliver - optician at *The Spectacles, 2nd house from Essex St, near Temple Bar, London*. Probably not telescopes. See RP, Refs. in *Cyclop.Part.1*.

COTES Roger - 1682-1716, first Plumian Professor of Astronomy and Experimental Philosophy, *Cambridge*, editor of 2nd Edition of NEWTON's *Principia*. See *Cyclop. Part 1* and R.Gowing, *Roger Cotes - Natural Philosopher, CUP 1983*.

CUTHBERT John - 1783-1854, *London*, associated with W & S. JONES, designer of a reflecting microscope (mid-1820s). See Turner 19C, 166.

DOLLFUS Andouin - eminent 20C French astronomer. He developed the solar telescope, and pioneered work in planetary & stellar polarisation.

DOUBLET T & H - optical & nautical instrument maker, *Finsbury, London* and *11 Moorgate St*. In the R.Andrews collection there is a 1-inch telescope with 3 draw tubes and leather-covered body, and total length 16 ins. See also CHrApr92.

DRESCHLER Georg - late 18C, *Hanover* and *London*. Georg (the elder) worked 5 years with RAMSDEN, and his son with the TROUGHTONS (moving to *Palermo* c.1805).

DREW - late-19C, English private astronomer, *Southampton*. See *Cyclop.Part 6, Fig. 293 in IAJ 23(2), 1996*.

DRURY W - late 18C, *Liverpool*. See Miller Antiq. Price Guide 1996, p.381 for description of 0.5-inch single-draw telescope with mahogany tube.

ELLICOTT Andrew - 1754-1820, US clockmaker & astr.instr.maker, *Pennsylvania*. See also under David RITTENHOUSE (1732-1796).

ELLISON William Frederick Archdall - 1864-1936. See *Cyclop.Part 1*.

ELLIOTT Ernest - present English telescope maker, engineer with BROADHURST CLARKSON since 1942 (now with Dudley K.M. FULLER of BCF, *London*).

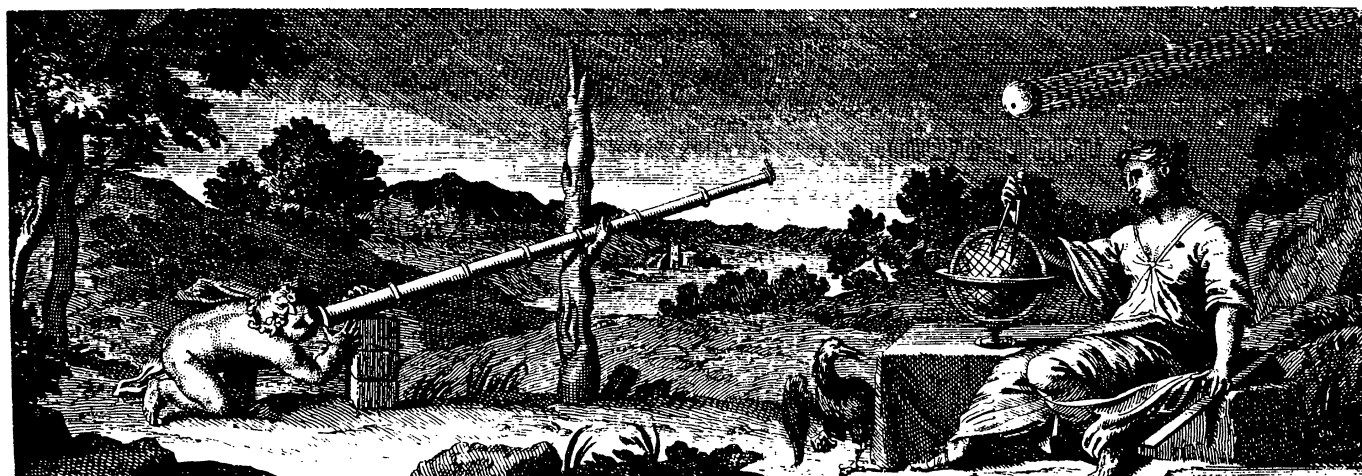
ÉPRY Ch. - mid-20C, instrument maker, *Paris*, successor to LEREBOURS et SÉCRETAN. See *Cyclop.Part 5, IAJ 23(1), 1996, Fig.260*. Also, King 244.

FERRNER Bengt - 1724-1802. See *Astronomy Today*, Dec.1969, p.109.

FLAMMARION Camille - notable private astronomer and author, founder of Soc.Astron. France (1887). See *Cyclop.Part 5, IAJ 23(1), 1996*.

FLETCHER Isaac - 19C, member of Parliament, *Tarn bank, Cockermouth (Cumbria)*, English private astronomer. FLETCHER owned a 6-inch f/14 COOKE refractor and 9.5-inch f/15.8 COOKE refractor (1860) and also a 4-inch COOKE on German mount.

FRITZ H - US instrument maker, *New York*. See CHrMar94, lot 243.



Matenaro In et deli.

J. du Guernier Sculp.