

Jan. 28, 1958

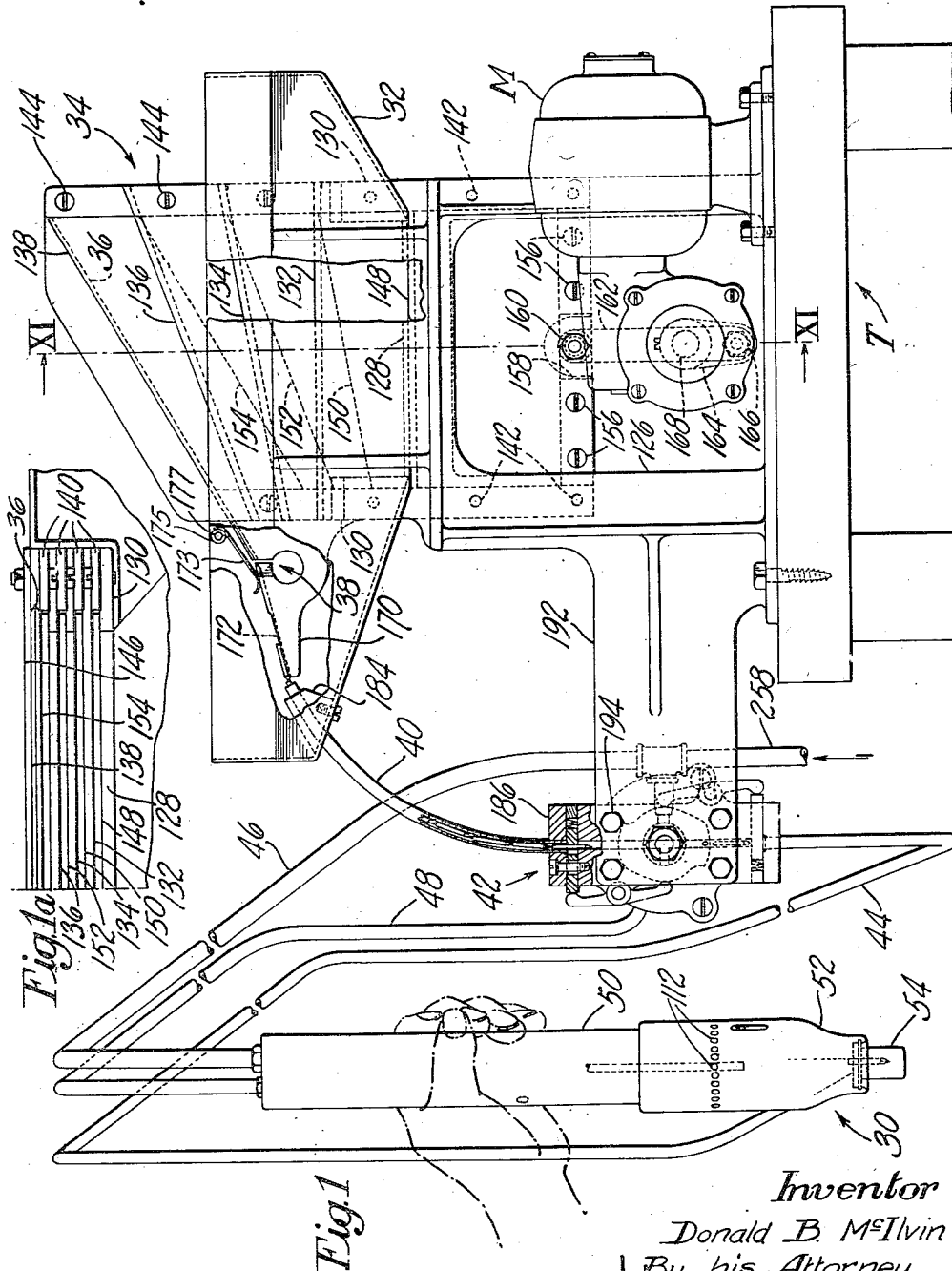
D. B. McILVIN

2,820,966

FASTENER HANDLING MACHINES

Filed May 3, 1954

4 Sheets-Sheet 1



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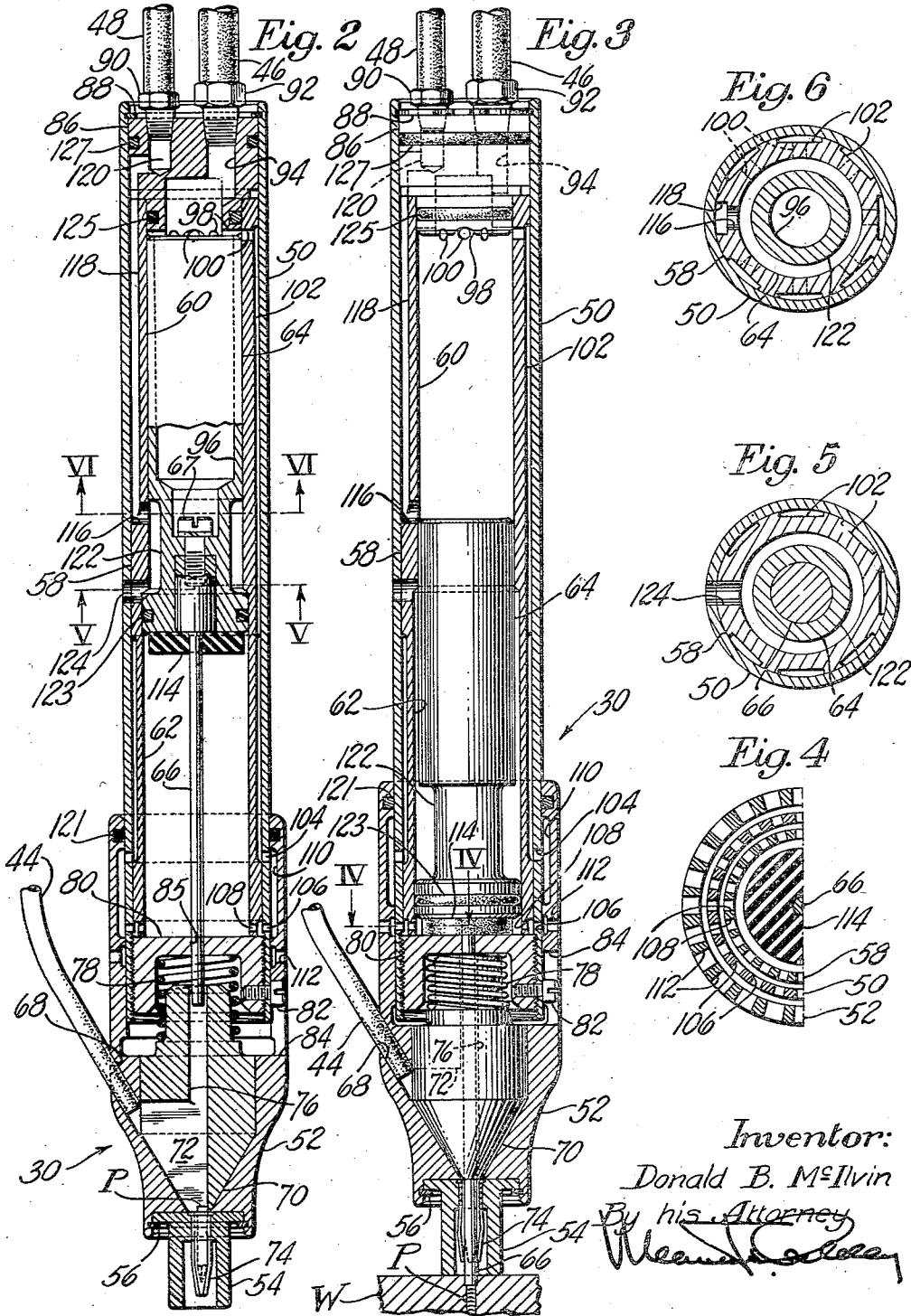
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4 Sheets-Sheet 2



Inventor:

Donald B. McIlvin

By his Attorney

Wm. H. McIlvin

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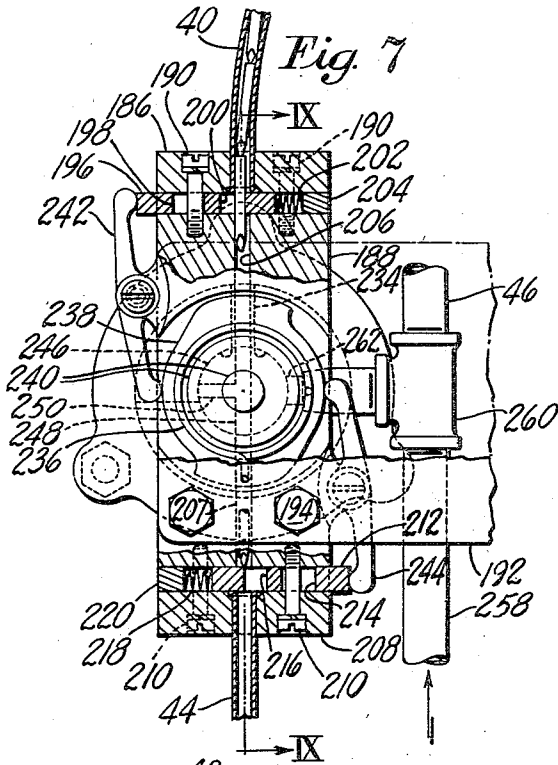
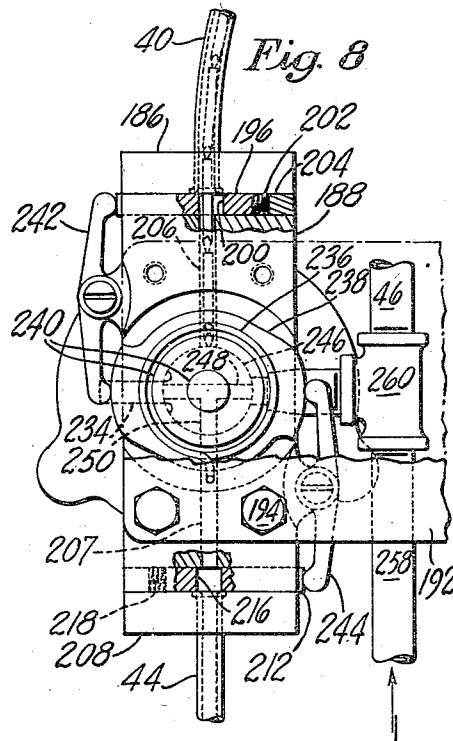
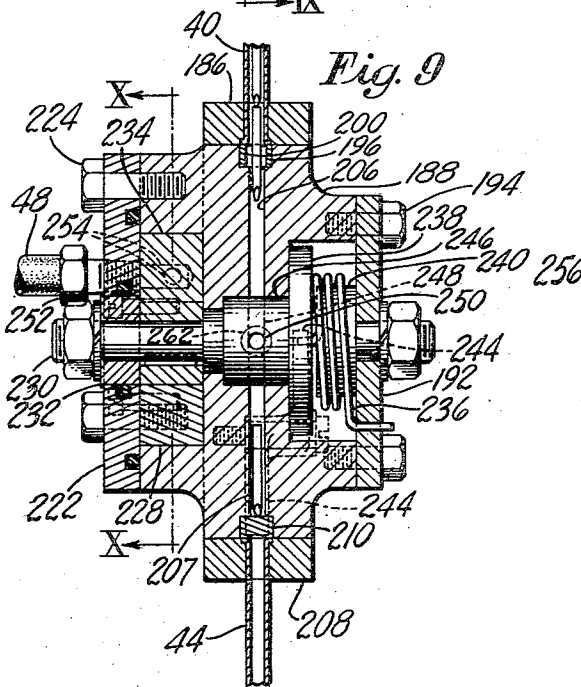
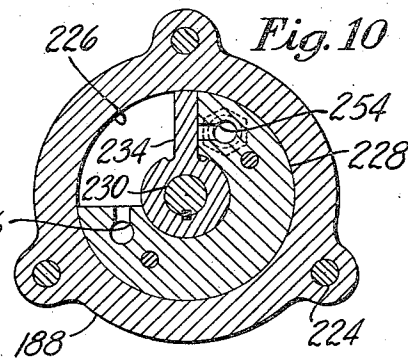
D. B. McILVIN

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4 Sheets-Sheet 3



Inventor:

Donald B. McIlvin

By his Attorney

Wm. H. C. C. C.

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2,820,966

FASTENER HANDLING MACHINES

Donald B. McIlvin, Danvers, Mass., assignor to United Shoe Machinery Corporation, Boston, Mass., a corporation of New Jersey

Application May 3, 1954, Serial No. 427,021

8 Claims. (Cl. 1—6)

The present invention relates to devices for automatically handling and driving fasteners and is herein illustrated as embodied in a pneumatically operated portable device for automatically driving pointed headless fasteners. However, in many of its novel aspects the present invention is not limited to portable inserting devices nor to handling headless pointed fasteners.

The mill work industry is today perhaps the largest user of pointed headless fasteners. In that industry it is common practice to fasten materials together with headless fasteners commonly known as sash pins, this name being derived from their primary use in joining the corners of window sashes. Generally, it is necessary to insert these pins so that their heads are a substantial distance beneath the surface of the work piece to enable further processing of the work piece. To insert these pins it has been the practice in the past for workmen to carry a supply of pins in an apron worn about their waist, and holding a limited number of pins in their left hand manually drive them with a common hammer, it being necessary afterwards to use a nail set to drive the pins beneath the surface of the work piece. This manual operation has to some extent been improved by the innovation of a device based on the principles of magazine type stapling machines. That is, the pins are purchased in strip form and the strips then inserted into the magazine of the device. A workman is then able to drive and set a pin with a single blow by using this device. The wholly manual operation is of course slow and time-consuming and while the improved magazine type device offers some advantages in providing faster insertion, the cost of sash pins in strip form suitable for loading into the magazine type device is such that the cost of the pins becomes disproportionate. The cost of sash pins purchased in this strip form is three to five times the cost of sash pins bought in loose form.

While there have been automatic devices for inserting fasteners proposed in the past, none of them are suitable for driving sash pins. These past developments have all been based upon means which utilize the head of the fastener in some manner to enable their operation. Though a limited number of prior devices have been developed for handling headless fasteners, such devices are inadequate since they depend upon some physical dimension of the fastener to be within extremely close limits to achieve proper orientation of the fasteners. While commercial manufacturing processes have been improved greatly, it is still impossible to produce sash pins of sufficient uniformity to make such prior headless fastener handling devices practical.

The larger size of sash pins as compared to tacks necessarily means that a given number of sash pins is substantially heavier so that no great supply of sash pins could be carried in a portable inserting device. This necessitates that the supply of fasteners be maintained in a hopper remote from the inserting device in order to enable constant and rapid insertion of fasteners.

While the present invention is directed primarily toward

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improved means for handling and driving headless fasteners, it will be appreciated from the following disclosure that many features may be utilized in handling other types of fasteners as well as elongated articles generally. Therefore the use of terms "sash pin" and "fastener" is in no way a limitation on the use of the several features of the invention.

It is an object of the present invention to provide a hand-held automatic fastener inserting device which is particularly adapted for inserting headless fasteners.

Another object of the present invention is to provide fastener handling means for orienting and separating fasteners one at a time which is particularly adapted for use in combination with automatic means for inserting headless fasteners.

More particularly, and in accordance with the various features of the present invention, a pneumatically operated hand-held sash pin driving tool or inserting gun is provided for flexible operation remotely of a supply of sash pins. The sash pins are stored in a hopper mounted on a relatively fixed support. Also mounted thereon is a separating mechanism which is adapted to separate one sash pin at a time for delivery to the inserting gun. The gun is connected to the separating mechanism by three flexible lines or tubes. One line delivers pressurized air for operating the gun. Through another, fasteners are delivered to the gun and the third line is a signal line connecting the gun to the separating mechanism which line when pressurized during a portion of the cycle actuates the separating mechanism.

Within the hopper a multiple lift slide mechanism is provided which transfers fasteners from a heterogeneous mass in the hopper to a downwardly extending track. At a point beyond the lift slide arrangement the track is abruptly broken and continues downwardly at a substantially shallower angle. At this point the upper end of the lower portion of the track is cut away to form a cam surface. Thus pins descending the track butt first are rejected by the cam surface from the track and returned to the hopper. Pins descending the track point first are by this arrangement able to pass beyond the break in the track and continue downwardly to a supply conduit leading to the separating mechanism. As an optional feature retaining means may be provided adjacent the point of change in angularity of the track. It has been found preferable to provide a retaining finger of very light construction which is effective upon pins descending point first slightly below the point of change in angularity. This finger properly constrains pins so that they will not bounce from the track because of their inertia or any irregularities in their manufacture. A supply of fasteners is thus provided in end-to-end relationship, point downward in this conduit. This broken track principle is not only effective in rejecting headless fasteners but other types of fasteners having a relatively small head such as brads or fasteners having a conical head, such as flat headed screws.

The lift slide mechanism within the hopper operates continuously to deliver fasteners to the track and comprises a series of lift slides which reciprocate with respect to a series of spaced stationary plates. As the lift slides reciprocate they carry sash pins from the hopper on their beveled upper edges progressively transferring them from one stationary plate to another until the pins reach the mentioned downwardly extending broken track. The angle of the upper edges of the lift slides and plates progressively increases from a horizontal plane to the plane of the downwardly extending track thereby placing the pins on this track in a gentle and uniform manner which greatly facilitates the proper functioning of the break in the track and the associated cam surface in rejecting pins which descend butt first and allowing pins

which descend point first to continue towards the separating mechanism. The lift slide mechanism is equally effective in delivering either headed or headless fasteners to a track having point orienting means.

The separating mechanism comprises a rotary control member, and means associated with the conduit leading from the hopper for gripping pins in the conduit and means for temporarily supporting a fastener within the delivery tube. When the signal line is pressurized a rotary piston within the separating mechanism is rotated 90 degrees thus rotating both the control member and a cam disk which controls the retaining and supporting means. This rotation causes the control member to block the bottom of the conduit and to introduce pressurized air into the delivery tube. The same rotation renders the retaining means ineffective allowing pins in the conduit to fall until the bottom pin strikes the control member at which time the next to the bottom pin is in line with the retaining means. The cam disk also displaces the supporting means allowing a previously separated fastener to be blown by the pressurized air along the delivery tube to the inserting gun. When the signal is depressurized the control member rotates allowing the bottommost pin to drop upon the stop means as the next to the bottommost pin is gripped by the retaining means.

The inserting gun includes a two diameter piston to which the driver is attached with air passages being provided so that in its at-rest position air pressure (at approximately 80 p. s. i. from a normal factory air system for example) acts against both ends of the piston holding the driver in a retracted position. The driver has a yieldable nose piece which, when the gun is forced against a work piece, is displaced to vent the lower surface of the piston to atmosphere and completely seal off the air passages leading to said lower surface. When the lower surface is thus vented, the piston and driver are driven rapidly downward to drive a sash pin which had previously been delivered to temporary retaining means within the end of the nose piece. The upper end of the piston is provided with a bore which serves as an accumulator. The air compressed within this accumulator has sufficient energy to drive the sash pin under normal adiabatic expansion without depending upon the flow of additional air from the air supply line. This feature greatly reduces the size of the gun necessary to drive a larger size fastener such as sash pins and eliminates the necessity of using extremely high air pressures.

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

In the drawings,

Fig. 1 is a general view in elevation showing the relation of my inserting gun and a remote hopper separator, certain parts being shown in section and others broken away for clarity;

Fig. 1a is a fragmentary view in plan of certain parts shown in Fig. 1;

Fig. 2 is a vertical section on an enlarged scale through the inserting gun shown in Fig. 1;

Fig. 3 is a view similar to Fig. 2 with the parts shown in a driving position;

Fig. 4 is a section on the line IV—IV of Fig. 3 on a slightly enlarged scale;

Fig. 5 is a section on the line V—V of Fig. 2;

Fig. 6 is a section on the line VI—VI of Fig. 2;

Fig. 7 is a view in front elevation, partly in section, of the separator shown in Fig. 1 but on an enlarged scale;

Fig. 8 is a view similar to Fig. 7 with certain operating parts in alternate positions and with other parts omitted for clarity;

Fig. 9 is a section on the line IX—IX of Fig. 7;

Fig. 10 is a section on the line X—X of Fig. 9;

Fig. 11 is a section on the line XI—XI of Fig. 1;

Fig. 12 is a view on an enlarged scale of certain elements shown in Fig. 11 showing their relationship to sash pins;

Fig. 13 is a view similar to Fig. 12 with certain parts shown in their alternate operating positions;

Fig. 14 is a view in elevation and on a further enlarged scale of the means for orienting sash pins with respect to their points, showing a sash pin descending a track point first;

Fig. 15 is a view in plan of the elements shown in Fig. 14;

Fig. 16 is a view similar to Fig. 14 but showing a pin descending a track butt first;

Fig. 17 is a view in plan of the elements shown in Fig. 16;

Fig. 18 is a section on the line XVIII—XVIII of Fig. 14; and

Fig. 19 is a section on the line XIX—XIX of Fig. 14.

Referring now to Fig. 1 the general arrangement of the present invention may be seen. A hand-held pneumatically operated inserting gun 30 is provided for flexible operation remote from a supply of sash pins which are contained in heterogeneous fashion in a hopper 32. The fasteners are transferred from the hopper 32 by a multiple lift slide mechanism 34 which places them on a downwardly inclined track or raceway 36. The angle of the track 36 is abruptly changed or broken at 38 in such a manner that pins descending the track 36 point first pass beyond this break and enter a supply conduit 40. Pins descending the track 36 butt first are rejected by the break at 38 and returned to the hopper 32 as will be explained. Thus a supply of sash pins is provided in end-to-end relationship in the conduit 40 with their points extending downwardly. A separating mechanism 42 is provided to insert a single sash pin at a time into a delivery tube or line 44 connected to the inserting gun 30. Also connected to the inserting gun 30 is a line 46 for supplying pressurized air thereto. A single line 48 connected to the gun 30 supplies a signal pressure for actuating the separating mechanism 42. In operation the gun 30 is placed in engagement with a work piece. By pressing the gun against the surface of the work, a sash pin is driven. At that time the signal pressure passing through the line 48 actuates the separating mechanism in such fashion that another sash pin is automatically delivered to the inserting gun 30. With this arrangement an operator may insert sash pins or other fasteners over a wide area, limited only by the length of the lines 44, 46 and 48.

In Figs. 2 and 3 the detailed construction of the gun 30 may be seen. It comprises a casing 50 of tubular form which the operator grips when using the gun. A nose piece 52 is slidably and yieldably mounted on the lower portion of the casing 50 and has secured to its lower end, by a snap ring 56, a nozzle 54. A sleeve 58 having two concentric bores 60, 62, is provided within the casing 50. Within this sleeve a piston 64 having two diameters corresponding to the bores 60, 62 is arranged for sliding movement with a driver 66 secured to its lower end by a screw 67.

The nose piece 52 is provided with an opening 68 into which is inserted the delivery tube 44. An insert 70 is secured within the nose piece 52 and has a slot 72 which is in register with the opening 68. A spring fingered quill 74 is secured between the insert 70 and the nozzle 54. This arrangement permits pins to be delivered through the delivery tube 44 under pneumatic pressure through the slot 72 and into the quill 74 where they are temporarily positioned preparatory to being driven. A bore 76 within the insert 70 provides a passageway for the driver 66. A compression spring 78 yieldably urges the nose piece 52 downwardly from the casing 50 of the gun 30, the spring 78 acting between a shoulder formed on the insert 70 and a cap 80 threaded into the casing 50. A screw 82 threaded into the cap 80 with its head riding in a slot 84 in the nose piece 52 limits the downward movement of the nose

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piece 56 and nozzle 54 relatively to the casing 50. The slot 84 is of sufficient length to allow the nose piece 52 to be moved against the action of the spring 78 until the insert 70 abuts the cap 80. The cap 80 is provided with a bore 85 through which the driver 66 passes; however the clearance is such that an air-tight seal is maintained.

The sleeve 58 is maintained in longitudinal position within the casing 50 by the cap 80 and by a plug 86 secured by snap ring 88 to the upper end of the casing 50. The signal line 48 and the air supply line 46 are secured to the plug 86 by suitable fittings 90, 92. The line 46 is at all times pressurized and communicates through an offset passageway 94 in the plug 86 with the upper surface of the piston 64. It should be noted that the piston 64 has a bore 96 extending from its upper surface which is adapted to serve as an accumulator. Pressurized air is also in communication with the lower surface of the piston 64 when the parts are in the positions shown in Fig. 2 through the following arrangement. The plug 86 is provided with a number of radial grooves 98 which communicate with holes 100 formed in the sleeve 58 which in turn communicate with slots 102 (Fig. 6) which extend downwardly along the sleeve 58 terminating at a point in register with holes 104 formed in the casing 50. The holes 104 are in communication with further holes 106, 108 formed in the casing 50 and the sleeve 58 respectively (Fig. 4) through an elongated annular recess 110 formed in the nose piece 52.

With the nose piece in its at-rest position (Fig. 2) the piston 64 is normally maintained in its upper position due to the fact that the lower surface of the piston has a larger area than the upper surface. When the gun 30 is pressed against a work piece W the nose piece 52 assumes the position shown in Fig. 3. The pressure acting on the lower surface of the piston 64 is immediately vented to atmosphere through the holes 106, 108 and a corresponding series of holes 112 formed in the nose piece 52. The piston moves with explosive force to drive a sash pin P which has previously been delivered to the quill 74. Movement of the piston 64 and the driver 66 is limited by engagement of a shock absorbing pad 114 with the cap 80. In the mill work industry it is often desirable to drive sash pins a substantial distance below the surface of the work piece as is shown in Fig. 3. The depth of drive of course is dependent on the length of the driver 66.

While the air supply from the line 46 at all times remains in communication with the upper surface of the piston 64 the accumulator formed by the bore 96 is of sufficient size so that the air compressed therein has sufficient energy to drive the sash pin P by adiabatic expansion without depending upon the flow of additional pressurized air through the line 46. Thus the energy for driving the piston is not dependent on the flow of air through openings which would act as restrictive orifices. This feature in combination with the large number of venting holes 106, 108 and 112 combines to provide a greater amount of energy in relation to the size of the inserting gun than has heretofore been obtained by using nominal air pressures in the range of 60-100 p. s. i. which are available in most all factory air systems. A further feature which increases the amount of energy available is provided by the construction of the nose piece 52. It will be noted that when the nose piece is in the Fig. 3 position, the holes 106, 108 and 112 have only one function, namely to vent the pressurized air from the outer bore of the sleeve 58 and in such position the pressurized air from the slots 102 is confined within the recess 110.

When the piston 64 is in its lower position the signal line 48 is pressurized for reasons which will further appear by the following arrangement. A passageway leading to the signal line 48 comprises a hole 116 formed in the sleeve 58, a groove 118 also formed in said sleeve which continues toward the plug 86, and through an offset

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passageway 120 in said plug which leads to the signal line 48. It will be noted that the hole 116 is so located that when the piston 64 is in its lowermost position the signal line is connected to the pressurized chamber above the piston 54, thus pressurizing the signal line 48. In order to prevent air leakage, there are provided within the gun 30 several annular rings of circular cross section which are fitted in appropriate recesses. These rings are preferably of polychloroprene. A ring 121 prevents leakage of air through the sliding connection between the nose piece 52 and the casing 50. A ring 123 serves as a seal between the upper and lower surfaces of the piston 64. A ring 125 prevents leakage of air from the grooves 98 into the groove 118 leading to the signal tube 48. A ring 127 forms an air-tight seal between the plug 86 and the casing 50. The ring 123 is of particular importance in that it greatly reduces the manufacturing tolerances which must be maintained in machining the bores 60, 62 and the corresponding diameters on the piston 64.

When the gun 30 is removed from the work piece W the nose piece 52 assumes the position shown in Fig. 2 under the action of the spring 78 whereupon the lower surface of the piston 64 again becomes pressurized causing the piston 64 to assume its upper position. The signal line 48 remains pressurized until the piston 64 has substantially reached its upper position after which it is depressurized by being vented to the atmosphere when a recess 122 formed on the piston 64 places it in communication with a hole 124 formed in the sleeve 58 and casing 50. The hole 124 serves a further function of eliminating any possible drag which suction might create as the piston is being driven. The specific construction of the gun 30 forms no part of the present invention but is claimed in my copending divisional application Serial No. 685,936, filed September 24, 1957.

As was mentioned above the main supply of fasteners is stored in the hopper 32 remotely of the gun 30. The hopper 32 is of sheet metal construction and of the general configuration shown in Figs. 1, 1a and 11. The hopper is secured to a bracket 126 which in turn is mounted for convenience on a table T. The bottom sides of the hopper 32 slope downwardly toward a surface 128 on the bracket 126. On either side of the surface 128 there is an upward extension 130 to which is bolted a series of stationary plates 132, 134, 136 and 138 and spacers 140 (Figs. 1a and 11). The plates 132 through 138 are mounted in this spaced relation on the bracket 126 and the extension 130 by screws 142 and to each other by bolts 144. A back-up plate 146 is also secured to this assembly by the bolts 144. Between the surface 128 which serves as the lowermost stationary plate and the stationary plates 132, 134, 136 and 138, lift slides 148, 150, 152 and 154 (Figs. 12 and 13) are slidably mounted. The lift slides 148 through 154 are secured together near their lower edges by screws 156 (Fig. 1) with spacers 158 being provided to maintain the proper space relationship of the lift slides with respect to the stationary plates (Figs. 1 and 11). A bolt 160 passes through the lift slides and spacers to provide a bearing for a link 162. The lift slides 150 and 152 and the centermost spacer 158 are cut away to provide suitable clearance for the link 162. The link 162 is connected to a crank arm 164 by a shoulder screw 166. The crank arm in turn is securely fastened to the drive shaft 168 of a continuously running gear reduction motor M which in turn is mounted on the table T.

It will be noted that the lift slide 148 and the stationary plate 132 have their upper edges in horizontal planes as seen in Fig. 1 and that the angles of the upper edges of slide 150, and the plate 134 are 10° from horizontal. The angles of the upper edge of the slide 152 and the plate 136 are 20° and the angles of the upper edge of the slide 154 and the plate 138 are 30°. It will also be noted that in a plane at right angles to the view in Fig. 1 the upper surfaces of the lift slides and stationary plates are

beveled with the exception of the plate 133 in which the V-shaped track or raceway 36 is formed. This novel lift slide construction forms no part of the present invention but is claimed in my co-pending application Serial No. 534,833, filed September 16, 1955.

The lift slides reciprocate constantly to deliver fasteners to the track 36 in the following manner. When the lift slides are in their lower positions as seen in Fig. 12, pins such as the pin P, will lie in the recess formed by the bevel on the upper surface of the slide 148 and the adjacent face of the stationary plate 132. When the lift slides move to their upper positions, the pin P drops a short distance into the recess formed between the beveled upper surface of the stationary plate 132 and the adjacent face of the lift slide 150 (Fig. 13). On the next succeeding movement of the lift slides the pin P would next lie in the recess formed by the beveled upper surface of the lift slide 150 and the adjacent face of the stationary plate 134. The pin P or any other pins which might be carried on the upper surface of the various lift slides are thus progressively raised until they drop into the V-shaped track 36. The progressively increasing angularity of the various stationary plates and lift slides is such that at no time does a pin fall freely any great distance. The action is therefore very gentle. Pins are deposited on the track 36 in a uniform manner so that there is no tendency for them to bounce and thus they descend the track 36 in a substantially uniform manner. The full benefits of this action will shortly be discussed. It should also be noted that the thickness of the stationary plates and lift slides is just slightly greater than the pin diameter thereby preventing pins from overlying each other. Where the lift slide arrangement is to be used for handling headed fasteners a similar arrangement of stationary plates and lift slides is equally effective. However, the downwardly extending track 36 may be modified in several ways to otherwise provide for orientation of headed fasteners with respect to their points. For example, the track 36 might be slotted so that as headed fasteners lie in the track and descend downwardly their body portions will fall freely within the slot thus orienting the fasteners properly.

The following mechanism is provided to orientate the headless sash pins with respect to their points although it is to be understood that headed fasteners can likewise be so oriented. The plate 138 has an extension 170 which is best seen in Fig. 1. The track 36 extends beyond the lift slide area a short distance to the point 38 at which point its angularity is abruptly changed. Beyond the point 38 (Figs. 14 and 15) a track 172 continues downwardly in alignment with and as an extension of the track 36 but on a substantially shallower angle. A beveled camming surface 174 is formed on the extension 170 at the point 38. A slot 176 and a hole 178 are also formed in the extension 170 for convenience of manufacture. They would not be necessary if, for example, the extension 170 were a separate piece. The lower end of the track 36 has a beveled surface 180 (Fig. 19) and the lower end of the track 172 has beveled surfaces 182 (Fig. 18) for reasons which will further appear. A retaining finger 173 attached to a hub 175 which is pivotally mounted on a fixed pin 177 may be provided for preventing pins descending the track 36 point first from bouncing therefrom as they pass beyond the point 38. The lower end of the retaining finger 173 is arranged to be effective upon pins entering the track 172 at a point just beyond the cam surface 174.

The so-called broken track mechanism described above provides an effective means for orienting headless pins with respect to their points. It is also effective in orienting other fasteners having a small head such as brads or a conical head such as flat headed screws. As pins descend the track 36 point first (Figs. 14 and 15), the point will enter the track 172 and continue downwardly along that track. It should be noted that the bottom of

the track 172 is slightly below the point of the pin P lying in the track 36. When pins descend the track 36 butt first (Figs. 16 and 17), the flat end of the pin cannot enter the track 172 but strikes the surface 174 and is cammed upwardly out of the track 36 and falls back into the hopper 32. The beveled surface 180 reduces the depth of the track 36 and facilitates the rejection of pins which descend the track 36 butt first. The uniform manner of descent of pins down the track 36 produced by the lift slide mechanism 34 also facilitates the selective action of this broken track arrangement.

The pins, after they have been oriented with respect to their points, pass along the track 172 and enter the supply conduit 40 which leads to the separating mechanism. The retaining finger 173, which is an optional feature, prevents pins descending the track 36 point first from bouncing back into the hopper 32 as they pass beyond the point of change of angularity 38. This feature is particularly useful where pins of irregular manufacture are being handled so that there is a danger of their inertia in combination with their irregularities being sufficient to reject them even though they are properly oriented. The lift slide mechanism 34 is designed to deliver fasteners more rapidly than they can be driven by the gun 30 in normal operation. Thus the conduit 40 will often become filled so that further pins which descend the track 36 point first lie in the track 172. Additional pins fall back into the hopper 32 as they are dislodged from the track 172 by the inertia of pins descending the track 36. The beveled surfaces 182 which reduce the depth of the track 172 have been found sufficient to prevent jamming without the use of additional means such as brushes.

The separating mechanism 42 will now be described in detail. The conduit 40 which carries pins to the separating mechanism has its upper end secured in a block 184 (Fig. 1) which is fastened to the hopper 32. The lower end of the conduit 40 enters a block 186 which is secured to a housing 188 by screws 190 (Fig. 7). The housing 188 is fastened to a projection 192 of the bracket 126 by screws 194. A retaining slide 196 reciprocally mounted in the upper end of the housing 188 is provided with two slots 198, 200. A spring 202 acting between the right-hand end of the slide 196 and a plug 204 urges the slide 196 toward the left (Fig. 7) at times to cause the pin in the conduit 40 and in an extension 206 thereof formed in the member 188 to be retained by the surface of the slide at the right-hand end of the slot 200.

A similar slide arrangement is provided at the bottom of the housing 188. The delivery tube 44 is carried by a block 208 which is secured to the housing 188 by screws 210. A bore 207 within the housing 188 forms an extension of the delivery tube 44. A stop slide 212 reciprocally mounted in the housing 188 is provided with a slot 214 and a hole 216. A spring 218 acting between the left-hand end of the slide 212 and a plug 220 normally urges the slide to the right in which position it prevents passage of pins to the delivery tube 44.

A cap 222 is secured to the rear surface of the housing 188 by screws 224 enclosing a chamber 226 (Figs. 9 and 10) within the housing 188. The chamber 226 is further defined by a plug 228. A shaft 230 journaled in the cap 222 through a bushing 232 and in the housing 188 carries a rotary piston 234 which is adapted for movement within the chamber 226. A torsion spring 236 acting between the projection 192 and an enlarged cam disk 238 formed on the shaft 230 urges said shaft in a clockwise direction as seen in Figs. 7 and 10. A stub shaft 240 secured to the projection 192 maintains the spring 236 in its helical form. Offset levers 242, 244 are pivotally mounted upon the housing 188. Each lever has one end in engagement with the cam disk 238 and their other ends in engagement with the slides 196 and

212 thereby controlling movement of their respective slides.

The shaft 230 has an enlarged diameter 246 which serves as a control member and in which is formed a hole 248 that registers at times with the extension 206 of the conduit 40 and the extension 207 of the delivery tube 44. A second hole 250 in the diameter 246 intersects the hole 248 and, also at times, is in register with the extension 207 of the delivery tube 44.

The signal line 48 from the gun 30 is secured to the cap 222 through a suitable fitting 252 and communicates with the rotary piston 234 through a passageway 254 formed in the plug 228. A second passageway 256 (shown in Fig. 10 only) within the plug 228 vents the chamber 226 to the atmosphere. Thus when the signal line is pressurized in the manner previously explained the piston 234 and the shaft 230 rotate 90 degrees in a counterclockwise direction to assume the positions shown in Fig. 8.

Pneumatic pressure for operating the present device is supplied from any well-known means (not shown) through a pipe 258 which is connected to a T fitting 260. The flexible air line 46 is connected to one outlet of the T fitting 260. The other outlet of the T fitting 260 is in communication with a hole 262 in the housing 188 which at times registers with the hole 248 as the shaft 230 is rotated.

In operation the motor M is continuously rotated thereby reciprocating the lifter slides 148 through 154 transferring sash pins from the hopper 32 to the track 36. Pins which descend the track 36 butt first are rejected by the camming surface 174 at the point 38 where the track is broken and fall back into the hopper 32. Pins which descend the track 36 point first continue to pass the point 38 along the track 172 and enter the supply conduit 40 which communicates with the separating mechanism 42 to form a reservoir or supply of properly aligned pins in end-to-end relationship.

Referring now to the operation of the gun 30, the gun is shown in its at-rest position in Fig. 2 with pressurized air from the supply line 46 acting against both the upper and lower surfaces of the piston 64. Due to the fact that the lower surface has a larger area, the piston 64 is maintained in an upper position. In the at-rest position the signal line 48 is depressurized and the separator mechanism is as shown in Fig. 7 with the lower most pin in the conduit 40 being clamped by the retaining slide 196 and with a previously separated pin resting upon the upper surface of the stop slide 212. To operate the gun 30 an operator may grasp it by the casing 50 forcing the nozzle 54 against a work piece W and compressing the spring 76 thereby causing the nose piece 52 to assume the position shown in Fig. 3. In this position air pressure acting against the lower surface of the piston 64 is vented to atmosphere through the holes 108, 106, and 112 and sealing off the supply of air pressure to said lower surface. Immediately the pressurized air accumulated in the bore or accumulator 96 forces the piston 64 and driver 66 downwardly in an explosive manner to drive a pin P temporarily retained in the quill 74 into the work piece W. The energy of the compressed air within the accumulator 96 is sufficient alone under adiabatic expansion to drive the pin P without depending upon further flow of air through the line 46.

When the piston 64 is in its downmost position, the signal line 48 becomes pressurized. Pressurization of the signal line 48 operates the separator 42 in the following manner. The rotary piston 234, the shaft 230 and the cam disk 238 are rotated in a counterclockwise direction to assume the positions shown in Fig. 8. Rotation of the cam disk 238 causes the lever 242 to be swung in a clockwise direction shifting the slide 196 to the right thereby releasing the pressure against the lowermost pin in the conduit 40 and allowing pins within that conduit to drop so that the bottommost pin strikes the diameter

or control member 246 formed on the shaft 230. The proportions of the separating mechanism are such that in this position the next to the bottommost pin is now within the slot 200 of the slide 196. Rotation of the cam 238 also causes displacement of the lever 244 in a clockwise direction and displacement of the slide 212 toward the left bringing its hole 216 into register with the delivery tube 44. At the same time the delivery tube is pressurized through the holes 262, 248 and 250 which communicate with the air supply. Thus a previously separated pin as is shown in Fig. 7 will be blown through the tube 44 to the gun 30. In most instances it has been found that the signal line 48 remains pressurized for a sufficient length of time to enable proper delivery of a pin. It will be noted in some instances that the pin P will arrive at the gun 30 while the driver 66 blocks entrance to the quill 74. However, there is enough air pressure remaining to force the pin into the quill 74 after the driver is withdrawn especially in view of the fact that the signal line 48 remains pressurized during a substantial portion of the upward movement of the piston 64. However, under certain circumstances it may be necessary to prolong the blast of air which delivers the pin through the tube 44. Under these circumstances a control valve system such as is disclosed in my copending application Serial No. 427,022, filed May 3, 1954, may be used.

When the gun 30 is removed from the work piece W the nose piece 52 again assumes the position shown in Fig. 2 and the piston moves upwardly as pressurized air is admitted to the lower surface of said piston. The signal line 48 is again depressurized and the elements of the operating mechanism 42 assume the positions shown in Fig. 7. The next to the last pin bottom in the conduit 40 is retained by the slide 196 and the bottommost pin falls through the hole 248 in the diameter 246 until it strikes the upper surface of the stop slide 212 where it is retained preparatory to the next succeeding operation of the gun 30.

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

1. In a fastener handling device the combination of a hopper for holding a supply of randomly oriented fasteners which are pointed at one end, a downwardly extending track associated with said hopper, means for transferring fasteners from said hopper to said track in such fashion that said fasteners lie longitudinally within said track and slide downwardly therein, said track being interrupted by an abrupt change in its slope, the lower portion of said track having a substantially shallower slope than the upper portion and having a cam surface formed at its upper end, said cam surface being shaped to reject fasteners descending said track unpointed end first from said track and to permit fasteners descending point first to continue to the lower portion of said track uniformly oriented with respect to their points.

2. In a fastener handling device the combination of a hopper for holding a supply of randomly oriented fasteners which are pointed at one end, a downwardly extending track adjacent said hopper, means for transferring fasteners from said hopper to said track in such fashion that they lie longitudinally within said track and slide downwardly therein, said track being interrupted by an abrupt change in its slope, the lower portion of said track having a substantially shallower slope than the upper portion and having a cam surface at its upper end shaped to engage the unpointed end of fasteners descending the upper portion of said track unpointed end first and deflect them out of said track and to permit fasteners descending point first to continue to the lower portion of said track properly oriented with respect to their points.

3. In a fastener handling device the combination of

a hopper for holding a supply of randomly oriented fasteners which are pointed at one end, a downwardly extending track adjacent said hopper, means for transferring fasteners from said hopper to said track in such fashion that they lie longitudinally within said track and slide downwardly thereof, said track having an upper and a lower portion, a cam member located at the upper end of said lower portion having a surface lying in a plane extending at an angle of less than 90° transversely of the path of movement of fasteners descending said upper portion, said cam surface being shaped to reject from the track fasteners descending said upper portion unpointed end first and to permit fasteners descending said upper portion point first to continue to the lower portion uniformly oriented with respect to their points.

4. In a fastener handling device the combination of a hopper for holding a supply of randomly oriented fasteners which are pointed at one end, a downwardly extending track adjacent said hopper, means for transferring fasteners from said hopper to said track in such fashion that they lie longitudinally within said track and slide downwardly thereof, said track having an upper and a lower portion, a cam member located at the upper end of said lower portion and having a surface lying in a plane extending at an angle of less than 90° transversely of the path of movement of fasteners descending said upper portion, said cam surface being shaped to engage the unpointed end of fasteners descending the upper portion of the track unpointed end first and deflect them out of said track and to permit fasteners descending point first to continue to said lower portion properly oriented with respect to their points.

5. In a fastener handling device the combination of a hopper for holding a supply of randomly oriented fasteners which are pointed at one end, a downwardly extending track associated with said hopper, means for transferring fasteners from said hopper to said track in such fashion that said fasteners lie longitudinally within said track and slide downwardly therein, said track being interrupted by an abrupt change in its slope, the lower portion of said track having a substantially shallower slope than the upper portion and having a cam surface formed at its upper end, said cam surface being shaped to reject fasteners descending said track unpointed end first from said track and to permit fasteners descending point first to continue to the lower portion of said track uniformly oriented with respect to their points, and means located adjacent the change of slope of said track for retaining fasteners descending point first within said lower portion.

6. In a fastener handling device the combination of a hopper for holding a supply of randomly oriented fasteners which are pointed at one end, a downwardly extending track adjacent said hopper, means for transferring fasteners from said hopper to said track in such fashion that they lie longitudinally within said track and slide downwardly thereof, said track having an upper and a lower portion, a cam member located at the upper end of said lower portion having a surface lying in a plane extending at an angle of less than 90° transversely of the path of movement of fasteners descending said upper portion, said cam surface being shaped to reject from the track fasteners descending said upper portion unpointed end first and to permit fasteners descending said upper portion point first to continue to the lower portion uniformly oriented with respect to their points, and a finger

located adjacent said cam member for retaining fasteners descending the track point first within the lower portion of said track.

7. In a fastener handling device the combination of a hopper for holding a supply of randomly oriented fasteners which are pointed at one end, a downwardly extending track associated with said hopper, means for transferring fasteners from said hopper to said track in such fashion that said fasteners lie longitudinally within said track and slide downwardly therein, said track being interrupted by an abrupt change in its slope, the lower portion of said track having a substantially shallower slope than the upper portion and having a cam surface formed at its upper end, said cam surface being shaped to reject fasteners descending said track unpointed end first from said track and to permit fasteners descending point first to continue to the lower portion of said track uniformly oriented with respect to their points, a length of the upper portion of said track immediately above said change of slope being cut away substantially to reduce the depth of the track along that length to prevent piling up of fasteners and to facilitate the rejection of fasteners descending said upper portion unpointed end first.

8. In a fastener handling device the combination of a hopper for holding a supply of randomly oriented fasteners which are pointed at one end, a downwardly extending track associated with said hopper, means for transferring fasteners from said hopper to said track in such fashion that said fasteners lie longitudinally within said track and slide downwardly therein, said track being interrupted by an abrupt change in its slope, the lower portion of said track having a substantially shallower slope than the upper portion and having a cam surface formed at its upper end, said cam surface being shaped to reject fasteners descending said track unpointed end first from said track and to permit fasteners descending point first to continue to the lower portion of said track uniformly oriented with respect to their points, the depth of the lower end of said lower portion of the track being reduced to prevent piling up of fasteners thereby to prevent jamming of fasteners when said lower portion becomes filled.

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