

AIRBORNE INSTRUMENTS LABORATORY, INC.

160 OLD COUNTRY ROAD

BOX 111

MINEOLA, NEW YORK

October 30, 1946

Mr. Grote Reber
212 W. Seminary Avenue
Wheaton, Illinois

Dear Mr. Reber:

I received your letter of October 24, and have spent some time in determining what your amplifier needs are. As I gather from your enclosed article as well as from the references in your article, you are mainly interested in a wide-band amplifier in the range of around 160 Mc with as low a noise figure as it is possible to achieve.

The amplifiers which I am going to discuss in my paper are all based on the use of lumped constant interstage networks using the method of stagger tuning. This method makes it possible to use single-tuned interstage networks with all the advantages of multi-tuning but without its disadvantages. An interesting point of coincidence is that the amplifier which is used as an example in my paper has a gain of about 95 db over the frequency range 150-170 Mc per second using 6AK5 miniature tubes and a 1N34 germanium crystal second detector.

Unfortunately, however, from your viewpoint no special circuits have been included in this amplifier to obtain an extremely low noise figure. The noise figure of our i-f amplifier is of the order of 12 db. Low noise figure input circuits are available and although the results have not been published as far as I know at present, they certainly should be in print in the near future. These circuits involve the use of a triode input tube followed by a grounded grid triode and theoretically should give in our amplifier a noise figure of better than 8 db. Wallman, at the Radiation Laboratory, has built 30 Mc wide-band i-f amplifiers with noise figures of $1\frac{1}{2}$ db.

I do not have any reprints of my paper at the moment, but will send you one as soon as I have them made. I should particularly refer you to several reports which, in case you do not have access to them in their original form, are available in photostats or microfilm copies through the Bureau of Commerce. These are Radiation Laboratory Report #524 by

Henry Wallman, entitled "Stagger-tuned I-F Amplifiers" and Radiation Laboratory Report #699 by C. P. Gadsden entitled "Low Noise Replacement Preamplifier for the SCR-584." This latter report shows a low noise preamplifier but without any derivations which you would certainly need if you were to do your own designing. It does give results which will give you an idea of the gains that can be made. Another article is one by R. F. Baum in the Journal of Applied Physics, Volume 17, pp. 519-529, and 721-730 entitled "Design of Broad-Band I-F Amplifiers." I found this article extremely difficult to use because of the theoretical derivations which are not of great practical importance to the engineer. However, with your background, I think you will find this paper easier to read than I did. Wallman's article is by far the simpler although it does not have the generality of Baum's.

I believe that the greatest advance which you would possibly be interested in is the one I mentioned concerning low noise input circuits. If and when the Radiation Laboratory series of books is published, this information is to be included in volumes 18 and 23.

I hope this answers your questions, although I realize that it is very sketchy. If you have a specific problem, I should be very glad to attempt a definite answer.

Very truly yours,

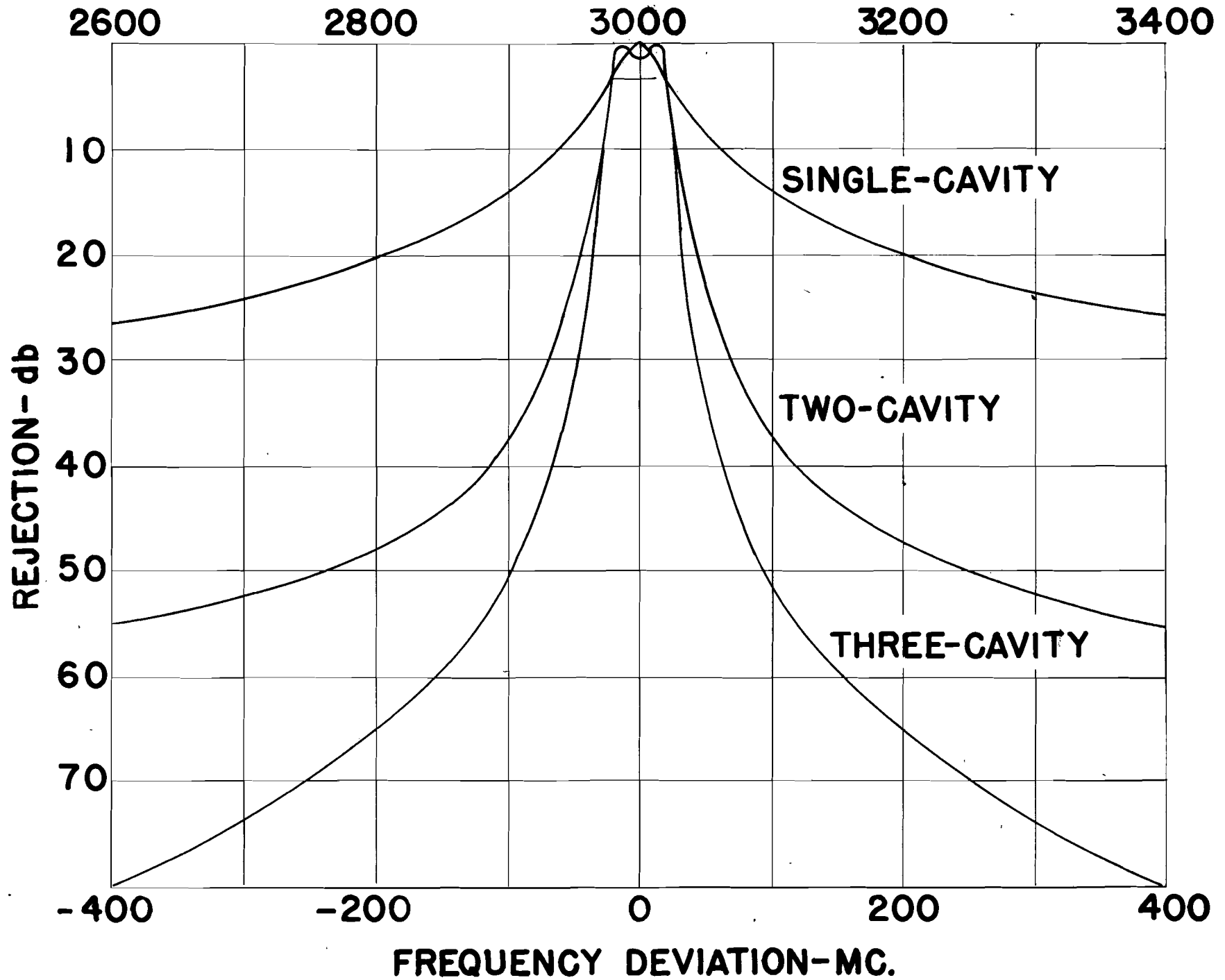
Matthew T. Lebenbaum
 Matthew T. Lebenbaum

MTL; cd

*See April 1947 Electronics
 (✓) Jan 1947 Communications*

*"Wide band amplifiers above 150 mc", Lebenbaum
 Communications, Dec 1946, Vol 26, No 12, p 24, 25 + 50*

FIGURE 1
MEGACYCLES



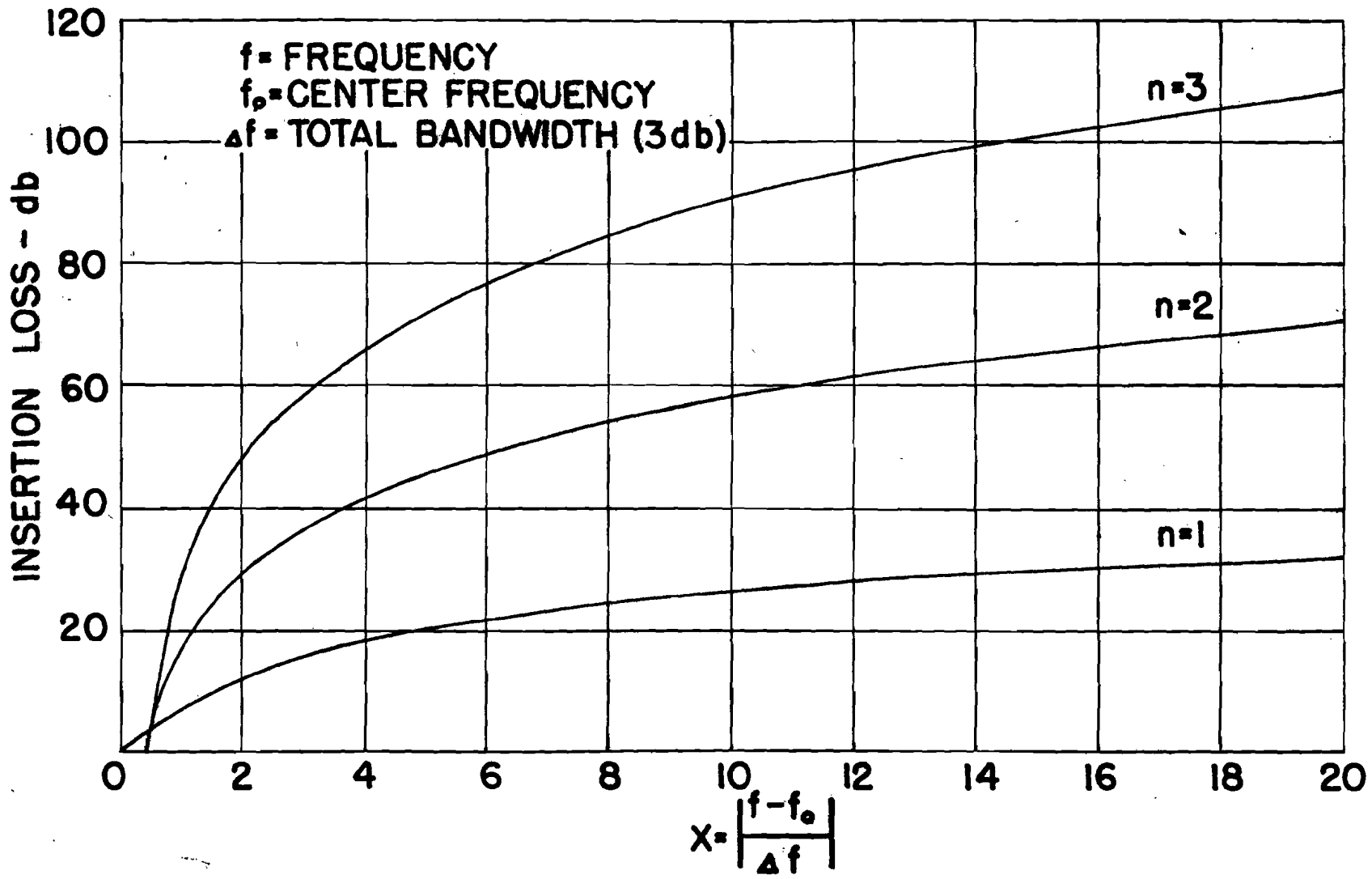


FIGURE 2

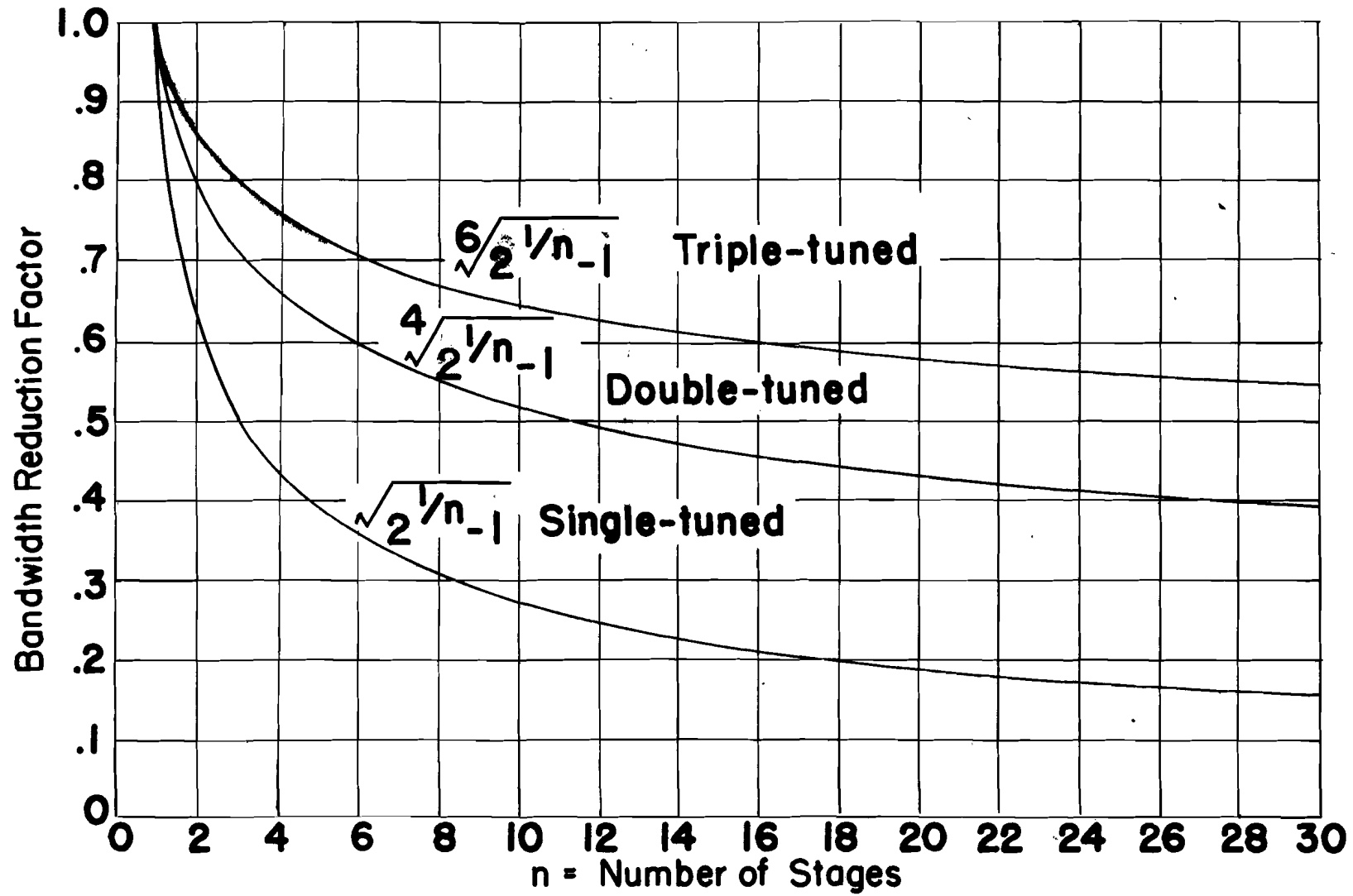


FIGURE 3

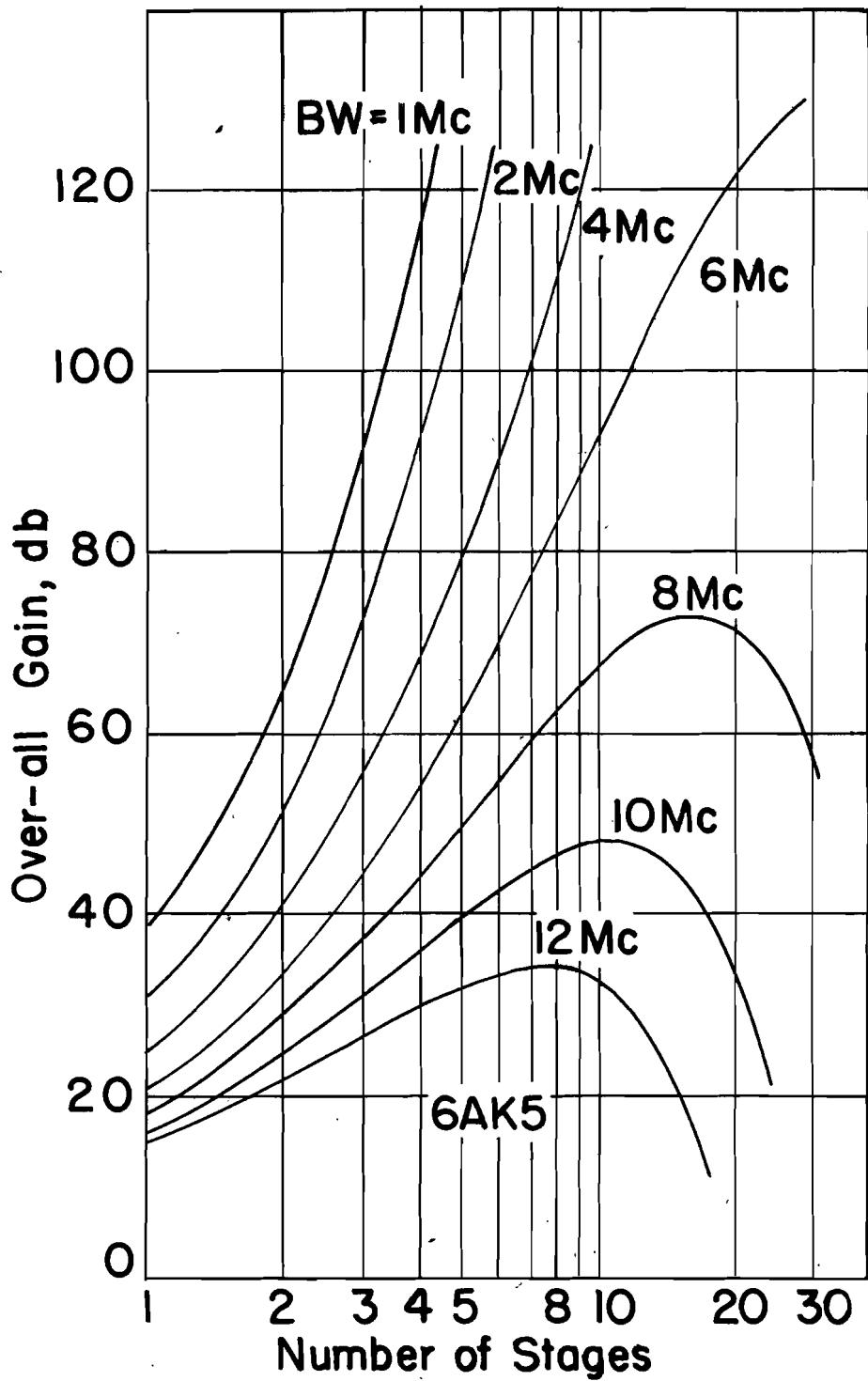
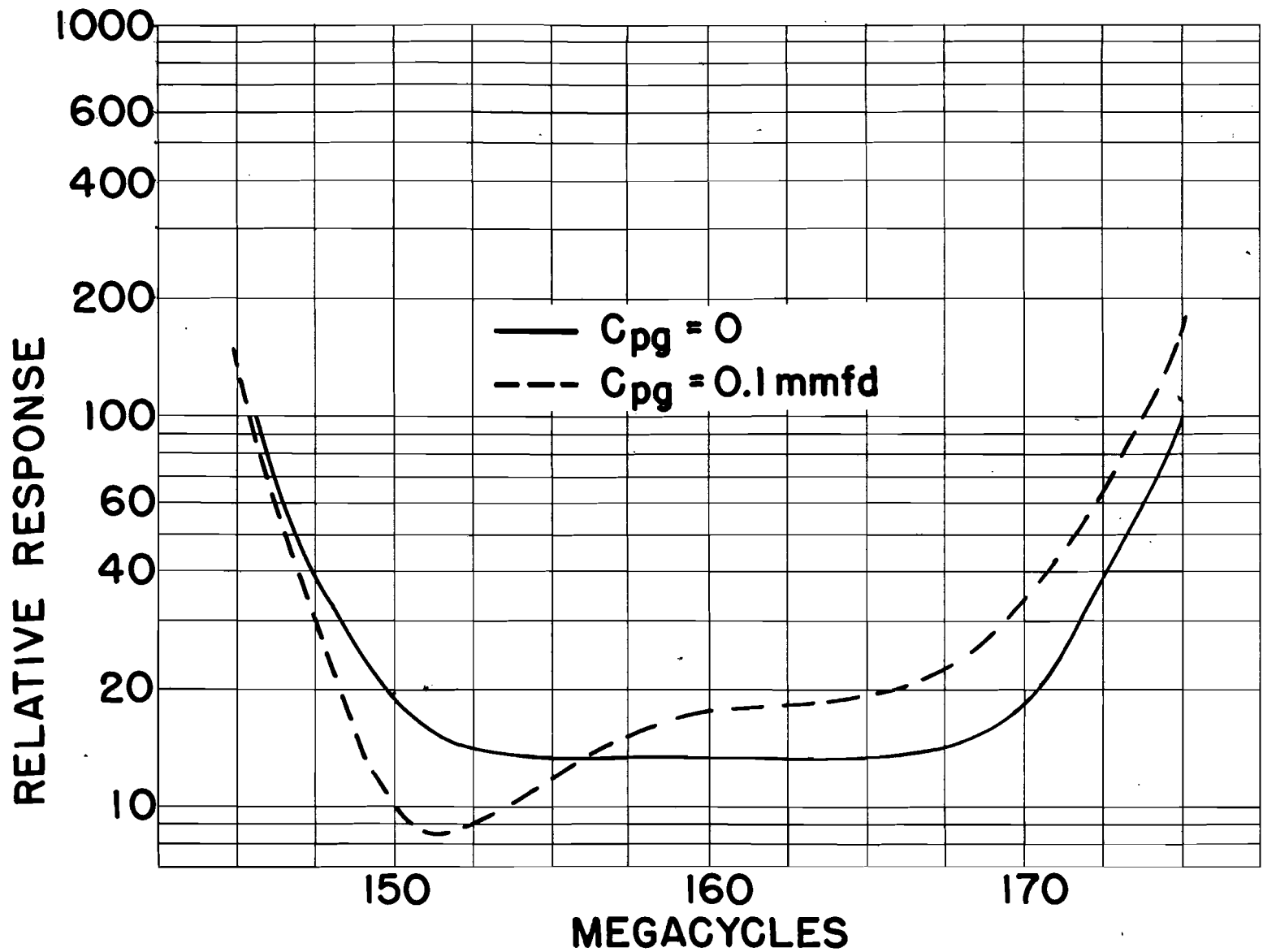


FIGURE 4

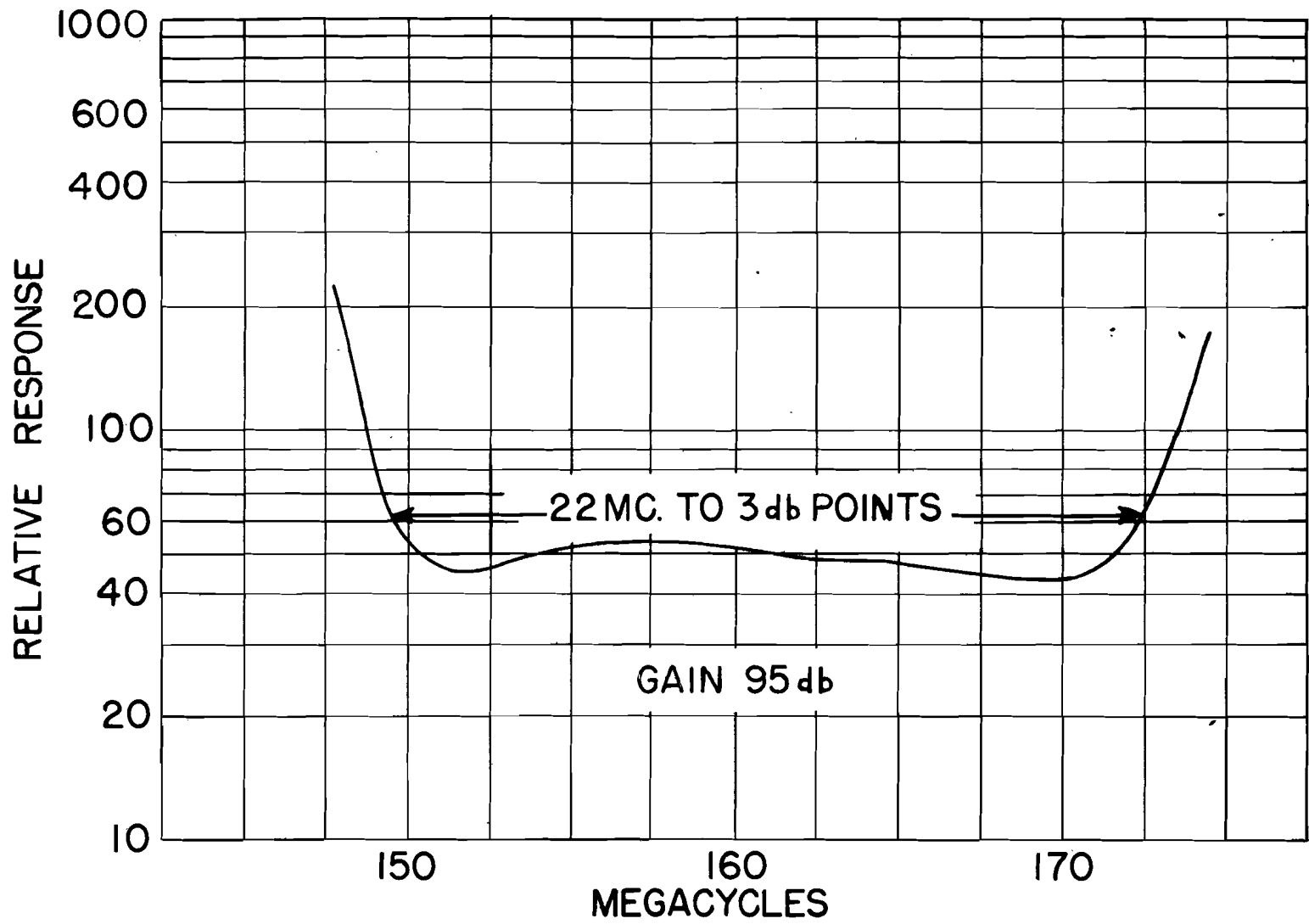
$BW = \sqrt{E}$

$G_m = 4500$



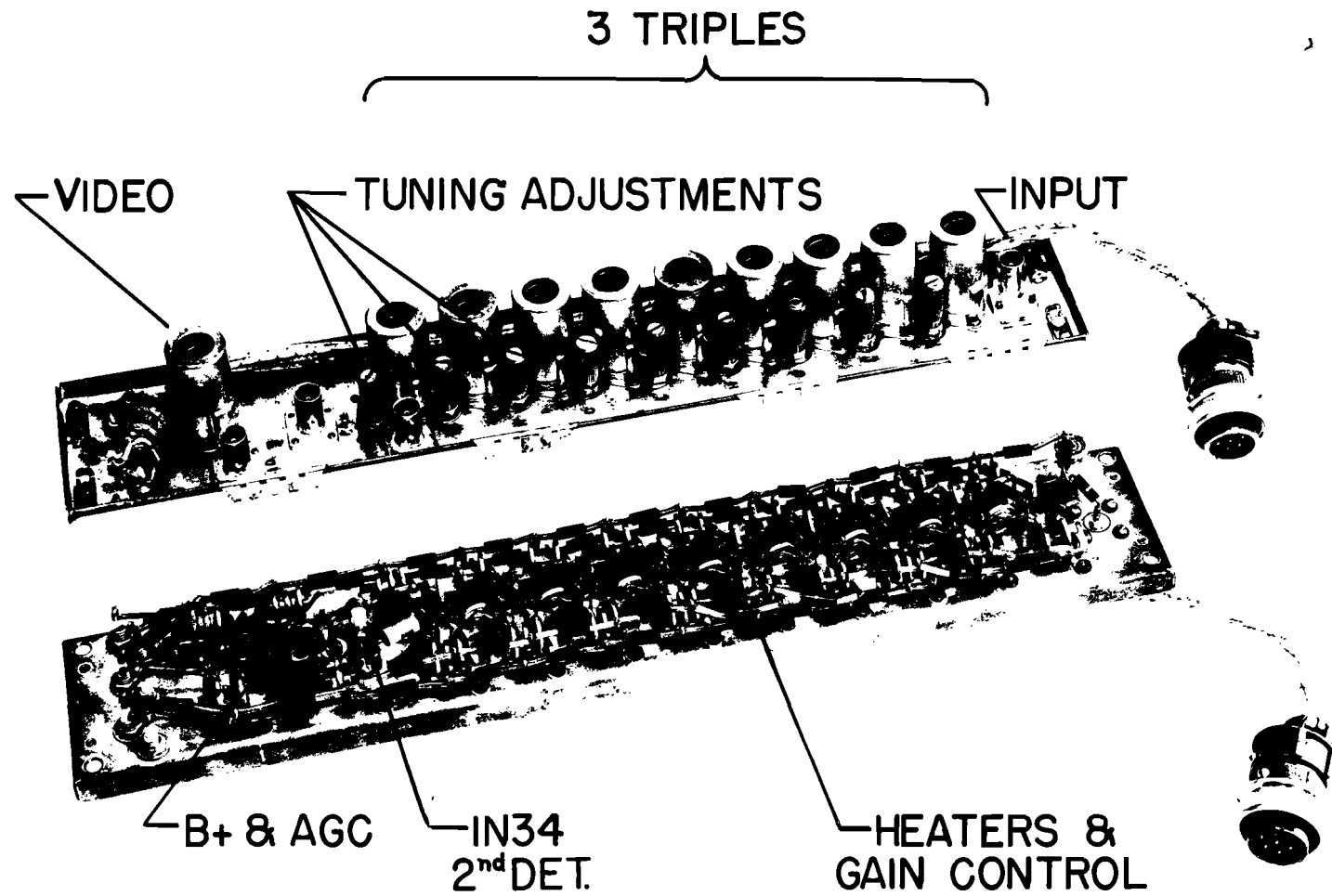
**EFFECT OF C_{pg} ON SELECTIVITY
9 STAGE AMPLIFIER (3 TRIPLES)**

FIGURE 5



SELECTIVITY CURVE OF AMPLIFIER OF FIGURE 7

FIGURE 6.



160 MC. IF AMPLIFIER

FIGURE 7

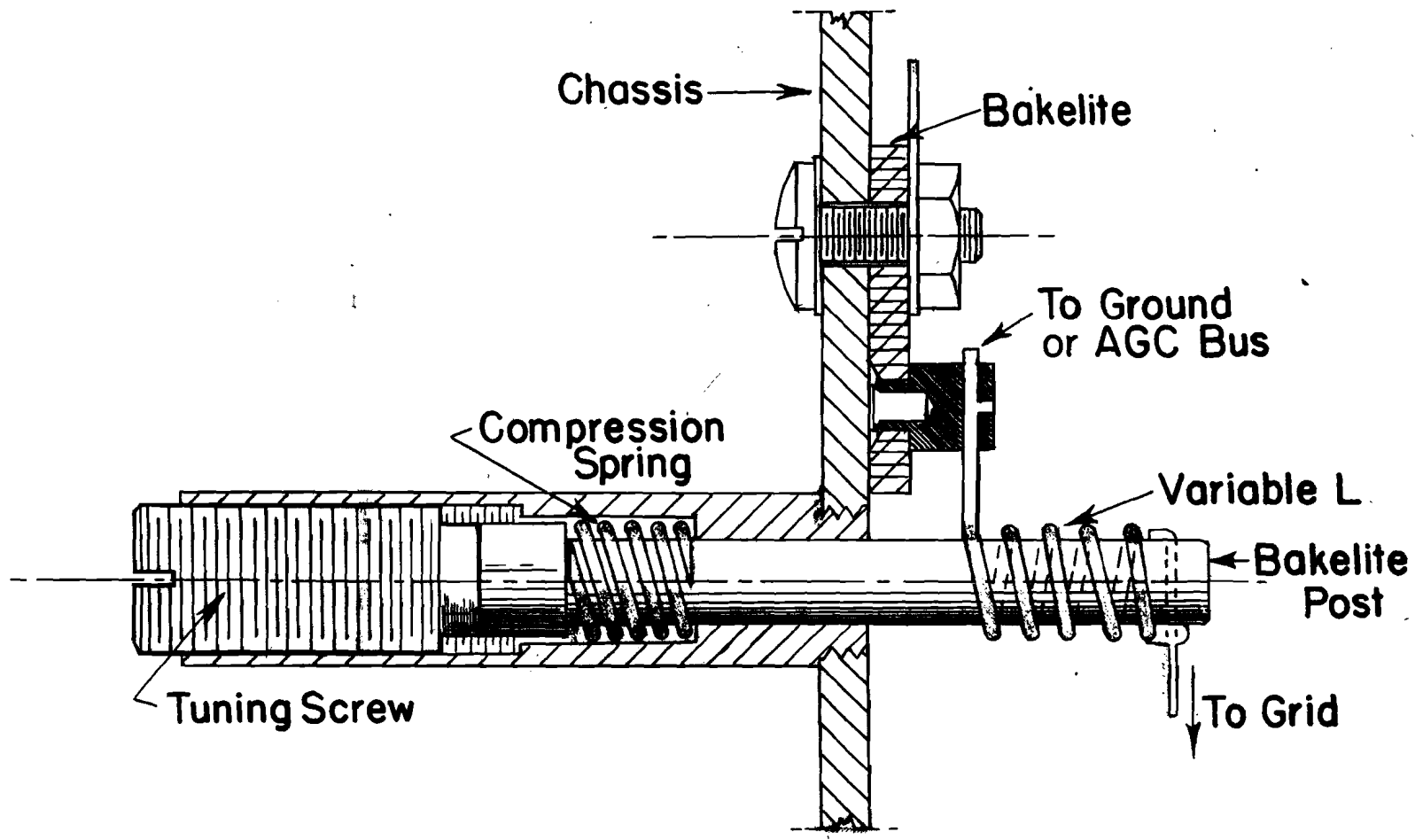


FIGURE 8

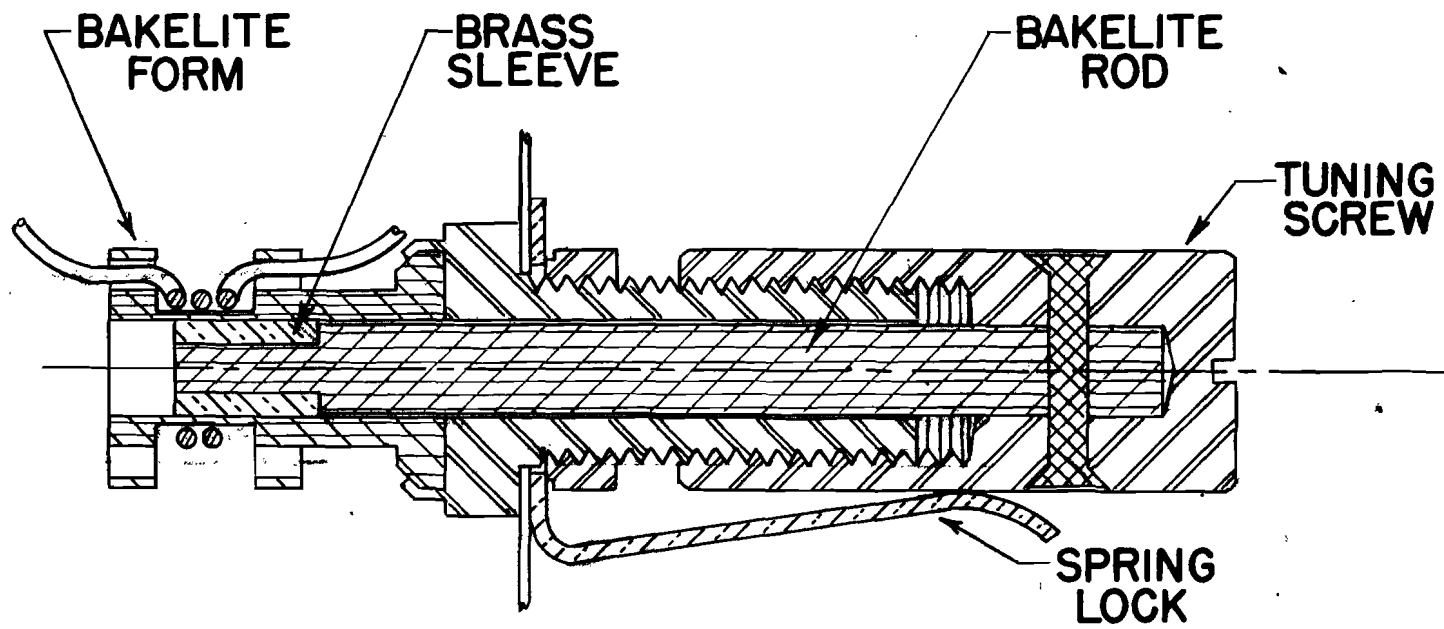


FIGURE 9