

The Project Gutenberg EBook of Astronomical Instruments and Accessories, by
Wm. Gaertner & Co.

This eBook is for the use of anyone anywhere at no cost and with
almost no restrictions whatsoever. You may copy it, give it away or
re-use it under the terms of the Project Gutenberg License included
with this eBook or online at www.gutenberg.net

Title: Astronomical Instruments and Accessories

Author: Wm. Gaertner & Co.

Release Date: December 10, 2008 [EBook #27477]

Language: English

*** START OF THIS PROJECT GUTENBERG EBOOK ASTRONOMICAL INSTRUMENTS ***

Produced by Matthew Rongey, Brownfox and the Online
Distributed Proofreading Team at <http://www.pgdp.net> (This
file was produced from images generously made available
by The Internet Archive)

Catalog A.

1908.

ASTRONOMICAL INSTRUMENTS

... AND ...

ACCESSORIES.

A telescope

WM. GAERTNER & CO.

5345-5349 Lake Ave.

CHICAGO.

Catalog A.

1908.

ASTRONOMICAL INSTRUMENTS

... AND ...

ACCESSORIES.

Decoration

WM. GAERTNER & CO.

5345-5349 Lake Ave.

CHICAGO.

Notice.

This catalogue supersedes former editions.

The prices given in this catalogue are net and do not include packing which will be charged at cost.

To avoid mistakes and delays when ordering please give catalogue number and shipping instructions.

Most of the instruments listed in this catalogue are constructed to order only but the smaller sizes of telescopes with accessories, chronographs, simpler measuring machines, etc., are usually kept in stock.

The apparatus listed in this catalogue is of our own manufacture, excepting the astronomical regulator clocks, which we have listed for the convenience of our customers.

All orders will be filled as promptly as possible with due regard to thorough workmanship and efficient inspection.

Everything that leaves our establishment is carefully tested and inspected and we can guarantee our apparatus to be, in every respect, fully as represented. Any piece, which does not come up to the most exacting requirements will always be promptly replaced within the shortest possible time.

We shall be glad to satisfy any special requirements of our customers and will make any desired alterations and additions on the standard designs.

Introduction.

In the following pages we have endeavored to give to our customers an idea of the line of astronomical instruments of the latest and most improved types which we have constructed for some of the leading observatories as mentioned in the text. We feel that this series of illustrations may not only be of general interest, but also of service in helping to determine further developments of modern astronomical and astrophysical equipment. We have not thought it advisable to describe in detail the various instruments of precision, which we have been called upon to construct from time to time for the scientists in the astronomical as well as other branches of science during the last ten years. As a rule every astronomer is interested in some special line of research, which for a successful investigation requires a special adaptation of the instrument he proposes to use, and in such cases we are confident we can fill the requirements and shall be happy to correspond with interested parties. We are in position to undertake the design of special apparatus and can furnish sketches and estimates in accordance with the suggestions of the customer on short notice in such cases, where the importance of the prospective business will warrant it. Among the various instruments which we have built, but which are not included in this catalogue, we wish to mention, spectroheliographs, planetary cameras, photographic plate holders, domes for observatories, etc.

The optical parts which we furnish are of the highest degree of excellence and are made for us by several of the most reliable firms in this line.

Mr. O. L. Petitdidier is closely located to our works, and during the last ten years has supplied most of our objectives, etc.

It is and has been the aim of our firm to produce apparatus of the highest grade and the constant growth of our business is a mute but eloquent testimonial that our efforts have been appreciated by our customers.

We are glad to acknowledge our indebtedness to many of the foremost astronomers, who have greatly assisted us by suggestions as to their particular requirements, and by supplying certain of the photographs here reproduced.

We take this opportunity to thank our customers for the favors rendered us in the past, and trust that in the future these mutually pleasant relations may be renewed.

A 101

A 101

A101. Alt-Azimuth Mounting on strong hardwood tripod. The vertical and horizontal axis have large bearing surfaces, assuring stability and steadiness of motion. All parts excepting the tripod head are made of brass and are nicely finished. The telescope is fitted with long rack and pinion motion. Three celestial eye pieces are included. Price with 2½" telescope

\$90.00

A102. The same as above with 3" telescope. Price

\$110.00

A103. The same as above with 3½" telescope. Price

\$140.00

A104. The same as above with 4" telescope. Price

\$200.00

Note.—All our astronomical telescope have objectives of the standard focal length (focus = to about 15 times diameter of aperture). The objective is mounted in the most approved manner and is provided with adjustment for collimation.

Note.—For accessories to these telescopes see page [11](#).

A 110

A 110

A110. Universal Equatorial Mounting. This form of mounting can be used equally well for celestial and terrestrial observations. The mounting is made to swivel on the tripod head, in order to set the instrument in the meridian. The polar axis can be set at any latitude and a graduated arc gives the exact position. The instrument is set level by means of two small levels attached to the tripod top. The polar axis is fitted with worm wheel and worm for slow motion. The handle with the universal joint can be clamped on either side of the worm shaft. Telescope of 3" aperture and three eye pieces. Price

\$165.00

A111. Same as above with 3½" telescope. Price

\$190.00

A112. Same as above with 4" telescope. Price

\$250.00

For accessories see page [11](#).

A 120

A 120

A120. Portable Equatorial Mounting with Driving Clock. This instrument was designed to meet the demand for portable low priced telescope suitable for the study of astronomy in the college, high school or for the amateur astronomer. Every observer and teacher in astronomy will appreciate the great usefulness of a driving mechanism, which will keep the star in the field during observation. After several years of experimenting we have succeeded in constructing a reliable clock which can easily be attached to our portable telescope mounting.

The instrument is mounted on strong hardwood tripod fitted with iron shoes. It is attached to the tripod top by a single screw which holds it firmly and allows adjustment in azimuth. The clock case carrying the bearing for the polar axis is made to swivel in the base casting, so that the polar axis may be easily set and firmly clamped at an angle from horizontal to vertical. A level is fitted to the tripod top and a graduated arc is fastened to the clock case. If the polar axis is set vertical and the worm wheel unclamped, the instrument is transformed into an alt-azimuth mounting. This feature will be found to be a great convenience especially for terrestrial observations.

Both the polar and declination axes are carefully fitted to their bearings and carry finding circles. The right ascension circle reads to 5 min., the declination circle to single degrees. The declination axis is fitted with clamp screw which is within convenient reach.

The clock has ample power and is enclosed in a heavy case which protects it from dust and injury. It is driven by two strong springs and will run about 12 hours without rewinding. A lever for starting or stopping is provided. Motion from clock to polar axis is transmitted by means of a set of bevel gears and worm and worm wheel. The worm wheel

is held by friction to the polar axis so that the telescope can be moved without loosening any screw and without affecting the clock. The clock will give steady and accurate motion to the telescope and with ordinary care it will keep in good repair for years. A slow motion adjustment independent of the clock is fitted to the polar axis.

With the instrument are furnished three celestial eye pieces giving a magnifying power of about 50, 100 and 150 diameters respectively.

The instrument is easily portable, the total weight of a 3" telescope being about 60 lbs. yet it is made heavy enough, and the material well distributed to insure strength and steadiness. Workmanship and finish of the instrument are the best. The brass parts are either lacquered yellow or bronzed. The iron parts are durably enameled and all exposed steel parts are nickel-plated.

A120. Telescope of 3" aperture. Price **\$190.00**

A121. Telescope of 3½" aperture, the same as above but the bearing parts made proportionally heavier. Price **\$240.00**

A122. Telescope of 4" aperture. Price **\$320.00**

For accessories see page [11](#).

Note.—An iron column can be provided for above telescopes in place of of the tripod, at an extra cost of \$20.00.

A 130

A 130

EQUATORIAL MOUNTINGS ON IRON PILLAR WITH DRIVING CLOCK, ETC.

On page 10 is shown an illustration of our standard high grade type of 6 in. equatorial. A description of the same will apply to practically all larger and smaller sizes.

The pillar is of rectangular cross section and well proportioned. The clock case is securely fastened to the top of the pillar but with provision for adjustment in azimuth. The clock has ample driving power, is very carefully constructed and regulated by friction governor (Design Prof. Young.) Maintaining gears are provided on the main shaft which allows the winding of the clock without retarding motion. Worm wheel and worm are carefully cut, and protected by brass shields. Right ascension and declination circles have fine graduation on solid silver and coarse finding graduation on the edge. Electric illumination and magnifying glasses are fitted to the verniers. The handles for all clamps and slow motions are fastened conveniently near the eye end of the telescope and are of different shape so as to distinguish in the dark right ascension and declination. The axes are of tool steel carefully fitted to their bearings, and on the larger instruments friction rollers are fitted to the polar axis. The telescope tube is made of steel, light but strongly constructed. The eye end has long and heavy rack and pinion motion and the whole can be easily removed.

Note.—The fine divided circles are often omitted on smaller equatorials, as they are not essential, the electrical illumination for the circles is also left off, and this will amount to a

material saving.

A130. Equatorial Mounting with 5 in. Telescope. According to above description with first class objective, and five eye pieces. Price	\$950.00
The same instrument without fine circles and electrical illumination. Price	\$825.00
A131. Equatorial Mounting with 6 in. Telescope. Complete as A130. Price	\$1500.00
A132. Equatorial Mounting with 8 in. Telescope. Same as above. Price	\$2500.00
A133. Equatorial Mounting with 9 in. Telescope. Same as above. Price	\$3300.00
A134. Equatorial Mounting with 10 in. Telescope. Same as above. Price	\$3700.00
A135. Equatorial Mounting with 12 in. Telescope. Same as above. Price	\$5500.00

Note.—We are equipped to construct larger instruments and are glad to give prices on application.

A 131

A 131

The above cut shows a driving clock for our standard 6 in. telescope.

We have constructed clocks for a number of larger telescopes among others the clock for the 24 in. Lowell Refractor.

ACCESSORIES TO TELESCOPES A101 TO A135.

A140. Finder fitted to 3" telescope. Price	\$12.00
A141. Finder fitted to 3½" telescope. Price	\$15.00
A150. Positive Eye Pieces. (Ramsden), focus 6 mm. to 25 mm. Price	\$4.50
A151. Negative Eye Pieces. (Huygenian), focus 5 mm. to 25 mm. Price	\$4.50
A152. Diagonal Eye Piece. The prism of the eye piece has guaranteed optically plane surfaces and will not affect the definition of the telescope. Price	\$12.00
A153. Terrestrial Eye Piece, focus 25 mm. Price	\$12.00
A154. Sun Caps, to fit above eye pieces. Price	\$1.50

The outside diameter of all our eye pieces is 1¼" excepting those used in our Micrometers.

A 201

A 201

A201. Position Micrometers for 6" to 8" Telescopes. Circle 15 cm. diameter, divisions on solid silver, verniers reading to 6 min., slow gear motion for rotating, electrical illumination, provided with different color screens. Screw guaranteed of highest accuracy. Price	\$200.00
A202. Position Micrometers for 4" to 5" Telescopes. Similar to above but rotation by hand and construction somewhat simpler. Price	\$100.00

A 203

A 203

A203. Small Position Micrometer for 3" to 4" Telescopes. Circle reads to single degrees. Electric illumination. Price **\$75.00**

A 301

A 301

Transit Instrument, with reversing arrangement, illumination with oil or electric lamp, Filari micrometer with two eye pieces. Weight of axis balanced by springs and rollers. The circle has a diameter of 150 mm., verniers read to 20 seconds. The instrument is mounted on an iron base plate, which is fitted with azimuth adjustment (not shown in cut).

A301. Transit with 2" Telescope. Price **\$550.00**

A302. Transit with 3" Telescope. Price **\$800.00**

A 401

A 401

A401. Universal Instrument. Telescope with objective prism. Vertical circle has a diameter of 13 cm. is divided to 10 min. and reads by means of two micrometer microscopes to 10 sec. The telescope is fitted with hard phosphor bronze bearing rings and is reversible. Aperture of objective is 30 mm. Two eye pieces are furnished giving magnification of 20 and 30 diameters. The prism has absolutely plane surfaces and will not affect the definition. Striding level reads to 2 sec. The horizontal circle is protected and reads by means of two verniers to 1 min. The instrument is packed in a light but strong case. Price complete with tripod **\$420.00**

Note.—This instrument was first constructed for Mr. E. de K. Leffingwell, who has found it very satisfactory for his work in the polar regions.

A 501

A 501

A501. Zoellner Astrophotometer. The instrument is made to attach to the eye end of the telescope and may be used with any size of refractor or reflector. An axis parallel to the telescope tube allows the instrument to rotate as a whole. A clamp is provided to hold it in position. The artificial star is formed by a small incandescent lamp which is adjustable in any direction, and in front of which is mounted a small diaphragm. The color changing device, consisting of Nicol prism and quartz plate, is fitted with a divided circle reading to single degrees. The circle revolving with the Nicol prism for changing the intensity of the star, has a diameter of 14 cm. and reads by means of two verniers to 6 min. A concave lens is mounted in the path of the artificial star to make the light diverging at the proper angle and a plane parallel plate is adjustably fixed in the center of the box in order to throw the light in the eye piece. An achromatic objective in front of the eye piece brings the images of the real and artificial star to a focus in the same plane. Price **\$150.00**

A 601 A 601

A 602 A 602

A601. Small Spectroscope. Suitable for telescope from 3 to 6 in. aperture. The collimator and observing telescope have an aperture of 25 mm., focus of 200 mm. Both are fitted with rack and pinion. The spectroscope may be used with a grating or a 60 degree prism, and for this purpose has openings for the telescopes at the proper angles. A position circle of 75 mm. diameter, reading to degrees, is fitted to the instrument. The slit has micrometer head.

Price, without grating, but including 60 degree prism **\$75.00**

Note.—This spectroscope can also be used on a support for laboratory work.

Support for above spectroscope. Price **\$4.50**

A602. Spectroscope for telescopes from 6 in. to 18 in. aperture and detailed description on application.

A 701

A 701

A701. Chronograph for physical and astronomical work. This chronograph is designed to meet the demand for a medium sized, well-made and accurate instrument of this kind and has given very good satisfaction. The cylinder is 15 cm. in diameter 25 cm. long, driven by strong, carefully made clock work, fitted with friction governor. Two different speeds for the cylinder can be obtained by means of change gears. The slow speed of the drum is one revolution per minute, and at this speed the drum will run for a full hour. The fast speed is 30 seconds per revolution. The carriage is driven by means of a screw, the nut of which is made to disengage easily.

Price of the instrument complete with two pens and glass cover **\$225.00**

A701a. Chronograph, the same as A701 but with only one pen. The carriage is so constructed that a second pen can easily be added later. Price with glass cover **\$195.00**

Note.—Every instrument is carefully tested before being sent out and we can guarantee the speed not to vary over 1-20 second during the full run of one hour. Large temperature changes will not affect the speed of the clock. A large number of the chronographs are in use and have given excellent satisfaction.

A 702

A 702

A702. Prof. G. W. Hough's Printing Chronograph. The instrument consists of two carefully and accurately constructed clock movements, which are driven by gravity and controlled electrically by the sidereal clock. The movements revolve three type wheels. One of these turns once per second, its edge is divided in 50 parts and it is driven by a separate movement. The second wheel turns once per minute and the third once per hour and they will print the seconds and minutes, while the first will give the hundredths of seconds. A strip of paper is carried over these wheels and moved forward by the same electro-magnet, which operates the printing hammers. The paper is sufficiently long for

1200 observations including spacing between records. The operation of the printing hammers is such that the uniform motion of the type wheel is not disturbed in the act of printing. The whole instrument is mounted on a heavy slate plate 45 cm. by 60 cm., and protected by a glass cover.

The manipulation of the apparatus is extremely simple and convenient and the records obtained are perfectly reliable and accurate within about 0.01 of a second. The saving of time and labor by the printing chronograph is very considerable and the filing of the records very convenient.

This printing chronograph has been in use at the Dearborn Observatory for about twenty years and during the last five years the following observatories have been equipped with the instrument: Amherst College Observatory; Case School of Applied Science, Cleveland; Philadelphia Observatory; Durham Observatory, Durham, England; Observatory of LaPlatta, Argentine; and Dominion Observatory, Ottawa, Canada.

Prof. Hough has kindly consented to inspect every chronograph before it leaves our shop. Price, complete on stand, glass cover, etc. **\$500.00**

A 801 A 801

A 802 A 802

A801. Laboratory Clock. This is an eight-day clock; has a movement of the best workmanship, is driven by two strong springs, and keeps accurate time. The dial is 12 inches in diameter and has hour, minute and second hands. Pendulum beats seconds and makes electric contact by means of an adjustable mercury cup. It is mounted in a hardwood case with glass door. Price. **\$27.00**

A802. Laboratory Clock. The same as preceding one, but with better clock movement, gravity driven. Price. **\$35.00**

A803. Regulator Clock. This clock has a first-class eight day movement with cut steel pinions. It is fitted with mercury compensation pendulum and electrical seconds contact. Price. **\$200.00**

Note.—We can furnish free of duty to educational institutions astronomical precision clocks made by C. Riefler, Germany, and will be pleased to quote prices to interested parties.

A 1200

A 1200

A1200. Simple Comparator. (Fig. A1200.) Built up of **Micrometer Slide M301** and **Microscope M101, with support M310 Fitted with Stage.** The stage is 150 mm. long and provided with clips for holding objects, such as spectrum photographs, scales, etc., and is fitted with illuminating mirror. Price **\$45.00**

A1201. Small Comparator. The instrument is intended for measuring spectra photographs, gratings, divided scales, or such objects which can be focused by the microscope and will allow rapid measurements of the highest possible accuracy. The measurement depends on the accuracy of the micrometer screw, which is cut and corrected with great care. The screw has a pitch of .5 mm. and diameter of 15 mm. The index head

attached to the screw is of considerable diameter so as to allow the direct reading of .001 mm. The head is divided on solid silver in 500 parts, and carries two rows of figures indicating the first and second half of the mm. The full mm. are read by means of a scale in front of the instrument. The bed plate is heavy, of cast iron, and the guides are carefully scraped true within 0.001 mm. The carriage has a movement of 80 mm., is made of gun metal and fitted exactly to the guides; it is also provided with a second or top carriage with 40 mm. motion. The top carriage can be moved by hand and accurately set by means of a micrometer screw. The microscope is of variable magnifying power, focused by rack and pinion. Illumination for transparent objects is given from below by means of a plane mirror. The instrument is mounted on heavy supports, under an angle to make it convenient for the observer. The instrument is finished in first-class manner, and the iron bed plate heavily copper and nickel plated.

The design of this machine was suggested by Prof. Edwin Frost of the Yerkes Observatory, where a number of these machines have been in constant use during the last five years. Careful tests have shown the screw accurate within .0003 of a mm. throughout the full length. Price

\$175.00

Note.—The micrometer on microscope as shown in cut is not furnished with instrument.

A tangent screw for revolving the eye piece with the spider thread can be attached at a cost of \$5.00.

A 1201

A 1201

A 1202

A 1202

A1202. Comparator for Measuring Spectra Photographs, Scales, Etc. Range 50 cm. The microscope travels on carefully straightened ways, and is moved by a screw of 1 mm. pitch. The screw head is faced with a silver band and is divided in 1000 parts. The handle for turning the screw is placed on the left side of the instrument so as to have the right hand free for recording readings.

A set of change gears can easily be engaged to give a fast motion to the carriage. The stage will hold plates from 3 to 8 cm. in width and of 60 cm. in length. It can be shifted lengthwise for a distance of 25 cm. and is provided with adjustment for aligning the plates. The whole stage can be easily removed from the instrument.

The microscope is fitted with variable magnifying power and is of standard size.
Price

\$450.00

Note.—The design of this comparator was suggested by Prof. Humphries, Director Laboratory of the U. S. Weather Bureau, for whom the first one was built.

A 1203

A 1203

A1203. Comparator for Star Photographs, measures in one direction 80 mm. and under right angle 60 mm. The lower part is constructed similar to our Comparator A1201. The top slide carries a divided circle for measuring position

angles. The circle is arranged similar to a position micrometer. It is fitted with quick gear motion and tangent screw and the two verniers read to 1-100 degree. The microscope has variable magnifying power and is provided with reversing eye piece. This machine has been furnished for and is in use at Yerkes, Lick and Kirkwood Observatories. Price

\$365.00

A 1204

A 1204

A1204. Comparator. For Plates 8×10 inches. This machine was constructed in accordance with suggestions given by Dr. Frank Schlesinger, Director of Allegheny Observatory. The ways are carefully straightened to within 0.002 millimeter. The carriage is moved by two racks and pinions and has a large handle on each side. Two concentric circles are fitted to the carriage, the inner circle carries the plate with the film in a fixed plane, no matter what the thickness of the glass may be. Both circles are provided with clamps and tangent screws, so that each one may be clamped and adjusted independently. The outside circle carries four index points 90 degrees apart. One of these marks is made adjustable. These four marks serve to turn the plate exactly 90 degrees so as to measure rectangular coordinates. The guide carrying the measuring microscope is adjusted exactly at right angles to the ways of the bed plate. The carriage supporting the microscope is moved by rack and pinion. The microscope is arranged to tilt, so as to view either the plate or the scale above. The eye piece is provided with a reversing prism. Measurements are made on the scale divided in millimeters. The smaller measurements, to 1-4000 of a mm., are made by the micrometer. The micrometer is fitted with sliding eye piece and counter for full revolutions. The scale is not marked in the usual way with single lines, but each millimeter is marked with a double line. This double line allows the use of one single spider thread, which is preferable to use for bisecting the star, and the double line on the scale allows a clear setting with the single spider thread. The stage is fitted with an adaptor for holding plates 4×5 inches. Price

\$450.00

This machine has been in use during the last years at the Yerkes Observatory and has been found very convenient and satisfactory in every way.

A graduated circle can be provided if desirable. Such division on solid silver, with verniers reading to 1-100 of a degree will increase the cost \$50.00.

A1205. Comparator, for plates 4×5 in. of the same design as A1204. Price

\$300.00

A 1206

A 1206

A1206. Comparator. A larger machine of the same design as A1204 with scale of 45 cm. length, divided in double lines to 0.25 mm., and with two carriages, one for spectrum plates of 18 in. length and the other with divided circles for star photographs 12"×14". This instrument was constructed for the Solar Observatory of the Carnegie Institution at Mount Wilson, California.

COELOSTAT.

COELOSTAT.

**As built for the United States Naval Observatory after design furnished by Mr. W. W.
Dinwiddie.**

ARMILLARY SPHERE.

ARMILLARY SPHERE.

Built after design of Prof. J. F. Lanneau, Wake Forest College, N. C.

NOVEMBER, 1905

Wm. Gaertner & Co.

Astronomical, physical and physiological Apparatus

5347-5349 LAKE AVENUE

CHICAGO

Spectrometers and Accessories

Cat. No. L4020 LABORATORY SPECTROMETER. This instrument is very rigid and accurate in construction and every part of its design has been carefully considered. The circle has a diameter of 15 cm. and the two verniers read to 20 sec. It is fitted with protecting plate which adds greatly to the value of the instrument if put in the hands of students. The graduation is on solid silver. The verniers are fitted with adjustable magnifying glasses, the telescopes have an aperture of 25 mm., focal length of 200 mm. A horizontal adjustment for the telescope is provided. No provision is made for radial adjustment, which correction is made before the instrument is sent out. The slit is accurately constructed; the jaws are of German silver and it is provided with comparison prism. The eye end of the observing telescope is of standard size so as to receive our micrometers M201 or M202, or the Auto Collimating eye piece (Lamont & Abbe) M540. Gauze eye piece is fitted to the instrument. The prism table and observing telescope have independent movements and each is provided with clamp and tangent screw. The prism table can be clamped to any part of the vernier plate. The prism holder has convenient leveling arrangement and will hold prism up to 35 mm. in height. The instrument is arranged to receive Fuess centering apparatus and crystal holder. A 60 degree heavy flint glass prism of best optical quality is included.

Price

\$75.00

L4020b CAMERA ATTACHMENT will fit in place of the observing telescope. It is fitted with long focus objective and standard plate holder $2\frac{1}{2}'' \times 2\frac{1}{2}''$. The plate holder is provided with swivel for proper focusing of the spectrum. The slit is so arranged that four exposures can be made on one plate.

Price

\$20.00

Cat. No. L4020c SCALE TUBE. The third arm of the instrument can be easily attached and rotated and clamped in any position. It may also be used for holding a second Collimator.

Price

\$20.00

Cat. No. L4021 STUDENT'S SPECTROMETER. This instrument is in every respect similar to our L4020, but some of the higher finish has been omitted. All the essentials are carefully constructed and the optical parts are of the best quality. The circle is protected but only one vernier reading to 30 sec. is fitted to the instrument. The magnifying glass is

omitted.

Price, including prism

\$60.00

TRANSCRIBERS' NOTES

General: Corrections to punctuation have not been individually noted.

General: Inconsistent spelling of catalog/catalogue preserved as in original.

Page 7: magnifiing corrected to magnifying and celestrial corrected to celestial.

Page 17: intensisy corrected to intensity.

Page 18: hundreths corrected to hundredths. LaPlatta as in original.

NB The final two pages of the book, on Astronomical, physical and physiological Apparatus, are in a slightly different format in the original. Particularly, prices are not in bold. That has been preserved in this version.

End of the Project Gutenberg EBook of Astronomical Instruments and Accessories, by Wm. Gaertner & Co.

*** END OF THIS PROJECT GUTENBERG EBOOK ASTRONOMICAL INSTRUMENTS ***

***** This file should be named 27477-h.htm or 27477-h.zip *****

This and all associated files of various formats will be found in:
<http://www.gutenberg.org/2/7/4/7/27477/>

Produced by Matthew Rongey, Brownfox and the Online Distributed Proofreading Team at <http://www.pgdp.net> (This file was produced from images generously made available by The Internet Archive)

Updated editions will replace the previous one—the old editions will be renamed.

Creating the works from public domain print editions means that no one owns a United States copyright in these works, so the Foundation (and you!) can copy and distribute it in the United States without permission and without paying copyright royalties. Special rules, set forth in the General Terms of Use part of this license, apply to copying and distributing Project Gutenberg-tm electronic works to protect the PROJECT GUTENBERG-tm concept and trademark. Project Gutenberg is a registered trademark, and may not be used if you charge for the eBooks, unless you receive specific permission. If you do not charge anything for copies of this eBook, complying with the rules is very easy. You may use this eBook for nearly any purpose such as creation of derivative works, reports, performances and research. They may be modified and printed and given away—you may do practically ANYTHING with public domain eBooks. Redistribution is subject to the trademark license, especially commercial redistribution.

*** START: FULL LICENSE ***

THE FULL PROJECT GUTENBERG LICENSE
PLEASE READ THIS BEFORE YOU DISTRIBUTE OR USE THIS WORK

To protect the Project Gutenberg-tm mission of promoting the free distribution of electronic works, by using or distributing this work

(or any other work associated in any way with the phrase "Project Gutenberg"), you agree to comply with all the terms of the Full Project Gutenberg-tm License (available with this file or online at <http://gutenberg.net/license>).

Section 1. General Terms of Use and Redistributing Project Gutenberg-tm electronic works

1.A. By reading or using any part of this Project Gutenberg-tm electronic work, you indicate that you have read, understand, agree to and accept all the terms of this license and intellectual property (trademark/copyright) agreement. If you do not agree to abide by all the terms of this agreement, you must cease using and return or destroy all copies of Project Gutenberg-tm electronic works in your possession. If you paid a fee for obtaining a copy of or access to a Project Gutenberg-tm electronic work and you do not agree to be bound by the terms of this agreement, you may obtain a refund from the person or entity to whom you paid the fee as set forth in paragraph 1.E.8.

1.B. "Project Gutenberg" is a registered trademark. It may only be used on or associated in any way with an electronic work by people who agree to be bound by the terms of this agreement. There are a few things that you can do with most Project Gutenberg-tm electronic works even without complying with the full terms of this agreement. See paragraph 1.C below. There are a lot of things you can do with Project Gutenberg-tm electronic works if you follow the terms of this agreement and help preserve free future access to Project Gutenberg-tm electronic works. See paragraph 1.E below.

1.C. The Project Gutenberg Literary Archive Foundation ("the Foundation" or PGLAF), owns a compilation copyright in the collection of Project Gutenberg-tm electronic works. Nearly all the individual works in the collection are in the public domain in the United States. If an individual work is in the public domain in the United States and you are located in the United States, we do not claim a right to prevent you from copying, distributing, performing, displaying or creating derivative works based on the work as long as all references to Project Gutenberg are removed. Of course, we hope that you will support the Project Gutenberg-tm mission of promoting free access to electronic works by freely sharing Project Gutenberg-tm works in compliance with the terms of this agreement for keeping the Project Gutenberg-tm name associated with the work. You can easily comply with the terms of this agreement by keeping this work in the same format with its attached full Project Gutenberg-tm License when you share it without charge with others.

1.D. The copyright laws of the place where you are located also govern what you can do with this work. Copyright laws in most countries are in a constant state of change. If you are outside the United States, check the laws of your country in addition to the terms of this agreement before downloading, copying, displaying, performing, distributing or creating derivative works based on this work or any other Project Gutenberg-tm work. The Foundation makes no representations concerning the copyright status of any work in any country outside the United States.

1.E. Unless you have removed all references to Project Gutenberg:

1.E.1. The following sentence, with active links to, or other immediate access to, the full Project Gutenberg-tm License must appear prominently whenever any copy of a Project Gutenberg-tm work (any work on which the phrase "Project Gutenberg" appears, or with which the phrase "Project Gutenberg" is associated) is accessed, displayed, performed, viewed, copied or distributed:

This eBook is for the use of anyone anywhere at no cost and with almost no restrictions whatsoever. You may copy it, give it away or re-use it under the terms of the Project Gutenberg License included with this eBook or online at www.gutenberg.net

1.E.2. If an individual Project Gutenberg-tm electronic work is derived from the public domain (does not contain a notice indicating that it is posted with permission of the copyright holder), the work can be copied and distributed to anyone in the United States without paying any fees or charges. If you are redistributing or providing access to a work with the phrase "Project Gutenberg" associated with or appearing on the

work, you must comply either with the requirements of paragraphs 1.E.1 through 1.E.7 or obtain permission for the use of the work and the Project Gutenberg-tm trademark as set forth in paragraphs 1.E.8 or 1.E.9.

1.E.3. If an individual Project Gutenberg-tm electronic work is posted with the permission of the copyright holder, your use and distribution must comply with both paragraphs 1.E.1 through 1.E.7 and any additional terms imposed by the copyright holder. Additional terms will be linked to the Project Gutenberg-tm License for all works posted with the permission of the copyright holder found at the beginning of this work.

1.E.4. Do not unlink or detach or remove the full Project Gutenberg-tm License terms from this work, or any files containing a part of this work or any other work associated with Project Gutenberg-tm.

1.E.5. Do not copy, display, perform, distribute or redistribute this electronic work, or any part of this electronic work, without prominently displaying the sentence set forth in paragraph 1.E.1 with active links or immediate access to the full terms of the Project Gutenberg-tm License.

1.E.6. You may convert to and distribute this work in any binary, compressed, marked up, nonproprietary or proprietary form, including any word processing or hypertext form. However, if you provide access to or distribute copies of a Project Gutenberg-tm work in a format other than "Plain Vanilla ASCII" or other format used in the official version posted on the official Project Gutenberg-tm web site (www.gutenberg.net), you must, at no additional cost, fee or expense to the user, provide a copy, a means of exporting a copy, or a means of obtaining a copy upon request, of the work in its original "Plain Vanilla ASCII" or other form. Any alternate format must include the full Project Gutenberg-tm License as specified in paragraph 1.E.1.

1.E.7. Do not charge a fee for access to, viewing, displaying, performing, copying or distributing any Project Gutenberg-tm works unless you comply with paragraph 1.E.8 or 1.E.9.

1.E.8. You may charge a reasonable fee for copies of or providing access to or distributing Project Gutenberg-tm electronic works provided that

- You pay a royalty fee of 20% of the gross profits you derive from the use of Project Gutenberg-tm works calculated using the method you already use to calculate your applicable taxes. The fee is owed to the owner of the Project Gutenberg-tm trademark, but he has agreed to donate royalties under this paragraph to the Project Gutenberg Literary Archive Foundation. Royalty payments must be paid within 60 days following each date on which you prepare (or are legally required to prepare) your periodic tax returns. Royalty payments should be clearly marked as such and sent to the Project Gutenberg Literary Archive Foundation at the address specified in Section 4, "Information about donations to the Project Gutenberg Literary Archive Foundation."
- You provide a full refund of any money paid by a user who notifies you in writing (or by e-mail) within 30 days of receipt that s/he does not agree to the terms of the full Project Gutenberg-tm License. You must require such a user to return or destroy all copies of the works possessed in a physical medium and discontinue all use of and all access to other copies of Project Gutenberg-tm works.
- You provide, in accordance with paragraph 1.F.3, a full refund of any money paid for a work or a replacement copy, if a defect in the electronic work is discovered and reported to you within 90 days of receipt of the work.
- You comply with all other terms of this agreement for free distribution of Project Gutenberg-tm works.

1.E.9. If you wish to charge a fee or distribute a Project Gutenberg-tm electronic work or group of works on different terms than are set forth in this agreement, you must obtain permission in writing from both the Project Gutenberg Literary Archive Foundation and Michael Hart, the owner of the Project Gutenberg-tm trademark. Contact the

Foundation as set forth in Section 3 below.

1.F.

1.F.1. Project Gutenberg volunteers and employees expend considerable effort to identify, do copyright research on, transcribe and proofread public domain works in creating the Project Gutenberg-tm collection. Despite these efforts, Project Gutenberg-tm electronic works, and the medium on which they may be stored, may contain "Defects," such as, but not limited to, incomplete, inaccurate or corrupt data, transcription errors, a copyright or other intellectual property infringement, a defective or damaged disk or other medium, a computer virus, or computer codes that damage or cannot be read by your equipment.

1.F.2. LIMITED WARRANTY, DISCLAIMER OF DAMAGES - Except for the "Right of Replacement or Refund" described in paragraph 1.F.3, the Project Gutenberg Literary Archive Foundation, the owner of the Project Gutenberg-tm trademark, and any other party distributing a Project Gutenberg-tm electronic work under this agreement, disclaim all liability to you for damages, costs and expenses, including legal fees. YOU AGREE THAT YOU HAVE NO REMEDIES FOR NEGLIGENCE, STRICT LIABILITY, BREACH OF WARRANTY OR BREACH OF CONTRACT EXCEPT THOSE PROVIDED IN PARAGRAPH F3. YOU AGREE THAT THE FOUNDATION, THE TRADEMARK OWNER, AND ANY DISTRIBUTOR UNDER THIS AGREEMENT WILL NOT BE LIABLE TO YOU FOR ACTUAL, DIRECT, INDIRECT, CONSEQUENTIAL, PUNITIVE OR INCIDENTAL DAMAGES EVEN IF YOU GIVE NOTICE OF THE POSSIBILITY OF SUCH DAMAGE.

1.F.3. LIMITED RIGHT OF REPLACEMENT OR REFUND - If you discover a defect in this electronic work within 90 days of receiving it, you can receive a refund of the money (if any) you paid for it by sending a written explanation to the person you received the work from. If you received the work on a physical medium, you must return the medium with your written explanation. The person or entity that provided you with the defective work may elect to provide a replacement copy in lieu of a refund. If you received the work electronically, the person or entity providing it to you may choose to give you a second opportunity to receive the work electronically in lieu of a refund. If the second copy is also defective, you may demand a refund in writing without further opportunities to fix the problem.

1.F.4. Except for the limited right of replacement or refund set forth in paragraph 1.F.3, this work is provided to you 'AS-IS' WITH NO OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PURPOSE.

1.F.5. Some states do not allow disclaimers of certain implied warranties or the exclusion or limitation of certain types of damages. If any disclaimer or limitation set forth in this agreement violates the law of the state applicable to this agreement, the agreement shall be interpreted to make the maximum disclaimer or limitation permitted by the applicable state law. The invalidity or unenforceability of any provision of this agreement shall not void the remaining provisions.

1.F.6. INDEMNITY - You agree to indemnify and hold the Foundation, the trademark owner, any agent or employee of the Foundation, anyone providing copies of Project Gutenberg-tm electronic works in accordance with this agreement, and any volunteers associated with the production, promotion and distribution of Project Gutenberg-tm electronic works, harmless from all liability, costs and expenses, including legal fees, that arise directly or indirectly from any of the following which you do or cause to occur: (a) distribution of this or any Project Gutenberg-tm work, (b) alteration, modification, or additions or deletions to any Project Gutenberg-tm work, and (c) any Defect you cause.

Section 2. Information about the Mission of Project Gutenberg-tm

Project Gutenberg-tm is synonymous with the free distribution of electronic works in formats readable by the widest variety of computers including obsolete, old, middle-aged and new computers. It exists because of the efforts of hundreds of volunteers and donations from people in all walks of life.

Volunteers and financial support to provide volunteers with the

assistance they need, is critical to reaching Project Gutenberg-tm's goals and ensuring that the Project Gutenberg-tm collection will remain freely available for generations to come. In 2001, the Project Gutenberg Literary Archive Foundation was created to provide a secure and permanent future for Project Gutenberg-tm and future generations. To learn more about the Project Gutenberg Literary Archive Foundation and how your efforts and donations can help, see Sections 3 and 4 and the Foundation web page at <http://www.pglaaf.org>.

Section 3. Information about the Project Gutenberg Literary Archive Foundation

The Project Gutenberg Literary Archive Foundation is a non profit 501(c)(3) educational corporation organized under the laws of the State of Mississippi and granted tax exempt status by the Internal Revenue Service. The Foundation's EIN or federal tax identification number is 64-6221541. Its 501(c)(3) letter is posted at <http://pglaaf.org/fundraising>. Contributions to the Project Gutenberg Literary Archive Foundation are tax deductible to the full extent permitted by U.S. federal laws and your state's laws.

The Foundation's principal office is located at 4557 Melan Dr. S. Fairbanks, AK, 99712., but its volunteers and employees are scattered throughout numerous locations. Its business office is located at 809 North 1500 West, Salt Lake City, UT 84116, (801) 596-1887, email business@pglaaf.org. Email contact links and up to date contact information can be found at the Foundation's web site and official page at <http://pglaaf.org>

For additional contact information:

Dr. Gregory B. Newby
Chief Executive and Director
gbnewby@pglaaf.org

Section 4. Information about Donations to the Project Gutenberg Literary Archive Foundation

Project Gutenberg-tm depends upon and cannot survive without wide spread public support and donations to carry out its mission of increasing the number of public domain and licensed works that can be freely distributed in machine readable form accessible by the widest array of equipment including outdated equipment. Many small donations (\$1 to \$5,000) are particularly important to maintaining tax exempt status with the IRS.

The Foundation is committed to complying with the laws regulating charities and charitable donations in all 50 states of the United States. Compliance requirements are not uniform and it takes a considerable effort, much paperwork and many fees to meet and keep up with these requirements. We do not solicit donations in locations where we have not received written confirmation of compliance. To SEND DONATIONS or determine the status of compliance for any particular state visit <http://pglaaf.org>

While we cannot and do not solicit contributions from states where we have not met the solicitation requirements, we know of no prohibition against accepting unsolicited donations from donors in such states who approach us with offers to donate.

International donations are gratefully accepted, but we cannot make any statements concerning tax treatment of donations received from outside the United States. U.S. laws alone swamp our small staff.

Please check the Project Gutenberg Web pages for current donation methods and addresses. Donations are accepted in a number of other ways including including checks, online payments and credit card donations. To donate, please visit: <http://pglaaf.org/donate>

Section 5. General Information About Project Gutenberg-tm electronic works.

Professor Michael S. Hart is the originator of the Project Gutenberg-tm concept of a library of electronic works that could be freely shared

with anyone. For thirty years, he produced and distributed Project Gutenberg-tm eBooks with only a loose network of volunteer support.

Project Gutenberg-tm eBooks are often created from several printed editions, all of which are confirmed as Public Domain in the U.S. unless a copyright notice is included. Thus, we do not necessarily keep eBooks in compliance with any particular paper edition.

Most people start at our Web site which has the main PG search facility:

<http://www.gutenberg.net>

This Web site includes information about Project Gutenberg-tm, including how to make donations to the Project Gutenberg Literary Archive Foundation, how to help produce our new eBooks, and how to subscribe to our email newsletter to hear about new eBooks.