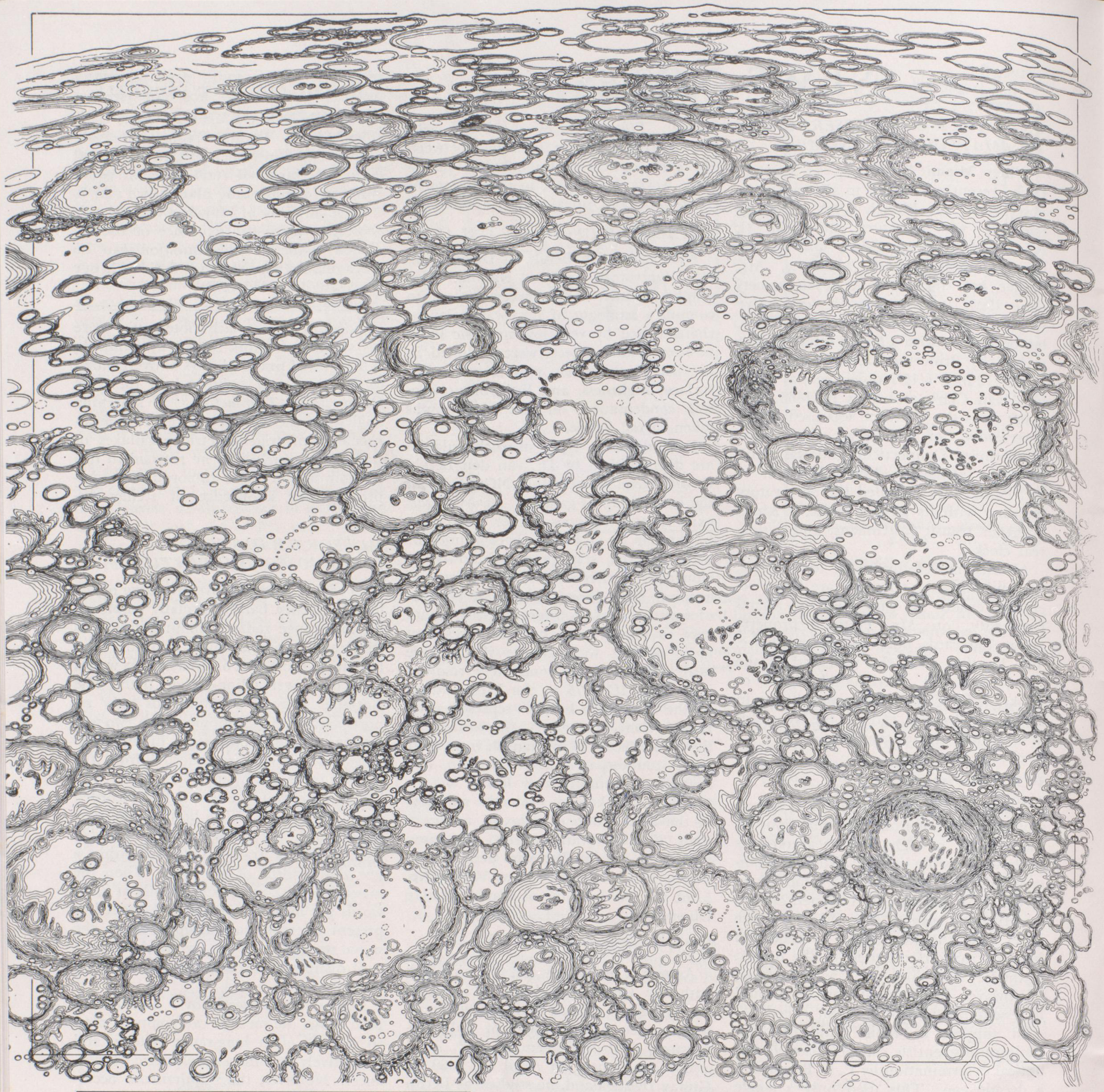
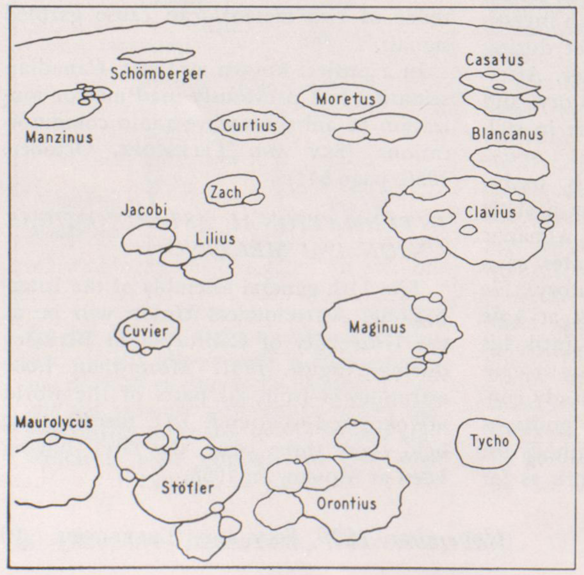




The southern part of the moon, as represented on one sheet of Philipp Fauth's great lunar map, left incomplete when he died in 1941 and now being prepared for publication by his son, Hermann Fauth. The original is on a scale of one to a million, corresponding to 11½ feet for the moon's diameter. This reproduction is on a scale only 29 per cent as great. The small key chart, left, identifies several of the more prominent craters, including Clavius, 144 miles in diameter; Tycho, 54; and Moretus, with its massive central peak, 73 miles. Fauth uses contour lines to indicate vertical relief, a change from the hachures in his earliest charts. These contours are careful estimates rather than the result of detailed measurements. Possibly never again will a lone selenographer prepare so elaborate a map of the whole moon entirely from his own visual observations. The multitude of smaller formations visible in very large telescopes is so great that future visual charting will probably be co-operative, insofar as it is not superseded by photography or actual exploration. To appreciate the amount of detail in Fauth's map, and to judge its accuracy, the reader should compare the view in his own telescope with the depiction of, say, the crater Clavius.

All illustrations with this article are courtesy Hermann Fauth.

PHILIPP FAUTH and the Moon

HERMANN FAUTH

ANYONE who writes about the history of selenography should no more omit the name of Fauth than those of Mädler and Schmidt. Fauth was a leader in lunar studies and the author of maps and publications showing his unprecedented knowledge of the moon's surface. Although this amateur was world-famed among astronomers during his lifetime, recent books either fail to mention him or give him only a few inadequate words. In America he has remained almost unknown.

Philipp Johann Heinrich Fauth was born on March 19, 1867, at Bad Dürkheim in the German Rhineland, the oldest of three children in a long-established family of pottery makers. From his father he acquired outstanding artistic talents, that later showed themselves in unsurpassed lunar maps, and a lifelong love for music. Tending the pottery kiln at night, the father would fetch his youngster out of bed and carry him outdoors, wrapped in a blanket, to show him the beauty of the stars and the sun rising over the vineyards of the Rhine Valley. Coggia's comet in April, 1874, made a deep impression on the boy.

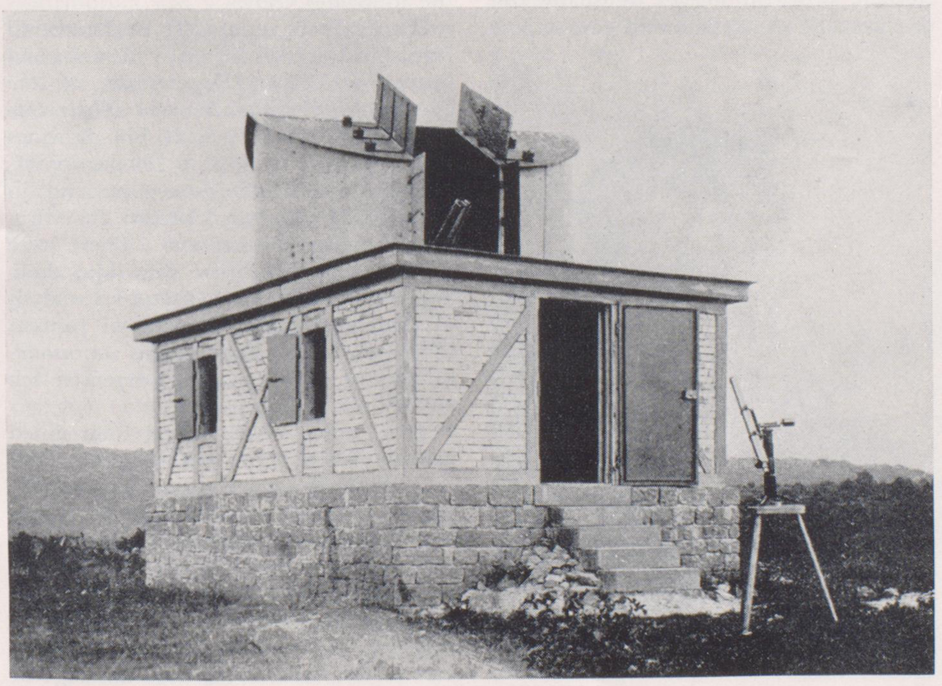
Philipp Fauth was 63 when this picture was taken in the summer of 1930. At that time, the German amateur was resuming lunar observations with a 15½-inch refractor at his fourth observatory (pictured on page 23), at Grünwald, in Bavaria.

At secondary school in Kaiserslautern, Fauth began an enthusiastic study of astronomy. In 1885 he started observing the sun and moon with a small 18-power telescope, and two years later acquired his first really serviceable instrument, a 3-inch refractor. His two aims were to become acquainted with everything to be seen in the sky, and to draw what he saw better than the usual pictures in books. (At that time astronomical photography was a little-known novelty.) The boy's inspiration came from books, for he had not yet visited an observatory or met an astronomer.

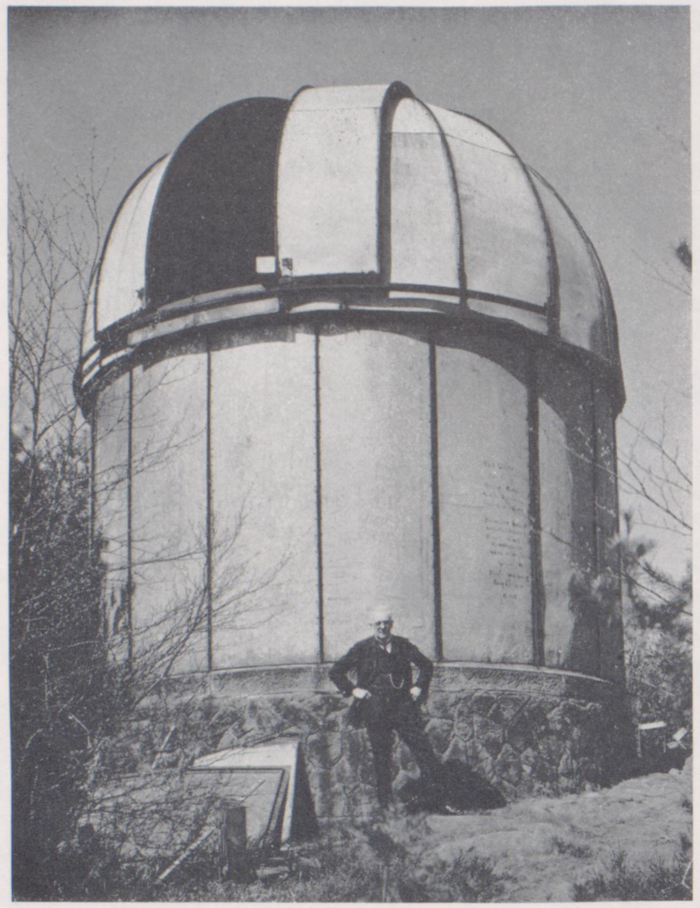
In 1890, when Fauth became a school teacher, he built his first observatory in the southern part of Kaiserslautern, equipping it with a 6-inch Pauly refractor. At that time the west German observatories of Karlsruhe, Heidelberg, and Cologne had nothing larger. He devoted himself at once to the moon, Jupiter, and the nebulae. But two years later, the school board transferred him to the remote town of Oberarnbach in the western Rhineland, for it was taken amiss that a young teacher should have such a good city post.

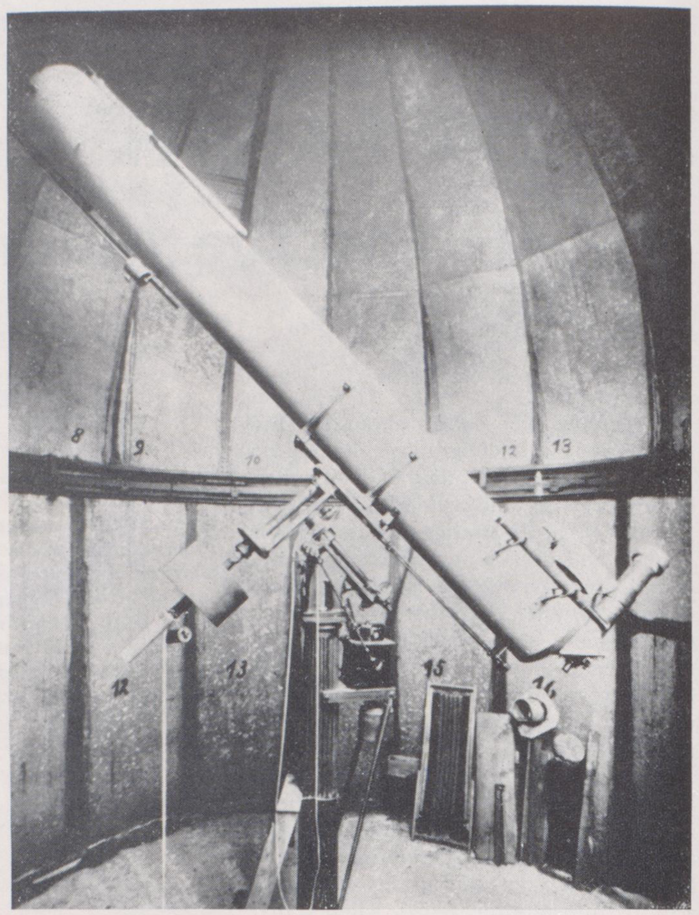
Now his observing had to be done long-distance, each working night requiring a three-mile walk over a hilly road, then a 10-mile train trip, and another half mile on foot to the observatory — and back again in the morning. He kept this up for four years, in addition to his regular school duties. Fauth recollected: "During those years I won my spurs as an astronomer. In the summers I more than once saw the sun set as I began to observe, and rise as I closed up the observatory. In winter I needed all my enthusiasm. Deep snow and bitter cold were obstacles, but steady seeing and a transparent sky encouraged me to persist; the unforgettable impressions even during winter nights are among my fondest observing memories."

The fruits of these strenuous years



Fauth's first observatory, in use from 1889 to 1895, was located on the Lämmchesberg, near Kaiserslautern. Here, with a 6-inch refractor, he made the observations on which was based his atlas of 25 lunar regions.





The third observatory that Fauth built, in use from 1911 to 1923, was on the Kirchberg near Landstuhl, in western Germany. At the left, Professor Fauth stands before the building. The interior view shows the 15½-inch medial refractor, an instrument of exceptional optical quality, which gave practically complete color correction. With this telescope the German amateur did much of his finest work.

were Fauth's first two memoirs, published in 1893 and 1895: *Astronomical Observations and Results in the Years 1890 and 1891*, and a similar report for 1893 and 1894. The latter included a topographic atlas of 25 lunar regions. Articles by him appeared in journals such as the *Astronomische Nachrichten* and *Sirius*, and he was already corresponding actively with fellow observers, especially Hermann Klein in Cologne, J. N. Krieger in Gern, Viktor Nielsen in Copenhagen, and Max Wolf in Heidelberg.

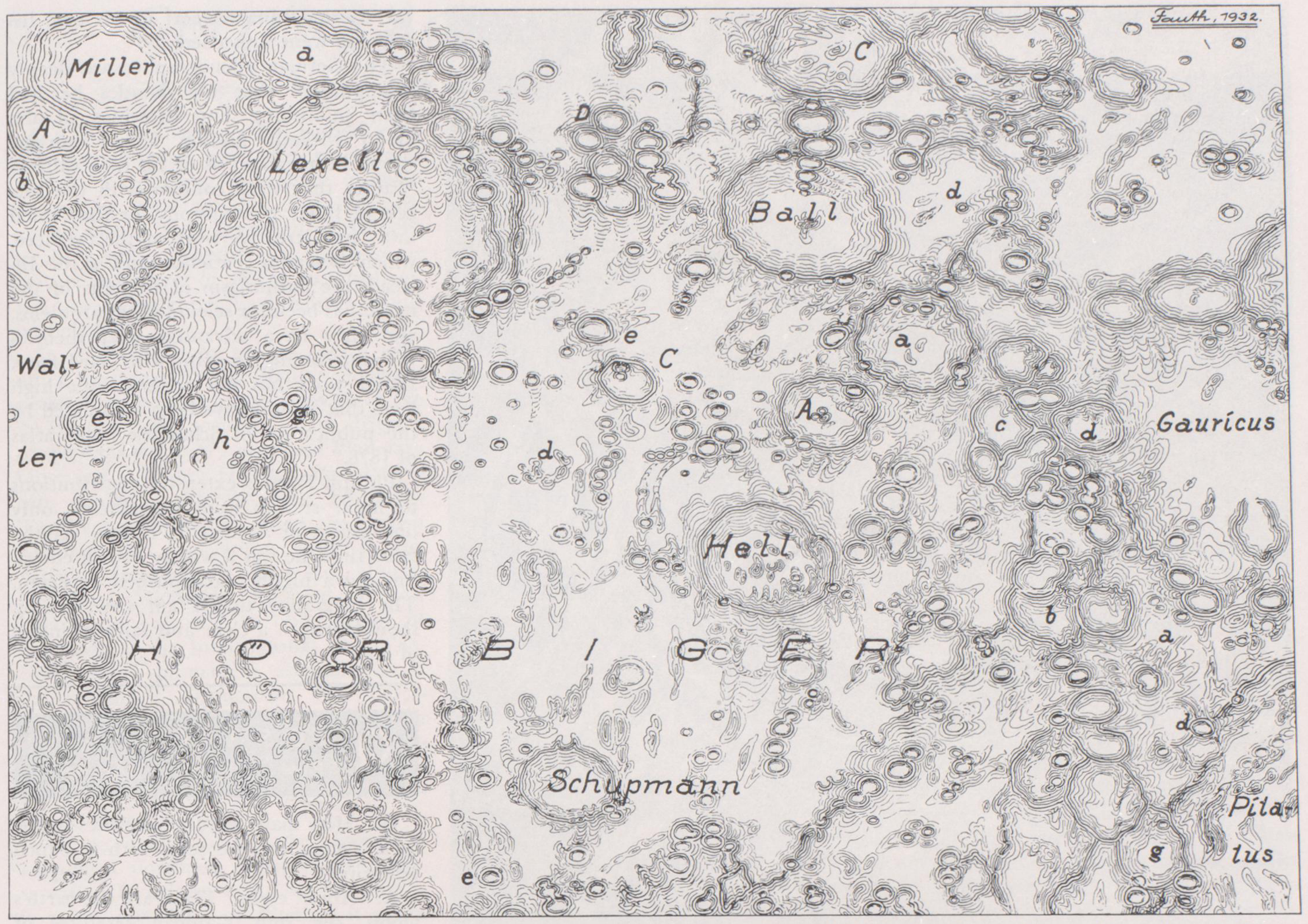
Fauth's success gained him the support of the Prussian Academy of Sciences for the construction of a more serviceable observatory in a better location. In 1895 he obtained a transfer to the school at neighboring Landstuhl, and near there on the Kirchberg he erected his second observatory, a dome-topped stone tower 26 feet high. It looked out over the treetops 450 feet above the town and 1,300 feet above sea level. Here Fauth obtained a wealth of observational results, and by 1902 had discovered some 5,600 new lunar craterlets and clefts. He was now established as a lunar specialist. In 1906, Wilhelm Foerster of Berlin encouraged him to write his first book, which also appeared in English translation as *The Moon in Modern Astronomy*, London, 1907. Professor Foerster furthermore recommended him for the post of assistant at a new observatory in Mexico, which, however, he decided not to accept.

In 1911 Fauth acquired a 15½-inch f/10 refractor of the medial type. This design, invented by Ludwig Schupmann of Aachen, provided images unusually free of chromatic aberration, and gave superb performance. The third observatory, built for this telescope, stood 600 feet south of the stone tower. To the low sheet-zinc dome in a grove of young pine trees, Fauth welcomed thousands of visitors in the following years.

This photograph, taken in 1890, shows the young schoolteacher at the outset of his career as a lunar specialist.

His 28 years of activity at Landstuhl furnished the basis for many memoirs and books: in 1898, *Observations of the Planets Jupiter and Mars at Their Oppositions of 1896-97*, with 147 drawings and five maps; in 1912, a 790-page work, *Hörbiger's Glacial Cosmogony;* and in 1916, his *25 Years of Planetary Investigation*, with 245 illustrations. There were also innumerable lunar drawings, thousands of sunspot sketches, and an analysis of almost 3,000 fine drawings of Jupiter. Moreover, he wrote numerous astronomical articles and kept up an extensive scientific correspondence.

This intense activity was interrupted in 1923, when Fauth left the Rhineland because of the French occupation, and he became a teacher in Munich. He could not bring his medial to Bavaria until 1930, when he set it up near the town of Grünwald, nine miles south of Munich. There he continued his work, publishing at the age of 70 a large collection of drawings of formations very near the edge of the moon, observed at times of especially favorable libration. Three years later he was planning to move his observatory to Rauhe Alb in Swabia, when he died on January 4, 1941. Philipp Fauth's last contribution was a yet-unpublished work of advice and suggestions for future lunar observers.

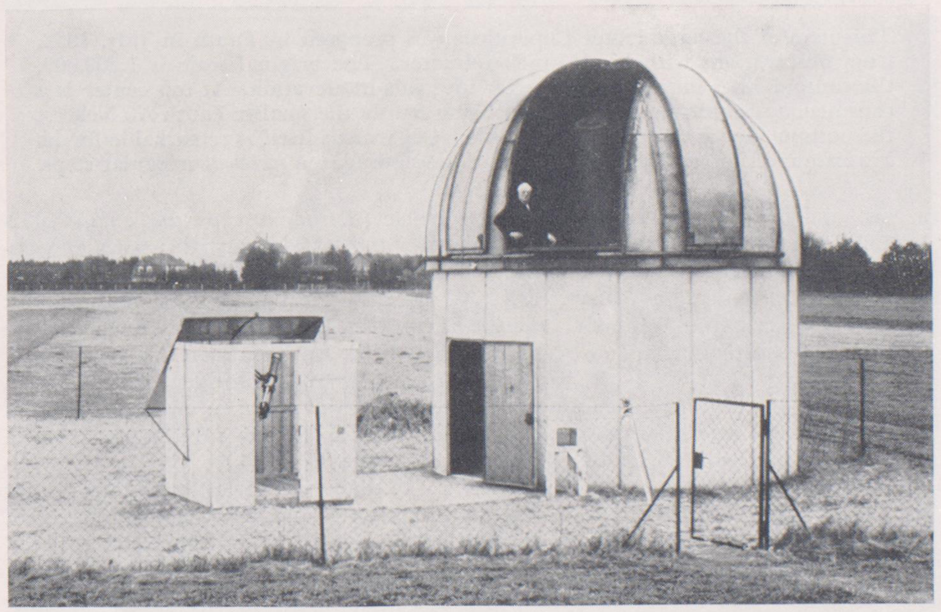


One of the 16 large-scale charts of Fauth's 1932 regional atlas shows the Hell Plain, in the south-central portion of the moon. The ruined and incomplete remains of an enormous crater, this plain has never been officially named, but Fauth designated it Hörbiger. About two inches left of the crater Hell on this chart is Cassini's bright spot, one of the most brilliant lunar areas at full-moon phase. The low-walled crater labeled Schupmann is generally known as Hell B.

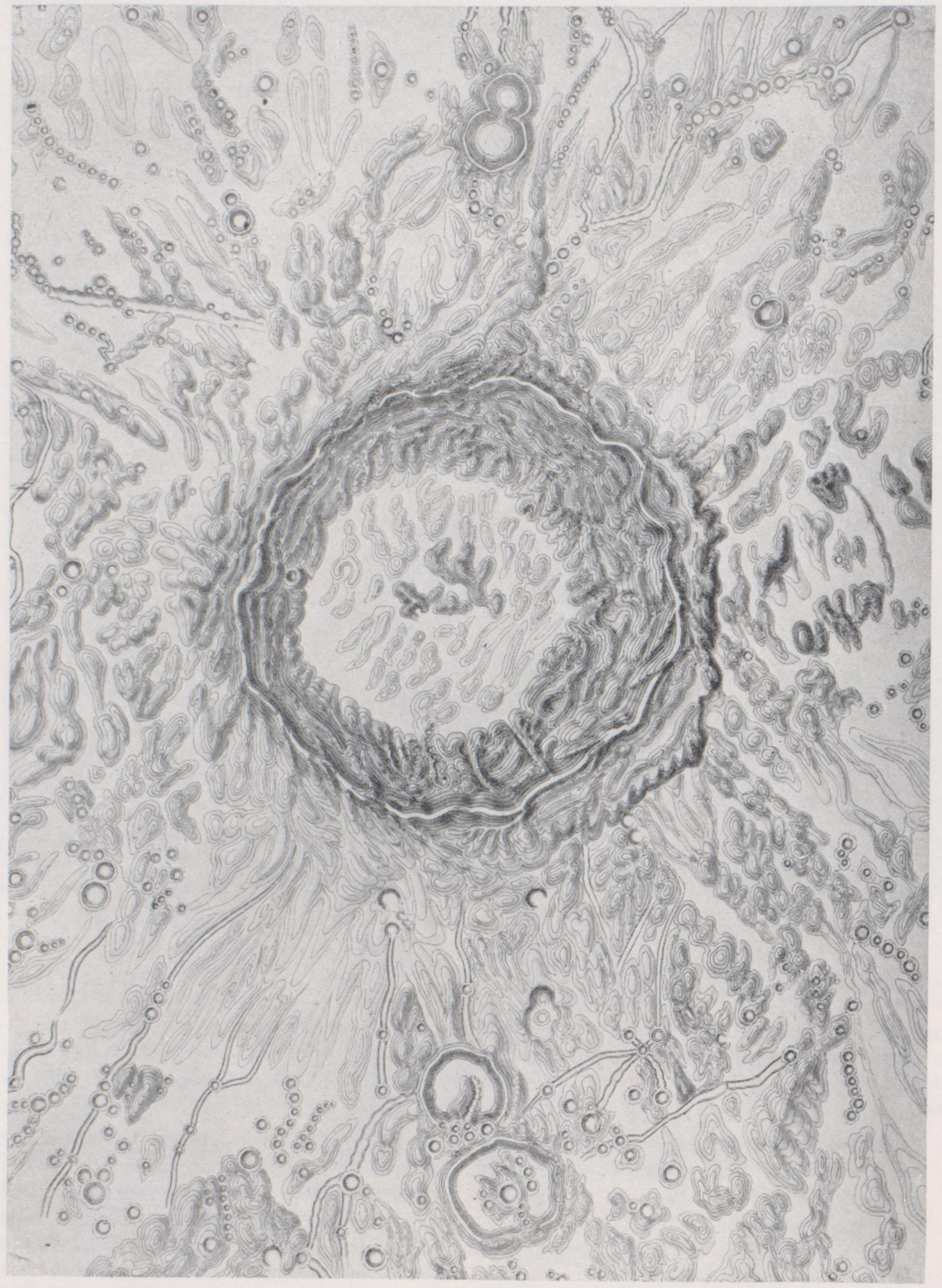
Today the sites of Fauth's four observatories have been absorbed by the growth of cities, and his famous medial telescope disappeared at the end of World War II. There remain only his dwelling and his grave in Landstuhl, and streets named for him in Bad Dürkheim, Landstuhl, and Grünwald. His main legacies are his great selenographical works: the comprehensive 600-page treatise of 1936, *Our Moon;* his lunar atlases of 1895 and 1932; and his great lunar map, 11½ feet in diameter and on a scale of 1:1,000,000.

The 22 sheets of this map survived World War II, but Fauth had lived only long enough to make the finished drawings for five of them. As his son, I have undertaken to complete the careful pencil drafts of the remaining 17 sections. The long-awaited publication of this map will probably be within a year. From the sample section reproduced on page 20, the reader may gather some impression of the remarkable detail and realism of Fauth's representation of the moon.

This map has had a long history. Over the years Fauth spent thousands of hours at the telescope, making the drawings that in 1936 he began to combine into a general map. Already in 1932 he had prepared a lunar atlas of 16 regional charts, the labor of a period when convalescence from a severe illness interrupted his observing. These 16 charts were beautiful depictions on a large scale of areas such as Eratosthenes, Taruntius, Plinius, Ptole-



Fauth's fourth observatory, at Grünwald, which he used from 1930 until his death in 1941. He is here sitting on the edge of the dome slit, and the medial can be seen inside. The hut at the left contains a small telescope for sunspot counts.



This map of the large crater Copernicus was prepared by Fauth in July, 1932, from observations with his 15½-inch refractor. The original scale is 1:200,000, the contour lines indicating 200-meter intervals in elevation. At top center is a conspicuous double crater, the larger being Fauth, the smaller Fauth A. Nearest the bottom edge is the crater Gay Lussac. Copernicus itself is remarkable for its intricate interior terraces, the inner wall descending in a series of irregular steps.

maeus, and Posidonius, as well as the Hell Plain, and the double crater Fauth (officially named after him). The great formation Copernicus is shown as it would be seen from directly above, without foreshortening, on a scale of 1:200,000.

The work on the 11½-foot map was delayed by Fauth's continual desire to add new details from additional observations. In 1939 he wrote, "I am constantly finding peculiarities that lend fresh interest to the work. In a way, all lunar maps are premature, for the detail is truly inexhaustible."

This cautious and responsible attitude helps explain Fauth's deep skepticism of reports of lunar change. In an important article (*Astronomische Rundschau, 3,* 172-176, 1901), he marshaled strong arguments that no alteration had actually occurred in the famous case of the object Linné, in Mare Serenitatis, and he again presented his proofs in his 1936 book. Yet others ignored his demonstration that Schmidt was mistaken in believing that Linné had altered from a crater to a bright patch.

"Without this error," he wrote, "lunar literature would be free from many of its fantasies; as it is, proofs of 'changes' on the moon spring up like weeds. We witness over and over again how 'scientific' methods and time and effort are squandered on unprofitable problems." Although Fauth was widely recognized as the leading lunar expert of his day, his warning went unheeded.

The German selenographer was deeply disappointed that for decades he had been publishing fine drawings of the moon without finding fellow workers whom he regarded as of his own caliber. "Either they were content with the success of lunar photography, or they shied away from creative work at the eyepiece, which demands patience and skill. Instead, the enthusiasm of students of the moon has been for selenological problems, and they have advanced wild theories without coming to grips with hard facts. Lunar work has not achieved the high level that should have been stimulated by the publication of Schmidt's lunar atlas of 1878."

Philipp Fauth's extensive contributions to lunar studies were nevertheless only one aspect of a versatile career. At the same time, he was a widely known educator and a highly accomplished musician. The biography that I am now writing should furnish a clear and faithful image of him.

QUESTIONS... FROM THE S+T MAILBAG

Q. How many natural satellites in the solar system can be seen with a 3-inch telescope?

A. About eight. These are the earth's moon, the four Galilean satellites of Jupiter, and three of Saturn's moons – Rhea, Titan, and perhaps Iapetus.

Q. Have any features on the invisible side of the moon been tentatively mapped?

A. Yes. Certain bright rays reach around the moon's edge into the visible hemisphere. On the assumption that these rays, like those of Tycho and Copernicus, diverge from craters, the locations of several craters have been derived on the far side of the moon.

Q. What does the symbol Δ mean when used with a number to label objects on a star chart?

A. These are southern clusters and nebulae in the catalogue of James Dunlop, who observed in Australia about 1825. Dunlop numbers are seldom used, as his list was superseded within a few years by John Herschel's catalogue.

Q. Which astronomical constants have been most precisely determined from observation?

A. The orbital periods of the earth and the moon, in terms of the length of the day.

Q. Who invented the telescope?

A. This question has never been fully settled. Apparently it was independently invented by several people at the beginning of the 17th century, among them Hans Lippershey, to whom credit is usually given. W. E. S.

Getting Acquainted with Astronomy

Techniques of Lunar and Planetary Observing — II

After the beginner has gained some acquaintance with the moon and planets, his growing experience is likely to suggest some specific observing programs, such as were described in the September issue. Whether his purpose is private enjoyment or adding to astronomical knowledge, the following hints should be helpful.

It is desirable to get in touch with other amateurs having similar interests, preferably by joining one or more of the major observing societies. The director of the Association of Lunar and Planetary Observers is Walter H. Haas, Pan American College Observatory, Edinburg, Tex. For information about the British Astronomical Association, write to the Assistant Secretary, 303 Bath Rd., Hounslow West, Middlesex, England. A new organization devoted to observations of the moon is the International Lunar Society, whose permanent secretary is A. Paluzie-Borrell, Diputacion 377, Barcelona, Spain. All three of these groups publish journals in which amateurs report their work. In addition, your local amateur society may have active observing sections.

An excellent habit for the observer is keeping a notebook in which every observation is written down at the time it is made, regardless of whether it seems important or not. Trust nothing to memory; a valuable discovery can be lost because the details were not written down when their recollection was fresh. Records should never be changed afterward. One convenient system is to keep the original in pencil and to make later additions in ink.

The practiced observer habitually records the time of observation for each entry in his notebook. On the moon, the advance of the sunrise or sunset line is so rapid that the appearance of details near it can change within a few minutes. The planets Mars, Jupiter, and Saturn can change their aspects rapidly as they rotate, so the exact moment of an observation must often be known for its proper interpretation.

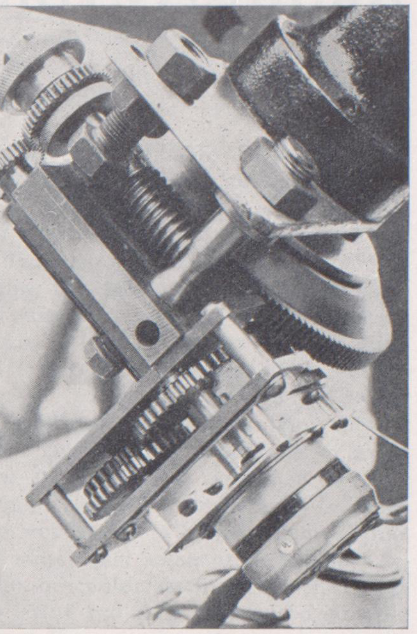
In addition, notes should be made of the sky conditions at the time. We observe from the bottom of a deep ocean of turbulent air, which bends light rays irregularly as they pass through it. Consequently, stars are seen by the unaided eye to twinkle, and telescopic images vibrate and lose their sharpness. At the same time, there may be dimming by clouds, smoke, or dust. A careful distinction is drawn between *seeing,* which indicates the steadiness of the atmosphere, and *transparency,* which indicates its ability to transmit light.

It is customary to record the seeing on a scale of 0 (worst) to 10 (best). Similarly, sky transparency is often described on a scale of 0 (nothing visible) to 5 (very clear). The subject of seeing is discussed further on page 37 of this issue.

One reference work that is invaluable to the serious lunar or planetary student is the *American Ephemeris,* in particular the section containing the ephemerides for physical observations of the moon and planets. It gives complete information about conditions of solar illumination and the orientation of their surfaces with respect to the earth. Simplified compilations of such data are given in the annual *Handbook* of the British Astronomical Association, and in the *Observer's Handbook* of the Royal Astronomical Society of Canada.

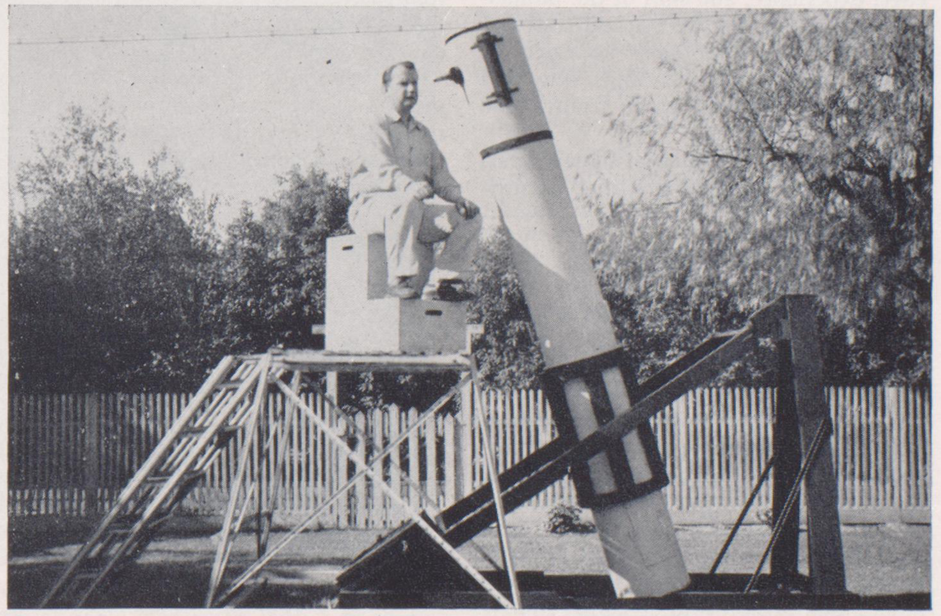
Anything that adds to the comfort and convenience of the observer will increase the amount of work he can do in an evening. If the telescope does not already have a clock drive, adding one should be seriously considered. With a driveless instrument, objects drift rapidly out of the field of view, especially when high powers are used, and the frequent resetting of the telescope is a nuisance. Moreover, brief intervals of fine seeing can be missed because the observer's scrutiny has been interrupted.

Many amateurs have built their own drives at low cost. The first two volumes of *Amateur Telescope Making* contain many descriptions and pictures of homemade drives. Edgar Everhart discussed gear ratios for sidereal and other drive rates in Sky and Telescope for August, 1957, page 494 (out of print). Of course, many commercial models are available. Setting circles are less necessary for the planetary observer, who would need them only for locating Uranus or Neptune, or for observing the brighter planets by day.



An electric drive for a 10-inch telescope, made by the late J. H. Pruett.

The eyepiece of a long-focus Newtonian reflector can sometimes be awkwardly high above the ground, unless there is a suitable support or short sturdy stepladder available. There should be a convenient place close at hand for the observer's notebook, sharpened pencils, and charts. One accessory that can be strongly recommended is a box with a top of heavy ground glass, perhaps one foot square, and containing an electric light. With such an arrangement, drawing paper can be illuminated from below, making sketching the moon or planets much easier.



Several years ago, Thomas R. Cave, Jr., Long Beach, California, designed this observing platform and stand for his clock-driven 12½-inch f/9.7 reflector.