May 12, 1970 R. G. MILLER 3,511,951

HAND-HELD SWITCHING DEVICE WITH INTERLOCKED TRIGGER ACTUATING MEANS

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FIG. 1.

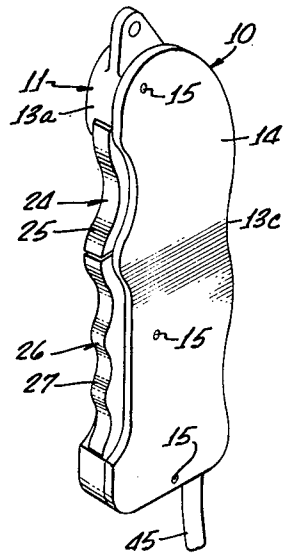


FIG. 3.

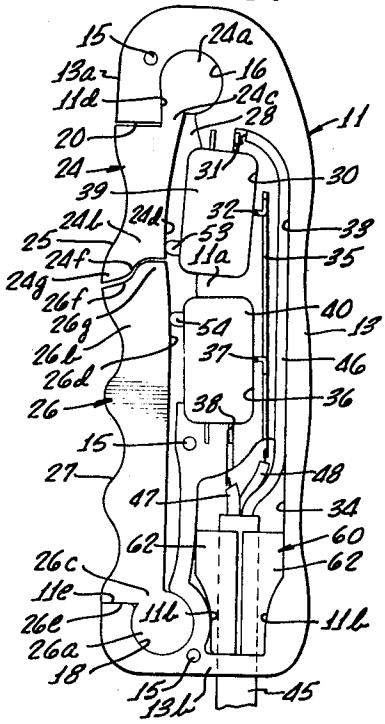
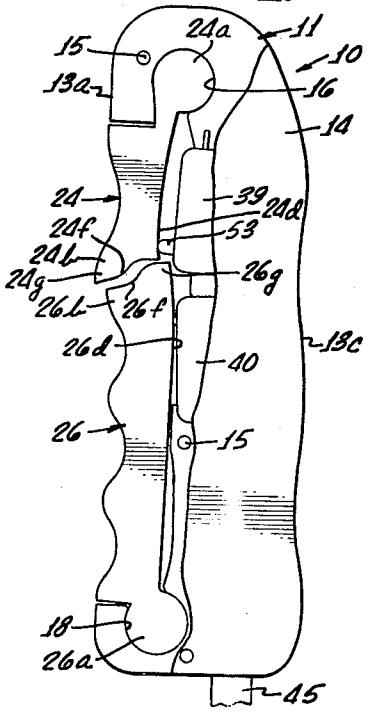


FIG. 4.



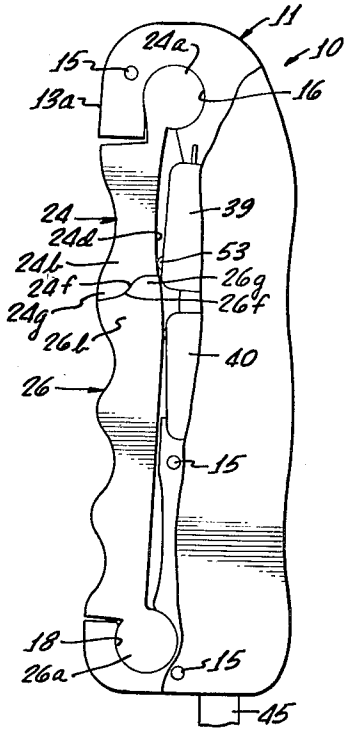


FIG. 5.

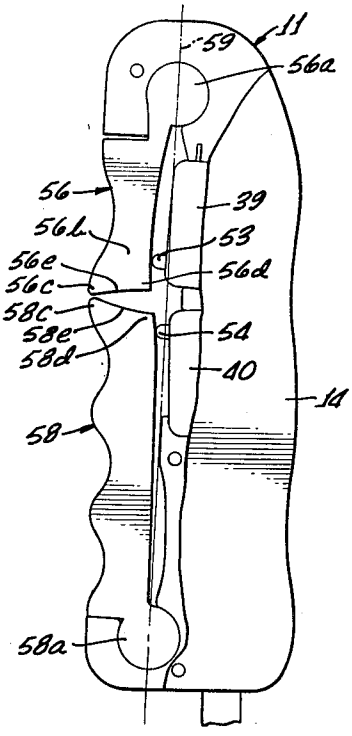


FIG. 6.

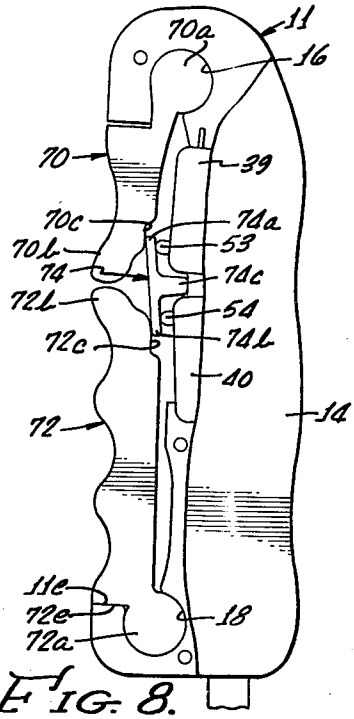


FIG. 8.

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FIG. 11.

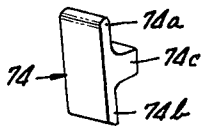


FIG. 2.

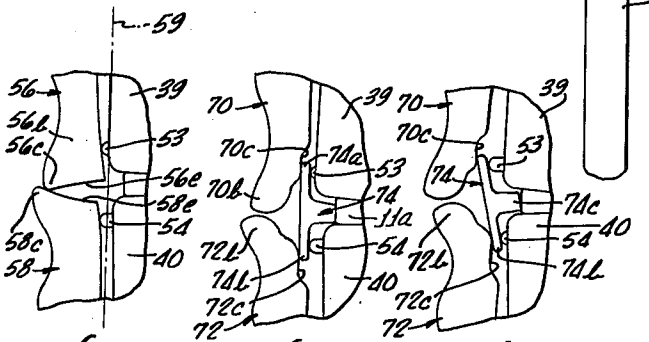


FIG. 7. FIG. 9. FIG. 10.

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HAND-HELD SWITCHING DEVICE WITH INTERLOCKED TRIGGER ACTUATING MEANS

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Int. Cl. H01h 9/06, 9/24, 21/10
U.S. Cl. 200—157 8 Claims

ABSTRACT OF THE DISCLOSURE

Two triggers are pivotally mounted along one edge of an elongated molded housing with their free ends extending toward each other and movable to operate a pair of switches confined by internal walls within the housing. In one embodiment, one trigger can be depressed independently of the other trigger to actuate a switch, but when the second trigger is depressed to operate a second switch, the free end of the second trigger engages the first trigger so that both switches are operated. In another arrangement using the same housing and switches, the free ends of the triggers move in overlapping paths so that either can be operated independently of the other but they cannot be operated simultaneously. In a third arrangement, a rocker element cooperates with the free ends of the triggers to prevent both triggers from being simultaneously operated.

BACKGROUND OF THE INVENTION

This invention relates to hand-held switching devices in which triggers for two switches operate in an inter-related manner. The invention further relates to an improved approach for assemblying a hand-held switching device. The devices are particularly useful in connection with controlling X-ray equipment or for controlling oppositely directed motion, such as up and down motion for an electric crane.

With X-ray apparatus including an X-ray tube having a rotating anode, it is essential that the anode be rotating when an exposure is made in order to avoid damage to the tube. Such apparatus normally includes a protective circuit which theoretically makes it impossible to make an exposure unless the anode is rotating; but since there is a possibility that such a circuit might fail, it is desirable that the switch device controlling the apparatus include means for providing additional protection to prevent such incorrect operation.

Such a control is not only important from the standpoint of protecting the expensive X-ray apparatus, but more importantly the patient should not be exposed to any unnecessary X-rays. To obtain a good diagnostic radiograph, the patient must be completely immobilized. This will enhance the detail and eliminate blurring. It is therefore important for an X-ray technician to make the exposure at the precise moment the patient is absolutely still. This is especially a problem with patients such as infants who are difficult to keep motionless. The need to repeat exposures also naturally wastes X-ray film and wastes the time of the machine, the operator and the patient.

A control of this nature may also be useful in other electrical circuits wherein sequence safety is desired. While hand-held switching devices directed to this general situation are known, they have not been completely satisfactory from a standpoint of convenience and reliability.

In the operation of certain electrical apparatus such as electrical overhead cranes, motor means are provided for up and down motion. It is desirable that two switches for controlling the motor means be positioned within a single hand-held switching device so that the operator has one hand free to position equipment being moved by the crane. To protect the equipment, it is desirable that the switching device be arranged so that only one switch at a time can be actuated.

In many operations, hand-held switching devices are subjected to considerable abuse such as being dropped or banged against heavy objects. Hence, it is very important that the device be ruggedly constructed to withstand such treatment without frequent repair. Further, it is important that such a device be constructed so that it can be easily and quickly assembled and disassembled, thereby permitting easy replacement of switches and repair of other components if necessary. It should be kept in mind that the equipment controlled by switching devices is often very expensive and in continual use by well paid personnel. X-ray equipment is a good example of this. Thus, delays due to inoperative switching devices are very costly. To be competitive, it is of course also necessary that a switching device be low in manufacturing cost.

SUMMARY OF THE INVENTION

In accordance with this invention, a pair of micro switches are supported within a housing adapted to be held in one hand. A first finger-operated trigger extends along one side of the housing and is supported by the housing in a manner such that one end of the trigger is movable to operate one of the switches. A second trigger extending along the same side of the housing is supported by the housing in a manner such that one end is movable to operate the second switch and is positioned adjacent to the movable end of the first trigger. The triggers are mounted so that in one manner of operation at least one of the trigger ends causes interference with the movement of the other trigger; and in another manner of operation, at least one of the triggers may be moved to operate its switch independently of the other trigger.

In one embodiment of the invention, the first trigger, which is operated by the last three fingers of one hand, has a portion which extends into the path of the second trigger, and the second trigger which is operated by the forefinger, has a portion which engages the first trigger as the second trigger is moved to operate its switch. Consequently, the first switch is operated each time the second trigger is moved to operate the second switch. When utilized to control X-ray equipment, the first switch is connected to control the rotating anode of the X-ray tube and other circuits while the other trigger controls the exposure circuit. The operator is supposed to depress the first trigger to energize the anode rotating means and then subsequently depress the second trigger to make the exposure when the patient is still. However, if the operator should make a mistake and depress the exposure trigger first, the anode trigger is nevertheless simultaneously depressed to actuate the switch controlling the anode rotor.

In accordance with a second embodiment of the invention, the ends of the two triggers are formed and situated so that either trigger can be operated independently of the other to actuate its switch; but if both triggers are simultaneously operated, they interfere so that neither switch is actuated. The interference is caused by the fact that the free ends of the triggers move in overlapping areas and engage each other if both are moved at the same time.

In a third embodiment of the invention, the trigger ends cooperate with a rocker element which prevents both triggers from being simultaneously depressed sufficiently to operate both switches.

The triggers of the three embodiments all fit within the same housing construction and cooperate with the same switches mounted within the housing. The housing is preferably molded of plastic in two sections held together by suitable fasteners. Inner walls within the

housing define cavities for confining the switches and recesses for portions of the triggers so that no additional screws or other fasteners are required to locate these components. The electrical leads are frictionally kept in contact with switch terminals thus eliminating the need for soldering or other mechanical connection. A strain relief arrangement for the electrical cord is also clamped within the housing without fastening elements. Thus, the entire construction permits easy repair or replacement of parts.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the hand-held switching device of one embodiment of the invention;

FIG. 2 is an exploded perspective view of the switch of FIG. 1 showing the internal structure;

FIG. 3 is a side cross-sectional view of the device of FIG. 1 with the switch triggers undepressed;

FIG. 4 is a view similar to FIG. 3 but with one of the triggers depressed;

FIG. 5 is similar to FIGS. 3 and 4 but with both triggers depressed;

FIG. 6 is a cross-sectional view of a second embodiment of the invention with the two triggers shown undepressed; and,

FIG. 7 is a view of a portion of the structure of FIG. 6 but with one of the triggers depressed;

FIG. 8 is a cross-sectional view of a third embodiment of the invention with the two triggers shown undepressed;

FIG. 9 is a partial view of the trigger ends of the embodiment of FIG. 8 with one trigger depressed;

FIG. 10 is view similar to that of FIG. 9 with the other trigger depressed; and

FIG. 11 is an enlarged perspective view of the rocker element of FIGS. 8–10.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiment of FIGS. 1–5

As seen in FIGS. 1 and 2, the hand-held switching device of the invention includes an elongated housing **10** which is formed to conveniently fit within one hand of an operator. The housing **10** includes a main section **11** having a large flat end or bottom wall **12** formed unitary with a plurality of edge walls **13**. A cover section **14** is joined to the edge walls **13** by suitable threaded fasteners **15**.

The housing **10** is preferably molded of a strong, rugged plastic or other suitable insulating material. Molded into the main housing section **11** are a plurality of inner walls defining various cavities and recesses for confining components of the switching device without fasteners other than the screws **15**. A generally circular recess **16** is formed in the upper end of the housing section **11**, and a similar recess **18** is formed in the lower end of the housing. These recesses **16** and **18** open on one side leading into an elongated opening **20** in the front edge wall **13***a*. The recesses **16** and **18** are also open at their ends remote from the end wall **12**.

Turning now to FIG. 3 as well as FIGS. 1 and 2, it may be seen that upper and lower elongated triggers or levers **24** and **26** are located in the opening **20** in the front edge **13***a* of the housing section **11**. A portion of each trigger extends slightly beyond the front edge of the housing so that the triggers may be easily gripped by the fingers of the operators hand. More specifically, the upper trigger **24** is positioned to be gripped easily by the forefinger of one hand on the contoured portion **25**, while the lower trigger **26** is positioned to be gripped easily by the other three fingers of the same hand on the contoured portion **27**.

The upper trigger **24** has an enlarged upper lobe **24***a* formed with a shape which is generally circular for more than 270°. This generally circular upper lobe **24***a* is confined for limited pivotal movement within the mating

recess **16** formed in the housing section **11**. The lower free end **24***b* of the upper trigger **24** is joined by a connecting neck portion **24***c* to the upper lobe **24***a*. The inner walls of the section **11** housing form a suitable space **28** for receiving the neck portion **24***c* and for permitting limited pivotal movement of the trigger free end **24***b* about the lobe **24***a*.

The lower trigger is formed with a similar enlarged lobe **26***a* on its lower end having a shape which is generally circular for more than 270° and is confined within a mating recess **18** formed in the lower end of the housing section **12**. The upper free end **26***b* of the lower trigger **26** is joined to the lobe **26***a* by a connecting neck portion **26***c*, which moves within a space **29** formed by the inner walls in the housing section **11** as the free end **26***b* is pivoted about the lobe **26***a*.

Referring to FIG. 2, the inner walls of the housing section **11** define a switch receiving cavity **30** near the upper recess **16**. End wall **12** forms an end of the cavity **30**, and the end remote from wall **12** is open until closed by the cover section **14**. The cavity **30** has a generally rectangular cross section, and the side nearest the front edge **13***a* of the housing opens into the elongated front edge opening **20**.

Leading outwardly from the recess **30** are a pair of narrow slots **31** and **32** defined by the housing inner walls formed unitary with the end wall **12**. The slot **31** further joins an elongated narrow channel **33** which curves around behind the recess **30** and into a cord terminating compartment **34** formed in the lower rear end of the housing section **11**. Similarly, the slot **32** joins an elongated narrow channel **35** which also opens into the compartment **34**.

A second switch receiving cavity **36** is defined by the housing inner walls below the cavity **30**, separated by a partition **11***a*. Again the end wall **12** of the housing section **11** forms an end of the cavity, while the other end is open, until closed by the cover section **14**. The cavity **36** has generally a rectangular cross section and the side of the recess nearest the front edge **13***a* of the housing opens into the elongated front edge opening **20**.

A narrow slot **37** opens from the back of the cavity **36** into the channel **35** which leads to the cord compartment **34**. Another narrow slot **38** opens from the end of the cavity **36** directly into the compartment **34**.

A pair of conventional, self-contained micro switches **39** and **40** are mounted respectively in the cavities **30** and **36**. The switch **39** is provided with a terminal **41** which extends into the slot **31**, and with a terminal **42** which extends into the slot **32**. The outer end of the terminal **42** is bent 90° to extend into the channel **35**. Similarly, the switch **40** has a terminal **43** which is bent at its outer end so that the terminal extends into the slot **37** and the channel **35**. A straight terminal **44** on the lower end of the switch **40** extends into the slot **38**. Note that the switches **39** and **40** with their terminals are transversely confined within their respective housing recesses **30** and **36**, and terminal slots **31** and **32**, and **37** and **38**.

A power cord **45** for connection to the switch terminals enters through an aperture **46** in the lower edge wall **13***b* of the housing section **11** into the compartment **34**. The cord **45** includes three insulated conductor wires, two of which **46** and **47** are connected to separate circuits, while the third **48** is common to both circuits. The wires are encased in a suitable insulation sheath **49**.

The wire **46** extends from the compartment **34** through the channel **33** and terminates connected to a U-shaped conductive element **50** positioned snugly within the slot **31**. The element **50** is positioned in the slot before the switch **39** is installed so that its terminal **41** is frictionally wedged into the slot **31** between the legs of the element **50** in good electrical contact with the terminal **41**, without any soldering or additional mechanical connection.

The conductor **47** is connected to a U-shape conductive element **51** which is similarly snugly positioned within

the slot **38**. When the switch **40** is installed within its cavity **36**, the straight terminal **44** is frictionally received within the U-shape conductive element **51** so that good electrical contact is made without soldering or any additional mechanical connection.

The common conductor **48** is connected to an elongated conductive strip or bus bar **52** which extends into the elongated channel **35**. The conductive strip **52** terminates with a U-shape conductive element **52***a* positioned adjacent the narrow slot **32**. Hench, when the switch **39** is positioned within its recess **30**, the outer end of its bent terminal **42** is frictionally received between the legs of the U-shape conductive element **52***a* so that good electrical contact is attained. Near the lower end of the conductive strip **52** there is formed another U-shape conductive element **52***b* which is located adjacent the narrow slot **37**. Thus, when the switch **40** is positioned and confined within the recess **36**, the outer end of its bent terminal **43** is frictionally received within the U-shape conductive element **52***b*.

Within the compartment **34** there is provided a strain relief means **60** for gripping the cord **45** in a manner such that the connections between the switch terminals and the conductor wires are not disturbed if someone applies a force to the cord by pulling on the housing **10**, as may frequently occur during utilization of the device. The strain relief means **60** includes a pair of mating gripping elements **62**, which as seen in FIG. 2 have their inner surfaces curved to mate with the cord **45**. The outer lower side surfaces **62***a* of each of the gripping elements **62** taper or converge downwardly to mate with similar converging walls **11***b* forming the lower side walls of the compartment **34**. The spacing between the tapered walls **11***b* is such that as the gripping elements **62** are forced downwardly with the tapered surfaces **62***a* in engagement with the walls **11***b*, the gripping elements **62** are forced into engagement with the insulation sheath **49** of the cord **45** so that they firmly grip the cord.

To retain the gripping elements **62** in their gripping position, a retaining element **64** is provided having a generally flat configuration which conforms to the shape of the upper portion of the compartment **34** above the elements **62**. The lower end of the retaining element **64** is bifurcated into two tongues **64***a* which engage the gripping elements **62**, while the space **65** between the tongues **64***a* receives the end of the cord sheath **49**. The length of the retaining element **64** between the elements **62** and the compartment end wall **11***c* is such that the gripping elements **62** are positively retained in their gripping position without any additional fastening means.

With the cover **14** closing the lower housing section **11**, the triggers, the switches and the cord are confined within the housing. Since none of these internal components are mechanically secured to the housing, replacement of components is a brief simple operation.

Each switch **39** and **40** is provided with a spring-loaded actuating button **53** and **54**, respectively, which extends outwardly toward the front opening **20** of the housing to be operated by the triggers **24** and **26**. More specifically, the upper switch **39** is formed with a button **53** near its lower end which engages the inner side surface **24***d* of the free end **24***b* of the upper trigger **24**. The switch button **53** urges the lower end of the upper trigger outwardly to its normally open or undepressed position. This outer movement is limited by the inter-engagement ofthe trigger neck portion **24***c* with the inner housing wall **11***d* defining one wall of the space **28**, as seen from FIGS. 2 and 3.

It should of course be understood the switches have internal contacts (not shown) controlled by the buttons **53** and **54**, and connected to the terminals. In the manner described herein, the switch contacts are normally open.

The inner upper surface **26***d* of the free end **26***b* of the lower trigger **26** engages the button **54** on the lower switch **40**, as can be seen from FIG. 3. The button **54** of the lower switch **40** urges the free end **26***b* of the lower trigger **26** outwardly into its normally open undepressed position. This outer movement of the free trigger end **26***b* is limited by the inter-engagement of the surface **26***e* of the lower trigger with the wall **11***e* on the lower end of the housing section **11**.

As can be seen from FIGS. 2 and 3, the outer faces **24***f* and **26***f* of the free ends of the triggers are arranged in generally opposing relation. The free end of the upper trigger **24** is formed with a depending projection **24***g* on its outer edge which mates with the surface **26***f* of the lower trigger **26** adjacent its outer edge. However, in the undepressed position of FIG. 3, the projection **24***g* is slightly spaced from the surface **26***f*. Similarly, the lower trigger **26** is formed with an upwardly extending projection **26***g* on its upper end adjacent its inner edge. This projection **26***g* mates with the inner portion of the surface **24***f* on the lower end of the upper trigger.

In operation, the switching device is grasped in one hand with the rear edge **13***c* of the device in the palm of the hand and the fingers engaging the triggers. The lower switch **40** may be actuated independently of the upper switch **39** by depressing the lower trigger **26** with the last three fingers of the hand so that the upper surface **26***d* of the lower trigger moves inwardly against the urging of the switch button **54** on the lower switch **40**, as shown in FIG. 4, to close its circuit. Note that the free end **26***b* of the trigger **26** moves freely away from the trigger **24**.

Referring now to FIG. 5, depressing the upper trigger **24** with the forefinger of the hand moves the free end **24***b* of the upper trigger **24** inwardly to depress the button **53** of the upper switch **39** and close its circuit. However, the free ends of the triggers move in overlapping paths or arcs. Depressing the upper trigger **24** causes its projection **24***g* to engage the projection **26***g* on the free upper end **26***b* of the lower trigger **26** so that the lower trigger **26** is depressed to actuate the lower switch **40** whenever the upper trigger **24** is moved to actuate the upper switch. The switches **39** and **40** are arranged so that the lower switch is closed no later than the upper switch when the upper trigger is depressed. In the depressed position of FIG. 5, the opposing surfaces **24***f* and **26***f* engage throughout their length.

When the switching device is used to control X-ray equipment (not shown), the circuit including the lower switch **40** is connected to energize the rotating anode of an X-ray tube and the upper switch **39** is connected to the circuits controlling the exposure of the X-ray film. Thus, in operation the operator is first supposed to depress the lower trigger **26** to actuate the lower switch **40**, and ready the equipment by energizing the motor for rotating the anode of the X-ray tube. Then when the subject is ready to be X-rayed, the upper trigger **24** is depressed by the operator's forefinger while the lower trigger **26** is still held closed. Upon completion of the exposure, both triggers are released so that they snap back to their normally open positions in response to the urging of the buttons of the respective switches. If the operator neglects to depress the lower trigger **26** so that the rotor of the anode motor is not operating when the upper trigger is to be depressed, the free ends of the triggers cooperate so that the lower trigger is depressed simultaneously with, or slightly before the upper trigger, thereby actuating the switch **40** and ensuring that the anode is always rotating before an exposure is made. To reduce the likelihood of operator error, the triggers are colored differently, such as black for the lower trigger **26** and red for the upper trigger **24**.

Embodiment of FIGS. 6 and 7

One of the features of the invention is that the arrangement shown in FIGS. 6 and 7 is identical to that of FIGS. 1–5 except that there is provided upper and lower triggers **56** and **58** that are formed differently and cooperate differently from that of the earlier described embodiment. Except for the triggers, the same numbering of identical components is used.

As can be seen from FIG. 6, the lower end **56***b* of the upper trigger is formed so that its outer lower corner **56***c* is in close proximity to the upper outer corner **58***c* on the upper end **58***b* of the lower trigger **58**. The inner corners **56***d* and **58***d* of the free ends of the upper and lower triggers are spaced from each other. The outer faces **56***e* and **58***e* of the free ends of the triggers are formed so that either trigger may be depressed without interfering with the other trigger. In other words as shown in FIG. 7, when the upper trigger **56** is pivoted inwardly about its axis to depress the button **53** of the switch **39**, its lower outer corner **56***c* subscribes an arc which just clears the upper corner **58***c* and the adjacent surface **58***e* of the lower trigger **58**. In the arrangement shown, the end surface **58***e* of the lower trigger **58** is essentially defined by this arc and its extension. However, it should be noted that the entire upper surface of the lower trigger **58** need not be formed as shown, in that it is only necessary that the lower trigger **58** does not interfere with the separate movement of the upper trigger **56**.

Similarly, when the lower trigger **58** is depressed to engage the button **54** and operate the switch **40**, its outer upper corner **58***c* subscribes an arc which approximately conforms to the lower surface **56***e* of the upper trigger **56**.

It can be seen from FIG. 6 that the arcs described by the corners **56***c* and **58***c* of the triggers intersect approximately where the triggers are in their normally open or undepressed positions. Consequently, movement of both triggers simultaneously will cause their corners **56***c* and **58***c* to interfere with each other so that neither trigger can be depressed. Thus, if the micro switches **39** and **40** are connected to operate the up and down motion of an electric crane for example, both up and down circuits cannot be simultaneously energized. However, either switch can be actuated independently of the other, as shown in FIG. 7, without any interference.

It should be noted that the mating ends of the upper and lower triggers need not be formed precisely as shown. It is only necessary that when both triggers are depressed, some portion of the opposing surfaces inter-engage to restrict further motion before either switch is actuated. To provide such an arrangement, it is necessary that the arcs described by the outermost portions of the free ends of the triggers intersect before the switches are actuated as the free ends of the triggers are moved inwardly towards a line **59**, connecting the pivotal axes **56***a* and **58***a* of the two triggers **56** and **58** in that so long as the corners **56***c* and **58***c* are moving towards the line **59**, they are moving closer to each other.

Embodiment of FIGS. 8–11

The hand-held switch device in the arrangement of FIGS. 8–11 is structurally identical to that of the previous two embodiments with the exception that there is provided a pair of triggers **70** and **72** which are different from those of the earlier arrangements, and there is further provided a rocker element **74** which cooperates with the free ends of the triggers **70** and **72**. The triggers **70** and **72** are each respectively provided with an enlarged lobe **70***a* and **72***a* which pivots within the mating recesses **16** and **18** formed in the housing as in the earlier arrangements. The free ends **70***b* and **72***b* of the triggers are spaced slightly so that either trigger may be depressed without directly engaging the other. The inner surfaces **70***c* and **72***c* of the triggers are recessed or formed to receive the rocker element **74**.

The rocker element **74** has substantially a T-shaped cross section as seen in FIG. 8 with the elongated upper portions of the element forming a pair of outwardly extending legs **74***a* and **74***b*. As seen from FIG. 8, the leg **74***a* extends between the switch button **53** and the surface **70***c* of the trigger **70**. Similarly, the leg **74***b* extends between the switch button **54** and the surface **72***c* of the trigger **72**. The third leg **74***c* of the rocker element **74** extends from between the legs **74***a* and **74***b* generally perpendicular to the legs **74***a* and **74***b*. The outer end of the leg **74***c* bottoms against the wall or partition **11***a* of the housing section **11** which extends between the two switches **39** and **40**.

As seen from FIG. 11, the width of the rocker element **74** is approximately the same as the widths of the triggers **70** and **72** with the result that the rocker element is limited in sideways movement by the housing end wall **12** and the cover section **14** forming the other housing end wall. Inward movement of the element **74**, as seen in FIG. 8, is limited by the partition **11***a*; outward movement is limited by the triggers **70** and **72**; and vertical movement of the element as viewed in FIG. 8 is loosely restricted by the switches **39** and **40** in cooperation with the triggers. Thus, the element is effectively confined as shown without the use of any additional fastening means.

In operation, the rocker element **74** prevents the triggers **70** and **72** from being simultaneously depressed sufficiently to operate the respective switches, in that the inward or sideways movement of the entire element is limited by the engagement of the leg **74***c* with the partition **11***a*. Depressing forces simultaneously applied to the rocker element by the triggers through opposite ends of the legs **74***a* and **74***b* are essentially balanced. However, when only one trigger, such as trigger **70** is depressed as shown in FIG. 9, the rocker element **74** is pivoted about the leg **74***c*, with the result that the leg **74***a* moves inwardly sufficiently to depress the switch button **53** and operate the switch **39**. This inward movement of the leg **74***a* causes the opposite leg **74***b* to pivot outwardly moving the free end of the trigger **72** slightly outwardly. The relationship between rocker element **74** and the trigger ends **70***c* and **72***c* and between the surface **72***e* and the housing wall **11***e* at the lower end of the trigger **72** is such that this limited outward movement is permitted. Thus, it will be seen that while the upper trigger **70** is depressed, the rocker element **74** prevents the lower trigger **72** from being depressed.

Referring to FIG. 10, it can be seen that the opposite result is obtained when only the lower trigger **72** is depressed. That is, the force applied against the lower trigger **72** causes the leg **74***b* of the rocker element **74** to move inwardly pivoting the rocker element about the end of the pivot leg **74***c* and causing the leg **74***a* of the rocker element to move outwardly and slightly move the free end **70***b* of the trigger **70**. Consequently, the switch **40** is operated while the rocker element prevents the trigger **70** from being depressed to simultaneously operate the switch **39**.

It will be realized that the switching device of the embodiment of FIGS. 8–11 is intended to perform the same switching function as the device of FIGS. 7 and 8, such as controlling the up and down motion of an overhead crane. The arrangement prevents actuation of both triggers at the same time. An advantage of this embodiment is that close tolerances of the components are not required. Both the housing and the triggers may be molded of plastic and the fit between the trigger lobes **70***a* and **72***a* and the housing recess as well as other mating surfaces of the components, is somewhat loose and need not be kept within precise tolerances for proper performance. Thus manufacturing techniques are simplified. Also, component wear is less significant when tolerances are not critical.

What is claimed is:

1. A hand-held switching device, comprising:

a housing adapted to be held in one hand;

first and second switches supported by said housing;

a first finger operated trigger extending along one edge of the housing and supported by the housing in a manner such that one end is movable to operate said first switch;

a second finger operated trigger extending along said one edge of the housing and supported by the hous-

ing in a manner such that one end is movable to operate said second switch and is positioned adjacent said movable end of said first trigger; and

said triggers being mounted so that in one manner of operation movement of at least one of said trigger ends causes interference with movement of the other and in another manner of operation at least one of the triggers may be moved to operate its switch independently of the other trigger;

the first trigger having a projection which extends into the path of said second trigger; and,

said second trigger having a projection which engages the projection on the first trigger as the second trigger is moved to operate its switch.

2. The switching device of claim **1**, wherein said switches are arranged such that the first switch is actuated no later than said second switch.

3. A hand-held switching device, comprising:

a housing adapted to be held in one hand;

first and second switches supported by said housing;

a first finger operated trigger extending along one edge of the housing and supported by the housing in a manner such that one end is movable to operate said first switch;

a second finger operated trigger extending along said one edge of the housing and supported by the housing in a manner such that one end is movable to operate said second switch and is positioned adjacent said movable end of said first trigger; and

said triggers being mounted so that in one manner of operation movement of at least one of said trigger ends causes interference with movement of the other and in another manner of operation at least one of the triggers may be moved to operate its switch independently of the other trigger, the triggers being mounted such that said movable ends cause interference when an attempt is made to operate both triggers at the same time, with the result that neither switch can be operated.

4. The switching device of claim **3**, wherein one trigger when actuated is in the path of the other trigger so that only one switch at a time can be operated.

5. A switching device, comprising:

first and second switches;

a first pivotally mounted trigger having a free end for actuating said first switch;

a second pivotally mounted trigger extending generally towards the other trigger and arranged so that its free end is adapted to operate said second switch and is close to the free end of the first trigger;

said free ends having cooperating surfaces arranged so that depressing said second trigger also depresses the first trigger and said second switch is operated at least as soon as said first switch is operated, and so that said first trigger can be depressed independently of said second trigger to operate said first switch.

6. The switching device of claim **5**, wherein said first trigger has a projection along one edge of its free end extending toward the second trigger, and said second trigger has a projection which engages the projection on the first trigger when said second trigger is depressed.

7. A switching device, comprising:

first and second switches; and

first and second pivotally mounted triggers arranged so that the outer faces of their free ends oppose each other;

said triggers being independently pivotable from unoperated positions toward operated positions wherein surfaces on said free ends adjacent said outer faces respectively actuate said first and second switches, the arcs subscribed by said trigger free ends intersecting as said triggers are pivoted from their unoperated positions toward their operated positions.

8. A hand-held switching device comprising:

an elongated housing;

first and second switches supported within said housing;

first and second switch triggers pivotally supported along one edge of said housing and movable to operate respectively said first and second switches, either trigger being movable independently of the other to operate its switch; and

means associated with said triggers for preventing either trigger from being moved to operate its switches while the other trigger is already moved to operate its switch, said means comprising portions formed on the triggers which interengage to prevent actuation of the switches when the triggers are simultaneously moved but which do not engage when independently moved.

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