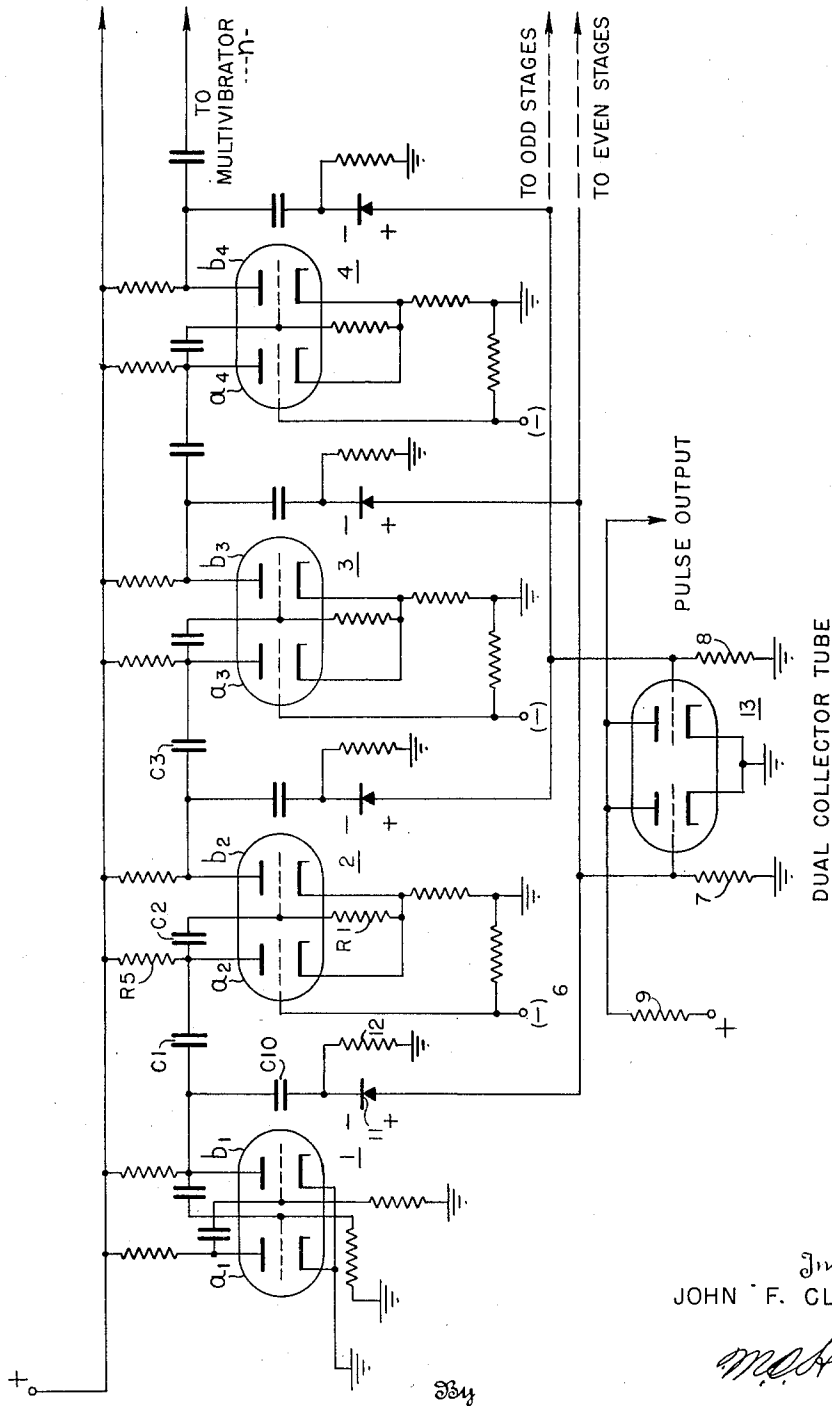


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PULSE COLLECTING METHOD

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PULSE COLLECTING METHOD

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1

2

This invention relates in general to pulse collecting apparatus and in particular to apparatus for collecting pulse signals from the several stages of a cascaded multivibrator chain or the like.

In the use of pulse transmitted intelligence systems it is frequently desired that a plurality of data be transmitted over a single wire or radio link. Degrees of magnitude or variation of the data furnished by a plurality of instruments is an often-used application of pulse type multiplex systems. In a pulsed system in general and in a telemetering system in particular, the data appear as successively transmitted pulses derived from a chain of multivibrator circuits, with the time spacing between pulses varying with the intelligence.

An object of this invention is to provide a means for the collection of intelligence pulses from each stage of a cascaded multivibrator chain or the like.

Another object of this invention is to provide a means for the collection of pulses from each stage of a cascaded multivibrator chain or the like, and particularly a means for the prevention of undesired interaction between successive stages and the cancellation or partial cancellation of desired pulses.

Other and further objects of this invention will become apparent from a consideration of the drawings, when taken together with the following detailed description.

In the drawings, the single figure shows a multivibrator chain embodying the invention and demonstrating the collection of pulses by a dual collector tube.

Referring to the figure, there is shown for purposes of illustration a multivibrator chain including a freely-running multivibrator 1 comprising a pair of regeneratively interconnected tubes a_1 and b_1 . Tube components a_1 , b_1 of the freely-running multivibrator are used to generate a rectangular type wave which is introduced into the grid of the second multivibrator 2, comprising tubes a_2 , b_2 . The frequency of multivibrator 1 may be selected so that only one pulse at a time is transmitted down the chain, or alternatively it may be selected so that more than one pulse at a time is transmitted down the chain. The circuit of multivibrators 2, 3 and 4 is exemplified as a single stable state, blocked type multivibrator and it should be noted that other circuits of diverse type may be substituted. In the example shown, the right hand tube, b series, of each multivibrator 2, 3 and 4 is normally conducting and the left hand tube, a series, is cutoff. To this end the

cathodes of the right and left hand tubes of each stage are connected together and returned to ground through a common resistor. The grid of the right hand tube is returned to its cathode to provide zero bias and the grid of the left hand tube is returned to a source of negative blocking voltage typified at 6 in stage 2. The output waveform from the freely-running multivibrator 1 after differentiation by the RC circuits comprising coupling capacitor C_1 , C_2 and grid and plate resistors R_1 and R_5 of stage 2 will trigger the tube b_2 of multivibrator 2 as follows: As tube a_1 cuts off and b_1 on, the resulting drop in plate potential of b_1 is transmitted to the grid of b_2 after differentiation, as a negative pulse or peak, which when impressed on the grid of b_2 cuts that tube off, and tube a_2 on, thus driving multivibrator 2 to its unstable state, from which it will recover after draining of the charge from C_2 through R_1 and the anode supply resistance of R_5 . These elements form in part the time constant of the unstable state of the multivibrator, and thus determine the duration of the positive pulse produced at the plate of tube b_2 .

In a similar manner, and at the end of the unstable period of multivibrator 2, the decay of potential in the plate circuit of b_2 when that tube is turned on again, is transmitted through coupling capacitor C_3 as a negative pulse to the right hand tube b_3 of the next multivibrator stage 3, thus driving this stage into its unstable state. Then again as this stage returns to its stable state it will drive the succeeding stage 4 into an unstable state and so on down the chain. There is thus produced from the output of the right hand tubes a series of negative trailing edge pulses, the spacing of which is determined by the time each multivibrator remains in the unstable state induced by the negative triggering pulse.

In collecting the successive pulses thus produced by the multivibrator chain the plate of each right hand tube of the several multivibrator stages in the chain is connected through a separate asymmetrical impedance network to a point of collection. Each asymmetrical coupling network is designed to pass unattenuated the negative trailing edges of the pulse output from each of the right hand tubes of the several stages but to suppress the positive leading edges of pulses therefrom. The impedance coupling networks comprise, as herein typified in stage 1, a serially connected differentiating condenser C_{10} and a half wave rectifier means 11 connected to pass negative pulses only from the multivibrator output waveform. The rectifying element 11 has

3

connected in shunt across it a resistance 12 of suitable value to provide a discharge path to ground for the condenser C10.

As exemplified in the drawing, it may be desired under certain operating conditions to use different points of pulse collections for the odd and even numbered stages of the chain. More particularly, the outputs of the first, third, fifth, and all subsequent odd stages are connected to the input grid circuit of the left hand triode section of the dual triode collector tube 13, whereas the outputs of the second, fourth, sixth and all subsequent even-numbered multivibrator stages are connected to the right hand input grid circuit of the collector tube 13. The collected output from the entire multivibrator chain is then combined in the common plate load resistance 9 of the dual collector tube.

In operation and as the multivibrator stages are driven successively into their unstable states, the positive pulses developed at the anodes of the right hand, b series tubes in the several multivibrator stages, are supplied to and differentiated by the condensers 10 included in the impedance coupling networks and are then applied to their respective grid circuits of the dual triode collector 13. The differentiated positively produced pulses which occur synchronously with the leading edges of the pulses produced at the plate of the right hand tube, block their respective rectifiers 11 and are accordingly sharply attenuated as they reach the input to the collector tube 13. The differentiated negatively produced pulses which occur synchronously with the trailing edges of the pulse produced at the output of the right hand tubes however render their respective rectifiers 11 conducting and are therefore passed unattenuated to the collector tube.

As will be noted from the drawings, the rectifiers 11 included in the several coupling networks in the chain and connected to the same collector triode grid are arranged in opposition to one another, so that negative pulses passed freely by one rectifier will be blocked by all other rectifiers from entering the grid circuits of the other stages in the multivibrator chain to prevent thereby improper inter-triggering between the several stages.

Finally, the purpose of connecting alternate stages to separate collector tube grid circuits is to prevent any traces of positive pulses produced at the leading edges of the positively rising waveform from leaking across the shunt resistances 12 or through the rectifying devices 11 and appearing synchronously with and thereby partially cancelling the desired negative pulses, such as would occur in coupling successive stages to a common point of collection. If, however, a certain amount of cancellation can be tolerated, a

4

single collector tube with all output circuits from the chain connected to the grid circuit, may be employed.

Although I have shown only a certain and specific embodiment of the invention it must be understood that I am fully aware that many modifications are possible thereof without departing from the spirit of the invention as defined in the appended claims.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed is:

1. In a cascaded pulse producing multivibrator chain or the like having a plurality of pulse output points therein; the combination of first and second pulse collection means, and means including a separate asymmetrical impedance network coupling the odd numbered output points in said chain to the first collection means and the even numbered output points in said chain to the second collection means.

2. In a cascaded pulse producing multivibrator chain or the like having a plurality of pulse output points therein; the combination of, first and second pulse collection means, and means including a separate asymmetrical impedance network comprising a unilateral impedance device coupling the odd numbered output points in said chain to the first collection means and the even numbered output points in said chain to the second collection means.

3. In a multiple pulse generating device comprising a plurality of stages of pulse generators connected in cascade relation, each stage having a separate output point; the combination of, first and second pulse collection means, and means including separate asymmetrical impedance networks coupling the outputs from the odd numbered stages in said pulse generating device to said first collection means and the even numbered stages in said device to said second collection means.

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