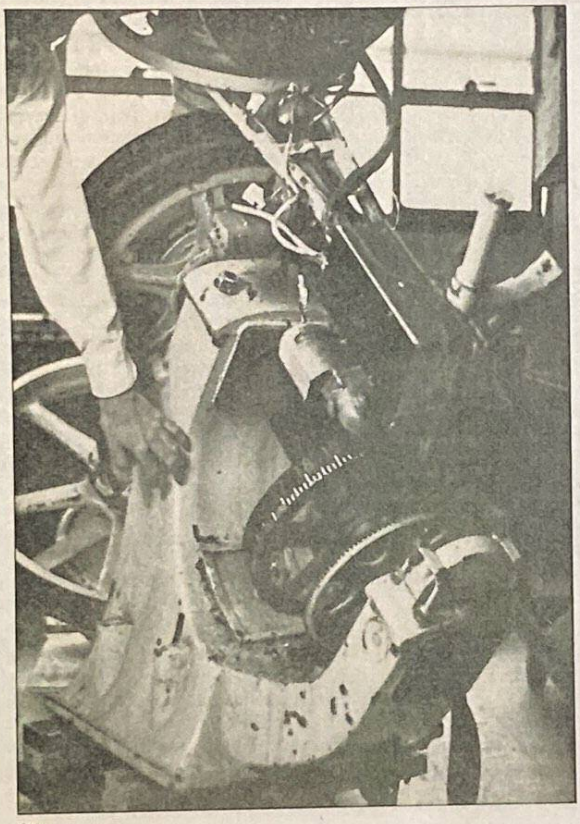
Refurbishing the U.S. Naval Observatory's 1892 Saegmuller 12" Refractor

At the U.S. Naval Observatory it was mainly all work and no play. On most nights, the Observatory's telescopes were engaged in specialized programs leaving no time for viewing for the pure fun of it. If an astronomer wished to view the Moon through a telescope, he had to wait for a public night and stand in line with the others.

But that situation started to change when Richard Schmidt, an astronomer in the Nautical Almanac Office, seeded the idea of returning an old abandoned telescope to service. The instrument he had in mind was a 12-inch equatorial refractor built by G.N. Saegmuller in 1892. The telescope had been removed from atop the main building of the Observatory in the 1950s to make room for a Moon camera used to detemine ephemeris time — a project that had been discontinued in 1974.



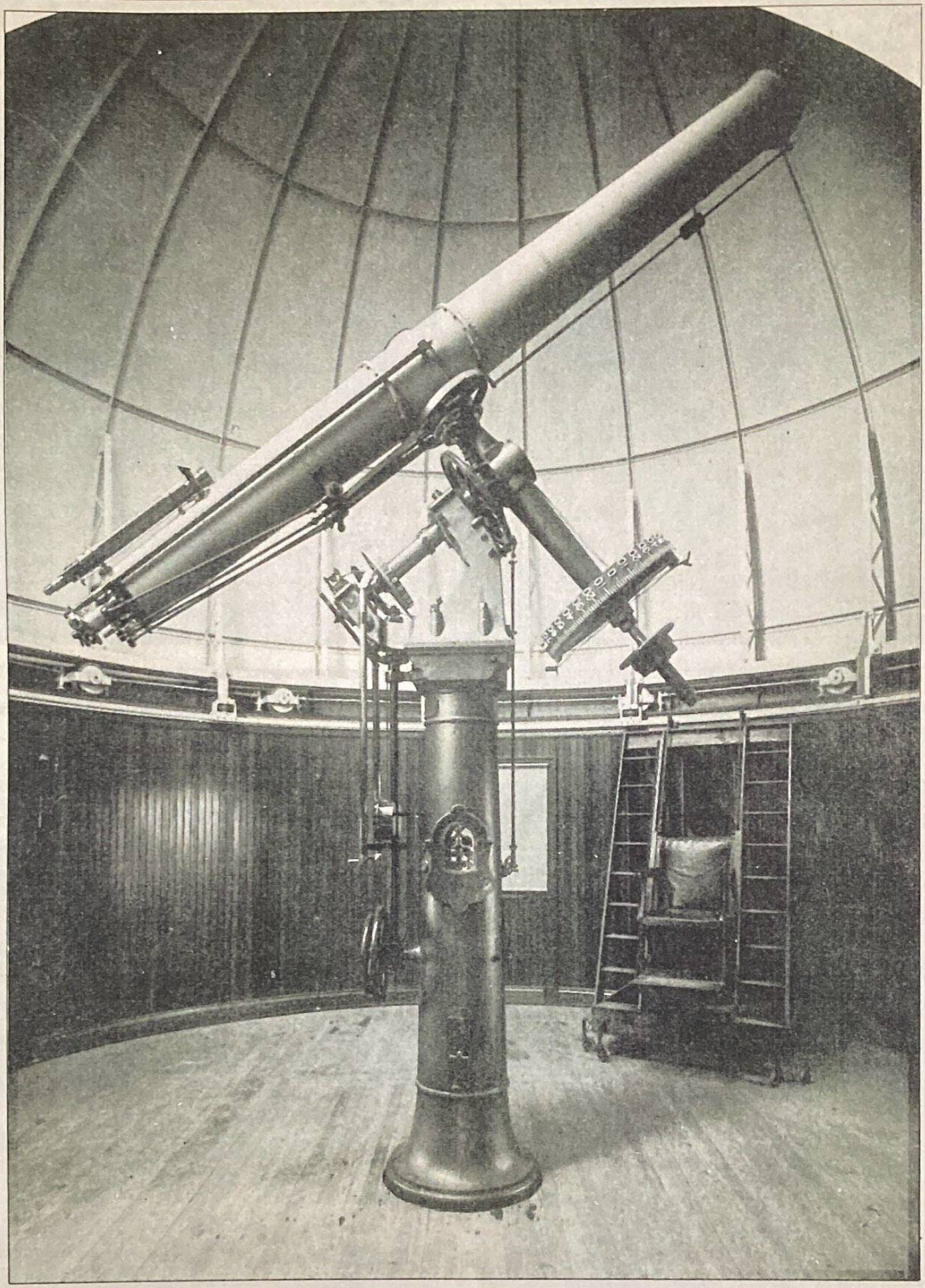
The affects of long years of storage are evident on the equatorial mounting.

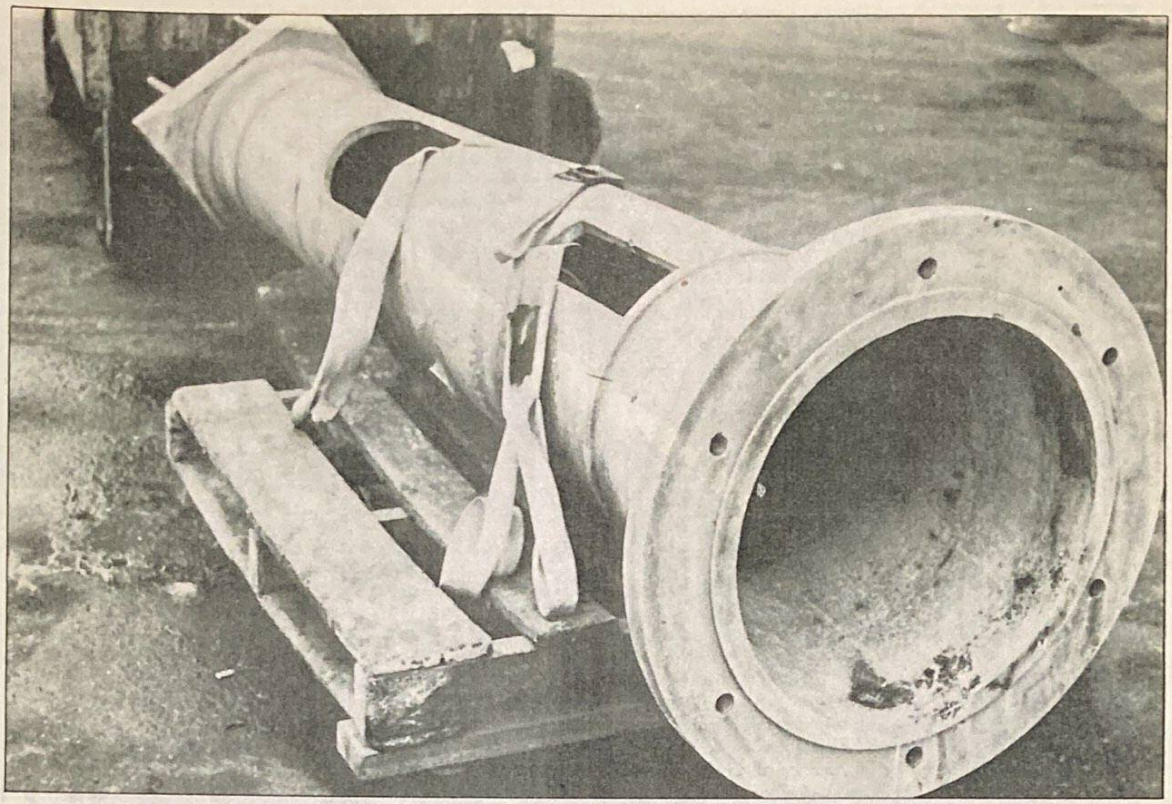
The 12-inch equatorial as it appeared around the turn of the century, The telescope stands about 17 feet high inside a steel dome 26 feet in diameter built by the Warner and Swasey Company. The objective of the Fraunhofer-Herschel design has a 180.6-inch focal length. The driving clock was located inside the cast iron pier, and consisted of a weight-driven double conical pendulum. The two hand-wheels located on the side of the pier allowed an astronomer to set the telescope in both coordinates with the aid of two setting dials just above the wheels. The driving clock, hand wheels, and setting dials have been lost over the years.

The objective of the Saegmuller telescope, figured by Alvan Clark and Sons, had been tested and shown to be unsuited for astrometric photographic work, but excellent for visual use. Most of the parts of the mounting, though many were badly rusted, were found after searching numerous storage places at the Observatory. So we had a telescope and a place to put it — all that was needed now was to clean the parts, paint them, put them all back together, and lift it back into its former dome!

The Observatory's Superintendent and Scientific Director supported the idea of having a telescope for the staff's personal use, and agreed to our proposed volunteer effort in which the astronomers would put the telescope back into shape on their own time. The Observatory would provide a workplace, supplies, and some money for restoring the telescope. So in the spirit of any good group of government employees, a committee was set up and the work began.

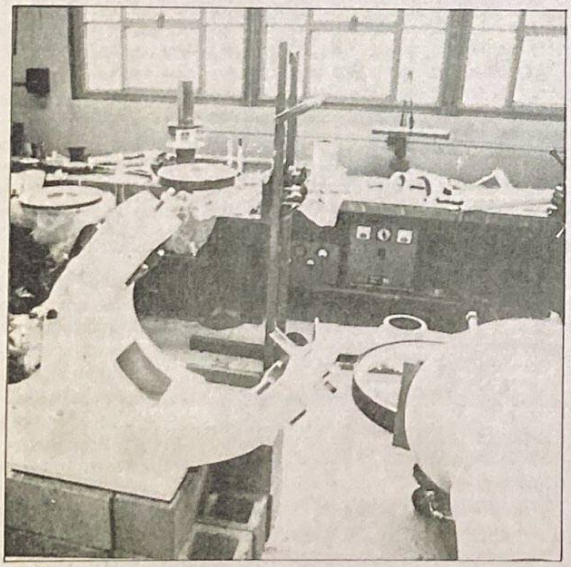
Refurbishing the telescope in Washington turned out to be a great advantage. The stripping company that removed the paint and rust from the largest pieces of the instrument without damaging the metal had done some work for the Smithsonian and was experienced at handling old items. The Navy Ship Research and Development Center repaired a major crack in the central tube section of the telescope as a training exercise — free of charge. The Washington Navy Yard provided the crane necessary to lift the pier and equatorial mounting five stories to its dome. The crane had been scheduled to raise a weather tower at the Observatory, a job which was delayed until the telescope parts were ready, then both jobs were done in one visit. Georgetown University operates a similar

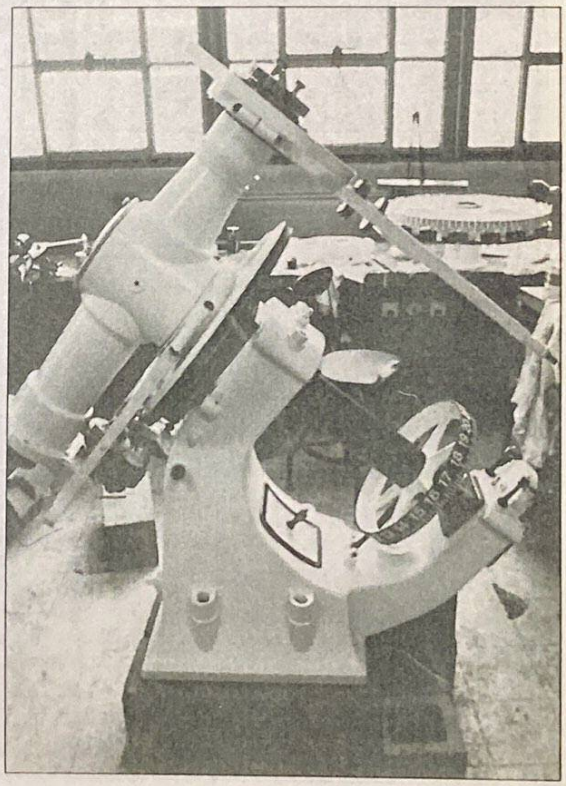




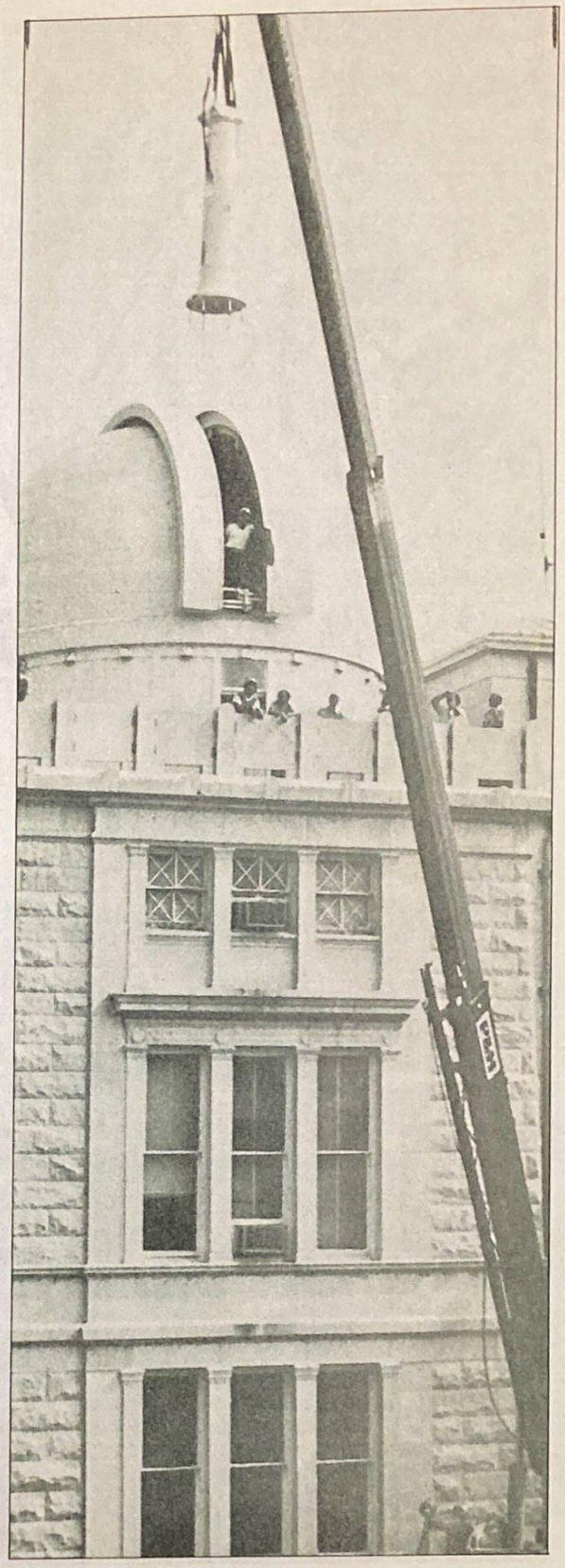
The largest parts of the telescope were taken to a local company for chemical derusting and paint stripping. The cast iron pier, pictured here, came out looking like new.

The work area where the telescope was cleaned and painted was often crowded with parts of the instrument. The equatorial mounting in the center of the room was assembled and disasssembled many times before we were certain that all the parts were fitted correctly.





Before the telescope was installed, the interior of the dome had to be cleaned and painted. Rich Schmidt is shown blasting old paint off the dome using a high-pressure air hose.



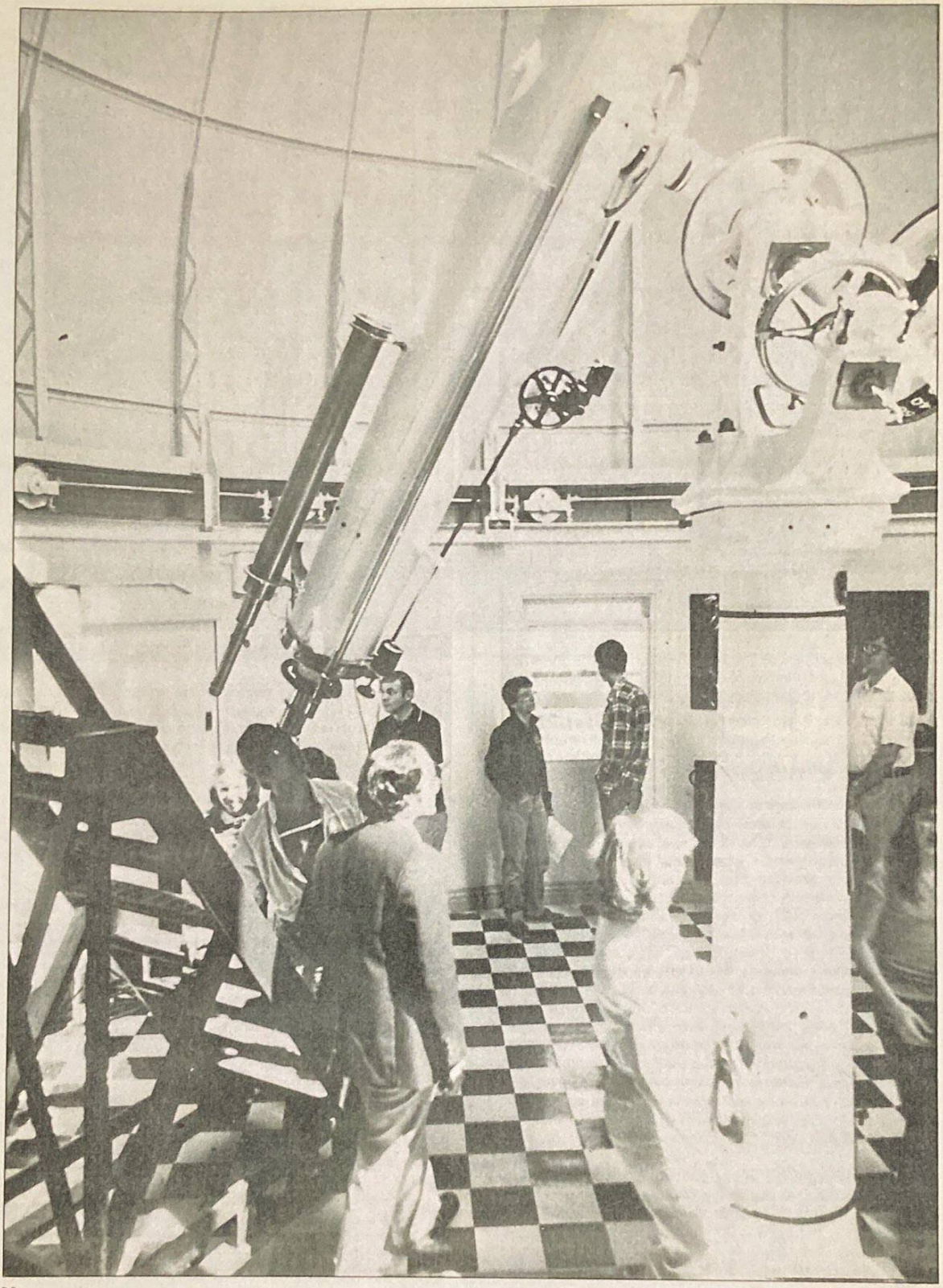
A crane from the Washington Navy Yard lifts the pier 59 feet to its original home atop the main building of the observatory. A small section of the shutter had to be cut back to allow the pier to fit through the opening.

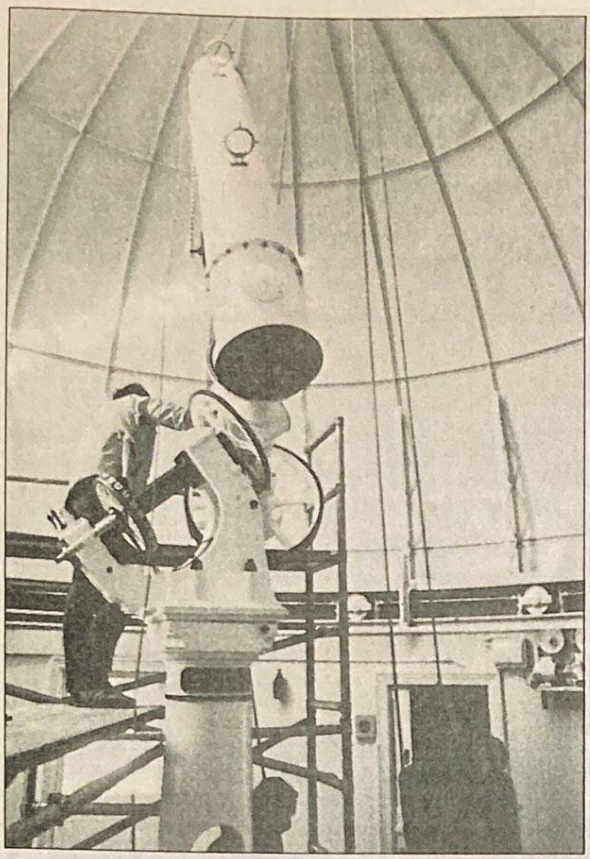
Saegmuller 12-inch refractor which we visited a number of times to see how certain parts were assembled. And, of course, the painters, electricians, engineers, and instrument makers of the Observatory staff were on hand and more than willing to answer questions and provide advice.

The telescope could not be restored to its original mode of operation since the manual devices for clamping and moving the instrument had been lost. The few motors and modifications we did add were kept simple in design and few in number — we did not want to have a complex instrument that the non-astronomical members of the staff would be unwilling to use.

In the span of one year, the telescope went from a state of decay to useful operation. Though the task was completed in the time planned, numerous problems plagued the project. The crack in the central tube section mentioned earlier made us wonder whether it would be wise to continue, since the weakened area lay where the declination axis connected to the tube.

Only one mechanical drawing of the telescope mounting could be found. With just that drawing, two photographs taken of the telescope at the turn of the century, and the Georgetown instrument, we did not always have enough information to deduce how certain parts went together. Many times we had the mounting almost together — only to find that it had to be





Assembling the tube of the telescope proved difficult since as each section was installed, the balance of the instrument would change dramatically. A scaffolding was used to support the counterweight of the declination axis while ropes held the tube sections.

At one of the open houses held at the Observatory, the 12-inch equatorial was fitted with a solar filter for the public to view sunspots. Rich Schmidt stands next to the observing ladder to operate the telescope and answer questions.

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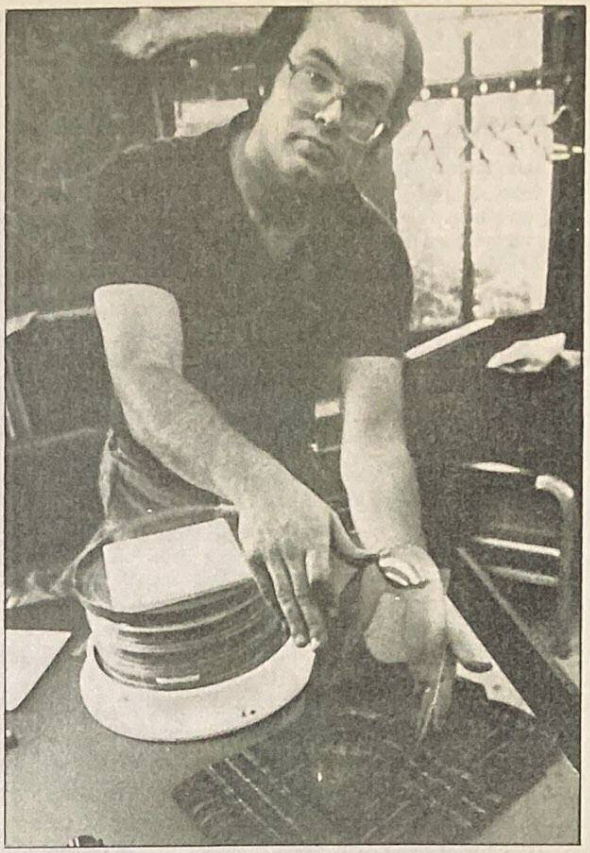
taken apart again because something did not work or because a piece had been forgotten. Once the larger pieces were raised into the dome, the other parts (some weighing over 100 pounds) had to be lifted in place by hand. Often a piece would be halfway in place only to discover that more help was needed.

Once the big parts were in place, we started troubleshooting the details. A number of motors for the telescope, for instance, produced more sparks and smoke than RPMs when first wired up. The clock drive motor, built in 1936, was rebuilt twice before it finally gave up the ghost just three days before the unveiling of the telescope to Observatory staff and members of the Saegmuller family. We quickly adapted another motor from a staff member's own telescope to replace it.

Another little crisis occurred when the slightly-deformed tube caused stresses on the cell of the objective lens, and one of the three spacers separating the two elements slipped to the center of the lens. The lens elements had to be removed and the spacers re-glued in place.

Even after those difficulties, the most frustrating problem was caused by two pigeons roosting in the shutter of the dome above the telescope. After numerous tries to keep them out of the dome failed, we put a scaffolding around the telescope and



Rich Schmidt holds the crown glass element of the 12-inch objective when the lens assembly had to be taken apart to re-glue the spacers between the elements.

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someone crawled on the top of the dome to install a screen around the sides of the shutter.

Finally, it was done. After hundreds of free man-hours of work and less than $500 spent, the Observatory staff had a telescope to use for the fun of it. We unveiled it at a rededication party with champagne cork-popping, live chamber music, and a few historical remarks about the instrument's makers by Deborah J. Warner of the Smithsonian. Over twenty relatives of G.N. Saegmuller attended the ceremony. The instrument is now included in the monthly public nights, open houses and many special tours.

In 1896, Dr. Henry Howe, Director of the Chamberlain Observatory in Denver, wrote the following about another Saegmuller refractor:

"When an astronomer's eye first rests upon a great telescope, with which it is to be his good fortune to storm the sky, his sensations are of the liveliest character. The mass of steel, iron, and brass which confronts him speaks eloquently of the patient ingenuity of the mechanician who calculated the form and dimensions of each of the hundreds of pieces of metal which joined in the intricate mechanism, and subordinated them all to one great purpose."

Those people who helped with the refurbishing of the 12-inch refractor can truly appreciate those words and the workmanship of the instrument's maker.

Theodore J. Rafferty
U.S. Naval Observatory
Washington, DC

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