United States Patent [19]

Brandt

[11] **3,748,985**

[45] **July 31, 1973**

[54] **PHOTOFLASH APPARATUS**

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[73] Assignee: **Polaroid Corporation,** Cambridge, Mass.

[22] Filed: **June 8, 1972**

[21] Appl. No.: **260,916**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 204,844, Dec. 6, 1971, abandoned.

[52] **U.S. Cl.** ..... **95/11 R,** 95/11 L, 240/2 C

[51] **Int. Cl.** **G03b 19/02**

[58] **Field of Search** ..... 95/11 L, 11 R, 11.5 R; 240/1.3, 2 C; 339/17 L, 17 LM, 17 D, 17 CF, 176 MP

[56] **References Cited**

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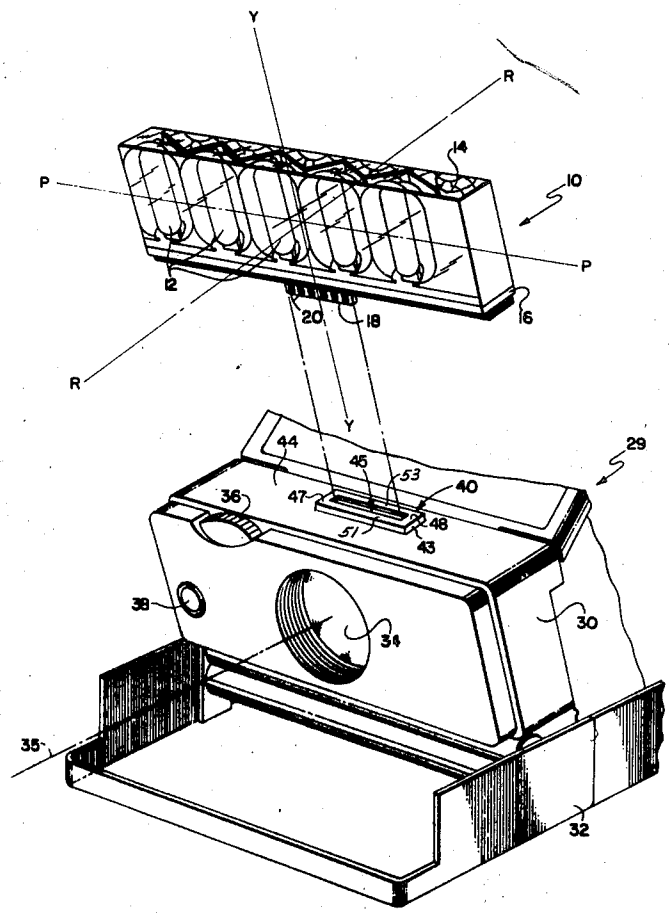
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Primary Examiner—Samuel S. Matthews
Assistant Examiner—Kenneth C. Hutchison
Attorney—Alfred E. Corrigan

[57] **ABSTRACT**

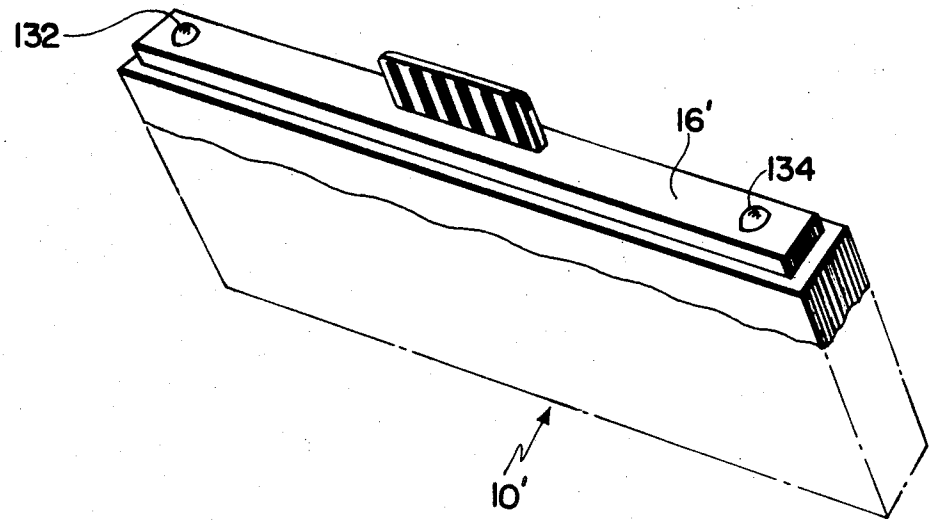
An extremely shallow flash socket assembly for use in or with a photographic camera is constructed to receive a multilamp flash assembly having at least one array of lamps facing in a common direction and a thin, shallow connector blade adapted to be inserted into the socket assembly. Anti-roll, anti-pitch, and anti-yaw structures are provided for accurately orienting and stabilizing the flash assembly in the socket assembly.

5 Claims, 17 Drawing Figures



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[45] **July 31, 1973**



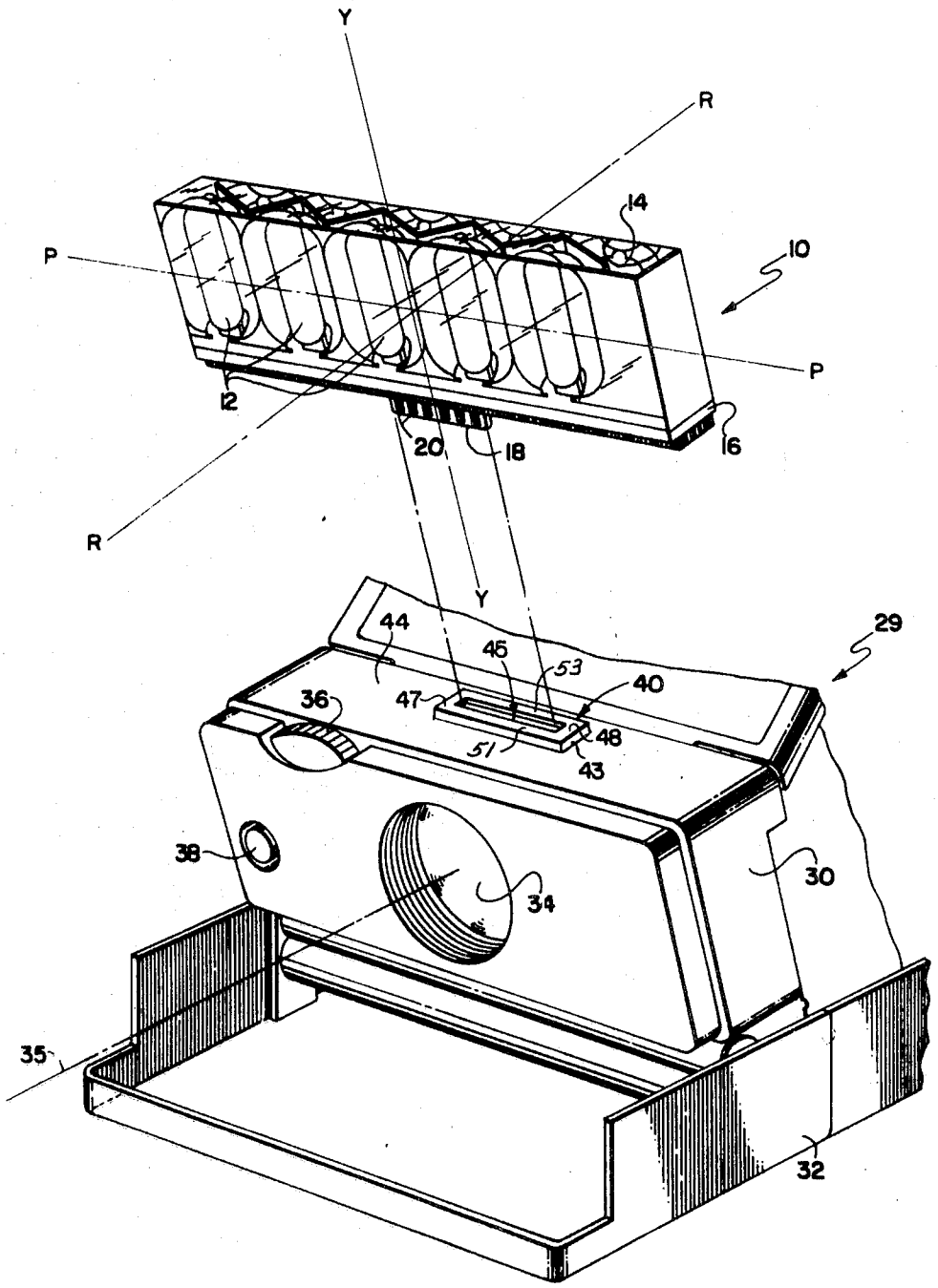


FIG. 1

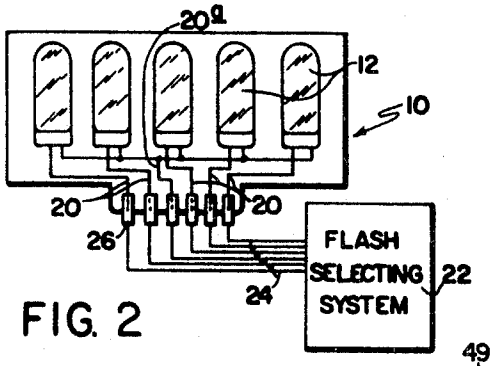


FIG. 2

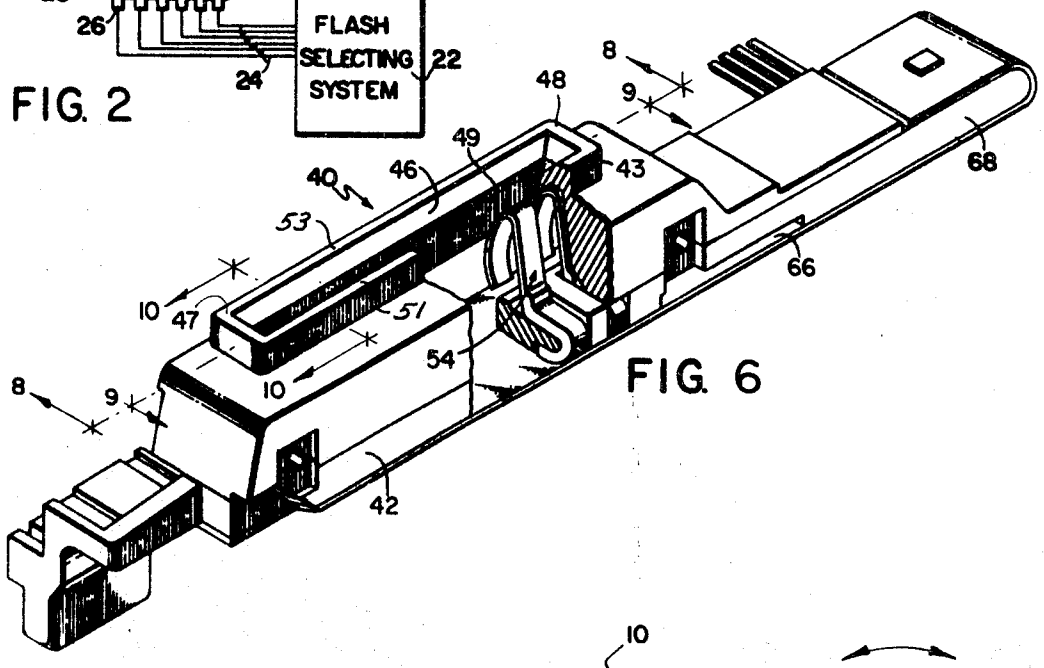


FIG. 6

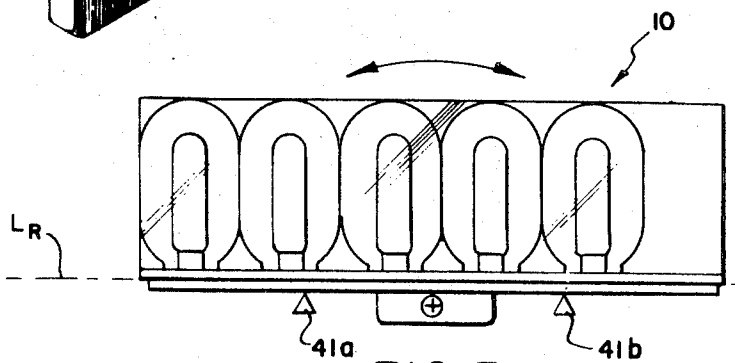


FIG. 3

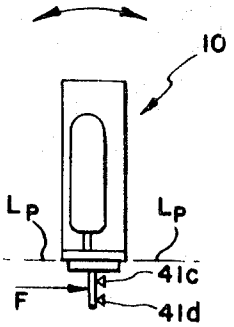


FIG. 4

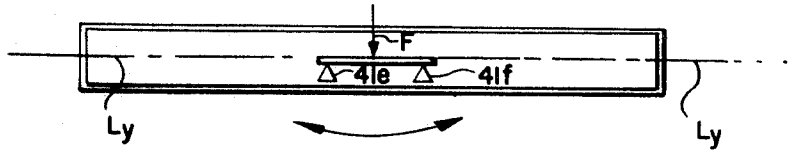


FIG. 5

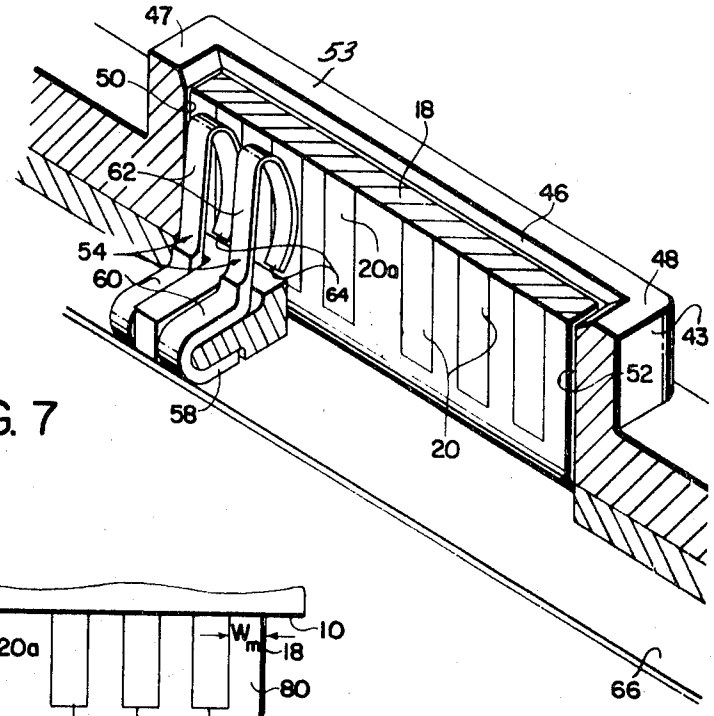


FIG. 7

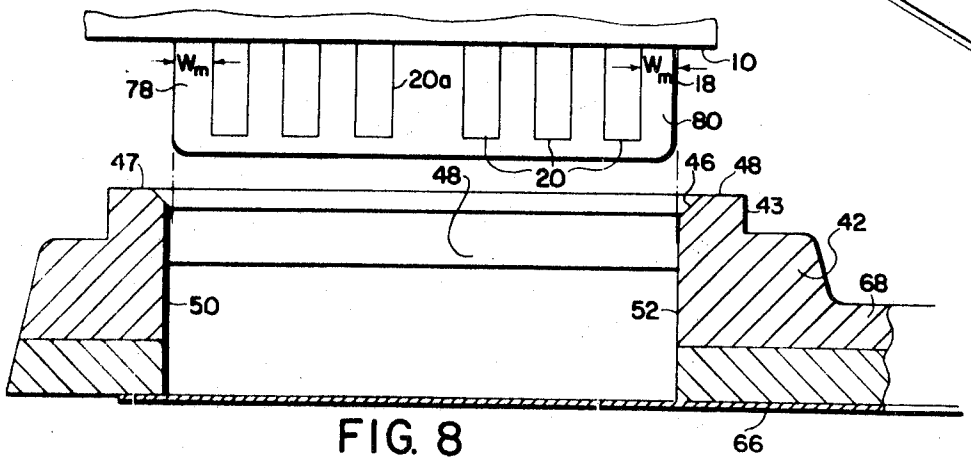


FIG. 8

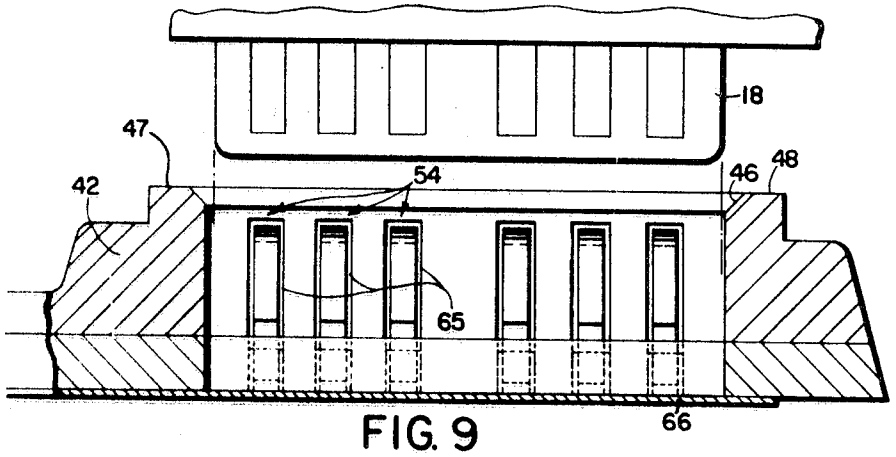


FIG. 9

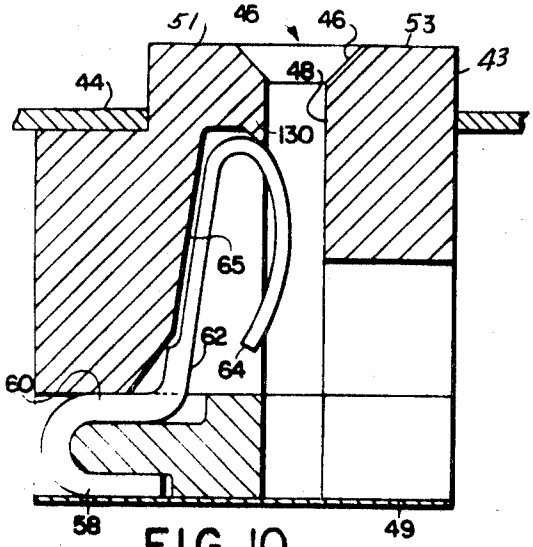


FIG. 10

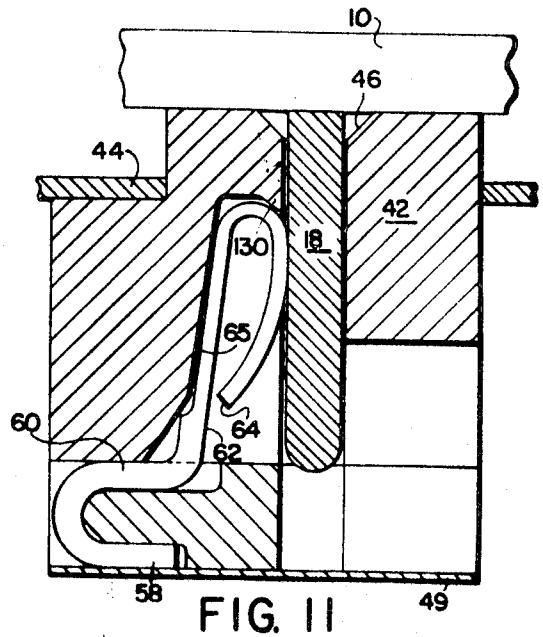


FIG. 11

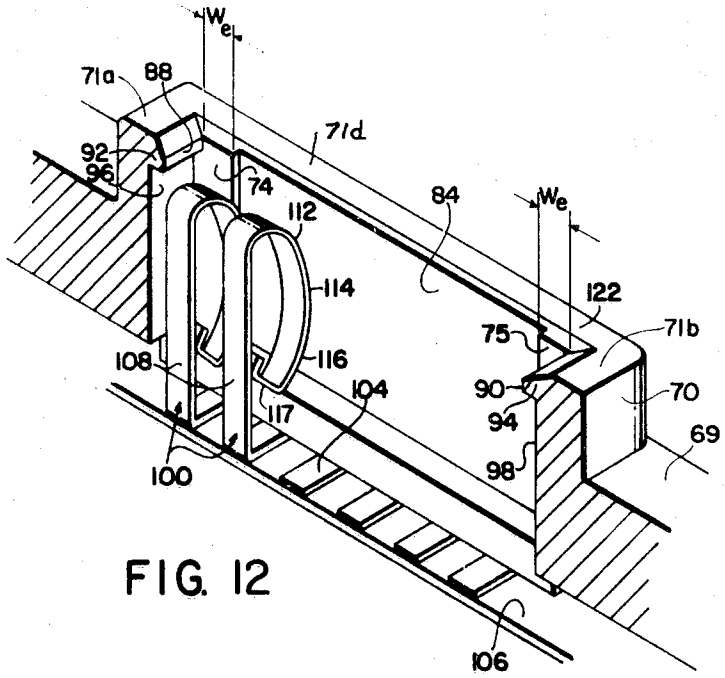


FIG. 12

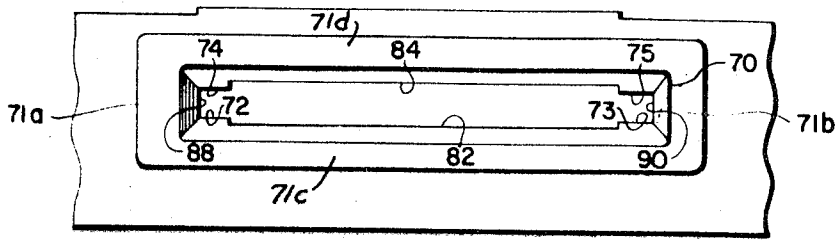


FIG. 13

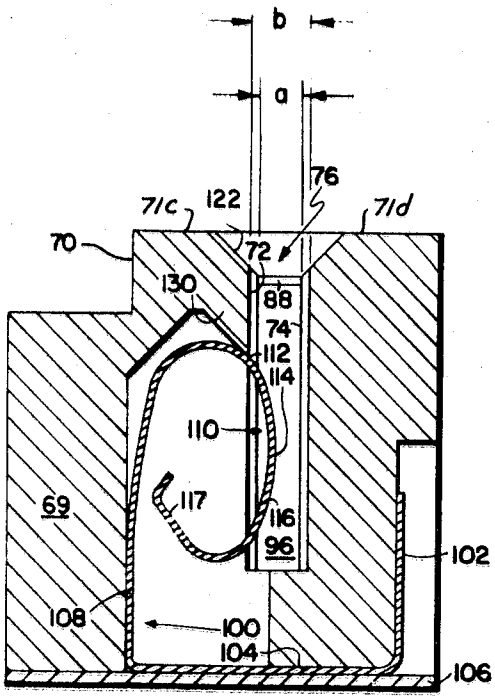


FIG. 14

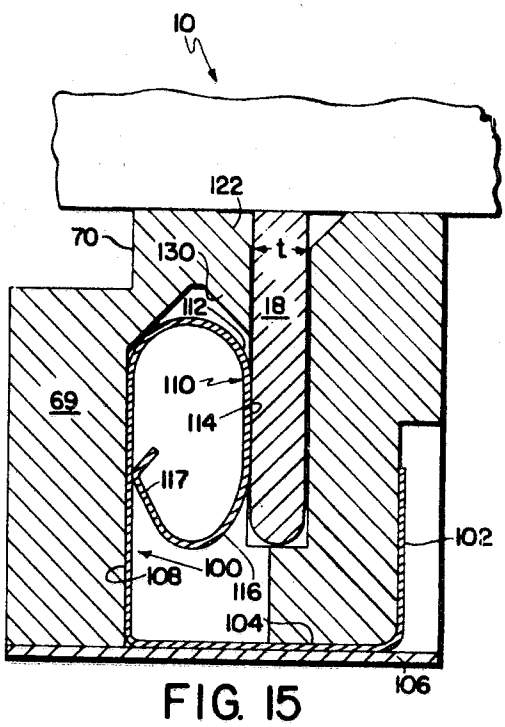


FIG. 15

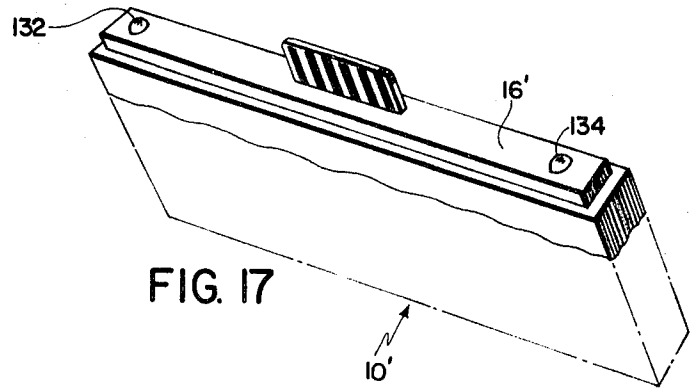


FIG. 17

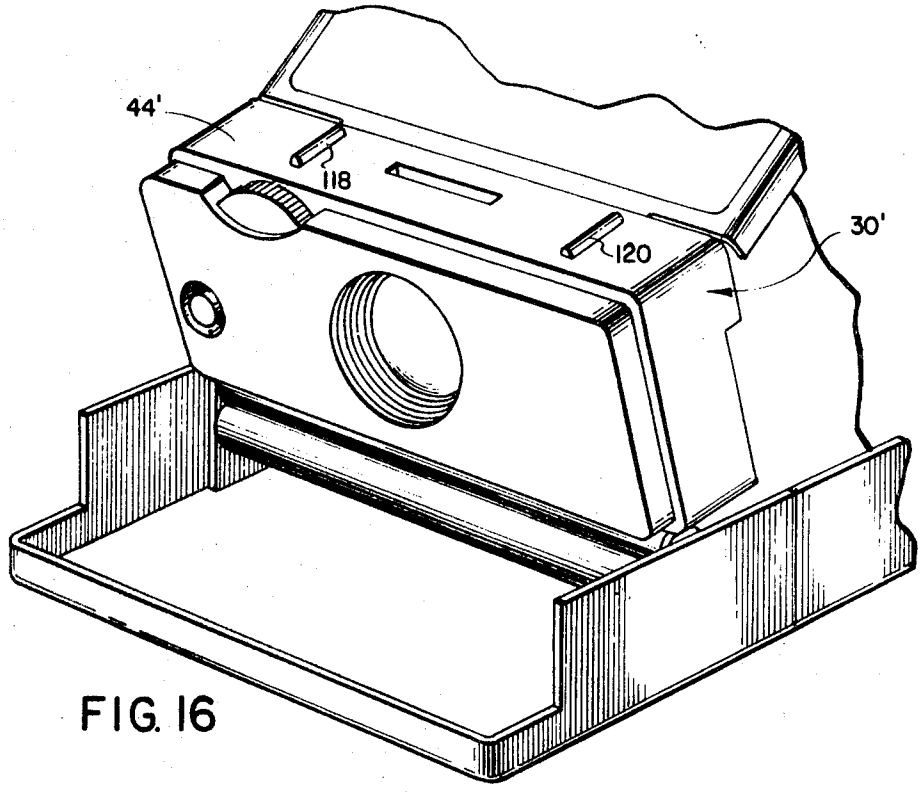


FIG. 16

PHOTOFLASH APPARATUS

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of my copending application Ser. No. 204,844 filed Dec. 6, 1971, and now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to photoflash illumination systems.

2. Description of the Prior Art

A new generation of photographic cameras has been revealed by the assignee of this application in recently issued patents, including U.S. Pat. Nos. 3,447,437; 3,543,662; 3,561,339; and 3,587,426. These patents disclose advanced folding cameras having an extremely high degree of compactness when in their folded state.

This invention concerns, in general, certain aspects of a novel flash illumination system intended especially for use in or with such advanced cameras. The system utilizes as its source of luminous energy a disposable multilamp flash assembly having at least one, but preferably two, arrays of lamps of common orientation, as shown and described, for example, in U.S. Pat. Nos. 3,598,984 and 3,598,985. In this flash illumination system, the flash assembly is interfaced with a flash selecting system which selects the flash lamp or lamps to be fired when a firing command is received. The flash selecting system is preferably a static electronic flash selecting circuit as shown, for example, in U.S. Pat. No. 3,618,492, assigned to the assignee of this application.

As shown in the referent U.S. Pat. Nos. 3,598,984 and 3,598,985, the multilamp flash assembly includes a support structure from which extends a shallow, thin connector blade carrying a set of electrical terminals for the lamps. The flash assembly has two back-to-back arrays of lamps having respective sets of terminal strips disposed on opposite sides of the connector blade. The arrays are used in sequence by first igniting the lamps in one array, then disconnecting the flash assembly from the associated flash socket, reversing the orientation of the assembly, and reconnecting the assembly in the flash socket.

It is extremely important that the flash assembly be oriented accurately and be supported firmly in the socket assembly so as to preclude any rolling, pitching, or yawing movements or displacements.

Any significant rolling movement or roll displacement of the flash assembly about an axis normal to the connector blade of the flash assembly (a roll axis) is apt to prevent or impair the proper alignment of electrical terminals on the connector blade with associated electrical contacts in the socket assembly. In an extreme situation, as where a user may improperly insert the flash assembly into the socket assembly such that it has a roll displacement, that is, such that it is tilted sideways in the socket assembly, certain contacts in the socket assembly may not engage or may make poor contact with the associated terminals on the connector blade of the flash assembly. It is evident, then, that proper roll orientation of the flash assembly and subsequent firm support thereof against any rolling movement are of great importance.

It is also important that the flash assembly be positioned and held accurately against pitching movement, i.e., against forward or backward rotation about a pitch axis (an axis extending side-to-side in the preferred embodiments). Any error in position or lack of stability in the pitch of the flash assembly is apt to result in a misdirection of the flash illumination pattern, or to impair proper flash contact-to-terminal engagement within the socket assembly.

A third consideration is the yaw position and stability characteristics of the flash assembly when connected in a socket assembly. Poor support of a flash assembly against yawing may result in inaccurate placement of the flash illumination pattern or in poor electrical interfacing of the lamp terminals on the connector blade of the flash assembly with the flash contacts in the socket assembly.

Further, primarily because of the limited space available in cameras of the nature above-described, any means provided for assuring proper initial orientation and operational stability of such flash assemblies must be extremely compact and resistant to overstressing or other damage.

A number of prior art patents disclose flash lamp assemblies having a plurality of lamps of common orientation which are ignited in sequence. U.S. Pat. 3,473,880 — Wick and 3,430,545 — Wick each disclose flash illumination systems employing a flash lamp assembly having a plurality of lamps of common orientation, and a connector blade for connecting the flash assembly with an associated socket assembly. However, neither of the noted Wick patents teaches or suggests any method or structure useful for stabilizing and accurately orienting a flash array in an extremely shallow and otherwise compact flash socket assembly.

U.S. Pat. No. 3,473,880 — Wick discloses a flash lamp assembly having a plurality of lamps of common orientation mounted on a vertical support structure. The support structure includes a relatively long and narrow bayonnet-type connector blade carrying on opposite sides of an end portion thereof a positve and a negative terminal for engaging a pair of contacts in an associated camera socket assembly. The Wick '880 system may be able to achieve positional stability and accuracy of orientation of the flash array by virtue of the long bayonnet type connector blade and associated receiving socket. In the system with which this invention is concerned, extreme space limitations preclude recourse to such prior art reachings as represented by Wick '880. The Wick '545 patent is similarly devoid of any teaching useful in solving the flash assembly stability and orientation problems attending the flash illumination system with which this invention is concerned.

OBJECTS OF THE INVENTION

It is a general object of this invention to provide an improved flash socket assembly for use in a photographic flash illumination system which employs as its source of luminous energy a disposable multilamp flash assembly having at least one array of lamps of common orientation and which includes means for providing accurate orientation and stable support of the disposable multilamp flash assembly.

It is another object of the invention to provide for use in a photographic camera having a socket assembly for receiving a multilamp flash assembly having a connector blade, apparatus for accurately orienting such flash assembly and for stably supporting such flash assembly against rolling, pitching and yawing movements.

It is yet another object to provide for use in photographic cameras having a socket assembly for receiving flash assemblies of the type described, apparatus for optimizing the accuracy of the flash illumination pattern cast by ignited lamps in the flash assembly.

It is still another object to provide flash assembly orienting and stabilizing apparatus which has the capabilities described and yet which is compact, resistant to damage and wear, and relatively low in manufacturing cost.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the apparatus possessing the construction, combination of elements and arrangement of parts which are exemplified in the following detailed disclosure and the scope of the application of which will be indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings wherein:

FIG. 1 is a perspective view of the front portion of a photographic camera embodying a flash illumination system including a flash socket assembly embodying the invention and a multilamp flash assembly adapted for connection into the socket assembly;

FIG. 2 is a schematic view of a flash illumination system with which this invention is concerned;

FIG. 3 is a highly schematic front elevational view of a flash assembly and anti-roll support structures provided by this invention for preventing rolling movement of the flash assembly and for defining a roll reference position thereof;

FIG. 4 is a highly schematic side elevational view of a flash assembly and anti-pitch structures provided according to this invention for preventing pitching movement of the flash assembly and for defining a pitch reference position thereof;

FIG. 5 is a highly schematic bottom elevational view of a flash assembly and anti-yaw structures provided according to this invention for preventing yawing movement of the flash assembly and for defining a yaw reference position thereof;

FIG. 6 is a perspective view, partly in section, of a flash socket assembly incorporating the teachings of this invention;

FIG. 7 is a fragmentary perspective sectional view of the socket assembly shown in FIG. 6 as it would appear with the connector blade of a flash assembly inserted into the socket assembly;

FIG. 8 is a fragmentary sectional view taken generally along lines 8—8 in FIG. 6 as it would appear empty and with contact members cut away;

FIG. 9 is a fragmentary sectional view taken generally along lines 9—9 in FIG. 6;

FIG. 10 is a fragmentary sectional view taken generally along lines 10—10 in FIG. 6 showing the socket assembly as it would appear when empty;

FIG. 11 is a view similar to FIG. 10 but showing the contact members as they would appear when a flash assembly is connected in the socket assembly;

FIGS. 12–15 are views illustrating an alternative embodiment of the invention; FIGS. 12, 14, and 15 are views corresponding to FIGS. 7, 10, and 11; FIG. 13 is a fragmentary top view of the socket assembly;

FIG. 16 is a fragmentary perspective view illustrating an alternative anti-roll structure which may be provided to implement the teachings of this invention; and

FIG. 17 is a perspective view of a modified multilamp flash assembly.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

This invention is in general concerned with an improved flash illumination system employing as its source of luminous energy a disposable multilamp flash assembly. FIG. 1 illustrates a flash assembly **10** of a type and construction as shown and described in the above-noted U.S. Pat. Nos. 3,598,984 and 3,598,985. The flash assembly **10** is shown as comprising a first linear array of lamps **12** and a second oppositely facing linear array of lamps **14.** A substantially planar support structure **16,** which extends substantially perpendicular to the arrays, supports the arrays of lamps **12, 14** and a relatively thin, shallow connector blade **18** extends downwardly therefrom and carries on opposite faces thereof first and second sets of terminals for the lamps.

FIG. 1 shows the terminals as taking the form of a set of terminal strips **20** disposed in parallel along the direction in which the flash assembly **10** is inserted into a socket assembly. A similar set of terminal strips (not shown) on the opposite face of the connector blade **18** are electrically connected to the array of lamps **14** facing in the corresponding direction (rearward in FIG. **1**).

The FIG. **2** schematic diagram illustrates the flash assembly **10** as being electrically interfaced with a flash selecting system **22** through a plurality of leads **24** which terminate in contact members **26** making engagement with the terminal strips **20.** As shown clearly in FIG. **2,** six terminal strips are provided for the five lamps in each array. The sixth terminal strip, designated **20***a* in FIG. **2,** is a ground terminal connected to a common ground wire for the lamps.

The flash selecting system **22,** shown in black box form in FIG. **2,** may take any of a variety of forms but preferably comprises a static electronic flash sequencing or programming circuit, as shown for example in the above-mentioned U.S. Pat. No. 3,618,492. A flash selecting system such as the system shown and described in the referent Pat. No. 3,618,492 is capable of selecting a lamp or lamps in an operatively connected flash lamp assembly according to a predetermined sequencing or other selection program. A flash illumination system of the nature described has no moving parts, may be programmed with a wide range of flash selection programs, is capable of automatically avoiding defective lamps, and has many other advantageous characteristics, as pointed out in detail in said patent.

As suggested above, flash illumination systems with which this invention is concerned have general utility in cameras of many types and constructions; however, apparatus according to this invention is perhaps most useful when embodied in ultra-compact cameras in which available space is at a premium. FIG. **1** shows a front portion of a folding camera **29** of a form disclosed in the above-noted patents held by the assignee of this invention, U.S. Pat. Nos. 3,447,437; 3,543,662; 3,561,339; and 3,587,426. The FIG. **1** camera **29** is illustrated as comprising a front assembly **30** mounted to pivot into a face-down position on a back housing plate **32** when the camera is folded for storage.

The front assembly 30 is shown as including an objective lens 34 having a picture-taking axis 35, a focus wheel 36 for focusing the lens 34, and a shutter actuator 38.

The front assembly 30 includes a flash socket assembly 40 embodying the teachings of this invention.

As pointed out in some detail above, it is extremely important that the flash array 10 be oriented in the socket assembly 40 with a high degree of positional accuracy and held firmly against any rolling, pitching, and yawing movements which might be induced, for example, by centrifugal, gravitational, impact, impulsive, or other usual or unusual forces to which the flash assembly might be subjected. Before entering into a detailed discussion of physical structures which may be employed to accurately orient and firmly stabilize a flash assembly 40 according to this invention, a general discussion of the stabilization principles employed by this invention will be undertaken.

FIG. 1 illustrates a roll axis R—R, a pitch axis P—P, and a yaw axis Y—Y for the flash assembly 10. Referring to the FIGS. 3–5 diagrams, this invention is directed to providing a socket assembly comprising support means for providing accurate orientation and stable support for a flash assembly, including anti-roll means defining at least two spaced collinear roll support points 41*a*, 41*b* for preventing rolling movement of the flash assembly 10 about a roll axis R—R (see FIG. 3) and for defining a roll reference position thereof on a roll reference line L_R—L_R.

The flash assembly 40 further includes anti-pitch means defining at least two spaced collinear pitch supports points 41*c*, 41*d* for preventing pitching movement of the flahs assembly 10 about a pitch axis P—P (see FIG. 4) and for defining a pitch reference position thereof on a pitch reference line L_P—L_P. Thirdly, the socket assembly 40 includes anti-yaw means defining at least two spaced collinear yaw support points 41*e*, 41*f* for preventing yawing movement of flash assembly 10 about a yaw axis Y—Y (see FIG. 5) and for defining a yaw reference position thereof on a yaw reference line L_Y—L_Y. The pitch and yaw support points 41*c*, 41*d* and 41*e*, 41*f*, are caused to lie on and to define a support plane (vertically oriented in FIGS. 3 and 4).

As will be described in more detail below, force-applying means are provided to develop a normal force F for urging the connector blade 18 of a flash assembly 10 connected in the socket assembly 40 firmly against the pitch and yaw support points 41*c*, 41*d* and 41*e*, 41*f*, respectively, i.e., in the said support plane. In accordance with a preferred implementation of this invention the force-applying means comprise a stationary set of resilient contact members arranged to engage the connector blade of a flash assembly inserted into the socket assembly.

The combined effect of the roll, pitch, and yaw support points is to orient the flash array in space and to stabilize it against angular components of motion. The flash array is also restrained against front-to-back translational movements by the force F which urges the connector blade 18 of a flash assembly against the described support plane. Side-to-side translational movement of the flash assembly are limited by socket structures provided for this purpose, described in detail below. Translational movements in the direction of blade insertion and withdrawal are restrained by frictional forces developed as a result of the application of force F. As described in detail below, the frictional forces are developed between the connector blade 18 and the contact members and other mechanical interfacing structures which engage the connector blade in the socket assembly.

FIGS. 6–11 illustrate a socket assembly 40 incorporating teachings of this invention. The socket assembly 40 includes a socket body 42, preferably formed as a two-piece injection molded structure from an electrically insulative plastic material. The body 42 includes an integral boss 43 extending through a top wall 44 of the front assembly 30. The boss 43 defines an entrance slot 45 for receiving the connector blade 18 of a flash assembly 10. In order to facilitate connection of a flash assembly 10 into the socket assembly 40, the socket body 42 has formed therein an outwardly beveled mouth 46 surrounding the entrance slot 45.

In accordance with this invention the boss 43 defines spaced roll support surfaces 47, 48 which act to prevent any rolling movement of the flash assembly 10 and represent a structural implementation of the roll support points 41*a*, 41*b* illustrated in FIG. 3 and discussed above and spaced pitch support surfaces 51 and 53. The roll support surfaces 47, 48, 51 and 53 are elevated above the surface of top wall 44 in order that any foreign object, or dirt accumulation located on the top wall 44, or any irregularity in the top wall 44 which might, for example, be introduced during manufacture of the camera front assembly 30, is less apt to obstruct proper alignment of the flash assembly on the support surfaces 47, 48, 51 and 53.

In the FIGS. 6–11 embodiment, blade support means are provided which define a support plane orthogonal to the roll axis R—R, and which implement the combined functions of the pitch support points 41*c*, 41*d* and yaw support points 41*e*, 41*f* discussed above with respect to FIGS. 4 and 5. As discussed above, it is essential that at least two spaced collinear pitch support points and at least two spaced collinear yaw support points be provided. However, as shown in the illustrated FIG. 6–11 embodiment, many more points of support than this minimum number may be provided. In the FIGS. 6–11 embodiment the described support plane for the connector blade 18 is defined by a planar rear support surface 49.

In order to contain side-to-side translational movements of the flash assembly 10 within predetermined narrow limits, the socket body 42 defines spaced end support surfaces 50, 52.

As discussed briefly above, force-applying means are provided for firmly urging the connector blade 18 of a flash assembly 10 into the support plane provided by the pitch and yaw support points, here implemented by rear support surface 49. As also stated above, the requisite blade-loading forces are preferably developed by contact means also serving to make electrical contact with terminal strips 20 on the connector blade 18.

The contact means are shown in FIGS. 6–11 as comprising a stationary set of rearwardly facing resilient contact members 54 arranged to engage the forwardly facing terminal strips 20 on a connector blade with a length-wise wiping action when a connector blade 18 is inserted into the socket assembly 40. Further, the contact members 54 exert a predetermined loading on the blade 18, urging the blade 18 against the rear support surface 49 and producing frictional forces which

are effective to retain the flash assembly **10** securely in the socket assembly **40.**

The contact members **54** are preferably composed of a spring material having high electrical conductivity and high tensile strength such as certain well-known beryllium-copper alloys. A nickel-silver coating is preferably applied to minimize contact resistance. In the illustrated FIGS. **6–11** embodiment, the contact members **54** are illustrated as each including a terminal section **58,** a curved section **60** adapted to be anchored in an opening in the socket body **42,** a spine **62** extending upwardly from the curved section **60** toward but short of the top of slot **45,** and a reversebent section **64** extending from the spine **62** downwardly along the direction of blade insertion for making operative electrical and mechanical engagement with a terminal strip **20** on a connector blade **18** inserted into the socket assembly **40.**

FIG. **10** illustrates a contact member **54** as it might appear in its unstressed state. FIG. **11** illustrates the same contact member **54** as it might appear if deflected and stressed by a connector blade **18** inserted into the socket assembly **40.**

FIG. **9** illustrates the rearwardly facing interior surface of the socket enclosure. In order to electrically isolate the contact members **54** from each other and in order to accurately position the contact members **54** in the socket assembly to insure registration with the terminal strips **20** on connector blade **18,** the socket body **42** preferably has formed integrally therein a plurality of separated recesses **65,** one for receiving each contact member **54.** By this expedient the contact members are self-aligned in the socket assembly and the possibility of electrical shorting between the contact members **54** is minimized.

In the illustrated preferred embodiment the leads (shown schematically at **24** in FIG. **2**) for connecting the flash selecting system **22** with the contact members **54** preferably take the form of conductors (not shown) printed on a flexible sheet substrate **66** such as Mylar (TM). The printed circuit conductors may be flow soldered to the terminal sections **58** of the contact members **54.** The flash selecting system **22** contains solid state circuitry fabricated in the form of an integrated circuit chip (not shown), the terminals of which are connected to the conductors on printed circuit substrate **66.** The printed circuit substrate **66** and the "chip" carried thereby are preferably supported on and protected by an extension **68** of the socket body **42.** The extension **68** also serves as a convenient means for handling the socket assembly **40** during fabrication thereof and during assembly into the associated photographic camera.

DETAILED DESCRIPTION OF ALTERNATIVE EMBODIMENTS

FIGS. **12–15** illustrate an alternative embodiment of the invention; FIGS. **12, 14,** and **15** are figures corresponding to FIGS. **7, 10,** and **11.** The FIGS. **12–15** embodiment comprises a socket body **69** having a boss **70** defining spaced roll support surfaces **71***a*, **71***b* and pitch support surfaces **71***c*, **71***d* configured and functioning like the roll and pitch surfaces **47, 48, 51** and **53** in the FIGS. **6–11** embodiment. The socket body **69** includes blade support means having forward support surface means and rear support surface means. The forward and rear support surface means have facing end marginal portions **72, 73** and **74, 75,** respectively, near the ends of entrance slot **76** separated by a distance *a* which is slightly greater than the thickness *t* of a connector blade **18** for firmly engaging and supporting marginal end portions of the connector blade **18,** designated **78, 80** in FIG. **8.**

Centrally disposed forward and rear surface portions **82, 84** are separated by a second distance *b* which is greater than the distance *a* whereby the blade is effectively supported by the facing end portions **72, 73, 74, 75** of the forward and rear support surface means, respectively.

The FIGS. **12–15** embodiment varies from the FIGS. **1** and **6–11** embodiment, then, in that the rear support surface is recessed such that connector blade **18** is loaded against the rear side marginal portions **74, 75** thereby greatly relieving the tolerance requirements which otherwise would necessarily have to be maintained across the full width pf the rear support surface. The end marginal portions **74, 75** in the FIGS. **12–15** embodiment provide, according to this invention, pitch and yaw support points which define a support plane for the connector blade **18,** as discussed above.

The necked end portions of the entrance slot **76** (shown with particular clarity in FIG. **13**) defined by end portions **72, 73, 74, 75** have a number of other important functions. Because the socket assembly is so extremely shallow, the working length of the contact members is necessarily extremely short. But in order to obtain the requisite blade loading force, the contact members **100** must have a relatively high effective spring rate. A high spring rate and a short working length, however, implies a relatively limited deflection tolerance to prevent overstressing of the contact. The necked end portions of the slot **76** act to limit pitching movement of the flash assembly **10** and thus control the stressing of the contact members **100** by connector blade **18.** Control of the pitching movement of the flash assembly **10** is also important in order to minimize off-target errors in the location of the projected flash illumination pattern.

As will be explained in detail below, the novel configuration of the contact members **100** is such as to produce a relatively high blade loading without a correspondingly high actual spring rate in the contact members **100.**

In order that the tolerance requirements may also be minimized in regard to the end-to-end dimensions of the blade-receiving space within the socket assembly, the FIGS. **9–12** socket assembly includes end support surfaces **88, 90** formed on lip portions **92, 94** below which are formed undercut surfaces **96, 98.** By this expedient a connector blade is confined in its side-to-side movement by the end support surfaces **88, 90** only. The socket end-to-end tolerances in the FIG. **12–15** embodiment must be held, then, only on the end support surfaces **88, 90.**

To minimize contact of the endmost terminal strips **20** on a connector blade **18** with the socket body **70,** in the FIGS. **9–12** socket assembly the maximum width $W_{e_{max}}$ of each of the facing end marginal portions **72, 73, 74, 75** is caused to be less than the minimum width $W_{m_{min}}$ of the marginal end portions **78, 80** of connector blade **18.**

The contact members **100** in the FIGS. **12–15** embodiment have a convolute configuration. The generally convolute configuration of the contact members

acts to maximize the effective working length of the contact members **100** and the tolerable deflection of the contact members before overstressing occurs. The contact members **100** each comprise an end section **102**, a base section **104** for connection to leads on a printed circuit substrate **106**, a spine **108**, and a reverse bent section **110**. The reverse bent section **110** is illustrated as having an entrance ramp portion **112**, a central portion **114**, and an exit ramp portion **116**.

The entrance and exit ramp portions **112, 116** assure a smooth, aesthetically pleasing insertion and withdrawal of the connector blade. The central portion **114** applies a loading force to the contiguous surface of a connector blade in a direction normal to the connector blade so as not to introduce any lifting force component which might tend to raise the connector blade from the socket assembly.

As noted above, it is desirable that the force required to insert the connector blade of a flash assembly into the socket assembly is less than the force required to withdraw the connector blade. To this end, contact members are each configured such that upon insertion of a connector blade, the reverse bent portion **110** of the contact member offers a predetermined resistance to deflection and introduces a known frictional force against the blade. The net blade insertion force is caused to fall at a predetermined level or range of levels by an appropriate selection of the spring loading force applied by the contact members, the effective entry angle and configuration of the entrance ramp portion **112**, and the coefficients of friction between the connector blade and the various surfaces which it engages during insertion into the socket assembly.

The withdrawal force is caused to be greater than this insertion force by virtue of a wedging action which is developed as the connector blade is withdrawn. It can be seen from a study of FIG. **15**, for example, that as the connector blade **18** is withdrawn, as a result of frictional forces developed between the connector blade **18** and the reverse bent section of each contact member **100**, the reverse bent section **110** will be drawn along with the connector blade, thus causing the contact member **100** to unroll slightly. As the contact member unrolls, its diameter expands causing wedging or pinching action of the reverse bent section **110** against the end marginal portions **74, 75** of the rear support surface. By this expedient, the flash assembly **10**, in spite of the extreme shallowness of the connector blade **18**, is held securely against gravitational, centrifugal, impulsive, impact, and other forces tending to dislodge the flash assembly from the socket assembly.

The contact portion **114** of each contact member **100** is caused to be as high as possible consonant with a reasonably shallow entry angle of the entrance ramp portion **112** in order that contact will be made with the terminal strips **20** on the connector blade **18** even in a situation wherein a flash assembly **10** is not fully inserted into the socket assembly.

As discussed above, it is desirable that the contact members **100** have a relatively low spring rate in order to minimize the likelihood of overstressing, and yet it is also desirable that the contact members **100** develop a relatively high blade loading force. To this end, contact members **100** include a tip section **117** extending from the reverse bent section **110** into engagement with the spine **108** to increase the effective spring rate of the contact members **100**. By this expedient, a relatively great blade loading force can be developed in a contact member having a relatively low spring rate, thus minimizing the chance that overstressing of the contact members **100** might occur. Minimization of the spring rate of the contact members **100** is also advantageous in that the wear rate of the contact members **100** and thus the change in the spring rate thereof due to wear, are correspondingly minimized.

In order to allow prestressing of the contact members so as to increase the blade loading forces developed thereby while assuring mutual alignment of the contact members even if unequally prestressed, the socket assemblies described above include limiter means for abutting the contact members to define a rearward limit position thereof. The limiter means takes the form of a wedge-shaped projection **130** formed integrally with the socket body which engages the entrance ramp portions of the contact members. Other structures for accomplishing the described limiting and aligning functions are contemplated.

As discusssed above, it is extremely important that contact resistance of the contact members **100** engaging the terminal strips **20** be minimized. Minimization of the contact resistance is achieved by virtue of the wiping of the terminal strips **20** by the contact members as a connector blade is inserted into the socket assembly, the wiping action serving to keep the terminal-contact member interfacing surfaces clean.

The invention is not limited to the particular details of construction of the embodiments depicted and it is contemplated that various and other modifications and applications will occur to those skilled in the art. For example, the embodiments described above show but two of the many anti-pitch and anti-yaw structures contemplated for carrying out this invention. FIG. **16** illustrates anti-roll means representing an alternative to spaced roll support surfaces on a boss, as depicted above. In the FIG. **16** embodiment, the anti-roll structures for providing spaced roll support points comprise a pair of spaced ridges **118, 120** which may be formed integrally with the top wall **44'** of a camera front assembly **30'**. Also, as shown in FIG. **17**, the support structure **16'** of the flash assembly **10'** may be provided with protrusions **132** and **134** which are adapted to engage surface **44** of front assembly **30** to assist roll support surfaces **47** and **48** in preventing rolling movement of the flash assembly **10'** relative to the front assembly **30**. The length of each protrusion may be equal to or slightly less than the distance between surface **44** and the top of boss **43** thereby precluding rotation of one of the terminals **20** out of electrical engagement with its associated contact **54**. Therefore, because certain changes may be made in the above-described apparatus without departing from the true spirit and scope of the invention herein involved, it is intended that the subject matter of the above depiction shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A photographic camera having a picture-taking axis, a socket assembly for receiving and retaining a multilamp flash assembly having first and second like but oppositely facing linear arrays of lamps of common orientation and a planar support structure perpendicular to the arrays of lamps from which extends a connector blade carrying on opposite faces of the blade corresponding in orientation to the orientation of the first and second arrays of lamps first and second electrically

isolated sets of electrical terminal strips for the lamps in the first and second lamp arrays, respectively, the strips in each set being arranged in parallel along the direction of insertion of the flash assembly into said socket assembly, said camera comprising:

a camera housing section;

means defining a boss extending outwardly from said camera housing section;

means defining an entrance slot in said boss for the connector blade which is perpendicular to said picture-taking axis of the camera, said means defining said entrance slot including anti-roll surface means for engaging the planar support structure of the flash assembly at laterally spaced points to accurately orient the flash assembly and to stably support the flash assembly against rolling movement about an axis normal to the connector blade when the latter is fully inserted into said socket assembly and at points on opposite sides of the connector blade for stabilizing movement of the flash assembly about a pitch axis;

blade support means for guiding the blade of the flash assembly from said entrance slot into an operative position within said socket assembly and for supporting the blade in said operative position, said blade support means including electrically insulative rear support surface means defining a support plane parallel to a roll reference line defined by said anti-roll surface means and perpendicular to said picture-taking axis of said camera;

contact means mounted within said socket assembly and extending toward but short of said entrance slot for making electrical contact exclusively with the terminal strips on the forwardly directed face of the blade of a flash assembly operatively connected in said socket assembly, comprising a stationary set of parallel and rearwardly facing resilient contact members arranged to register with and to engage the strips with a lengthwise wiping action when the connector blade of a flash assembly is inserted into said socket assembly, said contact members exerting a predetermined loading of the blade against said rear support surface means of said blade support means which is effective to restrain pitch and yaw movement of the flash assembly and which is such that the frictional forces exerted on the blade by said contact members and by said rear support surface means are solely effective to retain the flash assembly securely in said socket assembly; and

means for confining side-to-side translational movement of the blade in said socket assembly within predetermined narrow limits.

2. The camera defined by claim **1** wherein said socket assembly includes a body composed of a plastic material and having formed integrally therein said means defining an entrance slot and said blade support means, said body defining an outwardly beveled mouth surrounding said entrance slot for guiding the blade into said entrance slot.

3. The camera defined by claim **1** wherein said blade support means defines opposed end support surfaces having lip portions, one adjacent and beneath each end of said entrance slot for engaging opposite ends of the connector blade received in said socket assembly to effect said confinement of side-to-side translational movement of the blade, said end support surfaces being undercut below said lip portions to cause said end support surfaces to engage the connector blade only at said lip portions.

4. A flash assembly for use with a camera of the type having a housing including a surface surrounding a raised flash assembly receiving socket, said flash assembly comprising:

means for supporting a plurality of photoflash lamps of common orientation;

connector means extending from said support means and adapted to be received by said socket;

a plurality of terminals connected to said lamps, said terminals being mounted on said connector means for making electrical engagement with contacts located within said socket, said terminals extending in a row transverse to the direction of insertion of said connector means into said socket assembly; and

means protruding from said support means for engaging said surface to limit rotation of said flash assembly about an axis parallel to the camera's lens axis, said protruding means being adapted to engage said surface prior to one of said terminals rotating out of electrical engagement with one of said contacts in said socket.

5. A flash assembly is defined in claim **4** wherein said protruding means includes at least one protrusion on each side of said connector means.

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