United States Patent [19]

Cohn et al.

[11] **3,743,158**

[45] **July 3, 1973**

[54] **ROLLER MOUNTED NAILING MACHINE**

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[22] Filed: **Mar. 31, 1971**

[21] Appl. No.: **129,923**

[52] **U.S. Cl.** **227/8**, 227/110, 227/130

[51] **Int. Cl.** **B27f 7/02**

[58] **Field of Search** ..... 227/7, 8, 110, 111, 227/130, 152; 83/701, 561, 562; 266/23 K

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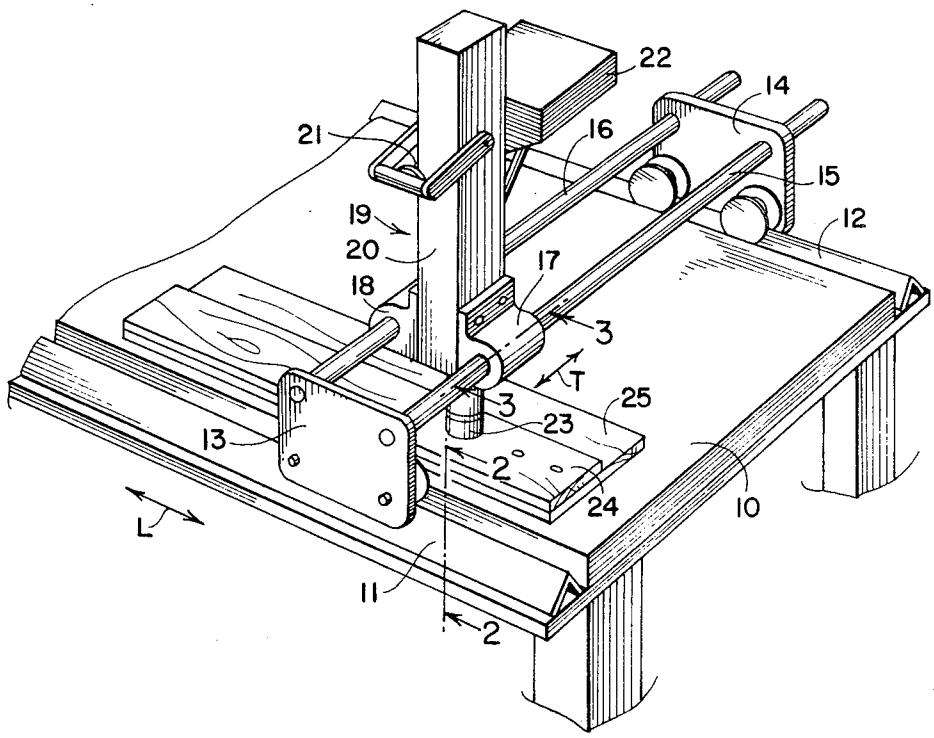
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[57] **ABSTRACT**

A roller mounted frame structure supports a pneumatically operated one shot nailing machine for movement along a work into which nails are to be driven. The arrangement is such that the nailing machine may be positioned over any selected point on the work and upon operation of the machine, a major portion of the machine drops on the work thus holding it while a nail is driven into the work by a single pneumatic blow.

6 Claims, 7 Drawing Figures



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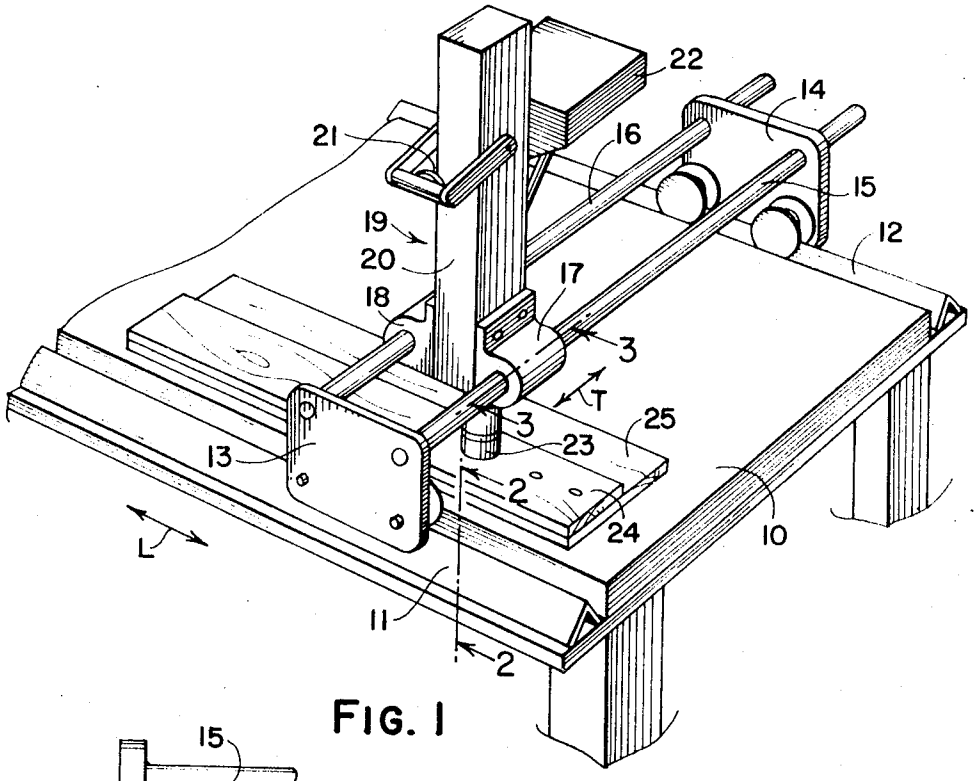


FIG. 1

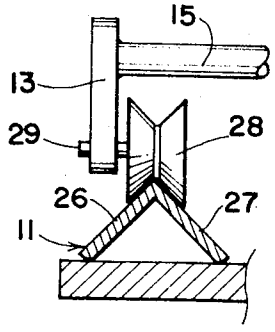


FIG. 2

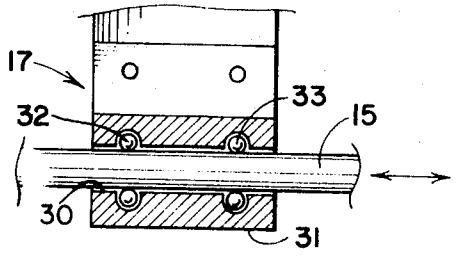


FIG. 3

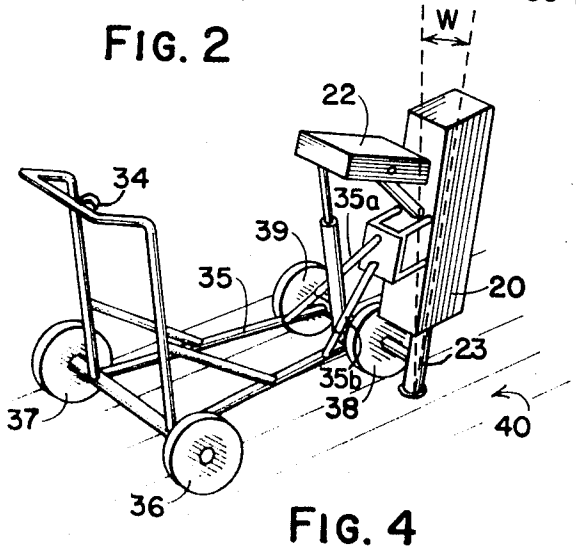


FIG. 4

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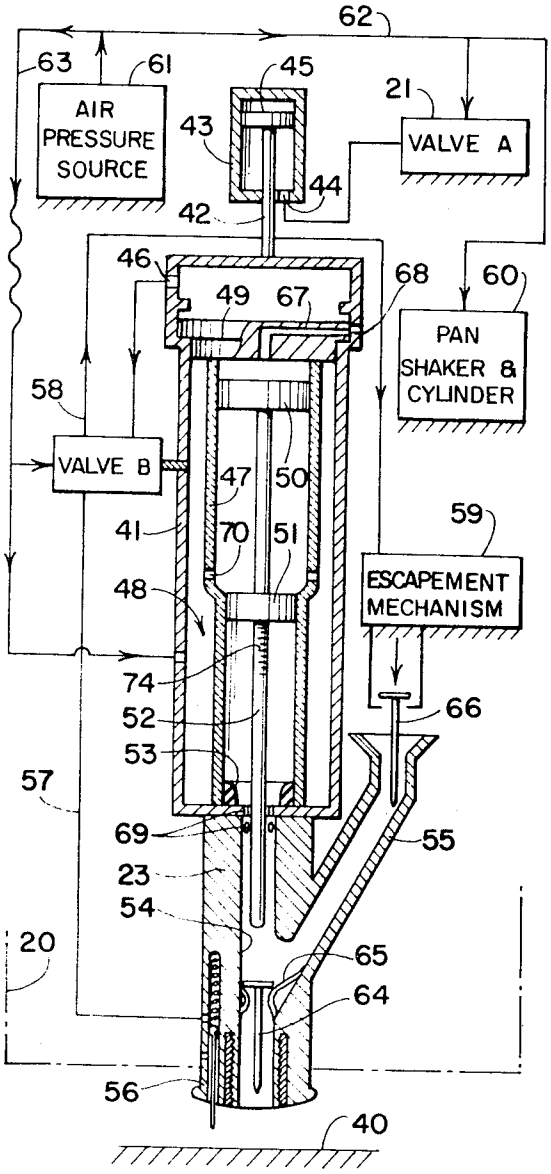


FIG. 5

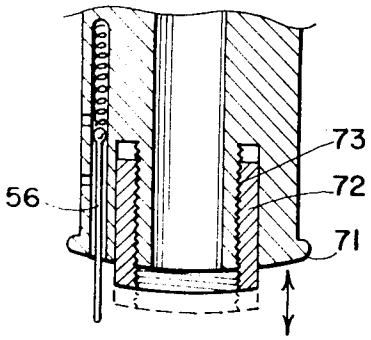


FIG. 7

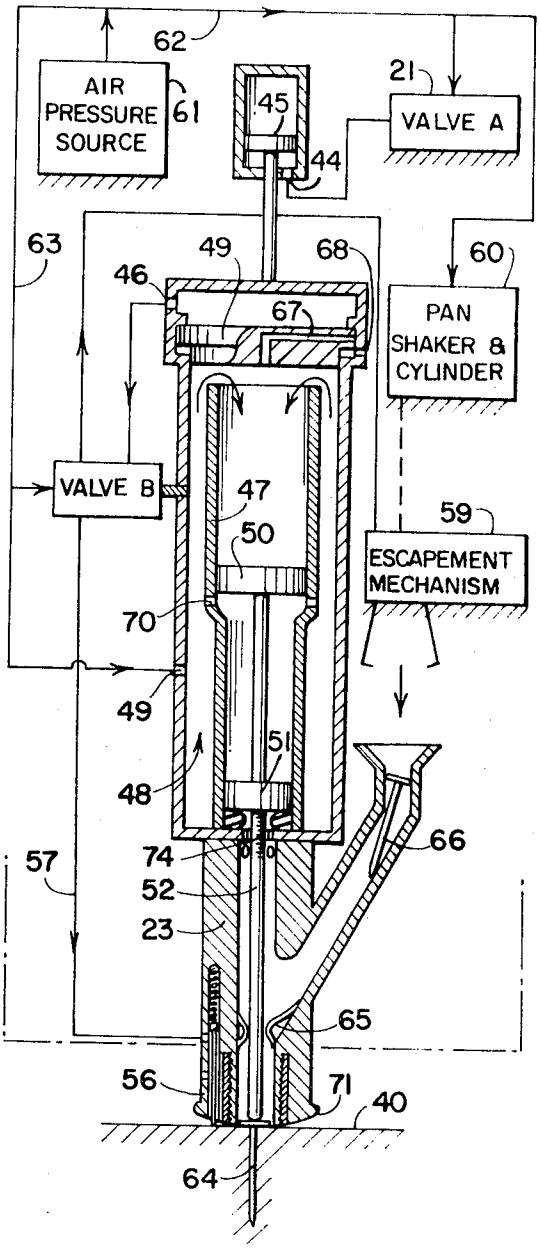


FIG. 6

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ROLLER MOUNTED NAILING MACHINE

This invention relates to a roller mounted nailing machine for increasing the speed and accuracy of nailing operations. The invention more particularly contemplates the combination of an improved one shot nailing machine with a suitable roller support to facilitate certain types of nailing operations.

BACKGROUND OF THE INVENTION

Automatic nailing machines used in the construction industry are ordinarily of two types. First, the automatic nailing machines may comprise large stationary structures incorporating one or more pneumatic nailers under which are fed materials to be nailed together. Second, the automatic nailers may comprise portable types to the extent that they may be guided by a worker with the aid of a foot stirrup such as shown and described in U.S. Pat. No. 2,799,858.

The first type of machines in the form of permanent installations are necessarily somewhat limited in flexibility and are designed primarily for use with mass production of prefabricated panels and the like. The second type of portable pneumatic machines, while quite versatile, lack the accuracy in properly positioning nails simply as a consequence of being physically moved and operated by the worker himself. In this respect, while the latter type pneumatic machines are indeed portable and can be carried by a worker, they are still heavy and accurate positioning thereof is relatively difficult as compared to a simple hand nailing operation.

BRIEF DESCRIPTION OF THE PRESENT INVENTION

With the foregoing considerations in mind, it is a primary object of the present invention to provide a combination roller structure and nailing machine which enables accurate and rapid positioning of the machine over any selected point of members to be fastened together all to the end that the greater versatility realizable with portable type pneumatic machines is realizable and yet easier handling, more accurate positioning and faster nailing can take place.

Another important object is to provide, in combination, an improved one shot type automatic nailing machine with a rugged roller supporting structure wherein the combination is such that a major portion of the tool is first dropped on the work to hold the work in a selected position while nailing takes place with a single blow.

Still other objects of this invention are to provide in a roller mounted nailing machine, means enabling toe nailing of a nail and means for adjusting the degree of countersinking or depth of driving of a nail.

Briefly, these and other objects and advantages of this invention are attained by providing in a first embodiment, a work surface which may constitute the flat top surface of a table for receiving materials upon which the nailer is to be used. First and second longitudinally extending guide tracks are provided adjacent to opposite sides of the work surface in parallel spaced relationship. First and second supports movable along the first and second longitudinally extending guide tracks are provided. Between these supports there are included first and second transversely extending guide tracks in parallel spaced relationship with their opposite ends secured to the first and second supports at a level above the work surface. A carriage frame in turn is mounted for transverse movement along the transversely extending guide tracks and serves to hold the improved one shot automatic nailing machine such that the machine may be readily moved in longitudinal and transverse directions to any selected position above the work surface.

In a second embodiment, a frame structure supporting the nailing machine is provided with front and rear pairs of rollers or wheels such that the machine may be rolled along a work surface such as a roof and periodically operated to effect a series of nailings in a row. In this respect, the result is similar to a foot guided portable nailing machine as described in the heretofore mentioned patent but is far easier to operate, faster, and enables greater positioning accuracy to be realized.

BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the invention will be had by referring to the accompanying drawings, in which:

FIG. 1 is a fragmentary perspective view of a work support and guide structure in combination with an improved pneumatically operated automatic nailing machine in accord with a first embodiment of the invention;

FIG. 2 is a fragmentary cross section taken in the direction of the arrows 2—2 of FIG. 1;

FIG. 3 is another fragmentary cross section taken in the direction of the arrow 3 of FIG. 1;

FIG. 4 is a perspective view of the roller mounted nailing machine in accord with the second embodiment of the invention;

FIG. 5 is a schematic illustration partly in block form of the improved nailing machine utilized in the embodiments of FIGS. 1 and 2 showing the relative positions of parts of the machine just prior to a nailing operation;

FIG. 6 illustrates the positions of the parts of FIG. 5 just at the completion of driving of a nail; and

FIG. 7 is a fragmentary cross section of the nose piece of the nailing machine.

DETAILED DESCRIPTION OF THE INVENTION

Referring first to FIG. 1 there is shown a table structure having a work supporting surface 10. First and second longitudinally extending guide tracks preferably in the form of inverted angle irons 11 and 12 are fixed to opposite sides of the work surface 10 as shown.

Cooperating with the longitudinally extending guide tracks are first and second vertically extending supports in the form of plates 13 and 14. Pairs of rollers arranged in tandem are mounted to the lower portions of these plates and are V-grooved to receive the angle irons forming the longitudinally extending guide tracks. One of these rollers is partially visible for the plate 13 received over the angle iron 11. The end of the shaft for the other roller on the plate 13 is also visible in FIG. 1. However, this second roller is eclipsed by the plate. The plate 14 includes a similar roller structure.

Supported between the vertical plates 13 and 14 are transversely extending guide tracks 15 and 16 in the form of rods. First ends of these rods are rigidly secured to the support plate 13, the other ends passing through bores in the plate 14 so that the distance between the plates and thus the rollers is adjustable.

The guide structure itself is completed by a support frame in the form of a carriage assembly including journal structures 17 and 18 receiving the transversely ex-

tending guide tracks or rods. An improved pneumatically operated nailing machine designated generally by the numeral 19 is shown in combination with the support structure. The main housing of the pneumatic nailer is indicated at 20. In addition, there is provided a manual gripping handle including a pneumatic trigger valve 21 secured to the upper end of the housing 20 as shown. The nailing machine also includes a nail pan 22 and lower nose piece 23.

The supporting carriage structure is so designed as to position the nailing machine at a given distance above the work surface 10. This distance is such that pieces of material such as 24 and 25 to be nailed together can be received under the nose piece and yet a proper nailing thereof can be achieved upon pneumatic operation of the nailer itself. While not shown specifically in FIG. 1, it should be understood that the vertical position of support of the nailing machine between the journal structures 17 and 18 could be made adjustable.

FIG. 2 shows in detail the structure of the inverted V-shaped guide track 11 on which the tandem rollers on the first vertical support plate 13 ride. As shown, the V-shaped member includes left and right flanges 26 and 27 defining the V walls of the track. Only one of the tandem rollers is visible in FIG. 2 and is shown at 28 grooved to ride on these flanges. This roller is mounted on a roller shaft 29 secured to the lower portion of the plate 13. Also illustrated in FIG. 2 is the rigid connection of the transversely extending guide track or rod 15 to the upper portion of the support plate 13.

FIG. 3 illustrates details of the transversely extending guide track or rod 15 and journal structure 17. As shown, the structure includes a journalling bore 30 formed in a support block 31. Suitable tandem located bearings such as at 32 and 33 receive the rod 15 so that the entire support structure can easily ride along the rod.

The support plate and journal structures for the plate 14 and journal 18 are substantially the same as those described in FIGS. 2 and 3 and further description is deemed unnecessary.

It will be evident from FIG. 1 that the support plates 13 and 14 together with the transversely extending guide tracks 15 and 16, the carriage structure, and the pneumatic nailing machine 19 may move as an entire unit in a longitudinal direction back and forth over the work surface 10 as indicated by the double headed arrow L. In this respect, the entire structure may be conveniently lifted from the inverted V tracks and stored when not in use. Also, the distance between the plates 13 and 14 may be adjusted to fit inverted V type tracks on other tables if desired.

In addition, it will be evident that the carriage structure together with the pneumatic nailing machine 19 may move transversely back and forth over the work surface 10 as indicated by the double headed arrow T. These movements are conveniently executed by an operator simply grasping the handle and properly positioning the nailer over a desired point on the work surface.

Referring now to FIG. 4, there is shown a second embodiment of the invention wherein a roller means includes a trigger valve 34 on a handle constituting part of a frame structure 35 supporting a pair of rear rollers or wheels 36 and 37 and a closer spaced pair of front rollers 38 and 39. The nailing machine may be identical to that shown in FIG. 1 except for the trigger handle structure which is spaced further from the machine and is mounted to the frame portion 35 rather than to the housing 20. The nailing machine is supported by the roller means such that the nose piece 23 is normally positioned above a work designated by the numeral 40 which may constitute planks on a roof or decking to be nailed.

In the embodiment of FIG. 4, it will be noted that the alignment of the nose piece when the same engages the work forms an acute angle W with the vertical. With this positioning of the nailing machine, a nail may be toe-nailed in the work. However, the support for the nailing machine by the frame may readily be adjusted as by adjusting the lengths of the frame bars 35*a* and 35*b* to position the nailer exactly vertically if desired.

FIGS. 5 and 6 show in partially schematic and partially block form the basic components of the nailing machine itself within the housing 20. The description of these figures applies to the machine as used with the roller means of FIG. 1 or with the roller means of FIG. 4.

Referring first to FIG. 5, a portion of the housing 20 is shown in phantom line at the lower end of the drawing. Within the housing, the machine includes a main cylinder 41 terminating at its lower end in the nose piece 23 and connected at its upper end to a piston rod 42 operable within a pilot cylinder 43 held stationary with respect to the roller means or housing. The pilot cylinder 43 has port 44 connecting to the pneumatic trigger valve 21 designated A in FIG. 5. The trigger valve A is arranged to exhaust air under pressure through the lower port 44 from the pilot cylinder 43 thereby permitting the pilot piston 45 at the end of the piston rod 42 to drop downwardly. Application of air pressure to the lower port 44 will simply act on the bottom of the pilot piston 45 to raise the piston rod 42. Essentially, the pilot cylinder 43 and associated piston and piston rod together with the trigger valve constitutes a lowering and rasing means for the main cylinder 41 and nose piece 23, the latter components constituting a major portion of the nailing machine.

The main cylinder 41 includes an upper port 46 connected to a pneumatic valve designated by the letter B. A stepped secondary cylinder 47 within the main cylinder 41 defines an annular chamber 48 the upper end of which together with the secondary cylinder is covered by a stepped poppet disc valve 49. Within the secondary cylinder are pistons 50 and 51. A driving rod 52 connects to the piston 51 and is received within the nose piece 23 as shown. A bottom cushioning member 53 may be provided in the bottom of the secondary cylinder 47 to check the downward stroke of the piston 51.

Referring specifically to the nose piece itself, the driving rod 52 extends into a nose piece passage 54 which laterally connects with a nail chute 55. The extreme lower end of the nose piece includes a retractable stem 56 which upon movement as a result of engagement of the nose piece with a work such as indicated at 40 permits air from the valve B to exhaust through a connecting line 57. This operation will become clearer as the description proceeds.

The valve B is also connected by a pneumatic line 58 to an escapement mechanism 59. This escapement mechanism is positioned to receive nails from a nail pan associated with a pan shaker and cylinder indicated

by the block 60. The nail pan itself may be as shown at 22 in FIGS. 1 and 4 and the cylinder for shaking the nail pan may be as indicated in FIG. 4 extending between a portion of the pan 22 and the frame 35.

An air pressure source means 61 connects through lines 62 and 63 directly to the trigger valve A, the valve B, and to the annular chamber 48 in the main cylinder. Also, this air pressure source means connects to the pan shaker and cylinder block 60 so that the pan can be shaken by this cylinder independently of the operation of control valves A and B. It will be understood, of course, that the escapement mechanism is positioned to successively receive nails from the nail pan and feed the same one at a time into the chute. In FIG. 5 a nail 64 is shown within the nose piece passage 54 preparatory to being driven into the work 40. Small spring clips 65 may be provided in the passage to support the nail in proper position to be struck by the driving rod 52 on the piston 51. A second nail 66 is shown by the arrow suspended from the escapement mechanism preparatory to being dropped into the chute upon actuation of the escapement mechanism 59 by the valve B.

In FIG. 5 it will be noted that the stepped poppet disc 49 includes a small air passage 67 placing the area above the piston 50 in communication with an exhaust port 68 in the main cylinder 41 when the poppet disc is in the position shown. Further, the area below the smaller piston 51 is in communication with the atmosphere at all times by way of the ports 69. The area between the pistons 50 and 51 is in communication with the annular chamber 48 by way of ports 70 and thus is always at the same air pressure as exists in the annular chamber.

FIG. 6 shows the relative positions of the components upon engagement of the nose piece with the work 40 at the point of completion of the driving of a nail such as the nail 64 into the work. It will be noted that the extreme end of the nose piece 23 terminates in a front portion 71 which engages the work to hold the same as the nail is driven thereinto. Further, it will be noted that when the poppet valve 49 is in its up position, the port 68 is closed off.

FIG. 7 shows in greater detail the end of the nose piece wherein it will be noted that a threaded sleeve 72 is received within the foot portion 71. By this arrangement, the sleeve may be threaded or unthreaded as at 73 to decrease and increase the effective length of the nose piece which in effect enables the extent of counter sinking of the nail by the driving rod 52 to be adjusted.

Alternatively, the rod 52 may be threaded into the end of the piston 51 as shown at 74 in FIGS. 5 and 6 and the degree of such threading will then determine the extent of any countersinking.

OPERATION

In operating the nailing machine, it will be clear from the description of FIGS. 1 and 4 that the machine itself may be easily and quickly positioned over the work into which a nail is to be driven. If the nail is to be toe nailed into the work, the adjustable feature as described in conjunction with FIG. 4 may be properly set to a given angle W such that the nail will enter the work at an angle and thus be toe nailed. It will be evident that such an adjustment may be utilized in the embodiment of FIG. 1 if desired.

In the event it is desired to countersink the nail, the threaded sleeve 72 may be threaded up on the thread 73 of the nose piece structure as shown in FIG. 7 to a sufficient extent that the lower end of the drive rod 52 for the nail will extend beyond the sleeve 72 so that a countersinking of the nail will take place. Alternatively, if it is desired to leave a part of the nail head protruding, the sleeve 72 is unthreaded to space further the foot 71 from the work, the driving rod 52 not being long enough to then extend from the bottom of the sleeve. As mentioned, an equilalent adjustment can be made by threading of the rod 52 in the piston 51.

After the foregoing adjustments have been made, the nailing machine nose piece 23 will be positioned over the work to be nailed. As already described in FIG. 1, the positioning is readily carried out by an operator with one hand simply grasping the handle for trigger 21 and moving the carriage structure transversely and longitudinally with the track arrangement set forth. In the case of FIG. 4, the particular roller support means would be utilized in effecting a series of nailings normally along a line.

With particular reference now to FIG. 5, the components are positioned when the nailing machine is not in operation. Initially, the air source pressure means 61 is turned on so that air is supplied to the first and second valves A and B, the pan shaker and cylinder 60, and the annular chamber 48 in the main cylinder. The cylinder for the pan shaker will then continuously operate to shake the nails and made sure that they can feed properly to the escapement mechanism 59.

After the machine has been properly positioned the operator will actuate valve A by the trigger 21 in the case of FIG. 1 or the trigger 34 in the case of FIG. 4. This action exhausts air from cylinder 43 and permits the main cylinder 41 to drop until the nose piece engages the work. Upon engagement of the nose piece with the work, the small stem 56 will be depressed up into the nose piece thereby opening the illustrated ports to exhaust air from a portion of the valve B. This pilot operation of the valve B serves to shift the valve and exhaust air from the upper port 46 of the main cylinder 41 resulting in the air under pressure in the annular chamber 48 raising the stepped poppet disc 49. The high air pressure in the annular chamber 48 then acts on the piston 50 driving it downwardly and thus driving the nail 64 into the work. Actuation of the valve B upon depression of the stem 56 also serves to actuate the escapement mechanism 59 to drop the nail 66. The component parts are now in the positions illustrated in FIG. 6.

With reference to FIG. 6, when the operator releases the trigger valve A, air under pressure from 61 passes into the port 44 of the pilot cylinder and raises the pilot piston 45 thereby raising the main cylinder and associated nose piece from the work.

Upon disengagement of the nose piece from the work 40, the stem 56 returns to its original position by the spring illustrated thereby blocking the small port in the nose piece and switching the position of the valve B back to its original position. In this original position, air from the pressure source passes into port 46 and seats the poppet disc 49 on top of the secondary cylinder 47. Air pressure builds up in the annular chamber 48 and through port 70 in the area between the pistons 50 and 51. Since piston 50 is larger, this air pressure will raise the pistons 50 and 51 and the driving rod 52. Air escapes from the top of 51 under the poppet disc valve to atmosphere through the passage 67 and port 68 per-

mitting the pistons to return upwardly to their normal positions.

Following the above action, the nail 66 falls into the nose piece passage to assume the position formally assumed by the nail 64. The cycle is thus completed and another nail will not be driven until the operator again actuates the trigger valve A.

From the foregoing description, it will thus be evident that the present invention has provided a greatly improved automatic nailing mechanism wherein the advantages of a portable machine are realizable without disadvantages formerly associated with the same. The entire mechanism can be operated with one hand and the worker is not burdened with carrying the machine. Very rapid and accurate positioning and nailing is thus possible, the particular embodiment of the roller means supporting the mechanism as described in FIGS. 1 and 4, respectively, being utilized depending upon the particular nailing job under consideration.

In both instances, the feature of dropping the major portion of the nailing machine such that the nose piece engages the work at the time the nail is driven is an important feature in that the weight of the major portion of the nailing machine and nose piece holds the work during the driving operation. Raising of the major portion of the mechanism in the form of a main cylinder and nose piece frees the work so that the nailing machine can be repositioned by means of the roller structure and without interference from the work itself.

What is claimed is:

1. In combination: a pneumatic nailing machine including a trigger valve for pneumatically actuating said machine and a nose piece from which a nail is driven; roller means supporting said machine above a work for movement along said work; and lowering and raising means secured to said roller means responsive to actuation of said trigger valve for lowering a major portion of said machine relative to said roller means to cause said nose piece to engage and hold said work while a nail is being driven into a selected point on said work, said lowering and raising means being responsive to release of said trigger valve to raise said major portion of said machine and thereby release said work after a nail has been driven thereunto, said major portion of said machine including a main cylinder terminating at its lower end in said nose piece; said lowering and raising means including a pilot cylinder in fixed position relative to said roller means; a lowering and raising piston in said pilot cylinder having a piston rod secured to said main cylinder, said trigger valve being pneumatically connected to said pilot cylinder and responsive to actuation and deactuation by the operator to lower and raise said pilot piston and thereby lower and raise said main cylinder; a nail driving piston means in said main cylinder having a driving rod extending into said nose piece; a pilot valve stem on said nose piece; a control valve responsive to engagement of said stem on said nose piece with said work pneumatically connected to said main cylinder to cause said piston means to move in a direction to drive a nail from said nose piece into said work, raising of said main cylinder upon deactuation of said trigger valve causing said stem on said nose piece to disengage said work, said control valve being responsive to the disengagement to return said piston means to its initial position preparatory to driving another nail; air pressure source means connected to said trigger valve and to said control valve; a nail pan for holding a reservoir of nails; pneumatic cylinder means for shaking said nail pan connected to said air pressure source means so that said pan may be shaken independently of operation of said trigger and control valves; a nail chute extending laterally from said nose piece; and an escapement mechanism positioned to receive one nail at a time from said nail pan and drop the nail into said nail chute, said escapement mechanism being connected for operation by said control valve when said valve is operated in response to engagement of said stem on said nose piece with said work, whereby successive nails are received in position for driving upon successive actuations of said trigger valve.

2. The subject matter of claim 1, in which said nose piece includes a threaded extension sleeve, threading and unthreading of the same decreasing and increasing the effective length of said nose piece whereby the extent of countersinking of a nail by said driving rod can be adjusted.

3. The subject matter of claim 1, in which said main cylinder includes a secondary cylinder of stepped configuration defining larger and smaller portions, the outer walls of said secondary cylinder further defining an annular chamber with the wall of said main cylinder, said piston means including first and second pistons in said secondary cylinder, said first piston being in the larger portion of said secondary cylinder and said second piston being in the smaller stepped portion; port means placing the area between said pistons in communication with said annular chamber; means connecting said source of air pressure with said annular chamber; a poppet disc valve covering the top of said secondary cylinder, the area in said main cylinder above said poppet disc valve communicating with said control valve; an exhaust port in said main cylinder, said poppet valve including air passage means for placing the area above said first piston in communication with said exhaust port when covering said secondary cylinder and blocking said exhaust port when moved to a position placing said annular chamber in communication with the area above said first piston, the area below said second piston being in communication with the atmosphere.

4. The subject matter of claim 1 in which said roller means includes first and second longitudinally extending guide tracks fixed adjacent to opposite sides of said work surface in parallel spaced relationship; first and second supports movable along said first and second longitudinally extending guide tracks in parallel spaced relationship having their opposite ends carried by said first and second supports; and a carriage frame mounted for transverse movement along said transversely extending guide tracks for holding said nailing machine such that said machine may be readily moved in longitudinal and transverse directions to any selected position above said work surface.

5. The subject matter of claim 4, in which each of said first and second longitudinally extending guide tracks comprises inverted V-shaped angle irons, each of said first and second supports including a vertical plate having a pair of rollers mounted in tandem adjacent to the lower end thereof and grooved to receive an associated V-shaped angle iron, each of said transversely extending guide tracks comprising rods, said carriage frame having journals on opposite sides receiving said rods, first ends of said transversely extending rods being rigidly secured to the upper portion of one of said vertical plates, the second ends passing through

bores in the other of said vertical plates whereby the distance between said plates is adjustable.

6. The subject matter of claim 1, in which said roller means includes a frame; and front and rear pairs of rollers rotatably mounted on said frame so that said frame may be rolled along a work, said frame including means for holding said lowering and raising means at an acute angle to the vertical so that said nose piece engages said work at said acute angle to thereby toe a nail driven into said work.

* * * * *