March 15, 1960 A. J. SOWER 2,928,095

NAIL-DRIVING MACHINE

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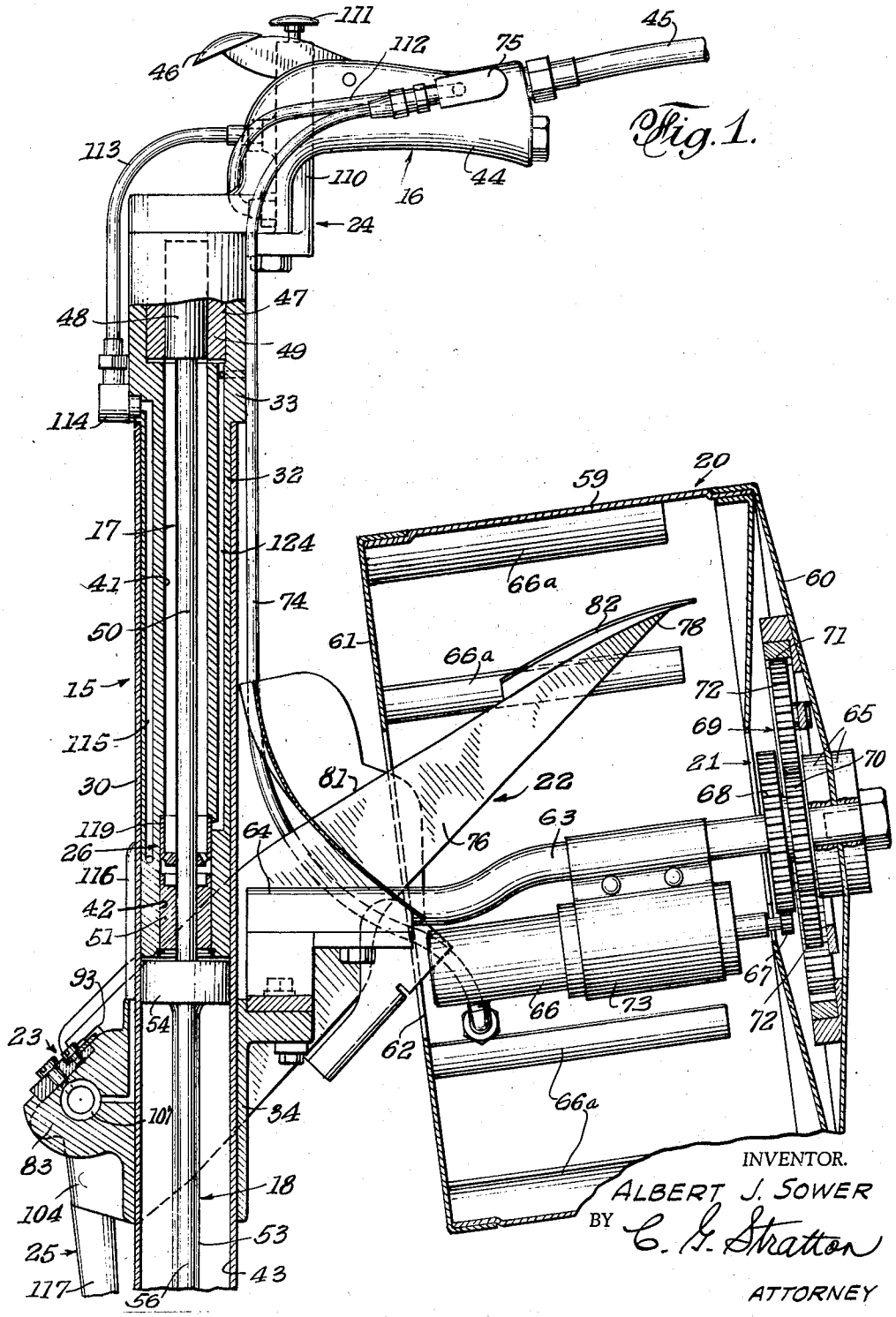


Fig. 1.

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Fig. 2.

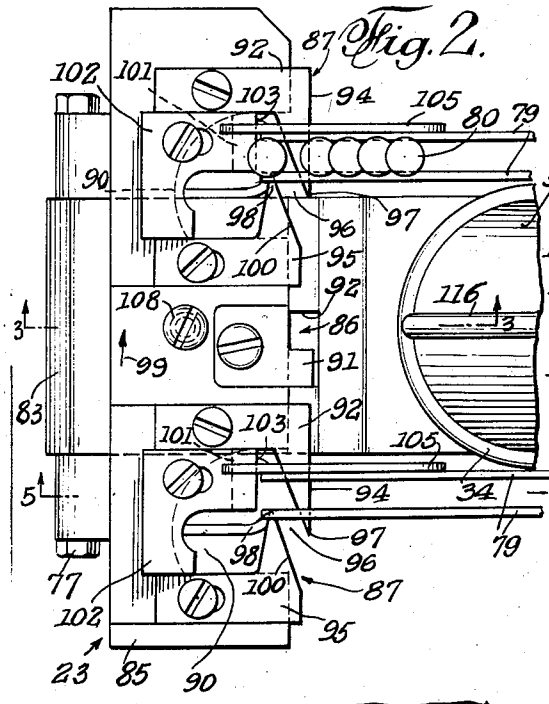


Fig. 4.

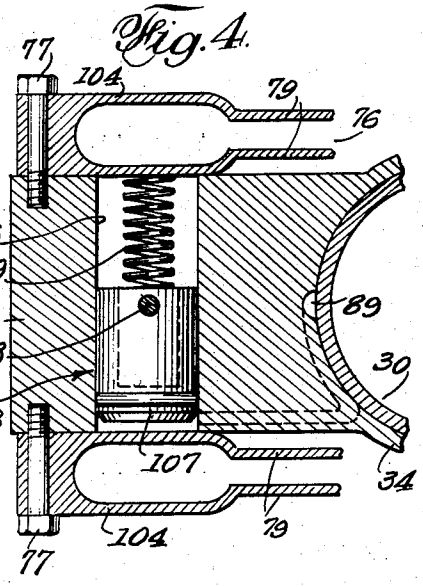


Fig. 3.

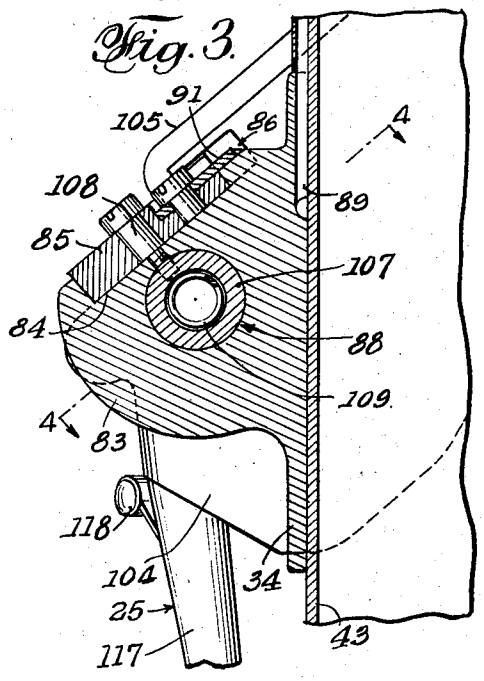
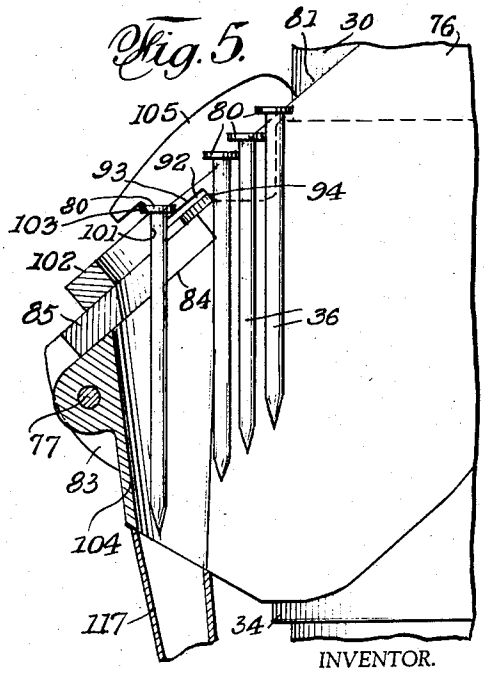


Fig. 5.



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Fig. 6.

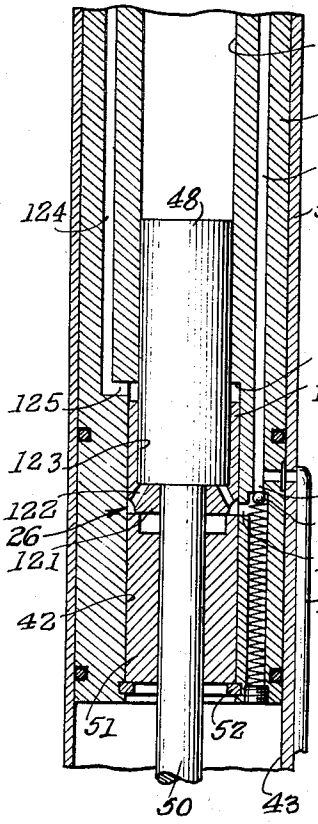


Fig. 7.

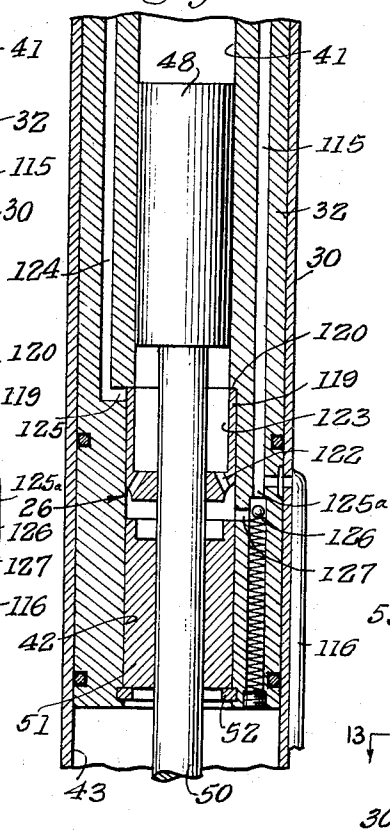


Fig. 12.

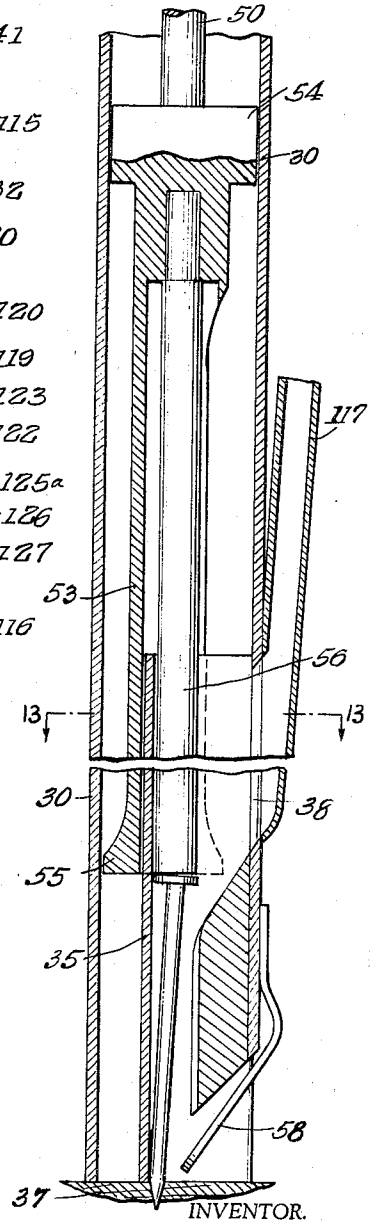
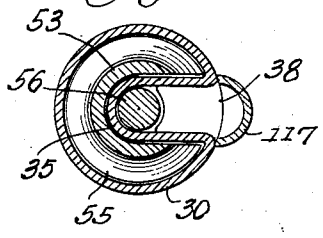


Fig. 13.



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Fig. 10.

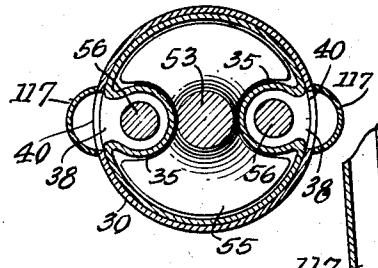


Fig. 8.

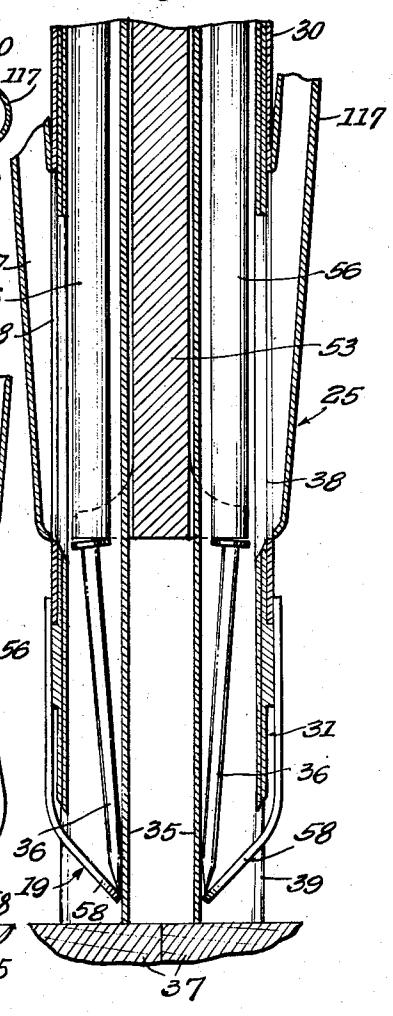


Fig. 9.

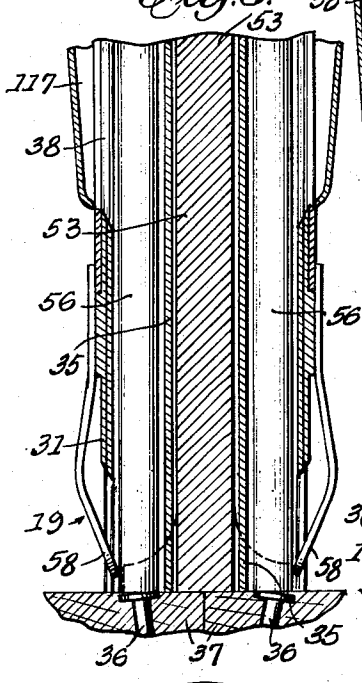


Fig. 1a.

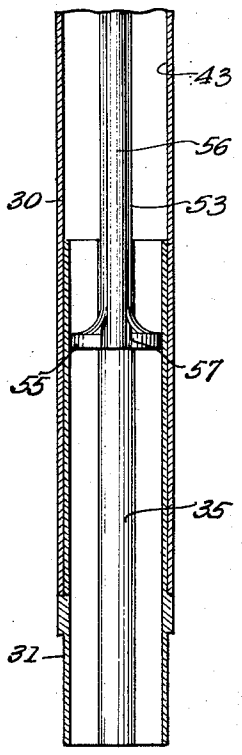
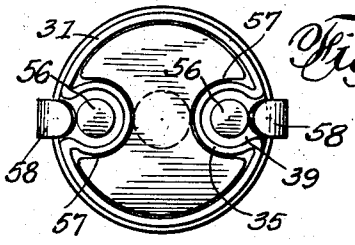


Fig. 11.



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2,928,095

NAIL-DRIVING MACHINE

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Application March 31, 1958, Serial No. 725,370

9 Claims. (Cl. 1—44.4)

This invention relates to a portable machine for driving nails and it is an object of the present invention to provide a machine that has full power operation in that compressed air is used both to drive nails and to effect recovery of the nail-driving means.

Another object of the invention is to provide a machine of the character referred to that embodies a novel nail feed and release so that nails are always available to be driven.

A further object of the invention is to provide a nailing machine provided with a novel nail-driving means of simple and effective design and construction.

A still further object of the invention is to provide a nail-driving machine embodying novel nail hopper and supply means and to operate the same by the compressed air used to drive nails.

A still further object of the invention is to provide, in a machine of the type referred to, novel nail chute means obviating nail jamming.

A yet further object of the invention is to provide a nailing machine that provides a dual control—one for driving a nail and the other for retracting the nail driver—and to provide novel valving means automatically effective, upon admission of compressed air, to return the nail-driving means to retracted or recovery position.

A yet further object of the invention is to provide a nail-driving machine that combines the features set forth in the foregoing objects of the invention.

The invention also has for its objects to provide such means that are positive in operation, convenient in use, easily installed in a working position and easily disconnected therefrom, economical of manufacture, relatively simple, and of general superiority and serviceability.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. However, the drawings merely show and the following description merely describes, preferred embodiments of the present invention, which are given by way of illustration or example only.

In the drawings, like reference characters designate similar parts in the several views.

Fig. 1 is a longitudinal sectional view of a nail-driving machine according to the present invention, the lower portion of the same being broken away and shown in the drawings as Fig. 1*a*.

Fig. 2, to an enlarged scale, shows a plan view of means to release nails to fall to the position from which driven.

Fig. 3 is a cross-sectional view as taken on line 3—3 of Fig. 2.

Fig. 4 is a cross-sectional view as taken on line 4—4 of Fig. 3.

Fig. 5 is a sectional view as taken on the plane of line 5—5 of Fig. 2.

Fig. 6 is an enlarged and fragmentary vertical sectional view of valve means shown in Fig. 1, the parts being in another position.

Fig. 7 is a similar view with the parts in still another position.

Fig. 8 is a vertical sectional view of the nail-driving means in a nail-driving position.

Fig. 9 is a similar view showing the end of the nail-driving operation.

Fig. 10 is a cross-sectional view thereof as taken at the upper end of Fig. 9.

Fig. 11 is a bottom plan view of the nail-driving means as in Fig. 9.

Fig. 12 is a broken longitudinal sectional view of a modification.

Fig. 13 is a cross-sectional view as taken on line 13—13 of Fig. 12.

The nail-driving machine that is illustrated comprises, generally, an elongated body **15**, combined handle and air control means **16**, an air-operated plunger **17** longitudinally movable in the body **15**, nail-driving means **18** connected to the lower end of said plunger, detent means **19** for holding nails in position to be engaged and driven by the means **18**, a nail hopper **20**, means **21** to rotate said hopper and thereby elevate nails and drop the same from elevated position, nail chute means **22** that receives nails thus dropped and along which the same move to feed position, means **23** to release nails from the chutes, air control means **24** to operate the means **23**, guide means **25** to guide released nails to driving position, and valve means **26** to effect retractive or recovery movement of the plunger **17** by air received from the control means **24**.

The body **15** is shown as comprising an outer tube **30** at the bottom of which is provided a nail-guiding fitting **31** and at the upper end of which is provided an elongated core **32** that terminates in an upper enlargement **33** beyond the upper end of the tube **30**. Intermediate its ends, said tube **30** has affixed thereto a bracket fitting **34**.

The nail-guiding fitting **31** comprises either a single nail guide **35**, as in the modification of Fig. 12, or two similar and opposite nail guides **35**, as in Figs. 8 to 11. Since the present machine is essentially devised to drive two nails **36** simultaneously, one on each side of the seam formed by two end-butted boards **37** (see Figs. 8 and 9), this description will emphasize a construction in which two nails are brought to driving position. It will be clear, however, that with respect to Fig. 12, a single nail may be delivered to nailing position by the herein-described machine.

It will be seen from Figs. 10 and 11 that the nail guides **35** comprise tubes that are each open at **38** to provide entry for nails and at **39** to provide operative clearance for the detent means **19**. The latter openings are preferably at the lower end of fitting **31** and the openings **38** are spaced thereabove according to the length of the nails to be handled by the machine. It will be understood that the body tube **30** has openings **40** that register with the openings **38**. As shown in Figs. 1*a* and 8, the fitting **31** terminates somewhat above the upper ends of nail openings **38** but materially below the lower end of the core **32**.

Said core **32** is provided with a longitudinal bore **41**, the same, at its lower end, terminating in a counterbore **42**. As can be seen from the lower end of Fig. 1 and the upper end of Fig. 1*a*, the interior of the body tube **30** constitutes a bore or cylinder **43** that guides the nail-driving means **18**.

The combined handle and air control means **16** is shown in Fig. 1 and comprises a handle **44** affixed to the core enlargement **33** and preferably extending laterally from the upper end of the body **15**. Thus, the handle is fixedly secured to said body and provides a means for bodily moving the machine from one nail-driving position to another. A hose **45** is attached to the handle

44 to conduct compressed air thereto and a control valve, represented by the lever 46, is embodied within the handle to control flow of compressed air from the hose 45 to the upper end of the core 32. It will be clear that depression of lever 46 admits compressed air to the bore 47 of enlargement 33.

The foregoing describes a conventional riveter having a pistol grip and it will be clear that the piston 48 is subject to be driven downwardly by said air out of bore 47 and downwardly through the bore 41 of the core 32. It will also be understood that the riveter produces a percussive type of operation in which the power imposed on piston 48 is in the form of intermittent percussions. The area 49 represents the conventional automatic valving with which riveters are provided for percussing a member such as the piston 48. Such conventional devices provide, of course, for exhausting the air used for percussive purposes, the same venting above the piston 48 in the usual way through the valve that is embodied in the pistol grip or handle 44 and is controlled by lever 46, when said lever is released.

The air-operated plunger 17 comprises the mentioned piston 48 and a rod extension 50 that extends downwardly in bore 41. The piston has a sliding fit in said bore. A bearing bushing 51 is fitted into the counterbore 42 and is retained in place by a snap ring 52. Said bushing provides a bearing for the rod 50 which, when the piston is in its uppermost position (Fig. 1), extends below the bushing and below the lower end of the core 32.

The nail-driving means 18 comprises an elongated guide member 53 having an upper head 54 and a lower flange 55. Said head and flange are loosely guided in the body 15—the head in the bore 43 and the flange in the bore of fitting 31. Said means 18 is secured to the lower end of rod 50, thus integrating the plunger 17 and the means 18 so that the latter partakes of the longitudinal percussive movement of the former.

The means 18 further includes a pair of driving pins 56 that are so spaced as to move in the guides 35, as can be seen from Figs. 8 to 11. The head 54 mounts said pins and the flange 55 is notched, as at 57, around said guides 35. Thus, the pins 56, which terminate level with the lower end of the guide member 53, as can be seen in Figs. 8 and 9, move up and down with the head 54 as the latter moves with the air-operated plunger 17.

The modification of Fig. 12 uses but one driving pin 56, the same being placed centrally and within the nail guide 35. Thus, the flange 55 of the modification has but one notch rather than the two of the other form, and the member 53 is tubular with an open side, instead of solid, as in Figs. 8 and 9.

The detent means 19 (Figs. 8, 9 and 11) comprises a pair of spring fingers 58 that, as shown in Fig. 8, close the lower ends of nail guides 35 and, therefore, intercept nails that enter said nail guides through openings 38 and when the nail-driving means is retracted, as in Fig. 1*a*. Said fingers are sloped so that a nail and then a driver pin 56 may spread the same to the position of Figs. 9 and 11 when the means 18 is projected.

If nails are fed to openings 38 while the means 18 is projected, said nails will encounter the sides of pins 56 and will be held thereby against entering the guides 35 until the driving means is retracted. Then the nails will drop onto the detent fingers, where they will remain, point down, until their heads are engaged by the lower ends of the driving pins 56.

The nail hopper 20 is shown as a preferably cylindrical drum or container 59 that has a closed outer wall 60 and an inner wall 61 that has a relatively large central opening 62. Said container is disposed alongside the body 15 and the same, as shown in Fig. 1, is arranged at an angle to said body so that the upper part is closer to the body than the lower part. The hopper 20 includes a mounting axle 63 that, by means of a bracket 64, is fixedly connected to the fitting 34. Said axle 63 has a small upward tilt when the present machine is in vertical nail-driving position. Thus, the container 59 is capable of rotation around the axle and is held thereon by means of suitable bearings 65 carried by wall 60, and is in the mentioned tilted position while so rotating.

It will be clear from the foregoing that nails in the hopper container will be tumbled to a position in the lower left corner of the container. Thus, vanes 66*a* will encounter such nails, lift them, and drop them when they have reached the top of the drum rotation. By terminating said nail-lifting vanes short of the outer wall 60, there is a space within the drum into which the nails may collect when the body 15 is tilted toward the right, as in Fig. 1. Hence, by so tilting the machine and continuing rotation of the drum, the nails therein are not tossed around. Such tossing occurs only when the machine is so disposed as to bring nails forwardly to be engaged by the vanes.

The hopper-rotating means 21 is shown as an air motor 66 having a drive pinion 67, a gear 68 on the axle 63 and driven by said pinion, and a drive comprising planetary gearing 69. Of the latter gearing, the sun gear 70 is affixed to driven gear 68, the outer ring gear 71 is affixed to the drum, as to wall 60, and the planetary gears 72 interconnect said sun and ring gears. In any case, the high speed of pinion 67 is translated into a slow rotational speed of the drum and, therefore, suitable tumbling of nails within the drum is provided.

The motor 66 is affixed to the axle 63 as by a clamp or bracket 73 and the same receives compressed air by means of a line 74 that is connected to a fitting 75. The latter is connected to the pistol grip handle 44 on the inlet side of the valve that is controlled by the lever 46. Hence, when there is compressed air in hose 45, the motor 66 is operating and the drum is rotating to tumble nails.

The nail chute means 22 is shown as two chutes 76—one on each side of the nailer body 15 and affixed to the fitting 34 as by bolts 77. The chutes are alike so one will be described.

The chute 76 extends angularly upward through the drum opening 62 and terminates in a pointed end 78 that is adjacent to and below the upper portion of said drum. Each chute comprises transversely spaced plates 79 that are parallel to each other, the spacing being of a size to freely accommodate nails 36 while the head 80 of said nails ride the upper sloping edges 81 of said plates 79. The pointed end 78 of the chute permits nails falling from the vanes 66*a* to freely seek a suspended position and, to guide nails to such position, skirt plates 82 form nail-intercepting means. Said plates 82 span between the two chutes to insure nail interception that will provide a full supply of nails to the lower ends of the two chutes 76. In Fig. 5, it will be seen how the nails hang by their heads, having slid down the slope of edges 81.

The means 23 is best seen in Figs. 1, 2, 3 and 5. The same is mounted on a forwardly projecting enlargement 83 of the body fitting 34 and is disposed at the lower ends of chutes 76.

Said means 23 comprises a transverse slideway 84 in enlargement 83 that is disposed at about the angle of slope of edge 81, a slide 85 in said slideway, means 86 to limit the opposite positions of the slideway, metering means 87 to release nails one at a time from the lower ends of the chutes 76, piston means 88 connected to the slide and controlling movement thereof and an air passage 89 to conduct compressed air to the means 88.

The slide 85 has openings or recesses 90 that are located at the ends of chutes 76 and ordinarily would receive and pass nails from said chutes. Said recesses are large enough to so receive nails regardless of the position of the slide, as limited by the means 86. The latter comprises a finger 91 having limited engagement with abutments 92 (see Fig. 2).

The metering means 87 first arrests the feed movement of nails and then releases them from their arrested or hung position. One such means is provided for each chute.

The metering means 87 comprises an interceptor plate 92 in the form of a transverse finger that passes through a clearance slot 93 in the lower end of the chute. Hence, said finger stands transverse to and closes off the space between plates 79, as clearly shown in Fig. 2. Thus, as seen in Figs. 2 and 5, the edge 94 of said finger arrests the downward travel of a nail. Other nails merely pile up in orderly array as seen in said figures. A metering plate 95 is so arranged with relation to the plate 92 that a passage 96 is defined therebetween, said passage being slightly angled relative to the normal line of movement of the nails. The longitudinal limits of the passage are defined by the ends or points 97 and 98, respectively, of the plates 92 and 95.

It will be clear from the foregoing that upon transverse movement of the slide 85 from the position of Fig. 2 in the direction of arrow 99, a nail hung against edge 94 is released, as the point 97 retracts, and falls onto the edge 100 of the metering plate 95. The nail will hang against said edge 100 until the slide 85 is moved back to its initial position, as in Fig. 2. Then, the nail will be released by the plate 95 as the point 98 recovers to said initial position.

When a nail is thus released, the same falls against the sloping face 101 of a member 102, the edges 103 of said member comprising a hanger edge for the head 80 of the nail. Fig. 5 shows how a nail released by the metering plate becomes hung up on the edge 103. It will be understood that, as the slide returns to its initial position, the point 97 intrudes itself between the nail being released and the next nail in the array or stack. The latter nail is now in the position of the nail just released, being hung on the edge 94 of plate 92. Fig. 2 shows the positions of the two nails in question.

When the slide is again moved in the direction of the arrow 99, the edge 103 releases the nail hung thereon so that the same may fall, point down, into an enlarged end closure 104 that closes off the space between the chute plates 76. Said closure 104, being open at the bottom, the nail will fall downward therethrough.

Since different sizes of nails may be handled by the machine, the plates 95 and 102 are mounted so as to be adjustable relative to the plate 92, thereby assuring proper release and feed of nails from the chutes 76. A plate 105, at the side of one chute plate, may be used to align the nail heads of a stack and, thereby, obviate such crowding as may be caused by clearance of the nails in the chute space between plates 76.

The piston means 88 is shown as a transverse cylinder 106 in the enlargement 83 of fitting 34, a piston 107 in said cylinder, a pin 108 connecting said piston to the slide 85 so that said piston and slide move together, and a spring 109 that biases the piston to a position that holds the slide 85 in the position of Fig. 2. When compressed air is introduced into passages 89, the same will move the piston against the bias of spring 109. Release of such air allows the piston to return to the position of Fig. 4 and the slide 85 to the position of Fig. 2.

The air control means 24 is shown as comprising a valve 110 that is disposed alongside of the pistol grip 44. Said valve is controlled by a pushbutton 111. An air line 112 extends between the valve and the handle 44 so that air in hose 45 uninterruptedly passes to said valve 110 where the flow is arrested. A push on button 111 opens said valve to flow of compressed air into a line 113 that, by means of a fitting 114, is connected to a passage 115 in the core 32. A tube 116 connects the passage 115 and the passage 89 in the fitting 34. Thus, when the valve 110 is open, compressed air is provided for shifting the piston 107 and, thus, the slide 85, in the direction of the arrow 99. When valve 110 closes, the

passage 115, which is connected with cylinder 106 through passage 89 and tube 116, vents to atmosphere in the usual way.

The means 25 to guide nails to be driven by the means 18 is shown as a pair of tubes 117, one connected to each chute 76 and connected to the lower end of the nail-passing enclosure 104 of each said chute. The connections are in the form of hinges 118 (Fig. 3) and springs biasing said tubes 117 to enclose the openings 38 may be provided to insure direct passage of nails to driving position, as shown in Figs. 8 and 9. In the event of nail jamming, said tubes can be swung outwardly on their hinges to give access to the nail-driving area in the lower end of the machine body.

The valve means 26 is shown in Figs. 6 and 7. The same comprises a sleeve 119 in the counterbore 42 and is of such length as to enable its movement endwise between the bearing 51 and the shoulder 120 that defines the upper end of the counterbore. The lower part 121 of sleeve 119 is provided with a hole to pass the rod or stem 50 and the diameter thereof is reduced so that holes 122 in said bottom communicate the interior bore 123 and the counterbore 42.

A passage 124 in the core 32 comprises a vent and opens, at 125, into the counterbore 42. The air passage 115 has an extension 125*a* that is normally closed by a check valve 126, the latter controlling flow from the passage 115 to a port 127 opening into the mentioned counterbore. It will be noted that the piston is adapted to enter the bore 123 during its low position, as in Fig. 6.

Operation

When compressed air is provided in flexible hose 45, the nail hopper is set into rotation and nails are thus fed to the metering device 23. At the same time, compressed air from said nose is conducted to the valve controlled by lever 46 and the valve 110.

Assuming the nail-driving means 18 to be projected as in Figs. 6 and 9, after a nail-driving operation, and the piston 48 in its low position within the bore of valve sleeve 119 the button 111 is depressed, opening valve 110 and allowing compressed air to enter the passage 115. This air does two things; it shifts the piston 107 to cause shift of the metering slide 85 to release a nail from each chute to fall in a position against the nail-driving rod on each side, and it opens check valve 126 so that air from port 127 encounters the reduced lower end of the valve sleeve 119, thereby shifting said sleeve upwardly to close the vent 124 and stop against the shoulder 120. Continued flow of air past the valve 126 now passes through small holes 122 and acts against the lower face of the piston 48 (see Fig. 7). Thus, said piston is raised, the same retracting the nail-driving means 18 and allowing nails to fall into positions retained by the detent means 19. The button 111 is then released and, with the machine in the position desired, the nails are driven by pressing lever 46. Release of button 111 causes the slide 85 to re-shift to its initial position.

As the piston 48 is being percussed downwardly, the air trapped in cylinder 41 will become compressed and shift the valve sleeve 119 downwardly, opening the vent 124. As a consequence, the nail-driving operation may proceed until the piston 48 reaches the low position of Fig. 6, at which time the nails will have been driven, as in Fig. 9.

It will be seen that merely by alternately pressing button 111 and lever 46, the machine operates to carry out its function of feeding and driving nails. Since the means 16 largely comprises a purchased riveter, the auxiliary parts and connections for driving the hopper, for operating the metering means, and for causing recovery of the nail-driving means, are shown as connected to the outside of the riveter. It will be understood, however, that such auxiliary means may be integrated into the pistol grip type of riveter for a neater and trimmer appearance.

While a foot stirrup is not shown, the same may be provided, in the usual way, at the lower end of the body to help manipulate the machine and guide the same from one nailing position to another.

Fig. 8 shows that there is considerable clearance in the guides 35. It will be clear, therefore, that the points of said nails will be inwardly directed by the spring fingers 58, so that the nails will be driven home into the boards 37 toed in toward each other, as shown. As a consequence, such toed-in nails will more surely enter a beam or joint beneath the boards 37 than would be the case if the nails spread or are driven straight in.

It is quite possible for two, three or more nails to so interlace as they enter the pointed ends 78 of the chutes 76 that the nail supply may be interrupted. Since nails are being tumbled every which way in the drum, the tip or end of a nail extending below such pointed end will be struck and the nail jam broken by a subsequent lifting of such struck nail from engagement of its head with plate 82 or other interlaced nails. When a jammed nail is so lifted, the interlacing nails may fall away, allowing the nail to slide properly down the chute, hanging by its head.

While the foregoing specification illustrates and describes what I now contemplate to be the best modes of carrying out my invention, the constructions are, of course, subject to modification without departing from the spirit and scope of the invention. Therefore, I do not desire to restrict my invention to the particular forms of construction illustrated and described, but desire to cover all modifications that may fall within the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A nail-driving machine comprising an elongated hollow body, a handle fixedly mounted on the upper end of said body and provided with an air connection, two independently operable valves controlling flow of compressed air through the handle into the body, a nail hopper rotationally mounted on said body, means utilizing compressed air from said connection to rotate the hopper and tumble nails therein, chute means affixed to said body to receive tumbled nails and guide the same outwardly from the interior of the hopper, metering means to intercept such guided nails, means controlled by compressed air, upon opening of one of said two mentioned valves, to operate the metering means to release nails to fall toward and within the lower end of said body, a nail driver controlled by compressed air released by operation of the other of said valves to percussively project, engage and drive nails from the position to which released by the metering means, and means controlled by the compressed air released by said one valve to return the nail-driving means to retracted position.

2. A nail-driving machine according to claim 1 in which the hopper is formed as a drum, and means including a fixed axle mounting the drum to rotate on an axis transverse to and on an upward angle with respect to the length of the body.

3. A nail-driving machine according to claim 1 in which the hopper is formed as a drum, means including a fixed axle mounting the drum to rotate on an axis transverse to and on an upward angle with respect to the length of the body, and the hopper-rotating means comprising a motor carried by the mentioned axle within the interior of the drum.

4. A nail-driving machine according to claim 1 in which the hopper is formed as a drum, means including a fixed axle mounting the drum to rotate on an axis transverse to and on an upward angle with respect to the length of the body, the hopper-rotating means comprising a motor carried by the mentioned axle within the interior of the drum, and reduction gearing carried by the drum and driven by said motor.

5. A nail-driving machine according to claim 1 in which the chute means extends from the upper interior of the hopper outwardly to and alongside the machine body, the upper end of said chute means being reducingly tapered to facilitate nail reception by said means.

6. A nail-driving machine according to claim 1 in which the chute means comprises two chutes, one on each side of the elongated body, and the metering means includes a slide disposed in transverse relationship at the lower end of said two chutes and embodying nail hanger means movable, upon operation of the metering means, between an aligned position with the chutes and a nail-releasing position offset therefrom.

7. A nail-driving machine according to claim 2 in which the means to operate the metering means comprises an air-movable piston connected to the cross slide and controlled by compressed air upon opening of said one valve.

8. In a nailing machine, a tubular body, a nail driver disposed within said body and longitudinally movable therein, said driver comprising an elongated guided member and at least one nail-engaging drive pin, and a fixed guide within said tube and interposed between said member and the drive pin, said fixed guide constituting a nail-guiding means for nails moving therein to driving position beneath the drive pin, said fixed guide having guiding engagement with the guided member.

9. In a nailing machine according to claim 8, two drive pins and two nail guides being provided, the elongated guided member being centrally disposed between the nail guides and the drive pins.

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