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TIMING APPARATUS FOR USE WITH PHOTOGRAPHIC EQUIPMENT

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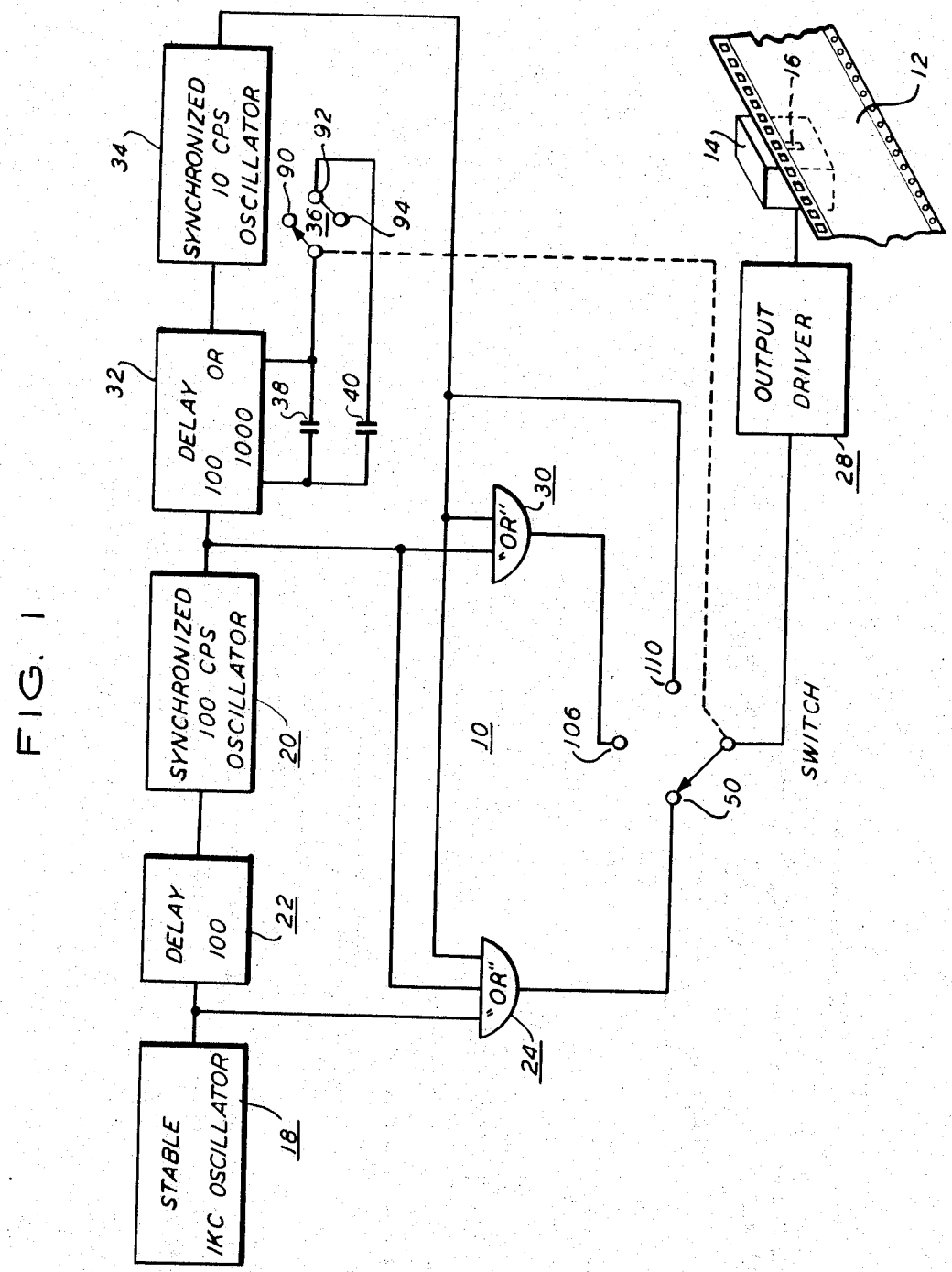


FIG. 1

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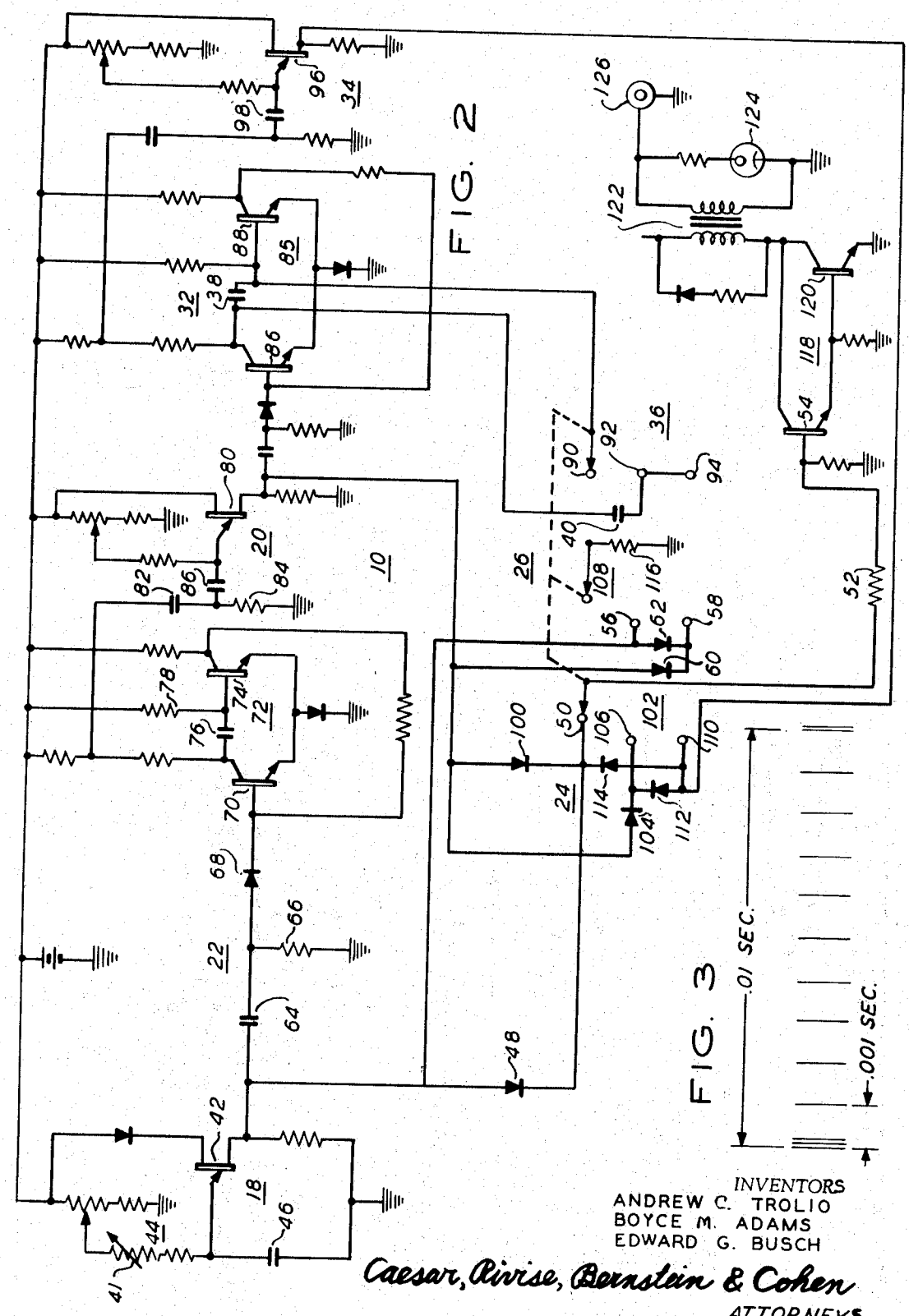


FIG. 2

FIG. 3

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TIMING APPARATUS FOR USE WITH PHOTOGRAPHIC EQUIPMENT

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In general, this invention relates to a new and improved timing apparatus and method for utilization with photographic equipment. More particularly, it relates to the utilization of a timing generator to mark film length in a manner whereby the elapsed time of events recorded on the film may be accurately determined.

In typical correlation studies of film it is necessary to determine the elapsed time from a given reference point. In the past, this has been achieved by placing a mark at spaced intervals along the length of the film adjacent the edge thereof. However, where thousands of marks on one film-run are involved, correlation can be an extremely tedious task.

Thus, the present invention is directed to a method of marking film along the length thereof which will substantially ease the correlation process and, further, is directed to a new and novel apparatus for performing the method.

Thus, it is the general object of this invention to provide a new and better apparatus for marking photographic film along the length thereof with an indication of the elapsed time on the film from a given reference point.

Another object of this invention is a provision of a new and better method for marking photographic film along the length thereof which will enable a person performing the correlation process to simply and easily determine the elapsed time on film relative to a given reference point.

A further object of this inevntion is a provision of a new and better timing generator for producing accurately spaced pulses with suitable additional pulses to indicate every tenth and every one hundredth pulse without affecting the spacing of the single pulses.

Other objects will appear hereinafter.

For the purpose of illustrating the invention, there is shown in the drawings a form which is presently preferred; it being understood, however that this invention is not limited to the precise arrangements and instrumentalities shown.

FIG. 1 is a schematic showing of the apparatus of the present invention.

FIG. 2 is a schematic circuit diagram for the timing pulse generator of FIG. 1.

FIG. 3 is a graph showing the operation of the circuit of FIGS. 1 and 2.

In FIG. 1, there is shown a timing pulse generator generally designated by the numeral **10** which is operative for utilization with a unique technique to reduce the human counting error as well as to alleviate the tedium in measuring the time on a film-run from a known reference point.

That is, unexposed motion picture film **12** is normally marked along one edge thereof by a neon bulb assembly **14** which places a line mark along the edge of the film **12** by reason of the slot type mask face **16** in the neon bulb assembly **14**. In typical correlation studies of films, the standard timing marks (basic frequencies of 10, 100, and 1000 pulses per second) must be counted from a known reference point. Where thousands of marks on one film-run are involved, the time correlation, it will be understood, can be extremely tedious.

The timing pulse generator **10** of the present invention

is intended to generate a double pulse every tenth mark and a triple pulse every one hundredth mark so that the elapsed time between any two points can be counted by units of 10 and 100.

In FIG. 1, there is shown a basic one kilocycle oscillator **18** which is the source of one kilocycle timing pulses. This oscillator indirectly "locks" a 100 cycle per second oscillator **20** through a 100 microsecond delay circuit **22**. The one kilocycle oscillator **18** is also connected to an OR circuit **24**. The OR circuit **24** is connected through one terminal **50** of a switch **26** to an output driver circuit **28**. The output driver circuit **28** is operatively connected to drive the neon bulb assembly **14**. Accordingly, it can be seen that with the pointer for the switch **26** on the terminal **50**, the output pulses from one kilocycle oscillator **18** are operatively supplied directly to the neon bulb assembly **14**.

The one hundred cycle per second oscillator **20** is also connected to the input of the OR circuit **24** as well as to a second OR circuit **30**. The second OR circuit **30** is connected to the one hundred cycle per second terminal **106** of the switch **26**.

Additionally, the one hundred cycle per second oscillator **20** is further connected to a second delay circuit **32** whose output signal drives a ten cycle per second oscillator **34**. The delay circuit **32** has a switch **36** connected thereto which is operative to change the time constant of the delay circuit **32** to vary the time delay thereof. That is, when the switch **36** is in the one kilocycle position of terminal **90** as shown in FIG. 1, only capacitor **38** controls the delay circuit **32** and accordingly, the delay circuit **32** has a time delay of 100 microseconds, similar to the delay circuit **22**. However, when the switch **36** is in the one hundred cycle per second or ten cycle per second positions, i.e. terminals **92** and **94** respectively, a second capacitor **40** is placed in parallel circuit relations with the capacitor **38** changing the delay or circuit 32 to 1000 microseconds.

The ten cycle per second oscillator **34** is connected to the OR circuits **24** and **30** as well as to the ten cycle per second terminal **110** of switch **26**. Switch **26** is mechanically coupled to switch **36** so that the respective contactors of the switches can be connected to their respective one kilocycle, one hundred per second, and ten cycle per second terminals.

The operation of the apparatus of FIG. 1 is as follows:

The stable one kilocycle oscillator **18** initially feeds a pulse through OR circuit **24**, switch **26**, and output driver **28** to the neon bulb **14** to expose the unexposed photographic film **12** along a line determined by the mask slot **16**. This would be the first pulse shown in FIG. 3. One hundred microseconds later, the one hundred cycle per second oscillator **20** transmits a pulse through the OR circuit **24**, switch **26**, and output driver **28** to the neon bulb **14** to produce a second line on the film **12** spaced, in time, 100 microseconds from the first line. Still another 100 microseconds thereafter, the synchronized ten cycle per second oscillator **34** will be energized through the delay circuit **32** to provide a third pulse transmitted through the OR circuit **24**, switch **26**, and output driver **28** to the neon bulb **14**. These are the first three pulses shown in FIG. 3. Then, the one kilocycle oscillator **18** will provide a pulse spaced in time .001 second from the first pulse. This will continue until 10 pulses have been supplied by the one kilocycle oscillator **18**. Then, after the tenth pulse the second pulse from the 100 cycle per second oscillator **20** will be transmitted (with a suitable 100 microseconds delay) to the OR circuit **24**.

Accordingly, every one thousandth of a second the oscillator **18** will provide a pulse which will be recorded on the film **12**. Every one hundredth of a second, or every 10 pulses from the oscillator **18** there will be provided a double pulse achieved by the two oscillators **18** and **20**.

Every 100 pulses from the oscillator **18**, three pulses will be provided, one for the oscillator **18**, one for the oscillator **20**, and one for the oscillator **34**. The oscillator **20** is indirectly locked to the oscillator **18** by reason of the delay circuit **22** and the oscillator **34** is indirectly locked to the oscillator **20** by the delay circuit **32**.

When the switches **26** and **36** have their contactors positioned on the one hundred cycle per second terminals **106** and **92** respectively, only the output signals from oscillators **20** and **34** are supplied to the output driver **28**. Thus, the one hundred cycle per second marks would be combined with delayed ten cycle per second marks to form double pulses every tenth one hundred cycle mark. To resolve the double mark more readily at the slow mark rate, the ten cycle per second delay circuit **32** is operative to delay the signal 1000 microseconds rather than the 100 microseconds provided when the switches were in the one kilocycle position.

It will be understood that in utilizing the teaching of the present invention one would operate the timing pulse generator **10** to produce the marks on the film **12**, which, after development, could be easily timed and correlated by merely checking the number of three pulse groupings from a given reference point and, then, checking the number of two pulse groupings to get the ten digit and, finally, the number of single pulses past the last two pulse grouping to determine the exact position on the film. This is far simpler than counting single pulses along the length of the film as has been required by prior art devices.

In FIG. 2, the circuit diagram for the timing pulse generator **10** of FIG. 1 is shown in detail. That is, the timing pulse generator **10** includes the stable one kilocycle oscillator **18** which includes a unijunction transistor **42** placed in a relaxation oscillator circuit, whose frequency is determined by resistors **41** and **44** and capacitor **46**. This stable oscillator **18** produces positive pulses on the first base spaced in time by .001 second. Positive pulses are taken off the first base of unijunction transistor **42** and supplied through a diode **48** to the one kilocycle terminal **50** of a first section **102** of gang switch **26**. Terminal **50** is connected through a resistor **52** to the base circuit of a transistor amplifier **54**. The first base of unijunction transistor **42** is further connected to two opened terminals **56** and **58** (the latter through diodes **60** and **62**) of switch **26**. Still further, the first base of unijunction transistor **42** transmits its output pulses to the time delay circuit **22** which circuit includes an initial shaping circuit formed of capacitor **64** and resistor **66**, which circuit shapes the input positive pulses and transmits them through a diode **68** to the base of a first transistor **70** forming part of the one-shot multivibrator circuit **72** which acts as the delay circuit **32**. The one-shot multivibrator **72** includes transistors **70** and **74** and has its time constant determined by capacitor **76** and resistor **78**. As was discussed previously, the capacitor **76** and the resistor **78** are set to provide a 100 microsecond delay in transmission of the pulse from the first base of output **42** to the 100 cycle per second oscillator circuit **20**. The oscillator **20** includes a unijunction transistor **80** arranged to operate in an unsynchronized manner at a frequency a fraction of a percent slower than 100 cycles per second. However, the synchronizing pulses from the output of transistor **70** forces it to run slightly faster. These synchronizing pulses are fed to the firing terminal of unijunction transistor **80** through a capacitor **82** and resistor **84** into the principal timing capacitor **86**. Every tenth synchronizing pulse from the one-shot multivibrator circuit **72** causes an output pulse from the one hundred cycle per second oscillator **20**.

The time delay circuit **32** comprises a second one-shot multivibrator **85** including transistors **86** and **88** and timing capacitor **38**. The second timing capacitor **40** is placed in the circuit by the switch **26**. As shown, the capacitor **40** is not in the circuit when the contactor is on the one kilocycle terminal **90**, but is placed in paralleled circuit relation when the contactor is connected to the one hundred cycle per second or ten cycle per second terminals **92** and **94**. The one-shot multivibrator **84** drives the ten cycle per second oscillator **96** through the timing capacitor **98**.

One hundred cycle per second oscillator **20** is connected through diode **100** to the terminal **50** of switch bank **102**; through diode **104** to one hundred kilocycle terminal **106** of which bank **102**; and through diode **60** to the ten cycle per second terminal **58** of a second bank of switches **108** forming part of the switch **26**.

The output of the ten cycle per second oscillator **34** is connected to the ten cycle per second terminal **110** of the switch bank **102**. Further, terminal **110** is connected to terminal **106** by way of a forwardly biased diode **112**. Similarly, ten cycle per second terminal **110** is connected to the one kilocycle terminal **50** by way of a forwardly biased diode **114**.

It can thus be seen that the diodes **48**, **100**, and **114** in combination with the switch **102** from the OR circuit **24**. That is, pulses from the oscillator **18** are fed through diode **48** to terminal **50**; pulses from oscillator **20** are fed through diode **100** to terminal **50**; and pulses from oscillator **34** are fed through diode **114** to the terminal **50**. When switch **102** is changed to close the circuit to 100 kilocycle terminal **106**, the OR circuit **30** is achieved in that the output of oscillator **18** is grounded through terminal **56** of switch **108** and its associated grounding resistor **116**. However, the output of oscillator **20** is fed through diode **104** to terminal **106** and, further, the output of oscillator **34** is supplied to the terminal **106** through diode **112**. It should be noted that diode **62** prevents the grounding of oscillator **20**. When the switch **26** is connected merely to the ten cycle per second terminals **110**, **58** and **94**, the oscillators **18** and **20** will not supply signals to the output driver circuit, but rather will transmit their output signals through the grounding resistor **116**.

However, the output of oscillator **34** will be supplied to the output driver circuit. The output driver circuit consists of amplifier **118** which includes transistors **54** and **120** with an output transformer **122** in the collector circuit of transistor **120**. An indicator lamp **124** is placed across the output terminals of transformer **122** so as to indicate to the user that the apparatus **10** is operative. The output of the transformer **122** is supplied to terminal **126** which is adapted to be connected to the neon bulb **14**.

It can thus be seen that the output driver circuit **118** will supply pulses from the oscillators in accordance with the position of the switch **26** in accordance with the teachings of the present invention.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed as the invention is:

1. Timing apparatus comprising a first source of constant frequency pulse signals, a second source of constant frequency pulse signals synchronized with said first source, said second frequency being an aliquot part of said first frequency, output means for receiving the output signals of said first and second sources and providing an output signal in accordance therewith, first delay means for delaying the output pulse signals from second source for a period less than the period between pulse signals from said first source so that said signals from said first and said second source are spaced in time, and film marking means for marking a moving photographic film each time an output signal is generated by said output means so that the marks on said film are never overlapping.

2. The timing apparatus of claim **1** wherein said marking means is a neon bulb and an adjacent mask positioned whereby light from said neon bulb can expose a small portion of photographic film through said mask.

3. Timing apparatus comprising a first source of constant frequency pulse signals, a second source of constant frequency pulse signals synchronized with said first source, said second frequency being an aliquot part of said first frequency, a third source of constant frequency pulse signals synchronized with said first source, said third frequency being an aliquot part of said second frequency, output means for receiving the output signals of said first, second and third sources and providing an output signal in accordance therewith, first delay means for delaying the output pulse signals from said second source for a period less than the period between pulse signals from said first source, a second delay means for delaying the application of said third source to said output means by a period greater than the delay period of said first delay means and less than the period between pulse signals from said first source and film marking means for marking a moving photographic film in accordance with the output signal from said output means.

4. The timing apparatus of claim 3 wherein the ratio of the frequency of the first source to the frequency of the second source is equal to the ratio of the frequency of the second source to the frequency of the third source.

5. The timing apparatus of claim 4 including switching means, said switching means being operative to disconnect one of said first source and said first and second sources from said output means whereby said marking means may be supplied with signals only from said second and third or said third source of pulse signals.

6. The timing apparatus of claim 5 including means for varying the time delay of said second delay means in accordance with the operation of said switching means.

7. The timing apparatus of claim 3 wherein said first delay means is connected between the output of said first source and the input to said second source and said second delay means is connected between the output of said second source and the input of said third source.

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