The Real Origins of Amateur Telescope Making

FIRST STELLAFANE By 1926, the Springfield Telescope Makers had built a clubhouse atop Breezy Hill on the outskirts of Springfield, Vermont, where they held the first official Stellafane Convention. But contrary to legend, the amateur telescope making movement began much earlier and far away.

SPRINGFIELD TELESCOPE MAKERS

Amateur astronomy is what it is today because of mirror-grinding enthusiasts more than a century ago.

Many things make history fascinating. One is that so much of today's world stemmed from little flukes of fate that might easily never have happened.

The fact that you became an amateur astronomer and are holding this magazine, for instance, and the fact that a magazine like this exists for you to hold, likely trace back to a shipwrecked Arctic explorer surviving two years of starvation and disease on a frozen island north of Russia from 1903 to 1905. Russell W. Porter was among the rescued crew. Beaten down by failure, he gave up his polar dreams and eventually settled down to be a machinist in Springfield, Vermont. There, pursuing a new enthusiasm he'd picked up leafing through some old magazines, he recruited fellow workers to do something few had heard of: build their own astronomical telescopes. An editor of *Scientific American* got wind of the group, wrote it up — and a movement was off and running.

Earlier, amateur telescopes had been the province of a few wealthy people who could afford to buy expensive small refractors. The new movement's step-by-step guides to grinding and figuring a large, high-quality parabolic mirror — and where to find clubs of other people doing the same — democratized astronomy for the 20th century.

Modern manufacturing later made telescopes as cheap to buy as to build. Today, amateur telescope making — ATMing — has shrunk to a niche for dedicated do-it-yourselfers and perfectionists who are unsatisfied with the adequate-to-okay mirrors churned out by machine in factories. But, goes the popular narrative, amateur astronomy would never have become the widespread thing it is today (why not amateur seismology? amateur chemical engineering?) were it not for those Vermont telescope makers, the movement they spawned, and the serious-telescope companies that some of the movement's members went on to found.

It's an inspiring story, often told. And like most such narratives, it's too tidy, too pat, and only partly right.

Russell Porter didn't spring from nothing. The movement wasn't founded in America, and it didn't begin as late as the 1920s with the Springfield Telescope Makers. Here is a deeper look at how it, and thus we, came to be.

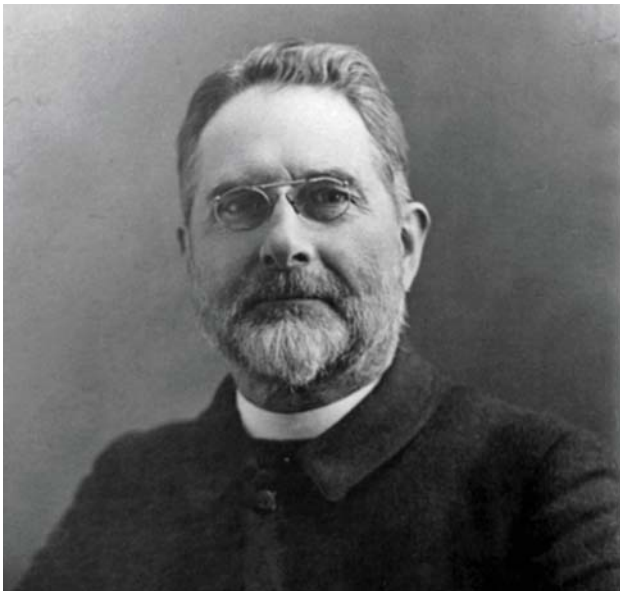
Origins

Until the late 19th century there was little to distinguish amateur from professional astronomy (*S&T:* June 2016, p. 36). This was also true for telescope making; scientists of many sorts generally had to craft their own instruments. But with the rise of specialist instrument makers in Europe and then the United States, well-to-do "gentleman astronomers" could satisfy their curiosity and show off their wealth by buying small refractors at prices equivalent to several thousand dollars today. As people less well off began to gain more education and a modicum of free time, some of them might have thought about making a telescope, but the optics were dauntingly hard to handcraft even by the most resourceful and motivated.

◀ FLUKE OF FATE On the failed Ziegler-Fiala polar expedition, the crew of the icebound ship *America* photographed it by moonlight on January 2, 1904, before it broke up and sank.

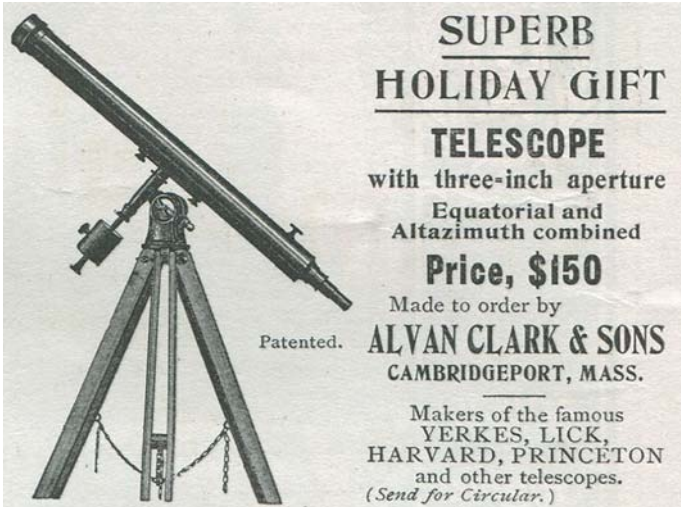
Then came two breakthroughs. The first was the chemical process to deposit silver on glass, perfected by C. A. Steinheil and Léon Foucault in 1857. No longer did telescope makers have to choose between small achromatic lenses or brittle, expensive mirrors made of speculum metal that needed frequent repolishing and refiguring.

The second was the Foucault knife-edge test, described by Léon Foucault the following year. It provided a simple but extremely sensitive way for a mirror maker to shape a glass

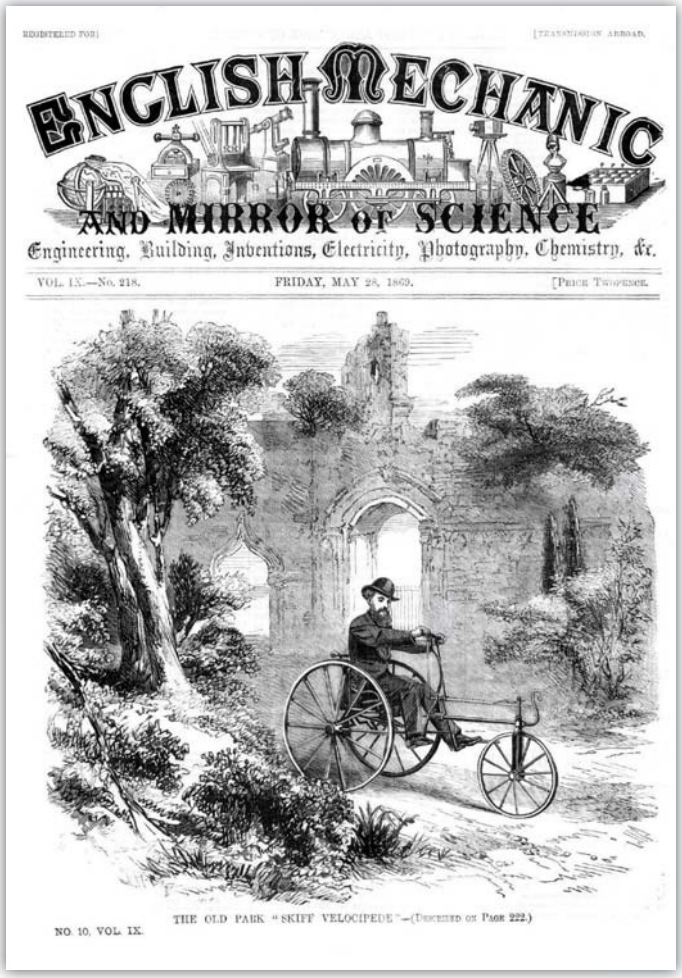


▲ TRUE FOUNDER Rev. William F. A. Ellison (1864–1936), rector of a small-town church in Northern Ireland, was the prime mover enabling amateur hobbyists to build serious astronomical telescopes.

SHIP: FRESHWATER AND MARINE IMAGE BANK / UNIV. OF WASHINGTON
ELLISON: ARMAGH OBSERVATORY



▲ **OUT OF REACH?** In 1900, the famed Alvan Clark & Sons offered an equatorially mounted 3-inch refractor for the equivalent of $4,000 today. Now you can get a similar 3-inch — but including a finder, star diagonal, and slow-motion controls — for about $150. Real telescope prices have declined since 1900 at the same average rate as inflation has grown: about 3% annually.



▲ **THE VEHICLE** The *English Mechanic,* 24 pages long and issued weekly, became the breeding ground for the telescope-making hobby.

disk to diffraction-limited quality in the workshop, without having to test it on a star outdoors at every step of the way as it neared completion.

Today you can start learning how to make a telescope with a quick web search. Books have always been central to learning a subject, but when the subject is evolving quickly, they're less useful. For early amateur telescope makers, the media that played the pivotal role were bulletins and magazines.

In 1865 a periodical appeared in England that would become just the right vehicle. Fascination with science and technology was spreading, and so were, for some, shorter working hours and more disposable income. The *English Mechanic* initially covered a wide range of subjects, but certain new developments in technology came to predominate (such as a deep interest in engines and motor cars around the turn of the 20th century). Each issue of the *English Mechanic* was about half articles and, importantly, half letters from mechanically inclined readers. These letters were the equivalent of internet users' groups today, and like today, many contributors used pen names to protect their privacy. The paper came out weekly, allowing threads of dialogue to build up quickly, often quite heated and impolite!

Astronomy and ATMing became a substantial part of the *English Mechanic*. Between 1900 and 1920, at times half of its content was astronomy related. Many of the contributors who can be identified were prominent and respected, and many were in the United States. Unfortunately some who used pen names have never been identified, such as "Southern Cross," a particularly prolific and forceful contributor.

One frequent contributor was the Rev. William F. A. Ellison, the well-educated rector of a small-town church in Ireland. His duties must have been mild, for they left him the time to write about 500 articles and letters for the *English Mechanic* over the years. Ellison also became adept at producing high-quality lenses and mirrors. His personal logbooks show that he worked on more than 170 mirrors and was employed by the George Calver optical firm to achieve the final figure on some of its own mirrors.

In 1918 the *English Mechanic* published a series of articles by Ellison describing how to make reflecting telescopes and, in particular, how to shape their parabolic mirrors. In 1920 Ellison collected the articles into a book: *The Amateur's Telescope*. They were remarkable in their level of detail, showing not just how to produce a basic telescope mirror, but how to determine and correct its aberrations and bring it to perfection.

Ellison's articles and book were a watershed. In 1918, as a result of his demonstrated expertise, he was appointed director of the Armagh Observatory in Northern Ireland, a post he held until his death in 1936.

The Americans

Winding back the clock a little, the pages of the *English Mechanic* show that other early pioneers were building their own telescopes in the United States. A major American contributor to its pages was John Mellish, born in 1886 as

▲ **STARS** Albert G. Ingalls (left) and Russell W. Porter pose in the early 1930s with a reflector on an equatorial "Springfield mount" of Porter's design. It kept the eyepiece at a fixed position, at the cost of three mirror reflections and a high counterweight.

the son of a farmer and living in Madison, Wisconsin. He was not only an accomplished telescope maker but also a very good observer, scrutinizing the planets and discovering a number of comets.

In 1907, when Mellish was about 21, the new American magazine *Popular Mechanics* published an article by him on building telescopes. By the time he was 26, Mellish had made increasingly large reflectors with apertures of 7½, 8½, 10, 11, 12, and 16 inches. A letter Mellish published in the *English Mechanic* in 1912 shows him proudly standing in a Wisconsin field by his massive, long-focus 16-inch.

Mellish also became secretary of the Society for Popular Astronomy (SPA) when it was formed in 1909 by Frederick C. Leonard — who was 13 years old. Perhaps because of his age, Leonard wasn't afraid to ruffle establishment feathers. The prevailing view at the time was that amateurs ought to work on behalf of professionals, and that to form a society of their own would interfere with the more learned bodies. Leonard's society lasted only until 1918, but by then it had set the mold for future amateur astronomical societies in America. Leonard was a prolific writer from an early age, and his articles and letters were a common feature of the *English Mechanic*.

Meanwhile, a 1910 article in *Popular Mechanics* had inspired Russell Porter, back from the Arctic, toward his new interest. Porter befriended the enthusiastic young Frederick, and in 1914 Porter hosted the first SPA Convention in his own home in Maine. It was a small affair, but a sign of greater things to come.

Flowering in Vermont

By that time Porter was 42 years old. Born in Springfield, Vermont, in 1871, he was educated as an engineer and architect but his dream was to reach the undiscovered North Pole. To this end he participated in six arctic expeditions, generally as a surveyor and artist. Most of these ventures ended in shipwreck or other calamity. The Ziegler-Fiala Expedition of 1903–05, whose crew was stranded for two years on the northernmost island of the Franz Josef Archipelago, finally ended Porter's polar ambitions. He tried to set up an artists' colony in Port Clyde, Maine, but it failed. He did, however, marry the local postmistress, Alice Marshall.

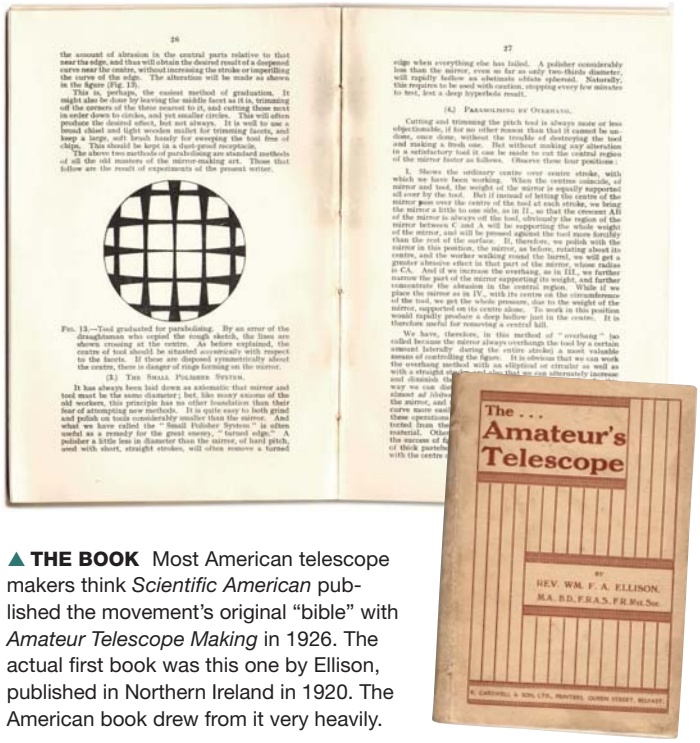
It seems that while recovering from an illness in the home of his friend James Hartness, an amateur astronomer and president of the Jones & Lamson Machine Company of Springfield, Porter passed time skimming through some back copies of magazines. Two articles from 1910 caught his attention: one by John Mellish on telescope making in *Scientific American,* and one on mirror making by Leo Holcomb in *Popular Astronomy.* In 1913 Hartness sent Porter two 16-inch glass blanks and some notes. Porter used these to make his "Polar Reflector," which he described in *Popular Astronomy* in 1916. It is thought that Porter used a book titled *Glass Working by Heat and Abrasion,* by Paul Hasluck, for very basic instruction on mirror making and testing. But it was published in 1899, and he would have had to make significant adjustments for newer grinding and polishing materials.

Porter moved back to Springfield in 1919 to work at Jones & Lamson. With his and Hartness' telescope-making experience, the company's facilities, and its technically skilled workforce, all the ingredients for something special were in place.

In 1920 Porter recruited 14 of the company's workers and a local schoolteacher into a series of evening classes on telescope making. Many of the group completed Newtonian reflectors and, in 1923, they formed the Springfield Telescope Makers. That year Porter wrote an article for *Popular Astronomy* describing the group and their work. He also provided some hilltop land, where the men built a clubhouse and named it Stellafane, "shrine to the stars." The club invited visitors and other groups to its site. In 1926 it hosted the first Stellafane Convention, which continues annually to this day.

Going National

We now turn to another key player in the story. In the photo of that first Stellafane Convention on page 22, Albert G. Ingalls stands at far right next to Porter. Ingalls had become an editor at *Scientific American* in 1923 and apparently saw Porter's many articles in *Popular Astronomy.* The two met in 1925 and started the long association and friendship that



▲ **THE BOOK** Most American telescope makers think *Scientific American* published the movement's original "bible" with *Amateur Telescope Making* in 1926. The actual first book was this one by Ellison, published in Northern Ireland in 1920. The American book drew from it very heavily.

truly set ATMing in America onto its historic course. In 1925 Ingalls wrote an article about the Springfield Telescope Makers and asked readers if they were interested in more information. Nearly 1,000 readers sent letters saying they were! So in 1926 he published two articles by Porter: the first on mirror making, and the second on mounts for reflecting telescopes.

Porter referred readers to material from Ellison's book for the necessary mirror-making details, but not for the mounts. Here he was full of ideas from his own training and experience as an engineer, and the article describes mounts that we would be familiar with today.

In 1926 Ingalls had *Scientific American* publish a groundbreaking book: *Amateur Telescope Making.* He pulled together contributions from many sources, including Ellison for the mirror-making section. Revised, expanded editions were later issued, and two additional volumes came out in 1937 and 1953 based on the abundance of ATM columns *Scientific American* had published by then. These books are still in print, in reorganized form (available from Willmann-Bell).

Thus was spread the material for a full-scale amateur movement. Telescope-making clubs sprang up around the country, some of the largest in the basements of big-city museums and planetariums that provided institutional support and publicity.

KEITH VENABLES

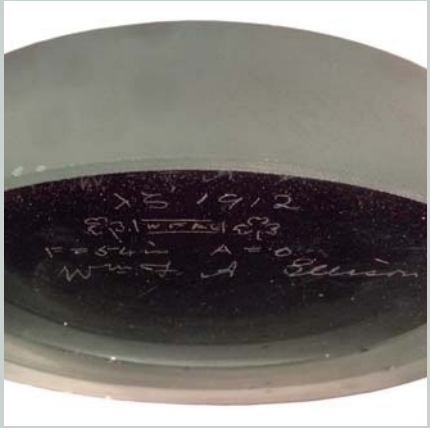
Restoring an Ellison Reflector

How I got interested in the history of amateur telescope making.

At a party in historic East London in 2009, my son-in-law mentioned that an old telescope had been found in the backyard of the premises. Would I give it a look? I was presented with a badly painted metal tube that looked like it had been driven over. The focuser and some fittings were of brass, all damaged to varying degrees. There was no mount. It didn't seem promising, but I took it home for further inspection.

The next day I dismantled the telescope to find the optics intact and some intriguing signs of quality and old age. The 6¼-inch primary mirror was wedged into a solid oak mirror cell that had shrunk and warped. Carefully prising out the mirror, I was surprised to see handwriting scratched into its back side. I have to admit not knowing the significance of the signature "Wm. F. A. Ellison," but an internet search quickly revealed who he was and produced his 1920 book *The Amateur's Telescope.* I was immediately struck by a photograph in the book of one of the author's telescopes. It looked like the very same one I had rescued!

I set about restoring it. As I peeled off layers of paint applied over many years, it quickly became clear that I did indeed have Rev. Ellison's 6¼-inch. I was able to make contact with his grandson, great-grandson, and Armagh Observatory, all of which were extremely interested and helpful in my research. An astronomy friend of mine, Brian Johnson, a professional metalworker, kindly helped me restore the damaged tube and focuser to excellent condition.



As for the mount, the photo in the book enabled me to reconstruct the altitude support and its adjustment mechanism quite faithfully. Unfortunately, the azimuth adjustment isn't really visible in the photo. I shall therefore do what Ellison probably did: make a mount based on contemporary telescopes of the time.

A number of interesting issues arose during restoration. The secondary mirror was not very good at all — its surface had a peak-to-valley deviation from flatness of 0.85 wave. But a contemporary Steinheil monocentric eyepiece was still in the focuser, and it has an estimated entrance pupil of about 2 mm, so only about the middle 25% of the secondary mirror would have been used, reducing the effect of such a poor surface. Ellison didn't attempt to work the surfaces of secondary mirrors; he cut them out of pieces of plate glass that he deemed most flat.

The primary was in a different league. It measured up with a peak-to-valley of 1/6 wave and an rms of 1/30 wave. This quality adds weight to Ellisons' own logbooks

KEITH VENABLES

IMPORTER In America, *English Mechanic* contributor John Mellish built telescopes and told Americans how it was done in a seminal *Popular Mechanics* article in 1907. Here he looks into Yerkes Observatory's 12-inch refractor in 1915.

S&T ARCHIVES

A number of these mirror grinders went on to form companies to make and sell serious astronomical telescopes in quantity, at reasonable prices. All these efforts enabled amateur astronomy to expand and become an important fount of science enthusiasm in America by the beginning of the Space Age.

To feed the interest, magazines continued to publish ATM articles, letters, and advertisements for supplies. New magazines appeared too — *Amateur Astronomy* in 1929, *The Telescope* in 1931, and *The Sky* in 1935. An indicator of the strength of reader interest was the addition of regular ATM columns to existing publications: "The Backyard Astronomer" section in *Scientific American* started in 1928, followed by "Gleanings for ATMs" in *The Telescope* in 1933.

The Great Depression forced some consolidation. *Amateur Astronomy* was absorbed into *The Sky,* and in 1941 *The Sky* and *The Telescope* merged to form the magazine you're holding. That tale is told in last November's 75th-anniversary cover story.

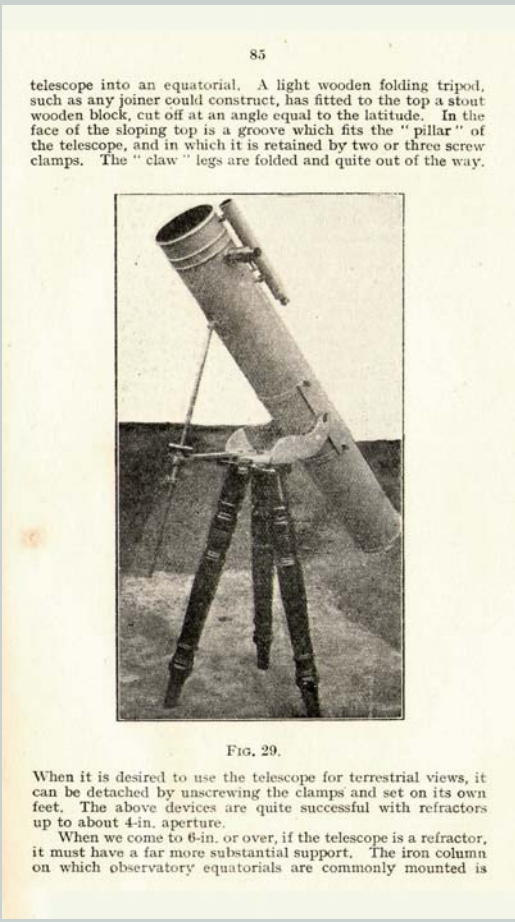
Although the birth of ATMing in America was clearly a second-generation birth, I would suggest that 1918 to 1926 was indeed the most crucial time, with perhaps 1920 as the key moment — with the publication of Ellison's book and Porter's evening class in telescope making. What is also evident, in my view, is the difference between the quite reserved English ATM scene where it all began, and the enthusiastic take-up of ATMing in the United States, which set the pace forever after.

■ **KEITH VENABLES**, FRAS, lives in the U.K. near London. He uses his skills as an engineer to make ultra-portable telescopes and is looking forward to his 18th trip to the Texas Star Party.

that suggest he was regularly figuring and refiguring mirrors for Calver telescopes.

Ellison's skill as a mirror maker is undoubted, but his mirror cells and tubes were less advanced. His reflectors usually had not a solid tube like my example, but a partially open arrangement of parallel wooden battens for ventilation. He thought that solid tubes could never produce satisfactory results due to thermal air currents. He may well have based that opinion on his use of this very scope. My own use of the telescope has led me to conclude that it isn't the solid tube but the thick, solid mirror cell in the back that was the problem.

How one of Ellison's telescopes ended up as junk in a backyard in East London we will probably never know. Fortunately, it led to a fascinating insight into a key period in the development of amateur telescope making.



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telescope into an equatorial. A light wooden folding tripod, such as any joiner could construct, has fitted to the top a stout wooden block, cut off at an angle equal to the latitude. In the face of the sloping top is a groove which fits the "pillar" of the telescope, and in which it is retained by two or three screw clamps. The "claw" legs are folded and quite out of the way.

FIG. 29.

When it is desired to use the telescope for terrestrial views, it can be detached by unscrewing the clamps and set on its own feet. The above devices are quite successful with refractors up to about 4-in. aperture.

When we come to 6-in. or over, if the telescope is a refractor, it must have a far more substantial support. The iron column on which observatory equatorials are commonly mounted is

▶ **RESCUE** The author discovered a 6¼-inch reflector made by William Ellison, and pictured in Ellison's 1920 book, as an apparent piece of beat-up trash in a London yard. He restored it to working order. *Left:* Scratched on the back of its mirror are William F. A. Ellison's signature, "1912," and Irish shamrocks.

KEITH VENABLES (2)