Introduction to the Problem

Class-C harmonic generators utilizing the conventional full sine wave drive are found unpractical for generating harmonics higher than the 5th order. This was explained by Terman[1] as early as 1938. The reason for this limitation was that the generation of higher order harmonics necessitated smaller angle θ_p of the plate-current flow. And that, the driving power required by these generators increased rapidly as θ_p became smaller. With the 5th order harmonic operation, the driving power tended to exceed the output power ! Because of this and limitations of maximum grid bias, frequency multiplication higher than the 4th or the 5th order, with a single multiplier stage, was found impracticable and usually not attempted.

Pulse drive method introduced by the author[2] (Patel, 1962), however, does not suffer from the above disadvantages. This is because, the harmonic generator then requires a grid-bias only slightly greater than the cut-off. In contrast with the case of the full sine wave drive, this bias remains the same for any desired angle θ_p of the plate-current flow. As a result, the driving power required for generating a particular harmonic is small and remains the same for all values of θ_p . With pulse drive, the generation of harmonics higher than the 5th order is thus practical.

The improvement made possible in the multiplier by pulse drive is by no means small. Here, the problem of generating short drive pulse gets shifted to a circuit external to the grid circuit of the multiplier. Thus, in effect, it makes practical generation of the harmonics of any order unless the generation is otherwise restricted by the multiplier tube and its associated circuits.

The present work is devoted to the rigorous analysis of the operation of the harmonic generators using pulse drive. To realise the full potentialities of these generators in high frequency communications, their operations as 10th order frequency multipliers have specially been explored at 2, 20 and 100 Mc/s frequencies.

REFERENCES

1. Terman, F. E., "Analysis and Design of Harmonic Generators", Trans. AIEE, 57 (1938), 640.

2. Patel, K. S., "A Comparative Study of the Performance of a Class-C Harmonic Generator with Fractional Sine Wave, Isosceles Triangular and Rectangular pulse drives", J. Inst. Telecom. Engrs., Vol.8, No.6 (1962), 298-305.