Oct. 26, 1926. 1,604,220

F. N. DAVIS ET AL

AUTOMATIC NAILING DEVICE

Filed August 12, 1925 2 Sheets-Sheet 1

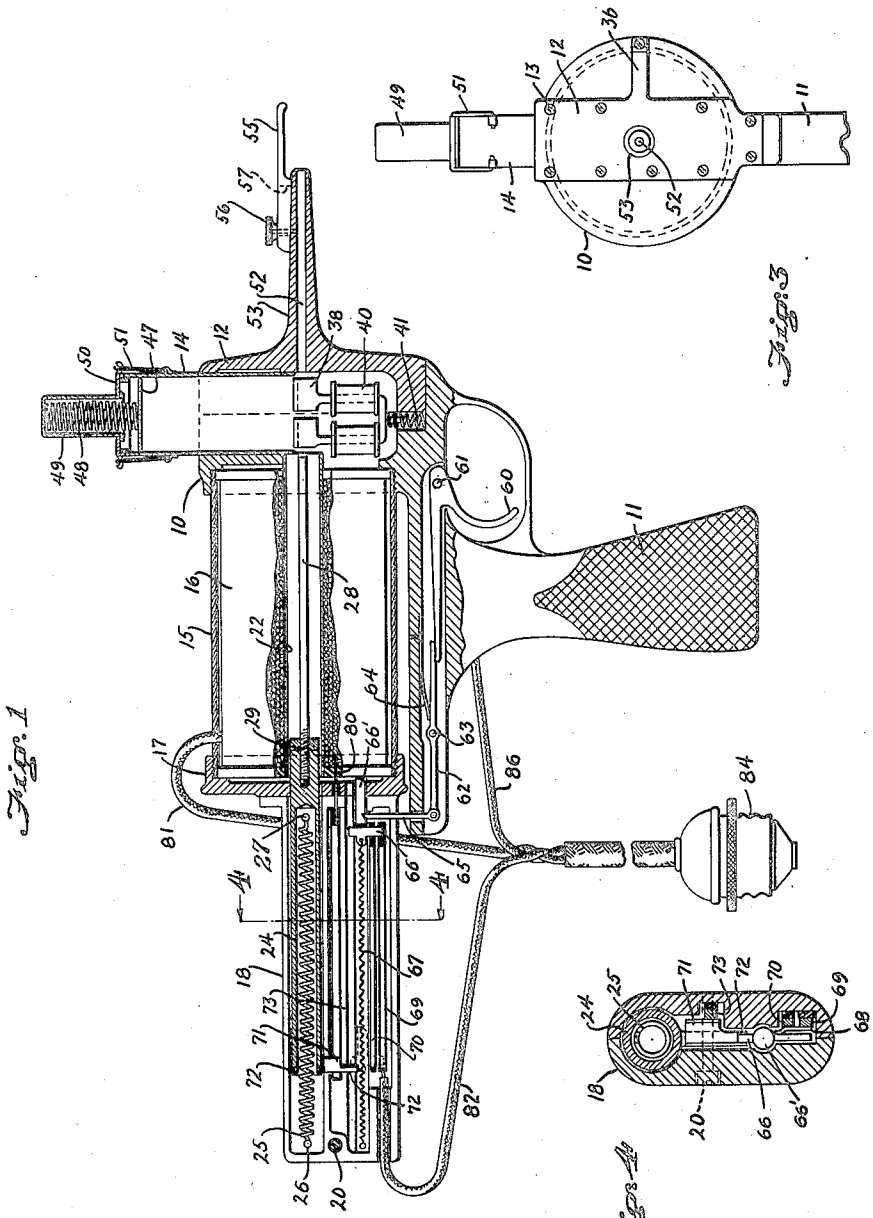


Fig. 1

Fig. 3

Fig. 4

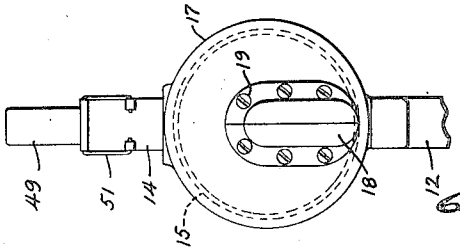


Fig. 2

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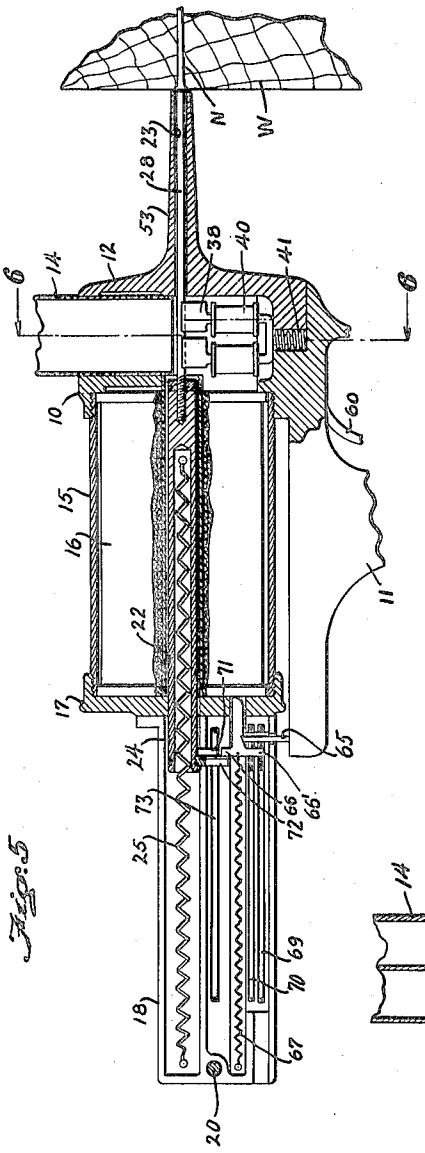


Fig. 5

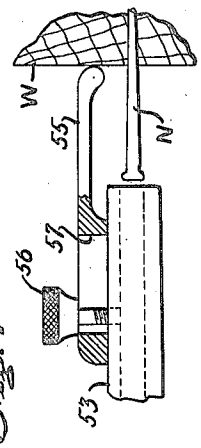


Fig. 7

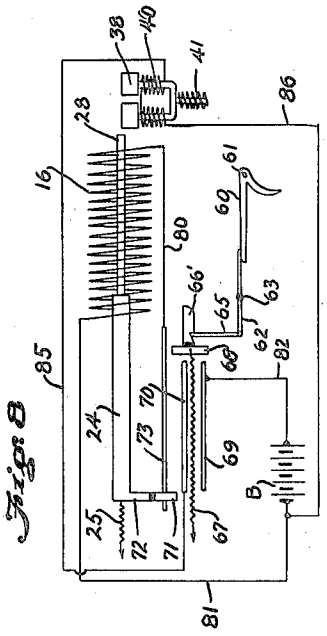


Fig. 8

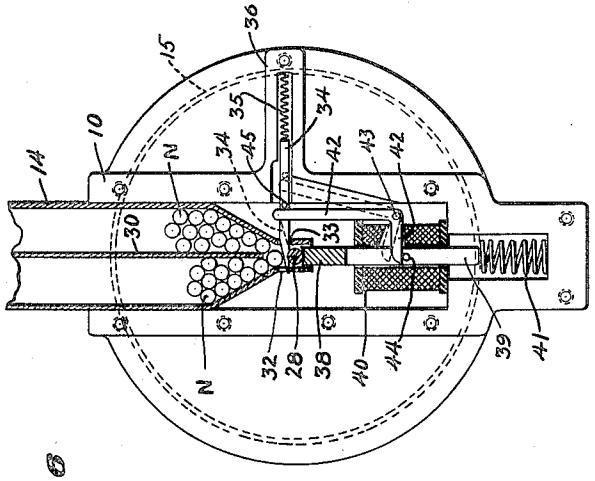


Fig. 6

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Patented Oct. 26, 1926. 1,604,220

UNITED STATES PATENT OFFICE.

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AUTOMATIC NAILING DEVICE.

Application filed August 12, 1925. Serial No. 49,730.

This invention relates to devices for automatically driving nails, and provides electrically operated means for this purpose.

An object of the invention is to provide nail driving means which will act automatically with great rapidity and with much ease and facility, it being also an object to provide such a device whereby nails may be driven by unskilled persons at least as rapidly and accurately as by skilled persons and without danger of striking or injuring the operator's hands or fingers.

A further object is to provide for continuous operation of the device until the nail is driven, and also preferably for automatically stopping operation of the device.

Another object is to make provision whereby, in using an automatic device of this character, any predetermined portion of a nail being driven may be left projecting, the driving operation being automatically stopped at the desired point.

Briefly, the invention comprises electrically energizable means for moving a nail into position for driving, and electrically energizable means for striking the nail repeatedly until driven the desired distance. These means comprise a trigger which releases a spring controlled contact adapted first to close a circuit through a solenoid for drawing a nail into position and separating the same from other nails, said contact then closing a second circuit through another movable contact for energizing a solenoid adapted to operate a hammer against spring tension. The throw of the hammer returns the first contact sufficiently to break the circuit through the hammer coil thereby allowing the spring to return the hammer, whereupon the first mentioned contact again closes said circuit and again operates the hammer. At the final stroke of the hammer the throw thereof is sufficiently long due to the gradual advancement of the nail to break circuit through the solenoids and to carry the first mentioned contact into position to be latched and held against the tension of its spring. The invention resides further in the novel combinations and arrangement of parts and in the features of construction illustrated in the accompanying drawings, described herein and pointed out in the appended claims.

In the drawings wherein certain embodiments of the invention are disclosed by way of example,

Fig. 1 is a longitudinal vertical section through the device in inoperative position.

Fig. 2 is a rear end view or elevation thereof.

Fig. 3 is a front elevation thereof.

Fig. 4 is a cross section taken on the line 4—4 of Fig. 1.

Fig. 5 is a longitudinal section showing the parts at the end of the last nail driving stroke.

Fig. 6 is a section taken on the line 6—6 of Fig. 5.

Fig. 7 is a detail showing of the gauge used in driving a nail only part way.

Fig. 8 is a diagrammatic showing of the wiring of the structure.

The device comprises a frame whose forward portion is in the form of a circular head 10 while a handle 11 is provided on the under side for manipulation thereof. A retaining cap and nail guide 12 of elongated form as seen in Fig. 3 is secured by screws 13 to the front of the head 10, and a pocket is provided between said cap 12 and head 10 for the reception and retention of a nail reservoir 14, to be more fully described hereinafter. A solenoid casing 15 is threaded into the rear of the head 10 and receives therewithin a solenoid 16, the rear of the casing having a cap or end closure 17 threaded thereon to which there is in turn secured a housing 18 for the operating parts. The housing 18 is retained by means of screws 19, and for convenience of assembly is divided as indicated in Fig. 4, the two parts being joined as by means of a screw or bolt 20.

The solenoid winding 16 is provided centrally with a guiding sleeve 22 for the core 24 which constitutes the principal driving element, the rear portion of the core 24 being provided with a bore which receives a returning spring 25 one end of which is secured to the housing 18 at 26 while its other end is secured at 27 within the core. Into the forward end of the core 24 a nail engaging and driving stem 28 is threaded, a lock nut 29 being employed to anchor the same. Thus the core 24 and the stem 28 taken as a unit constitute the hammer which drives the nails.

The nails N are carried in the reservoir

14 which is tapered at its lower end as seen in Fig. 6, and preferably is provided with a partition 30 which insures feeding of a single nail only into the neck or nozzle 32 from which the nail is to be carried by the stem 28. One side of the nozzle 32 is apertured at 33 for reception of the tapered extremity of a separator pin 34 which normally is urged into separating position as shown in Fig. 6 by means of a spring 35 seated in an extension 36. A single nail N is received in driving position in saddles 38 provided on the upper ends of cores 39 of a pair of solenoids 40 which draw the cores 39 into lowered position against the tension of a spring 41 as shown, when energized by the flow of electric current therethrough, the separator pin 34 being projected at this stage to separate the nail in the saddles for driving action and to hold back the nails in the reservoir 14. When the solenoids are not energized the cores are adapted to be elevated by the spring 41, and these cores withdraw the separator pin 34 through the medium of a bent lever 42 pivoted at 43 and movable into the dotted line, or withdrawn position by a stud 44 on one of the cores 39, the upper end of said lever 42 engaging a stud 45 on the separator pin 34 for withdrawing the latter against tension of the spring 36.

The nails in the reservoir may be urged downward by followers 47 pressed by springs 48 carried in a spring housing 49 on a cover plate 50 held on the top of the reservoir 14 by means of swinging bails 51. When a nail is driven it is carried by the driving stem 28 through a passage 52 in a nail guide 53 on the cap 12 and thereby projected and driven into the object receiving the same, the driving action being continued as hereinafter explained until the end of the stem 28 reaches the end of the guide 53. If desired to drive a nail less than its full length, a gauge 55 may be employed which is slidable along the guide 53 and is adapted to be fixed in adjusted position by means of a set screw 56 passing through a slot 57 in the gauge and seated in the guide 53.

The device is brought into operation through the medium of a trigger 60 pivoted at 61 near the handle 11, said trigger being adapted to actuate a lever 62 pivoted at 63 and working against a leaf spring 64. Movement of the lever 62 withdraws a latch 65 from the guided portion 66′ of a contact 66 which is insulatedly mounted on said portion 66′. Contact 66 when released is adapted to be drawn rearward by a spring 67 thereby first bringing a spring contact finger 68 (Fig. 4) on the side of contact 66 into sliding engagement with an insulated conductor rail 69 and into sliding engagement with an insulated conductor rail 70, following which the contact 66 engages an insulated contact 71 carried upon a projecting arm 72 on the rear end of the hammer core 24, said contact 71 having sliding engagement with an insulated conductor rail 73. Rail 73 is connected with an electric conduit 80 in circuit with the solenoid coil 16 whose opposite end has connection with a conduit 81 which co-operates with a conduit 82 connected with the rail 69 for supplying electric current to the device by way of a light socket plug 84, or the like, or with a battery B as indicated in Fig. 8. The contact rail 70 is in circuit through a conduit 85 with the solenoids 40 which have a return connection 86 with the conduit 81 (see Fig. 8.)

In operating the device for driving a nail, the end of the nail guide 53 is held firmly against the wall W or other object into which the nail N is to be driven and the trigger 60 is pressed to withdraw the latch 65 from the moving contact 66, whereupon the trigger is released. The contact 66 is then drawn rearward by the spring 67 which is comparatively light, the spring contact finger 68 passing into sliding engagement with both of the conductor rails 69 and 70 for closing the circuit to the solenoids 40 through the conduits 85 and 86, whereupon the cores 39 and their saddles 38 are drawn down against the tension of the spring 41 into the position shown in Fig. 6 for receiving and positioning a nail, the separator pin 34 being moved thereby into position to separate the positioned nail and restrain the others. This position is maintained until the end of the last stroke of the nail driving operation. The contact 66, 68 while in engagement with the two rails 69 and 70 slides back along said rails until the upper end of said contact 66 comes into engagement with the insulated contact 71 on the projecting arm 72 carried by the hammer core 24. This closes the circuit to the solenoid 16 by way of the rail 73 and conduits 80 and 81, whereupon the hammer core 24 is actuated for forcible engagement with the head of the nail N positioned in the saddles 38, whereby said nail is carried through the passage 52 in the nail guide 53 and is driven part way into the wall W. The mass of the contact 66 with its guiding portion 66′ is such as to have considerable momentum imparted thereto against the influence of the light spring 67 by the rapid forward movement thereof through engagement by the arm 72 and contact 71. so that upon the more or less sudden stoppage of the hammer when the nail strikes the wall the contact 66 will continue forward a short distance thereby disengaging the contact 71 and breaking the circuit through the solenoid 16, without disengaging the rails 69 and 70 or breaking the circuit through solenoids 40. This allows the hammer to be returned

by the relatively strong spring 25. However the contact 66 rapidly follows up under influence of its spring 67, again engaging contact 71 and closing the circuit through hammer-actuating solenoid 16 to propel the hammer again, the stroke of the hammer being a little longer than originally, and the circuit being again broken by movement of contact 66. This operation is repeated until the final stroke whereby driving of the nail is completed by a complete stroke of the hammer, in which instance the contact 66 is carried far enough forward to disengage both rails 69 and 70 and move into engagement with the latch 65, both circuits being thereby broken and the operation of the device stopped.

When desired to drive a nail only part way, the gauge 55 is set accordingly, the nose of the gauge is placed firmly against the object into which a nail is to be driven, and the trigger is pressed as before. The nail is then driven by repeated strokes until the head of the nail reaches the end of the guide 53 which permits a complete stroke of the hammer 24, 28, whereupon the contact 66 engages the latch 65 and the operation ceases, thus leaving the nail projecting the distance which the gauge is set beyond the end of the guide 53.

From the foregoing it will be clear that we have provided an efficient and effective device for rapidly and automatically driving nails.

What we claim is:

1. In a device of the character disclosed, means for holding a supply of nails, a solenoid having a core actuable for positioning a nail, a solenoid having a core actuable for driving the positioned nail, electric circuits to energize said solenoids, and means controlling said circuits to cause actuation of the nail-positioning core prior to actuation of said driving core.

2. In a device of the character disclosed, means for holding a supply of nails, a solenoid having a core actuable for positioning a nail, a solenoid having a core actuable for driving the positioned nail, electric circuits to energize said solenoids, means controlling said circuits to cause actuation of the nail-positioning core prior to actuation of said driving core, the driving core being movable at each stroke to break the circuit through its solenoid, and means for returning the same and permitting the controlling means to close the circuit again for repeating actuation of the hammer.

3. In a device of the character disclosed, means for holding a supply of nails, a solenoid having a core actuable for positioning a nail, a solenoid having a core actuable for driving the positioned nail, electric circuits to energize said solenoids, means controlling said circuits to cause actuation of the nail-positioning core prior to actuation of said driving core, the driving core being movable at each stroke to break the circuit through its solenoid, and means for returning the same and permitting the controlling means to close the circuit again for repeating actuation of the hammer, the circuit through the nail-positioning solenoid being unaffected when the hammer circuit is broken.

4. In a device of the character disclosed, means for holding a supply of nails, a solenoid having a core actuable for positioning a nail, a solenoid having a core actuable for driving the positioned nail, electric circuits to energize said solenoids, means controlling said circuits to cause actuation of the nail-positioning core prior to actuation of said driving core, the driving core being movable at each stroke to break the circuit through its solenoid, and means for returning the same and permitting the controlling means to close the circuit again for repeating actuation of the hammer, said controlling means including a movable contact actuable by said driving core upon a stroke which ejects the nail from the device to break the circuits through both solenoids.

5. In a device of the character disclosed, means for holding a supply of nails, a solenoid having a core actuable to position a nail, means actuable thereby to permit feed of a single nail at a time, a second solenoid having a core actuable for driving a positioned nail, means to return the driving core, circuits to energize said solenoids, and means operable through movements of the nail-driving core to break the circuit to its solenoid intermittently upon said movements.

6. In a device of the character disclosed, means for holding a supply of nails, a solenoid having a core actuable to position a nail, means actuable thereby to permit feed of a single nail at a time, and a second solenoid having a core actuable for driving a positioned nail.

7. In a device of the character disclosed, means to position a nail, a solenoid having a core actuable for driving a positioned nail, means to return said core, a circuit to energize said solenoid, and means operable through movements of the core to break the circuit to the solenoid intermittently upon said movements.

8. In a device of the character disclosed, means for holding nails, a solenoid having a core actuable to position a nail, a second solenoid having a core actuable to drive a positioned nail, circuits for said solenoids, a pair of conductor rails, a movable contact releasable to engage both of said rails, one of said rails being a feed rail and the other being connected in the circuit with the nail-positioning solenoid, a contact on the nail-

driving core engageable by the movable contact after closing the circuit with the nail-positioning solenoid, a third rail engageable by the last mentioned contact to close the circuit through the driving solenoid, the connection from the movable contact to the third rail through the contact on the driving core being broken through movements of the driving core, means to return the driving core when its circuit is broken whereupon contact may again be made, said movable contact being movable by the driving core upon a stroke which ejects the nail from the device to break both circuits, and a latch to engage and retain said movable contact upon breaking both circuits.

9. In a device of the character disclosed, means for holding nails, a solenoid having a core actuable to position a nail, a second solenoid having a core actuable to drive a positioned nail, circuits for said solenoids, a pair of conductor rails, a movable contact releasable to engage both of said rails, one of said rails being a feed rail and the other being connected in the circuit with the nail-positioning solenoid, a contact on the nail-driving core engageable by the movable contact after closing the circuit to the nail-positioning solenoid, a third rail engageable by the last mentioned contact to close the circuit through the driving solenoid, the connection from the movable contact to the third rail through the contact on the driving core being broken through movements of the driving core, means to return the driving core when its circuit is broken whereupon contact may again be made, said movable contact being movable by the driving core upon a stroke which ejects the nail from the device to break both circuits, a latch to engage and retain said movable contact upon breaking both circuits, and a trigger controlling said latch.

In witness that we claim the foregoing we have hereunto subscribed our names this 29th day of June, 1925.

FRANK N. DAVIS.
GROVER LAUBE