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INTRODUCTION

The work during this period was somewhat curtailed for several reasons: the AIMP-D project took a large number of man hours that otherwise would have been spent on the grant; several months elapsed between the renewal of the grant and the expiration of the grant; the inability to find a suitable theoretical person for help in analyzing the Mariner IV data; moving the laboratory from the far end of the building to the near end adjacent to the research shop, which is more convenient and saves time.

Some work has been done on the Mariner IV data, but this is far from complete. A joint paper with W. M. Alexander and C. W. McCracken appeared in Science, September 10, 1965, Vol. 149, No. 3689, pp. 1240-1241. The title was "Zodiacal Dust: Measurements by Mariner IV."

Three vacuum systems are in operation: one for vacuum coating, one for microphone calibrations, and one for the particle accelerator or plasma gun. The gun has been modified for faster operation.

New transducers for detecting cosmic dust have been constructed and new devices for calibrating them in vacuo have also been constructed.

The work planned for the future is: 1) analysis of Mariner IV data; 2) improvement of transducers; 3) high velocity impact studies; 4) completion of the theoretical expected impacts on Pegasus.

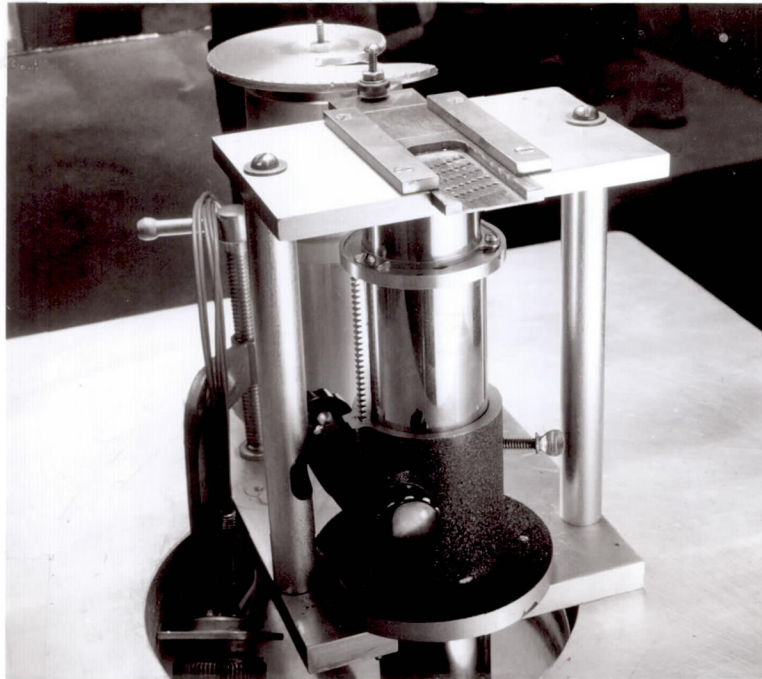
BEAD DROPPER

Capacitor microphones to be used for the detection of cosmic dust must be calibrated either by a primary or by a secondary standard. The primary standard is either a glass bead dropped in a vacuum or micron sized particles fired in a high voltage accelerator. The calibrations at Temple University are made by the first method while the second method is utilized at GSFC for final calibration of flight equipment.

The reason for dropping the beads in a vacuum results from the fact that the capacitor microphones will be used in a vacuum. The response in air is very low due to the damping effect of the air. The resonant frequency of the diaphragms is utilized in all calibrations and applications.

A bead dropper consisting of a circular glass plate fastened to a selsyn motor was designed to operate in a vacuum. Mounted on top of the glass plate was a stationary, flexible metal pusher that would push beads previously placed near the periphery of the circular plate, as the selsyn motor was slowly turned. This device was found unsatisfactory because we could not tell exactly where the bead would drop and furthermore, to map a microphone response over its surface was a very tedious process.

A new bead dropper was designed and is shown in photograph #1. A cam attached to a selsyn moves a plate, which has 5 rows of 7 holes each, over another plate with one row of 7 holes. The row of holes in the bottom plate is at 90° to the direction of motion and the top rows of holes are at an angle. In this way only one hole in the bottom plate and one hole in the top plate can coincide at one time. By activating the selsyn, 35 beads can be dropped in succession before the vacuum is



Photograph #1

is broken and reloading of the beads takes place. In the photograph a microphone is in position of testing. The preamplifier is in the tube below the microphone. The entire tube is adjustable for height.

SQUARE MICROPHONE

We constructed square microphones with some surprising results. These we find to be comparable to the circular microphones in response and in harmonic content. The bead dropper was used in a vacuum to get the data for the mapping of the response of both 1" round and 1" square microphones. These are shown in Figure 1 and Figure 2 respectively.

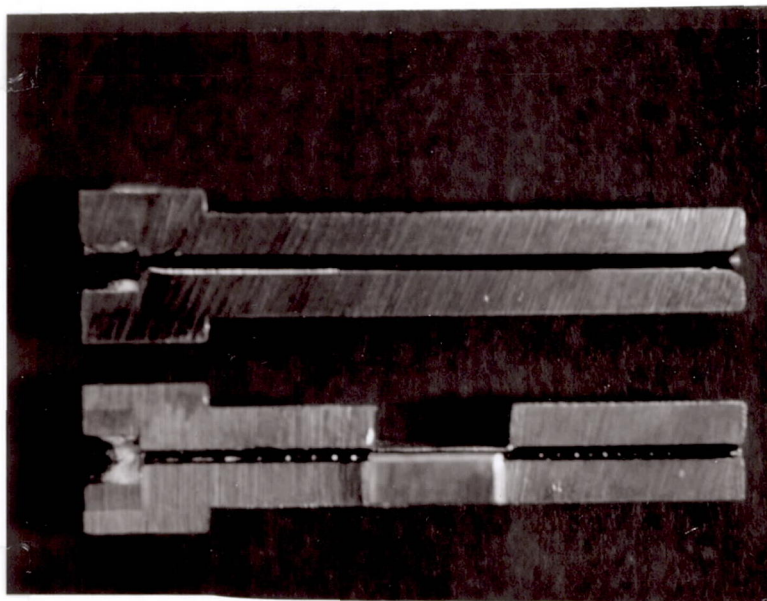
The square microphone is asymmetrical in response but we believe this can be remedied in the manufacturing process. The frequency is also adjustable in the manufacturing process. Presently we are in the process of making a 2" square microphone. We are mindful of the weight of these stainless steel microphones and are making a special effort to keep the weight to a minimum in this model.

HIGH VELOCITY GUN

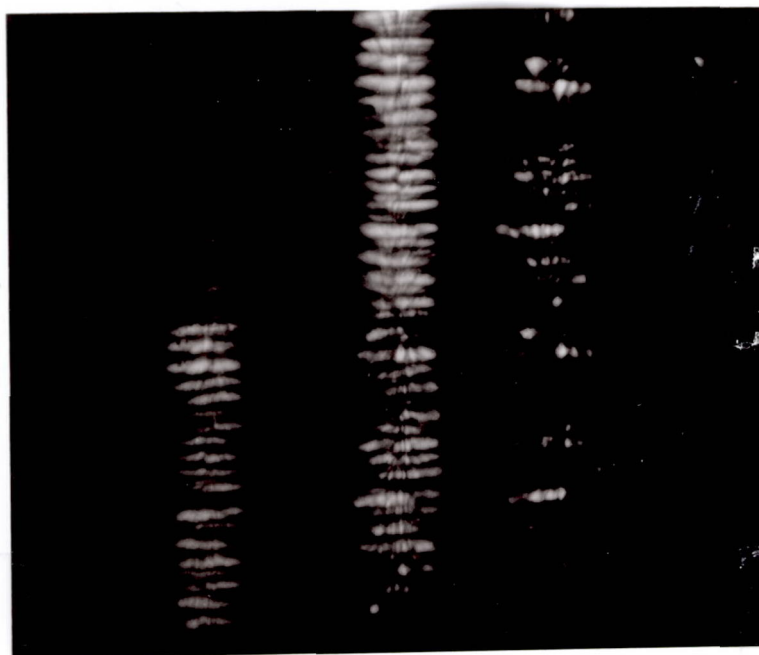
This gun is operated by discharging a 15 uf capacitor which may be charged to a potential as high as 20,000 volts, through graphite or lithium for the propulsive medium. The projectiles are usually 1 mm steel spheres or glass beads of $\frac{1}{2}$ mm or smaller.

A rather interesting problem was accidentally discovered. In photograph #2 a 1 mm brass barrel, used once in firing a 1 mm steel ball, cut lengthwise shows a series of bright spots along its length. The top is a similar barrel cut open but not used in firing and is for comparison only. Near the center of the bottom the barrel is cut at right angles to make certain that the bright spots are not in one direction only. The spots there are similar to those visible in the photograph.

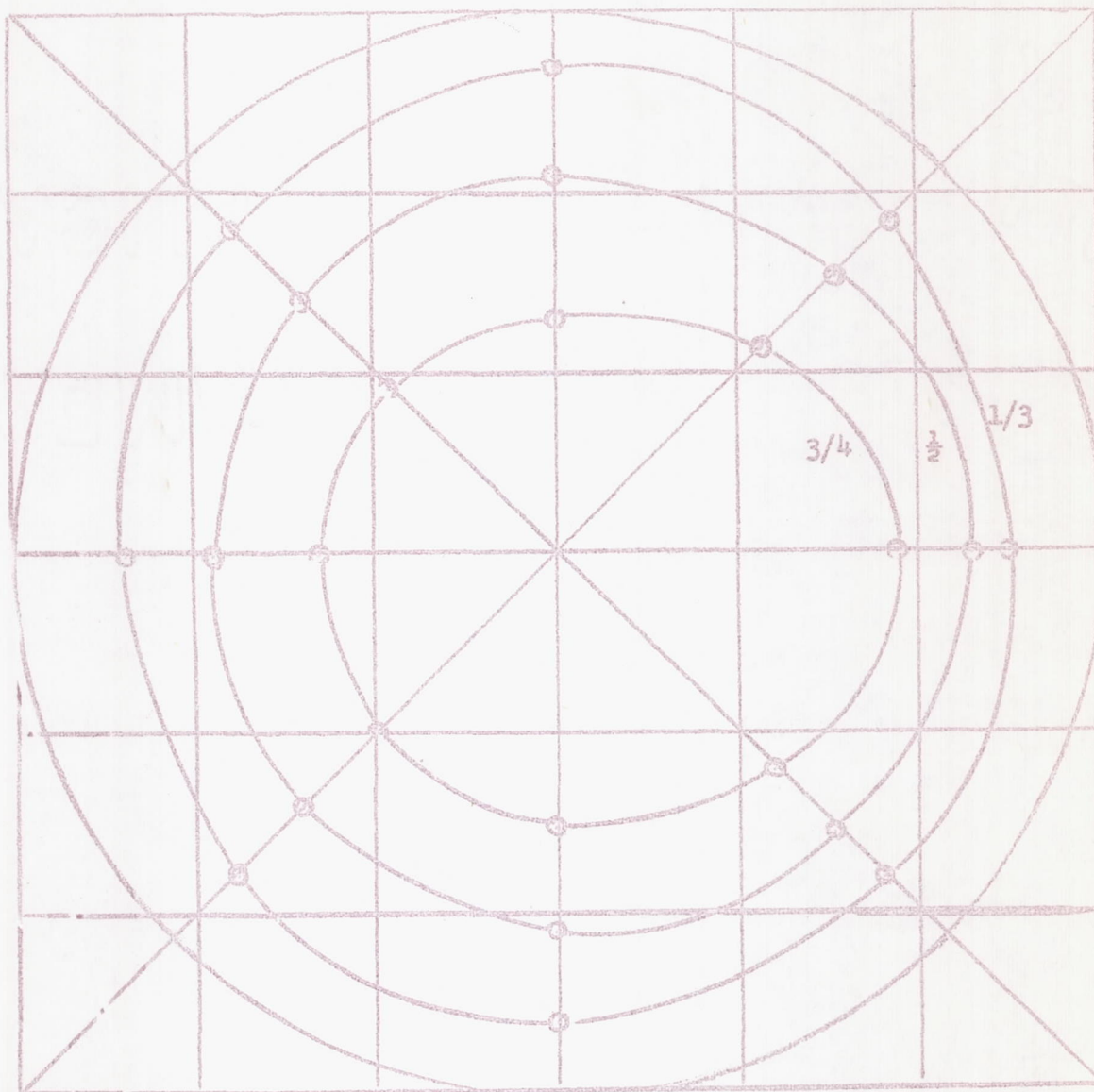
A number of firings in air always produced the aforementioned effect. When fired in a vacuum however, no such effects have been noticed. We have no solution for this and for comparison we show photograph #3 which is a 6X magnification of a wire exploding under water. These photographs were taken with a B&W camera at 2.2×10^6 frames per second. Such striations are normally present in exploding wires and also have not been explained satisfactorily.



Photograph #2



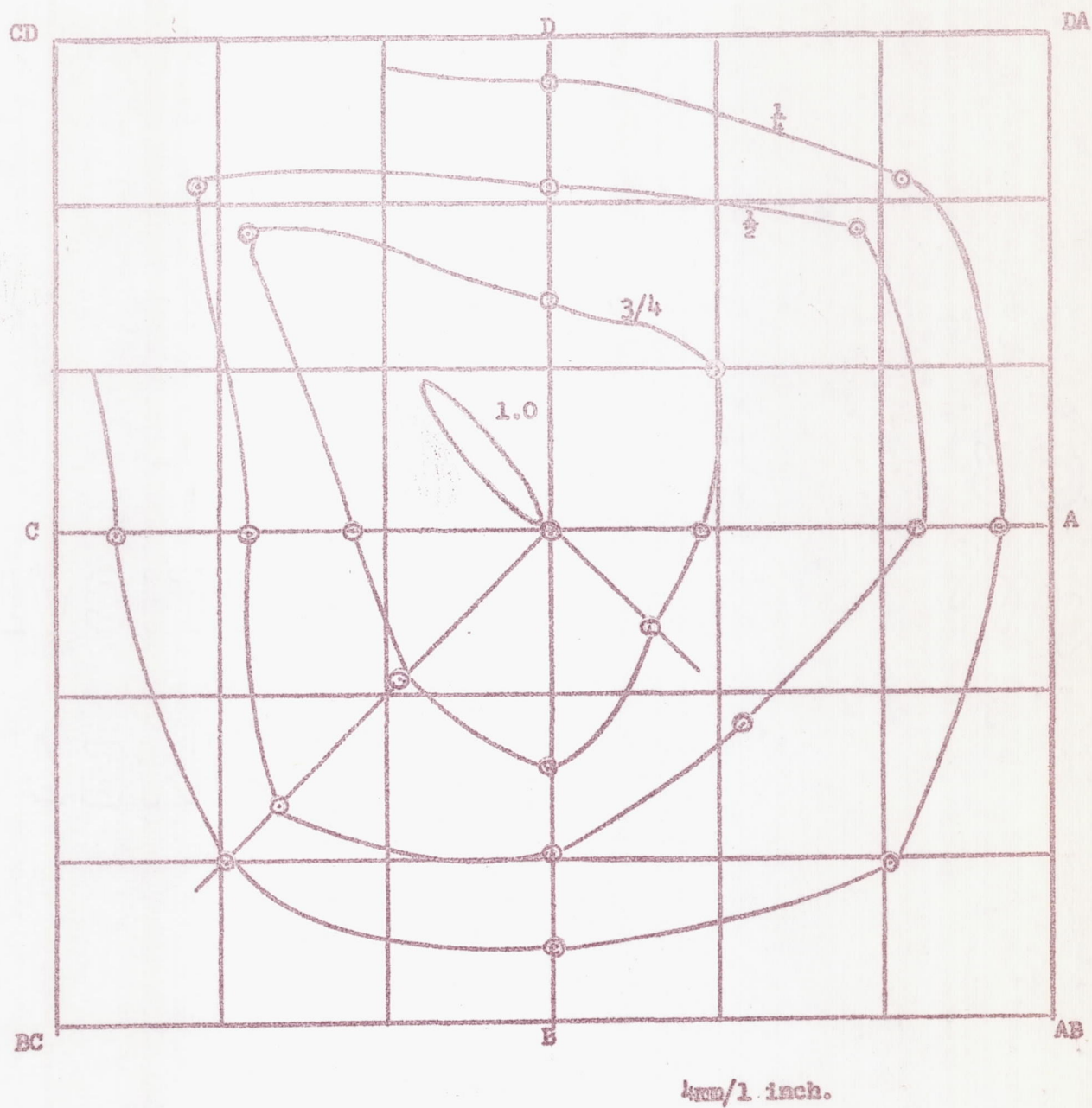
Photograph #3



4mm/1 inch

RESPONSE CONTOURS OF ROUND MICROPHONE

FIGURE #1



RESPONSE CONTOURS OF SQUARE MICROPHONE

FIGURE 2

Fig. 5 Prof. Van Biesbroeck at 16-inch telescope with 6-inch guider (May 4, 1965).



Fig. 2 View of new road from summit looking down on Geochronology Lab., Herring's small observatory (white shelter to right), St. Mary's Hospital and edge of City on plains.

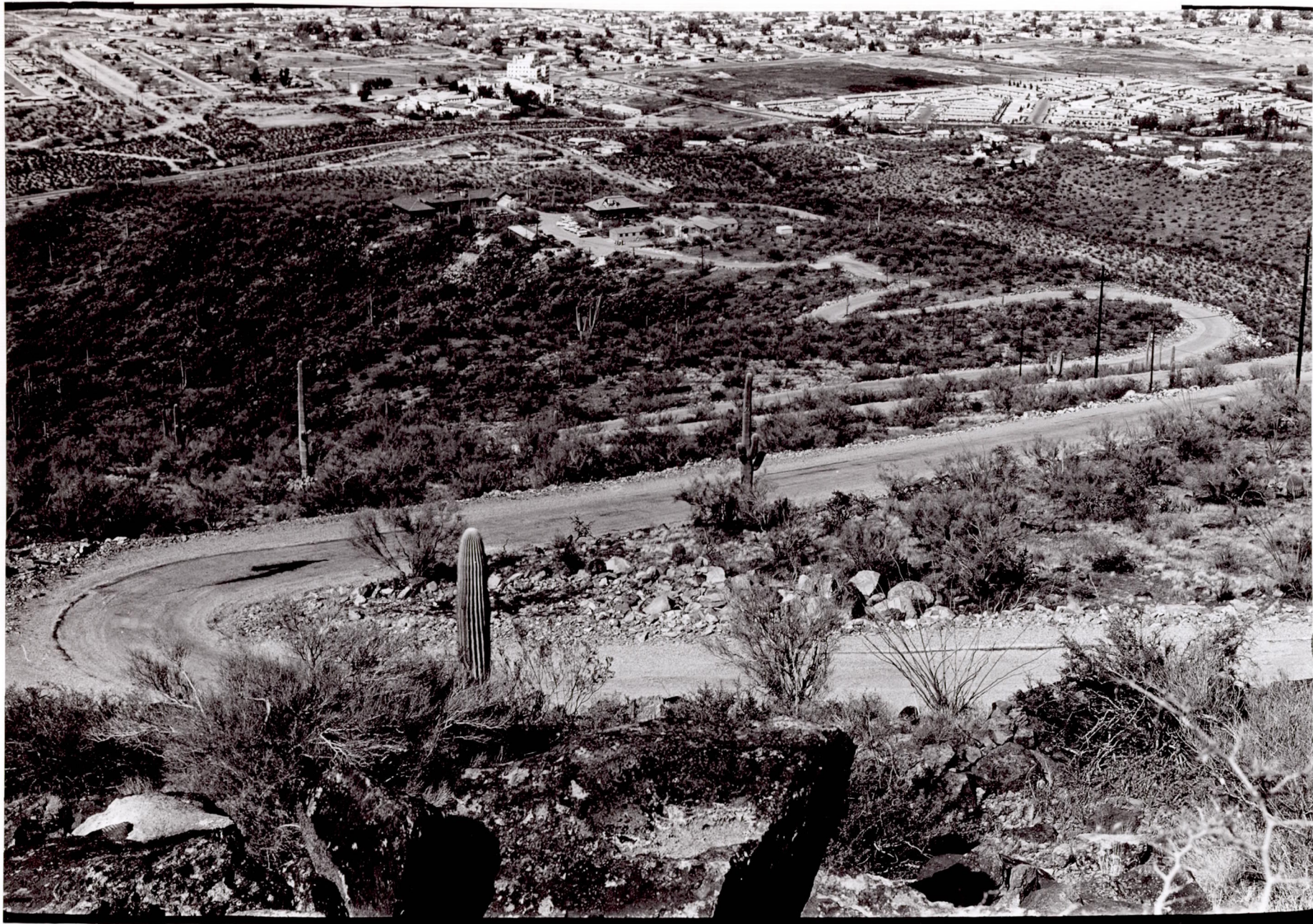


Fig. 3 16-inch telescope and dome with trailer laboratory (darkroom).



Fig. 4 Prof. Van Biesbroeck adjusting 16-inch telescope on Tumamoc Hill (May 4, 1965).

