side the amplifier was always adjusted in such a way that the rectified current was only about 0.2–0.4 μA, respectively. From this it was concluded that the first method of cancellation was not sufficient with this amplifier. On the other hand, the rectified current is equivalent to a loss resistance in parallel to the diode junction. This parallel resistance R_{par} can be transformed into a frequency dependent series resistance R_{ser} which is

$$R_{\text{ser}} = \frac{R_{\text{par}}}{1 + R_{\text{par}}^2\omega^2 C_0^2}. \tag{9}$$

With these additional resistances in the signal idler and pump circuits, (8) has to be rewritten to

$$\partial m_0 = -\frac{m_s^2}{m_0}\left[1 + \frac{|S_p|^2}{\omega_i^2(R_s + R_{\text{ser}_i})^2} - \frac{2|S_p|^2}{\omega_p\omega_i(R_s + R_{\text{ser}_i})(2R_s + R_{\text{ser}_p})}\right]. \tag{10}$$

As $R_{\text{ser}_p} < R_{\text{ser}_i}$ there is again cancellation possible for a certain R_{par} and a certain ω_i/ω_p relationship. To prove the possibility of canceling the "positive gain slope" by resistive loading of the idler circuit, the amplifier was adjusted in such a way that the gain characteristic was located at a point of the left slope of the signal-circuit characteristic, where normally a strong positive slope occurred for a signal input power changing from -30 to -20 dBm (Fig. 6). The signal center frequency f_{sc} was this time 3.65 GHz, $f_p = 11.76$ GHz. The necessary pump power for 12 dB gain at -30 dBm input power was 10 mW. It was impossible with the amplifier tested to load the idler circuit without loading the two other circuits also. Therefore, a resistive graphite coating was put on the diode holders which introduced loss to all three circuits. As can be easily shown, again for a certain (now much higher than for single idler loading) value of loading resistance, cancellation should be possible. After tedious experimenting with the coating, cancellation was achieved as shown in Fig. 7. The pump power for 12 dB gain was 20 mW, the rectified diode current 0.2 and 0.3 μA for -30, and -20 dBm signal input power, respectively.

Conclusion

It was shown that balancing of parametric amplifiers in respect to changes in the input signal level is possible by detuning the signal circuit in a proper way relative to the gain versus frequency characteristic or by resistive loading of the idler circuit. In a practical example it was shown that the necessary increase in pump power was less than 3 dB, the increase in noise figure only a few tenths of a dB.

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Correction

Y. Suematsu, K. Iga, and S. Ito, authors of "A Light Beam Waveguide Using Hyperbolic-Type Gas Lenses," which appeared on pages 657–665 of the December, 1966, issue of this Transactions, have called the following to the attention of the Editor.

On page 661, (24) should be read:

$$w_{\text{in}} = w_0\Bigg[\left(\cos 2\phi - \frac{Q}{2}\sin 2\phi\right)\left\{Q\cosh 2\phi + \left(1 + \frac{Q^2}{4}\right)\sinh 2\phi\right\} + \left(\cosh 2\phi + \frac{Q}{2}\sinh 2\phi\right)\left\{Q\cos 2\phi + \left(1 - \frac{Q^2}{4}\right)\sin 2\phi\right\}\Bigg]^{1/2} \times\Bigg[1 - \Bigg\{\cos 2\phi\,(\cosh 2\phi + Q\sinh 2\phi) - \sin 2\phi\left(Q\cosh 2\phi + \frac{Q^2}{2}\sinh 2\phi\right)\Bigg\}^2\Bigg]^{-1/4}$$

$$\frac{f_{\text{in}}}{k(0)} = 2w_0^2\Bigg[\left(\cos 2\phi - \frac{Q}{2}\sin 2\phi\right)\left\{Q\cosh 2\phi + \left(1 + \frac{Q^2}{4}\right)\sinh 2\phi\right\} + \left(\cosh 2\phi + \frac{Q}{2}\sinh 2\phi\right)\left\{Q\cos 2\phi + \left(1 - \frac{Q^2}{4}\right)\sin 2\phi\right\}\Bigg] \times[\sin 2\phi\,(Q\cosh 2\phi + 2\sinh 2\phi) + Q\cos 2\phi\sinh 2\phi]^{-1}. \tag{24}$$

On page 663, in Table II, Length l_g should be expressed in the unit of meters instead of millimeters.