The present invention generally relates to a machine for driving nails and more particularly to such a machine which is actuated by an electric motor and which is manually initiated but provided with an automatic cycle whereby each manual operation will start a sequence of events which will automatically follow each other until the nail driving cycle has been completed whereupon a second cycle may be initiated by again actuating the manual operating means.

It is an object of the present invention to provide a nail driver in which the power of an electric motor is utilized through a clutch element for causing downward reciprocation of a nail driving plunger for driving a nail into the surface of a device with there being means for limiting the driving movement of the plunger and automatically disconnecting the clutch mechanism upon movement of the plunger to a predetermined lower limit.

Another feature of the present invention is to provide a nail driver having a novel rotatable magazine for supporting a plurality of rows of nails for dispensing in position for engagement by the reciprocating plunger.

Still another important feature of the present invention is to provide a nail driver having novel means for holding the nail and receiving the nail from the magazine for engagement by the plunger.

Yet another important feature of the present invention is the provision of a hollow housing enclosing the various structural mechanisms for retaining the operating mechanism in clean condition and enabling better lubrication thereof.

Still other objects of the present invention will reside in its simplicity of construction, automatic operation, adaptation for its particular purposes and its relatively inexpensive manufacturing cost.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a perspective view of the nail driver of the present invention;

FIGURE 2 is a longitudinal, vertical sectional view taken substantially upon a plane passing along section line 2—2 of FIGURE 1 illustrating certain of the details of construction thereof;

FIGURE 3 is a longitudinal, plan sectional view taken substantially upon a plane passing along section line 3—3 of FIGURE 2 illustrating further structural details of the drive and control mechanism;

FIGURE 4 is a longitudinal sectional view illustrating further structural details of the device;

FIGURE 5 is a transverse, vertical sectional view taken substantially upon a plane passing along section line 5—5 of FIGURE 2 illustrating the structural details of the drive mechanism and of the nail magazine;

FIGURE 6 is a transverse, sectional view taken substantially upon a plane passing along section line 6—6 of FIGURE 1 illustrating further structural details of the plunger;

FIGURE 7 is a detailed sectional view taken substantially upon a plane passing along section line 7—7 of FIGURE 1 for illustrating the construction of the magazine;

FIGURE 8 is a detailed view showing the loading end of the magazine and the spring tensioned cover therefor;

FIGURE 9 is a sectional view taken substantially upon a plane passing along section line 9—9 of FIGURE 5 illustrating the latch mechanism for the magazine.

Referring now specifically to the drawings, the numeral 10 generally designates the driving mechanism of the present invention which includes a generally hollow housing or casing 12 divided into two separable parts along a centrally disposed division line 14 with the two halves of the housing being secured together by fastening members 16 extending through lugs 18. The two housing components are designated by the numeral 20 and the numeral 22 respectively. The housing section 20 is provided with a generally U-shaped handle 24 thereon and the housing section 22 is provided with a generally U-shaped handle 26 thereon which handles 24 and 26 are rigidly and integrally formed with the housing sections 20 and 22 respectively. The handle 24 is provided with a toggle switch or any suitable type of electric switch 28 for controlling the operation of an electric driving motor 25 and for supplying electrical current to the motor 25 from an electrical conductor 30 which may be provided with a suitable male plug on the free end thereof for engagement with a conventional female household plug.

The motor 25 is supported by any suitable brackets and is disposed between partition walls 32 formed in the housing 12 and the motor is provided with an output shaft 34 having a spur drive gear 36 thereon in meshing engagement with a larger spur drive gear 38 mounted on an idler shaft 40. The idler shaft 40 is provided with a smaller gear 42 thereon in meshing engagement with a larger spur gear 44 mounted on shaft 46 which parallels shafts 34 and 40. Thus, a reciprocation drive arrangement is provided with the gear 44 forming a drive gear for meshing engagement with a sliding gear 48 which is fixed to a sliding shaft 50 having a clutch member 52 on one end thereof. The shaft 50 is rotatable and slideable in bearings 54 and a coil compression spring 56 is disposed in encircling relation to a portion of the shaft 50 and abuts one of the partition walls 32 at one end thereof and abuts a collar 58 at the other end thereof with the collar 58 being adjustably secured in position by a set screw 60 thereby adjusting the tension of the spring 56. The spring 56 is such that it will normally urge the shaft 50 in a direction for disengaging the clutch member 52 and also disengaging the gear 48 from the gear 44.

For moving the shaft 50 in the other direction, there is provided a laterally extending arm 62 having a slot 64 in one end thereof receiving the shaft 50. The functions formed by the slot 64 engage a thrust collar 66 which engages the hub portion of the sliding or movable gear 48 which is keyed to the shaft 50. The other end of the laterally extending arm 62 is secured to an elongated operating rod 68 by virtue of a pair of collars 70 pinned to the rod 68 by pins 72. The rod 68 is slidable journaled in bearing member 74 in one of the partitions 32 in the casing. One end of the rod 68 is rounded at 76 and engages the free end of an operating lever 78 pivotally supported in the handle 26 by virtue of a pivot pin 80. The other end of the lever 78 is disposed in the path of movement of an operating arm 82 pivotally supported at the upper end of the handle 26 by a pivot pin 84 with the forward edge of the arm 82 actually forming a trigger so that a person gripping the handle 26 may move the lower end of the arm 82 rearwardly. A leaf spring 86 is connected to the handle 26 and engages the rear or trailing edge of the arm 82 for urging the same forwardly. Also, the free end of the arm 82 is provided with a projection 88 for limiting the forward movement thereof and also provided with a rounded projection 90.
The rearward movement of the arm 23 caused by squeezing of the handle 26 will cause forward movement of the bottom end of the lever 78 thus causing forward movement of the rod 68. Forward movement of the rod 68 causes the lateral extending arm 62 to move forward thus sliding the gear 48 into meshing engagement with the gear 44 and also sliding the clutch element 52 into positive engagement with a coacting and cooperating clutch element 92 carried by shaft 94. The shaft 94 is journaled in a bearing 95 supported by a partition wall 32 and is longitudinally orientated by a collar 98 secured in place by a set-screw 100. The outer end of the shaft 94 is provided with a pinion gear 102 which also serves to orientate the shaft 94 longitudinally so that when the clutch elements 52 and 92 are engaged, the shaft 94 and gear 102 can be caused to operate. Due to frictional engagement between the gears 48 and 44, the clutch elements 52 and 92 will remain in engaged relationship even though the trigger arm 82 may be released. However, when there is no driving force being transmitted, the spring 56 will normally assure that the clutch elements 52 and 92 will be disengaged and also will assure that the gear 48 will disengage from the gear 44.

The pinion gear 102 is in meshing engagement with a gear rack 104 formed on one wall of a vertical slot 106 provided in a reciprocable plunger or hammer member 108 which is guided in its vertical reciprocation by a substantially T-shaped longitudinal projection designated by the numeral 110. The T-shaped longitudinal projection 110 is provided with laterally extending vertical flanges 112 which are slidably received in corresponding grooves 114 in a vertical frame member 116 at the forward end of the housing. Thus, when the gear 102 is rotated in a particular direction, the rack 104 in meshing engagement therewith will be moved downwardly thus moving the plunger or hammer 108 downwardly.

One side of the hammer 108 is provided with a laterally extending bolt 118 to which a tension coil spring 120 is attached with the upper end of the spring 120 being attached to a screw threaded fastener 122 extending through the housing section 20 so that the tension of the spring 120 may be adjusted and also enabling the spring 120 to be easily removed. Thus, the spring 120 urges the hammer 108 upwardly and will normally re-extend the hammer to its uppermost position.

For limiting the downward movement of the hammer or plunger 108, there is provided a stop member 124 adjustably mounted on the side edge of the hammer 108 as in the spring 120. This portion of the side edge of the hammer 108 is serrated with transverse ridges and grooves 126 for engaging complementary serrations 128 on the stop member 124. The stop member 124 is provided with a vertically elongated slot 130 therein receiving a pair of fastening bolts 132 which extend into the anvil 128 with the inner ends of the fastening bolts 132 being received in threaded bores 134 in the hammer 108. With the fastening bolts 132, the position of the stop member 124 in relation to the hammer 108 may be vertically adjusted and then securely and rigidly locked in position.

The lower end of the stop member 124 is provided with a reduced depending projection 136 having a cushioning member 138 attached to the lower surface thereof by any suitable means such as by adhesive. The cushion 138 is designed with a cushion 140 carried by a stop block 142 supported on a bottom frame member 144 whereby the contact stop member 124 and stop block 142 will limit the downward movement of the hammer 108.

The other side edge of the hammer 108, that is opposite from the stop member 124, is also serrated as indicated by the numeral 146 for adjustably engaging a cam member 148 also having a serrated edge 150. The cam member 148 is secured by a pair of fastening bolts 152 which extend through a vertically elongated slot 154 for adjustably mounting the cam member 148 in position. As illustrated in FIGURE 4, the cam member 148 is provided with an inclined corner edge 156 forming the partition wall 32. The cam surface 156 is adapted to engage an inclined cam surface 158 on a cam member 160 carried by the outer end of the rod 68. The cam member 160 is slidably received and supported in a corresponding aperture 162 in the forwardlymost partition wall 32 which forms the forward wall for the partition which leaves the cam members 148 and 160 exposed as illustrated in FIGURE 1 with the front frame member 116 being disposed outwardly therefrom and with the bottom frame member 144 forming the bottom for this open area and the top wall of the housing sections 20 and 22 forming the top wall of this open area.

With this construction, the downward movement of the hammer 108 will cause the cam surface 156 on the cam member 148 to engage the cam surface 158 on the cam member 160 thus forcing the rod 68 rearwardly by by causing the laterally extending arm 162 to move rearwardly thereby disengaging the clutch members 52 and 92 and disengaging the gear 48 from the gear 44. This action takes place when the hammer has moved to its lowermost position as determined by the stop member 24 with the cam member 148 also being adjusted to correspond to the movement of the hammer. As soon as the clutch elements 52 and 92 are disengaged, the spring 120 will serve to retract the hammer 108 to its elevated position.

The lower end of the outer surface of the hammer 108 is provided with a recess 164 which receives the upper end 166 of a depending plunger 168 which is secured to the hammer 108 by fasteners 170. The plunger 168 extends into the central area of a slot 172 formed in the lower frame 144 with the slot having one removable wall formed by a removable plate 174 held in position by removable bolts 176. Laterally sliding in the slot 172 is a pair of nail gripping plates 178 and 180. The outer ends of the plates 178 and 180 are provided with a lateral extension 182 slidably received in a recess 184. A compression coil spring 186 is disposed in the recess and urges the plates 178 and 180 into gripping engagement with a nail 188 whereby the spring tension of the spring 186 will frictionally retain the nail 188 in position for engagement by the plunger 168 whereby the plunger 168 will force the nail downward through and between the plates 178 and 180 and discharge the nail through a discharge opening 190 in the bottom of the frame member 144 so that the nail 188 is driven into the floor surface or other surface.

The nails 188 are discharged into the area between the plates 178 and 180 through the longitudinally extending slot 192. This slot 192 communicates with a magazine generally designated by the numeral 194 which is received within a circular or tubular housing area 196 extending longitudinally in the bottom of the housing 12.

The magazine 194 includes a central tubular member 198 rotatably mounted on a shaft or rod 200 which has the inner end thereof threaded into a sleeve 202 carried by an anchor plate 204. The outer end of the shaft 200 is provided with a knurled operating knob 206 to permit removal of the rod 200 so that the magazine may be removed. The tubular member 198 is provided with a plurality of laterally extending or radially extending spaced pairs of plates 208 receiving a plurality of nails to be discharged between. A follower is provided for the nails 188 and is designated by the numeral 210 with there being a spring 212 behind the follower and the spring 212 has the other end thereof engaged with a pivoted plate 214 mounted on a pivot pin 216. A spring 218 is mounted on the pivot pin 216 and is arranged axially therewith for resisting urging the plate or door 214 in closed relation to the opening in the end wall of the housing which enables...
the follower and spring to be removed for replacing the support of nails 118.

When the supply of nails 118 has been discharged from one pair of converging plates 208, the outer cylindrical member 220 forms a bearing for rotating the magazine for aligning another pair of converging plates 208 with the support 192.

A latch is provided for locking the magazine in rotatably adjusted position with the latch being in the form of a knurled knob setscrew 222 having a rounded projecting point 234 extending through one of a plurality of circumferentially spaced apertures 226 in the end wall of the magazine thereby securing the magazine in rotatably adjusted position.

Briefly, the operation of the device is semi-automatic in that each time the trigger arm 82 is depressed with the motor 28 in operation, a complete cycle of events will occur resulting in the driving of a nail. When the trigger 82 is depressed, the shaft 68 will be moved forwardly thus engaging the clutch elements and also engaging the gear 48 with the gear 44 for rotating the shaft 50 and the shaft 94 thus causing rotation of the spur gear 102. Rotation of the gear 102 causes downward movement of the rack and the hammer connected thereto for driving a nail held by the nail holding plates. Downward movement of the hammer causes the cam elements 148 and 160 to be engaged thus moving the shaft 68 rearwardly and disengaging the clutch and the drive gear ready for a subsequent sequence of operation. When the clutch is disengaged, the spring will return the hammer to its uppermost position thus retracting the plunger and allowing another nail to be forced between the nail holding plates.

Suitable supporting feet or knobs may be provided and the entire device may be supported on an angled base if desired whereby the device may be used to drive nails in an inclined manner for instance such as when the device is used for nailing flooring in which case the nails are driven into the edge portions of the boards in an inclined manner. Various lubrication features may be employed wherein desired and various bearing materials may be employed for rendering the device long lasting and the particular gears may be varied as to size relationships for varying the speed and force of the operational stroke of the hammer.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A nail driving machine comprising a generally hol-

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Inventor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>371,863</td>
<td>Viser</td>
<td>Oct. 18, 1887</td>
</tr>
<tr>
<td>1,634,226</td>
<td>Albert</td>
<td>June 28, 1927</td>
</tr>
<tr>
<td>2,403,222</td>
<td>Howells</td>
<td>July 2, 1946</td>
</tr>
<tr>
<td>2,680,246</td>
<td>Rambo</td>
<td>June 8, 1954</td>
</tr>
<tr>
<td>2,771,609</td>
<td>Klopstock</td>
<td>Nov. 27, 1956</td>
</tr>
</tbody>
</table>