United States Patent

[11] 3,583,841

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[73] Assignee **Eastman Kodak Company**
Rochester, N.Y.

[54] **MEANS FOR DETERMINING THE CONDITION OF PERCUSSIVELY IGNITABLE FLASHBULBS**
8 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** 431/13, 431/93
[51] **Int. Cl.** **F21k 5/02**
[50] **Field of Search** ..... 431/92—97

[56] **References Cited**

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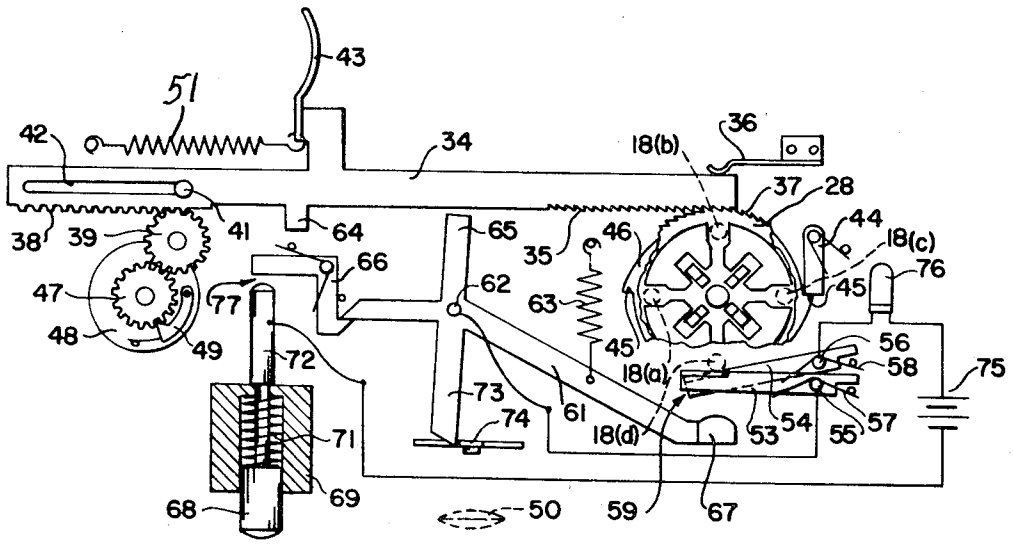
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Primary Examiner—Edward J. Michael
Attorneys—Robert W. Hampton and Leonard W. Treash, Jr.

ABSTRACT: The metallic ignition member of a percussively ignitable flashbulb is coated with an insulating material which melts, burns, vaporizes or becomes conductive under the influence of the heat produced when the flashbulb is ignited. A pair of spaced electrical contact members are adapted to engage the coated ignition member to provide a switch in series with a signal lamp or the like. If the bulb has not been fired, the contact members are insulated from the metallic ignition member by the coating material so that the switch remains in an open condition. After the bulb is fired, the fingers are shorted by the metallic ignition member to close the switch and thereby energize the signal lamp.



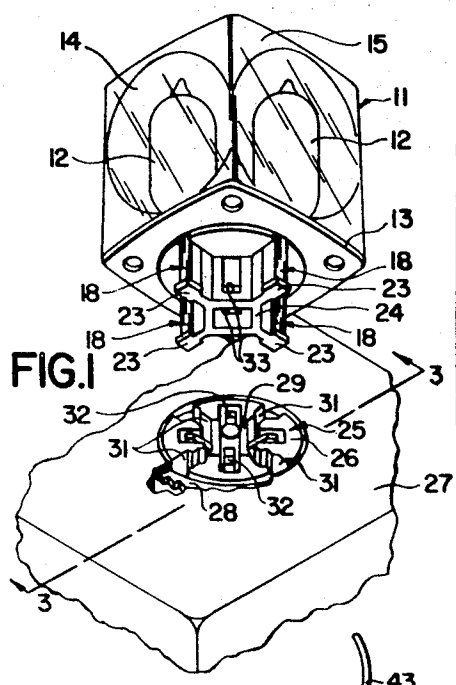


FIG.1

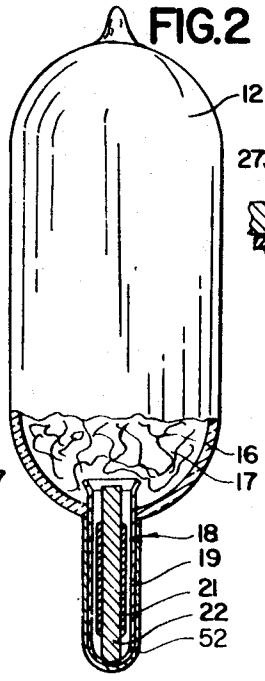


FIG.2

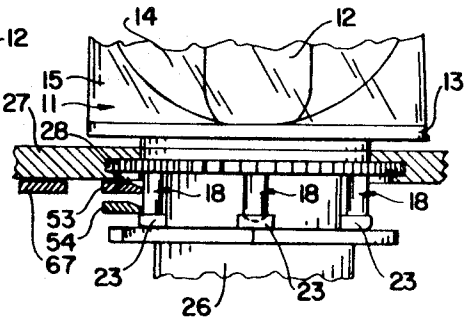


FIG.3

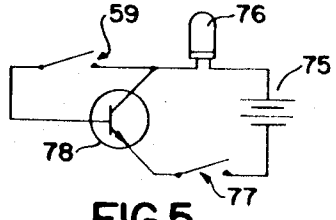


FIG.5

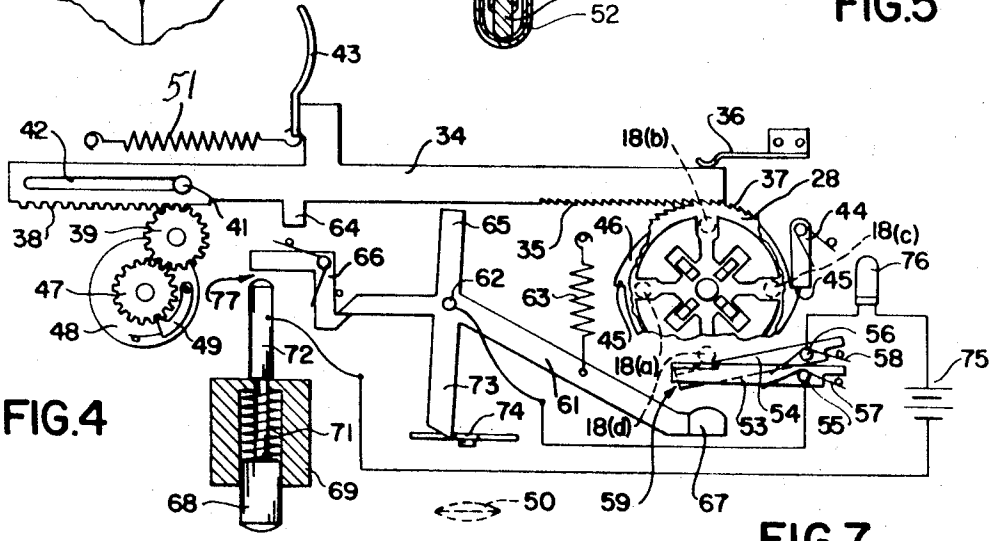


FIG.4

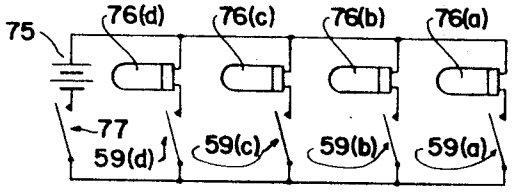


FIG.6

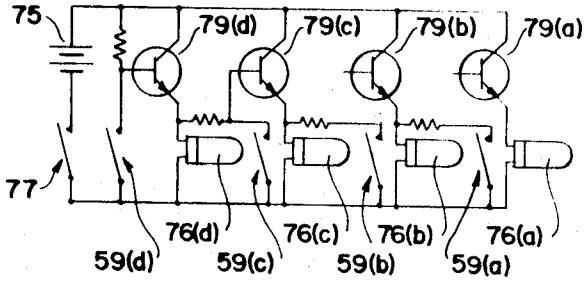


FIG.7

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MEANS FOR DETERMINING THE CONDITION OF PERCUSSIVELY IGNITABLE FLASHBULBS

REFERENCE TO RELATED APPLICATIONS

Reference is made to my cofiled application, Ser. No. 803,779 entitled PERCUSSIVELY IGNITABLE FLASHBULBS HAVING MEANS FOR DETERMINING THE CONDITION THEREOF.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to flash photography and more particularly to means for detecting the condition of percussively ignitable flashbulbs.

2. Description of the Prior Art

A recent improvement in flash photography has been the development of flashbulbs adapted to be ignited by percussion means rather than by electrical energy, thereby avoiding the need for providing relatively high amperage batteries or other electrical energy sources and eliminating the previously troublesome problem of malfunctioning attributable to poor electrical contact with the flashbulb terminals. Briefly, such a percussively ignitable flashbulb is provided with an ignition member comprising a metallic tube or the like containing a material responsive to deformation by a percussive blow. This material is adapted to ignite fine zirconium wire or other illumination producing material within the envelope of the bulb, thus producing the desired scene illumination.

As in the case of conventional electrically ignited flashbulbs, a plurality of such percussively ignitable bulbs can be combined in a so-called "flashcube" of the same general type disclosed in U.S. Pat. No. 3,327,105 issued to F. Kottler on June 20, 1967. A camera adapted to accommodate such flashcubes can be provided with a socket member which rotates through successive angular increments in response to operation of another mechanism in the camera, for example, the film winding mechanism, thereby bringing each of the bulbs, in turn, into an operative position at which it will illuminate the scene to be photographed. A striker member is adapted to strike the ignition member of the operatively positioned bulb of the flashcube in predetermined timed relation to operation of the camera shutter, thus providing the desired illumination of the photographed scene. A representative example of such a percussively ignitable flashcube and of a camera adapted to utilize the same is disclosed in U.S. Pat. application Ser. No. 765,930 entitled MULTILAMP UNIT, filed in the name of D. E. Beach on Oct. 8, 1968.

A common and very frustrating problem often encountered by photographers occurs when an attempt is made to take a flash illuminated photograph using a flashbulb that was previously fired. When a plurality of flashbulbs are incorporated in a flashcube, the likelihood of this occurrence is increased due to the fact that the photographer must remember not just whether a single bulb has been fired, but rather how many of the originally available bulbs have already been used.

To avoid the problem described above, it is well known to provide a camera or flashgun with an electrical signal circuit which determines whether the ignition filament of a particular flashbulb is still operative by temporarily connecting the two ignition terminals of that bulb with a source of electric current of insufficient amperage to ignite the flashbulb. Typically, a small indicator lamp is incorporated in the signal circuit and is adapted to provide visible illumination in the camera viewfinder if the flashbulb being tested is usable, as established by the electrical conductivity between its ignition terminals. This type of bulb testing arrangement is inapplicable to most percussively ignitable flashbulbs.

In one type of percussively ignitable flashcube, the ignition member of each flashbulb therein is adapted to be struck by a corresponding impact member permanently incorporated in the flashcube when that particular member is released from a prestressed cocked condition established during the initial assembly of the flashcube. Accordingly, as disclosed in U.S. Pat.

application, Ser. No. 767,145 entitled CONTROL AND SIGNAL MECHANISM FOR USE WITH PERCUSSION-IGNITABLE PHOTOFLASH LAMPS, filed in the name of Edwin L. Sturm on Oct. 14, 1968, the condition of each bulb in such a flashcube can be detected by means of a probe or the like which senses whether the corresponding impact member is in its cocked or released position. However, if a single impact member is incorporated in the camera or flashgun and is adapted to strike the ignition member of each successive bulb of a flashcube, it will be apparent that the above-described type of sensing device cannot be employed.

Another arrangement for detecting the condition of percussively ignitable flashbulbs which are fired in succession by the same impact member provided within a camera is disclosed in copending U.S. Pat. application, Ser. No. 767,102 entitled INDICATOR FOR USE IN PHOTOGRAPHIC APPARATUS TO AUTOMATICALLY SENSE A FLASH LAMP CONDITION, filed in the name of Donald M. Harvey on Oct. 14, 1968. In accordance with that disclosure, such a camera is provided with a mechanical sensing member that determines the condition of a flashbulb by detecting whether its ignition member has been bent out of its original position by a previous blow from the impact member. In order to function reliably, however, such a device requires the impact member to deform each ignition member significantly more than normally would be necessary to achieve bulb ignition.

SUMMARY OF THE INVENTION

As disclosed in my cofiled U.S. Pat. application, Ser. No. 803,779 entitled PERCUSSIVELY IGNITABLE FLASHBULBS HAVING MEANS FOR DETERMINING THE CONDITION THEREOF the conductive ignition member of a percussively ignitable flashbulb is coated with an insulating material which melts, burns, vaporizes or becomes electrically conductive under the influence of the heat to which the coating is subjected when that bulb is ignited. In accordance with this invention, a pair of spaced electrical contact fingers associated with the flashbulb or flashcube socket of a camera or flashgun are adapted to engage the ignition member of the flashbulb in question to provide a switch in series with an incandescent signal lamp or the like. If the bulb has not been fired, the fingers are insulated from the conductive ignition member by the coating material so that the switch is in an open condition. After the bulb has been fired, the fingers are shorted to close the switch and thereby energize the signal lamp. In accordance with various alternate embodiments of the invention, the same general type of bulb condition sensing arrangement can be adapted to identify the number and location of previously used flashbulbs carried by the socket member, to indicate that the next bulb in sequence has been previously fired, to disclose how many previously unfired bulbs remain available in uninterrupted sequence, or to make appropriate adjustments of an exposure control mechanism.

While the present invention requires a battery or other source of electrical energy, it should be recognized that the desirability of using percussively ignitable flashbulbs is not limited to cameras entirely devoid of such electrical energy sources. In other words, even though a camera may be provided with a battery or the like to supply electrical energy for an exposure control system, a low light indicator system, and/or the present type of bulb condition indicator, it nevertheless may be advantageous to employ percussively ignitable flashbulbs or flashcubes to improve the reliability of bulb ignition, to reduce the energy capacity of the required battery and also to enable flash illumination to be employed even if the power source becomes weak or dead.

Various means for practicing the invention and other advantages and novel features thereof will be apparent from the following detailed description of illustrative preferred embodiments of the invention, reference being made to the accompanying drawings in which like reference numerals refer to like elements.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 is a perspective view of a portion of a camera comprising a rotatable flashcube socket and of a flashcube according to the present invention in position for loading into the camera socket;

FIG. 2 is a partially cross-sectioned elevational view of a percussively ignitable flashbulb, the ignition member of which is provided with a heat sensitive insulating coating in accordance with the present invention;

FIG. 3 is a partially cross-sectioned view taken along line 3–3 of FIG. 1 showing the depicted flashcube socket with a flashcube located therein;

FIG. 4 is a schematic plan view of the operative elements of the camera shown in FIG. 1, including a flashbulb condition indicating system in accordance with the present invention;

FIG. 5 is a schematic diagram of a transistorized version of the circuit comprising the flashbulb condition indicating system shown in FIG. 4;

FIG. 6 is a schematic circuit diagram of an alternate embodiment of the invention adapted to indicate which bulbs of a particular flashcube are still in operative condition; and

FIG. 7 is a schematic circuit diagram of still another embodiment of the invention adapted to indicate the number of operative flashbulbs in a flashcube which are still available for use in uninterrupted sequence.

DESCRIPTION OF THE ILLUSTRATIVE PREFERRED EMBODIMENT

Referring to FIG. 1, a flashcube 11 of the type with which the present invention can be employed advantageously will be seen to comprise four flashbulbs 12 mounted on a base member 13. A reflector member 14 provides a concave reflecting surface behind each respective flashbulb, all of which are enclosed in a transparent housing 15 attached to the base member.

As shown in FIG. 2, each flashbulb 12 includes a glass envelope 16 which is partially filled with fine zirconium wire 17 or some other material adapted to provide illumination when it is ignited. At its base, each bulb includes an ignition member 18 comprising a hollow metallic ignition tube 19 which is closed at its bottom end and open into the lamp envelope at its top end. In FIG. 2, the size of the ignition tube is exaggerated relative to the size of the bulb envelope for purposes of clarity. A percussion sensitve primer material 21, is coated on an anvil pin 22 centered within tube 19 and is exploded or activated whenever the ignition tube is locally pinched against the anvil by a sudden impact. When this occurs, the burning primer material is thrown upwardly into the glass envelope and thereby effects ignition of the illumination producing material 17.

The ignition members of the respective flashbulbs extend downwardly through the base member 13 of the flashcube and are supported at their lower ends by ears 23 extending outwardly from a depending central retaining post 24, formed integrally with the base member. The flashcube socket 25 comprises socket member 26 which is rotatably supported in the top wall 27 of the camera housing by a toothed peripheral flange 28. Socket member 26 is provided with a central opening 29 adapted to receive the flashcube retaining post 24 and with lateral slots 31 which accommodate the respective flashbulb ignition members and their corresponding supporting ears. Latch members 32 incorporated in the socket member are adapted to engage openings 33 in the retaining post to releasably hold the flashcube in its loaded position. As seen in FIG. 3, the ignition members 18 of the flashcube bulbs are thus laterally accessible within the camera housing.

As is well known in the prior art, the flashcube socket member 26 is rotatable through successive 90° increments to bring each flashbulb thereof, in turn, into a forwardly facing position in which it can illuminate the scene to be viewed. A representative mechanism for effecting such incremental rotation of the flashcube is shown in FIG. 4 as comprising a slidable rack member 34 provided with a plurality of ratchetlike teeth 35 adapted to mesh under the influence of a light spring 36 with corresponding teeth 37 on the peripheral socket flange 28. At its opposite end, rack member 34 is provided with gear teeth 38 which are retained in mesh with rotatable pinion 39 by pin 41 extending through elongate slot 42 in the rack member.

Prior to each exposure, the camera operator manually slides operating handle 43 toward the right as viewed in FIG. 4 to the position determined by the engagement of pin 41 with the opposite end of slot 42. During the resulting movement of the rack member, ratchet teeth 35 remain in engagement with socket flange teeth 37. Accordingly, the socket member is rotated in a clockwise direction through somewhat more than 90° as spring loaded latch dog 44 rides past one of the four shoulders 45 of a second flange 46 surrounding the socket member below the flashcube ears 23. Concurrently, the clockwise rotation of pinion 39 imparts counterclockwise rotation to pinion 47. A disc member 48 is rotatably supported below pinion 47 in coaxial relation thereto and is provided with a spring loaded unidirectionally operable pawl 49 which engages pinion 47 below pinion 39 so that the disc member is also driven in a counterclockwise direction. The disc member is coupled to a rotatable frictionally retarded film takeup core, not shown, and rotates the latter so that the camera film is wound thereon to move a fresh exposure area into alignment with the camera's lens system represented at numeral 50.

When the operator releases handle 43, the rack member is returned to its former position by spring 51 but the accompanying clockwise rotation of pinion 47 does not affect the film takeup core due to the unidirectional coupling provided between that pinion and disc member by pawl 49. Simultaneously, the engagement between rack teeth 35 and and the teeth 37 of socket member flange 28 causes the socket member to rotate in a counterclockwise direction until latch dog 44 engages the adjacent shoulder 45 of the second socket member flange 46. Thereafter, rack bar teeth 35 slide past flange teeth 37 by deflecting the rack bar rearwardly in opposition to spring 36.

From the foregoing, it will be apparent that each complete reciprocation of lever 43 advances the camera film and also causes the flashcube to be rotated through a 90° clockwise angle, whereby each ignition member of the flashcube, in turn, successively assumes each of the positions shown at numerals 18 (*a*) through 18(*d*) in FIG. 4.

As best shown in FIG. 2, the metallic ignition tube of each flashcube bulb according to the present invention is initially insulated by a coating 52 of an electrically nonconductive material which loses its insulating effectiveness under the influence of the heat to which it is subjected when that bulb is fired. For example, an insulating coating comprising a thin layer of a plastic material, such as low melting point polyethylene, melts as a result of firing the bulb. Alternatively, however, the coating could be formed of any of a large variety of other materials which would likewise produce the same result under the influence of such heat, either through the destruction of the physical integrity of the coating resulting from melting, charring, burning or vaporizing thereof or by virtue of heat induced chemical changes which would render the coating itself conductive.

Within the camera housing, a pair of spaced contact members 53 and 54 are pivotally supported adjacent the socket member by respective pivot studs 55 and 56 and are biased by corresponding light springs 57 and 58 into lateral engagement with the ignition tube of the operatively positioned flashcube bulb, i.e., the ignition tube shown at 18(*d*) in FIG. 4. In the illustrated embodiment of the invention, the contact members are simply cammed outwardly by the flashcube ears 23 as the flashcube is installed in or removed from the socket, but it should be apparent that other means could be employed to retract the contact members temporarily during those operations.

When the flashbulb engaged by the contact members has not been fired, its ignition tube coating **52** insulates those contact members from the metallic ignition tube and thereby from one another. If the bulb has been fired, however, the two contact members are electrically shorted by the metallic ignition tube. Accordingly, it will be seen that the two contact members comprise a switch, designated by numeral **59**, which is in an open condition whenever a previously unfired bulb is facing the viewed scene and in a closed condition whenever that bulb has been fired.

A striker member **61** is pivotally supported by a pin **62** and is biased in a counterclockwise direction by a relatively heavy spring **63**. Each film advancing movement of rack member **34** causes ear **64** thereof to engage arm **65** of the striker member and to rotate the latter to its depicted position, where it is latched by latch member **66** with its striking head **67** aligned with but spaced from the upper contact member **53**. Pushbutton **68** is slidably supported by a stationary guide block **69** and is urged outwardly by a light coil spring **71** so that its inner head portion **72** is spaced slightly from latch member **66**. To effect a photograph, the operator pushes pushbutton **68** rearwardly so that its head portion **72** contacts the latch member and rocks the latter out of a latching engagement with the striker member. When this occurs, the striker member rotates rapidly in a counterclockwise direction under the influence of spring **63** so that striking head **67** hits the upper contact member and drives it forcibly into the side of the ignition tube of the forwardly facing bulb to effect ignition thereof. Concurrently, arm **73** of the striker member strikes the upwardly projecting ear **74** of a conventional pivotally mounted impact-type shutter blade to effect exposure of the film in predetermined timed relation to the ignition of the flashbulb.

The bulb condition indicating circuit includes a battery **75** which is connected in series with an indicator lamp **76**, through switch **59** comprising contact members **53** and **54**, and also through another switch **77** defined by the metallic pushbutton **68**, the metallic latch member **66** and the metallic striker member **61**. When the operator begins to depress the pushbutton, the initial engagement of pushbutton head **72** with latch member **66** closes switch **77** so that lamp **76** will be illuminated if switch **59** is also closed. Therefore, if a previously unused flashbulb is operatively positioned in the socket, the indicator lamp will remain unlit due to the open condition of switch **59**. However, if the flashbulb has been fired, the resulting closed condition of switch **59** will cause the indicator lamp to be illuminated so that the operator is alerted to discontinue depressing the pushbutton if he wishes to make a flash illuminated photograph. As is well known in similar camera indicator systems, lamp **76** preferably is mounted so that its illumination is visible in the camera viewfinder. The same circuit, of course, can also serve to adjust an automatic exposure control system or the like in accordance with the presence or absence of an operative flashbulb in firing position in the flashcube socket.

Rather than providing a warning system to indicate whether the forwardly facing flashbulb is operative, it may be preferable to alert the operator if the next bulb in sequence has already been fired, thereby giving him greater opportunity to replace the flashcube. This can be accomplished by the same circuit shown in FIG. **3** simply by relocating contact members **53** and **54** to engage the bulb ignition member located at the position designated by numeral **18**(*c*), in which case striking head **67** would be modified to deliver its blow directly to the ignition tube of the operatively positioned flashbulb.

In order to ensure that the indicator light will be illuminated even if only rather poor contact is made between the two contact members by the ignition tube of a previously fired bulb, the circuit shown in FIG. **4** can be modified as shown in FIG. **5** to include a transistor **78** which serves to amplify the current passing through switch **59**.

Rather than detecting the condition only of a flashcube bulb located at one particular position in the socket, the invention also contemplates providing contact members similar to members **53** and **54** adjacent each of the flashcube ignition members to establish separate switches **59**(*a*) through **59**(*d*) operated by the bulb ignition members at the corresponding locations **18**(*a*) through **18**(*d*). It will be apparent that this circuit can likewise employ transistor amplifier means in the same manner depicted in FIG. **5**.

As shown in FIG. **6**, switches **59**(*a*) through **59**(*d*) can be located in series with respective indicator lamps **76**(*a*) through **76**(*d*) in a parallel circuit so that the closing of switch **77** will cause the indicator lamps to show the locations of all of the previously unfired flashcube bulbs. Alternatively, by locating switches **59**(*a*) through **59**(*d*), as shown in FIG. **7**, in conjunction with respective transistors **79**(*a*) through **79**(*d*), the number of lamps illuminated upon the initial depression of pushbutton **68** will be indicative of the number of unfired flashcube bulbs still available in uninterrupted sequence.

The invention has been described in detail with particular reference to illustrative preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described hereinbefore and as defined in the appended claims.

I claim:

1. A photographic apparatus having socket means for receiving a percussively ignitable flashbulb, said flashbulb including an ignition member comprising a metallic member provided initially with a layer of insulating material adapted to lose its insulating effectiveness under the influence of the heat to which said material is subjected when said flashbulb is fired, said apparatus comprising:

a. percussion means for firing a flashbulb received in said socket means,

b. a source of electrical energy,

c. an electrically energizable device,

d. a switch defined by a pair of spaced contact members adapted to engage the ignition member of said flashbulb received in said socket, said contact members being insulated from one another by said insulating material before said flashbulb is fired to maintain said switch in an open condition and being shorted by said metallic member after said bulb is fired to close said switch, and

e. circuit means connecting said electrically energizable device with said source of electrical energy through said switch to energize said device upon closure of said switch.

2. An apparatus according to claim **1** in which said electrically energizable device comprises a signal lamp.

3. An apparatus according to claim **1** in which said socket means include:

means to receive a plurality of said flashbulbs; and

means to move said flashbulbs intermittently along a predetermined path to locate successive ones thereof at different preestablished positions, said pair of contact members being engageable with the ignition member of the one of said flashbulbs located at a predetermined one of said positions.

4. An apparatus according to claim **3** in which said pair of contact members is engageable with the ignition member of that flashbulb received by said socket means and located at the one of said positions which comprises a firing position.

5. An apparatus according to claim **3** in which said pair of contact members is engageable with the ignition member of that flashbulb received by said socket means and located at the preestablished position immediately preceding the one of said positions which comprises a bulb firing position.

6. An apparatus according to claim **3** including a plurality of pairs of said contact members defining a corresponding plurality of said switches, each of said pairs of contact members being engageable with the ignition member of a flashbulb located at a corresponding one of said preestablished positions, said apparatus including a plurality of said electrically energizable devices respectively connectable with said source of electrical energy through corresponding ones of said switches.

7. For use with a flash unit of the type having:

a plurality of percussively ignitable flashbulbs, and

a conductive member corresponding to each flashbulb coated with an insulating material which loses its insulating effectiveness under the influence of heat when its corresponding flashbulb is fired, an apparatus comprising:

means for receiving said unit with a flashbulb positioned for firing,

means for actuating percussive firing of said positioned bulb,

means for reclining a source of electrical energy,

electrical contact means for receiving one of the conductive members of said unit and connecting at least a portion of its normally insulating material in a series circuit with said source of electrical energy, and

means for detecting current in said circuit upon loss of the insulating effectiveness of said insulative material subsequent to firing of said positioned bulb.

8. A photographic apparatus for use with a flashbulb unit having a metallic member provided initially with a layer of insulating material adapted to lose its insulating effectiveness under the influence of heat generated when said flashbulb is fired, said apparatus comprising:

means for receiving a flashbulb unit;

means for receiving a source of electrical energy;

a switch defined by a pair of spaced contact members adapted to engage said metallic member of a flashbulb unit received in said socket, said contact members being insulatable from one another by said insulating material before said flashbulb is fired to maintain said switch in an open condition and being shortable by said metallic member after said bulb is fired to close said switch;

an electrically energizable device; and

circuit means for connecting said electrically energizable device with said means for receiving a source of electrical energy through said switch.