May 3, 1949. H. P. ROGANTI 2,468,781

CAMERA CONTROL FOR BOMBARDMENT AIRCRAFT

Filed Aug. 14, 1946 3 Sheets-Sheet 1

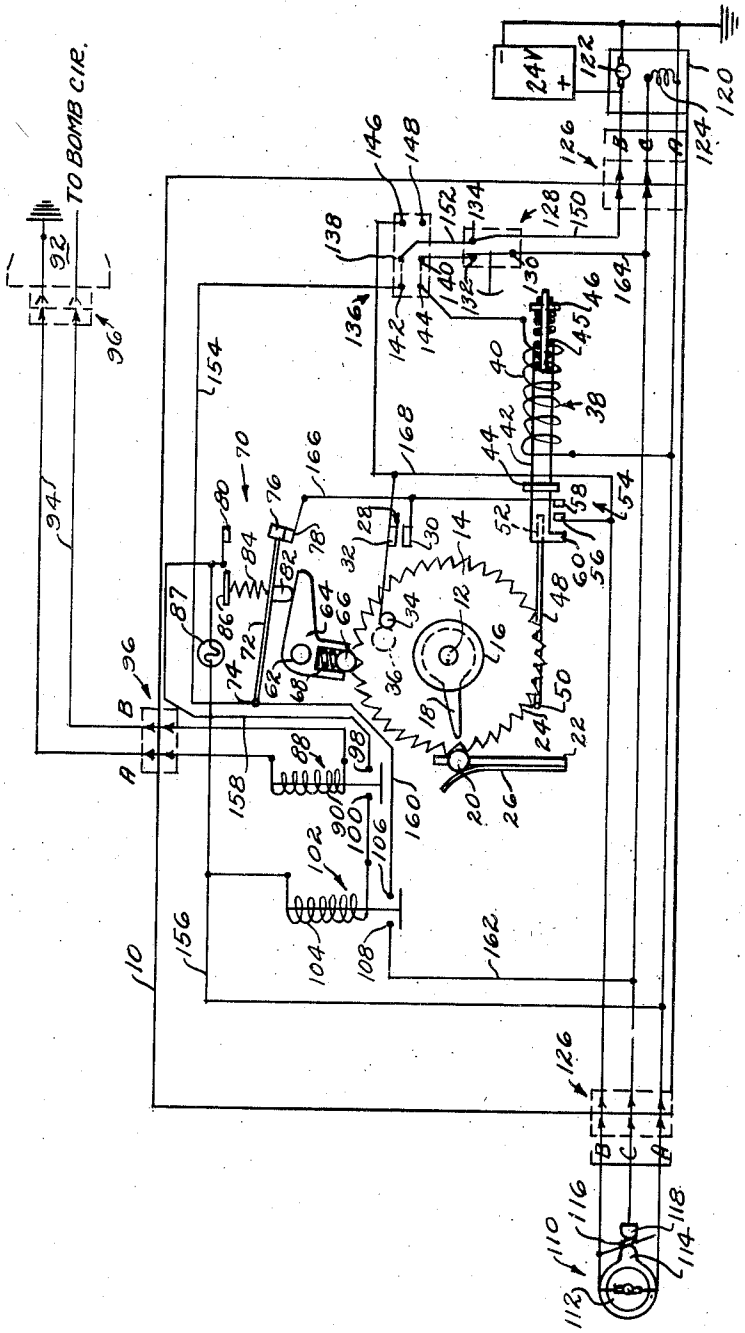


FIG. 1.

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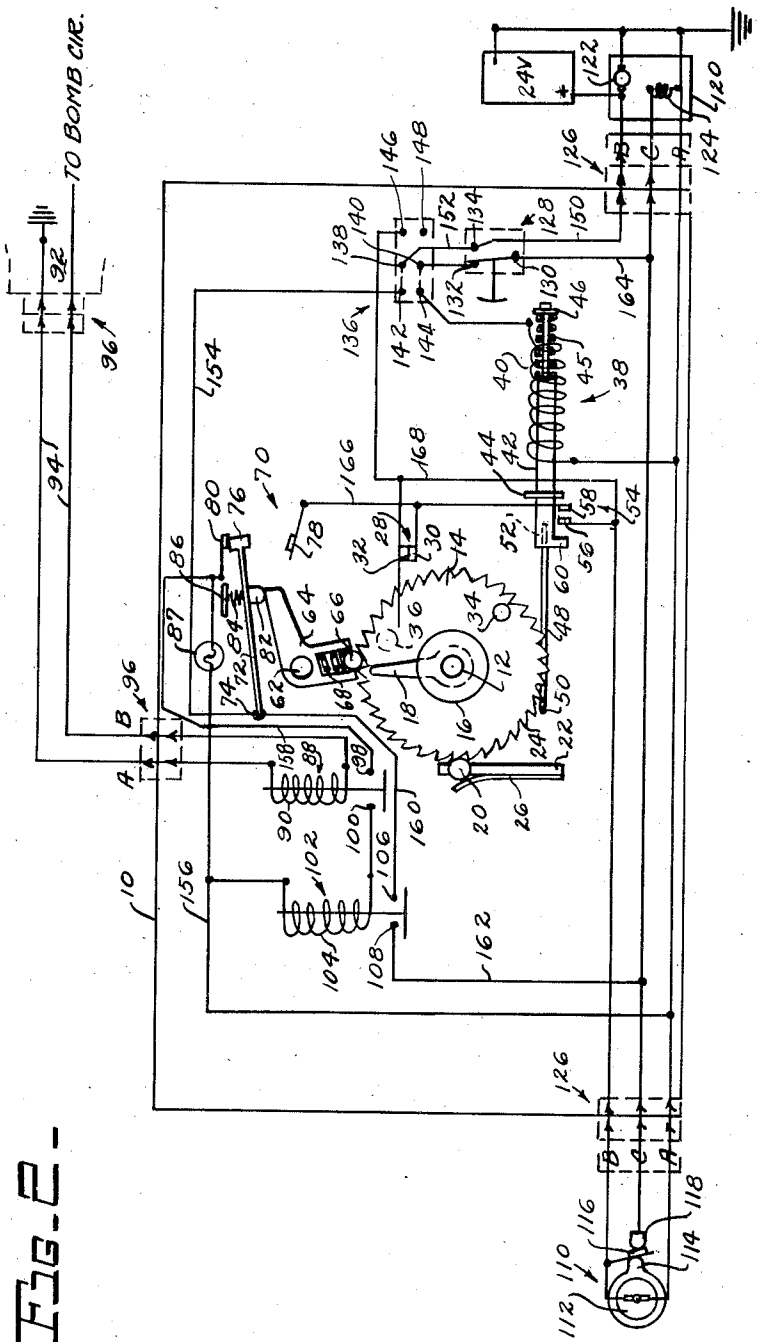


FIG. 2.

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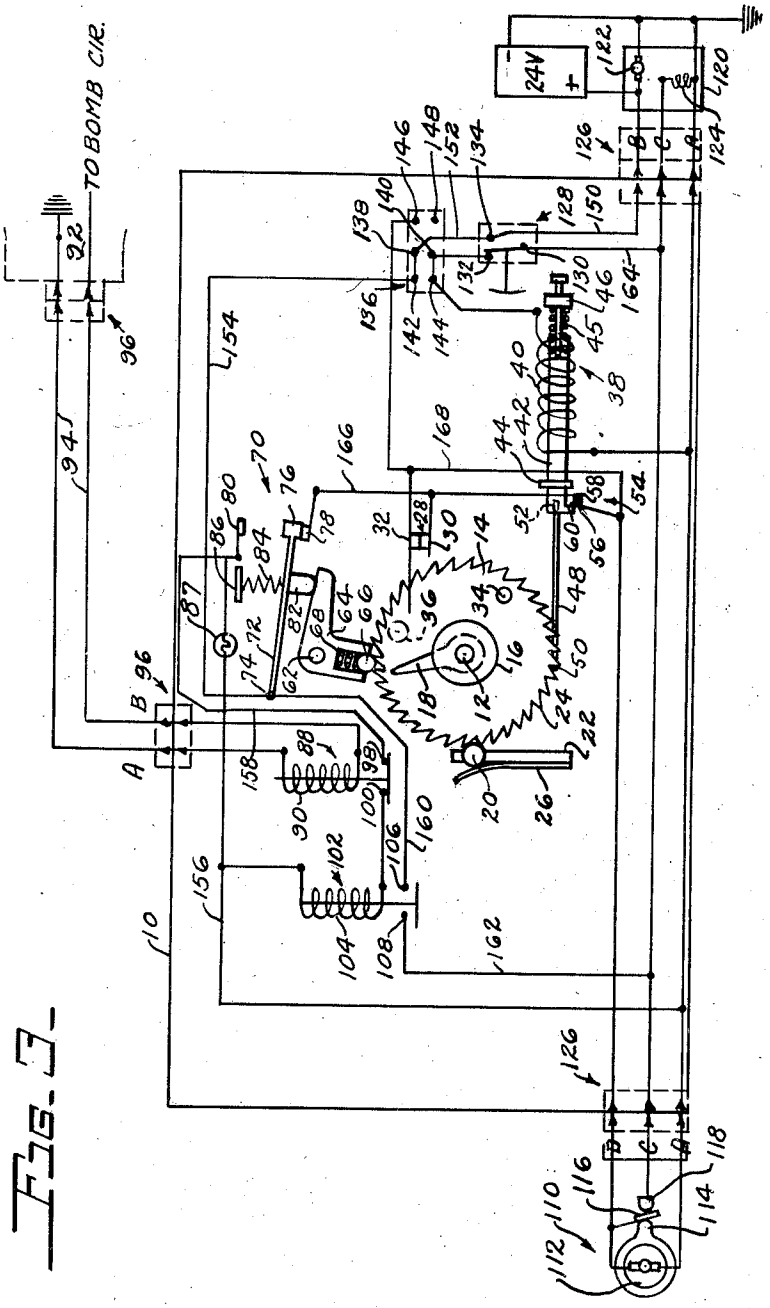


FIG. 3

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UNITED STATES PATENT OFFICE

2,468,781

CAMERA CONTROL FOR BOMBARDMENT AIRCRAFT

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Application August 14, 1946, Serial No. 690,431

8 Claims. (Cl. 161—1)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes without payment to me of any royalty thereon.

This invention relates to automatic control of aerial cameras and is particularly applicable to bombardment aircraft.

As is well known, it is customary in bombing operations to make a camera strip comprising a series of photographic exposures spaced over a period covering at least the duration of bomb releases, and since the desired interval between bomb releases seldom coincides with the desired interval between camera exposures, separate intervalometers are employed, one to automatically space the bomb releases and another to automatically space the camera exposures, but while the intervalometers do their spacing automatically after they are set off, they are usually manually initiated and they must be manually stopped when the desired number of exposures is reached.

A disadvantage in the above arrangement is that at the very moment that the bombardier should give most attention to initiating bomb release, he is required to initiate his camera strip also.

It is therefore an object of this invention to provide a device which will automatically initiate the taking of the camera strip at the instant of the first bomb release.

Another object is to provide a mechanism which, once the camera strip is initiated, will count the exposures and stop when a selected number of exposures has been effected.

Another object is to provide an arrangement wherein the selected spacing of the exposures on the camera strip and their number will be entirely independent of the spacing and number of bomb releases.

Another object is to provide a mechanism which will receive only the first impulse of the bomb release series, convert it into an initial exposure impulse of sufficient duration to operate any standard camera, simultaneously transfer control to the photographic intervalometer, and maintain power to the intervalometer and camera until the selected number of exposures has been completed.

Another object is to completely disassociate the initiating circuit from the camera circuit in order to prevent any possibility of feed-back into the bomb release circuit through any malfunctioning in the photographic equipment.

Other objects and advantages will be evident from a consideration of the following description

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when taken in conjunction with the drawings, wherein,

Fig. 1 is a schematic representation showing the condition of the mechanism just after it has completed one operation and before it is readied for the next.

Fig. 2 is a schematic representation showing the device conditioned for bomb release initiation of a camera strip of a selected number of exposures.

Fig. 3 is a schematic representation showing the mechanism as it appears after the first bomb release impulse has effectuated a camera operating impulse of sufficient duration to trip the camera for the first exposure of the strip and the device is ready to accomplish the next of the selected series of camera exposures.

Like reference characters refer to like parts throughout the several views.

Rotatable in bearings in the frame **10** is a shaft **12** to which a ratchet wheel **14**, a turning knob **16** and a pointer **18** are securely fastened to rotate in unison. A detent ball **20** freely contained in a pocket in a bracket **22** is lightly pressed into the spaces between the teeth **24** of the ratchet by a spring **26** thereby to yieldably hold the ratchet in any position to which it may be turned. The bracket **22** is fixed to the frame **10**. A dial (not shown) having graduations and indicia corresponding to the number of teeth in the ratchet **14**, with the zero line of the graduation passing through the center of the ball **20**, may be inscribed on the front cover of the frame **10**. The front cover which carries the dial is adapted to lie between the pointer **18** and ratchet **14** but in the schematic views has been removed for clearness.

A switch **28** carried on the frame **10** has one fixed contact **30** and a movable contact **32**, the switch being adapted to be opened as shown in Fig. 1 or closed as shown in Figs. 2 and 3 depending on the position of the switch operating pin **34**. The switch operating pin **34** (see Fig. 1), extends forwardly from the ratchet to open the switch when the ratchet is turned anticlockwise, and extends rearwardly from the ratchet to stop rotation of the ratchet when the operating pin **34** encounters the stop pin **36**. The stop pin **36** is fixed in the frame **10**. It limits the rotation of the ratchet wheel in either direction to slightly less than one turn and insures that the ratchet wheel will be stopped from anticlockwise rotation with the switch **28** open.

The ratchet operating solenoid **38** comprises a solenoid coil **40** and core **42**, the core being slidable axially in bearings **44** and **46** which are fixed

to the frame 10. A length of spring wire 48 is bent back on itself at 50 to form a hairpin contour, the wires at the open ends of the hairpin being fastened in the end of the solenoid core as at 52. The ratchet wheel 14 lies between the legs of the hairpin, whereby the closed end 50 will normally clear the tops of the ratchet teeth as in Figs. 1 and 2 but will engage and move the teeth when the core 42 is moved left as in Fig. 3. A spring 45 is provided for returning the solenoid coil 42 to its leftwise or home position.

A switch 54 comprises a contact 56 and a contact 58 both yieldably supported on the frame 10. A lug 60 depends from the solenoid core 42 and is operative when the core moves to the right as in Fig. 3, to press the contacts 56 and 58 together as there shown.

Pivoted on the frame 10 by the pivot pin 62 is a bellcrank 64. The lower leg of the bellcrank is drilled out for the ball 66 and spring 68. The position of the pivot pin 62 with respect to the ball 66 is such that in turning the ratchet wheel 14 clockwise an amount equal to one tooth 24, the bellcrank will have shifted from the position shown in Fig. 1 to the position shown in Fig. 2. After the first tooth any further clockwise turning of the ratchet wheel will not alter the position of the bellcrank from the position shown in Fig. 2.

A switch 70 has a movable contact arm 72 pivoted on the frame 10 at 74. The arm 72 carries a movable contact 76 at the free end which is operable one direction into engagement with the stationary contact 80. A lug 82 on the bottom of the contact arm 72 rests on the lateral leg of the bellcrank 64. A spring 84 is interposed between a lug 86 on the frame 10 and the contact arm 72 to urge the contact arm to its lower position as seen in Fig. 1. A signal light 87 burns when the contact 76 closes onto the contact 80 to complete an electrical circuit.

A relay 88 carried on the frame 10 has its coil 90 connected to the bomb release circuit 92 by means of standard cable 94 and plug and receptacle assemblies 96, whereby energization of the coil 90 closes the relay by electrically joining the contacts 98 and 100. A second relay 102 carried on the frame 10 has a coil 104 which, when energized, electrically connects the contacts 106 and 108. This second relay has incorporated therein a time delay feature which, when the coil 104 is fully energized and the relay 102 is thereby closed, it will remain closed for approximately one quarter second, during which the electromagnet 38 will make its first attract stroke at the completion of which the switch 70 is opened, the light 87 extinguished and the coil 104 deenergized. The electrical resistance of the coil 104 must therefore be carefully determined in order that it may be sufficiently energized before the switch 70 separates its contact 76 from its contact 80.

A standard intervalometer 110 comprises a motor 112 which drives a cam 114 which in turn opens and closes a contact 116 onto the terminal lug 118, whereby a pulsating current may be delivered to the conductor line C. Manual means (not shown) are a part of the intervalometer for selecting the interval which will elapse between successive contacts.

A standard aerial camera 120 includes a rewind motor 122 adapted to be connected across the A and B conductors to receive a steady current. The mechanism for stopping the motor 122 whenever the camera is fully rewound is not shown since it forms no part of the present invention.

Within the camera an electromagnetic means 124 is connected across the A and C lines to receive the pulsations from the intervalometer 110 for operating the camera shutter at the selected intervals. Standard plug and receptacle assemblies 126 connect the A, B, and C lines of the intervalometer to the A, B, and C lines of the control unit and the A, B, and C lines of the control unit to the A, B, and C lines of the camera.

A push button switch 128 normally connects switch terminals 130 to 132 but when manually actuated will connect terminals 130 to 134, whereby extra exposures may be manually effectuated. A double pole, double throw switch 136 normally connects terminals 138 and 140 to 142 and 144, respectively, but when thrown over will connect 138 and 140 to 146 and 148, respectively. The terminal 142 is the positive terminal and is connected through one side of the switch 136, conductor 152, terminal 134 and conductor 150 to the B line. Terminal 142 is the source of a steady current. The terminal 144 is also positive, being connected through the other side of the switch 136 and through the terminals 132, 130 and conductor 164 to the C line. Terminal 144 is the source of a pulsating current, the current being rendered intermittent by operation of the intervalometer switch 116—118.

The operation of the device is as follows:

Let it be assumed that the device is in the state shown in Fig. 1, that is, before it has been readied for initiation of the camera strip by effectuation of the first bomb release.

In order to put the device in the readied state shown in Fig. 2, the knob 16 which carries the pointer 18 and ratchet 14 should be turned clockwise to the number on the dial corresponding to the desired number of exposures, which, for illustrative purposes in the instant case, is nine. It is noted, however, that turning the ratchet clockwise a single notch will close the switch 28 and operate the switch 70 so as to engage its contact 76 with its contact 80 all as shown in Fig. 2. The effect of setting the switch 70 with the contacts 76 and 80 engaged, is to complete an electrical circuit between the positive steady current source 142 through a signal light 87 and to the ground which circuit includes conductor 154, arm 72, contacts 76 and 80, bulb 87 and conductor 156. A connection to a positive steady current through the same conductors is also made to the contact 98. The lighting of the bulb 87 indicates that the device is readied for operation. The operation henceforth will be automatic and its initiation requires only that a single impulse come from the bomb circuit by way of the conductors 94 to energize the coil 90 of the initiating relay 88, when the bomb circuit is pulsed to release the first bomb.

When the coil 90 is thus energized upon release of the first bomb, the relay 88 connects the terminals 98 and 100, whereby a circuit is completed from the source of steady positive current supply 142 through conductive elements 154, 74, 72, 76, 80, 158, 98, 100, 104, 156 and A to ground. This causes relay 102 to bridge the contacts 106 and 108 whereby a circuit is completed which is independent of the switch 70 and extends from the source 142 through conductive elements 154, 160, 106, 108, 162 to C. From C a pulsating circuit extends through conductive elements 164, 130, 132, 140, 144, 40 to A, whereby solenoid coil 40 is pulsed to operate the ratchet 14,

and a parallel pulsating circuit extends through the shutter operating solenoid 124 to ground.

Energization of the coil 40 moves the core 42 rightwise, turning the ratchet 14 through a single notch, which, acting through the bellcrank 64, resets the switch 70 to the lower position as seen in Fig. 3. It is here noted that while the time delay relay 102 is shown open in both Figs. 2 and 3, this relay must be closed and must remain closed for substantially one quarter second in order to furnish an impulse of proper duration suitable for operation of standard aerial cameras. This closure will also allow the solenoid 38 to make the first attract stroke, which turns the ratchet one tooth anticlockwise and resets the switch 70 from the state seen in Fig. 2 to the state seen in Fig. 3, whereby circuits which are independent of the initiating relay 88 or the time delay relay 102 are completed, one circuit extending from the source 142 through conductive elements 154, 74, 72, 76, 78, 166, 30, 32, 168 to B, then through intervalometer motor 112 to A and to ground, another from B through intervalometer pulsating switch 116—118 to pulsating line C, then through conductive elements 164, 130, 132, 144 and through coil 40 to A and to ground, and another through camera shutter operating solenoid 124 to ground.

In Fig. 3, therefore, which shows the first rightwise or attract stroke of the solenoid core 42 completed, there is a steady current flowing through the intervalometer motor 110 from B to A, a pulsating current through the ratchet operating solenoid coil 40 from C to A and to ground, and a pulsating current through the camera shutter operating solenoid 124 from C to A and to ground. It follows that each additional pulsation will turn the ratchet wheel one tooth anticlockwise until nine teeth are moved, the last rightwise movement of the solenoid core 42 serving to cause the pin 34 to place the switch 28 back to the open position seen in Fig. 1. The spring 45 will return the core 52 to the leftwise or home position at the end of the last impulse, in which position the closed end 50 of the hairpin shaped wire 48 will clear the tops of the ratchet teeth as seen in Figs. 1 and 2 so that thereafter the ratchet may be manually turned clockwise to reset it for subsequent operations. However, it is preferable that current will be maintained at the terminals of the intervalometer 112 until it has completed an impulse of normal duration for operation of the camera. The switch 54 is therefore provided and arranged in parallel with the switch 28, whereby it is assured that the current will be maintained at the intervalometer terminals until coil 40 is deenergized by the cessation of the intervalometer impulse causing core 42 to resume its leftwise position shown in Fig. 1. The switch 54 is an added precaution to prevent premature cessation of the last impulse from the intervalometer in order that the last exposure may be effectuated by all types of aerial cameras.

The switch 136 may be employed to bypass the device when desired, to deenergize the unit and the intervalometer, or to set the device for automatic operation as shown. The push button switch 130—132 may be used to manually control the camera regardless of the setting of the unit.

The device has many advantages.

As an accessory to standard intervalometers used in connection with standard cameras, the herein described control unit makes it possible to automatically effect a photographic exposure at the exact instant of the first bomb release and simultaneously initiate the taking of a photographic strip containing any preselected number of exposures taken at any preselected interval.

The operation of the device is independent of the duration, the frequency or the number of impulses delivered by the bomb-release interval-control of the aircraft regardless of the setting or mode of electrical bomb release. It accepts only the first impulse of the bomb release series, converts it into an initial exposure impulse of sufficient duration to properly execute the first exposure of any standard camera, simultaneously transfers control to the photographic intervalometer, and maintains power to the camera and intervalometer until the preselected number of exposures have been completed.

Electrical isolation of the initiating circuit by an initiating relay prevents any possibility of feed-back into the bomb circuit through any malfunctioning of the photographic equipment.

Having described an embodiment of my invention, I claim:

1. A device for use on bombardment aircraft of the type having a pulsating electrical circuit for intermittently releasing its bombs, which consists of a camera, an intervalometer for providing a pulsating current for operating the shutter of the camera, and a starting, counting and stopping mechanism for automatically controlling the taking of the camera strip, which comprises a toothed counter manually movable away from a home position, a selected number of teeth corresponding to the desired number of exposures, a switch opening means carried by said counter, a single switch mechanism held open by said switch opening means in the home position of said counter but adapted to be closed upon movement of said counter one tooth away from the home position, a double contact switch element, a first contact upon which said element is normally closed, a second contact, means operable by a one tooth movement of said counter away from its home position to close said element onto the said second contact, an electromagnetic device comprising means operable by the pulsating current of said intervalometer to return said counter one tooth per impulse back toward the home position, an initiating relay adapted to be closed by the first of the series of bomb releasing pulsations of the bomb circuit, a time delay relay adapted to be closed when energized through the closing of the initiating relay, a signal light bulb, a power source, conductive means operative when said counter is moved one or more teeth from the home position to electrically connect said source, through said element, said second contact and said bulb to the ground, conductive means operative when a first bomb release energizes and closes the initiating relay and thereby closes the time delay relay, to complete a circuit through the time delay relay and the electromagnetic device to thereby move said counter back toward its home position one tooth and coincidentally move said double contact switch element back into engagement with said first contact, thereby completing a circuit from said power source through said double contact switch element, said first contact, said single switch, through said intervalometer motor to ground, and through said intervalometer current interrupter, through the electromagnetic means and the camera shutter operating electromagnet in parallel, and to ground, whereby said electromagnetic device is intermittently energized by the pulsating circuit

of said intervalometer until said counter is returned to the home position and said single switch thereby opened.

2. In a device adapted to be initiated by the first of a series of pulsations from the bomb release circuit of a military aircraft for automatically controlling the number of exposures of an aerial camera, said camera having an intervalometer with current interrupter and a shutter operating electromagnet, the combination of a toothed counting ratchet manually rotatable away from a home position, a selected number of teeth corresponding to the desired number of exposures, a switch opening means carried by said ratchet, a single switch mechanism held open by said switch opening means in the home position of said ratchet but adapted to close upon movement of said ratchet one tooth away from the home position, a double contact switch element, a first contact upon which said element is normally closed, a second contact, means operable by a one tooth movement of said ratchet away from its home position to close said element onto the said second contact, an electromagnetic device comprising means operable by a pulsating current to return said ratchet one tooth per impulse back toward the home position, an initiating relay, adapted to be closed by the first of a series of bomb releasing impulses in a bomb circuit, a time delay adapted to close when energized through the closing of the initiating relay, a signal light bulb, a power source, conductive means operative when said ratchet is moved one or more teeth from the home position to electrically connect said source through said element, said second contact and said bulb to a ground, conductive means operative when a first bomb release energizes and closes the initiating relay and thereby closes the time delay relay, to complete a circuit through the time delay and the electromagnetic device to thereby move said ratchet back toward its home position one tooth and coincidentally move said double contact switch element back into engagement with said first contact, thereby to complete a circuit from said power source through said double contact switch element, said first contact, said single switch, through said intervalometer motor to ground, and through said intervalometer current interrupter through the electromagnetic means and the camera shutter operating electromagnet in parallel and to ground, whereby said electromagnetic device is intermittently energized by the pulsating circuit of said intervalometer until said ratchet is returned to the home position and said single switch thereby opened.

3. In a device for association with a bomb release circuit of an aircraft for automatically controlling an aerial camera having an intervalometer to provide a pulsating current, the combination of a ratchet manually rotatable away from a home position a selected number of teeth, a switch mechanism operated by said ratchet when in the home position but operable to be closed by movement of said ratchet one tooth away from the home position, a double contact switch element normally closed onto a first contact but operable by a one tooth movement of said ratchet away from its home position to close onto a second contact, an electromagnetic device operable by the pulsating current of said intervalometer to return said ratchet one tooth per impulse back to the home position, an initiating relay, adapted to be closed by the first of a series of bomb releasing impulses in the bomb circuit, a time delay relay adapted to close when energized through

the closing of the initiating relay, a signal light bulb, a power source, conductive means operative, when said ratchet is moved one or more teeth from the home position to electrically connect said source through said element, said second contact and said bulb to a ground, conductive means operative when a first bomb release energizes and closes the initiating relay and thereby closes the time delay relay to complete a circuit through the time delay relay and the electromagnetic device to thereby move said ratchet back toward its home position one tooth and coincidentally move said double contact switch back into engagement with said first contact thereby to complete a circuit from said power source through said double contact switch element, said first contact, said single switch, through said intervalometer motor to ground, and through said intervalometer pulsator through the electromagnetic means and the camera shutter operating magnet in parallel and to ground, whereby said electromagnetic device is intermittently energized by the pulsating circuit of said intervalometer until said ratchet is returned to the home position and said single switch thereby opened.

4. In a device adapted for association with a bomb release circuit of an aircraft for automatically controlling an aerial camera having an intervalometer, the combination of a toothed member manually movable away from a home position a selected number of teeth, a single contact switch mechanism opened by said toothed member in its home position but operable to be closed by movement of said toothed member one tooth away from the home position, a double throw switch normally closed in a first position but operable by a one tooth movement of said toothed member away from its home position to close said double throw switch in a second position, an electromagnetic device operable by a pulsating current to return said toothed member one tooth per impulse back to the home position, an initiating relay, adapted to be closed by the first of a series of bomb releasing impulses in the bomb circuit, a time delay relay adapted to close when energized through the closing of the initiating relay, a signal light bulb, a power source, conductive means operative when said toothed member is moved one tooth from the home position to electrically connect said source through the second position of said double throw switch and said bulb to a ground, conductive means operative when a first bomb release energizes and closes the initiating relay and thereby closes the time delay relay, to complete a circuit through the time delay relay and the electromagnetic device to thereby move said toothed member back toward its home position one tooth and coincidentally change said double throw switch back to its first position thereby to complete a circuit from said power source through the first position of said double throw switch, through said intervalometer motor to ground, and through said intervalometer pulsator through the electromagnetic means and the camera shutter operating magnet in parallel and to ground, whereby said electromagnetic device is intermittently energized by the pulsating circuit of said intervalometer until said toothed member is returned to the home position and said single contact switch thereby opened.

5. The structure defined in claim 4 with a second single contact switch in parallel with the first single contact switch, said second single contact switch being closed by the attract stroke of

the electromagnetic device which opens the first said single contact switch.

6. For use on a military aircraft having pulsating means to release a series of bombs and a camera having a pulsating intervalometer adapted to make a strip comprising a series of exposures, an accessory in the form of a starting, counting and stopping device for the camera which comprises, in combination, a ratchet wheel having a home position, manual means for turning said ratchet wheel a selected number of teeth corresponding to the desired number of exposures away from the home position, pulsation operated electromagnetic means for returning said ratchet wheel one tooth at a time to the home position, means responsive to the first pulsation of a series of bomb releases to operate said electromagnetic means to return said ratchet the first of the series of teeth toward the home position, switch means operative by the said first tooth return movement to connect said electromagnet to the pulsating intervalometer circuit, and means operative by the last tooth return movement to disconnect said electromagnet from the pulsating intervalometer circuit.

7. In a device adapted by connection to a bomb release circuit for controlling the making of a series of exposures with an aerial camera having a pulsating circuit for operating an electrically pulsated shutter, which comprises a toothed counter having a home position, manual means for moving said toothed counter a selected number of teeth corresponding to the desired number of exposures away from the home position, an electromagnet adapted by connection to the shutter pulsating circuit to return said counter one tooth at a time to the home position, a power source, a relay adapted to close upon receipt of a pulse of current from the first of a series of bomb releases and complete a circuit from the power source to the electromagnet to move said counter one tooth toward the home position, and means operable by said counter movement to break the first said circuit and make a second circuit from the power source through the intervalometer to the electromagnet to intermittently pulse said electromagnet and thereby return said counter to the home position.

8. In a device for bombardment aircraft having a pulsating bomb release circuit, said device comprising an aerial camera, an intervalometer for operating said camera at selected intervals, a counter adapted to be manually set to stop said intervalometer after the selected number of intervals has elapsed, electromagnetic means for operating said counter, switch means closable by operation of the first pulsation in the bomb release circuit to cause said electromagnetic means to operate said counter through the first interval, switch means closable by operation of said counter through the first interval to cause said electromagnet to maintain operation of said counter through succeeding intervals, and switch means to prevent energization of said electromagnet to stop said counter when the selected number of intervals has elapsed.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,342,509	Gaty et al.	Feb. 22, 1944
2,347,481	Hooven	Apr. 25, 1944
2,396,197	Peterson	Mar. 5, 1946