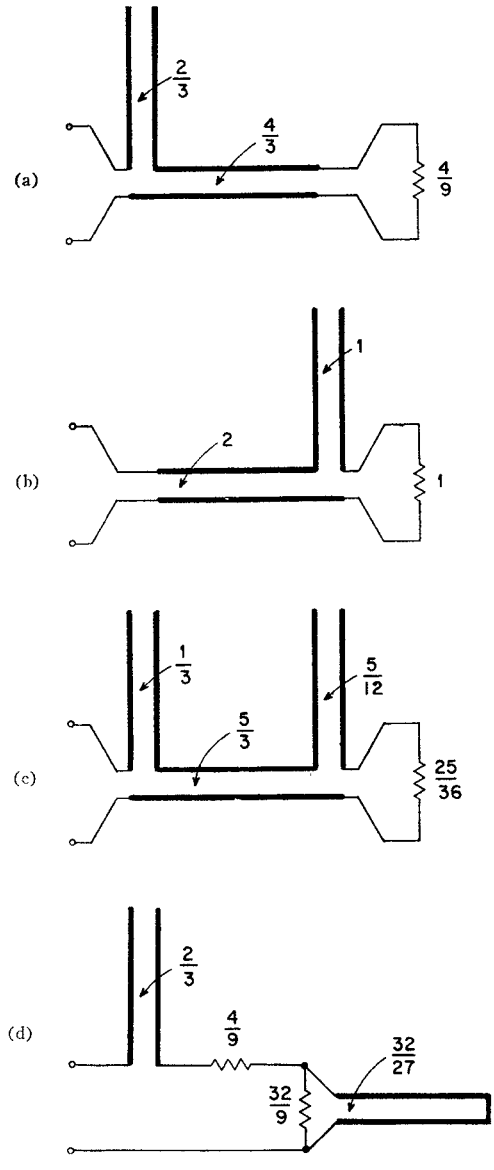

Fig. 1—Four circuits with the same input impedance (1). All lines are of length θ; all numbers are either resistances or characteristic impedances of lines.

The theorem thus stated specifically excludes common factors of (m_1+n_1) and (m_2+n_2). As Riblet has pointed out,[2] this results in a mathematical loss of generality, which however is physically trivial, since no measurement can distinguish between two one-ports consisting, respectively, of a resistance R, and a resistance R preceded by a length of transmission line of characteristic impedance R.

A final comment on terminology. In my paper[5] on the same subject, I specified "homogeneous" transformers without clearly defining this term, and would like to make up this omission now.

Definition: A homogeneous waveguide is one in which the guide wavelength is independent of position.

As a corollary, an inhomogeneous waveguide is one in which the guide wavelength varies with position; *i.e.*, it is not uniformly dispersive. The quarter-wave transformers which are the subject of this discussion and of the references mentioned so far are all homogeneous transformers. There has been little need in the past to distinguish between homogeneous and inhomogeneous quarter-wave transformers (as defined above), as no theory existed for the latter. However, inhomogeneous quarter-wave transformers have recently been analyzed,[6] and the above terminology was introduced to distinguish between these two situations.

LEO YOUNG
Electronics Div.
Westinghouse Electric Corp.
Baltimore, Md.

[5] L. Young, "Tables for cascaded homogeneous quarter-wave transformers," IRE TRANS. ON MICROWAVE THEORY AND TECHNIQUES, vol. MTT-7, pp. 233–237; April, 1959.

[6] L. Young, "Design of microwave stepped transformers with applications to filters," Dr. Eng. dissertation, The Johns Hopkins University, Baltimore, Md.; 1959.

Broad-Band Stub Design*

Mr. Muehe's results for broad-band stubs,[1] while going beyond that of previous investigators, are similar to my design curves published earlier without detailed derivation.[2] The main difference is that my curves were based on a formula involving the bandwidth as defined by the lowest and highest frequencies of *zero* reflection. Mr. Muehe's analysis is therefore superior to my simpler approach; my design curves erred on the safe side in predicting a slightly smaller bandwidth.

LEO YOUNG
Electronics Div.
Westinghouse Electric Corp.
Baltimore, Md.

* Received by the PGMTT, May 15, 1959.

[1] C. E. Muehe, "Quarter-wave compensation of resonant discontinuities," IRE TRANS. ON MICROWAVE THEORY AND TECHNIQUES, vol. MTT-7, pp. 296–297; April, 1959.

[2] L. Young, "Coaxial stub design," *Electronics*, vol. 30, p. 188; July 1, 1957.

Attenuation of the HE_{11} Mode in the *H*-Guide*

The properties of the lowest order hybrid mode of the *H*-guide line have been analyzed by Tischer in a number of papers.[1-3] This type of transmission line has also been under investigation at this laboratory for some time and a number of discrepancies exist between our analysis and those of Tischer.

The geometry of this line is shown in Fig. 1. For comparison purposes, the coordinates and notation introduced by Tischer will be used throughout this letter.

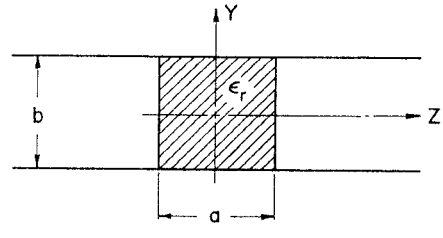

Fig. 1—Cross section of the *H*-guide line. The positive *x*-axis is into the paper.

In Tischer[1,2] the dielectric slab is considered thin and as a result, 1) dielectric losses are neglected, and 2) in the derivation of the expression for the wall losses the power flow in the dielectric slab and the losses in the portion of the walls contacting

* Received by the PGMTT, May 15, 1959.

[1] F. J. Tischer, "Microwellenleitung mit geringen verlusten" (Waveguides with small losses), *Arch. elekt. Uebertragung*, vol. 7, pp. 592–596; December, 1953.

[2] F. J. Tischer, "The *H*-guide, a waveguide for microwaves," 1956 IRE CONVENTION RECORD, pt. 5, pp. 44–47.

[3] F. J. Tischer, "Properties of the *H*-guide at microwaves and millimeter waves," 1958 WESCON CONVENTION RECORD, pt. 1, pp. 4–12.