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FASTENER INSERTING TOOLS

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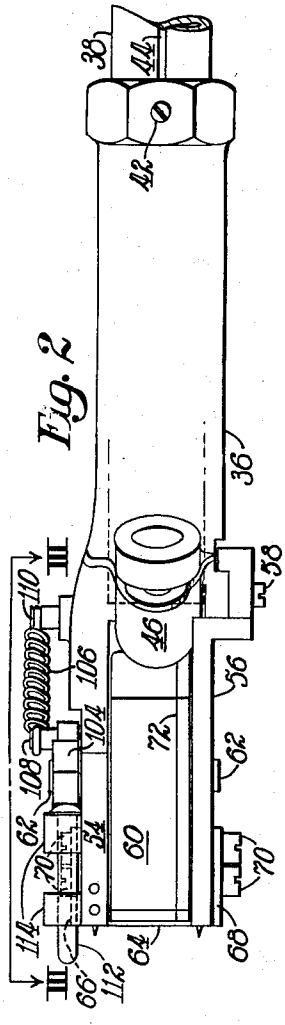


Fig. 2

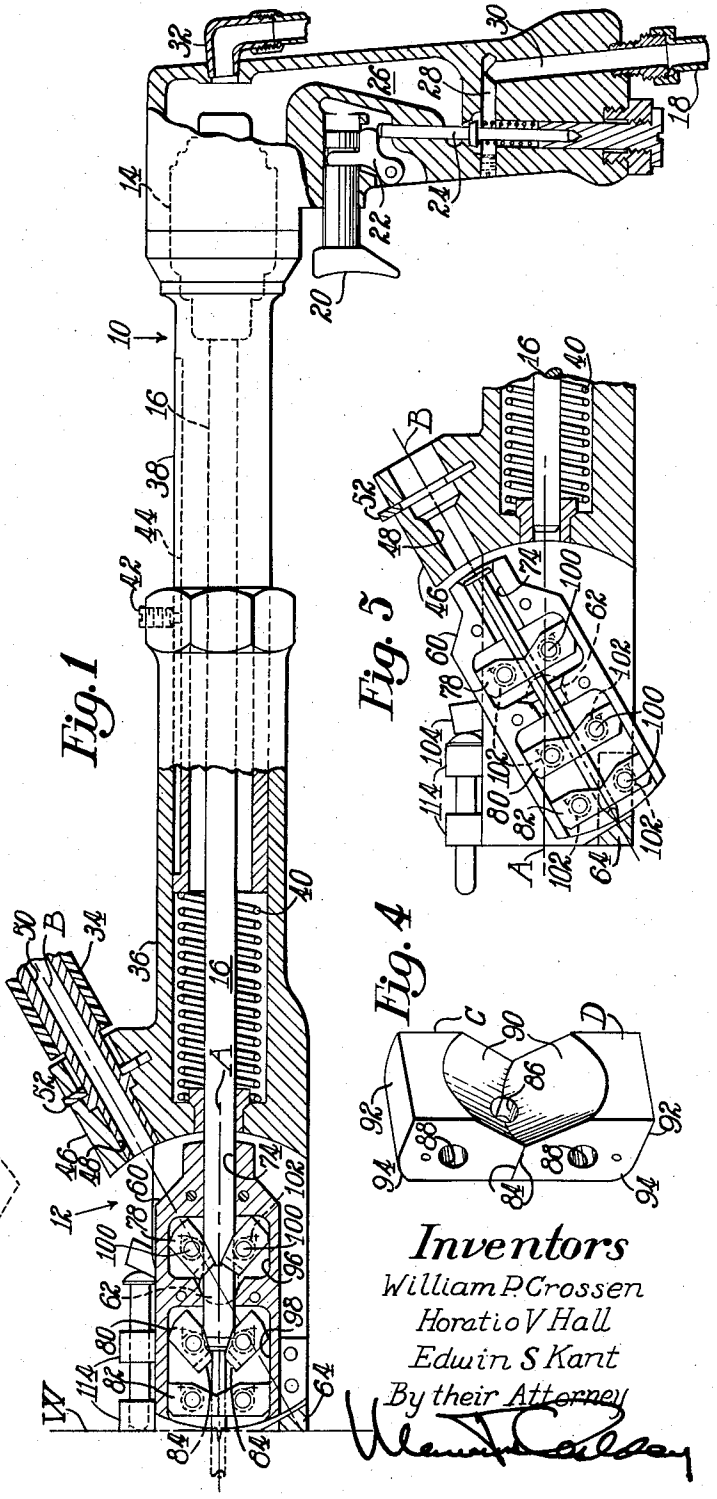


Fig. 1

Fig. 5

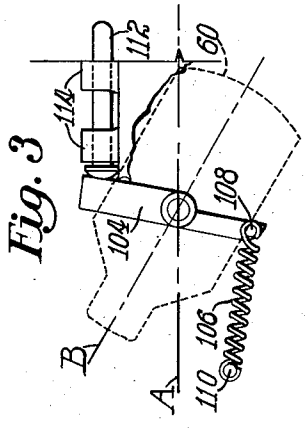


Fig. 3

Fig. 4

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FASTENER INSERTING TOOLS

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5 Claims. (Cl. 1—5)

This invention relates to fastener inserting and particularly to automatically fed portable tools which are adapted for impact driving of fasteners such as nails, sash pins, etc. This type of tool is frequently fed from a remotely located feeding mechanism, similar to that disclosed in United States Letters Patent No. 2,785,400, granted March 19, 1957, in the names of Donald B. McIlvin, et al., wherein fasteners are propelled one at a time by a blast of air through a flexible conduit to the driving tool upon receipt of a signal from the tool. In order to propel large fasteners, such as nails of 16*d* and upward, through a delivery conduit which may be as long as 25 or 30 feet, substantial air pressure is required and by the time the nail reaches the driving tool it usually has attained considerable momentum. The nail is usually received by the tool in some form of yieldable jaws which also serve to position the nail in the path of a driver and support it while it is being driven. However, it is not uncommon for a nail to enter the jaws with such speed and momentum that it passes completely out of the jaws which, of course, results in the tool misfiring. Furthermore, a nail entering the jaws point first with substantial momentum often will come to rest with its point and part of its shank extending out of the jaws leaving an insufficient amount of the shank in position to be gripped by the jaws to resist bending or displacement. In this case the nail must be pushed back into the jaws before being driven in order that the shank may adequately be supported and the head located in close proximity to the striking end of the driver.

It is an object of this invention to provide a driving tool having jaw means to receive, position and support a nail in the path of a driver and capable of preventing the nail from passing out of the jaws when propelled thereto with substantial momentum. It is another object of this invention to provide a driving tool having jaw means which will receive and support the shank of a nail and position its head in close proximity to the striking end of a driver.

With portable impact tools it has been found difficult to drive large sizes of box nails, which have relatively thin shanks in proportion to their lengths, successfully into hard wood. This is because such nails are prone to bending unless a substantial portion of their shanks are supported transversely of the direction of applied force during most of the driving operation. Attempts have been made to remedy this situation by employing rather lengthy jaws which grip the shank with considerable force. However, when the head of a nail passes through such jaws they must of necessity release their grip upon the shank and are of no further value in supporting it against bending.

It is another object of this invention to provide a nail driving tool having jaws which support the nail shank against bending during substantially all of the driving operation. It is still another object of this invention to provide a driving tool having jaw means which do not

lose their grip upon the shank of the nail when the head passes therethrough.

In accordance with the features of this invention there is provided a fastener inserting tool having a driver movable along a first axis and a fastener delivery tube disposed along a second axis intersecting said first axis, an abutment forming the terminus of said second axis. At the intersection of the axes there is pivoted a fastener receiving chuck normally aligned with the fastener passageway to receive a fastener from the tube as it strikes the abutment. The fastener is thereby prevented from passing out of the tool. Means are provided for pivoting the chuck into alignment with the driver whereby the received fastener may then be driven from the tool. The chuck comprises a plurality of independent jaws having fastener engaging surfaces for gripping the delivered fastener and supporting it against movement transversely of its length. The jaws are independently yieldable to release their grip upon the fastener, one at a time, as the fastener is driven lengthwise from the chuck whereby the fastener is supported throughout a substantial portion of the driving operation. The jaws are yieldable only to pressure applied axially of the fastener and thereby provide supporting means so that the fastener will not bend during driving.

The above and other features of the invention including various novel details of construction and combination of parts will now be more particularly described with reference to the accompanying drawings and pointed out in the claims.

In the drawings,

Fig. 1 is a side elevation partly in section of a nail driving tool embodying the invention;

Fig. 2 is a plan view of a portion of the tool shown in Fig. 1;

Fig. 3 is a detailed view on the line III—III of Fig. 2;

Fig. 4 is a perspective view on an enlarged scale of a pair of nail supporting jaws; and

Fig. 5 is a side elevation partly in section of a portion of the tool shown in Fig. 1 in the position wherein it receives a nail.

The invention is herein illustrated as embodied in a pneumatically operated multiple-blow nail driving gun. However, it may be employed in other types of impact tools as well, for example, mechanical or electric, single or multiple-blow guns. The driving gun comprises a pistol grip air hammer **10** of well-known construction and a nail handling nosepiece **12** slidably mounted thereon. A fluid motor **14** in the air hammer operates to impart a series of short rapid strokes to a nail driver **16** which extends through the hammer **10** into the nosepiece **12** and is movable along a path indicated by an axis A. Compressed air is supplied to the hammer through a line **18** and is introduced to the motor **14** by depressing a trigger **20** which, through the action of a bell crank **22** unseats a valve **24**, admitting air to a chamber **26** from passageways **28** and **30** communicating with the line **18**. Pressurization of the chamber **26** not only actuates the motor **14** but in addition pressurizes a signal line **32** which may be connected to a pneumatically operated nail delivery device of the above-mentioned McIlvin type, not shown and not forming part of the present invention. Pressurization of the signal line **32** activates the nail delivery device preparing it to propel a nail through a flexible delivery conduit **34** to the nosepiece **12** by compressed air upon subsequent depressurization of the signal line, all in a known manner.

A sleeve **36** on the nosepiece is slidable telescopically over a cylindrical extension **38** of the air hammer **10**, while a compression spring **40** at all times tends to urge the nosepiece **12** and the air hammer **10** away from each other. A setscrew **42** in the sleeve **36** engages a slot

44 in the extension 38 to prevent relative rotation of the parts and to limit the extent of their sliding movement. On the upper part of the nosepiece 12 is a boss 46 having a bore 48 into which fits a nozzle or tube 50. The flexible delivery conduit 34 is secured to the nozzle 50 which in turn is held within the boss 46 by a snap ring 52. The nozzle 50 forms part of a nail delivery passageway, intersecting, at an angle, the axis A of the driver path and indicated in Figs. 1, 3 and 5 as the axis B.

Extending to the left of the sleeve 36, as seen in Fig. 2, is a pair of spaced parallel plates 54, 56. The plate 56 is removable and is secured to the nosepiece by a plurality of screws 58, only one of which is shown. A chuck 60 is pivotally mounted between the plates 54 and 56 by a pair of trunnions 62. The axis of the trunnions passes through the intersection of the axis A of the driver and the axis B of the nail delivery passageway.

Mounted on the plates 54 and 56 and intersecting and forming the terminus of the axis B at the left-hand end of the nosepiece is an abutment or a nail stop 64. Between the plates 54 and 56 the nail stop is substantially triangular in cross section and on the outside of the plates has a pair of brackets 66, 68, securing it thereto by screws 70.

The chuck 60 is of irregular configuration and has a removable cover plate 72 (Fig. 2) facing the removable plate 56 on the nosepiece. The right-hand end of the chuck is provided with a bore 74 (Figs. 1 and 5) of sufficient diameter to accommodate the driver 16. Pivotally mounted in the chuck are a plurality of sets of jaws 78, 80 and 82. Each set of jaws comprises a pair blocks C and D, best seen in Fig. 4, having flat faces 84 arranged to contact each other substantially as shown. A central portion of each of the faces 84 of the jaw blocks are cut away to form between them, when the jaws are touching, a cylindrical opening 86 substantially the size of the shank of a nail. Vertically spaced from the face 84, each block is provided with a transverse bore 88, its axis paralleling the face 84 directly above the longitudinal midpoint of the opening 86. Each block also has a camming surface 90 herein shown as cylindrical and inclined toward its respective half of the opening 86. Also parallel with the face 84 each block has a substantially flat surface 92 and contiguous therewith a curved surface 94 concentric with the bore 88.

The jaws are pivoted in recesses 96 and 98 in the chuck 60 on studs 100 passing through the bores 88. Pivotally urging the faces 84 of the jaws into engagement are coil springs 102 surrounding each of the studs 100. When the faces 84 of the jaws are in contact, the flat surfaces 92 engage the walls of the recesses 96 and 98, preventing the jaws from opening toward the right. The curved surfaces 94, however, are arranged to clear the walls of the recesses 96 and 98 and permit the jaws to open toward the left, as seen in Fig. 1, when pressure is applied to the camming surface 90 in a manner hereinafter to be described. Pressure applied to the walls of the cylindrical opening 86 will not cause the jaws to open. By the construction of the jaws and their arrangement within the chuck 60 the aligned openings 86 form an elongated nail support yieldable only to pressure applied axially thereof.

On the outside of the plate 54 and secured to the trunnion 62 is a lever 104, the movement of which causes the chuck 60 to pivot between the plates 54 and 56. The lever, and consequently the chuck, are held in the position shown in Figs. 2, 3 and 5, by a tension spring 106 stretched between studs 108 and 110 on the lever and nosepiece, respectively. A plunger 112 is slidably mounted in a pair of ears 114 formed on the plate 54 and engages the lever 104. The opposite end of the plunger 112 extends beyond the end of the nosepiece and chuck and is engageable with a work piece.

The nail inserting gun operates in the following manner. The chuck 60 is held by the spring 106 in the

position shown in Fig. 5. The jaws are closed by the coil springs 102 and the driver is out of the chuck occupying a position substantially as shown. The flat contacting surfaces 84 of the jaws are in engagement and the cylindrical openings 86 are aligned with the axis B of the nail delivery nozzle 50. The nail, which is propelled from the delivery device through the flexible delivery conduit 34 in a known manner, enters the chuck point first passing through the cylindrical openings 86 in the jaws, its point striking the nail stop 64 which, as stated above, intersects the axis B and forms the terminus of the nail delivery passageway. Because of this construction the nail is prevented from passing out of the chuck regardless of how rapidly it is propelled thereinto from the delivery conduit. The nail is firmly gripped by the jaws 78, 80 and 82, the walls of the cylindrical openings 86 engaging its shank.

The nosepiece 12 of the gun is then pressed against a work piece W (Fig. 1) whereupon the plunger 112 is depressed pivoting the lever 104 and consequently the chuck 60 into the position shown in Fig. 1, whereupon the nail then lies along the axis A of the driver and is still supported by the jaws. The spring 106 which acts on the chuck is not as heavy as the spring 40 which is compressed between the sleeve 36 of the nosepiece and the extension 38 of the air hammer. Accordingly, by a single movement of the gun against the work, the chuck is first pivoted into alignment with the driver and then the spring 40 is compressed, the driver entering the bore 74 in the chuck and engaging the nail head. The trigger 20 is depressed admitting air to the chamber 26 to operate the motor 14 which through the driver delivers a series of sharp blows to the nail.

At the time the driver first contacts the nail head, all of the sets of jaws are in engagement with the shank of the nail supporting it against bending, but as the driver begins to drive the nail from the chuck into the work piece the jaws 78 are pivoted open to the left by the nail head and driver engaging the camming surfaces 90 of the jaw blocks. However, the jaws 80 and 82 retain their grip on the nail, supporting it against any tendency to bend. Eventually, with continued pressure and with the trigger still depressed the jaws 80 and then the jaws 82 also are pivoted open as the nail head and driver engage their camming surfaces 90 and pass therethrough. By the time the jaws 82 are pivoted open and release their grip on the nail, all but a small portion of the shank of the nail has entered the work and support is no longer necessary.

Upon the termination of the nail driving operation, the trigger is released and the gun is removed from engagement with the work piece, the spring 40 withdrawing the driver from the chuck. The spring 106 then pivots the chuck again into alignment with the axis B of the nail delivery nozzle 50 ready to receive another nail. Release of the trigger 20 stops the motor 14 and depressurizes the signal line 32 causing the then activated nail delivery device to propel another nail through the delivery conduit 34 whereupon the cycle may be repeated.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. A fastener inserting tool having, in combination, a movable driver, an elongated fastener support comprising a plurality of jaws engageable with a fastener lengthwise thereof, said jaws being yieldable only to pressure applied lengthwise of said support, and means for aligning said support with the path of movement of said driver whereby a fastener may be driven in a lengthwise direction while being supported by said jaws against transverse movement.

2. A fastener inserting tool having, in combination, a driver movable along a first axis, a fastener delivery passageway disposed along a second axis intersecting said first axis, a fastener abutment forming the terminus of

said passageway, a chuck adjacent said abutment and pivotal about the intersection of said axes, said chuck having an elongated fastener support comprising a plurality of jaws engageable with a fastener lengthwise thereof, said jaws being yieldable only to pressure applied lengthwise of said support, means normally maintaining said chuck in alignment with said passageway for receiving in said support a fastener delivered against said abutment, and means for pivoting said chuck into alignment with said driver whereby the fastener may be driven in a lengthwise direction while being supported by said jaws against transverse movement.

3. A fastener inserting tool having, in combination, a chuck having a plurality of sets of aligned jaws, said jaws forming an elongated fastener support, each jaw set being independently yieldable to release a fastener progressively of its length only when pressure is applied to each jaw set axially of said fastener support, means restricting said jaw sets from yielding when pressure is applied transversely of the fastener support, and a driver movable axially through said sets of aligned jaws to drive the fastener therefrom whereby the fastener is supported transversely of the direction in which it is driven by each jaw set independently of the other sets.

4. A fastener inserting tool having, in combination, a movable driver, a chuck, a plurality of sets of jaws in said chuck, each of said jaw sets comprising a pair of

blocks each having a fastener engaging surface, means normally urging said blocks toward each other whereby the surfaces form between them a fastener support, and means cooperating with said blocks to prevent movement thereof when pressure is applied only normal to said surfaces while permitting the blocks to yield in response to pressure applied axially thereof.

5. A fastener inserting tool having, in combination, a chuck having a plurality of sets of jaws, each jaw set including a pair of blocks, a recess in each block, yieldable means normally pivoting said blocks toward each other with said recesses forming between said blocks an aperture in each set of jaws, means mounting said jaw sets within said chuck with said apertures in axial alignment forming an elongated fastener support, means restricting the opening of said jaws when force is applied transversely of said aligned apertures but permitting opening thereof against the force of said yieldable means by force applied axially of said aligned apertures, and camming surfaces on said jaw blocks for receiving pressure applied axially of the aligned apertures.

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