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PREMIUM BONDS

General description of the Electronic Random Number Indicator Equipment

1. INTRODUCTION

The Electronic Random Number Indicator Equipment was designed and will be built at the Post Office Engineering Research Station to meet the following operational requirements:-

(i) each number will contain 9 digits;

(ii) each 9 digit random number will be associated with a 5 digit sequential draw number;

(iii) the second and third digits of the random number will be alphabetical characters, this means that for the second digit, counting must be in a scale of 23 (I, O and U are not used), for the third digit only ten letters will be used so that counting can be arranged as for the "numerical" digits;

(iv) the final output of the equipment will be presented on a page-printing teleprinter and also on gummed tape;

(v) associated with the equipment will be a distributor which will automatically route each random number to the appropriate one of a maximum of 20 teleprinters located at suitable points where the numerical registers of bonds are kept.

2. BASIS OF SYSTEM FOR NUMBER GENERATION

The starting point for the generation of each random digit is a source of electrical noise. That used is a gas discharge tube containing neon. When an electrical potential is applied to such a tube a discharge occurs which is manifest in a visible glow. In the tube the gas molecules move about in a random manner. The current which arrives at the anode consists of electrons whose passage through the tube has been subject to collision with the molecules of gas. They therefore arrive in varying numbers from instant to instant, this giving rise to random variations of current which can be detected by a suitable amplifier. By the use of a 'slicing' valve it is possible to neglect the preponderant number of changes

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which are of low amplitude and to amplify and 'square up' the remainder to operate a counter. In the noise generator the slicing level is such that about 3,000 such "squared up" pulses are recorded every second.

The number of pulses received by the counter in any one period will vary over wide limits, but there will be some average number and numbers near this average will occur more frequently than much smaller or much larger numbers of pulses. If the average number is large enough, as it is under the conditions of counting in the equipment, the number of pulses counted will terminate in the digits 0, 1, 2 up to 9 with equal frequency, subject to the conditions stated in the following paragraph.

If the counter started from zero every time, the digits produced would not - in theory - be equally likely, even though - in practice - the differences would be negligible. The digits can, however, be made equally likely by having different starting points for the counter and arranging that all starting points occur in the same proportions. There are various theoretically satisfactory ways of doing this, of which the most convenient is simply to start the counter from where it was left at the end of the previous count.

The foregoing description relates to the production of a succession of randum numbers, or letters, relating to one digit of the Bond number. In the complete equipment 9 sets of noise generators will drive 9 separate counters, one for each of the 9 digits. Eight of these counters read from 0 to 9 and one, in order to meet the requirements of the "alphabetical" digit, reads from 0 to 22. The counters are stopped simultaneously at fixed intervals. After the counters have been read the noise generators are allowed to drive the counters again. The counters move on from the position in which they were left so that the theoretical requirements are satisfied.

3. <u>OUTLINE DESIGN</u>

In order to safeguard the randomness of number generation and in order to ensure that there is no correlation between individual

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digits of the 9 digit number, each digit will be generated separately as already stated. To safeguard the possibility of any failure, each generator together with its associated counter, is provided in duplicate. The two counter outputs thus obtained will be added in combining units having 10 outputs. This safeguards the possibility of bias appearing in the number presented at the output due to a fault condition in one of the electronic tubes used for counting.

The outputs from the 9 combiners are transferred to primary storage equipment from which they, together with the fixed codes (figure shift, letter shift, line feed, carriage return and spaces) needed for the printing of the number on a teleprinter are assembled and scanned and fed to the teleprinters together with the sequential draw number.

A separate master pulse generating unit will provide the basic timing signals which start and stop the counting and control the teleprinters. The signals from the output stores will be released at a rate of about one every three or four seconds into the teleprinter distribution network.

In order that ineffective search time may be reduced to a minimum, arrangements are incorporated in the primary number storage for the inhibition of random numbers generated above a certain value, i.e., corresponding to ranges of bonds not yet offered for sale. This value can be pre-set for each of the 23 denominational codes separately. This "inhibitor" will be adjusted immediately before each draw on the basis of the maximum number of bonds sold in any particular denomination.

4. TELEPRINTER DISTRIBUTION NETWORK AND OUTLET SELECTOR

The equipment will also examine the first two digits of each number and as a result of that examination select and route the information to the appropriate one of a number of teleprinter stations located at the points where the numerical registers of Bonds are kept.

Each teleprinter station will contain a pair of teleprinters in order to provide the facilities required.
