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Geist

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[54] SAFETY ASSEMBLY FOR FASTENER DRIVING TOOL

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[52] U.S. Cl. 227/8

[51] Int. Cl. B27f 7/22

[58] Field of Search 227/7, 8

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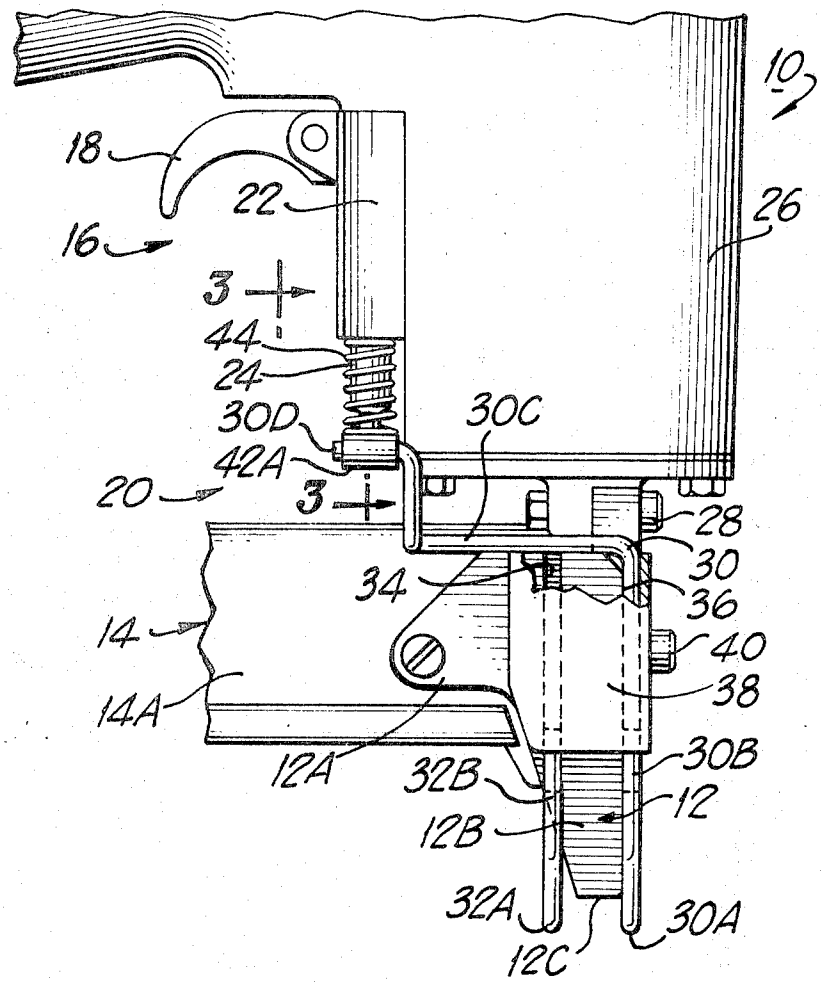
Primary Examiner—Granville Y. Custer, Jr.

Attorney—Richard D. Mason et al.

[57] ABSTRACT

A safety mechanism for a pneumatic fastener driving tool prevents operation of the tool when a nosepiece structure containing a fastener discharging opening is not disposed flush against and covered by a workpiece. This avoids "free flight" of power driven fasteners resulting from a tool being disposed at an angle adjacent an edge of a workpiece so that the fastener passes through only a portion of the workpiece. To accomplish this, the safety assembly includes two workpiece engaging members disposed on opposite sides of the nosepiece structure and coupled to opposite ends of a lever centrally fulcrumed on an operator for the tool firing control. Unless both members are elevated by engagement with the workpiece, the lever does not operate the control. To reduce the chances of tool operation when the tool is tipped in the plane of the workpiece engaging members, these members are so formed as to provide only point or small area contact with the workpiece.

10 Claims, 7 Drawing Figures



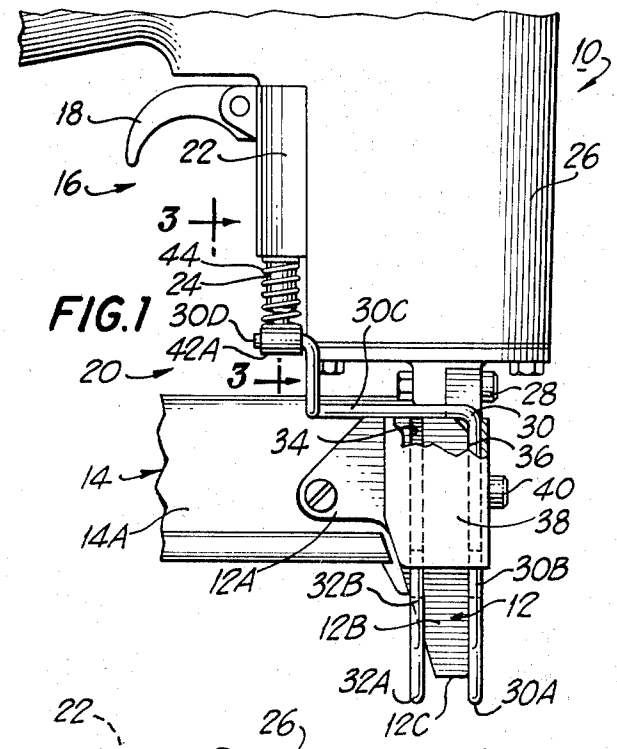


FIG. 1

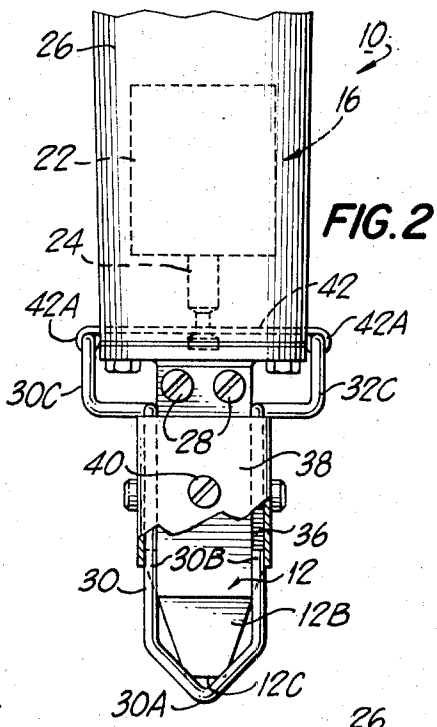


FIG. 2

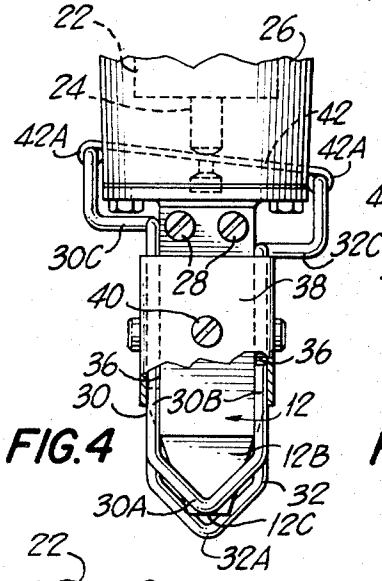


FIG. 4

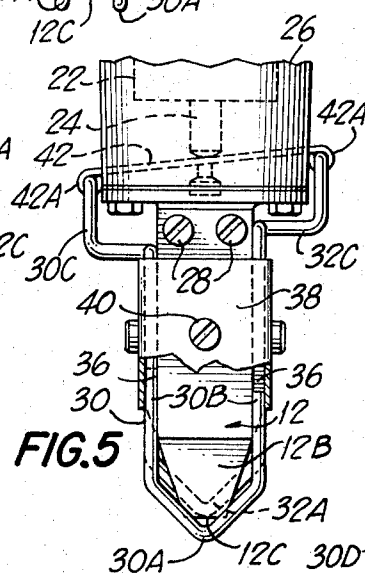


FIG. 5

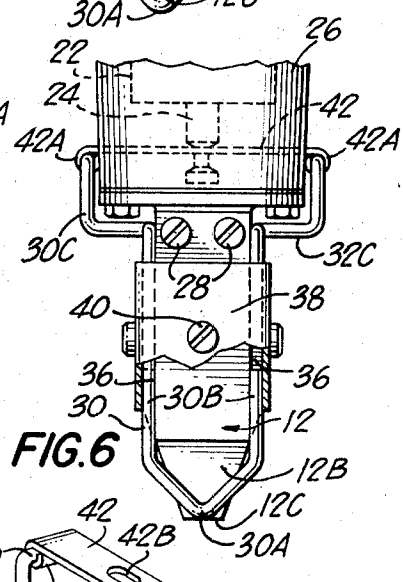


FIG. 6

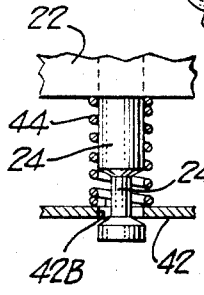


FIG. 3

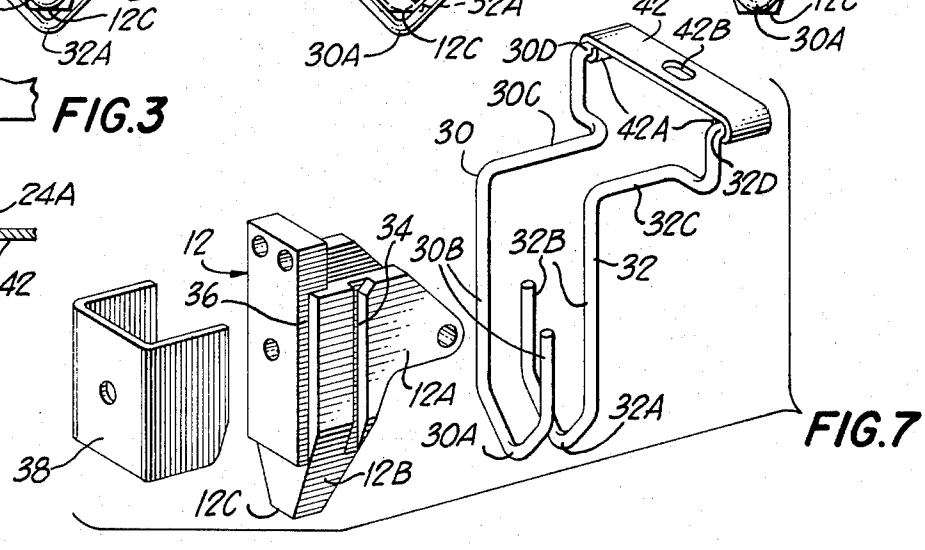


FIG. 7

SAFETY ASSEMBLY FOR FASTENER DRIVING TOOL

This invention relates to a fastener driving tool and, more particularly, to such a tool having a new and improved safety means for insuring that the fastener discharging opening of the tool is disposed flush against a workpiece into which the fastener is to be driven.

Pneumatic and other types of power driven fastener driving tools have long been provided with mechanical and/or pneumatic safety or touch-trip assemblies designed to prevent manually controlled operation of the tool unless and until the nosepiece structure of the tool through which the driven fastener is discharged is disposed against the workpiece. These arrangements commonly include a workpiece engaging element, either U-shaped or concentric with the nosepiece structure, which projects downwardly beyond the nosepiece to be elevated when the nosepiece is pressed against the workpiece. These elements operate a pneumatic valve or a machanical linkage associated with the trigger actuated firing control to permit the tool to be operated.

These workpiece engaging elements generally are rigid and either substantially completely embrace the nosepiece (U.S. Pat. Nos. 3,572,572 and 3,580,455) or extend almost completely across the width of the nosepiece (U.S. Pat. Nos. 3,172,124 and 3,194,324). These constructions are such that when the tool is inclined either in the plane of the tool or in a plane transverse to the plane of the tool the rigid workpiece engaging element is elevated sufficiently to release the tool for operation even though the lower wall of the nosepiece through which the staple or nail is ejected is inclined or tipped relative to the workpiece surface. This tipped position causes the fasteners to be driven at an angle with respect to the workpiece.

When fasteners are driven under these conditions and if the fastening operation is being performed adjacent the edge of a workpiece, the fastener such as a nail passes through only an edge portion of the workpiece and then enters "free flight." This occasions the possibility of injury to an operator or equipment and has, in some areas, led to work regulations forbidding the presence of more than a single tool operator in an assembly area. The use of single point contact safety actuators in some prior tools (U.S. Pat. Nos. 3,056,964 and 3,252,641) prevents tipping of the tool in a first plane, generally a plane transverse to the plane of the tool, but not in the direction of elongation of the tool.

Accordingly, an object of the present invention is to provide a new and improved fastener driving tool and, more specifically, a new and improved safety assembly for such a tool.

A further object is to provide a safety assembly for a power actuated fastener driving tool that requires the tool to be properly located with respect to a workpiece before the tool can be operated.

Another object is to provide a safety assembly including independently movable workpiece engaging elements disposed on opposite sides of the fastener discharge opening to insure that the opening is placed against the workpiece before the tool can be operated.

Another object is to provide such a safety assembly in which the workpiece engaging elements have point or small area contact with the workpiece in a position immediately adjacent the fastener discharging opening to insure that the safety cannot be released when the tool is tipped relative to the workpiece.

In accordance with these and many other objects, an embodiment of the invention comprises a pneumatic fastener driving tool formed by a housing containing a power unit whose actuation is controlled by a control unit including a trigger operator and a safety operator, both of which must be actuated to permit operation of the power unit. When the power unit is operated, a fastener driving element or blade is reciprocated through a drive track in a nosepiece structure to drive a staple or nail supplied from a magazine assembly into a workpiece.

In accordance with the present invention, a safety assembly is provided which prevents operation of the tool or actuation of the control unit unless and until the surface of the nosepiece containing the fastener discharging opening is disposed against and in a flush relation with the workpiece into which the fastener is to be driven. If the tool is disposed in a tipped or canted relation to the workpiece in virtually any plane, the control unit cannot be actuated to effect operation of the power unit. To accomplish this, a safety assembly is provided including a pair of independently movable workpiece engaging elements disposed on opposite sides of the drive track or fastener discharging opening. These workpiece engaging elements are coupled to a lever which in turn is coupled to the safety operator so that the safety operator cannot be actuated unless both of the workpiece engaging elements have been elevated by engagement with the workpiece. This insures that the nosepiece of the tool is flush against the workpiece in the plane of the tool. By providing the workpiece engaging elements with point or small area contact surfaces for engagement with the workpiece, it becomes difficult to effect full actuation of these elements when the tool is tipped in a plane transverse to the plane of the tool. Thus, the safety operator cannot be fully actuated in most circumstances when the tool is tipped in any direction relative to the workpiece, and the possibility that a fastener will be driven through only a portion of the workpiece and enter "free flight" is materially and substantially reduced.

Many other objects and advantages of the present invention will become apparent from considering the following detailed description in conjunction with the drawings in which:

FIG. 1 is a fragmentary side elevational view illustrating a pneumatic fastener driving tool embodying the present invention;

FIG. 2 is an end elevational view of the tool shown in FIG. 1 illustrating a dual element safety actuator assembly in a normal condition;

FIG. 3 is an enlarged fragmentary sectional view taken along line 3—3 in FIG. 1;

FIG. 4 is an end elevational view similar to FIG. 2 illustrating the safety assembly with one workpiece engaging element actuated;

FIG. 5 is an end elevational view similar to FIG. 4 and illustrating the safety assembly with the other workpiece engaging element actuated;

FIG. 6 is an end elevational view similar to FIGS. 2, 4, and 5 illustrating the safety assembly with both workpiece engaging elements actuated; and

FIG. 7 is an exploded perspective view of the safety actuating assembly.

Referring now more specifically to FIGS. 1 and 2 of the drawings, therein is illustrated a fastener driving tool which is indicated generally as 10 and which embodies the present invention. The tool 10 includes a power unit (not shown) of a suitable type, such as a pneumatic piston and cylinder, to which is attached a fastener driving element or driver for driving or setting fasteners, such as staples or nails, successively supplied to a drive track in a nosepiece structure indicated generally as 12 by a magazine assembly of conventional construction indicated generally as 14. To provide means for manually controlling operation of the tool or the power unit in the tool 10, there is provided a control unit indicated generally as 16. When a manually actuated trigger 18 forming a part of the assembly or unit 16 is actuated, the power unit in the tool 10 is rendered effective to drive a fastener only when and if a safety assembly indicated generally as 20 has been fully actuated to indicate that the fastener discharging opening in the lower end of the nosepiece structure 12 is against the workpiece into which the fastener is to be driven. In accordance with the present invention, the safety assembly 20 is so designed that the control unit 16 is inhibited to prevent actuation in response to operation of the trigger 18 if the tool 10 is tipped or canted with respect to the workpiece.

The tool 10 can be of any of the types well known in the art and can include, for example, a cylinder in which a piston coupled to the upper end of a driver blade is reciprocated by the selective admission of pressurized fluid or compressed air by a main valve, the opening and closing of which is controlled by the control unit 16. As an example, the tool can be constructed as shown and described in detail in U.S. Pat. No. 3,638,532. The control unit 16 can also be constructed as shown and described in detail in this patent. In general, the control unit 16 includes a housing 22 containing one or a number of valves for selectively controlling the admission of pressurized fluid to the cylinder of the power unit. When the trigger 18 which is pivotally mounted on the housing 22 is actuated and when the safety assembly 20 is actuated, the power unit is rendered effective to operate through one or a plurality of cycles during which one or a plurality of fasteners are driven.

To provide a means for controlling the effectiveness of the control unit 16 in dependence on the condition of the safety assembly 20, the control unit 16 includes a safety operator or an operator means 24 which, in the control unit shown in the safety assembly shown in the above-identified patent, comprises a valve stem. This stem 24 projects from the lower wall of the housing 22 (FIG. 3). When the safety operator 24 is in the lower position shown in FIGS. 1 and 3, the control unit 16 is disabled. When the operator 24 is moved upwardly into the housing 22 to the position shown in dashed outline in FIG. 6, the control unit 16 is placed in a condition in which it can be operated by depression of the trigger 18.

The nosepiece structure 12 is secured to the lower end of a housing 26 for the tool 10, as by a plurality of machine screws 28. The nosepiece structure 12 contains a drive track for reciprocably receiving the driver element actuated by the power unit for driving nails or staples supplied to the drive track from the magazine 14. The magazine 14 includes a body portion 14A, the forward end of which is secured to and between rearwardly extending projecting portions or tabs 12A (FIGS. 1 and 7) formed integral with the nosepiece structure 12. The lower end of the nosepiece structure 12 is provided with a downwardly and inwardly tapered portion indicated generally as 12B which terminates in a generally planar workpiece engaging surface or portion 12C in which is disposed a fastener discharging opening through which fasteners driven out of the drive track enter the workpiece.

The actuating or operating means for the safety assembly 20 is slidably mounted on the nosepiece structure 12. This actuating assembly includes a pair of workpiece engaging elements or members 30 and 32 preferably formed of bent wire stock and having a generally U-shaped configuration at their lower ends. Each of the elements 30 and 32 is formed with a somewhat V-shaped or pointed portion 30A, 32A at its lower end to provide a point or small area contact with the workpiece. To provide means for slidably supporting the elements 30 and 32 for independent movement, the nosepiece structure 12 is provided with two pairs of generally aligned slots or recesses 34 and 36 on its opposite side walls. The pairs of slots or recesses 34 and 36 are generally aligned with the back and front walls, respectively, of the nosepiece structure 12.

To slidably mount the workpiece engaging elements 30 and 32 on the nosepiece structure 12, vertically extending leg portions 30B, 32B of the members 30, 32 are disposed within the aligned slots or recesses 36, 34, respectively. A generally U-shaped closure element or retaining means 38 is secured to the nosepiece structure 12, as by a machine screw 40, with the bight portion of the member 38 overlying the front wall of the nosepiece structure 12 and with the two legs of the member 38 overlying the pairs of slots and recesses 34, 36 to slidably retain the members 30 and 32 within the slots and recesses. When the elements 30, 32 are mounted on the nosepiece structure 12, the workpiece engaging ends 30A, 32A of the elements 30, 32 are generally aligned with each other, considered in the plane of the tool, and are also aligned with the drive track and the fastener discharge opening in the nosepiece structure 12. As illustrated particularly in FIGS. 4 and 6 of the drawings, the workpiece engaging portions 30A, 32A are narrower than the adjacent wall of the workpiece engaging surface 12C of the nosepiece structure 12.

To provide means for coupling the workpiece engaging elements 30 and 32 to the safety operator 24, the upper free ends of these elements are provided with rearwardly, outwardly, and upwardly extending segments indicated generally as 30C and 32C which terminate in two laterally and rearwardly extending portions 30D and 32D. The portions 30D and 32D provide pivot pins received within two cylindrical sleeves 42A formed integral with the ends of a lever or coupling member 42. Thus, each of the workpiece engaging members 30, 32 is pivotally connected to an opposite end of the lever 42. The lever 42 is provided with a centrally disposed opening 42B in which is received a reduced diameter or shouldered portion 24A (FIG. 3) on the safety operator 24. A compression spring 44 interposed between the lower wall of the housing 22 for the control unit 16 and the upper surface of the lever 42 biases the workpiece engaging elements 30, 32 to their lower or inoperative position shown in FIGS. 1 and 2 of the drawings in which the workpiece engaging ends

30A, 32A project below the lower surface 12C of the nosepiece structure 12 to be disposed on opposite sides of or to the front and back of the drive track extending through the nosepiece structure 12.

When the tool 10 is to be operated, this tool is moved downwardly toward the workpiece at the point at which the fastener is to be driven until such time as the workpiece engaging surface 12C of the nosepiece engages the adjacent surface of the workpiece. If the tool 10 is disposed in a generally perpendicular relation with respect to the workpiece, both of the workpiece engaging elements 30, 32 are moved from the normal position shown in FIGS. 1 and 2 to the position shown in FIG. 6. In this position, the lower ends of the workpiece engaging portions 30A, 32A are substantially flush with the surface 12C of the nosepiece structure 12, and all of these elements are against the adjacent surface of the workpiece. As the elements 30, 32 move to the position shown in FIG. 6, both ends of the lever 42 are moved upwardly, and this lever compresses the bias spring 44 during the initial portion of its movement from the position shown in FIG. 3 to the position shown in dashed outline in FIG. 6. This movement is permitted without causing movement of the safety operator 24 because of the lost motion connection afforded by the reduced diameter portion 24A of the stem or operator 24. Toward the end of the upward movement of the lever 44, the edges defining the opening 42B in the lever 42 engage the upper shoulder of the safety operator 24 so that further upward movement of the lever 42 elevates the operator 24 to the position shown in FIG. 6. In this upper or operative position, the control unit 16 is in a condition in which actuation of the trigger 18 effects the application of power to the power unit so that the fastener supplied by the magazine assembly 14 is driven downwardly through the nosepiece structure 12 and into the workpiece.

The construction of the control unit 16 can be such that "touch-trip" operation can be provided. This means that the trigger 18 can be operated, and the surface 12C is then placed against the workpiece to actuate the safety assembly 20 so that the tool 10 operates only after the safety is actuated. Alternatively, the safety assembly 20 can be first actuated followed by the actuation of the trigger 18. Again alternatively, both the trigger 18 and the safety assembly 20 can be substantially concurrently operated to effect operation of the tool 10. On the other hand, the control unit 16 can be a sequential fire arrangement in which the safety assembly 20 must be actuated prior to the actuation of the trigger 18.

When the tool 10 is lifted from the workpiece, the compression spring 44 acts on the lever 42 to move this lever and the connected workpiece engaging elements 30, 32 downwardly to the normal position shown in FIGS. 1 and 2. During the initial portion of this movement, the lost motion connection afforded by the reduced diameter portion 24A permits the safety operator 24 to remain in its actuated position. Toward the end of the downward movement of the lever 42 and connected elements 30, 32, the lever 42 engages the lower shouldered portion of the operator 24 and moves this operator downwardly to its inoperative position. The provision of the lost motion connection afforded by the reduced diameter portion 24A tends to reduce multiple firing of the tool 10 arising from recoil when the fastener is driven. In other words, a certain return movement of the workpiece engaging elements 30, 32 is permitted before the safety 24 is actuated to its inoperative position so that continuous pressure forcing the tool 10 against the workpiece does not result in operation induced by momentary release and reactuation of the safety operator 24.

If the tool 10 is placed against the workpiece tipped forwardly within the plane of the tool, the engaging portion 30A of the element 30 engages the workpiece, and the element 30 is moved upwardly to the position shown in FIG. 4. However, the element 32A either does not engage the workpiece or is only partially actuated thereby with the result that the lever 42 is tipped to the position shown in FIG. 4. This movement of the lever 42 takes up the lost motion provided by the reduced diameter portion 24A on the safety operator 24 and does not cause upwardly directed movement of the operator 24 to its operative position in which the control unit 16 is released for operation. Similarly, if the tool is tipped rearwardly within the plane of the tool, the portion 32A of the work engaging member 32 engages the workpiece, and the member 32 is moved upwardly to its operative position, while the front workpiece engaging element 30 remains in its lower position, as shown in FIG. 5. This results in pivoting or tipping the lever 42 in the opposite direction from FIG. 4. This tipping movement of the lever 42 is again accommodated by the reduced diameter portion 24A, and even if some upward movement of the safety operator 24 takes place, this movement is not sufficient to move the operator 24 to its operative position, and the control unit remains disabled so that the tool 10 cannot be operated. Accordingly, when the tool 10 is tipped either in a forward or a reverse direction about the workpiece engaging surface 12C generally within the plane of the tool 10, only one or the other but not both of the workpiece engaging elements 30, 32 is fully actuated, and the lever or coupling member 42 is tipped different directions but is not elevated sufficiently to shift the operator stem 24 to its operative position. Accordingly, the control unit 16 is not released or rendered effective to operate the tool 10.

By providing the point or small area contact portions 30A, 32A for engaging the surface of the workpiece, the tool 10 or, more specifically, the safety assembly 20 is also able to provide a degree of control over tipping of the tool 10 in a plane transverse to the plane of this tool. More specifically, if the tool 10 is moved toward the workpiece in a position inclined to the right or to the left when viewed as shown, for example, in FIG. 6, the tapered or inclined sides rather than the point of the workpiece engaging portions 30A, 32A tend to first engage the workpiece to cause initial upward movement of the elements 30, 32. However, on continuing movement of the tool 10 toward the workpiece, one of the side edges of the lower surface 12C of the nosepiece structure tends to engage the workpiece prior to the time at which elements 30, 32 are fully elevated to a position in which the lever 42 shifts the operator 24 to its operative position. Only by pivoting the tool 24 to a position in which the surface 12C is flush with the workpiece surface can the elements 30, 32 be sufficiently elevated. If the elements 30, 32 had been provided with the conventional flat or wide area workpiece engaging surface substantially coextensive with the width of the lower surface of the nosepiece structure, the elements 30, 32 would be fully actuated by moving

the tool 10 toward the workpiece with this tool tipped to either side, as viewed for example in FIG. 6.

In summary, the improved safety assembly of the present invention insures that the tool 10 is flush against a workpiece before the tool can be operated. Further, by providing the elements 30 and 32 on opposite sides of the drive track, the tool 10 cannot be operated if the fastener discharging opening is not covered by a workpiece because one of the elements 30 and 32 would not be actuated. In addition, the provision of two workpiece engaging elements 30 and 32, both of which must be actuated for operation of the tool 10, reduces the possibility of a failure of the safety due to the workpiece engaging element being locked in an operated state by, for example, an accumulation of foreign matter in a guideway.

Although the present invention has been described with respect to a single illustrative embodiment thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art which fall within the spirit and scope of the principles of this invention.

What is claimed and desired to be secured by Letters Patent of the United States is:

1. In a fastener driving tool having a power unit for driving fasteners into a workpiece,
nosepiece structure through which the fasteners are driven and having a workpiece engaging portion,
a control unit for controlling the power unit and having an operator means movable between an inoperative position and an operated position in which the control unit can effect operation of the power unit,
a pair of workpiece engaging means independently movable relative to the nosepiece structure and disposed adjacent opposite sides of the workpiece engaging portion thereof,
and coupling means coupling the pair of workpiece engaging means to the operator means and operable to shift the operator means from it inoperative position to its operated position only when both of the workpiece engaging means are moved by engagement with the workpiece.

2. The fastener driving tool set forth in claim 1 in which
at least one of the workpiece engaging means is formed with a pointed or narrow workpiece engaging surface that provides a point or small area of contact with the workpiece aligned with the path of movement of the fasteners through the nosepiece structure.

3. The fastener driving tool set forth in claim 2 in which
the nosepiece structure includes a workpiece engaging surface that is wider than the workpiece engaging surface on the workpiece engaging means.

4. The fastener driving tool set forth in claim 1 in which
the coupling means includes a lever means engaged by the operator means at a first point and engaged by the workpiece engaging means at spaced second and third points.

5. The fastener driving tool set forth in claim 4 in which
the second and third points are spaced on opposite sides of the first point.

6. The fastener driving tool set forth in claim 4 in which
the second and third points are at the ends of the lever means,
and the coupling means includes means providing a fixed pivotal connection between the lever means and the workpiece engaging means at the ends of the lever means.

7. In a fastener driving tool using a power unit for actuating a driver element,
a nosepiece structure through which fasteners are driven by the driver element, said structure including a workpiece engaging structure adapted to be disposed adjacent a workpiece,
a control unit for controlling the operation of the power unit, said control unit including a manually operable trigger means and a safety operator,
a pair of workpiece engaging means mounted adjacent opposite sides of the workpiece engaging structure for independent movement,
and linkage coupling both of the workpiece engaging means to the safety operator and operable to actuate the safety operator only when both of the workpiece engaging means are moved by engagement with the workpiece.

8. The fastener driving tool set forth in claim 7 in which
the linkage includes a lever means coupled to the safety operator and having a pivotal engagement with each of the workpiece engaging means.

9. The fastener driving tool set forth in claim 8 in which
the linkage includes means providing a pivotal connection between opposite end portions of the lever means and separate ones of the pair of workpiece engaging means.

10. In a fastener driving tool with a power unit for driving fasteners into a workpiece,
a housing for the fastener driving tool,
a control unit on the housing for controlling the operation of the power unit to drive a fastener, said control unit including an operator means depending from the control unit, said operator means being normally in an inoperative position and being movable upwardly to an operative position to permit operation of the tool,
a movably mounted coupling member beneath the control unit and adapted to engage and move the depending operator means from its inoperative position to its operative position, said coupling member and operator means being engageable at a first point on the coupling member spaced from its opposite ends,
a first member slidably mounted on the housing beneath the coupling member for movement between a lower inoperative position and an upper operative position in which the first member elevates one end of the coupling member,
and a second member slidably mounted on the housing beneath the coupling member for movement between a lower inoperative position and an upper operative position in which the second member elevates the other end of the coupling member, the elevation of both ends of the coupling member by the first and second members elevating the coupling member to engage and move upwardly the operating means thereby to render the control unit effective to operate the power unit.

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