# A TREATISE ON MATHEMATICAL INSTRUMENTS: THEIR CONSTRUCTION, ADJUSTMENT TESTING AND USE CONCISELY EXPLAINED; EIGHT EDITION. [LONDON-1866]

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649724727

A Treatise on Mathematical Instruments: Their Construction, Adjustment Testing and Use Concisely Explained; Eight Edition. [London-1866] by J. F. Heather



Edited by Trieste Publishing Pty Ltd.
Cover @ 2017



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J. F. HEATHER

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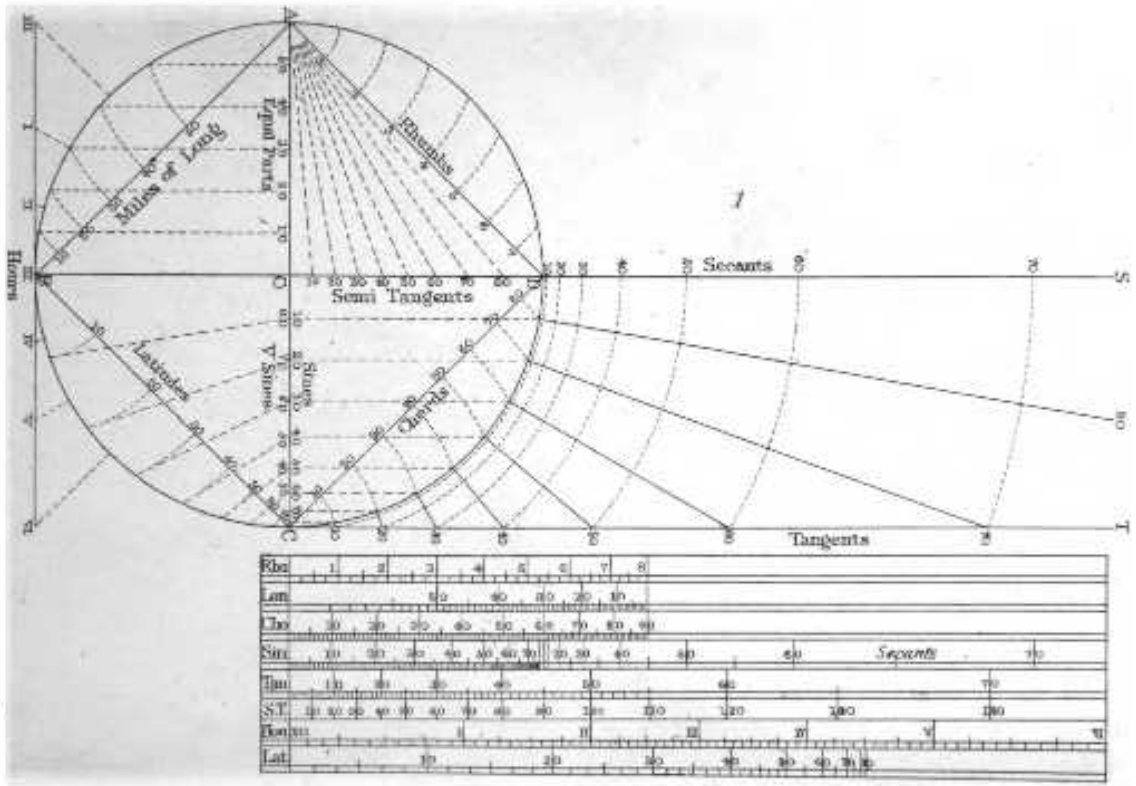
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# TREATISE

ON

# MATHEMATICAL INSTRUMENTS:

THEIR

CONSTRUCTION, ADJUSTMENT, TESTING, AND USE

CONCISELY EXPLAINED.

BY J. F. HEATHER, M.A.,

OF THE ROYAL MILITARY ACADEMY, WOOLWICH, AUTHOR OF "DESCRIPTIVE GEOMETRY."

EIGHTH EDITION,

ILLUSTRATED.

LONDON:

VIRTUE BROTHERS & CO., 26, IVY LANE,

PATERNOSTER ROW.

1866.

## PREFACE TO THE EIGHTH EDITION.

AN attempt has been made in the following pages to put within the reach of all a short and compendious treatise upon some of the ingenious instruments by which the scientific practitioner is aided in his observations, and in the delineation of the results obtained from them.

The instruments treated of have been divided into five classes, to each of which a part of the work has been devoted. The first part treats of Mathematical Drawing Instruments; the second, of Optical Instruments; the third, of Surveying Instruments; the fourth, of Astronomical Instruments, and the fifth, and last, of Goniometrical Instruments, for measuring the angles of crystals.

The greater part of the Wood Engravings, and some parts of the Text, of "Simms's Mathematical Drawing Instruments," have been pressed into the service of the present work; and the works of the best writers upon the several parts of the subject have been consulted, and much valuable matter has been extracted from them, particularly from Pearson's "Astronomy."

The limits of the bulk and cost of the work have forbidden any extensive excursion into the sciences in which the instruments are used; but it is hoped that a large mass of information has here been placed in a small compass without sacrificing perspicuity to undue compression.

An Appendix has been added, in which notices will be found of the chief improvements that have been recently effected in instruments of these classes.

J. F. H.

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# A TREATISE

ON

# MATHEMATICAL INSTRUMENTS.

## PART I.—ON MATHEMATICAL DRAWING INSTRUMENTS.

In this branch of the subject the limits of our little work will not permit us to enter upon all the beautiful contrivances which have been invented for facilitating the operations of the draughtsman; but we shall endeavour to describe the constructions and applications of such as are in most general use, and, as far as our space will allow, to exhibit the principles upon which they are founded, so that the student may readily extend his views, after having completely mastered the matter here presented to him, to the principles of any other instruments, which may be useful to him in whatever particular professional branch of practical mathematics he may wish to employ himself. With this view we shall describe the instruments in the ordinary case of drawing instruments, as sold by any mathematical instrument maker; viz.,

| | |
|---|---|
| Compasses with moveable point, ink point, and pencil point. | Drawing pen and pricking point. |
| Hair compasses. | Plain scale. |
| Bow compasses. | Sector. |

And we shall also give some account of the following; viz.,

| | |
|---|---|
| Whole and hálves. | Beam compasses. |
| Proportional compasses. | Plotting scales. |
| Triangular compasses. | The pantograph. |
| Marquois's scales. | Sliding Rule. |

### ON DRAWING COMPASSES.

This instrument consists of two legs moveable about a joint, so that the points at the extremities of the legs may be set at any required distance from one another; it is used to transfer and measure distances, and to describe arcs and circles.

The points of the compasses should be formed of well-tempered steel, that cannot be easily bent or blunted, the upper part being formed of brass or silver. The joint is framed of two substances; one side being of the same material as