

July 13, 1965

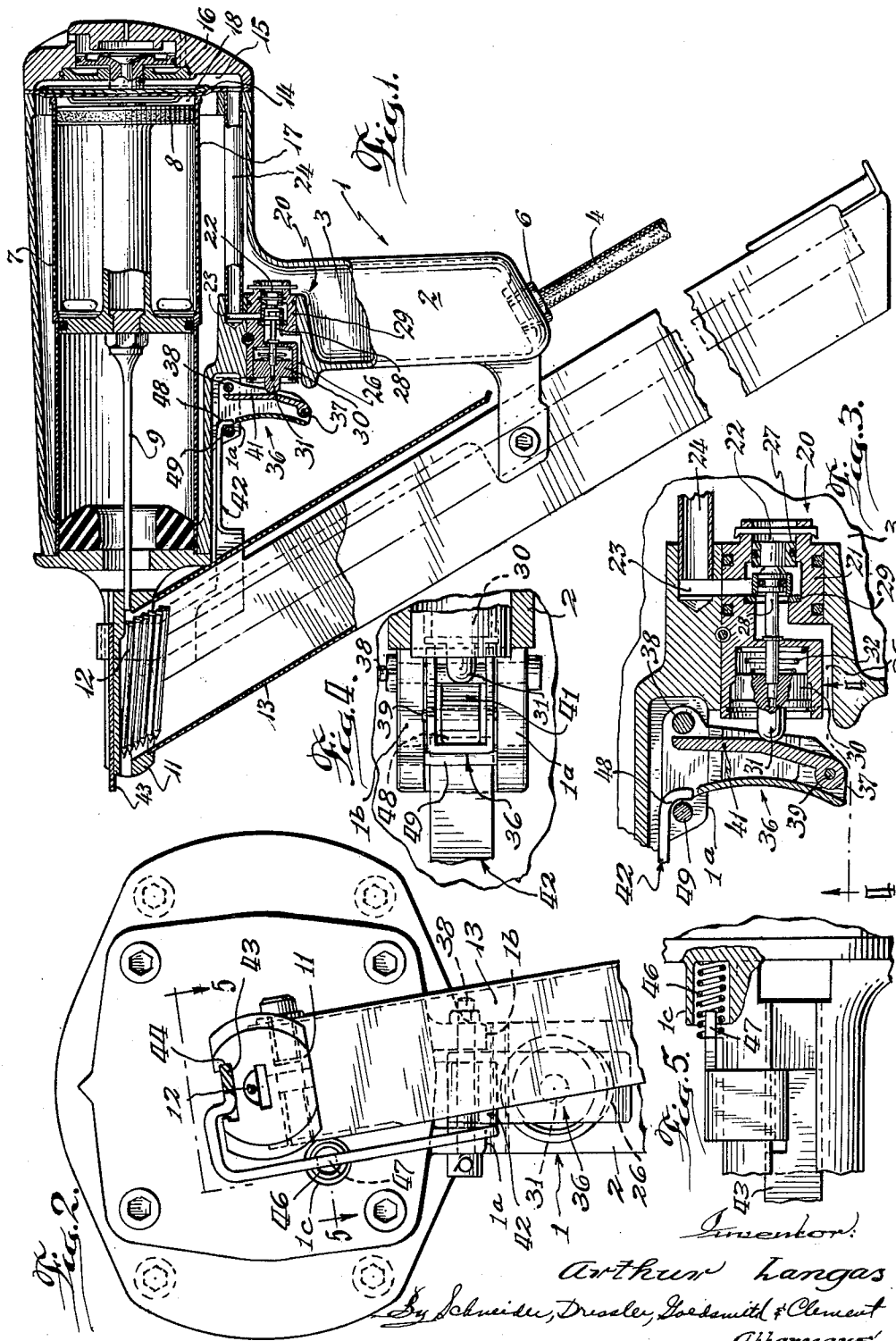
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FASTENER DRIVING TOOL

Filed March 13, 1963

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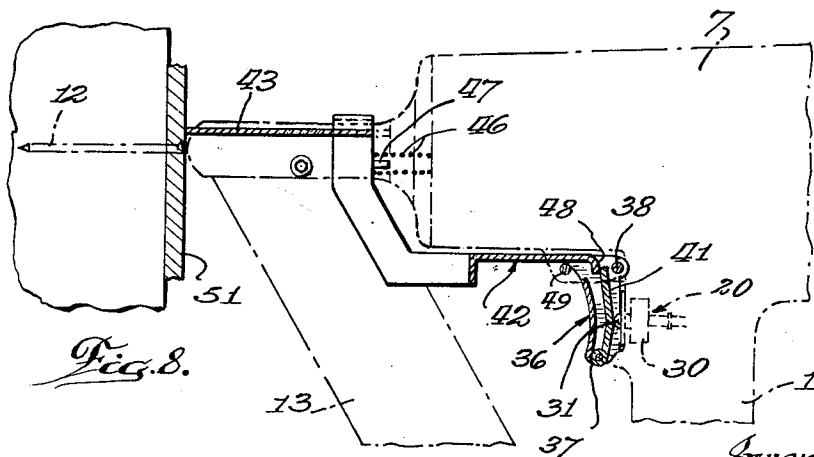
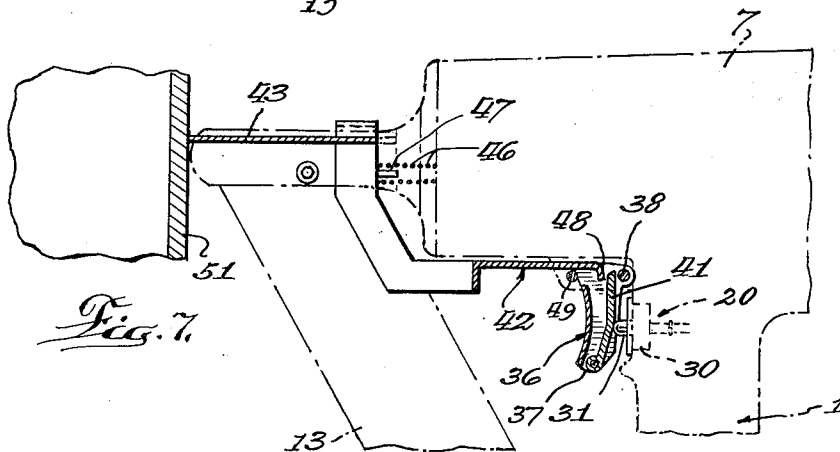
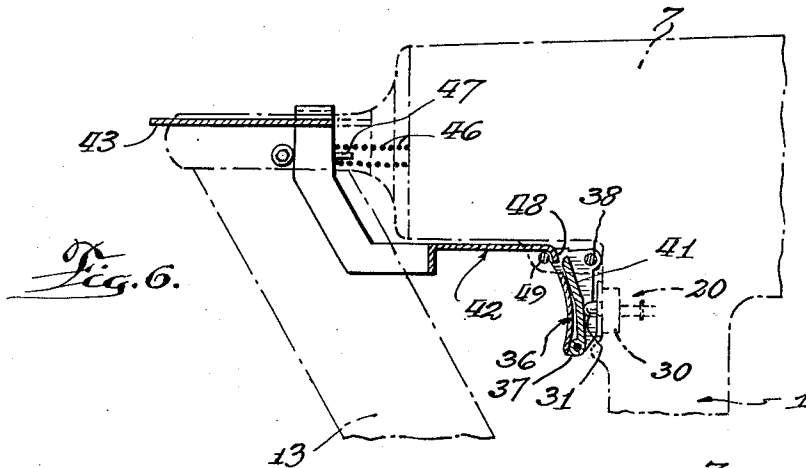
A. LANGAS

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2 Sheets-Sheet 2



Inventor:

Arthur Langas

E. J. Schaefer, Drexler, Goldsmith & Clement
Attorneys.

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FASTENER DRIVING TOOL

Arthur Langas, Chicago, Ill., assignor to Signode Corporation, a corporation of Delaware

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5 Claims. (Cl. 173—2)

This invention relates to a fastener driving tool and, particularly, to a safety mechanism for preventing accidental operation of the tool.

Fastener driving tools such as those that are pneumatically powered are generally controlled by a trigger operated valve mechanism that regulates the flow of high-pressure air to and from the driving member of the tool. These tools are used in a large number of industries such as furniture, luggage, and construction.

Tools of this type are designed to respond very quickly, and thus care must be taken to prevent them from being accidentally operated. These tools are used to drive fasteners such as nails, staples, and pins upon the introduction of high-pressure fluid to a driving member. Thus, for all intents and purposes such a tool is a gun that shoots a fastener instead of a bullet into and through members that are to be fastened together. Such a tool can obviously be a dangerous weapon in the hands of a careless, negligent, or playful operator. Unless the operator exercises extreme caution when handling the tool, it could be misdirected and fire a fastener other than into the work, which may damage something or injure someone standing near the operator.

It is with the above possibility in mind that safety mechanisms have been developed to prevent fastener tools from being fired, unless the tool is placed nearby or in actual contact with one of the members to be fastened. One such safety mechanism consists of a mechanical arrangement that locks the trigger against movement unless a safety pin is placed against the work. This type of mechanism has the obvious disadvantage of increasing the amount of time it takes an operator to drive a given number of fasteners. Another mechanism that has been used to prevent accidental firing is a multiple valve assembly employing two valves in series to control the flow of high-pressure fluid between the power supply and the driving member. Both valves have to be operated before a fastener would be driven. One valve is operated by the trigger and the second valve by the safety mechanism. This arrangement requires a large number of parts and is not "fail-safe" since if the valve operated by the safety mechanism develops a leak, the tool is no longer safe and can be fired by simply pulling the trigger.

In the two types of safety mechanisms discussed above, the members that must be actuated to effect operation of the tool are normally spaced at some distance from the point at which the nail is driven, which increases the possibility of the fastener being fired into space. Furthermore, the mechanical arrangement does not allow the trip for the tool to permit the tool to fire the instant actuating member or safety trip pin to serve as a "bottom the safety trip pin engages the surface that is to be nailed or stapled.

In accordance with the present invention, there is provided a safety mechanism that will prevent the tool from being fired unless the exit end of the tool is located immediately adjacent the point at which the fastener is to be driven. The novel safety mechanism may also be used as a bottom trip for the tool. Also, the safety mechanism is "fail-safe" and requires a minimum number of parts.

The safety mechanism embodying the present invention includes a safety trip pin that is located immediately adjacent the point at which the fastener is driven,

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which thus all but eliminates the possibility that a fastener will be driven other than into the member that is to be fastened. The trip pin can also be used to control the movement of the valve regulating the flow of air to the driving piston and thus eliminate the need for the operator to move the trigger each time a fastener is to be driven. This provides for very fast action of the tool without any danger to anyone standing near the tool. The novel construction of the safety device permits it to be used with any conventional tool that is trigger operated without requiring any modifications of the tool to which it is to be applied.

A tool of the type embodying the present invention is illustrated in the attached drawings. The particular tool disclosed is a pneumatic nailer but as such it is merely exemplary of the family of tools to which the safety mechanism can be attached. Generally speaking, the safety device functions to control the movement of the trigger assembly provided for operating the tool. The trigger assembly is designed so that unless the safety trip pin located in the nose of the tool is moved by the member to be fastened, the trigger is ineffective to move the valve to direct air to the driving piston of the tool. The safety trip pin is located in a groove disposed parallel to and immediately adjacent the guide passageway in the nose of the tool for the driving blade and the fastener and extends beyond the nose of the tool. The upper end of the safety mechanism consists of a flange portion that controls the movement of a safety trigger lever that forms part of the trigger assembly. The trigger assembly will not operate to move the valve controlling the flow of air to the driver until the safety trigger lever is properly positioned by the flange of the safety mechanism.

When the tool is first placed in contact with the member to be fastened, the trip pin is pushed back within the groove in the nose of the tool. This rearward movement of the trip pin moves the flange portion of the safety mechanism against the free end of the safety trigger lever to locate it so that pivotal movement of the trigger assembly moves the safety trigger lever against the valve to fire the tool.

It can be appreciated that the trigger can be held in the "on" position by the operator and the trip pin serves as the valve positioning mechanism.

The structure by which the above and other advantages of the invention are attained will be described in the following specification, taken in conjunction with the accompanying drawings illustrating a preferred structural embodiment of the invention, in which:

FIGURE 1 is a cross-sectional view of a fastener driving tool incorporating the safety mechanism;

FIGURE 2 is a bottom view of the tool shown in FIGURE 1;

FIGURE 3 is an enlarged sectional view of the actuating valve and safety trigger assembly;

FIGURE 4 is a view taken along lines 4—4 of FIGURE 3;

FIGURE 5 is a view, partially broken away, taken along lines 5—5 of FIGURE 2;

FIGURE 6 is an outline view of the tool and a sectional view of the safety mechanism with the trigger pulled and the safety mechanism out of engagement with the members to be fastened;

FIGURE 7 is a view similar to FIGURE 6 in which the tool is in position to be fired but the trigger has not been pulled; and

FIGURE 8 is a view similar to FIGURE 7 except that the trigger has been pulled to position the control valve to fire the tool.

Referring first to FIGURE 1, there is illustrated a nailer housing 1 having a body portion 2 that serves as

a handle by which the operator may grasp and manipulate the nailer. The handle portion is cored to provide a storage chamber 3 into which air under pressure from any suitable source is introduced through a hose 4 and hose nipple 6 connected to one end of the storage chamber 3. At the other end of the housing 1 is a cylinder 7 in which a driving piston 8 is slidably disposed. Secured to the underside of piston 8 is a nail driver 9 that extends through a driver and nail guide 11 wherein it engages the end nail 12 of an adhered row of nails located in a magazine 13 secured to the nail housing 1. The housing 1 and nail magazine 13 are interconnected by suitable fastening means.

The flow of compressed air between the storage chamber 3 and the interior of cylinder 7 above piston 8 is controlled by a diaphragm valve assembly 14 that seats against the upper edge of the cylinder 7. The diaphragm assembly is clamped between the cap 16 and the main portion of housing 1 and serves to block off the flow of compressed air between the annular chamber 17 surrounding cylinder 7 and in communication with storage chamber 3 and the chamber 18 within the cylinder immediately above piston 8. When the diaphragm assembly 14 is raised, the high-pressure air from chamber 17 enters chamber 18 and moves piston 8 and driver 9 with a sharp, quick driving action against the nail 12 to drive it into place.

The movement of the diaphragm assembly 14 is controlled by a pilot valve 20 located in a boss defined by the housing 1. As illustrated in FIGURE 3, the pilot valve 20 includes a valve housing 21 that has an inlet 22 in communication with the storage chamber 3, an outlet port 23 in communication with passage 24 that leads to the chamber 15 formed between diaphragm assembly 14 and cap 16, and an exhaust port 26. The flow of fluid between passage 24 and exhaust port 26 is controlled by a sleeve 27 that is slidably disposed within the valve housing 21 and positioned by a valve member 28. The valve member 28 is located within the sleeve 27 and when first moved engages the sleeve 27 to shut off the flow of fluid between the storage chamber 3 and outlet port 23 and upon further upward movement biases sleeve 27 away from valve seat 29 surrounding exhaust port 26 to connect chamber 15 and passage 24 with exhaust port 26 to vent chamber 15.

The valve member 28 is connected at its lower end to plunger 30 and is normally biased into the position shown in FIGURE 3 by a spring 32 extending between plunger 30 and a wall of the valve housing. Extending from the lower end of plunger 30 is a button 31.

The position of valve member 28 is controlled by the operation of the safety trigger assembly 36 to be described in detail hereinafter. When the tool is to be fired, the valve member 28 is moved upwardly by the trigger assembly 36 to first block off the flow of air from the storage chamber 3 to chamber 15 and then vent chamber 15 to atmosphere to permit the fluid under pressure in chamber 17 to raise the diaphragm assembly 14 off its seat to enter chamber 18 and act on the upper surface of piston 8 to move it in a driving direction against a nail 12.

The trigger assembly 36 consists of a U-shaped trigger member 37 that is pivotally mounted about pin 38 that extends through aligned openings in flanges 1a, 1b extending outwardly from housing 1 (see FIGURE 2). Located within the sidewalls of the trigger assembly and pivotally mounted to the end thereof opposite pin 38 by a pin 39 is a safety trigger lever 41. The lever 41, when positioned by the safety mechanism described hereinafter, functions to engage button 31 of valve 20 to effect opening movement of the diaphragm 14. It is to be noted that unless the safety trigger lever is positioned by the safety mechanism, as described hereinafter, the trigger member 37 will engage the tool housing before it can effect movement of valve button 31 (see FIGURE 6).

The safety mechanism for preventing accidental operation of the tool is illustrated in various positions in FIGURES 6, 7, and 8. This mechanism controls the actuation of the valve 20 by controlling the movement of the safety trigger lever 41.

When the tool is placed in contact with the work to be fastened as shown in FIGURE 7, the safety mechanism is positioned so that operation of the trigger assembly to the position shown in FIGURE 8 moves the valve 20 to drive a fastener into the work. With the safety mechanism in the position shown in FIGURE 6, movement of the trigger will be ineffective to change the position of the valve 20.

The safety mechanism 42 includes a safety trip pin 43 that is slidably disposed in a track 44 formed in the driver and nail guide 11. The track 44 extends parallel to the nail guide and is located immediately adjacent thereto. The end of the pin 43 is biased outwardly beyond the end of the guide by a spring 46 disposed in a recess 1c formed in the housing 1. The spring 46 is disposed around an upstanding finger portion 47 of the safety mechanism 42. A portion of the safety mechanism extends upwardly alongside the head portion of the housing and is bent over at its upper end to form an outwardly extending flange 48 that abuts the pin 49 when the safety mechanism is in its extended position. In this position, as shown in FIGURES 1 and 6, the safety trigger lever 41 is free to pivot about pin 39.

When the nose of the tool is placed in engagement with a board 51, the safety trip pin 43 is moved inwardly in track 44 against the action of spring 46 to move the safety mechanism to the position shown in FIGURE 7. In this position, the safety trigger lever 41 is restrained against movement between the flange 48 and pin 38. When this occurs, counterclockwise movement of the trigger member 37 moves safety trigger lever 41 against valve button 31 to raise the valve 28 to effect power operation of the fastener tool. The position of the valve, trigger assembly, and safety mechanism during the firing operation is illustrated in FIGURE 8.

If it is desired to continuously operate the fastener tool without having to repeatedly pull the trigger, the safety trip pin can be used as a bottom trip actuator. That is to say, the trigger can be held in the "on" position and the movement of the safety trip pin of the safety mechanism used to control the operation of valve 20 by moving the safety trigger lever 43 about pin 39.

While the trigger lever 41 is shown as being restrained between pin 38 and lip 48, the invention is not limited to this construction. It is not essential that the lever 41 come into contact with pin 38 during the operation of the trigger assembly. It is only necessary that the lever 41 be positioned by the safety mechanism 42 so that pivotal movement of the trigger assembly 36 will move the lever 41 into contact with the button 31 to operate the valve 20. This latter action will occur when the lip 48 moves and holds the free end of the lever 41 in a position where valve-actuating movement of trigger assembly 36 brings the lever 41 into contact with valve button 31.

From the foregoing, it will be observed that numerous variations and modifications may be effected without departing from the true spirit and scope of the invention. For example, the invention is not limited to the particular details of the valve mechanism and any valve capable of performing the functions of the one disclosed could be substituted therefor. Other changes could be made in the shape and design of some of the components of the structural elements illustrated.

It is, of course, intended to cover by the appended claims all such modifications as fall within the scope of the claims.

I claim:

1. In a pneumatic fastening tool having a handle and a head portion disposed adjacent thereto in which is located a fastener driver assembly, means for controlling

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the operation of said fastener driver assembly including a valve means, a trigger assembly mounted under said handle and positioned to be manipulated toward said handle to operate said valve means, said trigger assembly including a trigger member pivotally connected to said tool, a lever pivotally mounted at one end to said trigger, a stop disposed adjacent the other end of said lever, a safety mechanism for positioning said lever to condition the trigger assembly to operate said valve upon manipulation thereof, said safety mechanism including a portion adapted to engage said other end of said lever to dispose it adjacent said stop when the tool is brought into contact with a surface into which a fastener is to be driven.

2. A pneumatic fastening tool including a housing defining a handle portion and a head section disposed adjacent said handle containing a fastener driver assembly, means for controlling the operation of said fastener driver assembly including a valve means, a trigger assembly mounted under said handle and positioned to be manipulated toward said handle to operate said valve means, said trigger assembly including a trigger member pivotally connected to said tool, and a trigger lever pivotally mounted to one end of said trigger and adapted to engage said valve, a stop disposed adjacent the other end of said lever, a safety mechanism for positioning said lever adjacent the stop to position the lever to operate said valve upon manipulation thereof, said safety mechanism including a portion adapted to engage said other end of said lever to move it toward said stop when the tool is brought into contact with a surface into which a fastener is to be driven, and means for resiliently biasing said safety mechanism against said surface whereby when the tool is removed from said surface the safety mechanism will disable the trigger lever from operating said valve.

3. In a fastener driving tool having driver means and means for controlling the movement of said driver means including valve means; trigger means for operating said valve means comprising a U-shaped trigger member pivotally connected to said tool, a lever disposed within said trigger member and pivotally connected at one end thereof to said trigger member and adapted to engage said

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valve means; and a safety mechanism for positioning said lever to condition said trigger means when the tool is placed in contact with a surface into which a fastener is to be driven, said safety mechanism including an abutment portion adapted to engage said lever to pivot it about its connection to the trigger member to condition said trigger means whereby movement thereof will effect movement of the valve to operate said driver means.

4. In a fastener driving tool including a housing containing driver means, said housing defining a longitudinal track adjacent said driver means, and means for controlling the movement of said driver means including valve means; trigger means for operating said valve means comprising a U-shaped trigger member pivotally connected to said tool, a lever disposed within said trigger member and pivotally connected to one end thereof and adapted to engage said valve means; and a safety mechanism for positioning said lever to condition said trigger means, said safety mechanism including a trip member disposed in said track and extending beyond said housing to engage a surface into which a fastener is to be driven and a lip portion adapted to engage the other end of said lever, whereby when the tool is placed against said surface, the trigger means will be effective to position the valve to operate said driver means.

5. A fastener driving tool as set forth in claim 4 including resilient means positioned between said housing and said safety mechanism to normally position said safety mechanism out of engagement with said lever whereby the tool cannot be fired until said safety mechanism is positioned by contact with the surface into which a fastener is to be driven.

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GRANVILLE Y. CUSTER, JR., *Primary Examiner.*