Preface

The dissertation submitted presents the work carried out by the author in the Instrumentation Laboratory of the Saha Institute of Nuclear Physics, since 1959. The work sums up the theoretical and experimental studies of the operation of the Class-C harmonic generators using a pulsed drive.

The motivation for undertaking such a work arose out of the desire to overcome the 5th order harmonic limitation of the usual Class-C Harmonic generators studied by Terman (1938). This limitation, with the earlier drive method, in short, was due to the rapid increase in the driving power which became prohibitively large as higher order harmonics were attempted. The pulse drive method introduced by the author, however, does not seem to suffer from these disadvantages.

With the ground for the work thus reasonably set, the work started with the comparative study of the harmonic generator with plate currents of three different waveshapes. Such a study, however, made necessary the computation of the Fourier series coefficients of the pulse waveforms. The opening chapter is therefore devoted only to this computation. The study yielded, besides many new informations, the knowledge of generator conversion efficiency from the d-c for all harmonics upto the 15th, and the extent of its dependence on the current waveshapes. The details of this investigation are given in chapter 2.

While this study gave all encouragement for pursuing the scheme, the experimental frequency multipliers that were attempted revealed a most important drawback. It was found that the output fluctuates in amplitude at the fundamental frequency. In the light of this experimental result, the theoretical study of chapter 2, is modified in chapter 3, to provide a satisfactory explanation for the aforesaid observation. The results of this investigation revealed the exponential variation of the multiplier output clearly and also laid down the optimum condition of operation which is useful for design.

Based on this study, a working formula for studying the variation of the peak amplitude of the multiplier output with harmonic frequency is derived in chapter 4. This enabled the behaviour of the multiplier output to be studied in the two possible modes of operation of the multiplier.

Chapter 5 is devoted to a thorough analysis of the operation of a practical 2 Mc/s harmonic generator using a pulse drive. This was necessary to stimulate the development and design of ~~the~~ similar multipliers in view. Additional attraction of this circuit is the use of a simple limiter to remove fluctuations in the multiplier output.

Following this, the variation in the peak amplitude of the multiplier output with harmonic frequency is studied. The observed data on the multiplier outputs are then compared with the theoretical deductions made in chapter 4. These are covered in chapter 6.

Chapter 7 contains the experimental details of the circuit adopted for generating 20 Mc/s frequency from a 2 Mc/s input frequency. The design of this circuit could be made simpler than that of chapter 5, through the use of a crystal diode to generate short drive pulses.

Following this, the variation in the peak amplitude of the harmonic outputs of this multiplier are studied. The extension of this study to harmonic numbers greater than 10 showed inhibition of certain higher order harmonics. Their occurrence has been fully accounted for in chapter 8.

Finally, one more example confirming the applicability of the pulse drive method is provided with the satisfactory design of a frequency multiplier generating as 10th harmonic the frequency of 100 Mc/s (chapter 9).

The concluding chapter summarises the conclusions of the various chapters with an emphasis on the scope of these multipliers in the design of high frequency transmitters and standards.

The author is greatly indebted to Professor B. M. Banerjee for constant guidance, encouragements and for many stimulating discussions. Thanks are due to my colleagues : Mr. P. K. Gupta for some helpful criticisms; Dr. S. Nath for making available one wide band transistor pulse amplifier, at the author's disposal; Dr. (Miss) S. Chowdhury for general help. In the experimental work, the co-operation of laboratory and

workshop assistants was extremely helpful. The author acknowledges the help of Messrs. C. K. Bose, B. K. Roy and N. Adhikary in this connection. Mr. S. K. Manna who did all the typing also deserves heartfelt thanks. Lastly, the author is grateful to the Director of the Saha Institute of Nuclear Physics for his kind interest.

January, 1965.

(K. S. PATEL)