

# TESSERACT

Early Scientific Instruments

Special Issue:RARITIES & MASTERWORKS Catalogue One Hundred Ten Winter, 2019/2020 \$10

#### CATALOGUE ONE HUNDRED TEN

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## TESSERACT

Box 151 Hastings-on-Hudson New York 10706 USA

*telephone*: 1-914-478-2594 *e-mail*: mail@etesseract.com *web site*: http://www.etesseract.com



# RARITIES AND MASTERWORKS

#### \* \* \* \* \* ASTRONOMY \* \* \* \* \*



1. ASTRONOMICAL CALCULATOR MASTERPIECE, French, c. 1685, signed "P. Sévin à Paris." A 3" (7.8 cm) diameter main plate is set with a total of three volvelles, all in brass and exquisitely engraved on all visible surfaces, including floral and rope-twist decor to the centers. The calendrical and astronomical scales and information are rather overwhelming.

Side one has two fixed semicircular scales for day of the month (0 - 31 and 0 - 28/30 respectively), correlating with an outermost band for years 1685 - 1705. The volvelle is set by index to these external scales, and has three readout windows plus a wealth of indications, including risings and settings of the sun, plus a wonderful eccentric band filled with named events in the religious calendar.

Side two has fixed scales of lunar age plus months plus hours, a rotating volvelle with year band "années pour le Iours de Lune" plus "Iours des mois" and "Mois pour les Iours de la Semaine" bands, and an inner rotating volvelle with "Année pour les iours des Semaines" (again for the 20 coming years 1685 - 1705) correlating with weekdays plus a broad band of saints' days, etc.

This is the most elaborate pocket-size calendrical reckoner we have seen. In very fine condition, it is seemingly a unique survival.

The maker was Pierre Sévin, a superb mechanician, working c. 1662 - 1685, constructing instruments for the Observatoire de Paris (in collaboration with Chapotot), for voyages of exploration, for Royalty, etc. Among his special fabrications which survive are a wonderful polyhedral sundial in the Collection Landau in the Louvre, and the recipient angle in the Musée des Arts et Métiers.

This is a sophisticated instrument of exceptional craftsmanship. The closest we find in the literature is the "Instrument shewing the Eclipses of the Sun and Moon, the Months and Lunar Years, and also the Epacts" (see Stone's 1753 translation of Bion, pp. 168-171, and Plate XVI Fig. 13). \$25,000.





WILLIAM JONES' TELLURIAN / PLANETARIUM ENSEMBLE



LARGE VERSION OF THE "NEW PORTABLE ORRERY," English, c. 1795, 2. signed "Designed for the New Portable Orreries by W. Jones, and Made and Sold by W. & S. Jones, 30 Holborn, London; Jan'y 1st, 1794, Published as the Act directs by W. & S. Jones," and simply "Jones, London" on the earth globe, and with an early provenance to the Manchester Philosophical Society. Contained in the original 13-1/2" x 13-1/2" x 8" (34 x 34 x 20 cm) brown-stained pine box is the complete outfit fully described and illustrated by William Jones in his Description and Use of a New Portable Orrery, first published 1782. His portable orrery, in this large version, consists of the fully-geared hand-cranked Tellurian displaying the annual motions of the inner planets, and of the earth / moon system, about the sun. It maintains the earth's axis fixed in space, while driving the moon in its inclined monthly orbit, and showing the diurnal rotation of the earth. The rest of his orrery is the Planetarium, with the eight planets (out through Uranus, discovered 1781, but of course not yet Neptune 1846) surrounded by their known satellites, all positionable by hand. The baseplates are wood mounted with printed, hand-colored and varnished calendrical sheets presenting a great variety of solar system facts.

There are several accessories and alternate arrangements. A small oil lamp may be substituted for the Planetarium's sun, to demonstrate eclipses. Jones also recommends using this in a dark room, where the shadow of Jupiter and the four Galilean satellites explains the linear telescopic appearance of the Jovian system. He writes of many failures of the earth-centered Ptolemaic system, all demonstrable with his Orrery. There is even a small brass ball provided to replace the Earth ball, with the Earth transferred to the center. Another accessory shows the retrograde motion of planets as seen from earth, although only the long arm remains, lacking its mounting brackets. Otherwise the outfit is complete throughout, in very fine condition, noting only some slight disturbance of the paper due to wood shrinkage, and some losses of black enamel on the "night" sides of the planet balls.

The outfit was designed by William Jones, pupil of Benjamin Martin and employee of George Adams, and manufactured by Jones, partnering with his brother Samuel. Their firm was quite active, with special ability in the construction of philosophical demonstration apparatus (see, *e.g.*, their Atwood's Machine outfit, **Tesseract** Catalogue 4, Item 55), and Ferguson's Mechanical Wedge (5/56).

A remarkable survival of Jones' complete mechanical model of the machinery of the solar system. \$85,000.

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#### PROBABLY THE EARLIEST DATED GUNTER'S QUADRANT

3. IMPORTANT DAY / NIGHT HORARY QUADRANT WITH NOCTURNAL, English, 1632, signed "R.S." and dated. With an overall radius of 4-1/2" (11.6 cm) the brass quadrant is fitted with twin pinhole sights along the top edge, rotating volvelle to the reverse, and pierced for plumb line as necessary. It is beautifully laid out and masterfully engraved, the letters and numerals all hand formed but for a "zero" punch, which is used in all



the 0, 6, 8. and 9's. Condition is very fine, the brass with a uniform tan patina.

The front is laid out with the classic pattern designed by Edmund Gunter in 1618, published 1623. It has a projection of the sky (with a dozen bright stars marked) crossed by curved hour lines and sun's azimuth lines, as well as arcs of the equator, tropics, horizon, and ecliptic. It is laid out for 51.5° north latitude (that of London). There is a folded calendar scale (with vernal equinox of March 11, thus still in the Julian system), a degree quadrant, and a shadow square. Within the square is engraved a fine list of the twelve stars (of both N and S declinations) with their celestial coordinates. Using the edge sights, and hanging a plumb line, allows direct time measurement as an altitude sundial. Finally the front is engraved with lovely wandering strawberry vines.

The reverse is divided and engraved with concentric and parallel circles and arcs of degrees, hours, etc. It is centered with a volvelle having circumferential calendar ring with seven numbered stars located, and laid out with a de Rojas projection grid of hour lines crossed diagonally with a Zodiacal line, and with the twelve star positions plotted. Using a simple thread, this forms a planispheric nocturnal, one of two forms known on the reverse of quadrants (see Cowham, 2014, *A Study of the Quadrant*, pp. 26-28).

Only a few dated Gunter's quadrants are known from its first few decades. There is another by "R.S.," dated 1634, at the History of Science Museum in Oxford, similar to ours but with a table of planetary days and hours (as on the aide-mémoire **Tesseract** Catalogue 103 Item 1). Then there is the 1633 one signed "Nathanaell Heighemore," quite similar to ours and with the same projection / volvelle to the reverse, but highly decorated and of notably lower quality throughout. And finally there remains only a record of another by R.S., also dated 1632, "Ornamented with some fitures of animals and flowers punched," donated by A.W. Franks to the British Museum, and "Destroyed in the blitz" (Derek de Solla Price, 1955, *A Catalogue of the British Museum Collection of Scientific Instruments*, p. 167).

So ours appears to be the earliest dated one surviving. A tiny distinctive feature is common to all three from the 1630's, *i.e.*, the main quadrant degree scale is numbered both CCW (as usual) but also CW, and in the latter case, the numbers are engraved *upside down* in order to share the same "0" punch for economy. Thus what appears to read



"108" is really 10° CCW and 80° CW. This idiosyncrasy in some way ties Heighemore with R.S. The scholar E.G.R. Taylor (*The Mathematical Practitioners of Tudor and Stuart England*) cites two possibilities for our maker, one Robert Smith known for an "Invention to delineate a Sun-Diall," the other an astrologer, Richard Saunders of Chancery Lane, but not known as an instrument maker. \$23,500.



### THE ONLY SANSKRIT DOUBLE ASTROLABE NORTHERN / SOUTHERN HEMISPHERES



4. UNIQUE JAIPUR ASTROLABE FOR BOTH HEMISPHERES, Indian, 18th century. This brass astrolabe is constructed on a single plate 9-7/16" (24 cm) in diameter, with integral lobular throne and finial, mounted with shackle and ring to assure vertical suspension. Front and back bear circumferential scales divided every degree and labeled in Sanskrit every 6°. The front is engraved with the coordinate system for an observer at 27° North latitude (that of Jaipur and Agra), the back for 27° South latitude. There are two retes, one for each face, giving star maps for the two hemispheres, centered on the North and South poles respectively. The maps present many labeled (all in Sanskrit) star pointers, most of them sharply dagger shaped, some pierced within the concentric circular bands of the Tropics and Equator, or within the orthogonal bands of the equinoctial bar and solstitial bar. There are 35 stars on the Northern rete, 30 on the Southern. The astrolabe retains its alidade with sighting tube, pin, and wedge. On the reverse of the main plate is further engraved a pair of nested shadow squares. Condition is fine, the brass browned and lightly spotted.

This instrument is much more fully described in 14 pages of S.R. Sarma's 2019 A *Descriptive Catalogue of Indian Astronomical Instruments*, this a catalogue raisonné of all surviving Indian and Indo-Persian astrolabes, celestial globes, quadrants, sundials, qibla compasses, etc. Its 4454 pages are all available freely online. Sarma gives a complete analysis of this instrument (item D005) and includes full lists of the star names on its retes, an explanation of the Southern Hemisphere projection, etc.

Ours is the only such Sanskrit double astrolabe known. Sarma does record three surviving Indo-Persian north-south ones, just one of which utilizes separate retes, as here. The 18th century Jaipur maker of ours is unknown but he surely also made the two 27° standard astrolabes listed as D006 and D007.

An important survival.

\$135,000.









#### \* \* \* \* \* MICROSCOPY \* \* \* \* \*



5. JOHN CLARK'S THIRD FORM SIMPLE MICROSCOPE -- A TECHNICAL AND AESTHETIC MASTERPIECE, Scottish, 1773, signed on the mounting plate "Jn'o Clark, Edin'r, 1773." When assembled and mounted in the case, the microscope has an overall height of 6" (15 cm) extending to 7" by coarse focus slide. Designed and very finely crafted by this Edinburgh goldsmith, the brass microscope is constructed with a fixed vertical flat plate as body, with dovetailed coarse focus sliding plate to the rear carrying the lens arm, and dovetailed fine focus plate to the front driving the stage up and down by long screw with very fine pitch. The lens arm carries a wheel of five high power lenses giving very high quality images, plus a hanging above-stage 45° circular mirror to direct light onto the sample from above. The stage has a dovetailed fitting which accommodates a long brass slider with three windows and a pair of swing-away clips. Condition is very fine to excellent, all contained compactly in its 4" x 2-5/8" x



1-1/2" (10.5 x 6.7 x 4.0 cm) fitted wood case covered in black fishskin and lined in green silk and velvet.

This is an example of Clark's innovative third form, which for the first time incorporated his unique above-stage mirror, in the continued quest for ideal illumination of opaque objects. In advertisements Clark announced "his new method of illuminating opaque objects from above, which was much wanted...." Like all of John Clark's microscopes, this third form is quite rare. Announced in 1773, production seems to have continued for only three more years. The one in the Giordano collection is dated 1774, and one is illustrated in Clay and Court dated 1776. \$29,000.







#### THE SECOND RECORDED EXAMPLE



BENJAMIN MARTIN'S REMARKABLE "PORTABLE APPARATUS OF 6. MICROSCOPIC INSTRUMENTS," English, c. 1770's, unsigned. Contained in the original 6-1/4" (16 cm) long dome-topped black-fishskin-covered case, the outfit stows in two fitted layers lined in green velvet. The basic vertical drum microscope is constructed of lacquered brass, with drawtube and racked focus, insertable spring stage, adjustable plane substage mirror, adjustable specimen forceps / pin, three-element eyepiece, and choice for four regular and one Lieberkuhn objectives. There is also an objective extension tube, a covered objective (lacking lens), the original preparation forceps, and four prepared specimen sliders. The drum microscope converts to a handheld simple microscope with racked focus: a (replaced) ebony handle supports the instrument; a brass lens holder slides sideways through the drum's body, and accommodates any of the magnifiers plus its own special silver Lieberkuhn mirror; a special nosepiece attachment fits to the main tube, acting as a focusable holder for the auxiliary rectangular stage. Alternatively one can remove the base / mirror unit, replacing it with the special Lieberkuhn, and use the handheld portion as a racked focus instrument, with specimen holder instead of stage. The base of the drum unscrews to reveal a hidden compartment for the special Lieberkuhn. Condition is fine, noting the lacquer quite spotted, an old repair to the rectangular stage, and a couple of minor accessories lacking. The compendium thus assembles in at least three different formats,



analogous to the vertical drum microscope for transparent specimens, the compound opaque microscope, and Wilson's screw barrel instrument. The "drum" microscope form was invented by Benjamin Martin in 1738 -- it evolved into an all brass instrument, with substage mirror, in the third quarter 18th century. This remarkable compendium, the most complex "drum" microscope ever developed, was described by Martin in a small pamphlet in the 1770's, and was perhaps the first use of racked focus on a drum. We know of only one other example, that illustrated in Clay and Court. Millburn (1976) refers to the pamphlet but finds no other such instruments.

Important and most rare, complete with photocopy of Martin's pamphlet. \$19,500.









#### \* \* \* \* \* DIALLING \* \* \* \* \*

#### THE BEST BOXWOOD NOCTURNAL

# SIGNED, DATED, PROVENANCED, AND WITH CAPTAIN SAMUEL STURMY'S STAR DISK



7. BOXWOOD NOCTURNAL WITH STAR VOLVELLE, English, 1679, signed by the maker "Anselm Ienner fecit in Bristoll 1679" and for the original owner "Ioseph Tayler." Measuring 10-1/2" (26.6 cm) overall, one side is labeled "For the guards of Both Bears" and mounted with a long star alignment arm plus a twice-12 hour rotating volvelle divided every 15 minutes and bearing a single shaped index pointer. This pointer can be set against any of three circular scales on the main plate, one for Zodiacal date, one for calendar date if using the stars of the "G.B." (Great Bear), and one if the "L.B." It is a clever technique for needing but a single pointer. The other side carries calendar, hour, and degree scales, plus the wonderful and quite rare star volvelle with index, labeled for the meridian crossings of 31 stars, many with quaint designations and spellings (*e.g.*, "Gr Dogs Mouth," "Lyons Heart," and our favorite "Whail's Tayl"), and with each one's astronomical declination in degrees and minutes (from a high of 76°N to a low of 26°S). The instrument is also decorated, on both sides, and quite appropriately, with rings of star punches. Condition is very fine throughout.

Most nocturnals relied on the observations of the big and little Bear constellations to determine the time at night; this star volvelle permitted observation of any of the other bright stars surrounding the North Pole, for calculation of time, latitude, Moon's age, tide times, etc.

A similar construction, likewise with a 31-star volvelle, is illustrated and described in Samuel Sturmy's *The Mariners Magazine*, 1669 (and see back cover of this catalogue). Sturmy was born in 1633 in Gloucester, and in fact died in Bristol (1669). This form seems to have been made only during the fourth quarter of the 17th century, and is exceedingly rare (and see **Tesseract** Catalogue 43 Item 21).

Anselm Jenner is recorded by Taylor as mathematical instrument maker of Bristol who collaborated with Walter Hayes c. 1685, offering for sale Norwood's Encyclologium slide rule. Clifton records only the present extraordinary nocturnal.

The owner's name is more common, and harder to trace, although we find record (in the 1908 *Catalogue of the Royal United Service Museum* in Whitehall) of a watercolor of "Her Majesty's Ship 'Charles Galley,' commanded by Captain Joseph Tayler, engaged with four French Galleys...the 28th of May, 1705." \$29,500.



#### A UNIQUE SURVIVAL

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THE "RADIOMETRE" OF PIERRE LE CONTE, French, very early 17th century, 8. signed beautifully "Pierre Le Conte, Inventor; Anthoine De la Fosse, Fecit." This complex brass instrument hangs 11-1/2" (29 cm) tall suspended vertically, constructed with a fixed bar and a removable rotating one. Each bar is mounted at the ends with bull's eye sight vanes, and has lovely terminal shaping and engraving. The fixed bar is signed on the reverse and divided with precision calendrical and Zodiacal scales (vernal equinox 21 March as for the newly introduced Gregorian calendar). The bar's front is divided for French feet, inches and twelfths (marked "quart de Pied, Poulce, Lignes"), for hours (7am - 5pm, apparently), for intervals 0(15)75, and with angles  $0^{\circ}\pm 45^{\circ}$  by degrees. The rotating bar has, to the reverse, a finely engraved list of cities and their latitudes, in degrees and minutes, seemingly rounded to the nearest 5 minutes. The first nine locations are in France (some with old spellings like Roan and Poictiers), the second nine within greater Europe. The front is most complex, with multiple volvelles (twice-12 hours, and full circle Zodiac divided by 1/3 house, reading against degrees 0(10)90each quadrant), glazed compass rotatable against 0(10)360 CCW scale, central rotatable plates of "Gnomon" with vertical nonlinear edge scales 0(10)90, and a grid of arcuate hour lines and straight Zodiacal lines. The plates are restrained by a fixed band ("Ligne horizontale; Ligne Crepusculine") and central thumb screw. Condition is very fine, the brass bright but not abrasively cleaned.

This mysterious universal instrument is accompanied by the original 1605 publication which explains all: *La Fabrique et l'Usage du Radiometre, Instrument Geometrique, et Astronomique, utile tant en la Mer qu'en la Terre,* by Pierre Le Conte. A full 28 pages are devoted to the construction of the "radiometer," and then there are chapters on its use in astronomy, dialling, navigation, geography, cartography, and topography. The book is bound in vellum and has numerous diagrams in the text, plus two foldout illustrations. There are manuscript notes at the end, and geometric designs to the covers. It is somewhat tired overall, with restoration to page margins, but is extremely rare.

We know little of this innovative inventor, who descries himself as native of "Cheverain en Haynault" (probably modern day region of Hainaut in NE France and SW Belgium), and graduate of the school of medicine in Paris. Le Conte dedicated his book to the important Archbishop of Sens, "Primate of the Gauls and Germania." The craftsman of the radiometer is not found in the standard references, although the father of the famous 17th century playwright, Antoine De La Fosse (1650's - 1708) is recorded as having been a goldsmith by trade. \$60,000.



#### \*\*\*\* NAVIGATION \*\*\*\* THE MAGIC OF THE NATURAL LODESTONE

9. **IMPORTANT TRIPLE LODESTONE**, probably German or Northern Italian, c. first quarter 18th century, constructed with two rectangular blocks of naturally magnetic magnetite stone set with iron pole pieces and fully bound in highly engraved brass. Measuring 3-3/4" x 3-3/4" x 3" (9 x 9 x 7 cm) overall, this is an extraordinary example of a lodestone presenting *three* poles (a central southern one, Polus Antarcticus, and two northern ones, Polus Arcticus, to each side. The top plate has fine multiple ogee curve shaping and large support handle. The other five brass face plates are finely engraved with wonderful floral designs and monster heads and arms of war, and with Latin messages that the stone itself weighs three pounds ("Magnetis pondus est librarum 3") but will pick up 25 ("Magnes hic trahit usque ad libras 25"). Banners read "Natura" and "Ars" (i.e., Nature and/versus the Arts), and a small crowned vignette is labeled "Monstrat Iter" (i.e., "shows the way") with symbols of Sun, star (or compass rose), and a floating compass needle! Condition is very fine noting two mounting screws lacking and a tiny rough area. The brass retains much of an early streaky golden lacquer, and the stone retains notable magnetic force.

The fabulous engraving reminds one of c. 1700 Northern Italian decoration on brass, for example that by the Lusuerg family of scientific instrument makers. The shaping of the flat top is quite unusual, and reminds us of the mounting plate on a particular lodestone in the Cabinet of Astronomy and Physics in Kassel, Germany, that one made in Kassel in 1712, and signed by an established clockmaker "Natura Fecit Isaacus Ourry Perfecit" ("Nature made it, Isaac Ourry perfected it").

A magnet, even a natural lodestone, normally has one predominantly south pole and one north. The ingenious maker of the present one has trimmed two blocks of magnetite into rectangular solids, and mounted them with south poles together and north poles far apart, creating a lodestone with three poles!

The lodestone was, of course, essential for the early navigator, to apply and then restore as necessary the magnetism of his compass needle, without which he would be literally lost. The mystery and importance of lodestones has a long history, beliefs ranging from the ability of the stone to prevent baldness, to attract one's beloved, to enable one to hear the voices of the gods. Some believed the stone would lose power if placed in contact with diamonds, or even with garlic. And the processes of magnetising compass needles were often well-guarded secrets.

But very serious science was being done with them, and we find another reference to a three-pole stone in the writings of the famous English physician Martin Lister. He wrote an observational diary of his journey to Paris in 1698. He was interested in all the latest science and technology, and made a visit to Michael Butterfield, most famous for the pocket sundials he produced. Lister writes of Butterfield "Mr. Butterfield is a right hearty honest Englishman, who has resided in France thirty-five Years, is a very excellent Artist in making all sorts of Mathematical Instruments, and works for the King and all the Princes of the Blood, and his Work is sought after by all the Nations of Europe and Asia. He more than once shewed me (which is his great Diversion) a mighty Collection of Loadstones, to the value of several hundred Pounds Sterling," and devotes 12 pages to the subject. All manner of magnetic lodestones were displayed, including a tiny one which when properly shod with iron could support 144 times its weight, another of laminar slate, ones cut down into spherical *Terella* shapes, one which could affect a needle through a stone wall 18" thick, and a magnetic iron bar taken from the top of the steeple of the cathedral of Chartres. He writes of many experiments with lodestones, even "Another experiment was an Inch-broad Plate of Iron, turned into a Ring of about four inches diameter, which had evidently two North and two South poles, which he said he had seen in a Loadstone, and had contrived this in imitation of Nature."

A most remarkable instrument.

\$48,000.



#### COMPRISING SEXTANT WITH MULTIPLE MIRRORS AND SIGHTS, UNIVERSAL SURVEYING INSTRUMENT, GUNNER'S CALIPER, MULTIPLE SLIDE RULE, WEIGHING BALANCE, PROTRACTOR, PROPORTIONAL DIVIDERS, ETC.



10. THE ULTIMATE SCIENTIFIC INSTRUMENT COMPENDIUM, English, c. early 19th century. An abundance of lacquered brass items are fitted most compactly in the 12-7/8" x 3" x 1-9/16" (33 x 8 x 4 cm) polished mahogany box. The largest is a folding rule opening to 24" (61 cm) long on sector hinge, with long scale divided every 1/8", short scales labeled in Troy and Avoirdupois ounces and pounds, plus sovereign weight, and circular arcs around the hinge for degrees, interior and exterior angles, and shot. The rule is pierced with no less than 32 holes for accessory mountings, many of them lettered for guidance. A large 90° arc fits to the sector with clamp screw, finely divided on one side with "Circles" and "Lines," the other with scales of "Sex't Angles," "Elevation/Depression," and "Protractor." A glazed floating card compass, with momentary and locking card arrestors, mounts to the rule along with, presumably in various combinations, three fixed mirrors (one half-silvered), two pinhole sights each of which can accommodate an erect image telescope with solar filter, and even a boxwood slide rule with choice of three sliders. The whole seems to mount atop the case on short pillar with clamp screw, but three additional clamp screws (one balancing) are puzzling. In addition we find two suspension hooks, a scriber point, a fine little suspension ring, a ruling pen, and a ceramic note plaque (noting corner chip). Condition is excellent although a few other small accessories are clearly lacking.

This is evidently English work of very early 19th century, and although unsigned a likely candidate would be John (1755 - 1835) and/or William (c.1759 - 1825) Cary, the latter apprenticed to Ramsden. We know of nothing else like it, either as a surviving instrument or in the literature. It is the most multi-purpose, compactly-stowed outfit we have seen. In fact we should credit the anonymous master case maker for his achievement. Spectacular. \$22,000.









#### \* \* \* \* \* SURVEYING AND DRAFTING \* \* \* \* \*

#### WILLIAM COLLIER'S MASTERPIECE

**11. MOST ELEGANT SURVEYING OUTFIT,** English, c. 1720, signed "Will. Collier Fecit" on the surveying circle and "W. Collier Fecit" on the large sector. This important outfit is contained in the substantial original 15" x 15" x 4-3/8" (38 x 38 x 11 cm) case made of, apparently, mahogany and oak, covered with curly-grained veneer, and with banded stringing to the edges.

The massive 8.6 pound (3.9 kg) brass surveying instrument has a 14" (36 cm) diameter main plate formed with six spokes and mounted with rotating alidade, pair of opposing removable 5-1/2" (14 cm) tall slit-and-string sight vanes, and socket staff mount below, that removable by three butterfly thumb screws. The periphery has a fine scale divided every half degree 0-360 CW. The alidade also has two opposing removable vanes, and carries a magnificent 5" diameter glazed compass with exquisitely engraved silver rose, twin degree scales, fine arrow needle, and original cover engraved with twirling floral rose. The instrument is decorated throughout with geometric and floral designs, and with running leaf tip borders which go up and over the sight vanes. Condition is very fine with a little light staining, the surface cleaned but never abrasively polished.

The beautiful sector is made of lovely banded wood (curly maple?) set with brass sector hinge, brass terminal reinforcements, and hinged brass strut opening to 90° and pierced for hanging plumb line and bob. It opens to a full 24" (61 cm), and is divided on the sides and edges with numerous labeled mathematical scales including trigonometric functions, logarithms, hours, latitudes, etc. It gives the surveyor or explorer access to a full range of calculations, and is in excellent condition.

William Collier was in a line of some of the best mathematical instrument makers of the era. He apprenticed to the remarkable Thomas Tuttell, himself apprenticed to Henry Wynne. Collier was made free in the Goldsmiths Company 1703/4, and worked in London c. 1707 -

1745, having as one apprentice Samuel Saunders (II) who became Master Compass Maker to the Admiralty. William Collier's work was invariably of very high quality (see, e.g., **Ťesseract** Catalogue 17 Item 50), and here we have his large-scale richly decorated masterpiece outfit. \$60.000.

Provenance: Evelyn Butler Collection Philip Pfeiffer Collection



Latitudes W.Collier Fecit Chords







#### THE LUSUERG FAMILY OF INSTRUMENT MAKERS



12. EXCEPTIONAL CASED SET, Italian and English, 1675-1725. This set is contained in the c. 1700 slightly-domed fishskin-covered box measuring 10" x 6" x 2-3/4" (25 x 15 7 cm) overall, and has three layers of wonderful drafting tools. The case escutcheon has beautiful period engraving, and the case hooks of cut brass are splendid. The interior is fully fitted and lined with velvet and with watered paper (the paper probably later). Included are fine Lusuerg instruments, some signed and dated by various members of this important family of makers. (Multiple names and dates are not surprising -- the workshop obviously drew upon a stock of instruments made by various family members at various dates. Even the very finest Lusuerg cased Medici set(s) in Florence includes such a combination.)

The case lid holds three early English scale rules, with transversal interpolation at the ends, all late 17th or early 18th judging by the numeral shapes. The other layers carry various Lusuerg instruments. The removable tray has a number of dividers, ruling pens, etc, including a splendid single-handed dividers in brass and steel, reminiscent of those shown on some cartouches of early maps. There is a fine adjustable three-legged dividers, a fold-away little inking pen, the arm for a trammel ellipsograph which mates with the disk in the lower layer, a medium size ball-head dividers signed and dated (1687) by Iacobus and featuring fine adjustment screw-motion tilt of one arm, a larger unsigned but absolutely matching dividers with replaceable tips, etc. The exquisite lower layer has Dominicus' 1723 multi-hinged calibrated level (with separable plumb, the body of the plumb stowing in the removable tray), Iacobus' 1689 extremely finely engraved protractor/rule with scales and decoration on both sides, and a beautiful early unsigned but matching Lusuerg parallel rule constructed with concave undersides. The instruments are all in brass, some with steel tips and screws. There are no empty spaces in the case, and everything fits quite well. Condition is very fine to excellent throughout, and complete except for a tiny marking point on the trammel. This set includes the finest Lusuerg instruments we have ever handled. \$35,000.







13. EXCEPTIONAL CRAFTSMANSHIP IN A SURVEYING INSTRUMENT, Czech, 1753, signed "Ioanes Antonÿ Gravpaar, Eccon. ALP, Rochlitz, Ao, 1753, Franciscus Kosohorskÿ Hora." This brass graphometer/inclinometer measures 12-1/4" x 7" (31 x 17.5 cm), with semicircular main plate boldly divided every degree 0-180 and back, and embellished with lovely floral engraving, and deeply engraved with two marvelous sea creatures, their scales, facial features, etc. cut in almost three-dimensional relief. Their mouths form openings for plumb bobs (now absent) to be suspended from the reverse when using the instrument vertically for altitude measurements. The plate carries two sight vanes with pinholes and vertical alignment bars. There is a broad rotating alidade with beautiful symmetrical patterns of floral engraving, and with openwork index pointers at the ends plus vanes with multiple alignment sights (pinhole, vertical bar, and brass cross). Underneath is a slotted mount, probably for insertion of an auxiliary (woodmounted?) compass box, and a lead ball on stem for use on a pole- or tripod-mount. Here are found the elaborate signatures. Condition is fine noting usage.

Here we see cultural differences in instrument design and popularity. In 18th century France, the semicircular graphometer was extremely popular for surveying, in Germany much less so, but the existing ones are often of special beauty (*e.g.*, **Tesseract** Cat. 97, Item 20, with its angels among the foliage; and see somewhat similar floral decor illustrated in Jacob Leupold *Theatrum Arithmetico-Geometricum*, 1727). In the Netherlands, the full circle (sometimes termed "Holland Circle") was most used; in America it was the simple compass with two sight vanes, probably following English and Irish examples. Czech graphometers are almost unknown.

Our remarkable engraved "fish" appears most similar to the large and dangerous tigerfish (genus *Hydrocynus sp.*), and it resembles depictions of whales and fish in various medieval bestiaries and religious scenes (see illustration here).

The original owner of this wonderful instrument was, it seems, the important Czech cartographer and administrator of manor lands, Johann Antonin Graupaar, born c. 1723. Graupaar lived variously in Rokytnice nad Jizerou (also called Rochlitz or Nieder-Rochlitz), in Harrochov, and in Jelimnice, depending which estate he was administering (details thanks to Dr. Eva Novotná). These locations were all within a 15 km radius, today in northern Czech Republic. In 1752, at about 30 years old, and about the time he acquired this graphometer, he was commissioned with surveying and mapping one of the



large estates, and was soon responsible for collection of taxes and forest incomes, as well as having some managerial duties. An extraordinary map survives, the subject of an entire book (A. Valenta, 2016, *Grauparova mapa velkostatku Jilemnice* -- i.e. Graupar's Map of the Jilemnice Estate). \$28,500.





(St. Brendan and the Whale)





#### **EVOLUTION OF THE "HOLLAND CIRCLE"**

The full circle horizontal sighting instrument with compass (and often with supplementary vertical suspension), was basically developed in the second half 16th century, sometimes referred to as simple theodolite, and especially as the Holland circle. Jan Pietersz. Dou (1573-1635) is often credited with its invention, but it certainly predates Dou's 1612 publication of the circle (see Pouls, 2004). A search of the literature finds very few 16th century sighting circles; on Epact we see two Italian and one Spanish example, plus one by Habermel, and finally a Dutch one very similar to the one below. These early circles usually have the compass offset from the center. With time, the compass was incorporated at the center with the alidade. The Holland circle became a most important surveying instrument (see the one by Metz in **Tesseract** Catalogue 26, and the 18th century example here).



14. AMONG THE EARLIEST SURVIVING, Dutch, c. second half 16th century, constructed on a substantial brass plate 11-1/8" (28.1 cm) in diameter, further reinforced by a riveted circumferential band underneath. There are four fixed orthogonal sight vanes with slits, a rotating alidade with vanes, a suspension ring for use vertically, and an inset glazed compass with outer degree scale and fine needle. The main plate is finely engraved with concentric full-circle scales of degrees (0-90 CW in each quadrant), of shadow square units (0-50-0 in each quadrant), and of compass points (32 points beautifully labeled full circle, with 12 subdivisions between each, for a total of 384 headings). On all scales, alternate divisions are hachured, in the early fashion. Condition is good to fine, noting some surface roughness and lacking a staff mount.

This is one of the earliest surviving such circles, most similar to the 1565 example in the History of Science Museum in Oxford. \$28,000.



**15.** A FINE DUTCH HOLLAND CIRCLE, 1759, signed in flowing script "J. v. Wyk, Amsterd." and dated. The 11-1/2" (29 cm) brass main plate is boldly divided with a circumferential degree scale, and set with four fixed sight vanes spaced 90° apart, and with a fine suspension mount for vertical use. A rotating alidade has two tall (3-3/4") sight vanes, twin verniers reading to five arcminutes, and a compass engraved with degree scale and splendid rose marked with Dutch directionals. Main plate and alidade are both pierced with lovely arcuate shaping. Each vane has both slit and pointer sights, in alternating order, designed for fore and back sighting. Any mounting bracket is lacking, but four large screw heads could function as feet, for use on a plane table. Otherwise condition is fine, noting darkening to the brass.

The present example was made by Jan (or his brother Jacobus) van Wyk (also Wijk), recorded by Rooseboom and by the Websters as maker of octants and surveying instruments, flourishing c. 1759 - 1785. The Boerhaave, and the Utrecht University Museum, have examples of physics demonstration apparatus by van Wyk. And Mörzer Bruyns, in his 2003 thesis on the octant, records seven surviving van Wyk octants (and see **Tesseract** Catalogue 29 Item 32). \$12,500.

#### INNOVATIVE ARITHMETIC AND TRIGONOMETRIC CALCULATOR



**16. NYSTROM'S CALCULATING MACHINE**, American, third quarter 19th century, signed "Nystroms Calculator, No. 751, Patented March 4, 1851, Made by W.J. Young, Philada." Constructed with a heavy brass main plate 9-1/2" (24 cm) in diameter, the calculator is equipped with twin radial cursors rotatable independently or together, large thumb wheel with index arrow, two spring stops, and three ball feet. The main plate is crossed by various logarithmic and trigonometric curves, permitting numerical addition, subtraction, multiplication and division, plus fairly sophisticated trigonometric operations. The cursors are calibrated with scales labeled variously "lat, points, dep, cos, sin." The small index arrow is for temporarily noting the logarithmic index. The instrument is complete, functional, and in fine condition throughout, accompanied by a photocopy of the descriptive patent, as well as of 42 pages of his 1854 *Description and Key to Nystrom's Calculator*.

This sophisticated analogue calculator was invented in 1848 by a young Swedish immigrant to Philadelphia, John William Nystrom (1824 - 1885). He was granted U.S. Patent #7961 in 1851, and the machine was still being offered for sale in Young and Sons 1882 catalogue. Nystrom could boast that all the calculations in his Mechanic's Companion book had been solved on his calculator. But despite high hopes for a commercial success (*Scientific American* proclaiming this invention as "the most important one ever brought before the public"), extremely few were produced. Kidwell in *Rittenhouse* Vol. 1, No. 4, records only three examples, including the patent model held by the Smithsonian Institution.

The maker, William J. Young, was born in Scotland, immigrating to Philadelphia c. 1813, where he apprenticed to Thomas Whitney. Young became the foremost American maker in the mid-19th century, inventing the American transit, developing a highly refined dividing engine, and producing Burt's solar compass as well as Nystrom's extraordinary calculator. \$14,500.



#### ADRIAN METIUS' DESIGN

ecit, lus

- **17. AN EXTRAORDINARY** *REIGLE PLATTE*, probably Dutch, c. 1620's, signed "Wiglius fecit." The brass rule measures 10-1/2" x 1-7/16" (26.8 x 3.7 cm) overall, including finely shaped suspension end. It is beautifully engraved and divided on both sides with an abundance of mostly nonlinear scales. We note a few:
  - -- Circulus
  - -- Latera Fig. Reg.
  - -- Corporum Sphaerae Inscriptio
  - -- Fig. Reg. reductio
  - -- Scala Musicalis
  - -- Lin. Quadratrix
  - -- Grad. tang.
  - -- In Torment. Bell.
  - -- Cub.
  - -- Quad.
  - -- Lat.
  - -- Lin.

Some scale labels we simply cannot comprehend and transcribe, others are simply engraved shapes including geometric solids and a cannon. This most complex calculating rule and aide mémoire is in very fine condition with only light wear.

The flat mathematical scale rule is related to, and a predecessor of, the hinged sector. Ad Meskens published, in 1997, a very well researched paper on the early history of the sector (Michael Coignet's Contribution to the Development of the Sector, Annals of Science 54, 143 -160). In a Coignet manuscript of 1610, he finds drawings and description of the *reigle platte*, a pair of small rules with six scales on each, reminiscent of the scales on the present rule. Using compasses and a straightedge, one transferred measurements from the *reigle platte* to paper, and found extensive mathematical answers geometrically. The hinged sector, bearing similar scales, eliminated these steps in plotting. Thus Coignet's "pantometric rule" figures importantly in the early development of the sector. We also note a distant connection to Aspley's 1624 "Plain-Scale," to the Dutch "Pleinschaal," (e.g., Tesseract 94/32), and of course to the Gunter rule, all recently discussed by van Poelje (J. Oughtred Society 13, 11-22). We are aware of only a handful of examples of the *reigle*, most with Flemish connections (see **Tesseract** 78/31, 84/31, and 103/33 -- these the only ones we know). The engraving on the present large example is distinctly different, but the hook on the bottom of the "4" certainly suggests a Low Countries' origin.

Little is known of our exceptional maker, unknown to Zinner and recorded by the Websters on exactly two other instruments, both sectors. One of these is dated (1626), and is listed in a 1905 publication *The Cromwellian Collection...in the possession of Sir Richard Tangye*. It resides today in the Museum of London, and we have inspected it in person; it is likewise most exceptional in design and execution. And we have just identified Wiglius' source for our rule's layout and complement of scales, well illustrated and described in 1625 in *Geometriae Practicae, pars Tertia*, by Adrian Metius (1571 - 1635), the famous Dutch mathematician, surveyor, cartographer, and military engineer, associate of Snellius, Tycho Brahe, etc.









01
CORPORUM SPHARE INSCRIPTIO
FIG: REG: REDUCTIO.
Scala NEuficalis Dres 5
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HALLMARK 18. **VERIFICATION** PLATES, French, c. second quarter 19th century (mostly 1824). plates fill Ten the individual interior compartments of a wallet of green Morocco leather, 7" (18 cm) wide, with closing flap. The plates are made of copper, heavily plated, some with silver, some with gold. The preformed plates were then hand punched with hundreds of tiny detailed hallmarks ("poinçons"), being official evidence of the correct certifications required on manufactures of gold, silver, etc. The hallmark patterns are of

all manner of animals, head profiles, insects, geometric shapes, etc. For an object being approved (and taxed!), different hallmarks were specified depending on its material, size, region of France (as the purity requirements for the silver or gold objects varied with the district), purpose of guarantee (e.g., export vs. import vs. transit), and even the year (to some extent). Regulations were very specific as to exactly where the mark should be placed on each type of object (e.g., for Holy Water Sprinklers three punches on the ball, rose and ring; for Tongue-Scratchers on one of the ends). Most of the present plates are consistently dated with the year of issue (1824), numbered for the issuing bureau (here 48, for Saint-Lô in Normandy), and stamped with several fleur-de-lys representing this Royal period in France. Some specify the region concerned (e.g., Annecy, Saumur, Chatellerault, Paris). One is specifically for certification of "Horlogerie" (i.e., timekeepers). Three are very special presentations of "bigornes," the counter-punches left on the reverse of the punched area on the object, as the poincon was being applied to the front by punch and hammer. The circular plate gives the wonderful "Grosse Bigorne" of the Bureau of Paris and of the Départments, for the "Administration Générale des Monnaies," also hand punched with date (1824) and number (48), and presenting the wonderful scattered array of many dozens of very finely shaped punches of marvelous insects. One of the ten plates is clearly later (c. 1846); the rest seem an inspector's rather unified set. Condition throughout is fine to very fine, the original case fair.

By law, all French manufactures of silver or gold must bear certification hallmarks, sometimes several depending on its history. Tardy gives good coverage in *International Hallmarks on Silver* (1981) and in *Les Poinçons de Garantie Internationaux pour l'Or, le Platine et le Palladium* (1st ed. 1942). Yet the present plates are not themselves hallmarked objects, rather the very much rarer proofs, the guarantees, of the legitimate markings.

Termed "plaques d'insculpation," they were used by the controllers to detect fraud and certainly to help fill the tax coffers. This is our first discovery of such material, which is extremely rare. \$9800.





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#### \* \* \* \* \* MEDICAL \* \* \* \* \*



19. THE COMPLEX OPHTHALMOTROPE OF PROFESSOR RUETE, German, c. third quarter 19th century. Standing 15-1/2" (39 cm) tall, this extraordinary didactic ophthalmologic apparatus is constructed of gilt lacquered brass carrying eyeballs of palmwood, rising above a 10-1/4" x 11-1/2" (26 x 29 cm) walnut base with three leveling screws, and carrying a plumb line. Each eyeball is set in brass rings with four adjustment screws, and pulled in all orientations by six blue and red strings which feed back through pulleys and pierced plates to more pulleys, then back down past vertically calibrated plates (0±30 mm, read against brass clips on the strings) to spring-loaded attachments underneath. The eyes themselves have beautiful blue irises with yellow flecks, and are mounted with "lenses" to the front and ground glass to the back. It is complete and functional, in excellent condition throughout, noting only light spotting to the brass finish.

This is a superb example of the 1857 ophthalmotrope of Christian Georg Theodor Ruete (1810-1867), professor of medicine in Göttingen, then professor of ophthalmology in Leipzig. For the first time it was possible to demonstrate with a model eye the actions of the ocular muscles, separately for each of the various oblique and rectus ones. And for any direction of view the contraction or extension of each muscle is shown quantitatively. This ophthalmotrope further demonstrates Professor Listing's law of eye redirection and Professor Donder's law of pseudotorsion.

We find a second example in the Utrecht University Museum (see den Tonkelaar, Henkes, and van Leersum, *Eye and Instruments*, 1996, pp. 178-9, also *SIS Bulletin* #127, cover), and another recorded at the Royal College of Ophthalmologists in London. For the original description see Ruete, 1857, "*Ein neues Ophthalmotrop.....*"

A superb, rare survival of this complex mechanical ophthalmotrope, as sculptural as it is technical. \$35,000.



## A CHEF D'OEUVRE OF SURGICAL INSTRUMENT MANUFACTURE MINIATURIZATION OF BERNARD HEINE'S OSTEOTOME



20. THE HEINE CHAIN SAW IN MINIATURE, probably German, c. second quarter 19th century, signed simply "Heine." Constructed of polished steel with blued steel screws and lovely tortoiseshell handles and thumb rest, the saw measures 8-3/8" (21.2 cm) in overall length. A superbly cut serrated link chain rides in shaped grooves in the pulley wheel (turned by hand crank with ball-joint mounted handle) and in the forward nose, allowing cuts in the bone 1/20" (1.25 mm) thick. Tension in the chain is set and clamped with thumbscrews. A long articulated threaded spike, adjustable in length and angles, is designed to keep the instrument steady by screwing into a table or even into a convenient bone! Condition is fine, noting some surface spotting. There are no chain guards, and a couple of little clamp screws are lacking.

This is an example of the prize-winning bone saw invented by Dr. Bernhard Heine (1800-1846) of Würzburg, Germany. It was announced in 1830, and was really the first mechanical chain saw of any kind, forerunner of today's ubiquitous forestry saws. It quickly brought fame and recognition to this inventor and orthopedic surgeon. It did prove somewhat difficult to control, leading Charrière, in 1843, to add twin stabilizing handles up front. It is quite a complex instrument, and was apparently somewhat too efficient, cutting too far, too fast!

Only a small number of Heine saws are recorded (see the French example in **Tesseract** Catalogue 89 Item 44). At least one example was made by Tiemann and Company in the U.S., that with the encouragement of and facilitation of George Alexander Otis, Curator of the Army Medical Museum. Tiemann was apparently allowed to borrow a Heine saw, and created a fine "copy" in 1875 (see Edmonson, *American Surgical Instuments*, 1997, p. 112 and Plate 8). The company advertised it in their massive *American Armamentarium Chirurgicum* catalogue, but once again the very high price (\$300 compared to \$5 for a typical capital saw) must have contributed to its near zero production.

But here we have an even greater rarity, the only known example of a *miniature* Heine saw, undoubtedly crafted as a *chef d'oeuvre* for presentation at one of the great 19th century international exhibitions. \$19,500.









#### BY THE RENOWNED NEUROPATHOLOGIST DR. GLOBUS





21. TANGIBLE DOCUMENTATION OF CEREBRAL PATHOLOGY. American c. 1930's. These boxes, each about 10-1/2" x 6-1/2" x 6-1/4" (27 x 17 x 16 cm), contain a suite of 20 hand-cast, hand-painted replicas of actual human brains with various deformations, growths, malignancies, etc. Each box is labeled "Moulages Depicting Brains Lesions. New York Academy of Medicine Collection. Prepared by Joseph H. Globus, M.D., and co-workers at the Mount Sinai Hospital, New York," with the fourdigit P.M. (post-mortem, presumably) number, with the cryptic diagnosis, and mounted with a black-and-white silver print photo of the actual intact brain. The life-size castings are made of a special resin, each vividly colored and accompanied in the box with a similar original photographic print of the brain, plus (for most of them) a photomicrographic image of a thin section of the tumor documenting its pathology, plus a detailed sheet detailing the patient's PM #, Gender, Age, Evolution of Clinical Picture, Objective Findings, Diagnostic Tests, Diagnosis, Treatment and Course, and Necropsy Findings. Many of the models are formed in multiple (2, 3, or 4) parts. Condition is generally very fine to excellent, the moulages having been well padded and preserved (including with a few fragments of 1942 New York newspapers), the colors still bright and fresh as new. We note only that one model (the only one of a spinal cord) has two repaired breaks, and that one removable nodule within one model has several chips.

The maker was the pre-eminent neuropathologist, Dr. Joseph Globus, born in Russia in 1885, emigrated to the U.S. at age 20, died in New York in 1952. He held various professorships at Bellevue, Cornell, NYU, Columbia, and Mt. Sinai. His teaching and research led to authoring several books on neuroanatomy, and at least 75 research papers related primarily to brain tumors. He held presidencies of the major societies in his field.

Of moulages of the diseased brain, Globus suggested them "to preserve a record of the gross appearance of the disease process" and to do so in a true three-dimensional form. Histologic studies normally required the pathologist "to dismember it almost beyond recognition." He found great value in preserving permanent records of the whole organ, and in their use as teaching material "instead of the perishable, unwieldy and fragmentary wet specimens." Globus developed an inexpensive casting technique, and published all this as *Moulages -- Their Preparation and Service to the Neuropathologist*, in 1935, in *Archives of Neurology and Psychiatry* **34**, pp. 355-361.

Although the fatal maladies presented here may be somewhat troubling to consider, we find these moulages, with their accompanying documentation, to be exceptionally important for medical progress. An extraordinary collection. \$38,000.



Captain Samuel Sturmy's Star Dial, 1669 see item 7