June 21, 1955 C. E. FRANCIS 2,710,963

AUTOMATIC NAIL DRIVER

Filed Oct. 20, 1952 3 Sheets-Sheet 1

Fig. 1

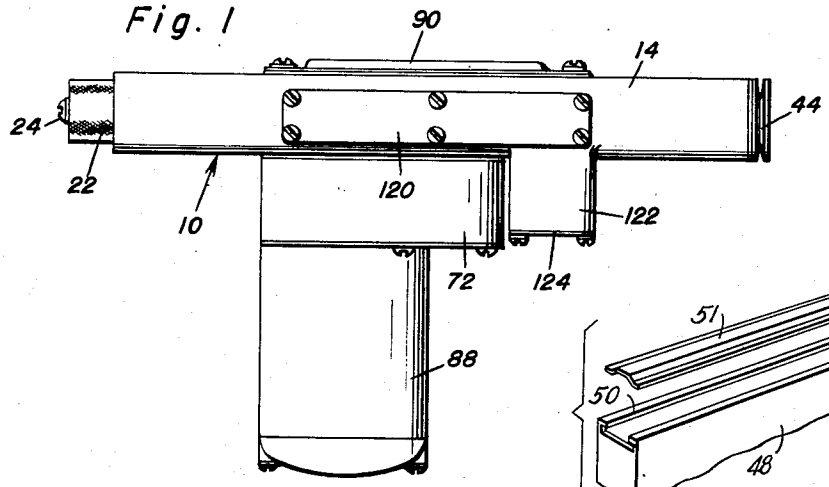


Fig. 11

Fig. 2

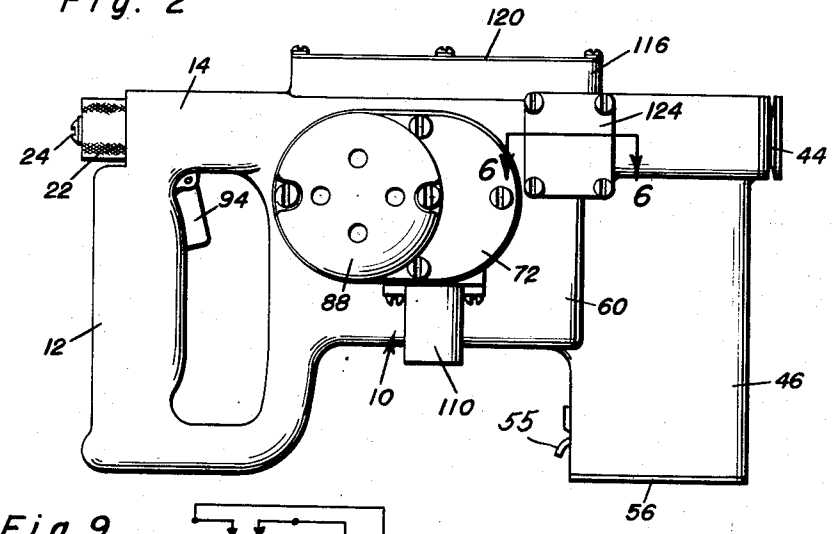
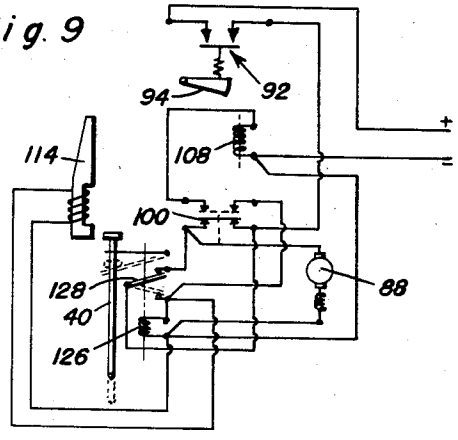


Fig. 9



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June 21, 1955 C. E. FRANCIS 2,710,963

AUTOMATIC NAIL DRIVER

Filed Oct. 20, 1952 3 Sheets-Sheet 2

Fig. 3

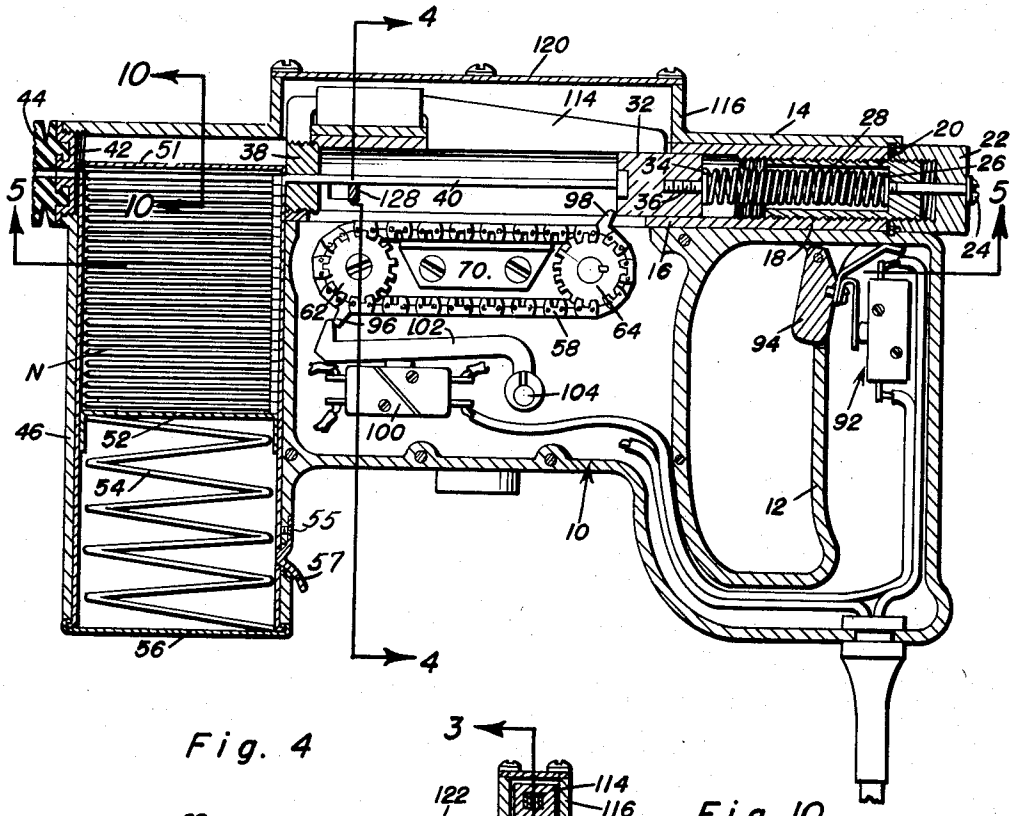


Fig. 4

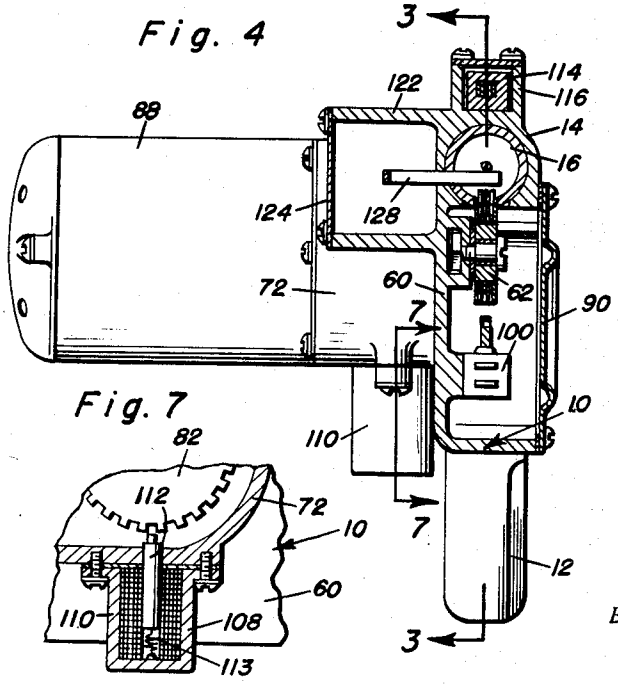
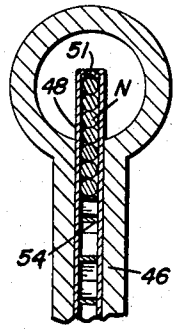


Fig. 7

Fig. 10



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June 21, 1955 C. E. FRANCIS 2,710,963

AUTOMATIC NAIL DRIVER

Filed Oct. 20, 1952 3 Sheets-Sheet 3

Fig. 8

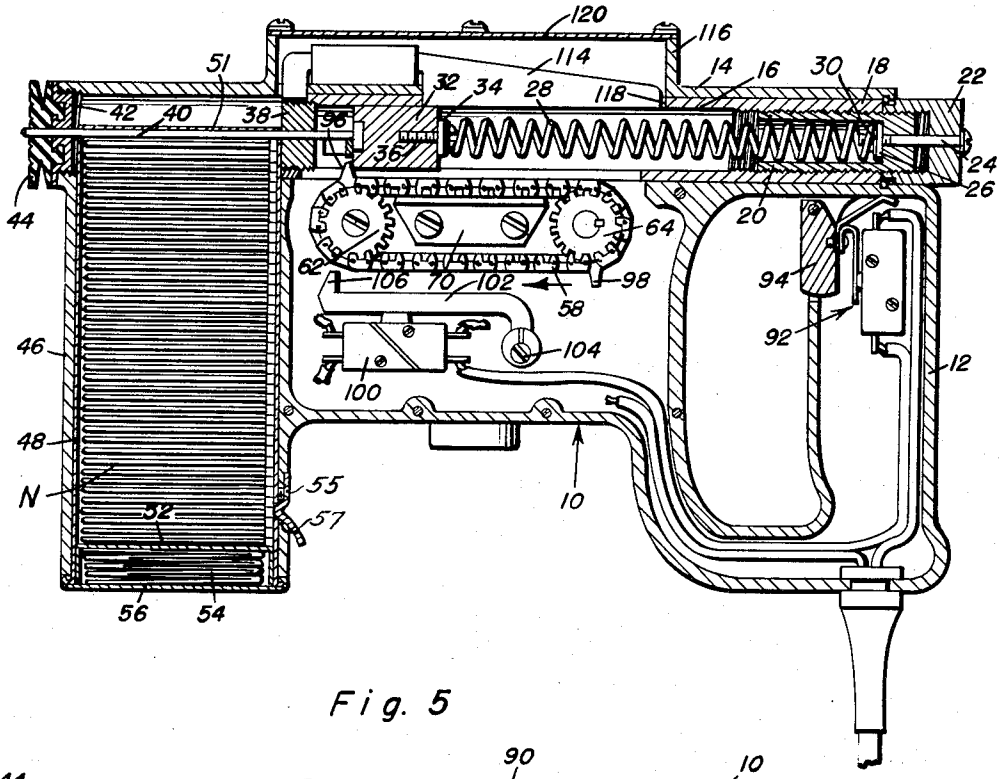


Fig. 5

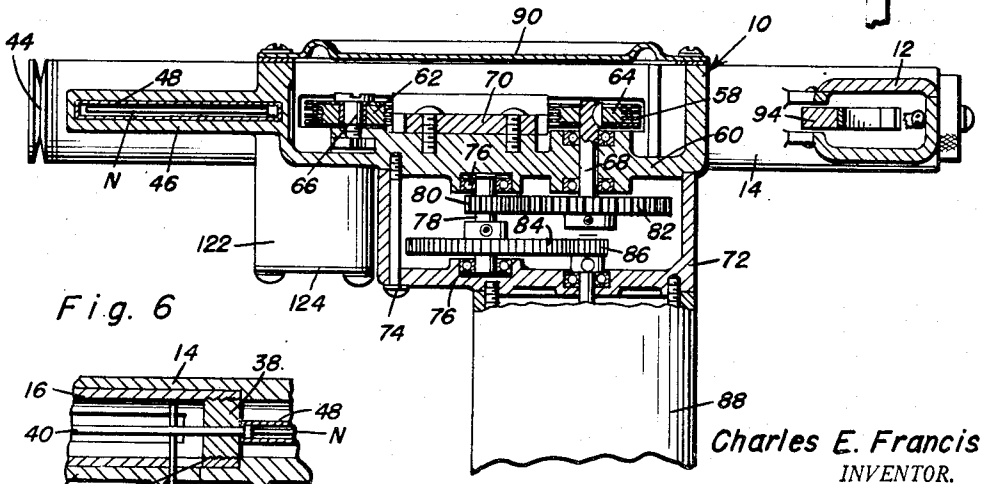
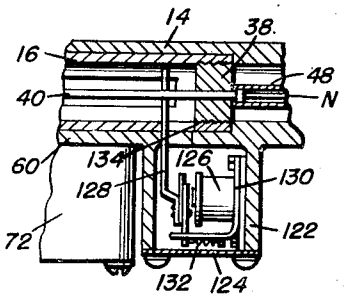


Fig. 6



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2,710,963

AUTOMATIC NAIL DRIVER

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Application October 20, 1952, Serial No. 315,630
9 Claims. (Cl. 1—46)

This invention relates to new and useful improvements in power hammers and the primary object of the present invention is to provide an automatic nail driver and set for finish carpentry work.

Another important object of the present invention is to provide an automatic nail driver and set that will avoid hammer marks and bruises in wood due to a resilient guide that will slidably receive a nail and a reciprocating set for the nail.

Yet another object of the present invention is to provide a power hammer including a spring driven hammer, a set driven by the hammer and novel and improved interconnecting means between the hammer and set whereby the same may be retracted as a unit.

Another feature of the present invention is the provision of a novel electrical circuit involving a power driven chain for retracting a spring driven hammer and which chain will actuate a circuit switch to energize the connecting means between the hammer and set.

A further object of the present invention is to provide a power hammer of the aforementioned character involving an electric locking means for the chain that will be actuated simultaneously with the opening of the circuit to the motor to restrict movement of the hammer when the latter is engaged with the chain.

A still further aim of the present invention is to provide a power hammer that is extremely simple and practical in construction, strong and reliable in use, small and compact in structure, light in weight, inexpensive to manufacture, assemble and service, and otherwise well adapted for the purpose for which the same is intended.

Other objects and advantages reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming part hereof, wherein like numerals refer to like parts throughout, and in which:

Figure 1 is a top plan view of the present invention;

Figure 2 is a side elevational view of Figure 1;

Figure 3 is a longitudinal vertical sectional view taken substantially on the plane of section line 3—3 of Figure 4;

Figure 4 is a transverse vertical sectional view taken substantially on the plane of section line 4—4 of Figure 3;

Figure 5 is a longitudinal horizontal sectional view taken substantially on the plane of section line 5—5 of Figure 3;

Figure 6 is an enlarged detail horizontal sectional view taken substantially on the plane of section line 6—6 of Figure 2;

Figure 7 is a detail vertical sectional view taken substantially on the plane of section line 7—7 of Figure 4;

Figure 8 is a view similar to Figure 3 but showing the driver and set moved to their nail driving position;

Figure 9 is a diagrammatic view showing the electrical circuit used in the present invention,

Figure 10 is an enlarged transverse vertical sectional view taken substantially on the plane of section line 10—10 of Figure 3; and

Figure 11 is an exploded perspective view of the upper end of the magazine for containing the nails.

Referring now to the drawings in detail, wherein for the purpose of illustration, there is disclosed a preferred embodiment of the present invention, the numeral 10 represents an elongated portable housing having a hand grip 12 formed at its rear end. The housing 10 is provided with a longitudinal tubular portion 14 in which there is suitably mounted a barrel 16 having an internally threaded rear end 18 that receivably engages an externally threaded sleeve 20.

The rear end of sleeve 20 projects rearwardly beyond the rear ends of the barrel 16 and tubular portion 14 to threadingly engage a cap 22. A headed fastener 24 extends axially through the cap 22 and the rear end wall of the sleeve. The forward end of fastener 24 passes through the rear eye end 26 of a coil spring 28 and carries a nut 30 that retains eye end 26 against the rear end wall of the sleeve 20.

A plunger 32 is slidably received in barrel 16 and the forward eye end 34 of the coil spring 28 is removably secured to the plunger 32 by a fastener 36, so that the plunger will be urged forwardly by the spring 28 as shown in Figure 8 to a nail driving position. Longitudinal adjustment of sleeve 20 within the barrel 16 will compensate for any loss in the initial resilient character of the spring 28.

The front end of barrel 16 is internally threaded to receivably engage the guide plug 38 having an axial opening that slidably receives the headed nail driver 40. The forward end of the tubular portion 14 is also provided with a threaded opening accommodating the guide plug 42 whose outer face removably carries a resilient, preferably rubber, pressure foot 44. Both the plug 42 and foot 44 are formed with central apertures for slidably receiving nails and the driver.

A hollow substantially rectangular arm 46 projects laterally from the forward end of the housing 10 and accommodates a magazine 48 that is removably held within the arm 46. The inner slotted end wall 50 of the magazine extends between the plugs 38 and 42 and supports a removable closure strip 51 that is concavo-convex to form a guide for nails as well as the driver. A feed member 52 is slidably received in the magazine 48 and is urged by a spring 54 toward the wall 50 so that nails N in the magazine may be fed toward the wall 50 to be ejected by driver 40. The closure strip 51 of the magazine 48 is readily removed from the magazine to permit refilling of the magazine with nails. As seen in Figure 11, the end wall provides a pair of inwardly extending flanges at the inner end of the magazine 48, and the strip 51 is provided with a pair of outwardly extending flanges which engage the lower faces of the inwardly extending flanges. The action of the spring 54 serves to retain the strip 51 in position. An outer end wall is secured to the magazine 48 and extends outwardly therefrom to abut the end of arm 46. A resilient spring 55 is fixedly secured on the arm 46 and projects through an aperture 57 therein to engage the wall of the magazine 48 to retain the magazine 48 in position within the arm 46.

Means is provided for retracting the plunger and then releasing the plunger so that the spring 28 may move the plunger to its nail driving position. This means comprises endless drive chain 58 supported alongside of a longitudinal side wall 60 of the housing 10 and engaged with sprockets 62 and 64 having supporting shafts 66 and 68 that are rotatably supported by the side wall 60, as shown in Figure 5. An angle guide 70 is removably secured to the wall 60 and slidably supports the flight of chain 58 that is parallel to and adjacent barrel 16.

A combined cover and support member 72 is removably secured to wall 60 by fasteners 74. Opposed recesses

in the member 72 and wall 60 accommodate bearings 76 for a drive shaft 78. A gear 80 on shaft 78 meshes with a gear 82 on shaft 68, and a second gear 84 fixed on shaft 78 meshes with a drive gear 86 on the armature shaft of an electric motor 88 that is supported by member 72.

The housing 10 is provided with an opening in registry with the sprockets 62, 64 and the chain 58. This opening is closed by a removable cover plate 90 so that the sprockets and chain may be inspected, repaired or replaced in a convenient manner.

A trigger operated switch mechanism 92 is supported on the hand grip 12 and includes a pivotal finger or trigger 94 that is pulled rearwardly to move the switch to its circuit closing position. The switch mechanism 92 is electrically connected to a source of electric current and to the motor so that the circuit to the motor may be selectively opened and closed.

A pair of lugs or fingers 96 and 98 are fixed on the chain 58 in spaced relationship for sequentially engaging the plunger 32 to permit retraction of the plunger by the chain as the latter rotates clockwise when viewing Figure 8.

A double-throw single-pole switch 100 is supported on the inner face of the wall 60. An actuator is provided for switch 100 in the form of a swingable lever 102 that is pivoted eccentrically, as at 104, to wall 60. The lever 102 extends across the button for switch 100 and is located between the chain 58 and switch 100 as shown in Figure 8. The free end of the lever 102 is formed with a laterally projecting lug element 106 that will be sequentially engaged by lugs 96, 98 to move the lever 102 to open and close the switch 100.

Means is provided for locking chain 58 against movement when the motor is not running so that when the plunger 32 is partially or completely retracted by the chain 58, depending on the instant that the motor was stopped, spring 28 cannot move the plunger 32 forwardly. This locking means comprises a solenoid 108 having a case 110 that is removably secured to the member 72 as shown in Figure 7. The solenoid 108 is provided with a conventional composite core 112 so as to have a portion thereof urged upwardly from the position shown in Fig. 7 when the solenoid is energized. Inasmuch as the solenoid 108 will be energized when the circuit to the motor is broken, the core 112 will be extended to have one end thereof engaged between a pair of adjacent teeth of the gear 82. A spring 113 is connected between the other end of core 112 and the case 110 to urge the core 112 from engagement with the gear 82.

Connecting means between the plunger 32 and the driver 40 is provided, whereby the plunger and driver may be retracted as a unit by the chain 58. This connecting means comprises an electro-magnet 114 supported within a hollow portion 116 of the housing 10 and disposed partially within a longitudinal slot 118 in the barrel 16 to be slidingly engaged with the plunger 32. The plunger 32 and driver 40 are of magnetizable materials so that when the magnet 114 is energized, the driver will be attracted to the plunger through the magnet.

The magnet 114 will be energized when the plunger 32 is moved forwardly and will remain energized as the plunger and driver are retracted until the driver clears the magazine so that a nail may be moved into alignment with the driver by the spring 54.

A cover plate 120 is removably secured to portion 116 and is removed for access to the means attachably securing the magnet 114 within portion 116.

The housing 10 is formed with a hollow projection 122 (Figs. 5 and 6) at its forward end having a removable cover plate 124. An electro-magnet or coil 126 is suitably supported in the projection 122 and faces a swingable switch arm 128 that is mounted on a bracket 130 within the projection 122. A spring 132 connects the arm 128 to bracket 130 and yieldingly urges the arm 128 from the coil 126 and to a circuit opened position. The end of arm 128 remote from spring 132 extends into barrel 16 through registering slots 134 in the barrel 16 and portion 14, so that the arm will be in the path of the plunger 32 or the head of driver 40 to be moved to its circuit closing position as the plunger and driver are moved forwardly.

The coil 126 will be energized as the switch 128 is moved toward the coil 126 so that the coil 126 will magnetically attract the arm 128 and retain the same in its closed position until current to the coil 126 fails to pass into the coil, whereupon the spring 132 will urge the arm 128 to its circuit open position after the plunger and driver have been retracted to their initial starting position shown in Figure 3.

In practical use of the present invention the magazine 48 is filled with nails after which the magazine is installed within arm 46 to position a nail in alignment with driver 40.

Initially, the plunger 32 is held retracted since the core 112 is engaged between a pair of the teeth of gear 82 and one of these teeth is in binding engagement with the core as a result of gear 82 being urged counterclockwise (Fig. 7) by spring 28 acting on plunger 32, lug 98 and chain 58.

With the switches 100 and 128 in the positions shown in solid lines in Figure 9, closing of switch 92 will cause the current to flow through the switch 100 to the motor 88 which will drive the chain 58. The solenoid 108 will not be energized due to the current being unable to flow thereto, and as the motor starts running, the pressure between the gear 82 and the core 112 will no longer exist, and spring 113 will pull the core 112 out of locking engagement with the gear 82. The gear 82 will then rotate, causing the chain 58 to travel over the sprockets 62 and 69. As the chain 58 moves clockwise, as viewed in Figure 3, the lug 98 will release the plunger 32 allowing the spring to move the driver 40. As the chain continues to move, the next lug will engage the plunger 32 and retract the same. The same sequence will then be repeated until the nail has been driven to the desired depth.

As the chain 58 rotates, the lugs 96 and 98 will successively engage lug 106 on the lever 102, causing the switch 100 to move to the dotted line position of Figure 9. The intermittent operation of switch 100 by the lugs 96, 68 has no effect on the motor since it remains energized by switch 128, and the brake solenoid 108 cannot be energized by way of switch 128.

When the nail has been driven to the desired depth, the driver 40 will engage switch 128, moving the switch to the dotted line position shown in Figure 9. The holding coil 126 will be thus energized and will retain the switch 128 in this position. The magnet 114 will also be energized whereby continued rotation of the chain 58 will cause the plunger 32 to draw the driver 40 into the barrel. When the plunger is fully retracted, one of the lugs 96, 98 will engage the lever 102, forcing switch 100 to the dotted line position. This will break the circuit to the motor 88, stopping the same. At the same time, solenoid 108 will be energized, forcing the core 112 into engagement with the teeth of gear 82. The plunger 32 will thus be locked in retracted position. Upon release of the trigger 94, the holding coil 126 will be de-energized, allowing switch 128 to return to the solid line position shown in Figure 9.

In the event that the device should stop with the switch 100 in the dotted line position, the current will flow when the trigger 94 is depressed through the by-pass around switch 100 to the switch 128 and back to the motor 88. The switch 128 can always be returned to the solid line position merely by releasing the trigger 94.

Having described the invention, what is claimed as new is:

1. A power hammer comprising an elongated portable

housing having a hand grip at one end, a barrel attached to and disposed longitudinally of the housing, a spring urged plunger slidably received in the barrel, a nail guide at one end of the barrel, said housing having a slot therein adjacent said one end of said barrel, means attached to the housing and projecting from and communicating with said slot for supplying nails to be driven by the plunger, a driver slidably carried by the guide and actuated to drive a nail by said plunger, means in the housing for retracting the plunger, said plunger and said driver being of magnetizable material, and a magnet mounted in said housing in contact with said plunger to magnetize the plunger and attract the driver to the plunger, whereby the plunger and driver may be retracted together.

2. A power hammer comprising an elongated portable housing having a hand grip at one end, a barrel attached to and disposed longitudinally of the housing, a spring urged plunger slidably received in the barrel, a nail guide at one end of the barrel, said housing having a slot therein adjacent said one end of said barrel, means attached to the housing and projecting from and communicating with said slot for supplying nails to be driven by the plunger, a driver slidably carried by the guide and actuated to drive a nail by said plunger, means in the housing for retracting the plunger, said plunger and said driver being of magnetizable material, a magnet mounted in the housing in contact with the plunger to magnetize the plunger and attract the driver to the plunger whereby the driver and plunger may be retracted together, means electrically connecting the magnet to a source of electric current, and a switch having an operator extending into the barrel to be actuated by the plunger as the driver is driven by the plunger, said switch being operatively connected to said electrical connecting means to complete a circuit to the magnet as the plunger is moved to its driver driving position.

3. A power hammer comprising an elongated portable housing having a hand grip at one end, a barrel attached to and disposed longitudinally of the housing, a spring urged plunger slidably received in the barrel, a nail guide at one end of the barrel, said housing having a slot therein adjacent said one end of said barrel, means attached to the housing and projecting from and communicating with said slot for supplying nails to be driven by the plunger, a driver slidably carried by the guide and actuated to drive a nail by said plunger, means in the housing for retracting the plunger, and means in the housing operatively engaged with the driver through the plunger for retracting of the driver with the plunger, said plunger retracting means including an endless chain having a pair of spaced lugs for sequentially engaging the plunger, an electric motor connected to the chain for driving the same, locking means for the chain, and means in the housing actuated by the lugs for activating the locking means.

4. A power hammer comprising an elongated portable housing, a barrel attached to and disposed longitudinally of said housing, a spring urged retractile plunger slidable in the barrel and advanced by said spring, a retractile nail driver slidable in said barrel and housing and engaged by and advanced by said plunger while being disconnected therefrom, means actuated under control of the plunger for releasably connecting the plunger and driver together, whereby the plunger may retract the driver, and power operated means in the housing operatively engageable with the plunger for retracting the plunger.

5. A power hammer comprising an elongated portable housing, a barrel attached to and disposed longitudinally of said housing, a spring urged retractile plunger slidable in said barrel and advanced by said spring, a retractile nail driver slidable in said barrel and housing and engaged by and advanced by said plunger while being disconnected therefrom, means actuated under control of the plunger for releasably connecting the plunger and driver together, whereby the plunger may retract the driver, an endless chain rotatably supported in the housing and having flights paralleling the barrel, spaced lugs on the chain for sequentially engaging the plunger to retract the plunger, and an electric motor in the housing operatively connected to the chain.

6. A power hammer comprising an elongated portable housing, a barrel attached to and disposed longitudinally of said housing, a spring urged retractile plunger slidable in said barrel and advanced by said spring, a retractile nail driver slidable in said barrel and housing and engaged by and advanced by said plunger while being disconnected therefrom, means actuated under control of the plunger for releasably connecting the plunger and driver together, whereby the plunger may retract the driver, an endless chain rotatably supported in the housing and having flights paralleling the barrel, spaced lugs on the chain for sequentially engaging the plunger to retract the plunger, an electric motor in the housing operatively connected to the chain for driving the latter, a trigger switch electrically connected to the motor and supported on the housing, and an electric locking device electrically connected to the motor and actuated to lock the chain against movement as the circuit to the motor is opened.

7. A power hammer comprising an elongated portable housing, a barrel attached to and disposed longitudinally of said housing, a spring urged retractile plunger slidable in said barrel and advanced by said spring, a retractile nail driver slidable in said barrel and housing and engaged by and advanced by said plunger while disconnected therefrom, means actuated under control of the plunger for releasably connecting the plunger and driver together, whereby the plunger may retract the driver, an endless chain rotatably supported in the housing and having flights paralleling the barrel, spaced lugs on the chain for sequentially engaging the plunger to retract the plunger, an electric motor in the housing operatively connected to the chain for driving the latter, a trigger switch electrically connected to the motor and supported on the housing, a double throw switch electrically connected to the motor, an operator for the double throw switch actuated by the lugs during rotation of the chain, a plunger actuated switch electrically connected to the double throw switch and actuated by the plunger during movement of the latter to its nail driving position and an electric locking lever for the chain and electrically connected to the plunger actuated switch to be actuated to lock the chain as the double throw switch and plunger actuated switch are activated.

8. The combination of claim 7 wherein said means connecting the plunger and the driver comprises an electro-magnet supported in the housing and contacted by said plunger, said plunger and said driver being of magnetizable material.

9. The combination of claim 7 wherein said plunger actuated switch comprises a spring urged switch arm, and a magnet under the arm and energized to retain the arm in its circuit closing position against action of the spring acting on the arm.

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