CATALOGUE. S.M. SECTION

SURVEYING

DRAWING AND NAUTICAL

INSTRUMENTS

J. H. STEWARD, LTD.

Opticians and Scientific Instrument Makers

406, STRAND & 457, WEST STRAND

LONDON, W.C.2

ESTABLISHED 1852. PHONE GERRARD 1867

CONTENTS

BUSINESS TERMS.

This Catalogue is the SM Section, and cancels all previous editions.

When ordering, the catalogue number and letters opposite the instrument referred to should be quoted.

For the convenience of customers abroad Telegraphic Code Words are given at the end of the catalogue.

Any instrument not specified in the catalogue can be constructed or obtained for clients, and estimates and descriptions furnished when required.

The prices quoted are **Net for Cash** exclusive of packing, which is charged at cost price.

Customers who have no ledger account with us should forward a remittance to the value of the goods ordered, or give the usual references. Payment can be made by Cheque, Banker's Draft or Postal Money Order, either of which should be made payable to J. H. Steward, Ltd., and crossed————————& Co.

In the case of foreign shipments it should be arranged for payment to be made in London, against shipping documents.

Carriage is paid by J. H. Steward, Ltd., to any place in Great Britain on orders of over £2 in value except in the case of a few bulky articles such as Drawing Boards.

To prevent error, customers ordering through their agents are respectfully requested to mention our name and address on the indent, and if possible also to advise us direct, enclosing a copy of that portion of the indent referring to our instruments.

Caution. We regret to have to caution the public against purchasing substitutes or inferior imitations of our instruments. It has come to our notice that such have been offered both at home and abroad.

Experimental Work carried out under personal supervision.

Repairs of all Optical and Scientific Instruments undertaken.

The Only Addresses of J. H. STEWARD, LTD., are as follows :—

406, Strand, on the north side, *between* the Adelphi and Vaudeville Theatres, and opposite the Hotel Cecil.

457, West Strand, on the north side, at the corner of Trafalgar Square.

Business Hours, 9 a.m. to 6 p.m.; Saturdays, 9 a.m. to 1 p.m.

Telephone	**GERRARD 1867.**
Inland Telegraphic Address ...	**"TELEMETER, RAND, LONDON."**
Cable Address	**"TELEMETER, LONDON."**

Telegraphic Code Words will be found at end of Catalogue.

INTRODUCTION.

Since the last edition of this catalogue of Surveying and Mathematical Instruments was issued, many improvements both optical and mechanical have been incorporated in various instruments, as experience showed them to be advantageous.

The long business relations which the firm of J. H. Steward, Ltd., has enjoyed with members of the Surveying and Allied Professions, and as contractors to H.M. Government, has put within their reach facilities for gaining practical experience which could not be otherwise obtained.

Opportunity is here taken of thanking those clients who have made valuable suggestions and have so generously placed at our disposal the results of their practical experience.

We have every facility in our Repair Department for repairing any make of Surveying and other Scientific Instruments, and also for carrying out experimental work and for constructing instruments to special specification.

We would draw attention to other departments of the business, of which further details will be found at the end of this catalogue.

Particulars of any instrument not dealt with in this catalogue will be furnished on request.

The firm of J. H. Steward, Ltd., has been established for more than 70 years, and has had the honour of supplying many instruments to various Government Offices, Public Institutions and Companies, some of which are enumerated below, and are offered as references to intending purchasers.

Various Departments of H.M. Government.

Admiralty and War Office.

H.M. Council of India.

Crown Agents for the Colonies.

The Foreign Governments of Argentine, Belgium, Brazil, Bulgaria, Chili, China, Egypt, Italy, Japan, Portugal, Russia, Siam, United States of America.

Universities, Schools and Technical Institutes at Home and Abroad

Railway, Steamship and Telegraph Companies.

National Rifle Association.

National Artillery Association.

J. H. Steward, Ltd., 406, Strand, and 457, West Strand, London, W.C.2.

THEODOLITES AND TACHEOMETERS.

The following is a general description applicable to theodolites described in this Catalogue. Other details are indicated in the description of each type of instrument.

Material.—Virgin metal only is used free from magnetic impurities—Care has been exercised to use only those metals which, by long experience, have been found to be most suitable for the different parts of the theodolite.

The Circles are graduated on solid silver except those of the "Explorer's" Theodolite, SM 32. Horizontal Circles are graduated in the sexagesimal system to 360 degrees and are figured clockwise. Vertical Circles are figured in quadrants from 0° horizontally to 90° vertically. The circles can be graduated or figured in any other way to meet the requirements of the purchaser. In some cases this may entail extra cost. The circles are read either by vernier or by micrometer microscopes as stated in the specifications.

The Standards are specially rigid and a screw adjusting sliding piece is fitted to one standard, for adjustment of the bearings of the transit axis, so that the telescope will transit on a vertical line. A Striding Level (SM 91, page 26) can be supplied for this purpose. (This does not apply to the "Explorer's" Theodolite SM 32, or the "Compact" Micrometer Theodolite, SM 25, the transit axes of which are not reversible).

Slow Motion and Clamps. Tangent screws to the slow motions work against opposing springs, preventing back lash. Clamps are so designed as not to disturb the centres or transit axis.

Telescopes. There are three distinct types fitted to Theodolites, the optical system being different in each type: (1) The "Ordinary" Telescope. (2) The "Internal Focussing" Telescope. (3) The "Anallatic" Telescope.

The "Ordinary" Telescope has a rack and pinion focussing adjustment to the tube which carries the object-glass, and the length of the telescope varies according to the distance of the object. When using this type of telescope for measuring the distance of the surveying staff, by means of stadia lines in the diaphragm, it is necessary to add a "constant" to the stadia measurement in order to obtain the distance of the staff from the centre of the theodolite. The "constant" is the sum of the equivalent focus of the object-glass and the distance of the object glass from the centre of the theodolite. The "O.S." Theodolite (page 12) is fitted with this type of telescope.

The "Internal Focussing" Telescope differs from the Ordinary Telescope in several details. The focussing operation is performed by the movement of a negative lens, introduced between the object-glass and the eye-piece, which remain stationary, and the length of the telescope never varies. When measuring the distance of the surveying staff by means of stadia lines in the diaphragm, the "correction" to be added to obtain the distance from the centre of the theodolite is so small as generally to be considered negligible. The "correction" is equal to about two-thirds of the equivalent focus of the object-glass which, in the case of "Rectiform" Theodolites (page 6), is under six inches, and is less than can be plotted except on large scales.

The Internal Focussing Telescope is less liable to get out of collimation than the ordinary telescope; the two ends of the telescope being practically sealed, dirt and wet are excluded; as the telescope always remains the same length its balance is not disturbed. This type of telescope is fitted to the "Rectiform" Theodolites (pages 6 to 10).

The "Anallatic" Telescope has an optical system specially designed for taking linear measurements by means of stadia lines in the diaphragm. A positive lens introduced between the object-glass and eye-piece, has the effect of referring all linear measurements automatically to the centre of the theodolite and there is, therefore, no "constant" to be added. The telescope is larger and more powerful than the two telescopes previously described, and has

THEODOLITES AND TACHEOMETERS—*Continued.*

a longer range. This type of telescope is fitted to theodolites known as Tacheometers (page 14).

The Eyepiece supplied with each type of telescope inverts the object. An erecting eyepiece which gives an upright image can be supplied, but is seldom used by surveyors as the necessary additional lenses lessen the resolving power of the telescope and shorten the range. For observing angles of great altitude a diagonal eyepiece can be supplied (SM 87, page 26).

The Magnifying Power of the telescope stated in the specifications is the power that has been found to give the best results under general conditions. Higher powers than those stated can be substituted, but it must not be overlooked that an increase of power diminishes the brightness of the object, and restricts the field of view.

Resolving Power is largely governed by conditions of light. The approximate distance at which the telescopes will resolve ·01 foot on the staff is from 800 to 1,000 feet. In the case of Tacheometers (page 14), the distance is increased 20 per cent., while in the case of the small theodolites (SM 32, SM 34), the distance is 20 per cent. less.

Diaphragms. The telescope can be fitted with either of the diaphragms illustrated on page 26, and diaphragms of different designs can be supplied to order. Unless ordered otherwise, theodolites are sent out with a web diaphragm in the telescope and a spare glass diaphragm packed in the case. Diaphragms are mounted in interchangeable cells, and in the event of damage, a diaphragm can be removed with the extractor tool supplied with the theodolite, and the spare diaphragm can be inserted in its place without disturbing the collimation adjustment. Unless otherwise ordered, stadia lines in diaphragms are spaced to read one unit on the staff for every hundred of distance.

The Spirit Levels are accurately machined and ground, and are graduated on the glass to read well within the limits of the instrument. The principal level is mounted on the vernier arm of the vertical circle, except in the case of the Railway Theodolites (SM 3 and SM 17), when it is mounted on the telescope. Tacheometers (page 14) have a level mounted on the telescope in addition to one on the vernier arm. A level is mounted on the horizontal plate of all theodolites.

A striding axis level (SM 91) for adjusting the bearings of the transit axis can be supplied to order.

Compass. Unless ordered otherwise, the compass supplied is of the trough pattern. A circular compass can be substituted if preferred. The needle is of the edge bar type and is furnished with a sliding weight for adjusting the dip.

The Levelling Base is attached permanently to the theodolite and has a 3-screw levelling system. A 4-screw levelling system can be substituted if desired.

The Centering Device is embodied in the instrument and is not attached to the tripod unless so ordered.

Case. The theodolite, with its accessories, is securely packed in a mahogany case with hook fastenings and lock. The shoulder strap is detachable.

Outer Carrying Cases of leather or canvas with shoulder strap, are made to contain the theodolite in its mahogany case, and are quoted for separately on page 27.

A Tripod is included with each theodolite as specified. The various types are illustrated on page 25.

Specifications may alter slightly as improvements are introduced.

J. H. Steward, Ltd., 406, Strand, and 457, West Strand, London, W.C.2.

"RECTIFORM" THEODOLITES.

Reading by Verniers.

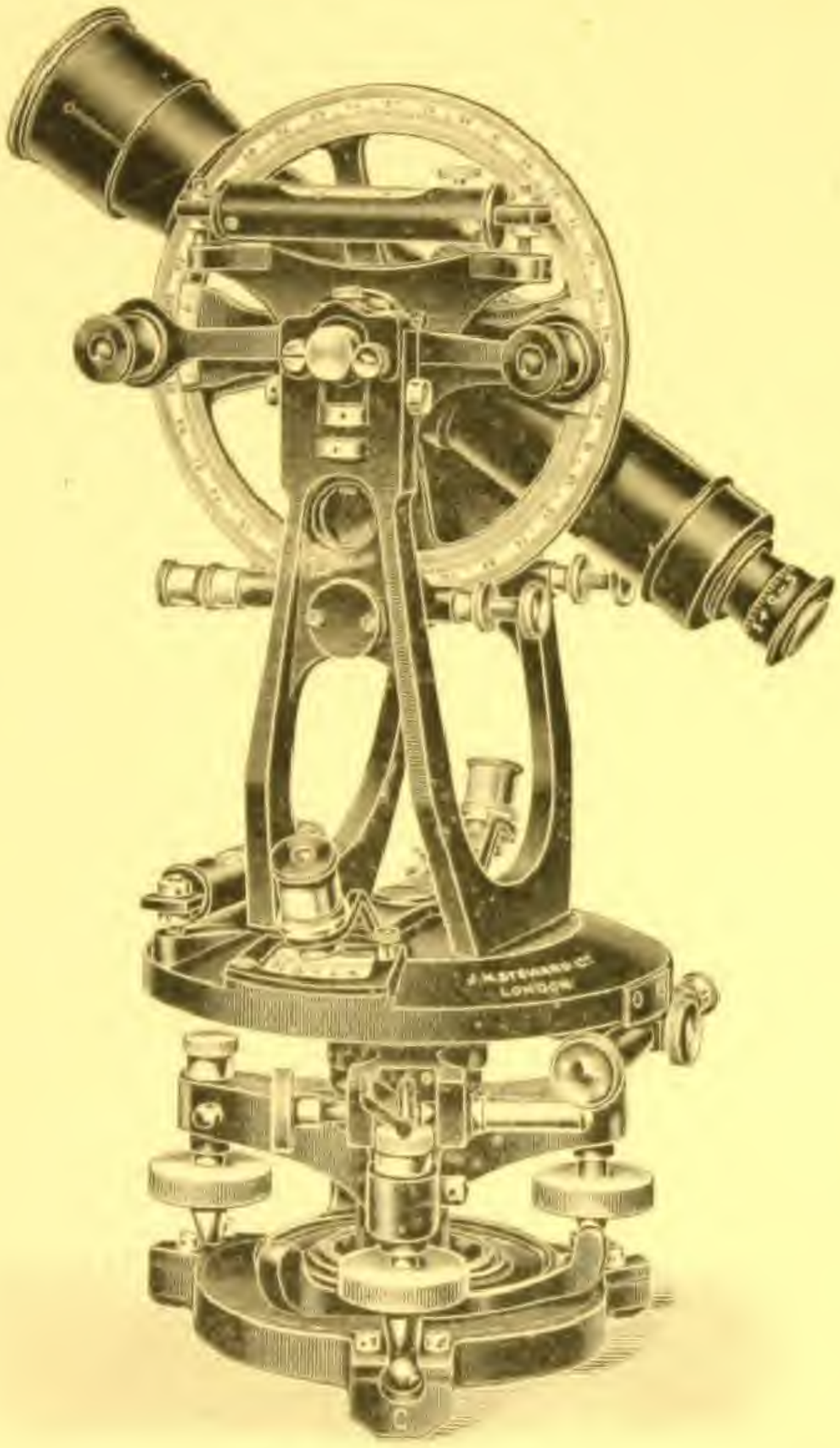


Fig. 1. Transit Theodolite.

Transit Theodolite. Horizontal and vertical circles, 5-inches diameter, graduated on silver and reading by opposite verniers to 20 seconds. Reading magnifier to each vernier with spiral focussing adjustment. The horizontal circle is graduated on the sexagesimal system and is figured to read in a clockwise fashion from 0° to 360°. The vertical circle is divided into 360°, and is figured in quadrants from 0° horizontally to 90° vertically, right and left. Any other method of figuring can be substituted at option of the purchaser. The horizontal circle is completely covered with a metal dust and water shield in which are glass windows over the reading apertures with light reflectors. The windows can be opened for the removal of any moisture that may condense on the underside.

TRANSIT THEODOLITES.—*Continued.*

Slow Motion with clamp to both circles and to the main centre.

Telescope with internal focussing system described on page 4. Magnifying power ×25 diameters, equivalent focus 9·2 inches, angular field 1° 35′. Inverting eyepiece with spiral focussing adjustment and scale by means of which it can be rapidly set to focus. Rayshade to object-glass. Two diaphragms mounted in interchangeable cells, described on page 5. Unless ordered otherwise, the theodolite is sent out with a web diaphragm in the telescope and a spare glass diaphragm packed in the case. The glass diaphragm has lines spaced 1:100 for stadia measurements. The telescope is mounted so that it can transit both ends, and there are means for adjusting the transit axis (see page 4), which is reversible in the standards.

Levels. The principal spirit level is mounted on the vernier arm of the vertical circle, and a spirit level is also mounted on the horizontal plate.

Levelling Base attached permanently to the instrument with a 3-screw levelling system. The screws are furnished with dust caps.

Centering Device embodied in the instrument, giving movement of ¾-inch in all directions.

Compass of the trough or long pattern with edge bar needle with sliding weight for adjustment of dip. This is priced separately.

Accessories. Tinted sun glass for eyepiece of telescope—Extracting tool for diaphragm—Plummet with suspension hook and cord—Screw-driver and tommy-pin—Camel hair brush—Waterproof theodolite cover for use in the field.

Mahogany Case to contain the theodolite which is packed in one piece. Detachable leather shoulder strap.

Tripod either with solid legs or open framed legs (see page 25). Three metal feet are cast on the trivet stage of the theodolite so that it can be set up on a wall or other support without the tripod.

SM 1.—**5-inch Transit Theodolite** as specification in mahogany case with accessories, and tripod..... Fig. 1 **£50 0 0**

SM 2.—**Trough Compass** attached to the theodolite..... **2 0 0**

SM 2a.—Complete **£52 0 0**

SM 3.—**5-inch "Railway" Transit Theodolite.** The same as SM 1, but without the vertical circle and with the principal level mounted on the telescope for levelling purposes, instead of on the vertical vernier arm. In mahogany case with accessories, and tripod..... **£44 0 0**

SM 4.—**Trough Compass** attached to theodolite **2 0 0**

SM 4a.—Complete **£46 0 0**

Variations and Accessories see pages 25 to 27.

J. H. Steward, Ltd., 406, Strand, and 457, West Strand, London, W.C.2.

TRANSIT THEODOLITES.—*Continued.*

SM 5.—**5-inch "Mining" Transit Theodolite.** The same as SM 1, with the following modifications. (1) The vertical as well as the horizontal circle is completely enclosed in a metal dust and water shield with glass windows over the reading apertures. (2) The centering device is designed so as to allow an increased range of movement of 2¼-inches. (3) Reference marks are engraved on both sides of the transit axis of telescope for accurately centering under a point by overhead plombing. (4) The tripod has adjustable sliding legs for use in confined positions (see SM 75, page 25). Mahogany Case to contain theodolite and accessories, with shoulder strap **£57 0 0**

SM 6.—**Trough Compass** attached to theodolite..... **2 0 0**

SM 6a.—Complete **£59 0 0**

SM 7.—**5-inch "Mining" Transit Theodolite.** The same as SM 5, with the addition of the auxiliary telescope SM 43 on page 15 **£70 10 0**

SM 8.—**Trough Compass** attached to theodolite **2 0 0**

SM 9.—Complete **£72 10 0**

Variations and Accessories.

Verniers can be arranged to read to 30 seconds or 1 minute.

Circles can be divided centesimally instead of sexagesimally.

The Principal Level can be mounted on the telescope instead of on the vernier arm

The 4-screw Levelling System can be substituted for the 3-screw system.

Accessories for Theodolites will be found on pages 25 to 27.

SM 11.—**Shaft or Tunnelling Theodolite** with hollow centre to the vertical axis so that sights may be taken vertically down a shaft through the head of the tripod which is erected over the shaft.

Complete specification given on application.

SM 12.—**Mine Surveying Outfit** consisting of Transit Theodolite and Sighting Targets for underground survey and Tripods, constructed to meet special requirements.

J. H. Steward, Ltd., 406, Strand, and 457, West Strand, London, W.C.2.

"RECTIFORM" MICROMETER THEODOLITES.

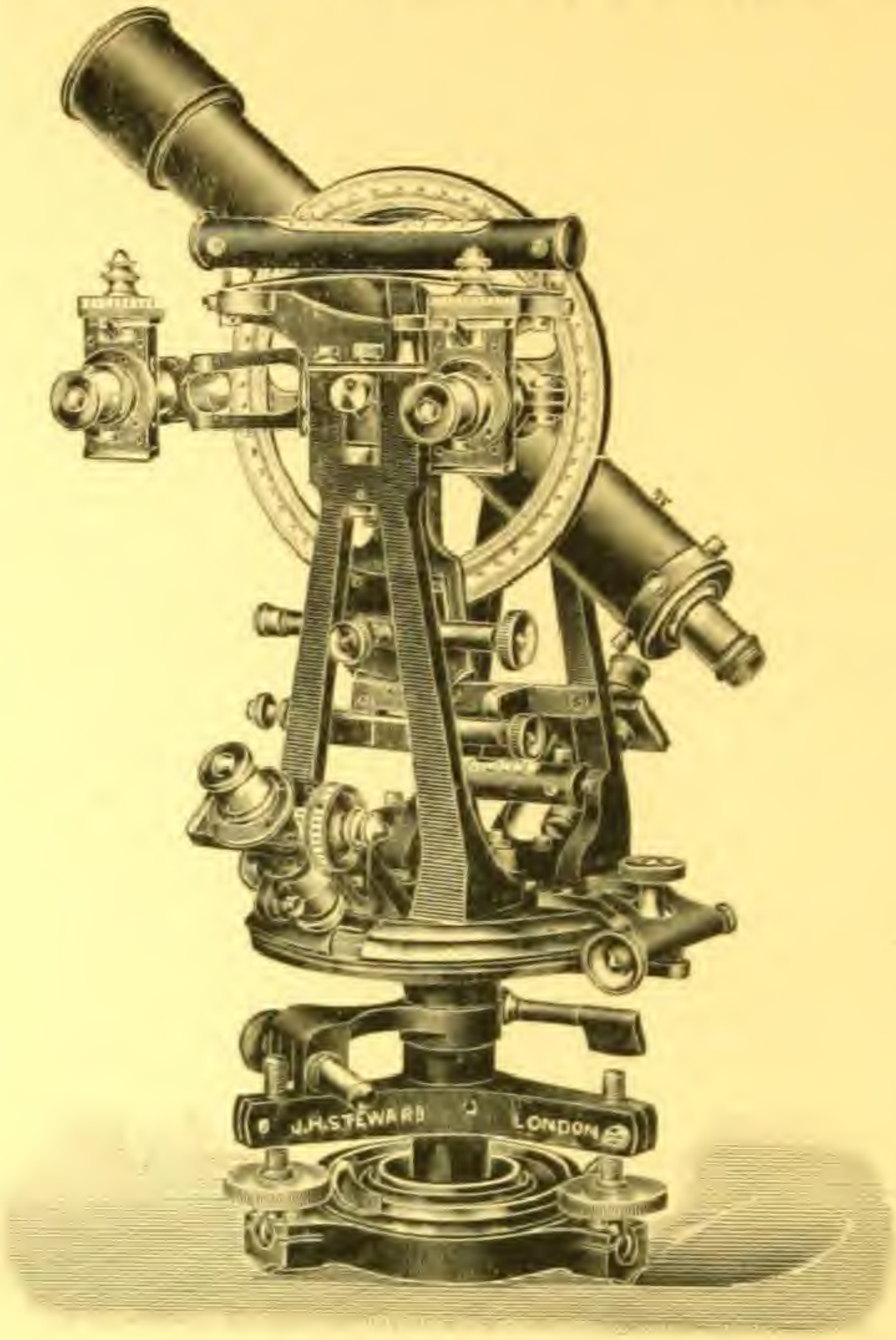


Fig. 2. Micrometer Theodolite.

Micrometer Theodolites. By subdividing the divisions of the circle by means of a Micrometer Microscope a much closer and more exact reading is obtained than can be obtained when the divisions on the circle are subdivided by a vernier. With the exception of the method of reading the circles by micrometer microscopes, this series of theodolites is constructed on the same lines as those specified on pages 6 to 8, and the general remarks on pages 4 and 5 also apply to these theodolites. The details of the Slow Motions—Telescope and Diaphragms—Levels and Levelling Base—Centering Device—Compass—Accessories—Tripod—are identical with those given on page 7.

SM 13.—**5-inch Micrometer Transit Theodolite** as specification with 5-inch Horizontal and 5-inch Vertical Circle and micrometer microscopes on both circles, reading on drums to 10 seconds and less by eye estimation. Both circles are completely enclosed in a metal dust and water shield, but in the illustration the vertical circle is shown without the shield. Packed in two mahogany cases with shoulder straps, to contain theodolite and accessories. Tripod either solid or open framed. Fig. 2 **£70 0 0**

SM 14.—**Trough Compass** attached to theodolite **2 0 0**

SM 14a.—Complete **£72 0 0**

MICROMETER THEODOLITES.—*Continued.*

SM 15.—**5-inch Micrometer Transit Theodolite** the same as SM 13, except that Micrometer Microscopes reading to 10 seconds are fitted to the horizontal circle only; the vertical circle is fitted with verniers reading to 20 seconds..... **£64 0 0**

SM 16.—**Trough Compass** attached to theodolite **2 0 0**

SM 16a.—Complete **£66 0 0**

SM 16b.—**The Vertical Circle** of SM 13 and SM 15 can be made 4-inches diameter instead of 5-inches at a reduction of..... **£4 0 0**

SM 17.—**5-inch "Railway" Micrometer Transit Theodolite** the same as SM 13, but without any vertical circle. The principal spirit level is mounted on the telescope for levelling purposes. Other details are the same as for SM 13..... **£58 0 0**

SM 18.—**Trough Compass** attached to theodolite **2 0 0**

SM 18a.—Complete **£60 0 0**

SM 19.—**"Mining" Micrometer Transit Theodolite** the same as SM 13, with the following additions and modifications.

(1) Light Shafts are fitted to illuminate the graduations of the horizontal circle by artificial light. A light shaft consists of a vertical tube with a rotary prism mounted on the top end. Any form of artificial light such as the "Orilux" lamp described on page 81, can be used, and the prism can be adjusted to throw the light from any direction on to the graduations of the horizontal circle. When the theodolite is used for surface-work the prisms are removed when the graduations will be illuminated from the sky.

(2) The centering device is designed to permit an increased range of movement of 2½-inches.

(3) Reference marks are engraved on both sides of the transit axis of the telescope, for accurately centering under a point by overhead plombing.

(4) The tripod has adjustable sliding legs for use in confined positions (see SM 75, page 25).

Packed in two mahogany cases with shoulder straps..... **£76 0 0**

SM 20.—**Trough Compass** attached to theodolite **2 0 0**

SM 20a.—Complete **£78 0 0**

SM 21.—**"Mining" Micrometer Transit Theodolite** the same as SM 19 with the addition of the Auxiliary Telescope described on page 15..... **£89 10 0**

SM 22.—**Trough Compass** attached to theodolite **2 0 0**

SM 22a.—Complete **£91 10 0**

Alternatives to "Mining" Micrometer Theodolites.

SM 23.—**The Vertical Circle** of SM 19 and SM 21 can be made 4-inches diameter instead of 5-inches at a reduction of **£4 0 0**

SM 24. **The Vertical Circle** of SM 19 and SM 21 can be fitted with verniers in place of the micrometer microscopes at a reduction of **£6 0 0**

Variations and Accessories.

Circles can be graduated centesimally to 400 grades instead of to 360 degrees.

The Principal Level can be mounted on the telescope instead of on the vernier arm.

The 4-screw levelling system can be substituted for the 3-screw system.

Accessories for Theodolites will be found on pages 25 to 27.

J. H. Steward, Ltd., 460, Strand, and 457, West Strand, London, W.C.2.

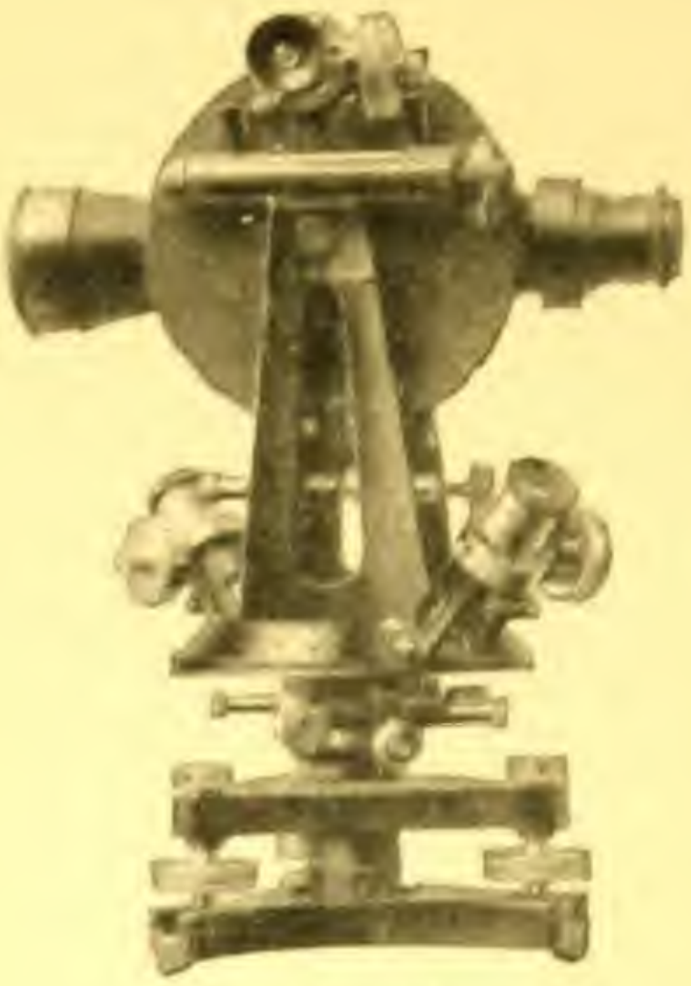


Fig. 3.

THE "COMPACT"

MICROMETER THEODOLITE.

An extra portable and

very accurate

TRANSIT THEODOLITE.

Adopted by

H.M. Government.

The "Compact" Micrometer Transit Theodolite. Horizontal and vertical circles 3½-inches diameter graduated on silver and reading by micrometer microscopes to 10 seconds and less by eye estimation. Two opposite micrometer microscopes are fitted to the horizontal circle and a single micrometer microscope to the vertical circle.

Slow Motion and clamp to both circles and to main centre.

Telescope with internal focussing system described on page 4, with inverting eyepiece—Magnifying power ×15 diameters—Glass diaphragm with stadia lines spaced 1:100 for measuring distance—Telescope arranged to transit both ends.

Levels. Principal spirit level mounted rigid with reading microscope of vertical circle, and a spirit level mounted on the horizontal plate.

Levelling Base attached permanently to the instrument with a 3-screw levelling system.

Centering Device and **Compass** can be supplied if required and are quoted for separately.

Mahogany Case to contain the theodolite packed in one piece, and the accessories. Detachable leather shoulder strap. Size of case 13×7½×7¼ inches. Weight of the theodolite with the case, approximately 12 lbs.

Tripod. Light pattern with open frame legs

SM 25.—**3½-inch "Compact" Micrometer Theodolite** as specified, in mahogany case and tripod ..... *Fig. 3* **£57 0 0**

ACCESSORIES.

SM 26.—**Trough Compass** **2 0 0**

SM 27.—**Centering Device** **2 0 0**

SM 28.—**Spirit Level** mounted on telescope **2 2 6**

SM 29.—**Outer Canvas Case** with shoulder strap **3 0 0**

SM 30.—**Outer Solid Leather Case** with shoulder strap **4 15 0**

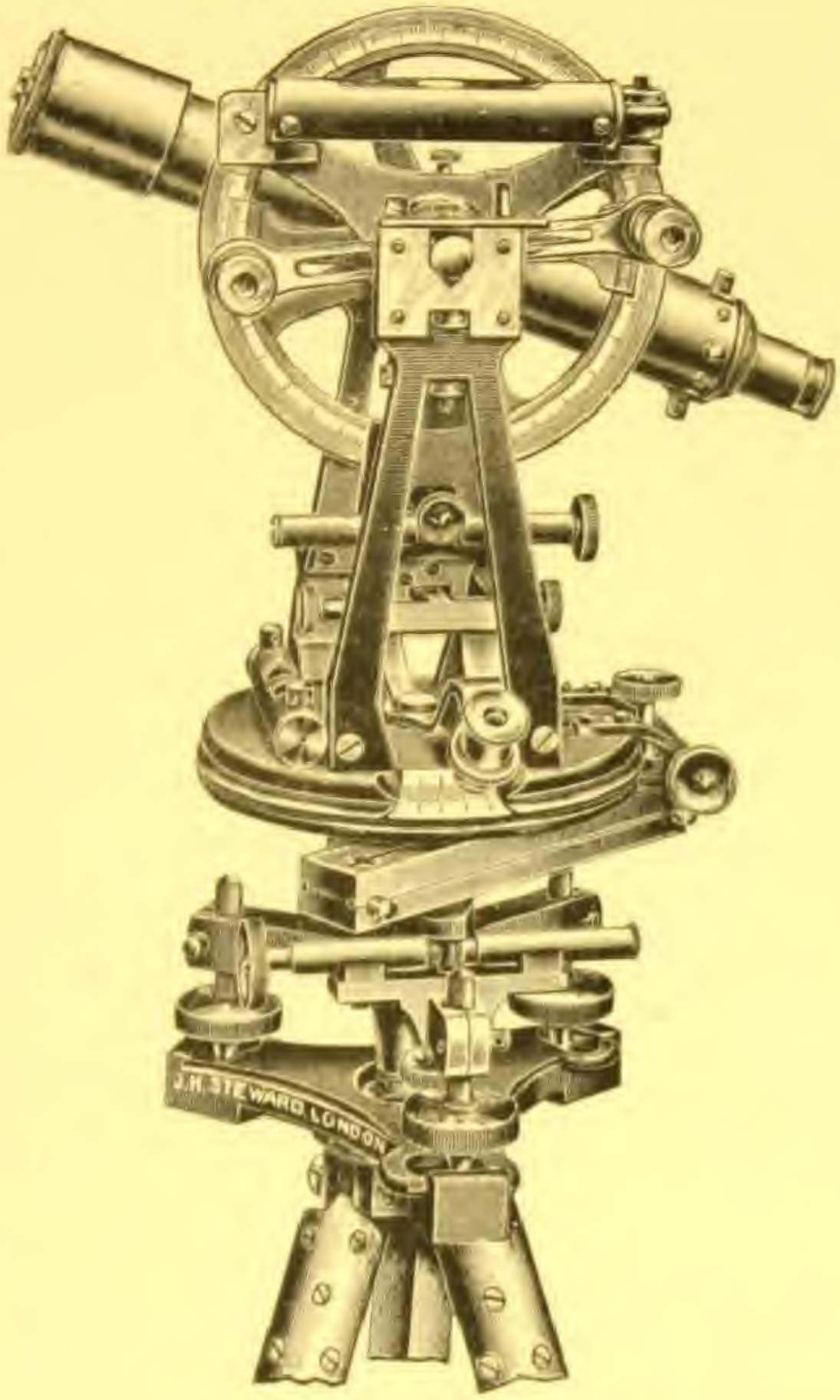


Fig. 4. **£45 0 0**

SM 31.—**The "O.S." Transit Theodolite.** Horizontal and vertical circles 5 inches diameter, graduated on silver and reading by opposite verniers to 20 seconds. Horizontal circle protected by a top plate with reading aperture.

Slow Motion with clamp to both circles and to main centre.

Telescope of the "ordinary type" described on page 4. Two inverting eyepieces, powers ×18 and ×10. Two interchangeable diaphragms as described on page 26, a web diaphragm in the telescope and a spare glass diaphragm with stadia lines spaced 1/100, packed in the case. The telescope transits both ends. There is an adjustment to the transit axis which is reversible in the standards.

Levels. The principal spirit level is mounted on the vernier arm of vertical circle, and a spirit level is mounted on the horizontal index plate.

3-Screw Levelling Base attached to the theodolite.

Centering Device embodied in the instrument giving a movement of ¾ inch in all directions.

Trough Compass with sliding weight to needle for adjusting dip.

Accessories. Tinted sun glass for eyepiece—Extracting tool for diaphragm—Plummet—Screw Driver—Tommy Pin.

Mahogany Case and **Tripod** with solid legs. ....., Fig. 4 **£45 0 0**

EXTRA PORTABLE THEODOLITES.

Fig. 5.

SM 32.—**3-inch "Explorer's" Transit Theodolite**—3-inch horizontal and vertical circles graduated on hardened gun-metal and reading by single verniers to one minute—Hand reading lens—Slow motion with clamp to both circles and to main centre—Telescope of the ordinary type described on page 4, with inverting eye-piece giving a power of ×8—Webbed diaphragm—Telescope transits eye-piece end—Principal level mounted on telescope and a level on the horizontal plate—Circular compass—Levelling base attached to instrument with 4-screw-levelling system—Tripod with sliding legs.—Box for theodolite 12 × 4¾ × 4½ inches—Approximate weight of the theodolite in its box, 8 lbs. .....Fig. 5 **£30 0 0**

SM 33.—Canvas Outer Case for theodolite with shoulder strap **£1 15 0**

SM 34.—**3-inch "Mountain" Transit Theodolite**. Horizontal and vertical circles 3-inches diameter, divided on silver and reading by opposite verniers to 30 seconds—Reading microscope to each vernier. Circular compass with bar needle. Telescope with internal focussing system described on page 4; power ×15. Telescope mounted to transit both ends, with adjustment to transit axis which is reversible in the standards. Principal spirit level mounted on the telescope and a level on the horizontal plate.

Levelling base attached permanently to the instrument with 3-screw levelling system or 4-screw if preferred—Tripod with sliding legs.

Weight of theodolite in its mahogany case about 10 lbs. ... **£45 0 0**

ACCESSORIES FOR MOUNTAIN THEODOLITE.

SM 35.—**Centering Device** to theodolite..... **2 0 0**

SM 36.—**Outer Leather Case** with shoulder strap **4 0 0**

SM 36a.—**Outer Canvas Case** with shoulder strap **2 15 0**

SM 37.—**Canvas Case** for tripod **2 0 0**

Accessories for Theodolite pages 25-27.

ANALLATIC TACHEOMETERS.

These Theodolites are constructed on similar lines to Fig. 1, page 6, but the telescope is larger, and the uprights are slightly taller to permit the telescope to transit. Also a large spirit level is mounted on the telescope in addition to the level on the vernier arm of the vertical circle.

Anallatic Tacheometer. Horizontal and vertical circles, graduated on silver on the sexagesimal system of 360° and reading by opposite verniers (if ordered specially the circles can be graduated on the centesimal system of 400 grades). The horizontal circle is completely covered with a metal dust and water shield with glass windows over the reading apertures and light diffusers.

Slow Motion with clamp to both circles and to main centre.

Anallatic Telescope as described on page 4. Inverting eyepiece giving perfect definition over a wide field. Magnifying power ×28. Two interchangeable diaphragms as described on page 26, one in the telescope and a spare one packed in the case. The stadia lines on diaphragm are spaced to read 1:50 and 1:100. Telescope mounted to transit both ends, with means of adjusting the transit axis which is reversible in the standards.

Spirit Levels. Two large levels, one mounted on the vernier arm of vertical circle and one on the telescope for taking levels without having to set the vertical circle to zero. A spirit level is also mounted on the horizontal index plate.

Levelling Base attached permanently to the instrument, with a 3-screw levelling system.

Centering Device embodied in the instrument giving a movement of ¾-inch in all directions.

Accessories Tinted sun glass for telescope and ray shade to the object glass; extracting tool for diaphragm; plummet with suspension cord; screw driver and tommy-pin; camel hair brush; waterproof cover for protecting theodolite in the field.

Mahogany Case to contain Tacheometer and accessories, with fastening hooks, lock, and detachable shoulder strap.

Tripod with solid legs or open framed legs (see page 25). Three metal feet are cast on the trivet so that the instrument can be set up on a wall without a tripod.

SM 38.—**5-inch Anallatic Tacheometer** both horizontal and vertical circle 5-inch diameter and reading by verniers to 20 seconds.....	**£68 0 0**
SM 39.—**Trough Compass** attached to tacheometer	**2 0 0**
SM 39a.—Complete	**£70 0 0**
SM 40.—**6-inch Anallatic Tacheometer** both horizontal and vertical circle 5-inch diameter and reading by verniers, the horizontal circle to 20 seconds and the vertical circle to 10 seconds.....	**£72 0 0**
SM 41.—**Trough Compass** attached to tacheometer	**2 0 0**
SM 41a.—Complete	**£74 0 0**

Accessories for Tacheometers see pages 25 to 27.

J. H. Steward, Ltd., 406, Strand, and 457, West Strand, London, W.C.2.

THE SOLAR ATTACHMENT.

Fig. 7

The Solar Attachment is used in connection with a transit theodolite for establishing the true meridian, or N. and S. line, by observation of the sun. Being unaffected by local attraction or diurnal variation, lines can be run and horizontal angles measured with an accuracy unattainable with a magnetic compass. The attachment can be fitted to any transit theodolite, and consists of a small solar telescope furnished with a prism eye-piece, webbed diaphragm, spirit-level, and sights for getting the sun into the field of view. The telescope is mounted between two standards at the extremity of a polar axis, and can be rotated, elevated and depressed. The polar axis is attached to the telescope of the theodolite and can be inclined to correspond with the inclination of the earth's axis, the inclination being indicated on the vertical circle of the theodolite. Tangent-screw fine adjustment and clamps are provided.

Latitude and time from apparent noon can also be ascertained by means of the solar attachment.

SM 42.—**Solar Attachment,** price when ordered with the theodolite Fig. 7 **£23 0 0**

THE AUXILIARY TELESCOPE.

FOR MEASURING STEEP ANGLES.

Fig. 8.

SM 43.—**The Auxiliary Telescope** for attachment either to the top of the telescope of a transit theodolite as illustrated, or to the side of same. Its object is to allow steep angles to be measured, which cannot be measured by the main telescope owing to the interference of the horizontal circle. It is specially useful for mine surveying and can be employed for transferring bearings down a shaft and for plombing. By means of a fine adjustment, the line across the diaphragm, can be set by the surveyor in the same plane as the line of collimation of the main telescope. A counterpoise prevents strain on the theodolite. For measuring steep horizontal angles the auxiliary telescope is attached to a fitting on top of the main telescope and for measuring precipitous vertical angles it is attached at the side to an extension of the transit axis of the main telescope..... Fig. 8 **£13 10 0**

Accessories for Theodolites see pages 25-27.

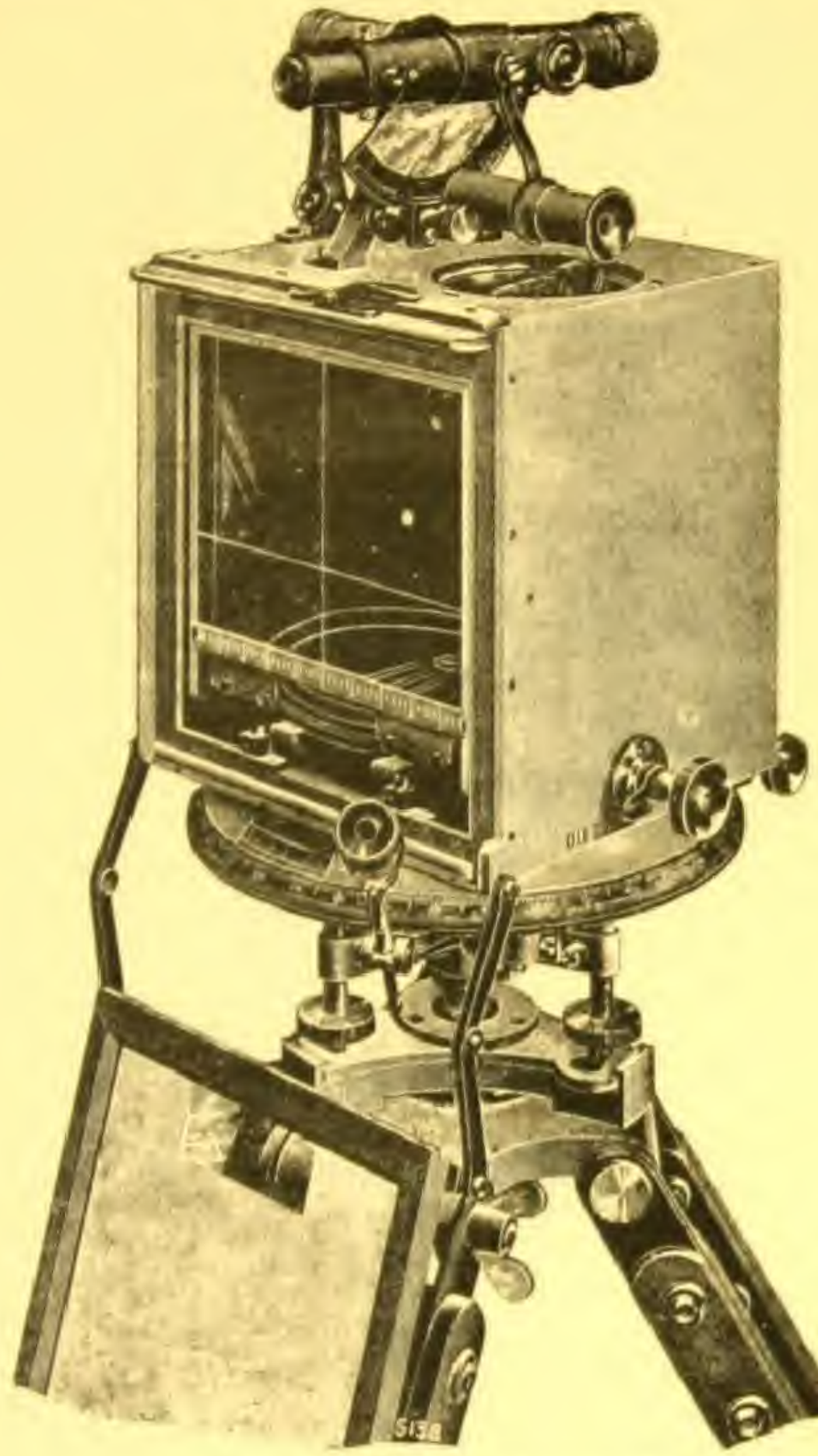


Fig. 9. Photo-Theodolite.

SM 44.—**The Bridges-Lee Photo-Theodolite** consists of a photographic camera made of aluminium and mounted on a divided horizontal circle that can be levelled, rotated, and clamped as an ordinary theodolite. Inside the camera is a magnetic compass having a transparent cylindrical circle of degrees which can be brought against the sensitive plate when the dark slide is in position. The compass in operation turns to the magnetic bearing, and as the light passing through the lens also passes through the compass ring the degrees are photographed on the negative at the same time as the view. In addition to this, horizontal and vertical wires are so placed that they are reproduced on the negative as lines, and a transparent scale, which is also photographed on the negative, shows actual proportions of the projected objects and ensures accurate measurements. A faithful record of the necessary data is thus obtained on the photograph itself, and a note book is unnecessary. This means a saving of time and reduction of risks of error.

The photographic system of surveying, especially in hilly countries, has been proved to be cheaper and quicker than any other method.

The instrument is finished in best style, and, beside the firm open-frame tripod and usual adjustments and spirit levels, has a telescope fixed to the top of the camera, with vertical arc and a reading microscope. The horizontal circle reads by vernier to minutes of arc. A photographic rectilinear lens and iris diaphragm, and six double dark slides for 5 by 4 sensitive plates are included Mahogany case..... Fig. 9 **£45 0 0**

MINING DIALS.

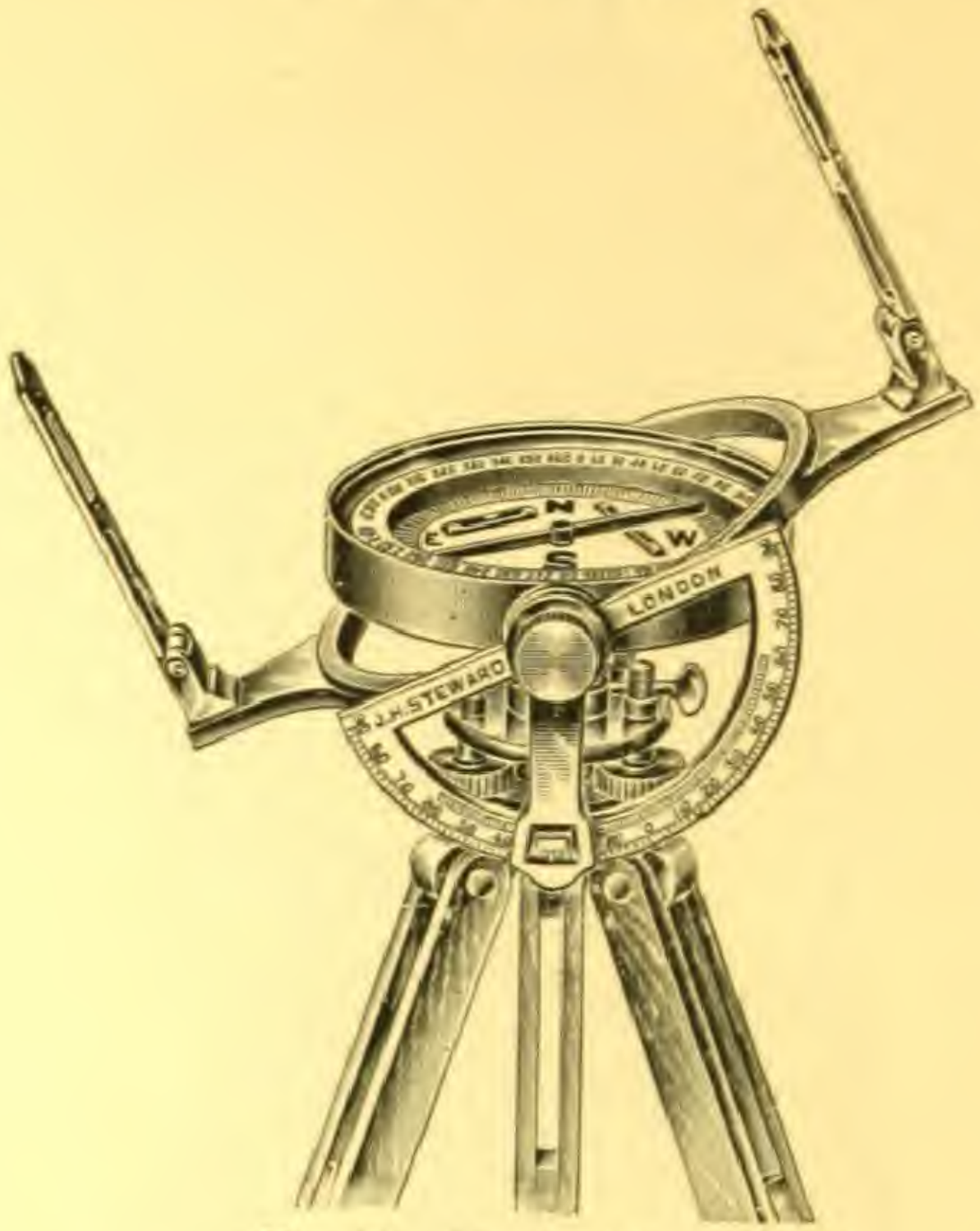


Fig. 10. Hedley-Steward Dial.

SM 45.—**6-inch Hedley-Steward Dial** with double folding sights, mounted on a swinging frame so that inclines and bearings may be taken simultaneously. Horizontal circle reading by vernier to 3 minutes. Lock to swinging frame for converting instrument to a plain dial. Bar needle to compass with dip adjuster. Cross levels on dial. Vertical arc divided to degrees and reading by estimation to ½ degrees. Tripod with sliding legs for quick levelling and for use in shallow seams. 4-screw levelling head with clamp to horizontal motion. Wood case for dial.
Fig. 10 **£25 10 0**

SM 46.....**ditto**.....with fine adjustment to horizontal motion; vertical arc reading to ½ degrees by vernier, quick levelling spherical head combined with 4-screws. Wood case for dial..... **£28 10 0**

SM 47.—.....**ditto**.....same as SM 46, with addition of a telescope which interchanges with the sights which are removable. A spirit level is attached to the telescope..... **£38 10 0**

SM 48.—**Additional Tripod** with 4-screw levelling head as supplied with SM 45 ..... **£7 0 0**

SM 49.—.....**ditto**.....with the addition of a quick levelling spherical head as supplied with SM 46 ..... **£10 0 0**

Sighting Lamp—Lamp Cup—Plummet Lamp to requirements.

SURVEYORS' LEVELS.

Owing to the various forms of Surveyor's Levels in use it is not possible to give a general specification applicable to all the levels enumerated in this catalogue. For convenience of comparison, the levels have been placed in two groups and the following notes may assist a purchaser in selecting the level most suitable for his purpose.

Group I.—Consists of levels which are set up and operated by the method most generally in use. In this group the sighting telescope with the attached principal level is *rigidly fixed* at right angles to a vertical axis, and the adjustment of setting the axis perfectly perpendicular, so that the line of collimation remains horizontal in all positions of the telescope, is performed by foot screws. This group of levels depends for accuracy mainly on the perfection of the vertical axis, and the relation between the axis and the line of collimation. The following levels belong to this group SM 53 to SM 69.

Group II.—Consists of levels in which the sighting telescope with the principal spirit level is *not rigidly fixed* to the vertical axis, but is pivotted to it in such a way that the telescope can be tilted in a vertical plane independently of the rest of the instrument. In this group the vertical axis need not be absolutely vertical and accuracy does not depend on its perfection, neither is it necessary that the line of collimation should be at right angles to the vertical axis. In setting up a level of this group it is only necessary to place the vertical axis approximately vertical by means of a small attached circular spirit level and the foot screws or spherical joint in the case of the "Rapid" Level, SM 71. The final adjustment of the line of collimation is made by bringing the bubble of the principal spirit level to the centre of its run by means of the fine screw below the eye end of the telescope. The final adjustment is gone through at each observation of the staff, and enables one to bring the bubble accurately to the centre of its run at every sight. The levels belonging to this group are SM 50, 51, 71.

The instruments of each group have their own advantages as follows.

The Dumpy Levels in **Group I.** being of very robust and rigid construction, are calculated to best withstand rough usage without getting out of adjustment.

The Tilting Levels in **Group II.** are considered more simple and more speedy to operate. Although the line of collimation has to be finally adjusted before each observation of the staff, it must be remembered that "reversions" are unnecessary and little time is needed to adjust the foot screws.

Telescope. Surveyors' levels are fitted either with an "Ordinary Telescope" or an "Internal Focussing Telescope," which are described on page 4.

The Magnifying Power stated in each specification is the power that has been found to give the best results. The Resolving Power of these telescopes, or in other words, the distance at which 0·01 ft. on a surveying staff can be read by a person with good eyesight in a good light is from 600 to 1,000 feet, except in the case of the telescopes of the small levels on page 24, of which the range is about half that distance.

J. H. Steward, Ltd., 406, Strand, and 457, West Strand, London, W.C.2.

"RECTIFORM" TILTING LEVEL.

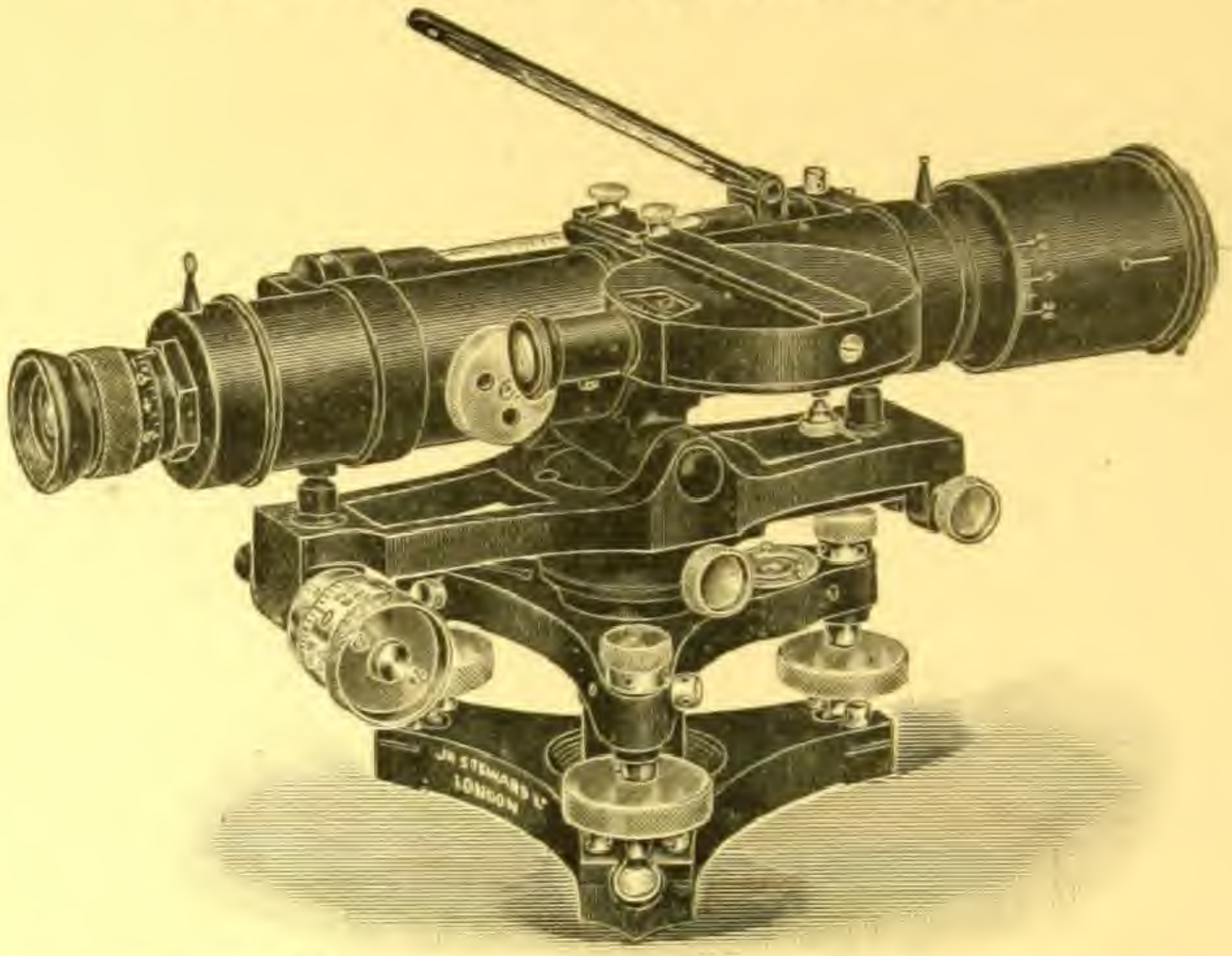


Fig. 11. "Rectiform" Level with Compass.

The "Rectiform" Level is a tilting level the main features of which are described on page 18, under Group II.

The Main Spirit Level is mounted at the side and the bubble and graduations are illuminated by a reflector underneath and can be read in a hinged mirror without moving from the eye-piece end of the telescope.

The Telescope has an internal focussing system described on page 4, with glass detachable diaphragm with stadia lines 1:100 unless ordered otherwise—Inverting eye-piece with screw focussing adjustment and dioptre scale for quick setting—Rayshade to object glass with cross sighting slits and scale of degrees for measuring angles from 0° to 20° above and below the line of sight of telescope—Pointer sights on top of telescope for quickly aligning the object. The telescope is secured to the vertical axis by a pivot and can be tilted in a vertical plane by a screw with micrometer drum at the eye end. The other end of telescope bears on a spring plunger ensuring accuracy of movement. The scale on the drum is divided into 50 equal parts and the movement of one division or 1/50th of a revolution, tilts the telescope or line of collimation 1 in 50,000. Ten revolutions of the drum tilt the line of sight to a reading of 1 ft. on a surveying staff erected vertically 100 ft. distant or 1:100, so that one revolution of the drum would read 1/10th of a foot vertical interval on a staff 100 ft. distant or 1:1000. The micrometer drum serves for linear and grade measurements.

Clamp and Slow Motions to main axis.

Tribach and 3-foot screws embodied in the instrument.

Circular Compass mounted at side of telescope and detachable, reading by lens from eye end of telescope (quoted separately).

Tripod either with solid or open framed legs (page 28)

Mahogany Case with shoulder strap.

SM 50.—**9-inch "Rectiform" Level** as specified. Telescope with object-glass 1·5-inch aperture—Power × 25. Case and tripod. Fig. 11	**£29**	**0**	**0**
SM 51.—**11-inch "Rectiform" Level** as specified. Telescope with object-glass 1·65 inch aperture—Power × 30—Case and tripod.....	**£30**	**10**	**0**
SM 52.—**Detachable Compass** to SM 50 or SM 51.....	**3**	**0**	**0**

Accessories for Levels pages 25-27.

ENGINEERS' DUMPY LEVEL.

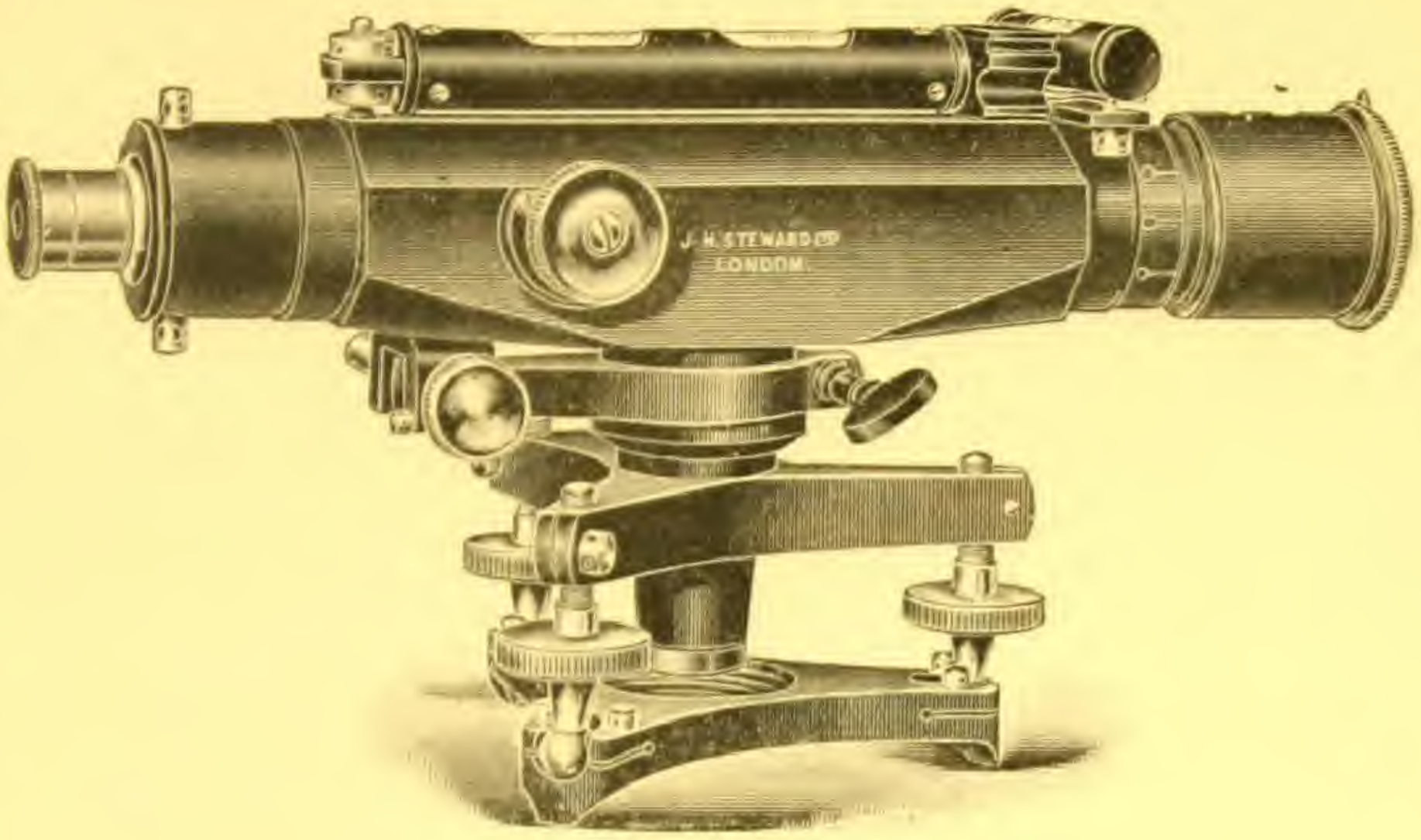


Fig. 12

"Engineers'" Dumpy Level with telescope body and main centre in one piece giving great strength and rigidity. Very sensitive main spirit level and cross level. The telescope is of the "ordinary" type described on page 4, with extra strong rack and pinion focussing adjustment to the object glass; webbed diaphragm unless ordered otherwise. Tangent screw slow motion to main centre with clamp. 3-screw levelling adjustment embodied in the instrument with means of taking up any wear of the levelling screws. Three small feet cast on the trivet stage permit the level to be used on a wall or other support without its tripod. Solid round pattern mahogany tripod (SM 77). Mahogany box with hook fastening and lock. A compass if required can be attached to a small fitting on the telescope and is quoted separately. Fig. 12.

SM 53.—**10-inch "Engineers'" Dumpy Level** as specified, "ordinary" telescope with object-glass 1·45 inch aperture and magnifying power ×15. ..... **£21 0 0**

SM 54.—**12-inch**.....**ditto**.....; "ordinary" telescope with object-glass 1·55 inch aperture and magnifying power ×18..... **£23 0 0**

SM 55.—**14-inch**.....**ditto**.....; "ordinary" telescope with object-glass 1·65-inch aperture and magnifying power ×21..... **£25 0 0**

SM 56.—**"Internal Focussing" Telescope,** described on page 4, fitted to either of the Engineers' Dumpy Levels in place of the "ordinary" telescope at an extra cost of **£2 0 0**

SM 57.—**Detachable Compass** with floating graduated aluminium ring and prismatic reading microscope fitted to either of the Engineers' Dumpy Levels **£3 0 0**

Accessories for Surveying Levels, pages 25-27.

DUMPY LEVELS.

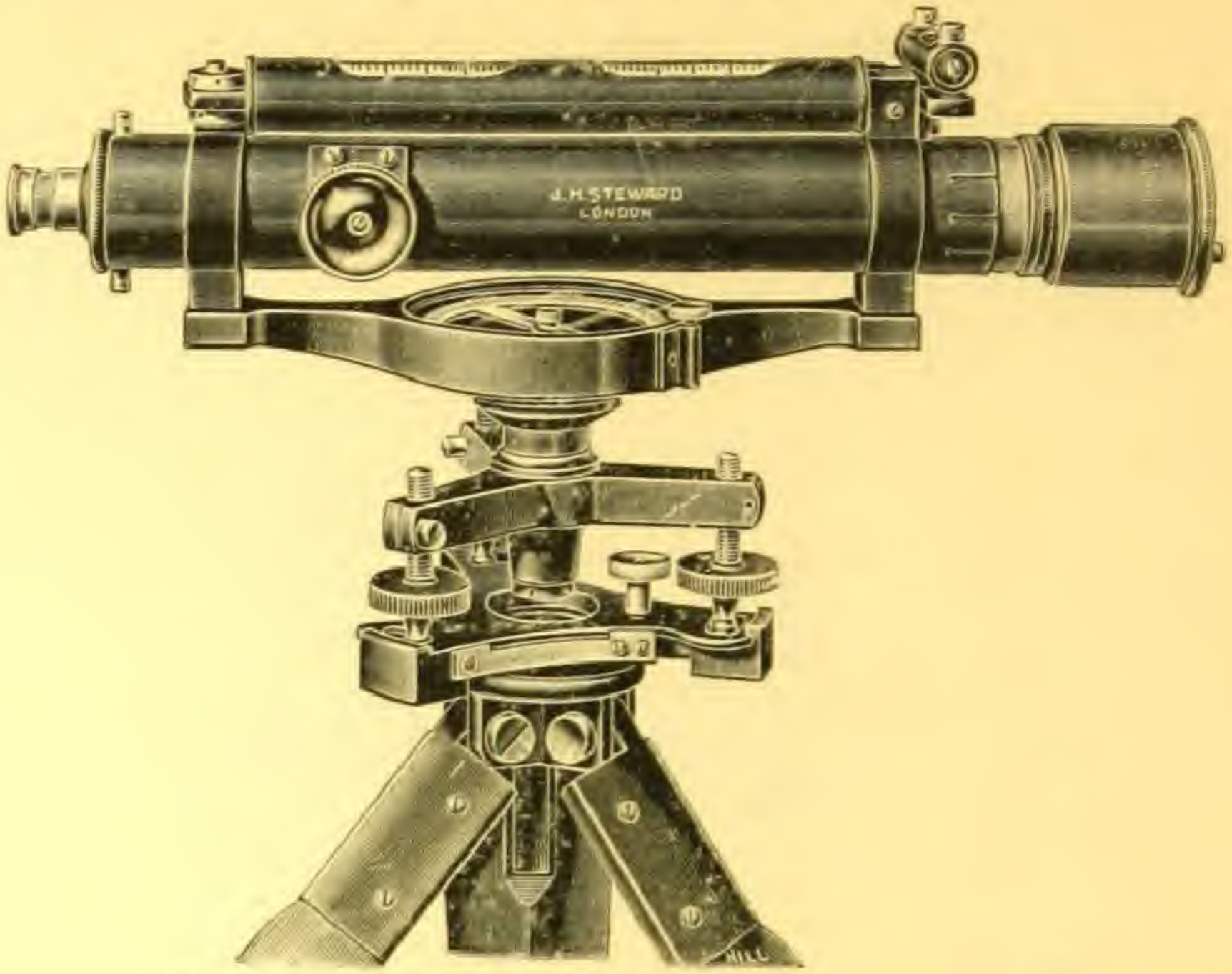


Fig. 13. Dumpy Level, with Compass.

Dumpy Level with axis and limb made in one casting. Telescope of the "ordinary" type, described on page 4, with rack focussing adjustment to object-glass end. Ray shade and shutter. Webbed diaphragm unless otherwise ordered. Very sensitive main spirit level and cross level. Three levelling screws with base plate permanently attached to the instrument and with means of taking up any wear of the levelling screws. Solid round pattern mahogany tripod (SM 77). These Dumpy Levels are made either with or without a compass. The compass has a floating aluminium ring divided to half degrees, and is furnished with a locking stop, and reading microscope. The extra cost of the compass is quoted separately. Mahogany box with hook fastenings and lock.

SM 58.—**10-inch Dumpy Level** as specified; "ordinary" telescope with object-glass 1·45-inch aperture. Power × 15..... **£18 0 0**

SM 59.—**12-inch.....ditto.....**" ordinary" telescope with object-glass 1·55-inch aperture. Power × 18. ..... **£19 0 0**

SM 60.—**14-inch.....ditto.....**" ordinary" telescope with object-glass 1·65 inch aperture. Power × 21. ..... **£20 0 0**

SM 61.—**"Internal Focussing" Telescope,** described on page 4, fitted to either of the Dumpy Levels in place of the "ordinary" telescope at an extra cost of..... **£2 0 0**

SM 62.—**Circular Compass** as illustrated Fig. 13, fitted to either of the Dumpy Levels. **£3 0 0**

SM 63.—**Horizontal Circle** graduated on brass and reading to ½ degrees, for laying out building sites, boundary lines, etc., fitted to either of the Dumpy Levels **£2 10 0**

SM 64.—**4-Screw Levelling Adjustment** can be supplied in place of the 3-screw system at same price.

Accessories see pages 25-27.

Y LEVELS.

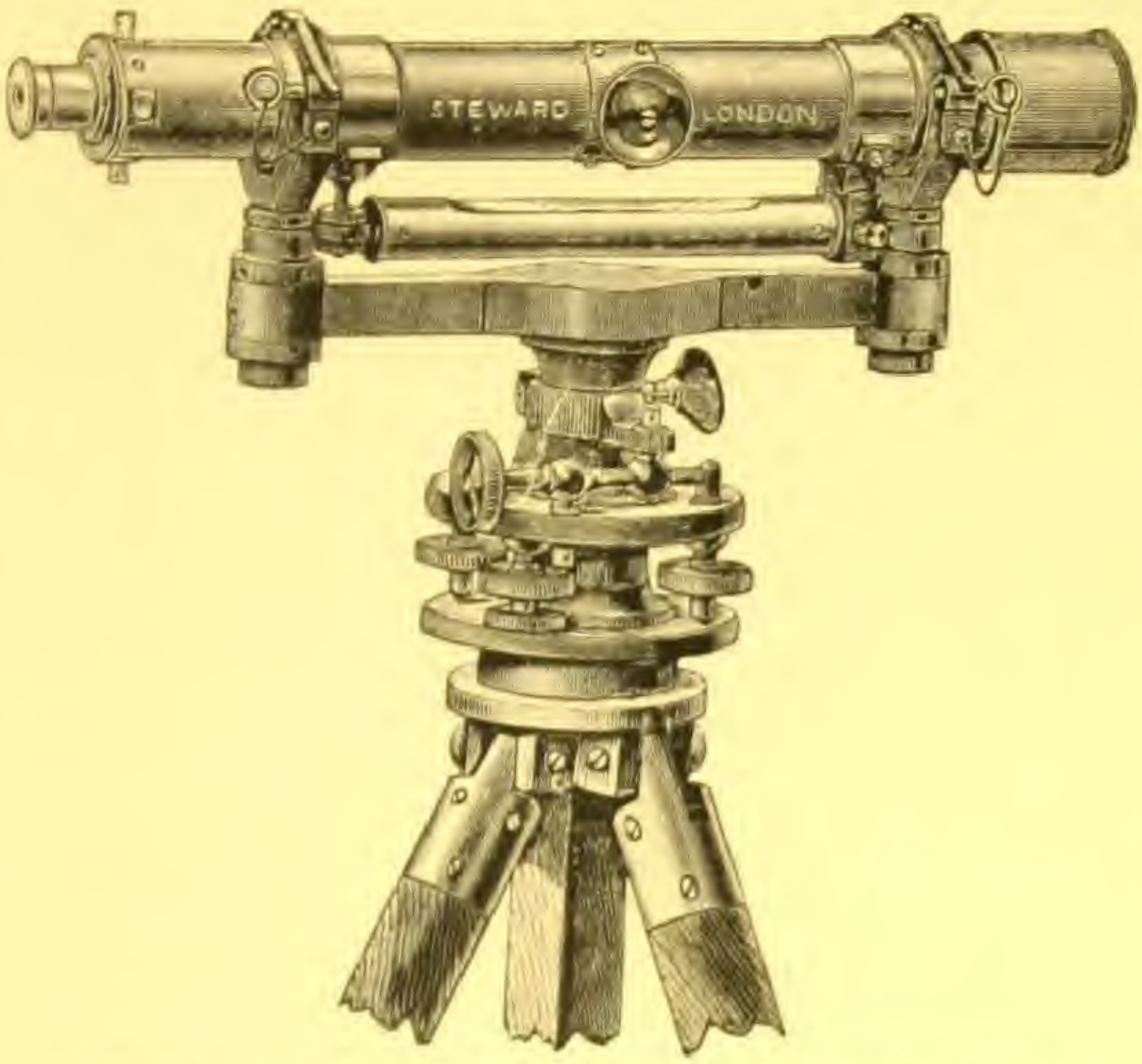


Fig. 14. Y Level, with 4 Screws, without Compass.

Y Level with telescope reversible in its supports, one support being adjustable vertically. The telescope is the "ordinary" type described on page 4, and has rack focussing adjustment to object-glass end. Ray shade and shutter. Webbed diaphragm unless ordered otherwise. Graduated bubble to underside of telescope. Tangent screw fine adjustment with clamp to axis. Levelling head with 4 screws, as illustrated Fig. 14 or 3 screws with locking plate permanently attached. Mahogany box with lock and key. The prices quoted include a solid round pattern mahogany tripod (SM 77). These levels are made with or without a compass. The compass has a floating aluminium ring divided to ½-degrees with locking stop and reading microscope, and the extra cost of same is quoted separately.

SM 65.—**12-inch Y Level** as specified, without compass, object-glass 1·4 inch aperture. Power ×18..... **£26 0 0**

SM 66.—**14-inch**.....**ditto**.....object-glass 1·55 inch aperture. Power ×21 ..... **£28 0 0**

SM 67.—**16-inch**.....**ditto**.....object-glass 1·55 inch aperture. Power ×24 ..... **£30 0 0**

SM 68.—**Circular Compass** to either of above levels. Extra **£3 0 0**

Accessories pages 25-27.

THE "COMPACT" DUMPY LEVEL.

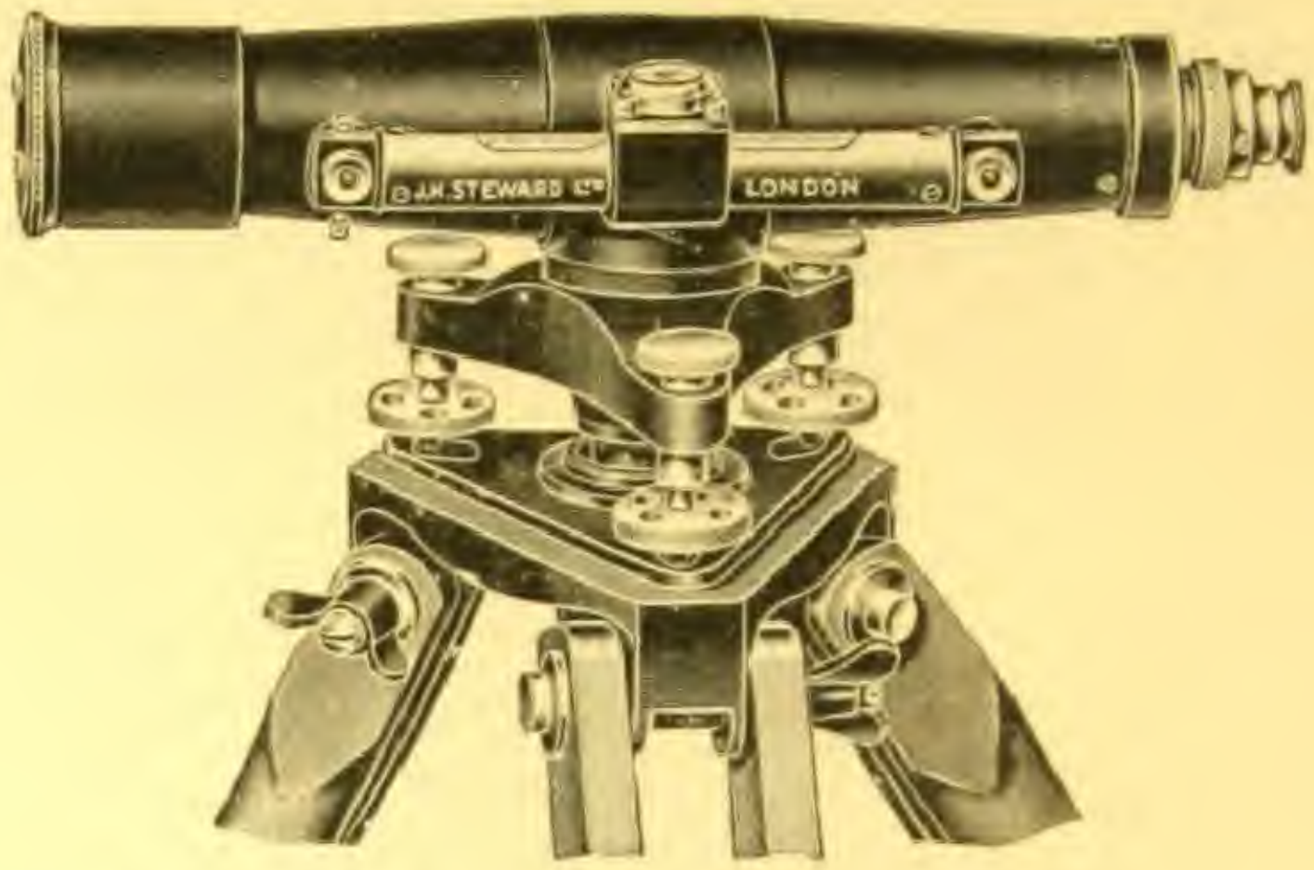


Fig. 15. The "Compact" Dumpy Level.

The "Compact" Dumpy Level is very portable and light in weight, but at the same time it is strong and capable of most accurate work.

The Principal Level is mounted at the side of the Telescope. Instead of the usual cross level, a circular spirit level is placed at the side over the main spirit level. This arrangement is very convenient for quickly setting up the instrument.

The Telescope has an internal focussing system, described on page 4. The eyepiece is focussed on the diaphragm by a rotary motion. The adjusting screws of the diaphragm are concealed and are protected by a metal cover. The total length of the Telescope is 10¼-inches. The focal length of the object-glass is 9-inches, and its aperture 1·4 inch. Magnifying power is ×24 diameters.

The Levelling Head is the 3-screw pattern with an adjustment to the levelling screws for taking up any wear, and is permanently attached to the instrument.

The Horizontal Circle is divided to every 2 degrees and can be read to 1 degree or less by estimation. This is useful for laying out angles or building sites, boundary lines, bridge and railway work. There is a tangent slow motion to main centre with clamp.

The Tripod is of the open frame pattern, light and strong.

Mahogany Case for Level 11½ × 5¼ × 5¼ inches. The weight of the level is 4¼ lbs., and the box 2¾ lbs.

SM 69.—**The "Compact" Dumpy Level** ..... Fig. 15... **£18 15 0**

SM 70.—**Leather Outer Case** and Shoulder Strap, to contain the level in its mahogany box **£2 15 0**

DRAINAGE AND BUILDERS' LEVELS.

Fig. 16.

SM 71.—**The "Rapid" Level** for drainage, agricultural and building work.
Telescope "ordinary" type described on page 4, with rack focussing adjustment, object-glass 1·2 inch aperture, magnifying power ×12, sufficient to read a levelling staff at 300 feet; stadia lines on glass diaphragm 1:100 for measuring distances.
Principal Level with hinged mirror for reading from eye end of telescope.
Horizontal Circle divided to single degrees for laying out building sites, boundary lines, etc.
Portable Tripod with sliding legs.
Spherical Joint for rapidly levelling the instrument by means of a supplemental circular bubble on the base. It is then only necessary to direct the telescope to the levelling staff and bring the main bubble to the centre of its run by the milled head under the eye-piece as explained on page 18. The entire operation is performed without moving from the eye end of telescope.
Leather Carrying Case with Shoulder Strap 9×5×4 inches.
Fig. 16 **£10 0 0**

Portable Levelling Staff (see No. SM 207, page 39).

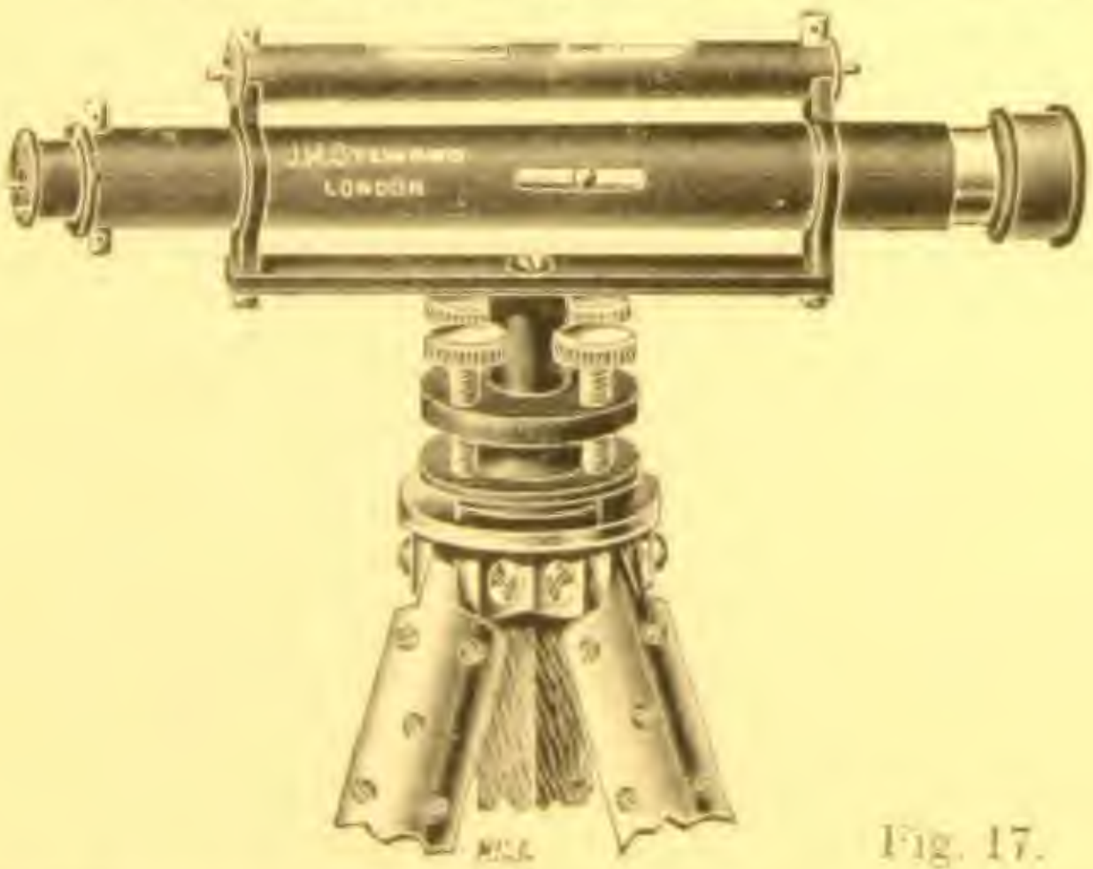


Fig. 17.

S.M 72—**8-inch Drainage and Agricultural Level.** Telescope "ordinary" type, described on page 4, with object-glass, 0·9 inch aperture, magnifying power ×10, with metal protecting cap and sliding focussing adjustment. Webbed diaphragm. Levelling head with 4 screws. Wood case. Round pattern tripod.
Fig. 17 **£7 7 0**

ACCESSORIES.

TRIPODS FOR THEODOLITES AND LEVELS.

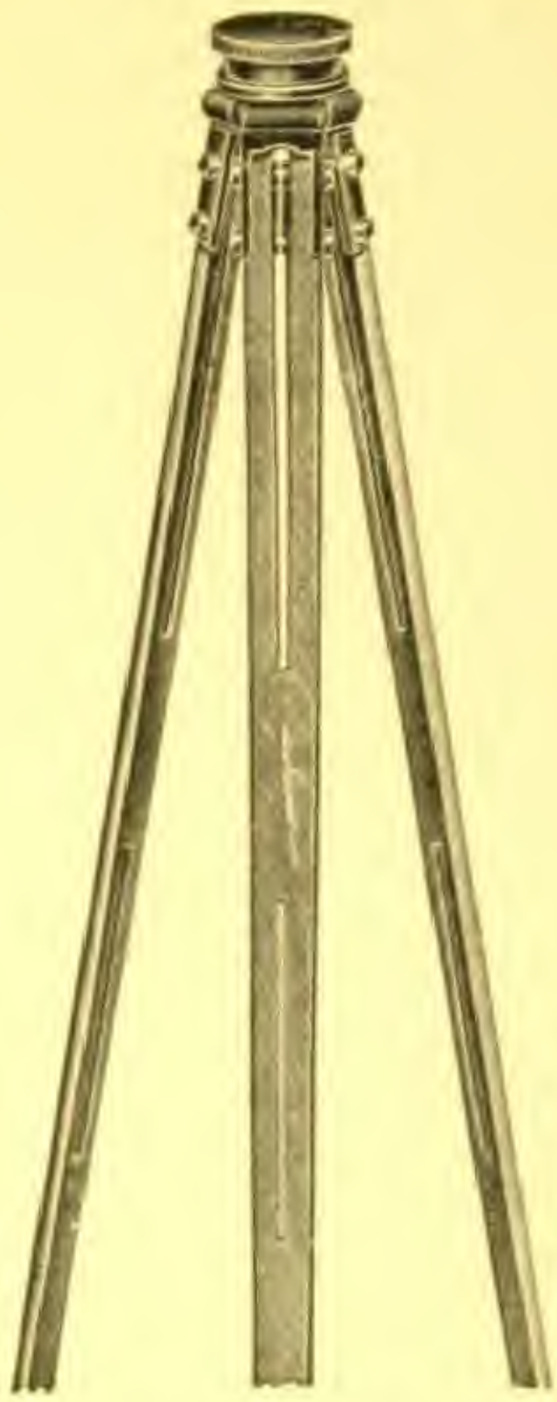
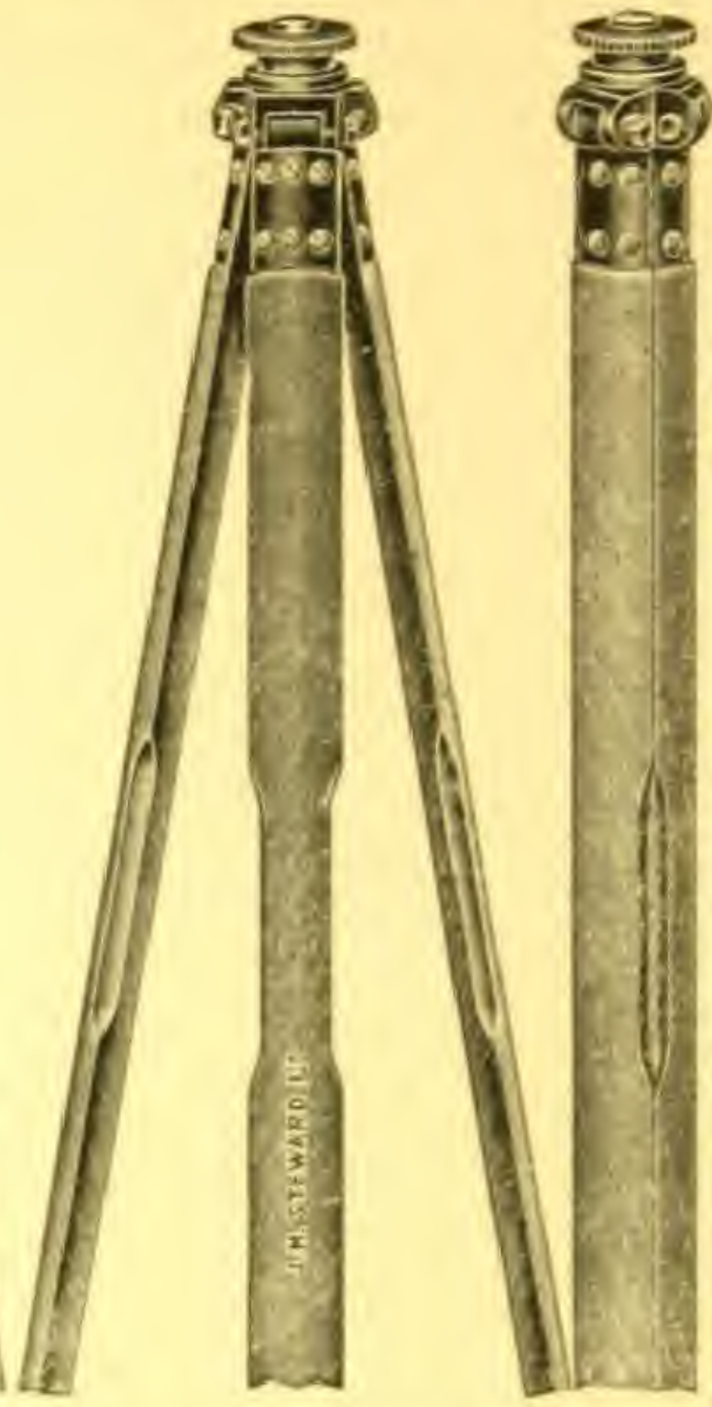


Fig. 18.



Figs. 19 and 20.

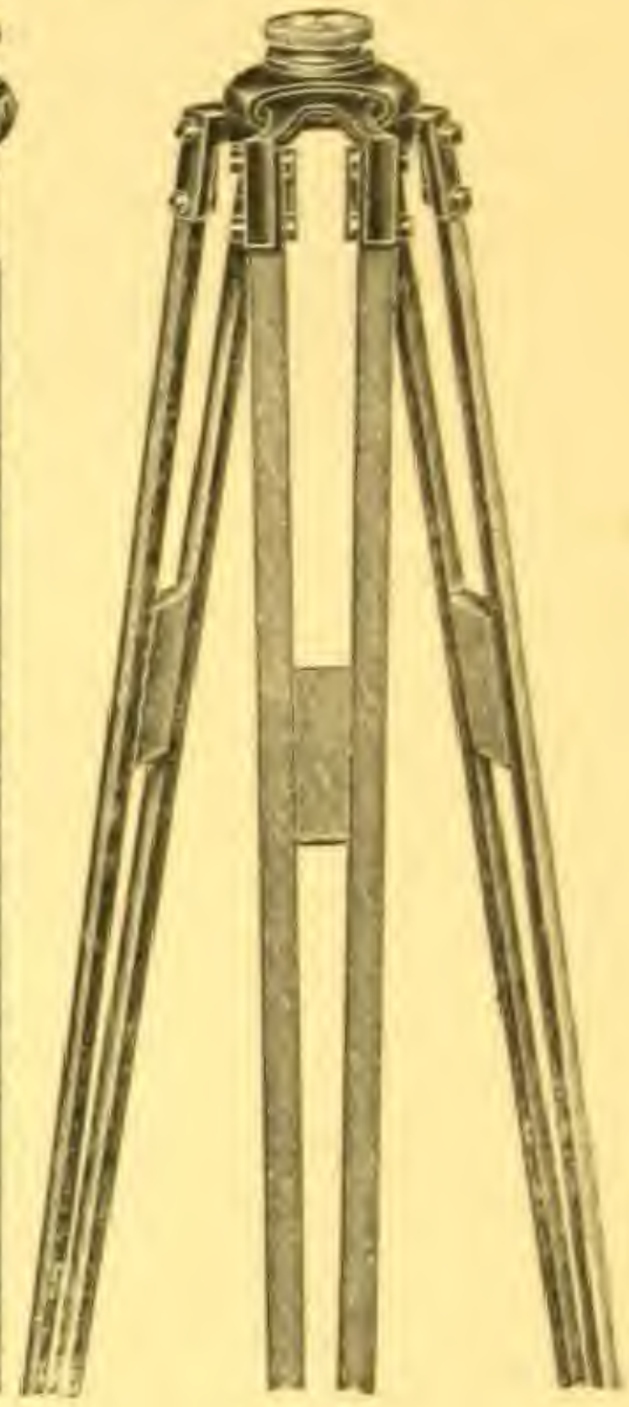


Fig. 21.

SM 73.—**Tripod with Solid Legs.** Metal head with ball joints and key with which the friction of all three legs can be regulated simultaneously. Fig 18 **£4 0 0**

SM 74.—**Tripod with Open-Frame Legs.** Metal head with ball joints as No. SM 73, and spanner for regulating friction..... Fig. 21 **£5 10 0**

SM 75.—**Tripod with Three Sliding Legs.** Metal head with ball joints as No. SM 73. All three legs can be adjusted to various lengths and rigidly clamped. Useful on uneven ground and for mining **£5 10 0**

SM 76.—**Tripod with One Sliding Leg.** Metal head with ball joints as No. SM 73. The sliding leg can be adjusted to different lengths and rigidly clamped. The other two legs are solid. Useful in mountainous country and for mining..... **£4 15 0**

SM 77.—**Tripod, "Round" Pattern.** A rigid tripod with solid legs, each leg being the section of a cylinder so that when folded the tripod forms a cylindrical pole and is very compact.....Figs. 19 & 20 **£4 10 0**

SM 78.—**Quick-Levelling Head.** Any of the tripods described above can be supplied fitted with a quick levelling spherical head, which permits a rocking movement in every direction. Extra cost **£3 0 0**

Tripods for small instruments see page 61.

ACCESSORIES FOR THEODOLITES AND LEVELS.

DIAPHRAGMS.

A B E C F

Fig. 22.

Diaphragms for the telescopes of surveying instruments are made in many patterns and a few of those most generally in use are illustrated. The lines are either webs or markings on parallel worked glass discs, and occasionally these are replaced by platinum iridium points.

Theodolites are sent out with two interchangeable diaphragms, a web diaphragm pattern B and a glass diaphragm with stadia lines spaced 1:100 pattern E, unless ordered otherwise. Two parallel vertical lines ruled close together for sighting on a plummet line are sometimes substituted for the single line in illustration E.

Dumpy Levels are sent out with a web diaphragm C; and **Y Levels** with a web diaphragm B. Glass diaphragms can be substituted if preferred.

SM 79.—**Webbed Diaphragm** A, B, or C **12 6**

SM 80.—**Glass Diaphragm** A, B, or C **15 0**

SM 81.—**Glass Diaphragm** with stadia lines E or F..... **17 6**

SM 82.—**Webbed Diaphragm**.....ditto..... **15 0**

SM 83.—**Point Diaphragm** with platinum iridium points **£1 5 0**

SM 84.—.....**ditto**.....with stadia points **1 15 0**

Any other design of diaphragm made to order. Unless otherwise ordered stadia lines are spaced to read 1 per 100 of the distance on the surveying staff.

EYEPIECES.

SM 85.—**Inverting Ramsden Eye-piece**—high or low power **£1 0 0**

SM 86.—**Erecting Eye-piece** giving an upright image..... **2 0 0**

SM 87.—**Inverting Diagonal Eye-piece** for taking steep angles of elevation with theodolite..... **£2 10 0**

SM 88.—**Erecting Diagonal Eye-piece** ditto..... **3 0 0**

SPIRIT LEVELS.

SM 89.—**Spirit Level** in metal mounts for fixing on the telescope of a 5-inch or smaller theodolite **£2 2 0**

SM 90.—.....**ditto**.....for 6-inch theodolite **2 5 0**

SM 91.—**Striding or Axis Level** in metal mounts with legs for testing the adjustment of the transit axis of a theodolite telescope..... **£2 10 0**

SM 92.—**Spare Spirit Level** unmounted for the vernier arm of vertical circle of a 5-inch theodolite..... **7 6**

SM 93.—.....**ditto**.....for a 6-inch theodolite **9 6**

SM 94.—**Spare Spirit Level** for the telescope of a 5-inch theodolite **7 6**

SM 95.—.....**ditto**.....for a 6-inch theodolite **9 6**

SM 96.—**Spare Spirit Level** for the horizontal plate of a 5-inch theodolite **5 6**

SM 97.—.....**ditto**.....for a 6-inch theodolite **7 6**

For particulars of other spirit levels see page 36.

ACCESSORIES FOR THEODOLITES AND LEVELS—
Continued.

Illuminating Apparatus for Theodolites when working underground or at night on the surface.

SM 98.—**Electric Outfit** for illuminating the telescope diaphragm through the pierced transit axis, consisting of an incandescent bulb, dry battery, terminals, fittings and the necessary flexible wire so arranged as not to get entangled when using the theodolite. **£3 0 0**

SM 99.—**Rheostat** for use with SM 98 for regulating the intensity of the light, so that it is not too bright or too faint..... **£1 10 0**

SM 100.—**Electric Outfit** for illuminating the telescope diaphragm as SM 98 and also for illuminating the micrometer microscopes on the circles of a theodolite. Complete with necessary bulbs, fittings, battery, connecting wires and a rheostat for regulating the illumination. **£10 0 0**

SM 101.—**Oil-Light Outfit** for illuminating the telescope diaphragm through the pierced transit axis of a theodolite, consisting of a silvered reflector and oil lamp on a support attached to one of the standards... **£3 0 0**

SM 102.—**Prism Reflector** fitted to the object-glass end of telescope so as to illuminate the diaphragm by a lamp held at the side..... **15 0**

SM 103.—**"Orilux" Electric Lamp** as described on page 81. Suitable for use with SM 102 ..... **£1 5 0**

PLUMMETS.

Plummets, solid brass with steel point, cord with grip runner and suspension hook.

SM 104.—4 ozs. **5/-** SM 105.—6 ozs. **5/6** SM 106.—8 ozs. **6/-**

SM 107.—12 ozs. **7/-** SM 108.—1 lb. **10/-** SM 109.—2 lbs. **15/-**

SM 110.—**Adjustable Plummet** with quick pitch thread for making final adjustment over a point, weight 6 ozs..... ... **15 0**

OUTER CARRYING CASES.

For THEODOLITES and LEVELS.

These cases are designed to contain the Theodolite or Level in its mahogany box. The leather cases are lined with felt and have a leather shoulder strap. The canvas cases are bound with leather with the top and bottom lined inside with felt and have a web shoulder strap.

Theodolite Outer Cases.		**Canvas.**	**Leather.**
Theodolites Nos. SM 1, 3, 5, 15, 17 31, 38	SM 111.—	**£3 10 0**	SM 111A.— **£5 6 0**
,, Nos. SM 7, 40	SM 112.—	**3 17 6**	SM 112A.— **5 17 0**
,, Nos. SM 13, 19 (2 cases)	SM 113.—	**6 0 0**	SM 113A.— **8 6 0**
,, No. SM 21 (2 cases)	SM 114.—	**6 10 0**	SM 114A.— **9 0 0**
Level Outer Cases.		**Canvas.**	**Leather.**
Levels. Nos. SM 50, 51, 53, 58....	SM 115.—	**£3 0 0**	SM 115A.— **4 8 0**
,, Nos. SM 54, 59	SM 116.—	**3 5 0**	SM 116A.— **4 12 0**
,, Nos. SM 55, 60	SM 117.—	**3 10 0**	SM 117A.— **4 17 0**

PLANE TABLES.

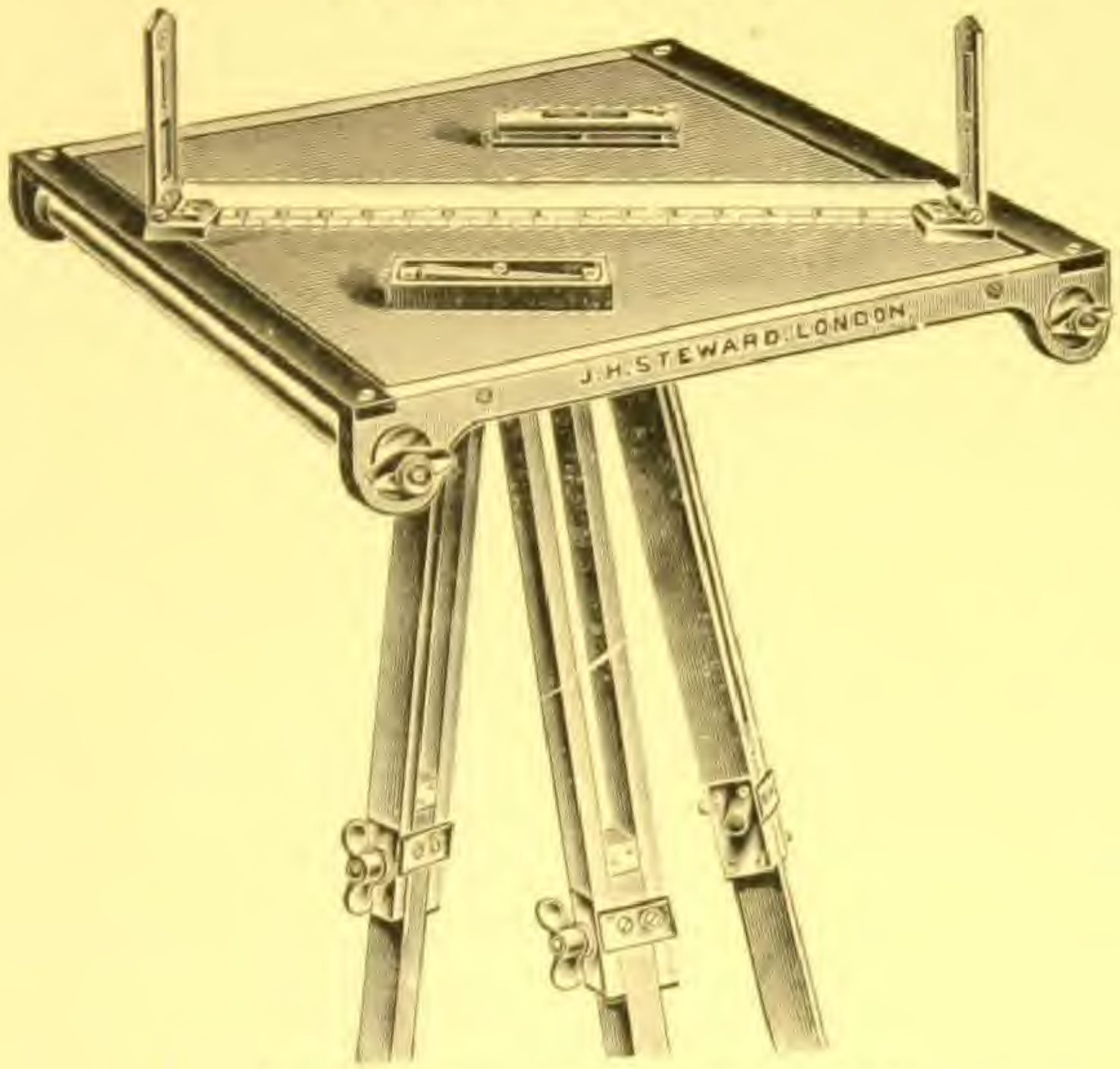


Fig. 26. Topographer's Plane Table.

SM 118.—**The Topographer's Plane Table,** with rollers to carry a continuous length of paper 18 inches wide. The board is framed, and has a working surface of 18 × 14-inches. The rollers are fitted below the surface so as not to interfere with the movement of the alidade, and the paper passes through slits, leaving the two ebony edges free to work from with a T square. A metal fitting underneath fits into a socket in the head of tripod and the board can be rotated and clamped in any position. The tripod has telescopic legs for levelling..... **£13 10 0**

SM 119.—**18-inch Metal Alidade** with folding sights and recessed bevelled edge graduated to parts of an inch or millimetres, in mahogany box with a 5-inch metal **Trough Compass** and a 3-inch metal mounted **Spirit Level** **7 15 0**

SM 120.—**Canvas Case** leather bound to contain table and alidade, with shoulder strap **2 5 0**

SM 121. Complete Outfit.... Fig. 26... **£23 10 0**

SM 122.—**The Topographer's Plane Table** to take roll of paper 18 inches wide, with a working surface of 24 × 18 inches. Tripod with telescopic legs as Fig. 26 ..... **£15 0 0**

SM 123.—**18-inch Metal Alidade,** with trough compass and spirit level in mahogany box. Same as SM 119..... **7 15 0**

SM 124.—Canvas Case with shoulder strap **2 15 0**

SM 125.—Complete Outfit **£25 10 0**

Levelling Heads and **Slow Motion** in azimuth (page 29).

Accessories for Plane Tables see pages 33 to 36.

THE "C.E." PLANE TABLE.

SM 126.—**The "C.E." Plane Table Outfit.** Board 24 × 18 inches with metal battens. The paper is pinned on to the board. Firm tripod with telescopic legs as in illustration, Fig. 26, for levelling. A fitting underneath the board goes into a socket in the head of the tripod, and the board can be rotated and clamped in any position **£10 10 0**

SM 127.—**18-inch Metal Alidade** with folding sights and recessed bevelled edge divided to parts of an inch or millimetres in mahogany box with a 5-inch metal **Trough Compass** and a 3-inch metal mounted **Spirit Level** **7 15 0**

SM 128.—**Waterproof Canvas Case,** leather bound with shoulder strap, to contain table and alidade **2 5 0**

SM 129.—Complete Outfit **£20 10 0**

SM 130.—**The "C.E." Plane Table Outfit.** Board 30 × 24 inches and Tripod with telescopic legs of same design as SM 126..... **11 10 0**

SM 131.—**18-inch Metal Alidade** in mahogany box, with 5-inch Trough Compass and 3-inch Spirit Level as SM 127..... **7 15 0**

SM 132.—**Waterproof Canvas Case,** leather bound with shoulder strap, to contain table and alidade..... **2 15 0**

SM 133.—Complete Outfit **£22 0 0**

LEVELLING HEADS AND SLOW MOTION.

SM 134.—**Quick-Levelling Spherical Head** fitted to the Tripod of Plane Tables Nos. SM 118, 122, 126 and 130 ..... **£2 0 0**

SM 135.—**3-Screw Levelling Head** fitted to the Tripod of Plane Tables Nos. SM 118, 122 126 and 130 ..... **£2 0 0**

SM 136.—**Combined 3-Screw and Quick-Levelling Head** fitted to the Tripod of Plane Tables Nos. SM 118, 122, 126 and 130..... **£4 0 0**

SM 137.—**Slow Motion in Azimuth** combined with a 3-screw levelling head fitted to Tripods of Plane Tables Nos. SM 118, 122, 126 and 130. **£4 17 6**

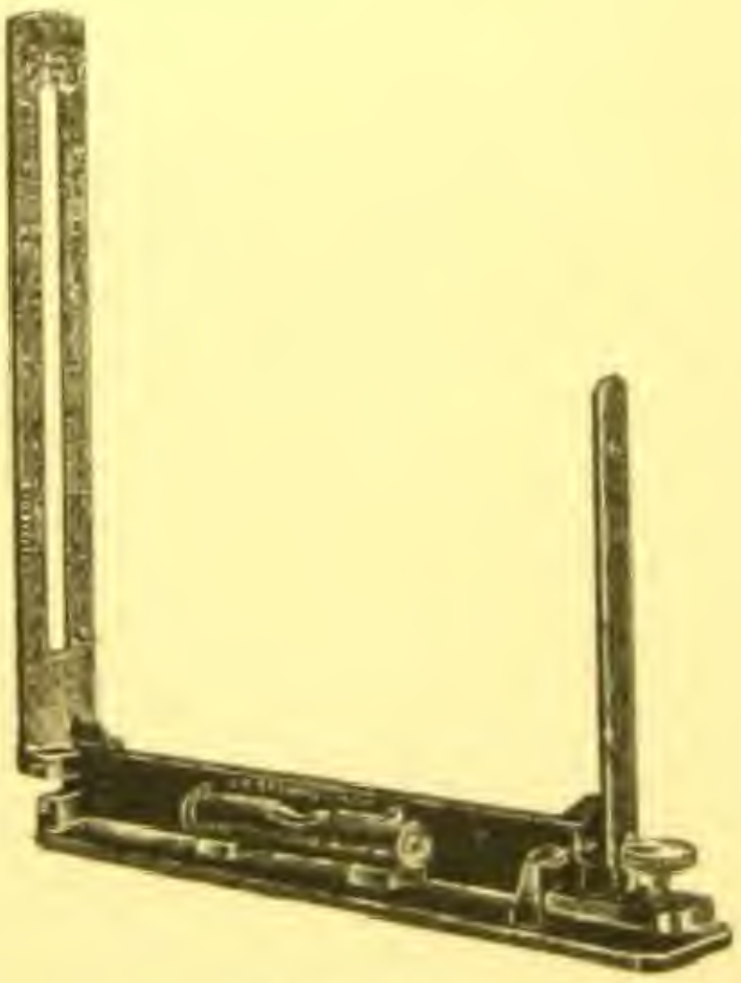


Fig. 27.

SM 138.—**Indian Pattern Clinometer** with folding sight vanes, and spirit level with adjusting screw, for use with plane table. Two scales on the taller vane, one giving angles of depression and elevation up to 23°, and the other a scale of tangents for ascertaining the relative heights of objects. In leather case, 9½ × 1½ × 1½ inches.
Fig. 27... **£5 10 0**

SM 139.—.....**ditto**.....with the scale of degrees divided to 20 minutes, and with a sighting index on the taller vane with rack adjustment. In leather case. **£7 15 0**

Accessories for Plane Tables see pages 33 to 36.

Plane Table Outfits made to meet special requirements.

PLANE TABLE OUTFITS.

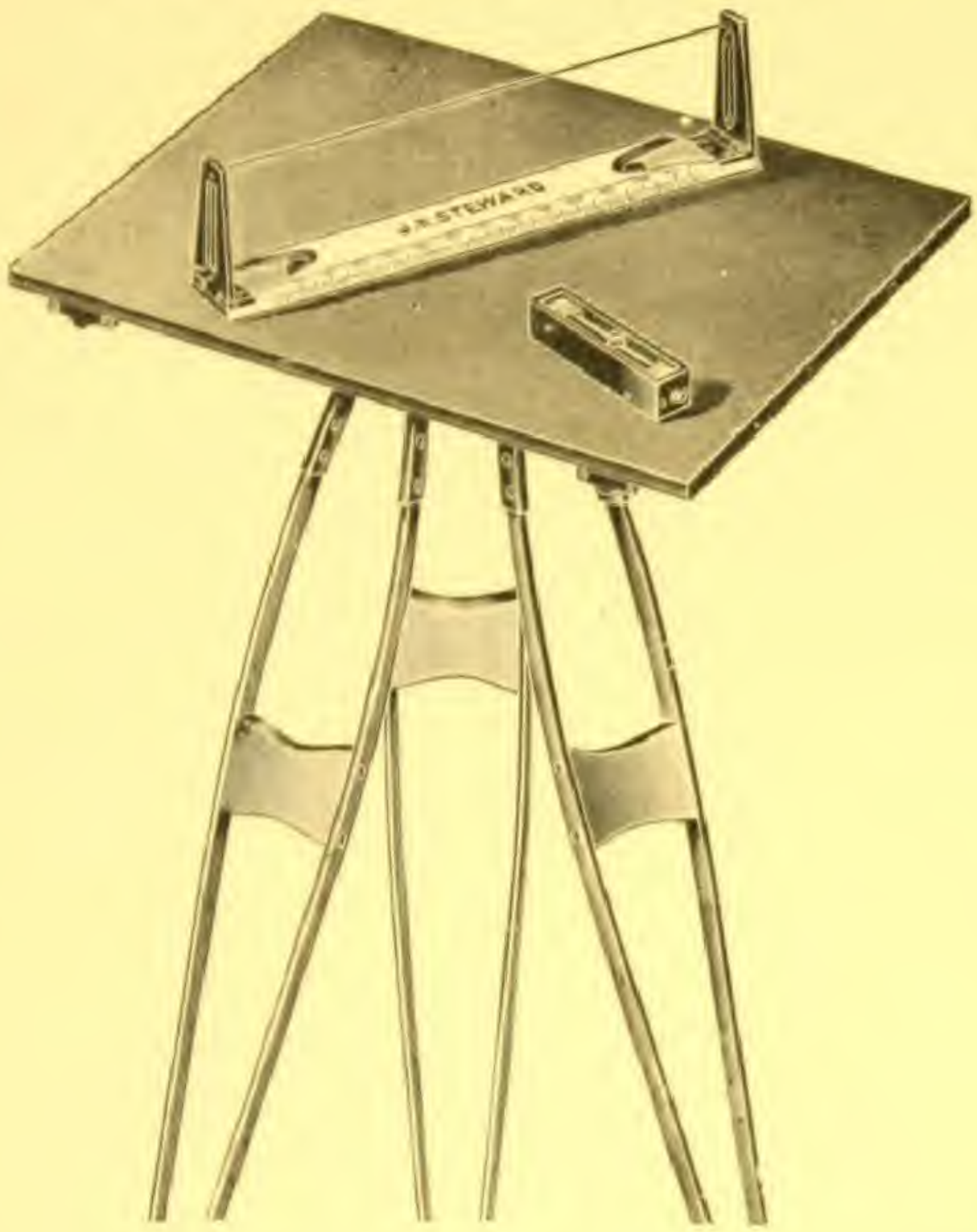


Fig. 28.

SM 140.—**Plane Table Outfit.** Board 24 × 18 inches with metal battens, and rigid crutch pattern tripod with large head ensuring steadiness to board, which rotates on a metal racer ring and can be set and clamped in any position ..... Fig. 28 **£8 5 0**

SM 141.—**15-inch Boxwood Alidade** with 4½-inch folding sights, bevelled edges with scales of inches to 10ths and centimetres to millimetres or other scales as desired (SM 173) **1 15 0**

SM 142.—**4-inch Metal Trough Compass** (SM 182)..... **1 5 0**

SM 143.—**3-inch Metal Mounted Spirit Level** (SM 179) ... **15 6**

SM 144.—**Waterproof Canvas Case** with shoulder strap for Board **1 15 0**

SM 145.—Complete Outfit **£13 15 6**

SM 146.—**Plane Table Outfit** Board 30 × 24 inches and Tripod of same design as No. SM 140 ..... **£9 5 0**

SM 147.—**15-inch Boxwood Alidade** as SM 173..... **1 15 0**

SM 148.—**4-inch Metal Trough Compass** as SM 182 ..... **1 5 0**

SM 149.—**3-inch Metal Mounted Spirit Level** as SM 179. ... **15 6**

SM 150.—**Waterproof Canvas Case** with shoulder strap **2 5 0**

SM 151.—Complete Outfit **£15 5 6**

Any of the above items may be omitted and price deducted.

Accessories for Plane Tables see pages 33 to 36.

"PORTABLE" PLANE TABLES.

Fig. 29. Portable Plane Table.

SM 152.—**"Portable" Plane Table,** 15 inches square, made of deal with battens underneath. Tripod with sliding legs extending to 4 feet 9 inches and closing to 2 feet, with head attached to the board. The table can be turned round and clamped when "set" **£2 15 0**

SM 153.—**Boxwood Alidade,** 12 inches long with 3 inch metal folding sight vanes, and bevelled edges divided with scales of inches to 10ths and centimetres to millimetres or as desired. The vanes can be connected by a string enabling rays to be taken on steep slopes..... **1 10 0**

SM 154.—**Wood Trough Compass,** with 2½ inch needle and stop. **9 6**

SM 155.—**Waterproof Canvas Cover,** for board, with shoulder strap and pockets for alidade and compass **15 6**

SM 156.—Complete Outfit. Fig. 29 **£5 10 0**

SM 157.—**"Portable" Plane Table,** and Tripod, similar to SM 152 but with larger table, 18 inches square **£3 5 0**

SM 158.—**Boxwood Alidade,** similar to SM 153, but 15 inches long. **1 15 0**

SM 159.—**Wood Trough Compass,** same as SM 154..... **9 6**

SM 160.—**Waterproof Canvas Cover,** for board, with shoulder strap and pockets for alidade and compass **17 6**

SM 161.—Complete Outfit **£6 7 0**

Accessories for Plane Tables see pages 33 to 36.

STUDENT'S PLANE TABLE.

SM 162.—**Student's Plane Table Outfit** consisting of a board 23 × 16 inches, tripod, trough compass mounted in wood, sight rule or alidade with folding sights and edge divided to inches and 10ths. The board can be rotated and clamped in position. This outfit has been designed for educational purposes and is not recommended for important survey work **£2 10 0**

Fig. 30.

SM 163.—**Regulation Cavalry Sketching Board** with metal rollers carrying 1 yard of paper. Working surface 7½ × 5 inches. Rotating compass for setting board to "working meridian." Pendulum clinometer at back with sights. Straight edge ruler. Scales of parts of an inch and yards, 2 miles = 1 inch, divided on edges of board... Fig. 30 **£2 17 6**

Fig. 31.

Camera Lucida, to attach to a plane table to assist in drawing objects in true perspective. Consisting of a prism attached to a telescopic rod, with adjustments enabling the prism to be placed in any position above the plane table. The draughtsman, on looking down through the prism, sees an image of the object on the plane table simultaneously with the pencil point. The brilliancy of the image is regulated by an adjustable diaphragm and a tinted glass. Two lenses are sometimes fitted to relieve the eye from fatigue.

SM 164.—**The Camera Lucida,** with adjustable diaphragm and tinted glass, in case. **£3 15 0**

SM 165.—.....**Ditto,**.....with the addition of lenses, in case. Fig. 31 **£4 10 0**

THE "ROWE" ALIDADE.

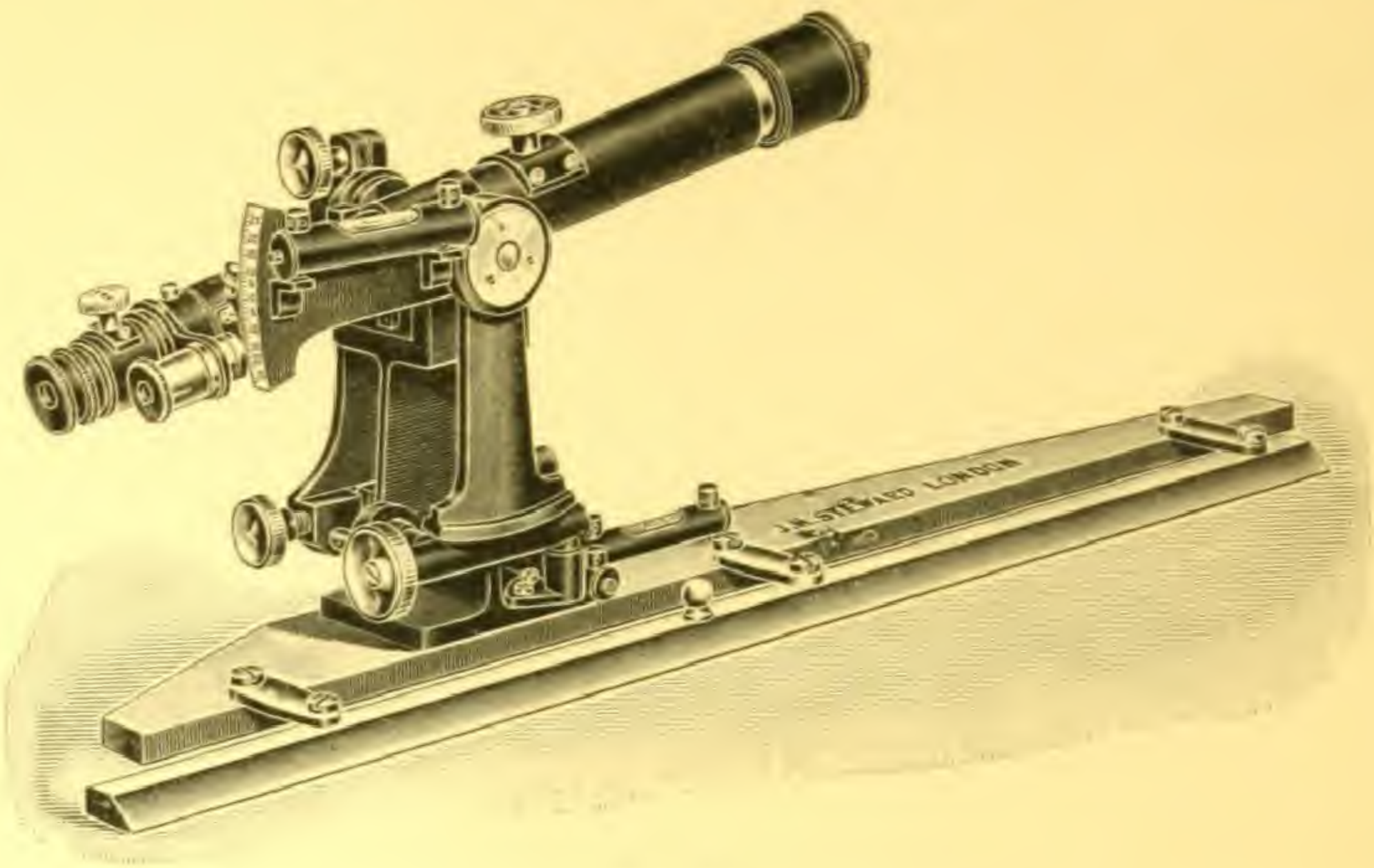


Fig. 32.

The "Rowe" Alidade with Telescope Sight, designed by Lt.-Col. G. H. Rowe, R.A. In constructing this instrument the object has been to obtain an alidade for the plane table that can be quickly and conveniently used and of which the different parts will be quite rigid and free from lateral play. At the same time the weight has been reduced without sacrificing stability by tooling out all unnecessary metal and by shaping off the base.

The gunmetal straight edge is 18 inches long and is mounted on an adjustable parallel bar. Two cross spirit levels are mounted on the base.

The telescope is mounted between trunions on a ribbed pillar and is very stable. It has a magnifying power of ×10 diameters and is fitted with rack and pinion focussing adjustment. The eye-piece is also fitted with rack and pinion. The lines of the diaphragm are ruled on glass and read 1 per 100 of base for stadia measurements.

The vertical motion of the telescope is provided with a clamp and a spring tangent slow motion actuated by a milled head.

The main spirit level is mounted on the arm which carries the graduated arc and is brought to the centre of its run independently of the telescope by means of a worm-wheel adjustment.

The vertical arc is divided on silver to a scale of natural tangents and reads to a pointer which is attached to the telescope together with the reading microscope. If preferred the arc can be divided to degrees of arc.

The reading microscope and the adjusting screws all being at the eye-piece end of the telescope the instrument can be conveniently and quickly used.

SM 166.—**The "Rowe" Alidade** in canvas covered case, with shoulder strap ..... Fig. 32 **£29 0 0**

ALIDADES FOR PLANE TABLES.

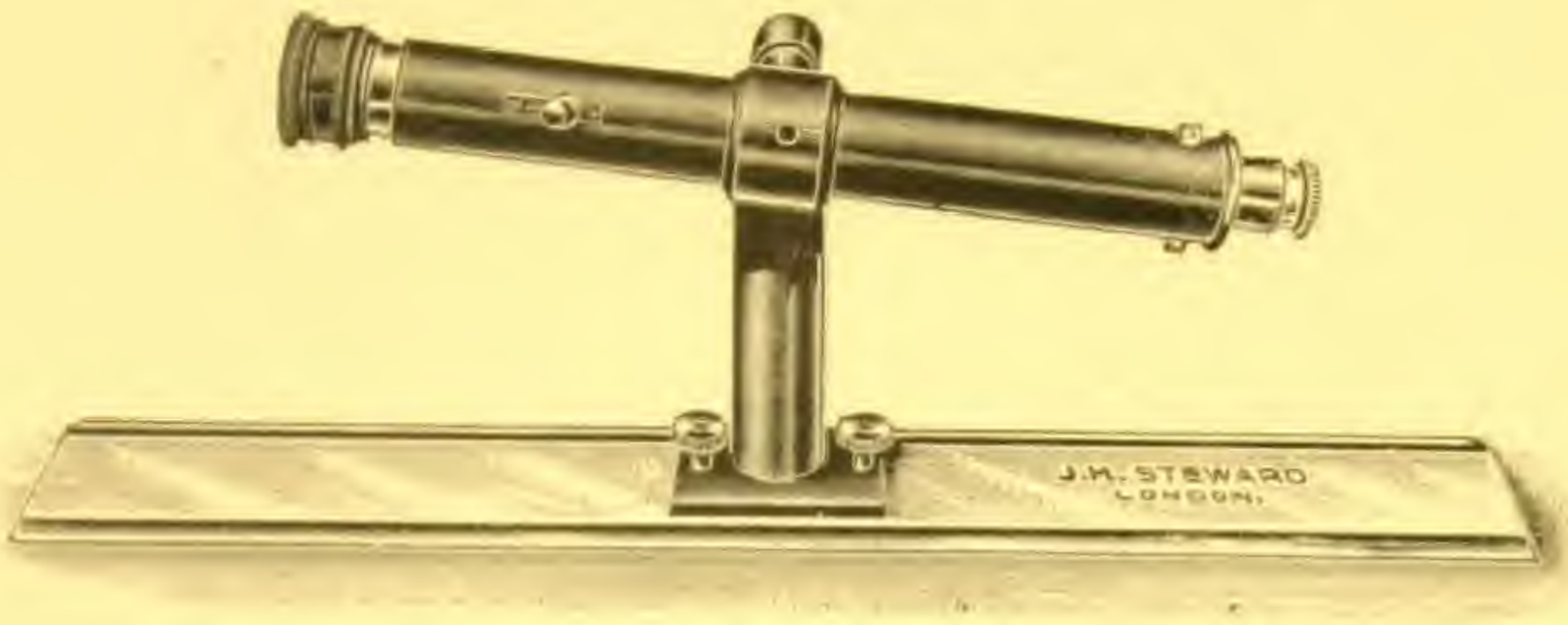


Fig. 33.

SM 169.—**Telescopic Alidade,** as supplied to the Ordnance Survey Department, 18-inch brass straight edge, with bevelled edges. 12-inch telescope, magnifying ×12 diameters, object-glass 1 inch in diameter, sliding focussing adjustment; glass diaphragm. The telescope is mounted on a pillar 5-inches high, with vertical motion, and is made to remove from the straight edge, and both are packed in a leather case, 1 ft. 7 × 4½ × 3 inches, with sling..... Fig. 33 **£11 0 0**

SM 170.—**Compact Telescopic Alidade.** 15-inch brass straight edge with bevelled edges. 8-inch telescope, magnifying ×9 diameter with sliding focussing adjustment and vertical motion. The pillar is hinged to the straight edge and folds down with the telescope for compactness. Mahogany box 16 × 4 × 3½ inches **£9 10 0**

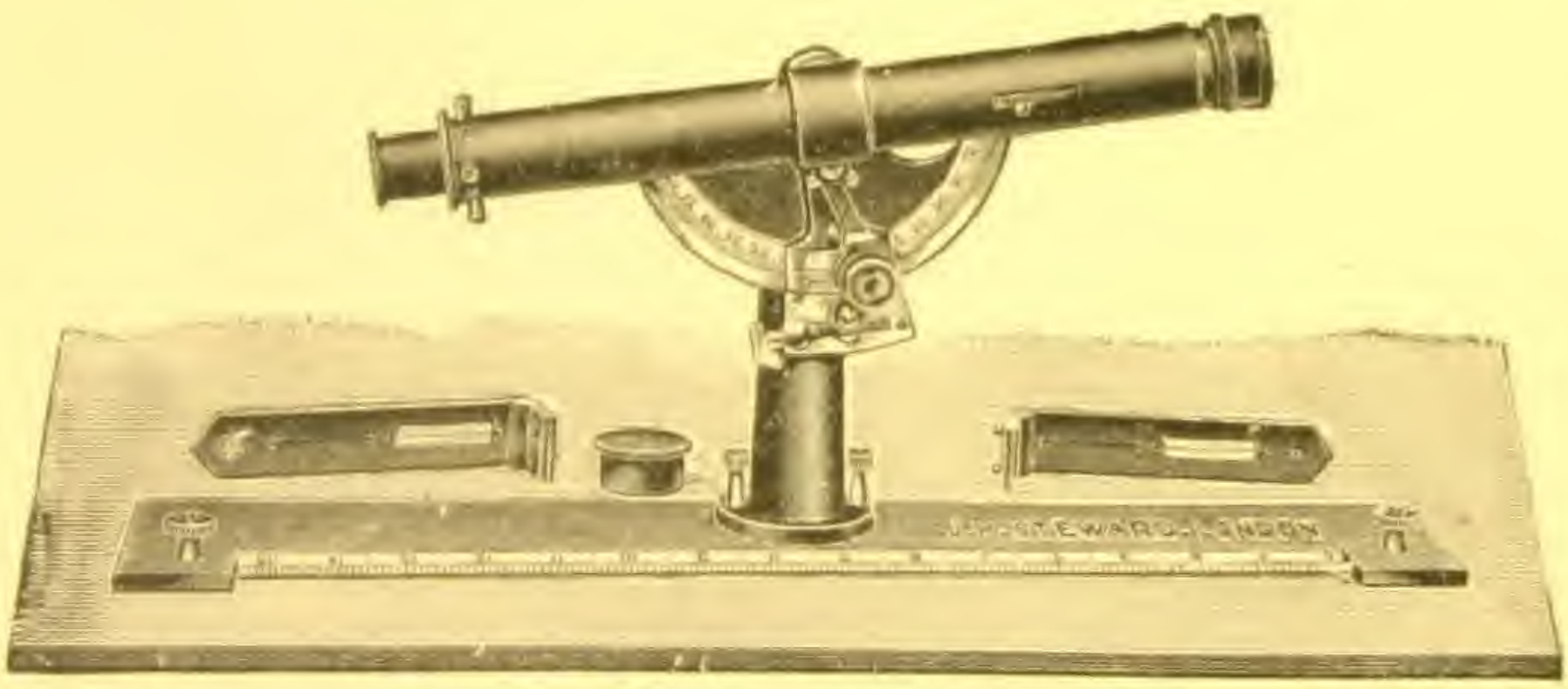


Fig. 34. Alidade with Telescope.

SM 171.—**18-inch Metal Alidade, with Telescope** and graduated arc reading to 1 minute by vernier and fitted with reading microscope. Quick and slow vertical motions with tangent screw adjustment and clamp. Supplemental open sights which can be attached to the alidade in place of the telescope which is removable. Bevelled edge to alidade divided to parts of an inch or millimetres at option of purchaser. In box ..... Fig. 34 **£19 10 0**

SIGHT RULES AND ALIDADES.

For Plane Table.

Fig. 35. Boxwood Alidade.

SM 172.—**12-inch Boxwood Alidade,** with 3-inch folding metal sights with holes for string attachment for taking rays on steep slopes, bevelled edges divided to inches and 10ths and millimetres. Fig. 35 **£1 10 0**

SM 173.—**15-inch**.....**ditto**..... **1 15 0**

SM 174.—**18-inch**.....**ditto**.....with 4-inch sights **2 2 0**

SM 175.—**18-inch Metal Alidade** with 4-inch folding double sights, recessed bevelled edge divided to 10ths of an inch or millimetres. This is similar to the alidade illustrated in Fig. 26, page 28 Mahogany box..... **£5 0 0**

Fig. 36. "Travers" Sight Rule.

SM 176.—**The "Travers" Sight Rule,** with adjustable parallel bar, doing away with the necessity of placing the ruling edge directly over the station on the paper before taking a sight and avoiding the use of pins. The ruler is 12 inches long and 2½ inches wide when closed, and is made of boxwood with bevelled edges, divided to 10ths of an inch and millimetres. The folding metal sights are 3½ inches high, and a hole is drilled in the top of each vane so that they can be connected by a fine cord as illustrated. This arrangement is very useful for taking rays in hilly country and on steep slopes..... ..... Fig. 36 **£2 10 0**

SM 177.—**18-inch Metal Alidade** with adjustable parallel bar similar in design to Fig. 36, but with a plain bevelled edge and without the cord attachment **£2 15 0**

SM 178.—**24-inch**.....**ditto**..... **3 5 0**

Any other scales than those mentioned can be divided on the alidades to order.

SPIRIT LEVELS.

Fig. 37.

SM 179.—**Spirit Level,** best quality, ground glass graduated bubble tube mounted on machined metal base with screw adjustments. Fig. 37.
3-inch base..... **15/6** 4-inch base **£1 2 6**

SM 180.—**Simple Spirit Level**, plain bubble tube mounted in metal with 4-inch base **5/6**

SM 181.—**Circular Spirit Level** for plane table..... **3/6**

TROUGH COMPASSES.

Fig. 38. Metal Trough Compass.

SM 182.—**4-inch Metal Trough Compass,** bar needle, 3-inches long, with jewelled cap, adjustable dip weight and locking stop. Graduated arc of degrees at the two extremities..... Fig. 38 **£1 5 0**

SM 183.—**5-inch**.....**ditto**.....with 4-inch needle..... **1 17 6**

SM 184.—**6-inch Metal Trough Compass** with bar needle 5-inches long, jewelled cap, adjustable dip weight and arcs of degrees, in mahogany box **£2 10 0**

SM 185.—**4-inch Plain Trough Compass** encased in wood, with 2¼-inch flat needle with jewelled centre and locking stop, reading into zero lines at extremity **9/6**

SM 186.—.....**ditto**.....without locking stop **7/6**

PLUMB-FORK.

SM 187.—**Plumb-Fork** for determining the point on the ground which corresponds with a given point on the paper on plane table. One arm terminates with a pointer which is set to any given point on the paper. The other arm is placed under the board with the terminal hook plomb with the pointer. A plummet suspended from the hook determining the point on the ground corresponding with the given point on the paper. **17/6**

SM 188.—**Plummet** for use with the plumb-fork **6/0**

LEVELLING STAVES AND RANGING POLES OR PICKETS.

Fig. 39.

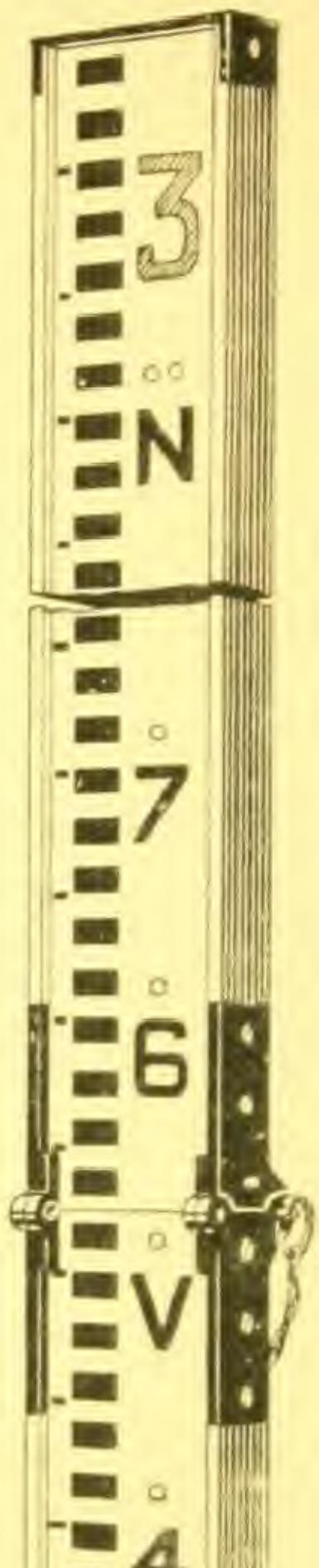


Fig. 40.

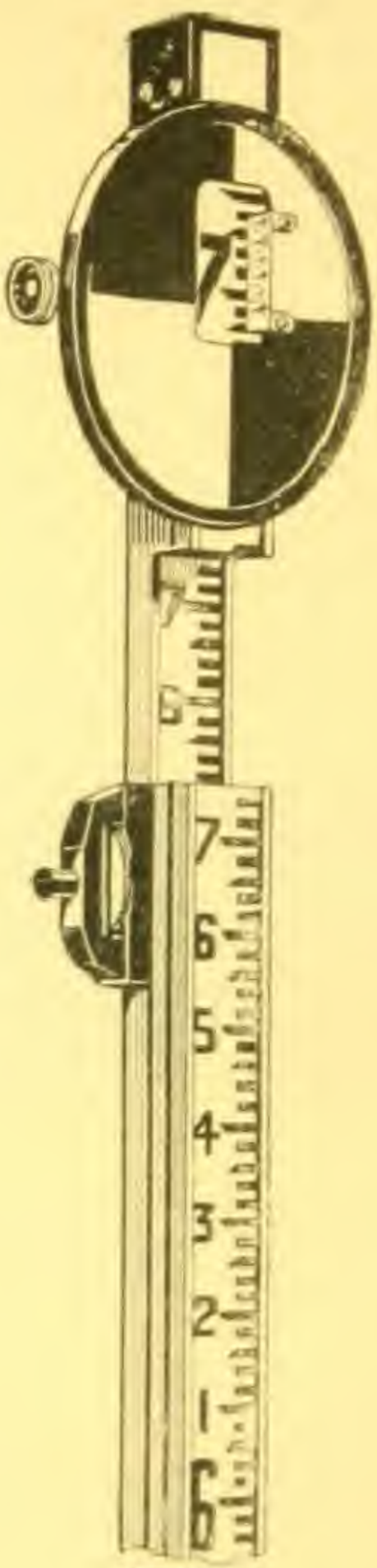


Fig. 41.

Fig. 42.

Fig. 43.

J. H. Steward, Ltd., 406, Strand, and 457, West Strand, London, W.C.2.

LEVELLING AND STADIA STAVES.

TELESCOPIC STAVES.

Telescopic Levelling Staff made of mahogany in three sections, the upper and smaller sections telescoping into the lower section. Scale graduated on a recessed face with paint specially prepared to resist damp and to retain its colour. Foot shod with metal and top of each section protected by a metal cap. Strong metal springs and catches to rigidly secure the section when extended. Graduations on a white ground, reading from the bottom upwards so that staff can be used partially extended. The numerals are painted on as illustrated but if desired the numerals can be inverted, so that when viewed through an inverting telescope they appear right way up. The most popular styles of graduations are illustrated, but the scales can be graduated in a variety of other ways without extra charge.

The Sopwith Telescopic Staff.—Scale divided to feet, 1/10ths, 1/20ths and 1/100ths of a foot. Each foot numbered on the left with a large red figure, and a small repeat figure between each foot, and every odd tenth numbered on the right with black figures. The figures representing the odd tenths are the depth of the sub-division they indicate, the top of each figure representing its value, while the intermediate even tenth is read from the bottom of the same figure. This arrangement prevents overcrowding. No. SM 191 is the most popular size Fig. 39

SM 189.—**18-ft. Sopwith Telescopic Staff,** closing to 6 ft. 9 inches. **£6 15 0**

SM 190.—**16-ft.** .....**ditto**.....closing to 6 ft. 2 inches **5 15 0**

SM 191.—**14-ft.** .....**ditto**.....closing to 5 ft. 4 inches **4 10 0**

SM 192.— **9-ft.**.....**ditto**.....closing to 3 ft. 6 inches **3 15 0**

SM 193.— **6-ft.**.....**ditto**.....closing to 2 ft. 6 inches **3 3 0**

Metric Telescopic Staff constructed in the same way as the Sopwith Staff, Fig. 39, but graduated in metres sub-divided to decimetres and centimetres as illustrated on Fig. 40. Metres indicated by large red numerals with repeat dots between each metre, and decimetres indicated by smaller black numerals. No. SM 196 is the most popular size.

SM 194.—**6-Metre Telescopic Staff,** closing to 2·2 metres..... **£8 10 0**

SM 195.—**5-Metre**.....**ditto**.....closing to 1·9 metre ... **5 15 0**

SM 196.—**4·25-Metre**.**ditto**.....closing to 1·6 metre **4 10 0**

SM 197.—**3-Metre**.....**ditto**.....closing to 1·5 metre **4 0 0**

SM 198.—**2-Metre**.....**ditto**.....closing to 0·85 metre ... **3 10 0**

TARGET LEVELLING STAFF.

SM 199.—**The Target Levelling Staff** or Philadelphia Rod is made in two sections sliding one over the other in metal sleeves. Length fully extended 13 feet and closed 7 ft. 4 inches. Recessed faces graduated in feet, 1/10ths and 1/100ths of a foot and reading by vernier to 1/1000ths of a foot. Feet figured with large numerals and tenths with small numerals. Sliding target which can be clamped at any height. Metal bindings and shoe..... Fig. 41 **£5 0 0**

LEVELLING AND STADIA STAVES—*Continued.*

Folding Levelling Staves or Stadia Rods made of pine with stout brass binding and caps at extremities, and strong hinge with locking pin. Scale the same width throughout and completely protected when the staff is folded with the graduated faces inwards. Fig. 40.

Sopwith Folding Staff with scale 2½ inches wide as illustrated Fig. 40, but graduated as Fig. 39.

SM 200.—	**14-ft. Sopwith Folding Staff,** closing to 7 ft.	**£4**	**18**	**6**
SM 200a.—	**12-ft. .....ditto**.....closing to 6 ft.	**3**	**16**	**6**
SM 201.—	**10-ft.....ditto**.....closing to 5 ft.	**3**	**7**	**6**

Stadia Folding Staff graduated to read 1:100 in feet, 1/10ths and 1/50ths of foot.

SM 202.—	**14-ft. Stadia Folding Staff,** closing to 7 ft.	**£4**	**18**	**6**
SM 203.—	**12-ft.....ditto**..... closing to 6 ft.	**3**	**16**	**6**
SM 204.—	**10-ft.....ditto**..... closing to 5 ft.	**3**	**7**	**6**

Metric Folding Staff with scale 64 mm. wide graduated metres, decimetres and centimetres as illustrated Fig. 40.

SM 205.—	**4·25-Metre Folding Staff** folding to 2·15 metres...	**£4**	**18**	**6**
SM 206.—	**3-Metre.....ditto**..... folding to 1·5 metres ...	**3**	**7**	**6**

SM 207.— **Builders Folding Staff.** A light 10-ft. Staff in three sections with two joints, folding to 3 ft. 6 inches. Scale painted on white ground with Sopwith graduations as on Fig. 39..... **£2 0 0**

SM 208.—.....**ditto**.....graduated feet, inches and eighths **2 0 0**

FLEXIBLE STAVES.

SM 209.— **6-ft. Flexible Levelling Staff** with foot plate and ring at extremities. Made of waterproof material to roll up. Graduated feet, 1/10ths and 1/100ths **16/0**

SM 210.— **2-Metre Flexible Levelling Staff** graduated metres, decimetres and centimetres **18/0**

RANGING POLES AND ACCESSORIES.

Ranging Poles or Pickets made from selected wood and shod with steel points rivetted on. Painted in three colours, red, white and black, with paint specially prepared to resist damp. Fig. 42. These poles can be painted in two colours only to order.

SM 211.—	**6-ft. Ranging Poles** divided to feet. Per dozen ...	**£3**	**10**	**0**
SM 212.—	**8-ft.....ditto**..... ,, ,, ...	**4**	**10**	**0**
SM 213.—	**10-ft.....ditto**..... ,, ,, ...	**6**	**0**	**0**
SM 214.—	**2-Metres Ranging Pole** to fifths of a metre. Per doz.	**4**	**0**	**0**
SM 215.—	**3-Metres.....ditto**..... ,,	**6**	**0**	**0**
SM 216.—	**Tripod Support** for holding pole upright on hard ground.		**15**	**0**
SM 217.—	**10-Link Offset Pole**, painted in links.....		**7**	**6**
SM 218.—	.....**ditto**.....with metal hook for chain. Fig. 43		**12**	**6**
SM 219.—	**Boning Rods** for drainage work, painted black with white band on top. Height 3-feet. Per set of three	**£1**	**5**	**0**

J. H. Steward, Ltd., 406, Strand, and 457, West Strand, London, W.C.2.

SURVEYORS' MEASURING RODS.

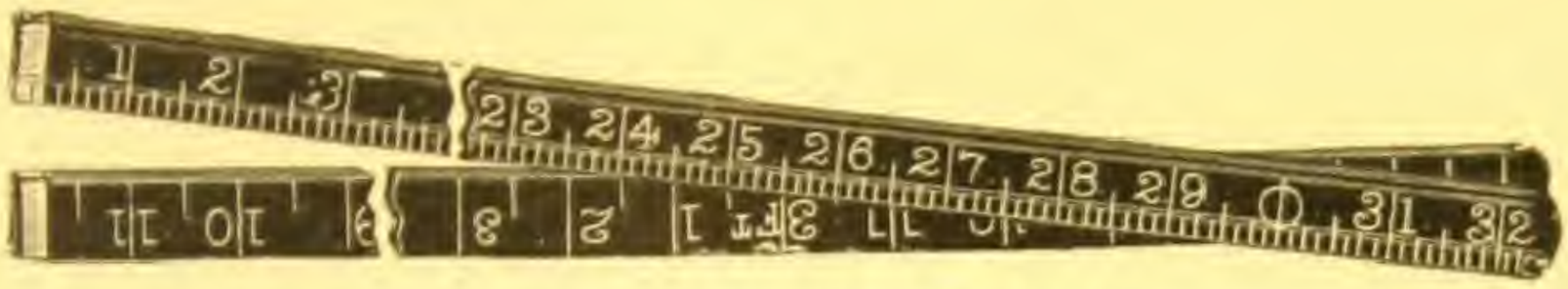


Fig. 44. Surveyors' 5-ft. Rod.

SM 220.—**5-feet Surveyors' Rod**, natural colour wood or stained black, folding to half length with spring lock joints, and brass tips. First foot divided to inches and $\frac{1}{8}$ths and the rest to every 3 inches **8/6**

SM 221.—.....**ditto**.....fully divided throughout to inches and $\frac{1}{8}$ths. **8/6**

SM 222.—**Leather Case** to hold a pair of 5-ft. rods..... **10/6**

SM 223.—**Pair of 5-foot Rods**, natural colour or stained black with brass connection to convert the two rods to a 10-ft. rod. The rods can be divided continuously from one to 10-feet, or each rod can be divided from one to 5-feet as required..... **£1 1 6**

SM 224.—**Leather Case** for the pair of rods with pocket for brass connector. **13/6**

SM 225.—**Bamboo Walking Stick** containing one stout 5-ft. folding measuring rod **£1 16 0**

Fig. 45.

SM 226.—**32-ins. Tropical Umbrella,** 4-ft. 6 ins. spread when open. White material lined with green. Paragon frame. Fan joint for setting umbrella at an angle. Jointed pole with metal spike for plunging into the ground.

Fig. 45 **£2 17 0**

SM 227.—.....**ditto**.....with cane non-magnetic ribs **£3 3 0**

Fig. 46.

Fig. 47.

SM 228.—Long Range Whistle, nickel-plated ..... Fig. 46 **2/0**

SM 229.—Flat Whistle with two notes, nickel-plated Fig. 47 **2/0**

LAND SURVEYING CHAINS.

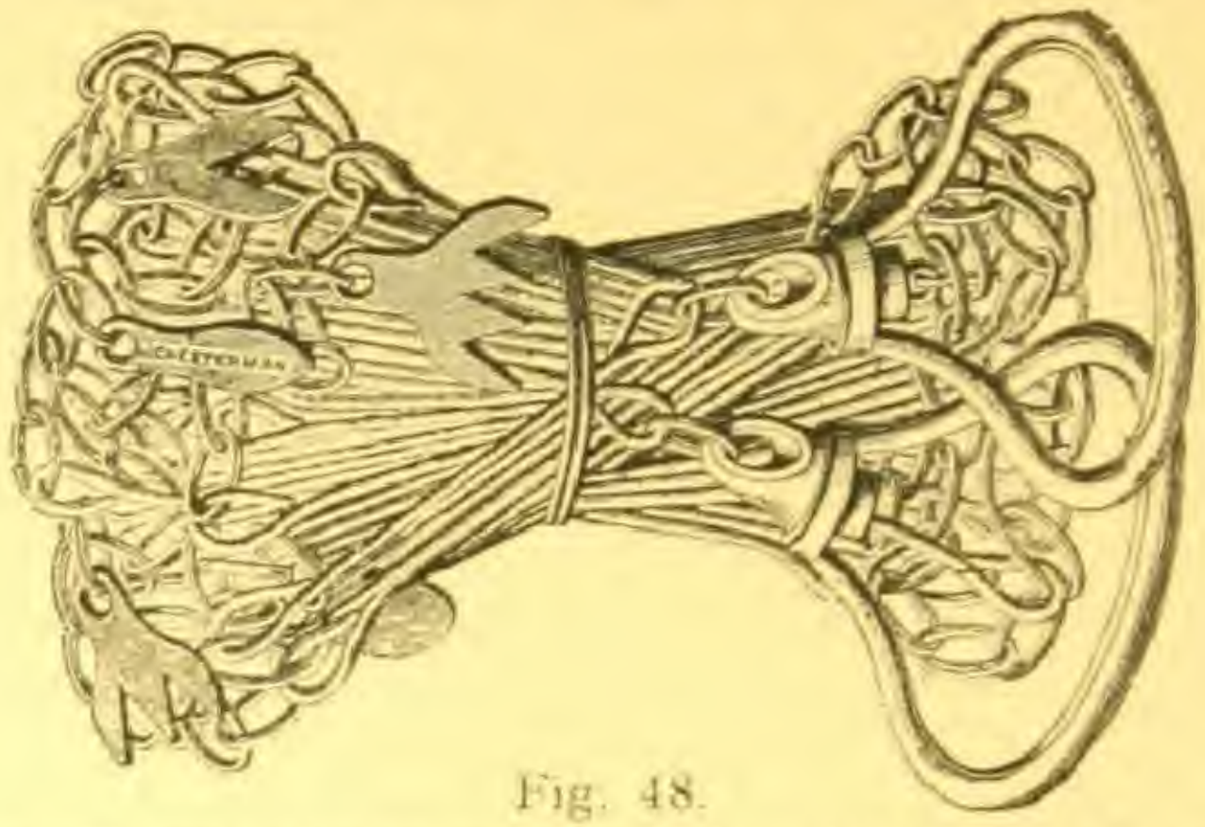


Fig. 48.

The 4-pole (66 feet) chains are divided to 100 links and tallied at every 10 links. The 100 feet chains are divided to feet and tallied at every 10 feet. The metric chains are divided to fifths of a metre and tallied at every 2 metres. All chains are fitted with brass swivel handles and tallies. Fig. 48.

	Length of Chain : 4 poles.	100 ft.	20 m.	25 m.
SM 230.—**Medium Iron Chain,** 9 W.G.	**14/6**	**17/-**	**14/6**	**18/-**
SM 231.—**Stout Iron Chain,** 8 W.G.	**18/-**	**20/-**	**18/-**	**22/-**
SM 232.—**Light Steel Chain,** 12 W.G., tempered and enamelled	**19/6**	**23/-**	**19/6**	**25/-**
SM 233.—**Stout Steel Chain,** 8 W.G., tempered and enamelled	**25/-**	**30/-**	**25/-**	**35/-**

Chains in any other measurement supplied to order.

Land Chain Arrows, 15-inches long, in sets of ten.

SM 234.—**Arrows** of best steel wire, hardened, tempered and enamelled black..... Per set of ten **3 0**

SM 235.—**Arrows** of iron wire **2 6**

STEEL BAND CHAINS.

Fig. 49. On Steel Cross.

Fig. 50. On Metal Cased Reel.

The Steel Band Chain is as strong as a chain of links. It is lighter, more compact, and easier to clean. It is furnished at the extremities with brass swivelled handles. When not in use the band is coiled on either a steel cross (Fig. 49), which is included in the price, or on a metal reel with handle (Fig. 50) at extra cost, as stated on next page.

The 4-pole (66 feet) bands are divided by brass studs at every link, and numbered at every 10 links, the first and last links into 10ths. The 50 feet and 100 feet bands are divided by brass studs at every foot, and numbered at every 10 feet, the first and last foot into 10ths or 12ths. The 20-metre bands are divided by brass studs at every 5th of metre, and numbered at every second metre.

For prices see next page.

STEEL BAND CHAINS—*Continued.*

Steel Band Chains, on Steel Cross (Fig. 49), for particulars see preceding page.

Length of Band.	4 poles.	50 feet.	100 feet.	20 metres.	30 metres
SM 236.—$\frac{3}{8}$-inch wide ...	**20/-**	**14/6**	**24/-**	**20/-**	**30/-**
SM 237.—$\frac{1}{2}$,, ,, ...	**22/-**	**16/6**	**27/-**	**22/-**	**32/-**
SM 238.—$\frac{5}{8}$,, ,, ...	**30/-**	**21/-**	**36/-**	**30/-**	**42/-**

SM 239.—**Metal Reel.**—The band chains can be supplied coiled on to a metal reel as illustrated (Fig. 50) in place of the cross at extra cost for the different sizes as follows: For bands $\frac{3}{8}$-inch or $\frac{1}{2}$-inch wide **8/-** and for bands $\frac{5}{8}$-inch wide **11/-**.

Steel Band Chains metre and feet) $\frac{3}{4}$-inch wide, etched in feet on one side and decimetres the other, coiled on a cross as illustrated (Fig. 49).

	33 feet and 10 metres.	50 feet and 15 metres.	66 feet and 20 metres.	100 feet and 30 metres.
SM 240.	**20/6**	**29/6**	**36/6**	**54/-**

SM 241.—**Metal Reel** as illustrated (Fig. 50) in place of the cross, **12/6** extra.

Steel Band Chains of other lengths can be supplied.

COMPOUND STEEL BAND CHAINS.

This form of band chain will be found very useful for chaining large tracts of country. It is composed of two or more sections of equal length, the first section being numbered and divided as specified, the other sections being plain. The sections which are joined together by swivels, can be used in lengths of 1, 2 or more sections. A pair of handles are provided and the bands are sent out coiled on a cross as Fig. 49. A metal reel similar to Fig. 50, can be supplied in place of the cross, the extra cost varying according to the number of sections the reel is constructed to carry With the bands of great length, 400 to 500 feet, it is usual to have the reel mounted on a stand, owing to the weight being too great to hold in the hand. Price according to requirement. The band is made in three different widths as enumerated.

Compound Steel Band Chain, with first section divided into feet and numbered at every ten feet. Each section is 100 feet long.

Number of sections	2	3	4	6
Full length of band	200 feet	300 feet	400 feet	500 feet
SM 242.—$\frac{1}{16}$-inch wide ...	**24/6**	**29/-**	**36/-**	**45/6**
SM 243.—$\frac{1}{8}$,, ,, ...	**29/-**	**39/-**	**48/-**	**58/-**
SM 244.—$\frac{1}{4}$,, ,, ...	**32/6**	**44/-**	**55/6**	**68/-**

Compound Steel Band Chain, with first section divided to links and numbered at every 10 links. Each section is one chain long.

Number of sections	2	3	4	5
Full length of band	2 chains	3 chains	4 chains	5 chains
SM 245.—$\frac{1}{16}$ inch wide ...	**20/-**	**24/6**	**30/-**	**36/-**
SM 246.—$\frac{1}{8}$,, ,, ...	**27/-**	**32/6**	**39/-**	**45/6**
SM 247.—$\frac{1}{4}$,, ,, ...	**27/-**	**32/6**	**41/-**	**48/-**

LONG STEEL BAND CHAINS.

Long Steel Band Chains made in one length of flat hardened steel wire in various widths, $\frac{1}{16}$ths, $\frac{1}{8}$ths, or $\frac{1}{4}$-inch wide. The bands are made in various lengths, 3, 4 and 5 chains, 300, 400 and 500 feet. They are divided in a variety of ways to suit requirements. A common way is to divide *Chains* into links for the first chain, and the remainder of the band with a numbered brass tally at every chain; *Feet* being divided to every 10-feet for the first 100-feet, with the remainder of the band tallied at every 100-feet. The bands are sent out coiled on a steel cross or a reel can be supplied in place of the cross at extra cost. With the longer and heavier bands it is usual to mount the reel on a stand on account of the weight. Quotations given on requirements being stated.

STEEL TAPES IN METAL CASES.

Fig. 51.

"Treble" Steel Tape, $\frac{3}{8}$-inch wide, coiled in an oxidised metal case with semi-flush handle. This is a strong and reliable tape, and can be supplied marked on one side only or on both sides as enumerated. Fig. 51.

"Treble" Steel Tape marked one side only—feet and inches to 8ths.

Length of Tape.	33	50	66	100 ft.
SM 248, ...	**10/6**	**14/6**	**18/-**	**25/6**

"Treble" Steel Tape marked on one side only—metres to millimetres.

Length of Tape.	10	15	20	30 metres.
SM 249.—	**10/6**	**14/6**	**18/-**	**25/6**

"Treble" Steel Tape marked on both sides, one side feet and inches to 8ths and other side metres to centimetres and millimetres.

Length of Tape.	10 metres and 33 feet	15 metres and 50 feet	20 metres and 66 feet	30 metres and 100 feet.
SM 250.—	**16/-**	**21/6**	**27/6**	**39/-**

Fig. 52.

STANDARD STEEL TAPES.

Steel Tape Measure in leather case with handle made to fold flush, leaving no projection. This is the most accurate form of tape and is "standard" at a temperature of 62° Fahr. The tape is made in three different widths as enumerated and can be supplied marked on one side only or on both sides. Feet are divided into inches and 8ths. Metres are divided to centimetres and millimetres. Fig. 52.

Steel Tape marked on one side, feet or metres.

Length of Tape.	25	33	50	66	100 ft.
SM 251.—Width ⅜ inch	**12/-**	**14/-**	**19/-**	**22/-**	**31/-**
SM 252.— ,, ½ ,,	**14/-**	**16/-**	**23/-**	**28/-**	**39/-**
SM 253.— ,, ⅝ ,,	**15/-**	**18/-**	**26/-**	**32/-**	**44/-**

Length of Tape.	10	20	25	30 metres.
SM 254.—Width ⅜ inch	.....	**15/-**	**24/-**	**30/-**	**34/-**
SM 255.— ,, ½ ,,	.....	**18/-**	**30/-**	**35/-**	**42/-**
SM 256.— ,, ⅝ ,,	.....	**20/-**	**34/-**	**40/-**	**47/-**

Steel Tape marked on both sides. Feet one side and metres the other.

Length of Tape.	10 metres and 33 feet	15 metres and 50 feet	20 metres and 66 feet	30 metres and 100 feet
SM 257.—Width ⅜ inch	**19/-**	**27/-**	**33/-**	**44/-**
SM 258.— ,, ½ ,,	**22/-**	**31/-**	**39/-**	**55/-**
SM 259.— ,, ⅝ ,,	**25/-**	**34/-**	**44/-**	**61/-**

SM 260.—**The "Compact" Steel Tape,** in leather case with rounded edges and "flush" handle; very convenient for the pocket. The 50-feet tape is only 2¾-inches diameter and weighs 6¼-ozs. The tape is ¼ inch wide.

Marked on one side only either (1) feet to inches and 16ths (2) feet to 100ths or (3) metres to millimetres.

Length of Tape	25	33	50	66 feet.	10	15	20 mtrs
	10/6	**11/6**	**16/6**	**20/-**	**13/-**	**18/-**	**22/-**

SM 261.—**The "Compact" Steel Tape,** marked on both sides, one side metres to millimetres and other side feet to parts of an inch.

Length of Tape.	10 metres and 33 feet	15 metres and 50 feet	20 metres and 66 feet.
	15/-	**22/-**	**27/-**

POCKET STEEL TAPES.

Fig. 53.

SM 262.—**Pocket Steel Tape,** in white metal case. When uncoiled the tape automatically locks at any length and recoils itself when a sliding stud is pushed aside. The tape is divided on both sides, one side to inches and 16ths, and the other side to centimetres and millimetres. Fig. 53.

Length of Tape—

3 feet and 1 metre	6 feet and 2 metres	12 feet and 4 metres.
6/-	**9/-**	**15/-**

MEASURING TAPES.

Fig. 54.

The "Constantia" Woven Wind-up Tape, made on a patent principle rendering it less liable to shrink than other woven tapes. Very strong and durable and strongly recommended as the most accurate tape made with the exception of the steel tape. The tape is $\frac{5}{8}$-in. wide, and is coiled in a leather case with handle made to fold flush, leaving no projection to catch in the pocket.

Feet are divided to inches and half-inches and numbered at every inch and foot.

Metres are divided to centimetres and numbered at every 10 centimetres.

For very precise measurements a steel tape should be used. If that is impracticable, the woven tape should be tested by comparison with a steel tape, before and after use, and allowance made for variation. Fig. 54.

SM 263.—**The "Constantia" Tape,** marked feet and inches one side, and links on the other side, with "flush" handle.

33 feet and 2 poles **10/6** ... 66 feet and 4 poles **15/-**

SM 264.—**The "Constantia" Tape,** marked feet and inches one side, and metres and centimetres on other side, with "flush" handle.

Length of Tape.	10 metres and 33 feet	15 metres and 50 feet	20 metres and 66 feet	30 metres and 100 feet.
	10/6	**12/6**	**15/-**	**21/-**

LINEN MEASURING TAPES.

SM 265.—**The "Treble" Wind-up Tape,** in leather case with "folding" handle. Tape $\frac{3}{16}$-inch wide, marked on one side only in feet, inches and half-inches, and numbered at every inch and foot. This is a useful woven tape for rough measurements but not so durable as the well-known Constantia Tape.

Length of Tape ...	25	33	50	66	100 feet
	4/-	**4/6**	**6/-**	**7/-**	**9/-**

GIRTHING TAPES FOR TIMBER.

SM 266.—**Timber Girthing Tapes.** Constantia Tape with ring at the beginning end marked Quarter Girth on one side, and feet, inches and halves the other.

Length of Tape ...	6	9	12 feet
	1/-	**1/6**	**2/-**

Dendrometer and **Auto Simplex Tree Measurer** see page 54.

THE TELAZIMETER.

The Telazimeter or Geographers' Theodolite consists of a 3½-inch compass with prismatic reading microscope for taking horizontal angles and a graduated arc with telescopic sight for taking vertical angles. The compass is divided to half degrees and has a supplemental sight for taking short shots underground. The vertical arc reads by vernier to 5 minutes and is fitted with quick and slow motions. The telescope gives an erect image and has a spirit level attached. A cross spirit level is also mounted on the compass box. For portability the telazimeter is mounted on an aluminium tripod which has a ball and socket head, for quickly levelling the instrument, which can be rotated in any direction. The weight of the telazimeter is 3¼ lbs.

Fig. 55.

SM 267. — **The Telazimeter** in leather sling case 7½ × 5½ × 4-inches and telescopic tripod ..... Fig. 55 **£18 0 0**

SM 268.—**Leather Sling Case** for tripod if desired **1 5 0**

PERAMBULATOR WHEEL.

SM 269.—**Perambulator Wheel or Viameter** for measuring roads or tracks, consisting of a wheel about 6-feet in circumference mounted between forks terminating in a handle similar to a bicycle handle. The wheel is pushed over the routes and a mechanical arrangement connected with the axle registers the number of revolutions made by the wheel or it can be arranged to indicate miles, furlongs and yards..... **£8 0 0**

THE "STEWARD" POCKET SURVEYING TELEMETER.

Fig. 56. The "Steward" Surveying Telemeter.

The "Steward" Pocket Surveying Telemeter is specially useful when a preliminary survey has to be made in a short space of time, and when the transport of cumbersome instruments is inconvenient. It affords a rapid means of measuring inaccessible distances, and is valuable as a check on salient points off the centre line. The instrument is designed to measure the two angles at the extremities of a base, forming a triangle with the object, of which the range is required. The construction is simple and not liable to derangement. Two adjustable plane mirrors are mounted on a base and enclosed in a metal tube. By rotating a collar at the end of the tube the index mirror is moved in azimuth, and the angular displacement is measured by reference to a scale of distances graduated on the exterior of the collar. The angle of double reflection can be varied several degrees on either side of the right angle, facilitating the determination of the direction of the base.

The range is read directly on the graduated scale in terms of units of the base, so that any system of measurement can be employed. By making the unit of measurement either short or long, distances of any length can be determined. The limit of distance that can be measured is governed in practical work by the length of base that can be employed and by the visibility of the object. The scale of distances is computed for a normal base of 20 units and is figured at every tenth division from 200 to 1,000, each division representing 10 units of distance. The accuracy of the indications is assured by empirically graduating each instrument. In certain operations it may be convenient to employ a base of constant ratio to the distance, and the telemeter is adapted also for this system of measurement. Results are given with great accuracy, the mean error working out at less than one per cent.

The instrument is provided with a sighting telescope of moderate power. The size of the telemeter is 4½ inches long by 1½ inch diameter, and the weight 10 ozs. It can be manipulated by one observer.

The Telemeter is most efficient as an instrument for rapid reconnaissance. In topographical survey from a fixed station any number of minor points can be located without intersection, and the distances from each other determined, as well as the distances from the fixed station. In traverse or route surveying the position of points on either side of the route can be rapidly determined The distance separating any two objects can be determined, although the objects may be inaccessible or invisible from each other.

A long base line, from which to carry out a survey, can be laid down, of any required length, between two points selected as stations for the ends of the base.

As an example of what the instrument is capable of doing, it may be mentioned that a complete survey of the extinct volcanoes of Nimrud, Binzol and Sipan was successfully made, and the accuracy of the results proved by intersection methods. Among other surveys the entire Western Coast of Lake Van, and also the course of the River Nile have been correctly mapped.

A paced base gives very approximate results, but where greater accuracy is aimed at, a tape should be employed for measuring the base.

SM 270.—**The "Steward" Pocket Surveying Telemeter,** in sling case, and booklet of instructions ..... Fig. 56 **£11 11 0**

THE PEDOGRAPH ROAD TRACER.

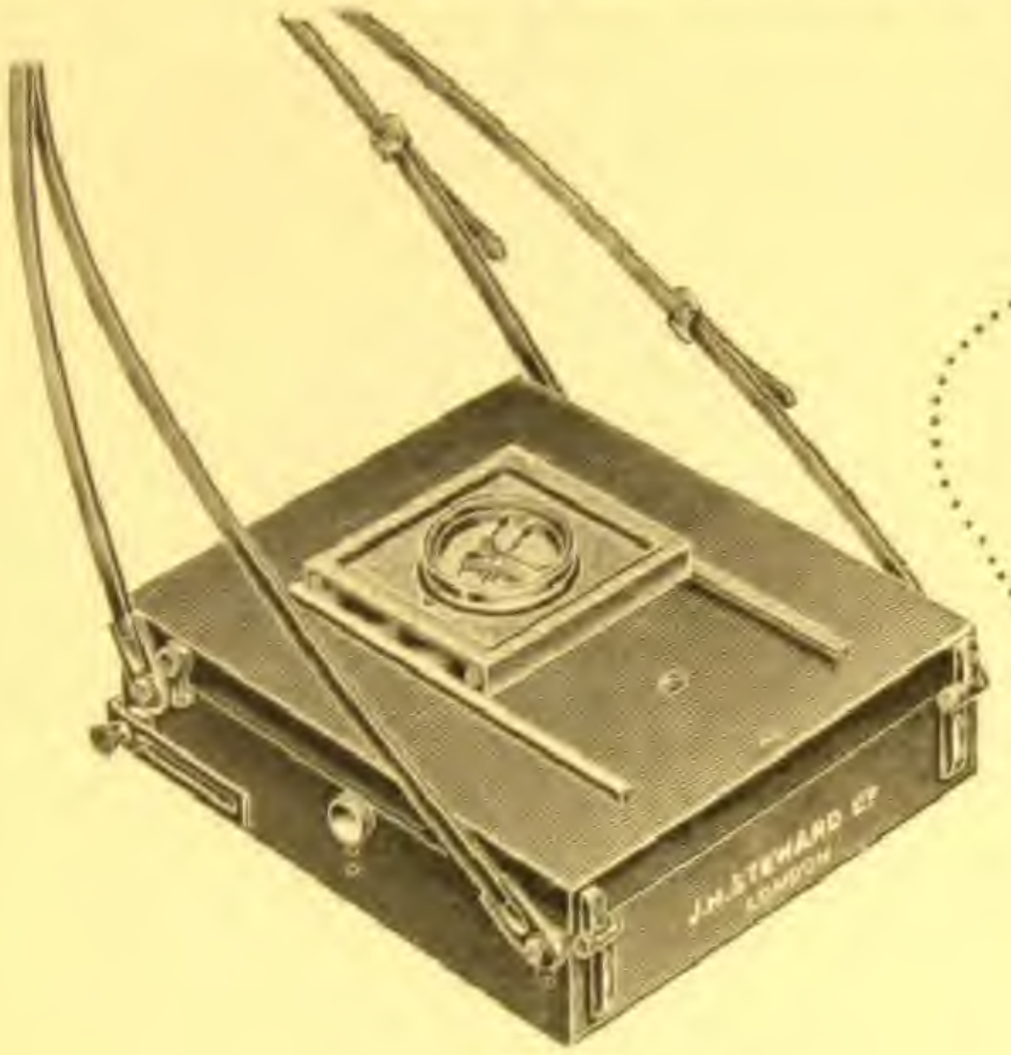


Fig. 56a.

A walk in Regent's Park, London

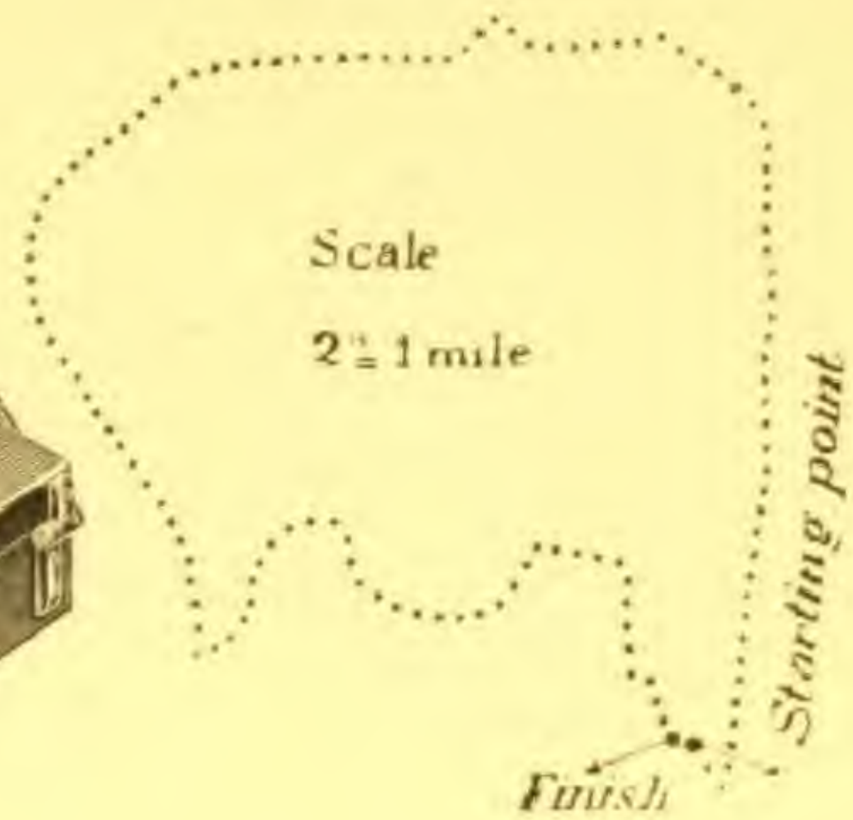


Fig. 56b.

The Pedograph is an automatic road tracer which reduces the method of traversing to a mechanical process and enables a person without previous training to produce a map to scale of any route walked over.

The instrument consists of a recording device contained in a flat metal box about 12-inches square, and is carried by a sling in front of the operator.

A compass with glass top and bottom, is let into the lid of the box and contains a pair of parallel magnetic needles, pivotted in such a manner as to remain very steady notwithstanding the jolting motion of a walk.

The route walked over is mapped on paper by a toothed wheel, which is caused to revolve by a pendulum oscillating vertically, in much the same way as the well known pedometer hammer, but much more surely.

The paper rests on a metal plate or plane table and is gripped between the toothed wheel and a smooth wheel in the lid of the box.

As the toothed wheel revolves it not only marks the paper but also imparts a progressive action to it.

In order to correctly orient the paper so that the distances recorded show the proper directions with all the angles and curves according to nature, the paper is ruled with parallel meridian lines and these are visible below the compass needles.

As the operator walks along, he keeps the meridian lines on the paper parallel to the compass needles, by turning a knob which projects from the side of the box, and which slews the paper round. This adjustment is made with every change of direction shown by the compass needles, and the plan is thus correctly oriented as it progresses.

The smooth wheel above the toothed wheel is supplied with ink from a saturated pad, which renders visible the tracing made by the toothed wheel.

The operator's position on map can be noted, and marked, and any necessary detail can be entered in a note book under a similar reference mark.

The recording device can be adjusted to plot maps to different scales ranging from a ratio of 1/10,000 to 1/100,000.

A route traced by the Pedograph (Fig. 56B.) compared with the same route on an ordnance map, showed distances to be correct within about 3 per cent. and directions within about 2 degrees of accuracy.

A large area of China has been successfully mapped with this instrument.

In hilly country all the curves of a route will be shown and reductions can be made by observations with a clinometer. The Pedograph is not suitable for use in a mountainous country. Weight of Pedograph 9 lbs.

SM 270a.—**The Pedograph** with waterproof cover. Fig. 56a. **£30 0 0**

PASSOMETER AND PEDOMETER.

Fig. 57.

Fig. 58.

The Passometer and Pedometer are made in the form and size of a watch, and are carried in the pocket. The former registers the number of steps taken, and the latter the distance walked in miles.

SM 271.—**Passometer,** registering every pace up to 100,000 paces, with action for setting indicators to zero..... Fig. 57 **£1 1 0**

SM 272.—**Pedometer,** registering every 80 yards up to 1,760 yards and miles up to 100 miles, with zero setting action..... Fig. 58 **£1 1 0**

SM 273.—**Pedometer,** registering every quarter of a mile up to 12 miles, with zero setting action..... **15 6**

MAP MEASURERS.

Fig. 59.

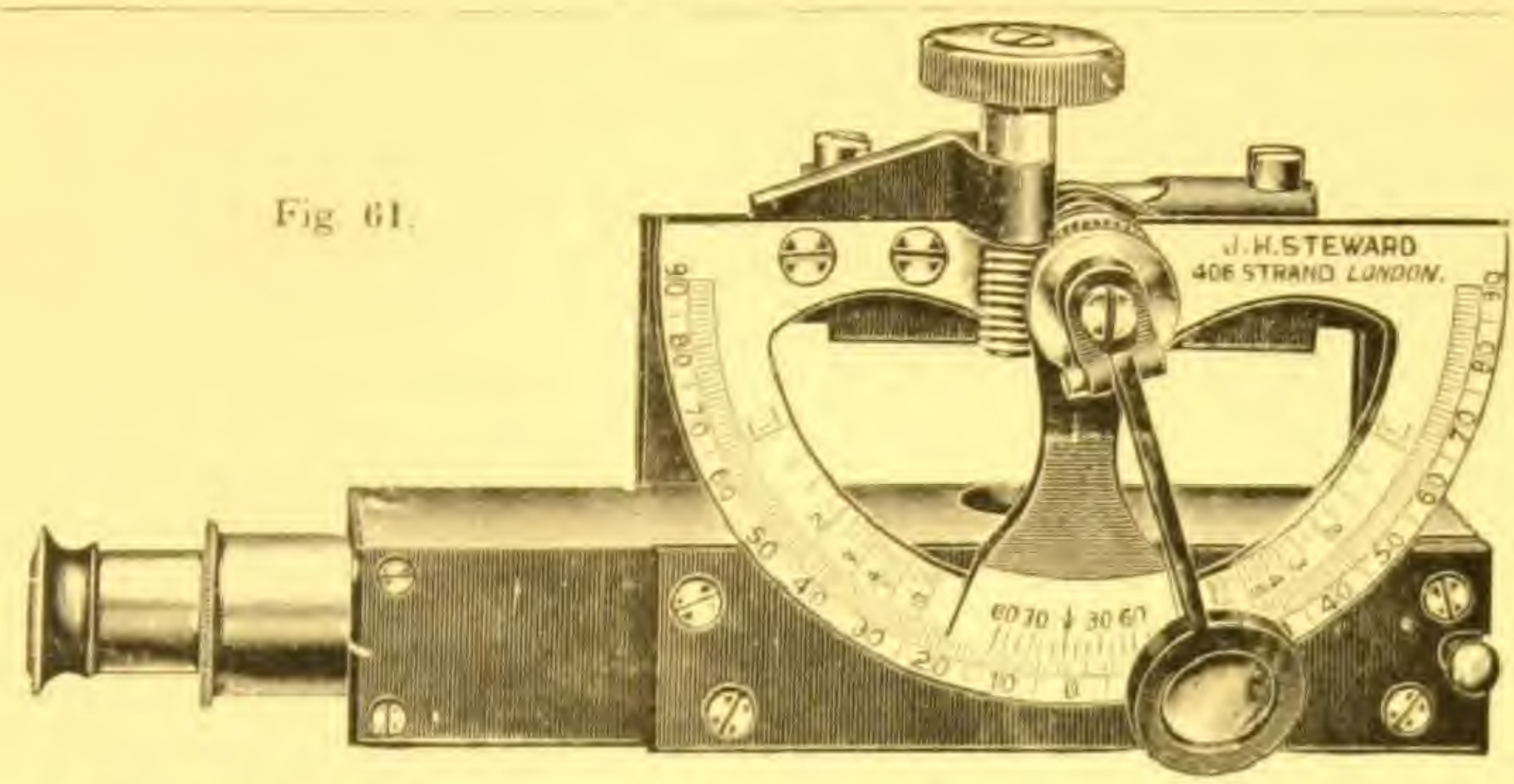
Fig. 60.

SM 274.—**The Universal Map Measurer.** The small wheel under the pointer is run over the roads on a map, and the hand indicates the distance covered with great accuracy in miles, kilometres and versts. The dial is 1¼ inch in diameter and is graduated to every ½ inch up to 39 inches and to centimetres.....Fig. 59 **5/6**

SM 275.—**The Self-Registering Map Measurer,** with fully divided scale reading to every $\frac{1}{16}$ of an inch, with supplemental dial registering up to 40 inches. Dial 1¼ inches diameter.....Fig. 60 **7/6**

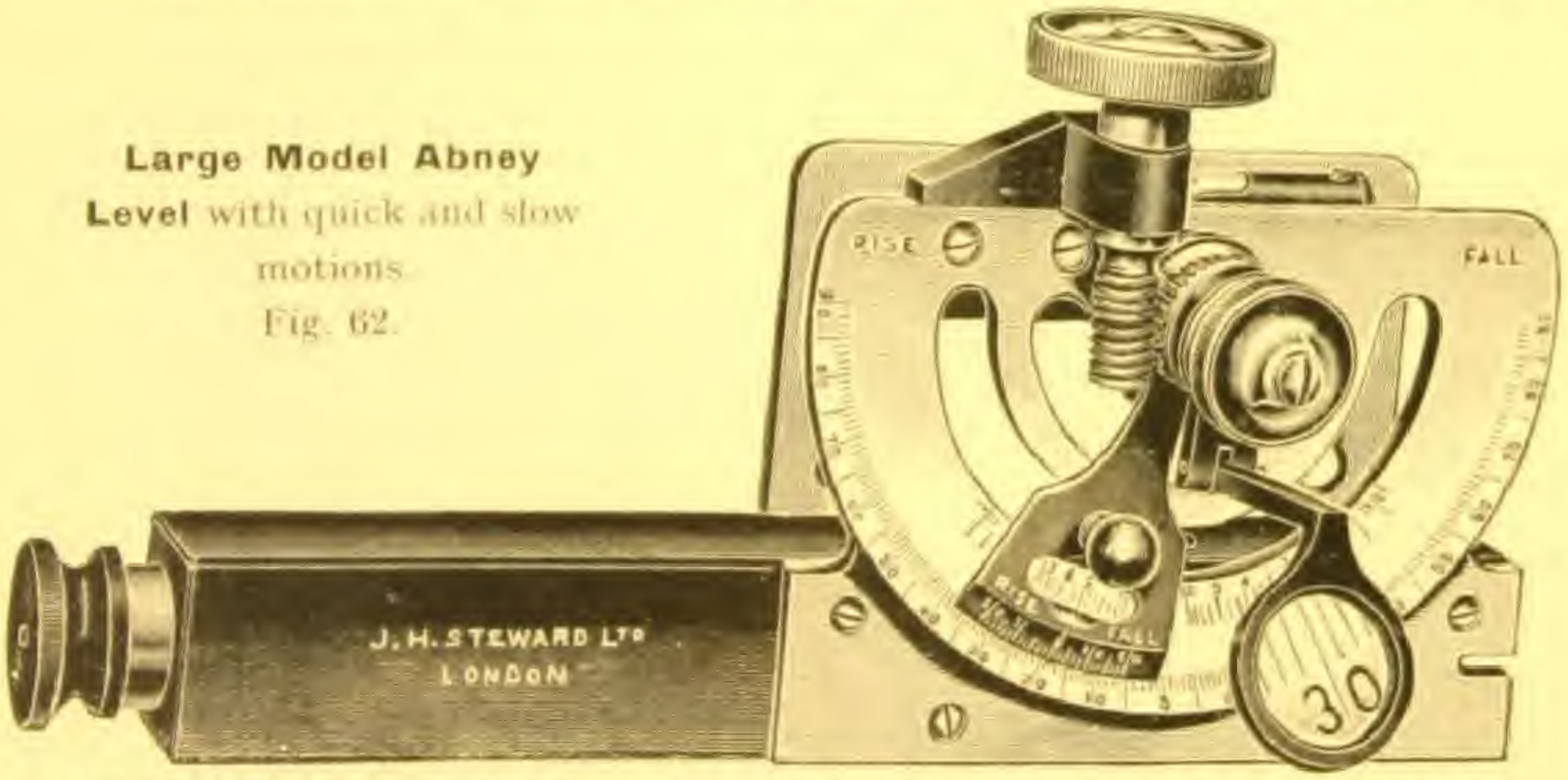
Long Handles. SM 274 and SM 275 with long handles, at same prices.

Fig. 61.



SM 276.—**The Abney-Steward Reflecting Level and Clinometer,** as adopted by the British Government for contouring and determining angles of "depression" and "elevation." The bubble is moved by a worm wheel which obviates the danger of tilting the instrument when sighting. The telescope tubes give a distance of 7 inches between the sights, increasing the accuracy. The large arc, 2⅝ inches diameter, gives an open scale divided to 90° each way, and reading by vernier to 10 minutes. A reading lens is attached. The supplemental "per centage" scale is useful for measuring heights of objects and for other purposes. The base of the instrument which is flat can be used as a plane of contact for ascertaining slopes, and also as a straight edge sight for obtaining profiles, side slopes, dip of strata and for plombing. The instrument fits into a leather sling case 4¼ × 2½ × 1¼ inches.....Fig. 61 **£4 10 0**

Large Model Abney Level with quick and slow motions.
Fig. 62.



SM 277.—**The Abney-Steward Reflecting Level and Clinometer.** Large size, with extra large arc, 3½ inches diameter reading by vernier to 5 minutes, and with supplemental scale giving slopes each way from $\frac{1}{1}$ to $\frac{1}{15}$, reading from a central indicator. Telescopic sighting tube extending to 9 inches. Large size spirit level and reflector. The adjustment for the bubble is fitted with a quick and slow motion. Key plate at back of arc for attaching instrument to a Jacob Staff when greater steadiness is desired. The instrument fits into a leather case 6 × 4 × 2½ inches, with sling.....Fig. 62 **£6 15 0**

SM 278.—**5-foot Jacob Staff,** with rocking head to carry the large size Abney-Steward Reflecting Level **£1 10 0**

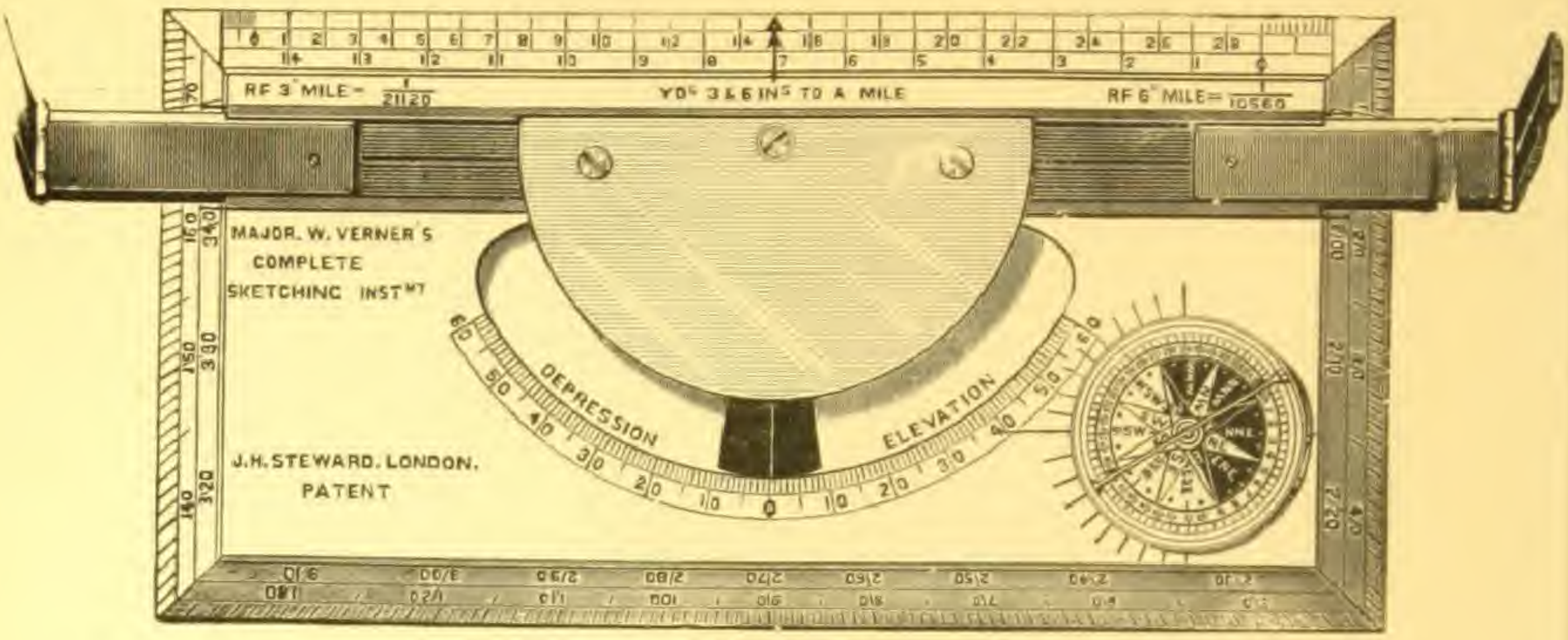


Fig. 63.

SM279.—**The "Verner" Rapid Sketcher** combines in one instrument a Clinometer, a Compass, a Sighting Rule, a Protractor, and a Plotter. Its dimensions are 6 × 3 inches. The distance between the sights when extended is 7½ inches.

Three bevelled edges of the instrument are divided to degrees for protracting angles, while the fourth edge on the front has a scale of "yards at 3 and 6 inches to the mile" with the R.F. (representative fraction) for each scale. On the back of the instrument are various scales and formulae, as follows:—Yards 1 inch, 2 inches and 4 inches to a mile, with Representative Fractions, Links Centimetres and Millimetres, Degrees of Slope. With case ..... Fig. 63 **£3 18 6**

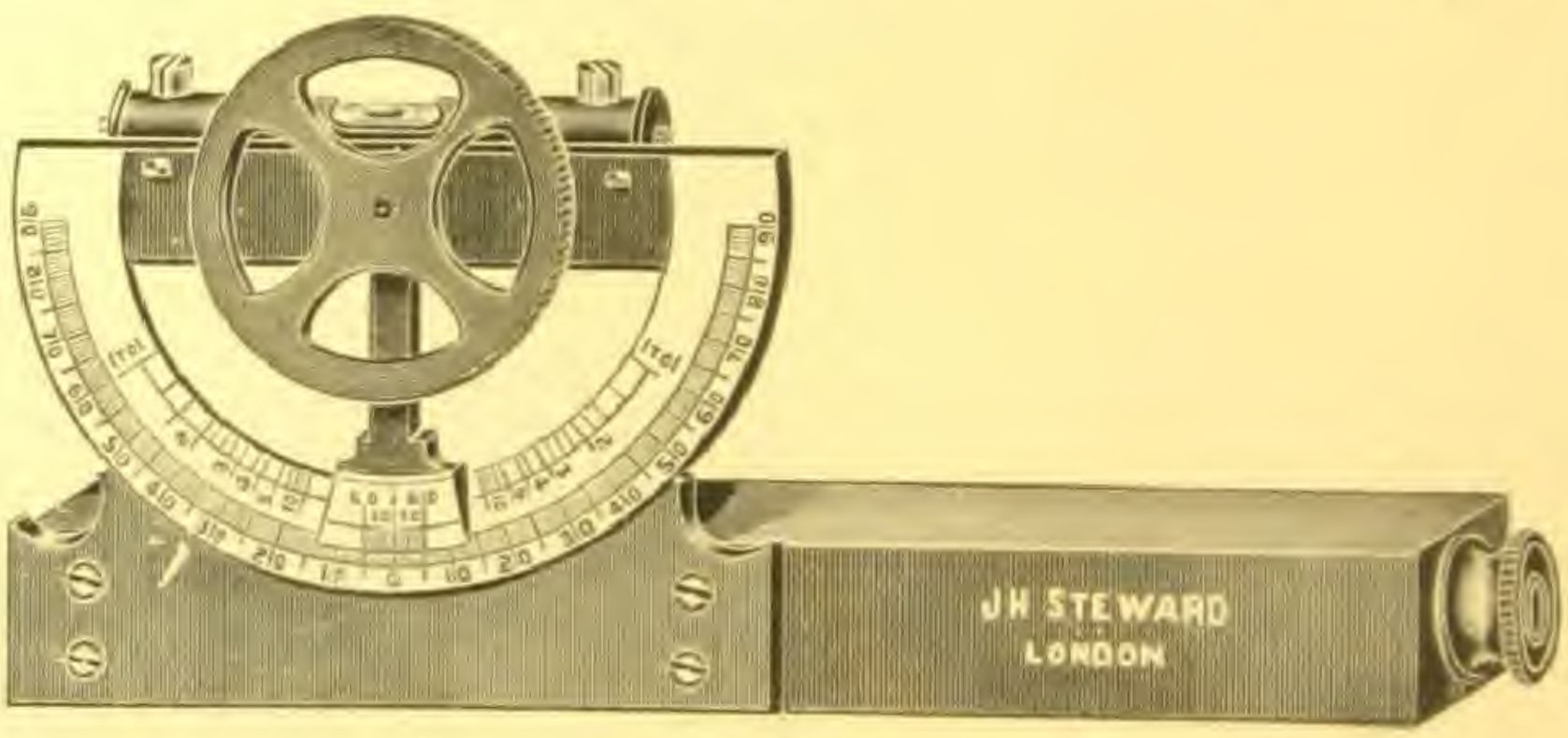


Fig. 64.

SM 280.—**Abney Reflecting Level and Clinometer,** with wheel adjustment to bubble and arc of degrees reading to 10 minutes by vernier; supplementary percentage scale of slopes from $\frac{1}{1}$ to $\frac{1}{10}$. Plane base for placing on a straight edge for ascertaining the batter of a wall or steep side slope and for plumbing, for which purpose the arc is divided up to 90°. In case, with reading lens ..... Fig. 64 **£2 15 0**

Fig. 65.

SM 281.—**Pocket Reflecting Sight Level,** 4¼ inches long. When the bubble is seen by reflection to be in the centre of its run, the object sighted through the tube, and intersected by the cross wire, will be on the same level as the eye of the observer. The base of the instrument is flat for use as an ordinary plane level; in case ..... Fig. 65 **£1 2 6**

SKI CLINOMETERS.

SM 282.—**The "Simplex" Ski Clinometer,** Mark I, for taking angles of slope either in declination, inclination or profile. "Safety" angles are graduated in degrees and figured at every 5 degrees from 15 to 35 degrees. The clinometer is made entirely of bronzed metal. In use it is held by the ring and allowed to swing freely. With instructions.

Fig. 66 ..... **15/6**

SM 282a.—Solid Leather Case **4/6**

SM 283.—**The "Simplex" Ski Clinometer,** Mark II. This is a modification of Mark I, with the scale of degrees extended from 5 degrees to 50 degrees **18/6**

SM283a.—Solid Leather Case **4/6**

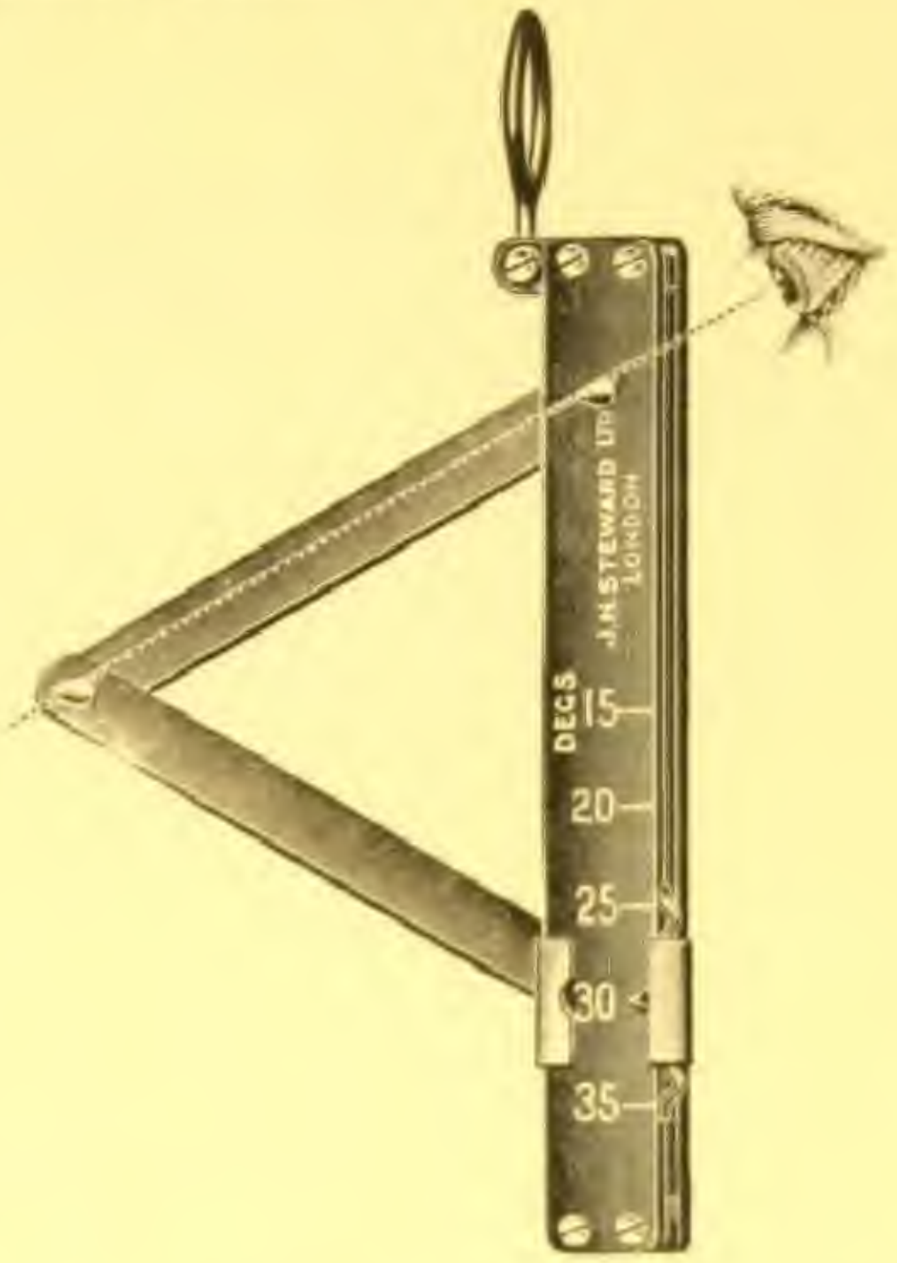


Fig. 66.

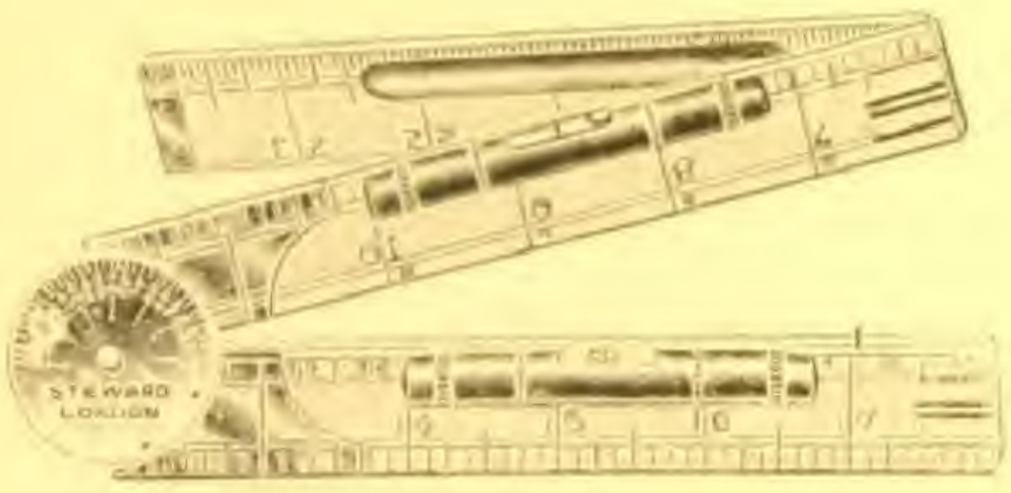


Fig. 66a.

SM 284.—**Geological Rule** for ascertaining dip of strata and angles of slope. A 2-ft. rule with scales of inches to 1/10ths and 1/8ths, and millimetres. Two levels on the arms which are pivotted to a protracted circle divided to every 5 degrees and reading by estimation to 2 degrees.

Fig. 66a **10 6**

SM 285.—**Mechanic's Spirit Level** with micrometer screw adjustment for measuring angles of tilt of both plane and curved surfaces such as piping. The mounts are of bronzed brass and the 3½ inch base has carefully machined flat and inverted V bearings. There is a range of 10 degrees elevation and depression and the graduated drums read to 1 minute of angle. A useful instrument in congested places and where there are obstructions. Leather case. Fig. 66b

£4 15 0

Fig. 66b.

CLINOMETER RULES.

Fig. 67. Pocket Clinometer Rule, **£5 5 0**

SM 286.—**Pocket Clinometer Rule and Compass,** in the form of a 12 inch one-fold pocket rule. When closed the compass folds into a recess and the instrument is then very compact and flat for the pocket. Dimensions, closed, $6 \times 1\frac{7}{8} \times \frac{3}{8}$ inches. The arms are boxwood with white metal mounts and flush are divided from 0° to 90°, with supplemental scale of rise in inches per yard of horizontal run. Spirit level let into each arm. Double folding sights for sighting up or down. Compass with bar needle and stop, mounted so that it can be placed in a horizontal plane for ascertaining the magnetic bearing of an object at the same time as the angle of elevation or depression. The faces of the rule are engraved with tables for ascertaining the vertical height of a distant object and transverse or lateral distances. The edges of rule are divided to parts of an inch and millimetres. A useful instrument for ascertaining various slopes, batters, pitches, dip and strike of strata, horizontal, lateral and transverse distances, vertical heights. In leather case.
Fig. 67 **£5 5 0**

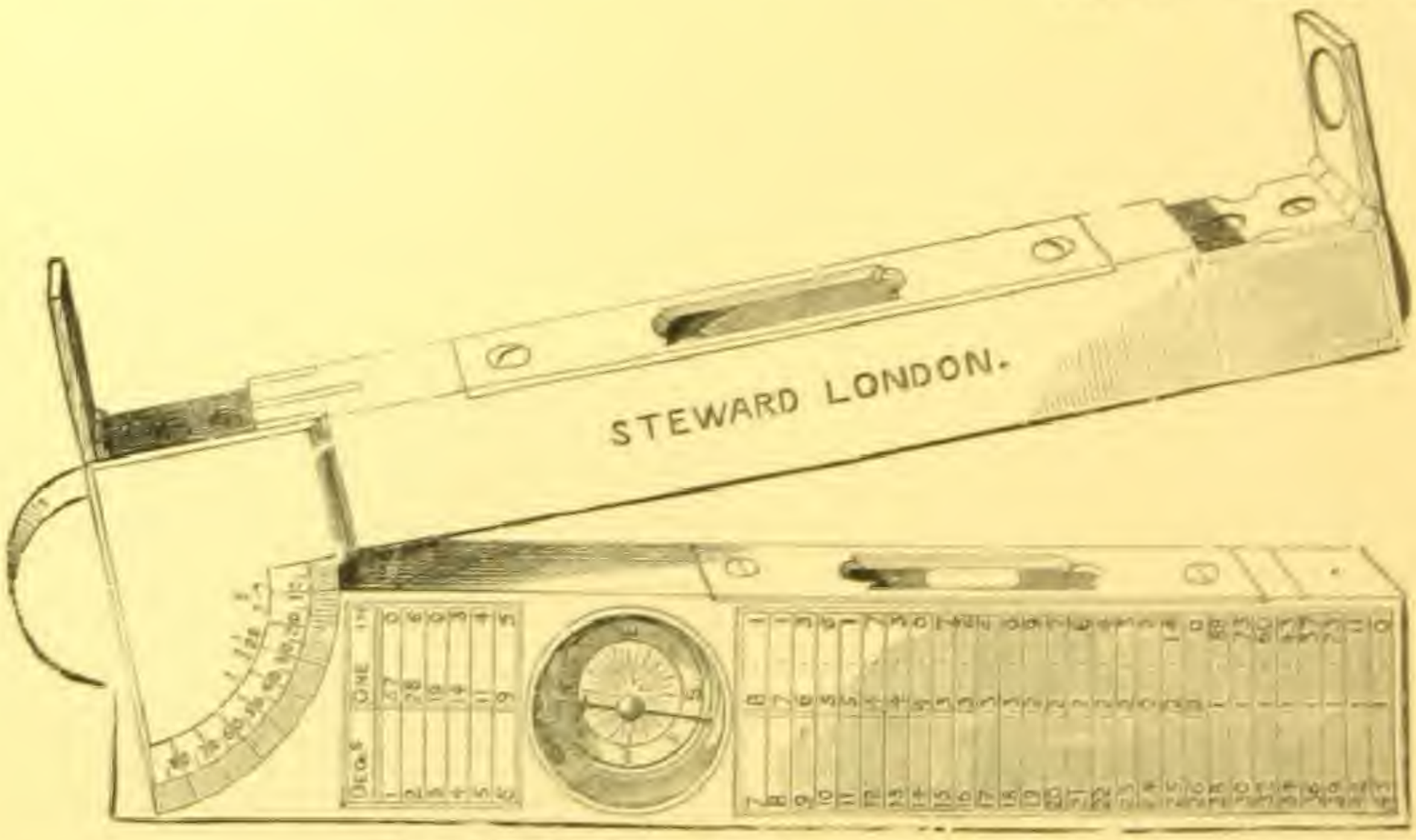


Fig. 68. Clinometer Rule, **£4 0 0**

SM 287.—**Plain Clinometer Rule,** with brass mounts. Arc divided from 0° to 90°. Table on arm for calculating horizontal distances for certain vertical angles, spirit level on each arm, fixed compass, folding sights. In case ..... Fig. 68 **£4 0 0**

AUTO SIMPLEX TREE AND HEIGHT MEASURER.

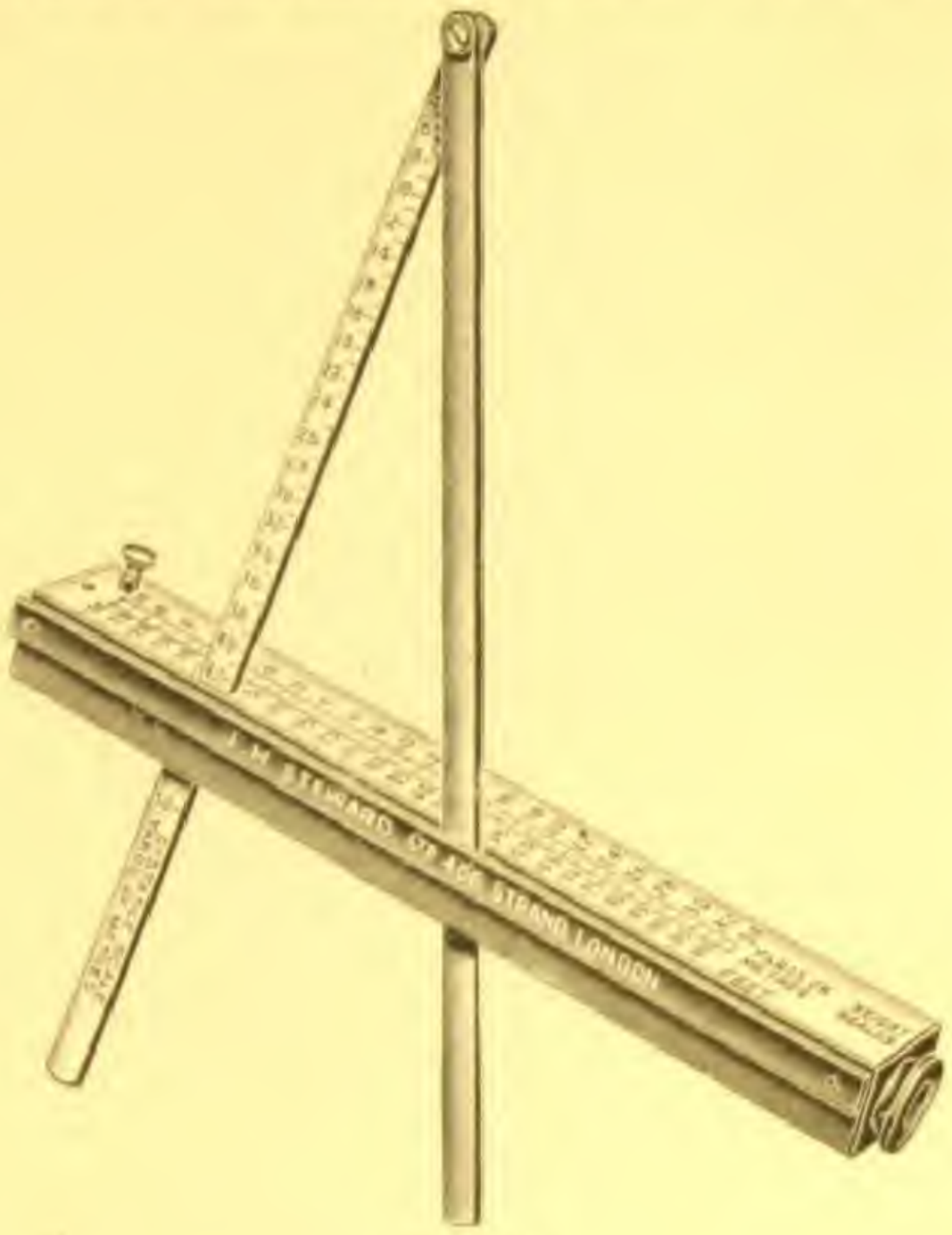


Fig. 69.

An instrument for measuring the height of trees and other objects, consisting of a combination of two scales set at right angles to one another, with an indicating pendulum and sighting tube attached.

The vertical scale is a scale of "distances," which is adjustable, and to which the indicating pendulum is attached.

The horizontal scale is a scale of "heights," and is engraved on the body of the sighting tube.

In use the vertical scale is first set to indicate the distance of the observer from the tree or other object.

With the pendulum swinging free the observer sights the summit of the object, through the tube, and then clamps the pendulum.

The height of the object is read from the "height" scale opposite the indicator line engraved along the pendulum.

Heights are given in feet, yards or metres.

SM 288.—**The Auto Simplex Tree Measurer** in flexible sheath, with instructions ..... Fig. 69 **£3 18 0**

SM 289.—**Stiff Leather Case** if preferred instead of sheath. Extra **9 6**

THE DENDROMETER.

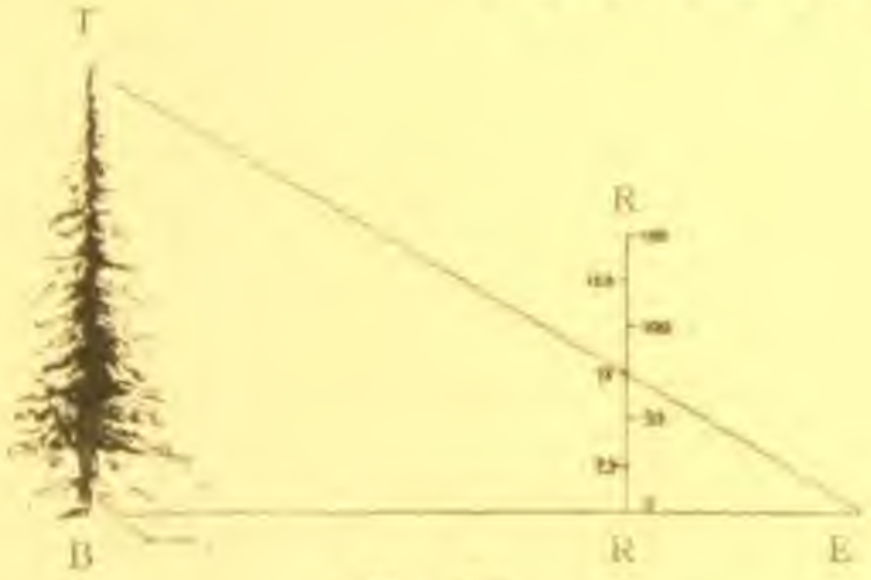


Fig. 70.

SM 290.—**The Woodman's Dendrometer,** for measuring the height of trees, consisting of a rod 24 ins. long, folding to 12 ins. with a cord of definite length attached to its lower extremity. The rod is divided to 100 parts, with bold figures at every fifth division. In use the woodman places himself at E, 30 yards from the tree BT, and with the free end of the cord held between his teeth, holds the rod RR vertically in one hand and stretches the cord taut. The rod is held so that the zero at the bottom R coincides with B the bottom of tree trunk, or with a mark placed on the trunk. The eye is then raised, and the division on the rod RR coinciding with T, the top of the tree indicates the height of the tree in feet, which in the diagram is shown as 75 feet. If it is found necessary to stand at a distance greater or less than 30 yards from the tree, the height indicated will be in proportion to the distance. With canvas case and instructions ..... Fig. 70 **12 6**

Timber Girthing Tapes, see page 45.

CLINOMETERS.

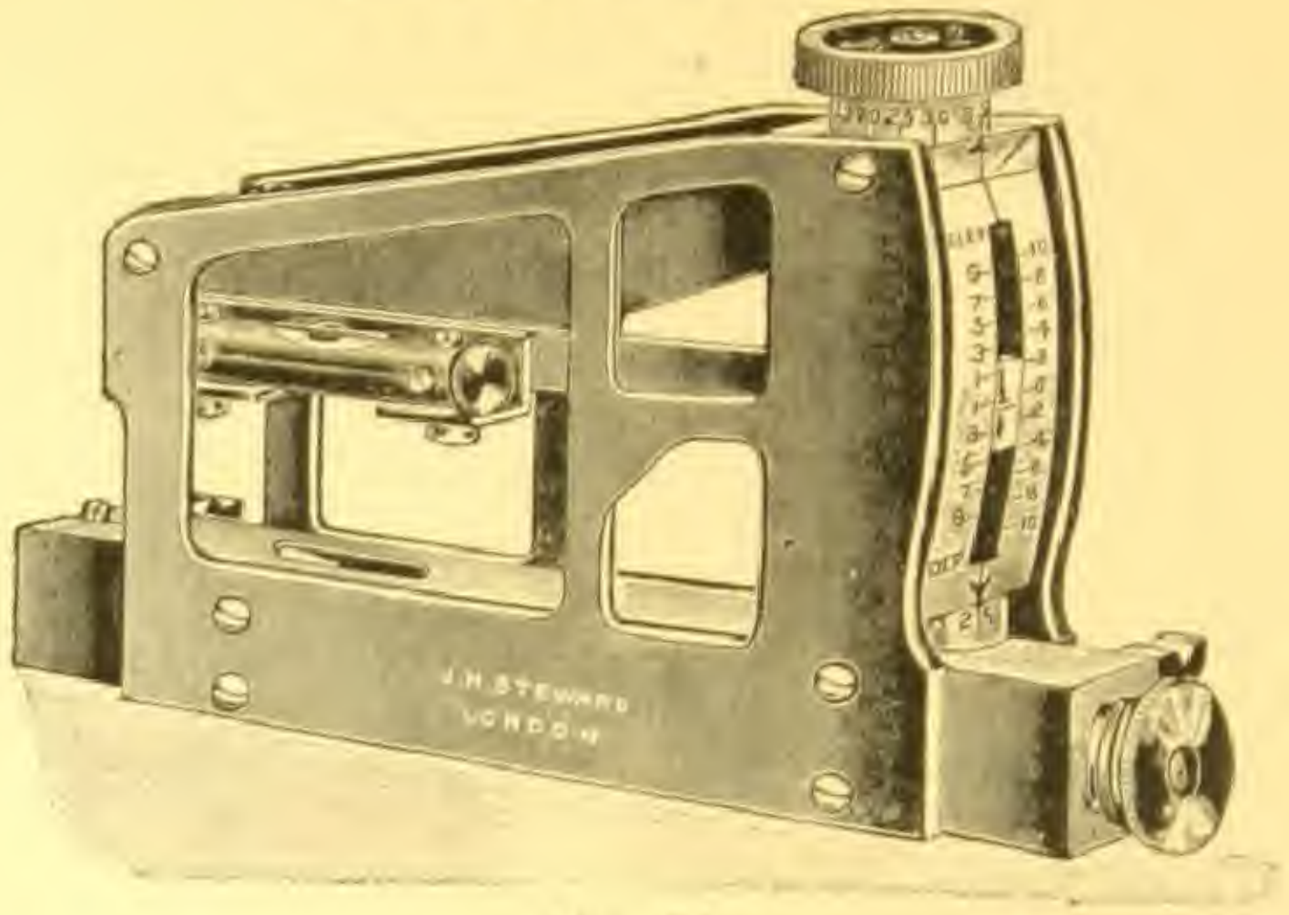


Fig. 71.

SM 291.—**The "Per Centage" Gradient Clinometer** is a reflecting clinometer constructed on the same principle as the Abney clinometer. After sighting the object through the tube, the bubble is brought to the centre of its run by means of a quick motion screw. The reading of the scale will indicate percentage of the horizontal distance. The arc is graduated in units from 0 to 20 per cent "Elevation" and "Depression," and is read to 0·05 per cent. by means of a graduated collar attached to the motion screw. The instrument has a plane base of 5 inches. In case..... Fig. 71 **£8 15 0**

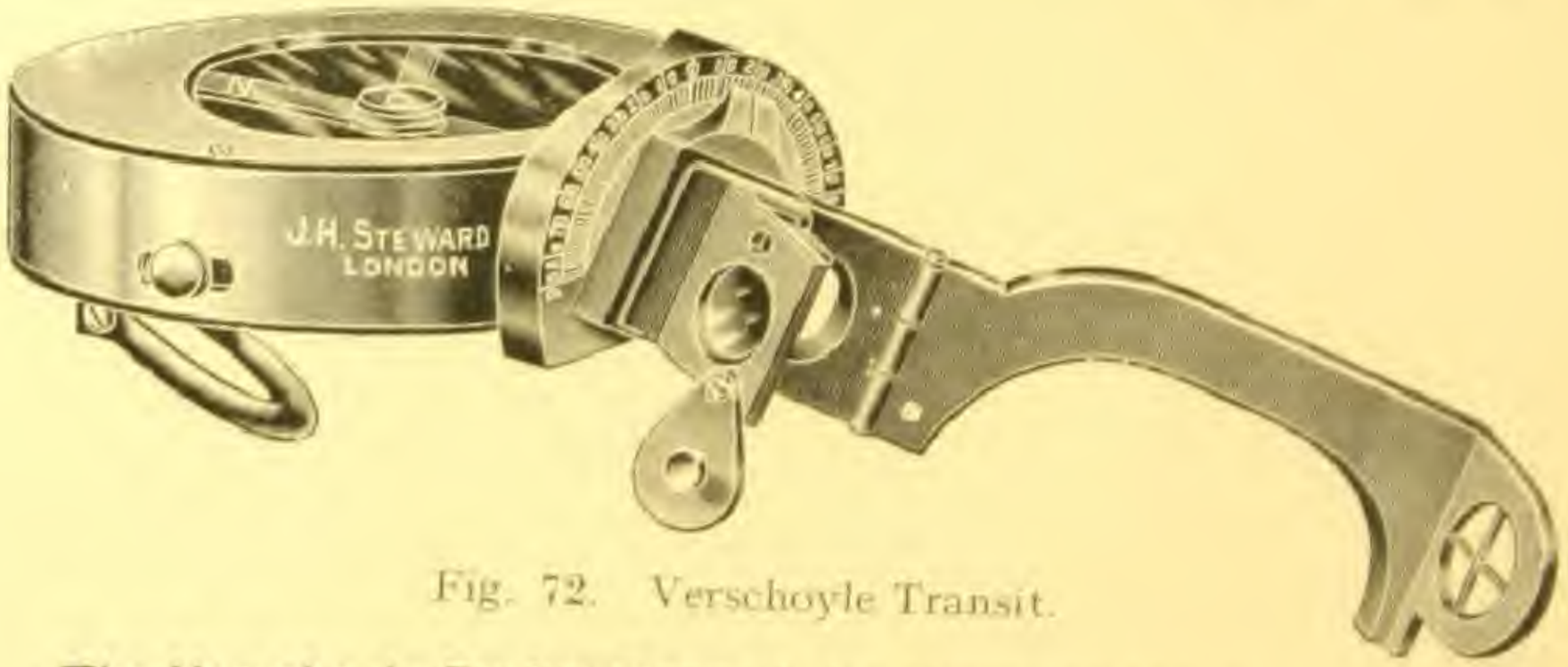


Fig. 72. Verschoyle Transit.

The Verschoyle Pocket Transit, for observing the magnetic bearings of lines, which may be either on the horizontal plane or at a considerable angle above or below the point of observation; and at the same time recording the value of their vertical angles.

The instrument is a combined prismatic compass and clinometer of special design. In use, the bubble of the spirit level is brought to the centre of its run by observation through the prism, and the object is intersected by the cross wires at the extremity of the revolving sight arm. Without removing the instrument from the eye, the magnetic bearing and vertical angle are read through the prism at one and the same time. Vertical angles are read to 10 minutes and magnetic bearings to ½ degrees.

The instrument weighs 11 ozs., and is used in the hand or can be attached to a special tripod with the necessary motions.

SM 292.—**The Verschoyle Pocket Transit,** in leather sling case. Fig. 72 **£7 0 0**

SM 293.—**Special Tripod Stand,** with necessary motions..... **2 10 0**

THE GEOLOGICAL CLINOMETER AND COMPASS.

Fig 73. Clinometer and Compass.

SM 294.—**The Geological Clinometer and Compass,** made at the suggestion of a Professor of the School of Mines. Square mahogany box with cross spirit levels and double sights for taking inclination and declination. Pendulum clinometer with stop and scales of degrees and percentage scale. Compass with metal dial divided to single degrees from 0° to 360° and with cardinal points, the E. and W. being transposed so that reading can be taken from N. end of needle, bar needle with agate centre, sliding weight to correct dip, and check and locking stop. The edge of case forms a straight edge for obtaining general slope of hills, dip and strike of strata, and for plotting. Size 3 × 3 × 1 ins.

Fig. 73 **£3 10 0**

BRIDGE SIGHT COMPASS AND CLINOMETER.

Fig. 74. Sight Compass and Clinometer.

SM 295.—**Bridge Sight Compass and Clinometer,** with bronzed brass mounts and folding sights. Metal dial. Compass circle divided to single degrees from 0° to 360° right round, and with E. and W cardinal points transposed. Bar needle with agate centre, sliding weight to correct dip and lock and check stop. Pendulum clinometer with scale of degrees divided each way from 0° to 90° for "Rise" and "Fall," and with supplemental "percentage" scale showing the ratio to the horizontal of the rise or fall of the gradient.

The bar with sights is pivoted at the ends and can be folded down at the side, making the instrument flat for the pocket. For taking magnetic bearings or inclines the sights are turned up as illustrated. The compass box is held in a horizontal plane for taking bearings and in a vertical plane for taking inclines. With the sights folded down the straight edge forms a sighting line for ascertaining dip of strata, or a contact surface for measuring slopes of inclined surfaces, strike of strata, etc. Size, 2⅝ inches diameter by ¾ inch deep. Leather pocket case..... Fig. 74 **£1 17 6**

THE CLINO-DIAL.

Also known as a Pocket Transit.

Fig. 75. The Clino-Dial.

The Clino-Dial, or Pocket Transit, consists of a mining dial or surveying compass combined with a clinometer. It embodies the principles of the Brunton Dial with modifications, and is much used for preliminary surveys on the surface and in mines, for ascertaining magnetic bearings, vertical angles or clinometric degrees, railway gradients, slopes, dip and strike of strata. It can also be used for plotting with the plane table and for plombing. Sights can be taken at any angle of elevation or depression and the angles read without the aid of an assistant. The instrument was designed for use in the hand, but it can be attached to a tripod when fore and back sighting, and for running long tangents and vein tracing.

The Compass circle is divided to single degrees, and figured from 0 to 360 right round. The E. and W. points are transposed and courses are read from the N. end of the needle, except when the sight is taken from the N. side of the dial, when the course is read from the S. end. There is a rack with pinion for setting off magnetic variation. The needle is the bar pattern with jewelled centre and riding weight for correcting dip. There is an automatic locking stop to prevent wear when travelling, and an independent stop to keep the needle clear of the clinometer when measuring vertical angles.

The Clinometer reads by vernier to 5 minutes, the attached spirit level being brought to the centre of its run by a lever at the back of the instrument. A second spirit level mounted at right angles to the clinometer level ensures holding the compass dial in a horizontal plane when taking courses.

The Sights can be adjusted to any angle and consist of a hinged mirror and open sight, with supplementary apertures and point sights, which are also hinged.

The Metal Box is made of aluminium alloy, with two sides finished off plane and parallel to the line of sight for use as planes of contact for ascertaining slopes, gradients and for plotting and plombing.

The weight of the Clino-Dial is about 9 ozs. and being 3 inches in diameter, it can be conveniently carried in a side pocket.

SM 296.—**The Clino-Dial,** as described	Fig. 75	**£6**	**0**	**0**
SM 297.—**Leather Case,** with shoulder strap	extra		**12**	**6**
SM 298.—**Brass Telescopic Tripod,** with universal head ...		**£2**	**10**	**0**

PRISMATIC ALTAZIMUTH INSTRUMENTS.

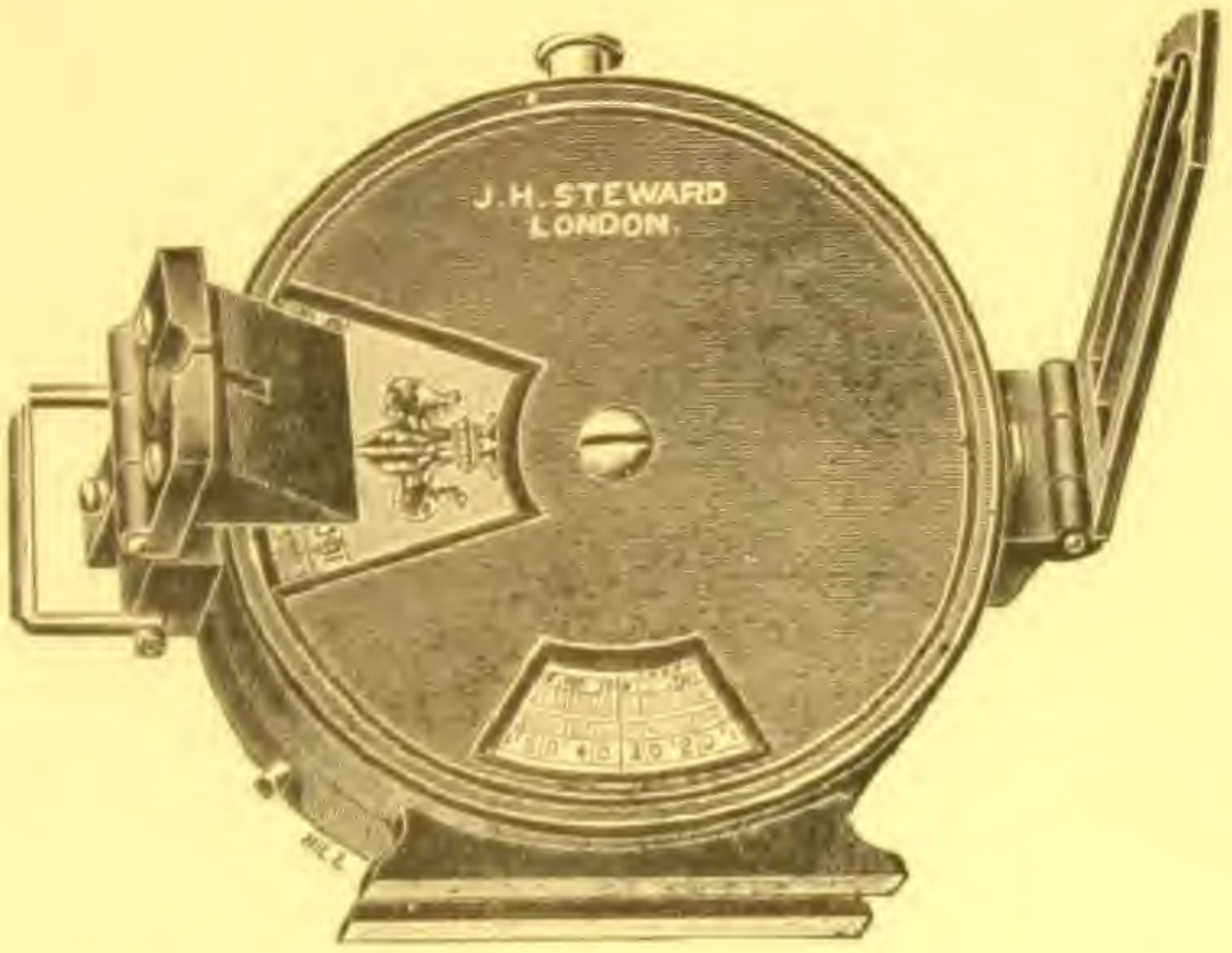


Fig. 76. Prismatic Compass and Clinometer.

The Prismatic Altazimuth, consisting of a prismatic compass combined with a disc clinometer, is a useful instrument for measuring angles in the horizontal plane by means of the compass, and in the vertical plane by means of the clinometer. The angle is read through the prismatic lens simultaneously with the sighting of the object. The compass and clinometer are divided to ½ degrees, and can be read by estimation to 15 minutes or less. The base of the instrument forms a plane of contact for ascertaining slopes and gradients and can also be used as a sight for measuring angles of slope in profile. These angles are read from a scale on the face of the clinometer disc by means of an index line etched on the glass. An additional "per centage" scale gives the ratio to the horizontal of the rise and fall of the gradient. The instrument is 2¾ inches diameter and check and locking stops are fitted to both compass and clinometer. It can be used either in the hand or attached to a tripod. Fig. 76.

SM 299.—**The Prismatic Altazimuth** with card dials in leather case with shoulder strap **£5 0 0**

SM 300.—.....**ditto**.....with engine divided aluminium ring to compass, and metal scale to clinometer. Recommended for use in hot and moist climates. Leather case with shoulder strap..... **£5 15 0**

SM 301.—**Reversible Azimuth Mirror** and tinted glasses as Fig. 77.
Extra **£1 0 0**

Tripod Stands, suitable for the Prismatic Altazimuth, Nos. SM 314, 317, 318 and 320, page 61.

PRISMATIC COMPASSES.

Fig. 77.

Prismatic Compass, with bronzed brass mounts and cover. Aluminium ring divided to half degrees. Needle with agate centre and sliding weight for adjusting dip. Check and lock stops. Reversible azimuth mirror for taking steep sights above or below the horizontal. Tinted glasses for observing sun's bearing. Adjustable prism reader. Threaded fitting to base for attaching to a tripod. Leather case with shoulder strap. Fig. 77.

The diameters stated are the diameters of the graduated ring. The outside diameter of the boxes is about ½ inch larger.

SM 302.—2½ ins. diameter, **£4 10 0** SM 304.—3½ ins. diameter, **£5 10 0**
SM 303.—3 ins. diameter, **£5 0 0** SM 305.—4 ins. diameter, **£6 0 0**
SM 306.—4½ ins. diameter, **£6 15 0**

Tripod Stands for Prismatic Compasses see page 61. Nos. SM 313, 316, 318, 319 and 321.

Fig. 78.

Fig. 79.

SM 307.—**Prismatic Compass,** 2¾ inches diameter, with fixed metal cover. Card dial divided to half degrees, with check and locking stops, adjustable reading prism. Leather sling case..... Fig. 78 **£3 3 0**

SM 308.—**The Service Mirror Clinometer,** with scale on pendulum to single degrees and reading to ½ degrees. The angle is read in a magnifying mirror simultaneously with sighting the object. Size of clinometer, diameter 2¾ inches, thickness ½ inch. Leather sling case.
Fig. 79 **£3 3 0**

LIQUID PRISMATIC COMPASSES.

Fig. 80.

Liquid Prismatic Compass with bronzed brass mounts and cover. Aluminium ring divided to ½ degrees. Agate centre to needle. Adjustable reading prism. The graduated aluminium ring which is attached to the magnetic needle is completely immersed in a non-freezable liquid in which it floats, and is thus kept very steady and free from troublesome oscillations. The ring comes quickly to rest, and a series of bearings can be taken in much less time than with an ordinary prismatic compass. Any expansion or contraction of the liquid due to temperature is compensated for by the special construction of the container. Should air bubbles appear in the liquid, they can be imprisoned in a patent bubble trap so that they cannot affect the movement of the floating ring. The compass can be used in the hand or attached to a tripod by means of a threaded fitting. Fig. 80.

SM 309.—**Liquid Prismatic Compass**, 3 in. box, 2⅛ in. graduated ring. Leather sling case **£7 10 0**

SM 310.—.....**ditto**.....4½ in. box, 3½ in. graduated ring... **9 15 0**

SM 311. **Reversible Mirror** to foresight for taking steep sights, and tinted glasses for observing sun's bearing as illustrated, Fig. 77, page 59. Additional cost if supplied with SM 309, or SM 310 ..... **£1 0 0**

Tripod Stands suitable for Prismatic Compasses Nos. SM 313, 316, 318, 319 and 321, page 61.

SM 312.—**Pocket Liquid Prismatic Compass.** Pearl dial divided to single degrees, and cardinal points. Notches for laying compass on a straight line for map setting and friction ring on base to prevent slipping when used on a plane table. Size 2 ins. diameter and 1 in. deep, and similar in outward appearance to Fig. 101, page 67. Leather case **£5.15. 0**

TRIPOD STANDS.

For Prismatic Compasses and Clinometers.

Fig. 81. Fig. 82. Fig. 83. Fig. 84.

SM 313.—**Aluminium Telescopic Tripod,** height 4 ft., closing to 15 ins., ball and socket head with rotary horizontal motion for prismatic compass..... **£2 15 0**

SM 314.—.....**ditto**.....with the addition of a vertical motion, suitable for compass or clinometer..... Fig. 81 **£3 5 0**

SM 315.—**Leather Sling Case** for Nos. 313 and 314..... **£1 5 0**

SM 316.—**Brass Telescopic Tripod,** height 4 ft. 9 ins. closing to 17 ins., ball and socket head with horizontal motion for compass... **£2 0 0**

SM 317.—.....**ditto**.....with the addition of a vertical motion suitable for compass or clinometer..... **£2 10 0**

SM 318.—**Walking Stick Mahogany Tripod,** with sliding extension, height 4 ft. 8 ins., closing to 3 ft., ball and socket head with rotary motion in horizontal and vertical planes for compass or clinometer. Metal cap and ferrule..... Fig. 82 **£3 5 0**

SM 319.—**Mahogany Tall Tripod,** height 5 feet, ball and socket head with horizontal motion for compass. Leather cap..... **£2 15 0**

SM 320.—.....**ditto**.....with addition of vertical motion for compass or clinometer..... Fig. 83 **£3 0 0**

SM 321.—**Light Tubular Ash Tripod,** height 52 ins., closing to 29 ins., ball and socket head with horizontal motion for compass. Fig. 84 **£1 15 0**

SM 322.—.....**ditto**.....with addition of vertical motion for compass or clinometer..... **£2 5 0**

SIGHT COMPASSES AND DIALS.

Fig. 85. Sight Compass.

SM 323.—**3-inch Pocket Compass or Dial, with Folding Sights,** to sight both ways, bar needle with agate centre and stop, raised circle divided to single degrees..... Fig. 85 **£3 3 0**

SM 324.—Leather sling case for above **12 6**

This compass can be used on a plane table or can be adapted to one of the tripods illustrated on page 61.

SM 325.—**Pocket Sight Compass or Dial,** 1¾ inches diameter, in bronzed brass box with metal cover. Folding sights, bar needle, agate centre and stop, metal dial divided into cardinal points and raised circle divided to every two degrees..... **£2 2 0**

Fig. 86. Prospector's Compass.

SM 326.—**The Prospector's Pocket Compass,** with aperture sight, and line in the hinged lid for taking bearings, best bar needle with jewelled centre and locking stop. Raised circle divided to every 2 degrees. E. and W. points transposed so that the bearing is read opposite the N. end of needle. The glass can be readily removed for adjusting the sliding weight on needle for dip, bronzed brass box, 1⅞ inches diameter.

Fig. 86 **£1 18 6**

Fig. 87.

SM 327.—**The "Steward" Liquid Pocket Compass,** in bronzed brass hunter case of strong construction with the lid made to fold right back for map setting. The V's cut in the bow ring and lid also serve as sights for taking bearings. The compass box is filled with a non-freezable liquid and hermetically sealed, and is specially constructed to allow for any expansion or contraction of the liquid. The compass dial being enveloped with the liquid is kept very steady by the resistance it offers. The dial is divided to every 5 degrees and cardinal points are also distinctly marked. The northern half of the dial is painted black and the southern half white, with luminous N. and S. points. Size 2 inches diameter and 7/10ths thick..... Fig. 87 **£2 10 0**

Fig. 88.

SM 328. **The "Steward" Liquid Wrist Compass** is similar in construction to No. SM 327, except that the metal hunter case has been dispensed with, considerably reducing the outer dimensions so that the compass can be worn comfortably on the wrist. A lubber's steering line is plainly marked on the metal mount.

Fig. 88 **£2 10 0**

Fig. 89.

Fig. 90.

SM 329.—**Watch Shape Compass,** 1⅛ inch diameter, with brass mounts. Floating card dial divided to every 2 inch and cardinal points. Check and locking stops..... Fig. 89 **6 6**

SM 330.—**The "Vedette" Compass,** in bronzed metal hunter case, 1⅛ inch diameter. Floating card dial divided to every 2 inch and cardinal points. Check and locking stops. The N. and S. points and direction line in lid are treated with luminous paint..... Fig. 90 **10 6**

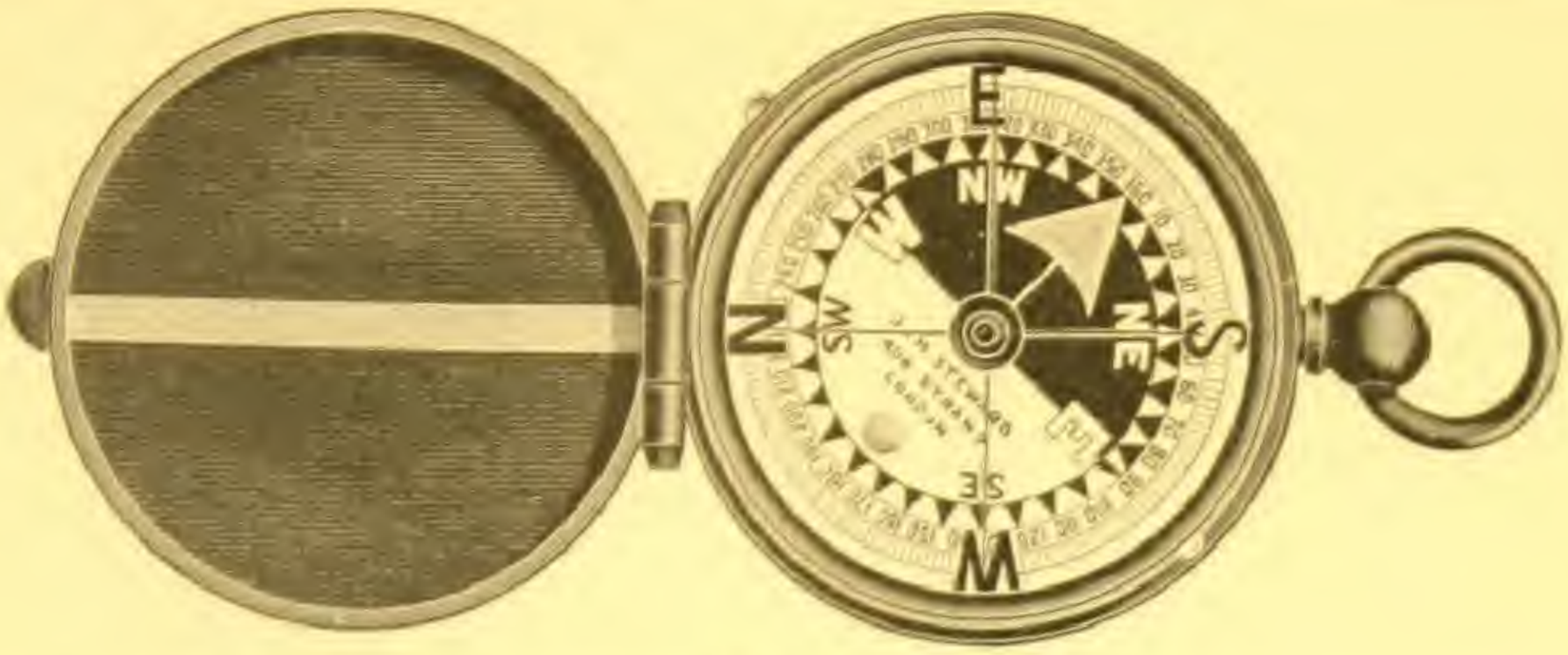


Fig. 91.

SM 331.—**The "Traveller's" Compass,** in extra strong bronzed metal case, with hinged cover made to fold right back for map setting. Sighting V's on bow ring and lid. Floating pearl dial, half black and half white so as to be visible in twilight, divided to every 2°, luminous N. and S. points and direction line on lid, agate centre, check and lock stops, red lines and cardinal points on glass to allow for magnetic variation and for map reading. Size, 1½ inches diameter..... Fig. 91 **£2 0 0**

Fig. 92.

Fig. 93.

SM 332.—**Bronzed Hunter Case Compass,** with spring cover, floating pearl dial divided to every 2°, with agate centre and stop. Size 1⅞ inches diameter..... Fig. 92 **£1 5 0**
SM 333.—.....**ditto**.....with floating card dial **15 6**
SM 334.—.....**ditto**.....fixed metal dial and bar needle Fig. 93 **1 0 0**
SM 335.—**Bronzed Hunter Case Compass,** larger size, 1⅞ inches diameter, floating pearl dial..... Fig. 92 **£1 10 0**
SM 336.—.....**ditto**.....with floating card dial **17 6**
SM 337.—.....**ditto**.....fixed metal dial and bar needle Fig. 93 **1 2 6**

SM 338.—**Transparent Compass,** with bar needle pivoted between two plates of optically worked Brazilian quartz, forming a strong magnifier and burning glass. Circle with degrees and cardinal points. This is an excellent horseback compass, and if held above the head the needle can be seen at night time against the sky. If laid on a map, being transparent, the directions of roads can be readily seen. Mounted in silver, 1¼ inches diameter..... Fig. 94 **£2 15 0**

SM 338A.—.....**ditto**.....with bronzed metal mounts and optically worked glass instead of quartz **£1 5 0**

Fig. 94.

SEMI-CIRCUMFERENTOR.

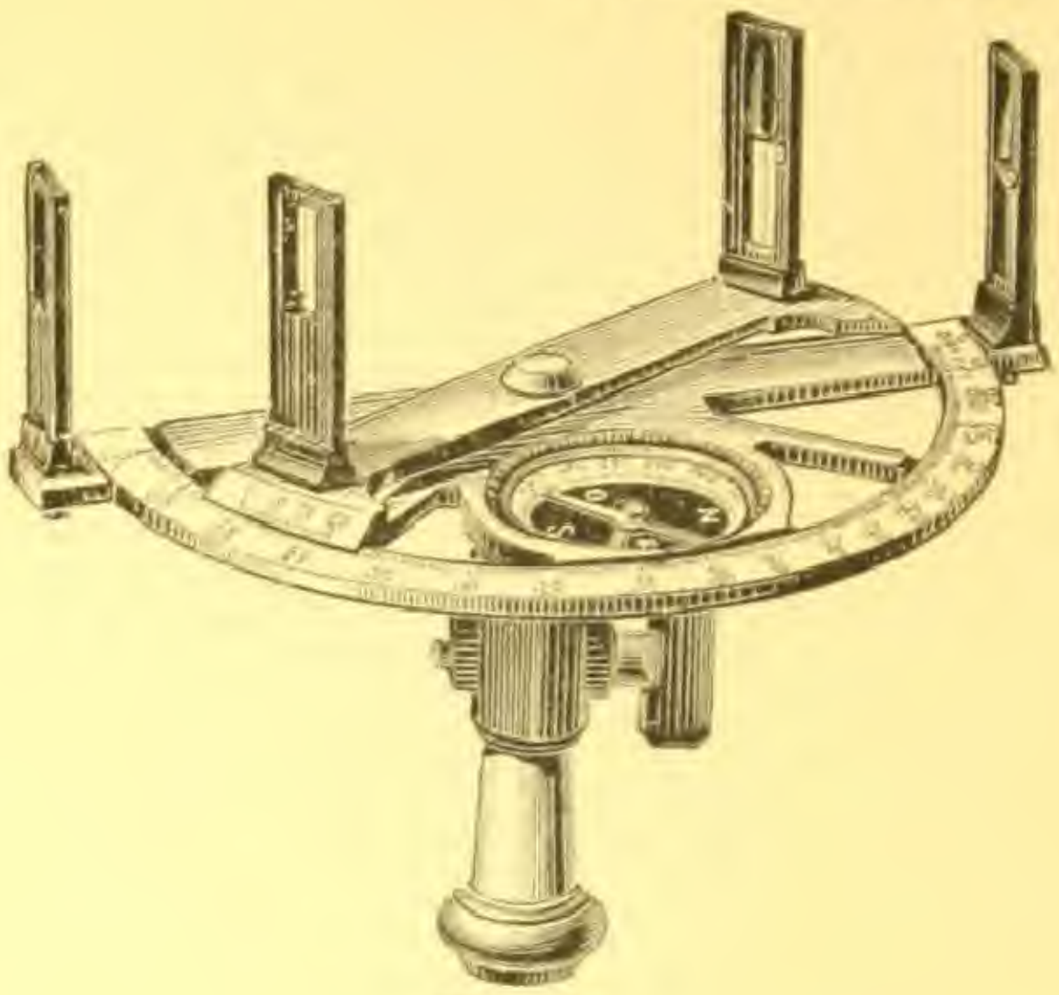


Fig. 95

SM 339.—**Semi-Circumferentor** or Graphometer for setting out land or buildings from plotted drawings. 7½ inches diameter with semi-circular arc divided to ½ degrees and figured both ways 0° to 180° so that angles can be laid out right round the circle. Double sights for sighting fore and back. Verniers to alidade reading to 1 minute. Magnetic compass. Ball and socket levelling head with clamp to rotating centre. Strong plain tripod. Hardwood case.

Fig. 95 **£5 15 0**

Fig. 96.

DIP COMPASS.

For Tracing Iron Ore.

SM 340.—**Transparent Pocket Dip Needle Compass,** 3 inches diameter, with suspending ring which is held in the hand when the compass assumes a vertical position by its own weight and the angle of inclination or dip is indicated by the needle on the graduated ring.

When held horizontally the instrument serves as an ordinary compass and indicates the magnetic meridian. In leather sling case..... Fig. 96 **£3 15 0**

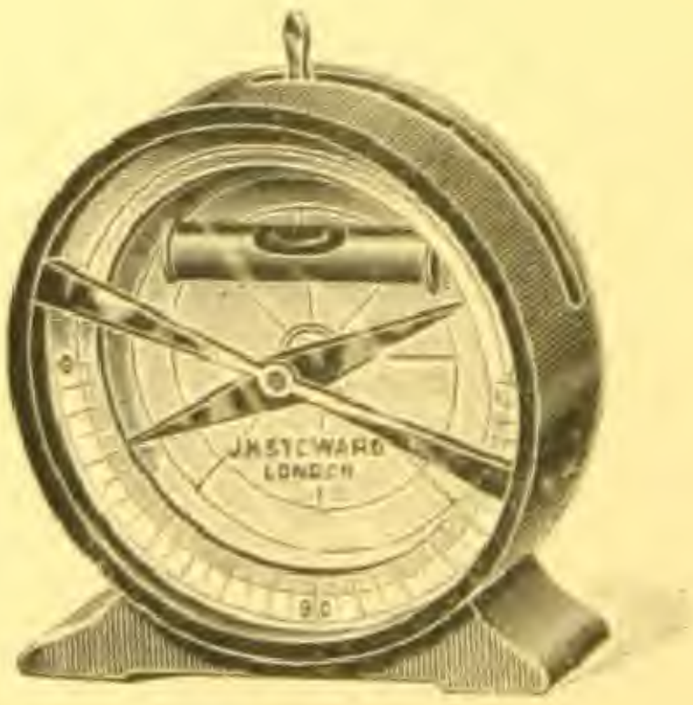


Fig. 97.

SM 341.—**Dip Needle Compass,** 3 inches diameter. Adjustable vertical arc of 180°, reading 90° to the right and left, with spirit level attached for setting the zero of the scale in a horizontal plane, which is effected by means of a small lever. Flat base for standing on a tripod or level surface. In snap case.

Fig. 97 **£5 15 0**

BINNACLE AND BOAT COMPASSES.

Fig. 98.

Binnacle Compass on gimbal rings with dial floating in liquid. Bright brass binnacle and lamp. Fig. 98.

SM 342.—3 ins. dial	£3	15 0
SM 343.—4 ins. ,,	4	4 0
SM 344.—5 ins. ,,	4	15 0

Binnacle Compass similar to above with top of binnacle made to remove.

SM 345.—4 ins. dial	£6	6 0
SM 346.—5 ins. ,,	7	7 0

LIQUID BOAT COMPASSES.

Liquid Boat Compass mounted on brass gimbal rings. Dial divided to degrees and cardinal points with jewelled centre. Brass bowl filled with liquid, completely enveloping the dial and keeping it steady and free from oscillation. An expansive chamber provides for any change of temperature. Mahogany box with sliding lid. Fig. 99.

Fig. 99.

SM 347.—3 ins. dial and 6 ins. box	£2	15 0
SM 348.—4 ins. ,, ,, 8 ins. ,,	3	3 0
SM 349.—5 ins. ,, ,, 9 ins. ,,	4	0 0

BOAT AND CANOE COMPASSES.

SM 350.—**Boat Compass,** not liquid, with 2¼ inch mariner's dial with agate centre, brass bowl and gimbal rings, in box with sliding lid, 4 inches square..... £0 15 0

SM 351.—...**ditto**...with 2¾ inch dial, and box 5 inches square... 0 18 6

SM 352.—...**ditto**...with 4 inch dial, and box 7 inches square ... 1 7 6

SM 353.—...**ditto**...with 5 inch dial, and box 8 inches square ... 1 13 6

LIQUID YACHT COMPASSES.

SM 354.—**Pocket Liquid Compass** mounted on gimbals. The dial, which is 1⅝ inch diameter, is divided to degrees and cardinal points, and is completely enveloped in liquid, which keeps it steady and free from oscillation. The metal box to which the gimbal ring is attached is made to telescope for portability when the compass is not in use. Leather outer case, 3½ inches diameter by 1½ inch deep.

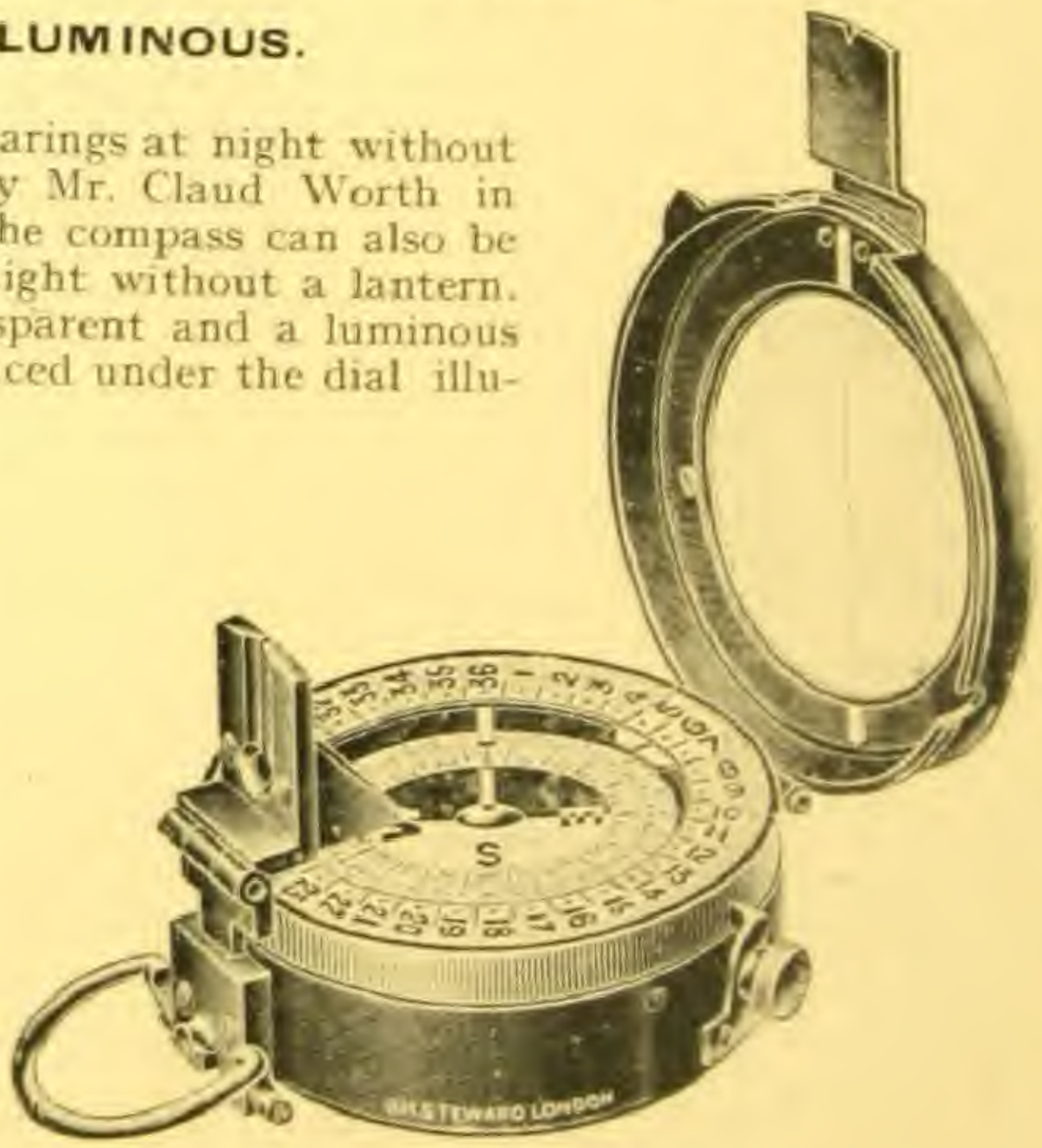
Fig. 100 **£4 10 0**

Fig. 100. Liquid Gimbal Compass.

THE "YACHTSMAN" PRISMATIC COMPASS.

LIQUID AND SELF LUMINOUS.

For taking and reading bearings at night without a lantern, as recommended by Mr. Claud Worth in his book "Yacht Cruising." The compass can also be used for steering by day or night without a lantern. The edge of the dial is transparent and a luminous patch of radium compound placed under the dial illuminates the degrees and numerals, so that a bearing can be read through the prism simultaneously with sighting the object. The outer scale of bearings which is also illuminated, can be rotated and set for steering on a given bearing, on the "Verner" principle so extensively used for military work. The dial is completely enveloped in liquid and keeps steady and free from oscillation. Size 2 ins. diameter by 1 inch deep. Leather outer case.



SM 355.— ..... Fig. 101 £7-7-0.

SEXTANTS.

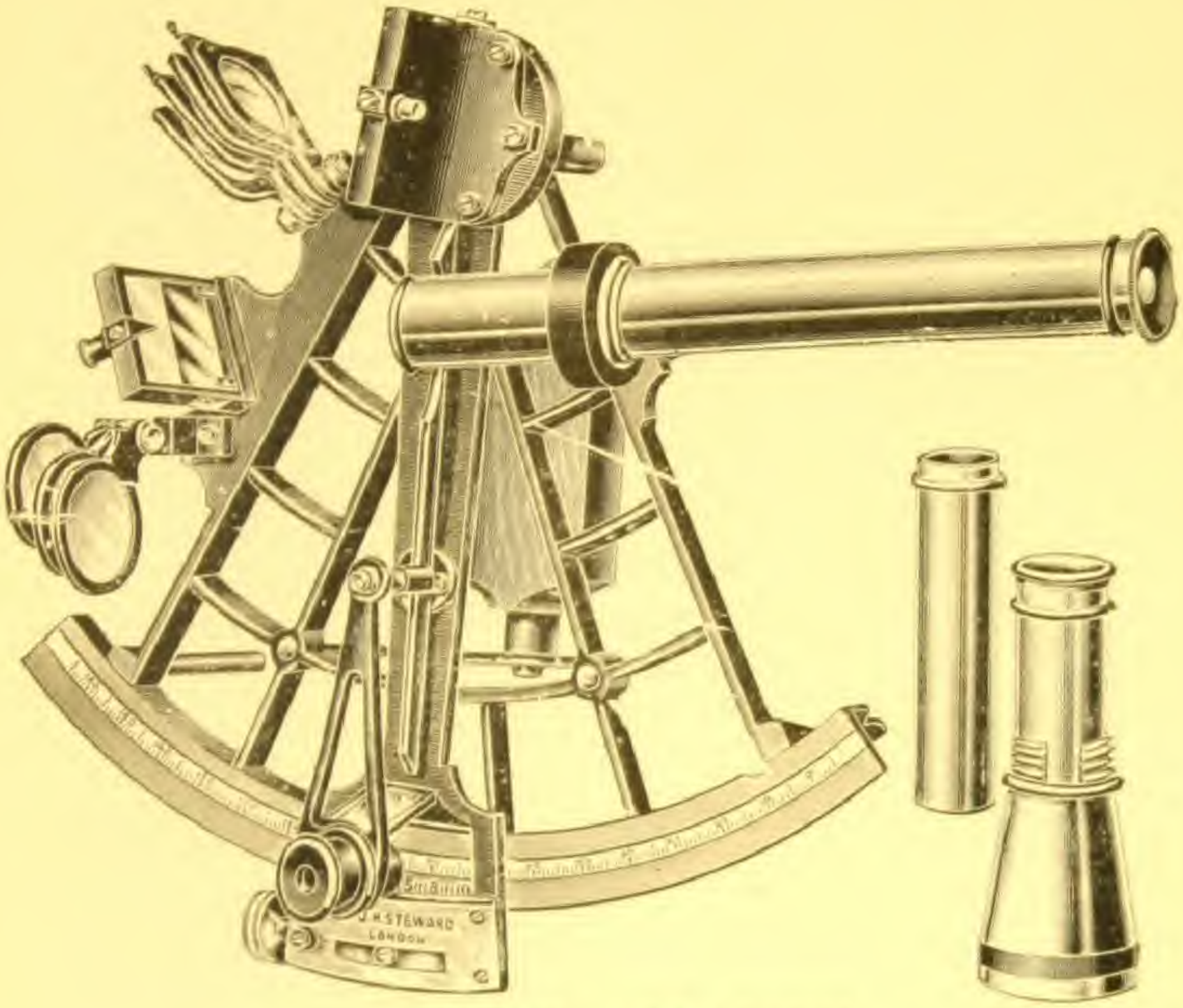


Fig. 102. "R.N." Sextant.

SM 356.—**The "R.N." Sextant,** with very rigid triangle pattern edge bar frame. Silver arc 7 inches radius with excess divisions, and reading by vernier to 10 seconds. Tangent screw slow motion to vernier arm with clamp. Ground glass diffuser to reading microscope. Large size mirrors with protecting caps to adjusting screws. Set of tinted fore and back shades. Inverting telescope with high and low power eye-pieces. Star telescope with wide angular aperture. Two shade heads for telescopes. Telescope and ring mount on rising piece with interrupted threads for quick adjustment. Large handle with ivorine memo tablet. Mahogany case with sunk handle and hooks, and lock and key. Class A., N.P.L. certificate.....Fig. 102 **£17 0 0**

SM 357.—**The "N.C." Sextant** with 3 circle frame. Silver arc 6½ inches radius with excess divisions and reading by vernier to 10 seconds. In other respects the sextant is similar to No. SM 356. Tangent screw slow motion to vernier with clamp. Mahogany case with sunk handle and hooks and lock and key. Class A., N.P.L. certificate... **£15 0 0**

SM 358.—**Mate's Sextant,** with 3 circle frame. Silver arc 6 inches radius reading by vernier to 10 seconds. Tangent screw slow motion to vernier arm with clamp. Set of fore and back tinted shades. Inverting telescope with high and low power eye-pieces. Star telescope. Magnifier. Mahogany case with lock and key. Class B., N.P.L. certificate **£11 0 0**

SEXTANTS—*Continued.*

SM 359.—**Sounding Sextant.** Silver arc 5 inches radius reading by vernier to 30 seconds. Tangent screw slow motion with clamp. Large size mirrors, but no tinted shades. Low power telescope with wide angular field and tinted shade. Mahogany case with lock and key. **£9 15 0**

SM 360.—**Booth Bubble Sextant,** and Artificial Horizon Combined, is an instrument of novel construction, specially designed for making rapid observations. Readings are taken from a graduated drum divided to 10 minute intervals and it is possible to estimate within 3 minutes. No telescope is required. Two tinted shades are so mounted that, by altering their angle, light can be regulated to the desired degree. The bubble is illuminated by an electric lamp, which also serves to illuminate the graduated drum for work at night..... **£36 0 0**

SM 361.—**Sextant Stand** made of bronzed metal with tribrach foot and levelling screws. Motions in azimuth and altitude. Counterpoise weights. Mahogany box **£13 10 0**

SM 362.—**Leather Overcase** to contain a sextant with its box, with shoulder strap. **£2 15 0**

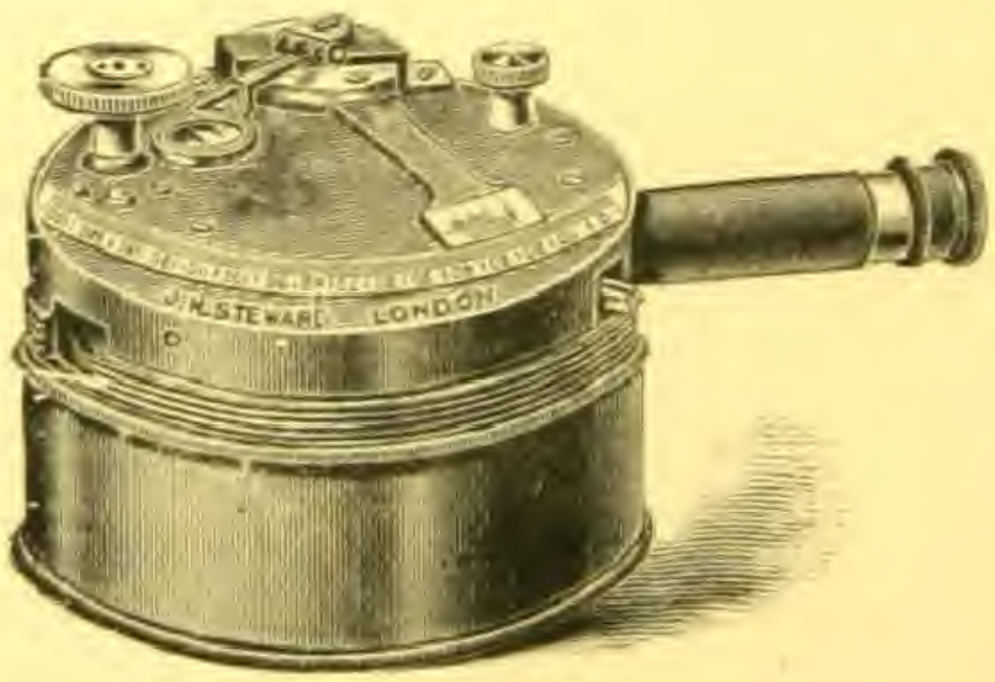


Fig. 103.

SM 363.—**Pocket or Box Sextant,** with arc divided on silver to measure angles up to within 120° and reading by vernier to 1 minute. Erecting telescope sight with sun tint and also a plain aperture sight. Tinted shades. Reading lens. When not in use the sextant is completely enclosed in a metal cover, which when reversed as in the illustration, serves as a handle. Size 3 × 1½ inches. Leather sling case. Fig. 103 **£7 10 0**

SM 364.....**ditto**.....without the telescope **6 10 0**

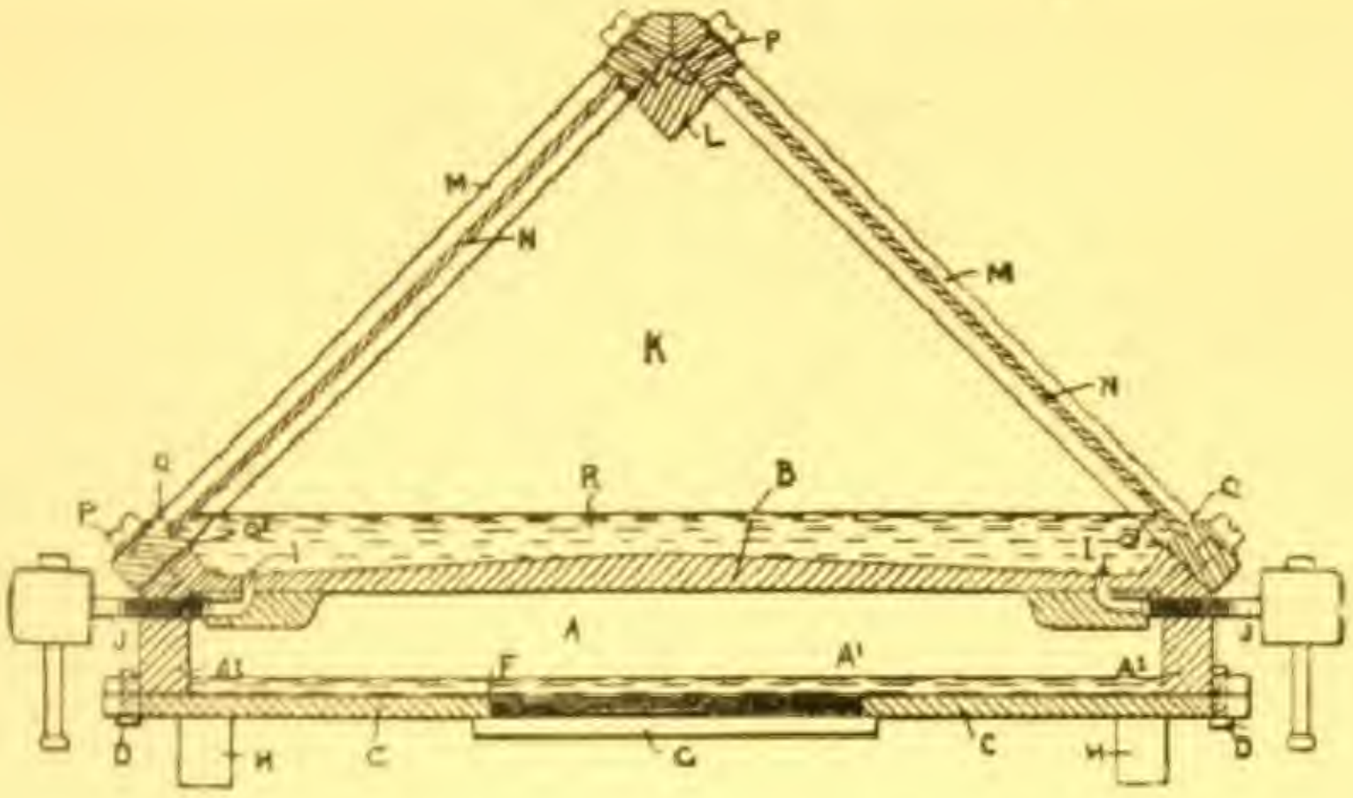


Fig. 104. "Shadbolt" Artificial Horizon.

The "Shadbolt" Artificial Horizon and mercury reservoir combined. The glass roof M is hermetically sealed to the base, and is so constructed that the mercury can be raised to such a height that almost its entire surface is within view, permitting the observation of very small angles of altitude. The base of the instrument forms a reservoir A, in which the mercury is stored when not in use. The mercury is never exposed to the air and cannot be lost even if the instrument is overturned. To prepare the instrument for use the valves J are opened, and the mercury is caused to flow into the upper chamber K until it reaches the level Q, where it comes into contact with the glass roof. The valves are then closed. The bottom B of the upper chamber slopes in opposite directions, and to return the mercury to the reservoir it is only necessary to open the valves J, when the mercury drains off. Any scum is left on the sloping bottom, and can be removed after unscrewing one side of the glass roof. There are no loose parts to get lost. Fig. 104.

SM 365.—**The "Shadbolt" Artificial Horizon,** with iron reservoir and mercury complete in mahogany box **£12 12 0**

SM 366.—**Artificial Mercurial Horizon,** plain pattern with iron trough and separate roof with parallel worked glasses. Iron bottle of mercury. Complete in case..... **£6 10 0**

SM 367.—**Glass Artificial Horizon**, consisting of an optically worked oblong black glass plate mounted in a bronzed brass frame with three levelling screws, and separate spirit level in box..... **£4 10 0**

SM 368.—.....**ditto**.....with parallel worked oblong silvered glass mirror. **£4 10 0**

SM 369.—.....**ditto**.....with unbreakable worked mirror of stainless steel **£6 6 0**

SM 370.—**Reversible Glass Artificial Horizon,** one surface consisting of an oblong optically worked black glass plate and the reverse surface a parallel worked silvered glass mirror. Metal mounts with three levelling screws and separate spirit level. In box **£7 10 0**

OPTICAL SQUARES AND CROSS STAFF.

Fig. 105.

Fig. 106.

Fig. 107.

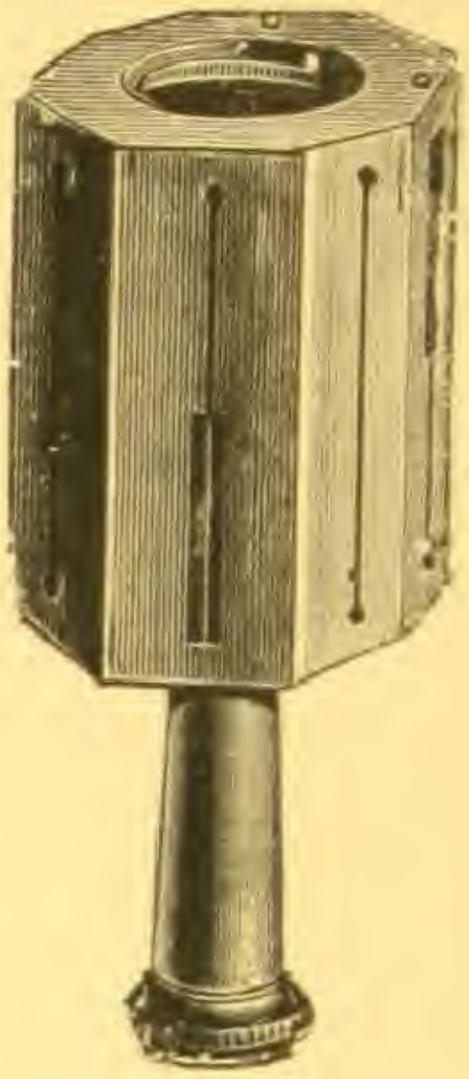


Fig. 108.

SM 371.—**Prismatic Optical Square**, consisting of a triangular prism in metal mounts with handle. The prism folds down flat for the pocket, when the polished surfaces are protected by metal shields. For more accurately locating the position on the ground a plummet can be attached to the handle..... Fig. 106 **£1 1 0**

SM 372.—**Prismatic Optical Square,** consisting of a five sided pentagonal prism mounted in metal with folding handle. This optical square is easier to manipulate than the triangular prism No. 371. It has a wider field of view and gives a more distinct and better illuminated, immovable image. A plummet can, when required, be attached to the handle. Fig. 107 **£1 5 0**

SM 373.—**Prismatic Optical Square and Cross Staff,** consisting of two triangular prisms of the same type as the prism in No. 371, mounted one above the other. With this combination of prisms it is possible to lay out a straight line to right and left of a point, and at the same time to lay out right angles in both directions. A plummet can be attached to the handle..... Fig. 105 **£1 15 0**

SM 374.—.....**ditto**.....consisting of two pentagonal prisms of the same type as the prism in No. 372 ..... **£2 12 6**

SM 375.—**Optical Square,** consisting of two plane mirrors mounted in a flat circular metal box about 2 inches diameter and arranged to reflect an angle of 90° **£1 10 0**

SM 376.—**Cross Staff Head,** octagonal pattern, 2½ inches diameter, for setting out angles of 45° and 90°. Socket for attaching to a wooden staff. Fig. 108 **12 6**

SURVEYING ANEROIDS.

The "Steward" Surveying Aneroids for measuring heights and for determining differences in gradients and rapidly laying down contour lines. In geological surveys the thickness of horizontal beds can be measured with sufficient accuracy, and the heights of a geological section across country can be determined if the distances are known (unknown distances can be measured with the Steward Pocket Telemeter, see page 47). These aneroids are also most useful to meteorologists for foretelling coming changes of weather.

As the greatest accuracy obtainable is required when surveying with an aneroid, instruments of the best quality only as supplied by J. H. Steward, Ltd., should be employed. These are constructed with carefully prepared metals and the movements are compensated so as not to be affected by temperature, and are thoroughly matured before being finally finished and adjusted.

Surveying aneroids are frequently made with the scale of altitudes divided into unequal parts, and in order to get the nearest approach to accuracy when measuring altitudes with them, it is necessary that the zero of the altitude scale should start from some fixed point on the barometrical scale, which is usually at 30 or 31 inches of pressure. Consequently, when measuring the difference of height between two stations it is necessary to take two readings; one at the first station, and another at the second station, deducting the lesser reading from the greater in order to arrive at the difference in height. This method causes delay and is a frequent source of error.

The Steward Surveying Aneroids are constructed on a different principle so that the scale of altitudes is divided into equal parts. The great advantage of this method is that the zero of the altitude scale can start from any point on the barometrical scale without introducing an error. This reduces the operation of measuring heights to the greatest simplicity, also considerable time is saved and sources of error eliminated.

To measure the height between two stations with a Steward Surveying Aneroid, the zero of the altitude scale is set opposite the index hand when at the first station. At the second station, the different position of the index hand brought about by the alteration in atmospherical pressure, will indicate the difference in height between the two stations. No calculation is necessary. If the maximum of accuracy is required, as when surveying, note should be taken of the air temperature at the time of observation, and should this be higher or lower than 50° Fahr., a correction should be made as explained in the paragraph marked "Temperature."

When selecting an aneroid, the altitude scale should exceed by about 2,000 feet, the highest altitude that is likely to be attained during the survey. This is necessary in order to allow sufficient margin for any change of barometrical pressure that may take place.

Thermometer. We do not recommend a thermometer to be attached to an aneroid. In that position it is of little use for survey purposes, and should it get broken the aneroid might be hopelessly ruined.

For taking the air temperature when measuring altitudes, a separate thermometer should be used. For this purpose the Swing Thermometer (SM 411, page 76), is very suitable. This is attached to a cord about three feet long, and whirled round until the mercury remains stationary. The reading will then give the air temperature.

Temperature. The Steward Surveying Aneroids are compensated so that their action is not affected by temperature, and they indicate the actual pressure of the atmosphere no matter what the temperature is. The atmosphere itself is, however, susceptible to changes of temperature, and its weight and density varies according to the temperature. The altitude scales of the Steward Surveying Aneroids are computed for an air temperature of 50° Fahr., and the height indicated would be correct for that temperature. Should the temperature of the air at the time of observation differ from 50° Fahr., a correction is necessary to arrive at the true altitude. For all practical purposes it is sufficient to add 2 per cent. to the observed altitude for every 10 degrees above 50° Fahr., or deduct 2 per cent. for every 10 degrees below 50° Fahr.

THE STEWARD HYPSOMETRIC ANEROID.

Fig. 109. The Hypsometric Aneroid, with altitude scale to 10,000 feet.

The scales of aneroids constructed in the usual way are of necessity irregularly divided, and to measure altitudes with accuracy various calculations have to be made. These operations, which cause delay and form a source of error, are eliminated by the special construction of the Hypsometric Aneroid, which permits the employment of an altitude scale, divided into equal parts, and forming a complete circle with an adjustable zero, the scale of ascents being to the left of zero and the scale of descents to the right. The operation of measuring an altitude is thus reduced to the greatest simplicity, the altitude being read direct from the altitude scale to as close as 5 feet without the application of a vernier, and without any calculations. By a special arrangement of the reading lens there is no error of parallax, and the movement being compensated, changes of temperature do not affect the reading.

The aneroid is carried in a specially designed sling case, and it can be set and used without removing it from the case. The altitude scale is rotated by rack and pinion, and when set, automatically locks so that it cannot shift in transit. A pointer on the circumference can be set to any reading for reference. A swing thermometer for ascertaining the temperature of the air is fitted in the leather case. The diameter of the dial is 3½ inches.

SM 377.—**Steward Hypsometric Aneroid,** with Swing Thermometer, in leather sling case. Altitude scale to 6,000 feet above sea level, divided to 10 feet and reading to 5 feet.....	**£12**	**10 0**
SM 378.—.....**ditto**.....10,000 feet, reading to 5 feet. Fig. 109	**12**	**15 0**
SM 379.—.....**ditto**.....15,000 feet, reading to 10 feet.	**13**	**10 0**
SM 380.—.....**ditto**.....20,000 feet, reading to 10 feet	**14**	**10 0**
SM 381.—.....**ditto**.....2,000 metres, reading to 2 metres	**12**	**10 0**
SM 382.—.....**ditto**.....3,000 metres, reading to 2 metres	**12**	**15 0**
SM 383.—.....**ditto**.....5,000 metres, reading to 5 metres	**13**	**10 0**
SM 384.—.....**ditto**.....6,000 metres, reading to 5 metres	**14**	**10 0**

THE STEWARD HYPSOMETRIC ANEROID.

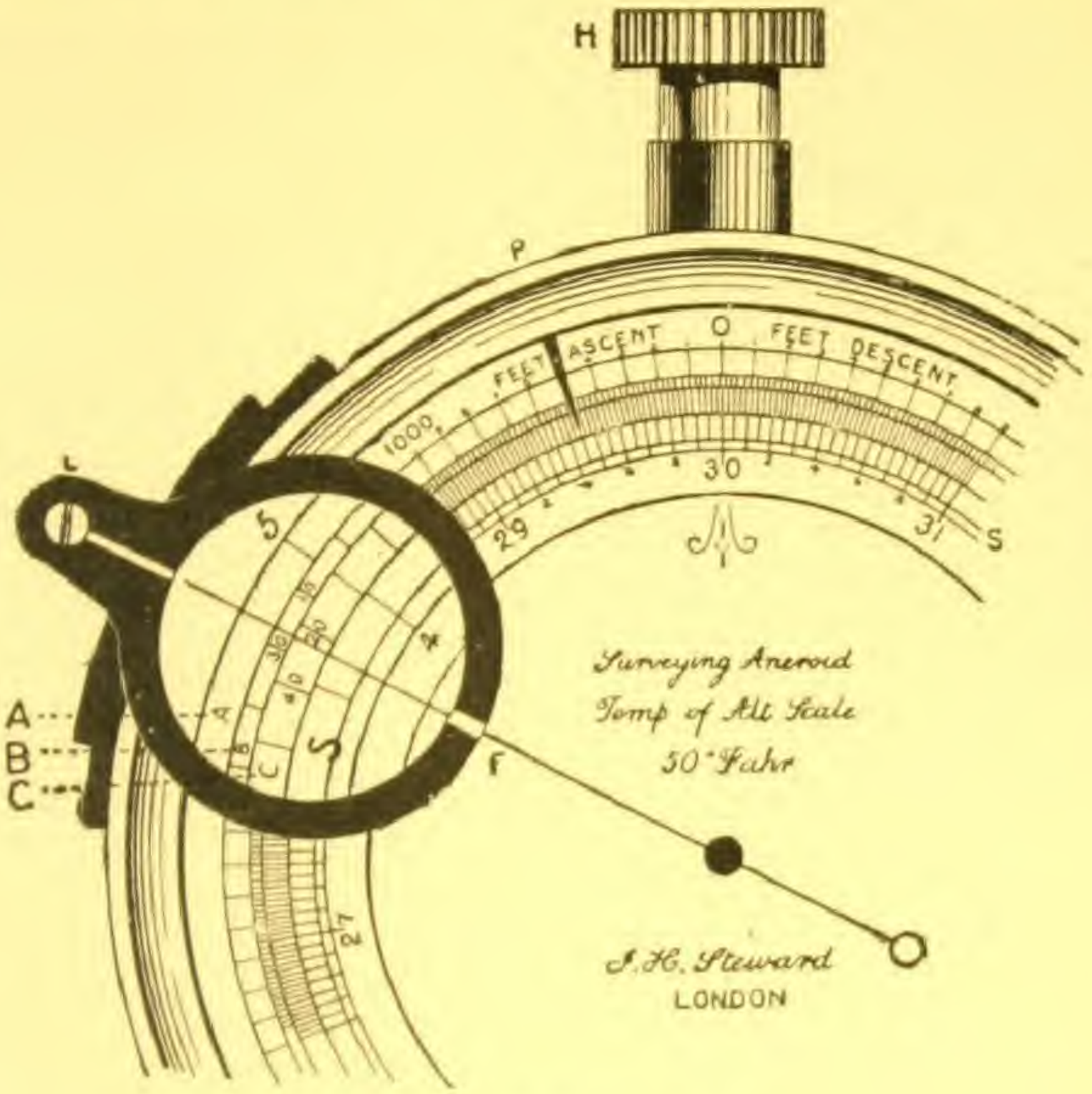


Fig. 110. Full size of dial.

Method of Reading the altitude scale of the Steward Hypsometric Aneroid described on page 73. The illustration Fig. 110 shows the full size of the dial, which is 3¼ inches diameter. The reading lens L (exaggerated in the illustration for clearness) which is attached to a movable ring, must be drawn out about an inch so that its rod can pass over the mount of the pinionH. Set the lens L over the index hand F and hold the aneroid at a convenient distance so that the white lines on the lens mount can be seen at the same time as the index hand is seen through the lens. Adjust the lens so that the index hand and the white lines on the lens mount appear in the same line as shown in the illustration. This will prevent any parallactic error. If an "ascent" has been made, the index hand F will have travelled over the black "ascent" scale to the left, and the altitude must be read from zero to the left. If a "descent" has been made the index hand will have travelled over the red "descent" scale to the right, and the altitude must be read from zero to the right. In the illustration it will be seen that the index hand F is to the left of zero, consequently it indicates an "ascent." Reading from zero to the left the index hand is seen to have passed 1,500 feet (1,000 feet is shown just outside the lens mount and 5 representing 500 is on the right-hand edge of the lens) and to stand half-way between the 20 line on circle C and the subdividing 30 line on circle B. The reading is therefore 1,525 feet. The numerals 10, 20, 30 and 40, shown in illustration under the lens, are not engraved on the instrument as it would overcrowd the scale. The movable pointer P can be set to any reading on the barometrical scale S for reference during the survey.

Directions for Use are sent out with each instrument.

J. H. Steward, Ltd., 406, Strand, and 457, West Strand, London, W.C.2.

SURVEYORS' ANEROIDS.

Fig. 111.

The "Steward" Surveying Aneroids are of the best quality and of the most approved construction, as described on page 72. The mounts are of bronzed brass and the scales are divided on silvered metal. The movement is compensated and is not affected by temperature. The altitude scale is divided into equal parts, and is movable, so that the zero can be set opposite the index at any altitude within the range of the scale without introducing error. No calculations are necessary when measuring heights. There are two sizes. The smaller size known as a Watch Aneroid is 2 inches diameter. Fig. 111 illustrates a watch aneroid with altitude scale of 10,000 feet divided to every 50 feet. The larger size is known as a Pocket Aneroid, and is 2¾ inches diameter. The larger size admits of a more open scale.

SM 385.—**Watch Aneroid,** with altitude scale of 6,000 feet, divided to every 50 feet, in snap morocco case **£4 5 0**
SM 386.—...**ditto**... 8,000 feet, divided to every 50 feet **4 7 6**
SM 387.—...**ditto**...10,000 feet ,, ,, 50 feet. Fig. 111 **4 10 0**
SM 388.—...**ditto**...12,000 feet ,, ,, 50 feet **4 15 0**
SM 389.—...**ditto**...15,000 feet ,, ,, 100 feet **5 0 0**
SM 390.—...**ditto**...20,000 feet ,, ,, 100 feet **5 10 0**

SM 391.—**Pocket Aneroid,** with altitude scale of 6,000 feet, divided to every 25 feet, in morocco snap case..... **£5 0 0**
SM 392.—...**ditto**... 8,000 feet, divided to every 25 feet **5 5 0**
SM 393.—...**ditto**...10,000 feet ,, ,, 25 feet **5 10 0**
SM 394.—...**ditto**...12,000 feet ,, ,, 50 feet **5 15 0**
SM 395.—...**ditto**...15,000 feet ,, ,, 100 feet **6 0 0**
SM 396.—...**ditto**...20,000 feet ,, ,, 100 feet **6 15 0**

Metric Scale. These Aneroids can be supplied with metric scales, the pressure scale being divided to millimetres, and the altitude scale to every 20 metres.

SM 397.—**Watch Aneroid,** with altitude scale of 2,000 metres, in morocco case..... **£4 5 0**
SM 398.—.....**ditto**.....altitude scale of 3,000 metres..... **4 10 0**
SM 399.—.....**ditto**..... ,, ,, 4,000 metres..... **4 15 0**
SM 400.—.....**ditto**..... ,, ,, 5,000 metres..... **5 0 0**
SM 401.—.....**ditto**..... ,, ,, 6,000 metres..... **5 10 0**

SM 402.—**Pocket Aneroid,** with altitude scale of 2,000 metres, in morocco case..... **£5 0 0**
SM 403.—.....**ditto**.....altitude scale of 3,000 metres..... **5 10 0**
SM 404.—.....**ditto**..... ,, ,, 4,000 metres..... **5 15 0**
SM 405.—.....**ditto**..... ,, ,, 5,000 metres..... **6 0 0**
SM 406.—.....**ditto**..... ,, ,, 6,000 metres..... **6 15 0**

SM 407.—**Solid Leather Case,** with shoulder strap, for any of the above aneroids **12 6**

OPEN RANGE ANEROIDS.

Fig. 112.

Open Range Surveying Aneroid for use in altitudes not exceeding 4,000 feet above sea level. This aneroid is of the same quality and construction as the surveyors' aneroids described on page 75. The mounts are of bronzed brass and the scales are divided on silvered metal. The movement is compensated and is not affected by changes of temperature. The altitude scale is movable and is divided into equal parts so that the zero can be set opposite the index hand at any altitude within the range of the scale without introducing errors and no calculations are necessary when measuring heights (see page 72). The scale is divided to every 10 feet up to 4,000 feet. Fig. 112.

SM 408.—**Watch Size,** 2 in. diameter, in snap case **£5 0 0**

SM 409.—**Pocket Size,** 2¾ in. diameter, with more open scale. **£5 15 0**

SM 410.—**Leather Sling Case** if required **12 6**

SM 411.—**Swing Thermometer** for taking air temperature as mentioned on page 72. Sheathed in metal with ring at end..... **10 6**

MERCURIAL MOUNTAIN BAROMETER.

SM 412.—**Mercurial Mountain Barometer** for determining altitudes from indications of barometrical pressure. The barometer is constructed on the Fortin principle with the pressure scale ranging from 32 down to 12 inches with a corresponding metric scale and is suitable for measuring altitudes up to 20,000 feet above sea level. It reads by vernier to 0·002 inch. A standard thermometer is attached. In use the barometer is suspended from a tripod and when carried it is enclosed in a leather case with shoulder strap and the tripod legs are strapped outside **£22 0 0**

BOILING POINT THERMOMETERS.

SM 413.—**Hypsometer or Boiling Point Thermometer** for ascertaining altitudes from the temperature of vapour given off from boiling water. This instrument is a useful check on the readings of an aneroid barometer, and consists of a thermometer with a finely divided scale graduated on its stem, and a portable apparatus with spirit lamp for boiling water, so arranged that the thermometer can be suspended above the water and completely enveloped in the steam.

The boiling apparatus with thermometer and wind screen complete packs into a leather sling case about 7 × 3 inches..... **£5 10 0**

SM 414.—Spare Thermometer **1 0 0**

BAROMETERS AND THERMOMETERS.

Fig. 113. Barograph.

The Barograph for making a record of fluctuations in barometrical pressure, showing the hour at which fluctuations take place. The instrument is left at a fixed station during a survey by aneroid or boiling point thermometer, and by comparing its readings with those obtained in the field at the same hour, altitudes can be computed with greater accuracy. There is a space on the chart paper for every day of the week, and unless ordered otherwise they are graduated from 28 to 31 inches of pressure for use at stations between sea level and 1,000 feet above. For use at higher altitudes than 1,000 feet, or in mines below sea level, the barograph can be specially adjusted, and the charts graduated to correspond at a small extra cost.

SM 415.—**Barograph** of best quality, compensated so as not to be affected by temperature, in oak or mahogany case 12 × 7 × 6 inches, with 52 weekly chart forms and bottle of ink..... **£11 11 0**

SM 416.—.....**ditto**.....encased in copper **11 11 0**

SM 417.—**Thermograph** for recording variations in temperature in the same way as the barograph records pressure, and showing what the temperature was at any hour. The instrument is encased in copper. Size 11 × 6 × 6 inches. With 52 weekly chart forms, with scale ranging from 0° to 100° Fahr.; and bottle of ink. (The range of scale can be varied to meet requirements) **£10 10 0**

SM 418.—**Standard Mercurial Barometer,** Fortin's principle, reading by vernier to ·01 inch and also ·1 millimetre. Attached thermometer with Fahrenheit and Centigrade scales..... **£10 10 0**

SM 419.—**Standard Maximum and Minimum Thermometer.** A pair of extra portable registering thermometers, divided on stem and with metal scales in mahogany box 6½ × 2½ × 1 inch..... **£3 15 0**

SM 420.—**Pocket Registering Maximum and Minimum Thermometer,** with Fahrenheit and Centigrade scales on ivory. Snap morocco case, 4 inches long **£2 2 0**

SM 421.—.....**ditto**.....6 inches long **2 5 0**

SM 422.—**Portable Mason's Wet and Dry Bulb Hygrometer,** divided on stem with metal scales, in mahogany box 7¾ × 3 × 2 inches, with N.P.L. Verification Certificate **£4 2 6**

SM 423.—**Whirling Hygrometer** in leather sling case..... **1 15 0**

SM 424.—**Swing Thermometer** for taking air temperature, encased in metal. Fahrenheit or Centigrade scale..... **10 6**

SM 425.—**8-inch Mercurial Thermometer** with tube sunk in boxwood, Fahrenheit and Centigrade scales **5 6**

SM 426.—.....**ditto**.....Fahrenheit scale only **3 0**

SM 427.—**Pocket Mercurial Thermometer** with tube sunk in 4 inch boxwood scale. Fahrenheit and Centigrade..... **5 6**

ANEMOMETERS OR AIR METERS.

For measuring the velocity of air currents and wind by recording the revolutions of a circular fan on a dial. For use in mines, tunnels, sewers, ventilators and public buildings, and for ascertaining the velocity and pressure of wind.

Fig. 114. Biram Anemometer.

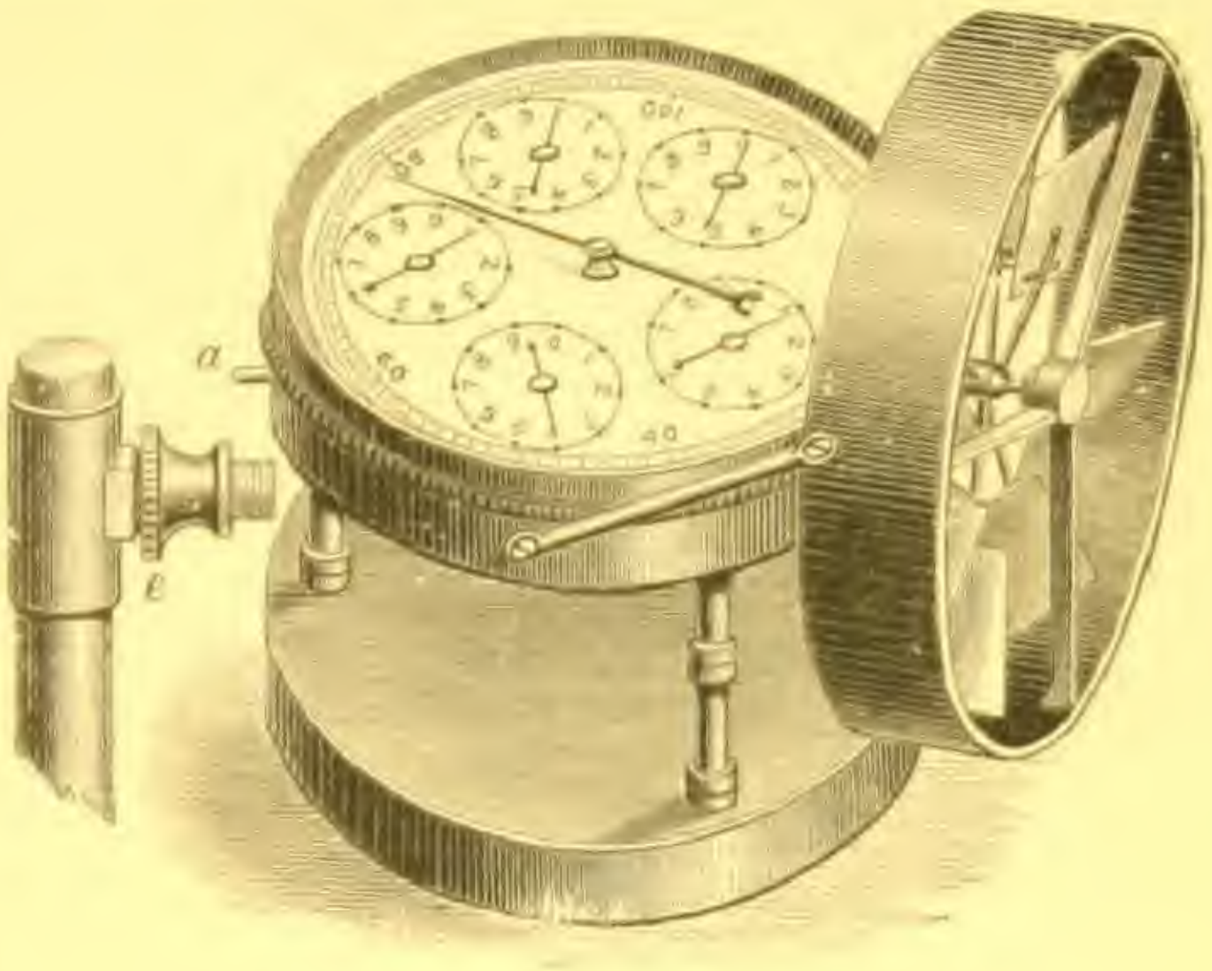


Fig. 115. Pedestal Anemometer.

SM 428.—**3-inch Biram Anemometer** for registering the velocity of any current of air up to a speed of 1,000 feet per minute. Dials divided to every foot up to 1,000 feet. Starting and stopping action, and attachment for setting hands back to zero. Suspensory ring and foot. In case with chart of corrections..... Fig. 114 **£5 15 0**

SM 429.—**4-inch**.....**ditto**.....for registering the velocity of air current up to a speed of 3,000 feet per minute. Dials divided to every foot up to 100,000 feet. In case with chart of corrections..... **£6 6 0**

SM 430.—**High Speed Anemometer** similar in design to Fig. 114, but specially constructed for registering very strong blast currents up to a velocity of 10,000 feet per minute. Dials divided to every 20 feet up to 200,000 feet. Starting and stopping action, and attachment for setting hands back to zero. Suspensory ring and foot. In case with chart of corrections. Note.—The lowest velocity this anemometer will register is 500 feet per minute..... **£8 15 0**

SM 431.—**Pedestal Anemometer** for registering the velocity of air currents up to 3,000 feet per minute. Dials divided to every foot up to 100,000 feet. Starting and stopping action, and attachment for setting hands back to zero. With chart of corrections in box about 3½ × 3½ inches. Fig. 115 **£6 6 0**

SM 432.—**Pocket Biram Anemometer** in the form of a hunter watch with hinged covers. Size 2 inches diameter by ¾ inch thick. Dials divided to every foot up to 1,000 feet. Starting and stopping action (not zero setting). Suspensory ring. With chart of corrections **£8 15 0**

RECORDING TIDE GAUGES.

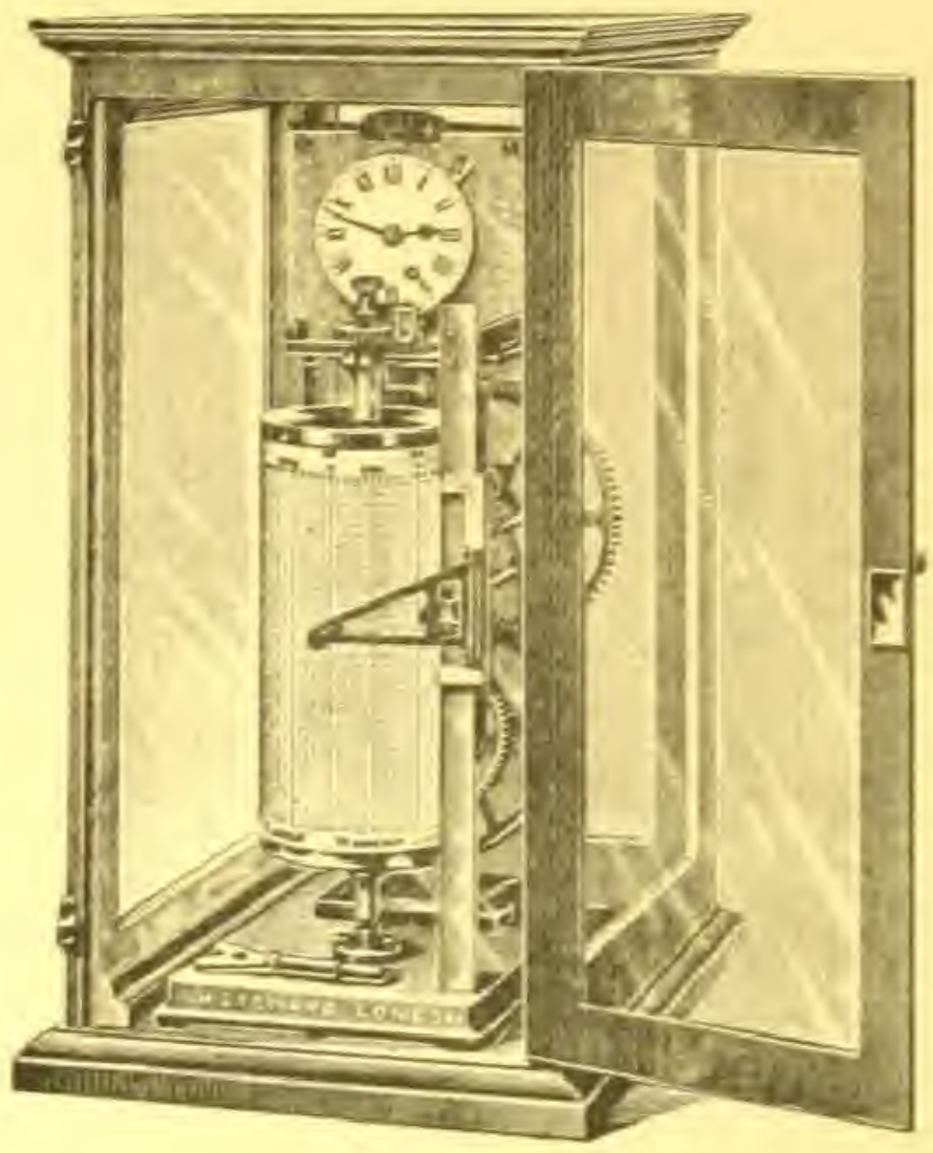


Fig. 116.

SM 433.—**Vertical Recording Tide Gauge** for automatically recording the rise and fall of tides, and the state of the tide at any time of the day, and alterations in the level of water in reservoirs, docks and canals.

A vertical drum 10 inches high is rotated once in seven days by clockwork, and carries a graduated paper chart with a space for each day of the week. The rise and fall of the water is recorded by a pen or pencil actuated by a float to which it is connected by a wire.

The entire instrument excepting the float is enclosed in a cabinet 2 ft. 4 ins. × 1 ft. 9 ins. × 1 ft. 4 ins. with glass door and sides, and can be set up at any convenient height above high water mark. With supply of 500 chart forms.

Fig. 116 **£110 0 0**

SM 434.—**Horizontal Recording Tide Gauge** with horizontal drum 26 inches long, and pendulum driving clock. Copper float and reduction gear to accommodate any specified rise and fall of tide. Drum 24 inches circumference giving a time scale of 1 inch per hour. Capacity 36 feet rise of tide. With 400 chart forms..... **£117 0 0**

SM 435.—**Cabinet** with hinged glass door for SM 434 ..... **16 0 0**

SM 436.—**Automatic Water Level Recorder** for use in rivers, reservoirs, etc. The apparatus is mounted on a cast iron pedestal, the total height being 5 feet. A vertical drum is driven by a clock with lever escapement and makes a complete revolution once in seven days. A paper chart is attached to the drum and the level of the water is traced on the chart by a pen connected with a copper float. The chart shows days and hours and the scale can be made to order with any range from 1 to 20 feet. A steel dome is provided to completely cover the apparatus and protect it from weather. The dome is removed for inspection of the chart.

£62 0 0

A float trunk of suitable diameter to allow the float to rise and fall with the water can be supplied, the price depending on the length of trunk required, which is governed by the height of the instrument above lowest low water mark.

When ordering a recorder it is necessary to state (1) The full range of tide that has to be recorded. (2) The distance from the lowest low water mark to the position where the recorder is to be fixed.

WATER CURRENT METER.

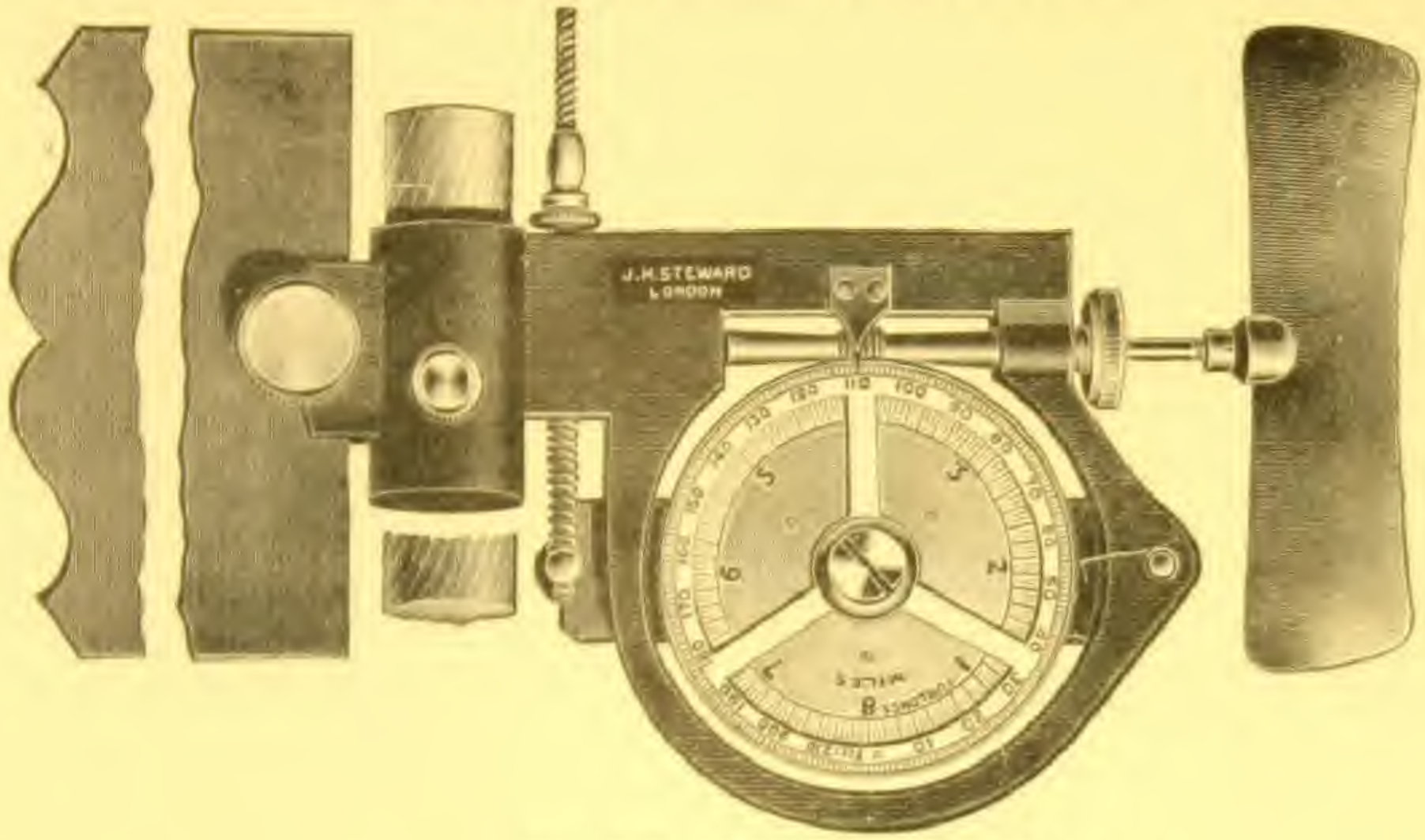


Fig. 117. Water Current Meter.

SM 437 —**Water Current Meter,** for use in rivers, streams and reservoirs, for ascertaining the rate of flow of the current or tide at different depths, or the volume of water discharged from a reservoir. The instrument is clamped to a pole of suitable length and submerged for a given time. A propeller drives round a horizontal spindle which is geared to counting wheels and is kept facing the current by a rudder. The counting wheels indicate the rate of flow by single feet up to 8 miles and can be thrown in and out of gear when submerged, by a cord running down the pole, or they can be kept constantly in gear by a screw stop. Fig. 117 **£8 10 0**

Electric Current Meters for determining the flow of water in rivers, harbours or sewers. Outfits constructed for different conditions of service. Estimates given on receipt of requirements.

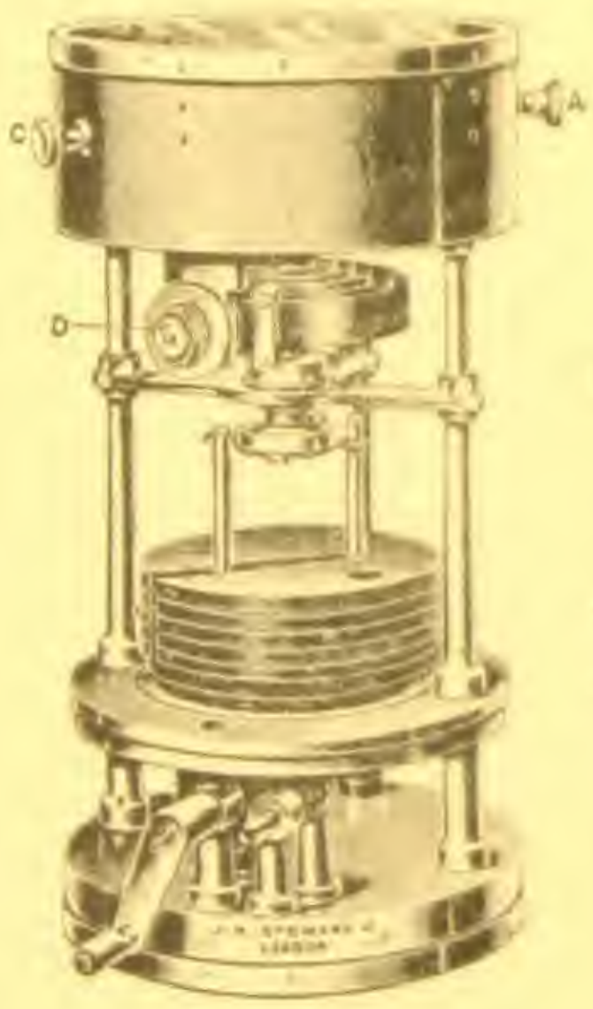


Fig. 118

THE DEELEY
FRICTION MACHINE.

For ascertaining easily and accurately the lubricating value of oils, also the oiliness or efficiency by determining the static friction between any desired metals. Fig. 118

SM 438 —"Simplex" Model **£50 0 0**

SM 438A.—"Laboratory" Model **85 0 0**

Descriptive pamphlet stating the principles on which the machine is based, with directions for testing oils, free on application.

HELIOGRAPH.

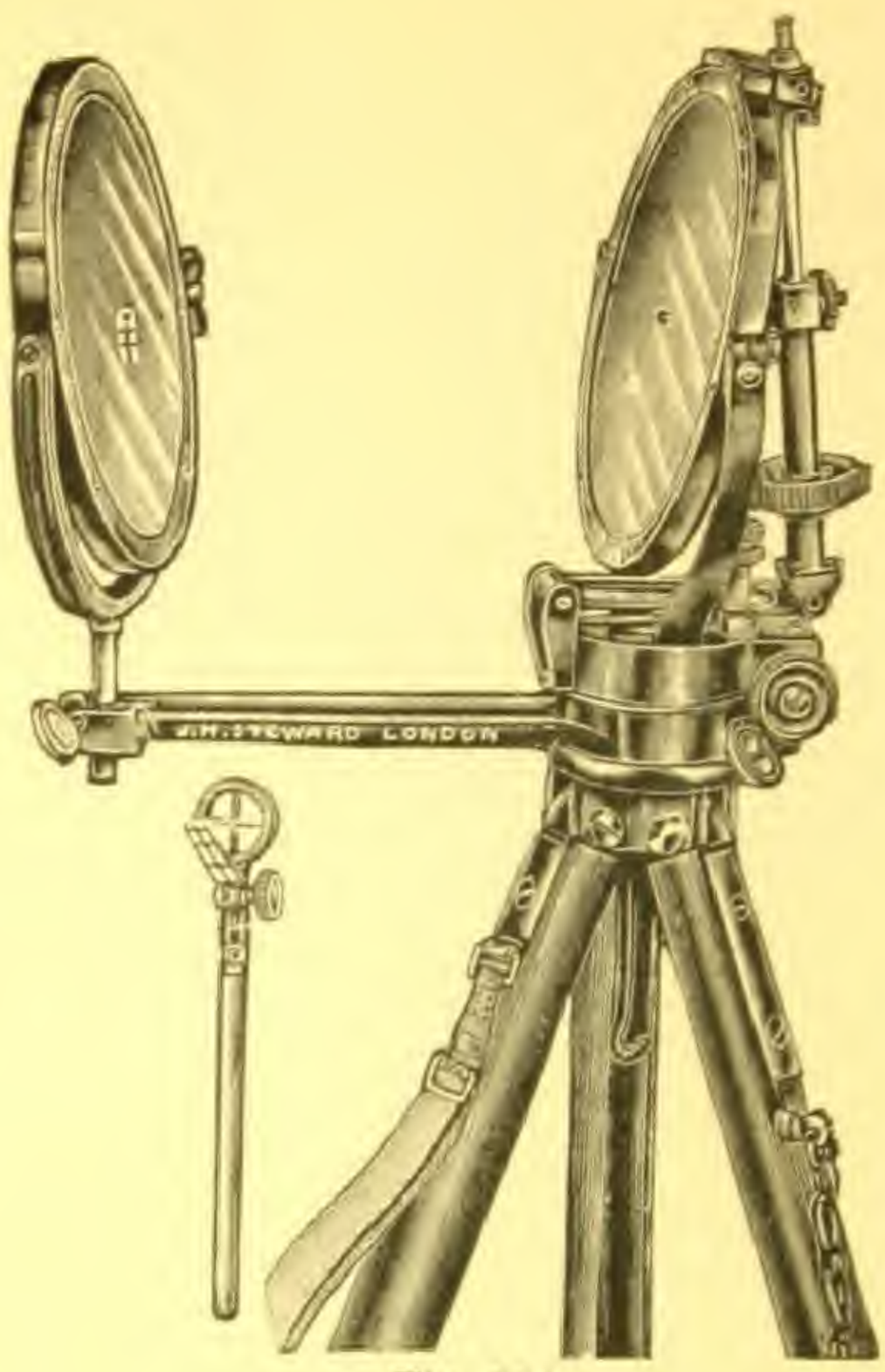


Fig. 119.

SM 439.—**Heliograph with 5-inch Mirrors** for throwing the sun's rays to a distant station for surveying observations and for signalling. Signalling mirror with Morse key for flashing signals, and fitted with horizontal and vertical slow motions for following the apparent motion of the sun from east to west and in altitude. Solid "Sight Arm" two Sighting Rods —one solid and the other with two joints—for rapidly elevating and depressing or getting a lateral motion. Duplex Mirror for use when the sun and distant station are in opposite directions. Leather case, with shoulder and waist straps for carrying the heliograph and containing spare mirror, spare parts, and an adjusting tool. Mahogany tripod with metal protecting cap, anchoring hook and carrying strap.

Fig. 119 **£14 14 0**

SM 440.—**Begbie Lamp,** a very powerful lamp burning mineral oil, suitable for observing a distant station at night, and for signalling by Morse Code, for which purpose the lamp is fitted with a louvre shutter worked by a signalling key. Sighting tube on top of lamp and threaded fitting underneath for attaching to the heliograph tripod. Box 1 ft. square with carrying handle..... **£4 10 0**

SM 441.—**Separate Tripod** for lamp, if required **3 15 0**

Fig. 120.

SM 442.—**The "Orilux" Lamp** with switch for constant light and dead beat key for Morse signalling. Although designed for military work, many thousands being used during the late Great War, the lamp is useful in many ways to the surveyor. The "Orilux" battery in combination with the "Orilux" bulb gives about 18 hours of intermittent light. In leather case to go on the belt.

Fig. 120 **£1 5 0**

SM 443.—"Orilux" re-fill battery **1/9**

SM 444.—"Orilux" Spare Bulb, **1/-**

MOUL'S HAND TACHOMETER.

Fig. 121.

Moul's Hand Tachometer is an instrument complete in itself and does not require the use of a watch or other time indicator. It furnishes the simplest method of ascertaining :—

(1) The revolution rate per minute (R.P.M.) of revolving objects such as engine shafts and spindles.

(2) The surface, cutting or periphery speeds in feet per minute (Ft. P.M.) of travelling objects such as fly wheels, pulleys, belts, drums, lathes, planers.

(3) Speed variations of a cyclic character (hunting).

(4) Belt slip and consequently waste of power.

The moment the spindle of the tachometer is held against the object under test, a reading is given independent of the direction of rotation. Revolution rate is instantaneously indicated on a dial, and the rate and extent of any change of speed is constantly indicated.

The action of the tachometer is due entirely to mechanical force, and its indications are unaffected by temperature or the presence of magnetic force.

There are seven patterns indicating a total range of speeds from 30 R.P.M. to 16,000 R.P.M. Each pattern has a different range of speeds as enumerated, so that the most suitable pattern for the purpose can be selected. Fig. 121.

The prices include a carrying case with the necessary accessories.

SM 445.—**C 1 Tachometer,**	Speed Range	60 to 2,400 R.P.M.	**£5 10 0**
SM 446.—**C 2 ditto**	,, ,,	100 to 4,000 R.P.M.	**5 10 0**
SM 447.—**C 3 ditto**	,, ,,	300 to 12,000 R.P.M.	**5 10 0**
SM 448.—**C 12 ditto**	,, ,,	30 to 4,000 R.P.M.	**6 10 0**
SM 449.—**C 14 ditto**	,, ,,	60 to 8,000 R.P.M.	**6 10 0**
SM 450.—**C 16 ditto**	,, ,,	120 to 16,000 R.P.M.	**6 10 0**
SM 451.—**C 22 ditto**	,, ,,	40 to 16,000 R.P.M.	**8 15 0**

MOUL'S TACHOCRON.

SM 452.—**Moul's Tachocron** is a pocket instrument consisting of an anti-magnetic chronometer combined with a revolution counter. It automatically gives positive readings of the revolution rate per minute or the linear speed in feet per minute. In cases where shaft centres are inaccessible, the revolution rate can be determined by using the measuring disc supplied with the instrument and converting the peripheral speed reading to the corresponding revolution rate. The reading unit=6 seconds. The watch is wound before each reading by simply pressing on a lever, which at the same time sets the counting mechanism to zero, doing away with the necessity of re-setting the counter after taking a test. The Tachocron is suitable for speeds up to 30,000 revolutions per minute. In case $4\frac{1}{2} \times 3\frac{1}{2} \times 1\frac{1}{2}$ inches..... **£3 15 0**

WATCHES—CHRONOGRAPHS—CHRONOMETERS.

Fig. 122.

Fig. 123.

Fig. 124.

SM 453.—**Waterproof Surveyor's Watch.** Half-chronometer movement—fully jewelled—compensated for temperature. Up and down indicator. Silver case, screwed together with waterproof joints, and waterproof cap to winding button. The watch can be immersed in water without sustaining injury ..... Fig. 122 **£55 0 0**

SM454.—**The "Bisley" Watch** as supplied to the National Rifle Association. A strong knockabout keyless watch. Solid nickel case..... **£2 2 0**

SM 455.—**The "Cbynite" Wrist Watch.** Black dial with luminous dot at each hour and luminous hands. Silver case..... **£3 15 0**

SM 456.—**The "Engineer" Chronograph Watch.** Lever escapement fully jewelled, compensated for temperature and non-magnetic. The large hand of chronograph records fifths of seconds and the small hand minutes to 30 minutes. Silver case. Starting, stopping and fly-back action ..... Fig. 123 **£15 15 0**

SM 457.—**"Service" Chronograph Watch,** similar in construction to SM 456, with second quality movement **£8 8 0**

SM 458.—.....**ditto**.....with oxidised steel case **5 17 6**

SM 458A.—**Split Seconds Stop Watch** for recording two periods of time. Stopping, starting and fly back actions. The large hands record fifths of seconds up to 60 seconds and the small hand minutes to 30 minutes. Nickel-plated case..... Fig. 124 **£7 10 0**

SM 459.—**30-minute Chronograph** with stopping, starting and fly back action. Records fifths of seconds to 60 seconds and minutes to 30 minutes. Nickel-plated case..... **2 2 0**

SM 460.—**30-minute Chronograph** with starting, stopping, fly back and follow-on action. Suitable for calculating the total length of time taken in carrying out an operation, allowing for interruptions. ... **£2 10 0**

SM 461.—**Yacht Timing Chronograph** showing seconds and minutes to elapse before the second gun. As each minute elapses a red disc vanishes from the dial up to 5 minutes. 2 inch dial graduated to seconds and fifths up to 60 seconds with bold numeral at every 5 seconds. Starting and set-back action. Nickel case **£3 5 0**

SM 462.—**Yacht Timing Chronograph.** 1¾ inch dial, graduated to seconds up to 60 seconds with bold numeral at every 5 seconds. Supplemental dial indicating minutes up to 5 minutes. Starting, stopping and fly-back action. Nickel case..... **£2 10 0**

SM 463.—**Marine Box Chronometer** with 2-day movement of best construction as supplied to the Admiralty. Fully jewelled, compensated for temperature, silvered metal dial with up and down indicator, mounted in box on universal gimbal. Outer guard case **£50 0 0**

SM 463A.....**ditto**.....with 8-day movement **65 0 0**

Fig. 125.

SUN DIALS.

If accurate time is required a pedestal sun-dial must be constructed specially for the locality in which it is to be used, and it is necessary to state the locality when ordering.

Horizontal Sundial with full instructions for fixing. Fig. 125.

SM 464.—10 inches diameter **£5 18 0**
SM 465.—12 ,, ,, **7 10 0**
SM 466.—15 ,, ,, **12 0 0**

SOLAR CHRONOMETER.

Fig. 126.

The "Ferguson" Solar Chronometer will give without calculation "Local Mean Time" or "Standard Time," and is of service for setting clocks in out of the way places. It is portable, and packs in a box for transport. In use the chronometer is placed in any place, in or out of doors, where the sun is shining. A level surface is not necessary, as the chronometer is complete in itself, and can be placed in position by its own indications, no magnetic compass or spirit level being required. An explanatory booklet accompanies each instrument.

SM 467.—**Model A. "Ferguson" Solar Chronometer,** 4 inches diameter. Adapted for use in any country between 60° North and 60° South latitude..... Fig. 126 **£5 15 0**
SM 468.—**Model B. "Ferguson" Solar Chronometer,** 6½ inches diameter. Adapted for use in any country **£6 15 0**
SM 469.—**Solar Compass Attachment,** which is an interesting addition, for use in connection with the Chronometer for ascertaining true North. **£1 10 0**

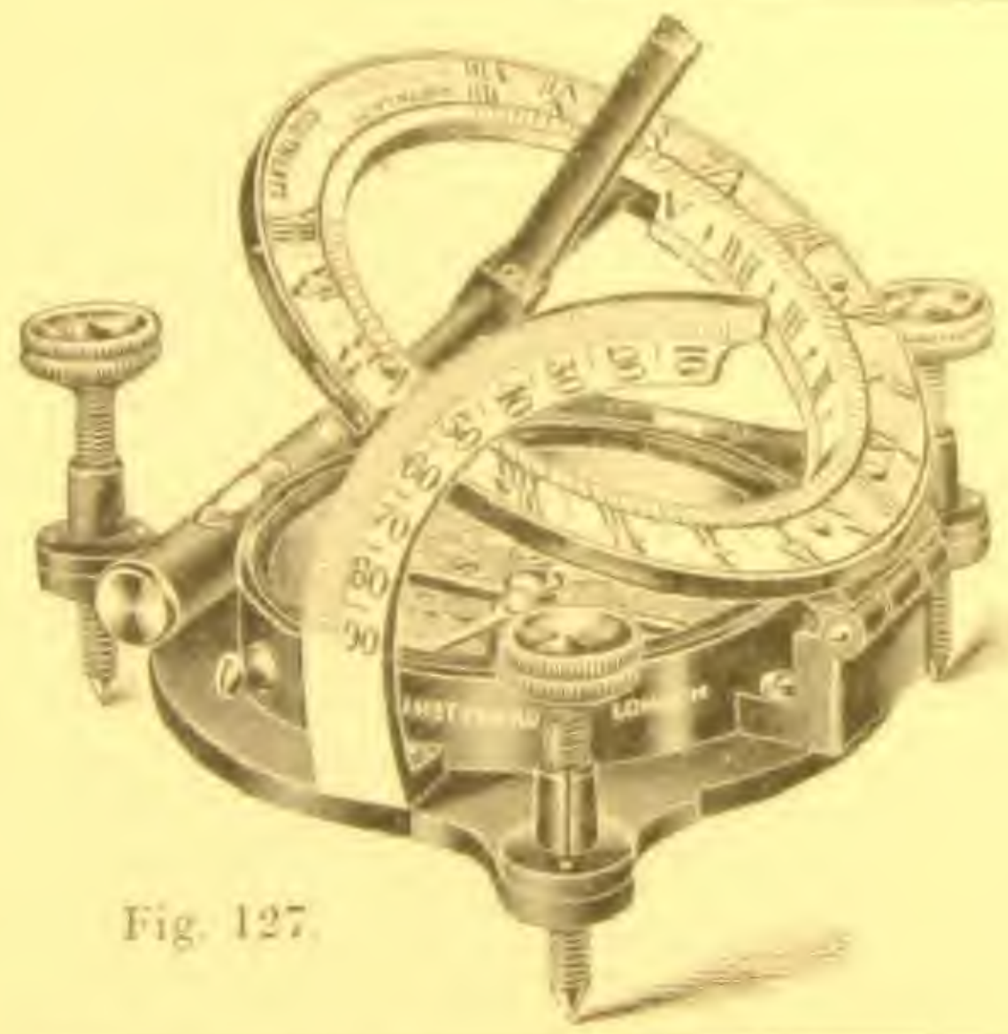


Fig. 127.

SM 470.—**Pocket Universal Sun-dial,** for use in any latitude, 2½ inches diameter, hour ring divided on face and edge for N. and S. latitudes with reversible gnomon. Folding latitude arc of degrees. Bar needle to compass with agate centre and stop and sliding weight for correcting magnetic dip, compass dial divided to every two degrees, with double set of cardinal points for N. and S latitudes, cross spirit levels and levelling screws. In case, with equations of time and instructions.
Fig. 127 **£6 10 0**

TRANSIT INSTRUMENTS.

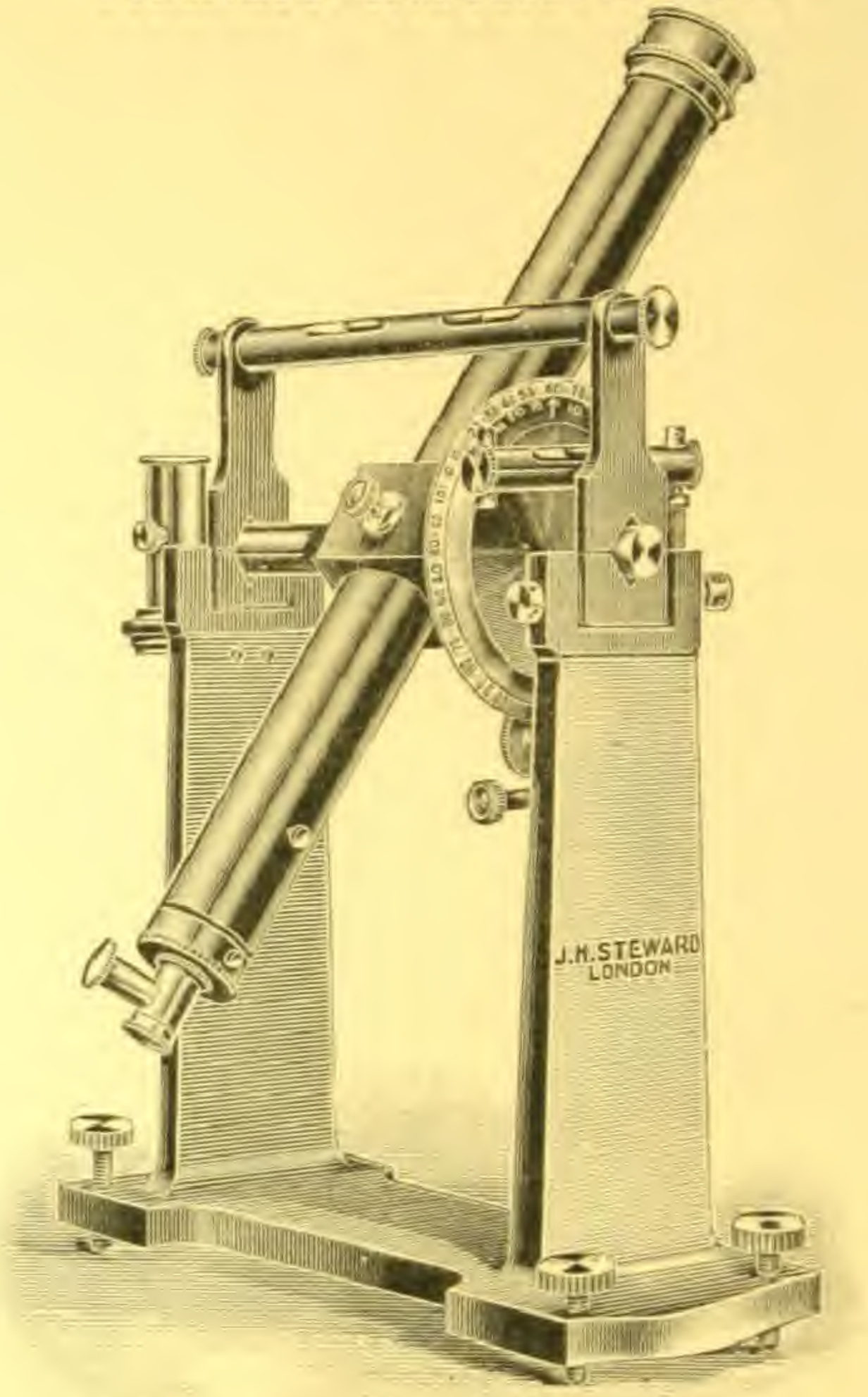


Fig. 128. The "Portable" Transit.

The "Portable" Transit, for obtaining correct local time and for determining the true right ascension of a star by observation of its passage across the celestial meridian. Reversible telescope, brass with bronze finish. Diagonal transit eye-piece with 1 horizontal and 5 equi-distant vertical lines. Altitude Circle, 5 inches in diameter, divided on brass and reading by vernier to 1 minute. Spirit level on vernier arm with antagonising screw adjustment, and graduated striding spirit-level to cross axis. Pierced axis with reflector and lamp for illuminating the wires at night time. Solid cast iron stand with meridional adjusting screws at base, and azimuthal adjustment to upright. Polished pine case to contain telescope, levels and apparatus..... Fig. 128.

SM 471.—**The "Portable" Transit,** telescope with object glass 1¾ inch diameter and 12 inches focal length..... **£30 0 0**

SM 472.—.....**ditto**.....telescope with object glass 1½ inch diameter and 15 inches focal length..... **£35 0 0**

SM 473.—.....**ditto**.....telescope with object glass 1¾ inch diameter and 18 inches focal length..... **£40 0 0**

Observatory Transits for fixing permanently in Observatories, constructed to meet requirements. Estimates given.

Astronomical Telescopes. Catalogue sent free on application.

STEREOGRAPHIC PROTRACTOR.

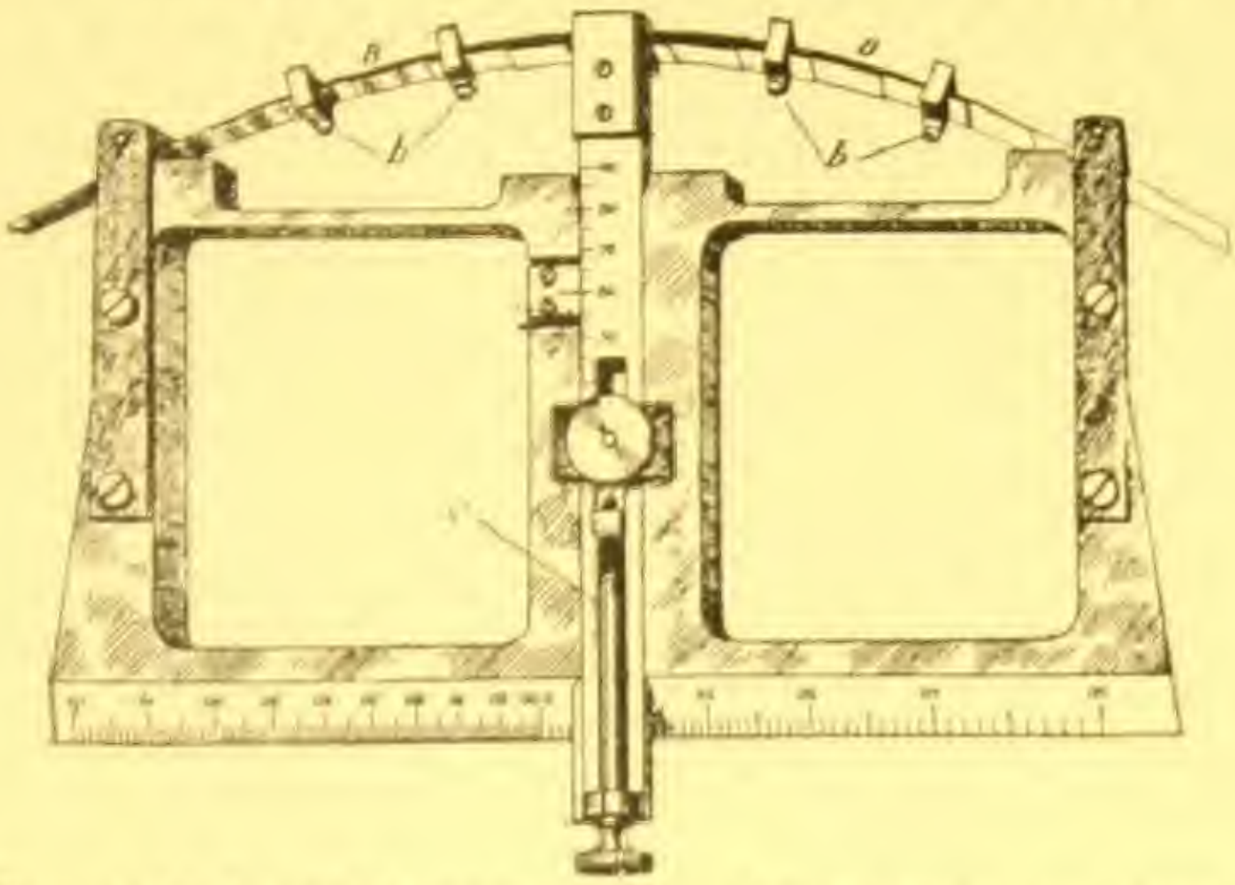


Fig. 129.

SM 474.—**The "H.S." Stereographic Protractor** for drawing circular arcs of large radii. Range of scale from 40° to 90°. Gun metal frame and multiple steel spring constructed to give regular curvature by bending. In case ..... Fig. 129 **£7 10 0**

THE "HERBERT SMITH" REFRACTOMETER.

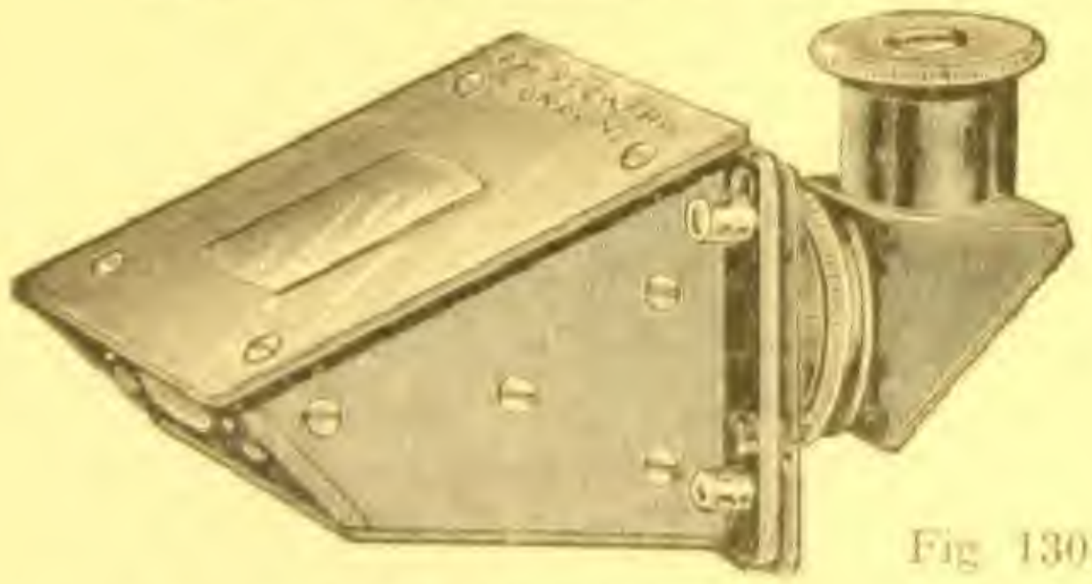


Fig. 130.

For determining Refractive Indices of Gem Stones and Minerals and approximately of Liquids and Fats, without calculation to ·01 and by estimation to ·001. The instrument will accommodate large or small specimens. Fig. 130

SM 475.—**Refractometer** in box, and descriptive pamphlet ... **£9 10 0**
SM 476.—Two bottles of necessary refracting liquid in box..... **15 0**

POCKET MAGNIFIERS.

Fig. 131.

Fig. 132.

SM 477.—**Aplanatic Compound Magnifier** for examining minerals and gems. Magnifying power ×10. Wide visual angle, flat field, great working distance. Nickel metal mounts..... Fig. 131 **£1 1 0**
SM 478.—**Doublet Lens** mounted in aluminium. Power of one lens ×5 and of the two combined ×8..... Fig. 132 **10 6**
SM 479.—**Single Lens**.....ditto.....power ×5 ..... **7 6**
SM 480.—**Scale of Hardness** for identifying stones by scratching, consisting of five fragments of minerals, of 6, 7, 8, 9 and 10 degrees of hardness in metal holders with leather purse..... **£1 10 0**

List of Instruments for use in the study of Mineralogy, Petrology and Crystallography, and for the detection of imitation gem stones free on application.

PROTRACTORS.

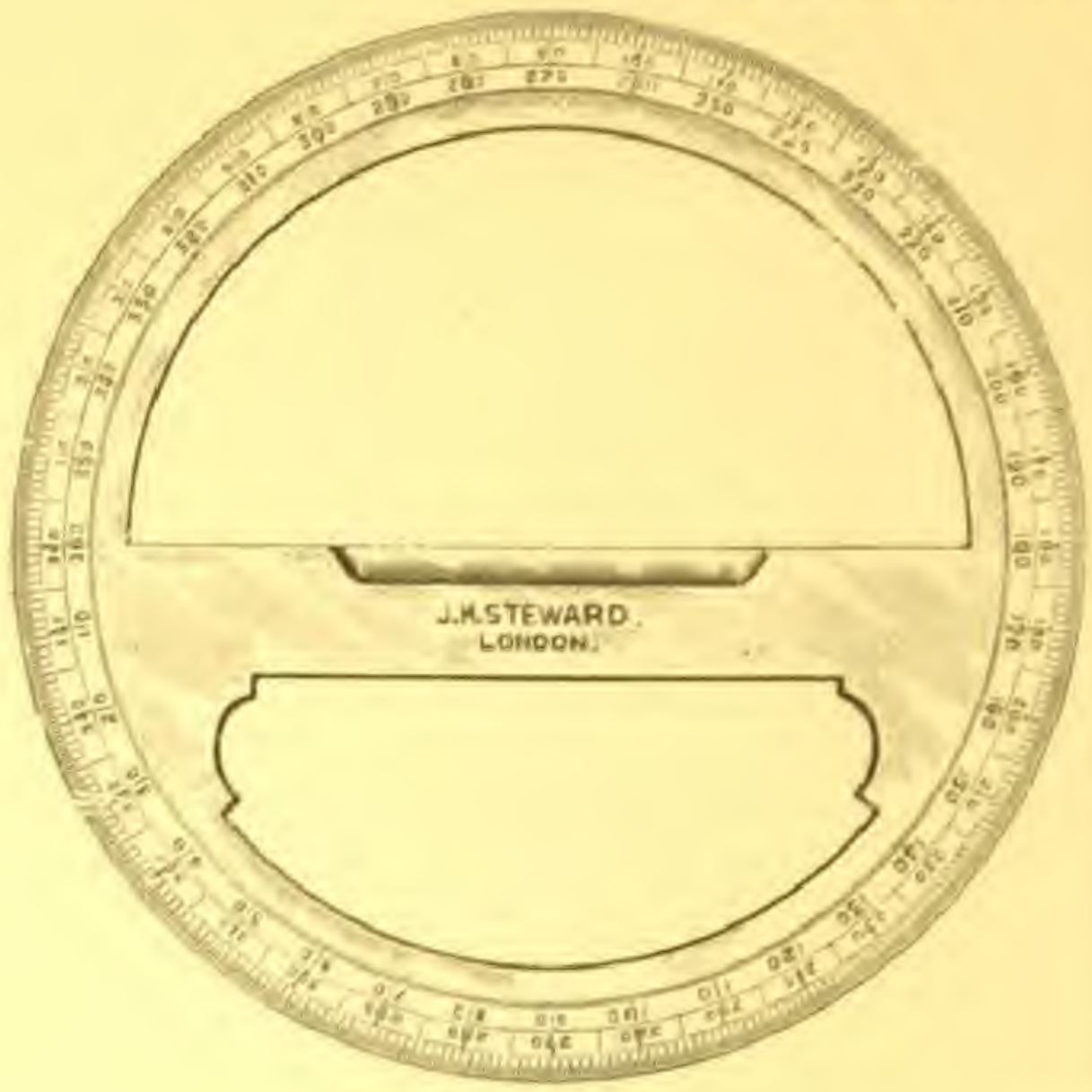


Fig. 151.
Circular Protractor.

Fig. 152.
Semi-Circular Protractor.

METAL PROTRACTORS.

SM 601.—**6-inch Brass Circular Protractor,** bevelled edge graduated to 360° in half degrees .....Fig. 151 **£1 5 0**

SM 602.—**8-inch**.....**Ditto** **1 15 0**

SM 603.—**Mahogany Case,** for 6-inch Circular Protractor **0 8 6**

SM 604.— **Ditto** ..... 8-inch ditto **0 12 6**

SM 605.—**6-inch Brass Semi-Circular Protractor,** bevelled edge, graduated to 180° in half degrees .....Fig. 152 **0 18 6**

SM 606.—**8-inch Brass**.....**Ditto** **1 5 6**

SM 607.—**Mahogany Case** for 6-inch Semi-circle Protractor ... **0 7 6**

SM 608.—.....**Ditto**.....for 8-inch.....**ditto** **0 9 6**

TRANSPARENT PROTRACTORS.

SM 609.—**Circular Transparent Protractors,** graduated to 360° in half degrees.

4-inch, 1/6 **6-inch, 3/-** **8-inch, 5/6**

SM 610.—**Semi-Circular Transparent Protractors,** graduated to 180° in half degrees.

4-inch, 1/- **6-inch, 2/6** **8-inch, 3/6**

RECTANGULAR PROTRACTORS.

Rectangular Protractors $6 \times 1\frac{1}{4}$ inches. Degrees of angle are protracted along the top and side bevelled edges and figured from 0 to 360. The bottom bevelled edge is divided to inches and 8ths, and on the face are 8 open divided scales, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$ and 1 inch to foot and a scale of chords. On the reverse are $\frac{1}{2}$ and 1 inch Diagonal Scales and 6 open divided scales, 30, 35, 40, 45, 50 and 60 to inch.

SM 611.—**Boxwood 2/6**..... SM 612.—**Ivory 13/6**

PROTRACTORS WITH VERNIERS.

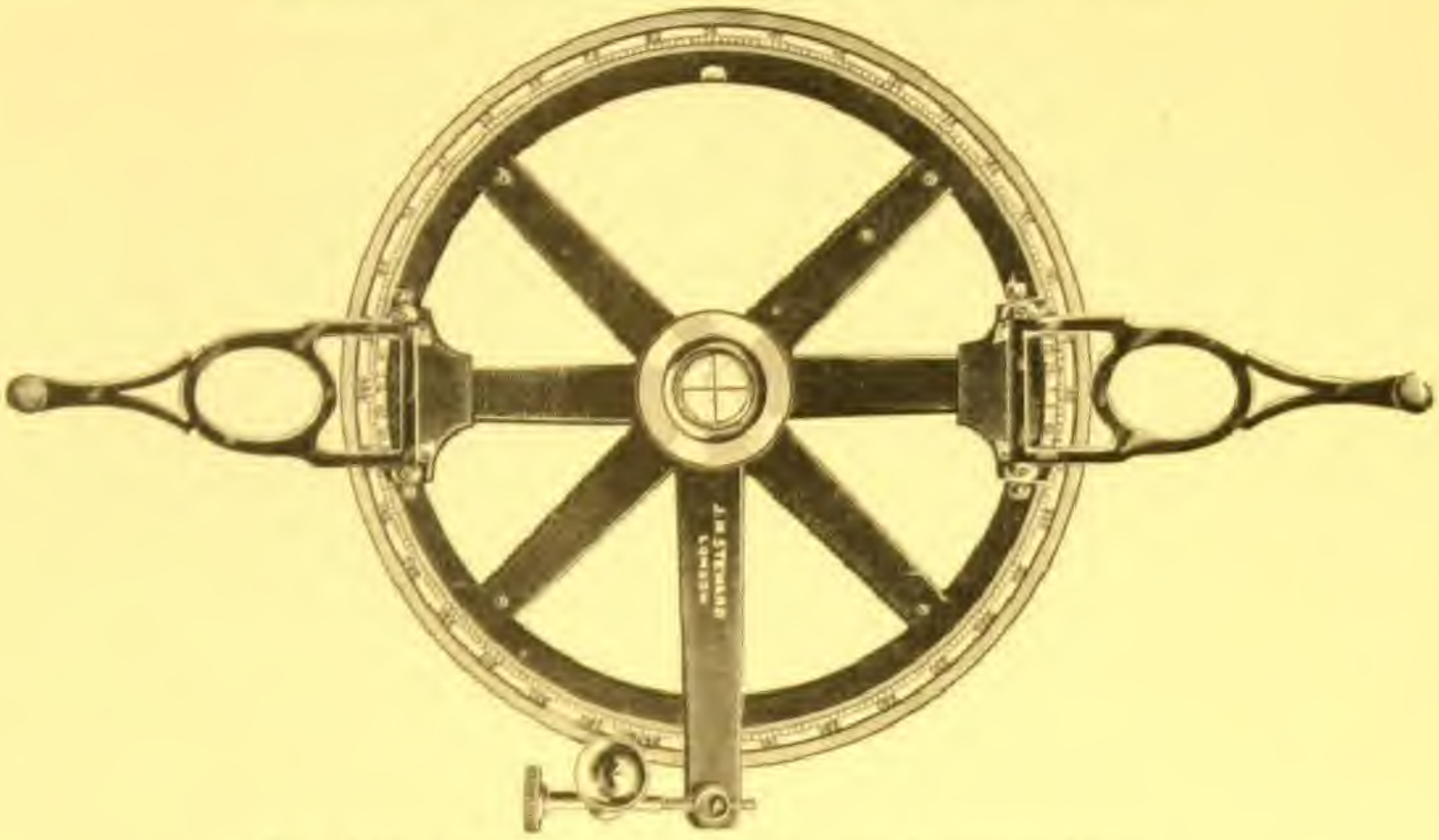


Fig. 153. Circular Protractor with Vernier Arms.

SM 613.—**6-inch Brass Circular Protractor** with scale engine divided on silver with two verniers reading to 1 minute. Two folding arms with springs to automatically lift points off paper. Tangent screw fine adjustment and clamp. Mahogany box.....Fig. 153 **£9 0 0**

SM 614.—**6-inch Brass Circular Protractor,** with one fixed radial arm with straight edge and marking point, divided on brass and reading to 1 minute by vernier. In mahogany box **£4 0 0**

STATION POINTERS.

SM 615.—**Station Pointer,** with 6-inch circle divided on silver to 360° with two verniers reading to 1 minute, tangent screw fine adjustments and clamps to movable arms, which are 12 inches long, with lengthening bars, making a total length of 24 inches. In mahogany box with magnifier **£15 15 0**

SM 616.—**Station Pointer,** with 6-inch circle, divided on brass, with two verniers reading to 1 minute but without tangent screws, arms 12-inches long. In mahogany box with magnifier..... **£10 15 0**

SM 617.—**Transparent Station Pointer** with 6-inch transparent celluloid circle divided to ½ degrees. Metal arms 14 inches long. In box **£2 17 6**

SM 618.—.....**Ditto**.....with transparent arms **£2 10 0**

PANTAGRAPHS AND EIDOGRAPHS.

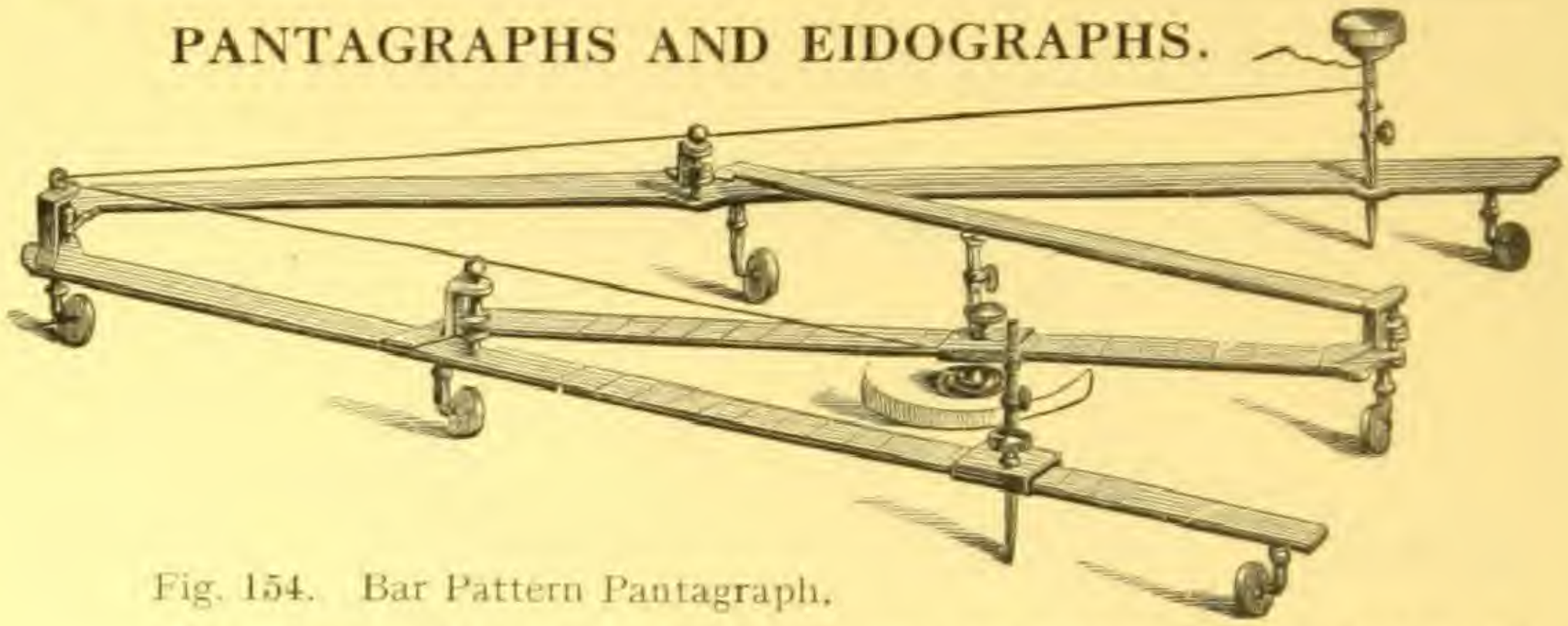


Fig. 154. Bar Pattern Pantagraph.

The Pantagraph, for reducing and enlarging plans. Scales of proportions engraved on arms. Sliding heads with sockets adapted to hold either pencil, tracer or fulcrum point, and fitted with clamps. Cord for raising pencil when it is required to pass over any part of the plan. The pantagraph is made in two patterns, the "bar pattern," as illustrated, Fig. 154, and the "tubular pattern." The arms of the latter are constructed of square brass tubes, and it is a lighter instrument and more free from friction and vibration than the "bar pattern" pantagraph.

BAR PATTERN PANTAGRAPHS.

SM 619.—**18-inch Bar Pattern Pantagraph,** brass, in mahogany box ..... Fig. 154 **£12 0 0**
SM 620.—**24-inch**.....**ditto** **13 0 0**
SM 621.—**30-inch**.....**ditto** **14 10 0**
SM 622.—**36-inch**.....**ditto** **16 0 0**
SM 623.—**42-inch**.....**ditto** **18 0 0**
SM 624.—**48-inch**.....**ditto** **21 0 0**

TUBULAR PATTERN PANTAGRAPHS.

SM 625.—**18-inch Tubular Pattern Pantagraph,** brass, in mahogany box **£14 0 0**
SM 626.—**24-inch**.....**ditto** **15 0 0**
SM 627.—**30-inch**.....**ditto** **18 0 0**
SM 628.—**36-inch**.....**ditto** **20 0 0**
SM 629.—**42-inch**.....**ditto** **22 0 0**
SM 630.—**48-inch**.....**ditto** **24 0 0**

SIMPLEX PANTAGRAPH.

SM 631.—**18-inch "Simplex" Pantagraph** for copying, reducing and enlarging. Drawings and plans can be reduced to sixteen different ratios or enlarged four times. The wood bars are furnished with brass fittings to give freedom of action. Complete with tracing and pencil points, and weighted fulcrum **£1 5 0**

EIDOGRAPHS.

The Eidograph, for enlarging and reducing plans and maps in various proportions and also for copying same. The arms and beam are of tubular construction with verniers to the scales. Adjustable ball bearings are fitted to the fulcrums to secure freedom of movement and the instrument can be well balanced by a series of balance weights. The Eidograph is packed in a hardwood case and is made in two sizes.

SM 632.—**30-inch size**..... **£33 0 0**
SM 633.—**36-inch size**..... **36 0 0**

PLANIMETERS.

The Planimeter is an instrument for mechanically measuring the area of a plane surface on a plan or map. The irregular outline of the area is followed by a tracing point causing motion to the mechanism, and the computation is arrived at by multiplying the reading recorded on a graduated wheel by a given factor.

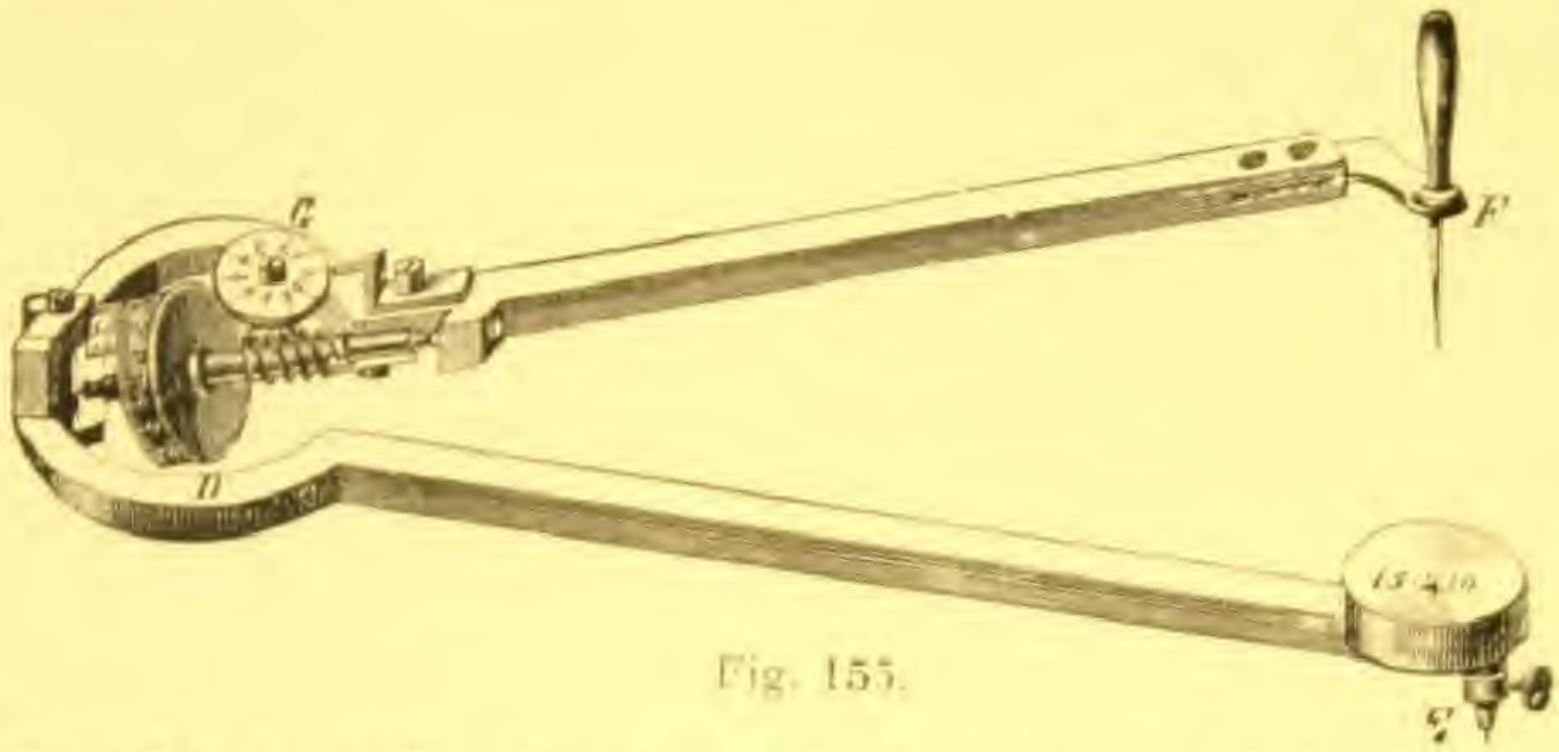


Fig. 155.

SM 634.—**Amsler's Planimeter,** made of electrum, with fixed index and counting disc reading in square inches only. Range, circle of 18-inches diameter. In case. With instructions.....Fig. 155 **£4 18 6**

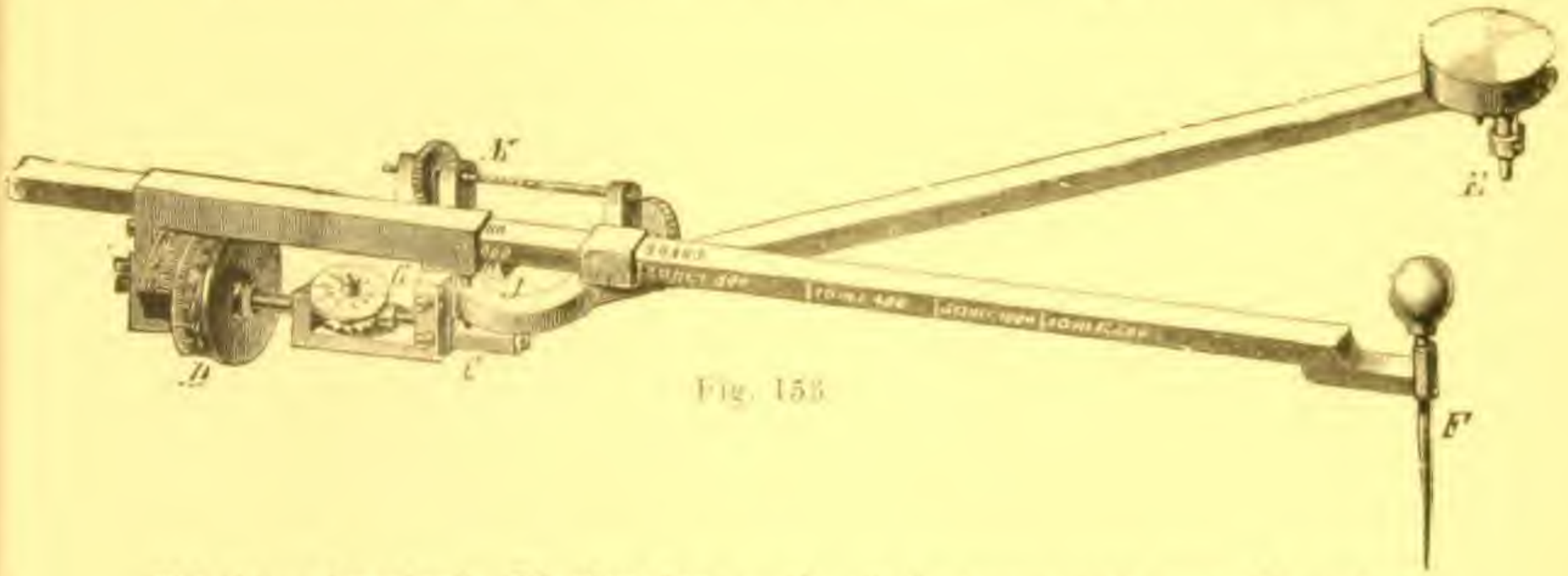


Fig. 156.

SM 635.—**Amsler's Planimeter,** made of electrum, with movable index which can be set to record measurements of areas in either of several units or scales:—square inches, square centimetres, square feet to scales of $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and 1-inch to the foot, acres to scales of $\frac{1}{500}$, $\frac{1}{2500}$ and 6-inches to the mile. Range, circle 24-inches diameter. In case. With instructions ..... Fig. 156 **£5 12 6**

SM 635A.—**Amsler's Planimeter,** similar to No. SM 635 but with the addition of gauge points for measuring the mean height of steam indicator diagrams. Range, circle of 25-inches diameter; length of diagrams 2 to 8-inches. In case. With instructions..... **£5 17 6**

COMPUTING SCALES.

SM 636.—**Computing Scale,** containing any two scales..... **£1 17 6**

SM 637.—**Universal Computing Scale,** containing eight scales, 1, 2, 3, 4, 5, 6 chains to an inch, 6-inches to the mile, and $\frac{1}{2500}$, complete in mahogany case **£4 0 0**

SM 638.—Extra scales made to fit same, **5/-** each.

SLIDE RULES.

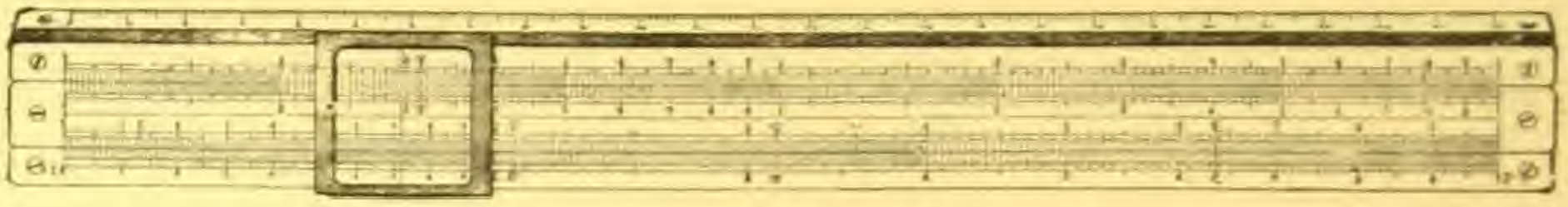


Fig. 157. "Standard" Slide Rule.

The "Standard" Slide Rule with white celluloid facings. Four logarithmic scales, A. B. C. & D. on the face, and on the reverse of the Slide, Scales of Sines, Tangents and Equal Parts. This Rule will enable calculations to be worked out in multiplication, division, proportion, combined multiplication and division, the finding of squares, square roots, cube and cube roots, the solution of plane triangles and trigonometrical computations, and the logarithms of numbers. Fig. 157.

SM 639.—**10-inch "Standard" Slide Rule** in case **£1 1 0**

SM 640.—**15-inch.....ditto** **2 2 0**

SM 641.—**20-inch.....ditto** **2 15 0**

SM 647.—**10-inch "Students" Slide Rule** with white celluloid facing with the A. B. C. & D. logarithmic scales as in the "Standard" Rules, but without scale of Sines and Tangents. In case..... **10 6**

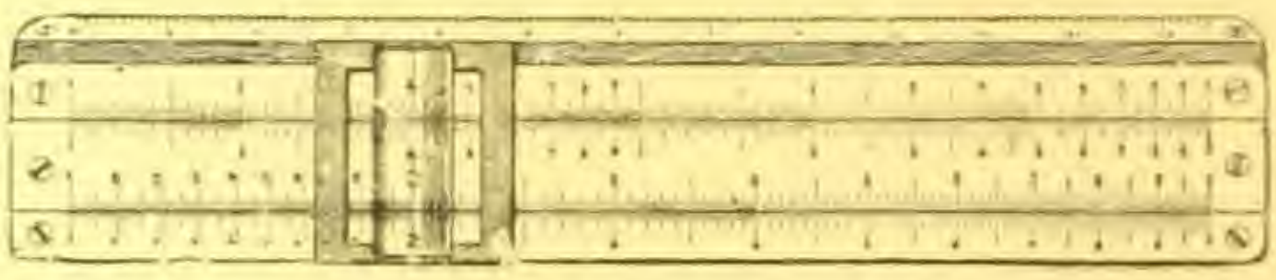


Fig. 158. "Pocket" Slide Rule.

SM 642.—**5-inch "Pocket" Standard Slide Rule** with white celluloid facings. Fully divided with the same number of divisions as No. SM 639. Owing to the closeness of the divisions they are difficult to read with the naked eye, but they are rendered quite distinct by means of a magnifying lens attached to the cursor. In case... Fig. 158 **£1 0 0**

SM 643.—**5-inch "Pocket" Slide Rule** with white celluloid facings. About half the divisions on SM 639 and Scale of Sines and Tangents, without magnifier. In case **12 6**

SM 644.—**4-inch "Lilliput" Pocket Slide Rule** with white celluloid facings. Open divided as SM 643. Suitable for pocket book. Size $\frac{5}{8}$-inch wide by $\frac{3}{16}$-inch thick. In case **8 6**

METAL SLIDE RULES.

SM 645.—**10-inch Metal Standard Slide Rule** constructed entirely of a light tough metal coated by a special process giving a durable surface. This rule is unaffected by climatic influences. In case..... **£1 1 0**

SM 646.—**10-inch.....ditto** .....with the addition of an inverted scale in centre of slide for solving Inverse Proportion, and simplifying calculations involving three factors. In case **£1 7 0**

SLIDE RULES—*Continued.*

Fig. 159. "Rietz" Slide Rule.

SM 648.—**10-inch "Rietz" Slide Rule**, with white celluloid facings containing the same scales as the Standard Slide Rule Fig. 157, and in addition two scales of cubes and equal parts on the face and a central inverted scale on the slide enabling reciprocals of any number to be found directly, and for easily solving Inverse Proportion. The central scale on the reverse of the slide is a scale of small angles, Sines and Tangents, less than 5° 40'. In case..... Fig. 159 **£1 4 0**

SM 649.—**20-inch**.....**ditto**.....In case **£4 0 0**

SM 650.—**10-inch "Precision" Slide Rule** with white celluloid facings. The logarithmic scales on this Rule are 20-inches, so that the precision of a 20-inch Rule is contained in a 10-inch length. On the faces of Slide and Rule are the A.B.C. and D. Scales, and the scale of Equal Parts. On the reverse of the Slide are the scales of Sines and Tangents, and on the edge of the Rule are scales of Cubes and Small Sine and Tangent angles. In case **£1 15 0**

SM 651.—**10-inch Electrical and Mechanical Engineer's Slide Rule** with white celluloid facings. In addition to the usual A. B. C. and D. Scales and Sines and Tangents, it carries a continuous Log-Log Scale 1·1 to 100,000 on the face, and underneath the Slide are two sets of logarithmic graduations for calculating efficiency of dynamos, output in kilowatts, effective horse-power, loss of potential, current strength, etc. In case **£1 11 6**

SM 652.—**20-inch**.....**ditto** **£4 0 0**

SM 653.—**10-inch K. & E. Log-Log Duplex Slide Rule,** has the two faces fully graduated on both sides. On the front face are the usual A. B. C. and D. logarithmic scales, with a scale of Sines in the centre of the Slide. On the reverse is a Log-Log Scale in three parts 1·01 to 22,000 for determining any root or power of any quantity up to 22,000 at one setting. Scale of Tangents and C and inverted C Scales arranged so that the tangent or co-tangent of any angle from 5° 43' to 84° 17' can be read or used as a factor. D. scale and scale of equal parts. There is a frameless cursor on the front and on the reverse, the index line encircling the rule and enabling coinciding points on either face to be found. The arrangement of the Scales simplifies calculations and reduces the number of operations for many problems involving three or more factors. In case and manual..... **£3 10 0**

SLIDE RULES—*Continued.*

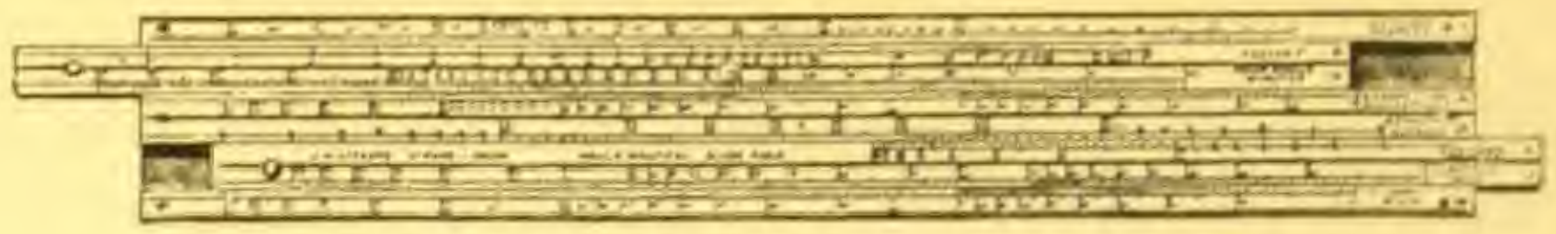


Fig. 160. Hall's Nautical Slide Rule.

SM 654.—**Hall's Nautical Slide Rule** divided on boxwood, 13 / 2-inches, with two sliding pieces—specially designed for "the reduction of an Ex-Meridian Sight" and "the correction of chronometer sights for error in Latitude" or "the correction of Ex-Meridian sight for error in Longitude." It also shows corresponding Departure and Longitude in any Latitude; the Dip for different heights of the eye and the values of trigonometrical ratios of angles. In addition it fulfils the purposes of an ordinary slide rule for multiplication, division and proportion, the solution of right-angles and plane triangles. In case with instructions ..... Fig. 160 **£1 7 6**

SM 655.—**10-inch Anido Slide Rule** with white celluloid facings. This rule will perform all the operations that can be performed with the "Standard" Slide Rule Fig. 157, and in addition it possesses the following exclusive features (1) Scales whereby any number can be raised to any power whether positive, negative, fractional or integral. (2) Greatly improved scales of sines and cosines. (3) Logarithms to base e. Also other devices to make the user independent of mathematical tables. In case and booklet of instructions **£1 10 0**

CURSORS FOR STANDARD SLIDE RULES.

For 5-inch and 10-inch Rules.

SM 656.—Framed.....**3/6** SM 657.—Frameless **4/6**

For 15-inch and 20-inch Rules.

SM 658.—Framed.....**5/6** SM 659.—Frameless **6/6**

Magnifying Lens cemented on cursors of Standard Slide Rules.

SM 660.—5-inch and 10-inch.....**3/6** SM 661.—15-inch and 20-inch...**5/6**

SM 662.—**Manual of Instruction for the Slide Rule.** By CHARLES N. PICKWORTH, WHSC. **Contents**. Mechanical and Mathematical Principles of Slide Rule. Multiplication. Division. Continued Multiplication and Division. Reciprocals. Proportions. Squares and Square Roots. Cubes and Cube Roots. Methods of obtaining Power and Roots. Continued Operations. Trigonometrical Applications. Stiff Cloth...**3/6**

Fig. 161. "Halden" Calculex.

SM 663.—**The "Halden" Calculex** is a slide rule in circular form and consists of two dials back to back, each dial being protected by a rotating glass on which a "cursor" line is engraved. The centre of the dials and either glass can be rotated independently of each other. The front dial contains two logarithmic scales for multiplication, division, proportion, etc., and a scale of square roots. The back dial contains scales of angles and cube roots and a scale for inverse proportion. Size of calculex, 2¼-inches diameter by ¼-inch thick. In case, with booklet. Fig. 161 **£1 1 0**

CALCULATING CIRCLES.

Fig 162.

The Fowler Watch-form Calculators have two rotating dials, 2½ inches diameter, fitted back to back, on which logarithmic and special scales are marked. On each glass is a fixed index line and the front dial is provided with a rotating cursor line. The two types H and RX are described below—Fig. 162 represents the Front Dial of Type H and also the Back Dial of Type RX.

SM 664.—**Type H Fowler Calculator.** Front Dial with six scales for calculations involving multiplication and division, logarithms, reciprocals, square roots, sines and tangents of angles. On the Back Dial is a scale of cubes and cube roots. In leather case with instructions **£0 18 0**

SM 665.—**Type RX Fowler Calculator.** Front Dial comprises an outer scale in a complete circle equivalent in length to 6·7-inches, for multiplication and division and a similar log scale 30-inches long on six inner circles for use when a greater degree of accuracy is required. The Back Dial is similar to the Front Dial of Type H, and gives squares, roots, sines, tangents, logs and reciprocals. In leather case with instructions..... **£0 18 0**

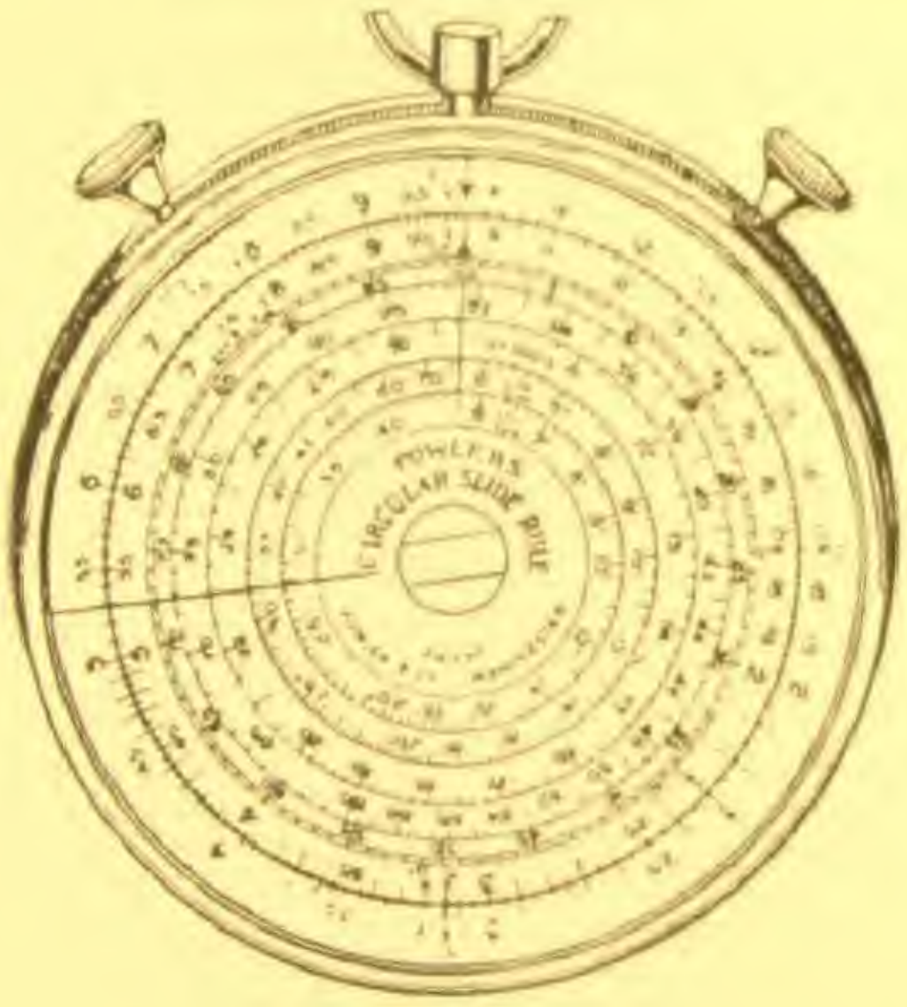


Fig 163

The Fowler Circular Slide Rule. Designed with the scales to read edge to edge after the manner of an ordinary straight slide rule. The two dials which are 2½-inches diameter are fitted back to back in a similar way to the Fowler Calculators. Fig 163 illustrates the Front Dial and is used for multiplication, division, squares, square roots, proportion, percentages, fractions to decimals, decimals to fractions, logarithms, natural or log tangents, sines and log sines for angles 6° to 90°, gauge points, etc. The Back Dial is used for cubes and cube roots, sines and log sines for small angles 35′ to 5° 45′ and reciprocals.

SM 666.—**Fowler Circular Slide Rule** in leather case with instructions **£0 18 0**

SLIDE RULES—*Continued.*

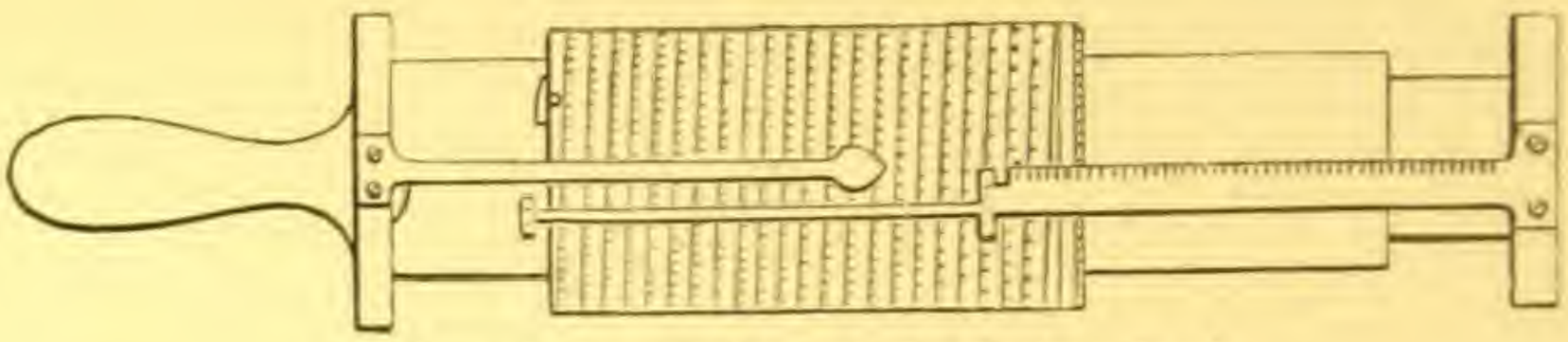


Fig. 164. Fuller's Calculating Scale.

SM 667.—**Fuller's Spiral Calculating Scale** consists of a cylinder, which can be moved up or down and around an inner cylinder and is provided with indices. The logarithmic scale is arranged spirally on the outer cylinder and is the equivalent of a straight scale of 500-inches rendering it possible to obtain four figures in a result. Besides the operations of multiplication and division, results requiring the reciprocals, powers, roots or logarithms of numbers can be obtained. The instrument is contained in a wooden case which also acts as a support when the instrument is in use. Complete with instructions. Fig 164. **£6 10 0**

SM 668.—**Fuller's Spiral Calculating Scale** as No. SM 667 with the addition of a scale of Sines on the fixed cylinder for the solution of triangles. In case, with instructions..... **£7 10 0**

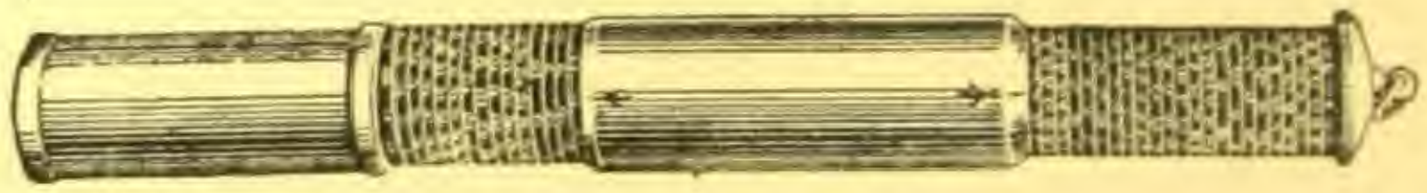


Fig. 165. Otis King Calculator.

The Otis King Calculator consisting of two metal cylinders on which spiral logarithmic scales are mounted. The smaller cylinder is free to slide and rotate within the larger cylinder, on which there is an adjustable tubular cursor. The size of the calculator when closed is 6 × 1¼-inches and it extends to 10-inches. The length of the spiral scale is 66-inches, giving very open divisions. There are two models. Fig. 165.

SM 669.—**Model K. Otis King Calculator** for Multiplication, Division, Proportion and Percentages, with black cursor. In case with instructions **£1 2 6**

SM 670.—**Model L.....ditto**.....which gives in addition Powers and Roots of numbers **£1 2 6**

Fig. 166. **£7 10 0.**

SM 671.—**8-inch Oak Case,** bound with metal, with lift-out tray containing the following first grade English electrum instruments with nut and bolt needle points.
6-inch Compass, double jointed, with sector head, jointed pen and pencil legs with hinged nib to pen, and lengthening bar,
5-inch Hair Divider with sector head.
Bow Pen and Bow Pencil with sector heads and double knee joints.
Set of 3 spring Bows, pen, pencil and divider,
6-inch Drawing Pen with square on ivory handle and hinged nib,
4½-inch Drawing Pen with round ivory handle and solid nib,
Pricker with ivory handle and spare needles,
Combined adjusting Key, Knife and Lead File .....Fig. 166 **£7 10 0**

SM 672.—**9-inch Oak Case** bound with metal, with lift-out tray containing first grade English electrum instruments as in No. SM 671, with the addition of a 6-inch Proportional Compass fully divided with scales of Lines, Linear Ratios, Plans and Solids **£9 10 0**

SM 673.—**10-inch Oak Case** bound with metal, with lift-out tray containing first grade English electrum instruments as in No. SM 671, with the addition of a 6-inch Proportional Compass as in No. SM 672, and a Beam Compass (No. SM 714, page 104), with needle points **£11 0 0**

Cases of Instruments made up to meet individual requirements.

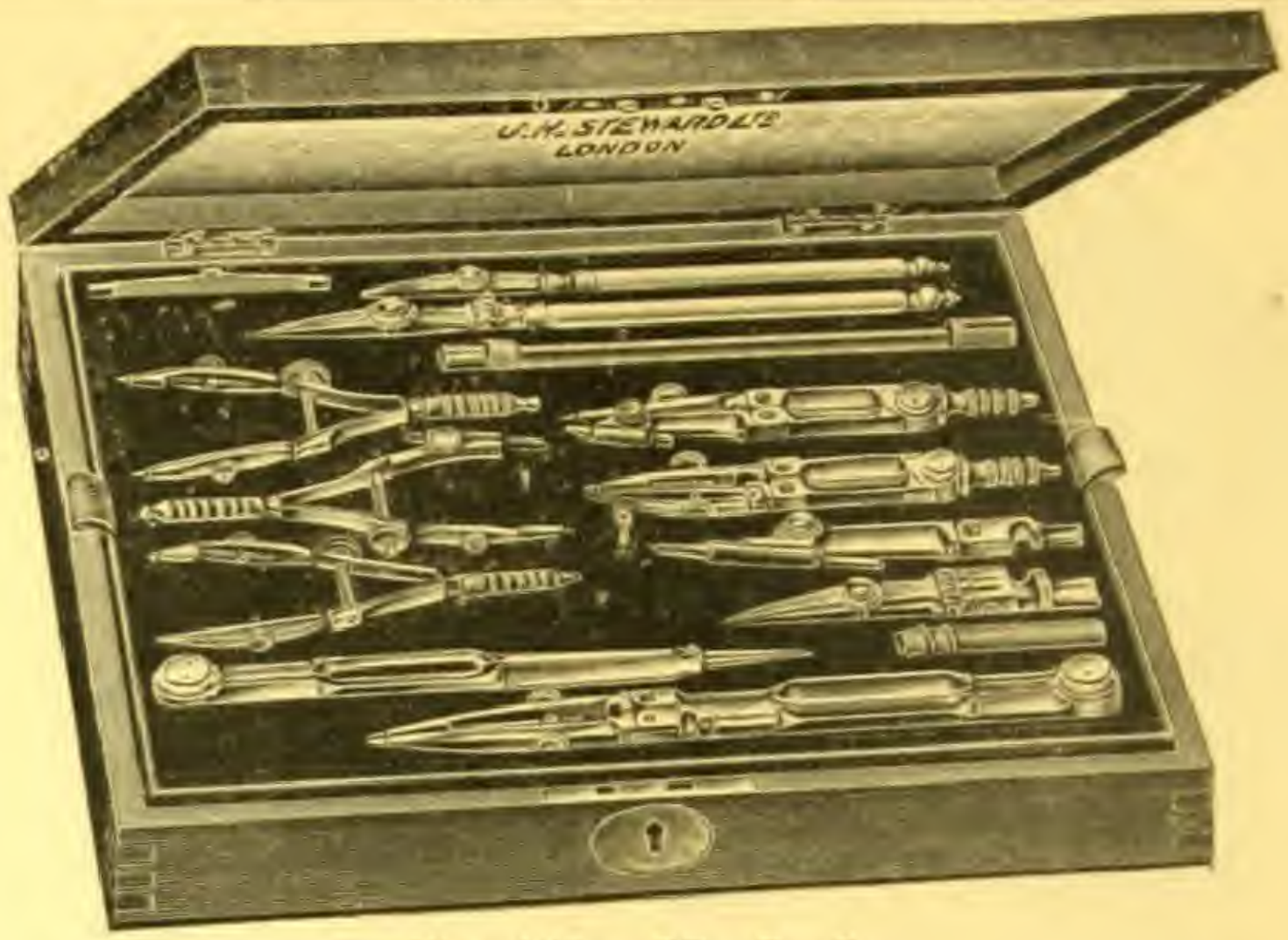


Fig. 167. **£5 5 0**

SM 674.—**8-inch Oak Case** with lift-out tray containing second grade English electrum instruments with nut and bolt needle points.
6-inch compass with sector head and double knee joints, jointed pen and pencil legs with hinged nib to pen, and lengthening bar,
5-inch Plain Divider,
Bow Pen and Bow Pencil with double knee joints,
Set of 3 Spring Bows, pen, pencil and divider,
6-inch Drawing Pen with round ivory handle and hinged nib,
4½-inch Drawing Pen with round ivory handle and solid nib,
Fig. 167 **£5 5 0**

Fig. 168. **£4 10 0** (Scales and Set Squares extra).

SM 675.—**13-inch Japanned Metal Box** with lift-out tray containing the following second grade English electrum instruments with nut and bolt needle points.
6-inch Compass with sector head and double knee joints, jointed pen and pencil legs with hinged nib to pen, and lengthening bar,
5-inch Plain Divider,
Bow Pen and Bow Pencil with double knee joints,
6-inch Drawing Pen with round ivory handle and hinged nib,
4½-inch Drawing Pen with round ivory handle and solid nib,
6-inch Boxwood Protractor and 6-inch ebonite Parallel Rule **£4 10 0**
There is space under the tray to contain 12-inch scales and requisites.

Fig. 169. **£6 10 0**

SM 676.—**Pocket Morocco Case,** lined with silk velvet, containing the following first grade English electrum instruments with nut and bolt needle points.
6-inch Compass with sector head and double knee joints, jointed pen and pencil legs with hinged nib to pen, and lengthening bar,
5-inch Hair Divider with sector head,
Bow Pen and Bow Pencil with sector heads and double knee joints,
Set of 3 Spring Bows, pen, pencil and divider,
6-inch Drawing Pen with square on ivory handle and hinged nib,
4½-inch Drawing Pen with round ivory handle and solid nib,
Pricker with ivory handle and spare needles,
Combined Adjusting Key, Knife and Lead File ... Fig. 169 **£6 10 0**

SM 677.—Pocket Japanned Metal Case containing the same instruments as No. SM 676..... **£6 15 0**

SM 678.—**Pocket Leatherette Case** containing the following second grade English electrum instruments with nut and bolt needle points.
6-inch Compass with sector head and double knee joints, jointed pen and pencil legs with hinged nib to pen and lengthening bar,
5-inch Hair Divider with sector head,
Bow Pen and Bow Pencil with double knee joints,
Set of 3 Spring Bows, pen, pencil and divider,
6-inch Drawing Pen with round ivory handle and hinged nib,
4½-inch Drawing Pen with round ivory handle and solid nib,
Adjusting Key **£4 15 0**

SM 679.—**Pocket Leatherette Case** containing second grade Entlish electrum instruments as in No. SM 678, but omitting the Bow Pen and Bow Pencil **£3 15 0**

POCKET DRAWING INSTRUMENTS.

Fig. 170. **£2 5 0**

SM 680.—**Small Size Pocket Snap Case,** 6 × 3½-inches containing the following first grade English electrum instruments. 4¼-inch Bow Compass, with double knee joints, sector head and nut and bolt needle point pen and pencil legs with hinged nib to pen, and lengthening bar making it possible to describe circles up to 16-inches diameter; 4-inch Hair Divider with sector head; 4½-inch Drawing Pen with square on ivory handle and hinged nib..... Fig. 170 **£2 5 0**

SM 681.—**Small Size Pocket Snap Case** containing the same instruments as in No. SM 680 and in addition a Spring Bow Pen and Spring Bow Pencil with nut and bolt needle points..... **£2 17 6**

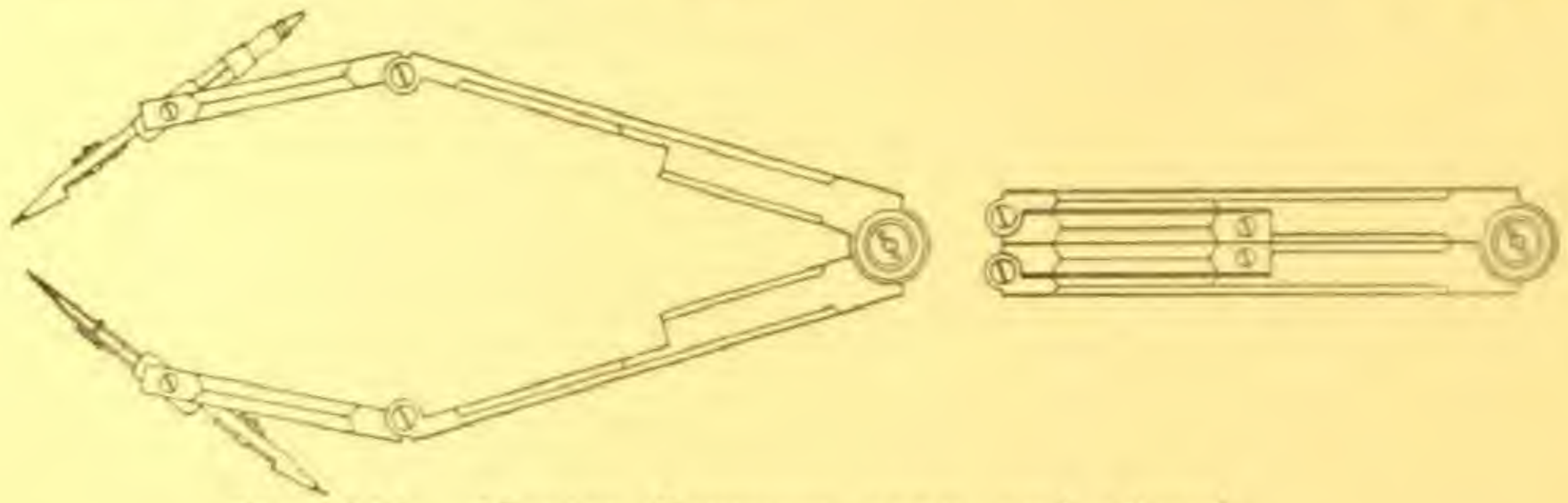


Fig. 171. Napier Compass open and closed.

SM 682.—**Napier Compass** forming a very compact pocket set of English electrum needle pointed instruments, comprising a 4½-inch Compass with double knee joints and pen, pencil and divider points. When fully extended it will describe a circle 15-inches diameter, and when closed it is no larger than a pen knife 2¾ inches long. With case Fig. 171 **£2 5 0**

SM 683.—**Napier Compass** same as No. SM 682 but with plain instead of needle points. With case..... **£1 10 0**

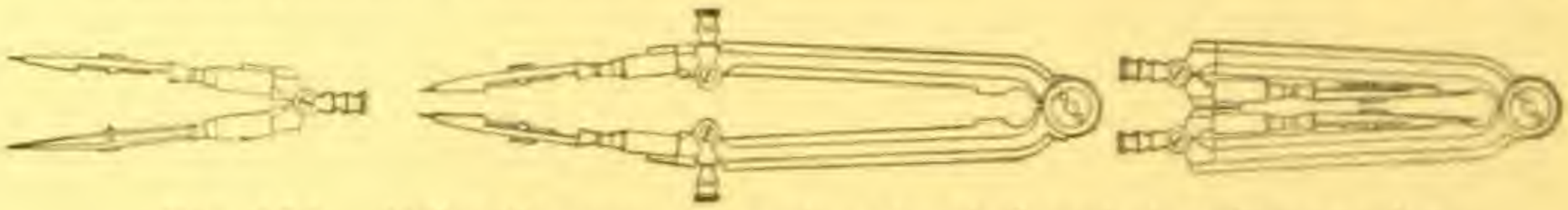


Fig. 172. Pillar Compass closed, extended and showing one bow.

SM 684.—**Pillar Compass** is a little less portable than the Napier Compass and forms a very complete set of English electrum needle pointed instruments comprising a 5-inch Compass with double knee joints, pen, pencil and divider points; Bow Pen and Bow Pencil. When fully extended it will describe a circle 14-inches diameter and the bows are useful for small work. When folded it is 3½-inches long. With case Fig. 172 **£2 15 6**

SM 685.—**Pillar Compass,** the same as No. SM 684 but with plain instead of needle points **£2 7 0**

MACHINE MADE DRAWING INSTRUMENTS.

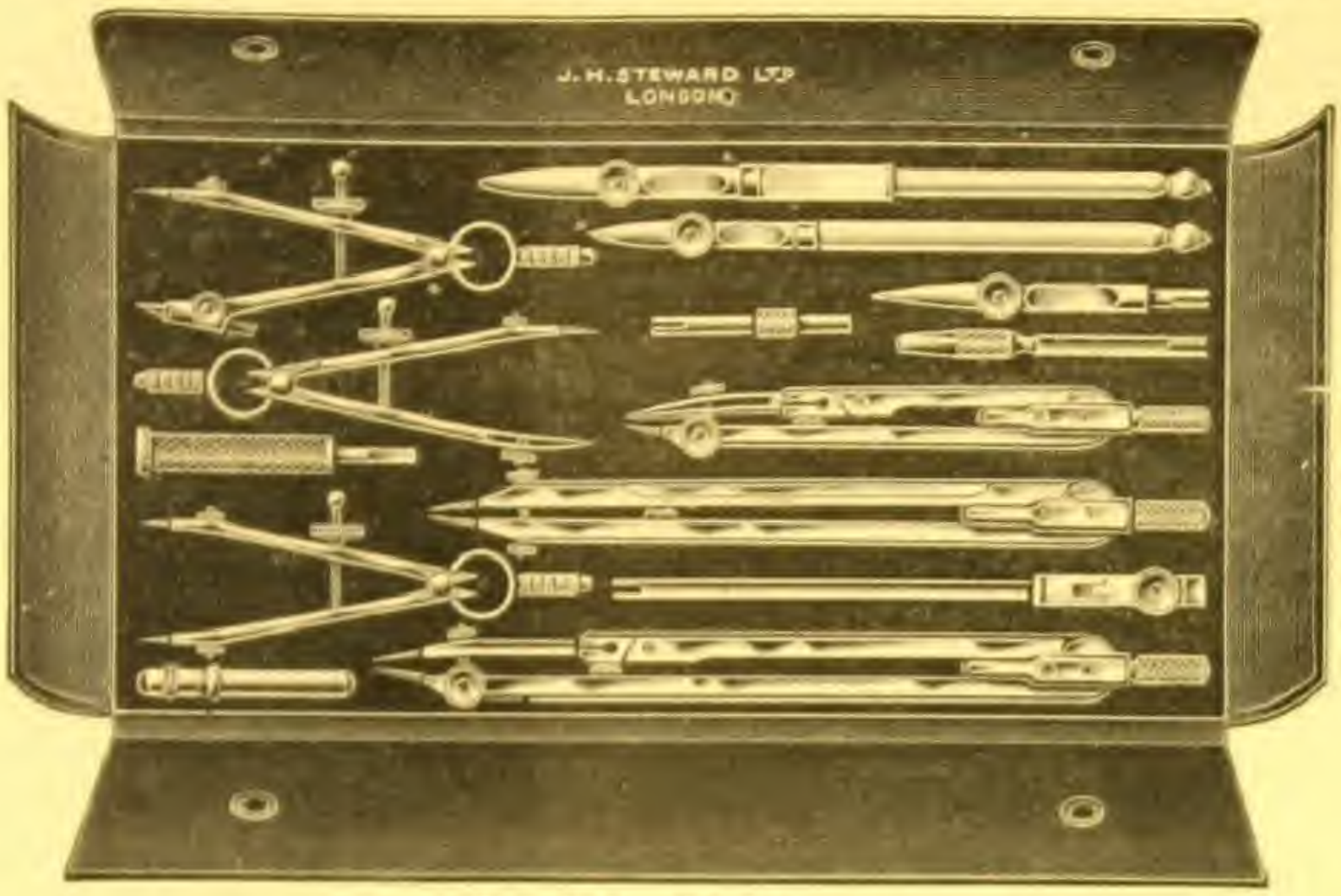


Fig. 173. **£3 18 6**

SM 686.—**Wallet Case** containing the following first grade English machine made electrum instruments, with reversible needles having a shouldered point one end and a tapered point the other. The two compasses and the Hair Divider have a central guide to the head so that the handle always remains vertical when the legs are opened or closed.
6-inch Compass with double knee joints, pen leg, pencil leg and lengthening bar,
5¾-inch Hair Divider,
4¼-inch Bow Compass with double knee joints, pen and pencil legs,
Set of 3 Spring Bows, pen, pencil and divider,
6-inch Drawing Pen with square on ivory handle,
5-inch Drawing Pen with round ivory handle,
Screw Driver, spare needles and Box of Leads .....Fig. 173 **£3 18 6**

SM 687.—**Wallet Case** containing the following second grade English machine made electrum instruments with reversible needles and plain heads to the compasses and divider.
6-inch Compass with double knee joints, pen leg, pencil leg and lengthening bar,
5¾-inch Plain Divider,
4¼-inch Bow Compass with double knee joints, pen and pencil legs,
Set of 3 Spring Bows, pen, pencil and divider,
6-inch and 5-inch Drawing Pens with metal handles,
Adjusting Key and Box of Leads **£2 5 0**

SM 688.—**Wallet Case** as No. SM 687 but without the 4¼-inch Bow Compass and 5-inch Drawing Pen..... **£1 15 0**

SM 689.—**Wallet Case** containing the following second grade English machine made electrum instruments with reversible needles,
6-inch Compass with plain head, double knee joints, pen and pencil legs,
6-inch Drawing Pen,
Spring Bow Pen and Spring Bow Pencil,
Key and Box of Leads **£1 2 6**

SM 690.—**Wallet Case** containing 6-inch Compass with reversible needles and pen and pencil legs; 6-inch Drawing Pen, Key and Box of Leads **13 6**

"STUDENT" DRAWING INSTRUMENTS.

Foreign make.

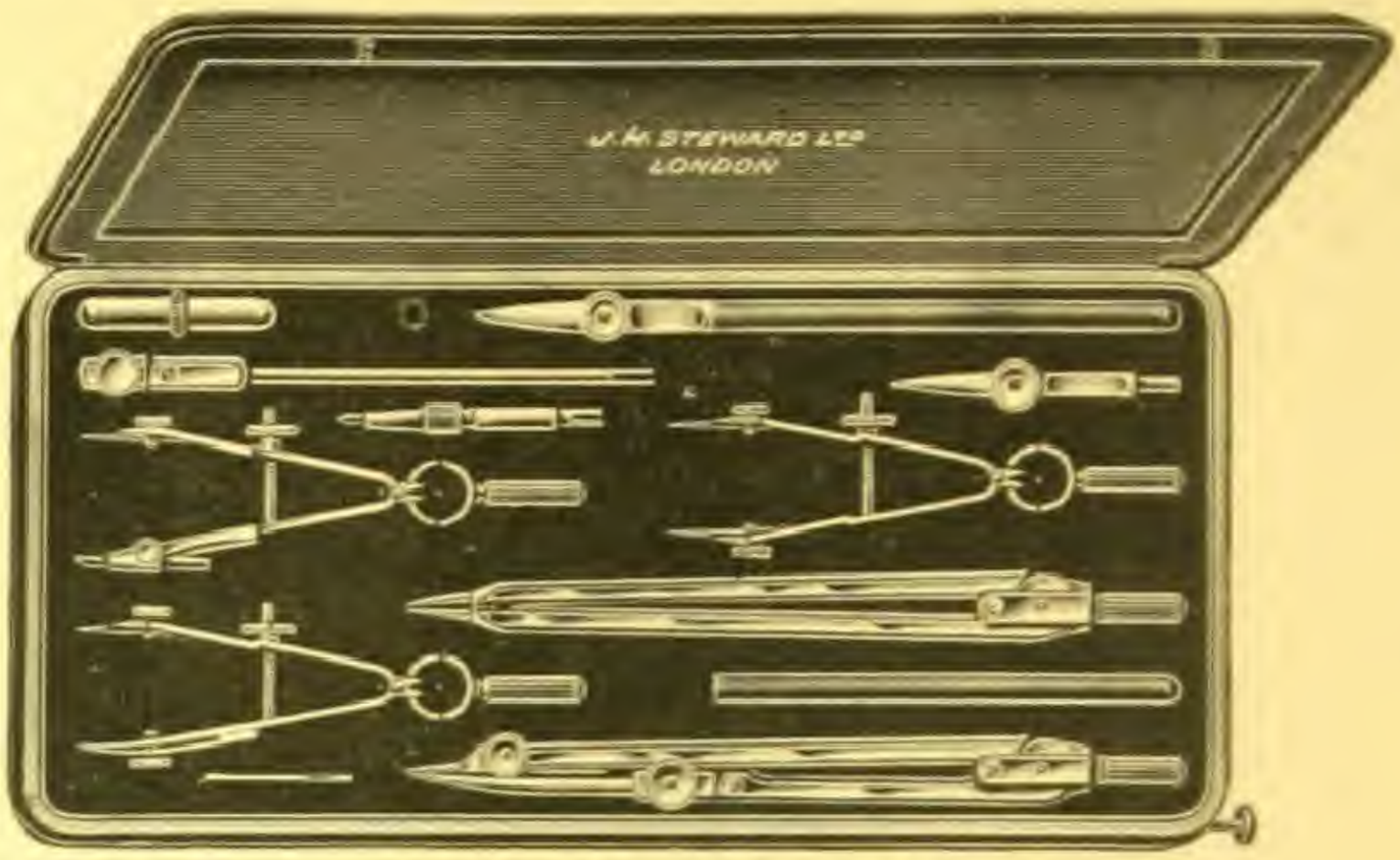


Fig. 174. **£1 5 0**

SM 691.—"**Student**" set of electrum drawing instruments with reversible needle points with tapered point at one end and shouldered point at other, in pocket leatherette case comprising :—
5½-inch Compass with double knee joints, pen and pencil legs and lengthening bar,
5½-inch Divider,
Set of 3 Spring Bows, pen, pencil and divider,
5-inch Drawing Pen,
Metal handle for using pen and pencil legs of compass as an additional drawing pen and pencil,
Compass Key and Box of Leads.....Fig. 174 **£1 5 0**

SM 692.—"**Student**" set of electrum drawing instruments with reversible needle points, in pocket leatherette case comprising :—
5½-inch Compass with double knee joints, pen and pencil legs and lengthening bar,
5½-inch Divider,
5-inch Drawing Pen,
Metal Handle for use with pen and pencil legs of compass,
Compass Key and Box of Leads **14 6**

SM 693.—"**Student**" pocket leatherette case containing 5½-inch electrum compass, with reversible needle points, double knee joints and pen and pencil legs,
5-inch Drawing Pen,
Metal Handle for use with pen and pencil legs of compass,
Box of Leads **8 6**

DRAWING INSTRUMENTS.

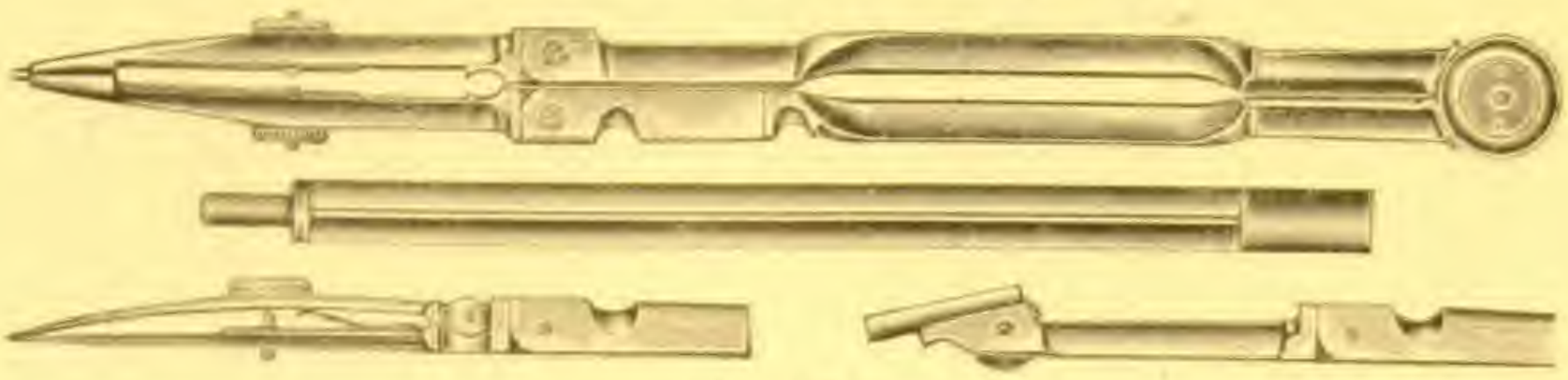


Fig. 175.

SM 694.—**Half Set,** first grade English electrum instruments consisting of 6-inch Compass with sector head and double knee joints, nut and bolt needle points, jointed pen with hinged nib, jointed pencil and divider legs, and lengthening bar..... Fig. 175 **£1 15 0**

SM 695.—.....**ditto**.....second grade, with fixed pen nib..... **1 9 0**

SM 696.—.....**ditto**.....first grade, as No. SM 694 but with 4½-inch compass **1 15 0**

SM 697.—.....**ditto**.....second grade, as No. SM 695 but with 4½-inch compass..... **1 9 0**

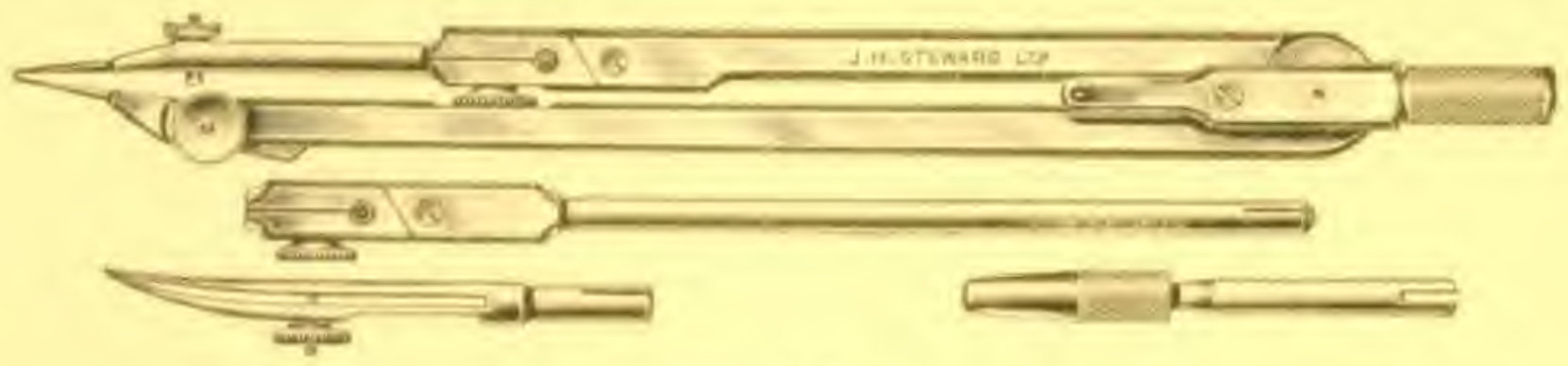


Fig. 176.

SM 698.—**Half Set,** first grade English machine made electrum instruments consisting of 6-inch Compass with central guide to head so that handle always remains vertical when legs are opened or closed, double knee joints, reversible needles having shouldered point one end and tapered point the other, pen, pencil and divider legs and lengthening bar. Fig. 176 **16 6**

SM 700.—....**ditto**...second grade machine made English electrum instruments consisting of 6-inch Compass with double knee joints, reversible needle points, pen, pencil and divider legs and lengthening bar **10 6**

Fig. 177.

Fig. 177A.

SM 701.—**3¼-inch Bow Pen,** first grade English electrum, sector head, double knee joints, nut and bolt needle points..... Fig. 177 **14 0**

SM 702.—**3¼-inch Bow Pencil,** first grade ...**ditto**..... Fig. 177A **14 0**

SM 703.—**3¼-inch Bow Pen,** second grade.....**ditto**..... **10 6**

SM 704.—**3¼-inch Bow Pencil,** second grade...**ditto** **10 6**

SM 705.—**4¼-inch Bow Compass,** machine made, with double knee joints, reversible needle points and interchangeable pen and pencil legs **6 6**

SPRING BOW COMPASSES.

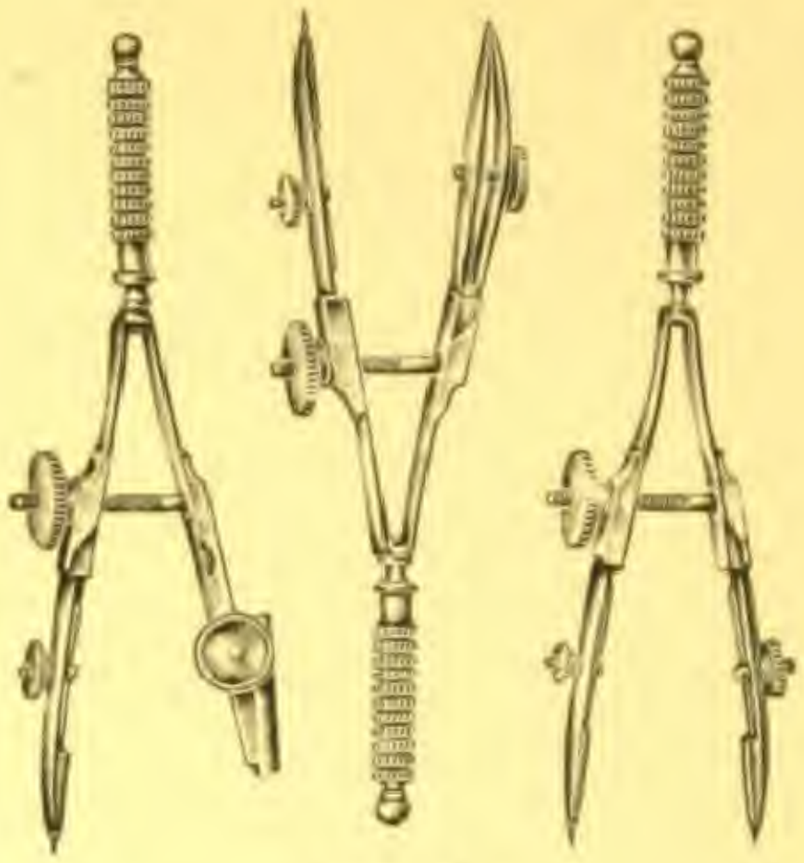


Fig. 178.
Flat Springs. Side Screws.

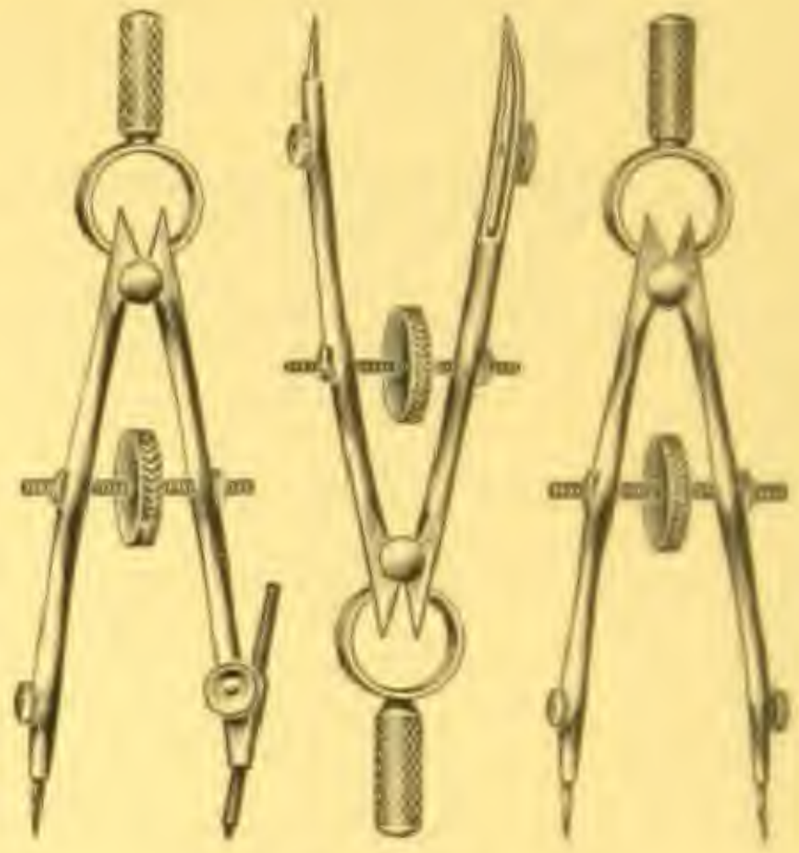


Fig. 179.
C Springs. Central Screws.

SM 706.—**Spring Bows,** first grade English hand made with flat springs, side screws, nut and bolt needle points. The set of three, pen, pencil and divider, in case ..... Fig. 178 **£1 7 0**
A single Spring Bow from set No. SM 706. **7/6.**

SM 707.—...**ditto**.....with flat springs and central screws. The set of three, pen, pencil and divider, in case **£1 11 6**
A single Spring Bow from set No. SM 707. **9/6.**

SM 708.—**Spring Bows,** first grade English machine made with C springs, side screws and reversible needles with shoulder and taper points. The set of three, pen, pencil and divider, in case **19 6**
A single Spring Bow from set No. SM 708. **5/-**

SM 709.—.....**ditto**.....with C springs and central screws. The set of three, pen, pencil and divider, in case ..... Fig. 179 **£1 4 0**
A single Spring Bow from set No. SM 709. **6/6**

SM 710.—**Spring Bows,** second grade English machine made with C springs, side screws and reversible needle points. The set of three, pen, pencil and divider, in case..... **14 0**
A single Spring Bow from set No. SM 710. **3/6**

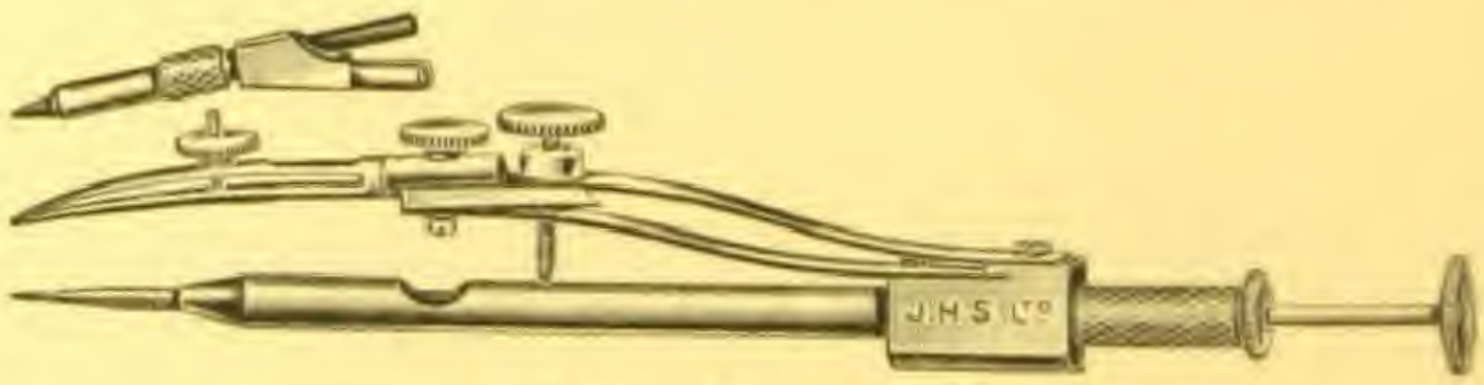


Fig. 180.

SM 711.—**Pump or Rotating Spring Bow,** for drawing small circles, pen, and pencil points which can be held off the paper while the centre point is located. The pen or pencil is then rotated round the fixed centre ..... Fig. 180 **12 6**

SM 712.—.....**ditto**.....with pen only..... **10 6**

SM 713.—**Case** for No. SM 711 or No. SM 712 ..... **4 0**

BEAM COMPASSES.

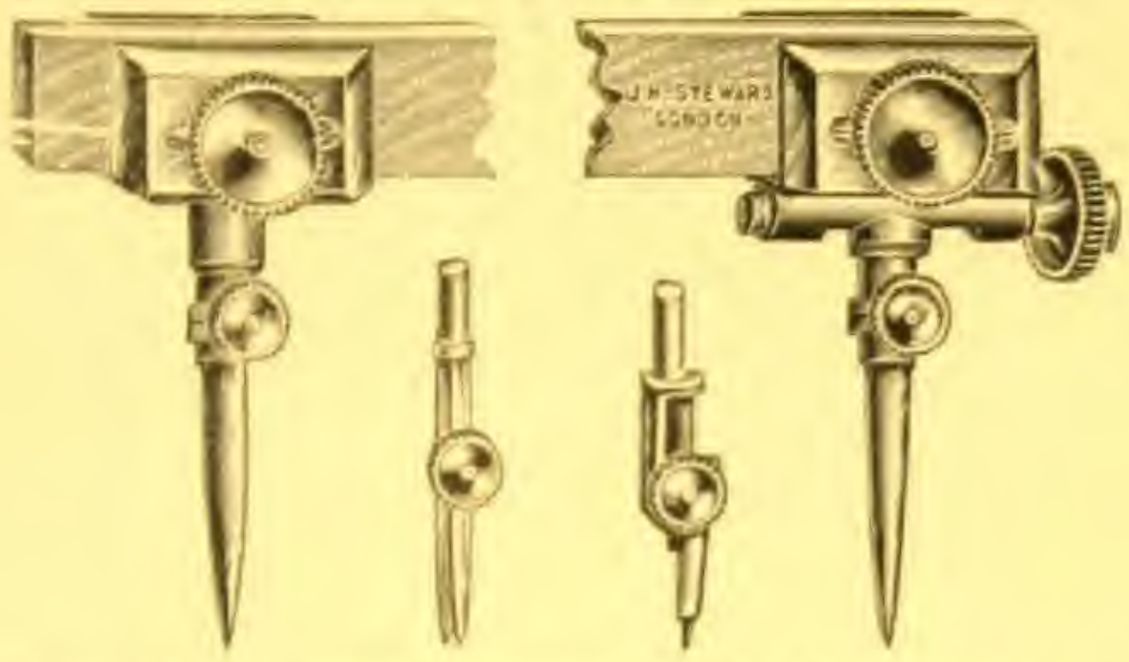


Fig. 181. Beam Compass, with plain points.

SM 714.—**Beam Compass,** to fit on beam lath of any length, electrum with needle points, pen and pencil legs, screw fine adjustment and 24-inch lath..... **£1 10 0**

SM 715.—.....**ditto**.....with plain instead of needle points Fig. 181 **1 7 6**

SM 716.—**Roller Beam Compass** to fit on lath of any length, electrum, with needle points, pen and pencil legs and 24-inch lath **1 10 0**

SM 717.—**Extra Beam Lath** for either of above.
24-inch **2/-**, 30-inch **2/6**, 36-inch **3/-**, 42-inch **3/6**, 48-inch **4/-**

SM 718.—**Snap Case** for beam compass..... **5 6**

SM 719.—**Universal Beam Compass** with roller adjustment to one head. Adaptable for use with any ordinary pen or pencil. Adjustable needle point. Price of the two heads and a 12-inch beam..... **11 0**

PROPORTIONAL COMPASSES.

Fig. 182.

SM 720.—**6-inch Electrum Proportional Compass** with scale of lines for reducing and enlarging drawings in given proportions and scale of circles for dividing the circumference of a circle into a given number of equal parts. Sliding adjustment..... **£1 10 0**

SM 721.—**6-inch Electrum Proportional Compass** with scale of lines and also scales of Linear Ratios for dividing lines into fractional parts. Plans for reducing and enlarging areas of plans, solids for reducing and enlarging the contents of a solid in given proportions. Sliding adjustment. **£1 15 0**

SM 722.—**6-inch Electrum Proportional Compass** fully divided as No. SM 721, with screw bar adjustment **£2 15 0**

SM 723.—**6-inch Proportional Compass** fully divided as No. SM 721, with points turned down at right angles, which permit of their being re-set if damaged. Sliding adjustment **£2 10 0**

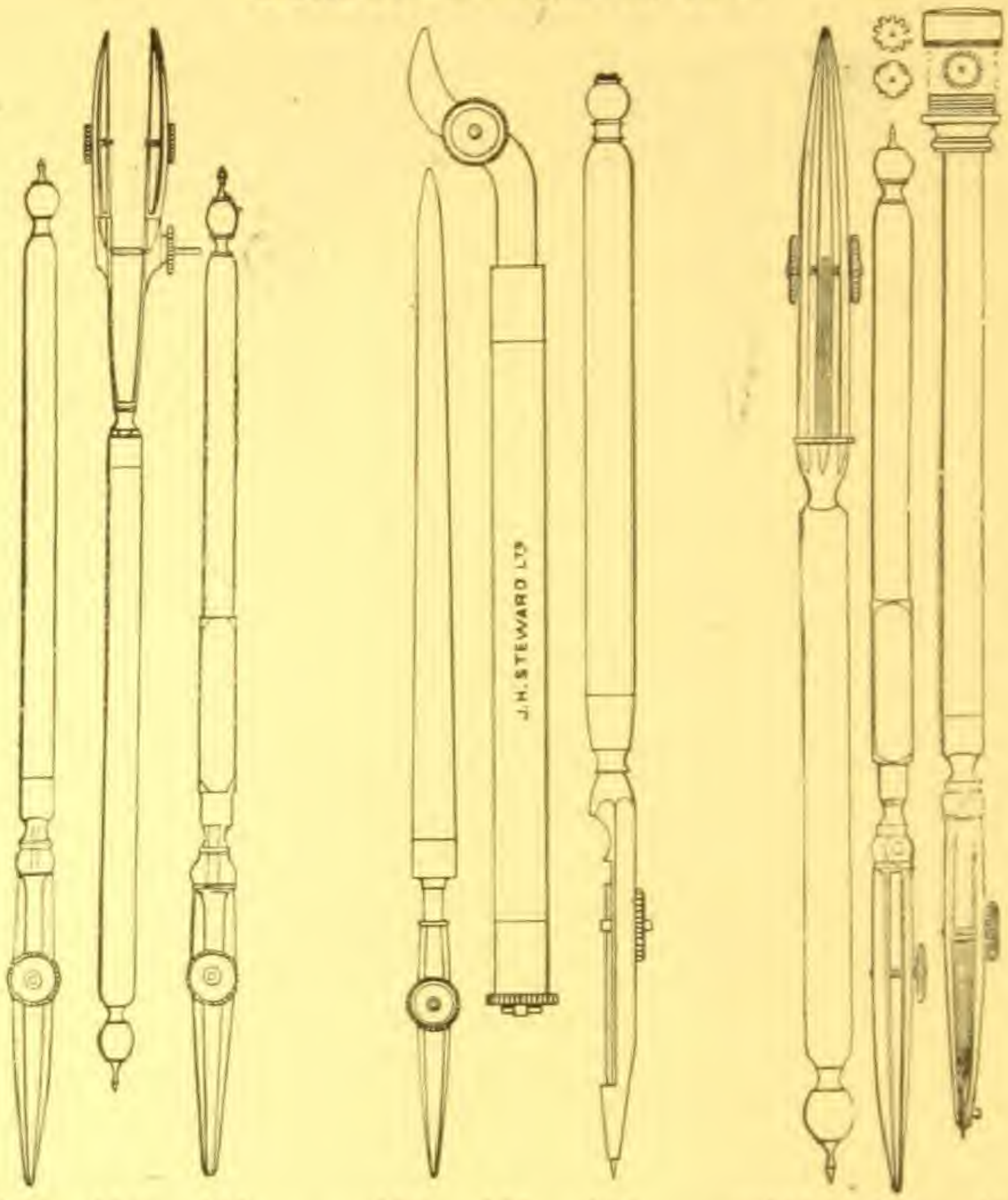
SM 724.—**9-inch Electrum Proportional Compass,** fully divided as No. SM 721. Sliding adjustment **£2 5 0**

SM 725.—**9-inch**.....**ditto**.....with turn down points as No. SM 723. Sliding adjustment **£3 10 0**

SM 726.—**Cases** for 6-inch Proportional Compass, straight points, **5/6**, turned points, **7/-**.

SM 727.—**Cases** for 9-inch ditto , straight points, **8/6**, turned points **11/6**.

DRAWING PENS, Etc.



Figs. 183 184 185 186 187 188 189 190 191

SM 728.—**Drawing Pen,** 6-inch with hinged lift up nib and extra stiff back nib, square on ivory handle ..... Fig. 190 **8/6**

SM 729.—**Drawing Pen,** 6-inch or 4½-inch with round ivory handle and hinged turn up nib **5/6**

SM 730.—.....**ditto**.....with square on ivory handle..... Fig. 185 **6/6**

SM 731.—**Drawing Pen,** 6-inch or 4½-inch with round ivory handle and plain steel nib ..... Fig. 183 **3/-**

SM 731A.—.....**ditto**.....with square on ivory handle..... **4/-**

SM 732.—**Drawing Pen,** 4½-inch, tapered ivory handle, extra fine plain steel nib ..... Fig. 186 **5/-**

SM 732A.—**Students Drawing Pen,** 5-inch, metal handle and plain steel nib **2/-**

SM 733.—**Bordering Pen,** 6-inch, with tongue to hold large supply of ink, round ivory handle ..... Fig. 189 **8/6**

SM 734.—**Road or Double Pen,** 6-in. for drawing parallel lines, Fig. 184 **10/-**

SM 735.—**Road or Double Pencil** ..... ditto **10/-**

SM 736.—**Dotting Pen,** 6-inch, ivory handle with box containing 4 interchangeable wheels to mark, dots, dashes with two intermediate dots, alternate dots and dashes, and single dashes ..... Fig. 191 **11/6**

SM 737.—**Red Ink Pen,** 6-inch, ivory handle, electrum nib **4/-**

SM 738.—**Curved Pen** for drawing curves and contour lines. Fig. 187 **6/6**

SM 739.—**Lithographic Pen** tempered for working on stone **6/-**

SM 740.—**Pricker** with nut & bolt needle point & spare needles, Fig. 188 **4/-**

SM 741.—**Lithographic Crow Quills.** 1 dozen on card with handle... **2/-**

SM 742.—**Mapping Pens,** 1 dozen on card with handle..... **2/-**

DIVIDERS.

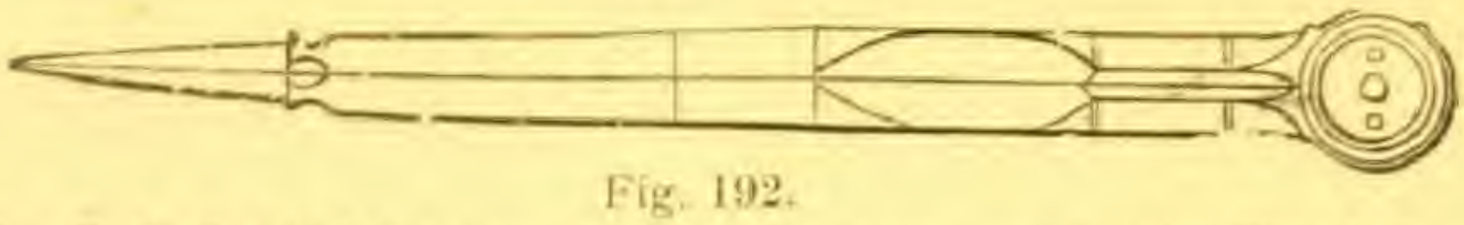


Fig. 192.

SM 743.—**5-inch Divider,** best English electrum, sector joint Fig. 192 **6/6**

Fig. 193.

SM 744.—**5½-inch Divider,** machine made, electrum with adjustable points ..... Fig. 193 **6/6**
SM 745.—**4-inch Divider** .....ditto **6/6**
SM 746.—**5-inch Divider,** machine made, electrum with fixed needle points. **4/6**
SM 747.—**4-inch Divider**.....ditto **4/-**

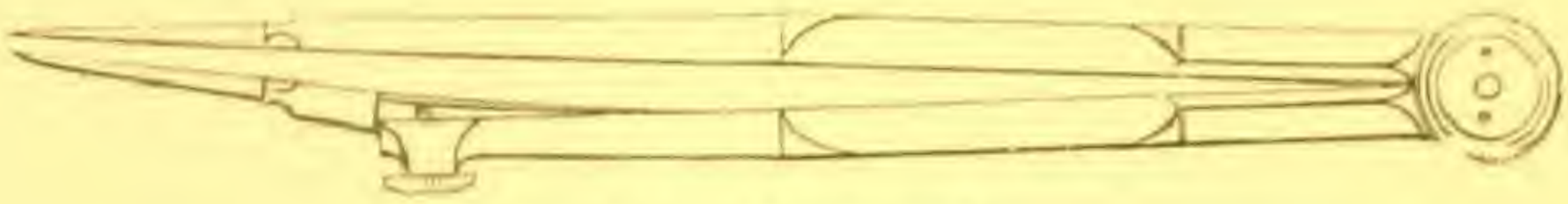


Fig. 194. Hair Divider.

SM 748.—**5-inch Divider,** best English electrum, sector joint and hair spring adjustment ..... Fig. 194 **9/6**

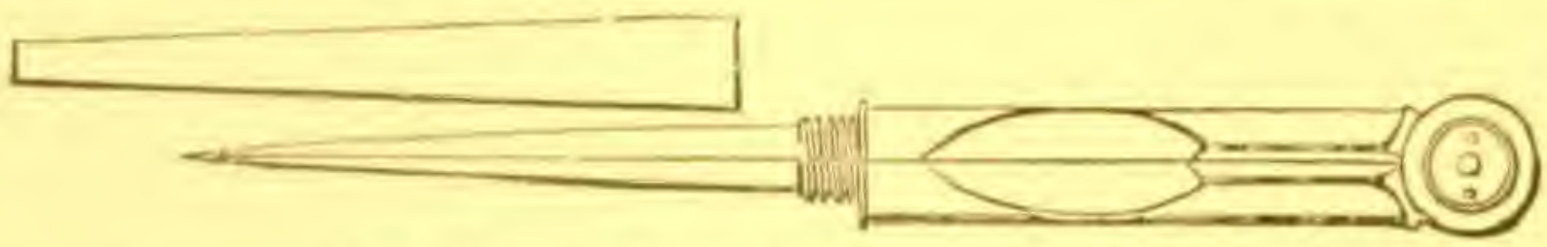


Fig. 195. Pocket Dividers with sheath.

SM 749.—**3-inch Pocket Divider,** with sheath, English electrum, sector joints ..... Fig. 195 **9/6**
SM 759.—**4-inch**.....**ditto**.....ditto..... **10/6**
SM 751.—**5-inch**.....**ditto**.....ditto **11/6**

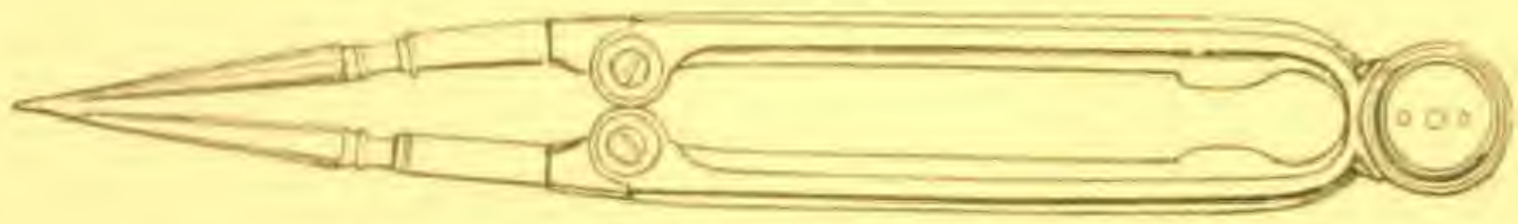


Fig. 196. Folding Divider.

SM 752.—**4-inch Folding Pocket Divider,** in electrum..... Fig. 196 **6/6**

Fig. 197.

SM 753.—**5-inch Chart Dividers,** with cross action for use with one hand. Fig. 197 **11/6**

PLOTTING AND DRAWING SCALES.

Fig. 198. Fully divided scale and flat section.

These scales are cut on to the material by a special dividing engine, ensuring great accuracy, and are graduated either on boxwood, white celluloid attached to a boxwood base, or ivory.

Chain Scales, flat section, with two opposite bevelled edges fully divided in either of the following ways :—

(*a*) Both edges alike, 10, 20, 30, 40, 50 or 60 divisions to the inch.

(*b*) With a different scale on each edge such as 10 × 20, 30 × 40, 50 × 60.

(*c*) With either 10, 20, 30, 40, 50 or 60 divisions to the inch on one edge and corresponding feet on the opposite edge.

	Boxwood.	Celluloid. Ivory Edges.	
SM 754.—**6-inch Chain Scale,** flat section, fully divided on two edges, as *a*, *b* or *c*	**2/-**	**4/-**	**10/-**
SM 755.—**12-inch**.....ditto	**3/-**	**6/-**	**25/6**
SM 756.—**18-inch**.....ditto	**7/-**	**12/-**	—
SM 757.—**2-inch Offset,** chain scale.....	**1/3**	**2/-**	**5/-**
SM 758.—**3-inch Offset,** chain scale.....	**2/-**	**3/-**	**7/6**

Ordnance Scales, flat section, with two opposite bevelled edges fully divided with either of the following scales :— $\frac{1}{2500}$ or 25·344 inches to the mile, $\frac{1}{500}$ or 10·56 feet to the mile, $\frac{1}{10560}$ or 6-inches to the mile, $\frac{1}{1056}$ or 5 feet to the mile, 11, 88, 22, 44 or any other ordnance scale to order.

(*d*) Both edges divided alike. (*e*) Different scales on opposite edges.

	Boxwood.	Celluloid. Ivory Edges.	
SM 759.—**6-inch Ordnance Scale,** flat section, fully divided on two edges, as *d* or *e*.....	**2/-**	**4/-**	**10/-**
SM 760.—**12-inch**.....ditto.....	**3/-**	**6/-**	**25/6**
SM 761.—**18-inch**.....ditto.....	**7/-**	**12/-**	—

Metric Scales, flat section, with two opposite bevelled edges fully divided in either of the following ways :—

(*f*) Both edges alike, ·001, ·002, ·003, ·004, ·005, ·006.

(*g*) Either of aforementioned scales on one edge, and feet equal to metres on opposite edge for reducing metric measurements to English.

(*h*) Parts of an inch on one edge such as $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1-inch, etc., and metres equal scale on opposite edge for reducing English measurement to metres.

(*j*) Millimetres on one edge and tenths or eighths of an inch on opposite edge.

	Boxwood.	Celluloid. Ivory Edges.	Ivory.
SM 762. —**6-inch Metric Scale,** flat section, fully divided as *f*, *g*, *h* or *j*	**2/-**	**4/-**	**10/-**
SM 762a.—**12-inch**.....ditto	**3/-**	**6/-**	**25/6**
SM 763. —**18-inch**.....ditto	**7/-**	**12/-**	—
SM 764. —**2-inch Offset Metric Scale**	**1/3**	**2/-**	**5/-**
SM 765. —**3-inch**.....**ditto**.....	**2/-**	**3/-**	**7/6**

ENGINEERS' AND ARCHITECTS' SCALES.

Fig. 199. Open divided scale and oval section.

Engineers' and Architects' Scale, oval section, open, divided on four bevelled edges in either of the following ways :—

(*l*) Eight scales, two on each edge, $\frac{1}{16}$, $\frac{3}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{16}$, $\frac{1}{2}$, 2 and 6-inches.

(*m*) Four scales, one on each edge, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, and 1 inch.

(*n*) Four scales, one on each edge, $\frac{3}{8}$, $\frac{3}{4}$, $1\frac{1}{2}$ and 3-inches.

	Boxwood. Edges.	Celluloid. Edges.	Ivory. Edges.
SM 766.—**6-inch Open Divided Scale,** oval section, divided on 4 edges, as *l*, *m*, or *n*	**3/-**	**6/6**	**12/-**
SM 767.—**12-inch**.....ditto	**4/-**	**10/-**	**27/-**
SM 768.—**18-inch**.....ditto	**9/-**	**19/-**	—

Armstrong Scale oval section, open divided on 4 bevelled edges, 2 scales on each edge, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 3-inches.

	Boxwood. Edges.	Celluloid. Edges.	Ivory Edges.
SM 769.—**6-inch Armstrong Scale**	**2/6**	**5/-**	**12/-**
SM 770.—**12-inch**.....**ditto**	**3/6**	**10/-**	**27/-**

Engineers' and Architects' Scales, oval section, fully divided on four bevelled edges in either of the following ways :—

(*s*) Containing $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$ and 1 inch.

(*t*) Containing $\frac{3}{4}$, $1\frac{1}{2}$ and 3-inches.

	Boxwood. Edges.	Celluloid. Edges.	Ivory. Edges.
SM 771.—**6-inch Fully Divided Scale,** oval section, with four edges divided as *s* or *t*	**3/-**	**6/6**	**12/-**
SM 772.—**12-inch**.....ditto	**4/-**	**10/-**	**27/-**
SM 773.—**18-inch**.....ditto	**9/-**	**19/-**	—

Engineers' and Architects' Scales, flat section, fully divided, with two scales on opposite bevelled edges in either of the following ways :—

(*o*) Both edges alike, with either of the following scales : $\frac{1}{16}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$ or 3-inches, fully divided throughout.

(*r*) With a different scale on each edge, as 1 and $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{8}$, $1\frac{1}{2}$ and 3, $\frac{3}{8}$ and $\frac{3}{4}$, full size and half size.

	Boxwood. Edges.	Celluloid. Edges.	Ivory. Edges.
SM 774.—**6-inch Fully Divided Scale,** flat section, divided on two edges as *o* or *r*	**2/-**	**4/-**	**10/-**
SM 775.—**12-inch**.....ditto	**3/-**	**6/-**	**25/6**
SM 776.—**18-inch**.....ditto	**7/-**	**12/-**	—

Special Scales. Any kind of scale divided to order and cases fitted up with sets of scales as selected.

POCKET RULES.

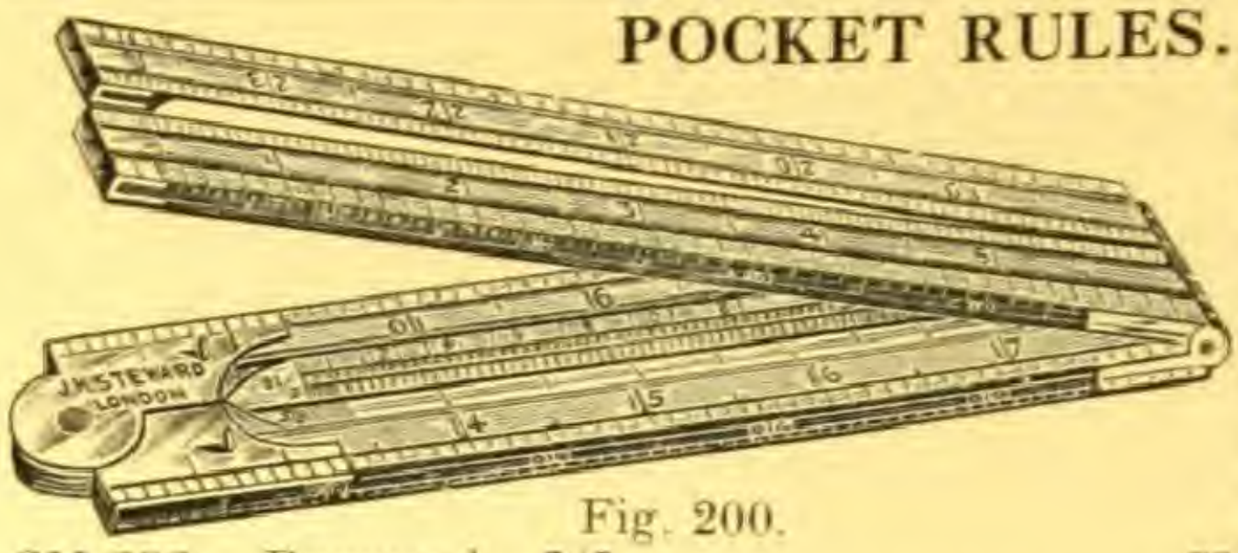


Fig. 200.

2-feet 4-fold Pocket Rule, folding to 6-inches with 4 bevelled edges; divided inches to $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{12}$, $\frac{1}{10}$ths and centimetres to millimetres on the faces; with 8 open divided scales on bevelled edges $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{2}$, 1-inch, $\frac{3}{8}$, $\frac{3}{4}$, $\frac{1}{5}$, $\frac{1}{10}$-inch. Fig. 200.

SM 777.—Boxwood **6/6** ..... SM 778.—Ivory **£2 10 0**

SM 779.—**2-feet 4-fold Plain Boxwood Rule,** folding to 6-inches, divided to inches $\frac{1}{8}$, $\frac{1}{10}$, $\frac{1}{12}$, $\frac{1}{16}$ths **3/0**

SM 780.—**1-foot**.....**ditto**.....folding to 3-inches, divided to inches, $\frac{1}{10}$, $\frac{1}{8}$, $\frac{1}{16}$ths **2/6**

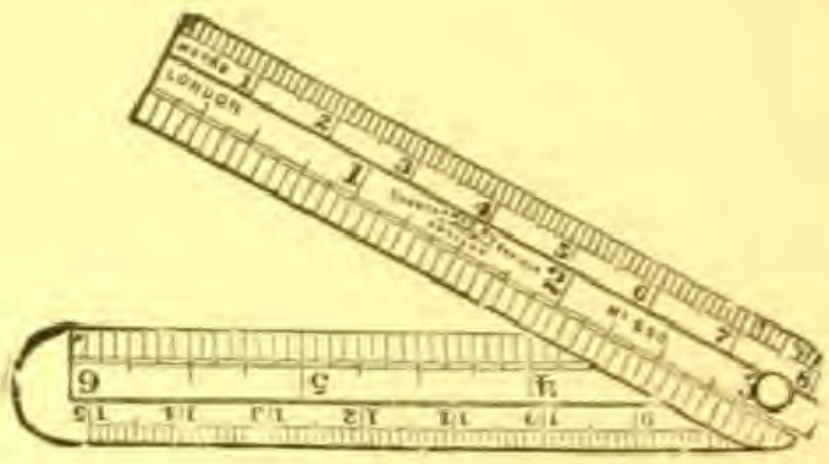


Fig. 201. 6-inch Rule.

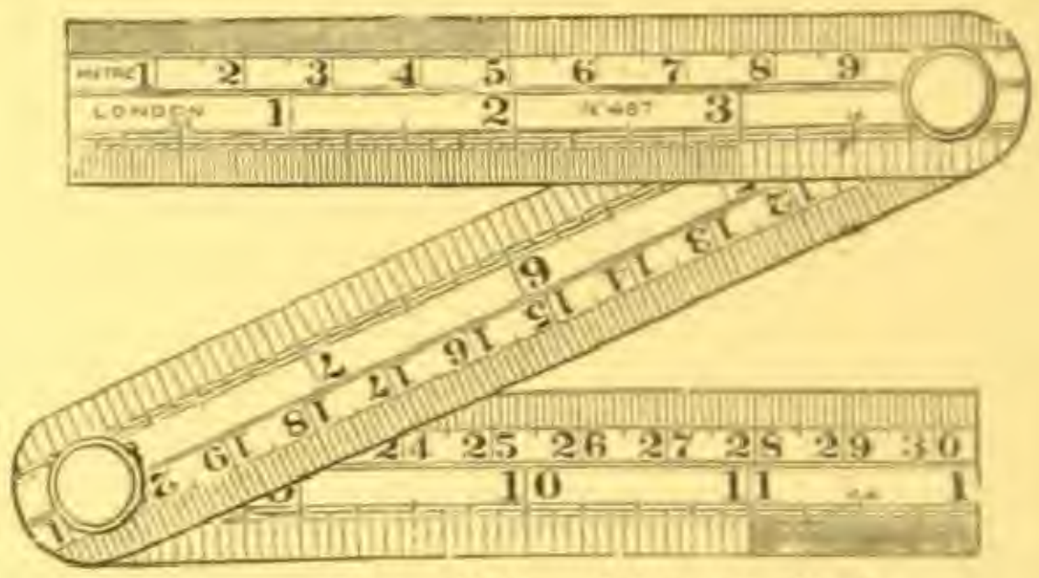


Fig. 202. 12-inch Rule.

SM 781.—**6-inch Folding Steel Rule,** $\frac{1}{2}$-inch wide, with rounded ends, marked on one side into inches and 16ths, and centimetres into millimetres ..... Fig. 201 **1/9**

SM 782.—**6-inch**...ditto...16ths, 32nds, 64ths, 10ths, 20ths, 50ths, and 100ths **2/-**

SM 783.—**12-inch Folding Steel Rule,** $\frac{1}{2}$-inch wide, folding to 4-inches, with rounded ends, marked on one side into inches, 16ths, 32nds, and 64ths..... **2/6**

SM 784.—**12-inch**.....ditto.....into inches, 16ths, 32nds, 64ths, centimetres, millimetres and half millimetres ..... Fig. 202 **2/9**

STEEL RULES WITHOUT JOINT.

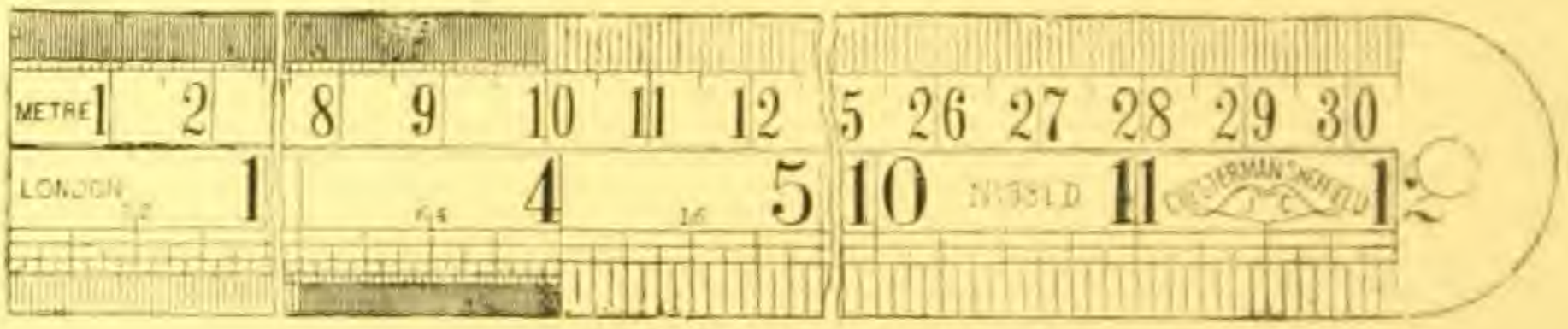


Fig. 203. Steel Rule.

Steel Rules made in one piece, not folding. The 4-inch and 6-inch rules are $\frac{3}{4}$-inch wide; 12-inch Rules $1\frac{1}{8}$-inch wide.

	Lengths 4-in.	6-in.	12-in.
SM 785.—**Steel Rule,** divided on two edges—inches to 10ths and 16ths	**1/-**	**1/3**	**2/-**
SM 786.—...**ditto**.....divided on four edges—inches to 8ths, 16ths, 32nds, 64ths, 10ths, 20ths, 50ths, 12ths, 24ths and 48ths	**1/9**	**2/-**	**3/3**
SM 787.—...**ditto**.....divided on two edges—inches to 16ths, 32nds, 64ths, and millimetres to halves. Fig. 203	**1/9**	**2/-**	**3/-**
SM 788.—...**ditto**.....divided on four edges—inches to 8ths, 16ths, 32nds, 64ths, 10ths, 20ths, 50ths, 100ths and millimetres to halves	**2/-**	**2/6**	**4/-**

MICROMETER CALIPER GAUGES.

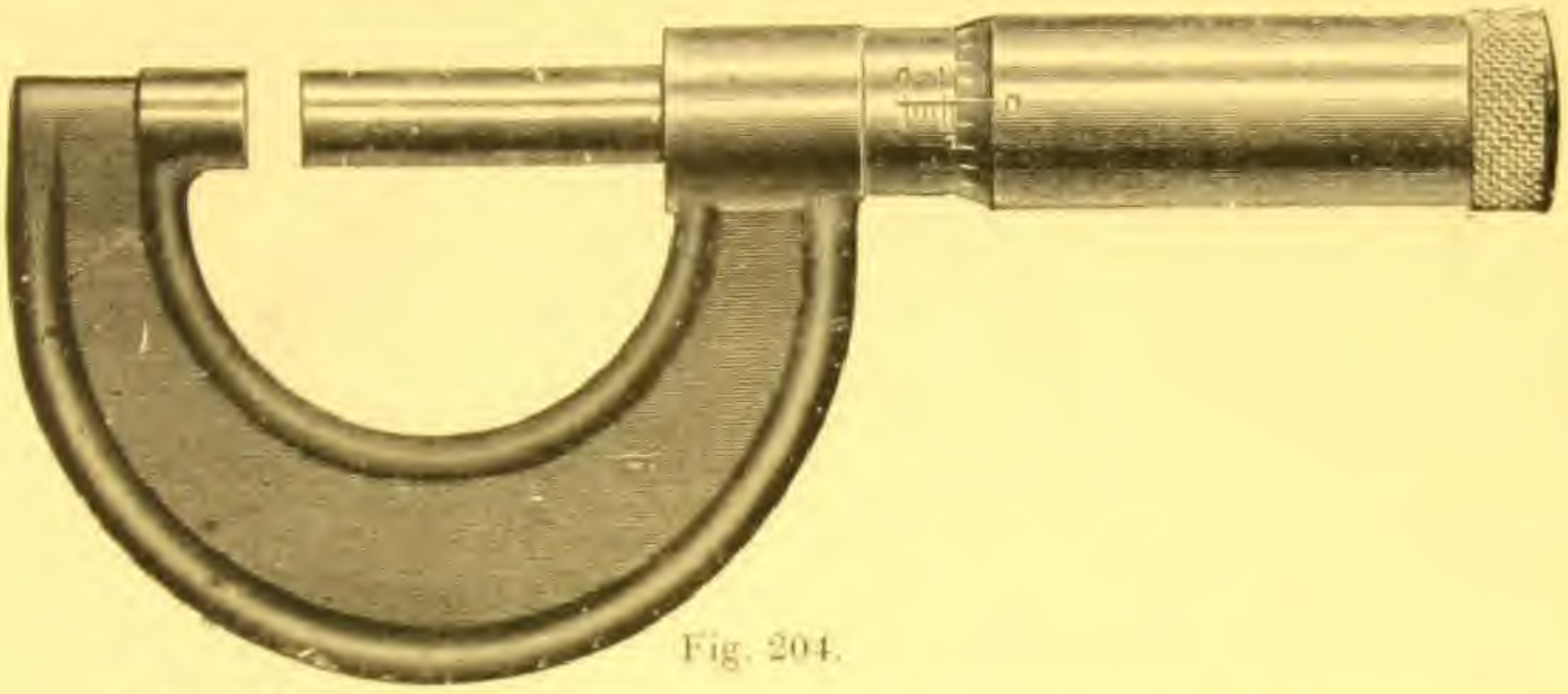


Fig. 204.

Steel Micrometer Caliper for making measurements by thousandths of an inch. Fig. 204. Six sizes as follows:—

SM 789.—**1-inch Micrometer Caliper** for making measurements from ·001 to 1 inch			**£1 6 6**
SM 790.—**2-inch...ditto**.....measuring from	1 inch	to 2 inches	**1 10 0**
SM 791.—**3-inch...ditto**.....	ditto	2 inches to 3 inches	**1 12 6**
SM 792.—**4-inch...ditto**.....	ditto	3 inches to 4 inches	**1 15 6**
SM 793.—**5-inch...ditto**.....	ditto	4 inches to 5 inches	**2 0 0**
SM 794.—**6-inch...ditto**.....	ditto	5 inches to 6 inches	**2 2 0**
SM 795.—**Complete Set** of Micrometer Calipers Nos. SM 789 to SM 794 in a case			**£11 17 6**

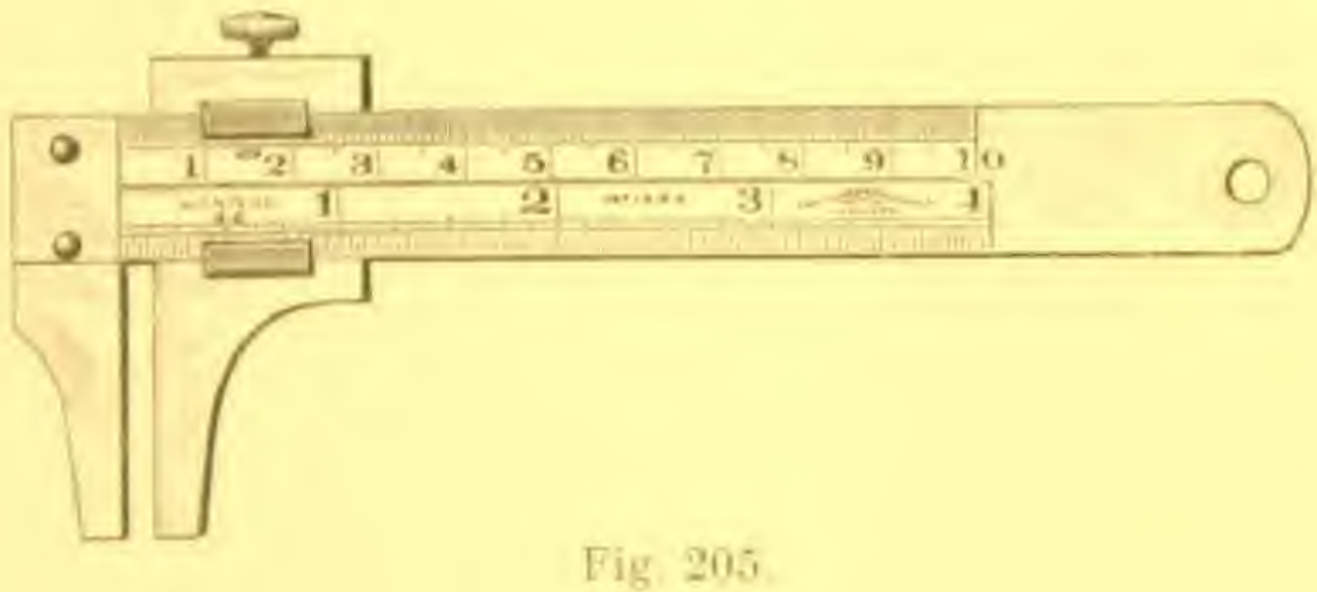


Fig. 205.

	Length of scale. Inches	3	4	6
SM 796.—**Steel Caliper Gauge,** divided on one side, inches to 32nds with corresponding scale of centimetres to millimetres and halves, with clamp to sliding jaw ..... Fig. 205		**10 6**	**11 6**	**12 6**
SM 797.—.....**ditto**.....divided on both sides, inches into 32nds, 48ths, 50ths, millimetres and halves		**11 6**	**12 6**	**13 6**

SM 798.—**Vest Pocket Steel Caliper Gauge** divided on one side with 1¼-inch scale to 64ths with corresponding scale of centimetres into millimetres and halves. Total length 2⅛-inches with ring for attaching to chain **7 6**

SET SQUARES.

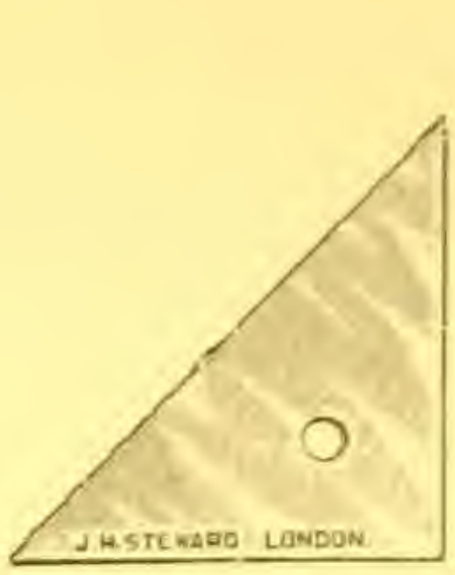


Fig. 206.

Fig. 207.

Fig. 208.

Fig. 209.

	Sizes in inches	4	6	8	10	12
SM 799.—**Transparent Set Squares** with square edges, 45°	Fig. 206	-/9	1/3	2/3	3/6	4/6
SM 800.—.....**ditto**..... 60° ...	Fig. 207	-/6	-/10	1/3	2/3	3/-
SM 801.—**Transparent Set Squares,** open centre, bevelled edges, 45°		1/3	2/-	3/-	5/-	5/9
SM 802.—.....**ditto**.....60°		1/-	1/4	2/-	3/-	4/-
SM 803.—**Vulcanite Set Squares,** with square edges, 45°	Fig. 208	1/-	1/6	2/6	3/6	4/6
SM 804.—.....**ditto**.....60° ...	Fig. 209	-/8	1/-	1/6	2/6	3/6

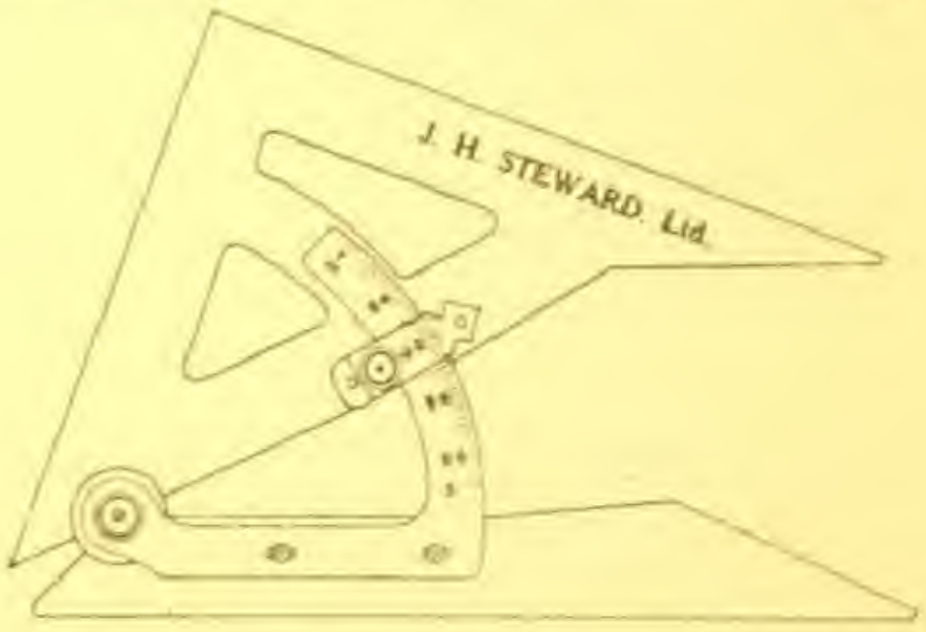


Fig. 210.

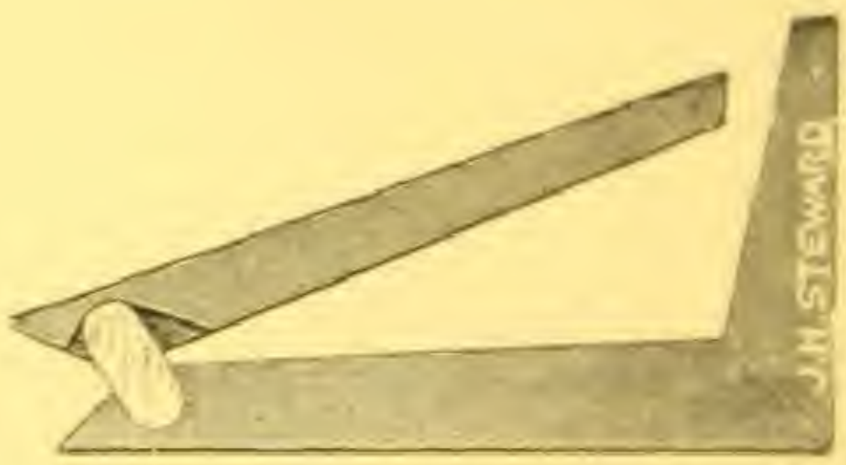


Fig. 211.

Adjustable Set Square made of transparent celluloid with an arc of 90°. At zero it is a set square of 45°, and can be fixed at any other angle up to 90°. It is made with a base of 7, 10 or 12-inches. Fig. 210.

SM 805.—7-inch **5/6** SM 806.—10-inch. **9/-** SM 807.—12-in. **12/6**

Clinograph or adjustable set square made of mahogany with friction tight movable arm, in two sizes. Fig. 211.

SM 808.—7-in..... **2/6** SM 809.—9-in..... **4/9**

T SQUARES.

	Length of Blade, inches	18	24	31	36	42	54
SM 810.—**Hardwood,** taper blade		2/6	3/-	3/6	4/6	6/-	—
SM 811.—**Mahogany,** taper blade with ebony edge		7/6	12/-	14/-	15/-	18/-	25/-
SM 812.—**Mahogany,** parallel blade with two ebony edges and double shifting stock		16/6	20/-	23/6	26/-	28/6	35/-

PARALLEL RULES.

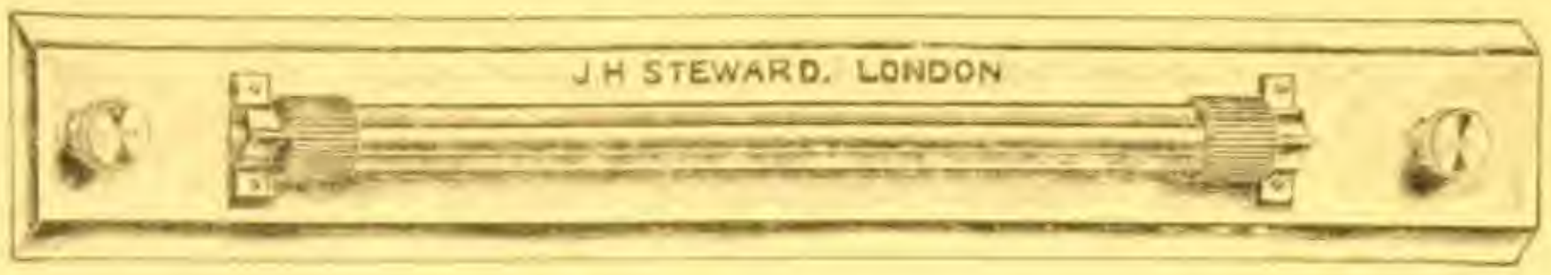


Fig. 212. Rolling Parallel Rule.

	Size in inches	9	12	15	18	24
SM 813.—**Rolling Parallel Rule,** plain ebony		**16/6**	**18/6**	**21/-**	**25/-**	**33/-**
SM 814.—**Rolling Parallel Rule,** solid brass, in mahogany case,	Fig. 212	**28/-**	**40/-**	**50/-**	**63/-**	**80/-**

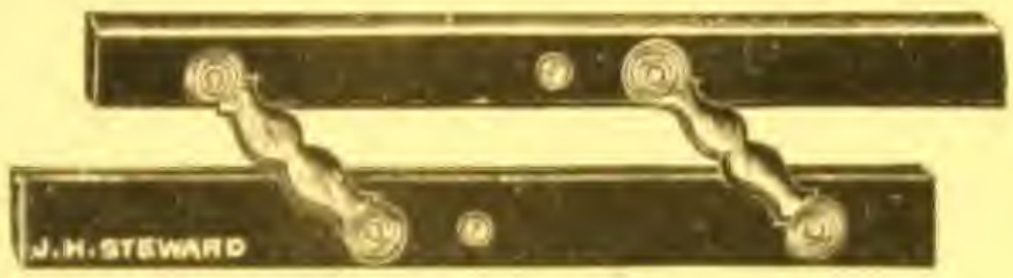


Fig. 213. Bar Parallel Rule.

	Size in inches	6	9	12	15	18
SM 815.—**Bar Parallel Rule,** plain ebony	Fig. 213	**2/-**	**4/-**	**6/-**	**7/6**	**9/6**

PARALLEL RULES FOR NAVAL CHARTS.

	Size in inches	12	18	24
SM 816.—**Captain Field's Parallel Rule,** with degrees and compass points. Bar pattern made of boxwood		**8/6**	**12/6**	**16/6**
SM 817.—**Captain Field's Parallel Rule,** roller pattern made of brass, in box		**50/-**	**65/-**	**90/-**

STRAIGHT EDGES.

	Length in inches	18	24	30	36	42	48	54
SM 818.—**Mahogany,** ebony edged		**4/6**	**6/-**	**7/6**	**9/-**	**11/-**	**12/6**	**16/-**
SM 819.—**Steel,** with one edge bevelled		**6/6**	**9/-**	**11/6**	**13/6**	**17/6**	**20/-**	**25/-**
SM 820.—**Electrum**...ditto		**12/6**	**17/6**	**21/6**	**25/-**	**32/6**	**40/-**	**45/-**
SM 821.—**Wood Case** for metal straight edge		—	**7/6**	**8/-**	**8/6**	**10/-**	**11/6**	**12/6**

DRAWING BOARDS AND TRESTLES.

Engineers' and Architects' Drawing Boards, of finest pine, with mahogany battens fastened with screws, which work in brass slots. One edge inlaid with ebony :—

SM 822.—23 by 16-inches	**£0**	**18**	**6**
SM 823.—32 by 23-inches (imperial)	**1**	**7**	**6**
SM 824.—42 by 29-inches (double elephant)	**2**	**2**	**0**
SM 825.—54 by 32-inches (antiquarian)	**2**	**15**	**0**
SM 826.—**Students Battened Drawing Board,** 23 by 16-inches	**0**	**9**	**6**
SM 827.—**Plain Oak Cross Trestles,** suitable for drawing boards 28 × 21 or 31 × 23-inches	**£2**	**5**	**0**
SM 828.—.....**ditto**.....for boards 42 × 29 or 54 × 32-inches	**2**	**7**	**6**
SM 829.—**Oak Cross Trestles with Adjustable Tilting Top** for boards 28 × 21 or 31 × 23-inches	**3**	**17**	**6**
SM 830.—.....**ditto**.....for boards 42 × 29 or 54 × 32-inches	**4**	**2**	**6**

CURVES, SPLINES, &c.

Fig. 214. Railway Curves.

	Card-board.	Hard-wood.	Trans-parent.
SM 831.—**Railway Curves,** set of 25, from 1½ to 30-inches radius, in mahogany case. Fig. 214	**22/-**	**32/6**	**60/-**
SM 832.—...**ditto**.....set of 50, 1½ to 120-inches radius	**40/-**	**63/-**	**107/6**
SM 833.—...**ditto**.....set of 100, 1½ to 240 inches radius	**67/6**	**117/6**	**195/-**

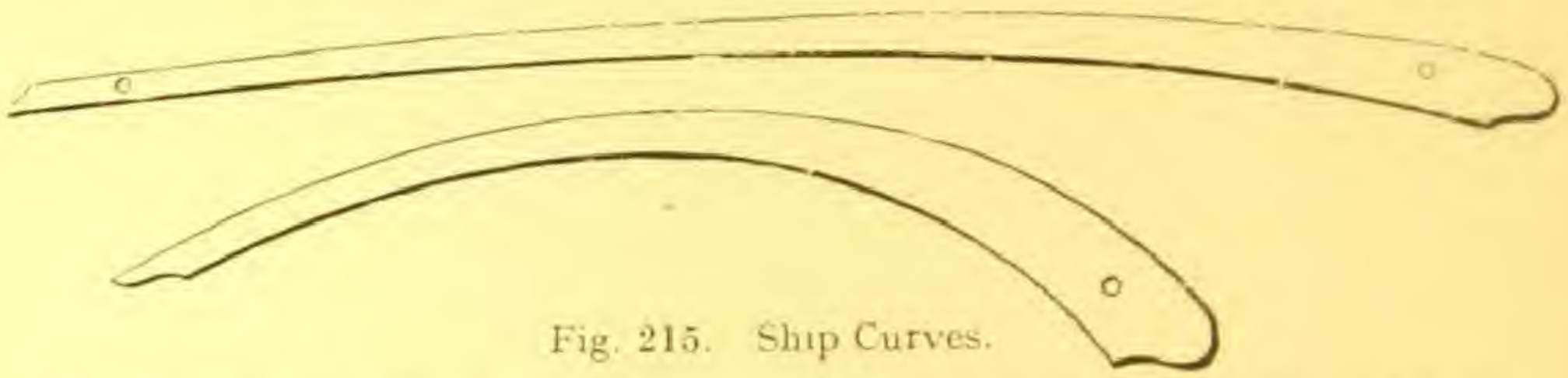


Fig. 215. Ship Curves.

SM 834.—**Ship and Yacht Curves** of various patterns cut to order in pearwood or transparent celluloid. Prices **2/-** to **7/6** each according to dimensions.

Splines or Penning Battens, set of 20 assorted sections and sizes from 18-inches to 5-feet in case.

SM 835.—Lancewood.... **£2 15 0** SM 836.—Celluloid..... **£5 15 0**

Single Splines cut to order any length and section.

SM 837.—**Spline Weights** about 6-lbs., covered with leatherette with mahogany base ..... each **15/-**

SM 838.—**French Curves,** assorted patterns, pearwood..... each **1/-**

SM 839.—.....**ditto**.....transparent celluloid, 6-in. **3/6**, 8-in. **4/-**, 10-in. **5/-**

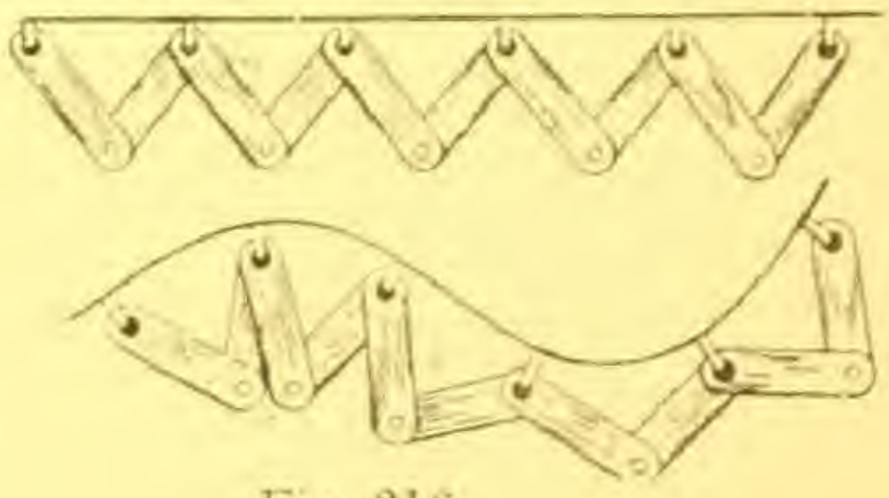


Fig. 216.

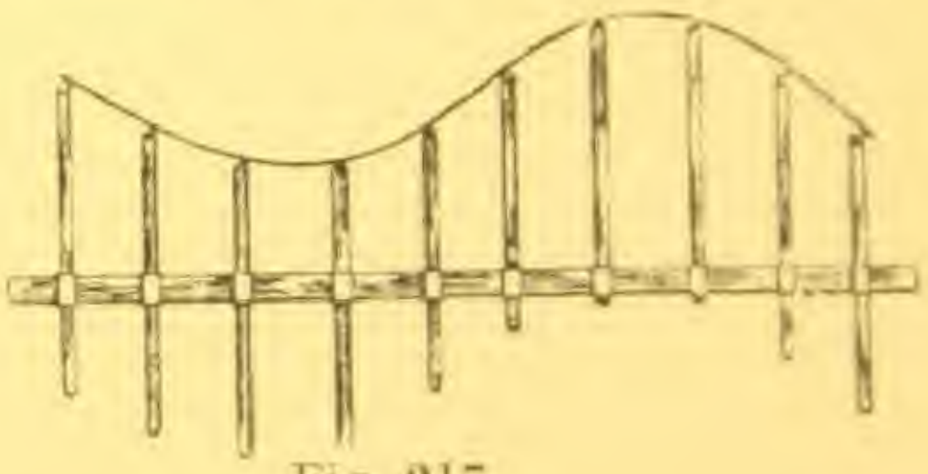


Fig. 217.

SM 840.—**Flexible Curves** of steel, which will retain any shape given Fig. 216 9-inches **3/6** 12-inches **5/3** 18-inches **7/-**

SM 841.—.....**ditto**.....for long curves. Fig. 217.
2-feet **8/3** 3-feet **11/3** 4-feet **14/3** 5-feet **17/3**

SM 842.—**Parabola,** Eqn. $y=x^2$, unit 1-inch. Axis, focus and latus rectum marked. Transparent celluloid..... **1/2**

SM 843.—**Hyperbola**: (Rectangular). Eqn. $xy=1$-inch. Axis marked. Transparent celluloid..... **1/2**

SM 844.—**Ellipse**: Major axis 3-inch, minor axis 2-inch. Axes and foci marked. Transparent celluloid..... **1/2**

SM 845.—**Cycloid**: Roulette of circle 2-inch diameter. Central ordinate marked. Transparent celluloid..... **1/2**

SM 846.—**Cubic Curve**: Eqn. $y=x^3$, unit 1-inch..... **1/2**

DRAFTING MACHINE.
(PATENT).

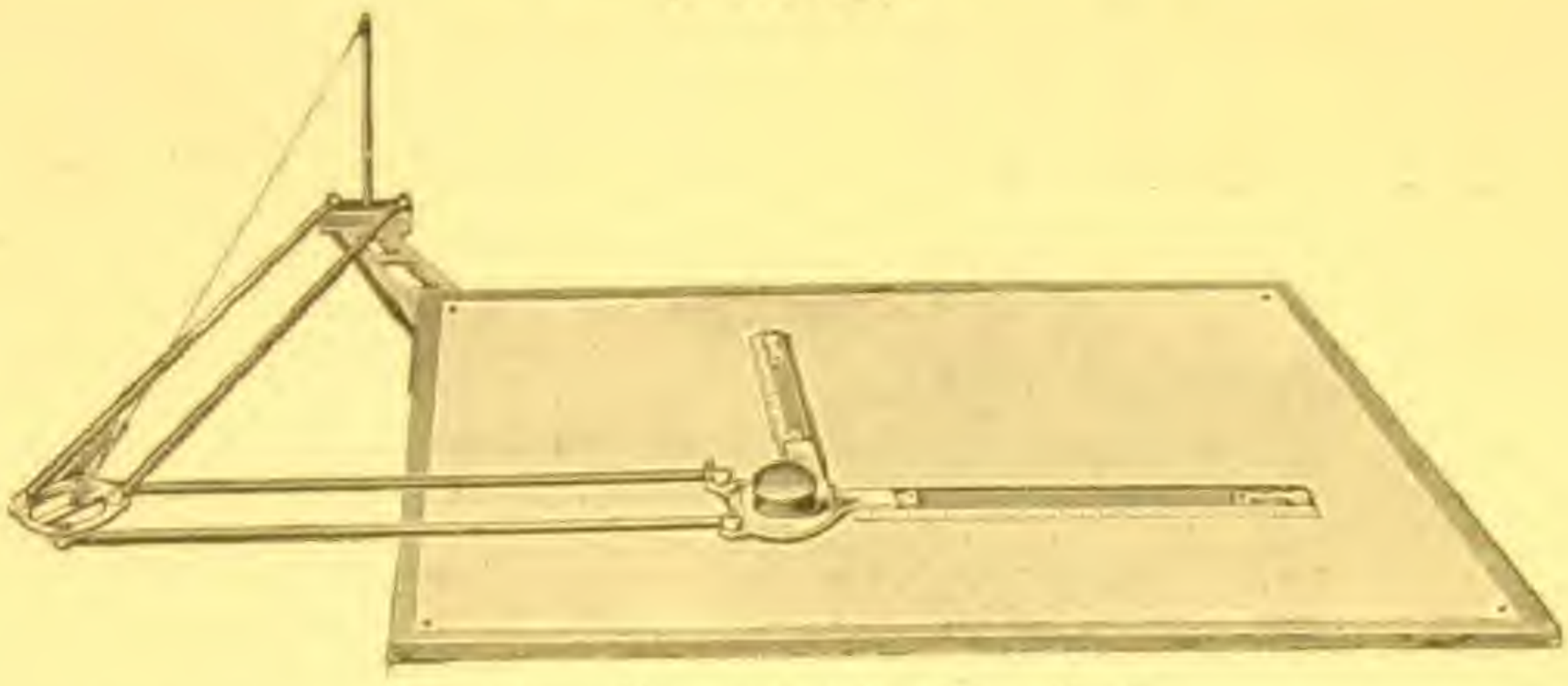


Fig. 218. Horizontal Drafting Machine.

The Drafting Machine can be attached to any drawing board or table and it does the work of the T Square, Set Square, Protractor and Drawing Scale. As lines can be measured, located and drawn in one operation, much labour and time is saved by its use.

The Drafting Machine consists of a Square formed by two drawing scales held at right angles to one another, and connected to a rotary protractor, which is attached to one end of a flexible arm, consisting of two pivotted parallelograms, by which a parallel motion is obtained. The square can be moved about the board in all directions and placed over any spot, whilst always retaining its original angle.

An anchor plate attached to the board serves to connect the machine to the board. By having additional anchor plates the same machine can be used on any number of boards.

The pair of scales forming the square usually consists of one 12-inch and one 18-inch scale, each being divided in a similar manner. They are interchangeable and reversible. Any number of scales of different lengths, and divided in any required manner, can be supplied for the same machine. The graduations are on white celluloid.

The scales serve as straight edges for drawing with the pencil. For inking in a plain straight edge can be substituted.

The square can be set for drawing lines at any required angle, and automatically stops at the principal angles of 30, 45, 60 and 90°. It can also be fixed at any intermediate angle by a clamp.

The Drafting Machine is made in two patterns, one for use on Horizontal boards, Fig. 218, and the other for use on Vertical or inclined boards.

SM 847.—**Horizontal Drafting Machine** for double elephant (42 × 29-inch) board **£10 10 0**

SM 848.—.....**ditto**.....Antiquarian (54 × 32-inch) board... **11 10 0**

SM 849.—**Vertical Drafting Machine** for double elephant (42 × 29-inch) board **£14 10 0**

SM 850.—.....**ditto**.....Antiquarian (54 × 32-inch) board ... **15 0 0**

The above prices are exclusive of the scales particulars of which are given below :—

SM 851.—**Scales** divided as required with metal fitting for attaching to the drafting machine. A pair of scales is necessary to form the square and they are similarly divided on two edges.

12-inch.....**9/-** 18-inch.....**13/6** 24-inch.....**17/6** 36-inch.....**24/-**

SM 852.—**Straight Edge** for inking in with metal fitting.

6-inch.....**7/-** 12-inch.....**10/-** 18-inch.....**13/-** 24-inch.....**18/6**

SM 853.—**Anchor Plate** for attaching Drafting Machine to additional board ..... each **£1 2 6**

COPPER STENCIL PLATES.

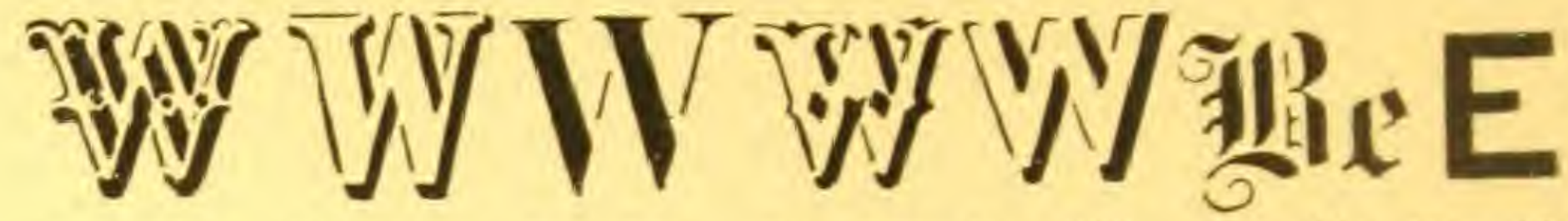


Fig. 219. Fig. 220. Fig. 221. Fig. 222. Fig. 223. Fig. 224. Fig. 225

Alphabets consist of 26 letters and "&." "Capital" and "lower case" letters are the same price.

Numerals.—A set consists of the ten numerals and No.

Words are charged at the *rate* of so much per dozen letters.

Height of letters	⅛-in.	¼-in.	⅜-in.	½-in.	⅝-in.	¾-in.	1-in.
SM 854.—**Plain Block,** Alphabet .....Fig. 225	4/-	4/4	4/9	5/9	6/6	7/3	9/-
SM 855.—**Ditto,** set of numerals	2/-	2/2	2/6	2/9	3/-	3/6	5/-
SM 856.—**Ditto,** words per doz. letters	1/8	2/-	2/6	2/9	3/-	3/3	4/9
SM 857.—**Shaded Block,** Alphabet .....Fig. 223	—	5/8	6/3	7/6	8/9	9/6	12/-
SM 858.—**Ditto,** set of numerals	—	2/10	3/4	3/10	4/3	4/6	6/6
SM 859.—**Ditto,** words per doz. letters	—	2/8	3/3	3/9	4/-	4/3	6/3
SM 860.—**Plain Roman,** Alphabet .....Fig. 221	4/-	4/4	4/9	5/9	6/6	7/3	9/-
SM 861.—**Ditto,** set of numerals	2/-	2/2	2/6	2/9	3/-	3/6	5/-
SM 862.—**Ditto,** words per doz. letters	1/8	2/-	2/6	2/9	3/-	3/3	4/9
SM 863.—**Shaded Roman.** Alphabet .....Fig. 220	—	5/8	6/3	7/6	8/9	9/6	12/-
SM 864.—**Ditto,** set of numerals	—	2/10	3/4	3/10	4/3	4/6	6/6
SM 865.—**Ditto,** words per doz. letters	—	2/8	3/3	3/9	4/-	4/3	6/3
SM 866.—**Old English.** Alphabet .....Fig. 224	—	6/-	7/-	8/-	9/-	10/6	12/6
SM 867.—**Ditto,** set of numerals	—	3/-	3/6	4/-	4/6	5/3	6/-
SM 868.—**Ditto,** words per doz. letters	—	4/-	4/6	5/-	5/6	6/-	7/-
SM 869.—**Ornamental.** Alphabet.....Figs. 219 & 222	—	7/6	8/6	9/6	10/6	11/6	16/-
SM 870.—**Ditto,** set of numerals	—	3/9	4/3	4/9	5/3	5/9	8/-
SM 871.—**Ditto,** words per doz. letters	—	3/3	3/7	4/3	4/9	5/3	7/-

SM 872.—**Ornamental Headings** and word plates cut to order.

SM 873.—**Ornamental Corners** and borders 2/6 3/6 4/6

SM 874.—**Tree Plates** and plantations 2/6 3/6 4/6

SM 875.—**North Points**..... 2/6 3/6 4/6

Stencil Plates of any design cut to order.

SM 876.—**Stencil Ink**..... -/9

SM 877.—**Stencil Brush** ..... -/8

FIELD AND LEVELLING BOOKS.

SM 878.—**Field Survey Book** 8×4-inches with two red lines down the centre 2/6

SM 879.—**Level Book,** 7×4½-inches with columns for Back Sight, Intermediate, Fore Sight, Rise, Fall, Height above base, Distance and Remarks..... 2/6

J. H. Steward, Ltd., 406, Strand, and 457, West Strand, London, W.C.2.

DRAWING PAPER.

Cartridge Drawing Paper in sheets:

SM 880.—Imperial, 30 × 22-inches, per quire of 24 sheets **6/-**
SM 881.—Double Elephant, 40 × 27-inches ditto **9/-**

Continuous Cartridge Drawing Paper in rolls of 25 yards.

	Width in inches	30	40	60
SM 882.—Thin paper, per roll of 25 yards.....		**9/-**	**12/-**	**19/-**
SM 883.—Thick paper ditto		**10/6**	**14/6**	**22/-**

Whatman's Drawing Paper, in sheets. "Natural" surface or "Hot-pressed" smooth surface.

SM 884.—Imperial, 30 × 22-inches..... per quire **20/-**
SM 885.—Double Elephant, 40 × 27-inches ..... per quire **37/-**
SM 886.—Antiquarian, 53 × 31-inches ..... per quire **£6 4 0**

TRACING PAPER AND TRACING CLOTH.

Tracing Paper in rolls of 20-yards, with glazed or unglazed surface.

SM 887.—30-inches wide. Per roll. Thin paper ... **7/6** Thick paper... **9/-**
SM 888.—40-inches wide ditto ... **9/6** ditto **11/6**

Detail Paper in rolls.....Width in inches 30 40 60

SM 889.—Price per roll of 50-yards **7/-** **10/-** **14/-**

Tracing Cloth in rolls of 24-yards.

SM 890.—30-inches wide.....**66/-** 40-inches wide..... **83/6**

SECTIONAL PAPERS.

SM 891.—**Sectional Drawing Paper** in rolls 10-yards long by 24-inches wide. Rulings, $\frac{1}{8}$, $\frac{1}{10}$, $\frac{1}{12}$, $\frac{1}{16}$, $\frac{1}{20}$-inch or millimetres ..... per roll **10/6**

Pads or Blocks of sectional drawing paper. 50 sheets with lines on one side.

Size in inches	$8\frac{1}{2} \times 5\frac{1}{2}$	$11 \times 8\frac{1}{2}$	17×11
SM 892.—Rulings $\frac{1}{8}$ or $\frac{1}{10}$-inch.....	**1/9**	**3/-**	**5/6**
SM 893.—Rulings millimetres	—	**5/-**	**9/6**

Books of sectional drawing paper, 100 leaves, oblong shape.

Size in inches	$6\frac{1}{4} \times 4$	$7\frac{3}{4} \times 5$	$11 \times 8\frac{1}{2}$
SM 894.—Rulings $\frac{1}{8}$ or $\frac{1}{10}$-inch.....	**3/3**	**4/6**	**8/6**
SM 895.—Rulings millimetres	**5/6**	**7/6**	**13/6**

Profile Paper ruled to the scale of 20-feet to 1-inch horizontally and 4-feet to 1-inch vertically.

SM 896.—Per roll of 10-yards by 20-inches wide **10/6**

DRAWING ACCESSORIES.

SM 897.—**Drawing Pins,** best steel points and brass heads.
Per dozen $\frac{1}{2}$-inch...**1/-** $\frac{3}{4}$-inch...**1/2** $\frac{7}{8}$-inch...**1/3**

SM 898.—**Liquid Indian Ink,** waterproof. 1 oz. bottle..... **1/-**

SM 899.—**Coloured Inks,** carmine, brick red, blue, green, brown, yellow, scarlet, vermilion, orange, indigo, and violet. These inks can be thinned with water. When dry they are waterproof..... Per 1 oz. bottle **1/-**

SM 900.—**Pencils.** Sovereign Hexagon Drawing Pencils in varying degrees of hardness. F, B to 3 B, H to 6H, HB...**4d.** each, or per dozen **3/9**

SM 901.—**India Rubber,** grey, pliable..... per piece **-/6** and **-/9**

TELEGRAPHIC CODE.

Inland Telegraphic Address: "TELEMETER, RAND, LONDON."

Cable Address: "TELEMETER, LONDON."

Send quotations with time for delivery of the following ...	Oblation
How soon can you deliver	Oblique
Quote price, packed and f.o.b. London	Obscure
Quotation received, send goods ...	Observe
Quotation received, send goods omitting the following ...	Obstinate
Put in hand at once	Obstruct
Remittance forwarded	Obviate
Apply for payment to	Occult
Ship by first steamer	Occupy
Send by parcel post	Octavo
Send by letter post	Ocular
Please supply the following ...	Opaque
Apply for shipping instructions to	Obelisk
Goods must all be here at the latest by...	Oblong
All instruments to have metrical scales	Occur
Can deliver immediately	Obtuse
Can deliver in	Obligate
Order received	Officious
Order not yet received	Olive
Goods were forwarded to you on...	Onset
Goods were forwarded to you by...	Onward
We are sending particulars by post	Operate
Answering your inquiry our price is	Ocean
Have received your letter or telegram and are giving the matter attention	Ode

Page 7.

SM1. Fabian
SM2. Fable
SM2A Fabric
SM3. Fabricant
SM4. Fabricate
SM4A Fabrication

Page 8.

SM5. Fabulosity
SM6. Fabulous
SM6A Facade
SM7. Face
SM8. Faceless
SM9. Faceted
SM11. Facetious
SM12. Facial

Page 9.

SM13. Facilities
SM14. Facing
SM14A Fact

Page 10.

SM15. Factionist
SM16. Factitive
SM16A Factor
SM16B Factorage
SM17. Factorial
SM18. Factorize
SM18A Factorship
SM19. Factory
SM20. Factotum
SM20A Facture
SM21. Faculty.
SM22. Fad
SM22A Faddle
SM23. Fadeless
SM24. Fadge

Page 11.

SM25. Fagging
SM26. Fagot
SM27. Fail
SM28. Failing
SM29. Failure
SM30. Faint

Page 12.

SM31. Fainting

Page 13.

SM32. Fair
SM33. Fairway
SM34. Fairy
SM35. Faith
SM36. Faithful
SM36A Farthless
SM37. Fake

Page 14.

SM38. Falcation
SM39. Falcon
SM39A Falconry
SM40. Fall
SM41. Fallacious
SM41A Fallacy

Page 15.

SM42. Fallen
SM43. Fallible

Page 16.

SM44. False

Page 17.

SM45. Falsehood
SM46. Falsetto
SM47. Falsifier
SM48. Falsity.
SM49. Faltering

Page 19.

SM50. Fame
SM51. Fameless
SM52. Familiar

Page 20.

SM53. Familiarity
SM54. Family
SM55. Famine
SM56. Famishing
SM57. Famous

Page 21.

SM58. Fan
SM59. Fanatic
SM60. Fancied
SM61. Fanciful
SM62. Fancy
SM63. Fanfare
SM64. Fangless

Page 22.

SM65. Fanner
SM66. Fantasia
SM67. Fantastic
SM68. Fantasy

Page 23.

SM69. Far
SM70. Farcical

Page 24.

SM71. Fare
SM72. Farm

Page 25.

SM73. Farmer
SM74. Farming
SM75. Farrier
SM76. Farrow
SM77. Farthing
SM78. Fascinate

Page 26.

SM79. Fashion
SM80. Fashionable
SM81. Fast
SM82. Fasten
SM83. Fastening
SM84. Fastidious
SM85. Fastish
SM86. Fastness
SM87. Fat
SM88. Fatal
SM89. Fatalism
SM90. Fatality
SM91. Fated
SM92. Fateful
SM93. Father
SM94. Fatherhood
SM95. Fatherland
SM96. Fatherless
SM97. Fathom

Page 27.

SM98. Fatness
SM99. Fatten
SM100. Fatuitous
SM101. Fatuous
SM102. Fault
SM103. Faulty
SM104. Favour
SM105. Favourable
SM106. Favourite
SM107. Fawn
SM108. Fawning

Page 27 *(con.)*

SM109. Fealty
SM110. Fear
SM111. Fearful
SM111A Fearless
SM112. Fearnought
SM112A Feasibility
SM113. Feasible
SM113A Feast
SM114. Feaster
SM114A Feastful
SM115. Feasting
SM115A Feather
SM116. Feathering
SM116A Feature
SM117. Featureless
SM117A Febrifuge

Page 28.

SM118. Febrile
SM119. Feckless
SM120. Federacy
SM121. Federal
SM122. Federation
SM123. Federate
SM124. Fee
SM125. Feeble

Page 29.

SM126. Feeding
SM127. Feetless
SM128. Feign
SM129. Feldspar
SM130. Felicital
SM131. Felicitous
SM132. Felicity
SM133. Feline
SM134. Fellow
SM135. Fellowship
SM136. Felon
SM137. Felting
SM138. Female
SM139. Feminine

Page 30.

SM140. Fence
SM141. Fencer
SM142. Fencing
SM143. Fender
SM144. Fermentable
SM145. Fermentation
SM146. Fern
SM147. Fernery
SM148. Ferocious

Page 30 (*con.*)

SM149. Ferocity
SM150. Ferret
SM151. Ferrule

Page 31.

SM152. Ferry
SM153. Fertile
SM154. Fertility
SM155. Fertilize
SM156. Fervency
SM157. Fervent
SM158. Festival
SM159. Festive
SM160. Festivity
SM161. Festoon

Page 32.

SM162. Fetch
SM163. Fetlock
SM164. Fettered
SM165. Feud

Page 33.

SM166. Feudal

Page 34.

SM169. Feverish
SM170. Few
SM171. Fiat

Page 35.

SM172. Fib
SM173. Fibre
SM174. Fickle
SM175. Fiction
SM176. Fictitious
SM177. Fiddle
SM178. Fiddling

Page 36.

SM179. Fidelity
SM180. Fidget
SM181. Fiducial
SM182. Fief
SM183. Field
SM184. Fiendful
SM185. Fiendish
SM186. Fierce
SM187. Fiery
SM188. Fife

Page 38.

SM189. Fifth
SM190. Fig.
SM191. Figment
SM192. Figurable
SM193. Figure
SM194. Filament
SM195. Filar
SM196. Filbert
SM197. Filch
SM198. File
SM199. Filial

Page 39.

SM200. Filibuster
SM200A Filical
SM201. Filigree
SM202. Filings
SM203. Fill
SM204. Fillet
SM205. Fillibeg
SM206. Fillip
SM207. Fillister
SM208. Filly
SM209. Film
SM210. Filose
SM211. Filter

Page 39 (*con.*)

SM212. Filtering
SM213. Filtrate
SM214. Filtration
SM215. Fin
SM216. Finable
SM217. Final
SM218. Finality
SM219. Finance

Page 40.

SM220. Financial
SM221. Finch
SM222. Finched
SM223. Find
SM224. Finder
SM225. Finding
SM226. Fine-drawn
SM227. Finery
SM228. Finesse
SM229. Finger

Page 41.

SM230.
4 p. Fingering
100 ft. Finicking
20 m. Fining
25 m. Finish
SM231.
4 p. Finished
100 ft. Finisher
20 m. Finishing
25 m. Finite
SM232.
4 p. Finitude
100 ft. Finless
20 m. Finlike
25 m. Finny
SM233.
4 p. Fiord
100 ft. Fire
20 m. Fireman
25 m. Firer
SM234. Fireside
SM235. Firing

Page 42.

SM 236.
4 p. Firkin
50 ft. Firm
100 ft. Firmly
20 m. Firmament
30 m. Firman
SM237.
4 p. First
50 ft. Firstling
100 ft. Firth
20 m. Fiscal
30 m. Fish
SM 238.
4 p. Fisher
50 ft. Fisherman
100 ft. Fishery
20 m. Fishgarth
30 m. Fishing
SM239. Fishy
SM240.
33 ft. Fissile
50 ft. Fissility
66 ft. Fission
100 ft. Fist
SM241. Fistic
SM242.
200 ft. Fisticuff
300 ft. Fistular
400 ft. Fistulate
500 ft. Fistulose
SM243.
200 ft. Fit
300 ft. Fitch
400 ft. Fitched

Page 42 (*con.*)

500 ft. Fitful
SM244.
200 ft. Fitting
300 ft. Fitweed
400 ft. Fitz
500 ft. Fives
SM245.
2 ch. Fix
3 ch. Fixable
4 ch. Fixation
5 ch. Fixed
SM246.
2 ch. Fixture
3 ch. Fizz
4 ch. Flabby
5 ch. Flabellate
SM247.
2 ch. Flaccid
3 ch. Flaccidity
4 ch. Flacker
5 ch. Flacket

Page 43.

SM248.
33 ft. Flag
50 ft. Flagellant
66 ft. Flagellate
100 ft. Flageolet
SM249.
10 m. Flagging
15 m. Flaggy
20 m. Flagitous
30 m. Flagon
SM250.
10 m. Flagrancy
15 m. Flagrant
20 m. Flail
30 m. Flake

Page 44.

SM251.
25 ft. Flaw
33 ft. Flambeau
50 ft. Flamboyant
66 ft. Flameless
100 ft. Flamen
SM252
25 ft. Flaming
33 ft. Flammable
50 ft. Flange
66 ft. Flank
100 ft. Flanker
SM253.
25 ft. Flannel
33 ft. Flannelled
50 ft. Flap
66 ft. Flapper
100 ft. Flare
SM254.
10 m. Flaring
20 m. Flash
25 m. Flasher
30 m. Flashing
SM255.
10 m. Flashy
20 m. Flasket
25 m. Flat
30 m. Flatter
SM256.
10 m. Flattering
20 m. Flattery
25 m. Flattish
30 m. Flatulence
SM257.
10 m. Flatwise
15 m. Flaunt
20 m. Flaunter
30 m. Flaunting
SM258.
10 m. Flautist
15 m. Flavine

Page 44 (*con.*)

20 m. Flavorous
30 m. Flavour
SM259
10 m. Flavoured
15 m. Flavourless
20 m. Flaw
30 m. Flawless
SM260.
25 ft. Flawy
33 ft. Flax
50 ft. Flaxen
66 ft. Flaxy
10 m. Flay
15 m. Flayer
20 m. Flea
SM261.
10 m. Fleak
15 m. Fleaking
20 m. Fleam
SM262.
3 ft. Fleche
6 ft. Fleck
12 ft. Flecker

Page 45.

SM263.
33 ft. Flecked
66 ft. Flection
SM264.
10 m. Flector
15 m. Fledge
20 m. Fledgeling
30 m. Flee
SM265.
25 ft. Fleece
33 ft. Fleeceless
50 ft. Fleecer
66 ft. Fleecy
100 ft. Fleerer
SM266.
6 ft. Fleering
9 ft. Fleet
12 ft. Fleeting

Page 46.

SM267. Fleming
SM268. Flemish
SM269. Flesh

Page 47.

SM270. Fleshed

Page 48.

SM270A Flesher

Page 49.

SM271. Fleshing
SM272. Fleshless
SM273. Fleshment
SM274. Fletch
SM275. Fletcher

Page 50.

SM276. Flew
SM277. Flewed
SM278. Flex

Page 51.

SM279. Flexibility
SM280. Flexible
SM281. Flexion

Page 52.

SM282. Flexor
SM282A Flexure
SM283. Flexuose
SM283A Flexuous
SM284. Flibustier
SM285. Flickeringly

Page 53.

SM286. Flier
SM287. Flight

Page 54.

SM288. Flighted
SM289. Flighty
SM290. Flimflam

Page 55.

SM291. Flimsy
SM292. Flinch
SM293. Flincher

Page 56.

SM294. Flinchingly
SM295. Fling

Page 57.

SM296. Flinger
SM297. Flint
SM298. Flinty

Page 58.

SM299. Flip
SM300. Flipflap
SM301. Flippancy

Page 59.

SM302. Flippant
SM303. Flirt
SM304. Flirtation
SM305. Flirting
SM306. Flisk
SM307. Flit
SM308. Flitch

Page 60.

SM309. Flitty
SM310. Float
SM311. Floatage
SM312. Floater

Page 61.

SM313. Floating
SM314. Floaty
SM315. Floccose
SM316. Flocculence
SM317. Flock
SM318. Flockly
SM319. Floe
SM320. Flog
SM321. Flogging
SM322. Flood

Page 62.

SM323. Flooding
SM324. Flookan
SM325. Floor
SM326. Flooree

Page 63.

SM327. Flooring
SM328. Floorless
SM329. Flop
SM330. Flora

Page 64.

SM331. Floral
SM332. Floran
SM333. Floreated
SM334. Florence
SM335. Florentine
SM336. Florescence
SM337. Floret
SM338. Floriage
S.M.338A. Floricomous.

Page 65.

SM339.Floricultural
SM340. Floriculture
SM341. Florid

Page 66.

SM342. Floriferous
SM343. Floriform
SM344. Florin
SM345. Florist
SM346. Floss
SM347. Flossy
SM348. Flota
SM349. Flotant
SM350. Flotation
SM351. Flotilla
SM352. Flotsam
SM353. Florence

Page 67.

SM354. Flounder
SM355. Flour

Page 68.

SM356. Flourish
SM357. Flourishing
SM358. Flout

Page 69.

SM359. Flow
SM360. Flowage
SM361. Flower
SM362. Floweret
SM363. Flowering
SM364. Flowing

Page 70.

SM365. Fluctuate
SM366. Flue
SM367. Fluency
SM368. Fluent
SM369. Fluff
SM370. Floid

Page 71.

SM371. Fluke
SM372. Flukey
SM373. Flurry
SM374. Flush
SM375. Flusher
SM376. Flushing

Page 73.

SM377. Flushness
SM378. Fluted
SM379. Fluter
SM380. Fluting
SM381. Flutish
SM382. Flutter
SM383. Fluttering
SM384. Fluty

Page 75.

SM385. Flurial
SM386. Fluriatic
SM387. Fluriatile
SM388. Flux
SM389. Fluxation
SM390. Fluxibility
SM391. Fluxible
SM392. Fluxility
SM393. Fluxion
SM394. Fluxional
SM395. Fluxionary
SM396. Fluxionist
SM397. Fly
SM398. Flying
SM399. FRONTLET
SM400. Frost
SM401. Frosted
SM402. Frostless
SM403. Froth
SM404. Frounce
SM405. Froward
SM406. Frown
SM407. Frozen

Page 76.

SM408. Fructed
SM409. Fructify
SM410. Frugal
SM411. Frugality
SM412. Fruit
SM413. Fruitage
SM414. Fruiterer.

Page 77.

SM415. Fruitful
SM416. Fruiting
SM417. Fruition
SM418. Fruitless
SM419. Fruity
SM420. Frump
SM421. Frumpish
SM422. Frush
SM423. Frustrate
SM424. Frustration
SM425. Fry
SM426. Fubby
SM427. Fucate

Page 78.

SM428. Fuchsia
SM429. Fucoidal
SM430. Fuddle
SM431. Fuddler
SM432. Fudge

Page 79.

SM433. Fuel.
SM434. Fueller
SM435. Fuero
SM436. Fuffy

Page 80.

SM437. Fugile
SM438. Fugitive
SM438A. Fugleman

Page 81.

SM439. Fulcrum
SM440. Fulfil
SM441. Fulfilment
SM442. Fulfilling
SM443. Fulgency
SM444. Fulgent

Page 82.

SM445. Full
SM446. Fullery
SM447. Fulminate
SM448. Fulsome
SM449. Fumage
SM450. Fumatory
SM451 Fumble
SM452. Fumbling

Page 83.

SM453. Fume
SM454. Fumid
SM455. Fumigate
SM456. Fun
SM457. Function
SM458. Functional
SM458A. Functionary
SM459. Fund
SM460. Funding
SM461. Funded
SM462. Funeral
SM463. Fungi
SM463A. Fungibles

Page 84.

SM464. Fungoid
SM465. Fungus
SM466. Funicle
SM467. Funicular
SM468. Funk
SM469. Funnel
SM470. Funny

Page 85.

SM471. Fur
SM472. Furbelow
SM473. Furbish

Page 86.

SM474. Furcate
SM475. Furiosity
SM476. Furious
SM477. Furl
SM478. Furlong
SM479. Furnace
SM480. Furniture

Page 87.

SM601. Foal
SM602. Foaling
SM603. Foamless
SM604. Foamy
SM605. Fob
SM606. Focal
SM607. Focalize
SM608. Focus
SM609. Fodder
SM610. Fodient
SM611. Foe
SM612. Foeman

Page 88.

SM613. Fog
SM614. Fogey
SM615. Foilable
SM616. Foiled
SM617. Foist
SM618. Fold

Page 89.

SM619. Foliage
SM620. Folder
SM621. Folding
SM622. Foldless
SM623. Foliage
SM624. Foliate
SM625. Foliation
SM626. Folio
SM627. Folious
SM628. Folk
SM629. Folkland
SM630. Folknote
SM631. Follicle
SM632. Follicular
SM633. Follow

Page 90.

SM634. Follower
SM635. Following
SM635A Folly
SM636. Foment
SM637. Fomentation
SM638. Fond

Page 91.

SM639. Fondle
SM640. Font
SM641. Fontal
SM642. Food
SM643. Foodful
SM644. Foodless
SM645. Foolery
SM646. Foolish
SM647. Foolscap

Page 92.

SM648. Football
SM649. Foothold
SM650. Footless
SM651. Footwear
SM652. Footmark
SM653. Footprint

Page 93.

SM654. Footstep
SM655. Fop
SM656. Foppery
SM657. Foppish
SM658. For
SM659. Forage
SM660. Foraging
SM661. Forasmuch
SM662. Foray
SM663. Forbear

Page 94.

SM664. Forbearance
SM665. Forbid
SM666. Forbidden

Page 95.

SM667. Force
SM668. Forceful
SM669. Forceless
SM670. Forcemeat

Page 96.

SM671. Forceps
SM672. Forcible
SM673. Forcing

Page 97.

SM674. Ford
SM675. Fordable

Page 98.

SM676. Forearm
SM677. Forebode
SM678. Forecast
SM679. Foreclose

Page 99.

SM680. Foredoom
SM681. Forefather
SM682. Forefend
SM683. Forefinger
SM684. Forefront
SM685. Forego

Page 100.

SM686. Foregone
SM687. Foreground
SM688. Forehead
SM689. Foreboding
SM690. Foreign

Page 101.

SM691. Foreigner
SM692. Forejudge
SM693. Foreknown

Page 102.

SM694. Foreknowledge
SM695. Foreland
SM696. Forelooader
SM697. Forelock
SM698. Foreman
SM699. Forenoon
SM701. Forensic
SM702. Forepeak
SM703. Foreprize
SM704. Forerun
SM705. Foresaid

Page 103.

SM706. Foresee
SM707. Foreshadow
SM708. Foreshame
SM709. Foreshorten
SM710. Foreshow
SM711. Foreside
SM712. Foresighted
SM713. Foreskirt

Page 104.

SM714. Foresleeve
SM715. Forespeech
SM716. Forespent
SM717. Forespoken
SM718. Forest
SM719. Forestage
SM720. Forestall
SM721. Forester
SM722. Forestry
SM723. Foretaste
SM724. Foretell
SM725. Forethink
SM726. Forethought
SM727. Foretoken

Page 105.

SM728. Foretop
SM729. Forever
SM730. Forevouched
SM731. Forewarn
SM731A. Forewind
SM732. Forfeit
SM732A. Forfeitable
SM733. Forfeiture
SM734. Forfend
SM735. Forge
SM736. Forgeman
SM737. Forgery
SM738. Forget
SM739. Forgetful
SM740. Forgeing
SM741. Forgivable
SM742. Forgive

Page 106.

SM743. Forgiveness
SM744. Forgiving
SM745. Fork
SM746. Forkhead
SM747. Forkless
SM748. Forktail
SM749. Forlorn
SM750. Form
SM751. Formal
SM752. Formalism
SM753. Formality

Page 107.

SM754. Formation
SM755. Formed
SM756. Formic
SM757. Formicant
SM758. Formidability
SM759. Formidable
SM760. Formless
SM761. Formula
SM762. Formulary
SM762A. Formularize
SM763. Forsake
SM764. Forsooth
SM765. Forswear

Page 108.

SM766. Fort
SM767. Forthcoming
SM768. Forthright
SM769. Forthwith
SM770. Fortifiable

Page 108 (*con.*)

SM771. Fortification
SM772. Fortify
SM773. Fortitude
SM774. Fortnight
SM775. Fortress
SM776. Fortuitous

Page 109.

SM777. Fortunate
SM778. Fortune
SM779. Fortuneless
SM780. Forty
SM781. Forum
SM782. Forward
SM783. Forwarding
SM784. Fosse
SM785. Fossil
SM786. Fossilize
SM787. Foster
SM788. Fosterage

Page 110.

SM789. Foul
SM790. Found
SM791. Foundation
SM792. Founder
SM793. Foundry
SM794. Foundling
SM795. Fount
SM796. Fountain
SM797. Four
SM798. Fourfold

Page 111.

SM799. Fourpenny
SM800. Fourscore
SM801. Fourteen
SM802. Fourthly
SM803. Fowler
SM804. Fowling
SM805. Fox
SM806. Foxglove
SM807. Foxtail
SM808. Fracas
SM809. Fraction
SM810. Fracture
SM811. Fragile
SM812. Fragility

Page 112.

SM813. Fragment
SM814. Fragrance
SM815. Frail
SM816. Frailty
SM817. Frame
SM818. Framework
SM819. Framing
SM820. Franc
SM821. Franchise
SM822. Franciscan
SM823. Frangible
SM824. Franking
SM825. Frantic
SM826. Fraternal
SM827. Fraternity
SM828. Fraternize
SM829. Fraud
SM830. Fraudless

Page 113.

SM831. Fraudulent
SM832. Fraught
SM833. Fray
SM834. Fraying
SM835. Freak
SM836. Freakish
SM837. Freckle
SM838. Free
SM839. Freebooter
SM840. Freeborn
SM841. Freedom
SM842. Freehold
SM843. Freeman
SM844. Freemasonry
SM845. Freeze
SM846. Freight

Page 114.

SM847. Freightage
SM848. French
SM849. Frenchify

Page 114 (*con.*)

SM850. Frenchman
SM851. Frenzied
SM852. **Frenzy**
SM853. Frequency

Page 115.

SM854. Frequent
SM855. Frequenter
SM856. Fresco
SM857. Fresh
SM858. Freshen
SM859. Freshman
SM860. Fret
SM861. Fretful
SM862. Fretwork
SM863. Friable
SM864. Friar
SM865. Friary
SM866. Friction
SM867. Frictional
SM868. Friday

Page 115 (*con.*)

SM869. Friend
SM870. Friendless
SM871. Friendly
SM872. Friendship
SM873. Frieze
SM874. Frigate
SM875. Fright
SM876. Frighten
SM877. Frightful
SM878. Frigid
SM879. Frigidity.

Page 116.

SM880. Frill
SM881. Frilled
SM882. Fringe
SM883. Fringeless
SM884. Fripper
SM885. Frippery
SM886. Frisk

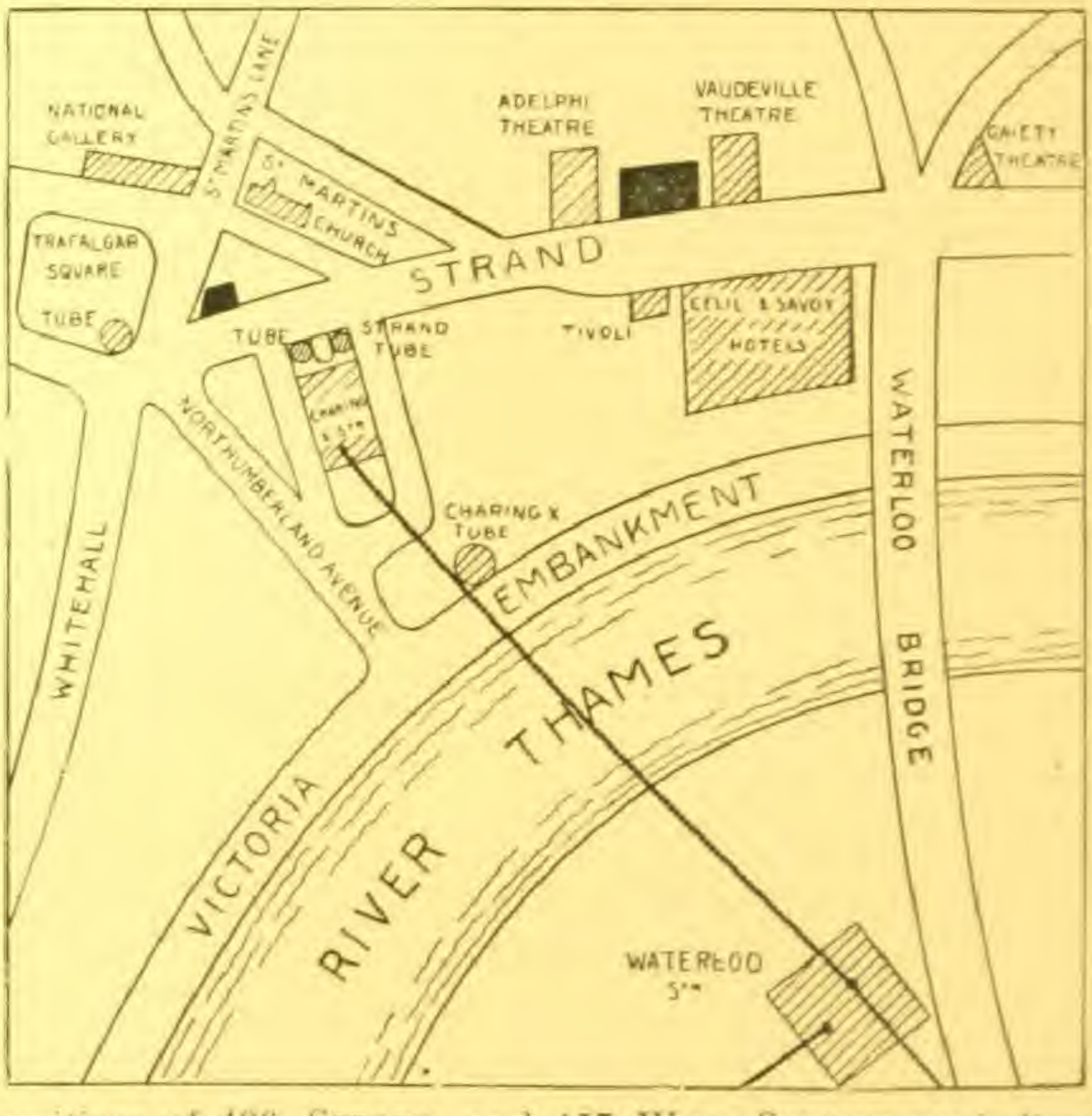
Page 116 (*con.*)

SM887. Frisket
SM888. Frisky
SM889. Fritter
SM890. Frivolity
SM891. Frivolous
SM892. Frock
SM893. Frockless
SM894. Frog
SM895. Frolic
SM896. Frolicsome
SM897. From
SM898. Frond
SM899. Frontage
SM900. Frontal
SM901. Frontier

Cover.

SM902. Frontate
SM903. Frontated
SM904. Fronted
SM905. Frontispiece

For continuation of Code Words see Code Index for Page 75.



The positions of 406, STRAND, and 457, WEST STRAND, are indicated by the black patches.

Nearest Railway Stations—Charing Cross; Strand and Trafalgar Square.

Buses from Victoria and other directions pass the door.

Trams run along the Victoria Embankment.

CAT 71

THE "RECTIFORM" PRISM FIELD GLASSES.

The "Rectiform" Prism Binocular Field Glasses. Wide angular field combined with great brilliancy of the object. Adjustment to eye-pieces for equalising vision of the two eyes. Jointed bars for setting the eye-pieces to suit width of user. Leather sling case to take the binocular set to focus ready for instant use. Sealed mounts to prevent ingress of dust and moisture. Neck strap to binocular to leave hands free without returning binocular to its case. Made in two models, one with independent focussing adjustment to each eye-piece as illustrated and the other with central focussing wheel for adjusting the two eye-pieces simultaneously, the price of which is quoted separately.

SM 902.—**"Rectiform" Prism Binocular,** as illustrated, power × 6, with sling case..... (Post free)... **£8 10 0**

SM 903.—...**ditto**.....power × 8 ..... **(Post free)... 9 5 0**

SM 904.—If fitted with wheel focussing adjustment.....Extra **1 5 0**

THE "LORD BURY" TELESCOPE.

SM 905.—**The "Lord Bury" Telescope.** Bronzed brass mounts with body covered with leather. Object Glass 1¾ diameter with sunshade and protecting cap. Variable magnifying power × 25 to × 35 by means of pancratic draw. Length closed 10½-inches, extended 31-inches. Leather case with shoulder strap..... (Post free)... **£8 8 0**

Part 1.—Catalogue of Field Glasses and Telescopes. Post Free.

J. H. STEWARD, Ltd.

Opticians and Scientific Instrument Makers,

406, STRAND, AND 457, WEST STRAND, LONDON, W.C.2.

FIELD, MARINE and OPERA GLASSES.

Prismatic Binoculars—Race Glasses—Binoculars for Military Officers and Naturalists—Marine Binoculars—Night Glasses—Opera Glasses.

TELESCOPES.

The " Lord Bury " Telescope for Sportsmen—Telescopes for Naval and Military Officers—Spotting Telescopes for use on the Rifle Range—Look-Out Telescopes—Astronomical Telescopes.

BAROMETERS and THERMOMETERS.

Aneroid and Mercurial Barometers for the House and for the Observatory —Aneroids for Mountain Climbing—Aero Aneroids—Barographs.

Thermometers for the House or Garden and for the Laboratory—Bath Thermometers—Clinical Thermometers—Thermographs.

MICROSCOPES.

The "Rectiform" Microscopes for Students of Histology, Bacteriology and Agriculture—The " Rectiform" Petrological and Metallurgical Microscopes— The " Britex " School Microscope—Dissecting Microscopes—Pocket Lenses.

MINERALOGY, CRYSTALLOGRAPHY.

Instruments for use in Mineralogy, Crystallography, Petrology, and for the study of Precious Stones, and the detection of imitation Gem Stones.

MILITARY INSTRUMENTS.

Instruments for Reconnaissance—Liquid and Luminous Prismatic Compasses—Instruments for Gunnery—Map Scales—Protractors—Slide Rules---Sketching Instruments—The "ORILUX " Belt Lamp.

OPTICAL AIDS TO RIFLE SHOOTING.

Spotting Telescopes—Optical Sights for Long Range and Miniature Rifles—N.R.A. " Rectiform " Shooting Spectacles for ensuring distinct vision when aiming obliquely through the spectacles—" CHROMOS " Spectacles for reducing the effect of irradiation, increasing the visibility of the aiming mark and sharply defining the foresight of rifle.

SPECTACLES and EYEGLASSES.

Spectacles and Eyeglasses with " Rectiform " Lenses specially adapted for Reading, Tennis, Golf, Motoring, Shooting, Billiards—" Rectiform " Bi-focal Lenses serving the purpose of two separate pairs of Glasses for reading and distance—" Crookes " tinted glass for absorbing harmful light and heat rays.

Fully equipped Testing and Fitting Rooms at the disposal of clients.

PARTICULARS OF ANY OF THE ABOVE FREE ON APPLICATION.

J. H. STEWARD, LTD.

Official Opticians to the N.R.A. and Contractors to H.M. Government,

406, STRAND and 457, WEST STRAND, LONDON, W.C.2.