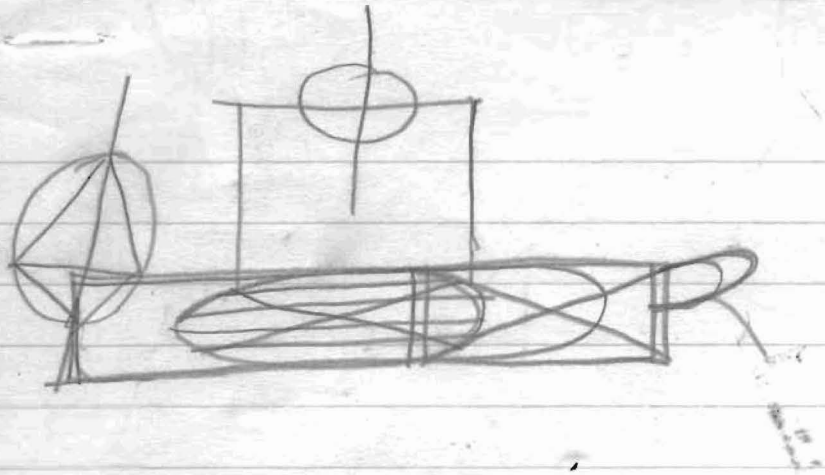
November 12, 1948

Memorandum on Galactic Radiation

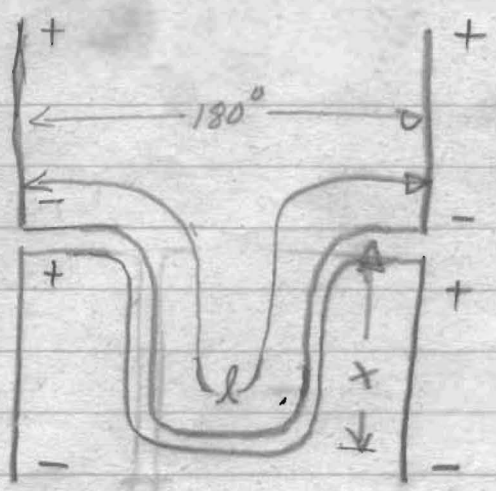
M. Ryle and F. G. Smith describe in Nature Magazine, 18th September, pages 462-463 a very interesting experiment. They constructed two aerials approximately one-half kilometer apart for frequency of 80 Mc and connected the outputs together, thereby forming a Michaelson Interferometer for radio wave lengths. They detected radiation from Cygnus, Cassiopeia and Ursa Major. By means of the interference patterns obtained with this pair of antennas it was possible to learn not only the position of these sources but also get an upper estimate as to their possible size. Thus they have a very powerful technique for measuring galactic radio-waves. It is proposed to use this technique for similar experiments at Sterling, Virginia. The main requirement is a long east-west base line. Fortunately, the Sterling Laboratory has a maximum dimension in the east-west direction, thus it is proposed to install one antenna in the south-east corner beyond building 2 and a second antenna in the south-west corner near building 5. These two antennas are to be connected by means of a buried transmission line along the south line of the property. A small equipment shelter is to be installed near the middle of this line. Each aerial is to consist of an array approximately 4 or 5 wave lengths on a side. The array will consist of east-west dipoles spaced approximately one-quarter wave above ground. All elements in each east-west line will be connected permanently in phase. Adjustment will be provided between successive lines so that each line may be advanced adjusted or retarded in phase comparative to its neighbor. This will be a semi-permanent adjustment which will allow the antenna beam to be swung northward or southward from the zenith. This north-south motion will allow various parts of the sky to be explored. East-west motion will be provided by the rotation of the earth. Thus, all the region from declination -20 to +90 should be covered. If only one of these arrays is connected to a receiver it will be possible to map out constant intensity contours in the same fashion as has previously been done at much higher frequencies. When two aerials are used, an interference pattern will be formed which will allow the accurate measurement of position and size of various point sources. It is proposed to proceed with the erection of the first aerial in the south-east corner of the grounds next spring as soon as weather conditions permit. During the summer it should be possible to collect sufficient data to plot the above mentioned contours. By the following year the south-west corner of the grounds should be available to erect the second aerial and at that time the various high intensity points found during the previous survey may be investigated accurately for position and size.

Proposed frequency of operation near 10 mc



"Gain of Directive Antennas"
G.C. Southworth, Proc IRE Sept 1930
Figure 15 page 1518 + 1519.

If elements are spaced $\lambda/2$ and phase between elements is θ, the beam turns 2θ
Direction of beam rotation is inverse to added phasing. ~~If the phase~~ Continued adding of phasing amounts to negative rotation of the beam.

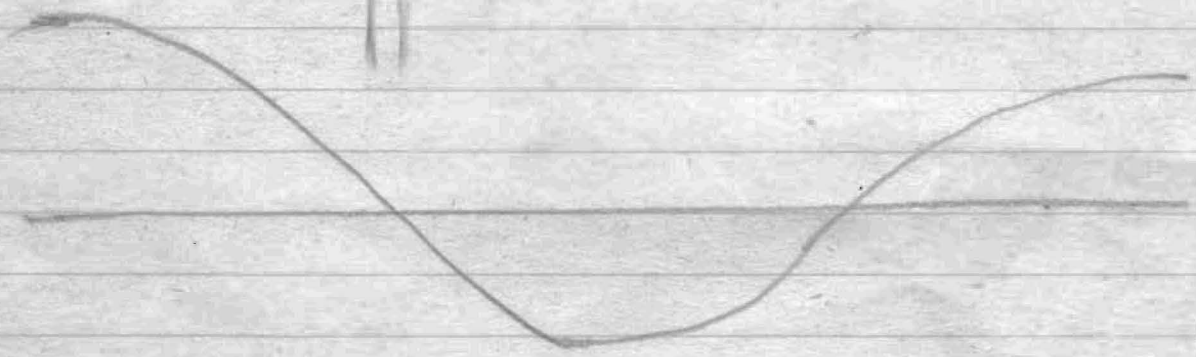


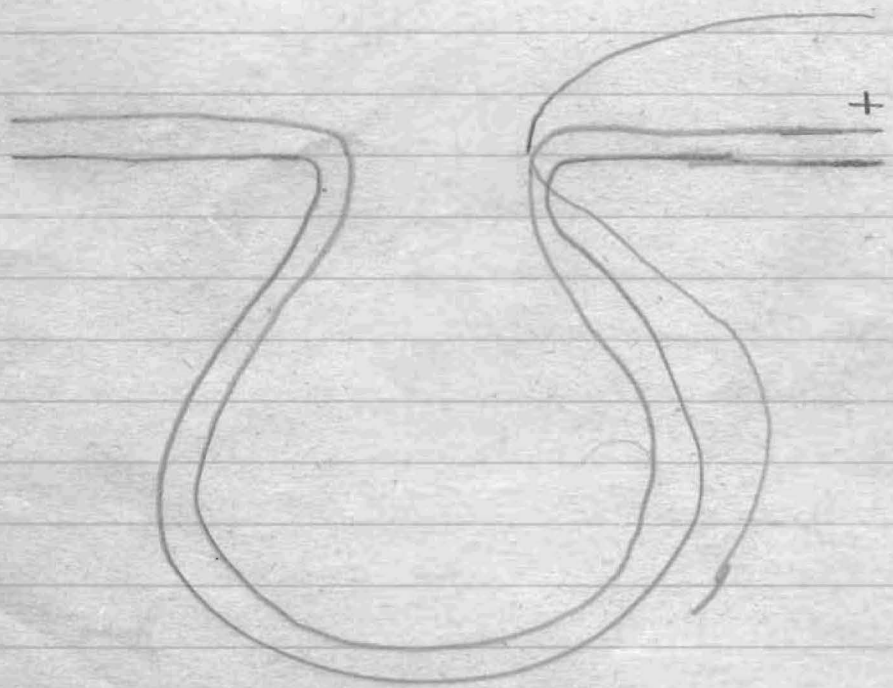
when $l = 360°$ all elements in phase beam points to zenith

when $l = 320°$ beam tips 80° north.

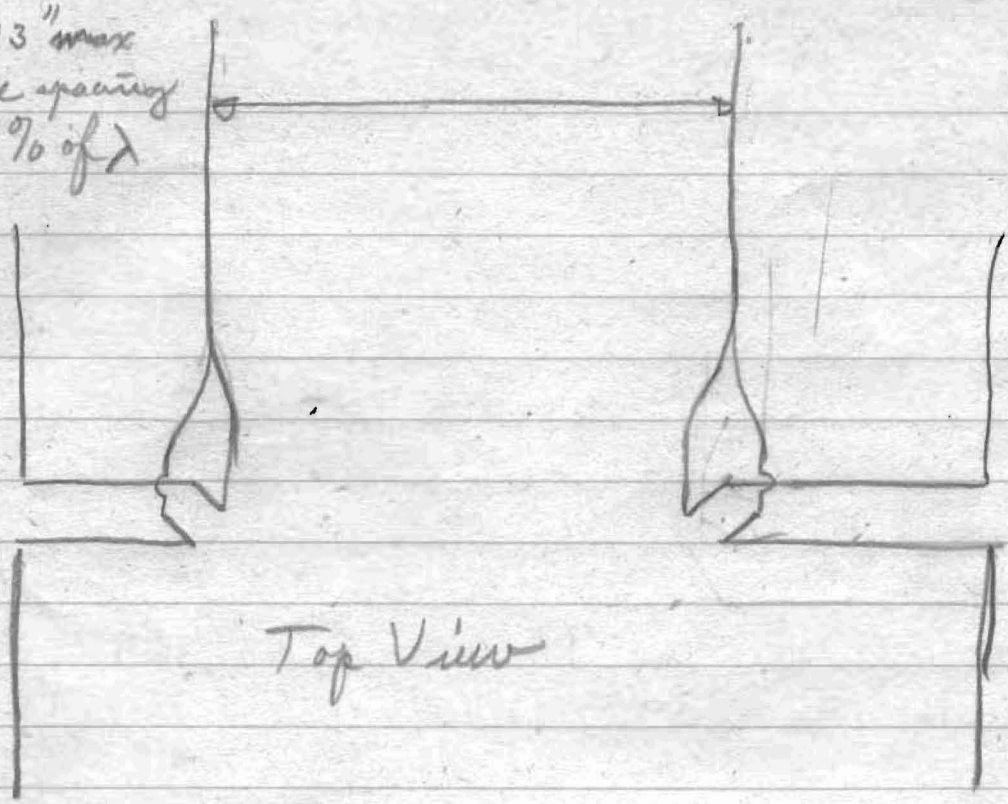
when $l = 400°$, beam tips 80° south

x varies $\frac{140°}{2}$ to $\frac{220°}{2}$ or 70° to 110°

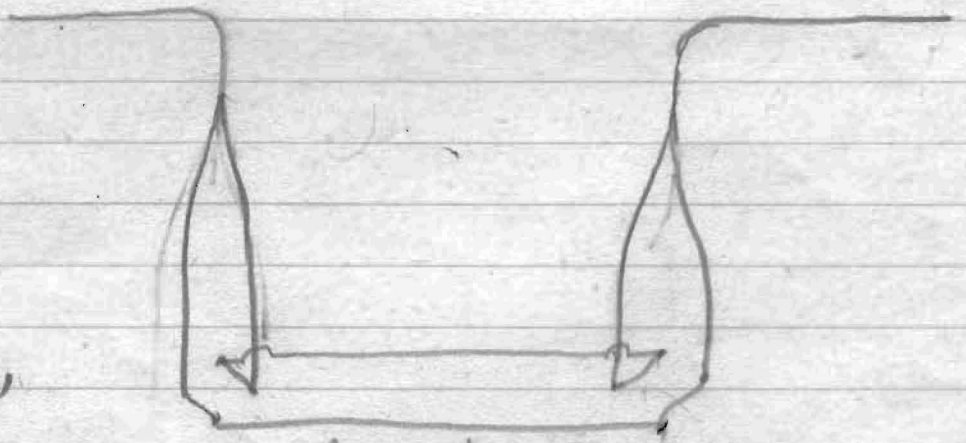




$\frac{30}{100} \times 40'' = 13''$ max wire spacing or 1% of λ

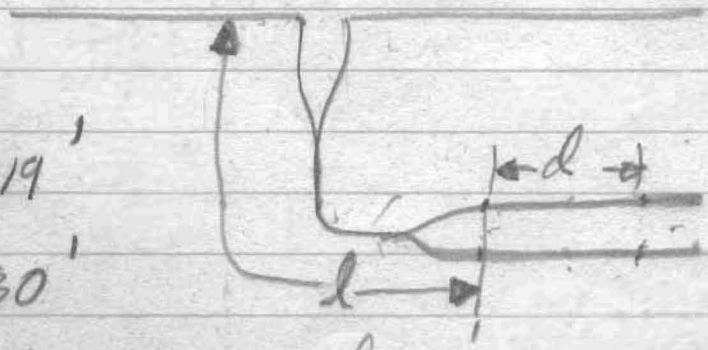


Top View



$\lambda/4 = 24\frac{1}{2}'$

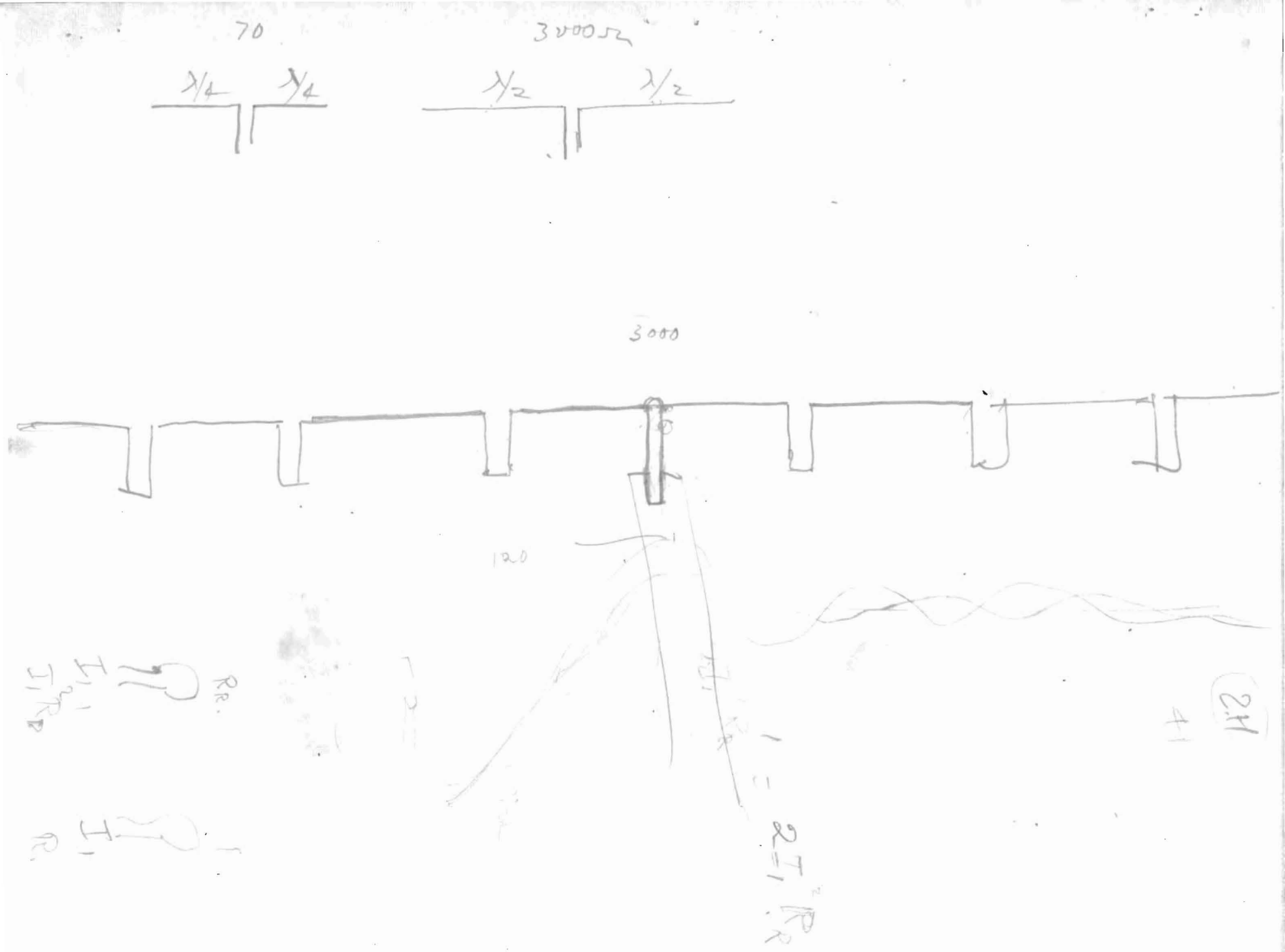
side view

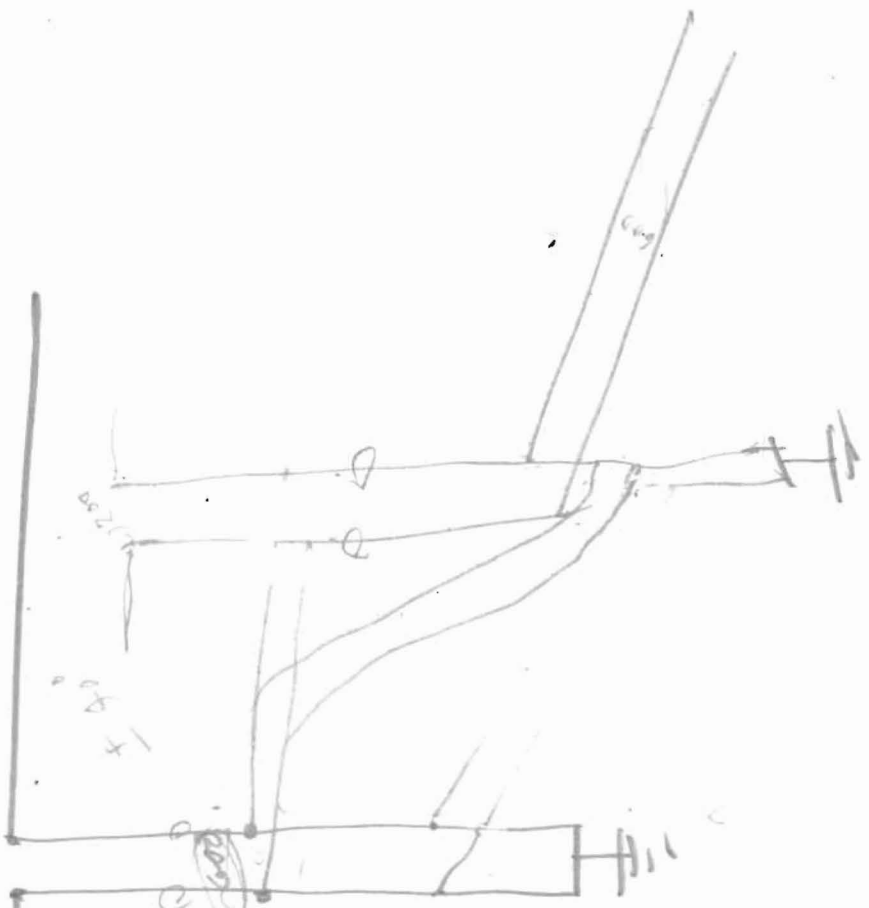


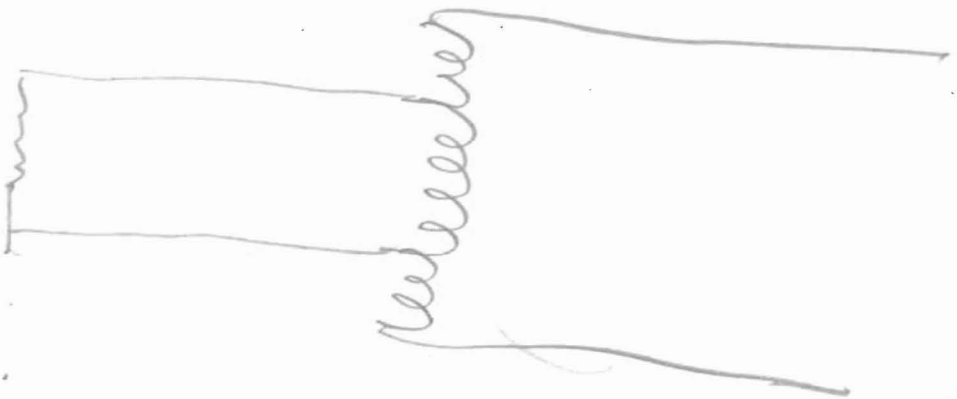
$\ell = 70° = 19'$

$\ell = 110° = 30'$

end view


70
λ/4
λ/4
3000Ω
λ/2
λ/2
3000
120

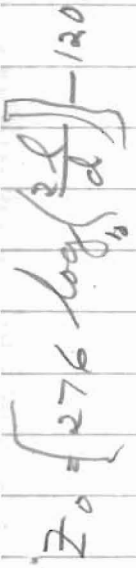


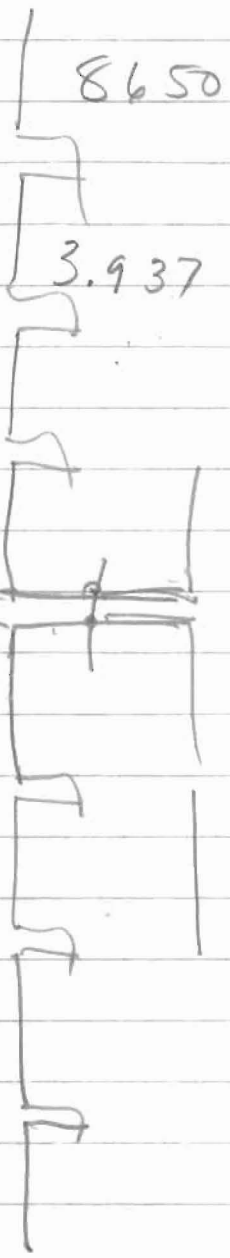


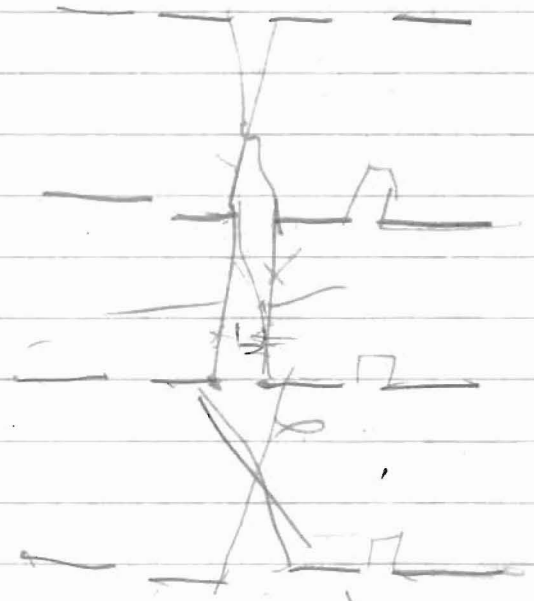
Malloy + Co :-

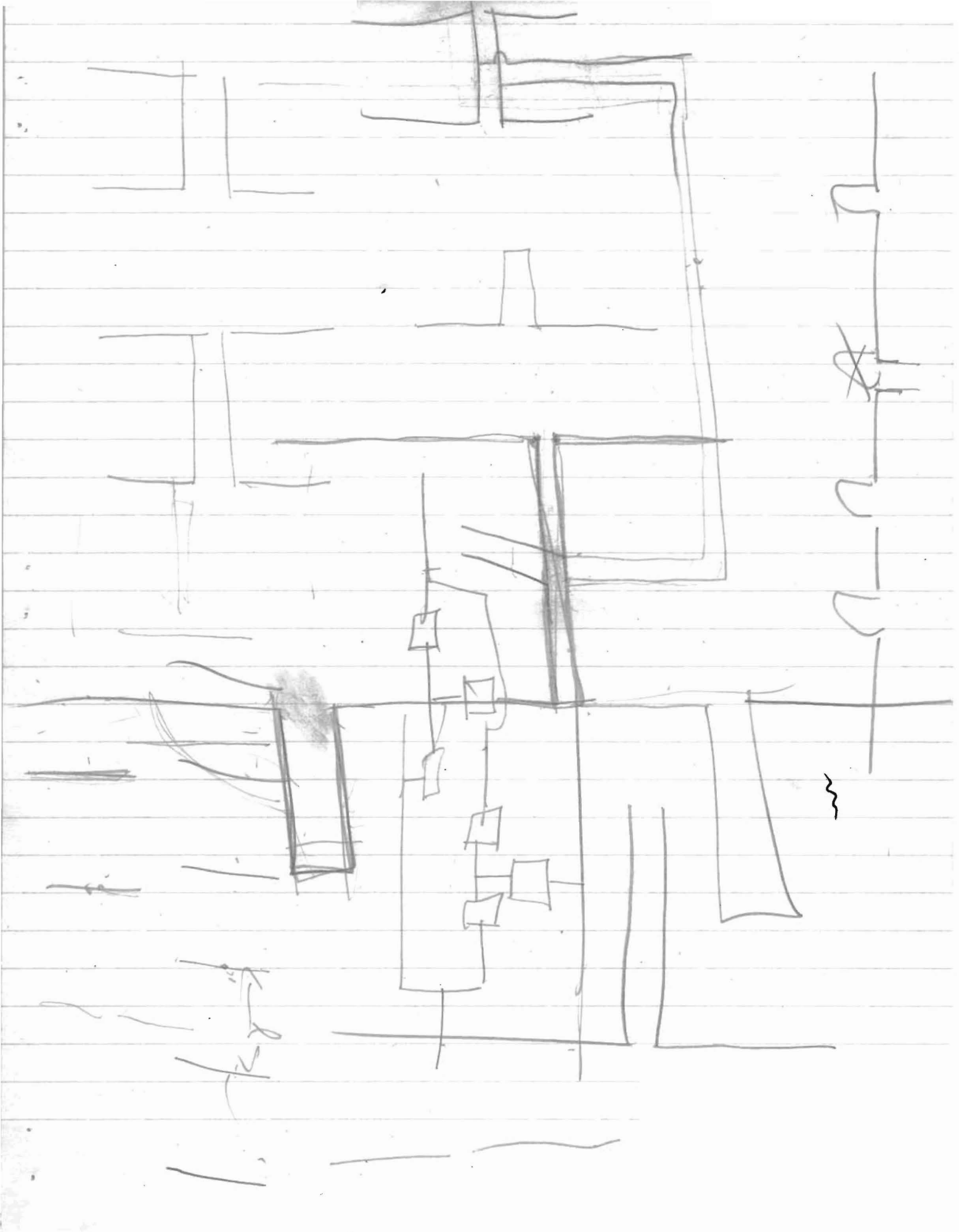
45 x 12 x 16

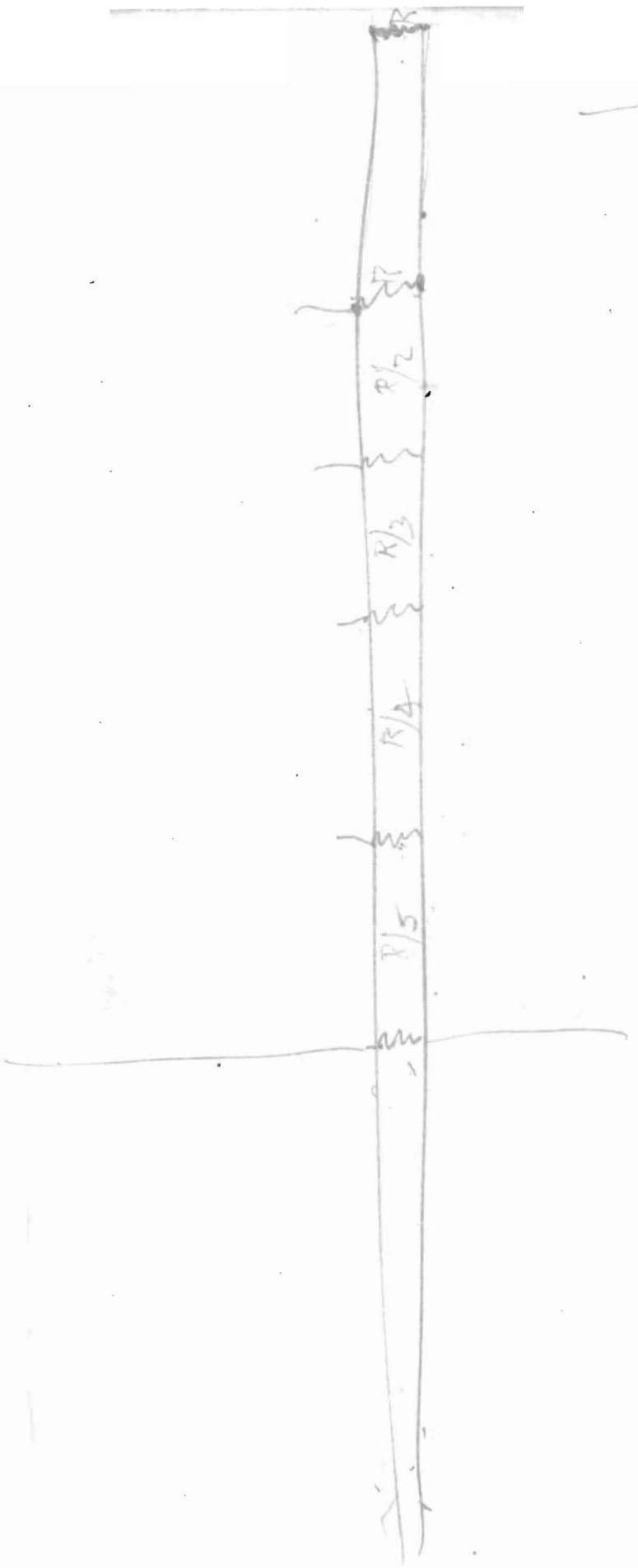
1/16










R/2
R/3
R/4
R/5