Sept. 27, 1949. S. RAPPORT 2,482,872

NAILING MACHINE

Filed Feb. 4, 1946 5 Sheets-Sheet 1

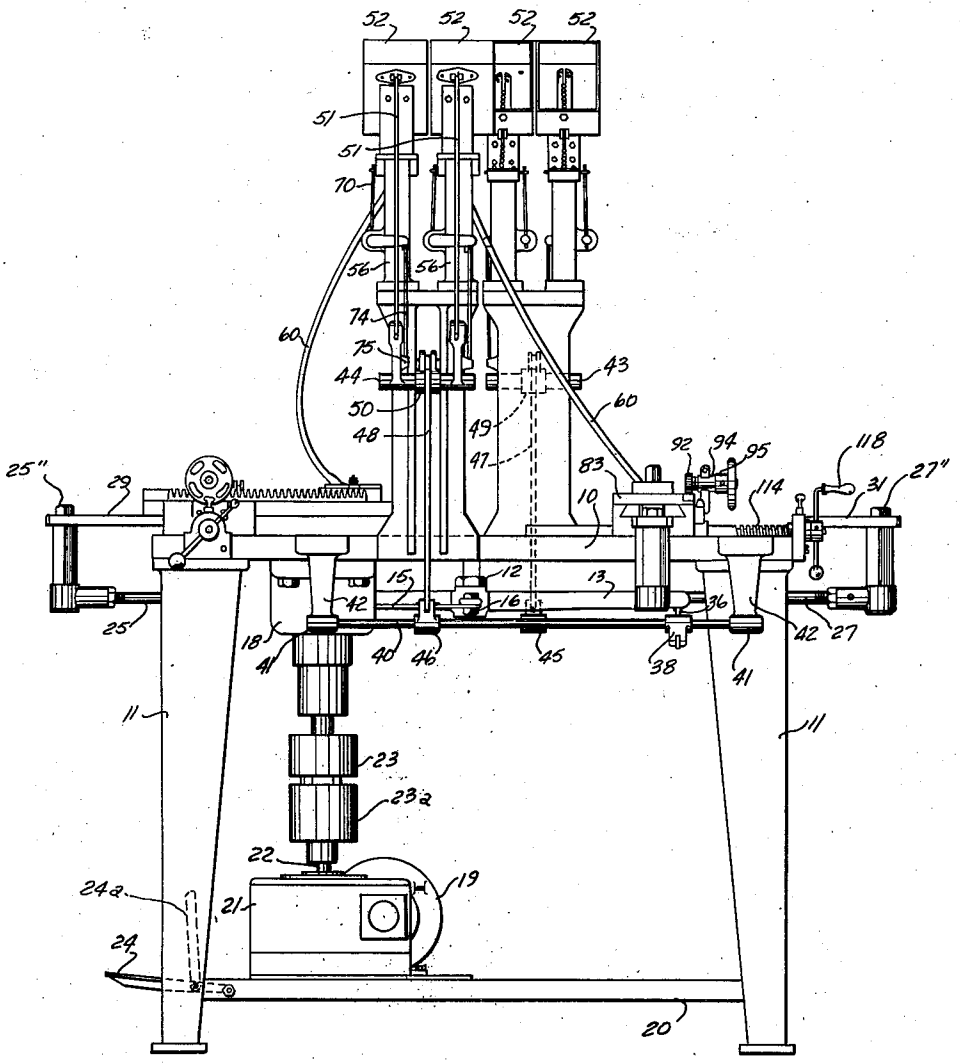


Fig. 1

INVENTOR
SOLOMON RAPPORT
BY Green Freeman
ATTORNEY

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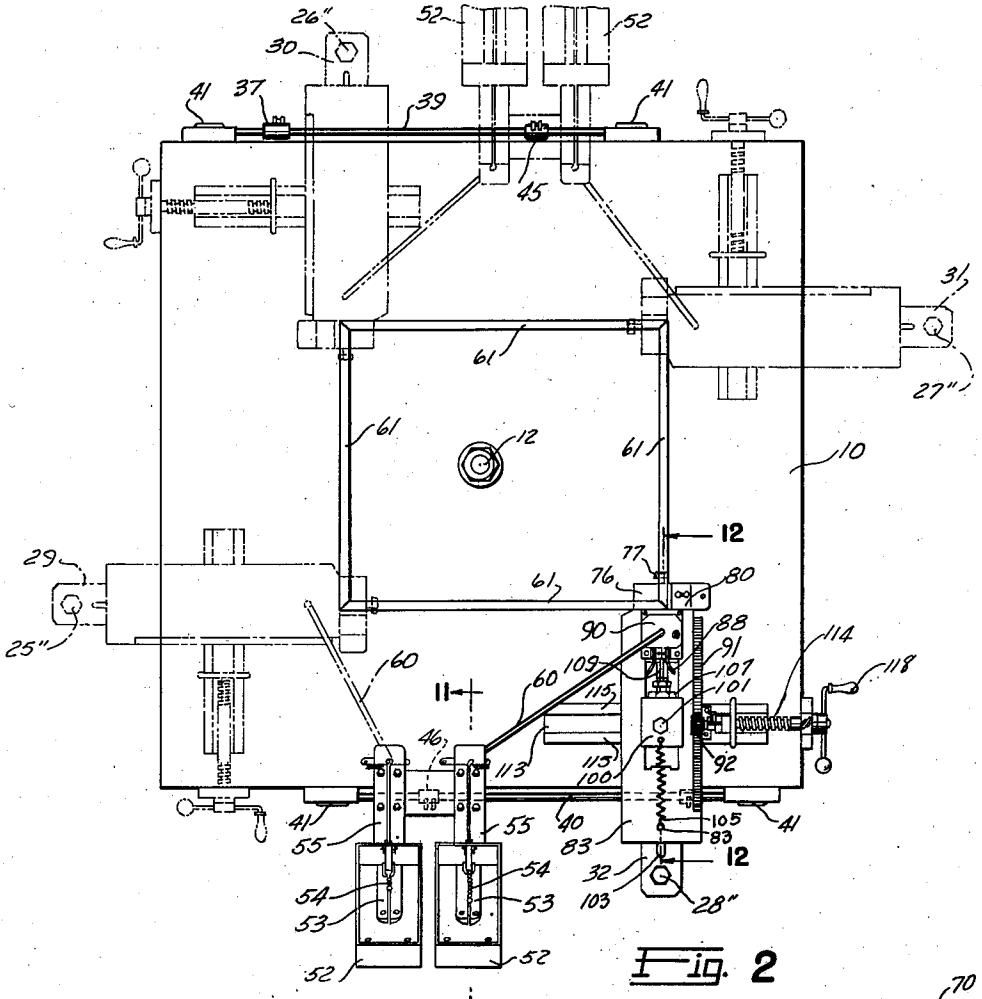


Fig. 2

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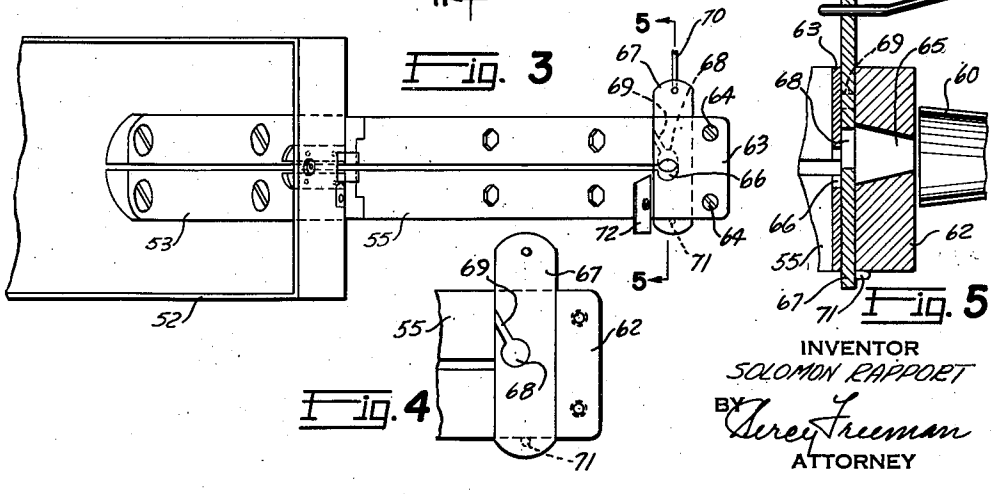


Fig. 3

Fig. 4

Fig. 5

INVENTOR
SOLOMON RAPPORT
BY Darey Freeman
ATTORNEY

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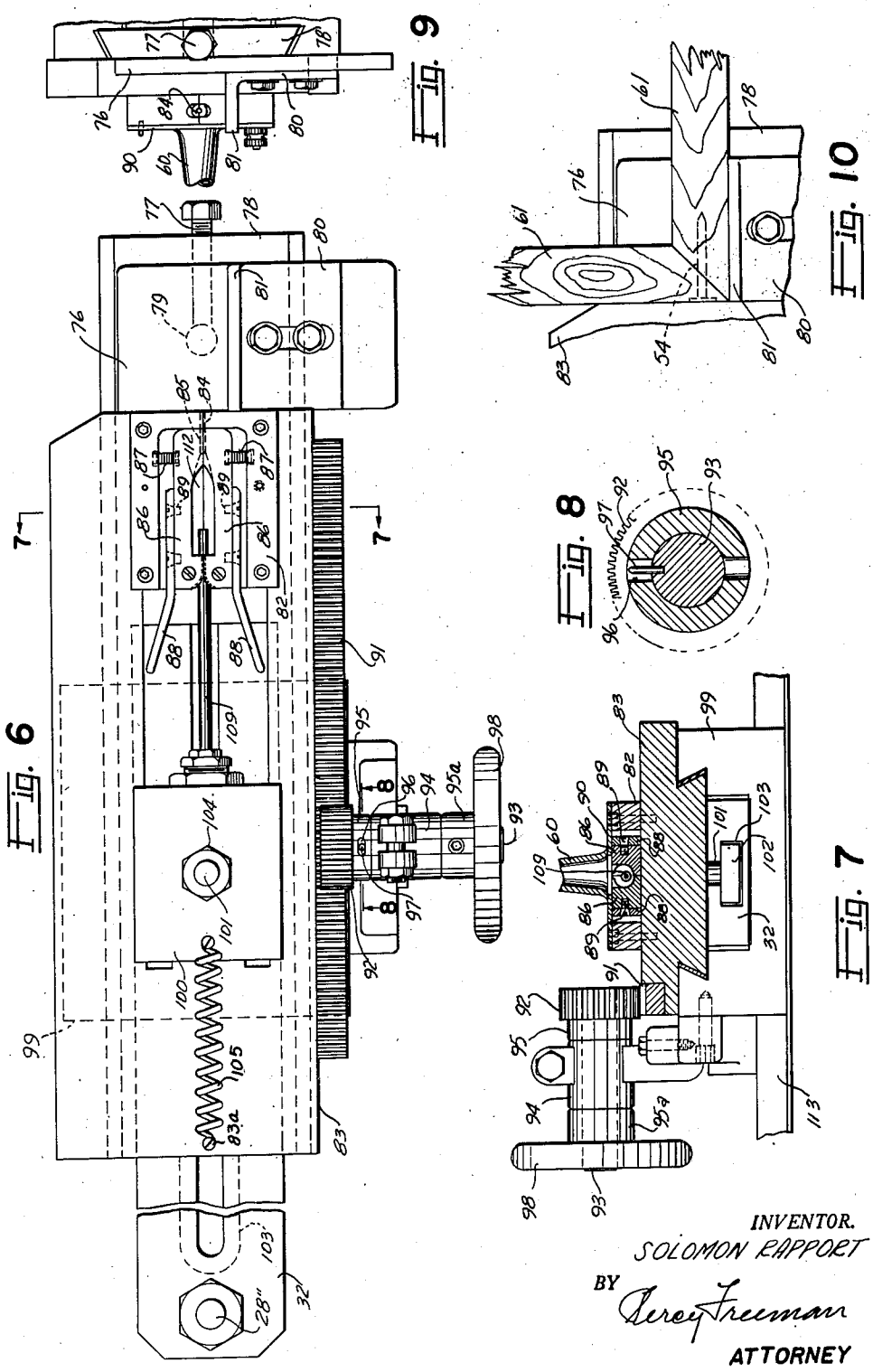


Fig. 6

Fig. 9

Fig. 10

Fig. 8

Fig. 7

INVENTOR.
SOLOMON RAPPORT
BY Percy Freeman
ATTORNEY

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NAILING MACHINE

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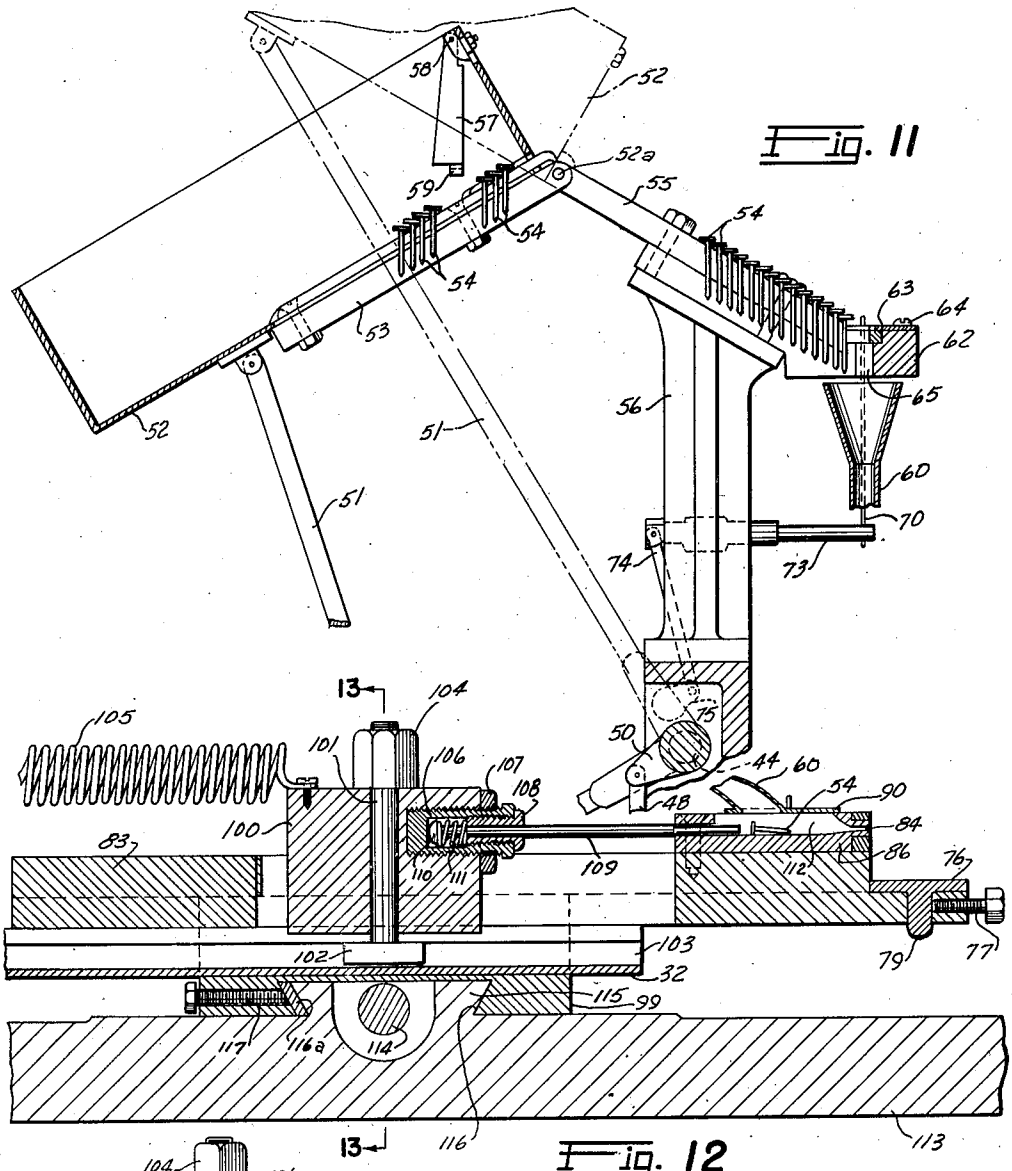


Fig. 11

Fig. 12

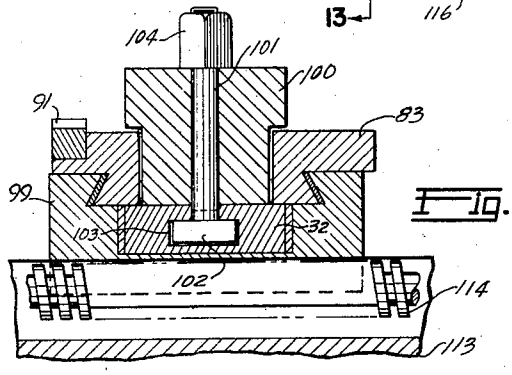


Fig. 13

INVENTOR.
SOLOMON RAPPORT
BY Dorey Freeman
ATTORNEY

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NAILING MACHINE

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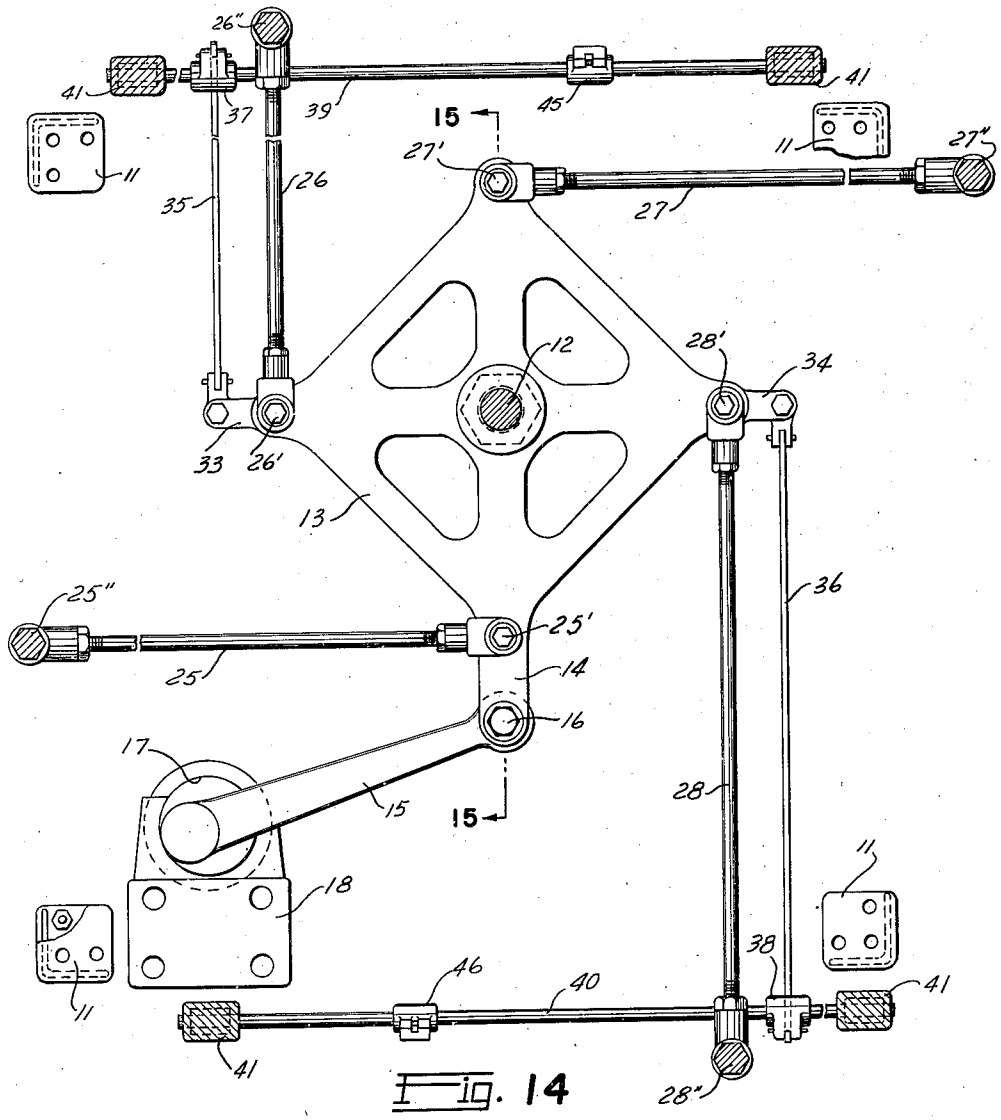


Fig. 14

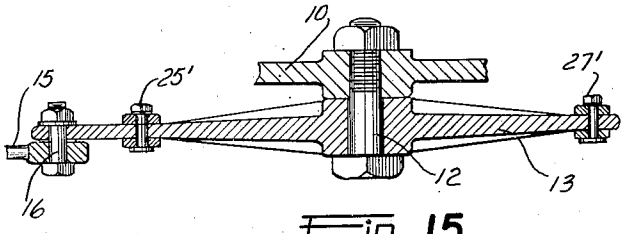


Fig. 15

INVENTOR.
SOLOMON RAPPORT
BY Sereg Freeman
ATTORNEY

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UNITED STATES PATENT OFFICE

2,482,872

NAILING MACHINE

Solomon Rapport, New York, N. Y.

Application February 4, 1946, Serial No. 645,268

7 Claims. (Cl. 1—1)

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The present invention relates to the nailing of picture frames and to a method of and machine for nailing picture frames in a horizontal position.

Picture frames have heretofore been nailed either by hand or by a machine similar to a box nailing machine which acts in a vertical direction to drive one or two nails at a time downwardly into a mitered frame corner, this requiring two or four separate nailing operations and appropriate manipulation of the mitered frame members. Such machines require considerable operating labor and are not readily adapted to nail frames of various sizes. As a result, the production rate is not particularly high and the costs of the nailing operations are excessive. In addition, the results produced are apt to be non-uniform with too great a percentage of defective or sub-standard frames.

An object of the present invention is to overcome the above-outlined and other disadvantages and to effect picture frame nailing in a simple, rapid economical manner, free from defective or sub-standard frames.

Another object of the invention is to nail picture frames while all four frame members are assembled and held in a horizontal position.

A further object of the invention is to insert four nails simultaneously in directions 90° apart in a picture frame held in a horizontal position.

A still further object of the invention resides in means for feeding the nails into proper positions for the nailing operations and in driving such nails into the picture frame members while both nails and frame members are in a horizontal position.

Other and further objects and advantages lie in the various procedural and structural combinations and sub-combinations hereinafter described and claimed and in such additional matters as will be understood by those skilled in this art.

In the accompanying drawings:

Fig. 1 is an elevational view of a machine responding to my present invention.

Fig. 2 is a plan view of my new machine.

Fig. 3 is a fragmentary plan view on an enlarged scale of the nail-feeding and picking off devices.

Fig. 4 is a detail view of the nail pick off device.

Fig. 5 is a sectional view taken on line 5—5 of Fig. 3.

Fig. 6 is a plan view of one of the four nail-driving mechanisms.

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Fig. 7 is a sectional view taken on line 7—7 of Fig. 6.

Fig. 8 is a sectional view taken on line 8—8 of Fig. 6.

Fig. 9 is an end elevational view of certain parts of Fig. 6, but with the nail-feeding tube in place.

Fig. 10 illustrates how each nail is inserted in a mitered corner of the assembled frame members.

Fig. 11 is an enlarged elevational view, partly in section, of one of the nail feeding and pick off devices, on line 11—11 of Fig. 2.

Fig. 12 is a sectional view through one of the nail-driving mechanisms, on line 12—12 of Fig. 2.

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

Fig. 14 is a plan view of the means for actuating the nail-driving mechanism.

Fig. 15 is a fragmentary section of Fig. 14 taken on line 15—15 thereof.

Like numerals designate corresponding parts in the various views of the drawings.

My new nailing machine includes a table top 10 supported by corner legs 11 which are suitably bolted or otherwise secured beneath the table top. A central bolt 12 holds a spider 13 in pivotal relationship beneath the table top. This spider is provided with an extension 14 to which one end of connecting rod 15 is loosely secured by bolt 16. The other end of connecting rod 15 is cam-actuated in a circular path within guide 17 which is held in place under the table top by means of a hanger bracket 18. A motor 19, mounted on a base member 20, acts through a gear box 21 to drive vertical shaft 22 which is provided with clutch elements 23 and 23a through which the said connecting rod end is cam-actuated as stated. The clutch elements may be engaged by manipulation of a foot pedal 24 in a well-known manner.

The construction and arrangement is such that, when the foot pedal is depressed and immediately released, shaft 22 makes one complete revolution and only one revolution. By maintaining the foot pedal in a depressed position, shaft 22 rotates continuously, such being undesired in the normal use of the machine. During each revolution of shaft 22, spider 13 is pivoted back and forth through a small angle by connecting rod 15, as will be appreciated from Fig. 14. Such movement in turn effects certain movements of other parts of the machine as will be more fully explained hereinafter.

Spider 13 has four rods 25, 26, 27, 28, rigidly secured thereto by bolts 25', 26', 27', 28' at points

90° apart, the rods each extending in a different direction 90° from each other as will be seen from Fig. 14. The other end of each such rod is connected by a bolt 25'', 26'', 27'', or 28'', to a T-slotted drive plate 29, 30, 31 or 32, respectively. Spider 13 also has a pair of oppositely extending projections 33 and 34 to each of which one of the bars 35, 36 is connected. The other end of each such bar is pin-connected to a sleeve 37 or 38 mounted on a cross shaft 39 or 40, respectively. Shafts 39 and 40 are journalled in end bearings 41 disposed on the lower ends of hangers 42 depending from the table top 10. It will be appreciated that each time spider 13 is actuated, shafts 39 and 40 are partially rotated and then returned to their normal positions. This movement correspondingly moves shafts 43, 44 through connectors 45, 46, bars 47, 48 and connectors 49, 50.

The movements of shaft 44 which are thus brought about, serve to actuate and control the nail storage and feeding accessories. A pair of bars 51 are connected to shaft 44 and to the underside of nail receptacles 52 which latter are hinged at their forward ends so that they may be pivoted about the hinge connection as will be understood from the full and dotted line positions indicated in Fig. 11. The bottom of each such receptacle is provided with a slotted member 53 for the reception of nails 54 which, during the movements of the receptacles 52, align themselves in the slots, as shown. When the receptacles 52 are in their uppermost position (the dotted line position of Fig. 11) the slotted members 53 become aligned with the inclined slotted members 55 which are fixedly mounted on standards 56. The slots of members 55 are likewise shown as containing a succession of nails 54 arranged in single file, points downward, and ready to be fed for nailing purposes. Each receptacle 52 has a freely swingable gravity actuated member 57 pivoted at 58 to the upper forward portion of the receptacle and having a reduced end 59 adapted to drop into the slot between the guide flanges 53a when the receptacle rises, thus blocking further forward sliding movement of any nails 54, which are not correctly positioned with their points downward. When the receptacle is lowered, the weighted member 57 remains substantially stationary, but the relative movement of the member 57 and the receptacle 52 now causes the member 57 to kick any misplaced nails away from the guide slot and to break up any tendency of the nails to bunch together at the forward end of the receptacle. The member 57 is vertically adjustable to allow for passage below it of various sized nails. The elevated guide flanges 53a are fixedly spaced from the edge of the slot 53 to accommodate the nail heads. The lower end of the slot in each member 54 communicates with a pick-off device by means of which one nail is fed, as needed, into the upper funnel-shaped end of a flexible tube 60 down which each nail slides point first until it is delivered into the position shown in Fig. 12, ready for driving into the picture frame members 61. The pick-off device, as best understood from Figs. 3–5, includes a block 62 having a pick-off plate 63 secured thereto as by screws 64. Block 62 has a tapering opening 65 therethrough underlying an opening 66 in pick-off plate 63 larger than the nailheads of nails 54. A pick-off slide 67 has an opening 68 of the same size as, and registrable with opening 66 in pick-off plate 63, and also an oblique connecting slot 69. Pick-off slide 67 is longitudinally actuated by bent rod 70 and limited as to its sliding movement by depending pin 71. Each time pick-off slide 67 is actuated, the lowermost nail is picked from the descending row of nails and dropped into the upper end of the flexible tube, and the next nail is held for the subsequent movement of the pick-off slide 67, and so on. If desired, supplemental manual member 72 on member 55 can be moved (slid) inwardly to form a stop preventing further movement of the nails along the slot. During the normal operation of the machine, member 72 is in the inoperative position shown in Fig. 3. Rod 70 is actuated by shaft 73 which is in turn reciprocated by link 74 connected at one end to shaft 73 and at the other end to a lateral cam-like projecting member 75 operatively associated with the lower end of bar 51 (see Fig. 11).

As will be observed from Fig. 2, the mitred picture frame members 61 are assembled in horizontal position and are so clamped prior to nailing. The mitred corners of the frame members are disposed upon plates 76 which are held in place by screws 77 which extend inwardly from the front edges of slides 78 and bear against the projections 79 depending from the underside of plates 76. An angle plate 80 is adjustably bolted to each plate 76 and has a vertical flange 81 against which one of the picture frame members 61 abuts (note Fig. 10). A chuck frame 82 is mounted, as shown in Fig. 6, in the forward portion of the chuck table 83. Chuck frame 82 is yoke-shaped with a central aperture 84 aligned with an opening 85 formed between opposed jaw members 86 which are normally urged toward each other by springs 87. While, as hereinafter explained, jaws 86 are forced open when a nail 54 is driven into picture frame members 61, jaws 86 may be opened manually by means of hand actuated extension plates 88 secured to the jaws by screws 89. A removable cover plate 90, preferably integral with the lower end of flexible tube 60, normally covers the chuck plate and jaws and can be removed at will. Chuck table 83 is provided along one side with a gear rack 91 which meshes with a pinion 92 which is mounted on one end of a stub shaft 93. A split bearing clamp 94 encircles the mid-portion of shaft 93 between hubs 95 and 95a, for the purpose of permitting relative adjustment between hammer block 100 and drive plate 32 to accommodate various sizes of frames to be nailed. The hub 95 adjacent pinion 92 is provided with a slot 96 and shaft 93 is provided with an upstanding pin 97 projecting into slot 96 and constituting a lost motion device. A hand wheel 98 is disposed on the outer end of shaft 93.

A carriage 99 lies under chuck table 83 and is undercut to provide a slideway for the flaring bottom extension of chuck table 83. Carriage 99 also is cut out centrally for the passage of slotted drive plate 32 therethrough. A hammer block 100 is slidably mounted on drive plate 32. The chuck table 83 is cut out for the reception of the lower reduced portion of hammer block 100, as shown best in Figs. 6, 12 and 13. A bolt 101 extends through hammer block 100 and through the slot in drive plate 32, the lower enlarged head 102 of bolt 101 lying in the T slot 103 of drive plate 32. A nut 104 on the upper end of bolt 101 maintains the assembly and permits disassembly or relative adjustment when such is required. A helical spring 105 has one end connected to hammer block 100 and the other end connected to an

upright member 83a on the rear of chuck table 83. The front of hammer block 100 is recessed and threaded and a threaded bushing 106 is located therein (Fig. 12). A nut 107 locks bushing 106 in place. Bushing 106 is hollow and is adapted to receive a second threaded bushing 108 which is apertured for the passage of hammer rod 109. The end of rod 109 which projects through bushing 108 is provided with an enlarged terminal 110, and a helical spring 111 lies between terminal 110 and the rear end of bushing 108. The other end of hammer rod 109 passes between the rear portions of jaws 86 and partway into the space 112 between such jaw members and into which space successive nails 54 fall after their travel through flexible tube 60. It will be understood that movement of hammer block 100 correspondingly advances rod 109 and drives each nail 54 out through openings 84, 85, between jaws 86 which latter yield against springs 87 to permit such action. The nails 54 are thus driven into picture frame members 61 with a single smooth stroke which avoids splitting and marring of the frames. Four nails are thus simultaneously driven in four different directions at 90° angles to each other. This will be apparent from Fig. 2 in particular.

As hammer block 100 moves forwardly, spring 105 exerts enough force to move chuck table 83 along with it until the frame members 16 are yieldingly clamped.

In order to accommodate picture frames as well as moldings of different sizes, the entire driving assemblies can be advanced toward or retracted from each other. For this purpose, a bed plate 113 has a central longitudinal trough in which a long feed screw 114 is disposed and a pair of parallel rail-like members 115 defining the central trough. (Figs. 2, 7 and 12.) Carriage 99 is provided with a complementary dovetail slot 116 which fits over the trough and over members 115. The frictional resistance between 116 and 115 may be adjusted by the set screw 117 against the gib 116a. An operating handle 118 is provided for each long screw 114, and by means thereof the screw can be advanced or retracted and the driving assembly correspondingly moved to alter the distance between the frame receiving plates 76.

It will be understood and appreciated that each of the four nail-holding and feeding devices is identical and that the description of one suffices for all. The same is true for the nail-driving mechanisms which are all identical.

The operation of the nailing machine as a whole will be understood from the foregoing description and the explanation of the operation of the various sub-assemblies. For convenience, such operation can be summarized as follows: Actuation of spider 13 from motor 19 (or hand actuation by means of auxiliary devices forming a part of the machine for use where or when electricity is not available but not illustrated, to avoid confusion) effects reciprocatory movement of rods 25, 26, 27 and 28. This causes corresponding movements of T-slotted drive plates 29, 30, 31 and 32 and movement of hammer blocks 100 and driving rods 109. For convenience, the operation of only a single driving head will be described, it being understood that all four of the corners of the machine, that is all four driving heads operate similarly. As the T-slotted drive plate 32 moves forward with its hammer block, it draws forward the chuck table 83 by reason of the fact that the chuck table and the

hammer block are interconnected by spring 105, and this forward movement of the chuck table continues only until the chuck table contacts the frame members 61, at which time further forward movement of the chuck table is prevented. This forward movement of the chuck tables effects yielding clamping of the picture frame members 61 tightly together at the miter joints. The extent of movement of the chuck table is of the order of about ⅛", so that sufficient clamping can take place between the picture frame members prior to the nailing together thereof. As the drive plate and hammer block continue to move forward, the spring 105 is merely extended since its rear end is secured to the chuck table, and thus the chuck table maintains continued yielding pressure against the miter joints of the picture frame members. On the return stroke, however, of the drive plate, the hammer block 100 finally reaches the rearward end of the slot in the drive plate and also backs off the drive plate so as to bring the front end of the lost motion slot 96 against the pin 97, ready for the next cycle of operation. After the first portion of such movement, chuck tables 83 move forwardly, clamping the picture frame members 61 tightly together at the mitre joints. The lost motion arrangement at 95, 96, 97 permits such and then the remainder of the stroke is completed. Meanwhile, the movement of spider 13 also rotates shafts 39 and 40 through an angle to raise and lower nail receptacles 52 and to provide a succession of prearranged nails, the lowermost of which is picked off and dropped through the flexible tubes, landing in front of the forward ends of drive rods 109 at such a time as to be driven out through the jaws 86 and into the frame members 61. The machine is operated only once for each frame which is thereafter removed and replaced by a succession of frames. In this way, the production of nailed frames can be carried out rapidly and efficiently representing substantial savings in labor and other costs as compared with existing practices.

From an examination of Figs. 2 and 10 in particular, it will be appreciated that in the finished frame each frame member has one nail extending longitudinally into an end thereof and another nail extending transversely through the other end thereof. The nails (four only in number) lie in four different directions at 90° to each other. Frames so produced are unusually strong and resist distorting forces surprisingly well. While the machine is normally so constructed and arranged that the nails are driven into the frames until the heads are flush with the frame surfaces, it will be readily understood that bushing 106 can be screwed partly out of the recess in hammer block 100 so that during operation of the machine the drive rod 109 moves forward an extra increment. In this way the nail heads can be countersunk. By covering over the nail heads and filling the small recesses with a suitable material, the presence of the nails can be completely hidden and an unusually fine appearing picture frame produced. While wood frames are usually and preferably employed, I could nail frames of any other materials into which nails can be driven successfully.

While the above invention has been described with respect to the nailing of mitred picture frames, it will be understood that any mitred frame might be nailed in this manner.

While in the drawings and specifications the invention has been illustrated as driving a single

nail into each frame member, it should be further understood that the same method and procedure may be used for driving two nails into each frame member, in which case, it would be merely necessary to provide two chuck frames in superimposed relation so that the nails are driven at different vertical levels. Such change can be made by anyone skilled in the art, without involving invention.

Likewise, it should be obvious that if frames are to be made without mitred corners, the frame members may be butted against one another in a well-known manner, with or without half-lapped corners, and nailed in a similar manner.

Numerous changes in construction and detail can be made without departing from the spirit or principle of the invention which is that defined by the appended claims.

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

1. A machine for nailing frames which comprises means for clamping four frame members in horizontal position and means for simultaneously driving four nails into such frame members in four different directions 90° apart from each other, and in non-opposing relation.

2. A machine for nailing frames which comprises means for clamping four frame members in horizontal position, means for feeding four nails into positions from which they can be linearly driven toward said frames and means for driving said nails toward and into said frames simultaneously in four different directions 90° apart from each other, and in non-opposing relation.

3. A machine for nailing frames which comprises means for clamping four frame members in horizontal position, means for feeding four nails into positions from which they can be linearly driven toward said frames and means for driving said nails toward and into said frames simultaneously in four different directions 90° apart from each other, said first-named means including four frame supporting plates and abutments for securing and maintaining the frame members in position for nailing.

4. A machine for nailing frames which comprises means for clamping four frame members in horizontal position, means for feeding four nails into positions from which they can be linearly driven toward said frames and means for driving said nails toward and into said frames simultaneously in four different directions 90° apart from each other, said last-named means including a plurality of slotted drive plates, hammer blocks operatively associated with said drive plates, a driving rod projecting from each such hammer block, a chuck at one end of each driving rod, and a chuck table associated with each hammer block and on which each chuck is mounted.

5. A machine for nailing frames which comprises means for clamping four frame members in horizontal position, means for feeding four nails into positions from which they can be linearly driven toward said frames and means for driving said nails toward and into said frames simultaneously in four different directions, said last-named means including four transversely adjustable nail-driving units spaced 90° apart and facing in directions 90° from each other, a slotted drive plate for actuating each such unit and a common device for simultaneously and synchronously actuating such drive plates.

6. A machine for nailing frames which comprises means for clamping four frame members in horizontal position, means for feeding four nails into positions from which they can be linearly driven toward said frames and means for driving said nails toward and into said frames simultaneously in four different directions, said last-named means including four transversely adjustable nail-driving units spaced 90° apart and facing in directions 90° from each other, a slotted drive plate for actuating each such unit and a common device for simultaneously and synchronously actuating such drive plates, and comprising a spider, a plurality of rods secured to said spider and to said drive plates and power means for imparting a limited pivotal movement to said spider in a horizontal plane.

7. In a machine for nailing frames, a spider mounted for limited pivotal movement, a plurality of rods connected thereto at angles of 90° to each other, a pair of spaced shafts, a bar connecting said spider with each of said shafts and a drive for imparting pivotal movement to said spider, whereby said rods are reciprocated and said shafts are simultaneously partially revolved.

SOLOMON RAPPORT.

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