Aug. 4, 1970 R. W. HOLMES 3,523,168

PUSHBUTTON SWITCH CONSTRUCTION WITH POSITIVE PLUNGER SAFETY STOP CARRIED BY A CASING

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FIG-1

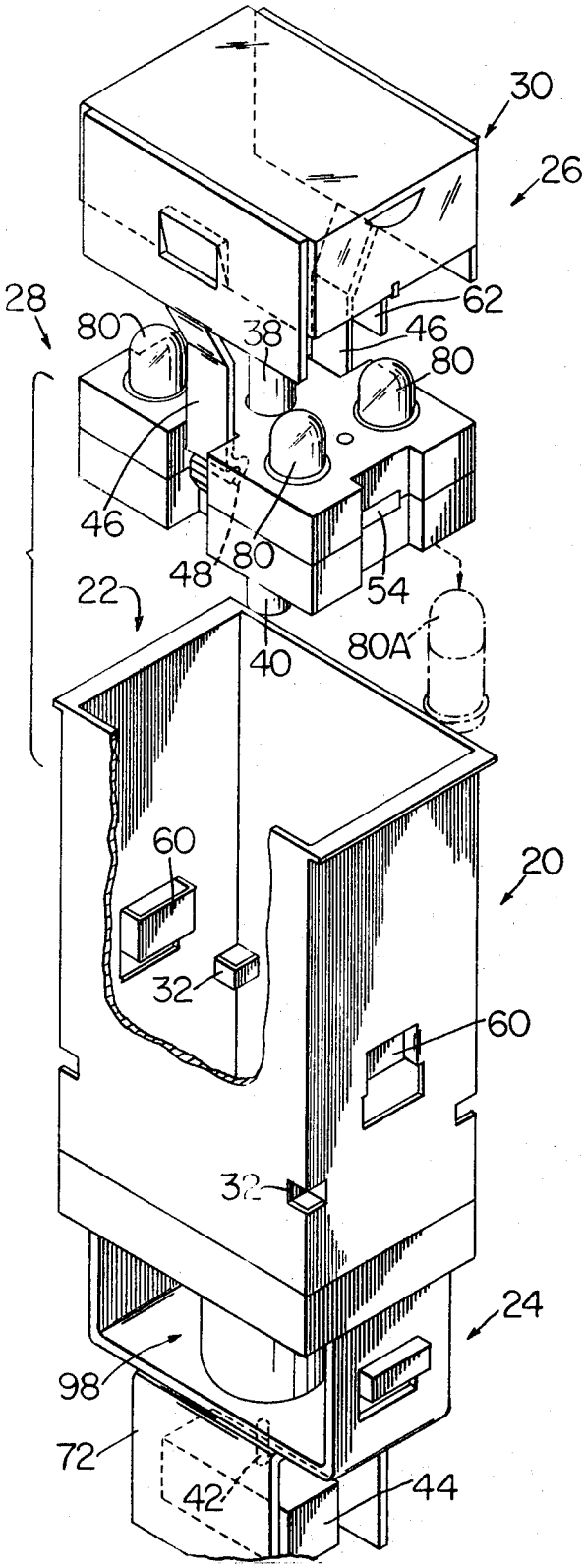


FIG-2

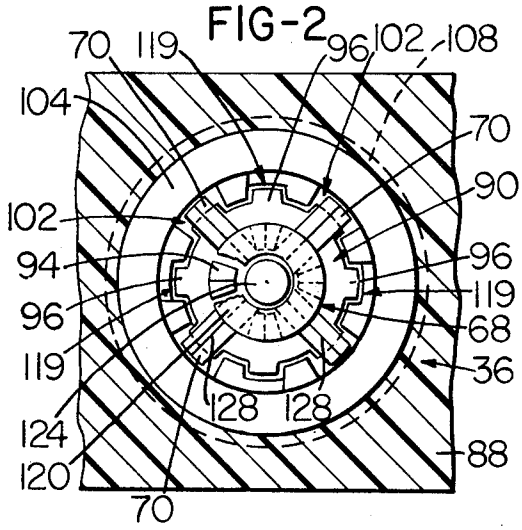
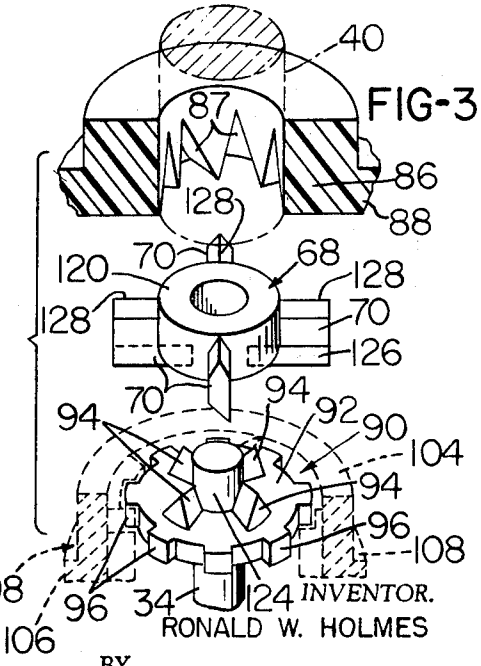


FIG-3



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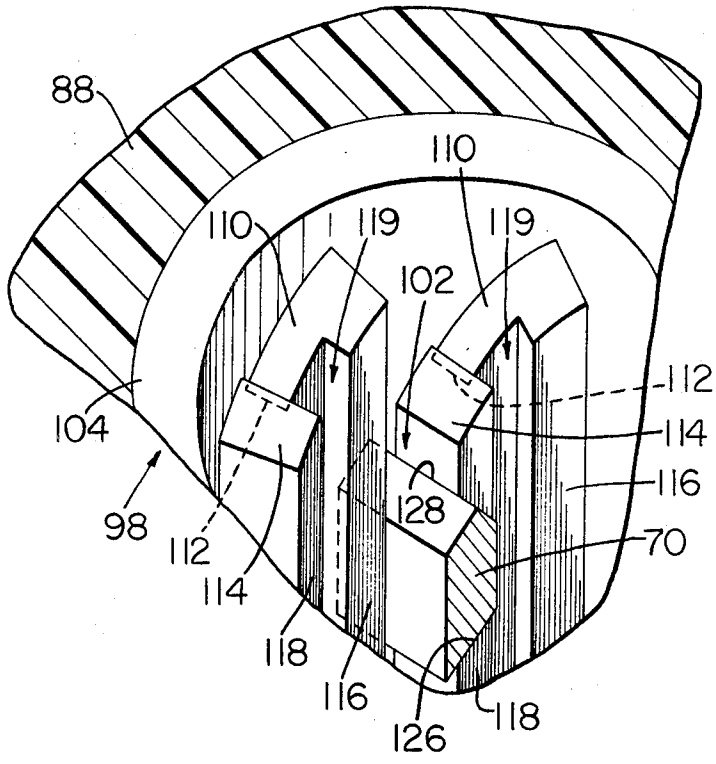
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Aug. 4, 1970 R. W. HOLMES 3,523,168
PUSHBUTTON SWITCH CONSTRUCTION WITH POSITIVE
PLUNGER SAFETY STOP CARRIED BY A CASING
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FIG-2A



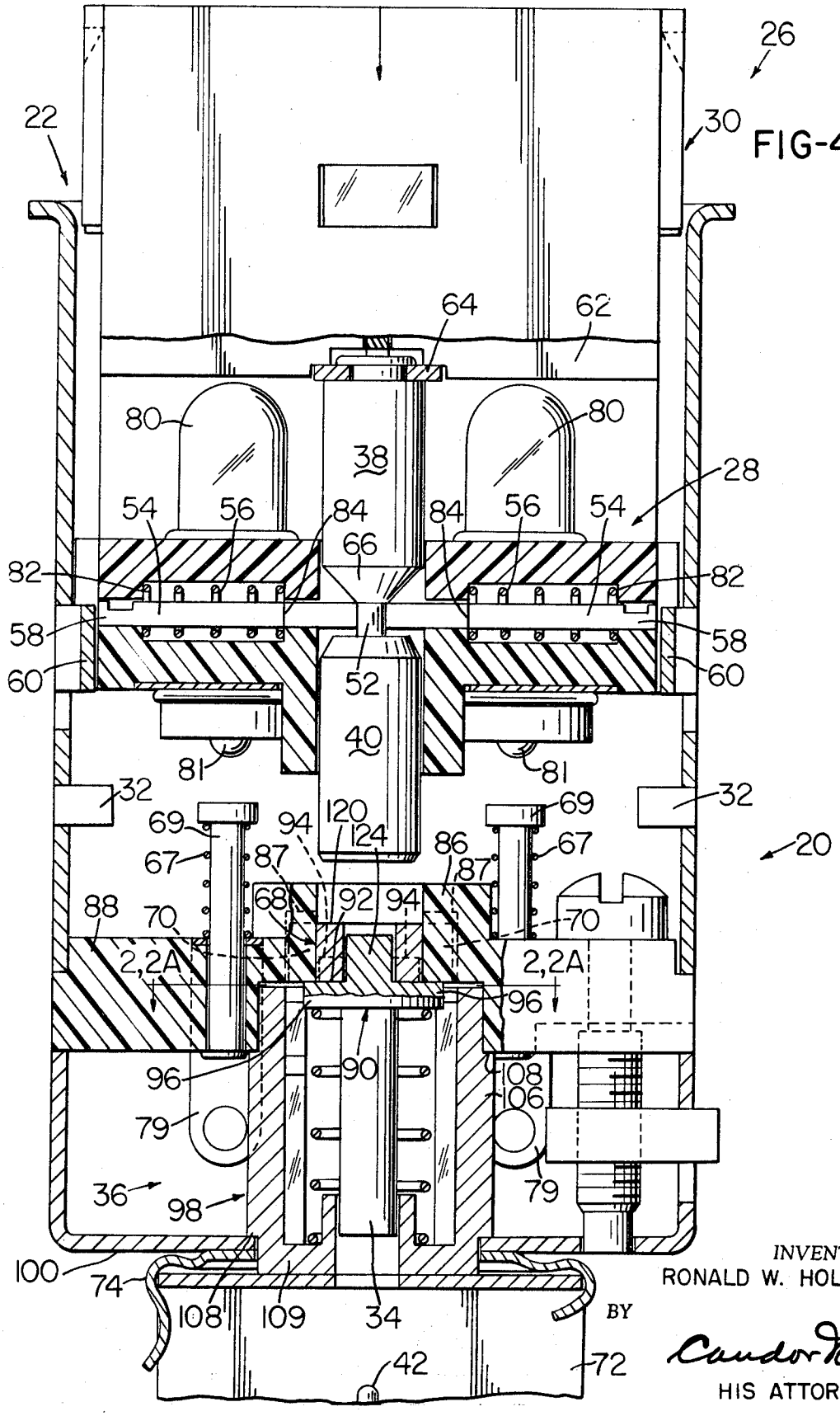
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PUSHBUTTON SWITCH CONSTRUCTION WITH POSITIVE PLUNGER SAFETY STOP CARRIED BY A CASING

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FIG-4



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PUSHBUTTON SWITCH CONSTRUCTION WITH POSITIVE PLUNGER SAFETY STOP CARRIED BY A CASING

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FIG-4A

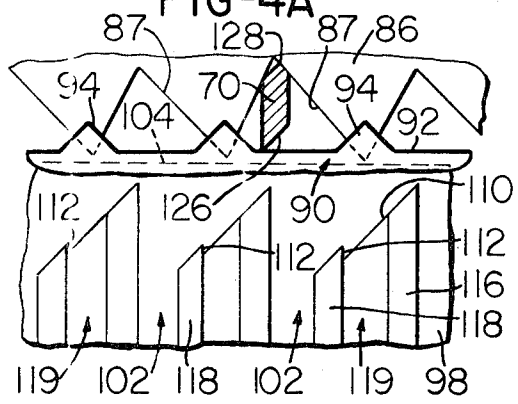


FIG-5A

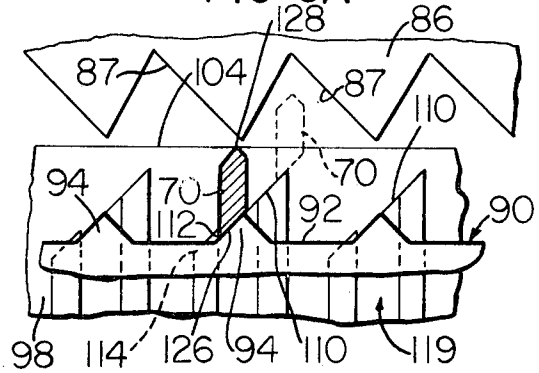


FIG-6A

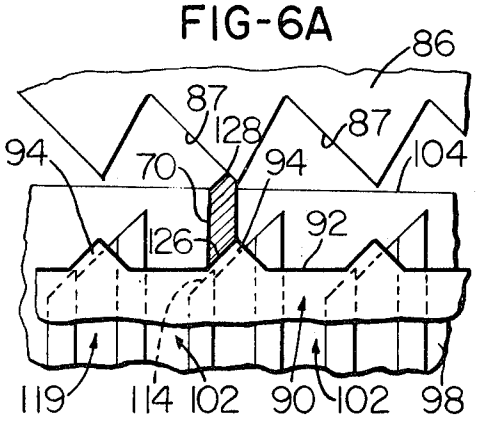


FIG-6B

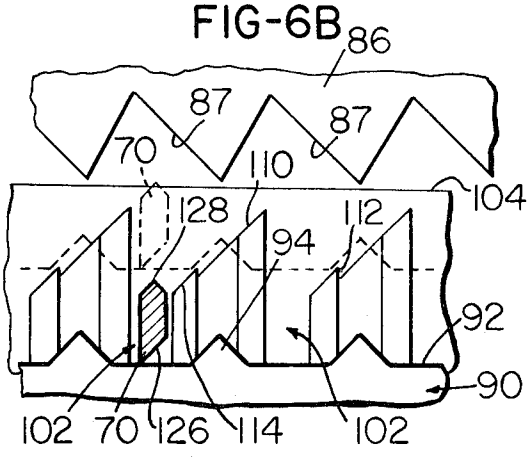


FIG-9A

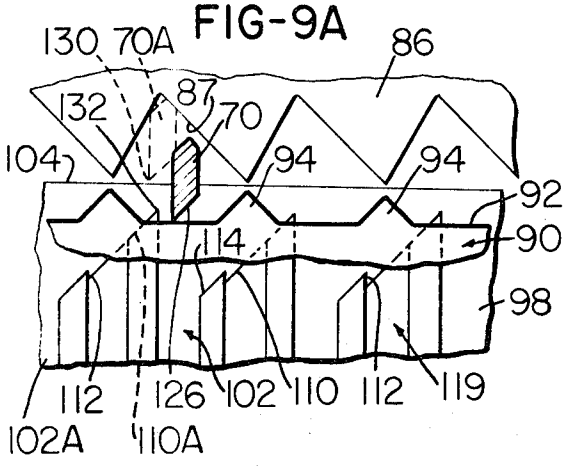
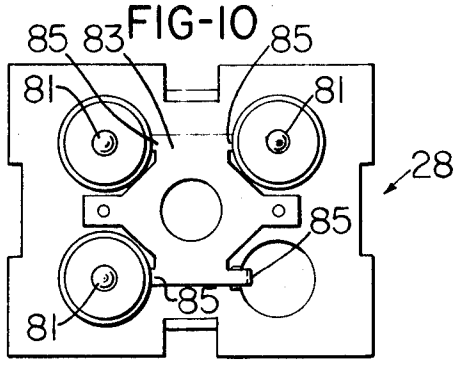


FIG-10

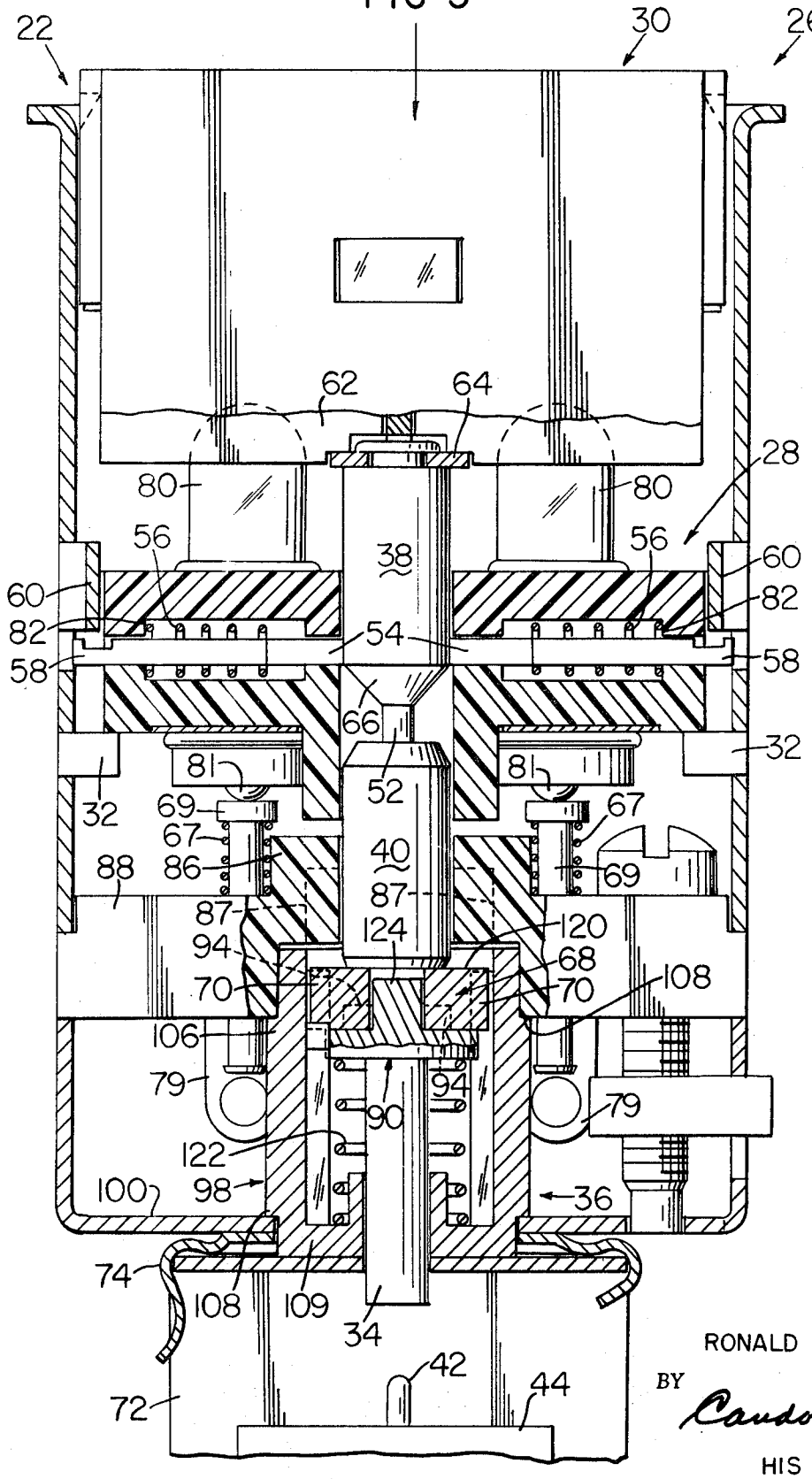


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FIG-5



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PUSHBUTTON SWITCH CONSTRUCTION WITH POSITIVE PLUNGER SAFETY STOP CARRIED BY A CASING

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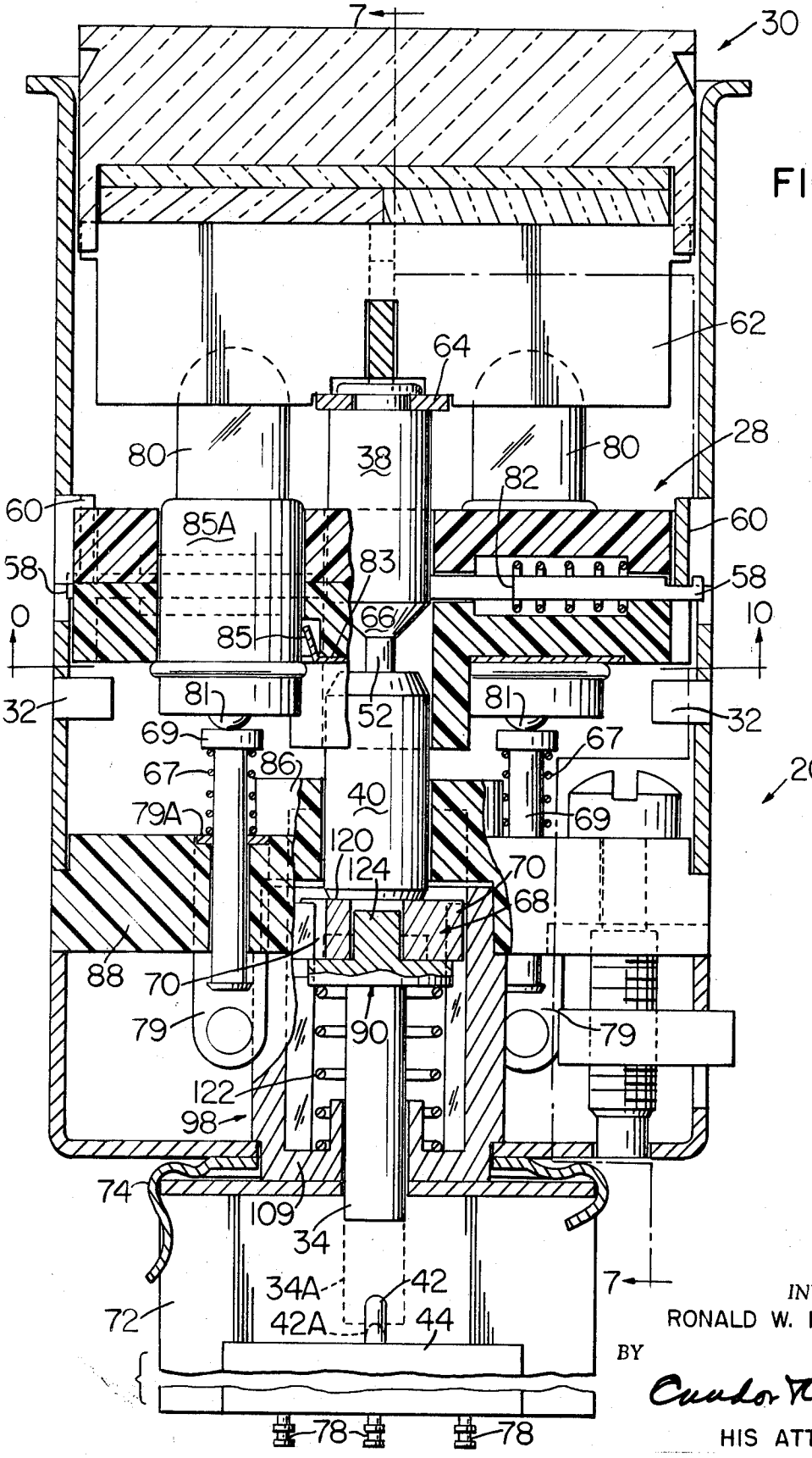


FIG-6

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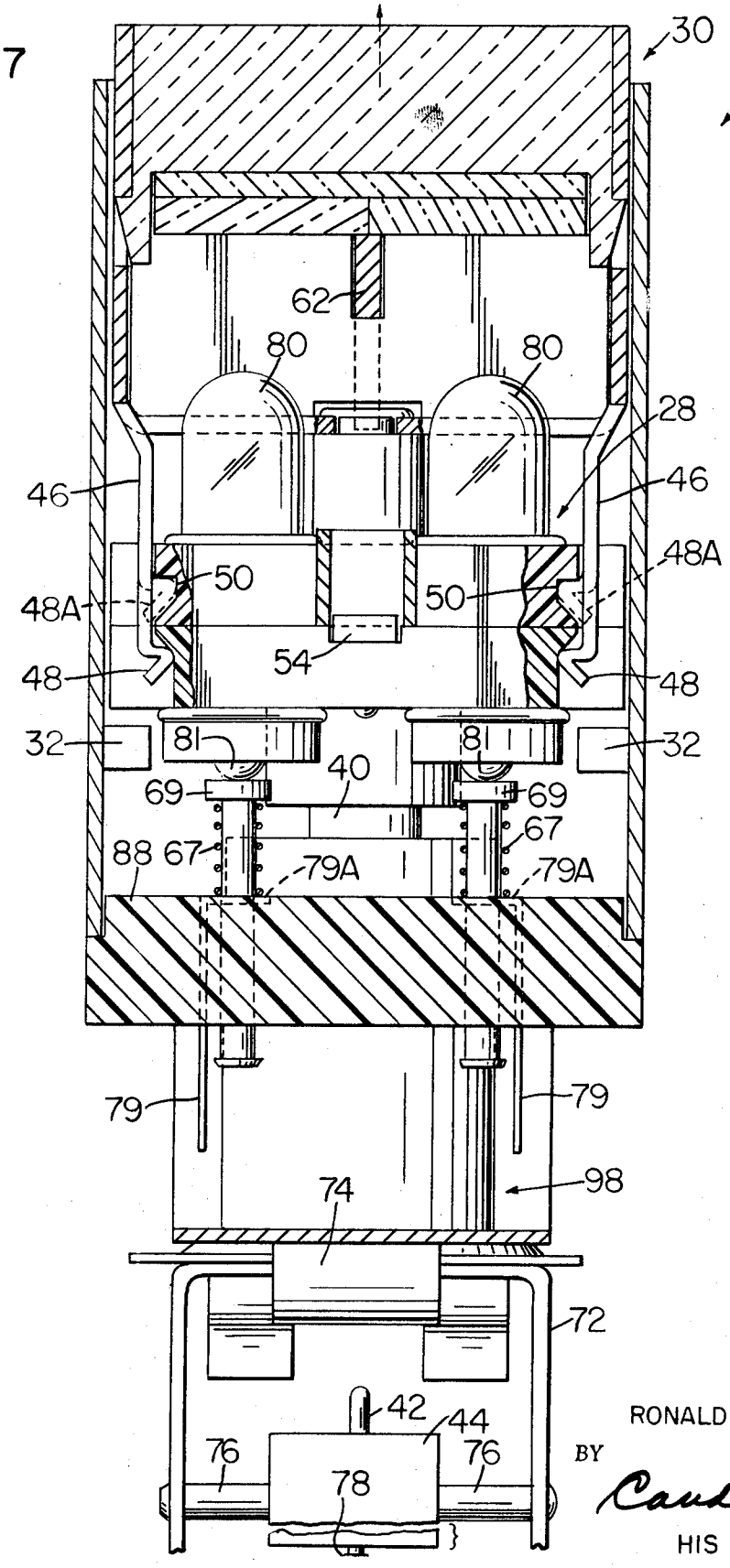
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Aug. 4, 1970 R. W. HOLMES 3,523,168
PUSHBUTTON SWITCH CONSTRUCTION WITH POSITIVE
PLUNGER SAFETY STOP CARRIED BY A CASING
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FIG-7



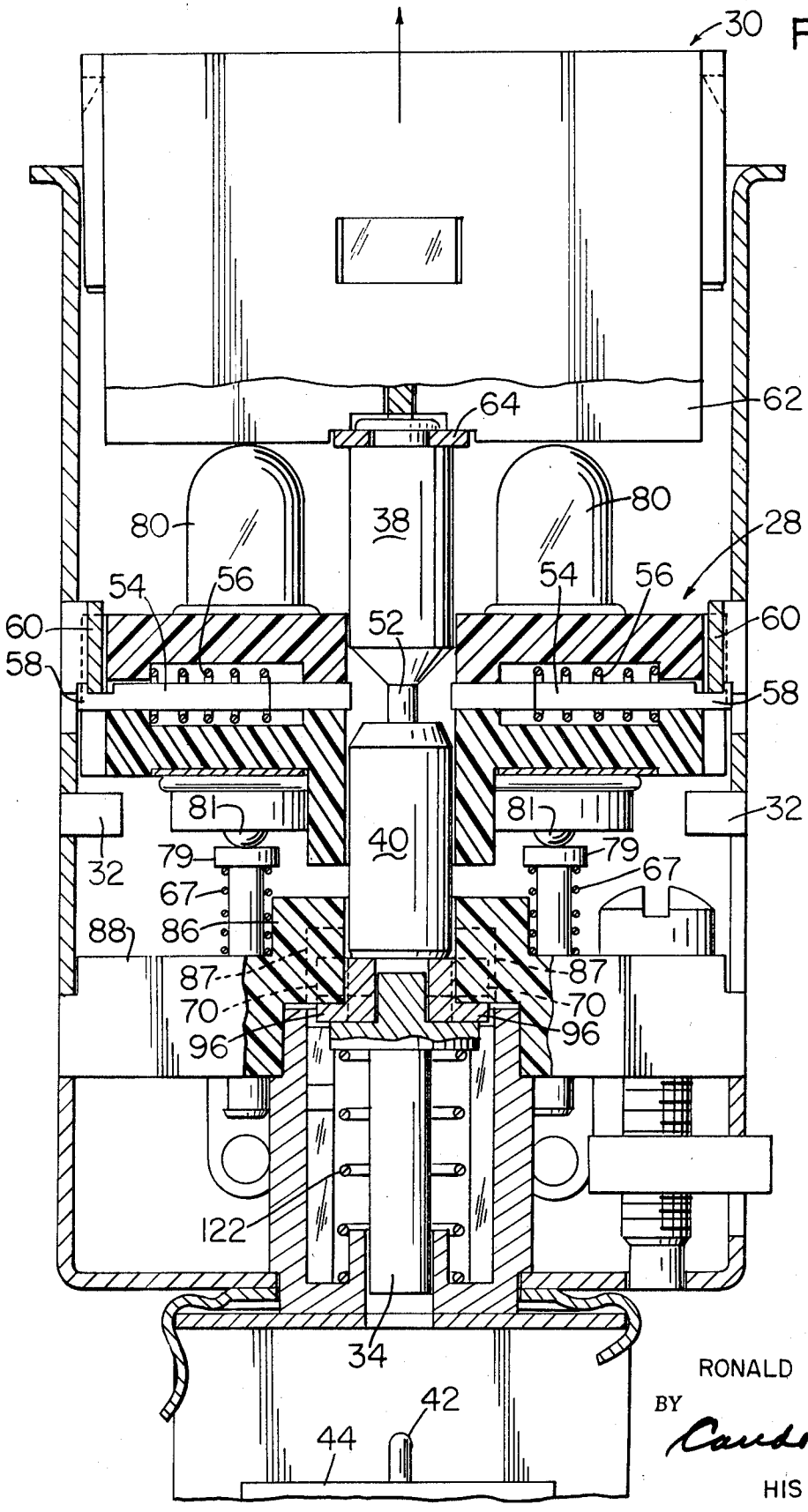
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PUSHBUTTON SWITCH CONSTRUCTION WITH POSITIVE PLUNGER SAFETY STOP CARRIED BY A CASING

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FIG-8



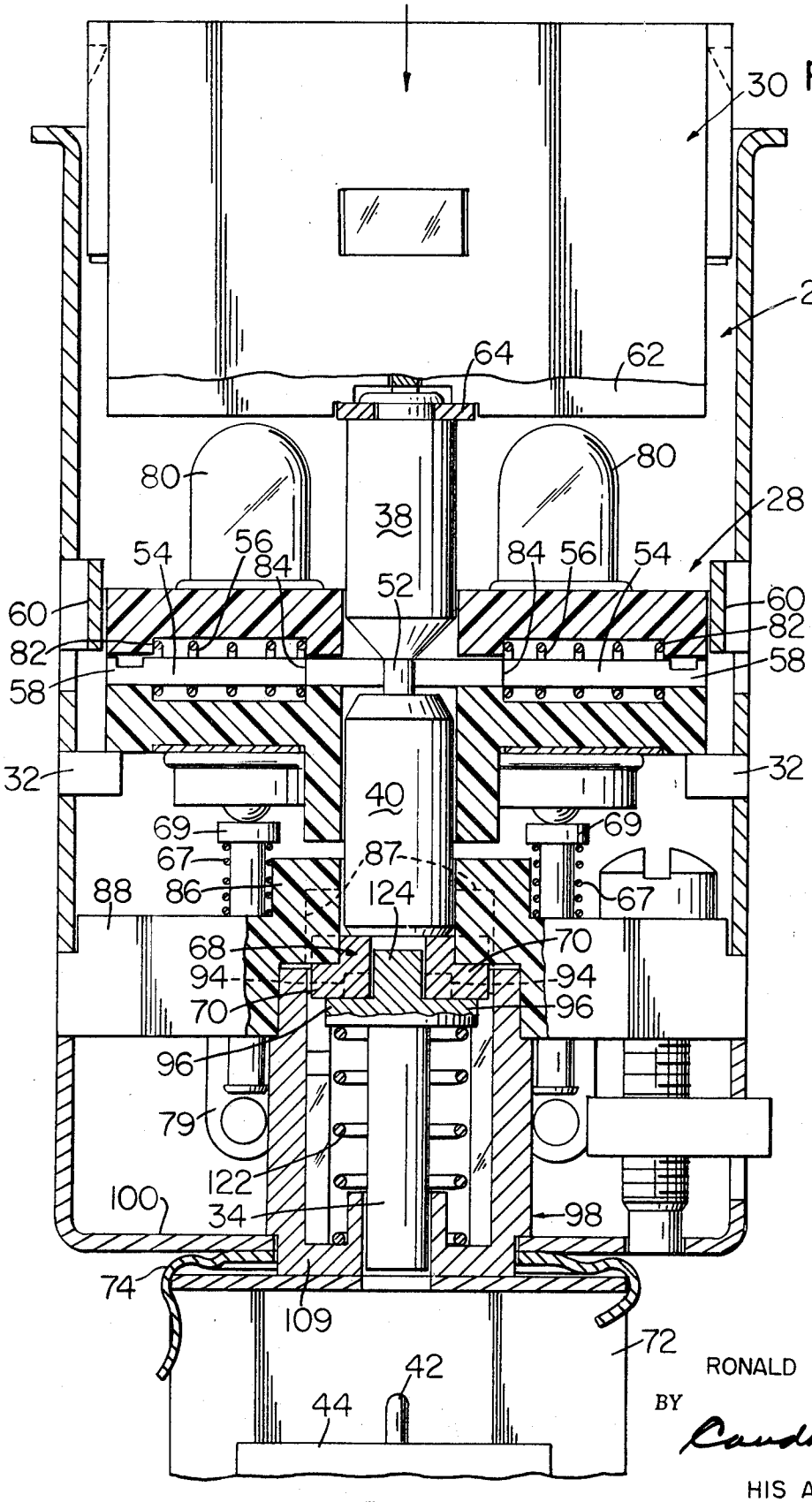
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PUSHBUTTON SWITCH CONSTRUCTION WITH POSITIVE PLUNGER SAFETY STOP CARRIED BY A CASING

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FIG-9



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United States Patent Office 3,523,168 Patented Aug. 4, 1970

3,523,168

PUSHBUTTON SWITCH CONSTRUCTION WITH POSITIVE PLUNGER SAFETY STOP CARRIED BY A CASING

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Filed July 26, 1968, Ser. No. 748,017
Int. Cl. H01h 3/12, 3/20, 9/18
U.S. Cl. 200—159 21 Claims

ABSTRACT OF THE DISCLOSURE

This application discloses an illuminated pushbutton switch construction having a tubular casing that receives a pushbutton construction means at the upper casing end and has a lower switch means at the lower casing end. The pushbutton construction means is movable inward into the upper casing end by an initial pushing in action and thereafter movable upwardly by a release counterspring action. This places the pushbutton construction means in operable locked condition to operate the switch means as often as desired. The pushbutton means may be removed from the casing by an upward or outward movement, followed by an inward, downward pushing action of the pushbutton construction means. Thereafter, the pushbutton means may be removed from the casing by an upward and outward removing action completely to remove the pushbutton from the casing. The pushbutton construction means is prevented from actuating the switch means during the initial introduction of the pushbutton means into the casing by a positive stopping action of the switch operating plunger and its supporting structure and the push button can only operate the switch means after the plunger has been released from the first pushing in action.

This application relates to a pushbutton switch construction with a positive plunger safety stop.

One of the features of this invention includes a construction in which a pushbutton construction means is introduced into the upper end of a casing and is then released to place the pushbutton construction means in operable locked condition to operate a switch means at the lower end of the casing. The pushbutton means cannot operate the switch means during the first or initial introduction of the pushbutton means into the casing because the pushbutton is stopped by a positive plunger stop but can operate the switch means as often as desired after the pushbutton construction means has been released from the first or initial "pushed in" position, because the positive plunger stop has been rendered inoperative by said release of said pushbutton construction means.

Another feature includes a construction whereby the pushbutton construction means may be removed from the casing by a pulling out action followed by a pushing in action.

Another feature of this invention includes a construction in which a plunger is provided at the lower end of the casing to actuate the switch means, with said plunger having positive stop means to stop said plunger during the initial pushing in action of said push button construction means.

Other features of this invention are apparent from this description, the appended claimed subject matter, and/or from the accompanying drawings in which:

FIG. 1 is an exploded diagrammatic perspective view of an illuminated switch construction according to this invention.

FIG. 2 is a cross section taken along the line 2—2 of FIG. 4.

FIG. 2A is a diagrammatic perspective cross section taken along the line 2A—2A of FIG. 4.

FIG. 3 is an exploded perspective view of certain parts shown in FIGS. 2 and 4.

FIG. 4 is a diagrammatic vertical cross section of the casing, pushbutton construction means, and plunger controlling construction at an early stage of the initial pushing in action of the pushbutton construction.

FIG. 4A is a flat development view of certain parts of FIGS. 2, 2A and 3 in the condition which they have in FIG. 4.

FIG. 5 is a view similar to FIG. 4 and showing the parts at a later stage of the initial pushing in action.

FIG. 5A is a view similar to FIG. 4A but showing the parts in the stage of FIG. 5.

FIG. 6 is a view similar to FIG. 5 but showing a stage of operation later than that of FIG. 5, with the pushbutton construction locked and ready for switch means actuation and switch means unactuation.

FIG. 6A is a view similar to FIGS. 4A and 5A but showing said parts of FIGS. 2, 2A and 3 immediately after a slight release of the pushbutton construction means from the position of FIG. 5A.

FIG. 6B is a view similar to FIG. 6A but showing the parts when the plunger is pushed down to switch means actuating position shown in dotted lines in FIG. 6.

FIG. 7 is a cross section transverse to FIG. 6 and taken along line 7—7 of FIG. 6.

FIG. 8 is a view similar to FIG. 6, but showing the push button pulled out to the dotted line position shown in FIG. 7.

FIG. 9 is a view similar to FIG. 8 but showing the pushbutton slightly pushed into cause the releasing action for the pushbutton, which pushbutton may then be completely pulled out with the lamp holder to the position of FIG. 1.

FIG. 9A is a view similar to FIGS. 4A–6B but showing the parts in full lines in the condition of FIG. 9, and in dotted lines in the condition after the pushbutton construction means has been removed from the casing.

FIG. 10 is an upward plan view of certain parts taken along the line 10—10 of FIG. 6 and with one of the lamps omitted.

Certain words, which indicate direction, relative position, and the like, are sometimes used in this application for the sake of brevity and clearness. However, it is to be understood that these words are used only in connection with the views in the drawings, and that in actual use the parts so described may have entirely different direction, relative position, and the like. Examples of such words are "vertical," "horizontal," "upper," "lower," etc.

An embodiment of this invention may include a casing **20** which may be a tubular casing. The casing **20** may have an upper pushbutton construction means receiving upper end or aperture means **22** and a lower switch means receiving second casing end **24**. A pushbutton construction means **26** is movable inward relatively to said upper casing end **22** by an initial pushing in action, such as shown sequentially in FIGS. 4 and 5.

The pushbutton construction means **26** is positively stopped at the position of FIG. 5. This positive stopping action includes a positive stopping action of the lamp holder **28** or lamp holder section or means **28** of the pushbutton construction means **26**, and also by a positive stopping action of the pushbutton or pushbutton section or means **30** of the pushbutton construction means **26**.

The lamp holder section or means **28** is positively stopped during the initial pushing in action by the casing positive stop means or corner stops **32**, which are engaged by the corners of the lamp holder **28**, as in FIG. 5.

The pushbutton or pushbutton section or means **30** is positively stopped during the initial pushing in action by positive stop means, to be more fully described, and which includes a switch actuating plunger **34**, and a switch plunger support means **36** carried by the casing **20** independently of said pushbutton construction means **26**, to stop said switch actuating plunger **34** and a pushbutton plunger construction **38**, **40** in the switch means unactuating position shown in FIG. 5. This positively stops the pushbutton section **30** in said switch means unactuating position of FIG. 5.

After the initial pushing in action of FIGS. 4 and 5, the pushbutton **30** may be released by the operator so that the pushbutton **30** is movable upwardly slightly from the position of FIG. 5 to the position of FIG. 6. This renders said stop means inoperative to stop the plunger **34** in the switch unactuating position of FIG. 5 and full line position of FIG. 6 and releases the plunger **34** to be movable to the switch actuating position **34A**, which is shown in dotted lines in FIG. 6 so that the pushbutton **30** is pushed down by the operator after such release. Thereafter the operator may push the pushbutton **30** down and release the same as often as desired to actuate and unactuate the switch means **44** by the actuator **42** of the switch means **44** as often as desired, as indicated by the full line and dotted line showing of switch actuating plunger **34**, **34A**.

The locking of the pushbutton construction means **26** in the casing **20** is also shown in FIG. 6 with the preliminary steps leading thereto being shown in FIGS. 4 and 5.

The initial pushing in step is shown in FIG. 4 where the pushbutton **30** and the lamp holder **28** are pushed downwardly by the operator. The pushbutton legs **46**, FIGS. 1 and 7, have their lower hooks **48** in the upper groove **50** of the lamp holder **28** so that the narrow neck **52**, FIG. 4, between the plungers **38** and **40** allows the inwardly spring pressed latching arms **54** to be pressed inwardly by the compression springs **56** so that the outer locking hooks **58** of the arms **54** pass inside the locking brackets **60** which are carried by casing **20**. The plungers **38**, **40** and neck **52** are fixed and secured to the lower part of the pushbutton **30** by any suitable construction, such as shown, including a cross bar **62**, FIGS. 1 and 4, which may be welded to the ring **64** which is fastened to the upper end of the plunger **38**.

The locking operation of the lamp holder **28** is continued as shown in FIG. 5. The frusto cone **66** of plunger **38** has pushed the arms **54** outwardly from their inward position of FIG. 4 to the position of FIG. 5. The hooks **58** have been moved under the locking brackets **60**. This has been accomplished by the continued downward push by the operator on the pushbutton **30**. The lamp holder **28** has been positively stopped by the corner stops **32** of casing **20**. The pushbutton **30** has been positively stopped by the action of the pushbutton plungers **38** and **40**, neck **52** and the positive stop action on the switch actuating plunger **34** by the plunger support means **36** to be described.

The lamp holder locking operation is completed, as shown in FIG. 6. The pushbutton **30** has been released upward by the operator, and this has allowed the compression springs **67** of the lamp contactors **69** to push the lamp holder **28** upward slightly, so that the locking hooks **58** have locked under the locking brackets **60** and have firmly locked the lamp holder in the position of FIG. 6 against upward and outward movement.

In the full line position of FIG. 6, the pushbutton **30** may be pushed inwardly and downwardly to cause a downward pushing action on the pushbutton plungers **38** and **40** to push downwardly the switch actuating plunger **34** through the medium of a cam or cam means **68** and its fingers or finger means **70** in a manner to be more fully described. The plunger **34** may be pushed down to the dotted switch actuating position **34A**, so that the switch actuator **42** may be pushed down to the dotted switch actuated position **42A** to actuate the switch means **44**.

Thereafter the operator may alternately push in and release the pushbutton **30** from the position of FIG. 6 to actuate and unactuate the switch means **44** as often as desired.

The switch means **44** is supported from the casing **20** by any suitable means, such as bracket means **72** which may be inverted U-shaped, if desired, and be detachably secured to the casing **20** by a resilient hook construction **74** which also may be inverted U-shaped. The switch means **44** is supported from the downward arms of the bracket **72** by suitable fasteners **76**, FIG. 7, which may be screws, rivets, or the like.

The switch means **44** may have electrical connectors **78** which may be connected to any circuit to be controlled by the pushing in and releasing actions of the pushbutton **30**. A plurality of illuminating lamps **80** may be part of such circuit and may be controlled by the switch means **44** and pushbutton **30** in any well known manner. Some type of circuit may connect the connectors **78** to one or more of the connectors **79** which are bent horizontally at **79A**, FIGS. 6 and 7, and which are electrically connected to the lamp contacts **69** and lamp contact buttons **81**.

A neutral plate **83**, FIGS. 6 and 10 may be provided under the lamp holder **28** which may be contacted by one or more neutral contactors, not shown, which may be similar to contactors **69**. This plate may have neutral tongues **85** which engage the neutral sleeves **85A** of the lamps **80**.

Whenever it is desired to change or replace any one or more lamps **80**, the pushbutton construction means **26** may be removed from the casing **20** to the position of FIG. 1, so that such lamp or lamps **80A** may be removed and/or replaced.

The pushbutton construction means **26** may be removed from the casing **20** by the steps shown in FIGS. 7–9 and 1.

The pushbutton construction means **26** may be released and removed from the locked condition shown in full lines in FIGS. 6 and 7, by an initial pulling out action on the finger notch, FIG. 6, of the pushbutton **30**, to the position shown in dotted lines at **48A** in FIG. 7 and in full lines in FIG. 8. This brings the neck **52**, FIG. 8, in alignment with the locking arms **54** and places the hooks **48** in the dotted line position **48A** of FIG. 7. Then a slight pushing in action on the pushbutton **30** and on the lamp holder **28** is produced by the operator to the position of FIG. 9. This pushes the locking arms **54** and their hooks **58** below the locking brackets **60**, so that such arms **54** and hooks **58** are pushed inwardly by the compression springs **56** acting on the shoulders **82** of lamp holder **28** and on the discs **84** which are secured to the arms **54**.

The slight pushing in action of the pushbutton **30** and lamp holder **28** in FIG. 9 releases button **30** and holder **28** so that they can be pulled out as a unitary pushbutton construction means **26** completely out of casing **20** to the position of FIG. 1. Any one or more lamps **80** may then be replaced or adjusted, as indicated in FIG. 1.

Thereafter the unitary pushbutton construction means **26** may be reinserted into the casing **20** at the upper casing end **22**. Then the operations of FIGS. 4–6, which have been previously described, can be repeated. This includes the reactivation of the positive stop means to stop the plunger **34** in unactuating position during this repeated or subsequent initial pushing in action.

THE POSITIVE STOP BY CAM MEANS 68

Positive stop means in the plunger support means **36** is produced by the cam means **68** to stop said plunger **34** in switch means unactuating position during the initial lock-

ing pushing in action, as shown in FIGS. 4, 4A, 5, and 5A. The stop inoperative rendering means responsive to the initial release of the pushbutton **30** to render said positive stop means inoperative to stop said plunger **34** in unactuating position is shown in FIGS. 6, 6A and 6B. The details will now be further described.

Said positive stop means and stop inoperative rendering means may include a serrated member **86**, with downward serrations **87** which may be the central part of the lamp contact block **88** which holds the lamp contacts **69**. See FIGS. 2, 2A, 3 and 4. Such means may also include the rotatable cam or cam means **68** with its fingers or finger means **70**. Such positive stop means and stop inoperative rendering means may also include the plunger **34** with certain parts including an upper plunger disc **90**, which has an upper flat surface **92** with a plurality of ridges **94**. Such disc may also have a plurality of teeth **96**. The plunger **34** and its said parts **90**, **92**, **94** and **96** reciprocate together vertically but are locked against substantial relative rotation with respect the serrated member **86**, and a cylindrical case or plunger guide means **98** that is secured to the bottom floor **100** of the casing **20**.

Such plunger guide means **98** may have a plurality of grooves **102** and **119** in which the teeth **96** of plunger disc **90** reciprocate vertically so that the plunger **34** can not substantially rotate relatively to the plunger guide means **98**. The guide means **98** also has an upper circular edge or end **104** above the grooves **102**. The guide means **98** is enlarged radially outwardly at **106** to provide shoulders **108** to hold the upper end **104** and lower bottom **109** of plunger guide means **98** between the lamp contact block **88** and the bottom floor **100** of the casing **20**.

The plunger guide means **98** has a plurality of slanting upper surfaces **110** which extend from slightly below and inward of the end **104** of guide means **98** to a plurality of stop notches or offsets **112**. Then a plurality of continuing lower slanting surfaces **114** extend into the grooves **102**. A plurality of inward columns **116** and **118** are provided below the slanting surfaces **110** and **114** to provide inwardly extending side walls to produce the grooves **102** and **119** between the columns **116** and **118**. The teeth **96** of the plunger disc **90** can reciprocate in the grooves **102** and **119**, and the fingers **70** can reciprocate in grooves **102**.

The fingers **70** of the cam **68** reciprocate downwardly and upwardly as the upwardly biased switch actuating plunger **34** and cam **68** are downwardly and upwardly reciprocated by the pushbutton plunger **40**. The plunger **40** pushes downwardly on the central ring **120** and fingers **70** of cam **68** and plunger **34** from the positions of FIG. 4 to FIG. 5. Then the plunger **40** releases slightly upwardly to the position of FIG. 6, then down and up repeatedly to actuate and unactuate the switch means **44**. Then the plunger **40** pushes slightly downwardly and releases upwardly until the lamp holder **26** and pushbutton **30** are pulled outwardly of the casing **20**, leaving the fingers **70** to be moved into new serration notches **87** as indicated in FIG. 9A, in a manner to be more fully described.

The serrated member **86** may be a cylindrical serrated member with a plurality of cylindrically arranged downward indentations **87** which are substantially aligned with the cylindrically arranged slanting surfaces **110**, stop notches **112** and intermediate grooves **102**, and in which the plurality of fingers **70** slidingly engage said cylindrically arranged downward serrations **87**.

The switch actuating plunger **34** is upwardly biased by the compression spring **122**. The ends of spring **122** engage the case bottom **109** and the plunger disc **90**. Such spring **122** causes the plunger disc **90** to move upwardly as far as permitted by cooperating members. The plunger **34** has an upper extension **124**, FIG. 3, which receives the ring **120** of the cam **68** and around which the ring **120** rotates.

The cam **68** has finger means or fingers **70** each of which has a single slanting bottom edge **126** and a double slanting surface upper ridge **128**, FIGS. 2, 2A, 3, 4A, 5A, etc. The lower edges **126** of fingers **70** extend below the lower surface of the cam ring **120** so that such edges **126** can ride on the upper flat surface **92** of the plunger disc **90** without interference from the ridges **94** under certain conditions, such as shown in FIGS. 4A, 6A, 6B and 9A. The double upper ridges **128** can engage the under surfaces of the downward serrations **87** of serrated member **86**, as shown in FIG. 4A.

When the cam ring **120** and fingers **70** and plunger **34** are not pushed down by pushbutton plunger **40**, as in FIGS. 4 and 4A, the lower edge **126** of each finger **70** rides on the upper flat surface **92** of plunger disc **90**, and the upper edge **128** of each finger **70** extends into a downward serration **87** of the serrated member **86**.

When the pushbutton **30** and the pushbutton plunger **40** are pushed down to the position of FIGS. 5 and 5A, the plunger **40** pushes the cam ring **120**, each finger **70** and lower finger edge **126** downwardly so that lower edge **126** rides down upper slanting surface **110** to rotate the cam **68** and each finger **70** until each lower edge **126** is positively stopped by the corresponding stop notch **112**, as in FIG. 5A. This positively stops the downward motion of plunger **34** and of the pushbutton **30**, so that the user or operator must release the pushbutton **30** slightly upward, as in FIGS. 6 and 6A to permit the lower edge **126** of each finger **70** to be lifted above the stop notch **112**. The upper ridge **128** is also lifted upwardly at this time, with the aid of ridge **94** so that upper ridge **128** engages the next leftward downward serration **87**, as indicated in FIG. 6A, so that such finger **70** is rotated leftwardly slightly in readiness to cause the lower edge **126** of such finger to engage the lower slanting surface **114** when the pushbuton **30** is pushed down to cause actuation of the switch means **44**.

When the pushbutton **30** is pushed down in FIG. 6, from the position of FIG. 6A, for switch actuation, the cam **68** and each finger **70** will be pushed down by pushbutton plunger **40** and each lower surface **126** of each finger **70**, will slide down along lower surface **114** of FIG. 6A so that such finger will move leftwardly and enter the next leftward groove **102**, as shown in FIG. 6B. At the same time the plunger disc **90** will be pushed down by the cam ring **120** so that the plunger **34** will be pushed down to the dotted line switch actuating position **34A** of FIG. 6. Thereafter the pushbutton **30** may be upwardly released to the switch unactuation position to move the plunger **34** to the full line position of FIG. 6 as often as desired.

Each finger **70** will likewise move to the dotted upper position and full line lower position shown in FIG. 6B, as often as desired.

This will continue until it is desired to remove the pushbutton **30** and lamp holder **28** from the casing **20** for lamp replacement or the like and for reinsertion into casing **20**.

The action of the cam **68** and of each of its fingers **70** during such removal and reinsertion of the pushbutton **30** and lamp holder **28** is shown in FIG. 9A, when considered with FIG. 6B and the positions of the cam **68** and fingers **70** during the positions of the pushbutton plunger **40** as it is moved in the casing **20** during the withdrawing operations of FIGS. 8 and 9 and during the complete withdrawal to the position of FIG. 1 and then to the reinsertion, as in FIG. 4.

While the plunger **40** is moved slightly up in FIG. 8 to move each finger **70** above the normal position of FIG. 6B and then slightly down, as in FIG. 9, such positions of FIGS. 8 and 9 are above the normal positions of FIG. 6B, and each finger **70** reciprocates in and above the groove **102** shown in FIG. 6B, as indicated at FIG. 9A. However, when the pushbutton plunger **40** is completely withdrawn from the casing **20** for lamp replace-

ment and the like, to the position of FIG. 1, then the cam **68** and each cam finger **70** and plunger disc **90** is forced upwardly by compression spring **122** to the highest possible dotted position **70A** of FIG. 9A which is in the apex of a new serration **87**. This will place the lowest point **130** of each finger **70A** slightly leftward of the highest point **132** of a new slanting wall **110A**.

When the pushbutton construction **26** of FIG. 1 is then reinserted into the casing **20** and the pushbutton plunger **40** again engages the cam **68**, as in FIGS. 4, 5, and 6, the above finger **70A** will then move into a new groove **102A** which will be the next leftward groove **102** compared to the groove **102** which is utilized by such finger **70** in FIGS. 4A, 5A, 6A and 6B.

This change of grooves **102** occurs whenever the pushbutton construction means **26** is removed from the casing for lamp replacement and the like.

OPERATION

In using this invention, the user, or operator, may start with the parts as shown in FIG. 1. The operator holds the pushbutton **30** and inserts the lamp holder **28** first and then the pushbutton **30** into the casing end **22** as shown in FIG. 4. He continues to push the pushbutton **30** inwardly until the lamp holder **28** is stopped by the corner stop **32**, FIG. 5. At this time the pushbutton **30** and lamp holder **28** are held together by the legs **46**, FIGS. 1 and 7. The pushbutton **30** may be further pushed in with the plunges **38** and **40** pushing down on cam **68** so that each cam finger **70**, FIG. 4A pushes down on surface **92** of plunger disc **90**.

He continues to push down on pushbutton **30** so that plunger **40** causes cam **68** and each finger **70** to push plunger disc **90** down, as shown at FIGS. 5 and 5A, so that each finger **70** moves down from its position in FIG. 4A to the dotted line position of FIG. 5A and then slides down slanting surface **110** of guide **98** to the full line position of FIG. 5A where the finger **70** is stopped by stop slot **112**. This positively stops finger **70**, cam **68**, plunger **34** and **40** and pushbutton **30** in the position of FIGS. 5 and 5A, with the locking hooks **58**, FIG. 5, under the locking brackets **60** of casing **20**.

The user or operator then releases the pushbutton **30**, so that the springs **67** and lamp contacts **69** push the lamp holder **28** upward slightly to the position of FIG. 6. This locks the lamp holder **28** in the casing **20** with the hooks **58** engaging the casing brackets **60**. At the same time each cam finger **70** is raised to the position of FIG. 6A by the compression spring **122** which acts on the disc **90** and raises the lower end or the finger **70** above the stop notch **112**. Thereafter the user or operator may alternately push down and release the pushbutton **30** as often as he desires, and the plunger **36** will alternately actuate the switch means **44**, as shown in dotted lines in FIG. 6 and unactuate the switch means **44** as shown in full lines in FIG. 6. This controls any desired circuit and any lamps **80** which may be electrically connected to the switch connectors **78**. During this time the full line finger **70** of FIG. 6A slides down slanting surface **114** and reaches the full line position of finger **70** in slot **102** of FIG. 6B during the first actuating push in of pushbutton **30**. Thereafter the finger **70** may alternate between the full line and dotted line positions of FIG. 6B in the slot **102** as the pushbutton **30** is pushed down and released to actuate and unactuate the switch means **44** as shown in FIG. 6.

When the user or operator desires to remove the pushbutton construction means **26** from the casing **20** for relamping or other purposes, he pulls outwardly on pushbutton **30** as indicated by an arrow in FIG. 7 to pull up on legs **46** to the dotted line position **48A** of the leg ends so that the pushbutton **30** is pulled up to the position of FIG. 8. This brings the narrow throat **52** in line with the locking arms **54** ready to permit them to be pushed in by the compression springs **56**.

Thereafter the user pushes in slightly on push button **30**, as in FIG. 9. This moves the locking arms **54** down below the bracket **60**, so that the arms **54** are pushed in against the throat **52**. During the movements of the push button **30**, as in FIGS. 8 and 9, the plunger **40** has been moved to higher positions than in FIG. 6. This permits the compression spring **122** to push the plunger disc **90** to a higher position than in FIGS. 6A and 6B to the position of FIG. 9A, and higher. As the disc **90** is moved up in FIG. 9A the finger **70** is pushed up against downward serration **87** as shown in full line and farther, to the position shown in dotted lines **70A**. As the pushbutton construction means **26** is pulled out of the casing **20** to the position of FIG. 1, the lower end **130** of the finger **70A**, FIG. 9A is moved leftwardly of the highest point **132** of slanting wall **110A**.

When the pushbutton construction means **26** is reinserted in the casing end **22** and into the positions of FIGS. 4–6, the finger **70A** of FIG. 9A will eventually slide down slanting wall **110A**, etc., and into new leftward slot **102A** of FIG. 9A. The foregoing operations may be repeated as often as desired.

It is thus to be seen that a new, useful and unobvious pushbutton construction has been provided with a positive plunger safety stop.

While the form of the invention now preferred has been disclosed, as required by statute, other forms may be used, all coming within the scope of the claimed subject matter which follows.

What is claimed is:

1. In combination:

a casing having a receiving casing aperture means;

switch means connected with said casing;

pushbutton construction means to actuate and unactuate said switch means and being movable inward relatively to said casing aperture means by a pushing in action;

locking means and withdrawing means to lock said pushbutton construction means in switch means actuating and unactuating operable locked condition by an initial locking pushing in action of said pushbutton construction means into said aperture means followed by an initial release of said pushbutton construction means, and to withdraw said pushbutton construction means for said operable locked condition by a pulling out action of said pushbutton construction means, said pushbutton construction means being inwardly actuatable and outwardly releasable to operate said switch means respectively to actuated switch means condition and to unactuated switch means condition while said pushbutton construction means is in said locked operable condition;

safety means to prevent said pushbutton construction means from operating said switch means to actuated condition during said initial locking pushing in action and including a switch actuating plunger movably mounted and retained in a plunger support means carried by said casing independently of said pushbutton construction means, said plunger being movable toward and away from said switch means by said pushbutton construction means to actuate and unactuate said switch means, positive stop means, in said plunger support means, to stop said plunger in said switch means unactuating position during said initial locking pushing in action, and stop inoperative rendering means responsive to said initial release of said pushbutton to render said positive stop means inoperative to stop said plunger in unactuating position.

2. A combination according to claim **1** in which said pulling out action include a releasing pushing in action followed by a complete withdrawal of said pushbutton construction means from said casing.

3. A combination according to claim 1, in which stop reactivating means are provided responsive to said pulling out action includes a releasing pushing in action to reactivate said positive stop means to stop said plunger in unactuating position during a subsequent initial locking pushing in action, which follows a complete removal of said pushbutton construction means from said casing.

4. A combination according to claim 3 in which said positive stop means, said stop inoperative rendering means, and said stop reactivating means include:

a stationary serrated member with downward serrations;

said switch actuating plunger;

a plunger guide means for said switch actuating plunger;

said serrated member, said plunger and said plunger guide means being keyed together so that they cannot substantially rotate with respect to each other, and with said plunger being free to move longitudinally with respect to said serrated member and said plunger guide means;

cam means free to rotate between and relatively to said serrated member, said plunger, and said plunger guide means;

said plunger having upward ridges and upward flat surfaces;

said plunger guide means having slanting surfaces with stop notches and intermediate grooves;

said cam means being upwardly and downwardly movable with said plunger;

finger means on and movable with said cam means which engage said serrations, said ridges, said upward flat surfaces, said slanting surfaces, said stop notches, and enter in and move in said intermediate grooves;

said positive stop means, said stop inoperative rendering means and said stop reactivating means cooperating to cause said positive stop means to stop said switch activating plunger in switch unactuating position during an initial pushing in action of said push button construction means and to reactivate said positive stop means during a subsequent initial locking pushing in action of said push button construction means which follows a complete removal of said push button construction means from said casing.

5. A combination according to claim 4 in which said push button construction means includes a push button means and a lamp holder means, and in which said lamp holder means is positively stopped by casing stop means and said push button means is positively stopped by positive stop means connected with said switch actuating plunger during said initial pushing in action.

6. A combination according to claim 5 in which said pushbutton is movable relatively to said lamp holder means, and said pushbutton means has a pushbutton plunger means passing through said lamp holder means and operating said switch actuating plunger.

7. A combination according to claim 6 in which said pushbutton plunger means engages said cam means and causes said finger means to enter in and move in said intermediate grooves.

8. A combination according to claim 7 in which said plunger guide means is a cylindrical plunger guide means with a plurality of identical cylindrically arranged said slanting surfaces with said stop notches and said intermediate grooves, and said cam means and finger means have a plurality of fingers sliding on respective said slanting surfaces, engaging respective said stop notches, and entering and moving in respective said intermediate grooves.

9. A combination according to claim 8, in which said serrated members is a cylindrical serrated member with a plurality of cylindrically arranged downward serrations which are substantially aligned with said cylindrically arranged slanting surfaces, stop notches and intermediate grooves, and in which said plurality of fingers slidingly engage said cylindrically arranged downward serrations.

10. A combination according to claim 9 in which said plurality of fingers enter new intermediate grooves after said pushbutton construction means has been completely removed from said casing and is being reinserted into said casing.

11. A combination according to claim 4 in which said switch actuating plunger has an upper plunger disc.

12. A combination according to claim 11 in which said disc has an upper flat surface.

13. A combination according to claim 12 in which said flat surface has a plurality of ridges.

14. A combination according to claim 13 in which said disc has a plurality of teeth.

15. A combination according to claim 4 in which said plunger guide means is a cylindrical plunger guide means.

16. A combination according to claim 15 in which said guide means has a plurality of grooves, and said switch actuating plunger has an upper disc with a plurality of teeth engaging said grooves.

17. A combination according to claim 16 in which said guide means has an upper circular end and has a plurality of slanting upper surfaces which extend below and inward of said end which are engaged by said finger means.

18. A combination according to claim 17 in which said slanting surfaces have a plurality of stop notches which are engaged by said finger means.

19. A combination according to claim 18 in which said slanting surfaces have a plurality of continuing lower slanting surfaces extending into said grooves.

20. A combination according to claim 19 in which said guide means has a plurality of inward columns below said slanting surfaces to provide inwardly extending side walls to produce said grooves between said columns.

21. A combination according to claim 4 in which said serrated member is a cylindrical serrated member with a plurality of cylindrically arranged downward serrations, and in which said plunger guide means is a cylindrical plunger guide means having a plurality of grooves, a plurality of slanting upper surfaces, and a plurality of stop notches in substantial alignment with said cylindrically arranged downward serrations.

References Cited

UNITED STATES PATENTS

3,090,949	5/1963	Hallerberg	200—159 X
3,158,956	11/1964	McMains.	
3,197,598	7/1965	Andersen et al.	
3,394,403	7/1968	Dennison.	
3,437,775	4/1969	Piber	29—622 X

FOREIGN PATENTS

929,828	1/1948	France.
1,163,964	10/1958	France.
1,223,508	6/1960	France.

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