

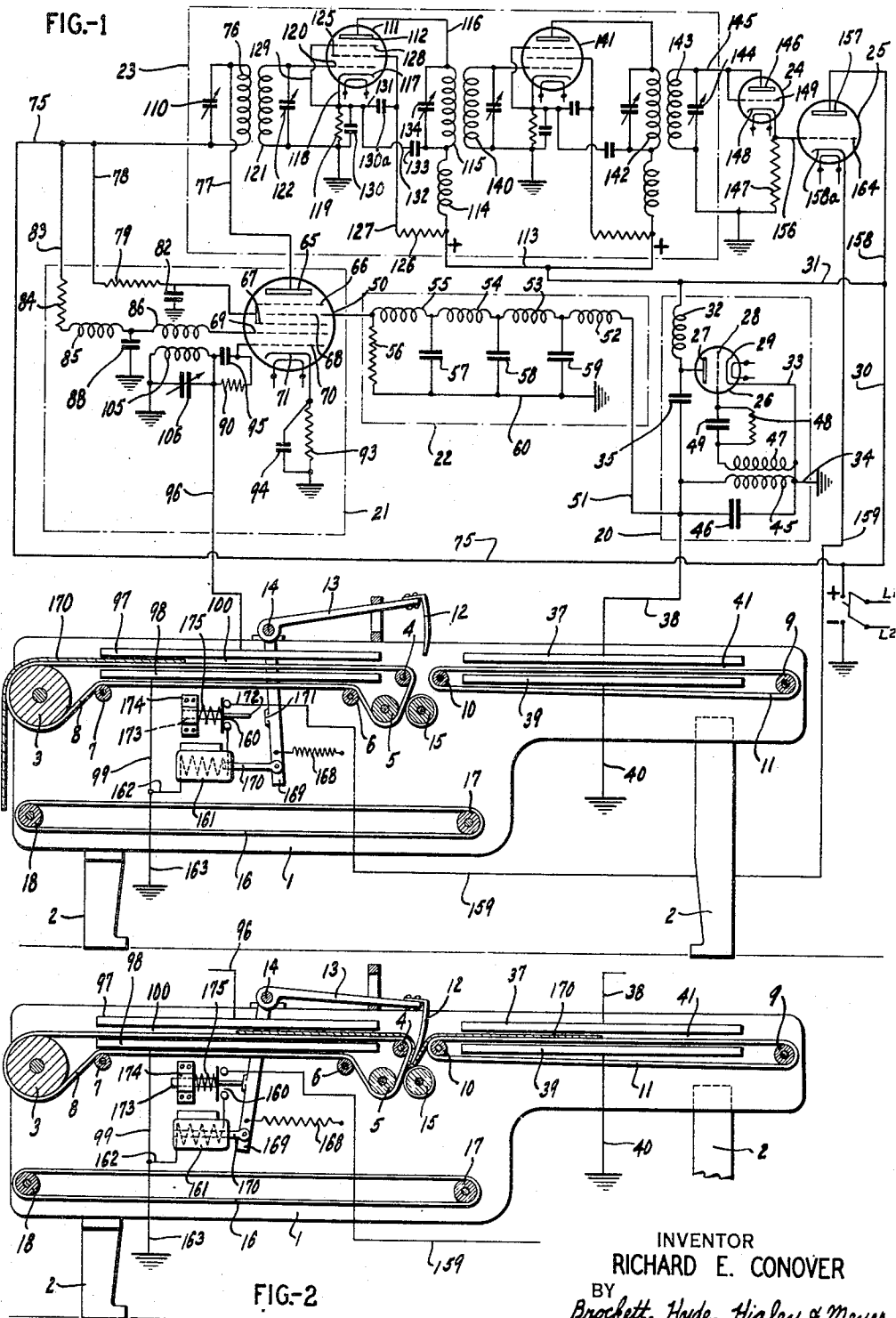
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R. E. CONOVER

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ELECTRICAL CONTROL CIRCUIT FOR FOLDING MACHINES

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INVENTOR
 RICHARD E. CONOVER
 BY
Brockett, Hyde, Higley & Meyer
 ATTORNEYS

UNITED STATES PATENT OFFICE

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ELECTRICAL CONTROL CIRCUIT FOR FOLD-
ING MACHINES

Richard E. Conover, Dayton, Ohio

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My invention relates to machines for folding articles, such as laundry flatwork, and more particularly to an electrical control circuit for supplying electrical energy for operating the folding mechanism of such machines at the proper time.

Folding machines, such as those designed for folding laundry flatwork, have heretofore been equipped with elaborate and complex timing means for insuring that the folding blade will perform its function when the article has travelled to the proper position. In accordance with my invention I have provided a folding mechanism, including an improved electrical control circuit, by means of which laundry flatwork, such as sheets or other articles, may be accurately folded at the desired time.

It is therefore an object of my invention to provide an improved electrical control circuit for supplying current to operate the blade of folding machines by means of which articles, such as flatwork, may be folded along the desired line.

Another object of my invention is to provide an electrical control circuit for folding machines in which the movement of the article to be folded through the machine varies the capacitance of the control circuit in such a manner that an electrical circuit is established at a predetermined time in response to the change in capacitance which supplies current to operate the folding blade.

A further object of my invention is to provide an improved electrical control circuit for folding machines in which the movement of the article to be folded through the machine varies the capacitance of the control circuit in such a manner that an electrical circuit is established to operate a folding blade in response to change in capacitance including means associated with the control circuit for varying the time at which the blade operating circuit is established.

Another object of my invention is to provide an improved electrical control circuit for folding machines, including two oscillating radio frequency generators and means in response to the change of capacitance in the circuit during the movement of the article to be folded through the machine for establishing an electrical circuit which supplies current to operate the blade of the folding machine.

A still further object of my invention is to provide an improved electrical control circuit for folding machines, including two radio frequency oscillators, the capacitances of which are varied by the passage of the article to be folded through the machine in such a manner that an electrical circuit is established which operates the blade of the folding machine, including means for preventing the formation of a circuit for operating the folding blade when the capacitance in one of said circuits is fixed.

My invention will be better understood by reference to the accompanying drawing, in which

Fig. 1 is a diagrammatic view, partly in cross section, of a folding machine, showing my improved electrical circuit and means controlled by the circuit for actuating the folding mechanism; and

Fig. 2 is a similar view of the machine, showing the folding mechanism in actuated position.

Referring to the drawing, the folding machine comprises a frame 1 suitably mounted on legs or standards 2. Supported on frame 1 is a driver roll 3 and idler rolls 4, 5, 6 and 7 which support a conveyor or belt 8. The roll 3 may be driven from any suitable source of power, such as a motor, and the work is conveyed from left to right as illustrated in Fig. 1 of the drawing. Another belt or conveyor 11, supported by driven roll 9 and an idler roll 10 in line with conveyor 8 to receive work therefrom, is driven in synchronism with belt 8.

An article of flatwork is thus conveyed along these belts and a folding blade 12, mounted upon an arm 13 which is attached to a shaft 14, is actuated to thrust the article through a small gap between the conveyors and from thence between roll 15 and conveyor 8. The roll 15 is rotated in an opposite direction to roll 5 and the article in folded form drops upon a conveyor 16 which is mounted upon a driven roll 17 and an idler roll 18.

The blade 12 is actuated at the desired time by means of a control circuit including a source of direct current L₁, L₂, a radio frequency oscillator 20, a low pass filter 22, a radio frequency oscillator 21, an amplification system 23, a rectifier 24, and a grid glow or ignition controlled discharge tube 25.

The radio frequency oscillator 20 includes a tube 26 provided with an anode 27, a grid 28 and a cathode 29. Current is supplied to the anode from line L₁ through conductors 30 and 31 and a radio frequency choke 32. The cathode is connected to the negative terminal L₂ through conductors 33 and 34. The plate 27 is also connected to one terminal of a fixed condenser 35, the other terminal of condenser 35 being connected to a plate 37 by means of a conductor 38 which is supported above conveyor belt 11. An additional plate 39 is fixed to the frame below the upper portion of conveyor belt 11 and conductor 40 electrically connected to plate 39 leads to the negative terminal L₂. Plates 37 and 39 form a condenser 41, the capacitance of which is variable when the article to be folded is drawn between the two plates upon conveyor belt 11. An inductance coil 45 and a condenser 46 are connected in parallel from conductor 33 to conductor 38 and current is supplied to grid 28 of vacuum tube 26 through inductance coil 47 and grid leak 48, a

grid condenser 49 being interposed between the terminals of the grid leak resistor 48.

The oscillating current generated by radio frequency oscillator 20 is conducted through the low pass filter 22 to vacuum tube 50 of radio frequency oscillator 21. As illustrated, the low pass filter comprises a series of induction coils 52, 53, 54 and 55, a resistor 56 and a plurality of condensers 57, 58 and 59 which are connected across conductor 51 and a conductor 60 leading to the negative terminal L_2 at points between the respective inductance coils.

Radio frequency oscillator 21 includes a vacuum tube 50 which is of the pentagrid convertor type and includes an anode plate 65, grids 66 and 67 which are connected together to form a screen grid, a detector control grid 68 which leads from low pass filter 22, a plate grid 69, a control grid 70 and a cathode 71. Current is supplied to anode 65 from the line L_1 through conductor 75, intermediate frequency transformer primary 76 and conductor 77. Screen grids 66 and 67 are supplied from L_1 through a resistor 79 the radio frequency being bypassed by a condenser 82. Current is supplied to the plate grid 69 from the positive terminal through conductors 75 and 83, resistor 84 and radio frequency choke 85 and oscillator coil 86, the radio frequency component being bypassed by condenser 88. The control grid 70 is biased through resistor 90, the bias being obtained from the voltage drop across resistor 93. Condenser 94 bypasses resistor 93.

A fixed condenser 95 is connected to control grid 70 and the other terminal leads through a conductor 96 to a plate 97 which is affixed to the frame of the machine above conveyor 8. An additional plate 98 is affixed below the upper line of travel of conveyor 8 and is connected by means of a conductor 99 to the negative terminal L_2 . Plates 97 and 98 provide a condenser 100, the capacitance of which is variable when an article is passing upon conveyor 8 between plates 97 and 98. One terminal of an inductance coil 105 is connected to condenser 95, the other terminal leading to the negative terminal L_2 , and a variable condenser 106 is connected in parallel with coil 105.

As the tube 50 of radio frequency oscillator 21 is a pentagrid convertor, it performs the dual function of generating a voltage having one frequency and combining the voltage of the frequency generated by oscillator 20 into a voltage having a resultant intermediate frequency which is applied to primary 76. Coil 76 is provided with a variable condenser 110 and the voltage is amplified by means of a system designated generally by the numeral 23, which, as illustrated, includes two amplification stages, each of which is provided with a pentode tube.

Pentode tube 111 of the first amplification stage is provided with a plate 112 which is supplied with current from line L_1 through conductors 30, 31 and 113, radio frequency choke 114, intermediate frequency transformer primary 115 and conductor 116. The cathode 117 of pentode 111 is connected to the negative terminal L_2 through conductor 118 and resistor 119.

Voltage is applied to control grid 120 of pentode tube 111 from the secondary coil 121 of the intermediate frequency transformer which has a variable condenser 122 connected across its terminals. Pentode tube 111 is also provided with a screen grid 125, to which voltage is applied from conductor 113 through a resistor 126 and a conductor 127, and with a suppressor grid 128

to which voltage is applied from conductor 118 through conductor 129. The amplifier is also provided with the usual condensers 130 and 130a. Current from cathode 117 passes through conductors 131 and 132 and condenser 133 to intermediate frequency transformer primary 115 connected in circuit with a variable condenser 134. The intermediate frequency voltage passing through inductance coil 115 is induced in secondary 140 of a second amplification circuit including a pentode tube 141 and an output coil 142. This circuit is similar to that just described.

The voltage from coil 142 is induced in coil 143 which is in circuit with a variable condenser 144. One terminal of coil 143 is connected to the plate 146 of rectifier 24 and the other terminal is connected through resistor 147 to the cathode 148 of the rectifier. Rectifier 24 is also provided with a control grid 149 which is connected to conductor 145. The cathode of rectifier 24 is connected through resistor 147 to the negative terminal L_2 .

Voltage is applied to control grid 164 of ignition controlled discharge or grid glow tube 25 by means of a conductor 156. The ignition controlled discharge tube 25 is of the usual type and contains a vapor such as argon, helium, mercury, neon or caesium. The grid glow tube is provided with a plate 157 which is connected to positive terminal L_1 by means of conductors 30 and 158 and with a cathode 158a which is connected by means of a conductor 159 to the switch 160, the other terminal of switch 160 being electrically connected to the coil 161 of a solenoid, and conductors 162 and 163 to negative terminal L_2 . Ignition controlled discharge tube 25 is of the type that requires a positive grid voltage to cause ignition.

In the operation of my improved circuit for controlling the folding operation, an oscillating current is generated by oscillator 20, the frequency of which is controlled by the amount of inductance and capacitance in the circuit including the capacitance of condenser 41. In a like manner the frequency of the oscillating current generated by oscillator 21 is controlled by the inductance and capacitance in that circuit, including the capacitance of condenser 100 which is formed by plates 97 and 98. As the article 170 to be folded is passed between plates 97 and 98, the capacitance of condenser 100 is increased while the capacitance of condenser 41 is fixed. As the article passes between plates 37 and 39, however, the capacitances of both condensers become variable. A frequency difference is then produced between oscillator 20 and oscillator 21.

When this frequency difference becomes the same as that to which the intermediate amplifier 23 is tuned, transmission occurs to the rectifier tube 24 the rectified voltage appearing across resistor 147.

A voltage is thus impressed upon control grid 164 which renders it positive with respect to its cathode 158a. A circuit is accordingly established from line L_1 through conductors 158 and 159, switch 160, solenoid coil 161 and conductors 162 and 163 to the negative terminal L_2 . Folding blade 12 is normally held in open position by means of a spring 168 which is attached to an arm 169 extending downwardly from arm 13. A rod 170 fixed to arm 169 has its free end extending into the coil 161 and as coil 161 is energized the arm 170, which constitutes the armature of the solenoid, is drawn into the coil against the tension of spring 168 which actuates the blade

12, thus folding the article and forcing it through the narrow gap between rolls 4 and 10 as illustrated more particularly in Fig. 2 of the drawing. As blade 12 is forced downwardly a boss 171 on arm 169 is moved in contact with a tongue 172 projecting inwardly from switch 160. The other end of the switch is provided with a rod 173 which extends through an opening in a bracket 174 affixed to the frame of the machine. A spring 175 is interposed between switch 160 and bracket 174 which normally holds the switch in closed position. When the boss 171 engages tongue 172, however, the switch is forced outwardly against the compression of the spring and the switch is opened, thereby breaking the current flowing through ignition controlled discharge or grid glow tube 25. Spring 168 then moves blade 12 to its normally inoperative position as illustrated in Fig. 1 of the drawing.

Low pass filter 22 is provided to prevent the premature closing of folding blade 12. It will be understood that the frequency appearing in the plate circuit of the pentagrid convertor may be a combination of the fundamental frequencies of oscillators 20 and 21 or be the combination of any of the harmonics of the oscillating currents. If oscillator 20 were connected directly to the mixer circuit of oscillator 21 it might be possible to produce a frequency to which the amplification system 23 was tuned while the article is passing between plates 97 and 98 before its forward end reaches a position between plates 37 and 39 and blade 12 would be prematurely actuated. In other words the second harmonic of oscillator 21 might be combined with the fundamental of oscillator 20 because with material passing between plates 97 and 98, oscillator 21 would generate the lower frequency. This combination is particularly apt to happen when oscillator 20 is fixed and oscillator 21 is variable. To prevent this the low pass filter 22 is inserted between oscillator 20 and the mixing circuit of the pentagrid convertor. The cutoff frequency of this filter is such that no transmission can take place until after the material has entered between the plates 37 and 39. After this time both oscillators are continuously variable and the chances of other than fundamental frequencies combining to produce the correct intermediate frequency is extremely remote.

The time at which blade 12 is actuated may be predetermined by means of variable condenser 106 of the oscillator circuit 21. It will be noted that condenser 106 of oscillator 21 is variable, whereas condenser 46 of oscillator 20 is fixed and has a capacitance value which is normally higher than the capacitance of condenser 106 when condenser 106 is adjusted to a low point setting. Condenser 106, however, has a capacitance value which is equal to condenser 46 when condenser 106 is adjusted to its middle point setting and a lower capacitance value than condenser 46 when condenser 106 is adjusted to its high point setting.

Assuming that it is desired to fold the article at a point one-third of its length from its forward edge, condenser 106 is adjusted to a low value capacitance setting so that when one-third of the article has passed folding blade 12, the frequency of oscillator 20 will combine with the frequency of oscillator 21 and a resulting intermediate frequency will be produced which, when amplified, will cause a discharge of the ignition controlled discharge tube 25 whereby blade 12 may be operated. If it is desired to fold the arti-

cle along a line midway between its ends, condenser 106 is adjusted to its middle point setting which increases the capacitance of oscillator 21 and the combined frequency produces an intermediate resulting frequency which operates blade 12 when the middle portion of the article is below the blade. To fold the article along a line which is one-third of the length from the rear edge condenser 106 is adjusted to its high point setting and the frequency of the two oscillators are not combined to produce the intermediate resulting frequency to which the amplification system is tuned until two-thirds of the length of the article has passed under blade 12. It will therefore be seen that by simply adjusting condenser 106, the article may be folded along any desired line between its ends.

From the foregoing specification it will be apparent that I have provided an improved control circuit for folding machines by means of which the article may be automatically folded at the desired time.

It will also be seen that by a simple adjustment of the variable condenser in oscillator circuit 21 the line at which the fold occurs may be predetermined so that the article may be folded along any desired line.

It will also be apparent that by providing a low pass filter between the two oscillators the danger of premature folding of the article will be prevented.

To those skilled in the art many modifications of and widely different embodiments and applications of my invention will suggest themselves without departing from the spirit and the scope thereof. My disclosure and the description herein are purely illustrative and are not intended to be in any sense limiting.

What I claim is:

1. A folding machine comprising an article conveying means, article folding means, an electrical control circuit, means for varying the electrostatic capacitance of said circuit when articles are conveyed through said machine, and means responsive to the variation of the capacitance of the control circuit for actuating the folding means.

2. A folding machine comprising an article conveying means, article folding means, an electrical control circuit, including two condensers located at opposite sides of said folding means and being so arranged that the article to be folded passes between the plates of each of said condensers thereby varying the electrostatic capacitance of said condensers, and means responsive to the variation in the capacitance of said condensers for actuating the folding means.

3. A folding machine comprising conveying means, article folding means, an electrical control circuit, including an ignition controlled discharge tube having a plate, a grid and a cathode, means for supplying current to the plate of said tube, and two condensers located at opposite sides of said folding means and being so arranged that the article to be folded passes between the plates and varies the capacitance of each condenser, means responsive to a predetermined variation in the capacity of said condensers for applying voltage to the grid of said tube, whereby said tube is discharged, and means responsive to the discharge of said tube for actuating said folding mechanism.

4. A folding machine comprising article conveying means, article folding means, a control circuit including two radio frequency oscillators,

the capacity of one of which is varied by the movement of an article to the folding means and the capacity of the other of which is varied as the article passes beyond the folding means, an ignition controlled discharge tube having an anode plate, a grid and a cathode, means for supplying current to the plate of said tube, means responsive to the change in capacity of the radio frequency oscillators for applying voltage to the grid of said tube, thereby causing a discharge of said tube, and means responsive to the discharge of said tube for operating the folding mechanism.

5. A folding machine comprising article conveying means, article folding means, a control circuit including two radio frequency oscillators, the capacity of one of which is varied by the movement of the article to the folding means and the capacity of the other of which is varied as the article is passed beyond the folding means, means for combining the voltages generated by said oscillators when the capacities of said circuits are at a predetermined value, an ignition controlled discharge tube having an anode plate, a cathode and a grid, means for applying the combined voltages generated by said oscillators to the grid of said tube, whereby discharge of said tube occurs, and means responsive to the discharge of said tube for operating the folding mechanism.

6. A folding machine comprising article conveying means, an article folding means, a control circuit including an ignition controlled discharge tube having a plate, a grid and a cathode, means for supplying current to the plate of said tube, two radio frequency oscillators, the capacity of one of which is varied as the end of the article moves toward the folding means and the capacity of the other of which varies as the forward end of the article moves beyond the folding means, means for combining the voltages generated by said oscillators, means for amplifying the voltage and applying the amplified voltage to the grid of said discharge tube, and means responsive to the discharge of said tube for operating the folding means.

7. A folding machine comprising an article conveying means, article folding means, a control circuit including an ignition controlled discharge tube having a plate, a grid and a cathode, two radio frequency oscillators, the capacity of one of which is varied by the movement of the forward end of the article to the folding means and the capacity of the other of which is varied by the movement of the article beyond the folding means, means for combining the oscillating voltages generated by said oscillators at a predetermined time after the forward end of the article has been moved past the folding means, means for amplifying the voltage and applying the amplified voltage to the grid of said discharge tube, and means responsive to the discharge of said tube for operating the folding mechanism.

8. A folding machine comprising article conveying means, article folding means, a control circuit including an ignition controlled discharge tube having a plate, a grid and a cathode, two radio frequency oscillators, one of which has an adjustable capacitance and a capacitance which varies as the article moves towards the folding mechanism and the other of which has a fixed capacitance and a capacitance which varies as the article moves beyond the folding means, said radio frequency oscillators being connected together and one of said oscillators being

provided with means for combining the oscillating voltages of both oscillators and converting the combined voltage into a voltage having intermediate frequency oscillations, means for applying current to the plate of said discharge tube, means for amplifying the converted oscillating voltage and applying it to the grid of the discharge tube, thereby causing a discharge of said tube, and means responsive to the discharge of said tube for actuating the folding mechanism.

9. A folding machine comprising an article conveying means, article folding means, an ignition controlled discharge tube having a plate, a grid and a cathode, two radio frequency oscillators, means responsive to the movement of the article upon said conveying means for varying the capacity of both of said oscillators, an adjustable condenser associated with one of said oscillators, and a fixed condenser associated with the other oscillator, means for connecting said oscillators together, means associated with one of said oscillators for combining the oscillating voltages generated by both oscillators and converting them into an intermediate frequency voltage, means for amplifying said voltage, and means for applying the amplified voltage to the grid of said discharge tube, thereby causing a discharge of said tube, and means responsive to the discharge of said tube for actuating the folding means, the time at which the folding means is actuated being determined by the relative capacitance of the two oscillators.

10. A folding machine comprising an article conveying means, article folding means, a control circuit including an ignition controlled discharge tube having a plate, a grid and a cathode, means for applying current to the plate of said discharge tube, two radio frequency oscillators, the capacity of each of which is varied by an article being conveyed through the machine, a low pass filter connecting the two oscillators, one of said oscillators being capable of generating an oscillating voltage and combining it with the voltage of the other oscillator to produce an intermediate frequency voltage, means for amplifying the intermediate frequency voltage, means for applying the amplified voltage to the grid of said discharge tube whereby said tube is discharged, and means responsive to the discharge of said tube for actuating the folding mechanism.

11. A folding mechanism comprising an article conveying means, article folding means, a control circuit including an ignition controlled discharge tube having a plate, a grid and a cathode, means for supplying current to said plate, two radio frequency oscillating circuits, one of said oscillating circuits including a pentagrid convertor and an adjustable condenser and the other circuit including a fixed condenser, means for varying the capacity of both oscillating circuits when the article passes through the folding means, means including a low pass filter for connecting the oscillating circuits whereby oscillating voltage from both oscillators is combined and converted into an intermediate oscillating voltage, means for amplifying the converted voltage, and means for applying the amplified voltage to the grid of the discharge tube, whereby said tube is discharged, and means responsive to the discharge of said tube for actuating the folding mechanism, the time at which the folding means is actuated being determined by the capacity of the adjustable condenser.