

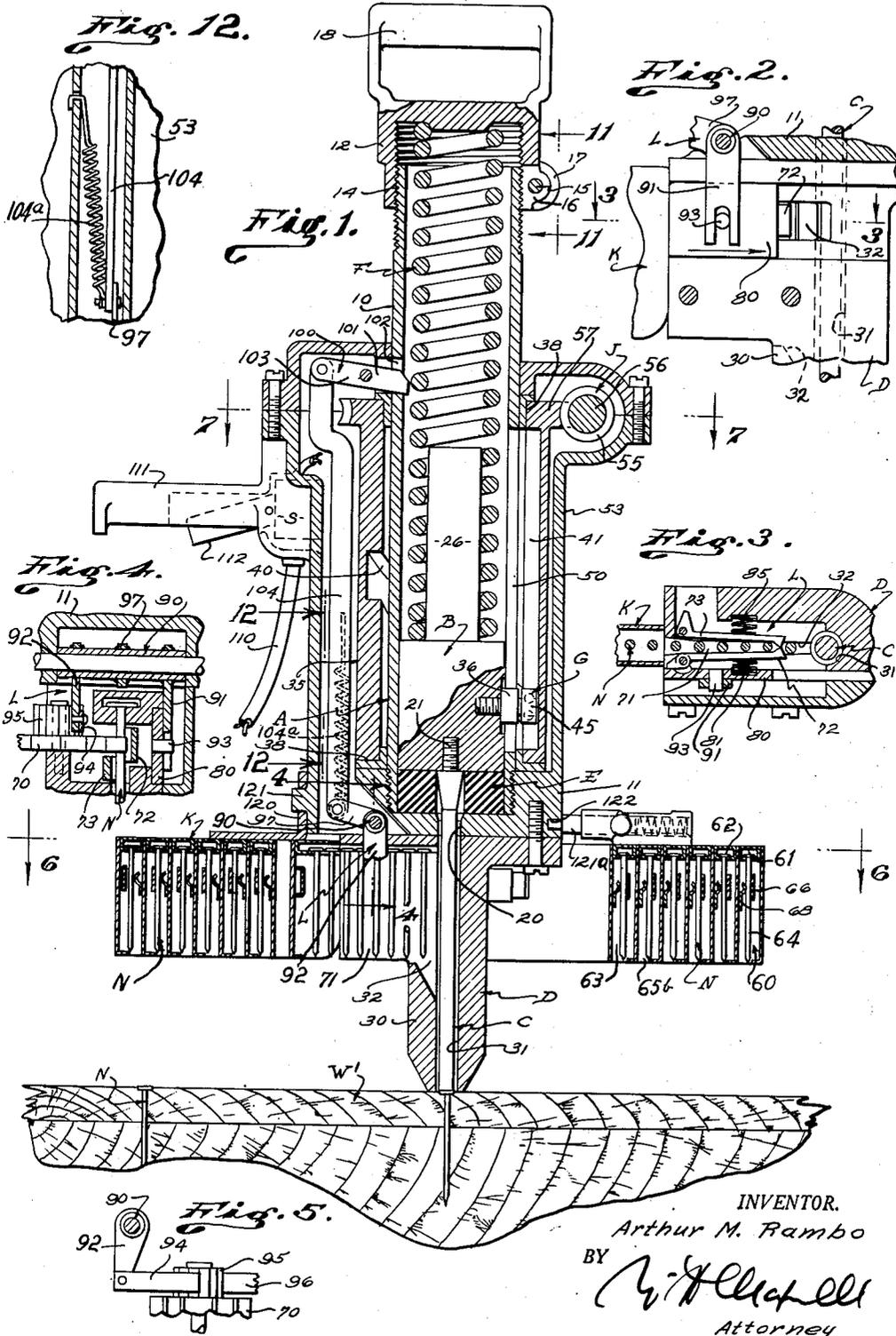
June 8, 1954

A. M. RAMBO
NAIL DRIVER

2,680,246

Filed May 27, 1950

2 Sheets-Sheet 1



INVENTOR.
Arthur M. Rambo
BY *W. J. Mitchell*
Attorney

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2 Sheets-Sheet 2

Fig. 6.

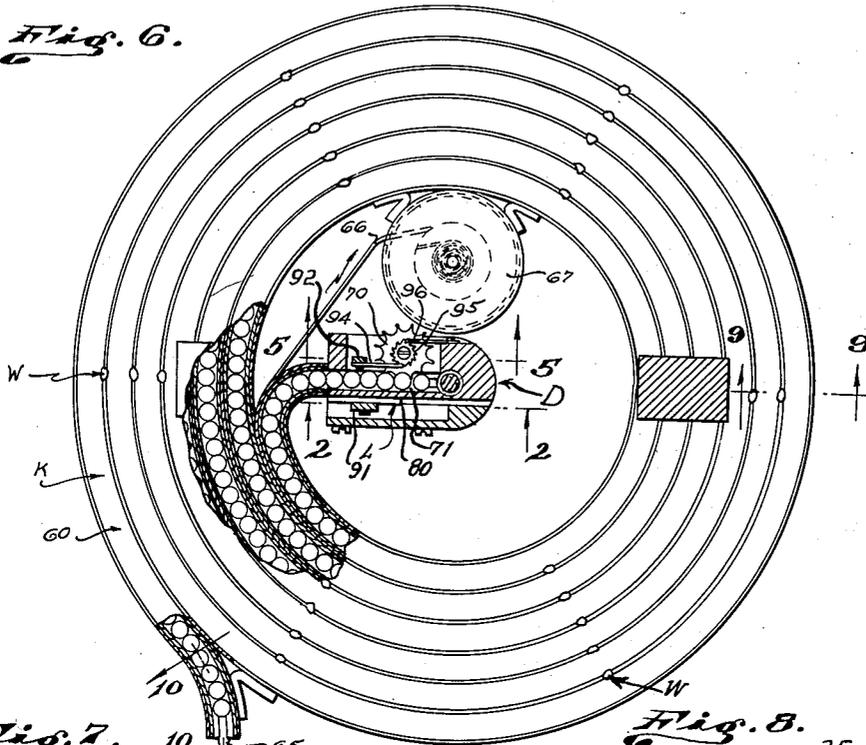


Fig. 7.

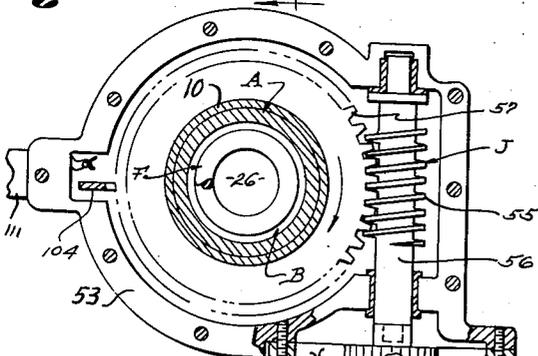


Fig. 8.

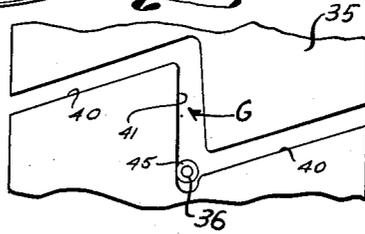


Fig. 9.

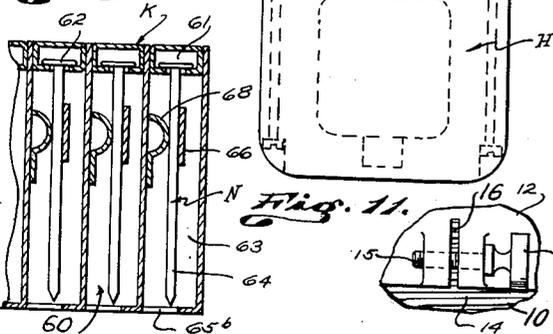


Fig. 11.

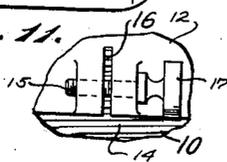
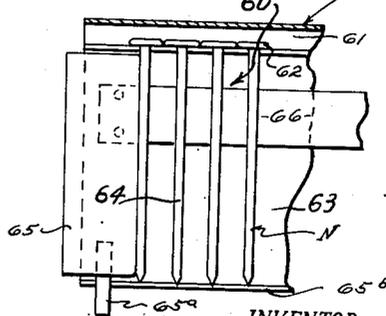


Fig. 10.



INVENTOR.
Arthur M. Rambo
BY *W. H. H. H. H.*
Attorney

UNITED STATES PATENT OFFICE

2,680,246

NAIL DRIVER

Arthur M. Rambo, Huntington Beach, Calif.

Application May 27, 1950, Serial No. 164,665

6 Claims. (Cl. 1-46)

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This invention has to do with a nail driver and it is a general object of the invention to provide a simple, practical, dependable and effective mechanism that is easily transportable and which serves to drive or apply nails, spikes, or like articles.

There are numerous situations where nails or the like are to be driven and where the usual driving by means of a hammer becomes a tedious and laborious task.

A general object of the present invention is to provide a simple, compact, manually portable device serving to handle a supply of nails and operating to drive the nails one at a time without requiring appreciable exertion on the part of the user.

Another object of the invention is to provide a device of the general character referred to in which the driving action is gained through a mechanism, preferably a cam mechanism operated by a small prime mover such as an electric motor.

It is a further object of this invention to provide a mechanism of the general character referred to which operates to deliver uniform blows at uniform intervals of time and which is such that the blow delivered may be adjusted or varied as circumstances require.

Another object of the invention is to provide a mechanism of the general character referred to including a driving device and means supplying nails thereto so that a quantity of nails can be stored in the device to be driven one at a time as the user desires.

The mechanism of the present invention involves, generally, a cylinder with a plunger therein. A driver is carried by the plunger and projects from the lower end of the cylinder to operate in a guide and a shock absorber limits the operation of the driver. A drive spring is carried in the cylinder and operates the plunger and a cap on the upper end of the cylinder is adjustable to vary the action of the spring and the cap also serves as a mounting for a handle to be conveniently grasped by the user. Elevating means operates to lift or elevate the plunger against the resistance of the spring and is preferably a cam means involving a revolving cam sleeve around the cylinder. A drive for the cam sleeve involves an electric motor and a worm gear mechanism between the motor and the sleeve. The cam mechanism is such as to lift or elevate the plunger gradually and at a uniform rate and to liberate it suddenly to be driven downwardly under the action of the spring.

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A supply means carries nails to be delivered to the guide in which the driver operates and may include a magazine in which nails are held. In a typical case the magazine may be helically formed and the nails may be advanced by a tape arranged in the chute and operated by a spring motor or the like, the tape having a follower attached thereto to act on the nails in the chute.

A feed handles the nails from the magazine and delivers them to the guide and may involve a star wheel advancing the nails one at a time and a pusher synchronized with the star wheel to push the nails one at a time into the guide. A check pawl prevents over-feed of the nails and a drive preferably synchronized with the action of the plunger operates the star wheel and the pusher.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of the invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a central vertical sectional view of a typical embodiment of the present invention showing the plunger fully operated so that the driver has engaged and fully driven a nail. Fig. 2 is an enlarged detailed view of a portion of the magazine taken as indicated by line 2-2 on Fig. 6. Fig. 3 is a plan section taken as indicated by line 3-3 on Fig. 2. Fig. 4 is a detailed sectional view taken as indicated by line 4-4 on Fig. 1. Fig. 5 is a detailed sectional view taken substantially as indicated by line 5-5 on Fig. 6. Fig. 6 is a plan section taken substantially as indicated by line 6-6 on Fig. 1, certain parts being broken away to illustrate the mechanism involved. Fig. 7 is a plan section taken substantially as indicated by line 7-7 on Fig. 1. Fig. 8 is a somewhat diagrammatic view illustrating the cam formation that may be involved in the magazine. Fig. 9 is an enlarged detailed sectional view taken as indicated by line 9-9 on Fig. 6, and Fig. 10 is an enlarged detailed sectional view taken as indicated by line 10-10 on Fig. 6. Fig. 12 is a sectional view taken as indicated by line 12-12 on Fig. 1.

The mechanism provided by the present invention involves, generally, a body A, a plunger B operating in the body, a driver C carried and operated by the plunger, a guide D carried by the base portion of the body and guiding the driver, a shock absorber E cushioning over-travel of the driver and plunger, a drive spring F carried by the body and operating the plunger, elevating means G operating to elevate the plunger in the

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body and suddenly releasing it to be driven by the spring, power means H, preferably in the form of an electric motor, drive means J from the power means to the means G, means K supplying nails and advancing means L operating to receive nails from the means K and deliver them one at a time to the guide in which the driver operates.

The body A in its preferred form involves an elongate cylinder 10, closed at its lower end by a base 11 and at its upper end by means of a cap 12. The cylinder is preferably round in cross sectional configuration and the base 11 provided at the lower end of the cylinder is preferably joined thereto as by a threaded connection such as is shown in Fig. 1 of the drawings. Through the construction provided the base is rigid with what may be considered the lower end of the cylinder and serves as a mounting or carrier for other elements of the structure, as will be hereinafter described. The cap 12 is preferably attached to the upper end of cylinder 10 as by a threaded connection 14, and a suitable screw clamp 15 is provided for setting the cap against movement or rotation on the upper end of the cylinder. In the particular case illustrated the threaded portion of the cap is split at 16 (Fig. 11) and the clamp 15 is carried by the split portion of the cap and has an operating knob 17 facilitating its operation. A handle 18 is carried by or is provided to project from the cap so that it extends transversely of the cylinder and is located above the upper end of the cylinder providing a part that can be conveniently gripped by the user of the structure.

The plunger B is slidably carried in the cylinder 10 and in practice may be a simple body or block of suitable metal of such size and shape as to have considerable mass.

The driver C is carried by and depends from the plunger B so that it projects downwardly through an opening 20 in the base E and enters the guide D which depends from the base. The driver is shown in the drawings as an elongate member of suitable size or diameter and it is shown releasably joined to the plunger by a threaded connection 21 so that it can be replaced or renewed as circumstances require. In the preferred arrangement the driver is located centrally of the plunger or so that it is concentric with the mechanism generally. A shock absorber E, preferably a body or block of rubber or like material, is provided in the cylinder 10 to occur within the base 11 and beneath the plunger B. The shock absorber serves to cushion movement that might be considered over-travel of the plunger and thus prevents undue shock or hammering occurring between rigid parts of the structure.

The drive spring F is carried in the cylinder 10 between the upper end of the plunger B and the cap 12 and in the preferred form of the invention it is a heavy, helical spring that operates under compression. In the particular form of the invention illustrated the plunger B has a central vertical extension 26 projecting upwardly into the lower end portion of the spring F. The extension 26 serves to add mass to the plunger and it also serves as a guide centralizing the spring in the cylinder.

The guide D is carried by the base portion of body A and depends therefrom. The guide has an elongate tip portion 30 extending downwardly a substantial distance below the base 11 and it has a central opening 31 in which the

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driver C operates. The upper end portion of the guide is provided with a side or lateral nail receiving opening 32 which opening is of such vertical extent as to readily receive nails so that they enter the guide to be positioned ready for driving by means of the driver C.

The elevating means G operates to lift or elevate the plunger B against the resistance of spring F and in the preferred form of the invention it is a cam means. In the particular case illustrated the cam means that elevates the plunger involves a rotating cam member 35 in the form of a sleeve surrounding the cylinder 10 and a follower 36 projects from the plunger B and cooperates with a suitable cam opening in the sleeve. In the case illustrated in the drawings the cam sleeve 35 fits around the cylinder 10 with suitable clearance and is supported for rotation relative to the cylinder by suitable bearings 38.

The cam sleeve 35 is intended to rotate, for instance, at a uniform or consistent speed when the mechanism is in operation, and the cam opening or cam faces provided thereon may be such as to impart any desired motion to the plunger B through the follower 36 which projects from the plunger. In the case illustrated the cam faces or parts of the sleeve 35 are such as to elevate and release the plunger once for each rotation of the sleeve. The nature of the cam slot or groove provided in the sleeve 35 is illustrated in Fig. 8 where it will be seen that the cam slot has an inclined or helically pitched portion 40 that extends substantially 360° around the interior of the sleeve and a vertical or longitudinal portion 41 which extends between and connects the ends of the helical portion 40 which are spaced a substantial distance apart longitudinally of the sleeve by reason of the pitch of portion 40.

The follower 36 projects from one side of plunger B and is shown provided with an anti-friction member or roller 45 which operates in the cam groove provided in the interior of sleeve 35. The roller 45 is so proportioned to the cam portions 40 and 41 as to operate freely through the cam groove. The cam follower 36, in extending from the plunger to the cam groove in sleeve 35, extends through a vertical or longitudinal guide-way 50 in cylinder 10. The cooperation of the follower with the guide-way 50 holds or maintains the plunger B against rotation relative to cylinder 10 while at the same time it allows for free full longitudinal movement of the plunger in the cylinder.

In the preferred form of the invention a housing or jacket 53 is provided to encase the mechanism just described. The particular housing 53 shown in the drawings is carried by and projects upwardly from the base 11 and its upper end portion fits closely around the cam 35, as clearly shown in Fig. 1 of the drawings.

The motor H is preferably a typical or simple electric motor such as is commonly used to operate hand tools of the general character under consideration. In the case illustrated the motor H is shown mounted on the upper portion of the housing 53 at the exterior thereof. A suitable power line 110 is shown connected with the structure for energizing motor H and a handle 111 is shown on one side of housing 53 projection from a point where a suitable switch S is located. An operating trigger 112 for the switch is located at handle 111.

The drive J from motor H to the cam sleeve 35 may be any suitable mechanism that will

result in the desired rotation of the cam sleeve when the motor is energized. In the form of the invention illustrated the means J involves a worm gear 55 on a shaft 56 supported in the housing 53 and directly coupled to and driven by the shaft of motor H. A worm gear 57 is fixed to or pivoted on the sleeve 53 and is engaged by the gear 55. With the construction just described and which is illustrated in Figs. 1 and 7 of the drawings the cam sleeve 35 rotates at a suitable speed when the motor H is in operation.

The means K provided for supplying nails to the driver and guide may be any suitable structure or device that will serve this purpose. In the particular case illustrated the means K involves a magazine that carries a supply of nails and which is made up, essentially, of a helical chute 60. The chute is carried by the base portion 11 of body A and surrounds the upper end portion of the guide D and is located so that it is generally concentric with the guide. The outer end of the chute is open to receive nails and the inner end of the chute is open to or communicates with the feed L so that nails are supplied thereto for delivery into the guide.

The particular chute illustrated in the drawings has an upper channel 61 carrying the heads 62 of the nails N and it has a lower channel 63 which carries the shanks or body portions 64 of the nails. Advancing means serves to operate the nails in the chute, and in the case illustrated this means involves a follower 65 located in the chute outward of the nails and operable in the channel 63 of the chute to press or urge the nails inwardly or toward the inner end of the chute. A handle 65^a (Fig. 10) depends from follower 65 through a slot 65^b in the bottom of the chute 60 so the follower can be operated manually. A tape or flexible band 66 is attached to the follower 65 and extends through channel 63 of the chute. The tape emerges from one side of the chute at the inner end portion thereof and enters a suitable winding device 67 which may be a spring operated device tending to normally yieldingly operate the tape in the direction indicated by the arrow in Fig. 6.

In the particular case illustrated the tape as it extends through the chute may engage or bear upon nails in the chute in which case a suitable support or nail slide 68 is provided in the chute opposite the point where the nails are engaged by the tape 66, see Fig. 9 of the drawings.

The adjacent convolutions of the chute 60 are preferably fixed or secured together as by welding W or the like, and the unit formed by the chute is detachable from the base 11. The mounting means releasably securing the chute to the base is shown as involving an apertured bracket 120 on the upper side of the chute receiving a lug 121 projecting laterally from one side of the base. A simple spring-pressed latch bolt 121^a is carried by the chute and engages an opening 122 in the base diametrically opposite the lug 121.

The feed means L provided by the invention serves to feed nails from the supply means K to the guide D, and in accordance with the broader principles of the invention it may be any suitable mechanism that will serve this purpose. In the case illustrated the feed means L involves, generally, a star wheel 70 (Fig. 6) designed to engage and advance the nails in a channel 71 which continues laterally from the opening 32 provided in the side of the guideway. A pusher 72 engages nails advanced or fed by the wheel 70 and a

check pawl 73 may be provided to control the feeding of the nails.

In the particular case illustrated the channel 71 in which the nails operate connects the inner end of the nail chute 60 with the opening 32 at the side of the guide D. The star wheel 70 is mounted on a vertical axis or so that its axis is parallel with that of the nails carried in the channel 71 and upon intermittent operation of the star wheel through suitable amounts the nails are advanced one at a time toward the guide D.

The pusher 72 is provided to engage the nails one at a time as they are advanced by the star wheel and acts to push the nails through the opening 32 and into the guide. In the particular case illustrated the pusher 72 is pivotally mounted on a slide 80 mounted to reciprocate in a direction normal to the longitudinal axis of the guide. A spring 81 is provided between the pivoted pusher and its supporting slide and is such as to normally yieldingly urge the pusher toward the nails in the manner illustrated in Fig. 3 of the drawings.

The check pawl 73 is pivotally supported to cooperate with the star wheel and pusher so that nails are retained at the star wheel as the nail being fed is advanced or pushed by the pusher 72. The pawl 73 is supported on a fixed pivotal axis parallel with that of the pusher 72 and is normally yieldingly urged toward the nails by means of a suitable spring 85.

A drive is provided for operating the star wheel 70 and the pusher 72 in suitable synchronism with each other and in synchronism with the plunger B. In the case illustrated the drive involves a pivoted rocker 90 having projecting arms 91 and 92 operatively connected with the slide 80 and star wheel 70 respectively. The arm 91 is slidably pivotally connected at 93 to the slide 80 while the arm 92 is connected with the star wheel through a spring arm 94 that cooperates with a ratchet wheel 95 fixed relative to the star wheel. A spring pawl 96 engages the ratchet wheel and checks reverse operation thereof.

The rocker 90 (Figs. 4 and 5) has a driving arm 97 projecting therefrom which is angularly related to the arms 91 and 92. A pivoted lever 100 has an arm 101 projecting into the cylinder 10 through an opening 102 and has an arm 103 to which a link 104 is connected. The link 104 connects arm 103 with the arm 97 of the rocker 90. The arm 101 projects into the cylinder 10 so that as the plunger B reaches the upper end portion of its stroke the lever 100 is rocked a suitable amount, causing the link 104 to operate the rocker 90 with the result that the star wheel and pusher are operated suitable amounts. It is to be observed that when the plunger B is at the upper end of its stroke operating the lever 100 the driver is elevated so that it leaves the lateral opening 32 in communication with the opening 31 unobstructed and such as to receive a nail as it is advanced by reason of the operation of the pusher. As the pusher is advancing a nail into the guide B the star wheel is advancing a nail ready for the next operation, and the nails behind the one thus advanced are restrained by the pawl 73. A spring 104^a anchored in sleeve 53 and coupled to the link 104 at the lower end thereof normally yieldingly tends to hold the mechanism above described in the position shown in Fig. 1.

From the foregoing description it will be understood how a person using the structure after suitably charging it with nails may introduce it

to parts to be nailed by grasping the handles 18 and 111. To cause driving of a nail the trigger 112 controlling switch S is actuated causing energization of motor H. When the motor is put in operation the cam sleeve 35 is rotated and through cooperation of the cam sleeve 35 and follower 36 the plunger is elevated against the resistance of spring F. As the plunger reaches the upper end of its stroke a nail is fed into the guide D by the feed means L. When the plunger B reaches a predetermined elevated position it operates lever 100 which moves link 104 down causing the pusher 72 related to the link 104 to be operated. When the plunger finally reaches the extreme upper end of its stroke the follower enters the elongate portion 41 of the cam slot releasing the plunger so that it is driven downwardly by the spring F. The driver C operated downwardly by the plunger engages the nail in the drive D and drives it into the work W in the manner shown in Fig. 1 of the drawings. When the plunger leaves the up position the feed means L returns immediately to the unactuated position. As the cam sleeve 35 continues to rotate the action just described is repeated and between strokes of the driver the user may shift or advance the structure from one location to another so that successive nails are driven in different parts of the work W'.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art and fall within the scope of the following claims.

Having described my invention, I claim:

1. A nail driver of the character described including, an elongate cylinder, a plunger carried by and operating longitudinally in the cylinder, a guide rigid with the cylinder and projecting from one end thereof, an abutment at the other end of the cylinder, a nail driver carried by the plunger and projecting therefrom into the guide, a compression spring within the cylinder engaged between the plunger and the abutment and adapted to operate the plunger to advance the driver, a feed delivering objects one at a time to the guide to be operated upon by the driver, means adapted to engage and to intermittently operate the plunger longitudinally in the cylinder against the resistance of the compression spring to a predetermined position where it is released and free for operation by the spring, said means including, a rotating cam sleeve concentric with and surrounding the cylinder and a cam follower on the plunger and cooperatively engaging the cam sleeve, and power means driving the cam sleeve, said cylinder having a longitudinal passageway through which the cam follower extends.

2. A driver of the character described including, a cylinder and an abutment at one end with a longitudinal guideway opening in the side thereof, a plunger carried by and operating longitudinally in the cylinder, a guide rigid with the cylinder and projecting from the other end thereof, a driver carried by the plunger and projecting therefrom to operate in the guide, a spring within the cylinder and engaged between the abutment and plunger and adapted to operate the plunger to advance the driver, a feed delivering objects one at a time to the guide to be operated

upon by the driver, and means intermittently operating the plunger in the cylinder toward the abutment and against the resistance of the spring to a position where it is disengaged and free to be operated by the spring, said means comprising, a rotating cam sleeve surrounding the cylinder and a follower on the plunger projecting laterally therefrom and cooperatively engaging the cam sleeve, the follower being engaged in the guide opening extending longitudinally in the cylinder, the cam sleeve having a circumferential cam part cooperating with the follower to elevate the plunger and having a longitudinal part relative to which the follower moves freely under action of the spring.

3. A driver of the character described including, a cylinder, a base fixed at one end of the cylinder, a cap carried by the cylinder at the other end thereof, a plunger operating in the cylinder, a drive spring in the cylinder under compression between the plunger and cap, a guide carried by the base, a driver projecting from the plunger and operating in the guide, and means intermittently operating the plunger in the cylinder to compress the spring and release the plunger for free operation by the spring including an elongate cylindrical cam part concentric with longitudinal axis of the cylinder, a cam follower on the plunger engageable with the cam, and power means rotating the cam.

4. A driver of the character described including, a slotted cylinder, a base fixed at one end of the cylinder, a cap carried by the cylinder at the other end thereof, a plunger adapted to operate in the cylinder, a compression spring in the cylinder adapted to be engaged between the plunger and cap, a guide carried by the base, a driver carried by the plunger and operating in the guide, and means engaged with the plunger and adapted to operate the plunger in the cylinder to a predetermined position where it is released for operation by the spring, said means including a rotating cam sleeve surrounding the cylinder, a motor driving the cam sleeve, and a follower projecting from the plunger to project through the slot of the cylinder and cooperatively engaging a cam in the sleeve.

5. A driver of the character described including, a cylindrical body, a cylinder within the body and having a longitudinal guide opening therein, a base carried by the body and fixed at one end of the cylinder, a cap carried by the cylinder at the other end thereof, a plunger adapted to operate in the cylinder, a compression spring in the cylinder engaged between the plunger and cap, a guide carried by the base, a driver carried by the plunger and operating in the guide, and means adapted to intermittently operate the plunger in the cylinder to compress the spring and then release the plunger for operation by the spring, said means including a cam sleeve rotatably supported by the base and surrounding the cylinder, a motor mounted on the body in fixed relationship to the cylinder, a speed reducing drive from the motor to the cam sleeve surrounding the cylinder, and a follower projecting laterally from the plunger through said longitudinal guide opening in the cylinder to move longitudinally therein and cooperatively engaging the cam sleeve.

6. A driver of the character described including, a cylinder, a base fixed at one end of the cylinder, a cap threaded on the other end of the cylinder, a plunger operating in the cylinder, a compression spring in the cylinder engaged between the plunger and cap, a guide carried by the base, a driver carried by the plunger and

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adapted to operate in the guide, and means adapted to intermittently operate the plunger in the cylinder to compress the spring and thereafter release the plunger for operation by the spring, said means including a sleeve rotatably supported by the base and surrounding the cylinder and having a cam on its inside wall, a motor mounted at the exterior of the structure in fixed relationship to the cylinder, a speed reducing drive from the motor to the sleeve, and a follower projecting radially from the plunger and cooperatively engaging the cam in the sleeve, the cylinder having a longitudinal guide opening

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through which the cam follower projects for free longitudinal movement therein.

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