

Dec. 30, 1958

J. F. FREEMAN ET AL.

2,866,199

HAMMER

Filed Oct. 19, 1955

3 Sheets-Sheet 1

3 INVENTORS
JOHN F. FREEMAN
ALBERT M. ROCKWOOD
BY JAMES W. SMELKER

Dec. 30, 1958

J. F. FREEMAN ET AL

2,866,199

HAMMER

Filed Oct. 19, 1955

3 Sheets-Sheet 2

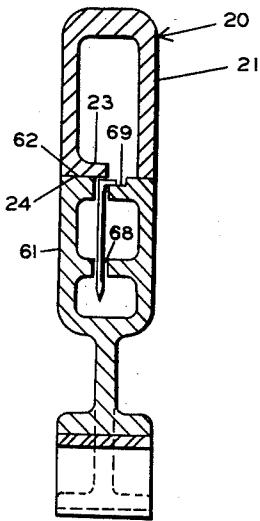


FIG. 3

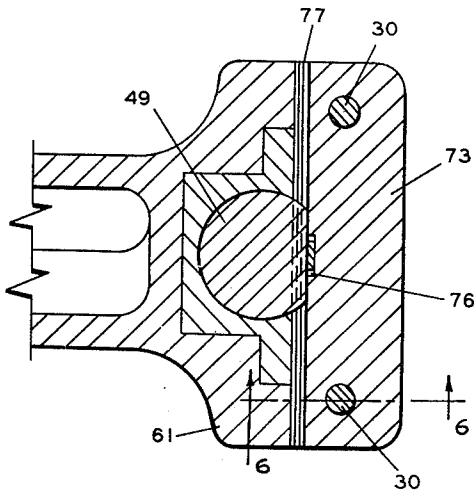


FIG. 4

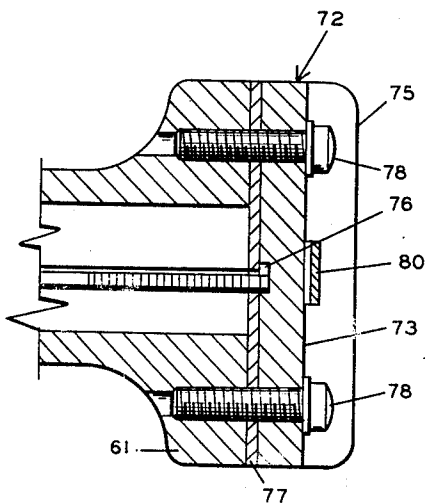


FIG. 5

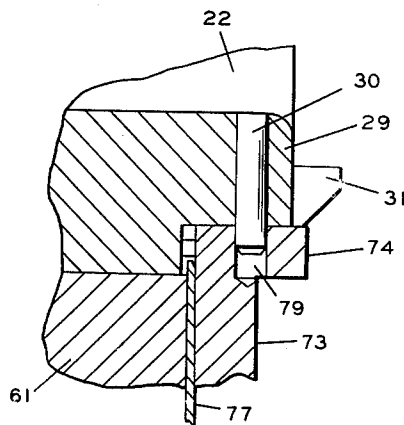


FIG. 6

INVENTORS.
JOHN F. FREEMAN
ALBERT M. ROCKWOOD
BY JAMES W. SMELKER

Jerome R. Cox

ATTORNEY

Dec. 30, 1958

J. F. FREEMAN ET AL

2,866,199

HAMMER

Filed Oct. 19, 1955

3 Sheets-Sheet 3

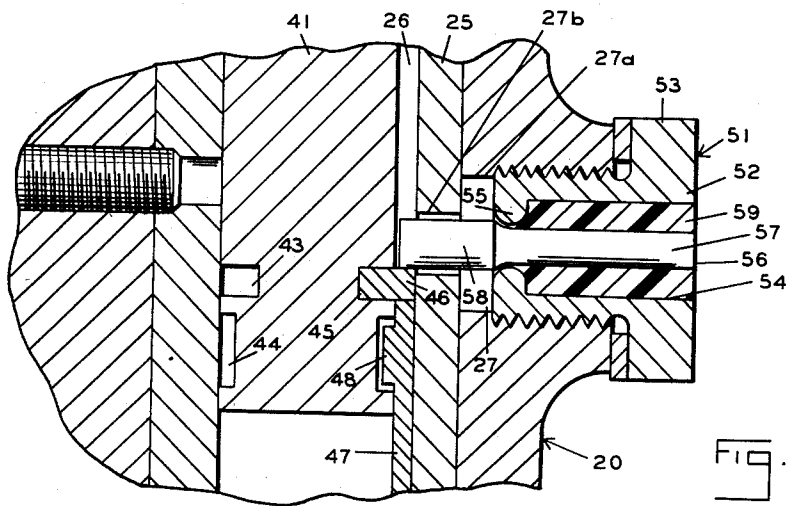


Fig. 7

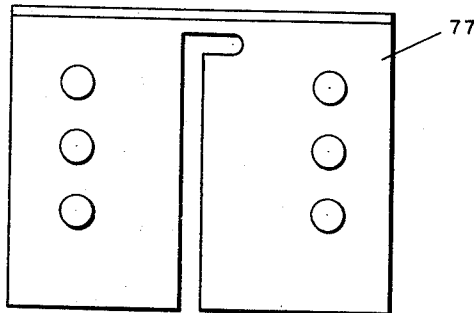


Fig. 8

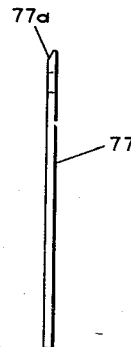


Fig. 5



Fig. 10

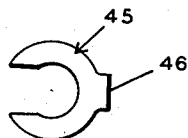


Fig. 11

INVENTORS
JOHN F. FREEMAN
ALBERT M. ROCKWOOD
BY JAMES W. SMELKER

Jerome R. Cox
ATTORNEY

1

2,866,199

HAMMER

John F. Freeman, Worthington, and James W. Smelker
and Albert Miller Rockwood, Columbus, Ohio, as-
signors, by mesne assignments, to Bond Nail, Incor-
porated, Columbus, Ohio, a corporation of Ohio

Application October 19, 1955, Serial No. 541,326

7 Claims. (Cl. 1—46)

The inventions disclosed in this application relate to nailing machines and are particularly useful in connection with semi-automatic nailing machines which are portable and which are operated by striking a reciprocating plunger with a hammer or mallet. It is illustrated by such a semi-automatic nailing machine.

Many such nailing machines have been heretofore designed. While saving much valuable skilled labor in that one man can by the use of such machines drive many more nails than he can by the old fashioned way of driving nails yet such nailing machines have either been heavy, cumbersome and hard to handle or are subject to frequent breakage thus causing frequent work stoppages.

It is an object of our invention to provide a semi-automatic nailing machine which is both light in weight and rugged in construction, thus having ease of operation and substantial absence of failure.

A further object of our invention is to provide such a semi-automatic nailing machine which is easy to load and reload.

The semi-automatic nailing machines in which our inventions are especially useful are as stated operated by striking a reciprocating plunger with a hammer or mallet. In actual practice in the use of such portable semi-automatic nailing machines, the blows from the hammer or mallet are often not perfectly aligned with the plunger. That is, the blows usually glance off the plunger at varying angles of deflection. This causes the plunger to tend to rotate about its longitudinal axis. If the plunger is not allowed to rotate, the force tending to rotate it will cause the plunger to wear unevenly and may often cause something to break.

It is therefore a further object of our invention to provide a driving means which uses a cylindrical plunger to actuate a floating nail driving blade whereby the plunger is at all times free to rotate, resulting in uniform wear of the plunger shaft and a minimum of breakage.

Also, in the type of nailing machine to which our invention especially relates, the plunger reciprocates downward and upward, the downward force being supplied by the hammer striking the plunger and the return or upward moving force being supplied by a spring which tends to drive the plunger upward out of the housing. It is therefore necessary to stop the upward movement of the plunger when the plunger reaches its outermost predetermined position, an operation which produces impact forces having magnitudes sufficient to shear a stopping or retaining pin.

It is a further object of our invention to provide novel means for stopping the plunger when it reaches its predetermined outermost position.

More specifically, it is a further object of our invention to provide means for resiliently stopping the plunger when it reaches its predetermined outermost position so that the impact forces are reduced to within non-shearing limits.

As stated above, many such nailing machines have been heretofore designed. In general, these machines are constructed with a work surface engaging face which is designed to make face to face contact with the board or

2

surface to be nailed when the machine is in proper nailing position. The work surface engaging face of a given nailing machine is arranged so that it cooperates with the rest of the structure to fix the angle at which nails will be driven into the work surface. Since the work surface engaging face is not usually adjustable, a given nailing machine can usually properly drive nails at only one angle, and is not a satisfactory instrument for driving nails at other angles. Although a nailing machine adapted to properly drive nails at one angle may be used to drive nails at other angles by tilting the machine so that the work surface engaging face makes an angle with the work surface, the results are not likely to be satisfactory.

Therefore, where a workman has occasion to drive nails both perpendicular to the work surface, which is generally the case when he is putting down sub-flooring, and at an angle of approximately 45° with the work surface, which is generally the case when he is putting down finished flooring, he is required to use two different nailing machines. Moreover, the nails used for the sub-flooring are usually thicker and have a larger head than the nails used for securing the finished flooring. This requires the workman to carry an additional nailing machine from job to job, which adds weight and takes up valuable space in his tool chest and presents, in addition, an unnecessary economic burden.

It is therefore an object of our invention to provide a portable nailing machine which is adaptable to driving nails at more than one angle with the work surface.

It is a further object of our invention to provide a nailing machine in which the nail driving means is carried in a housing and nails are carried in a nail carrying means including a nail magazine, disengageably secured to the housing from which the nails are fed into cooperating position with the nail driving means so that the nails can be driven from the machine.

It is a further object of our invention to provide an arrangement in which the nail carrying means, including the nail magazine, has a work surface engaging face, whereby the nail carrying means cooperates with the housing to determine the angle at which the nails will be driven into the work surface when the work surface engaging face is in face to face contact with the work surface.

It is a further object of our invention to provide an arrangement whereby the nail carrying means, including the magazine, may be removed easily and quickly from the housing.

It is a further object of our invention to provide a nailing machine having interchangeable nail carrying means each cooperating with the housing to drive nails at a different angle and if desired to supply different types of nails so that nail carrying means cooperating to drive one type of nail at one angle with the work surface may be replaced easily and quickly by nail carrying means cooperating to drive the same or a different type of nails at a different angle with the work surface.

Further objects and features of our invention will be understood from the following specification and claims when considered in connection with the accompanying drawings illustrating an embodiment of our invention.

In the drawings illustrating an embodiment of our invention:

Fig. 1 is a side elevational view, partly in section, of one embodiment of our invention;

Fig. 2 is a rear elevational view of said embodiment of our invention with the nail stop plate removed and with the means for positively urging nails through the nail carrying means removed, and also with the upper and lower parts of the machine broken away;

Fig. 3 is a sectional view taken along line 3—3 of

3

Fig. 1 with the means for positively urging nails through the nail carrying means removed;

Fig. 4 is a sectional view taken along line 4—4 of Fig. 1;

Fig. 5 is a sectional view taken along line 5—5 of Fig. 1;

Fig. 6 is a sectional view taken along line 6—6 of Fig. 4;

Fig. 7 is an enlarged view of the plunger retaining means shown in the embodiment of Fig. 1;

Fig. 8 is a front elevational view of the stripper plate;

Fig. 9 is a side elevational view of the stripper plate of Fig. 8;

Fig. 10 is a side elevational view of the blade; and

Fig. 11 is a plan view of the drive washer.

Referring now to Fig. 1, it is seen that the embodiment of our invention illustrated comprises generally a housing 20, a nail driving means 40 received in the housing 20, and a nail carrying means 60 disengageably secured to housing 20, a nail aligning means 72 secured to nail carrying means 60, and a nail feeding means 90 pivotally secured within housing 20 for feeding nails one at a time into cooperating position with the nail driving means 40 so that said driving means 40 may drive the nails and thus eject them from said nail aligning means 72.

Still referring to Fig. 1, it is seen that the housing 20 comprises a hollow generally horizontal U-shaped body 21 (also shown in Fig. 3) closed at both ends, and a generally vertical head 22 extending upwardly from one end of the body 21. As particularly seen in Fig. 3, the body 21 has an inwardly projecting longitudinal and horizontal ear or flange 23, partially closing its open lower side. The ear or flange 23 has a machined face 24, which face is perpendicular to the longitudinal axis of the head 22. The housing 20, preferably cast from aluminum alloy, is cast integral with a bored pre-cast steel sleeve 25, in which the nail driving means 40 reciprocally operates. The longitudinal axis of the sleeve 25 coincides with the longitudinal axis of the head 22 so that the bore of said sleeve is thus perpendicular to the machined face 24. Axially disposed along the periphery of the bore of the sleeve 25 is a rectangular keyway 26 which is positioned so that it extends outward from the bore toward the front of the housing 20. This keyway 26 is provided as a guideway for the driving blade and for an ear on the drive washer (all of which will be described fully later herein) and as a shoe whereby said blade and washer may be initially assembled and whereby the parts may be afterwards disassembled should need arise. The keyway 26 is in communication with the front face of the head 22 by means of a radial passage 27 spaced downward from the top of said head and having its central axis perpendicular to the root face of said keyway. The passage 27 (Fig. 7) extends through the head 22 and through the sleeve 25 and is countersunk in the sense that the bore 27a or portion of the passage within the head 22 has a larger diameter than the diameter of portion 27b of the bore 27, through the wall of the sleeve 25. The portion 27a extends from the outer face of the front side of the head 22 to the outer face of the sleeve wall and is provided with threads so that the passage 27 may threadably receive retaining means 51 associated with the driving means 40 which will be described in full at a later point.

Extending rearwardly from the body 21 is a generally vertical longitudinally extending ear 28 having a hole passing laterally through it, said ear constituting part of means for aligning the rear end of the nail carrying means 60 with the rear end of the nail driving means 40 pivotally connecting the nail carrying means 60 to the housing 20. Also the base 21 is enlarged at the front at the lower part of the head 22 laterally outward from each side of its base as at 29 (see Fig. 2). The enlargements on each side have a vertical hole into each of which

4

is pressed a dowel pin, such as pin 30, to provide an appropriate standout which constitutes means cooperating with the nail carrying means 60 to align the front end of said nail carrying means 60 with the front end of the nail driving means 40. The base of the head 22 also has a frontwardly extending projection 31 (see Fig. 1) for cooperating with the nail carrying means 60 to disengagingly hold said nail carrying means in a closed position relative to the housing 20. The top of the body 21 and back side of the head 22 are provided with threaded holes so that a handle 32 may be attached thereto by screws such as 33.

Still referring to Fig. 1, it is seen that the nail carrying means 60 comprises a magazine 61 having a machined horizontal face 62 which engages the face 24 of housing 20 in face to face contact, and is preferably cast from aluminum alloy. Extending vertically from the machined face 62 of magazine 61 and adjacent to one end thereof are two longitudinally extending, laterally disposed ears 64 and 65 (seen best in Fig. 2) each having a hole passing laterally through it, so that when ear 28 is positioned between ears 64 and 65, the lateral holes passing respectively through each ear will align with one another and cooperate in receiving a hinge pin 66 to provide the pivotal means connecting the housing 20 to the nail carrying means 60. The pin 66 is of conventional type and is removably maintained in position by snap rings such as 67. If necessary, shims may be disposed between the contact surfaces of the ears to eliminate galling of the two contacting aluminum surfaces and to eliminate any excessive side play of ears 64 and 65 relative to ear 28. This structure completes the means for aligning the rear end of the nail carrying means with rear end of the nail housing referred to above.

Passing longitudinally through the magazine there is a generally inverted L-shaped nail guiding passage 68 (best seen in Figs. 2 and 3) having one leg vertical and the other leg horizontal and arranged to form an exposed longitudinal horizontal lip 69, spaced from but adjacent to the machined face 62, upon which nails may be slidably moved through the nail guiding passage 68 and therefore longitudinally through the magazine 61. As is seen in Fig. 3, the ear 23 of body 21 provides a partial roof for the nail guiding passage 68 whereby the nails in said passage would be prevented from falling out the top if the nailing machine were upset. Closing the entrance of the nail guiding passage 68, at the pivoted rear end of the magazine 61, is a nail stop plate 70 (see Fig. 1) removably secured to the back face of the magazine 61 by means of a single bolt, such as 71. Secured to the vertical lateral front face of magazine 61 farthest from the pivoted end is a nail aligning means comprising an assembly 72, which receives nails from the nail guiding passage 68 and aligns them, one at a time, in cooperating position with the nail driving means 40 so that one nail will be ejected from the carrying means 60 for each operation of the nail driving means 40.

Referring generally to Fig. 1, and also particularly to Figs. 4, 5, 6, 8 and 9, it is seen that aligning means 72 comprises a generally channel shaped front plate 73, preferably made of steel, having forwardly extending generally horizontal ribs 74 and 75. The front plate 73 has a centrally located rectangular vertically extending driving throat 76 along the face opposite to that from which ribs 74 and 75 extend. Disposed between the plate 73 and the magazine 61 and making face to face contact therewith is a stripper plate 77, preferably made from steel, having an inverted L-shaped passage therein aligned with the inverted L-shaped nail guiding passage 68 and connecting said passage with the driving throat 76. The front plate 73 and stripper plate 77 are secured to the magazine 61 in their properly aligned positions by means of suitable fasteners such as bolts 78. The face of the plate 77 in contact with the plate 73 has its upper lateral edge chamfered as at 77a for reasons which will be described

later. The plate 73 has two vertical holes such as 79 which are positioned to receive the pins 30 and cooperate with said pins to properly align the front end of the nail carrying means 60 with the housing 20. Attached to the front of the plate 73 is a latch spring 80 which cooperates with the projection 31 of the housing 20 to disengagingly lock the nail feeding means 60 to the housing 20.

The nail driving means 40 will now be described. Referring generally to Fig. 1, it is seen that the nail driving means 40 comprises a cylindrical plunger 41, preferably made of steel, slidably and rotatably received in the bore of the sleeve 25. The plunger 41 has an enlarged head 42 formed at its upper end and has, adjacent to its lower end, two annular grooves 43 and 44, spaced axially from each other. Received in groove 43 is a horseshoe shaped drive washer 45, preferably made from steel, having an ear 46 (best shown in Fig. 11) and arranged so that the plunger 41 is free to rotate within the central opening of drive washer 45 while the ear 46 slidably moves in the keyway 26. Also slidably received in the keyway 26 and in cooperating position with the ear 46 of the drive washer 45 is a floating blade 47. The blade 47 has a projection 48 which is received by groove 44 so that the blade is floatingly carried by the plunger 41. That is, the blade 47 is free to move relative to the plunger 41 for small distances longitudinally while plunger 41 remains free to rotate within the bore of sleeve 25. When the plunger 41 is stationary or is moving upward, the blade 47 is carried by the lower lip of the annular groove 44. When the plunger is moved downward, such as by a blow from a hammer, the blade 47 floats upward relative to the plunger 41 until its upper end comes in contact with the ear 46 of the drive washer 45 at which point the downward force of the plunger 41 is transmitted through the drive washer 45 to the blade 47 thereby driving the blade 47 downward. This type of construction including the drive washer 45 allows the use of high strength material to withstand impact and at the same time allows the use of a less expensive plunger. The washer 45 thus allows the use of a solid plunger which is necessary to keep the plunger from breaking. This type of construction prevents uneven wear on the plunger wall, due to glancing blows of the hammer striking the head, normally associated with nailing machines having a square or rectangular plunger. A glancing blow tends to rotate the plunger, which would cause uneven wear on the wall of the plunger if the plunger were prevented from rotating. The arrangement just described overcomes this difficulty since the plunger is at all times free to rotate. The lower end of the blade 47 is slidably guided by the keyway 76 of the plate 73, which is in alignment with keyway 26, and is thus guided into cooperating position with the head of the nail to be driven, where it engages said nail, driving it from the nail feeding means 60. The upper portion of the blade 47 is always maintained in sliding contact in the keyway 26 by the plunger 41. When the plunger is in its uppermost position the lower end of the blade is slidably received in driving throat 76, and is maintained in sliding contact therewith by means of a retainer plug 49 which is pressed into the bore of the sleeve 25 and has its bottom face complementing housing 20 in completing the machined face 24. So that only one nail will be driven at a time, the thickness of the blade 47 must be slightly smaller than the thickness of the thinnest nail to be driven; and the keyway 76 must be of a thickness slightly greater than the thickest nail to be driven and slightly smaller than twice the depth of the thinnest nail to be driven. The driving means 40 has a compression spring 50. The design of this spring is important. An external spring can thus be used having a low spring rate and giving a uniform distribution of return force which keeps the plunger from binding. The spring 50 surrounds the shaft of the plunger 41. It has one of its ends in contact engagement with the head 42 of the plunger 41 and has its other end in contact engagement with the top of sleeve 25. The

spring 50 operates at all times to urge the plunger upward in sleeve 25, thereby providing the means for returning the plunger 41 to its uppermost position after a nail has been driven.

To prevent the spring 50 from driving the plunger 41 clear out of the sleeve 25, we provide a retaining means 51 which operates to stop the upward movement of the plunger 41 at a predetermined point. As shown in detail in Fig. 7, the retaining means 51 includes an externally threaded plug 52 having an enlarged head 53 formed at one end. Passing longitudinally through the plug 52 is a substantially cylindrical passage 54. However, formed at the inner end of passage 54 is a rounded inwardly projecting annular rib 55. Within the cylindrical passage 54 and extending partially within the rib 55 is a hollow cylinder 59 of resilient bonding material such as rubber. The hollow of the cylinder 59 together with the rib 55 defines a cylindrical space in which we position one end of a pin 56. The pin 56 has a relatively small end 57 in the cylindrical space of the cylinder 59 and a relatively large end 58 positioned in the bore 27b of the sleeve 25. The two ends 57 and 58 of the pin 56 meet in a filleted portion, the surface of which conforms to a degree with the inner surface of the rib 55. The portion 57 has a diameter slightly less than the diameter of the circular opening formed by the rib 55, and the portion 58 adjacent to the other end has a diameter several thousandths of an inch less than the smaller diameter of the bore 27b, said portions 57 and 58 meeting each other in said filleted surface. The portion 57 extends into the passage 54 of plug 52 through the opening described by the annular rib 55 so that the annular rib 55 is adjacent to the filleted surface connecting portions 57 and 58. The pin 56 is resiliently bonded to the housing by means of the resilient hollow cylinder 59. The plug 52 is screwed into the bore 27a of housing 20 so that that portion 58 of pin 56 extends through the bore 27b of sleeve 25. The pin 56 thus has its free end adjacent to the plunger 41. The top of ear 46 of driving washer 45 is in contact with the portion 58 of pin 56 when the plunger 41 is in the uppermost position. Thus it is seen that the pin 56 restricts the upward movement of the plunger 41 so the plunger may not move upward beyond a predetermined point. After a nail has been driven the spring 50 cooperates with the sleeve 25 to drive the plunger 41 upward. When the ear 46 of drive washer 45 reaches the pin 56, the upward movement of plunger 41 is suddenly stopped, resulting in impact forces being transmitted to the pin 56. If the pin 56 were rigidly secured, the plunger 41 would theoretically be stopped in zero distance resulting in impact forces of magnitude sufficient to shear the pin 56 and to shear the ear 46 from the drive member 45. To overcome this shearing effect we have resiliently mounted the pin 56 so that it may move several thousandths of an inch in bringing the plunger 41 to a stop. This reduces the magnitude of the impact forces to a point where they are no longer sufficient to shear the pin 56.

I also provide in my nailing machine, nail feeding means generally designated as 90 for continually and positively urging the nails longitudinally forward through the nail guiding passage 68 of the nail carrying means 60 into cooperating position with the nail driving means 40. The nail feeding means 90 for urging the nails forward is carried in part within the body 21 of housing 20 and in part within the nail guiding passage 68 of the nail carrying means 60, and comprises a floating U-shaped bracket 91 pivotally connected at its open end to housing 20 by means of a pin 92. The U-shaped bracket 91 rotatably carries a spring roller 93 adjacent to its closed end. The roller 93 is mounted on an axle 97 extending through the legs of the bracket 91 and into the side of the base 21 of the housing 20. If desired, the axle 97 may be shortened so that it extends through the legs of the bracket 91 and not into the base 21. Other means of securing the axle end of bracket 91 to the base 21 or of restrain-

ing its movement in one direction may be provided if desired, or the axle end of 91 may be left absolutely free in the base 21. Passing over the roller 93 is a nail follower spring 94 having one end attached to the pin 92 and having the other end attached to a channel shaped nail follower 95 as at 96. The nail follower is slidably positioned in the nail guiding passage 68 of the nail carrying means 60 and is in contact engagement with the rear-most or last nail in the passage 68. The nail feeding means 90 for urging the nails forward is arranged so that when the housing 20 is closed, the spring 94 exerts a continual positive force keeping the follower 95 in contact engagement with the said last nail so that it positively urges the nails into cooperating position with the nail driving means 40.

As is evident from the foregoing description, we provide an arrangement whereby the nail carrying means 60 may be removed easily and quickly from the housing 20 by releasing the latch spring 80 and removing one or both of the snap rings 67 and the pin 66. This allows one nail carrying means to be substituted for another nail carrying means with little effort inasmuch as we make the nail carrying means interchangeable. With this in mind, we have provided an arrangement whereby the nail carrying means will cooperate with the housing 20 to determine the angle at which the nails will be driven into the work surface so that one nail carrying means, such as 60 (shown in Fig. 1), which cooperates with the housing 20 to drive the nails at an angle of approximately 45° with the work surface, may be quickly and easily replaced by another nail carrying means such as 160. Such other nail carrying means 160 is shown in Fig. 12 and carries, if desired, the same type of nails or, if desired, a different type of nails. The nail carrying means 160 cooperates with the housing 20 to drive nails at another angle, such as 90° with the work surface. The angle at which the nail carrying means cooperates to drive the nails is determined entirely by the particular nail carrying means used and of course may be any predetermined angle from 0° to 90° with the work surface depending upon the construction of the particular nail carrying means, which construction in this respect will now be described.

Referring now again to Fig. 1, it is seen that the nail carrying means 60 is cast integrally with a support portion 81 projecting from its lower side in a position adjacent to the end at which the nails are ejected. The support 81 has a work surface engaging face 82, which is preferably covered with a floor mat 83 to prevent scratching the work surface. As seen in Fig. 1, the work surface engaging face 82 makes an angle of approximately 45° with the plane of action of blade 47. Thus when the face 82, or the floor mat 83, if such is used, is in face to face engagement with the work surface, the nails are ejected from the nailing machine and driven into the work surface at an angle of approximately 45° therewith. In the particular embodiment shown, the leg 75 of plate 73 has an angular laterally extending groove 84 cut in its bottom face having one face parallel to and one face perpendicular to the work engaging face 82 of support 81. The groove 84 cooperates with the beading 200 of the board being nailed to keep the nailing machine in the proper position relative to the work surface.

The operation of our nailing machine has already been described relative to the various independent operations of the subassemblies. The general operation will now be described with particular reference to Fig. 1.

To load the nails into the machine, the latch spring 80 is disengaged from the projection 31 and the nail carrying means 60 is swung in an arc away from the housing 20, exposing the nail guiding passage 68 and carrying the stack of nails 300. The nail follower 95 is thereby slidably moved automatically to the end of the nail guiding passage 68 covered by the nail stop plate 70. While the follower 95 is so held, a stack of nails 300 is dropped into the nail guiding passage 68 so that the

heads of the nails are in contact engagement with the lip 69 whereby the nails are slidably carried by the lip 69 as best shown in Fig. 3. The nail carrying means 60 is then swung in an arc toward the housing 20 until the latch spring 78 reengages the projection 31 locking the nail carrying means 60 to the housing 20. The follower 95 is thus moved to the position shown in Fig. 1 causing the spring 94 to pull the follower 95 into driving engagement with the last nail of stack 300. Before the latch spring 80 reengages the projection 31, the pins 30 engage the holes 79 properly aligning the nail carrying means 60 with the housing 20. After the latch spring 80 has reengaged the projection 31, the machine is ready for use. To drive a nail, the face 82 of the support 86 or the floor mat 83, if such is used, is placed in face to face contact with the work surface, in the desired position upon said surface, relative thereto, and the head 42 of plunger 41 is struck a solid blow with a hammer or mallet. This causes the plunger 41 to move downward against the force of spring 50, carrying the drive washer 45 with it. The drive washer 45 in turn, by means of ear 46, engages the blade 47, driving said blade downward into driving engagement with the first nail of stack 300. Said first nail (as may be clearly understood) has before this time, by action of the forward urging means 90, been positioned in the driving throat 76, in cooperating position with regard to the blade 47. The blade 47 thereby drives the nail out of the machine into the work surface. Since the blade 47 is no thicker than the thinnest nail, it engages only the first nail of stack 300, said nail being stripped from the adjacent nail of stack 300 by the stripper plate 77.

The plunger 41 is immediately thereafter returned upwardly by means of the spring 50 until the ear 46 of drive washer 45 strikes portion 58 of retainer pin 56. The force with which the drive washer 45 strikes the retainer pin 56 causes the portion 58 of said pin to move slightly upward and portion 57 to move slightly downward into the resilient material 59, said pin pivoting upon the filleted surface connecting the portions 57 and 58, of pin 56 whereby the plunger 41 is resiliently brought to a stop and placed in a position to drive another nail. Portion 57 moving into the resilient material 59 imparts thereto a great amount of the energy to be absorbed thus reducing the impact force to a value below that which would shear the pin 56 and/or the ear 46 of the washer 45. After the blade 47 clears the now first nail of stack 300, during the upward movement of plunger 41, the now first nail of stack 300 is fed into the driving throat 76 into cooperating position with the blade 47 by the nail feeding means 90, and the machine is ready to drive another nail.

Where the nail carrying means 60 of my nailing machine is used, in laying horizontal flooring, the means 90 for urging the nails longitudinally through the nail carrying means 60 may be omitted since the longitudinal axis of the nail guiding passage 68 makes a sufficient angle with a horizontal work surface (approximately 45°) to allow gravity to feed nails properly into cooperating position with the nail driving means 40.

Where this particular arrangement is used, nails may be loaded into the machine as previously described, omitting that part of the procedure relating to the nail follower. Here the machine may also be loaded by rotating the nail stop plate 71 covering the end of nail guiding passage 68, thereby exposing said nail guiding passage, dropping the stack of nails 300 therein and rotating the nail stop plate back so it again covers the end of the nail guiding passage.

It is to be understood that the above described embodiments of our invention are for the purpose of illustration only and various changes may be made therein without departing from the spirit and scope of our invention.

We claim:

1. In a nailing machine having a housing, a nail driv-

ing means comprising; a sleeve within the housing having a bore and formed with a longitudinally extending keyway along the periphery of the bore of said sleeve, a cylindrical plunger received in the bore of said sleeve, so as to slidably reciprocate and rotate coaxially therewith, said plunger having an enlarged portion adjacent to one end and formed with two adjacent annular grooves near to but spaced from the other end; a flat blade received in the keyway of said sleeve so as to slidably reciprocate longitudinally within said keyway and having a projection near to but spaced from one end thereof, said projection being received in the groove of said plunger nearest the end of said plunger opposite to the end having the enlarged portion so that said blade is carried by said plunger which remains free to rotate within said bore, said projection having a depth less than the depth of said groove and having a width in the axial direction of said plunger substantially less than the corresponding dimension of said groove so that said blade is free to float for small distances longitudinally relative to said plunger; a drive washer having a rectangular ear and being received in the other groove of said plunger so that it is carried thereby, said plunger remaining free to rotate coaxially within the bore of said sleeve, said ear being reciprocally and slidably received in the keyway of said sleeve and engaging said blade during the driving stroke; a compression spring surrounding the shaft of said plunger and bearing on said sleeve so as to urge said plunger out of the bore of said sleeve; and stop means including a stepped cylindrical pin being formed with body portions adjacent each end thereof of substantially different diameters connected by an intermediate filleted annular surface, and a hollow cylinder of resilient material surrounding one end of the pin and secured within the housing, said pin being pivotally carried on its filleted surface by the housing so that the portion of said pin having the larger diameter is movably received within the keyway of said sleeve and is engaged by the ear of said washer during the driving stroke and so that the portion of said pin having the smaller diameter is resiliently attached within said housing; whereby said plunger is free to rotate relative to said sleeve, said blade and said drive washer as said plunger reciprocates and whereby said plunger is resiliently restrained from moving out of the bore of said sleeve by said pin engaging the ear of said drive washer.

2. In a nailing machine, nail driving means including; a housing having a bore and formed with a longitudinally extending keyway along the periphery of said bore; a cylindrical plunger received in said bore so as to be coaxially and slidably reciprocable and rotatable therein, said plunger having an annular groove adjacent to one end; and a blade slidably received in the keyway of said housing being longitudinally reciprocable therein and having a projection adjacent to one end thereof, said projection being received in the groove of said plunger, having a depth less than the depth of the groove of said plunger and having a width in the axial direction of said plunger substantially less than the corresponding dimension of the groove of said plunger; whereby said blade is carried by said plunger so that said blade is free to float for small distances longitudinally relative to said plunger and said plunger is free to rotate within said bore.

3. In a nailing machine, nail driving means including; a housing having a bore and formed with a longitudinally extending keyway along the periphery of the bore of said housing; a cylindrical plunger received in said bore so as to be reciprocally and coaxially rotatable and slidable therein, and formed with two adjacent annular grooves near to but spaced from one end; a blade slidably received in the keyway of said housing so as to be longitudinally reciprocable therein, having a projection near to but spaced from one end thereof, said projection being received in one groove of said plunger, having a depth less than the depth of said groove and having a width

in the axial direction of said plunger substantially less than the corresponding dimension of said groove so that said blade is free to float for small distances longitudinally relative to said plunger; and a drive washer having a rectangular ear and being received in the other groove of said plunger so that it is carried thereby, said ear being slidably received in the keyway of said housing, so as to be longitudinally reciprocable therein, and engaging said blade in driving contact during the driving stroke, whereby said plunger is free to rotate relative to said blade and said drive washer as said plunger reciprocates.

4. In a nailing machine having a housing, nail driving means comprising; a sleeve in said housing; a plunger received in said sleeve so as to be reciprocally slidable therein for driving nails from the nailing machine; a spring bearing on said plunger so as to urge said plunger from said sleeve of said housing; and a stepped pin resiliently secured within said housing and formed with body portions adjacent each end thereof of substantially different cross section and with an intermediate filleted surface, said pin being pivotally carried on its filleted surface by the housing so that the portion of said pin having the larger dimension is movably received in said housing, whereby said pin cooperates with said plunger to resiliently restrain said plunger from moving out of said housing.

5. In a nailing machine having a housing, nail driving means comprising a cylindrical plunger received in said housing so as to be reciprocally slidable in a longitudinal direction and reciprocally and slidably rotatable about its longitudinal axis; a blade received in said housing and rotatably and floatingly carried by said plunger; and a drive washer reciprocally and slidably received in said housing so as to be free to reciprocally slide longitudinally in a channel thereof, said washer being carried by said plunger and engaging the blade during the driving stroke, so that said plunger is free to rotate relative to the housing, blade and drive washer as it reciprocates; a spring in compressional engagement with said plunger to urge said plunger from said housing; and resilient retaining means for retaining said plunger in said housing against the urging force of said spring.

6. In a nailing machine having a housing, nail driving means comprising; a plunger reciprocally received in said housing; a blade reciprocally received in said housing and floatingly carried by said plunger; a spring in compressional engagement with said plunger to urge said plunger from said housing; and resilient retaining means for retaining said plunger in said housing against the urging of said spring.

7. In a nailing machine having a housing, nail driving means comprising a cylindrical plunger received in said housing so as to be slidably and rotatably reciprocable along and about the longitudinal axis of said plunger; a blade slidably received in said housing so as to be longitudinally reciprocable therein, said blade being floatingly carried by said plunger; and a drive washer slidably received in said housing so as to be reciprocable longitudinally within a channel of said housing, said washer being carried by said plunger and engaging the blade during the driving stroke, so that the plunger is free to rotate relative to the housing, blade and drive washer as it reciprocates.

References Cited in the file of this patent

UNITED STATES PATENTS

1,186,458	Von Vass	June 6, 1916
2,412,620	Kipp	Dec. 17, 1946
2,427,358	Kovach	Sept. 16, 1947
2,430,321	Anstett	Nov. 4, 1947
2,430,322	Anstett	Nov. 4, 1947
2,525,637	Bell	Oct. 10, 1950
2,714,208	Jenny	Aug. 2, 1955