My "Three Guinea Microscope Copy”

Fritz Schulze / Canada

Early on after I started seriously to collect antique microscopes I found on eBay an instrument that appealed to me. It looked sufficiently old and complete. It came in a box, had two objectives and a bull's eye condenser on a stand. After I received and examined it, I got curious who made this unsigned instrument. So I wrote to the British Royal Society Archives and received promptly a most informative answer.

It appears that my unsigned microscope is one of the many copies of the famous "Three Guinea Microscope" made in the mid 19th century by R. Field & Son, Birmingham.

A section in **The History of the Royal Society of Arts** by Sir Henry Truman Wood (published in 1913) explains the background of this remarkable microscope:

During the period with which we are now engaged some special prizes of importance were offered. The Society's colour box has already been mentioned. This was the most popular of all its awards. The most important was the prize offered for a microscope. In the summer of 1854 Dr. W.B. Carpenter suggested to the Council that a prize should be offered for a cheap microscope, the cost of such instruments being then such as to put them out of the reach of students and teachers of elementary science. The proposal was approved, and on the recommendation of a committee of microscopists, two medals were offered, one for a simple and one for a compound microscope, to be supplied at the price of 10s,6d and £3,3s,** respectively. It was said that at such prices nothing of any practical use could be provided, but Messrs. Field, of Birmingham, produced two excellent instruments at the stipulated prices, and the prizes were awarded to them.*

In the simple microscope, a tubular stem, which screwed into the top of the box containing the instrument when not in use, carried an inner rod fitted with a rack and pinion, and on this rod the lenses were mounted. There were three lenses, giving separately or in combination a range of magnification from about five to forty diameters. The top of the stem carried a stage, to which could be fitted a condensing lens for illumination or a stage-forceps. The little instrument which was sold for 10s, 6d., was well suited for the examination of botanical and other natural history specimens. In construction and design it seems to have been quite novel at the time..

The compound microscope was a really excellent instrument. It had a cast-iron stand, very firm and steady, two eye-pieces, two objectives giving a range from 25 to 200 diameters, a stage with rotating diaphragm, coarse and fine adjustments, adjustable mirror with plane and concave sides, separate condenser, stage-forceps and live-box. It was not, of course, an instrument suited for scientific research, but it was a thoroughly serviceable one, and nothing like it had ever before been produced at such a price. Dr. Carpenter, in his well-known book on

the microscope, speaks highly of it and in his third edition, published in 1872, he says that by the end of the year 1861, 1800 instruments had been sold.

The principal value of the reward was that it proved that a serviceable microscope could be produced at a cost far lower than that of any previous instrument, and the natural result followed that it had many successors, some of them improvements on the original, though perhaps there were none which competed with it in the lowness of price. Certainly more than twenty years after its introduction microscopes were being sold which professed to be the Society of Arts pattern, and resembled it more or less closely both in character and merits. Later still, of course, much greater improvements were made, especially in the optical part, and inexpensive microscopes can now be bought compared with which the original Society's microscope is but a very inefficient tool. But it remains the first of its sort, and its introduction was a great boon to the scientific student of fifty years ago.

* William Benjamin Carpenter CB FRS MD LLD 1813 - 1885, was an English physician and zoologist, and president of the Quekett Microscopical Club from 1883 - 1885. He published his book: *The Microscope and its Revelations* in 1843.

** In the pre-decimal British coinage £sd meant pound (£), shilling (s) and pence (d, plural of penny). 1 pound counted 20 shillings, each shilling 12 pence. Until 1816 a gold coin, originally from Guinea, was in circulation and counted 21 shillings. For a long time, I guess until decimalisation, physicians billed their patients in guineas.(I wonder why?).

As my Three Guinea Microscope is not signed it must be one of the many copies that were manufactured shortly after the resounding success of the original in 1854. It follows closely the specification - and construction design - of the original.

The microscope is firmly mounted on a wooden base that slips into its box. This board has also a fitted recess to hold the lower end of the tube when stored in the box. A black cast iron swallows tail base carries two S-shaped brass uprights with the tilt bearings. The brass stage plate, 70x75mm, unites the base and the main body in so far as it has on the underside two bearings that engage with the uprights and allows the instrument to be tilted into the horizontal. At the rear extension of the stage plate is mounted the cylindrical block with the coarse-focusing gear with its two bilateral large brass knobs (40mm diam.) and the triangular guide for the brass prism bar carrying the tube. The friction of the pinion can be adjusted by tightening the holding plate with 4 screws. While more expensive and later microscopes have the rack recessed in a flat side of the prism bar, for economic reasons in this case one edge of the prism points backwards and has the rack cut in the narrow edge. This makes it subject to much wear and almost impossible to repair once worn or damaged. Furthermore, there is no shimming plate for compensating any looseness in the guide block.

The triangular prism bar carries the horizontal limb with a large thread at the end into which the tube is screwed. The cylindrical tube is 170mm long, has an inner diameter of 26mm and

accepts in its upper end the Huyghenian unmarked eyepiece. At its lower end is the fine focusing mechanism which consists of a smaller inner tube with a RMS thread which is swiveled in a lever system, held in place by a spring. A screw with a knurled wheel on the side can move this tube and with it the objective up and down within a range of 3mm. As an unintended side effect I found that this system serves also as object protection!

The stage has a 21mm opening equipped with a fine thread (for some unknown accessory) and a black revolving diaphragm disc underneath (without click stops) with three diaphragms 15, 10, and 5mm diameter.. Two holes on either front corner of the stage are intended for holding a stage forceps or clips. There is also a gliding object holder with a 22mm opening. It has two spring clips and, on the underside, two springs that hold it to the stage plate. I found it works very well, the two lateral handles are just right for manoeuvring the specimen.

At the bottom of the cylindrical block for the prism bar is attached a long cylindrical tube 75mm long and 21mm diameter that holds the sliding mirror assembly with its gimbal mount. The one-sided concave mirror's silvering is, unfortunately, severely compromised, dull but still useable.

Apart from the box, the instrument came with a bull's eye condenser on a lead-weighted stand, a live box and a brass tweezer. The well-made box of exotic wood is fitted to accept the microscope, once its tube is unscrewed, and its accessories.. It also has a spacious drawer with slots for 26 slides of 4¼" (!) length. The box has a lock and key. The canister for the standard objective has an RMS thread in the lid to secure the objective inside.

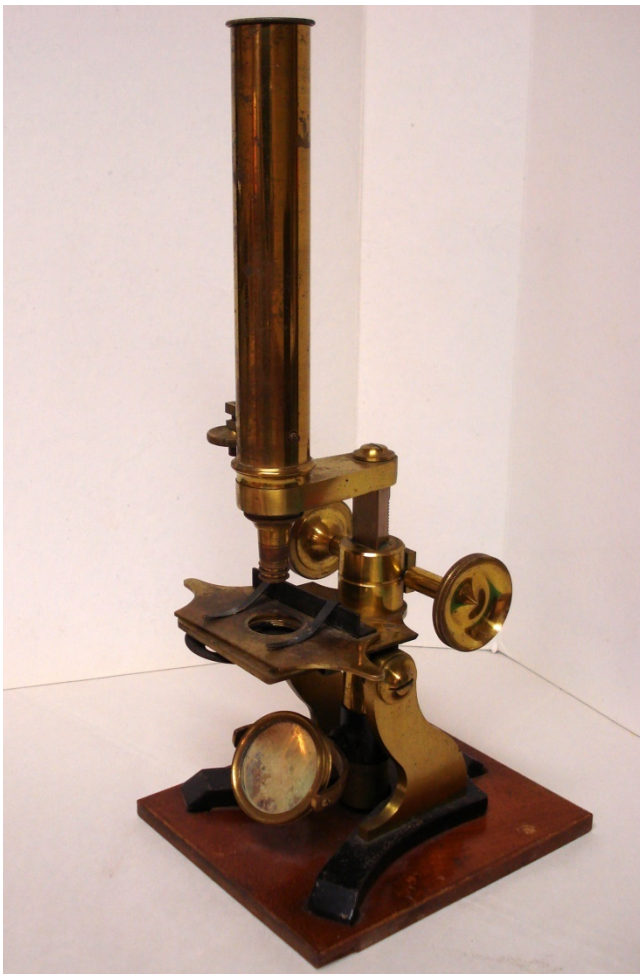
Whenever I bought a microscope for my collection I always looked for features I did not yet have. This is the only instrument I have with a separate bull's eye condenser. (One other instrument had the place for an attached one which was missing, so I had to manufacture a replacement).

The optical quality of the divisible objective leaves a lot to be desired. As I unscrewed it a thin spacer ring fell out. Although only 0.5mm thick, it is threaded. I couldn't recall whether it belonged between lens 1 and 2 or 2 and 3. I inserted it between 2 and 3 and obtained a totally useless image. Inserted between 1 and 2, however, yielded a reasonable image. Reducing the substage diaphragm to 3mm improved the contrast noticeably.

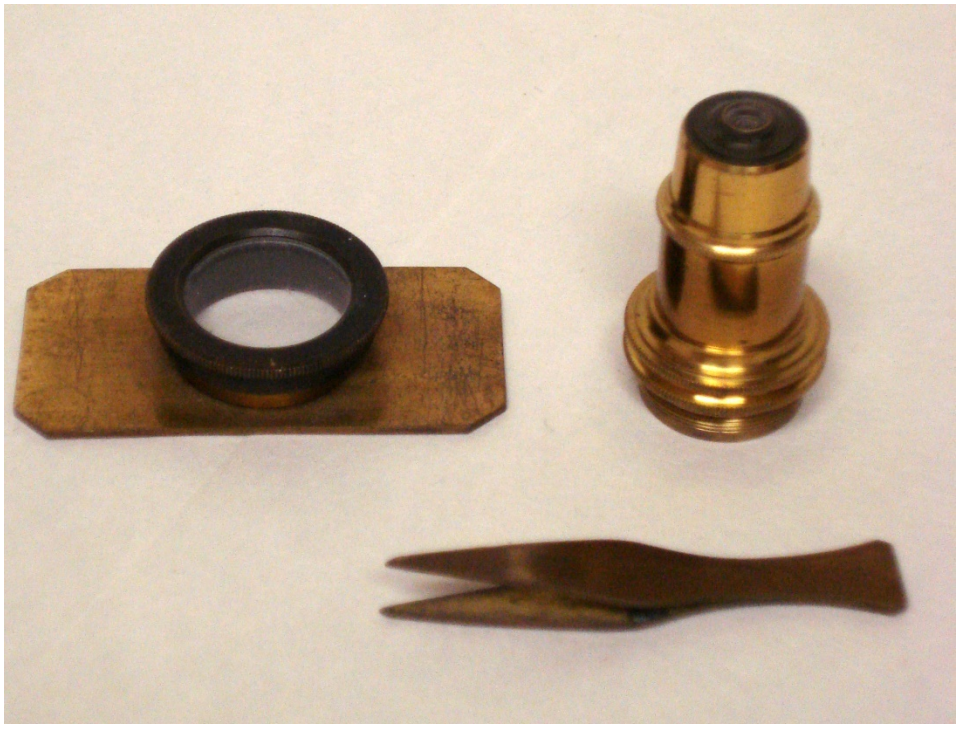
On the other hand, the superior image quality of the standard objective and its general appearance could indicate that it was obtained from a different manufacturer. Many microscope makers bought the optics from specialized manufacturers, who, though, would often put their name on their products.

Whoever made my "Three Guinea Microscope Copy", for how much he sold it, and how it ended up in an antique store in New York State, remains a mystery..

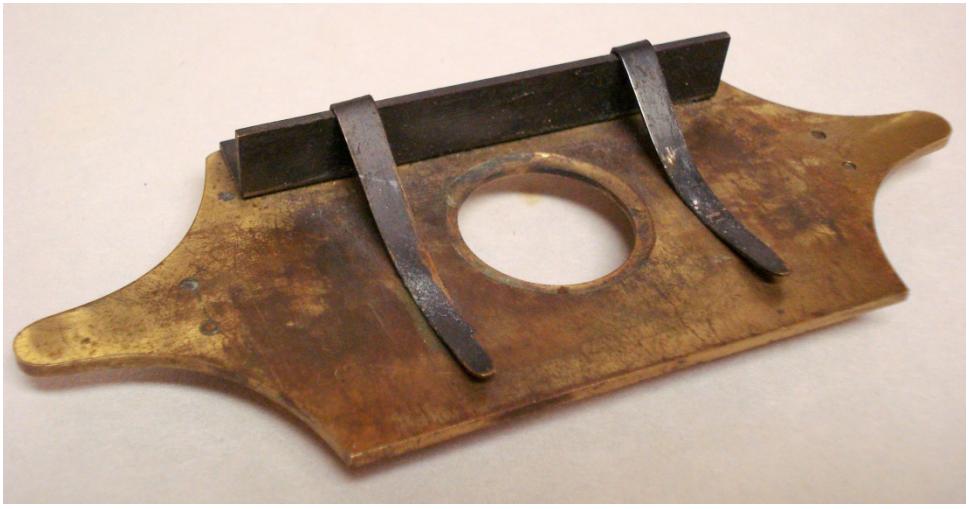
A few words about the photomicrographs. To focus the image on the camera's monitor is almost impossible. I, therefore, focused the test object first visually with the eyepiece and then slid the microscope under the camera mounted on the copystand. I could then center the circular picture on the monitor by moving the microscope while adjusting the mirror for optimum even illumination. My small Sony Cybershot camera cannot be fitted with a remote release, so vibrations from activating the release button are a constant danger. I do not know to what extent the auto-focus interferes with the final focusing of the image. but it seems not too much.



Two views of the Microscope and its box



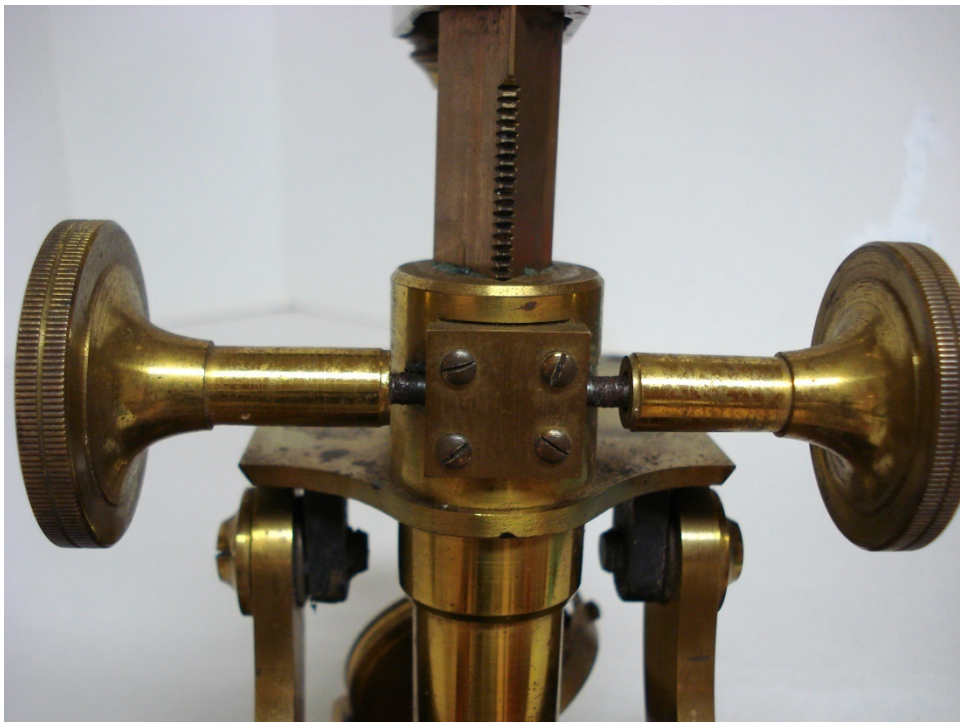
The live box, the standard objective and the forceps



The gliding object holder

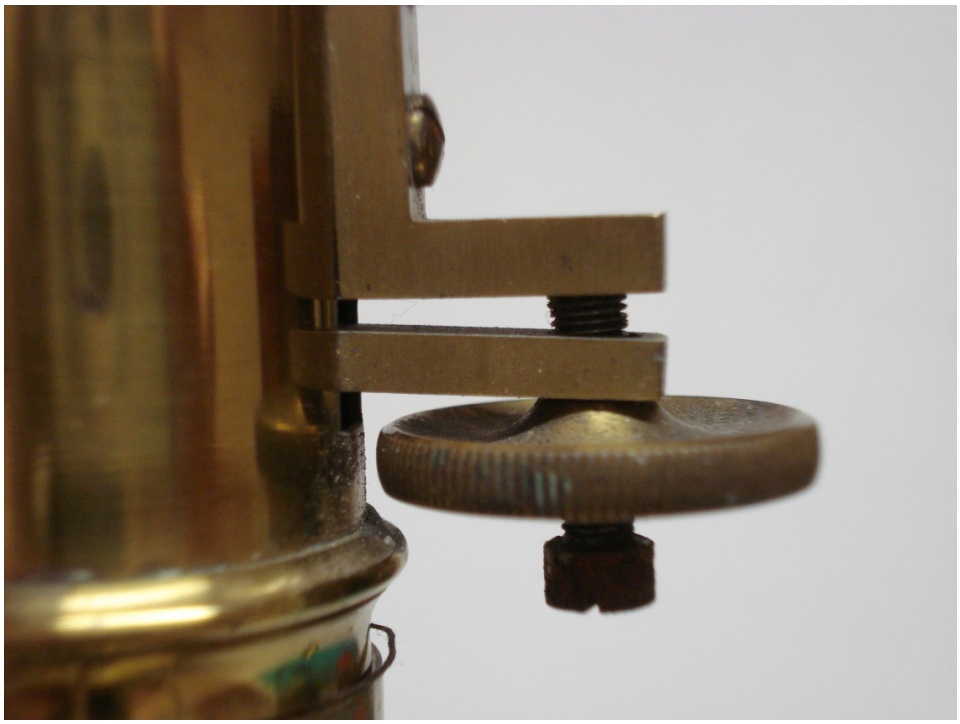
The bull's eye condenser with stand

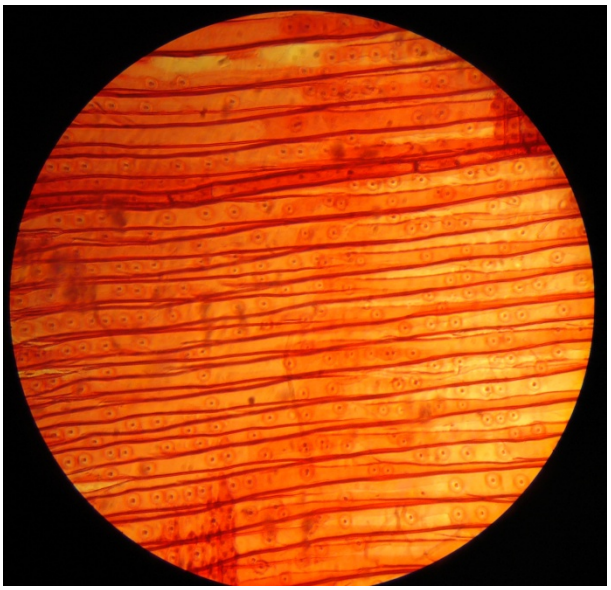
My set-up for taking photomicrographs
on home-made macro-stand

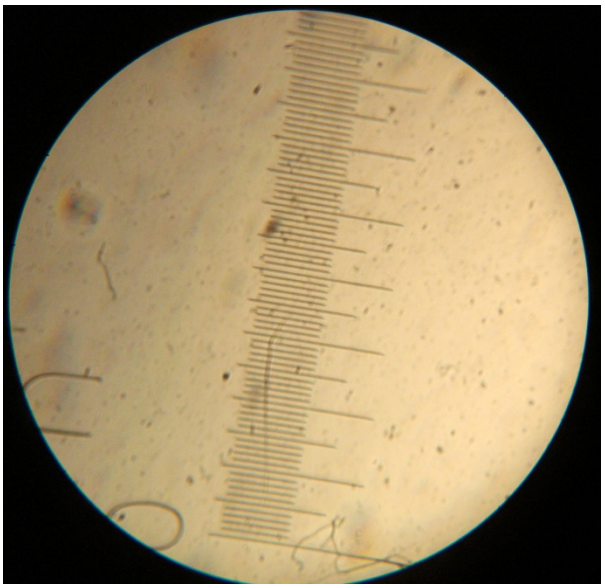


This view of the coarse focusing mechanism shows the 4 screws of the bearing plate that can be used to adjust the smoothness. Also visible is the narrow rack cut into the edge of the prism

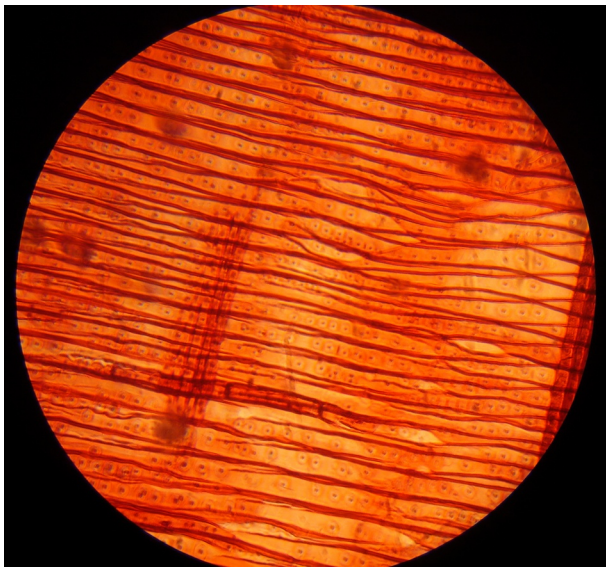
Below is the fine focusing mechanism with the knurled knob. The range is about 3 mm.

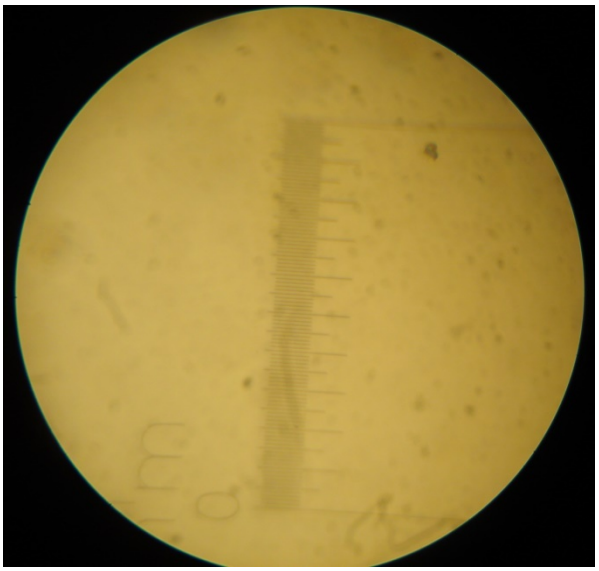




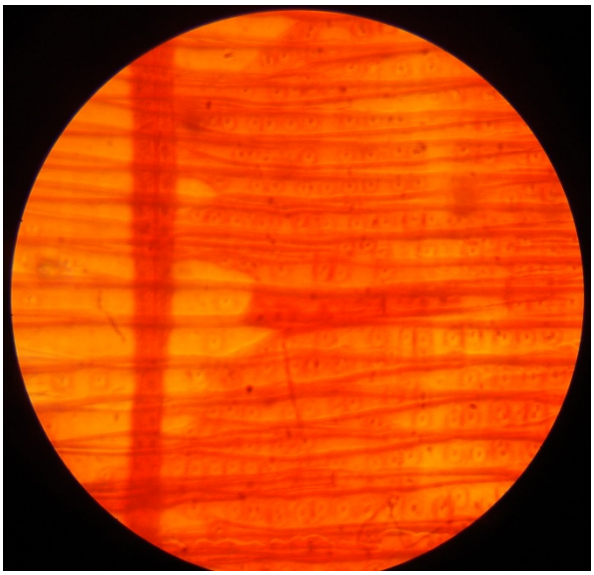


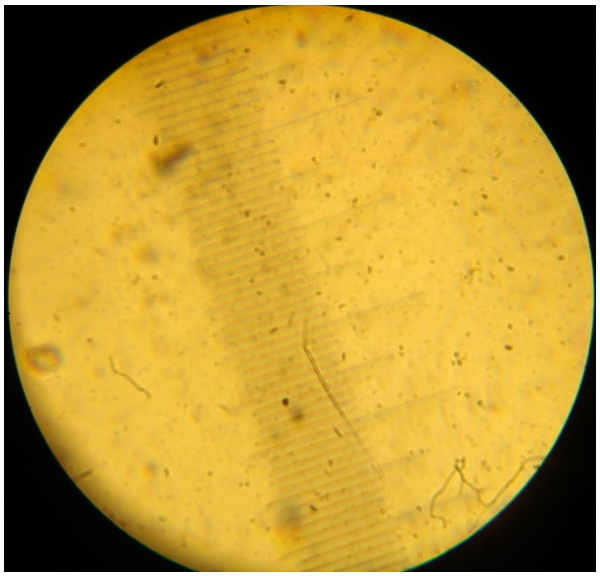
Taken with the standard objective, magn. approximately 16x.



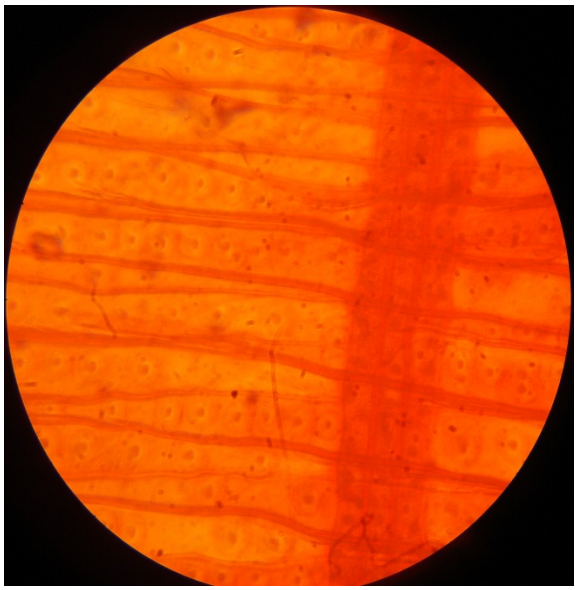


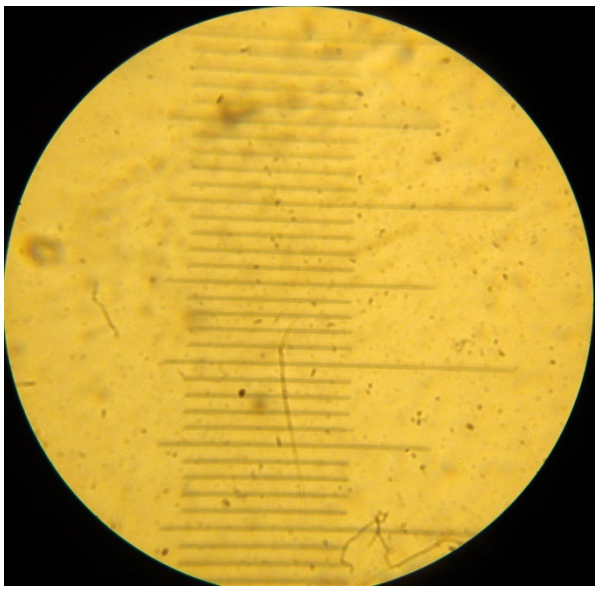
With divisible objective, basic lens, objective magn. approximately 12x.





Taken with the divisible objective lens 1 and 2, objective magn. approximately 20x





Taken with the divisible objective and all three lenses, objective magn. approximately 42x.

The pictures were taken with a Sony Cybershot 7.2MP, the zoom setting chosen to fill the screen. The microscope substage diaphragm was set to 5mm. The light source was a 15V 150W halogen fibre illuminator. The specimen shows the vascular system, tracheids, of cedar.

Field's Dissecting and Mounting Microscope, a simple microscope, which can also be used as compound microscope with the tube and a "divided objective with three powers" (sic)..

(Carpenter, *The Microscope and its Revelations, 6th edition 1891)*

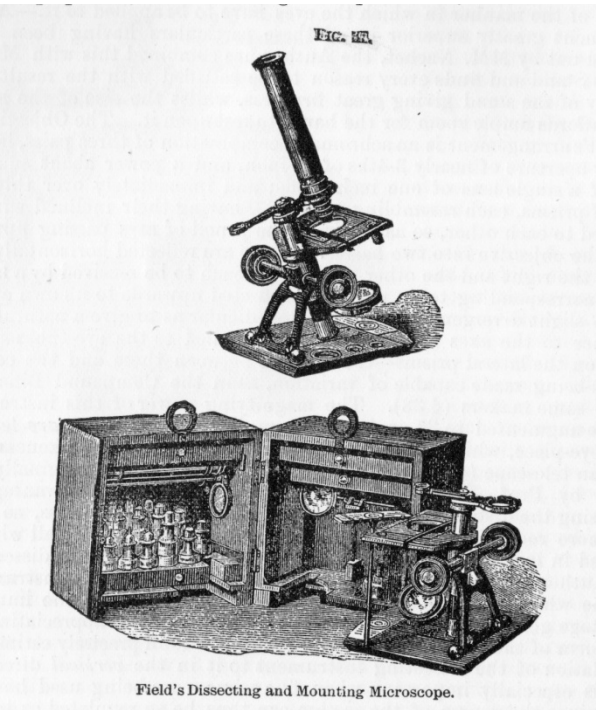


FIG. 81.

Field's Dissecting and Mounting Microscope.

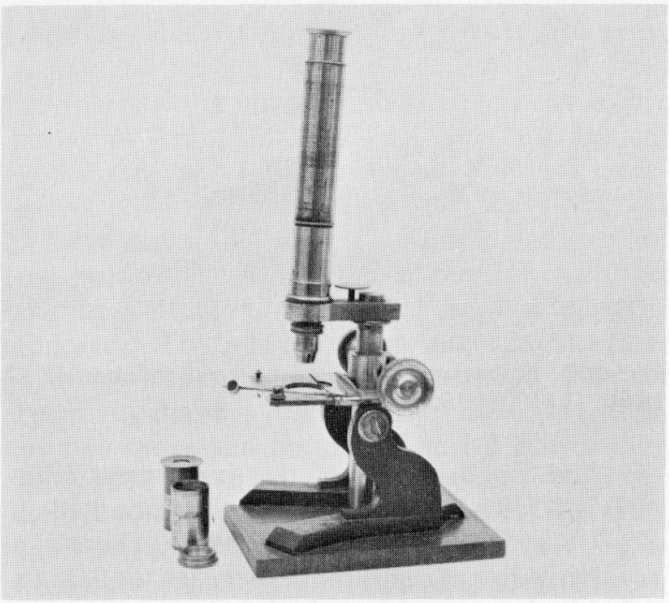


Fig. 405. R. Field & Son, Birmingham, England; compound monocular; C. 1855. (AFIP 709643 - 68-8625-6)

Field's Three Guinea Microscope as shown in The Billing's Microscope Collection, 2nd edition, 1974.

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