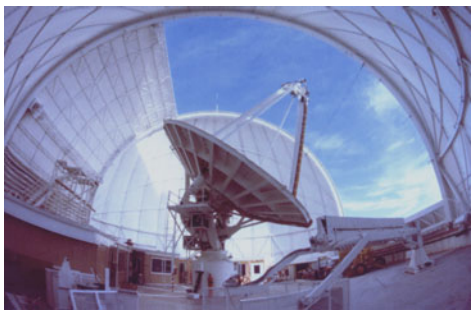
Some Tucson Engineering Recollections

A Sampling from John Payne's many Tucson Projects

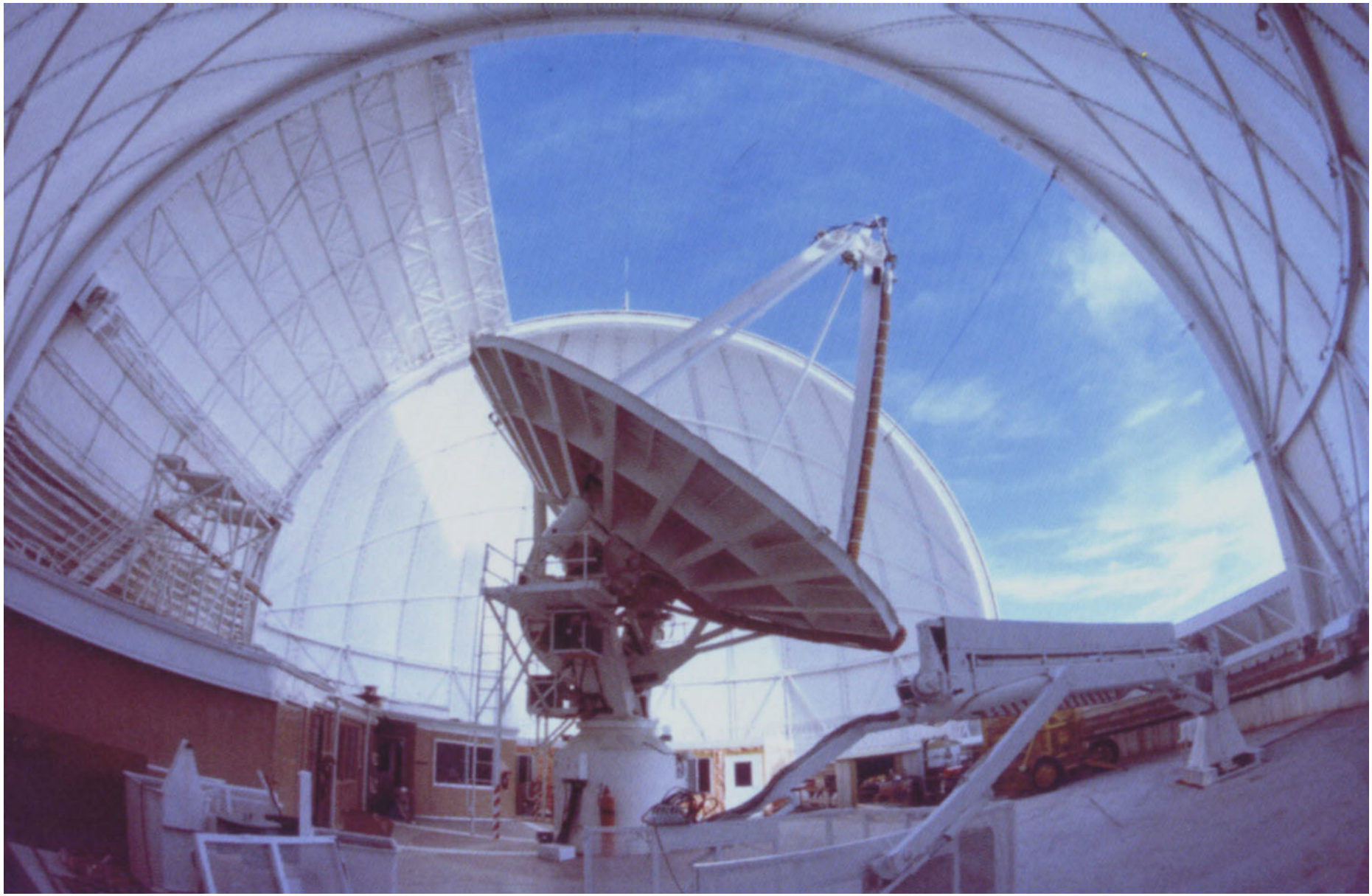


from Darrel Emerson

On the occasion of the John Payne Tribute Symposium, October 26 2006

BC 348 receiver, c.1942

(Part of the fittings of John Payne's house, where many Tucson Engineers and Scientists began their stay in Tucson)



NRAO’s 36-foot mm-wave telescope at Kitt Peak

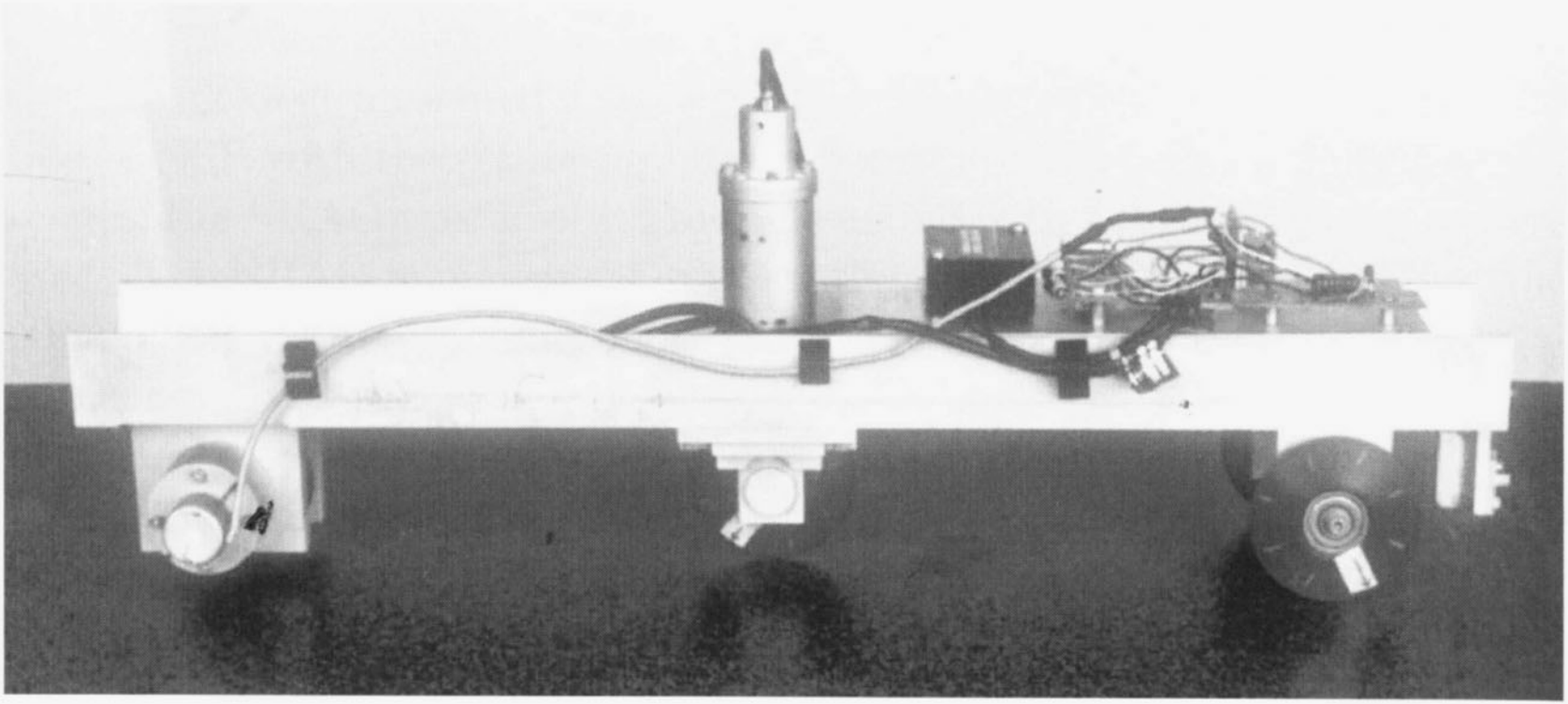
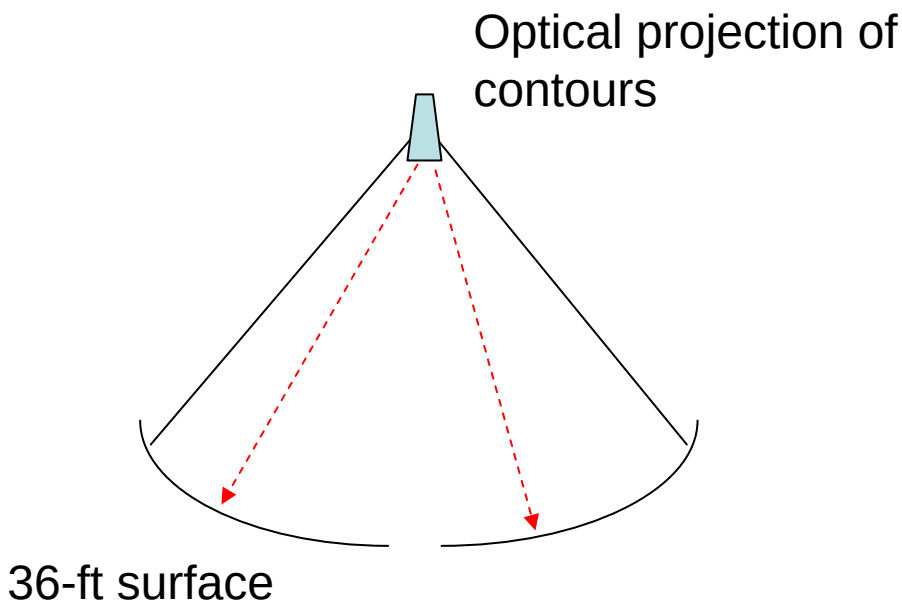
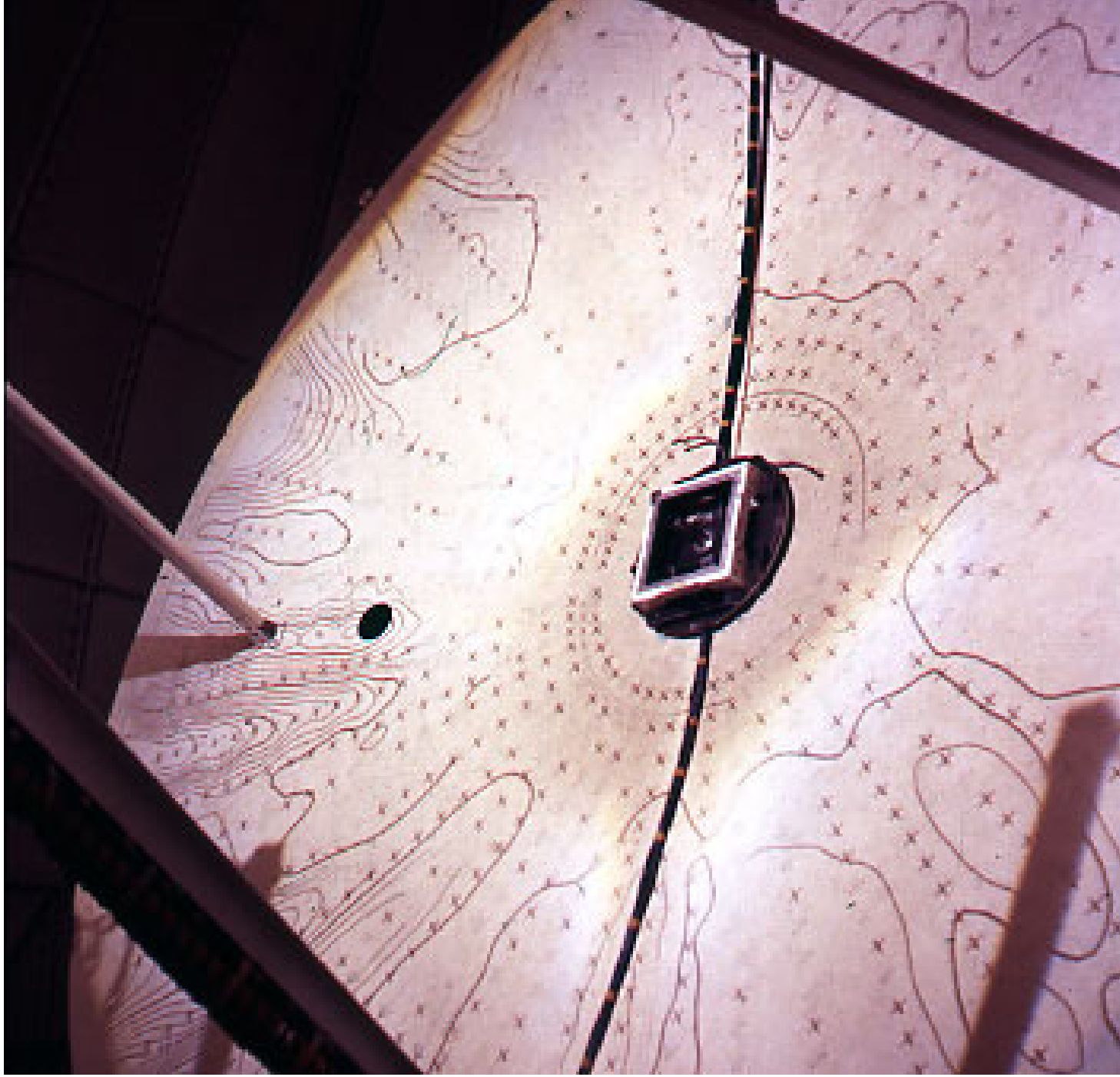


Figure 12.1: The spherometer developed by John Findlay for measuring the surface figure. Basically, it was a device to differentiate the curvature at one azimuth angle running from the center to the lip of the reflecting surface, with a linear resolution of the wheel base ($\mathrm{dr}/\mathrm{d}\ell \equiv$ depth/wheelbase).

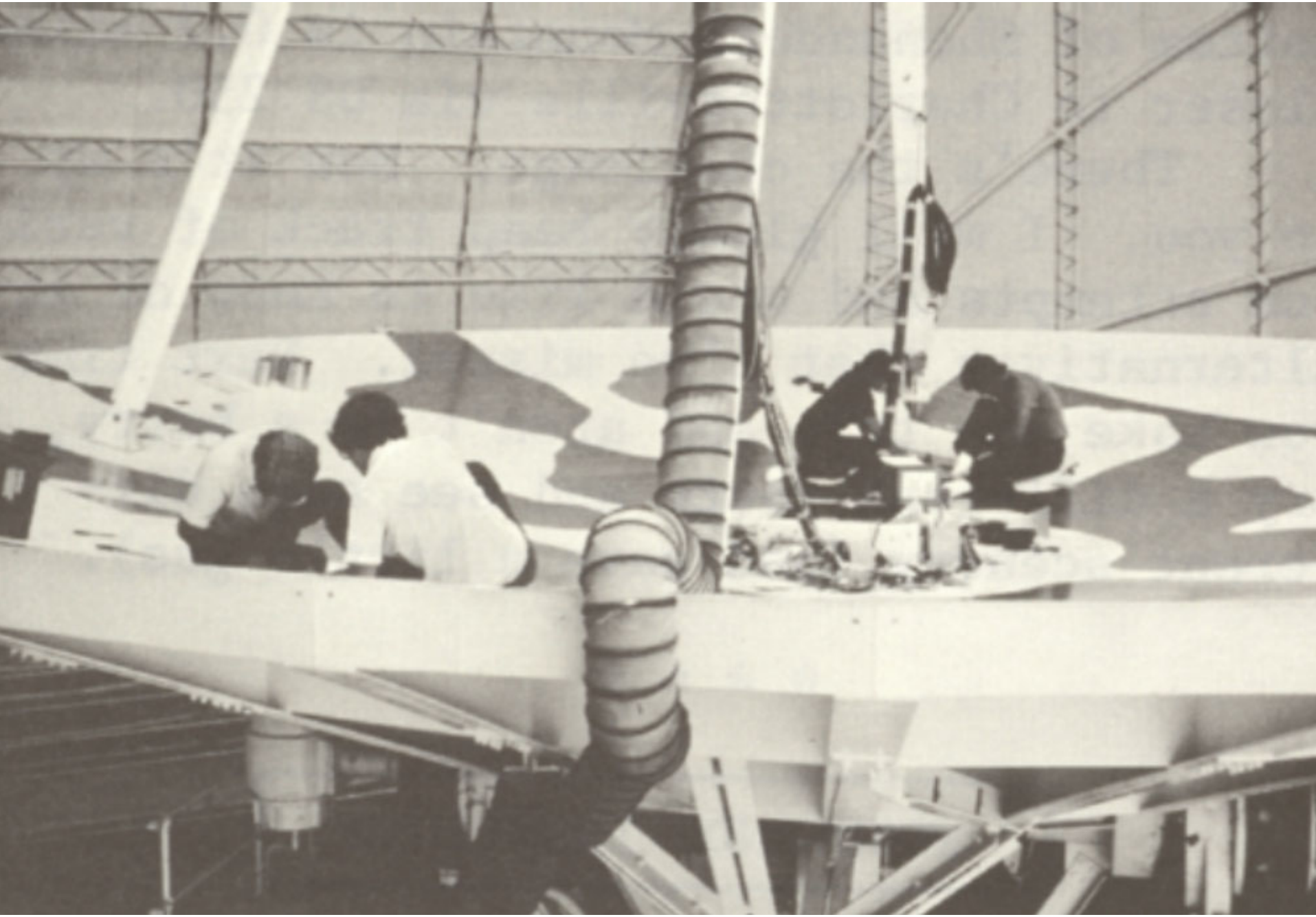
Marking the 36-ft surface with error contours



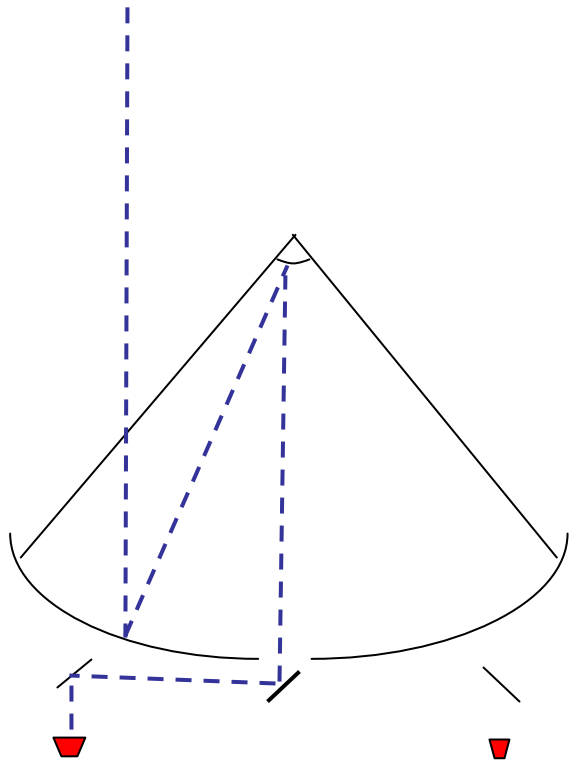
Contours of surface error projected optically on to the surface of the 36 ft telescope



Filling in the contours with layers of aluminum foil

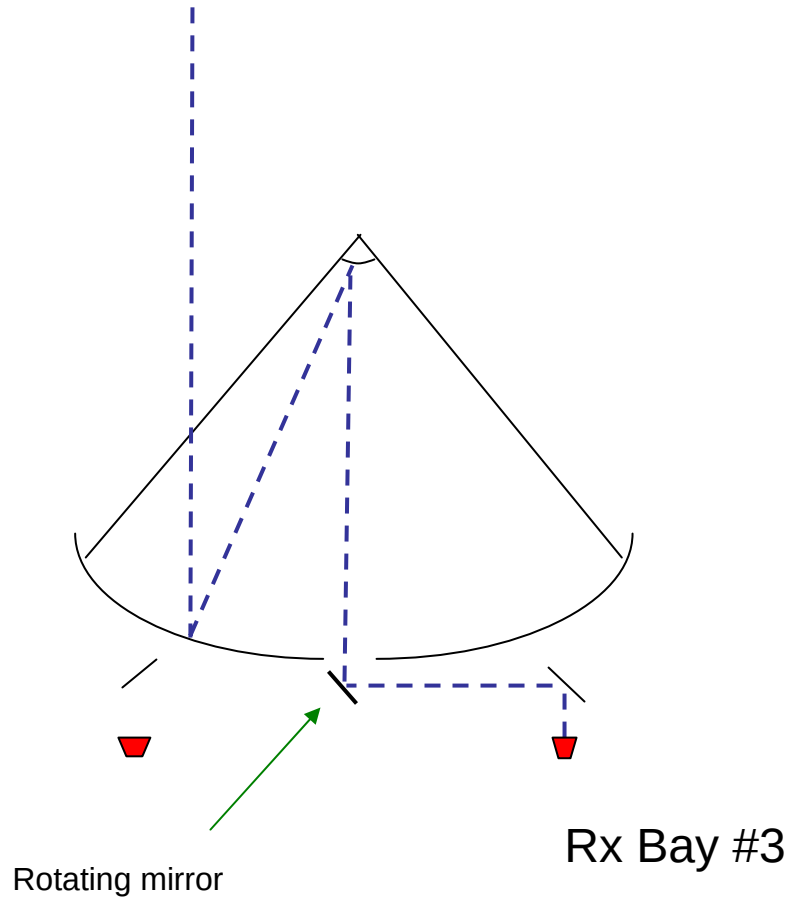


Optics arrangement of the 12 Meter Telescope at Kitt Peak



Rx Bay #1

Optics arrangement of the 12 Meter Telescope at Kitt Peak



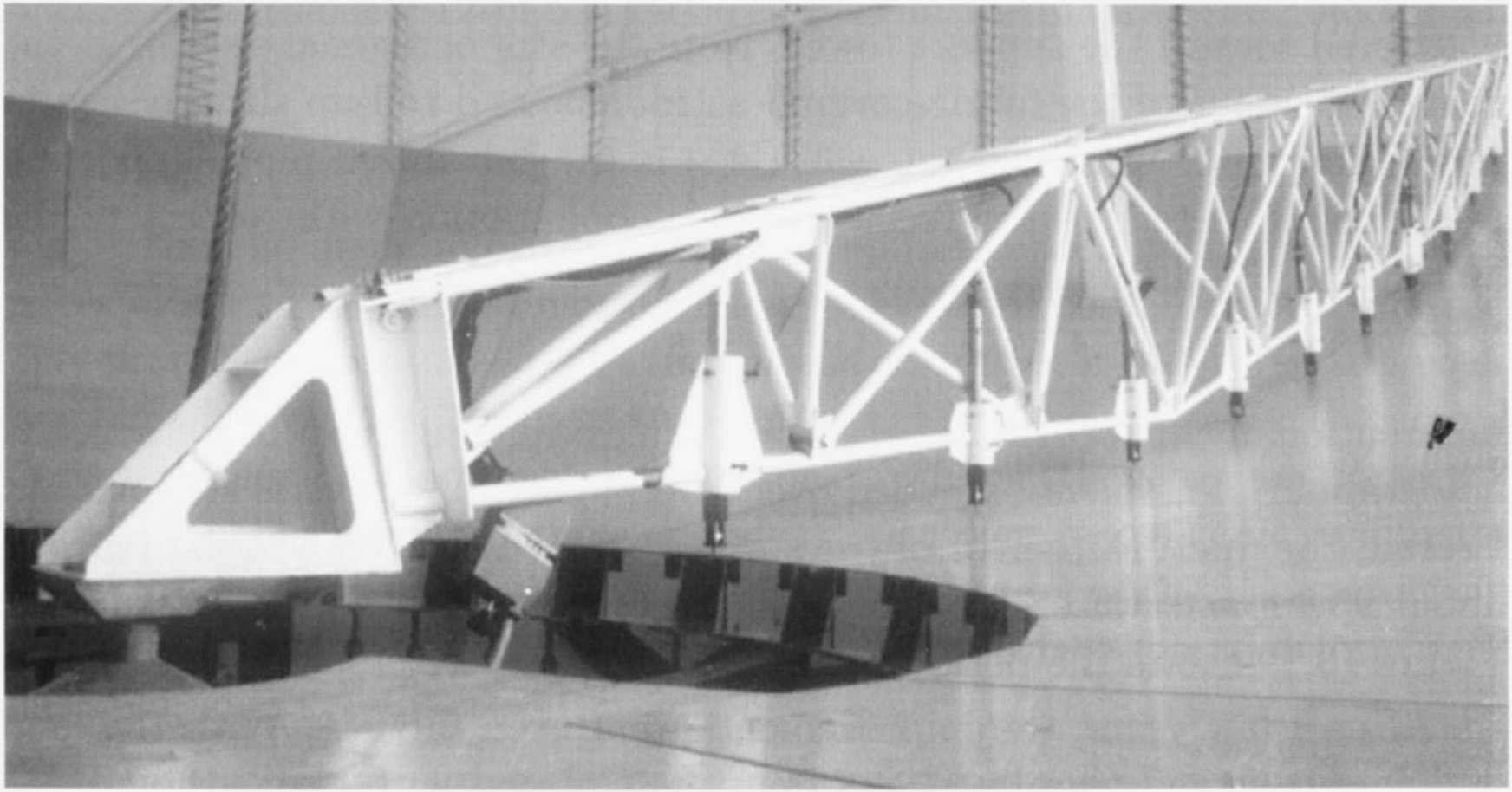
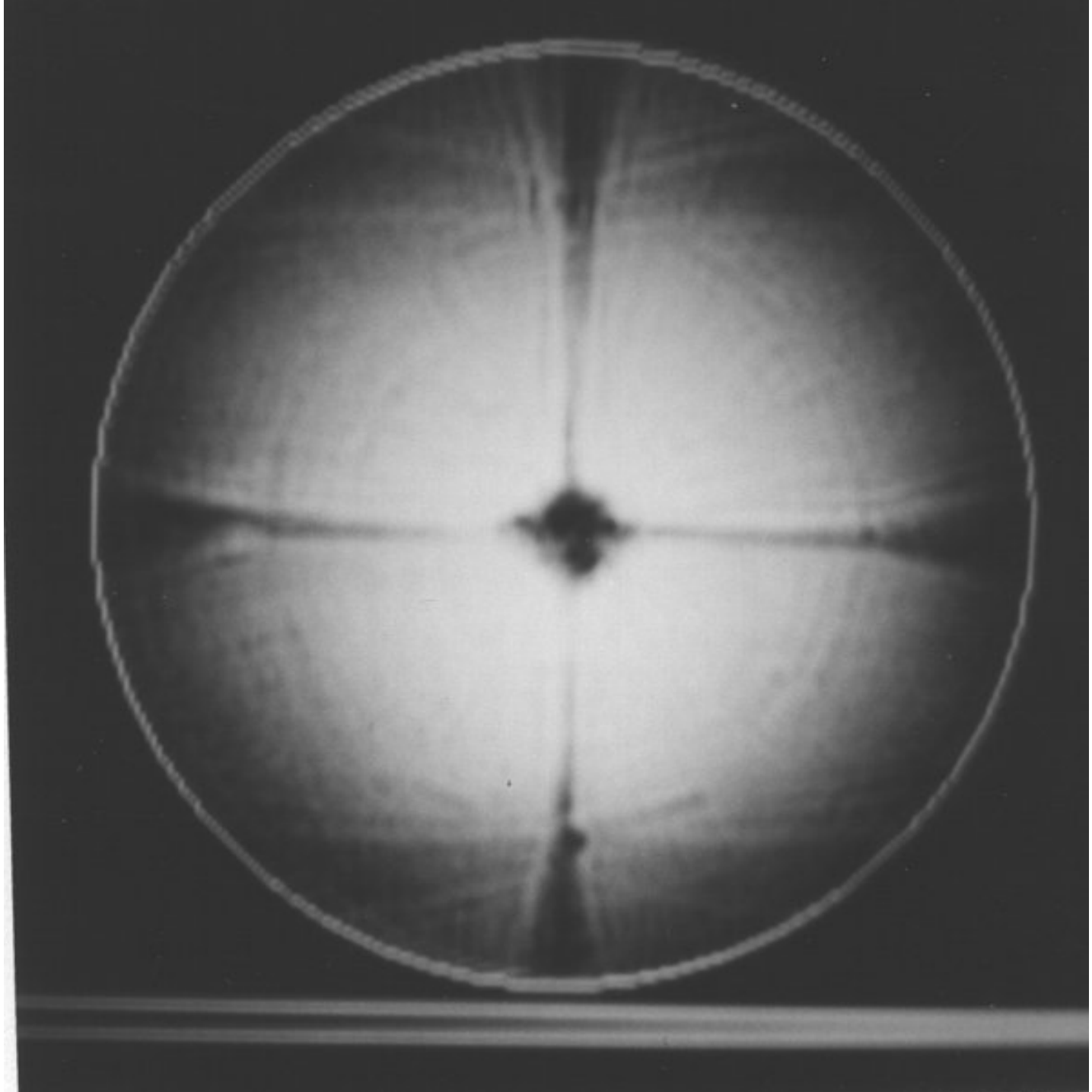


Figure 13.16: The mechanical measurement jig used for the initial setting of the 12-m surface panels. The central end (left) lies upon a pivot; the outboard end (right), upon one of the fiducial pins set into the rim of the back structure. The vertical sensors seen on the truss transmit position information to computer. Author photo.



Multi-feed Systems for Radio Telescopes
ASP Conference Series, Vol. 75, 1995
Darrel T. Emerson and John. M. Payne (eds.)

THE UPGRADE OF THE NRAO 8-BEAM RECEIVER

J. M. PAYNE AND P. R. JEWELL
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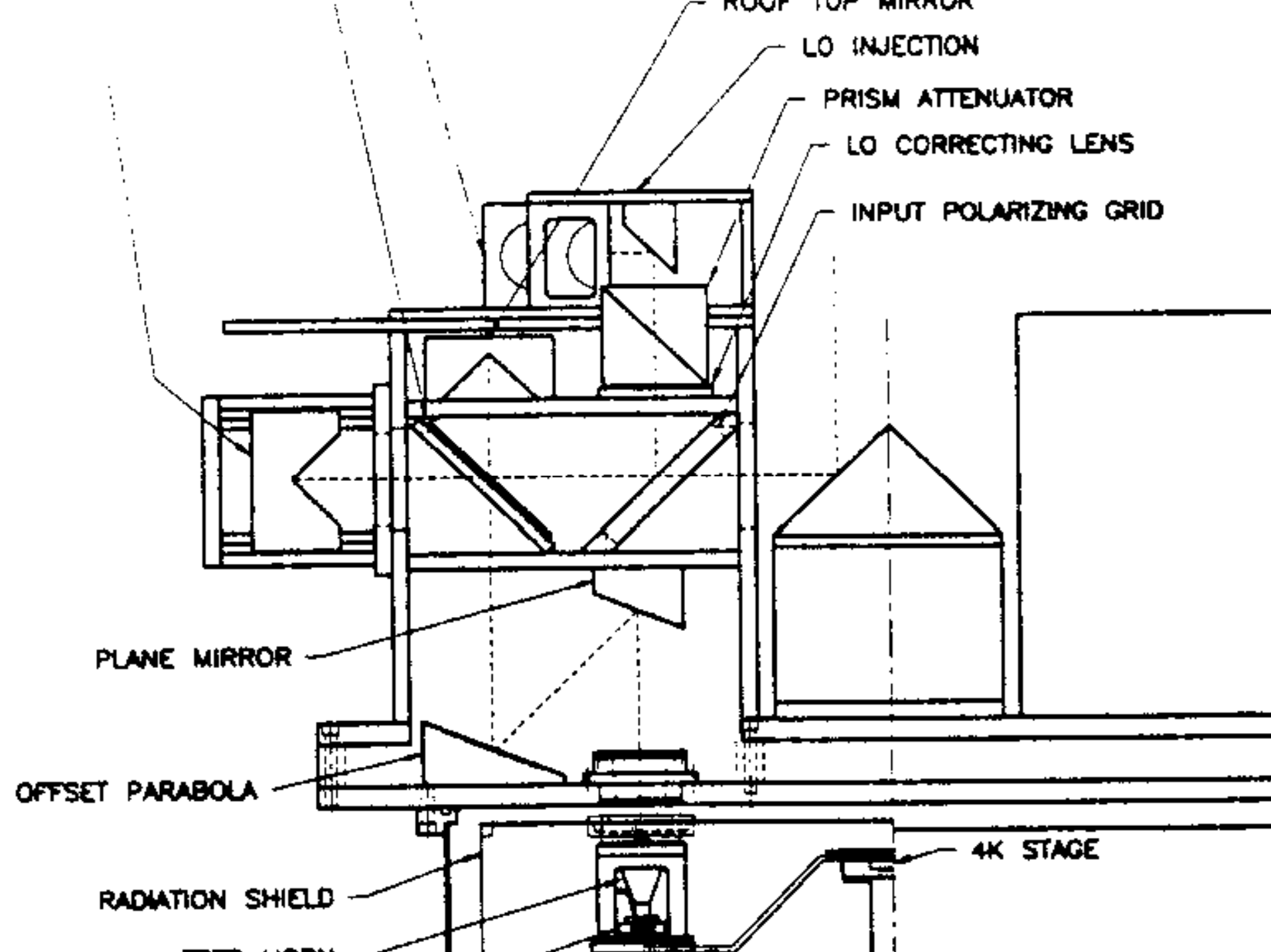
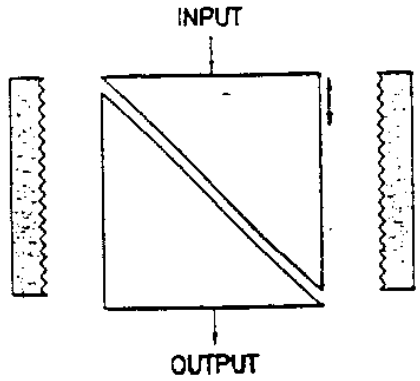
ABSTRACT The modification of the NRAO 8-beam 230-GHz Schottky mixer receiver to use SIS mixers is described. The upgrade involves changes to the optics and cryogenics and should result in a significant increase in observing efficiency for mapping extended sources when compared to the existing dual-channel 230-GHz SIS receiver.

INTRODUCTION

In 1988 NRAO completed an 8-beam 230-GHz receiver using Schottky-mixer technology (Payne 1988). The motivation for building the receiver was to use observing time more effectively when mapping extended sources. The time required to map a given area to a given signal-to-noise level decreases linearly with the number of beams, provided the area is much larger than the maximum beam separation. The 8-beam receiver, therefore, offered a four-fold improvement over the dual-polarization, single-beam Schottky receiver that was in service at that time.

The time required to achieve a given signal-to-noise level decreases with the


ROOF TOP MIRROR
LO INJECTION
PRISM ATTENUATOR
LO CORRECTING LENS
INPUT POLARIZING GRID
PLANE MIRROR
OFFSET PARABOLA
4K STAGE
RADIATION SHIELD



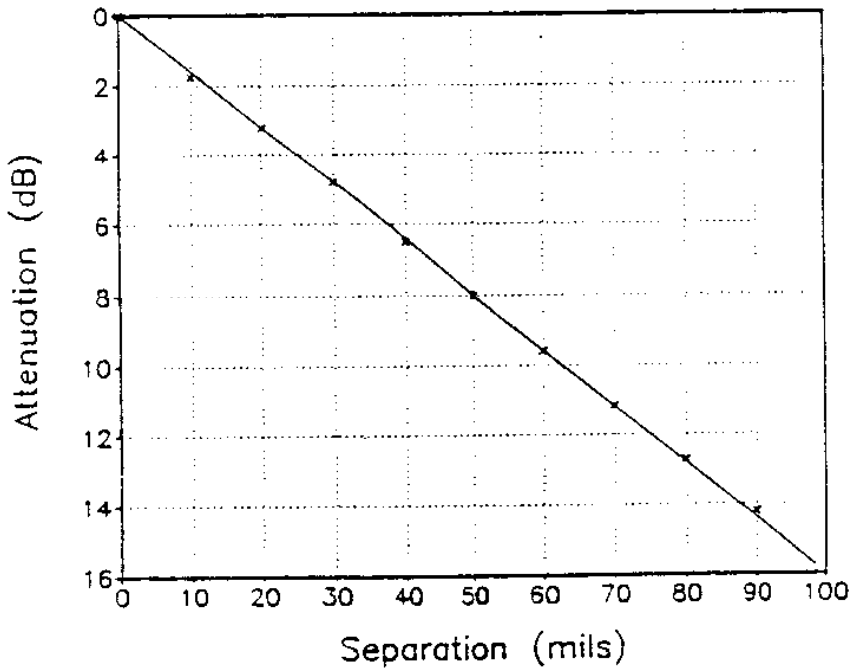


FIGURE 3 Double prism attenuator.

Classified report from the Royal Radar Establishment, Malvern.

March 1958

“Bible” for mm-wave optics

From RRE
Report #3020,
March 1958

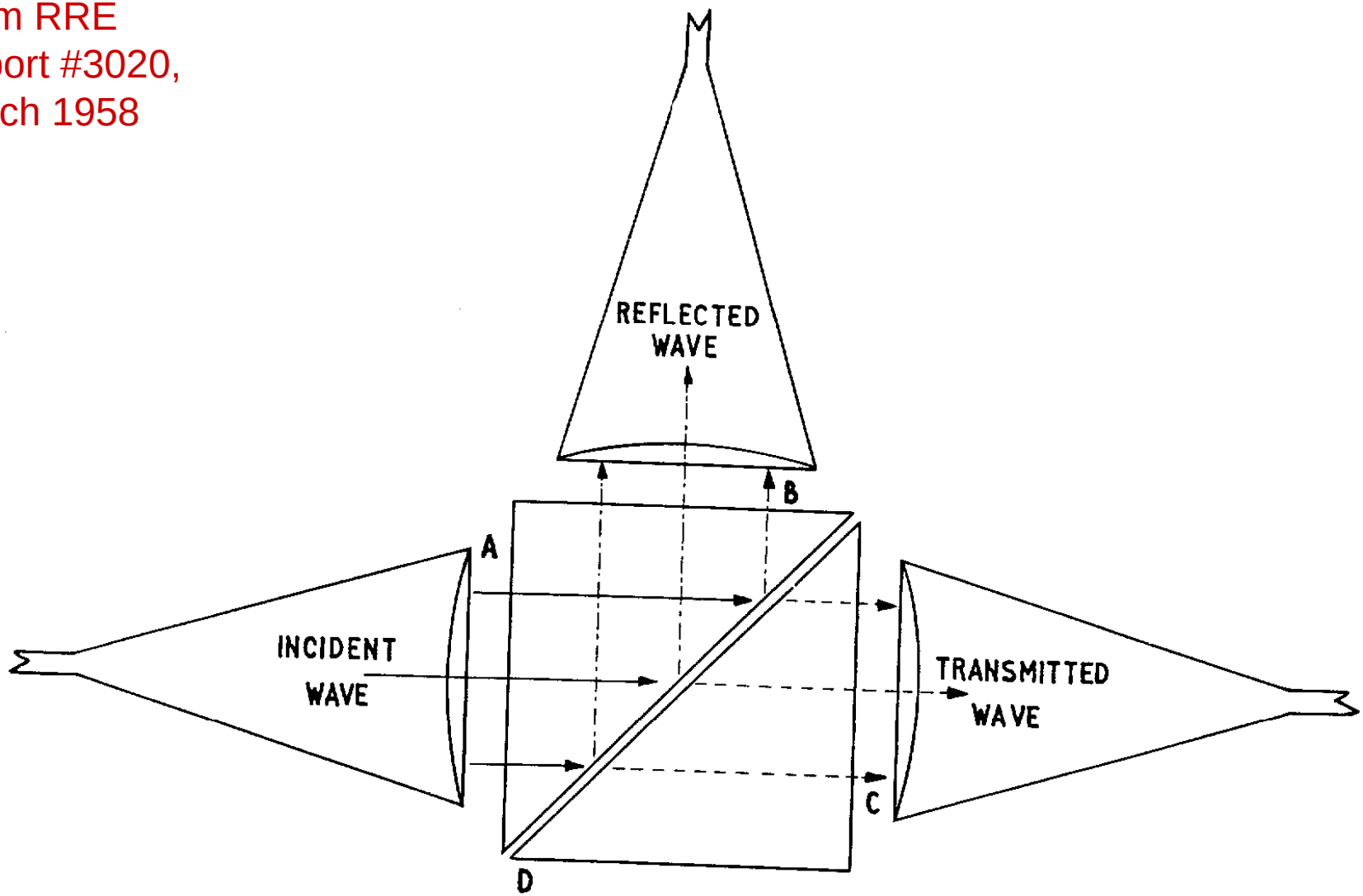
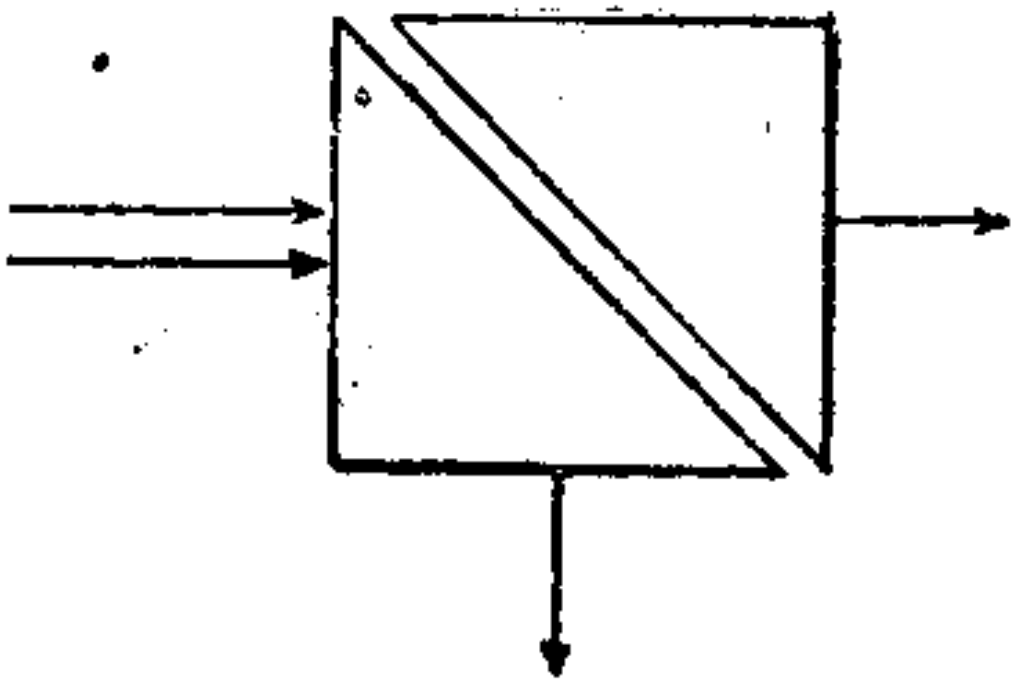
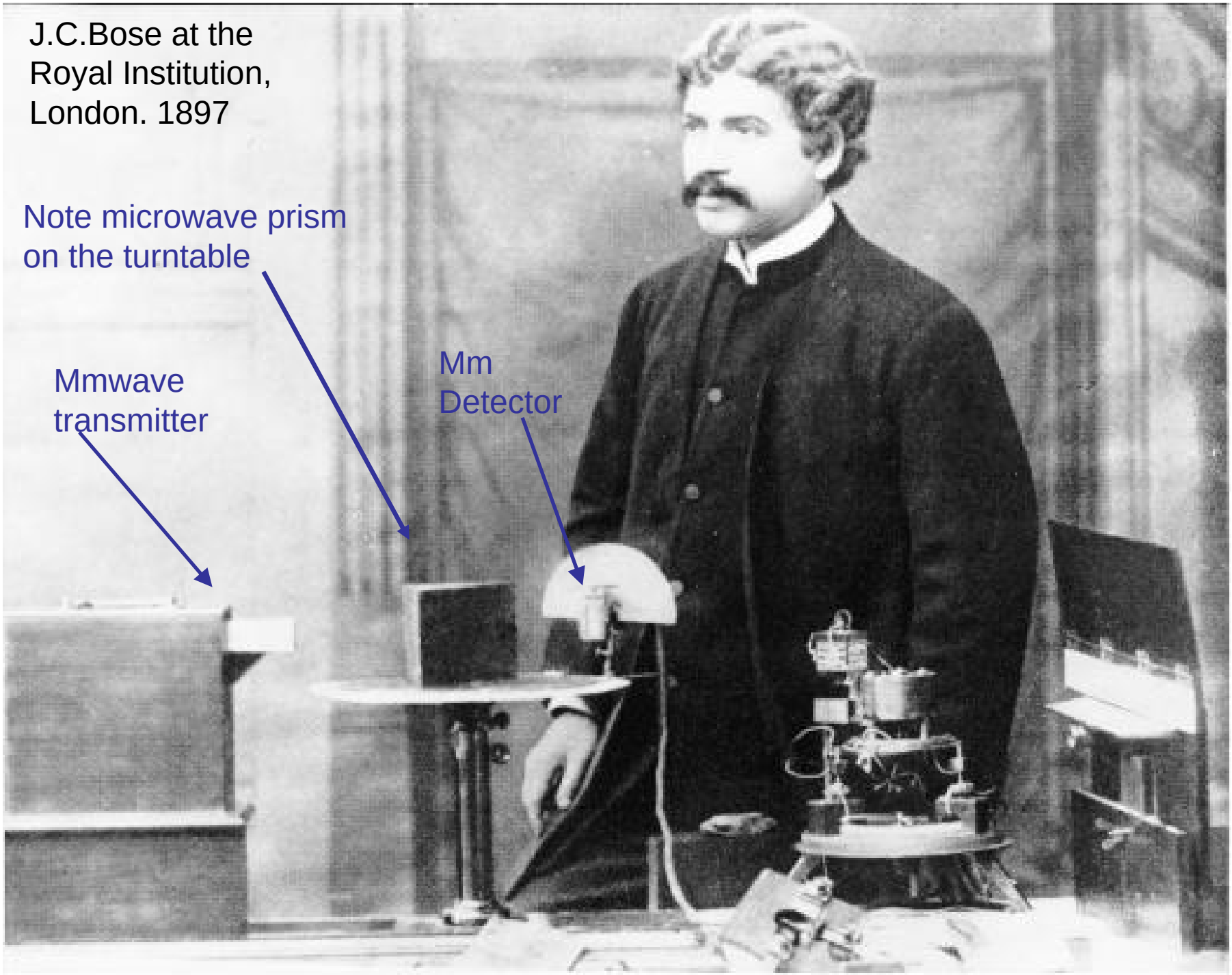


FIG. 11.

THE DOUBLE-PRISM ATTENUATOR AS USED AT MILLIMETRE WAVELENGTHS.



From J.C. Bose, Proc. Roy.Soc Nov 1897


J.C.Bose at the
Royal Institution,
London. 1897
Note microwave prism
on the turntable
Mmwave
transmitter
Mm
Detector

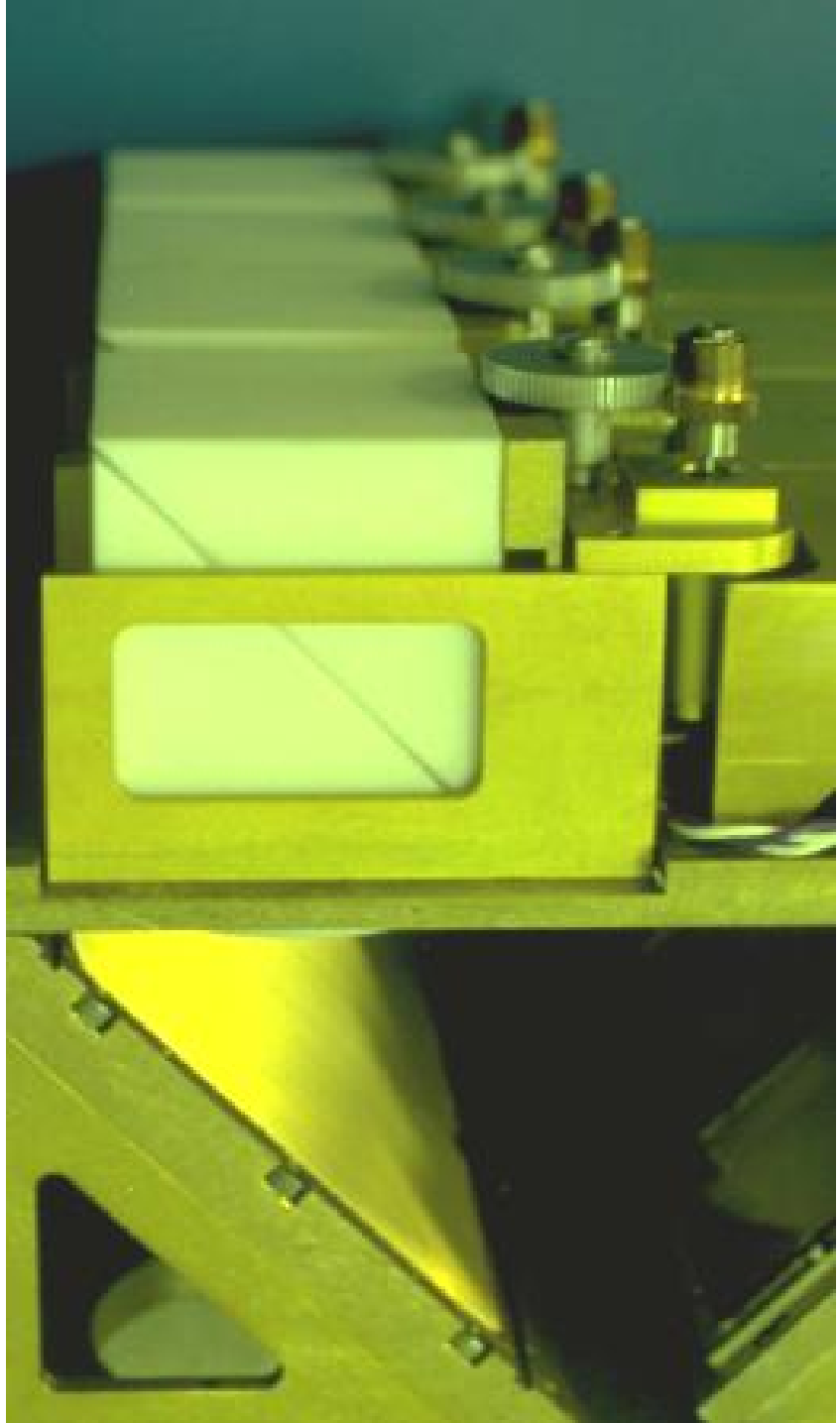
J.C. Bose apparatus for investigating the dual-prism attenuator at short wavelengths

Transmitter (spark) left, and horn antenna receiver + detector (right)

J.C. Bose dual prism microwave attenuator with adjustable air gap. Calcutta 1896

John Payne's Dual-Prism Attenuators with Adjustable Air Gap.
Tucson, 1995.

Four of the 8 attenuators from the 1.3 mm 8-feed system are shown



Local Oscillator

Variable Attenuator

Rx

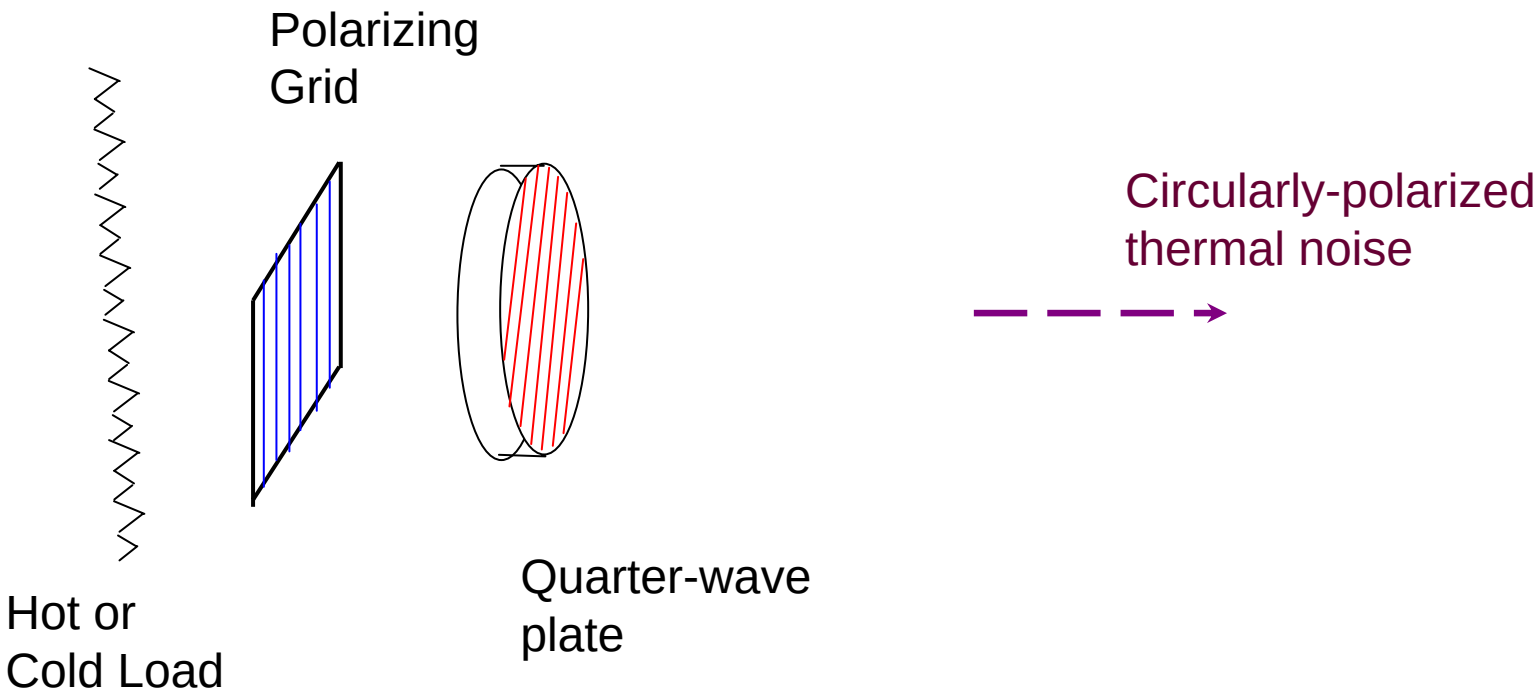
REFERENCES

Bose, J.C. 1927, *Collected Physical Papers of Sir Jagadis Chunder Bose*, Longmans, Green and Co., Originally published in *Proc. Roy. Soc.*, Nov. 1897

Goldsmith, P.F. 1982, "Quasi-optical Techniques at Millimeter and Submillimeter Wavelengths", *Infrared and Millimeter Waves*, ed. K.J. Button, Academic Press, **6**, 277

Payne, J.M. 1988, "A Multi-beam Receiver for Millimeter-wave Radio Astronomy," *Rev. Sci. Inst.*, **59**, 1911

Payne, J.M., Lamb, J.W., Cochran, J.G., and Bailey, N. 1994, "A New Generation of SIS Receivers for Millimeter-wave Radio Astronomy," *Proc. IEEE*, **82**, No. 5



John’s VLBI verifier: a circularly polarized hot/cold load

Thanks, John!