April 19, 1966 F. W. HICKS, JR., ETAL 3,246,728

SAFETY SWITCH

Filed Aug. 21, 1962 2 Sheets-Sheet 1

FIG. 1

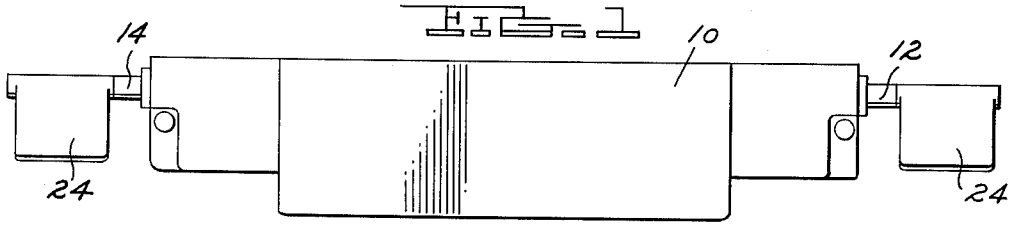


FIG. 2

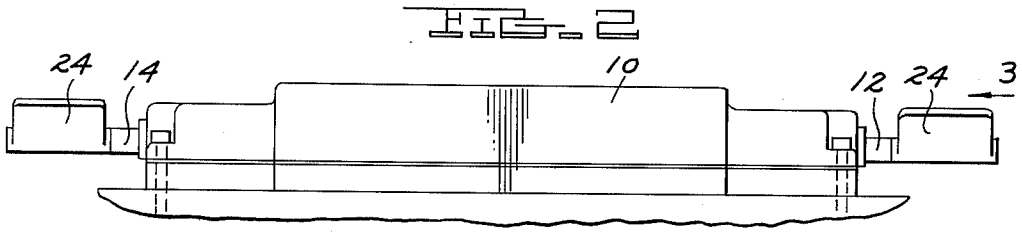


FIG. 3

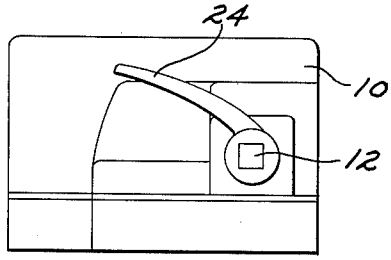
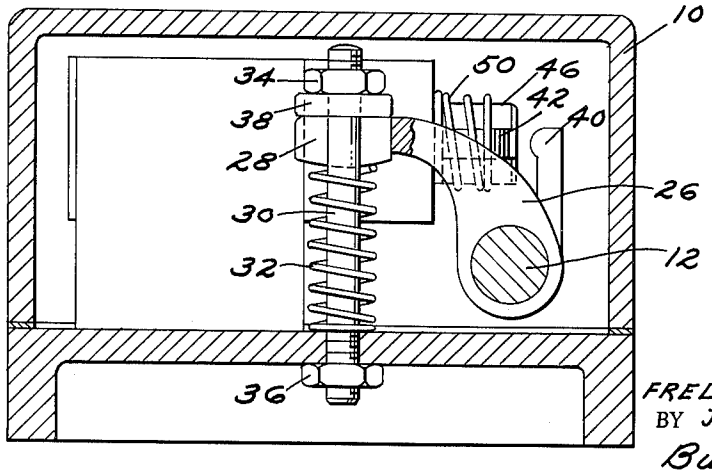


FIG. 5



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SAFETY SWITCH

Filed Aug. 21, 1962 2 Sheets-Sheet 2

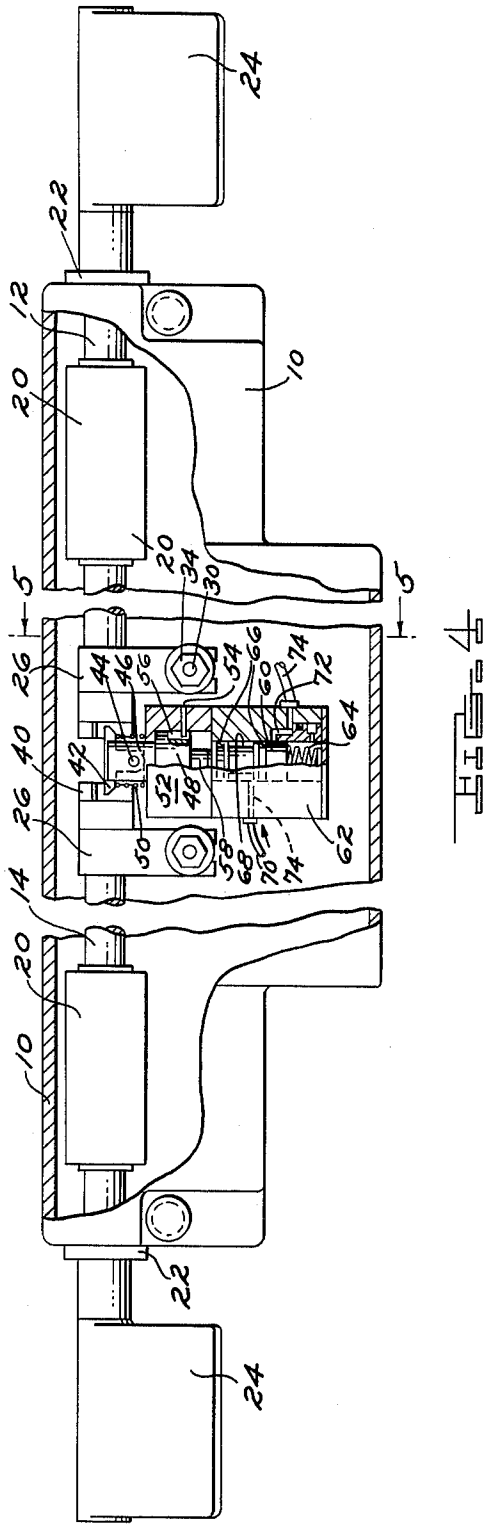

FIG. 4

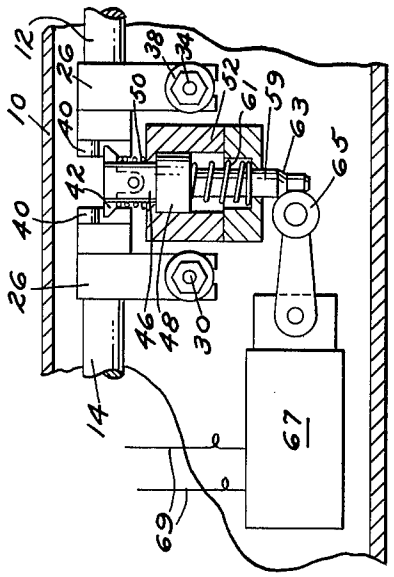

FIG. 7

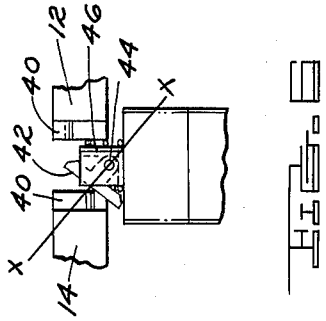

FIG. 5

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SAFETY SWITCH

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2 Claims. (Cl. 192—131)

This invention relates to safety control mechanism for a switch designed for use in controlling the operation of power driven machines such as power presses or the like. In the operation of such power driven machines suitable switches are used to control the application of power to the machine: fluid pressure switches for fluid power and electric switches for electric power are commonly employed.

An object of this invention is the provision of effective safety control mechanism for the switch device which controls the application of power to the machine, and which control mechanism requires the constant simultaneous operative presence of the two hands of the machine operator on two handles of the control mechanism itself to institute and maintain the power movement of the machine.

It is common knowledge that machine operators, notwithstanding instructions to the contrary, will use one hand to throw the switch to actuate the machine and will use the other hand to move a piece of work into place on the machine, and as a result injury to an operator's work-manipulating hand often results.

Switches have heretofore been provided with control means wherein two handle portions were employed and wherein each handle portion requires manual pressure thereupon to effectively actuate the switch, and operators have been known to actuate one handle portion with one hand and to actuate the other handle portion with the elbow of the same arm whereby the other hand of the operator was left free to manipulate the work. Various other expedients have been employed to actuate the control switch and leave one hand of the operator free. In fluid power switches variation in fluid pressure at different points have produced undesired operation. Operators have been known to wire around safety points of electric switch control mechanism to obtain a free hand for work manipulation.

An object of the instant device is the provision of switch control mechanism which, it is believed, cannot be circumvented or by-passed, and which will require the presence of both hands of the operator upon separated handle portions of the switch continuously and simultaneously to institute switch action.

More particularly, this improved switch control mechanism comprises two manually operable elements each having a handle part, which handle parts are spaced apart such a distance that they cannot be readily bridged by an operator to respond to movement of one arm or hand, but will require the substantially constant simultaneous maintenance of both hands of the operator thereupon.

This control mechanism provides a mechanical coupling arrangement extending from each of the two handle parts to the switch itself, and which mechanical coupling arrangement is protected from unauthorized meddling. The switch mechanism might be fluid or electric or as desired, but the control to actuate the switch must be such that only when both handle parts of the control are moved in unison by the two hands of the operator will the switch respond. This control mechanism is rendered mechanically ineffective to operate the switch upon nonsimultaneous actuation of its handle parts or actuation of only one handle part.

More particularly, the control mechanism is operably shiftable to actuate the switch in response to a predetermined coordinated movement of the two handle elements, but is inoperably shiftable in response to other or independent movement of such elements.

The mechanical arrangement which constitutes the connecting linkage extending between the two hand engageable parts of the two shiftable elements includes a displaceable part or tiltable plate as a part of the linkage. This plate is so supported that it must be acted upon simultaneously by pressure applied from both handle portions or the plate will be displaced so as to be rendered ineffective to transmit an operating impulse to the switch which controls the functioning of the machine. Once this plate is displaced or tilted out of the way so that it does not transmit operating movement to the switch, the control mechanism must be fully released to return to its original starting position. In other words, it is not possible to apply pressure initially to one handle and then apply pressure later to the other handle and thereby obtain operative functioning.

Moreover, if the two handle elements are properly actuated to institute a movement of operation, but before the movement or operation is completed one handle element is released, thereby releasing the pressure exerted by such handle element actuated part upon its side of the tiltable plate, such side of the tiltable plate will swing upwardly and the plate tilts to an inoperative position. The opposite ends of this plate are so positioned as to be acted upon beyond the point of the pivot support of the plate in a direction toward the part acting upon the plate so that when the plate is acted upon by linkage associated with one member only the plate tilts about its pivotal support as shown in FIG. 6 rather than moves as a unit on an even keel to operate the switch. It will be noted that when the plate has tilted as shown in FIG. 6 the pressure thereupon to actuate the same is not in the direction to produce responsive movement of operation, but is a sidewise thrust so transmission of motion of actuation is interrupted.

Through employing a mechanical transmisison of motion mechanism rather than utilizing other media the control means is particularly foolproof and effective.

FIG. 1 is a plan of the safety control mechanism of this invention;

FIG. 2 is a fragmentary side elevation thereof;

FIG. 3 is an end view showing the handle of the operating element;

FIG. 4 is a plan partly broken away showing the operating device coupled with a fluid control switch to actuate the same;

FIG. 5 is a vertical section taken along line 5—5 of FIG. 4;

FIG. 6 is a fragmentary elevation showing tilting of a part of the control mechanism in response to ineffective actuation; and

FIG. 7 is a fragmentary broken away elevation partly in section showing the control associated with an electrically responsive switch.

In the drawings my control mechanism is shown in FIG. 4 as associated with a fluid pressure responsive switch device to control functioning of a power machine, not shown. In the modification of FIG. 7 the control mechanism is shown associated with an electrically responsive switch for a similar purpose. The invention relates to the control mechanism and not to the conventional switch means which may be associated with the machine, except as the control mechanism has such switch associated therewith.

The control linkage of this invention is in the form of a mechanical construction which, as to its operating parts that respond to the manually actuated handles,

is enclosed within a casing **10** or the like, which casing is so dimensioned and formed that the two manually responsive handles cannot be operated by one hand of an operator or conveniently bridged for operation by one hand. There are two complementary manually shiftable handle elements which are here illustrated in the form of rotatably supported shaft elements **12** and **14**. Each of these shafts **12** and **14** is supported within suitable bearings. There is a large bearing element **20** located within the casing for each shaft. Each shaft has a handle part **24** whereby the shaft may be manually rotated.

Mounted upon each shaft is an arcuate lever **26**. In FIG. 4 it is shown as mounted upon shaft section **12** as such figure is taken along section line **5—5**. The free end of this lever is slotted as at **28** (FIG. 5) to travel over a fixed pin **30** carried by the casing **10** against pressure of expansion spring **32**, the tension of which spring can be regulated by an adjusting nut **34**. This pin is mounted within the interior of the casing and is held in place by nut **36**. Superposed over the slotted end of the lever **28** is washer **38** held down by nut **34**, the pressure of the spring acting upon the lever **26** tends to hold the shaft normally at the idle position as shown in FIG. 4. The shaft is rotated against the tension of the spring by manual pressure upon the handle **24**.

There is mounted upon the inner end of each shaft a lever **40** (FIG. 5). These two complementary levers **40** are supported as shown in FIG. 4 so as to engage opposite ends of a tiltable plate **42**. This plate is pivotally supported as at **44** upon a pivot pin carried by the upper slotted end **46** of a plunger which has an enlarged diameter portion **48**. This plate is maintained normally upon an even keel by a light spring **50** which bears at its upper end against the plate and at its lower end against the casing **52** within which the plunger is supported for reciprocation. To prevent undesirable rotation of the plunger a pin **54** extends through the casing and is received within a slot **56** formed within the enlarged diameter portion **48** of the plunger. The lower end **58** of the plunger is of reduced diameter and bears against the upper end of a fluid pressure valve piston **60** as shown in FIG. 4.

This valve piston **60** is shown in FIG. 4 as mounted within a surrounding cylinder **62**. The piston is held upwardly by spring **64**. The piston is provided at opposite ends with sealing O-rings **66**. The intermediate portion of the piston is shown as of reduced diameter as at **68** to provide a passageway for fluid around the piston. This circumferential passageway has an inlet **70** extending through the casing for the intake of fluid under pressure. On the opposite side the casing is provided with an outlet passage **72**. Fluid pressure lines **17** and **74** communicate with these two flow passageways **70** and **72**. One of them leads to a fluid control switch, not shown, which is associated with the machine to be controlled.

FIG. 7 shows two shafts **12** and **14** extending into the casing **10** and having the levers **40** at their inner ends disposed above the opposite ends of the tiltable plate **42** as heretofore described. The arcuate levers **26** which are carried by these two shaft sections **12** and **14** have their slotted ends received over the pins **30** as shown. The tilt plate **42** is held upwardly by spring **50** as heretofore described. The plunger **46** has its enlarged portion **48** slidably mounted within the casing **52** and a guide pin **54** shown in FIG. 4 but not in FIG. 7 would be provided to guide the reciprocation of this plunger and prevent its rotation.

The reduced lower end of the plunger is indicated as **59**. An expansion spring **61** encircles this portion **59** and holds the plunger upwardly within the casing as shown in FIG. 7. The immediate lower end portion of the plunger is bevelled as at **63** and this bevelled area directly engages the control lever **65** shown within the electric switch assembly **67**. Two wires leading from this switch member are indicated as **69**. The switch is conventional. The swinging of the lever in response to movement of the plunger actuates the switch and makes the circuit through the switch and through the control switch on the machine itself. This electric switch **67** takes the place of the fluid pressure control valve shown in FIG. 4 and serves the same purpose.

FIG. 6 illustrates what happens if only one manually shiftable element is operated. For example, if shaft **14** were rotated independently of the shaft **12** its lever **40** would tilt plate **42** as shown in such FIG. 6. Each of the two levers **40** is shown as superimposing the table **42** off-center its pivotal support so that the table tilts upon pressure applied from either one of the two levers only. When it is tilted to the position shown in FIG. 6 it is apparent that it is not in position to respond to actuation by the lever **40** of the other shaft. Its tilting has also prevented response of the switch control mechanism in such a manner as to close a circuit or energize switch control for the power machine itself.

It will be noted that when the plate **42** has been fully tilted through actuation by only one lever or cam **40** as shown in FIG. 6, that the lever **40** which has tilted the plate is in contact therewith below a center line which is established by the line X—X. This line X—X is a center line which is vertical to the plane surface of the tiltable plate **42** and the engagement or thrust of the lever **40** against such plate is shown in FIG. 6 as below this center line and as exerting a side thrust against the plunger rather than a downward thrust. If the lever **40** shown in engagement with the plate **42** were in contact therewith above the center line X—X, it is apparent that it would exert a downward thrust on the plunger and such downward thrust might operatively actuate the plunger. It is important, therefore, that the thrust engagement of the levers or cams **40** be against the tiltable plate as specified so that when the plate **42** tilts in response to pressure thereagainst of one lever only, that such lever pressure is against the plate at such a point that the pressure thrust is sideways when the plate has tilted as shown in FIG. 6.

From the above it will be apparent that in the normal operation of the machine when both handle portions **24** are depressed simultaneously that pressure will be brought to bear upon the opposite ends of the tilt plate **42** and through the pivotal connection of such plate with the plunger **46** such plunger will be depressed. Depression of this plunger (considering FIG. 4) will depress the fluid pressure piston and the feed lines **70** and **72** will both be brought into communication with the circumferential passageway which surrounds the intermediate reduced diameter portion **68** of the piston so that fluid pressure will be transmitted directly to the fluid control which actuates the machine. When the two handles **24** are released by the two hands of the operator the two shaft sections **12** and **14** are reversely rotated by the action of the springs **32** acting upon the arcuate levers **26** and the spring **64** lifts the piston **68** within the plunger **46** so that the several parts occupy the position shown in FIG. 4 being ready for a new cycle.

It is apparent that the safety control mechanism cannot be operated so as to respond to the manual depression of only one handle. Not only will it fail to respond to such but as long as this one handle is held depressed the tilt plate **42** will be so disposed that depression of the other handle would have no operating effect. It is also apparent that the two handles must be operated in a determined coordinated fashion as to their operation if the control device is to be effective to actuate the control switch of the machine.

In the operation of the device it is essential that the pressure of both hands of the operator be maintained on the handles or pressure pads **24** throughout the operation. If pressure were brought to bear upon both handles **24** and a movement started but not completed and then one handle were released, the shaft carrying such handle would be reversely rotated by the spring **32**. As a result of this

the tiltable plate 42 would respond to its own spring 50 and the action of the spring 64 on the plunger itself, and the action of such springs would result in the tilting of the plate 42 to a position such as shown in FIG. 6, and the device would be rendered inoperative. It is necessary, therefore, that once the action is instituted the pressure of both hands must be retained on both handles to accomplish the completion of the operation.

What we claim is:

1. Safety control mechanism for a switch comprising, in combination: an elongated housing having remotely arranged opposite ends at such distance from each other as to require a human operator to spread his arms to reach such ends, two shaft sections disposed in axial alignment and rotatably supported in the housing with the inner ends of said sections lying in spaced apart relation and the outer ends of the shaft sections projecting out of said opposite ends of the housing and provided with relatively short handle portions disposed adjacent said ends of the housing and lying substantially wholly within the transverse width of the housing for manual engagement one by each hand of an operator of the mechanism, each shaft section being independently rotatable in response to manual pressure on said handle portion, a laterally projecting lever arm within the housing fixedly secured to each of said shaft sections adjacent the inner end thereof, a switch control plunger supported in the housing for reciprocation in alignment with the space between the inner ends of said shaft sections and tensioned toward said inner ends, said plunger having a bifurcated end adjacent said shaft sections, a plate pivotally mounted within the bifurcated end of the plunger and having opposite end portions disposed laterally of the plunger on opposite sides thereof in the path of swingable movement of said lever arms on said shaft sections to be actuated thereby upon rotation of the shaft section, and spring means tensioning said plate to a position normal to the plunger, said plunger responsive in reciprocable movement to actuate the switch when the end portions of the plate are acted upon simultaneously by the lever arms of the two shaft sections, said plate responsive to tilt ineffectively about its pivot without shifting said plunger when only one of said end portions of the plate is acted upon by the lever arm of one shaft section, the other end of the plate being tilted out of the path of actuating movement of the lever arm of the other shaft section causing free idle movement of the latter lever arm along its path.

2. The invention as defined in claim 1 characterized in that said spring means tensioning said plate to a position normal to the plunger comprises a coil spring encircling said plunger and bearing against said opposite ends of said plate.

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