

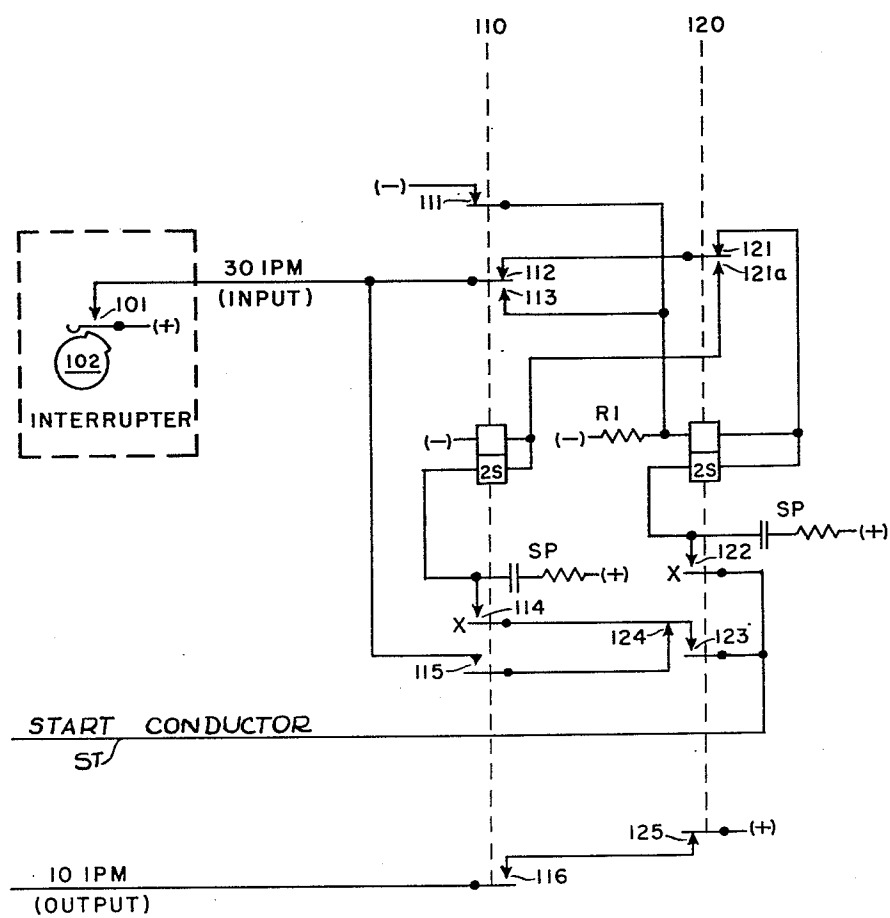
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PULSE GENERATOR

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PULSE GENERATOR

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This invention relates to pulse generator equipment, and more particularly to frequency converting means.

A first object of this invention is to provide a new and improved relay pulse generator circuit.

A second object of this invention is to provide means for converting a first frequency of pulse signals into a second frequency of pulse signals.

It is thought that these and other objects may be understood best by making reference to the attached drawing, which shows a relay interrupter or frequency conversion unit.

Briefly, this circuit provides means for receiving pulses at a first frequency. In the particular case shown in the drawing, this is 30 I. P. M. Two-step, counting relays 110 and 120 follow these pulses and produce new outgoing pulses at a different rate. In the case shown in the drawing, this is 10 I. P. M.

In greater detail, the circuit starts to function when a suitable ground marking (not shown) is connected to the conductor marked ST. This same ground marking may be used also to start a common interrupter which generates pulses at any desired rate of speed, for example, at 30 I. P. M. Any suitable type of common interrupter may be used; however, the drawing shows machine driven, cam controlled contacts 101 which open and close at the prescribed rate. The first pulse received from interrupter contacts 101 is extended through contacts 112, 121, the upper winding of relay 120 and contacts 111 to (—) battery. Relay 120 operates to its first step when energized over its upper winding. On this step it operates only its "X" or preliminary contacts 122. Ground is now connected to both sides of the lower winding of relay 120 so that it may not operate to its second step. This circuit may be traced from the input conductor designated 30 I. P. M., through contacts 112, 121, the lower winding of relay 120, and "X" or preliminary contacts 122 to the start ground conductor ST.

After a brief interval determined by the speed of the interrupter, ground is removed at contacts 101 from the input conductor. Relay 120 no longer has its lower winding shunted so that it is energized over its upper and lower windings in series to operate to its second step at which time all of its contacts are operated. This circuit may be traced from the start ground conductor ST, through contacts 122, the lower and upper windings of relay 120 in series, to (—) battery at contacts 111. Contacts 121 open so that relay 120 may not be influenced by the next pulse. Contacts 121a close to prepare an operating circuit for relay 110. Contacts 123 close to prepare a holding circuit for relay 110.

Nothing further happens until the next ground pulse is received from the common interrupter. When this happens, ground (+) is extended from contacts 101, through contacts 112, 121a, and the upper winding of relay 110 to (—) battery. Relay 110 operates to its first step when energized over its upper winding. In this manner it closes only its "X" or preliminary contacts

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114. The lower winding is shunted since ground is applied to both sides of it. This circuit may be traced from the start ground conductor ST through contacts 123, 114, the lower winding of relay 110, operated contacts 121a, rest contacts 112 and the input conductor to ground at the common interrupter.

After another brief interval of time, ground is removed from the input conductor by the common interrupter. When this occurs the lower winding of relay 110 is no longer shunted. Relay 110 operates to its second step, the circuit being from ground on the start ground conductor, through operated contacts 123, operated contacts 114, the lower and upper windings of relay 110 in series, to (—) battery. Relay 110 opens contacts 111. This removes the (—) battery potential which was connected with relay 120. Relay 120 is constructed so that it will hold when energized in series with resistor R1. Therefore, relay 120 does not fall at this time, the holding circuit being from (—) battery, through resistor R1, the upper and lower windings of relay 120 in series, operated contacts 122 and the ground on the start conductor. Contacts 112 open to break the original energizing circuit for relay 120. Contacts 113 close in preparation for the next pulse to be received from the common interrupter. Contacts 115 close, also in preparation for the ground pulse which is to be received next.

After still another brief interval of time, the third ground pulse appears on the input conductor under the control of cam 102. This ground marking is extended through contacts 113 to the lefthand terminal of the upper winding of relay 120. Relay 120 is released since ground is also connected to the left-hand terminal of its lower winding. The circuit is from the start ground conductor through contacts 122, the lower and upper windings of relay 120 in series, contacts 113 and the input conductor to ground (+) at interrupter contacts 101. When relay 120 releases, contacts 125 close and a ground pulse is transmitted over the outgoing conductor marked (Output). Relay 110 has its original locking path broken when contacts 123 open. However, contacts 124 close before contacts 123 open; hence, relay 110 continues to be held over a circuit which may be traced from ground (+) at contacts 101, over the input conductor, contacts 115, 124, 114, and the lower and upper windings of relay 110 in series to (—) battery. During the period that remains before contacts 101 open, the outgoing pulse is transmitted from ground (+) through contacts 125 and 116 to the output conductor.

After another brief interval of time, the common interrupter removes ground from the 30 I. P. M. conductor. This causes relay 110 to release. Contacts 116 open to terminate the outgoing impulse. Both relay 110 and relay 120 are restored at this time so that the next pulse once more will begin the cycle of operation that was just described. Hence, it is seen that three pulses received over the input conductor are required for causing the transmission of one pulse over the output conductor. Hence, current which is pulsating at one rate of speed on the input conductor is converted to current which is pulsating at another rate of speed on the output conductor. In this case the ratio of input to output is 3 to 1.

I have shown and described a single modification of my invention in the attached drawing. However, it should be obvious to those skilled in the art that a different ratio of input to output rate of pulse speed may be produced by changing the number of relays in the counting circuit. Therefore, it is my object to claim not only the specific features shown in the attached drawing, but also to claim all modifications which may fall within the true spirit of my invention.

What I claim is:

1. A pulse generator comprising a predetermined number of counting relays, a source of cyclically recurring pulses, means for connecting said relays to be operated sequentially by said pulses, an output circuit controlled by said relays, and means responsive to said relays counting a number of pulses equal to one more than said predetermined number for causing said output circuit to generate a pulse whereby said cyclically recurring pulses drive said counting relays to produce another series of cyclically recurring pulses, which other series is at a pulse speed that is different than the pulse speed of said first mentioned pulses.

2. A relay interrupter comprising a source of cyclically recurring pulses, two counting relays, means for connecting said relays to be driven by said pulses comprising means for operating and locking said first relay responsive to the first of said pulses to be received, means for operating and locking the second of said relays responsive to the second of said pulses, means for releasing the first of said relays responsive to the third of said pulses, means responsive to the release of said first relay when said second relay is operated for transmitting an outgoing pulse, and means effective after transmission of said outgoing pulse for releasing said second relay.

3. A relay pulse frequency converter comprising a source of cyclically recurring pulses, two two-step counting relays, means for connecting said relays to be driven by said pulses comprising means for operating and locking said first relay through its two steps responsive to the first of said pulse, means responsive to operation of said first relay for preparing for operation of the second of said two relays, means for operating and locking the second of said relays through its two steps responsive to the second of said pulses, means for releasing the first of said relays responsive to the third of said pulses, means responsive to the release of said first relay when said second relay is operated for transmitting an outgoing pulse, and means responsive to termination of said third pulse for releasing said second relay.

4. A relay circuit for converting a first frequency of signals into a second frequency of signals comprising a source of cyclically recurring pulses; a plurality of counting relays; means responsive to the initiation of a first of said pulses for preparing a first of said relays to operate, means for operating and locking said first relay responsive to the termination of said first pulse; means responsive to operation of said first relay for connecting the next of said relays to be controlled by said pulses; means for repeating said cycle of operation for each of said counting relays, whereby the initiation of each succeeding pulse prepares the next relay for operation, the termination of each succeeding pulse operates and locks the next relay, and the operation of said next relay connects the following relay in said counting chain to be controlled by the following pulse; means responsive to operation of the last of said relays for releasing the first of said relays; means responsive to said release of said first relay when the other of said relays are operated for transmitting an outgoing pulse; and means for thereafter releasing all of said counting relays whereby said counting chain is returned to normal and is made ready to repeat the process responsive to the receipt of the next of said cyclic pulses.

5. A relay interrupter comprising a source of cyclically recurring pulses; a plurality of two-step counting relays; means responsive to the initiation of a first of said pulses for operating a first of said relays to one of its said two steps, means for operating and locking said first relay on the other of its said two steps responsive to the termination of said first pulse; means responsive to operation of said first relay to its said other step for connecting the next of said relays to be controlled by said pulses;

means for repeating said cycle of operation for each of said counting relays, whereby the initiation of each succeeding pulse operates the next relay to one of its said steps, the termination of each succeeding pulse operates and locks the next relay on the other of its said steps and the operation of each relay to its said other step connects the following relay in said counting chain to be controlled by the following pulse; means responsive to operation of the last of said relays for releasing the first of said relays; means responsive to said release of said first relay when the other of said relays are operated for transmitting an outgoing pulse; and means for thereafter releasing all of said counting relays whereby said counting chain is returned to normal and is made ready to repeat the process responsive to the receipt of the next of said cyclic pulses.

6. A relay interrupter comprising a source of cyclically recurring pulses, two counting relays, means for connecting said relays to be driven by said pulses comprising means for operating said first relay responsive to the first of said pulses to be received, means for operating the second of said relays responsive to the second of said pulses, means for releasing the first of said relays responsive to the third of said pulses, means responsive to the release of said first relay when said second relay is operated for transmitting an outgoing pulse, and means effective after transmission of said outgoing pulse for releasing said second relay.

7. A relay pulse frequency converter comprising a source of cyclically recurring pulses, two two-step counting relays, means for connecting said relays to be driven by said pulses comprising means for operating said first relay through its two steps responsive to the first of said pulse, means responsive to operation of said first relay for preparing for operation of the second of said two relays, means for operating the second of said relays through its two steps responsive to the second of said pulses, means for releasing the first of said relays responsive to the third of said pulses, means responsive to the release of said first relay when said second relay is operated for transmitting an outgoing pulse, and means responsive to termination of said third pulse for releasing said second relay.

8. A relay circuit for converting a first frequency of signals into a second frequency of signals comprising a source of cyclically recurring pulses; a plurality of counting relays; means responsive to the initiation of a first of said pulses for preparing a first of said relays to operate, means for operating said first relay responsive to the termination of said first pulse; means responsive to operation of said first relay for connecting the next of said relays to be controlled by said pulses; means for repeating said cycle of operation for each of said counting relays, whereby the initiation of each succeeding pulse prepares the next relay for operation, the termination of each succeeding pulse operates said next relay, and the operation of said next relay connects the following relay in said counting chain to be controlled by the following pulses; means responsive to operation of the last of said relays for releasing the first of said relays; means responsive to said release of said first relay when the remaining relays are operated for transmitting an outgoing pulse; and means for thereafter releasing all of said counting relays whereby said counting chain is returned to normal and is made ready to repeat the process responsive to the receipt of the next of said cyclic pulses.

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